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Giga-tronics

Operation and Maintenance Manual

Model GT 9000S
Synthesized Microwave Sweeper

CE ..... Certified Product

ISO 9001 ..... Certified Process

Registra: BSI, Certification No. FM 34226, Registered 04 June 1996

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About This Manual

This Operation and Maintenance Manual covers all aspects of the Giga-tronics Model GT 9000S Synthesized Microwave Sweeper. The information required to operate, calibrate and maintain the instrument is provided.

Preface: In addition to a comprehensive Table of Contents and general information about the manual, the Preface also contains a record of changes made to the manual since its publication, and a description of Special Configurations. If you have ordered a user-specific manual, please refer to page xix for a description of the special configuration.

Chapter 1: Introduction — This chapter contains a general introduction to the instrument and its performance specifications.

Chapter 2: Operation — A user's guide to the instrument and its controls.

Chapter 3: Theory Of Operation — A description of the instrument's design and internal functioning, to the block diagram level.

Chapter 4: Calibration and Testing — Procedures for inspection, calibration and performance testing.

Chapter 5: Maintenance — Procedures for maintenance and troubleshooting.

Chapter 6 : Parts Lists — Parts lists for circuit boards and assemblies (parts lists for accessories and options are in Appendix A).

Chapter 7: Diagrams — Component diagrams and schematics for circuit boards and assemblies.

Appendices:

A: Options — Description of accessories and options that are available for this instrument.

Index — A subject listing of contents

Conventions

The following conventions are used in this manual. Other conventions not included here will be defined at the time of usage.

Warning

WARNING

The WARNING statement is enclosed in double lines and centered in the page followed by bold text. This calls attention to a situation, or an operating or maintenance procedure, or practice, which if not strictly corrected or observed, could result in injury or death of personnel. An example is the proximity of high voltage.

Caution

CAUTION

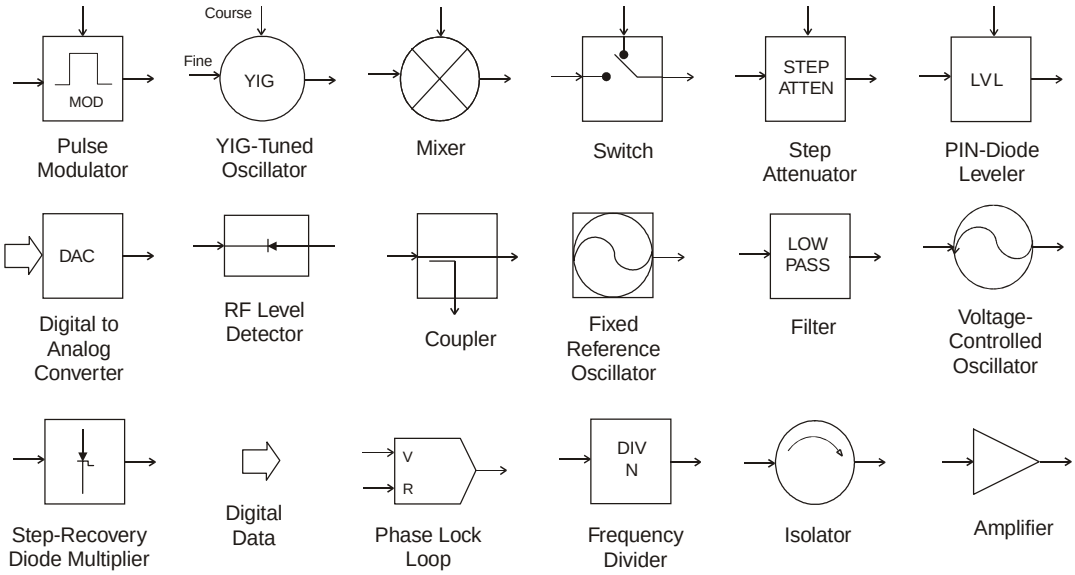
The CAUTION statement is enclosed within a single heavy line and centered in the page followed by bold text. This calls attention to a situation, or an operating or maintenance procedure, or practice, which if not strictly corrected or observed, could result in temporary or permanent damage to the equipment, or loss of effectiveness.

Notes

NOTE: A NOTE highlights or amplifies an essential operating or maintenance procedure, practice, condition or statement.

Symbols

Block diagram symbols used in this manual are illustrated below.



Configuration Data

Part Numbers

This operation and maintenance manual is valid for all Model GT 9000S instruments. The instruments in the series differ primarily in their frequency ranges, which are indicated by a suffix in the model number. Each instrument contains a frequency assembly appropriate to its range. The part numbers for these assemblies are shown in the table below:

Frequency Range	Frequency Assembly Part Number
.01 to 20 GHz	120DA00500
.5 to 20 GHz	120DA00510
2 to 20 GHz	120DA00520
.01 to 26 GHz	120DA00501
.5 to 26 GHz	120DA00511
2 to 26 GHz	120DA00521

Options, Special Configurations and Modifications

Examine the Model/Serial/Configuration sticker affixed to the rear panel of the instrument. If the *Config.* line is blank, there are no options installed in the instrument. If the line contains one or more two digit numbers (e.g., 11), the standard options corresponding to those numbers are installed. Information concerning them will be found in Appendix A of this manual.

If the *Config.* line contains a three digit number (e.g., 241), there is a combination of options and/or special modifications installed in the instrument. Information relating to special configurations will be contained in supplemental pages included with this manual.

Serial Numbers

Each instrument has a seven-digit serial number, shown on the sticker on the rear panel.

Record of Manual Changes

This table is provided for your convenience to maintain a permanent record of manual change data. Corrected replacement pages will be issued as Technical Publication Change Instructions, and will be inserted at the front of the binder. Remove the corresponding old pages, insert the new pages, and record the changes here.

Change Instruction Number	Change Instruction Date	Date Entered	Comments

Special Configurations

When the accompanying product has been configured for user-specific application(s), supplemental pages will be inserted at the front of the manual binder. Remove this page and replace it with the furnished Special Configuration supplemental page(s).

1

Introduction

1.1 General Information

1.1.1 Introduction

The Model GT 9000S is a Synthesized Microwave Sweeper with a sweep capability over a range of synthesized microwave frequencies and power levels in a variety of modulation modes. The GT 9000S can generate output signals over a frequency range of 10 MHz to 26 GHz. The frequency range is dependent on the model number. The RF output can be fixed (CW), swept, or externally frequency modulated. The RF output can be fixed, swept, or amplitude or pulse modulated. The following are the GT 9000S model numbers and corresponding frequency ranges:

- GT 9000S/.01 - 2010 MHz to 20 GHz
- GT 9000S/ .5 - 20500 MHz to 20 GHz
- GT 9000S/ 2 - 202 GHz to 20 GHz
- GT 9000S/ .01 - 2610 MHz to 26.5 GHz
- GT 9000S/ .5 - 26500 MHz to 26.5 GHz
- GT 9000S/ 2 - 262 GHz to 26.5 GHz

The GT 9000S generates output signals under manual control from the front panel, or by remote computer control over the IEEE-488 General Purpose Interface Bus (GPIB). Performance specifications are in Section 1.3.

The GT 9000S has a nominal weight of 45 pounds. It measures 5.25 inches high by 16.75 inches wide by 24 inches deep. Power requirements are 100/120/220/240 Vac ±10%, 47-400 Hz, 250 Watts nominal.

The GT 9000S is type tested to MIL-T-28800E, Type III, Class 5, Style E, except as follows:

- Operating temperature range is 0 to 50 °C.
- Warm-up time is 20 minutes for normal operation (for warm-up time prior to calibration and testing, see Chapter 4).
- Storage temperature is -40 °C to +70 °C.
- Relative humidity is limited to 95% non-condensing.
- Altitude and EMI requirements are not specified.

1.1.2 Items Furnished

Accessories and options are detailed in Appendix A to this manual. In addition to options and/or accessories specifically ordered, the following items are furnished with the instrument:

1 ea. - Operation and Maintenance Manual
1 ea. - 6 ft. power cord
2 ea. - PC Extender Boards
1 ea. - PC Card Extractor

1.1.3 Items Required

An IEEE-488 interface cable is needed for remote control operation. Appropriate RF output cabling made to fit the female type SMA output connector can be ordered as an Accessory Cable Kit, No. A001.

1.1.4 Tools and Test Equipment

No special tools are required to operate the GT 9000S. Test equipment required for calibration or performance verification is described in Chapter 4.

1.1.5 Cooling

A cooling fan is installed in the instrument. The cooling air intake and exhaust are both located on the rear panel. Care must be taken to avoid obstructing the flow of air into and out of the instrument.

1.1.6 Cleaning

The air inlet screen should be cleaned whenever a significant amount of dirt or dust has accumulated. Whenever the instrument covers are removed, the interior should be blown out with dry air at a low velocity.

1.1.7 Installation and Preparation for Use

The instrument is shipped in operational condition and no special installation procedures are required. A warm-up time of 20 minutes is recommended for normal operation (for warm-up time prior to calibration and testing, see Chapter 4).

1.1.8 Receiving Inspection

Use care in removing the instrument from the carton and check immediately for evidence of shipping damage such as loose or broken control knobs, bent or broken connectors, dents or scratches on the panels, etc.

Each Giga-tronics instrument must pass rigorous inspections and tests prior to shipment. Upon receipt, it should immediately be subjected to a performance check to insure that operation has not been impaired during shipment. The performance verification procedure is described in Chapter 4 of this manual.

1.1.9 Preparation for Reshipment

To protect the instrument during reshipment, use the best packaging materials available. If possible, re-use the original shipping container. If this is not possible, a strong carton (350 lbs./sq.in. bursting strength) or a wooden box should be used.

Wrap the instrument in heavy paper or plastic before placing it in the shipping container. Completely fill the areas on all sides of the instrument with packaging material. Take extra precaution to protect the front and rear panels.

Seal the package with strong tape or metal bands. Mark the outside of the package FRAGILE — DELICATE INSTRUMENT.

If corresponding with the factory or the local Giga-tronics sales office regarding reshipment, please reference the full model number and serial number. If the instrument is being reshipped for repair, be sure to enclose all available pertinent data regarding the problem that has been found.

☞ **NOTE:** If you are returning an instrument to Giga-tronics for service, first contact Customer Service at **(800) 444-2878** or Fax at **(925) 328-4702** so that a return authorization number can be assigned. You can also contact Customer Service over their e-mail address ***repairs@gigatronics.com***

1.2 Safety Precautions

CAUTION

The instrument can be damaged if you attempt to operate it while the line voltage selector and fuses are incorrect for the applied line voltage.

Before operating the instrument, make sure that the instrument power requirements are compatible with the power source to be used. The instrument has been designed for international voltages of 100, 120, 220, or 240 Vac, ±10%, at 50-400 Hz. The GT 9000S uses an internationally approved connector that includes voltage selection, fuse and filter for RFI protection.

The GT 9000S has a 3-wire power cord with a 3-terminal polarized plug for connection to the power source and safety ground.

WARNING

The safety ground is connected directly to the chassis. If a 3-to-2 wire adapter is to be used, be sure to connect the ground lead from the adapter to earth ground. Failure to do this could cause the instrument to float above ground, posing a shock hazard.

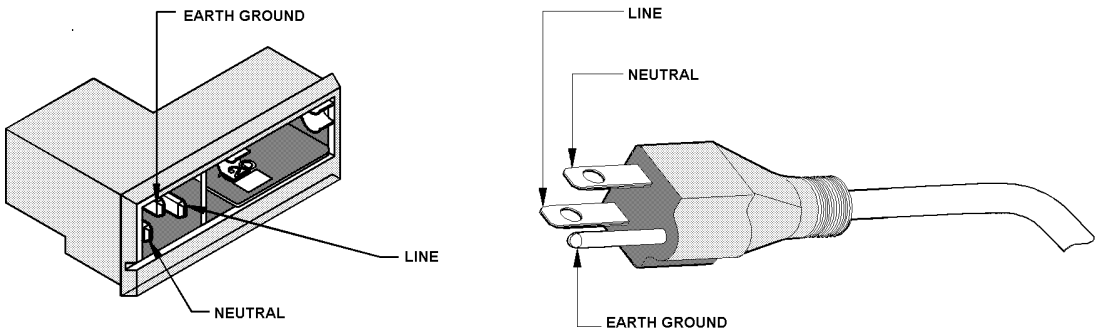


Figure 1-1. Power Line Connection

1.2.1 Voltage and Fuse Selection

When the instrument is shipped from the factory, it is set for a line voltage of 120 V for domestic destinations. The power line fuse for this setting is a 4 A 3AG Slo-Blo. If the instrument is set to operate on a 240 V power line, the fuse must be changed to a 2 A 3AG Slo-Blo.

To select a different operating line voltage and fuse, proceed as follows:

1. Open the cover door and rotate the fuse-pull to the left; remove the fuse.
2. Select the operating voltage by orienting the PC board so that the correct voltage label is on the top left side.
3. Push the board firmly into the module slot.
4. Rotate the fuse-pull back into the normal position and reinsert the fuse into the holder, using care to select the correct fuse value.

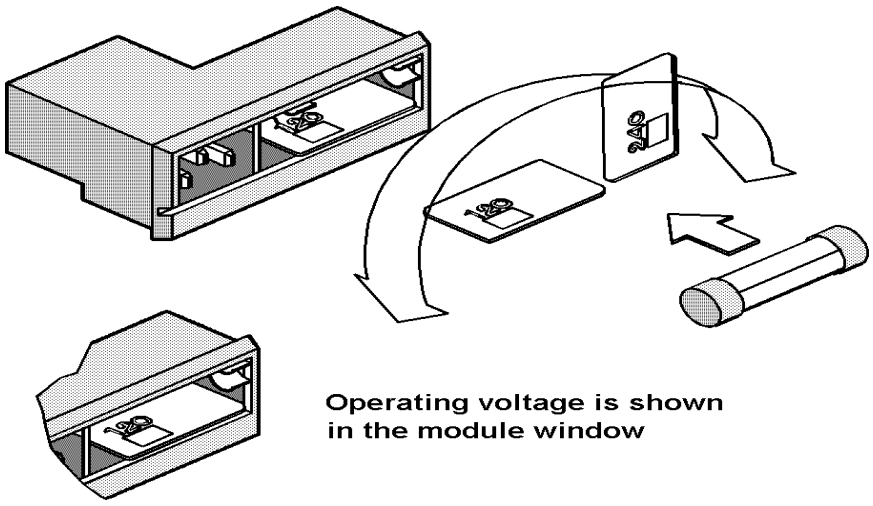


Figure 1-2. Voltage Selector and Fuse Holder

1.3 Performance Specifications

1.3.1 RF Output Frequency

Range: .01, .5, or 2 GHz to 20 or 26 GHz (see the serial number tag).

Resolution: 1 kHz (1 Hz with Option 16).

Accuracy and Stability: Identical to time base oscillator.

Time Base (Internal): 10 MHz

Aging Rate: $<1 \times 10^{-9}$/day after 72 hours continuous operation ($<5 \times 10^{-10}$/day with Option 28).

Temperature Stability: $<\pm 2 \times 10^{-10}$/ °C (0 to +50 °C).

Time Base (External): 5 MHz or 10 MHz, $\pm 1 \times 10^{-6}$ or better.

Switching Time: <50 ms (20 ms, typical) to within specified frequency accuracy.

1.3.2 RF Output Power

Maximum Leveled Output:

Frequency Range (GHz)	Standard	With Option 26
.01 to 2	+13 dBm	+13 dBm
>2 to <8[1]	+15 dBm	+15 dBm
8 to 15	+14 dBm	+13 dBm
>15 to 20	+13 dBm	+11 dBm
20 to 26.5	+9.5 dBm	+7.5 dBm

[1] Specification applies for 2 GHz for Models GT 9000S/2-20 and GT 9000S/2-26

Incremental Level Range: -20 to +20 dBm

Resolution: 0.01 dB, entry and display to -99.99 dBm (display is 0.1 dB at ≤-100.0 dBm).

Minimum Output Level: -10 dBm (-20 typical); -110 dBm with Option 26.

RF Off: Typically attenuates a 0 dBm signal to <-140 dBm at the output connector.

Output Accuracy (internally leveled, CW or frequency sweep modes, Scan/AM off): <±2 dB (-10 dBm to maximum specified power). Add ±.1 dB/10 dB with Option 26.

Output Flatness: <±2 dB

Output Switching Time: Typically <1 ms; 20 ms with attenuator change (Option 26).

Output Impedance: 50 Ω, nominal.

Output SWR: <2:1

External Leveling: Output power may be externally leveled by positive or negative ZBS detectors or power meters.

1.3.3 Spectral Purity

Harmonics
(measured at +6 dBm): -40 dBc, .01 to .1 GHz
-50 dBc, >.1 to 2 GHz
-65 dBc, >2 to 26 GHz

Subharmonics: None

Nonharmonics: <-55 dBc

Single-Sideband Phase Noise: dBc/Hz noise bandwidth, CW mode, all power levels

Freq.	Offset from Carrier				
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
250 MHz	-87	-87	-85	-122	-135
500 MHz	-97	-95	-95	-127	-135
2 GHz	-90	-91	-90	-125	-130
6 GHz	-80	-83	-81	-115	-130
10 GHz	-75	-80	-80	-105	-128
20 GHz	-72	-75	-75	-105	-120
23 GHz	-65	-70	-70	-97	-108
For 2 to 20 and 2 to 26 GHz instruments					
2 GHz	-83	-85	-84	-118	-130

Residual FM: Hz, RMS, CW mode

Frequency Range (GHz)	Post-detection Bandwidth	
	30 Hz to 3 kHz	50 Hz to 15 kHz
.01 to <0.5	10	75
.5 to 2	5	25
>2 to <8[1]	20	100
8 to 20	30	300
20 to 26.5	40	400

[1] Specification applies for 2 GHz for Model GT 9000S/2-26

1.3.4 Analog Frequency Sweep

Continuous sweep, generated within the instrument, is phase-lock corrected at the start frequency and at band crossing frequencies. It can be operated simultaneously with digital or analog power sweep.

Range: From FA (minimum frequency of instrument) to FB (maximum frequency of instrument).

Sweep Time: 2 ms to 200 s in five ranges. Minimum sweep time is determined by the sweep width and the maximum sweep speed.

Range	Resolution
2 ms to 20 ms	10 µs
20 ms to 200 ms	100 µs
200 ms to 2 s	1 ms
2 s to 20 s	10 ms
20 s to 200 s	100 ms

Minimum Sweep Width: 1 MHz

Maximum Sweep Speed: 600 MHz/ms

Band Crossing Dead Time (at 2 and 8 GHz): 50 ms, nominal

Sweep Width Resolution: 0.1% of sweep width

Start Frequency Accuracy: +0.5 MHz

Sweep Linearity (relative to a linear Ramp Out voltage, sweep time ≥100 ms): +1% of sweep width or ±50 MHz, whichever is less.

1.3.5 Analog Sweep Modes

Start/Stop (FA ≤ [F1 ≠ F2] ≤ FB): Sweeps up or down from a preset start frequency (F1) to a preset stop frequency (F2).

Start/Δ (FA ≤ [F1 ± ΔF] ≤ FB): Sweeps up or down from a preset start frequency (F1) through a preset sweep width (ΔF).

CTR/Δ (FA ≤ [CF ± (ΔF/2)] ≤ FB): Sweeps up or down through a preset sweep width (ΔF) centered symmetrically about a preset center frequency (CF).

D MKR (FA ≤ [Mx ≠ My] ≤ FB): Sweeps up or down from any preset marker (Mx) to any other preset marker (My).

1.3.6 Analog Sweep Functions

Auto:	Continuous cycle of the preset sweep.
Single:	A single cycle of the preset sweep, initiated by manual operation of the front panel pushbutton.
EXT:	A single cycle of the preset sweep, initiated by a trigger input from an external source.
Stop/Reset:	Stops the sweep when activated by the front panel pushbutton, to permit manual tuning of the frequency at any point in the sweep. Pressing the pushbutton a second time resets the sweep to the initial conditions.

1.3.7 Analog Sweep Frequency Markers

Eight intensity or amplitude markers, individually selectable from the front panel or via the GPIB.

Resolution:	Sweep width ÷ 4,000
Accuracy:	Same as sweep linearity except marker may vary ±25 mV relative to the linear 0 to +10 V RAMP OUT.
Amplitude Markers:	Approximately -3 dB change in RF output power during analog frequency sweep markers.

1.3.8 Digital (Step/Dwell) Frequency Sweep

Range:	FA (minimum frequency of instrument) to FB (maximum frequency of instrument).
Step Size:	Any increment within the frequency resolution.
Dwell Time:	May be set in 1 ms increments from approximately 1 ms to 200 sec.
Setup Time:	25 ms/step, typical.
Accuracy And Stability:	Same as in CW when locked at each step during dwell time.

1.3.9 Digital Sweep Modes

Start/Stop (FA ≤ [F1 ≠ F2] ≤ FB):	Sweeps up or down from a preset start frequency (F1) to a preset stop frequency (F2).
Start/Δ (FA ≤ [F1 ± ΔF] ≤ FB):	Sweeps up or down from a preset start frequency (F1) through a preset sweep width (ΔF).
CTR/Δ (FA ≤ [CF ± (ΔF/2)] ≤ FB):	Sweeps up or down through a preset sweep width (ΔF) centered symmetrically about a preset center frequency (CF).
Start/Steps (FA ≤ [F1 ± (step size × no. of steps)] ≤ FB):	Sweeps up or down from a preset start frequency (F1) through a preset number of frequency steps.

1.3.10 Digital Sweep Functions

Auto: Continuous cycle of the preset sweep.

Single: A single cycle of the preset sweep or (with stop activated) a single preset step, initiated by manual operation of the front panel pushbutton.

EXT: A single cycle of the preset sweep or (with stop activated) a single preset step, initiated by a trigger input from an external source.

EXT Step: A single step of a preset sweep, initiated by a trigger input from an external source.

Stop/Reset: Stops the sweep when activated by the front panel pushbutton, to permit manual tuning of the frequency at any point in the sweep. Pressing the pushbutton a second time resets the sweep to the initial conditions.

1.3.11 Analog Power Sweep

Continuous sweep, generated within the instrument. May be operated simultaneously with analog or digital frequency sweep.

Range: 20 dB maximum, up or down, within the incremental level range (-10 dBm to maximum specified output power).

Sweep Time: 2 ms to 200 sec in five ranges. Minimum sweep time is determined by the sweep width and the maximum sweep speed.

Range	Resolution
2 ms to 20 ms	10 µs
20 ms to 200 ms	100 µs
200 ms to 2 sec	1 ms
2 sec to 20 sec	10 ms
20 sec to 200 sec	100 ms

Minimum Sweep Width: 0.01 dB

Maximum Sweep Speed: 1 dB/ms

Sweep Level Resolution: 0.01 dB

Start Level Accuracy: +1 dB (-10 to +11 dBm)

Sweep Level Linearity: +5% of sweep width

1.3.12 Analog Power Sweep Modes

Start/Stop ($LA < [L1 \neq L2] \leq LB$): Sweeps up or down from a preset start level (L1) to a preset stop level (L2).

Start/Δ ($LA \leq [L1 \pm \Delta L] \leq LB$): Sweeps up or down from a preset start level (L1) through a preset sweep width (ΔL).

Ctr/Δ ($LA \leq [CL \pm (\Delta L/2)] \leq LB$): Sweeps up or down through a preset sweep width (ΔL) centered symmetrically about a preset center level (CL).

1.3.13 Analog Power Sweep Functions

Auto:	Continuous cycle of the preset sweep.
Single:	A single cycle of the preset sweep, initiated by manual operation of the front panel pushbutton.
Ext:	A single cycle of the preset sweep, initiated by a trigger input from an external source.
Stop/reset:	Stops the sweep when activated by the front panel pushbutton, to permit manual adjustment of the level at any point in the sweep. Pressing the pushbutton a second time resets the sweep to the initial conditions.

1.3.14 Digital (Step/Dwell) Power Sweep

Range:	LA (minimum level of instrument) to LB (maximum level of instrument).
Step Size:	Any multiple of 0.01 dB up to maximum sweep range.
Dwell Time:	May be set in 1 ms increments from approximately 1 ms to 200 sec.
Setup Time:	25 ms/step, typical.
Accuracy & Stability:	Same as in CW when leveled at each step during dwell time.

1.3.15 Digital Power Sweep Modes

Start/Stop (LA $\leq$ [L1 $\neq$ L2] $\leq$ LB):	Sweeps up or down from a preset start level (L1) to a preset stop level (L2).
Start/Δ (LA $\leq$ [L1 $\pm$ ΔL] $\leq$ LB):	Sweeps up or down from a preset start level (L1) through a preset sweep width (ΔL).
Ctr/Δ (LA $\leq$ [CL $\pm$ (ΔL/2)] $\leq$ LB):	Sweeps up or down through a preset sweep width (ΔL) centered symmetrically about a preset center level (CL).
Start/Steps (LA $\leq$ [L1 $\pm$(step size $\times$ no. of steps)] $\leq$ LB):	Sweeps up or down from a preset start level (L1) through a preset number of level steps.

1.3.16 Digital Power Sweep Functions

Auto:	Continuous cycle of the preset sweep.
Single:	A single cycle of the preset sweep or (with stop activated) a single preset step, initiated by manual operation of the front panel pushbutton.
Ext:	A single cycle of the preset sweep or (with stop activated) a single preset step, initiated by a trigger input from an external source.
Ext Step:	A single step of a preset sweep, initiated by a trigger input from an external source.
Stop/reset:	Stops the sweep when activated by the front panel pushbutton, to permit manual adjustment of the level at any point in the sweep. Pressing the pushbutton a second time resets the sweep to the initial conditions.

1.3.17 PM Envelope Parameters

Pulse/Square Wave Modulation (PM) specifications apply with Scan/AM and FM off. PM may be operated with FM.

On/Off Ratio:	>80 dB
Rise/Fall Times:	<10 ns
Overshoot, Undershoot & Ringing:	+2 dB, maximum
Settling Time (to within 1 dB):	<100 ns
Leveled Pulsed Output Power (referenced to leveled, unmodulated output power):	+0.5 dB, typical (≥100 ns pulse width); ±1 dB, typical (<100 ns pulse width).

1.3.18 Internally Generated PM Repetition Rate

Repetition Rate:

Range	Resolution
1 Hz to 100 Hz	1 Hz
100 Hz to 1 kHz	1 Hz
1 kHz to 10 kHz	10 Hz
10 kHz to 100 kHz	100 Hz
10 kHz to 1 MHz	1 kHz
1 MHz to 3 MHz	10 kHz

Accuracy:	+0.02% of range maximum value.
Jitter:	Same as instrument time base.

1.3.19 Internally Generated PM Delay

(referenced to Sync Output)

Range:	0 to 2 sec
Resolution:	10 ns
Accuracy:	±1% of setting or 20 ns, whichever is greater.
Jitter:	0.01% of setting or 100 ps, whichever is greater.

1.3.20 Internally Generated PM Width

Range:	50 ns to 2 sec
Resolution:	10 ns
Accuracy:	±1% of setting or 20 ns, whichever is greater.
Jitter:	0.01% of setting or 100 ps, whichever is greater.

1.3.21 External PM Envelope

(one envelope produced by each trigger supplied)

Repetition Rate:	5 Hz to 5 MHz
Pulse Delay:	Set by internal delay control.
Pulse Width:	Set by internal width control.
Input Trigger Required:	Positive or negative-going TTL level trigger pulse, >25 ns wide.

1.3.22 Externally Generated PM Envelope

(one envelope produced by each pulse supplied)

Repetition Rate:	5 Hz to 5 MHz, leveled output; DC to 10 MHz, unleveled output.
Pulse Delay (output envelope leading edge referenced to input pulse leading edge):	50 ns, typical
Input Pulse Required:	Positive or negative-going TTL level pulse, $\geq$50 ns wide (leveled output); $\geq$20 ns wide (unleveled output).

1.3.23 FM Envelope Parameters

(Wide or Narrow Mode)	Frequency Modulation (FM) specifications apply with Scan/AM and PM off. FM may be operated simultaneously with Scan/AM or PM.
Distortion:	<5%
Incidental AM:	<±0.2%/MHz of deviation
Modulation Accuracy:	+5%, at maximum deviation and a 1 kHz rate.

1.3.24 FM Envelope Parameters (Wide Mode)

Max Deviation:	2.5 MHz peak (≤2 GHz); 10 MHz peak (>2 GHz). For 2-26 GHz instruments: 10 MHz peak (*$\geq$2 GHz)*.
Flatness:	+2 dB for rates from 10 Hz to 1 MHz; ±3 dB for rates from 1 to 5 MHz.
Residual FM (50 Hz to 15 kHz post-detection bandwidth):	<750 Hz, typical (at ≤2 GHz); <3 kHz, typical (at >2 GHz). For 2-26 GHz instruments: <3 kHz rms, typical (*$\geq$2 GHz)*.

1.3.25 FM Envelope Parameters (Narrow Mode)

Max Deviation (narrow mode):	The lesser of 25 × Fmod or 2.5 MHz, peak (≤2 GHz); the lesser of 100 × Fmod or 10 MHz, peak (>2 GHz). For 2-26 GHz instruments: the lesser of 100 × Fmod or 10 MHz, peak (*$\geq$2 GHz)*.
Flatness (narrow mode):	+2 dB for rates from 20 kHz to 1 MHz; ±3 dB for rates from 1 to 5 MHz.
Residual FM (narrow mode):	Same as an unmodulated RF output (see Spectral Purity).

1.3.26 FM Indicator

Readout:	6 digits; displays deviation (also displays rate if Option 24 is installed).

1.3.27 Internally Generated FM Envelope

(Option 24 only)

Waveform: Sine, square, or triangle wave.

Rate: 10 Hz to 1 MHz

Resolution: 1 Hz

Accuracy: +0.01 Hz

1.3.28 Externally Supplied FM Envelope

Waveform: Any waveform compatible with bandwidth considerations.

Rate: 10 Hz to 5 MHz

Sensitivity: Settable; calibrated for 1 Vp input

External FM Sensitivity			
RF Output Frequency	**Deviation at 1 Vp in**	**Deviation Range**	**Deviation Increments**
<2 GHz	2.5 MHz	0 to 2.5 MHz	625 Hz
>2 GHz	10 MHz	0 to 10 MHz	2.5 kHz
For 2-26 GHz instruments:			
>2 GHz	10 MHz	0 to 10 MHz	2.5 kHz

Input Impedance: 50 Ω, nominal

1.3.29 Amplitude Modulation

☛ NOTE: The AM specifications given here do not apply to instruments with Option 27; see Appendix A for option information. AM may be operated simultaneously with FM.

Modulation Depth: 0 to 90%, typical, at 0 dBm out

Modulation Bandwidth: DC to 30 kHz, ±3 dB, typical, at 0 dBm out

Modulation Accuracy: Set depth ±10% depth (e.g., the depth as a 50% setting may be 40 to 60%).

1.3.30 AM Indicator

Depth Readout: 4 digits; 0.1% depth resolution

Rate Readout (Option 24 only): 6 digits; 1 Hz rate resolution

1.3.31 Internally Generated AM Envelope

(Option 24 only)

Waveform: Sine, square, or triangle wave.

Rate: 1 Hz to 100 kHz

Resolution: 1 Hz

Accuracy: +0.01 Hz

1.3.32 Externally Supplied AM Envelope

Waveform: Any waveform compatible with bandwidth considerations.

Input Sensitivity: 1 Vpp for 50% depth ±10% depth, at a 1 kHz rate.

Depth is settable; sensitivity is calibrated for a 2 Vpp input, as shown in the table:

AM Input Sensitivity			
Depth at 1 Vpp in	**Depth at 2 Vpp in**	**Depth Range**	**Depth Increments**
50%	~100%*	0 to 90%	.1%
* Although the hypothetical 100% modulation depth at 2 Vpp is not within specified performance limits, 2 Vpp is used as a reference level for AM input sensitivity.			

Input Impedance: 600 Ω, ±120 Ω

1.3.33 External Automatic Level Control

Ext ALC Input: Signal input for remote leveling of output power, by positive or negative polarity ZBS detectors, or by applicable power meters.

Range: 500 µV to 2 V

Loop Bandwidth: 50 kHz, nominal (ZBS detector); 0.7 Hz, nominal (power meter)

Input Impedance: 10 kΩ, nominal

1.3.34 Front Panel Inputs/Outputs

(type BNC connectors, unless otherwise stated)

RF OUT: The RF output signal on a type SMA connector. (Option 22 relocates the connector to the rear panel.)

SWP TRIG IN: This connector accepts a sweep trigger input, ≥50 ns wide, at TTL levels, to initiate a sweep or step.

RAMP OUT: A 0 to +10 V ramp output, proportional to progress between sweep limits.

AM IN: Input signal for external amplitude modulation.

FM IN: Input signal for external frequency modulation.

PM IN: Input signal for external pulse modulation.

1.3.35 Rear Panel Inputs/Outputs

(type BNC connectors, unless otherwise stated)

5-6 MHz IN: A 5 to 6 MHz input, at 2 Vpp (input impedance is 50 Ω, nominal) for controlling the frequency of the signal generator; it makes possible fine frequency resolution control from an external synthesized source (increasing the input above 5 MHz causes a one-for-one change in the RF output frequency).

REF OUT: A buffered sine wave output at 10 MHz, 2 Vpp into 50 Ω, derived from the internal timebase, or an external timebase.

REF IN:	An external timebase input signal, 10 MHz or 5 MHz, $\pm 1 \times 10^{-6}$ or better, 0.5 to 5 Vpp; overrides the internal time base. Input impedance is 100 Ω, nominal. To specify the frequency of the external timebase, press [SHIFT] [SPECIAL] [11]. Press [MODE] to toggle between the 10 MHz and 5 MHz settings.
PEN LIFT OUT:	TTL compatible output, low during a sweep and high during a sweep retrace.
STOP/SWP I/O:	TTL compatible input/output (low input to stop a sweep, or low output to indicate that a sweep has been stopped).
LOCK/LEVEL OUT:	A TTL compatible output (high to indicate that the output frequency is phase locked and the output power is leveled).
ALC IN:	An input signal, for remote level control of output power by positive or negative polarity ZBS detectors, or by applicable power meters (see Section 1.3.16).
PM VIDEO OUT:	A pulse modulation envelope waveform, at TTL levels (approximately 1 V into 50 Ω).
$\overline{\text{BLANK/MKR}}$ OUT:	A sweep related output: +5 V during band changes, filter changes, and sweep retrace; 0 V during sweep; -5 V at marker frequencies.
RAMP OUT:	A 0 to +10 V ramp output, proportional to progress between sweep limits (it duplicates the front panel RAMP OUT).
PM SYNC OUT:	A 50 ns wide trigger pulse output (approximately 1 V into 50 Ω), coincident with the leading edge of the pulse modulation envelope waveform.
NEG BLANK OUT:	A sweep related output: -5 V during band changes, filter changes, and sweep retrace; 0 V during sweep.
SWP TRIG IN:	This connector accepts a sweep trigger input, ≥50 ns wide, at TTL levels, to initiate a sweep or step (it duplicates the front panel SWP TRIG IN connector).
AM SIG OUT:	An amplitude modulation waveform output, at 2 Vpp into 1 MΩ.
.5V/GHz OUT:	An output voltage directly proportional to the RF output frequency.
PM IN:	This connector accepts the input signal for external pulse modulation (it duplicates the front panel PM IN connector).
FM SIG OUT:	A frequency modulation waveform output, at 2 Vpp into 1 MΩ.
AM IN:	This connector accepts the input signal for external amplitude modulation (it duplicates the front panel AM IN connector).
FM/ΦM IN:	This connector accepts the input signal for external frequency modulation (it duplicates the front panel FM IN connector).

1.3.36 General Specifications

Remote Interface:	IEEE STD 488-1978 (all parameters except AC power on/off).
Operating Temperature:	0 to 50 °C.
Environmental:	Complies with MIL-T-28800E, Type III, Class 5, Style E.
Power:	100/120/220/240 Vac ±10%, 50-400 Hz, 250 Watts, nominal.
Dimensions:	13.3 cm high x 42.5 cm wide x 60.9 cm deep (5.25 in x 16.75 in x 24 in)
Volume:	1.22 ft^3 (.0345 m^3)
Weight:	20.5 kg (45 lbs)

2

Operation

2.1 Introduction

This chapter contains the operating instructions for the GT 9000S Synthesized Microwave Sweeper. It is divided into the following operational areas:

- The Front Panel
- The Rear Panel
- Remote Programming (GT 9000S Syntax)
- Remote Programming (1026 Syntax)
- HP 8757 Interface
- Giga-tronics 8003 Interface

2.2 Front Panel Description

The Model GT 9000S front panel is versatile and easy to use. It is designed with displays and fields as illustrated in Figure 2-1. Each display and field is contained within a surrounding border, and is discussed below to identify its functions.

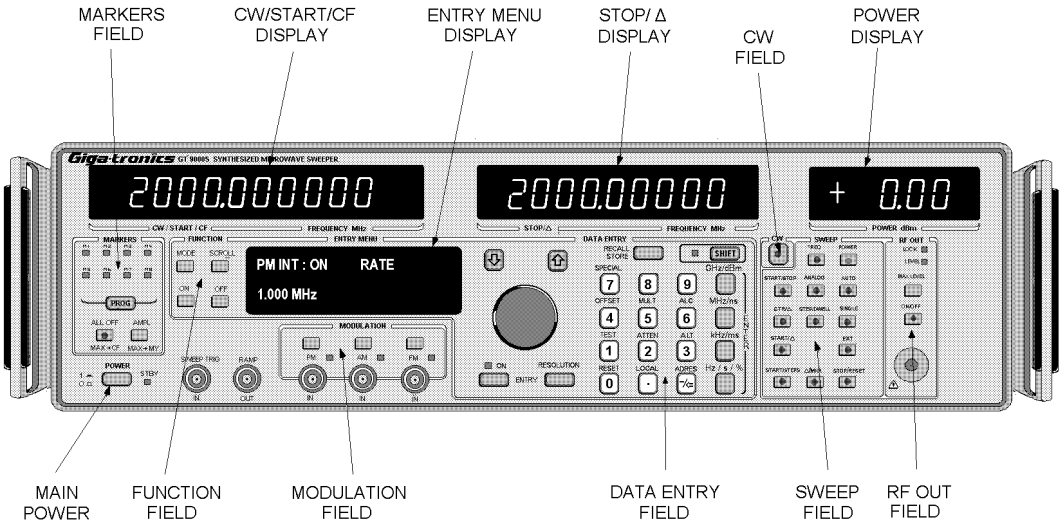


Figure 2-1. Front Panel Layout

2.2.1 Entry Menu

The Entry Menu displays real-time configuration and operating data (see Section 2.2.2). Front panel settings are automatically saved in non-volatile memory when the instrument is powered off, and restored when it is powered back on. Up to ten front panel setups can be saved in non-volatile memory for later retrieval.

The top line of the Entry Menu identifies any parameter (such as frequency or level) which needs to be specified for the selected function. The bottom line displays the current value of that parameter. The value can be changed with the keypad, digi-dial, or up-down keys.

At power-on, the Entry Menu displays the model and frequency range of the instrument (e.g., **MODEL GT 9000S, 10 MHz to 26 GHz**). The last settings made before power-off remain in effect. The default settings can be enabled with the Reset function (see Section 2.2.1). The default settings are minimum frequency, 0 dBm level, no modulation.

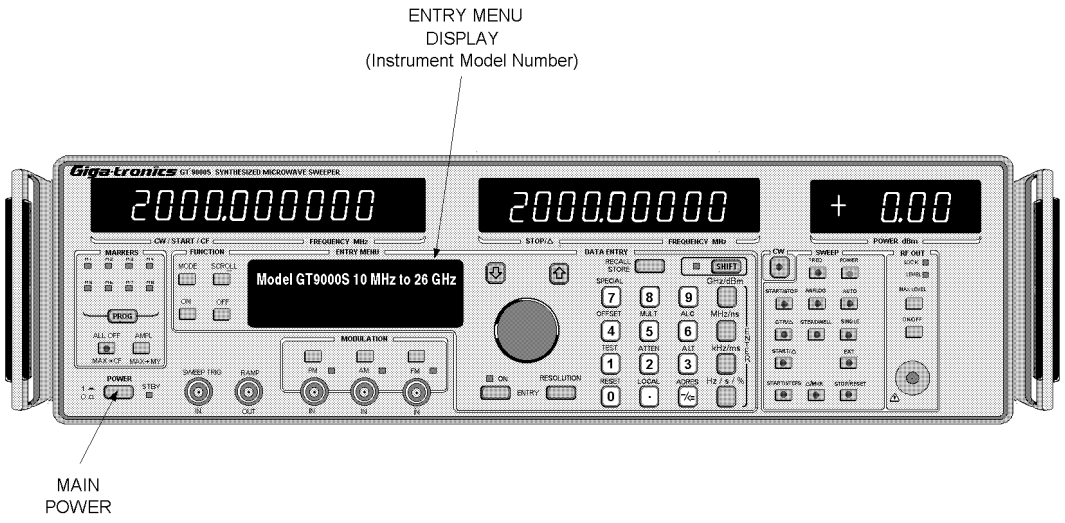


Figure 2-2. Entry Menu Display

2.2.2 Data Entry Field

The Data Entry field contains the following controls:

- Numeric keypad and parameter units keys (GHz, MHz, kHz and Hz).
- The Digi-Dial
- Up/down keys
- Entry On/Off
- Entry Resolution
- Store/Recall
- Shift key

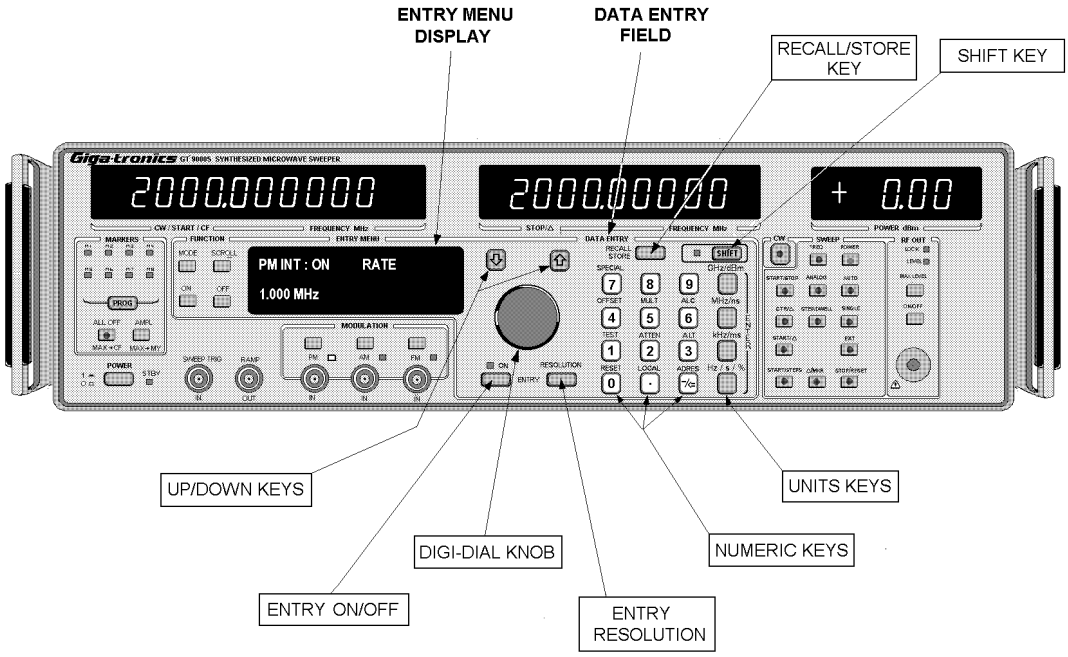


Figure 2-3. Data Entry Field

The value of a parameter can be entered in any of three methods: The numeric keypad, the digi-dial, or the up/down keys.

Numeric Keypad

The first method is to enter digits with the numeric keypad. Keyed digits appear in the bottom line of the Entry Menu. When all digits have been entered, press the appropriate units key (the right column of the numeric keypad). The units key has the same effect as pressing an Enter key, and sets the parameter to the displayed value. If you enter a value exceeding the allowable range for that parameter, the setting will default to the nearest value that is within range.

The –/⇐ key (located below the numeric 3 key) has a dual function. If it is pressed before a numeric key, a minus sign will precede the value entered. If it is pressed after one or more numeric keys, it functions as a backspace.

Digi-Dial

The second method of data entry employs the digi-dial to change the value of the parameter displayed in the Entry Menu. The value on the bottom line of the Entry Menu changes as the knob is turned until the minimum or maximum value is reached. If necessary, the entry resolution of the digi-dial can be changed (see *Entry Resolution* below).

Up/Down Keys

The third method of data entry is to increment or decrement the parameter value by steps with the up/down keys. This is similar in operation to the digi-dial. If necessary, the step resolution of the up/down keys can be changed (see *Entry Resolution* below).

Entry On/Off

The digi-dial and up/down keys can be disabled when not in use to avoid accidental changes to parameters. They are toggled on and off by pressing Entry [ON], located below the digi-dial knob. The LED above the On key turns on whenever the keys are enabled, and turns off when they are disabled.

When you are finished using the digi-dial and up/down keys, press Entry [ON] to disable their operation so that erroneous information will not be entered if they are touched inadvertently.

Entry Resolution

The resolution of the digi-dial and the up/down keys is programmable and is set for both at the same time. Entry resolution is limited only by the resolution of the instrument (e.g., in the case of a GT 9000S with 1 Hz frequency resolution, entry resolution can range from 1 Hz to the maximum frequency). Entry resolution is set independently for different functions (for example, resolution can be different for RF frequency and PM rate).

To set the resolution for the parameter displayed in the Entry Menu, press [RESOLUTION] in the Data Entry field. The Entry Menu top line will now read **... RESOLUTION**. Enter the desired value of resolution with the numeric keypad and terminate with the appropriate units key. Resolution can also be stepped in increments of powers of ten with the up/down keys (e.g., 2, 20, 200). When you have set the desired resolution, press Entry [RESOLUTION] or a unit key to return to the numeric entry mode.

Recall/Store

Up to ten front panel setups can be stored in non-volatile memory. After the desired parameters have been set (or allowed to default), the setting can be stored by first pressing [SHIFT] (see Section 2.2.3), followed by [STORE] and then the desired memory number (0 to 9). The data is stored immediately. To recall a setup, press [RECALL] followed by the memory number (0 to 9).

Shift

The SHIFT key converts the numeric keys into the functions printed in blue above the respective keys. See Section 2.2.3 for operation of shifted functions.

2.2.3 Shifted Functions

A number of the keys in the numeric keypad have an additional use when preceded by the Shift key (see Figure 2-4). These additional uses are labeled in blue. When [SHIFT] is pressed, the LED to the left lights and remains on until a function key is pressed (the Shift key and the function key should not be held down at the same time).

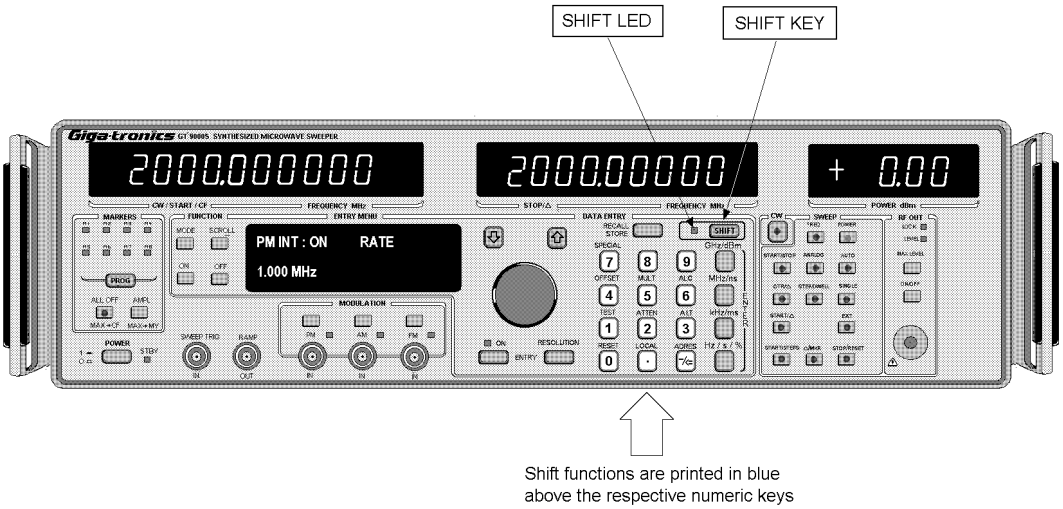


Figure 2-4. Shifted Functions

The following shifted functions are available (each heading is followed by the numeric key which performs the shifted function).

Reset (0)

Press [SHIFT] [RESET] to reset parameters to the default conditions listed in Table 2-1.

Table 2-1. Parameter Default Conditions

Parameter	Default Condition	Parameter	Default Condition
CW Frequency	Minimum	FM Rate (Opt. 24)	1 kHz
RF	On	FM Mode (Opt. 24)	Sine
RF Level	0 dBm	FM Deviation	5 MHz
Amplitude Modulation	Off	Pulse Modulation	Off
AM Rate (Opt. 24)	1 kHz	PM Rate	100 kHz
AM Mode (Opt. 24)	Sine	PM Mode	Internal
AM Depth	50%	PM Width	5 us
Frequency Modulation	Off	PM Delay	0 ns

Local (.)

The LOCAL function disables remote control and returns control of all instrument functions to the front panel. All parameters programmed while in the remote mode remain in effect.

Adrs (-/⇐)

The ADRS (address) function, when first activated, displays **GPIB ADDRESS** on the top row of the Entry Menu. The current address is displayed on the lower row. The address value (0 to 30) can be changed with the keypad, the digi-dial or the up/down keys. If the keypad is used to enter a new value, any units key can be used as an enter key. Selecting any other function will clear the Entry Menu and display the new function.

Test (1)

The TEST function performs an instrument self-test program to verify that all circuits are functioning normally.

Atten (2)

The ATTEN (Attenuator) function sets the step attenuator to a fixed value. While the attenuation is fixed, the output power is still controllable over a limited range by the automatic level control loop. For example, if the attenuator is fixed at -20 dBm, the instrument can be set from -40 to 0 dBm (that is, from 20 dB below the attenuator setting to 20 dB above it). The top of the range can only be reached if the instrument is capable of generating 20 dBm at that frequency. If the instrument cannot achieve sufficient power to provide the requested level, the level indicator will turn off. This feature allows the output level to be varied across what would ordinarily be an attenuator switch point to prevent the slight discontinuity in level which can occur at such a switch point.

Alt (3)

The ALT (alternate) function enables the sweeper to alternate between two or more sweep settings. The Entry Menu displays **ALT BETWEEN**. Enter the memory numbers where the desired sweep setups are stored (for example, enter 134 to alternate between the sweep setups stored at locations 1, 3, and 4).

Offset(4)

The OFFSET function makes it possible to add an offset to the frequency display for convenience in certain test applications involving mixers. The offset can be positive or negative. The size of the offset is limited by the frequency range of the instrument. The value of the offset can be entered with the keypad, the digi-dial, or the up/down keys. After you have entered an offset frequency, the offset will be added to the frequency display; the actual RF output frequency will be displayed in the Entry Menu.

Mult (5)

The MULT (multiplier) function enables operator control of a frequency multiplier or extender (such as any of the Giga-tronics Series 800 instruments) by entering the desired output frequency from the keypad of the instrument. Both the Entry Menu and the frequency display will show the desired final output frequency. However, the actual output frequency of the GT 9000S will equal the displayed value divided by the multiplication factor. The value of the multiplication factor can be entered with the keypad, the digi-dial, or the up/down keys.

For example, if a 3x frequency multiplier is being used, set the multiplier value to 3 and select an output frequency of 30 GHz. The instrument will generate a 10 GHz output to the frequency multiplier.

ALC (6)

The use of the ALC (automatic level control) function allows the ALC circuit to take level feedback from an external detector or power meter DC-output (see the rear panel External ALC connector).

Special (7)

The SPECIAL feature provides access to numbered special functions. When you press [SHIFT] [SPECIAL], the Entry Menu displays **ENTER SPECIAL #** or **SCROLL**. Use the Scroll key to review the available functions listed below.

00 Erase Memories. Press [ON] to erase stored setup memories 0 to 9.

01 Model & Version. Press [ON] to display the model number, frequency range, and software version.

02 Display Bright. Press [ON] to adjust the brightness of the entry display.

11 Ext Ref. Select 5 MHz or 10 MHz external reference (see Option 11).

20 RF Off @ PWR Up. This function controls RF output power upon instrument power-up. Press [ON] or [OFF] to enable or disable this function.

21 RF ON @ FREQ CNG. This function controls RF power output during frequency changes, except during band or filter changes. Press [ON] or [OFF] to enable or disable this function.

30 Special Step Sweep. In this version of step sweep, when the dwell time is set, it is interpreted as the total sweep time and the step size is calculated by the instrument.

40 HP GPIB Syntax. Press [ON] to use the normal (GT 9000S) remote control command set.

41 GT GPIB Syntax. Press [ON] to use the Giga-tronics 1026 remote control command set.

50 Yig Fast Mode. Press [ON] or [OFF] to enable or disable (this function is used only for test purposes).

51 Unlocked Mode. Press [ON] or [OFF] to enable or disable (this function is used only for test purposes).

99 Clear Specials. Press [ON] to reset all special functions to the default mode.

Store

The Recall/Store key is used for storing front panel setups in non-volatile memory. See Section 2.2.2 for instructions on how to store and recall panel setups.

MX → CF and Mx - My

These are also shifted function keys in the Markers field. See Section 2.3.2 for their description and operation.

2.2.4 CW Frequencies

To set a fixed frequency output from the generator, press [CW] and then key the desired frequency (see Figure 2-5). For example, enter

[CW] [2.468] [GHz]

When you press [CW], the LED in that key turns on and the Entry Menu displays **CW FREQUENCY** on the top line. The frequency value will display on the bottom line in real-time as the numbers are keyed in. The CW/Start/CF display shows the value last set. Enter the desired value then press the units key to set the output and CW display to the new frequency.

Fine adjustments of the frequency can be made at any time by enabling the digi-dial and up/down keys (see Section 2.2.2). If it is necessary to change the step resolution of the digi-dial or the up/down keys, press Entry [RESOLUTION], then use the up/down keys or the numeric keypad and units keys to select the desired resolution. The Entry Menu will show **FREQ RESOLUTION** while you are adjusting the resolution. After the resolution is set, press [CW] again to adjust the frequency in the chosen increments. When you are finished using the digi-dial and up/down keys, press Entry [ON] again to disable their operation so that erroneous information will not be entered if they are touched inadvertently.

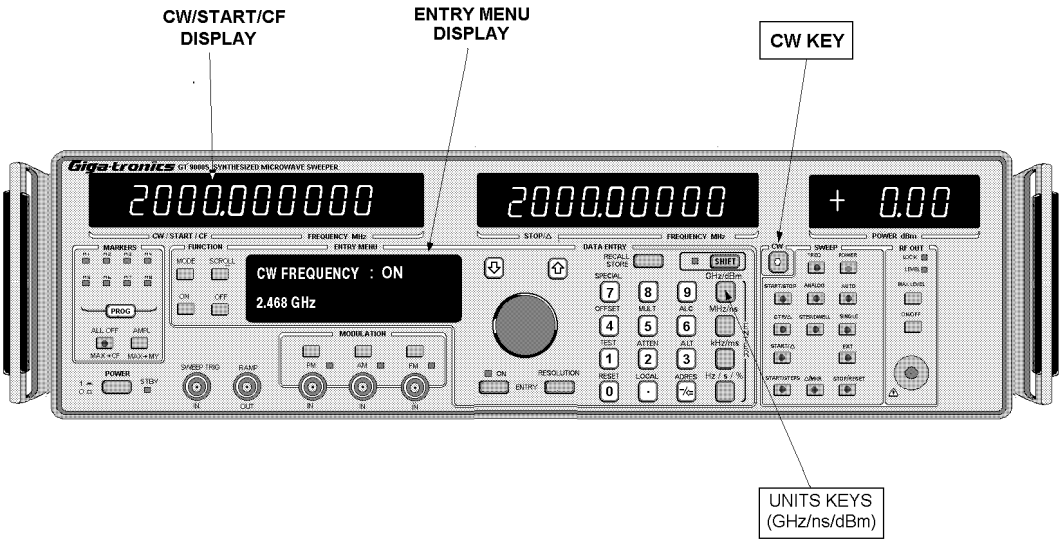


Figure 2-5. CW Frequencies

2.2.5 RF Level

To set the RF power output from the signal generator, press [LEVEL]. Enter the desired power level with the numeric keypad, then press the [dBm] units key. If a negative value is desired, press [-] before the first value key (see Figure 2-6). For example, to set the RF level to -15 dBm, enter

[LEVEL] [-] [15.5] [dBm]

When you press [LEVEL], the Entry Menu displays **RF LEVEL** with the value and units of the last level setting, and will display the real-time numbers as they are keyed in. The Power display shows the last level setting until [dBm] is pressed. After the desired power setting has been keyed in, press [dBm] to change the output and Power display to the selected level.

Fine adjustments of the power can be made at any time by enabling the digi-dial and up/down keys (see Section 2.2.2). If it is necessary to change the power resolution of the digi-dial or the up/down keys, press [RESOLUTION], then use the up/down keys or the numeric keypad and units keys to select the desired resolution. The Entry Menu will display **POWER RESOLUTION** while you are adjusting the resolution. After the resolution is set, press [LEVEL] again to adjust the level in the chosen increments. When you are finished using the digi-dial and up/down keys, press Entry [ON] again to disable their operation so that erroneous information will not be entered if they are touched inadvertently.

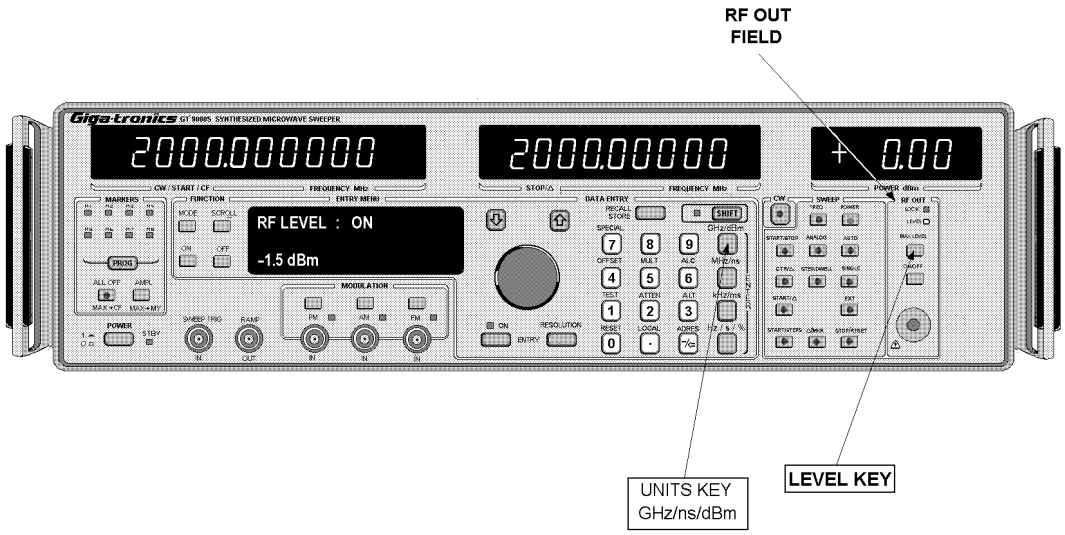


Figure 2-6. RF Level

2.2.6 Pulse Modulation

External modulation signals are applied to the PM IN connector, which is duplicated on the front and rear panels.

The Pulse Modulation function has a number of programmable modes and parameters (see Figure 2-7).

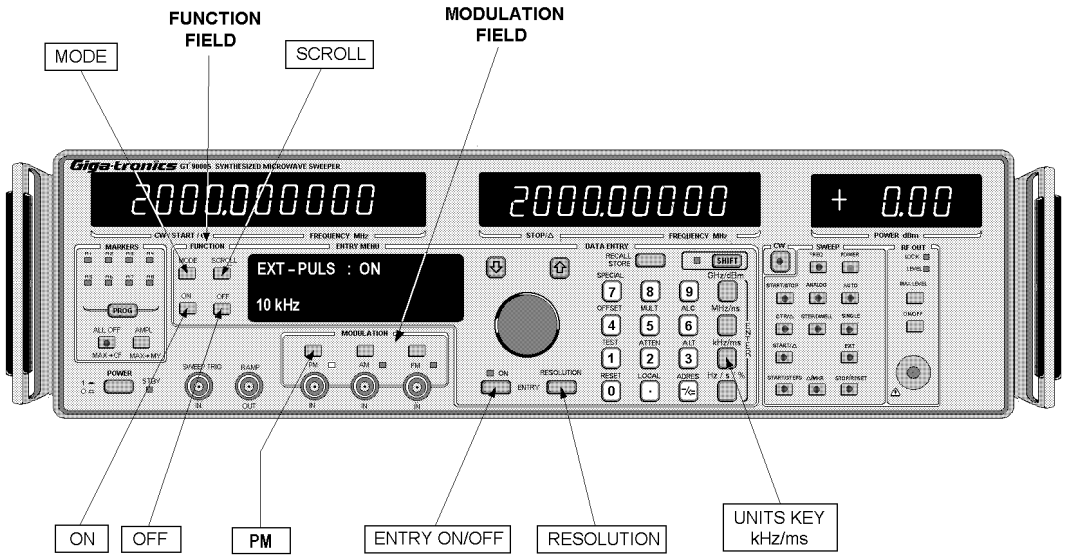


Figure 2-7. Pulse Modulation

When you press [PM] in the Modulation field, the Entry Menu displays the last mode, whether PM is on or off, and the last parameter with its value.

The On and Off keys in the Function field turn the modulation on and off.

For some functions, it is necessary to select sub-functions as well. For example, the PM function requires you to specify such parameters as rate, width, and delay. Sub-functions are selected with the Mode and Scroll keys in the Functions field.

Press [MODE] to change the mode to any of the selections below.

INT	Internal
EXT + PULS	External pulse positive true
EXT - PULS	External pulse negative true
PM + TRIG	External rising edge trigger
PM - TRIG	External falling edge trigger

Press [SCROLL] to select the mode parameters:

RATE	Pulse rate
WDTH	Pulse width
DELY	Pulse delay

When RATE, WDTH or DELY is selected, the appropriate numeric value can be entered through the Data Entry field. For example, to set an internal 10 kHz rate 50 µs width pulse with a sync to output delay of 300 ns, enter

[PM] [MODE] [SCROLL] [10] [kHz] [SCROLL] [50] [us] [SCROLL] [300] [ns] [ON]

When you first press [PM], the Entry Menu will display the last setting. Press [MODE] repeatedly until INT is displayed in the Entry Menu. Now press [SCROLL] repeatedly until **RATE** displays in the Entry Menu. Key in the desired numeric value [10] followed by the appropriate units [kHz]. Note that the new value is displayed in the Entry Menu as it is keyed in, but does not become effective until the units key is pressed. Press [SCROLL] again and WDTH displays in the Entry Menu. Enter the value with the numeric keys.

Press [SCROLL] again and **DELY** displays in the Entry Menu. Enter the value with the numeric keys, then press [ON] to activate Pulse Modulation.

Fine adjustments of rate, width, and delay can be made at any time by enabling the digi-dial and up/down keys. (see Section 2.2.2). If it is necessary to change the step resolution of the digi-dial or the up/down keys, press [RESOLUTION], then select the desired resolution with the up/down keys or the numeric keypad and units keys. The Entry Menu will display **PULSE RATE RESOL, PULSE WDTH RESOL**, or **PULSE DELY RESOL** while you are adjusting the resolution. After the resolution is set, press [PM] again to adjust the level in the chosen increments. When you are finished using the digi-dial and up/down keys, press Entry [ON] again to disable their operation so that erroneous information will not be entered if they are touched inadvertently.

2.2.7 Frequency Modulation

Modulating signals for frequency modulation must be applied to the FM IN connector from an external source, unless Option 24 (internal modulation) is installed. The FM IN connector is duplicated on the front and rear panels.

The FM function has a number of programmable modes and parameters (see Figure 2-8).

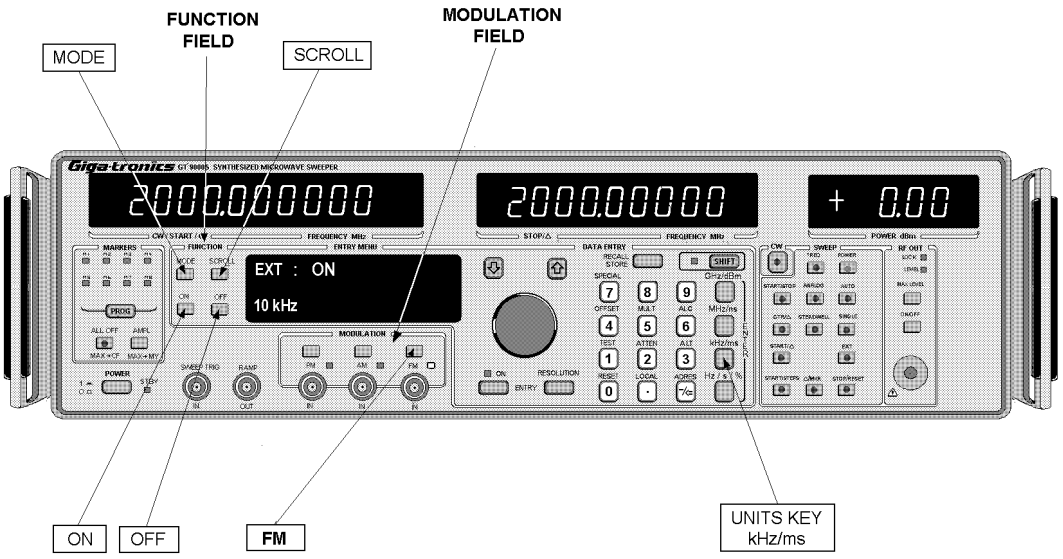


Figure 2-8. Frequency Modulation

When the FM key is pressed, the Entry Menu shows the last mode set, whether FM is on or off, and the last parameter set and its value. To select Narrow FM, press [SHIFT] [FM]. To return to Wide FM, press [SHIFT] [FM] again. The Narrow FM mode is indicated by FM*n* in the Entry Menu. Press [MODE] in the FUNCTION field to change the mode.

SIN	Sine wave (Option 24 only)
SQR	Square wave (Option 24 only)
TRI	Triangle wave (Option 24 only)
EXT	External source

Press [SCROLL] in the FUNCTION field to select the parameters:

RATE	Modulation rate (Option 24 only)
DEV	Deviation

When either RATE or DEV is selected, the appropriate numeric value can be entered through the Data Entry field. The On and Off keys in the Function field to turn the modulation on and off.

For example, to select 10 kHz sine wave modulation at a deviation of 300 kHz, enter

[FM] [MODE] [SCROLL] [10] [kHz] [SCROLL] [300] [kHz] [ON]

When you first press [FM], the Entry Menu displays the last setting. Press [MODE] repeatedly until the desired mode is displayed in the Entry Menu. Now press [SCROLL] repeatedly until RATE displays in the Entry Menu. Key in the desired numeric value [10] followed by [kHz]. Note that the value is displayed in the Entry Menu as it is keyed in. The new value becomes effective only when a units key is pressed. Press [SCROLL] again and **DEV** displays in the Entry Menu. Use the numeric entry to set the value. Press [ON] to activate frequency modulation.

Fine adjustments of either RATE or DEV can be made at any time by enabling the digi-dial and up/down keys. To do so, press [SCROLL] to select the parameter to be adjusted, then enable the digi-dial and the up/down keys (see Section 2.2.2). If it is necessary to change the step resolution of the digi-dial or the up/down keys, press [RESOLUTION], then enter the desired resolution with the up/down keys or the numeric keypad, and a units key. The Entry Menu will display **FM RATE RESOL**, or **FM DEV RESOL** while you are adjusting the resolution. After the resolution is set, press [FM] again to adjust the level in the chosen increments. When you are finished using the digi-dial and up/down keys, press Entry [ON] again to disable their operation so that erroneous information will not be entered if they are touched inadvertently.

2.2.8 Amplitude Modulation

NOTE: Modulating signals for amplitude modulation must be applied to the AM IN connector (which is duplicated on the front and rear panels) from an external source, unless Option 24 (internal modulation) is installed.

The Amplitude Modulation function has a number of programmable modes and parameters (see Figure 2-9).

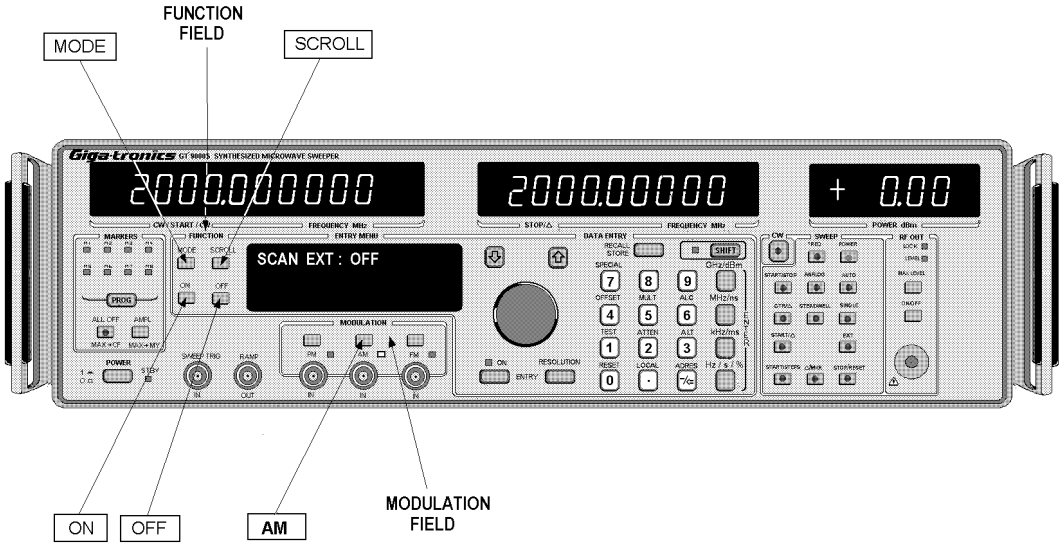


Figure 2-9. Amplitude Modulation

When the AM key in the MODULATION field is pressed, the Entry Menu shows the last mode, whether AM is on or off, and the last parameter with its value. Press [MODE] in the FUNCTION field to change the mode.

SIN	Sine wave (Option 24 only)
SQR	Square wave (Option 24 only)
TRI	Triangle wave (Option 24 only)
EXT	External source

Press [SCROLL] in the FUNCTION field to select the parameters:

Rate	Modulation rate (Option 24 only)
Depth	Modulation depth When either RATE or DEPTH is selected, the appropriate numeric value can be entered with the data entry system. The On and Off keys in the FUNCTION field turn the modulation on and off.

For example, if you wish to set a 10 kHz sine wave modulation at a depth of 30%, enter:

[AM] [MODE] [SCROLL] [10] [kHz] [SCROLL] [30] [%] [ON]

When you first press [AM], the Entry Menu will automatically show the last setting. Press [MODE] repeatedly until the desired mode is displayed in the Entry Menu. Now press [SCROLL] repeatedly until RATE is displayed in the Entry Menu. Key in the desired numeric value [10] followed by [kHz]. Note that the value is displayed in the Entry Menu as it is keyed. The new value becomes effective only when the units key is pressed. Press [SCROLL] again and DEPTH displays in the Entry Menu. Again, use the numeric entry to set the value. Note that the only valid units are %. Now press [ON] to turn on the Amplitude Modulation.

Fine adjustments of RATE or DEPTH can be made at any time by enabling the digi-dial and up/down keys. To do so, press [SCROLL] to select the parameter to be adjusted, then enable the digi-dial and the up/down keys (see Section 2.2.2). If it is necessary to change the step resolution of the digi-dial or the up/down keys, press [RESOLUTION], then enter the desired resolution. The Entry Menu will display **AM RATE RESOL**, or **AM DEPTH RESOL** while you are adjusting the resolution. After the resolution is set, press [AM] again to adjust the level in the chosen increments. When you are finished using the digi-dial and up/down keys, press Entry [ON] again to disable their operation so that erroneous information will not be entered if they are touched inadvertently.

2.3 Sweep-Related Features

2.3.1 Front Panel Connectors

The **RAMP OUT BNC** connector (duplicated on the front and rear panels) provides a 0 to +10 V output that is proportional to progress between sweep limits. The ramp output is used in all types of sweeping (frequency or power sweeping in analog or digital modes). When frequency and power are swept simultaneously, the ramp output represents frequency. In CW mode, the output is a fixed voltage proportional to the output frequency (with 0 and +10 V representing the limits of the frequency range).

The **SWP TRIG IN BNC** connector on the front panel accepts an external sweep trigger input in the form of a TTL low-going pulse (width ≥50 ns).

For additional sweep-related signals, see *Rear Panel BNCs* in Section 2.4.

2.3.2 Markers

M1 - M8

Markers M1 through M8 are used in frequency sweeping. When the light above a marker number is on, it indicates that the marker is enabled.

PROG

This key displays the selected marker in the Entry Menu. Press [PROG] to display a marker number, the frequency value, and whether the marker is on or off. Each time you press [PROG], it increments to the next marker (use [SCROLL] to decrement). Use the numeric keypad, the digi-dial or the up/down keys to set the frequency, and the On and Off keys in the Function field to enable or disable a marker. You can change the frequency of a marker or turn it on or off only while that marker is displayed.

ALL OFF

This feature turns all markers off and back on to the last programmed marker setup. Marker frequency values remain stored in memory and can be recalled when the selected marker is activated.

AMPL

Functioning markers are usually displayed as intensified dots on a CRT display. By selecting [AMPL], enabled makers are displayed as amplitude spikes (an abrupt discontinuity in the sweep trace).

MX → CF

This shifted function sets the center frequency of the sweep to the marker displayed. Select any marker M1 through M8, then press [SHIFT] [MX→CF] to change the center frequency of the sweep of the selected marker frequency. The frequency length will not change unless the new sweep limit is greater than the frequency range of the unit. The instrument will automatically scale the frequency length within the operating frequency range.

MX - MY

This shifted function displays the difference between M3 and M1.

2.3.3 Frequency Step/Dwell Sweep Operation

Frequency Sweep has a number of programmable features, modes of operation, and parameters (see Figure 2-10). To initiate a sweep, press [FREQ] in the SWEEP selection area. The LED in the CW key will extinguish, while the LED in the FREQ key and any other associated keys will light. Press [CW] to return operation to a fixed frequency.

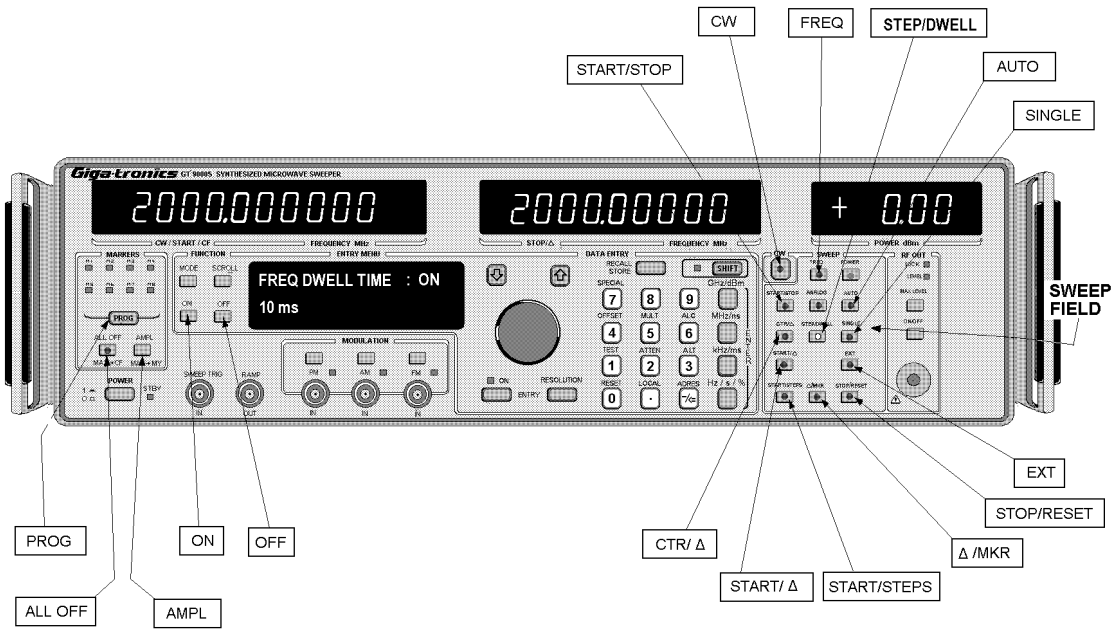


Figure 2-10. Frequency Step/Dwell Sweep

STEP/DWELL

Initiates the STEP/DWELL Sweep mode. This key sets both the step size and the dwell time for each step. These parameters are used by all of the previously described sweep modes. Press [STEP/DWELL] and either **FREQ STEP SIZE** or **FREQ DWELL TIME** will display on the top line of the Entry Menu. Enter a numeric value and press [STEP/DWELL] again to enable the other parameter for entry. Parameters set with this key are active for all sweep modes.

In some cases, a sequence of keys must be pressed to specify a function (for example, to select the STEP/DWELL Frequency Sweep mode, press [FREQ] [STEP/DWELL]).

START/STOP

This mode of operation causes a sweep up or down from a programmable start frequency to a programmable stop frequency. Press [START/STOP] and either **START FREQUENCY** or **STOP FREQUENCY** will display on the top line of the Entry Menu. Enter a numeric value and press [START/STOP] again to enable the other end of the desired sweep for entry. The sweep can be increasing or decreasing in frequency.

CTR/Δ

This provides a preset frequency sweep pattern (up or down), centered symmetrically around a given preset frequency. Press [CTR/Δ], and either **CENTER FREQUENCY** or **DELTA FREQUENCY** will display

on the top line in the Entry Menu. Enter a numeric value and press [CTR/Δ] again to enable the other parameter for entry. To sweep down through the selected center frequency, press [-] prior to entering the DELTA FREQUENCY numeric value.

START/Δ

This mode is the same as CTR/Δ except that the sweep originates at a given start frequency rather than sweeping symmetrically about a center frequency.

START/STEPS

This mode allows sweeping up or down from a programmable start frequency through a programmable number of steps. Press [START/STEPS] and either **START FREQUENCY** or **NUMBER OF STEPS** will display on the top line of the Entry Menu. Enter a numeric value and press [START/STEPS] again to enable the other parameter for entry. Note that any ENTER key can be used to terminate the numeric entry for NUMBER OF STEPS. To sweep down from the start frequency, press [-] prior to entering the NUMBER OF STEPS numeric value.

D/MKR

This mode allows sweeping between two markers. Press [Δ/MKR] and either START MKR *n* FREQ or STOP MARKER *n* FREQ will be in the top line of the Entry Menu (*n* represents the marker number). Press [Δ/MKR] again to enable the other parameter for entry. Use the Scroll key to change the marker number. To change the frequency of the marker, enter a new frequency value using any of the data entry methods.

AUTO

The AUTO sweep function, when enabled, causes the previously set sweep mode to continuously recycle.

SINGLE

In SINGLE sweep, a single cycle of the previously set sweep mode will occur.

EXT

Allows the same action as the front panel Single key, with the exception that the action is initiated by a trigger (TTL low) from an external source.

STOP/RESET

This key stops the sweep and allows the frequency to be manually adjusted with either the digi-dial or the up/down keys (keypad entry is not permitted). Press [STOP/RESET] a second time to reset the sweep to the previous sweep conditions.

2.3.4 Frequency Analog Sweep Operation

The Frequency Sweep has a number of programmable features, modes of operation, and parameters (see Figure 2-11). To initiate the sweep press [FREQ] in the SWEEP selection area. The LED in the CW key will turn off while the LED in the FREQ key and any other associated keys will turn on. Press [CW] to return to a fixed frequency operation.

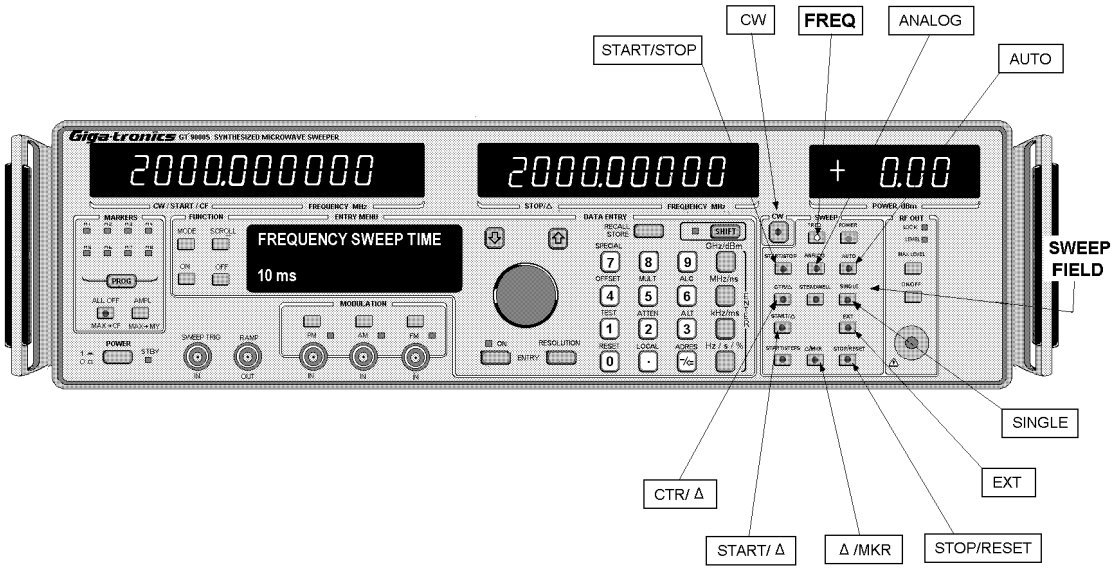


Figure 2-11. Frequency Analog Sweep

ANALOG

Initiates Analog Sweep mode. This key permits setting Analog Sweep time. These parameters are used by all of the previously described sweep modes. Press [ANALOG] and **FREQUENCY SWEEP TIME** will display on the top line of the Entry Menu. Enter a numeric value and press [ANALOG] again to enable the other parameter for entry. Parameters set with this key are active for all sweep modes.

START/STOP

This mode of operation causes a sweep up or down from a programmable start frequency to a programmable stop frequency. Press [START/STOP] and either **START FREQUENCY** or **STOP FREQUENCY** will display on the top line of the Entry Menu. Enter a numeric value and press [START/STOP] again to enable the other end of the desired sweep for entry. The sweep can be increasing or decreasing in frequency.

CTR/Δ

This selection provides a preset frequency sweep pattern (up or down) centered symmetrically around a given preset frequency. Press [CTR/Δ] and either **CENTER FREQUENCY** or **DELTA FREQUENCY** will display on the top line in the Entry Menu. Enter a numeric value and press [CTR/Δ] again to enable the other parameter for entry. If it is desired to sweep down through the selected center frequency, press [-] prior to entering the DELTA FREQUENCY numeric value.

START/Δ

This mode operates in a manner identical to CTR/Δ except that the sweep originates at a given start frequency rather than sweeping symmetrically around a center frequency.

D/MKR

This mode allows sweeping between two markers. Press [Δ/MKR] and either **START MKR** *n* FREQ or **STOP MARKER** *n* FREQ will display in the top line of the Entry Menu (*n* represents the marker number). Press [Δ/MKR] again to enable the other parameter for entry. Press [SCROLL] to change the marker number. To change the frequency of the marker, enter a new frequency value using any of the data entry methods.

AUTO

The AUTO sweep function, when enabled, causes the previously-set sweep mode to continuously recycle.

SINGLE

In SINGLE sweep, a single cycle of the previously-set sweep mode will occur.

EXT

Allows the same action as the front panel Single key, with the exception that the action is initiated by a trigger (TTL low) from an external source.

STOP/RESET

Press this key to stop the sweep and allow the frequency to be manually adjusted using either the digi-dial or the up/down keys (keypad entry is not permitted). Press STOP/RESET a second time to reset the sweep to the previously set sweep conditions.

2.3.5 Step/Dwell Power Sweep Operation

The Power Sweep has a number of features, modes of operation, and parameters which can be set (see Figure 2-12). To initiate the sweep, press [POWER] in the SWEEP selection area. The LED in the POWER key and any other associated keys will light. Press [POWER] again to return operation to a fixed level.

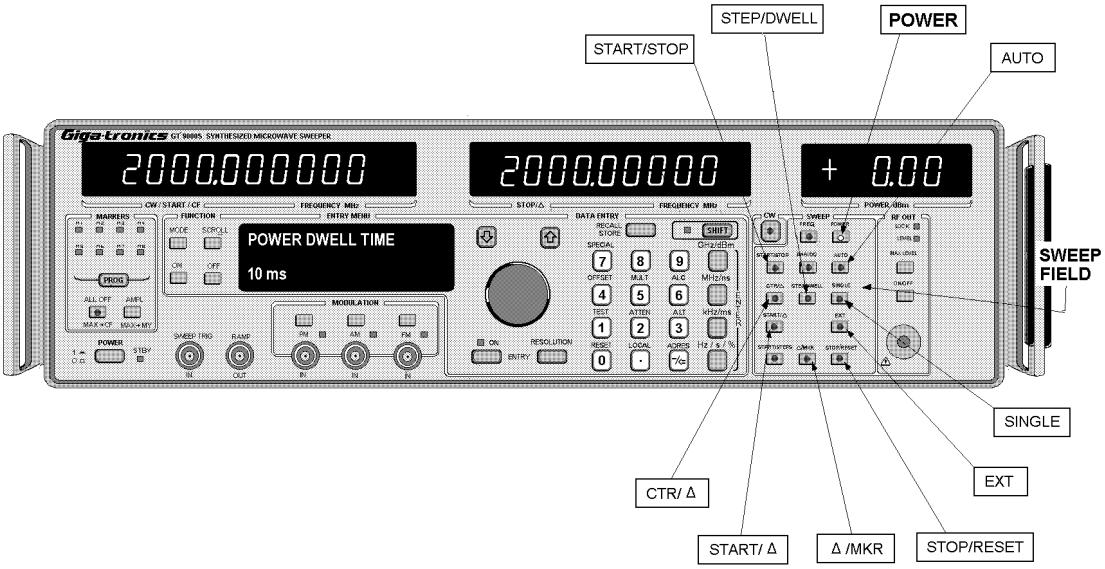


Figure 2-12. Step/Dwell Power Sweep

STEP/DWELL

Initiates STEP/DWELL Sweep mode. This key sets both the step size and the dwell time for each step. These parameters are used by all of the previously described sweep modes. Press [STEP/DWELL] and either **POWER STEP SIZE** or **POWER DWELL TIME** will display on the top line of the Entry Menu. Enter a numeric value and press [STEP/DWELL] again to enable the other parameter for entry. Parameters set with this key are active for all sweep modes.

START/STOP

This mode of operation causes a sweep, up or down, from a programmable start level to a programmable stop level. Press [START/STOP] and either **START POWER** or **STOP POWER** will display on the top line of the Entry Menu. Enter a numeric value and press [START/STOP] again to enable the other end of the desired sweep for entry. The sweep can be increasing or decreasing in level.

CTR/Δ

This selection provides a preset frequency sweep pattern (up or down) centered symmetrically around a given preset frequency. Press [CTR/Δ] and either **CENTER POWER** or **DELTA POWER** will display on the top line in the Entry Menu. Enter a numeric value and press [CTR/Δ] again to enable the other parameter for entry. If it is desired to sweep down through the selected center frequency, press [-] prior to entering the DELTA POWER numeric value.

START/Δ

This mode operates in a manner similar to CTR/Δ except that the sweep originates at a given start level rather than sweeping symmetrically around a center level.

START/STEPS

This mode allows sweeping up or down from a preset start level through a preset number of steps. Press [START/STEPS] and either **START POWER** or **NUMBER OF STEPS** will display on the top line of the Entry Menu. Enter a numeric value and press [START/STEPS] again to enable the other parameter for entry. Any of the units keys will terminate the numeric entry for NUMBER OF STEPS. To sweep down from the start level, press [-] prior to entering the NUMBER OF STEPS value.

AUTO

The AUTO sweep function causes the previously set sweep mode to cycle continuously.

SINGLE

In SINGLE sweep, a single cycle of the previously set sweep mode will occur.

EXT

The EXT mode allows the same action as the front panel Single key, with the exception that the action is initiated by a trigger (TTL low) from an external source.

STOP/RESET

This key stops the sweep and allows the level to be manually adjusted using the digi-dial or the up/down keys (keypad entry is not possible). Press [STOP/RESET] a second time to reset the sweep to the previously-set sweep conditions.

2.3.6 Analog Power Sweep Operation

The Power Sweep function has a number of features, modes of operation, and parameters which can be set (see Figure 2-13). To initiate the sweep, press [POWER] in the SWEEP selection area. The LED in the Power key and any other associated keys will light. Press [POWER] to return operation to a fixed level.

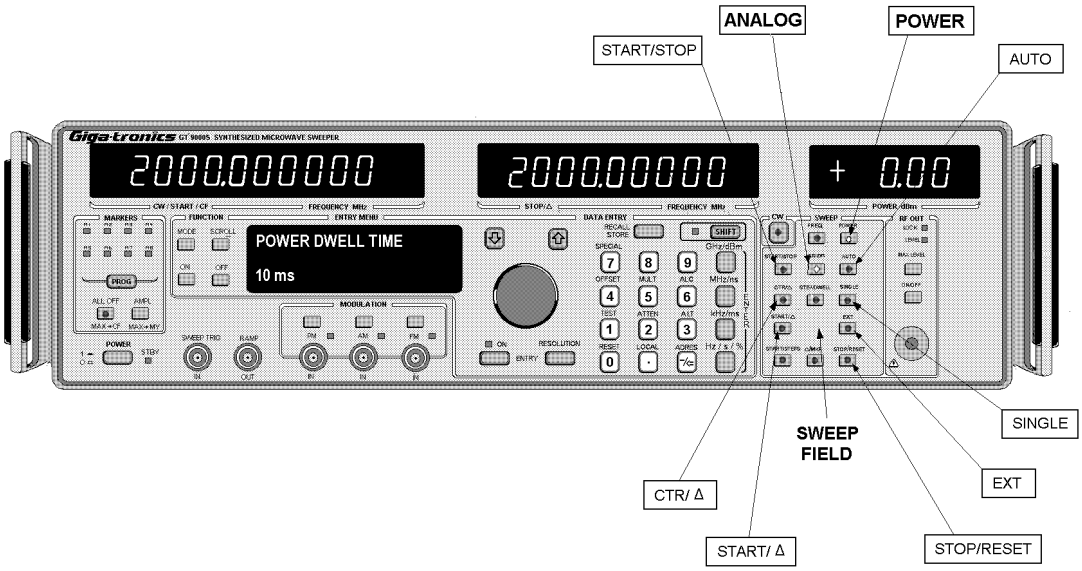


Figure 2-13. Analog Power Sweep

ANALOG

Initiates Analog Sweep mode. This key sets Analog Sweep time. Press [ANALOG], and **POWER SWEEP TIME** will display on the top line of the Entry Menu. Enter a numeric value . Parameters set with this key are active for all sweep modes.

START/STOP

This mode of operation causes a sweep, up or down, from a programmable start level to a programmable stop level. Press [START/STOP], and either **START POWER** or **STOP POWER** will appear on the top line of the Entry Menu. Enter a numeric value and press [START/STOP] again to enable the other end of the desired sweep for entry. The sweep can be increasing or decreasing in level.

CTR/Δ

This selection provides a preset frequency sweep pattern (up or down) centered symmetrically around a given preset frequency. Press [CTR/Δ] and either **CENTER POWER** or **DELTA POWER** will appear in the Entry Menu on the top line of the display. Enter a numeric value and press [CTR/Δ] again to enable the other parameter for entry. If it is desired to sweep down through the selected center frequency, press [-] prior to entering the DELTA POWER numeric value.

START/Δ

This mode operates in a manner similar to CTR/Δ except that the sweep originates at a given start level rather than sweeping symmetrically around a center level.

AUTO

The AUTO sweep function when enabled causes the previously-set sweep mode to continuously recycle.

SINGLE

In SINGLE sweep, a single cycle of the previously-set sweep mode will occur.

EXT

This mode allows the same action as the front panel SINGLE key with the exception that the action is initiated by a trigger (TTL low) from an external source.

STOP/RESET

Press this key to stop the sweep and allow the level to be manually adjusted using either the digi-dial or the up/down keys (keypad entry is not possible). Press [STOP/RESET] a second time to reset the sweep to the previously set sweep conditions.

2.3.7 Sweep Combinations

Frequency and Power STEP/DWELL

When frequency and power sweep are used simultaneously, they partially interact. The main factor determining their interaction is dwell time.

When Dwell times are equal:

The unit is in Power Slope Mode. The power step size is calculated so that the frequency and power sweeps have the same number of steps. For example, if a 10 GHz frequency sweep is combined with a 10 dB power sweep, and the frequency step size is 1 GHz, the power sweep step size will be set to 1 dB, so that both sweeps have 10 steps. Attempting to change the power step size would have no effect.

When Dwell times are NOT equal:

If the frequency step dwell time is greater, one complete power sweep will occur for each frequency step. If the power step dwell time is greater, one complete frequency sweep will occur for each power step.

Frequency and Power Analog

The instrument is in Power Slope Mode. When the power tracks the Frequency Sweep so that Delta Power coincides with Delta Frequency, the Power SWEEP time is the same as the frequency sweep time.

Frequency and Power STEP/DWELL and Analog

The mode (Frequency or Power) that is Analog takes one complete sweep for each step of the mode (Frequency or Power) that is Step/Dwell.

2.4 Rear Panel Description

This section explains the functions on the rear panel (see Figure 2-14).

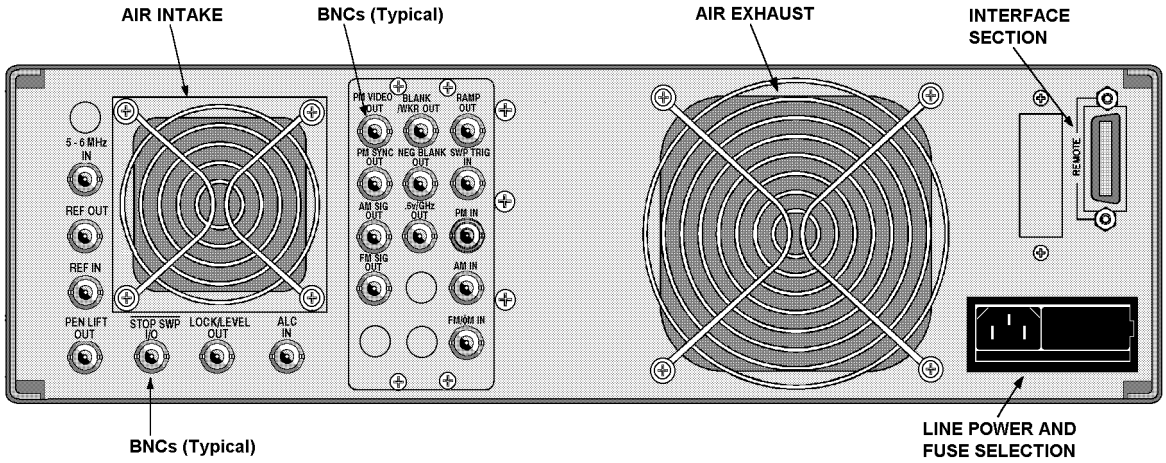


Figure 2-14. The Rear Panel

2.4.1 BNCs

5-6 MHz IN	A 5 to 6 MHz input, at 2 Vpp (input impedance is 50 Ω, nominal), for controlling the frequency of the signal generator; it makes fine frequency resolution control possible from an external synthesized source (increasing the input above 5 MHz causes a one-for-one change in the RF output frequency).
REF OUT	A buffered sine wave output at 10 MHz, 2 Vpp into 50 Ω, derived from the internal or external timebase.
REF IN	An external timebase input signal, 10 MHz or 5 MHz, $\pm 1 \times 10^{-6}$ or better, 0.5 to 5 Vpp (input impedance is 100 Ω, nominal); overrides the internal time base. To specify the frequency of the external timebase, press [SHIFT] [SPECIAL] [11]. Press [MODE] to toggle between the 10 MHz and 5 MHz settings.
PEN LIFT OUT	A TTL compatible output, which is low during a sweep and high during a sweep retrace.
STOP SWP I/O	A TTL compatible input/output (low input to stop a sweep, or low output to indicate that a sweep has been stopped).
LOCK/LEVEL OUT	A TTL compatible output (high to indicate that the output frequency is phase locked and the output power is leveled).
ALC IN	An input signal, for remote level control of output power by positive or negative polarity ZBS detectors, or by applicable power meters (see Section 1.3.16 for specifications).
PM VIDEO OUT	A pulse modulation envelope waveform, at TTL levels (approximately 1 Vpp into 50 Ω).

BLANK/$\overline{\text{MKR}}$ OUT	A sweep related output: +5 V during band changes, filter changes, and sweep retrace; 0 V during sweep; -5 V at marker frequencies.
RAMP OUT	A 0 to +10 V ramp output, proportional to progress between sweep limits (it duplicates the front panel RAMP OUT).
PM SYNC OUT	A 50 ns wide trigger pulse output, coincident with leading edge of the pulse modulation envelope, at TTL levels (approximately 1 V into 50 Ω).
NEG BLANK OUT	A sweep related output: -5 V during band changes, filter changes, and sweep retrace; 0 V during sweep.
SWP TRIG IN	This connector accepts a sweep trigger input, ≥50 ns wide, at TTL levels to initiate a sweep or step (it duplicates the front panel SWP TRIG IN connector).
AM SIG OUT	An amplitude modulation waveform output, at 2 Vpp into 1 MΩ.
.5V/GHz OUT	An output voltage directly proportional to the RF output frequency.
PM IN	This connector accepts the input signal for external pulse modulation (it duplicates the front panel PM IN connector).
FM SIG OUT	A frequency modulation waveform output, at 2 Vpp into 1 MΩ.
AM IN	This connector accepts the input signal for external amplitude modulation (it duplicates the front panel AM IN connector).
FM/ΦM IN	This connector accepts the input signal for external frequency modulation, or for phase external modulation in instruments configured to have that feature (it duplicates the front panel FM IN connector).

2.4.2 Line Power and Fuse

Power Input	A 3-terminal polarized connector with safety ground wired to the chassis.
Line Selection	Four input line voltages can be selected: 100, 120, 220, or 240 VAC.
Fuse Holder	Retains the power fuse (see Section 1.2.1 for fuse ratings).

2.4.3 Interface

Remote (24 pin connector)	Provides an interface connection between the GT 9000S and other equipment. The interface type is GPIB IEEE-488-1978.

2.5 IEEE-488 Interface

Model GT 9000S permits data bus control in accordance with the IEEE Standard Digital Interface for Programmable Instruments, IEEE-STD 488-1978. Table 2-2 shows which subsets of the standard are implemented in the GT 9000S.

Table 2-2. IEEE-488 Interface Subsets

Subset	Title	GT 9000S Implementation
SH1	Source Handshake	Complete Capability
AH1	Acceptor Handshake	Complete Capability
T8	Talker	Basic Talker, No Serial Poll
TEO	Extended Talker	No Capability
L4	Listener	Basic Listener, No Listen Only, Unaddressed if MTA
LEO	Extended Listener	No Capability
SRO	Service Request	No Capability
RL2	Remote/Local	Complete Capability
PPO	Parallel Poll	No Capability
DCO	Device Clear	No Capability
DTO	Device Trigger	No Capability
CO	Controller	No Capability

2.5.1 Interface Hardware Configuration

A standard IEEE-488 interface cable can be used to connect the GT 9000S to a controller. The 24-pin interface connector, located on the rear panel of the GT 9000S, has the pin assignments listed in Table 2-3.

Table 2-3. Interface Connector Pin Assignments

Pin	Signal	Pin	Signal	Pin	Signal
1	D101	9	IFC	17	REN
2	D102	10	SRQ	18	GND (6)
3	D103	11	ATN	19	GND (7)
4	D104	12	Shield	20	GND (8)
5	EO1	13	D105	21	GND (9)
6	DAV	14	D106	22	GND (10)
7	NRFD	15	D107	23	GND (11)
8	NDAC	16	D108	24	GND Logic

2.5.2 Address Assignment

The remote control address is assigned from the front panel of the instrument (see ADRS in Section 2.2.3). The available range of addresses is 0 through 30.

2.5.3 Command Interpretation

The instrument uses a 40-character buffer to accept and store characters sent to it through the interface. Spaces are ignored. The buffer contents are interpreted and the buffer is reset upon receipt of a character sent with the EOI line asserted or upon receipt of any of the following delimiter characters:

< CR > < LF > , : ; / \

Multiple commands can be sent in a single message if they are separated from each other by a space or one of the delimiter characters. Each command will be interpreted individually upon receipt. If spaces are used to separate commands, care must be taken to assure that the 40-character buffer does not overflow. Buffer overflow can cause some commands to be ignored.

2.6 GT 9000S Syntax

The GT 9000S can accept commands from a remote controller over the IEEE-488 interface. The default GT 9000S syntax emulates the HP 8340. A separate syntax is available which emulates the Giga-tronics 1026. If you select the 1026 syntax (using the GT command), you can recall the default syntax later by sending the HP command.

The GT 9000S syntax is designed to make the GT 9000S a compatible substitute for the HP 8340 in most remote-control operations. However, differences between the GT 9000S and the 8340 require some alteration of the 8340 command set; new commands are added, some existing commands differ slightly from their usual function when they are applied to the GT 9000S, and some existing commands are unsupported. See the command descriptions in Table 2-4 for the Giga-tronics implementation of these commands.

Commands in the GT 9000S syntax are represented in this manual by upper case letters. Some commands are followed by one or more lower case letters. These letters are interpreted as follows:

a Indicates that alphanumeric characters are expected.

b Indicates that one or more 8-bit bytes (entered in binary form) are expected.

d Indicates that a decimal number is expected. Decimal numbers can be signed. Exponents may be indicated by an E; thus, +4.5E-6 represents 4.5×10^{-6}.

h Indicates that a hexadecimal number is expected.

n Indicates that a single digit (0-9) is expected.

t Indicates that a terminator is expected. Usually, codes which specify units are used as terminators. The codes are Hz (Hz), KZ (kHz), MZ (MHz), GZ (GHz), DB (dB), DM (dBm), S (seconds), MS (ms), and US (µs). Alternately, a comma or line feed can be used as a terminator; this causes the instrument to scale the corresponding function to the fundamental units of Hz, dB, dBm, or seconds.

The absence of lower case letters in a command indicates that the command is complete as shown, and requires no variables.

The commands of the GT 9000S syntax are described in Table 2-4. Commands which are identical with existing HP 8340 commands are shown in bold print; all other commands are either modified or invented for application to the GT 9000S.

Table 2-4. GT 9000S Syntax Commands

Code	Operation	Example	Notes
A1	leveling mode, internal	**A1**	Select the internal ALC mode.
A2	leveling mode, external	**A2**	Select the external ALC mode with a negative detector.
A3	leveling mode, power meter	**A3**	Select the external ALC mode with a power meter.
AC0	AM correction off	(These commands are used for diagnostic purposes only.)	
AC1	AM correction on		
AD d	AM depth	AD40	Set the AM depth to 40%.
AF0	Fast always off	AF0	Set all YIG drivers to the SLOW mode.
AF1	Fast always on	AF1	Set all YIG drivers to the FAST mode.
AK0	amplitude marker off	**AK0**	Activate/deactivate a function which causes a 3 dB drop in RF output level to occur at marker frequencies.
AK1	amplitude marker on	**AK1**	
AM0	AM off	**AM0**	Deactivate amplitude modulation or linear AM (Opt. 27).
AM1	AM ext on	**AM1**	Activate external amplitude modulation or external linear AM (Opt. 27).
AM2	AM int sine on	AM2	Activate internal AM (Opt. 24) or internal linear AM (Opts. 24 & 27), with a sine wave.
AM3	AM int square on	AM3	Activate internal AM (Opt. 24) or internal linear AM (Opts. 24 & 27), with a square wave.
AM4	AM int tri on	AM4	Activate internal AM (Opt. 24) or internal linear AM (Opts. 24 & 27), with a triangle wave.
AMF0	AMF (linear AM) off	AMF0	Deactivate linear AM (Opt. 27).
AMF1	AMF ext on	AMF1	Activate external linear AM (Opt. 27).
AMF2	AMF sine on	AMF2	Activate internal linear AM (Opt. 27), with a sine wave.
AMF3	AMF square on	AMF3	Activate internal linear AM (Opt. 27), with a square wave.
AMF4	AMF tri on	AMF4	Activate internal linear AM (Opt. 27), with a triangle wave.
AR d t	AM int rate	AR400HZ	Set the internal AM rate to 400 Hz (Opt. 24)
AT d t	set attenuator independently of level control, in 10 dB increments	AT80DB	Set the attenuator to 80 dB (the attenuator must first be uncoupled from the level control system, by means of the SHSL command).
AU	shortest sweep time	AU	Set the sweep time to the minimum.
BC	band change	BC	Not applicable to this model.
CB h	clear bit	(These commands are used for diagnostic purposes only.)	
CC0	freq. correction off		
CC1	freq. correction on		
CF d t	AFS center freq	**CF4GZ**	Set the analog sweep center frequency to 4 GHz.

Code	Operation	Example	Notes
CS	clear both status bytes	**CS**	Clear the 16-bit status bytes used for output status.
CW d t	CW freq	**CW2.4GZ**	Set the CW frequency to 2.4 GHz.
D1	FSD continuous	D1	Activate digital frequency sweep, automatic repetitive sweep mode.
D2	FSD single	D2	Activate digital frequency sweep, single sweep mode.
D3	FSD manual	D3	Activate digital frequency sweep, manual sweep mode (stop sweep & permit incremental adjustment of frequency).
DF d t	FSA delta freq	**DF2GZ**	Activate analog frequency sweep, set Δ freq. to 2 GHz.
DN	down step	**DN**	Equivalent to pressing [DOWN], to decrement the parameter that was last set.
DU 0	display update off	**DU0**	Blank the front panel display.
DU 1	display update on	**DU1**	Show and update the front panel display.
EF	entry display off	**EF**	Deactivate the entry display, digi-dial, & up/down arrow keys.
EK	enable knob	**EK**	Allow the front panel digi-dial to be active during remote control operation.
FA d t	FSA start freq	**FA2GZ**	Activate analog frequency sweep, set the start freq. to 2 GHz.
FB d t	FSA stop freq	**FB5GZ**	Activate analog frequency sweep, set the stop frequency to 5 GHz.
FC d t	FSA sweep time	FC100MS	Activate analog frequency sweep; set the sweep time 100 ms.
FD d t	FM deviation	FD2MZ	Activate frequency modulation; set FM deviation to 2 MHz
FM 0	FM off	FM0	Deactivate frequency modulation.
FM 1	FM ext on	FM1	Activate external FM.
FM 2	FM int sine on	FM2	Activate internal FM (Opt. 24), with a sine wave.
FM 3	FM int square on	FM3	Activate internal FM (Opt. 24) with a square wave.
FM 4	FM int tri on	FM4	Activate internal FM (Opt. 24), with a triangle wave.
FR d t	FM int rate	FR50KZ	Set the internal FM rate to 50 kHz (Opt. 24).
GA d t	FSD start freq	GA1GZ	Activate digital frequency sweep; set the start freq. to 1 GHz.
GB d t	FSD stop freq	GB5GZ	Activate digital frequency sweep; set the stop freq. to 5 GHz.
GC d t	FSD freq step	GC100MZ	Activate digital frequency sweep; set the step size to 100 MHz.
GD d t	FSD dwell time	GD100MS	Activate digital frequency sweep; set the dwell time to 100 ms.
GE d t	FSD special sweep time	GE1S	Activate digital frequency special step sweep (special function 30); set the sweep time to 1 second.

Code	Operation	Example	Notes
GT	Giga-tronics 1026 syntax	GT	Select the 1026 syntax for the remote interface (use the HP command to return to the GT-9000S syntax, which emulates an HP 8340).
IF	increment frequency	**IF**	Raise the CW frequency by the minimum resolvable step.
IP	instrument preset	**IP**	Simulates pressing [SHIFT] [Reset]; leaves the digi-dial disabled; disables the NSR command if currently enabled.
KK a	virtual keystroke (front panel)	KK02	Simulates pressing the front panel CW key (see Table 2-5).
KR	keyboard release	KR	Not applicable to this model.
LC 0	level correction off	(These commands are used for diagnostic purposes only.)	
LC 1	level correction on		
M0	marker (most recent) off	**M0**	Deactivate the marker that was last activated.
M1 d t	marker 1 on	**M12GZ**	Activate marker 1; set it to 2 GHz.
M2 d t	marker 2 on	**M23GZ**	Activate marker 2; set it to 3 GHz.
M3 d t	marker 3 on	**M34GZ**	Activate marker 3; set it to 4 GHz.
M4 d t	marker 4 on	**M45GZ**	Activate marker 4; set it to 5 GHz.
M5 d t	marker 5 on	**M56GZ**	Activate marker 5; set it to 6 GHz
M6 d t	marker 6 on	M67GZ	Activate marker 6; set it to 7 GHz.
M7 d t	marker 7 on	M78GZ	Activate marker 7; set it to 8 GHz.
M8 d t	marker 8 on	M89GZ	Activate marker 8; set it to 9 GHz.
MA h	memory address set	(This command is used for diagnostic purposes only.)	
MC	marker to center freq	**MC**	Set the marker last selected to the sweep center frequency.
MO	marker (most recent) off	**MO**	Deactivate the marker that was last activated.
MS	ms unit (ignore if cmd)	(This command is not supported.)	
NA b	network analyzer cfg	(This command is not supported.)	
NM	next modulation, FM	NM	Toggle between available FM modes.
NSR	never say remote	NSR	Activate the front panel controls and displays (the instrument will accept commands via the front panel AND the remote control bus).
O etc.	output commands (suffixes in parentheses indicate format of output data)	listed below	Send data to the controller, specifying current parameters in fundamental units of Hz,, dB(m), or seconds.
OA (d)	output active param	**OA**	Send the parameter that was last changed.
OB (d)	output next band change	(This command is not supported.)	
OC (d, d, d)	output coupled params	**OC**	Send the start frequency, center freq., and sweep time.

Code	Operation	Example	Notes
OD (5a)	output diagnostic characters (you must first run self test; see command SHM4)	OD	Send 5 diagnostic ASCII characters; each is either 0 for unlocked/unleveled or 1 for locked/leveled. The characters (from the left) represent (1) the output PLL, (2) the reference PLL, (3) the fixed L.O. PLL, (4) the 100 MHz PLL, and (5) automatic level control.
OGI	output Giga-tronics identification (not an output command; see notes)	OGI	Changes the information sent in response to an OI command (example: GT 9000S .01-20GHz VER.B144 2/1/1994 SN74029).
OI (19a)	output identification	**OI**	send HP8340/8341
OM (8b)	output mode data	(This command is not supported.)	
OPAS (d)	output status string	OPAS	Send the status string.
OPCF (d)	output center freq	OPCF	Send the sweep center frequency.
OPCW (d)	output CW freq	OPCW	Send the CW frequency.
OPDF (d)	output delta freq	OPDF	Send the sweep delta frequency.
OPFA (d)	output start freq	OPFA	Send the sweep start frequency.
OPFB (d)	output stop freq	OPFB	Send the sweep stop frequency.
OPM1 (d)	output mkr 1 freq	OPM1	Send the marker 1 frequency.
OPM2 (d)	output mkr 2 freq	OPM2	Send the marker 2 frequency.
OPM3 (d)	output mkr 3 freq	OPM3	Send the marker 3 frequency.
OPM4 (d)	output mkr 4 freq	OPM4	Send the marker 4 frequency.
OPM5 (d)	output mkr 5 freq	OPM5	Send the marker 5 frequency.
OPM6 (d)	output mkr 6 freq	OPM6	Send the marker 6 frequency.
OPM7 (d)	output mkr 7 freq	OPM7	Send the marker 7 frequency.
OPM8 (d)	output mkr 8 freq	OPM8	Send the marker 8 frequency.
OPPL (d)	output power	OPPL	Send the output power level.
OPSF (d)	output CW freq step	OPSF	Send the frequency sweep step size.
OPTC (d)	output temp cal pmtr	(This command is used for diagnostic purposes only.)	
OR (d)	output power level	OR	Send the output power level.
OS (2b)	output status bytes	(This command is not supported.)	
P1	PSA, auto	P1	Activate analog power sweep; select automatic repetitive sweep mode.
P2	PSA, single	P2	Activate analog power sweep; select single sweep mode.
P3	PSA, manual	P3	Activate analog power sweep; stop sweep and permit incremental adjustment of level.
PA d t	PSA start power	PA5DM	Activate analog power sweep; set the sweep start level to +5 dBm.
PB d t	PSA stop power	PA10DM	Activate analog power sweep; set the sweep stop level to +10 dBm.
PC d t	PSA sweep time	PC100MS	Activate analog power sweep; set the sweep time to 100 ms.
PH2	Hi-power module lock on	PH2	Lock the hi-power module on even below 8 dBm so that the RF path can be characterized at 8 dBm.
PL d t	power level	**PL-5.1DM**	Set the output level to -5.1 dBm.
PM 0	PM off	**PM0**	Deactivate pulse modulation.

Code	Operation	Example	Notes
PM 1	PM ext + on	**PM1**	Activate pulse modulation, external pulse positive true.
PM 2	PM int on	PM2	Activate internal pulse modulation.
PM 3	PM ext - on	PM3	Activate pulse modulation, external pulse negative true.
PM 4	PM trig + on	PM4	Activate pulse modulation, external rising edge trigger.
PM 5	PM trig - on	PM5	Activate pulse modulation, external falling edge trigger.
PR d t	PM int rate	PR50KZ	Set the internal pulse modulation rate to 50 kHz.
PS 0	APS off	**PS0**	Deactivate/activate power analog sweep.
PS 1	APS on	**PS1**	
PW d t	PM int width	PW1US	Set the internal pulse modulation width to 1 µs.
PY d t	PM int delay	PY.1US	Set the internal pulse modulation delay to .1 µs.
QA d t	DPS start power	QA2DM	Activate digital power sweep; set the sweep start level to 2 dBm.
QB d t	DPS stop power	QB8DM	Activate digital power sweep; set the sweep stop level to 8 dBm.
QC d t	DPS step size	QC.1DB	Activate digital power sweep; set the sweep step size to .1 dB.
QD d t	DPS dwell time	QD30MS	Activate digital power sweep; set the dwell time to 30 ms.
RC n	recall front panel setup	**RC6**	Recall the front panel setup saved in memory location 6.
RF 0	RF off	**RF0**	Deactivate/activate the RF output.
RF 1	RF on	**RF1**	
RFD0	RF ON @ Freq Cng off	RFD0	Deactivate/activate Special Function 21 (RF on at frequency change); this function causes the RF output to remain on during frequency changes (band changes and filter changes excepted).
RFD1	RF ON @ Freq Cng on	RFD1	
RM b	status byte mask	(This command is not supported.)	
RS	reset sweep	**RS**	Reset the sweep.
S1	FSA auto	**S1**	Activate analog frequency sweep; select the automatic repetitive sweep mode.
S2	FSA single	**S2**	Activate analog frequency sweep; select the single sweep mode.
S3	FSA manual	**S3**	Activate analog frequency sweep; stop the sweep and permit incremental adjustment of frequency.
SB h	set bit	(This command is used for diagnostic purposes only.)	
SC0	scan off	SCO	Deactivate scan modulation or variable attenuation (Opt. 27).
SC1	scan ext on	SC1	Activate external scan modulation (Opt. 27).
SC2	scan sine on	SC2	Activate internal scan modulation (Opts. 24 & 27), with a sine wave.

Code	Operation	Example	Notes
SC3	scan square on	SC3	Activate internal scan modulation (Opts. 24 & 27), with a square wave.
SC4	scan triangle on	SC4	Activate internal scan modulation (Opts. 24 & 27), with a triangle wave.
SC5	variable attenuation on	SC5	Activate variable attenuation (Opt. 27).
SD d t	internal scan modulation or variable attenuation depth	SD-20DB	Set depth for scan modulation or variable attenuation (Opt. 27) to -20 dBm.
SF d t	freq. resolution increment	**SF50MZ**	Set the frequency resolution to 50 MHz.
SG	FSA, single sweep	**SG**	Activate analog frequency sweep; select the single sweep mode.
SHA1	unleveled	SHA1	Select the unleveled mode (disable automatic level control).
SHCW d t	CW resolution increment	**SHCW1KZ**	Set the CW frequency resolution to 1 kHz.
SHM4 d t	self test	SHM4 10 MZ	Run the instrument self test program in 10 MHz steps and display the results.
SHM5	turn off diagnostics	(This command is not supported.)	
SHPL d t	set power level step	**SHPL3DB**	Set the level resolution to 3 dB.
SHPM	8757A mode (ext PM on)	SHPM	Activate external PM (for use with Model 8757A).
SHPS d t	uncouple atten & ALC; set attenuator in 10 dB increments	SHPS40DB	Uncouple the attenuator from the level control system; set the attenuator to 40 dB.
SHRF	unleveled	SHRF	Select the unleveled mode (disable automatic level control).
SHS1 0	displays not blanked	SHS10	Deactivate/activate blanking of the front panel displays.
SHS1 1	displays blanked	SHS11	
SHSL d t	uncouple atten & ALC; set attenuator in 10 dB increments	SHSL10DB	Uncouple the attenuator from the level control system; set the attenuator to 10 dB.
SM	sweep, manual	SM	Stop the sweep (frequency or power sweep) and permit incremental adjustment of frequency or power.
SN d	digital sweep steps	SN20	Activate digital frequency sweep start/steps mode, selecting 20 steps.
SP d t	power step size	**SP1DB**	Set the power resolution to 1 dB.
SN d	digital sweep steps	SN20	Activate digital frequency sweep start/steps mode, selecting 20 steps.
SP d t	power step size	SP1DB	Set the power resolution to 1 dB.
SR d t	internal scan modulation rate	SR2KZ	Set the internal scan modulation rate to 2 kHz (Opts 24 & 27).
ST d t	FSA & PSA sweep time	**ST500MS**	Set sweep time 500 ms, analog frequency sweep or analog power sweep.
SV n	save instrument state	**SV4**	Store the current front panel setup in memory location 4.
TS	FSA single sweep	**TS**	Activate analog frequency sweep; select single sweep mode.

Code	Operation	Example	Notes
UN 0	unlocked mode off	UN0	Disable/enable the unlocked mode (in unlocked mode, the output phase lock loop is disabled).
UN 1	unlocked mode on	UN1	
UP	up step	**UP**	Equivalent to pressing the UP key, to increment the parameter that was last set.
WR h	write data	(This command is used for diagnostic purposes only.)	

2.6.1 GT 9000S Syntax Virtual Keystrokes

These commands simulate pressing keys on the front panel. Command sequences must begin with KK. Codes intended to represent shifted keys must be preceded by the code 82. The sample command sequence of **KK 82 D0 02 D2 DC** is equivalent to pressing [SHIFT] [0] (reset) [CW] [2] [GHz/dBm]. This sequence resets the instrument and sets a CW frequency of 2 GHz.

Key functions shown in bold type are pseudo-keys; they do not represent actual front panel keys, but they are needed to insure that certain front panel functions (markers, scroll, and mode) are reset to their initial state before other keystrokes modify them.

Table 2-5. GT 9000S Virtual Keystrokes

Code	Key	Shifted Key	Code	Key	Shifted Key
00	FREQ		90	OFF	
01	POWER		91	ON	
02	CW		92	MODE	
10	ANALOG		93	SCROLL	
11	STEP/DWELL		**94**	MODE 0	
20	START/STOP		**95**	SCROLL 0	
21	CTR/DELTA		A0	UP	
22	START/STEPS		A1	DOWN	
23	START/DELTA		C0	RESOLUTION	
24	DELTA/MKR		D0	0	RESET
30	AUTO		D1	1	TEST
31	SINGLE		D2	2	ATTEN
32	EXT		D3	3	ALT
33	STOP/Reset		D4	4	OFFSET
40	LEVEL		D5	5	MULT
50	PM		D6	6	ALC
51	AM		D7	7	SPECIAL
52	FM	NARROW	D8	8	
60	ALL OFF	MX ⇒ CF	D9	9	
61	AMPL	MX - MY	DA	DOT	LOCAL
62	PROG		DB	MINUS	ADRS
63	MKR1		DC	GHz/ns/dBm	
70	RECALL	STORE	DD	MHz/µs	
80	RF ON/OFF		DE	kHz/ms	
81	ENTRY		DF	Hz/s/%	
82	SHIFT		**E0**	DISPLAY 0	
			E1	DISPLAY	

2.7 1026 Syntax Interface

In addition to the default GT 9000S syntax, Model GT 9000S can also be remotely controlled using the 1026 syntax (Giga-tronics 1026 emulation), as described below. This syntax is selected by sending the command GT (the HP command is used to return to the GT 9000S syntax).

2.7.1 Character Representation

Command names are represented in capital letters. Small letters are used for special characters, as listed in Table 2-6.

Table 2-6. Character Representations

Shown as	Interpreted as
(cr)	carriage return
(lf)	line feed
s	one space
z	zero or more spaces
b	one or more spaces
a	alphabetic character
d	one decimal digit
n	numeric argument (see below)

2.7.2 Command Format

The standard command format consists of a verb, followed by zero or more spaces, followed by an argument. In the command GENzFIXED, GEN is the verb and FIXED is the argument. In a few cases, the argument is omitted (the GT command, for example). Sometimes the argument consists of a number. In the command FAz12.3E+3, FA is the verb and 12.3E+3 is the argument.

Numeric arguments are used in the frequency and level setting commands, and are represented in command descriptions by a lower case n. The format for numeric arguments is sufficiently flexible that no special formatting will be needed when using most IEEE-488 controllers. Signed or unsigned numbers are acceptable. Integers or decimal fractions are permitted and can be followed by a signed or unsigned one or two digit exponent. Leading zeros are permitted, but spaces within a number are not permitted. The integer and optional fractional part are each restricted to a maximum length of 10 digits. Examples of valid numeric arguments are listed in Table 2-7.

Table 2-7. Command Format Translation

Entered as	Interpreted as
_25.7	25.7
_7_	7
-32.1	-32.1
2.6E-6	2.6×10^{-6}
6E-10	6×10^{-10}
-000.145E+9	-0.145×10^{9}
1E6	1×10^{6}

2.7.3 Commands

The remote commands used in the 1026 syntax are listed in Table 2-8. In the case of a command requiring a numeric argument, the acceptable range of values is determined by the specifications of the instrument. For example, it is not permitted to specify a frequency outside of the range of the instrument.

Table 2-8. 1026 Syntax Commands

Command	Description
AC0	disable AM correction
AC1	enable AM correction
AF0	fast always off
AF1	fast always on
DISP0	displays off
DISP1	displays on
EXTALCzOFF	disable external automatic level control
EXTALCzON	enable external automatic level control
FAzn	set FA (RF output frequency) to n MHz
FBzn	set FB (sweep stop freq.) to n MHz
FCzn	set FC (sweep step size) to n MHz
GENzASWP	generate analog sweep from FA to FB
GENzCSWP	generate analog sweep centered on FC; Δ = FB
GENzFIXED	generate fixed (CW) frequency
GENzLSWP	generate locked frequency sweep (step/dwell mode)
GENzMSWP	generate analog sweep between markers (from MA to MC)
HP	select GT 9000S syntax (use GT command to return to the present syntax)
LCO	level correction off
LC1	level correction on
LEVELzn	set output level to n dBm (entry resolution .1 dB)
LVLCRSzn	set attenuator to n dB, independently of leveling loop (entry resolution: 10 dB steps); output level is the sum of LVLCRS & LVLFNE arguments
LVLFNEzn	set leveling loop to n dB, independently of attenuator (entry resolution: .1 dB); output level is the sum of LVLCRS & LVLFNE arguments
MAzn	set first marker frequency to n MHz
MBzn	set second marker frequency to n MHz
MCzn	set third marker frequency to n MHz
MODzAM	external amplitude modulation
MODzCONTzOFF	AM/scan modulation off
MODzCONTzSCAN	scan modulation on
MODzCONTzAM	external AM on
MODzDESCRzEXT+	external pulse modulation, rising-edge triggered

MODzDESCRzEXT-	external pulse modulation, falling-edge triggered
MODzDESCRzOFF	pulse modulation off
MODzDESCRzPULSE	internal pulse modulation
MODzDESCRzSQR	internal pulse modulation, 50% duty cycle
MODzEXT+	external pulse modulation, positive trigger
MODzEXT-	external pulse modulation, negative trigger
MODzOFF	modulation off
MODzPULSE	internal pulse modulation, 1 kHz rate, 1 µs width
MODzSQR	internal square wave modulation, 1kHz rate
NSR	never say remote (activates front panel controls and displays; instrument accepts commands via front panel controls AND remote control bus)
POWERzINT	measure internal power
PULSEzEXT	external pulse modulation, positive trigger
PULSEzOFF	pulse modulation off
SENDzFREQ	send data to controller, specifying current output frequency or measured frequency
SENDzPOWER	send data to controller, specifying current output power or measured power
SENDzSTATUS	send data to controller, specifying current lock and level status
SWEEPzAUTO	frequency sweep mode: automatic repetitive sweep
SWEEPzONCE	frequency sweep mode: single sweep
SWEEPzRATEza	select sweep rate a; available rates are: A = 10 ms, B = 20 ms, C = 50 ms, D = 100 ms, e = 200 ms, F = 500 ms, G = 1000 ms, H = 2000 ms, I = 5000 ms, J = 10000 ms.
SWEEPzReset	reset sweep
SWEEPzSTEP	increment output frequency by one step (step size is defined by FC)
SWEEPzSTPzTRIG	increment output frequency by one step upon receipt of trigger input (step size is defined by FC)
SWEEPzTRIG	frequency sweep mode; triggered single sweep
UNz1	unlocked mode on

2.8 HP 8757 Interface

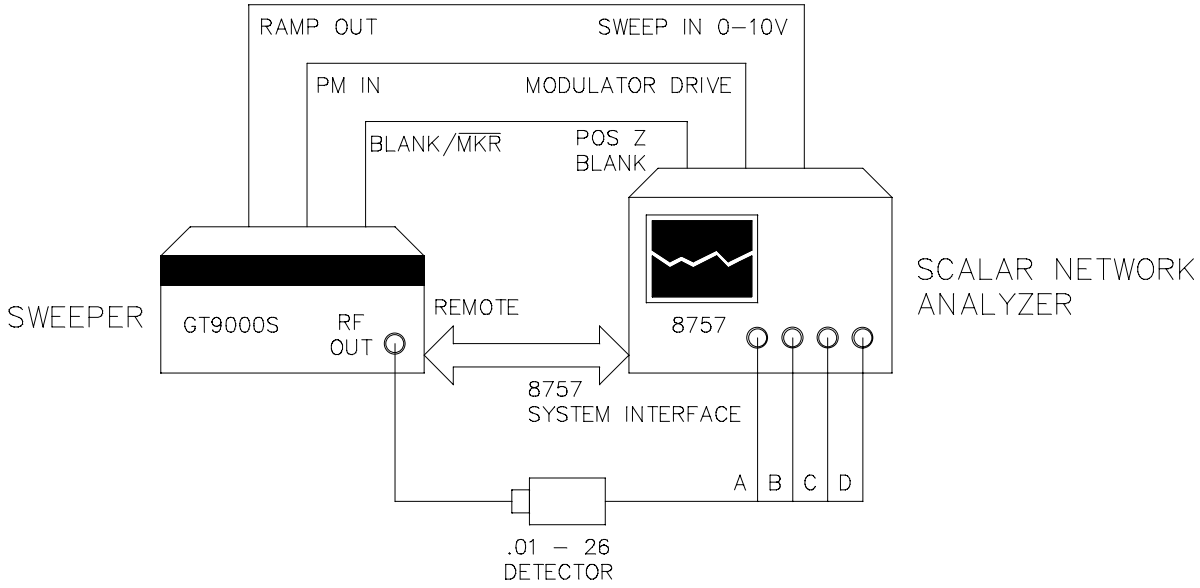


Figure 2-15. GT 9000S to 8757 Connection

These are instructions on how to operate the instrument in conjunction with the HP 8757 Scalar Network Analyzer:

1. Connect the GT 9000S BLANK/$\overline{\text{MKR}}$ BNC to the 8757 POS Z BLANK BNC.
2. Connect the GT 9000S RAMP OUT BNC to the 8757 SWEEP IN 0-10 V.
3. Connect the GT 9000S PM IN BNC to the 8757 MODULATION DRIVE.
4. Do not connect the GT 9000S $\overline{\text{STOP SWP}}$ I/O BNC to the 8757.
5. Connect an IEEE cable from the GT 9000S REMOTE connector to the 8757 SYSTEM INTERFACE (the source address for the 8757 must match the address of the GT 9000S).
6. Press [SHIFT] [0] on the GT 9000S to reset it.
7. Verify that the 8757 is set to talk to the GT 9000S at the IEEE address. This can be checked under the 8757 LOCAL menu (it is called sweeper address). Alternatively, GT 9000S address can be changed to match the sweeper address for the 8757. Press [SHIFT] [ADRS] on the GT 9000S front panel, enter the 8757 source address, then press any units key.
8. Verify that the GT 9000S is set to GT 9000S GPIB syntax, using special function 40. Press [SHIFT] [SPECIAL], enter 40 at the prompt; press [ON] to activate this syntax if it is off.
9. Press [PReset] on the 8757.
10. The units should now be in interface mode.

2.9 Giga-tronics 8003 Interface

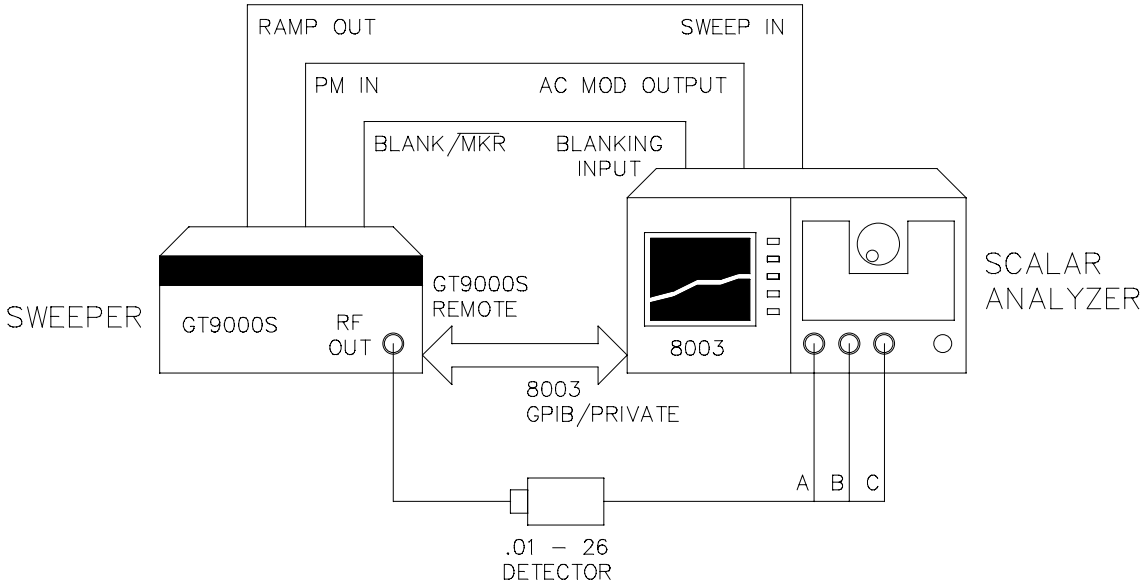


Figure 2-16. GT 9000S to 8003 Connection

These are instructions on how to operate the instrument in conjunction with the Giga-tronics 8003 Scalar Analyzer:

1. Connect the GT 9000S BLANK/$\overline{\text{MKR}}$ BNC to the 8003 BLANKING INPUT BNC.
2. Connect the GT 9000S RAMP OUT BNC to the 8003 SWEEP IN BNC.
3. Connect the GT 9000S PM IN BNC to the 8003 AC MOD OUTPUT.
4. Connect an IEEE cable from the GT 9000S REMOTE connector to the 8003 GPIB/PRIVATE BUS connector (not the GPIB/SYSTEM connector). The source address for the 8003 must match the address of the GT 9000S.
5. Press [SHIFT] [0] on the GT 9000S to reset it.
6. Verify that the 8003 is set to communicate with the GT 9000S at the GT 9000S IEEE address. This can be checked under the 8003 CONFIG menu. Press CONFIG; press GPIB DEVICES; press PVT BUS ON/OFF to activate the private bus; press SOURCE; enter the remote address to which the GT 9000S has been set, and press GIGA-TRONICS if the menu includes that option. Alternatively, the GT 9000S address can be changed to match the source address for the 8003. Press [SHIFT] [ADRS] on the GT 9000S and enter the 8003 source address, then press any units key.
7. Verify that the GT 9000S is set to the GT 9000S GPIB syntax, using special function 40. Press [SHIFT] [SPECIAL], enter 40 at the prompt; press [ON] to activate this syntax if it is off.
8. Press [PReset] on the 8003; press [CONFIRM PReset] on the 8003.
9. After an interconnection delay, the units should be in interface mode.

3

Theory of Operation

3.1 Physical Configuration

The GT 9000S Synthesized Microwave Sweeper chassis is divided into five main sections (see Figure 3-1 — the diagram is a top view of the instrument with the rear panel shown on the left). The I/O bus holds several boards, which control the frequency of the RF output, including YIG driver circuits and phase lock loop circuits. The microwave deck houses the microwave-frequency devices, most of which are contained in a single module. The YIG oscillators are mounted on the underside of the microwave deck. A downconverter module is mounted on top of the RF module in instruments that include the downconverter range (below 2 GHz).

The power supply furnishes DC voltages to the various circuits, and is contained in a metal housing behind the front panel. The AC power input and fuse, and the timebase are located in the space between the computer bus and the rear panel. The computer bus holds several plug-in circuit boards, which make up the internal computer. It also holds the sweep, modulation, and level-control circuits.

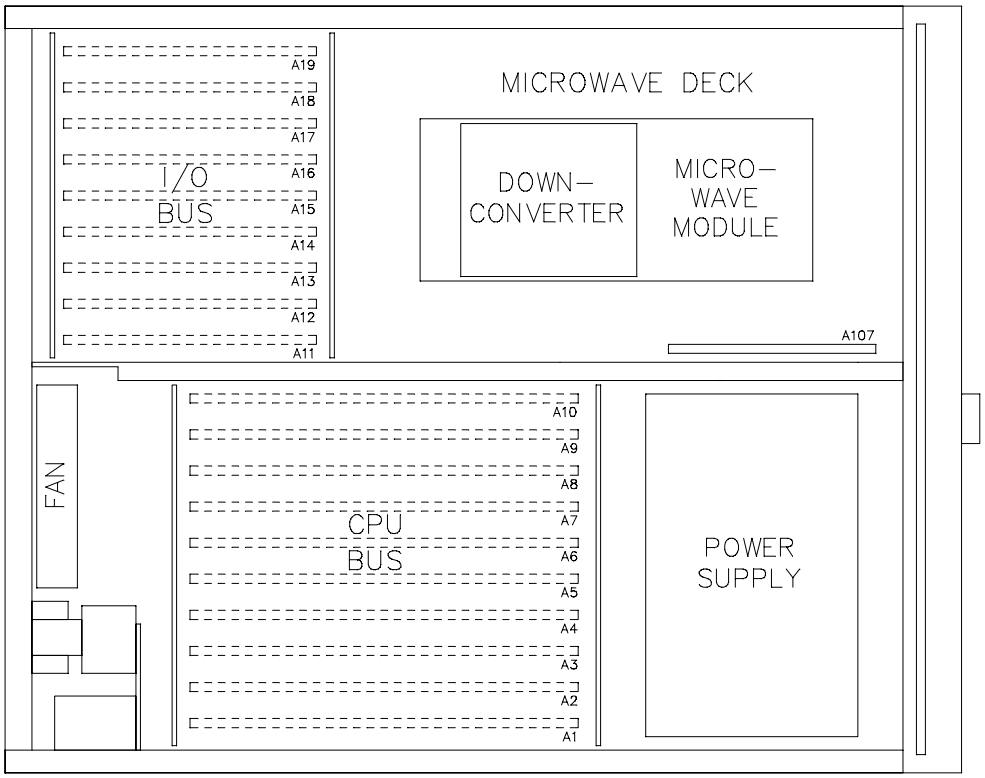


Figure 3-1. Internal Layout of Circuits

3.2 The Computer

The GT 9000S is controlled by an internal microcomputer based on the 68000 microprocessor, running at 8 MHz. The microprocessor controls and communicates with other circuits by means of a data bus system and a series of latches. This system, along with the various memory devices, will be referred to collectively as the computer (see Figure 3-2).

The standard memory package includes a memory board and front panel interface board with 128K of RAM and 192K of ROM, with expansion sockets for additional RAM or ROM. The configuration ROM (located on the A1 PC board) is programmed with initialization data, correction data for the leveling control system, and other information unique to the individual instrument.

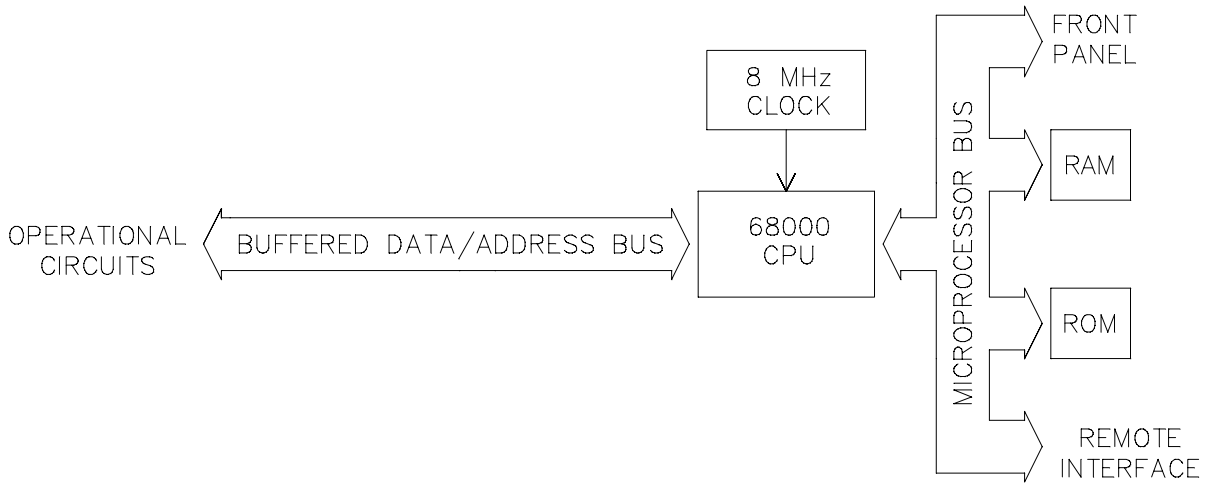


Figure 3-2. The Computer

The computer generates and receives digital information required for operation of almost every instrument function. In this capacity, it

- receives and interprets the operator commands through either the front panel pushbuttons or the remote interface
- returns information to the operator through either the front panel displays or the remote interface
- selects appropriate reference frequencies and intermediate frequencies needed to generate the RF output
- activates and tunes the appropriate YIG oscillators
- selects appropriate filter lines, detectors and RF paths for a given frequency
- controls the power level and modulation of the output
- monitors the functioning of the instrument, and supplies error messages and fault indications to the operator.

3.3 The RF Path

The path of transmission between the output of the fundamental YIG oscillator and the output of the instrument includes circuits for functions such as RF coupling, leveling, switching and filtering. Keeping the RF path as compact as possible with a minimum of cabling and interconnections is highly desirable because it minimizes power loss while improving performance and reliability. Most of the RF path and circuits are incorporated into a single module. The circuits which perform path switching, filtering, coupling, amplification, pulse modulation, and level control for the fundamental outputs of the YIG oscillators are all housed within this module. A separate module is installed in instruments which include the downconverter band (below 2 GHz). This module includes the mixer and frequency dividers to generate low frequencies, together with the circuits which amplify, modulate, and control the level of these frequencies.

3.4 Phase Lock Loops

The purpose of a phase lock loop is to control the frequency of a variable oscillator to give it the same accuracy and stability as a fixed reference oscillator. The PLL works by comparing two frequency inputs, one fixed and one variable, and supplying a correction signal to the variable oscillator to reduce the difference between the two inputs.

For example, a 10 MHz source with a stability of 1 x 10^{-6}/year can transfer that stability to a voltage controlled oscillator (VCO) (see Figure 3-3). The 10 MHz source is applied to the reference input of a phase lock loop circuit. The signal from the VCO is applied to the variable input. A phase detector in the PLL compares the two inputs and determines whether the variable input waveform is leading or lagging the reference. The phase detector has two outputs; pulses will appear at one of them (which one depends on whether the variable is leading or lagging), and the width of the pulses is proportional to the degree of phase difference. The pulses are averaged by a low pass filter and DC amplifier into a correction signal which (depending on polarity) causes the VCO to increase or decrease in frequency to reduce the phase difference. When the two inputs match, the loop is locked and the variable input from the VCO equals the reference input in phase, frequency, accuracy and stability.

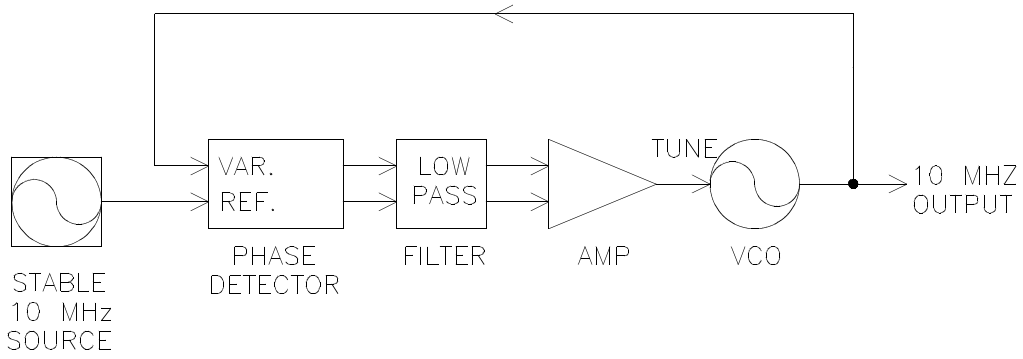


Figure 3-3. Phase Lock Loop Circuit

The preceding description implies that the two oscillators must be of equal frequency, but that is not the case in practical applications. Usually, a prescaler (that is, a frequency divider) is introduced between the output of the variable oscillator and the variable input to the PLL (see Figure 3-4). The circuit can then be used to control a frequency that is an exact multiple of the reference. If a divide-by-two circuit is used, the variable oscillator can be twice the frequency of the reference and still be phase locked to it; the variable oscillator acquires the stability of the reference without equaling its frequency. A 100 MHz VCO can be controlled by a PLL using a 10 MHz reference, provided a divide-by-ten circuit intervenes between the VCO output and the variable input to the PLL. Then both inputs to the phase detector will be 10 MHz when the loop is locked.

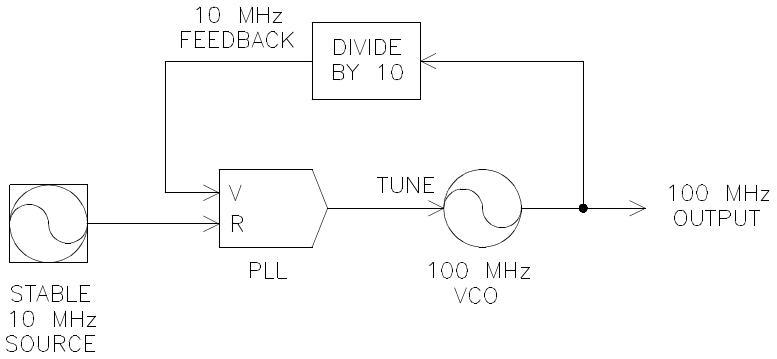


Figure 3-4. Phase Lock Loop Circuit With Prescaler

If the prescaler is a programmable divider, a number of different frequencies can be phase-locked to the same reference, with the limitation that all must be exact multiples of that reference. One of the PLLs employed in this instrument, for example, has a divide-by-N circuit that can be programmed with 300 different integer divisors; therefore it can phase-lock 300 different frequencies to the same reference.

The phase lock loops used in Giga-tronics instruments employ integrated circuit phase detectors with external filter components and amplifiers designed to minimize the sidebands, which the output pulses of the phase detector tend to contribute to the variable frequency.

3.5 Dual-Loop Indirect Synthesis

The output of a synthesized signal generator is phase-locked to a stable reference signal, such as that produced by a crystal oscillator, to give the generator output the stability and accuracy of the reference. This can be difficult to achieve, however, in broad-band generators.

In order to produce stable, spectrally pure frequencies over a wide frequency range, Giga-tronics employs a dual-loop synthesis technique. The two loops are (1) the output loop, which phase-locks the synthesizer output frequency to a reference frequency, and (2) the reference loop, which phase-locks the reference frequency to the timebase. The timebase or master reference is a highly stable 10 MHz source built into the instrument; an external source can be easily substituted for it at the option of the user.

3.6 The Output Loop

Up to three fundamental YIG oscillators are needed to generate the RF output. The ranges of the individual YIGs are 2-8 GHz, 8-20 GHz, and 20-26.5 GHz. Frequencies below 2 GHz are produced by downconversion (mixing and/or dividing the outputs of two oscillators to obtain an intermediate frequency). The frequency of a YIG oscillator is controlled by means of the tuning coil and the FM coil (see Figure 3-5).

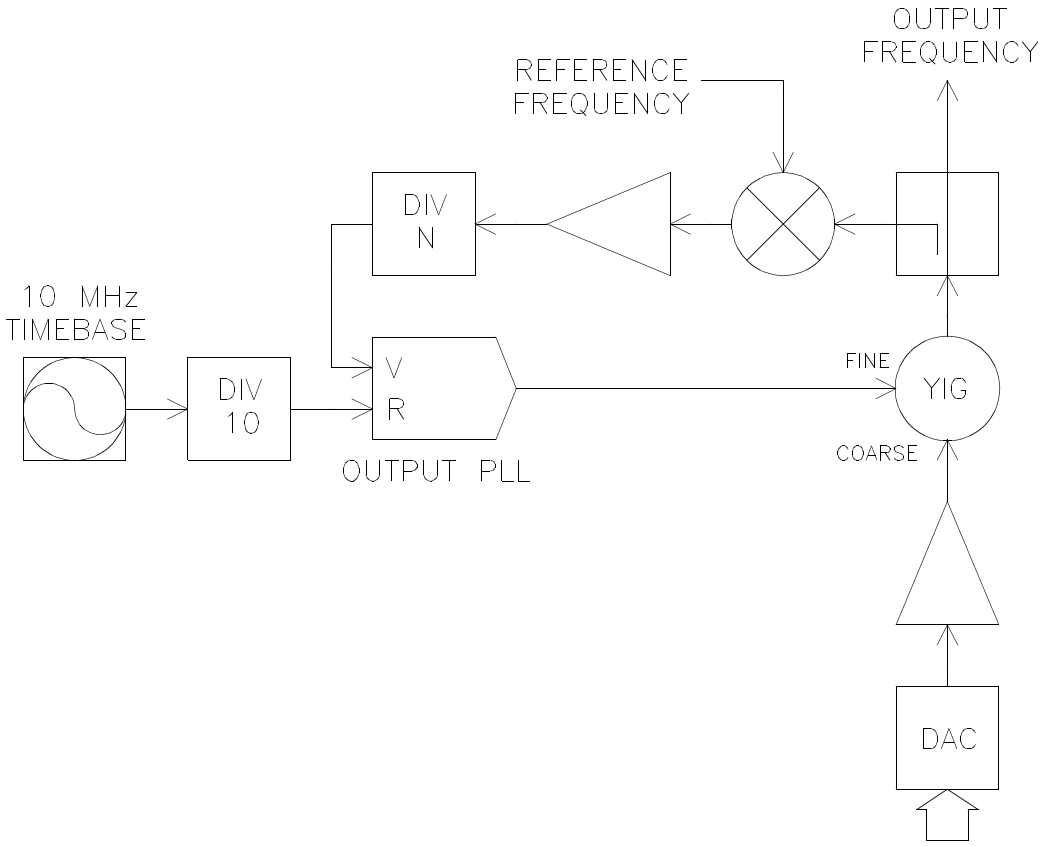


Figure 3-5. The Output Loop

The tuning coil is used for coarse tuning under the direct control of the computer. The computer sends digital data to the YIG driver circuit, where a digital-to-analog converter and an amplifier turn this data into a controlled current supply to the YIG tuning coil. In this way the oscillator can be tuned to within about 10 MHz of the desired output frequency.

The FM coil is used for fine tuning of the oscillator under the control of the output phase lock loop circuit. The output PLL controls the current through the FM coil to phase-lock the YIG to the PLL reference frequency.

When the operator selects an output frequency, the computer selects the appropriate YIG oscillator and (using the tuning coil) coarse-tunes it to within about 10 MHz of the desired output. The signal produced by this YIG will, at some point in the RF path, pass through a coupler which will return a sample of it to the reference mixer.

The other input to the reference mixer is not generated within the output loop; it comes from the reference loop, and is generated by the 1.9-8.7 GHz YIG (the reference YIG). This reference frequency is selected by the computer, and is 95 to 395 MHz lower than the frequency of the output YIG. The IF output of the reference mixer is equal to this difference between reference and output frequencies (in other words, the IF output has a range of 95 to 395 MHz).

The output loop requires a 1 MHz signal from the divide-by-N circuit regardless of the output frequency, because the output loop phase detector compares the output of the divide-by-N with a timebase-derived 1 MHz reference. Therefore, the divide-by-N must be programmed so as to divide the mixer IF down to 1 MHz (the range of divisors for this circuit is 95 to 395). The divisor (N) selected by the computer is equal to the mixer IF, in MHz. If the mixer IF is 195 MHz, N is set to 195. The 195 MHz IF is divided by 195 and a 1 MHz quotient results. The output PLL then compares the two 1 MHz inputs, and adjusts the current in the FM coil of the output YIG oscillator to achieve and maintain phase lock.

For example, if the user requests a 3000 MHz RF output, the computer selects the 2-8 YIG and tunes it to 3000 MHz, but only roughly (the YIG could, at this point, be generating 2994 or 3003 MHz, for example). At the same time, the computer selects the appropriate reference frequency (in this case 2905 MHz) and the appropriate divisor for the divide-by-N circuit (in this case 95, since there is a 95 MHz difference between the two loops).

A sample of the output frequency is furnished to the reference mixer by means of a coupler in the RF path. The other input to the mixer is the 2905 MHz reference frequency. The mixer produces an IF equal to the difference between the reference and output frequencies. The divide-by-N circuit, as programmed by the computer, divides this IF by 95 and supplies the result to the output phase lock loop.

However, since the output oscillator is not tuned to precisely 3000 MHz, the two loops will not be precisely 95 MHz apart, the mixer IF will not be precisely 95 MHz, and the result of dividing the IF by 95 will not be precisely 1 MHz. The output phase lock loop must correct the error.

Comparing the rough 1 MHz signal from the divide-by-N circuit to an exact 1 MHz signal (derived from the timebase), the output PLL determines whether the mixer IF, and therefore the output loop (since the reference loop is assumed to be correct) is too high or too low in frequency, and sends to the output YIG FM coil whatever correction is needed to reduce the error. In this way the output frequency can be fine-tuned to 3000 MHz, with the result that the mixer IF becomes precisely 95 MHz, the divide-by-N (programmed with a divisor of 95) supplies a precise 1 MHz input to the output PLL, and phase lock is achieved.

3.7 The Reference Loop

The operation of the output loop requires a stable reference frequency that is relatively close to the RF output frequency (the limitations of the divide-by-N circuit demand that the difference between the two loops be no greater than 395 MHz). Therefore, the reference loop must accomplish the task of generating a broad range of frequencies and locking them to a single timebase.

The heart of the reference loop is the step recovery diode multiplier, located within the sampling mixer module (see Figure 3-6). This circuit generates multiple harmonics of the signal that is applied to it by the 100 MHz VCXO. Even frequencies as high as 8700 MHz (the 87th harmonic) are generated at useful amplitudes. This permits mixing of the desired harmonic with the microwave signal produced by the reference oscillator.

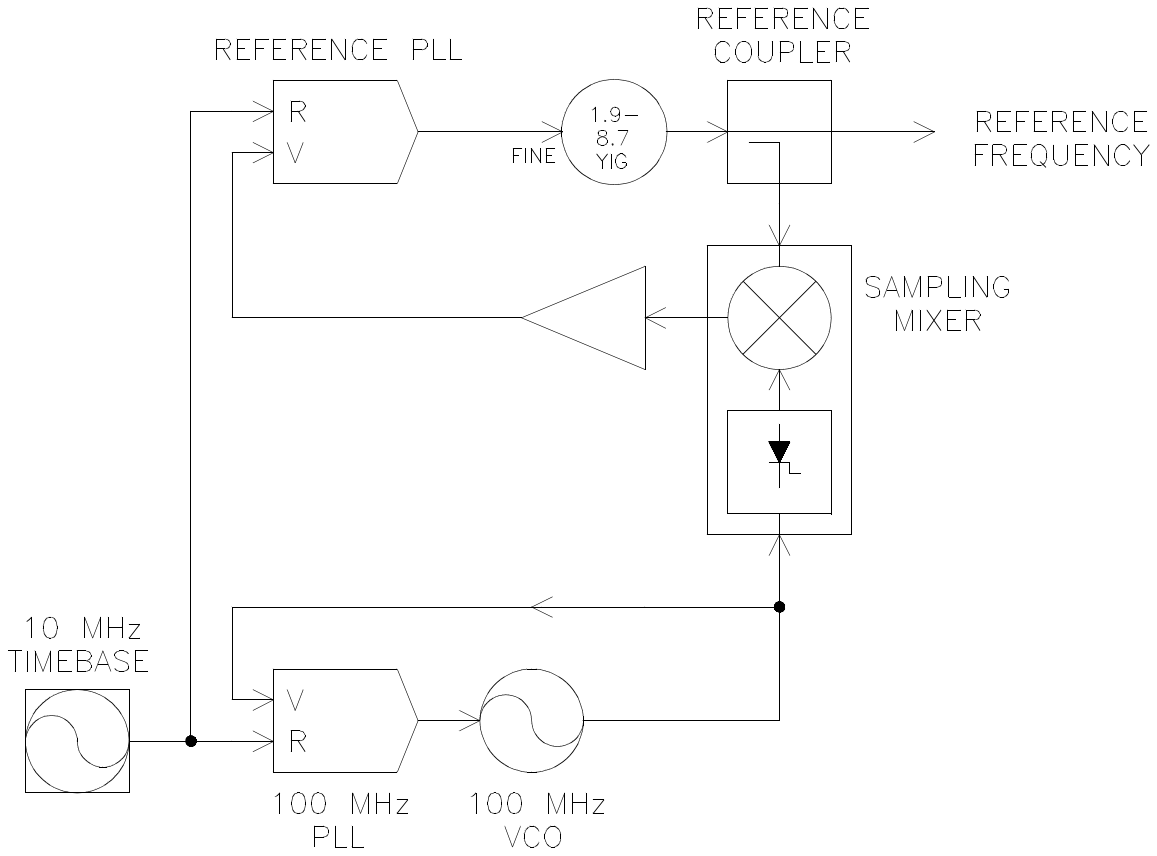


Figure 3-6. The Reference Loop

Since the harmonics generated by the multiplier are based on the 100 MHz VCXO, they have the same stability as the VCXO. When the 100 MHz VCXO is phase-locked to the master reference, these harmonics have the same stability as the master reference. The 100 MHz VCXO is controlled by the 100 MHz PLL circuit, which compares the 10 MHz master reference to the output of the VCXO (suitably divided by ten) and sends a correction signal to the VCXO to maintain phase lock. The harmonics generated by the multiplier have not only the stability and accuracy of the master reference, but also the superior phase noise characteristics of the VCXO. By phase-locking the reference loop to one of the harmonics, it is possible to impart these desirable characteristics to the reference frequency as well.

The reference frequencies selected by the computer are always offset from a multiple of 100 MHz. This offset is equal to either 5 MHz, or 1.667 MHz (which is 5 MHz divided by three). For example, a

reference frequency of 2705 MHz is the 27th harmonic of 100 MHz, plus an offset of 5 MHz. The sampler would mix 2705 MHz with 2700 MHz (the 27th harmonic of 100 MHz) to yield a 5 MHz intermediate frequency (IF). If the reference frequency were 7601.667 MHz, the sampler would mix it with 7600 MHz to yield a 1.667 MHz IF. The 5 MHz or 1.667 MHz IF (following amplification and filtering) is supplied to the reference phase lock loop, which compares the IF to a timebase-derived reference and sends to the reference YIG FM coil whatever correction signal is needed to maintain phase lock. As with the output YIGs, the 1.9 to 8.7 Reference YIG has a tuning coil for coarse tuning under the direct control of the computer, and an FM coil for fine tuning under the control of the reference PLL.

The reference loop operates in virtually the same way for any reference frequency; the harmonic used and the size of the offset varies (5 MHz or 1.667 MHz). The sampling mixer is not actually capable of choosing harmonics. Its IF output includes many intermodulation products, but these higher frequencies are excluded by a low-pass filter on the sampling mixer output. Only an IF in the desired range can pass through to the phase detector of the reference loop.

The choice of a 5 MHz or 1.667 MHz offset is determined by the output frequency. The 1.667 MHz offset is used when the frequency of the output oscillator exceeds the range of the reference oscillator. For example, an output frequency of 15000 MHz is well outside the range of the reference oscillator. In this case the reference frequency is set to 4901.667. The third harmonic of that frequency, 14705, is only 295 MHz lower than the output frequency. The reference mixer produces a 295 MHz IF based on the difference between the output frequency and the third harmonic of the reference frequency. This kind of third-harmonic mixing is required at output frequencies above 8000 MHz and also at down-converted frequencies from 495 to 1999 MHz. It has no effect on the reference loop, except that the timebase must be divided differently to provide a 1.667 MHz reference to the reference PLL phase detector. Reference frequencies (f_{ref}) for all output frequencies (f_{out}) are listed in Table 3-1.

Table 3-1. Output and Reference Frequencies (in MHz)

fout	fref	fout	fref	fout	fref
10-48	2601.667	1150-1174	4505	2000	(see note)
49-123	2701.667	1175-1199	4605	2001-2099	1905
124-198	2801.667	1200-1224	4705	2100-2199	2005
199-273	2901.667	1225-1249	4805	2200-2299	2105
274-348	3001.667	1250-1274	4905	2300-2399	2205
349-423	3101.667	1275-1299	5005	2400-2499	2305
424-498	3201.667	1300-1324	5105	2500-2599	2405
499	3301.667	1325-1349	5205	2600-2699	2505
500-524	1905	1350-1374	5305	2700-2799	2605
525-549	2005	1375-1399	5405	2800-2899	2705
550-574	2105	1400-1424	5505	2900-2999	2805
575-599	2205	1425-1449	5605	3000-3099	2905
600-624	2305	1450-1474	5705	3100-3199	3005
625-649	2405	1475-1499	5805	3200-3299	3105
650-674	2505	1500-1524	5905	3300-3399	3205
675-699	2605	1525-1549	6005	3400-3499	3305
700-724	2705	1550-1574	6105	3500-3599	3405
725-749	2805	1575-1599	6205	3600-3699	3505
750-774	2905	1600-1624	6305	3700-3799	3605
775-799	3005	1625-1649	6405	3800-3899	3705
800-824	3105	1650-1674	6505	3900-3999	3805
825-849	3205	1675-1699	6605	4000-4099	3905
850-874	3305	1700-1724	6705	4100-4199	4005
875-899	3405	1725-1749	6805	4200-4299	4105
900-924	3505	1750-1774	6905	4300-4399	4205
925-949	3605	1775-1799	7005	4400-4499	4305
950-974	3705	1800-1824	7105	4500-4599	4405
975-999	3805	1825-1849	7205	4600-4699	4505
1000-1024	3905	1850-1874	7305	4700-4799	4605
1025-1049	4005	1875-1899	7405	4800-4899	4705
1050-1074	4105	1900-1924	7505	4900-4999	4805
1075-1099	4205	1925-1949	7605	5000-5099	4905
1100-1124	4305	1950-1974	7705	5100-5199	5005
1125-1149	4405	1975-1999	7805	5200-5299	5105
5300-5399	5205	7700-7799	7605	13600-13899	4501.667
5400-5499	5305	7800-7899	7705	13900-14199	4601.667

fout	fref	fout	fref	fout	fref
5500-5599	5405	7900-7999	7805	14200-14499	4701.667
5600-5699	5505	8000-8199	2601.667	14500-14799	4801.667
5700-5799	5605	8200-8499	2701.667	14800-15099	4901.667
5800-5899	5705	8500-8799	2801.667	15100-15399	5001.667
5900-5999	5805	8800-9099	2901.667	15400-15699	5101.667
6000-6099	5905	9100-9399	3001.667	15700-15999	5201.667
6100-6199	6005	9400-9699	3101.667	16000-16299	5301.667
6200-6299	6105	9700-9999	3201.667	16300-16599	5401.667
6300-6399	6205	10000-10299	3301.667	16600-16899	5501.667
6400-6499	6305	10300-10599	3401.667	16900-17199	5601.667
6500-6599	6405	10600-10899	3501.667	17200-17499	5701.667
6600-6699	6505	10900-11199	3601.667	17500-17799	5801.667
6700-6799	6605	11200-11499	3701.667	17800-18099	5901.667
6800-6899	6705	11500-11799	3801.667	18100-18399	6001.667
6900-6999	6805	11800-12099	3901.667	18400-18699	6201.667
7000-7099	6905	12100-11499	3701.667	18700-18999	6201.667
7100-7199	7005	11500-11799	3801.667	19000-19299	6301.667
7200-7299	7105	11800-12099	3901.667	19300-19599	6401.667
7300-7399	7205	12100-12399	4001.667	19600-19899	6501.667
7400-7499	7305	12400-12699	4101.667	19900-20000	6601.667
7500-7599	7405	12700-12999	4201.667		
7600-7699	7505	13000-13299	4301.667		

Notes

1. At 2000 MHz, the reference frequency is 7905 for instruments which include the downconverter range (<2 GHz), and 1905 for instruments which do not include this range.
2. See Table 3-2 for output and reference frequencies to 26.5 GHz.

For instruments to 26.5 GHz, the range above 20 GHz is generated by a 20-26 YIG oscillator. The reference frequencies for the different ranges are listed in Table 3-2.

Table 3-2. 20-26 GHz YIG Reference Frequencies

f_{OUT}	f_{REF}	f_{OUT}	f_{REF}	f_{OUT}	f_{REF}
20000-20199	6601.667	22000-22299	7301.667	24100-24699	8101.667
20200-20499	6701.667	22300-22599	7401.667	24700-24999	8201.667
20500-20799	6801.667	22600-22899	7501.667	25000-25299	8301.667
20800-21099	6901.667	22900-23199	7601.667	25300-25599	8401.667
21100-21399	7001,667	23200-23499	7701.667	25600-25899	8501.667
21400-21699	7101.667	23500-23799	7801.667	25900-26199	8601.667
21700-21999	7201.667	23800-24099	7901.667	26200-26500	8601.667

3.8 The Downconverter

Frequencies up to 2000 MHz are generated within the downconverter module. The 10 to 2000 MHz range of the downconverter spans more than seven octaves. The module is divided into multiple paths to accommodate changes in component frequency response across the wide range of the downconverter (see Figure 3-7).

Frequencies in the range of 875 to 2000 MHz are generated as follows. The output of the 2-8 GHz YIG, tuned to a frequency in the range of 3500 to 8000 MHz, is applied (through a switch) to a Divide-by-4 circuit. The Output PLL locks the YIG output to a frequency which is four times higher than the desired output.

Frequencies in the range of 500 to 875 MHz are generated in the same way except that a different Divide-by-4 circuit with a lower input range is used. In this band, the YIG is tuned by the Output PLL to a frequency in the range of 2000 to 3500 MHz, and the divider reduces it to the desired output frequency.

Frequencies in the range of 10 to 500 MHz are generated by downconversion (that is, by mixing two high-frequency signals to obtain an intermediate frequency in a lower range). In this band, the 2-8 YIG is locked on 8005 MHz. The 8-20 YIG is locked on a frequency in the 8045 to 10005 MHz range (this frequency is set higher than 8005 by an amount equal to the desired output frequency). These two signals are applied to a mixer. The IF output of the mixer (which equals the difference between the two inputs, and has a range of 40 to 2000 MHz) is applied to the second Divide-by-4 circuit, which reduces it to an output in the range of 10 to 500 MHz.

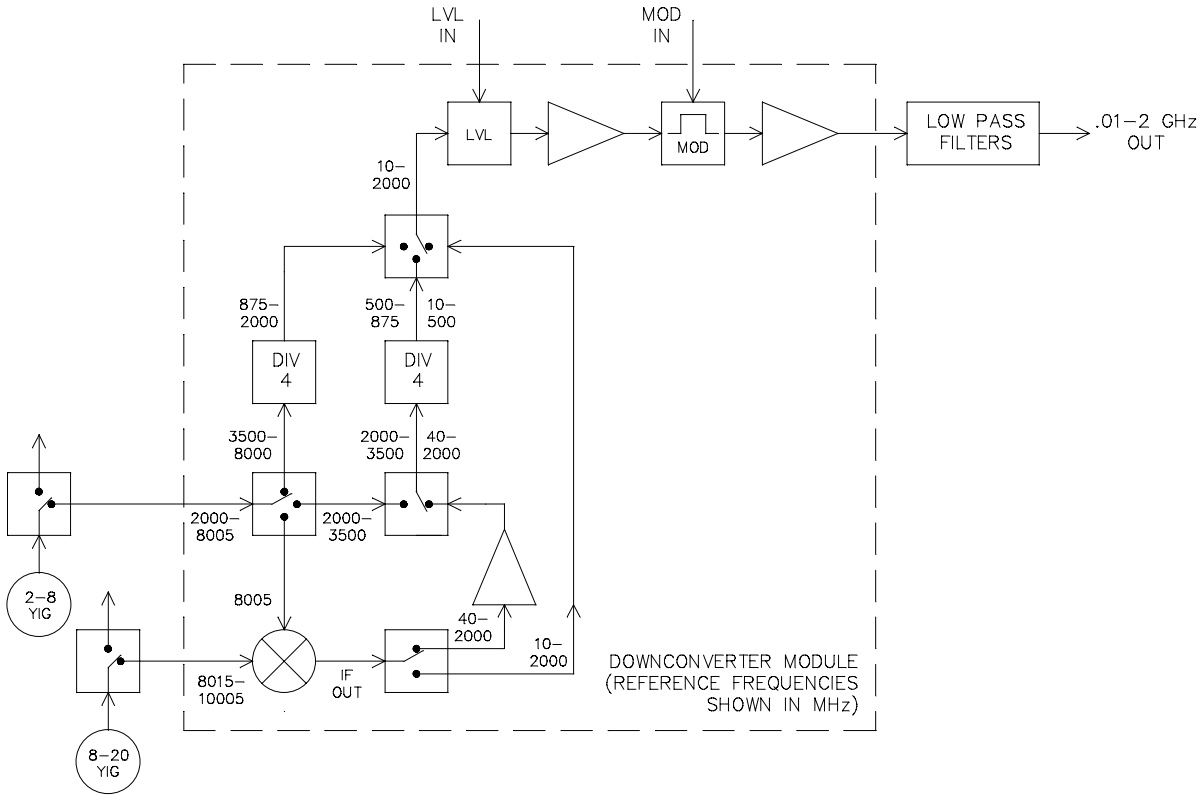


Figure 3-7. Downconverter Module

Because two YIG oscillators are required for downconversion, two PLL circuits are needed (see Figure 3-8). The 8-20 YIG is tuned by the Output PLL circuit, and the 2-8 YIG (which generates a fixed 8005 MHz output) is tuned by the Downconverter PLL circuit. Feedback coupled from the 2-8 YIG output is applied to a sampling mixer, and combined with a timebase-derived 8000 MHz harmonic to produce a 5 MHz IF, which in turn is applied to the variable input of the Downconverter PLL. The PLL tunes the 2-8 YIG to 8005 MHz.

In instruments which do not include the range below 500 MHz, the downconverter mixer and the downconverter PLL are not used, and all frequencies up to 2000 MHz are generated by the 2-8 YIG and divided down to the desired output.

A second downconverter scheme bypasses the frequency dividers, and uses the downconverter mixer to generate the entire 10 to 2000 MHz range (see Figure 3-8). In this scheme, the 8-20 YIG is tuned to a frequency in the range of 8015 to 10005; this frequency, mixed with 8005 MHz output of the 2-8 YIG, produces an IF in the 10 to 2000 MHz range. Ordinarily, this no-divider scheme is not used, because the dividers improve the phase noise characteristics of the YIG output, and the mixer alone does not. However, during analog frequency sweep operation, or when certain special functions are used, the dividers are bypassed to produce faster frequency changes.

The output frequency (in the range of 10 to 2000 MHz) passes through a leveler, pulse modulator, and amplifiers on the way out of the downconverter module. A separate module contains the low pass filters which remove harmonics from the output of the downconverter module.

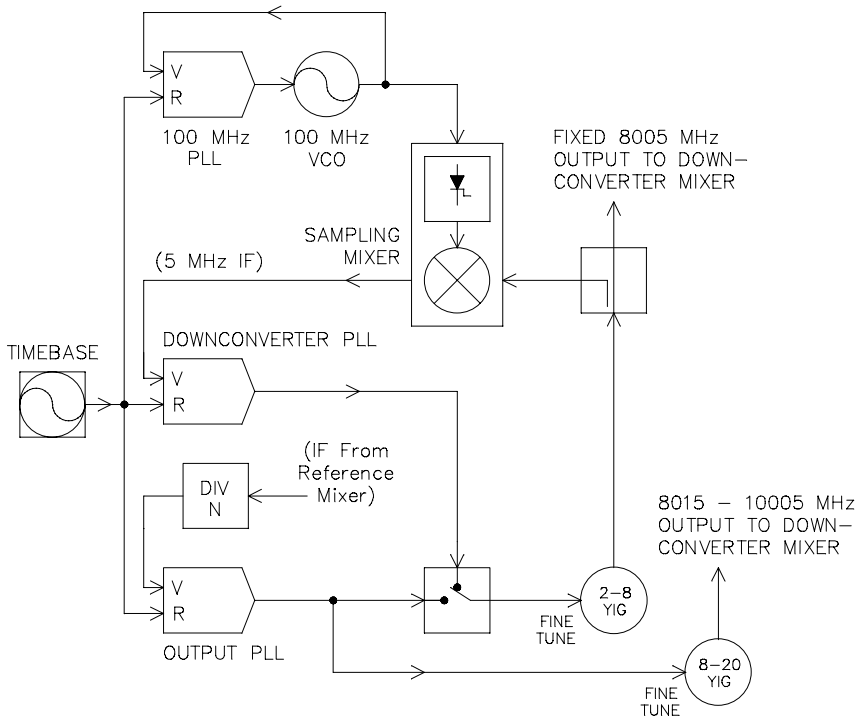


Figure 3-8. Downconverter Phase Lock Loop

3.9 Frequency Sweep

3.9.1 Step/Dwell Frequency Sweep

Because it is computer controlled, the synthesizer can easily be set up to sweep across a range of frequencies. You can select start and stop frequencies and the instrument progresses between those limits, once or repetitively by various increments and at various rates (or in single steps which are each triggered by the operator). An analog output proportional to progress between sweep limits is available, with 0 volts at the start frequency and +10 volts at the stop frequency. A pen lift output signal is provided for controlling a recorder pen. The signal is low (a transistor to ground) during sweep and is high during sweep reset or when the sweep is in hold. A single sweep or a single step can be initiated by means of a trigger input as well as by pushbutton.

3.9.2 Analog Frequency Sweep

Analog frequency sweep operation is driven by a 10 V analog ramp generator. The CPU sets the speed of the ramp to control sweep time. The ramp output is applied through a summing circuit to a multiplying digital-to-analog converter. The summing circuit combines the 10 V ramp with a band change voltage. The CPU sets the multiplying factor for this DAC to control the amplitude of the ramp, and therefore, to control the width of the sweep. The DAC ramp is summed with the main tuning output of the YIG driver circuit and applied to the main tuning coil of the YIG oscillator to raise the output frequency from its starting value. An inverting amplifier can be switched into the path between the DAC and the main tuning coil to reverse the sweep direction.

The CPU programs two other DACs to generate band-change voltages and marker voltages. Comparators detect when one of these voltages is reached, and trigger the sweep circuits to initiate a band change or produce a marker output. In addition, the band-change voltage passes through an inverting amplifier and is summed with the 10 V ramp at band changes, so that each band in the sweep begins with a zero-volts sweep input to the YIG driver circuit (this insures that the sweep band begins from the correct starting frequency).

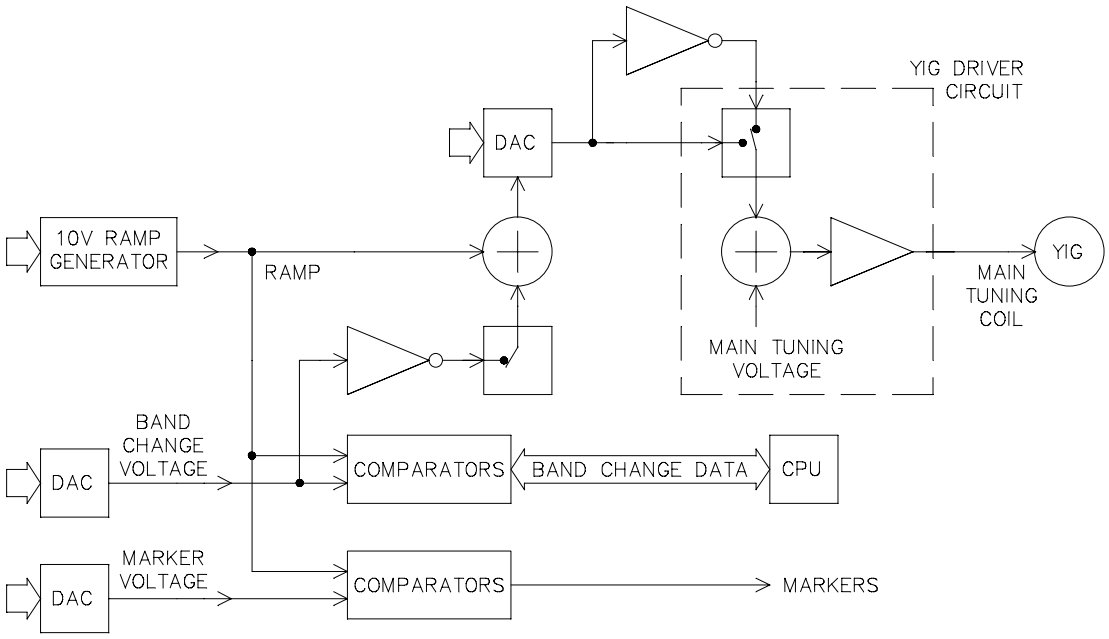


Figure 3-9. Analog Frequency Sweep

3.10 Frequency Modulation

This feature is implemented by injecting a modulation signal into the output phase lock loop circuit (see Figure 3-10). The modulation input is summed with the output of the loop phase detector and integrator. The combined signal drives the FM fine tuning coil of the YIG oscillator. Because of the modulation input, the input to the FM coil varies; the YIG output frequency tracks these variations.

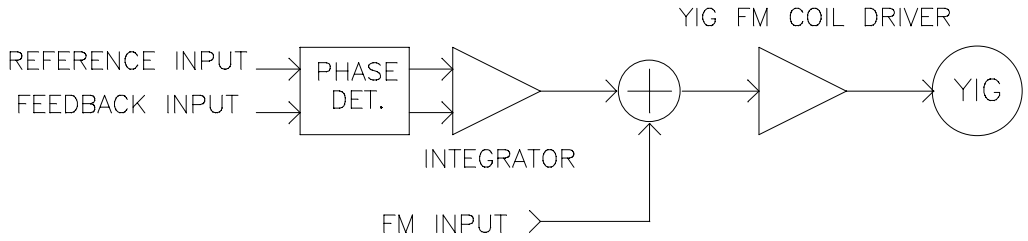


Figure 3-10. Frequency Modulation

3.11 Amplitude Modulation

Amplitude modulation is accomplished by adding a modulation input to the level control loop. The AM input is combined with the leveling reference generated by the CPU and DAC, in such a way that the amplitude of the modulating signal tracks any changes in level (this insures that AM depth remains constant for different levels). The level control circuit output to the leveler is therefore modulated by the AM input waveform, and the RF output becomes amplitude modulated.

This modulation method is not used in instruments with Option 27 (see Appendix A of the manual for Options information).

3.12 Pulse Modulation

Pulse modulation is essentially a means of shutting off the output signal for short periods. The modulation OFF pulses are applied to PIN diode switches within the RF module. During the OFF intervals, the particular RF path which is normally activated for the present output frequency is temporarily shut down. That is, during the ON periods one output path is open, and during the OFF periods no output path is open.

The very fast rising and falling edges of the modulating pulses are produced by pulse driver circuits, in response to a modulation waveform. The modulation waveform can be generated within the instrument, or it can be supplied by an external source. The internal modulation source is a pulse generator with variable pulse rate, width, and delay. The timebase is used as a reference by the generator, so all rates and intervals are highly accurate. For the purpose of synchronizing auxiliary instruments, a TTL level modulation waveform output is available, whether the modulation source is internal or external.

3.13 Level Control

RF output amplitude is controlled by a combination of fixed-step attenuation and closed-loop leveling. The RF output stage includes a step attenuator providing up to 110 dB of attenuation in 10 dB steps. Finer control of the output power level is provided by the closed loop leveling system, also referred to as Automatic Level Control or ALC.

The level control system operates similar to a phase lock loop in that it produces a correction signal based on the difference between a feedback input and a reference input. The feedback input comes from a level coupler/detector in the RF path. The reference input is generated by the computer, based on the requested level setting and on correction data stored in memory. The output correction signal drives a leveler (a variable attenuator circuit), placed in the RF path ahead of the level detector (see Figure 3-11).

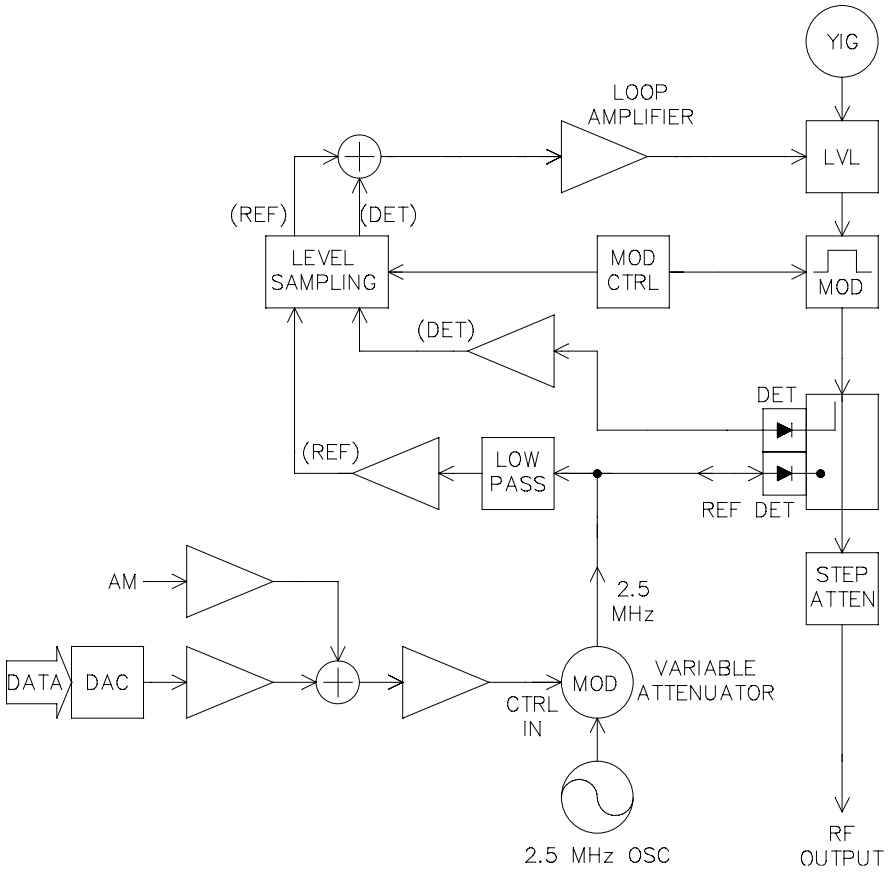


Figure 3-11. Automatic Level Control and AM

The CPU programs a digital-to-analog converter with level data, including correction factors stored in the characterization tables, to generate a DC reference signal. However, this reference signal needs to be further corrected for the non-linear response curve of the level detector. This is accomplished by turning the DC reference signal into a 2.5 MHz signal of variable amplitude, which is applied to a reference detector. The reference signal is applied to the control input of a balanced modulator on the output of a 2.5 MHz crystal oscillator. The modulator serves as a variable attenuator, controlling the amplitude of the 2.5 MHz output. The modulated 2.5 MHz signal is applied to the reference detector, which is matched to the level detector and is located in the same module. The DC voltage rectified by the reference diode is furnished by a low pass filter and amplifier to the summing junction of the loop amplifier.

This system corrects not only for detector non-linearity, but also for temperature changes (because both detectors are located in the same place and have matching characteristics, temperature-related variations will cancel out). The level detector output is amplified and furnished to the summing junction of the loop amplifier. The loop amplifier output drives a PIN diode attenuator circuit (also known as a leveler) in the RF output path to adjust the output level. The loop amplifier drives the leveler in whichever direction will equalize the detector feedback signal and the reference signal.

Two separate level detectors are used for the output ranges above and below 500 MHz, but the same compensation detector is used in both cases. A remote detector (or the DC output of a power meter) may be substituted for the internal detectors during operation in the External ALC mode.

The RF path through the microwave module is divided into different paths for different frequency ranges; there are separate levelers for the 2-8 GHz, 8-20 GHz, and 20-26 GHz ranges. During operation in the downconverter band (frequencies up to 2 GHz), power is controlled by a leveler in the downconverter module.

3.14 Power Sweep

3.14.1 Step/Dwell Power Sweep

Because it is computer controlled, the synthesizer can easily be set up to sweep across a range of power levels. The user selects start and stop levels, and the instrument progresses between those limits, once or repetitively, by various increments, at various rates (or in single steps which are each triggered by the user). A single sweep or a single step can be initiated by means of a trigger input as well as by pushbutton.

3.14.2 Analog Power Sweep

This feature is implemented by applying a ramp to the AM input of the level control circuit (see Figure 3-12). The CPU programs a 10 V ramp generator, setting the speed to control sweep time. The ramp is applied to a multiplying digital-to-analog converter; the CPU programs the DAC multiplier to control the amplitude of the ramp and therefore the sweep range. The DAC output passes through an anti-logarithmic amplifier (which corrects for the non-linearity of the compensation detector in the level control loop) and is applied to the AM input of the leveling circuit. The level control output, and therefore the RF output amplitude, tracks the ramp input.

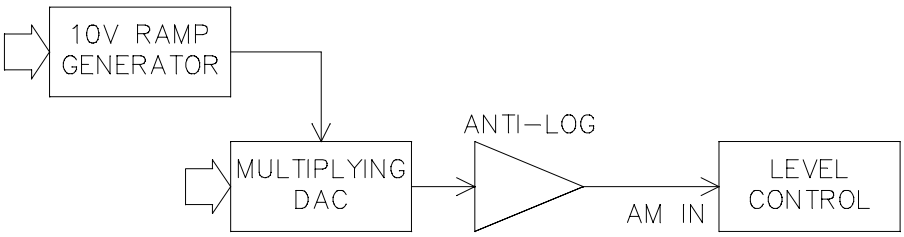


Figure 3-12. Analog Power Sweep

3.15 Assembly Circuit Descriptions

The following sections describe the circuit theory and operation of specific assemblies in the GT 9000S Microwave Synthesizer. Each section heading includes the PC assembly number as shown in the related circuit drawings.

3.15.1 Front Panel Interface, PC Assembly A1

The Front Panel Interface PC assembly interfaces the front panel and the computer. This includes front panel data entry (in the form of keystrokes or knob movement) as well as front panel data display.

U1, a 4-to-16 decoder, decodes the chip selects for the different front panel displays and interfaces. U14A thru U14D provide the individual chip selects for the front panel ENTRY MENU displays, which are gated by the UR/UN line. U2A provides a load signal for loading data to these displays.

The U3 Keyboard decoder, where D1 thru D11 represent columns and S1 thru S8 are rows, identifies keys pressed and outputs information to the computer bus via the U5 buffer. U15B provides a clock circuit for scanning the keyboard. Whenever the keyboard is active, U15A detects the Data Available line and causes an interrupt to be generated by U6A and U11B. When the computer responds with a chip select from U1 indicating that the keyboard can be read, the interrupt is cleared via U6A. U7A and U11A activate the Memory Ready line which slows the CPU as required for read cycles to occur.

When the front panel knob is turned, the optical decoder generates pulses at U8A and U8B; the flip-flops of U8 are set so that the output at U8-9 indicates which way the knob was turned. U8-5 flips, generating an interrupt via U11C. When the computer selects the knob to be read, a chip select is received at U7B from U1 to clear the interrupt.

U4, U5, U9, and U18 provide buffers for computer bus interface.

U12 is the Configuration ROM. It stores the information such as the frequency range and what options are installed. It is also programmed to hold various characterization data.

U13 is a non-volatile RAM chip to store the current unit settings when the power is turned off. It also stores multiple unit setups in memory locations 0 thru 9.

3.15.2 IEEE / TIMER, PC Assembly A2

U10 is the interrupt timer for the CPU. It is clocked by the oscillator consisting of Y1, C10, and C12.

U8 and U9 provide for the addition of an RS-232 interface feature which is not yet implemented.

U12, U13, and U14 operate the remote control interface, which conforms to the IEEE-488 standard.

U3 decodes chip selects for the circuits on this board. U11 acts as a buffer for certain computer bus lines.

The outputs of flip-flop U5 latch attenuator data; U7 and U4 provide the proper logic levels for driving the attenuator. The outputs of flip-flop U6 latch miscellaneous computer control lines.

3.15.3 Memory, PC Assembly A3

U1 through U4 are RAMs used by the CPU for temporary data storage.

U5 through U14 are ROMs used to store the operational software.

The RAMs and ROMs are 32K x 8 and are used in pairs (one for even addresses and the other used for odd), to simulate 32K x 16 as required by the 16-bit data bus.

3.15.4 CPU, PC Assembly A4

Y1, C3, C4, Q1, and U6A provide clocking for U1, the 68000 microprocessor chip.

U2, U3, and U4 buffer the output to the I/O data bus.

U5A and B make up the Power-On Reset logic. The presence of the clock is detected at U5-2. There is a set delay before the reset line switches to prevent failures during brownout or power glitch conditions.

U7 decodes interrupts. When the CPU receives an interrupt, one of the FC0 - FC2 lines is activated causing U8, U9, and U10 to generate several different logic signals. VPAN puts the CPU into the non-vectored interrupt mode to handle the interrupt. The MR (Memory Ready) logic is also generated, which slows the CPU for read/write cycles.

U11 and U12 are a buffer between the I/O bus and the CPU.

U1, U3, and U15-U18 decode chip selects for boards or circuits on the I/O bus. U19, U20, and U21 give a startup vector to the CPU on power up.

3.15.5 Pulse Driver, PC Assembly A5

The pulse driver PC assembly has various logic circuits required for directing the pulse signals to the proper locations, as well as the actual pulse driver circuitry which drives the pulse modulators. U12-U15 are latches providing interface between the I/O bus and the individual circuits on the driver board as well as the pulse generator board (A5A1). U11 decodes the chip selects for the latches and other circuits.

When EXT Pulse Modulation is selected, the external pulse signal is received at PM_IN, U1-5. The external signal and its complement are output on U1-2 and U1-4. EPM- logic at U1-7 selects one of the signals to propagate U2A or B, selecting + or - edge triggering when EXT TRIG (+ or -) or EXT PULS (+ or -) is selected. In the case of EXT TRIG, the trigger signal (TRIGN) is supplied to the pulse generator PC assembly (A5A1) via U4D, U8C and U9C.

The external pulse signal from U2A or B passes thru U2D to the pulse drivers when U2D is enabled via U3A and the EXTPUL logic signal. The PULSE signal from the pulse generator PC assembly passes thru U2C and on to the pulse drivers when the INT/TRIG signal is true. This allows only one signal at a time, either the external pulse signal or the internal pulse signal, to drive the pulse modulators.

The selected pulse signal is provided to the rear panel as the PM_VIDEO signal after being translated to a TTL signal. U6A, U4 and associated components allow the rising and falling edge of this signal to be positioned to align with the actual pulsed RF out of the unit.

The selected pulse signal (referred to as SAMPN on the schematic) is used for the purpose of sampling the detector voltage on the leveling board when the RF is on. In order to do this it is necessary to delay and shorten the pulse. This is done by U8A, B, D, and U9A, B, D. The signal is then translated by U10A, U10B, Q7 and Q8 to signal levels that are capable of switching the FET samplers on the Leveling PC assembly. The resulting signal is called SAMPLE.

U1C and D, and U3D handle the logic which selects the proper driver to be enabled at U5A, B or C. The pulse signal is translated to TTL levels at U6B thru D.

When pulse modulation is not selected, the FET samplers on the leveling PC assembly must stay on continuously. The PULSE_OFF logic signal serves this purpose through U3C and U7A.

3.15.6 Pulse Generator, PC Assembly A5A1

The pulse generator consists of the rate generator, the delay generator, and the width generator.

The rate generator employs a programmable phase lock loop circuit, consisting of a 3-10 MHz VCO (U1), and two synthesizer chips (U3/U4) containing phase comparators and programmable dividers. The PLL circuit uses the 10 MHz timebase (translated to TTL levels by U20D and enabled by U2B when the internal pulse mode is selected) as a reference input, and generates a series of stable frequencies, selected by the programming of the synthesizer chips. There are actually two ranges of frequencies, depending on whether U2C (Range 1) or U2D (Range 2) is enabled. The signal propagates through U5A and U5B to U33A. In the case of externally triggered modulation, U7A is enabled and the TRIGN input propagates through it to U33A. The output of U33A (STARTN) gates (via U6A) a 100 MHz delay line clock

consisting of U8D, U22, C32, and C33. This signal is converted to a PM_SYNC signal by U33D, U7B, U7C, U33C, and U20C, for output to the rear panel.

The delay is generated in 10 ns increments by multiple counters which are clocked by the 100 MHz clock described above. U10 is a 4-bit counter which counts delays up to 160 ns; U16 is an 8-bit counter which counts up to approximately 40.9 µs in 160 ns increments. U17 counts up to approximately 10.485 ms in 40.9 µs increments and U23 counts up to approximately 2.6 s in 10.485 µs increments. These counters are programmed by the computer, allowing up to 2 seconds of delay, programmable in 10 ns increments. When the delay cycle is completed and the DEND from U28A and the COUT from U10 have propagated through the gates giving low inputs at U8-6 and U8-7, U6-10 is toggled and the width cycle starts on the next clock cycle. The beginning of the width cycle causes U6-15 to go high. This signal, after propagating through U13A and U33B, is the actual pulse signal which will ultimately drive the RF pulse modulators.

The width is also generated in 10 ns increments and the counters (U11, U25, U26, and U27) are set up similar to those which control the delay cycles. The width cycle ends when both inputs to U8C are low to reset U6 (this is controlled by U11 COUT and U28 DEND).

The next trigger from the rate generator will start another delay and width cycle.

3.15.7 AM/FM Driver, PC Assembly A6

The AM/FM driver PC assembly has two main functions. The first is to select the internal or external AM or FM signal. The second is to adjust the amplitude of the selected signal according to the depth or deviation required before outputting the signal to the level board (for AM) or the output PLL (for FM).

U3 is an analog switch to select the external AM signal or a signal from the internal generator. The selected signal is buffered by U1 and then converted to a differential signal by U7A and B. One side of this differential signal is buffered by U25A for output to the rear panel as the AM_SIG output. The U8 Modulator IC functions as a variable attenuator controlled by a voltage from the DAC U4. The voltage at U5-7 changes according to the selected AM depth of modulation. The DAC has a reference voltage which is derived from U9, inverted and attenuated to give 3.2 volts. The output of the variable attenuator U8 is a differential signal which is combined by U2A to give a single AM signal output. U23 switches this output (the signal can be switched to be DC coupled or inverted to give an output 180 degrees out of phase with the input signal) to the input of U25B, which provides the AM signal to the level board A10.

U10 is an analog switch to select the external FM signal or a signal from the internal generator. The selected signal is buffered by U11 and converted to a differential signal by U13A and B. One side of this differential signal is buffered by U26A for output to the rear panel as the FM_SIG output. The voltage from DAC U4 and U5A controls the amplitude of the FM signal via U14, depending on the deviation selected. The output of the variable attenuator U14 is a differential signal combined by U15 to give a single signal output. This output is then switched by U21 (the signal can be switched to be DC coupled or inverted to give an output which is 180 degrees out of phase with the input signal) to the input of U26B, which provides the FM signal for the output PLL board A18.

U16 decodes chip select lines for other IC's on the board. U17 thru U20 are required to latch data for circuits on this board and also for circuits on the A6A1 PC assembly.

3.15.8 Function Generator, PC Assembly A6A1

The heart of this assembly is the Function Generator chip U1. This IC requires a 10 MHz clock supplied external to the board but buffered on board by Q1 and Q2. The IC actually contains two function generators which have been designated as gen A and gen B.

For gen A multiplexers, U2, U3 and U4 address RAMs U8, U9 and U10. If INT SINE wave is selected, the computer stores data into the RAMs equal to the address being programmed. However, if INT TRI wave is selected, the computer performs a function on the address data which turns the data from sine data into triangle data and stores the new data into the RAMs. Now, a sine or triangle wave is created

when the function generator chip outputs data which addresses the RAM, and the RAM data becomes DAC U15 input data. The output of this DAC will be the sine or triangle wave (whichever was selected). The components L1, L2, C21, C22, C23 form a low pass filter required to filter glitches out of the 10 MHz clock. The SINE CAL pot R4 is used to adjust the amplitude of the sine wave which is then amplified by U16A. The output is switched by analog switch U20 or U21. U21 can be switched to allow the sine wave to be converted to a square wave, via U17. The duty cycle of U17 can be adjusted with R31 and R32. The output of U17 A drives the SQR CAL pot which allows adjustment of the amplitude of the square wave. The signal then buffered by U16B before arriving at U20 analog switch. At U20, the Sine or Square wave signal is switched for A_GEN output to the AM/FM Driver PC assembly (A6).

Generator B operates identically to generator A and has its own set of multiplexers U5, U6 and U7, RAM's U11, U12, U13, DAC U18 and sine wave to square wave converter U17D.

3.15.9 Scan Modulation, PC Assembly A7

This circuit translates the internal or external modulating signal into a control signal for regulating the attenuation of the scan module.

U10 and U35 decode certain control inputs from the computer. U10 enables and disables the 10 MHz clock (used to drive DACs and ADCs on this circuit board when they are needed).

U35 switches Q1 on and off to control the relay that switches the scan module into or out of the RF output path.

U11B generates a reference voltage needed by the analog-to-digital converter U12.

U11A generates a reference voltage needed by U2B, U33A, and U33B.

U33A and U33B generate reference voltages needed by FETs in the scan module.

The modulating input signal (internal or external in origin) is received by switch U3B (jumpers P2 and P3 control the input impedance for the external modulation input; normally it is 50 ohms). Between U3B and a second switch (U3A) are two paths for the modulating signal: An AM path includes scaling and logarithmic amplification circuits (U2B, U1, U4, U2A) needed in the Linear AM mode, and a Scan path which bypasses these. After U3A, the modulating signal passes through a shaper circuit (U5) which compresses its range to

±1 V so that it can drive U12, an analog-to-digital converter.

The digital outputs of the ADC are applied to the address switches (U19, U20, U21) to control addressing of the RAMs U22, U23, and U24. Together, these RAMs make up a 4K x 12 volatile memory (scan module correction data are downloaded into this memory from ROM when scan modulation is selected).

As the modulating input changes, the digital output of the ADC tracks it, retrieving from RAM the appropriate correction data at each point. The data from RAM is applied to the U29 DAC, which converts it into an analog control signal to drive the scan module (via U44 and U45).

For internal modulation, the U39 DAC is used by the computer to add an offset to the internal modulating signal to control the depth of modulation. The DAC output, amplified by U40A and U40B, is summed with the internal modulating signal at U38-6. Switch U37B controls the gain of U40B, which is reduced by half when the variable attenuation mode is selected.

3.15.10 Analog Sweep #1, PC Assembly A8

The analog sweep board provides many signals required during analog sweep. The board has Digital-to-Analog Converters (DACs), which provide ramps for driving the main tune coils of the YIGs. It also has DACs to provide ramp voltages to trigger a number of comparators, thus generating various logic signals necessary to switch various filters and bands. Another set of DACs is used to control comparator reference voltages according to the marker frequencies which may be set. These comparators then generate the marker pulses.

DAC U1A gives a DC voltage at the output of U11B which determines the rate at which the unit sweeps. DACs U1B, U2A and B are set up to give a voltage at the output of their respective amplifiers (U11A, U14B and A) which corresponds to frequency band changes (at 2, 8 and 20 GHz). Specifically, for the 2 GHz band switch point the voltage from U11-1 is the reference voltage for comparator U4D. The 10 V_RAMP from A8A1 is the other input to the comparator. When the ramp voltage reaches the reference voltage the comparator switches, resulting in a pulse at U6-8 which propagates thru U7 and U16, clocking flip flop U8A. This causes the Q-not output to go low signaling the computer that a band change must take place. This Q-not output also causes the hold line (U15-10) to trigger thereby stopping the ramp on the A8A1 board. In addition the signal is output to the rear panel as the STOP SWP I/O logic signal. When the band change is complete the computer sends a signal CONTN to reset the flip flop U8. The 8 and 20 GHz band changes work similarly.

The 10 V reference from U17 is inverted by U12 giving a negative reference. The +10 V reference is used as the reference for the U4C comparator. This comparator switches at the end of each sweep and generates a pulse. When the SWP_TRIGN signal is received, (this signal is produced by the front panel SWP TRIG input) U15A and U8B cause the RAMP_RESET line to reset the ramp voltage on A8A1.

The 10 V_RAMP is applied to U19A where it is inverted and then summed at U19B with different offset voltages, switched by U18, at each band change. These offset voltages cause the ramp at U19-7 to start at 0 V for each new band. The amplitude of the ramp is then adjusted by DAC U20A and B (using both sections gives a greater range). The resulting ramp is buffered by U47B and summed together at U22B with other signals, including the frequency correction signal from the digital ramp board A9. The switch U23 can then select the ramp or an inverted version of this ramp (U22A) for output to the YIG driver, depending on whether the frequency sweep is increasing or decreasing. Another signal is summed into the ramp at U22B; this signal is YIG lag compensation. At the start of each band U16C triggers U24A causing a pulse at the Q output. The negative going pulse at U25A is turned into a negative going spike with decay by the diode CR3 and C20. This is buffered by U25B and the amplitude is adjusted by DAC U46 according to the sweep rate. The amplitude of the spike is maximum for the highest sweep rate. The output of U47A is then summed with the frequency correction and the ramp voltage at U22B.

U32 thru U35 DACs provide reference voltages for up to eight analog sweep markers. For example, when a marker is set, DAC U32A generates a reference voltage at U36-7 for comparators U40C and D. When the 10 V_RAMP reaches the reference voltage the comparators flip, generating a marker pulse at the output U40 pin 13 and 14. The width of this pulse is determined by IR1 and R41. The pulse then propagates thru U45 and is buffered to be supplied to the rear panel. The rest of the markers are generated in the same way and are NOR'ed at U45.

U44 and U26 decode chip selects for the board. U27, U28 and U29 provide buffering for the computer bus interface.

3.15.11 Analog Sweep #2, PC Assembly A8A1

The main function of this board is to generate the various sweep rates.

A DC voltage SWPV is received from the A8 board with a magnitude that varies according to the sweep rate selected. U1 switches resistors in parallel with R3 and R4, which gives decade changes in the rate by switching the current flow generated by the current source U2A and Q1. The rates are controlled by the rate at which C1 charges. The charge on C1 results in a ramp at U2-7 which can be fine tuned by the RATE voltage summed into U2-6. This 0-10 V ramp or an external ramp can be selected by U3 as the 10 V ramp output. U4A is used for the purpose of resetting the rate ramp, when RAMP_RESET is selected at U3, by pulling U2-7 to 0 V. When HOLD is selected, the CR1 cathode is pulled low, sinking current from the current source and biasing CR2 such that the voltage on C1 is held constant. This allows the ramp voltage to be held during band crossovers.

3.15.12 Digital Ramp, PC Assembly A9

The Digital Ramp circuitry includes circuitry which generates voltage ramps required for both analog and digital sweep modes. It also provides level correction and frequency correction data required during analog sweep.

The DAC U1 section generates a 0 to 10 V digital frequency ramp available at the output of U4B. U10B is used to switch either this digital frequency ramp or a 10 Volt ramp from the analog sweep board which is supplied to U12B which provides the ramp output voltage to the front panel. The output of U10B switch is also provided to U22B which inverts the ramp. The frequency ramp or the negative frequency ramp is selected by U33B depending on the direction of the sweep. The ramp selected is the input to the B section of DAC U1 which multiplies the ramp by some factor resulting in a ramp output at U4A which is proportional to the delta or width of the sweep. DAC U2A provides a DC output voltage at U5B which is proportional to the start frequency of the sweep. This start frequency voltage and the voltage ramp are summed together at U7A resulting in a -.5 Volt per GHz ramp. This signal and an inverted form of the same signal (U7-7) are used by the level correction circuitry. The .5 V/GHz signal is also buffered by U12A for output to the Rear Panel.

U2B generates a 0 to 10 Volt digital power ramp available at U5-1. This ramp or a 10 Volt ramp from the analog sweep board is selected by U10A to be buffered by U13A for optional Power Ramp to the rear panel, and to be fed back to U33A. U33A is used to switch the power ramp or a .5 V/DB input (optional) from the rear panel, to the input of DAC U3A which multiplies the ramp by some factor resulting in a ramp output at U6-7 which is proportional to the delta or width of the power sweep. This delta power ramp or its inverse (U11B) is selected by switch U14A. It is inverted again at U9B and summed at U9A with a voltage proportional to the start power. This voltage is generated by DAC U3 and U6A, resulting in a signal out at U9-1 which is .1 V/DB an optional rear panel output. The delta power ramp amplitude can also be calibrated by R3 before it is anti-logged by U8. U8 output is shifted and offset appropriately (R13 and R12) so that at the output of U11A the delta power ramp is linear in dB. Either this signal or the straight delta power ramp (calibrated at R17) is selected at U14B providing a power sweep voltage, linear in voltage or in dB, to the level control board.

The level correction circuitry requires the + .5 V/GHz and - .5 V/GHz ramp inputs as well as a + and - 10 V reference. U17B and U18A along with their corresponding pots allow the ramp signal to be modified by 2 different slopes. The pots R32 and R37 allow the different slopes (controlled by R34 and R39) to start at different places corresponding to different frequencies. The resulting modified ramp is selected by U20A to be used for frequencies greater than 2 GHz. There are two slope adjustments, U18B and U19A and corresponding pots, which can be selected to be used at frequencies less than 2GHz. To these slopes, specific to > or < 2GHz frequency bands, is added an additional universal slope, created by U17A and its pots R27 and R29. This addition takes place at U19B where yet another input may be selected by U20B. This input is the amplitude marker input, which when enabled, pulses the output level at a frequency set by the marker. The final level correction voltage is available at U19-7 and is summed into the level board A10.

U13B input is the marker signal which is amplified by U13B to provide an optional rear panel output MKR_GATE which is provided for the purpose of gating an external counter.

U23 provides a +10 volt reference which is also inverted by U22A giving a -10 volt reference as well. U32 and U15 provide the necessary buffering for interfacing with the computer bus. U16 decodes chip select lines.

U24 and U27 digitally generate a similar slope correction as is created by the level correction circuitry. DAC U24A provides a DC offset voltage at U25-1 which controls what frequency (or voltage) the slope (in this case generated by -.5 V/GHz ramp) summed into U26A, begins having an effect. The steepness of this slope is then adjusted by the DAC when the signal is fed back into section B. The result is an output at U25-7 which has some specific slope starting at some specific frequency. This slope or its inverse is selected (U30A) and summed together with another similar slope signal (generated by U27, U28 and U29). The result is a frequency correction signal at U31-1, which is summed with the YIG ramp on the A8 board, to keep the frequency correct during analog sweep.

3.15.13 Level, PC Assembly A10

The leveling scheme used in the GT 9000S series can be compared to a Phase Locked Loop. The similarities are that the leveling loop has a reference and a variable input which are compared, and the loop action adjusts the variable input (proportional to the actual unit output level) until the two inputs are balanced. The comparison is made at the summing junction of an op amp integrator. The output of the integrator controls PIN leveling diodes to adjust the RF power level. The power level is detected and amplified as required, and returned as the variable input to the integrator.

On this board, U17A is the op-amp integrator. The summing junction at pin 2 compares a reference input and the detected RF input. The reference input is the REFX20 input from the detector buffer module A200, which is amplified by U15. The gain is adjustable via pots R27 (GAIN $\leq$2 for downconverter frequencies) and R29 (GAIN >2 for frequencies >2GHz) and is switched by U14A and B, depending on the output frequency. The variable input to the U17 summing junction is the actual RF detector voltage, which has been amplified at the detector buffer module A200. Q2 samples this signal (DETX20) when the unit is pulse modulated. When the unit is not pulse modulated, Q2 is turned on and the detector voltage, buffered by U30, can be inverted by U27, depending on whether the detector voltage is negative or positive. This inversion is controlled by switch U16A and B. In addition to these two inputs to the summing junction of U17, offset voltages are summed in as well. Two different adjustable offsets (R28 and R30) are available and are switched by U14A and B depending on whether the output frequency is > or $\leq$2 GHz. Q1 samples the signals at this summing point when in pulse modulation mode or, if pulse is turned off, Q1 is turned on all of the time. The summing integrator U17A has variable feedback paths available. U18A and B are switched in as appropriate for different leveling modes. The output of the amplifier is fed to U19 via CR1 and CR2. This serves as a window detector to detect when the leveling loop is unleveled. When the loop is unleveled, U19-7 goes low to light DS1 and send a low logic signal to the computer. The output of the U17A amplifier is also amplified by U17B. Its gain is adjustable via the R50 (LGAIN) pot. The output of U17B is the level voltage which goes to the level driver board (A10A1) to drive the PIN leveling diodes.

The reference signal is generated on this board. The 2.4596 MHz oscillator is composed of U1 A, B, C, and Y1. Its square wave output is turned into a sine wave via filter L1, L2, C10, C11, and C9. The R3 and R4 pots allow a variable amplitude of this signal to be tapped off and amplified. U2A and B switch in the appropriate pot depending on whether the frequency selected is > or $\leq$ 2 GHz. The signal is amplified and fed to modulator U8 (which functions as a variable attenuator controlled by a voltage which may be a composite of different signals). The output of the modulator is sent via U10 to the Detector Buffer module to be amplified and returned to the leveling board as REFX20.

The main control voltage for the modulator ICs (U8, U28, and U9) is generated by the U24 DAC. This voltage changes as the power level changes and controls the gain of U28. U28 adjusts the level correction voltage which is switched in by U16A and amplified by U7A. The amplitude of this signal is adjusted by the modulator U28 according to the power level the instrument is set to. U29A amplifies the modulator output and sums it with the standard main control voltage at U29B. The output of U29B is inverted at U13B to control the modulator U9, which adjusts the amplitude of the AM signal when enabled by U2A. R5 calibrates the AM signal which is then translated into a differential signal by U6B and U7B and applied to the modulator U9 input. The outputs of U9 are summed by U6A, and the AM signal amplitude has been adjusted according to the control voltage. The result is that the AM signal level is correctly calibrated for any power level. This AM signal is then summed with its control voltage at U5A and inverted at U5B, forming a composite signal used for appropriately modulating the reference signal at U8. VR3 and R51 are set to limit the control voltage so that it does not overdrive the modulator.

U31 is a DAC programmed by the computer to give an output voltage at U32B. This voltage is the appropriate offset required for the PIN leveling diode drivers on the A10A1 level driver board.

The U26 Reference provides a 5 volt reference, which is filtered by L3 and C66 and C67. This filtered 5 volt reference is also amplified by U32A to give a 10 volt reference. The 5 volt reference is also divided down by pot R48 to give a 3.2 volt reference.

U20 provides decoding for the chip select lines. U21, U22, and U23 provide the necessary buffers for the bus interface lines.

3.15.14 Level Driver, PC Assembly A10A1

The level driver contains amplifiers and filters which drive the levelers (variable attenuator circuits) in the microwave module.

LEVELV, the output of the Level PC board (A10), is amplified by the circuit. The amplifier circuit has four levels of AC gain activated (in order of decreasing gain) as the AC input level increases and switches on the diodes CR9, CR7, and CR6. The SCANSIG input is not used in this instrument. The amplifier output at U6-6 (LVL) is supplied to the level drivers associated with particular bands.

Inside the microwave module, the leveler for Band 0 (the downconverted range, below 2 GHz) consists of a pair of FETs which act as variable attenuators. Separate driver outputs are required to control the series FET and the shunt FET. For Band 0, the LVL signal is converted by a differential amplifier consisting of U1A, U3A, and U3B into two outputs. The BAND0LVL VP output is applied to the series FET, and the BAND0LVL VS output is applied to shunt the FET. Both outputs are transmitted through low-pass filter elements (see L1 and L2) to the microwave module. Relays K1 and K2 bypass these filters during AM operation (the control input labeled SCAN N is on only during amplitude modulation, not scan modulation).

Higher frequency bands are level-controlled by PIN diode attenuator circuits in the microwave module. These attenuators do not require differential control inputs. For Band 1 (2-8 GHz), the level driver is the circuit which includes U5. The filter associated with this band (see L3) is bypassed through relay K3 during AM operation. For Band 2 (8-20 GHz), the level driver is the circuit which includes U10. The filter associated with this band (see L4) is bypassed through relay K4 during AM operation.

The remaining level drives are unused in this design.

3.15.15 Power Supply, PC Assembly A11

Most of the power is furnished directly from the switching power supply assembly to the circuits that require it. However, some voltages require further conditioning or are independent of the switching PS assembly. For those voltages, the Power Supply PC assembly provides the functions of rectification, regulation, filtering, and switching.

The circuit consisting of R22, R23, and C1 filters the +24V supply to eliminate fan-generated noise.

The +15 V input at J1-23 is furnished to the front panel display drivers, and also (through power FETs Q1 through Q6) to various band-related sections of the microwave module. To minimize power dissipation in this module, each FET is switched on only when the associated frequency band is in use. The FETs are switched by gates U7A through U7-F, which are in turn switched by the computer by way of the latch (U6) and the latch strobe (U5). The voltages for the frequency doublers in the 20-28 band (Q5) and the 28-40 band (Q6) are re-regulated down to +12 V by U2 and U1. The +15 V supply is also applied to an overload detection circuit (see U8), which is needed to protect the power FETs. If the +15 V input falls below an acceptable level, the latch is cleared, the FETs are turned off, and the OVERLOAD LED is turned on.

Standby power (including a heater voltage for the timebase oscillator crystal oven) is supplied through a small transformer located near the cooling fan. The 20 VAC inputs from the transformer are rectified by CR2 and regulated by U3 as a +15 V heater voltage for the timebase. The rectified 20 VAC input drives the line power relay, and is also doubled by CR3 and CR4 and regulated by U4 to make a +35 VDC output for the front panel fluorescent displays.

3.15.16 100 MHz Reference PLL, PC Assembly A14

This circuit phase locks the 100 MHz oscillator (A201) to the internal 10 MHz timebase or to an external timebase. In addition to the loop output, it produces a lock indicator signal and a set of buffered 10 MHz outputs used as references for other loops in the instrument.

The 100 MHz input at J5 is buffered by U10B before being divided down to 10 MHz by U4. The 10 MHz is then buffered by U8A, B, C and U9A, B and C so that it can be used by other circuits in the unit which require a 10 MHz reference. The signal is also applied to the variable input of the phase detector U5-9.

The reference input to the phase detector U5-6 comes from a switching circuit, which selects either an internal or external 10 MHz reference. When no external reference is present at J3, the internal 10 MHz reference at J4 (buffered by U11A) is allowed to propagate through U12C and on to the phase detector (U5-6). When an external 10 MHz signal is present at J3, it is buffered by U11A and allowed to propagate through U12A to the phase detector. The presence of an external 10 MHz reference is detected when C38 is charged, causing the switching circuit (comparator U14) to switch to a high state. This causes the U13 output to go high to turn off the supply to the internal 10 MHz reference. The switching circuit also enables the external reference path at U12A and disables the internal reference at U12C. The selected reference is then available through Q1 and Q2 as the 10 MHz reference output on the rear panel.

The phase comparator U5 compares the 10 MHz reference with the output of the divider U4 and determines which signal leads or lags the other. The output pulses at U5-12 and U5-3 are integrated or filtered by U6B, resulting in a tuning or correction voltage at J6 which will steer the 100 MHz VCXO oscillator in the proper direction (a more positive voltage increases frequency) to acquire and sustain a locked condition. When the loop is phase locked (the reference and variable input frequency and phase are equal), the output pulses of the phase detector will be extremely narrow at a 10 MHz rate. U7, CR1 and CR2 along with other components serve as a window detector which detects the tuning voltage and unlocked conditions. When the loop unlocks, U7-7 goes low, lighting DS1 and sending the unlock logic level to the computer via U2, a tri-state buffer which serves as the interface to the bus. U1 is a 3-to-8 decoder for decoding chip selects.

U3 regulates +22 V to +15 V which is then filtered by L1, C16 & 17 providing a clean voltage for U6, thereby reducing noise introduced by the tuning voltage to the oscillator.

3.15.17 1 Hz PLL, PC Assembly A15

The 1 Hz Phase Locked Loop circuit synthesizes a reference frequency programmable in fine increments. This reference is substituted for the standard timebase signal used by the reference phase lock loop. By setting the reference output from this circuit, the computer is able to specify RF frequency in 1 Hz increments. The output at J3 has a range of 10-12 MHz and a resolution of 2 Hz. When divided in half at the reference PLL input, the result is a 5-6 MHz reference programmable in 1 Hz steps.

A 100-120 MHz voltage controlled oscillator (Q3) is controlled by U5. U5 is a synthesizer chip containing several programmable frequency dividers and a phase comparator, used in conjunction with an external prescaler (U7, which is programmed by U5 to divide by 40 or 41). U5 compares the prescaled feedback input from the VCO (U5-3) to the timebase input (U5-7) and produces pulsed outputs at U5-17 or U5-16, depending on which input is leading. A filter/amplifier circuit (U9A) averages these pulses to produce a tuning input to the VCO. By programming the dividers in U5, the computer sets the VCO frequency in 50 kHz increments. The VCO frequency is buffered (Q2, U8 A and B) and applied to a mixer circuit consisting of the flip-flops of U16.

The second frequency input to the U16 mixer circuit is produced by a second VCO (Q4) having the same range (100-120 MHz) but programmed in finer increments (20 Hz). This VCO is controlled by a PLL circuit consisting of a phase comparator (U12) and a filter/amplifier circuit (U13A). The inputs to the phase comparator consist of feedback from the mixer circuit (U16-15) and a reference input from a third VCO circuit (Q1) divided down (by U3 and U4) to 100-150 kHz, giving 20 Hz increments. The PLL circuit phase locks the VCO to this reference. The circuit consisting of U13B and U17B performs as a window detector. When the PLL circuit is out of its normal control range, U17-7 goes high, illuminating

the LED unlock indicator and pulling the LOCK line low. The VCO output (from Q4) is divided by 10 (U14) yielding an output at J1 with a frequency range of 10-12 MHz and a resolution of 2 Hz.

The third VCO (Q1) has a frequency range of 100-150 MHz, programmed in 20 kHz increments. Dividers U3 and U4 reduce this frequency to 100-150 kHz so that it can be used as a reference input by phase comparator U12. U1 is the same type of synthesizer chip as U5, and its prescaler chip U2 also divides by 40 or 41. Filter/amplifier circuit U6A converts the phase comparator outputs of U1 into a tuning voltage for the VCO. U11 is a decoder chip used for decoding chip selects. U10 is a tri-state buffer for outputting board outputs to the bus.

3.15.18 Reference / Downconverter PLL, PC Assembly A16

Reference PLL

The Reference Phase Locked Loop circuit contains the Reference PLL, and the Downconverter (or Fixed LO) PLL circuitry as well as the logic and drivers for the Downconverter filters.

The Reference PLL fine tunes the reference YIG oscillator to phase lock it to a harmonic of the 100 MHz oscillator (see A201) and ultimately to the instruments timebase. The phase detector U5 compares two 5 MHz inputs, one from the reference sampler IF (J2), buffered by U1C, and the other one from the internal or external input (J4 or J3 respectively). If the two 5 MHz inputs are out of phase, wide pulses will appear at one of U5 outputs (pins 3 or 12, depending on which input is leading). The filter/amplifiers (U6A and B and associated components) convert these pulses into a correction voltage which is filtered by L1, C12 & C13 and then supplied to U9, which drives the fine tuning (or FM) coil of the reference YIG oscillator. The PLL circuit adjusts the frequency of the oscillator in whichever direction will reduce the phase difference between the two 5 MHz inputs. The PLL output goes more positive to increase frequency and more negative to decrease it.

The reference frequency is mixed with a 100 MHz comb line and should be 5 MHz above the 100 MHz multiple. If the reference frequency falls above the desired multiple, the output voltage at U6-1 will be higher than normal. The kicker circuit U7A and associated components will detect this by comparing the voltage with a reference voltage set by R30, R31 and kick the output of U6B high, resulting in the output of U6A going low, decreasing the oscillator frequency. If the output frequency is too low, the kicker circuit U7B and associated components will detect the output of U6A being below a certain voltage level (set by R79, 32 and 33) and kick U6 such that the output at pin 1 will go high, thereby increasing the output frequency.

Whenever the circuits (U7) kick, C10 or C9 are charged so that the lock detector U8 pulls the REF_LOCK signal low, thereby illuminating the lock LED DS1.

The 5 MHz input to the phase detector is derived either from the 10 MHz input at J4 or from the 5-6 MHz input at J3. The 5-6 MHz input, if present must be detected so that the 10 MHz path will be disabled. This is achieved by delaying one input to U2B with R7 and C3. This causes U2-3 output to be low and disable the 10 MHz from propagating thru U3A. Instead, the 5-6 MHz input propagates thru to the phase detector U5. When no 5-6 MHz input is present, the 10 MHz propagates thru U3A and B, being divided by two, and then on thru U2C to the phase detector input.

At some output frequencies the sampler IF is 1.667 MHz rather than 5 MHz. In this situation, the control input at Q1 enables flip-flop U4 to remove two pulses out of every three coming from either U2-2 or U3-15. This effectively divides the 5 MHz by three, which yields the desired 1.667 MHz signal.

Downconverter PLL

The Downconverter PLL (or Fixed LO PLL) circuitry is similar to the Reference PLL. One difference is that there is only one set of inputs to the phase detector U11, the 10 MHz and the DC sampler IF. When the loop is locked, the DC sampler IF should be 5 MHz, the flip flop U12 divides the 10 MHz reference by two yielding 5 MHz. The other difference is that this loop is turned off by U16 and Q2 when the unit is not operating in the downconverter range. This reduces spurs and noise which can be added by this circuitry when it is not locked.

This board also provides downconverter filter drive logic. U17 is a 4-to-16 decoder which decodes logic from the computer to select each of the downconverter filters as appropriate via their drive circuitry U18 thru U25. The GENN and MEAS logic drives for the computer are provided by U29.

U27 provides chip selects for various IC's on the board and U26 and U28 serve as buffers required for computer bus interface.

3.15.19 Divide-By-N, PC Assembly A17

This circuit is a programmable frequency divider. It is set by the computer with a divisor between 95 and 395. Its frequency input is the 95 to 395 MHz IF from the reference mixer. The divided IF is supplied to the output phase lock loop and should be exactly 1 MHz when the output loop is locked. A two-stage amplifier provides enough gain throughout the operating frequency range to drive the Mod-8/9 counter (U11). AR1 and AR2 are amplifiers. CR1,2 and C23 detect the level of the signal at the output of AR1, and U12A and Q1 provide bias to CR3, CR4, CR7 and CR8 to attenuate the signal as required, thereby providing a form of automatic level control. L2, C24 and C27 are required for power supply filtering. L3, C54, C55, and L1, C25, C22 are low pass filters for the IF signal.

In the discussion of the divider circuit, terms are defined as follows:

- IF cycles refers to the amplified IF from the reference mixer, which is used as a timing clock by the Mod 8/9 counter.
- Clock cycles refers to the output of the Mod 8/9 counter, U11-2, which is used as a timing clock by the 3-bit and 6-bit counters.
- Division cycles refers to the output signal, U9-14, which should have a rate of 1 MHz when the loop is locked.

IF cycles are the fastest of the three; division cycles are the slowest.

The divisor, selected by the computer, is supplied as a 9-bit binary number at TTL level to the 10124 translators (U1, 2 and 3), which convert the bits to ECL levels. Bits 0, 1 and 2 control the 3-bit counter (U5) and bits 3 through 8 control the 6-bit counter consisting of U4, 6 and 7. These two counters operate independently, but they use the same timing clock and they count down simultaneously.

The outputs of the 3-bit counter U5, by way of gate U8, program the Mod-8/9 counter U11. While U5 is counting down, U11 divides the IF by 8. In the case of most divisors, it is necessary for the IF to be divided by 9 for some portion of the division cycle; only when the three lowest bits are all zero is U11 programmed as a Mod-8 counter throughout the division cycle (a situation which can only occur if the divisor is an even multiple of 8). Whenever it reaches zero, U5 stops counting until it is preset at the next division cycle.

The 6-bit counter (U6 and U7) continues counting down after U5 has reached zero and U11 has entered the Mod-8 phase of the division cycle. The lowest number it ever counts down from is 11, (binary 001011) whereas the highest number the 3-bit counter ever counts down from is 7 (binary 111); therefore the 3-bit counter always finishes first. When the 6-bit counter has completed its count, gate U8-14 goes high; this line, applied to U9D, allows U9-14 to go low (this represents the falling edge of the output waveform) on the next clock transition. The output is also used to pre-set the 6-bit counter. The 3-bit counter is pre-set by U9-2; this transition occurs a half-cycle later than for the other counter because U9-2, unlike U9-15, is triggered by the complement of the divider circuit clock (U11-3). The delays involved in driving the output low, presetting the counters, and triggering them to count down again result in the addition of two clock cycles to the division cycle (i.e., U11 will perform two extra divisions by 8 before the next division cycle can begin). To compensate for this, the U6 Q1 output is not connected to the OR gate U8-14; the 6-bit counter counts down only to 2, not to zero, before sending the high level to U9 that initiates the output transition and presets the counters. The duration of the output low pulse is one clock cycle, which is equal to eight IF cycles. Because the IF is variable, the width of the low pulse varies (between about .02 and .08 microseconds).

Example:

When the divisor is to be 195 (this occurs when the IF is 195 MHz), the translators are programmed with the binary equivalent of 195 (011000011). This breaks down as 3 for the 3-bit counter (binary 011), and 24 for the 6-bit counter (binary 011000). For the first three clock cycles U11 divides the IF by 9, for a total of 3 x 9 = 27 IF cycles. The 3-bit counter then reaches zero and programs U11 to divide by 8 for the remaining clock cycles (21, since three of the 6-bit counter 24 cycles have already been counted simultaneously with the other counter). After 21 x 8 = 168 further IF cycles (bringing the total so far counted to 195), the low-going pulse of the output waveform occurs. The counters are preset and the division cycles recommences. To compensate for the cycles added by delay in presetting the counters, the 6-bit counter actually stopped early by 2 clock cycles (2 x 8 = 16 IF cycles); the high level at U8-14 occurs two clock cycles before the beginning of the next division cycle, because two clock pulses are needed to initiate that division cycle. Since 195 IF cycles occurred during one division cycle, the circuit has divided the input frequency by 195.

The OR gate U10 and four passive components are used to shut down the output of the circuit under conditions that would interfere with normal operation of the phase lock loop. Under normal conditions, with an IF input in the 95-395 range, the clock frequency applied to U10-4 will be above 10 MHz. The filter components between the three gates produce a low at U10-12, and the third gate does not interfere with the circuit output frequency. If the IF drops substantially below the normal range, however, and the clock frequency at U10-4 falls well below 10 MHz. The filter action will not be sufficient to have the same effect. U10-9 will go to an ECL high, preventing any waveform from reaching the phase lock loop. The reason for this precaution is that the Mod-8/9 counter responds erratically to frequencies below its intended range, and could prevent the PLL circuit from recovering phase lock when the output frequency is too low. When the output waveform has been shut down, the PLL circuit reacts by kicking the output frequency to a higher value. This forces the IF to a higher frequency within the range of the divider circuit. After the IF has been forced higher, the kicker circuit again allows the output frequency to reach the PLL.

U16 thru U20 provide drive for the REFerence COUPLER and the REFerence SWITCH filters. The U18B signal switches the downconverter coupler port.

U15 is a decoder which decodes chip selects. U13 and U14 are buffers required for interfacing with the computer bus.

3.15.20 Output PLL, PC Assembly A18

The Output Phase Locked Loop circuit compares the output of the divide-by-N circuit (A17) to a timebase-related reference signal, and fine-tunes the output YIG oscillator to stabilize the divide-by-N output at 1 MHz.

The 10 MHz timebase input (J3) is buffered by U1 and applied to U3, a frequency divider with a divisor of 10. The 1 MHz output of U3 is the reference input to the phase detector U2-6. The variable input at U2-9 is the output of the divide-by-N circuit (J2), buffered by U1, which will be at 1 MHz when the loop is locked, thus giving the correct RF output frequency. If the two inputs to the phase detector are not in phase, wide pulses are produced at either U2-12 or U2-3, depending on whether the variable input is leading or lagging the reference. The loop amplifier/filter circuit U4A and B averages these pulses to produce a fine-tuning signal for the output YIG oscillator. The object is to adjust the oscillator frequency in the direction that will reduce the phase difference between the inputs to the U2 phase detector.

In the CW mode, the outputs of the amplifier/filter U4A and B are applied via analog switches U7A and B to a low pass filter (C54-56 and L1), required to filter out the 1 MHz reference frequency. The output of the filter is then applied to U18B, an amplifier with variable AC gain to compensate for loop gain changes due to a changing divide-by-N output. R83 and R84 provide AC attenuation. The PLL voltage is buffered by U18A before being applied to one of three summing junctions. Analog switches U19A & B select one of 3 circuits, U20, U21, or U22, which drive the FM tuning coils of the output YIG oscillators for each frequency band.

U6 is a lock detector circuit which detects when the loop voltage goes beyond a given window, thus indicating that the loop is unlocked. This circuit pulls the output lock signal low, causing the lock LED

DS1 to light. When the loop voltage is within the window the loop is locked, the OUTPUTLOCK logic line is high and the DS1 board is dark.

When the FM mode is enabled, an alternative loop amplifier/filter is required. In this case U5A and B filter the output pulses of the phase detector. The outputs of both amplifier/filter circuits, U5 and U4, are applied to U7, an analog switch. When the FM mode is selected and the switch U7A enables the U5 amplifier/filter. Additionally, during FM mode the modulating signal is summed in with the loop voltage at one of the three FM drive circuits U20, U21, or U22. The modulating signal sensitivity is adjusted with R33, R34, or R35, depending on which frequency band is active. The appropriate sensitivity is selected with switch U14A and B, and the modulating signal is then amplified by U16 and U17. U19A switches the PLL voltage from the fixed LO PLL PC assembly to the 2-8 GHz oscillator when required for downconversion of frequencies below 2 GHz.

U8 provides an interface between the computer and the PC assembly by decoding the chip select lines. U9 buffers the output logic from the PC assembly so that it can be read by the computer. U10 and U11 are latches for logic input from the computer bus.

3.15.21 YIG Driver, PC Assembly A19

The YIG Driver assembly consists of four YIG driver circuits, one for each of the frequency bands (2-8, 8-20, 20-26 GHz and the Reference oscillator). In addition, the circuitry on this board generates the logic for different frequency bands, and for switching filters in RF modules. It also generates logic used during sweep.

The YIG driver circuit for BAND1 consists of DAC U1 section B whose output is converted to voltage by U7B. MIN 1 pot (R11) is used for adjusting the voltage to the YIG when at the minimum frequency in band 1. The reference voltage is also summed in at U7-2 thru MAX 1 pot (R12) which is used to adjust the voltage provided to the YIG when at the maximum frequency in band 1. At the output of U7 A there is a filter which can be switched in by U6 B when the Unit is in CW or SLOW mode, (i.e., when the Unit is not sweeping or changing frequency). This filter is disabled, when the unit is sweeping or changing frequency, allowing the YIG voltage to change rapidly. This switched filter is known as the Fast/Slow circuitry. When analog sweep is activated U4 A is switched allowing a ramp voltage to be summed into the amplifier U7 to sweep the YIG thru the specified band. Q4 is required to turn off the tuning voltage to the YIG when the band is not selected. Q3 provides the drive for the Main tune coil of the YIG.

This circuit is repeated for each of the bands. The only difference is that in the reference band there is not a ramp voltage summed in during analog sweep.

Filter switching logic and sweep logic signals are also generated on A19. When the unit is not in analog sweep U21 is cleared thereby enabling U22 and U23 to propagate the logic latched by U14 from the computer bus. These outputs drive U25 and U26 which drive the filter switches for the output switch module. When the unit is in analog sweep, the computer cannot provide the logic signals at the appropriate times therefore another method is used to detect when to switch the filters. For example, in band 1 this method involves sampling the main tuning voltage and using a comparator U15C to detect when the main tune voltage reaches a voltage set by the 5.2 pot (R49). This 5.2 reference voltage can be adjusted to insure that the comparator output switches when the frequency is at 5.2 GHz. The output then propagates thru to U21 which is enabled during analog sweep. The remaining logic along with flip flops U18, U19 and U24 work in conjunction to supply the remaining filter logic and blanking signals required during analog sweep.

Decoder U2 decodes the chip select lines for circuits on this PC board. U3, U10 and U14 are required for computer bus interface.

3.15.22 Display Driver, PC Assembly A20

The Display Driver PC assembly drives the fluorescent displays and the LEDs on the front panel.

U2 is a counter which is clocked by U1. It cycles thru the addresses corresponding to each display digit segment. When the computer updates the display or when a setting has been changed, the LD line is activated, and counter U2 stops counting and outputs the address on the AD inputs to QA-QD outputs. This addresses the decoders and RAMS when the appropriate chips are selected by the read/write lines. At this time, data is available at the input of the latch U4 and can be loaded into the RAM U3. When the data has been updated for all addresses, the LD line becomes inactive and the counter U2 again cycles thru the addresses, selecting data for specific segments to be driven via U9. At the same time, decoder U5 decodes the addresses to select each individual digit via U10. This scheme is used to drive all three fluorescent displays.

A similar scheme is used for lighting the LEDs on the front panel, the only difference is that they are addressed by rows and columns via U22 and U23 respectively.

3.15.23 Pushbutton, PC Assembly A105

The Pushbutton assembly contains the pushbuttons for the sweep functions, the level buttons and their corresponding LEDs as well as the LOCK and LEVEL LEDs.

The buttons are connected together in a manner that they can be read and identified using a row and column scheme. The LEDs are set up the same way using a row and column scheme (denoted RL and CL) to light the appropriate LEDs.

3.15.24 Data Entry, PC Assembly A106

This board holds the pushbuttons for the main power, numerical keypad, modulation buttons and the sweep marker buttons, as well as any corresponding LEDs. In addition the Intelligent HP alpha numeric displays reside on this board.

As on the Pushbutton Board A105, the pushbuttons are read and the LEDs are lit using the rows and columns scheme. The four 8-digit Intelligent HP alpha numeric displays (DS1 thru DS4) receive address and data information from the display driver board.

When the unit has power applied to it, the standby LED DS13 is lit by the 20 V from the power supply via P2. When the power switch is activated the 20 V coming in on P2 is switched to energize the power relay switch which supplies power to the rest of the unit.

3.15.25 Main Tune, PC Assembly A107

The Main Tune assembly is mounted on the chassis between the microwave deck and the power supply capacitors. The board holds the transistors which provide the current drive to the Main Tune coils of each of the YIG oscillators. These transistors must provide high currents with substantial power dissipation, which requires the transistors to have a heat sink. The diodes at the base of each transistor prevent the voltage from going too far negative.

3.15.26 Detector Buffer, PC Assembly A200

The Detector Buffer module is an important part of the leveling system. The 2.5 MHz Reference signal is received from the level board (A10) at J7. This signal is detected by a detector at J6 and a DC voltage proportional to the power level of the reference signal is returned. L1, L2, C15 and C16 filter the reference signal from the DC voltage returned from the detector, which is then amplified by U5 and returned to the leveling board thru J5.

The detector inputs for leveling the output signal are at J4, J3, J2, which are for an external detector (external ALC mode), the <2-band detector and >2-band detector respectively. The appropriate detector is

selected by a respective logic line which switches one of three comparators (U4 A, C and D) which in turn switches on one FET (Q2, Q4 or Q5). The active FET feeds the proper detector signal to the amplifier consisting of U3, U2 and U1. The output is then fed back to the leveling board (A10). The remaining logic signal at P4 serves two purposes:

1. When it is low it turns on the FET Q1 which allows the full voltage of the External Detector signal to be applied to Q2. When the logic is high the External Detector voltage is divided down by a factor of 10.
2. Switches in a capacitor (when the logic is low) in the <2-path to filter out the RF signal which is coming in on the detector voltage. This logic signal remains low from 10 MHz to 50 MHz and then above 50 MHz it goes high which switches the capacitor out of the <2-detector path.

3.15.27 100 MHz Oscillator/Sampler Driver, PC Assembly A201

This module includes a 100 MHz Voltage Controlled Crystal Oscillator to drive the sampling mixers, and two identical amplifier circuits to increase the low level IF from those mixers to ECL voltage levels.

100 MHz Oscillator

Transistor Q2, regulated by crystal Y1, oscillates at a frequency very near 100 MHz. This frequency can be varied slightly by changing the Phase Lock Loop input voltage (and thus changing the capacitance of tuning diode CR1). This variation permits the oscillator to be phase-locked to the Master Reference. In order to bring the oscillator frequency within the relatively narrow adjustment range of the PLL circuit, nominal capacitor C21 is selected during production test, and variable capacitor C23 is adjusted during calibration. With the circuit correctly set up, the 100 MHz loop should become locked with a PLL voltage of +3 VDC (this voltage is most easily measured at the Test Point on PC Assembly A8, the 100 MHz PLL). Buffer IC4 produces four 100 MHz outputs; two drive the sampling mixers, one returns to the 100 MHz PLL, and one supplies a stable 100 MHz reference to the Frequency Counter and/or the 10-12 MHz PLL (1 kHz Resolution Circuit), if installed.

Sampler Driver

The twin amplifier circuits (Q3-Q4 and Q5-Q6) supply a large (4-6 Vpp) 100 MHz signal to the sampling mixers. Variable capacitors C32 and C33 are used for peaking this signal. The sampling mixers include a step-recovery diode multiplier, which produces numerous harmonics of the 100 MHz input. The RF input to the sampler is mixed with these high frequencies, one of which will be near enough to it in frequency to create an IF that is within the bandwidth of the Sampler IF Amplifier.

Example: For an RF input to the sampler of 6905 MHz, the sampler will mix the 69th harmonic of 100 MHz (6900 MHz) with the RF input and produce a 5 MHz IF output.

Sampler IF Amplifier

The twin amplifier circuits (Q1-IC2-IC1 and Q7-IC6-IC5) convert the low level IF produced by the samplers to ECL-level signals. Between the transistor amplifier stage and the video amplifier (IC2/IC6) is a low-pass filter that limits the bandwidth to 50 MHz to block undesired high frequencies produced by the mixer. Low frequency noise is blocked by capacitors C62 and C63. The buffers (IC1/IC5) convert the IF to an ECL level signal for use by the Reference PLL and Downconverter PLL circuits. The IF will be 5 MHz or 1.667 MHz, depending on the RF frequency input to the sampling mixer.

4

Testing and Calibration

4.1 Introduction

This chapter provides step-by-step procedures to calibrate and test the GT 9000S Synthesized Microwave Sweeper. The first part of the chapter provides performance test procedures, and the second part contains calibration procedures.

The required warm-up time before calibration or testing is 72 hours. The warm-up period can be reduced to 2 hours if an external timebase is used, or if timebase accuracy is not to be tested.

In these procedures, the GT 9000S being tested or calibrated is referred to as the UUT (Unit Under Test).

4.1.1 Recommended Equipment

The following equipment is recommended before starting the calibration and performance test routines:

- Frequency Standard, 10 MHz
- Oscilloscope, Tektronix 2465 or equivalent
- Microwave Frequency Counter, Systron Donner 6245B or equivalent
- Power Meter/Sensor, Giga-tronics 8541 with 80303 sensor, or equivalent
- Spectrum Analyzer, HP 8566B or equivalent
- Detector, Herotek Model # DZ262-44 or equivalent
- Function (Audio) Generator, Wavetek 191 or equivalent
- Measuring Receiver, HP 8902A or equivalent
- Distortion Analyzer, HP 339A or equivalent
- L.O. Generator, Giga-tronics Microwave Synthesizer
- Universal Counter, Racal Dana 1994 or equivalent
- Mixer IF Amplifier with Divide-by-40 output (Giga-tronics Mixer/Divider, Part Number 002CA04900)

4.2 Performance Tests

4.2.1 Introduction

The procedures in this section verify the electrical performance of the Model GT 9000S using the specifications in Chapter 1.

Each of the Performance Test Procedures in this section includes a list of recommended test equipment. There is a consolidated list at the beginning of this chapter. Equivalent test equipment may be substituted provided that the accuracies and specifications are sufficient.

A Test Data Sheet is included for you to enter the various readings taken. The specification and tolerance range is listed to allow ease of verification. It is suggested that copies be made of the manual sheets. When automated tests are run, a printed data sheet is produced.

Periodic performance verification is required to ensure proper instrument performance. The instrument performance should be checked at least once each year.

Each of the procedures specifies a required warm-up time if the procedure is to be done individually. For a sequence of tests only one warm-up period is required. All test equipment must be warmed up according to specifications.

4.2.2 Frequency Range, Resolution and Accuracy

Specifications

Range:	.01, .5, or 2 GHz to 20 or 26.5 GHz
Resolution:	1 kHz (1 Hz with Option 16)
Accuracy:	Same as time base accuracy

Description

The output of the UUT is connected to the input of a frequency counter. The internal time base of the counter is used as a reference for the UUT to eliminate time base errors from the measurements. This procedure does not check for time base accuracy, and therefore the frequency in the UUT display should agree with the counter, within the resolution of each instrument.

It is possible for a fault in the UUT to cause a frequency error even though the lock indicators show normal operation. For this reason a number of specific frequencies are tested. Test frequencies have been selected so that any defective circuits will be easily isolated.

Equipment Required

Frequency counter
Coaxial cable
SMA to BNC adapter

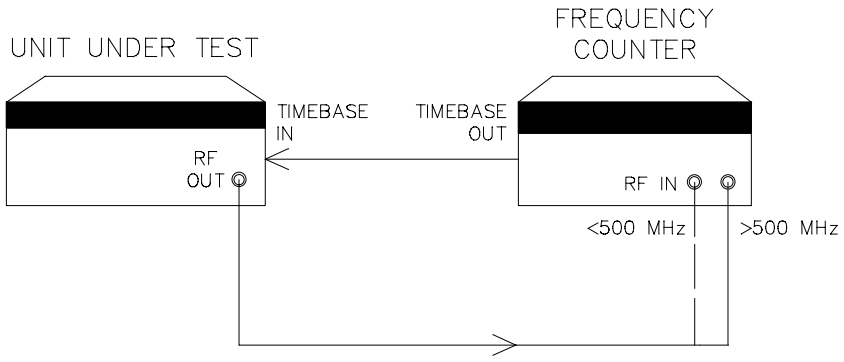


Figure 4-1. Frequency Range, Resolution, Accuracy

Procedure

1. Connect the equipment as shown in Figure 4-1. Connect the UUT RF Output to the 10 MHz-500 MHz counter input using the coaxial cable and the SMA to BNC adapter. Allow the equipment at least 30 minutes of warm-up. Since the UUT and the counter use the same time base, time base errors are eliminated. The UUT will automatically switch to the external reference when it is connected.
2. Press [SHIFT] [RESET] on the UUT, then set the UUT to its minimum frequency. Press [LEVEL] and enter [-] [1] [0] [dBm]. The counter should read the frequency set ±1 Hz ± the counter resolution.
3. Connect the UUT RF out to the counter 500 MHz-40 GHz input. Press [SHIFT] [RESET] on the UUT, then enter the maximum frequency of the UUT. The counter should read the entered frequency ±1 Hz ± the counter resolution.
4. To check that the Divide-by-N circuit is functioning properly, refer to the Test Data Sheet and program each of the listed frequencies into the UUT by entering (for example) [CW] [2] [0] [0] [1] [MHz]. For each listed frequency the counter should read the entered frequency ±1 Hz ± the counter resolution. The frequencies listed are arranged in a binary sequence since the

Divide-by-N circuit works in that manner. By setting the frequencies listed, each data bit supplied to the divider is individually tested.

5. If the UUT includes the 1 Hz resolution option, perform this test. This test exercises the 1 Hz through 100 kHz digits in such a manner that any incorrect digital programming data being sent to the 1 Hz Resolution assembly will be detected. Improper operation of the 1 Hz assembly will be indicated. Refer to the Test Data Sheet and program each of the listed frequencies into the UUT.

4.2.3 Spurious Signals Tests

Specifications

Harmonics:	-40 dBc, .01 to .1 GHz -50 dBc, >.1 to 2 GHz -65 dBc, >2 to 20 GHz *For 2-20 or 26.5 GHz instruments:* -65 dBc, 2 to 20 GHz or 2 to 26.5 GHz
Subharmonics:	none
Nonharmonics:	<-55 dBc

Description

The output of the UUT is connected to a spectrum analyzer. Various frequencies are selected and the analyzer tuned to determine the presence of either harmonically or non-harmonically spurious signals.

Equipment Required

Spectrum analyzer
Coaxial cable

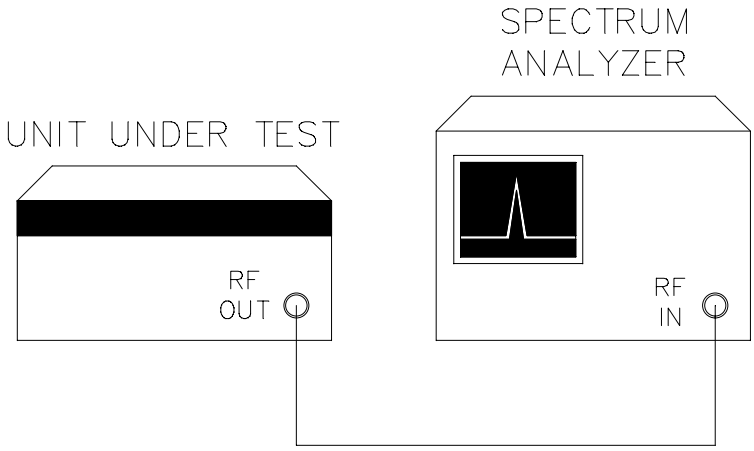


Figure 4-2. Spurious Signals Test

Procedure

1. Connect the equipment as shown in Figure 4-2. Allow the equipment at least 30 minutes of warm-up time. Press the [SHIFT] [RESET] on the UUT. Press the [FREQ] key and enter the first Test Data Sheet frequency within the range of the particular instrument. The RF amplitude should be at 0 dBm (the reset value). Press the [RF ON/OFF] button and turn on the RF output.
2. Set the spectrum analyzer to view the UUT output signal. Adjust the analyzer reference level such that the peak of the displayed signal is at the top graticule line.
3. Set the spectrum analyzer to maximum span, with the signal centered on the screen. Gradually narrow the span, keeping the signal centered, to observe any spurious signals. Use appropriate resolution and video bandwidths to allow sufficient dynamic range.
4. Repeat steps 2 and 3 for the other frequencies on the Test Data Sheet which are within the operating range of the instrument.

Many spectrum analyzers have a tuned preselector when the frequency is above about 2 GHz. This reduces the likelihood of analyzer generated spurious signals, but does not eliminate the possibility. If in doubt, increase the RF attenuation of the analyzer by 10 dB. The signal in question should be reduced by exactly 10 dB. If not, it is analyzer generated. It is also important for frequencies below the range of the preselector, that sufficient analyzer RF Attenuation be used (typically 30 dB) to avoid the analyzer

generating harmonics of the input signal. The above attenuator shift technique will also allow verification of harmonic levels.

If a spurious signal appears to be out of specification, first check that the fundamental signal level is at 0 dBm. Next verify the analyzer accuracy by connecting a known amplitude signal (from the GT 9000S, for example) at the spurious frequency.

The digi-dial of the GT 9000S may generate some noise spikes when it is rotated. The acquisition of the various phase lock loops in the instrument can also cause transients (within the specified settling time). Both of these effects will disappear when a steady state condition has been reached.

It is important to identify the particular class of spurious signal as the specifications may be different for each. If the spurious signal is an exact multiple of the UUT RF output then the harmonic specification applies. Any other spurious signal must meet the non-harmonically related specification.

For frequencies above the fundamental range of the spectrum analyzer, either a mixer supplied with the spectrum analyzer or an external mixer and local oscillator may be used to downconvert the signal. Care must be taken to identify spurious signals which are inherently generated by the mixing process.

4.2.4 Single Sideband Phase Noise

Specifications

Frequency	Offset from Carrier				
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
250 MHz	-87	-87	-85	-122	-135
500 MHz	-97	-95	-95	-127	-135
2 GHz	-90	-91	-90	-125	-130
6 GHz	-80	-83	-81	-115	-130
10 GHz	-75	-80	-80	-105	-128
20 GHz	-72	-75	-75	-105	-120
2 GHz specification for 2-20 and 2-26 GHz instruments					
2 GHz	-83	-85	-84	-118	-130

Description

The test described here is limited by the measuring system and only verifies the majority of the phase noise specification. To completely test the phase noise specification requires a far more sophisticated measurement system. This test uses the spectrum analyzer to make all measurements from 100 Hz to 100 kHz offsets. The 100 Hz and 100 kHz offsets are particularly susceptible to measurement system limitations.

Equipment Required

Spectrum analyzer
Coaxial cable

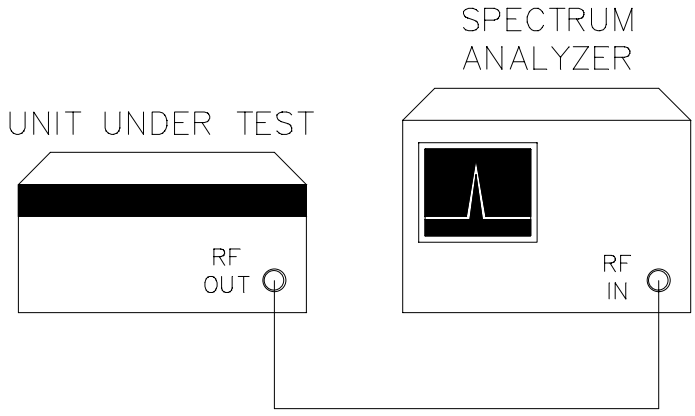


Figure 4-3. Single Sideband Phase Noise

Procedure

1. Connect the UUT RF output to the spectrum analyzer input. Place the UUT on a foam pad to isolate it from any external mechanical vibrations which could affect the phase noise measurement.
2. Press [SHIFT] [RESET] on the UUT.
3. For the first frequency on the Test Data Sheet within the range of the instrument, press [CW] and enter the frequency. Tune the spectrum analyzer to the generator frequency and adjust the UUT RF level to obtain a reference of 0 dBm on the analyzer. This allows direct measurement of the phase noise by the analyzer.
4. Set the analyzer span such that the desired offset is at ±2 divisions, select an appropriate bandwidth, activate the phase noise measurement and place the marker two divisions above the carrier. Read the phase noise in dBc/Hz. Repeat for all offsets.
5. Repeat steps 3 and 4 for the other Test Data Sheet frequencies which are within range of the UUT.

4.2.5 RF Output Power Tests

Specifications

Maximum Leveled Output:

Frequency Range (GHz)	Standard	With Option 26
.01 to 2	+13 dBm	+13 dBm
>2 to <8	+15 dBm	+15 dBm
8 to 15	+14 dBm	+13 dBm
>15 to 20	+13 dBm	+11 dBm
20 to 26.5	+12 dBm	+10 dBm
For 2-20 and 2-26 GHz instruments		
2 to <8	+15 dBm	+15 dBm

Minimum Output Level: -10 dBm (-20 typical);
-120 dBm with Option 26.

Output Accuracy (internally leveled, Scan/AM off): < ±2 dB (-10 dBm to maximum specified power). Add ±.1 dB/10 dB with Option 26.

Output Flatness: < ±2 dB

Description

Although it is possible to make the following measurements manually, it is extremely tedious. It is recommended that an automated system be set up to take and record the data. Three tests are run. The first measures the maximum available output with the level control loop disabled. The second verifies the accuracy and flatness across the operating frequency range at a fixed output (0 dBm). The remaining test checks the step attenuator accuracy at a number of frequencies. The procedure outlines the general procedure followed by the automated system, a similar measurement could be done manually.

Equipment Required

Local Oscillator
Measuring receiver/sensor
Downconverter
Plotter
Computer and programs

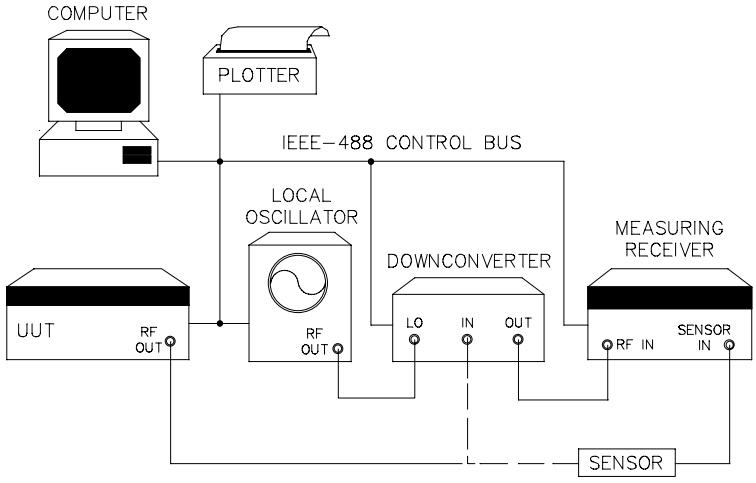


Figure 4-4. RF Output Power Tests

See Procedures on the next page

Procedure

1. Connect the power sensor to the UUT. Disable the leveling system of the UUT. Step the frequency across the particular instrument operating range in 50 MHz increments. At each point measure the power, apply the appropriate sensor correction factor, and plot the result.
2. Using the above setup, set the UUT to 0 dBm with the leveling enabled. Again, step the frequency across the operating range; measure, correct, and plot the power.
3. *For instruments with Option 26:*
   Connect the UUT to the measuring receiver via the downconverter. With the UUT at 0 dBm and set to the first test frequency, establish a reference on the receiver. Reduce the UUT output in 10 dB steps, observing and recording the receiver reading. As needed, perform the recalibration requested by the receiver.
4. Repeat for the remaining test frequencies.

4.2.6 Pulse Modulation On/Off Ratio Test

Specifications

On/Off Ratio: >80 dB

Description

The GT 9000S is set to a CW frequency at a power level of 0 dBm. A spectrum analyzer is used to view the signal. The pulse modulation is then enabled and the resulting waveform is measured.

Equipment Required

Spectrum analyzer
Coaxial cable

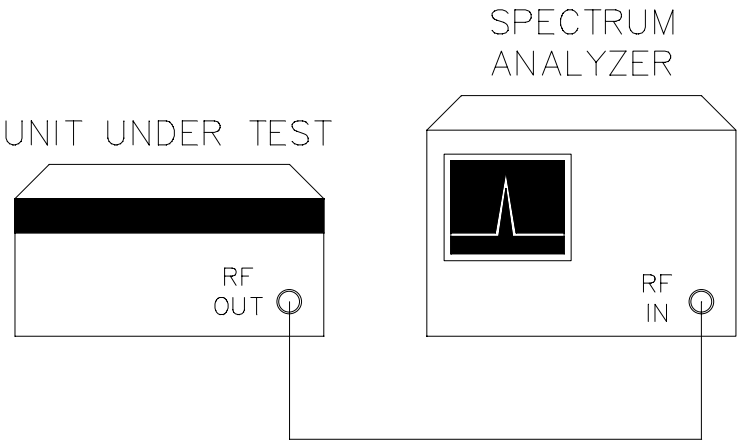


Figure 4-5. Pulse Modulation On/Off Ratio Test

Procedure

1. Connect the equipment as shown in Figure 4-5. Allow 20 minutes warm-up time.
2. Press [SHIFT] [RESET] on the UUT and enter the first frequency on the test data sheet within the frequency range of the instrument. The RF power level should be at 0 dBm.
3. Tune the analyzer to the source frequency, select an analyzer span of 0 Hz, and fine tune the analyzer to place the line at the top of the screen graticule (adjust analyzer reference level as needed).
4. Set the pulse modulation on the UUT. Press [PM] [RATE] [100] [HZ] [WIDTH] [5] [MS] to establish a 100 Hz squarewave.
5. Adjust the analyzer sweep time to display a few cycles of the waveform. Use internal triggering. Reduce resolution bandwidth and carefully retune the analyzer center frequency until the maximum resolution is achieved. Read and record the peak-to-peak value (use marker delta).
6. Repeat steps 3, 4 and 5 for all other Test Data Sheet frequencies which are within the range of the instrument. Note that the dynamic range of the analyzer may limit its measurement capability.

4.2.7 Pulse Modulation Rise and Fall Time Test

Specifications

Rise/Fall Time: <10 ns

Description

A crystal detector is connected to the GT 9000S, terminated in 50 Ω, and monitored with an oscilloscope.

NOTE: It is very important to use either the specified detector or one with similar rise time characteristics. Even when terminated in 50 Ω with a short cable, the detector parameters can markedly influence the measurement.

Equipment Required

Oscilloscope
Crystal detector

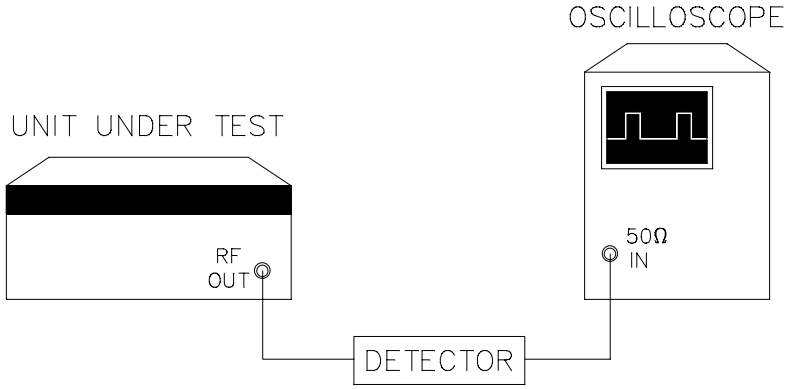


Figure 4-6. Pulse Modulation Rise/Fall Time Test

Procedure

1. Connect the equipment as shown in Figure 4-6. The cable from the detector to the oscilloscope should be kept as short as possible.
2. Press [SHIFT] [RESET] on the UUT and set the frequency to the first Test Data Sheet frequency within the operating range of the instrument.
3. Enable the pulse modulation of the UUT by pressing [PM] [MODE..(INT)] [SCROLL..(RATE)] [1] [MHZ] [SCROLL..(WIDTH)] [.5] [US] [ON].
4. Set the oscilloscope to 5 mV/div and using the RF Level control of the UUT, adjust the peak to peak oscilloscope display to fall on the dotted lines on the screen (100% and 0%). Adjust the oscilloscope sweep time to 5 ns/div. Measure and record the rise and fall times between the 10% and 90% points.
5. Repeat Step 4 for each of the Test Data Sheet frequencies within the operating range of the instrument.

4.2.8 Pulse Modulation Overshoot and Settling Time

Specifications

Overshoot/Undershoot/Ringing:	±2 dB maximum
Settling Time:	<100 ns to within 1 dB

Description

A crystal detector is connected to the GT 9000S, terminated in 50 Ω, and monitored with an oscilloscope.

☛ **NOTE:** It is very important to use either the specified detector or one with similar rise time characteristics. Even when terminated in 50 Ω with a short cable, the detector parameters can significantly influence the measurement.

Equipment Required

Oscilloscope
Crystal detector

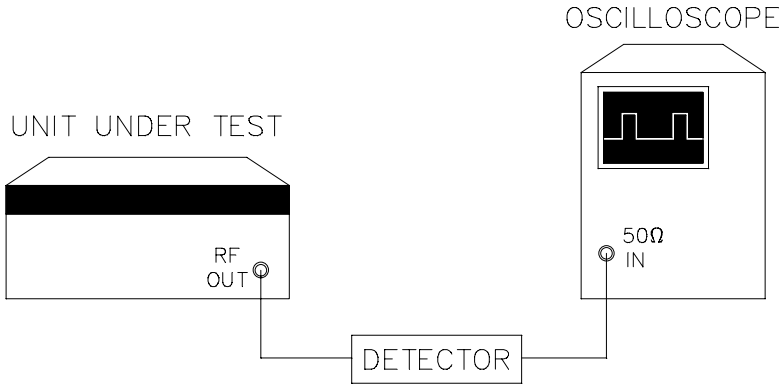


Figure 4-7. PM Overshoot and Settling Time

Procedure

1. Connect the equipment as shown in Figure 4-7. The cable from the detector to the oscilloscope should be kept as short as possible.
2. Press [SHIFT] [RESET] on the UUT and set the frequency to the first Test Data Sheet frequency within the operating range of the instrument.
3. Enable the pulse modulation of the UUT by pressing [PM] [MODE..(INT)] [SCROLL..(RATE)] [1] [MHZ] [SCROLL..(WIDTH)] [.5] [US] [ON].
4. Set the oscilloscope to 5 mv/div and using the RF Level control of the UUT and the vertical position of the oscilloscope, adjust the peak to peak oscilloscope display to be from the top of the screen (pulse off) to 2 divisions below the center line (pulse on). Adjust the oscilloscope sweep time to 50 ns/div. Change the level setting of the UUT by plus and minus 1 dB and note the graticule position of the pulse on level. Return to the original value. Measure and record the time for the pulse to be within 1 dB of its final value.
5. Change the level setting of the UUT by plus and minus 2 dB and note the graticule position of the pulse on level. Return to the original level. Measure and record any undershoot/overshoot of the signal.
6. Repeat Steps 4 and 5 for each of the Test Data Sheet frequencies within the operating range of the instrument.

4.2.9 Pulse Modulation Accuracy Test

Specifications

Leveled Pulsed Output Power(referenced to leveled, unmodulated output power):	±.5 dB, typical (≥100 ns pulse width) ±1 dB, typical (<100 ns pulse width)

Equipment Required

Oscilloscope
Crystal detector

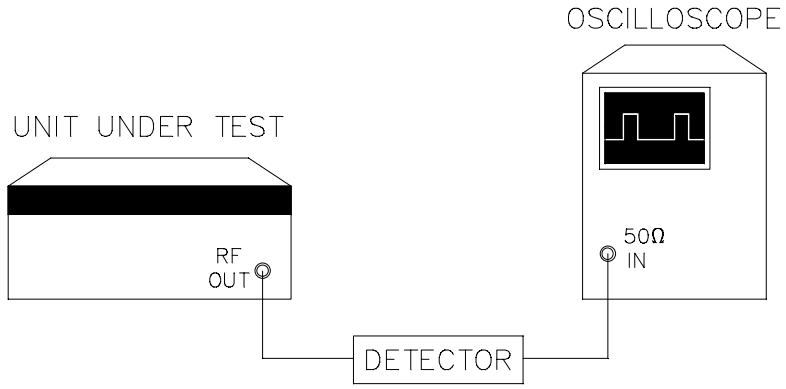


Figure 4-8. Pulse Modulation Accuracy Test

Procedure

1. Connect the equipment as shown in Figure 4-8. The oscilloscope input impedance should be 50 Ω. Allow 20 minutes warm-up.
2. Press [SHIFT] [RESET] on the UUT and set the frequency to the first Test Data Sheet frequency within the operating range of the instrument.
3. Set the oscilloscope to 5 mv/div and using the vertical position of the oscilloscope, adjust the trace to the centerline of the screen. Change the level setting of the UUT by plus and minus 1 dB and note the trace position on the screen. Return to 0 dBm.
4. Enable the pulse modulation of the UUT by pressing [PM] [MODE..(INT)] [SCROLL..(RATE)] [200] [kHz] [SCROLL..(WIDTH)] [.1] [US] [ON].
5. Measure and record the difference between the CW reference level and the negative peak of the pulse.
6. Change the pulse width to 50 ns and again measure and record the difference between the CW reference level and the negative peak of the pulse.
7. Repeat Steps 3-6 for each Test Data Sheet frequency within the operating range of the instrument.

4.2.10 Internal Pulse Generator Tests

Specifications

Repetition Rate Accuracy:	±.02% of range maximum value.
Delay Accuracy:	The greater of: ±1% of setting, or 20 ns.
Width Accuracy:	The greater of: ±1% of setting, or 20 ns.

Description

The time interval counter is used to measure each of the specified parameters at the rear panel PM Video output. The pulse delay measurements are referenced to the rear panel PM Sync output.

Equipment Required

Time interval counter

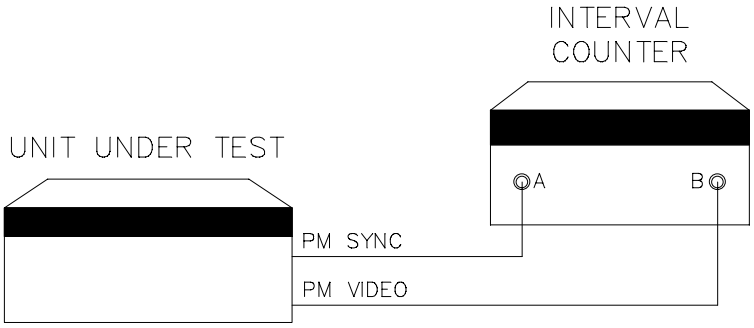


Figure 4-9. Internal Pulse Generator Tests

Procedure

1. Connect the PM sync to the counter A input and the PM Video to the B input.
2. Set the counter to measure Freq A. For each Repetition Rate shown on the Test Data Sheet, measure and record the actual Pulse Repetition Frequency.
3. Set the counter to measure TI A to B. For each Delay shown on the Test Data Sheet, measure and record the actual Pulse Delay.
4. Disconnect Sync from Channel A. Connect Video to Channel A. Set the counter to measure Pulse width A. For each width shown on the Test Data Sheet, measure and record the actual Pulse Width.

4.2.11 Frequency Modulation Tests

Specifications

Maximum Deviation (wide mode):	2.5 MHz peak (≤2 GHz); 10 MHz peak at (>2 GHz). *For 2-20 or 2-26 GHz instruments:* 10 MHz peak (>2 GHz).
Deviation Flatness:	±2 dB for rates from 10 Hz to 1 MHz; ±3 dB for rates from 1 to 5 MHz.
External Sensitivity:	Settable; calibrated for 1 Vp input (see Performance Specifications in Chapter 1 for further information).

Description

The output from the UUT is connected to a discriminator. The discriminator output is monitored on an oscilloscope to determine deviation and bandwidth.

Equipment Required

Function Generator
Oscilloscope
Digital Voltmeter
FM Test Fixture

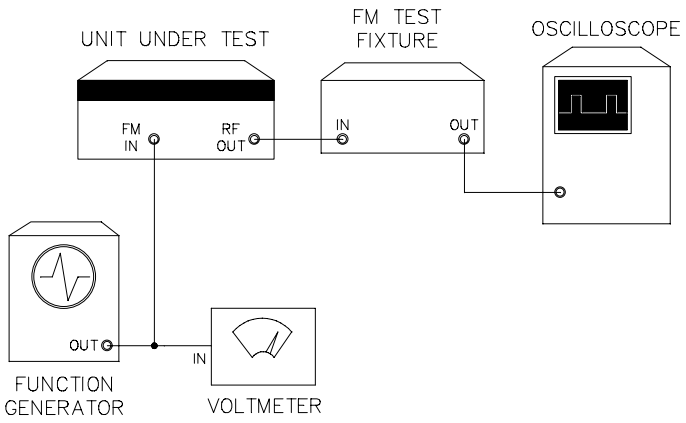


Figure 4-10. Frequency Modulation Test

Procedure

In order to calibrate and test the frequency modulation circuits, a special test fixture must be assembled. The recommended FM test fixture includes an RF splitter, two lines of equal length, and an RF mixer. The RF output of the UUT is divided by the splitter into two signals, unequally delayed. The required differential delay can be obtained by using two coaxial cables of, for example, 5 and 10 inches in length. The outputs of these delay lines are furnished to the two inputs of the RF mixer. For certain frequencies, which may be identified by experiment, the mixer will produce a DC voltage near zero. The number of null frequencies can be increased by making the delay lines longer in absolute terms or by increasing the ratio between their lengths. If the output becomes frequency modulated, the mixer output voltage will change, and the voltage variation will be proportional to FM deviation. The polarity of the voltage change may be either directly or inversely related to the direction of frequency deviation. When voltage levels have been established for different frequencies, the mixer output can be monitored on an oscilloscope to provide a continuous display of FM deviation.

1. Connect the FM test fixture to the RF OUT connector of the UUT as shown in Figure 4-10.
2. Monitor the mixer output with the oscilloscope (5 mV/div). For each test data sheet frequency, set the UUT to the closest null frequency (that is, at a frequency where the mixer output voltage is zero); +5 dBm out, no modulation.

3. Establish the voltage at 3 MHz above and 3 MHz below the null frequency. Adjust the oscilloscope gain and the UUT output power level (near +5 dBm) to place the null point at the center of the screen and the 3 MHz deviation points at 3 divisions above and 3 divisions below the null point.
4. *Instruments with Option 24:*
   Set the UUT to the FM internal 100 kHz SINE mode. Set the FM deviation to 3 MHz. Verify that the waveform is six divisions peak to peak ± .3 divisions.
5. Set the UUT to EXT FM. Connect the function generator, set to a 100 kHz rate SINE wave, 2 Vpp. Verify that the waveform is 6 divisions peak to peak (± .3 divisions).
6. Adjust the UUT FM deviation for exactly a six division peak to peak display. Vary the function generator from 10 Hz to 1 MHz and verify that the display remains between five and seven divisions peak to peak. Vary the function generator from 1 to 5 MHz and verify that the display remains between four and eight divisions peak to peak.

4.2.12 Internal Modulation Generator Tests

(Option 24 Only)

Specifications

Range:	10 Hz to 1 MHz
Accuracy:	±.01 Hz
Resolution:	1 Hz
Waveforms:	Sine, square, triangle

Description

The output of each of the internal modulation generators (AM and FM) is connected to the frequency counter where the frequency range, resolution and accuracy is tested. The three waveforms are observed on an oscilloscope.

Equipment Required

Frequency counter
Oscilloscope

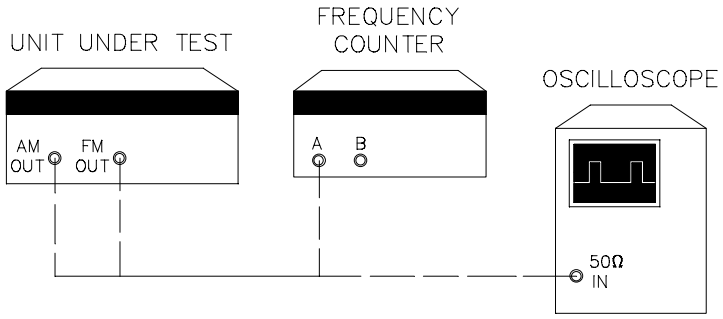


Figure 4-11. Internal Modulation Generator Tests

Procedure

1. Connect the equipment as shown in Figure 4-11. Allow about 20 minutes warm-up time. The AM and FM generator outputs are on the rear panel of the UUT.
2. Set the UUT to AM INT SQR and connect the AM out to the counter. Set the AM RATE to 1 Hz and, using the period mode of the counter, determine the accuracy of the output.
3. Select each of the frequencies shown on the Test Data Sheet to verify proper resolution and range of the output. The counter should be in frequency measurement mode for these tests.
4. Disconnect the modulation generator output from the counter and connect it to the oscilloscope. Select SQR, SIN, and TRI waveforms and verify a proper waveform.
5. Set the UUT to FM INT SQR and connect the FM out to the counter. Set the FM RATE to 10 Hz and using the period mode of the counter, determine the accuracy of the output.
6. Select each of the frequencies shown on the Test Data Sheet to verify proper resolution and range of the output. The counter should be in frequency measurement mode for these tests.
7. Disconnect the modulation generator output from the counter and connect it to the oscilloscope. Select SQR, SIN and TRI waveforms and verify a proper waveform.

4.3 Calibration Procedures

Calibration tolerances referred to in these procedures are intended to optimize the performance of the UUT; they should not be construed as published specifications. Performance specifications are presented in Chapter 1 of the manual.

The recommended interval between calibrations is one year.

4.3.1 Power Supply Calibration

This procedure checks power supplies at test points on PC board A11. Voltages are also verified on the motherboard, A101.

1. On the A11 board, use a DVM and measure the following power supplies (adjust the appropriate pot if required):
   a. On A11, check TP2 for 8.0 V. Adjust the +12A pot.
   b. On A11, check TP1 for 12.0 V. Adjust the +12B pot.
   c. On A11, check TP3 for 35.0 V. Adjust the +35 pot.
2. On the A101 motherboard, or at test points on the A11 board, verify the voltages in Table 4-1 are accurate within 0.3 V.

Table 4-1. Power Supply Voltage Test Points

Supply	Location	Color
+20 V*	A11-85	Brown
+8 V (A)	A11-15 or TP2	White, Gray
+12 V (B)	A11-95 or TP1	Red, Black
+15 V (hot)	A11-95	Blue, Black
+24 V	A101	Orange or Yellow
+15 V	A101	Blue
-15 V	A101	Violet
-5.2 V	A101	Green
+5 V	A101	Red, Green

* No specified tolerance

4.3.2 Phase Lock Loop, 100 MHz

1. Ensure that the high stability oscillator has warmed up for two hours. The warm-up time is not required if an external 10 MHz standard is used. PC boards A14 and A201 are referenced in this procedure.
2. On the A14 board, monitor TP4 with a scope. On the A201 board, adjust C23 to +3.0 V ±0.1 V. On A14, the unlock LED should be off, indicating a locked condition. The front panel lock LED should be lit.
3. At the rear panel, apply a 10 MHz external source to the REF IN connector. Verify that the UUT phase locks on the 10 MHz source, and that the front panel lock LED is on.
4. Disconnect the 10 MHz source.
5. Connect a BNC cable from a scope to the rear panel REF OUT connector. Verify that the 10 MHz output is at least 2 Vpp into 50 Ω.
6. Disconnect the BNC cable from the scope.
7. While the BNC cable is still connected to REF OUT, connect the other end of this cable into the rear panel REF IN connector. Verify that the instrument unlocks (on A14 the unlock LED is lit, the lock LED on the front panel is off).
8. Disconnect the BNC cable.

4.3.3 Sampler Drivers, 100 MHz VCO (Optional)

This procedure is optional. Remove the Philips screws on the 100 MHz VCO panel cover. On the A201 board, monitor the sampler driver signal at R45* with the scope. Peak the sampler driver by adjusting C32 for maximum peak-to-peak voltage. The scope should indicate a voltage of roughly 4 Vpp, or greater. Repeat the procedure for the second driver (monitor R46*, adjust C33). Replace cover and torque screws to 10 in/lb.

* R45 and R46 (10 Ω) are on the Sampler LO ports.

4.3.4 YIG Driver Calibration

This procedure ensures the accuracy of the coarse and fine tuning of the YIG oscillators. This procedure calibrates each driver at the high and low ends of the frequency range. PC boards A16 and A19 are referenced in this procedure.

1. *Reference YIG*: Monitor TP1 on the A16 PC board. On the A19 board adjust the min and max pots of the reference YIG driver at the min and max reference frequencies for 0 V ±1 V on TP1. See Table 4-2.

Table 4-2. Reference YIG Driver Frequencies

Output Frequency (GHz)	Adjust Pot A19	Reference Freq (GHz)
7.9	R2 Max	7.805
2.01	R1 Min	1.905

2. The min and max pots interact, so you should repeat step 1 until both voltages are 0 V ±1 V.
3. *Optional Frequency Check*: Monitor the reference frequency test port J5 on the RF module.

4. (Output YIGs): Monitor TP1 on the A18 board. On the A19 board, adjust the min and max pots of the output YIG drivers, at the min and max frequencies of the YIGs, for test point voltages of 0 V ±1V on TP1. Refer to Table 4-3.

Table 4-3. Output YIG Driver Frequenices

Set Frequency	Adjust Pot, A19
7.9 GHz	R12 Max
2.1 GHz	R11 Min
20.0 GHz	R24 Max
8.0 GHz	R23 Min
26.0 GHz	R26 Min
20.0 GHz	R35 Max

5. Since the min and max pots for each YIG interact, repeat step 4 for each band until the output voltages are all 0 V ±1 V.
6. *Optional Frequency Check*: Monitor the front panel RF output with a frequency counter.
7. After all of the min and max pots have been calibrated, monitor the test points on the A16 and A18 PC boards (as described above), and use the front panel UP/DOWN keys to step through the frequency range in 100 MHz increments. Both test points should remain at 0 V ±1 V.

4.3.5 Level Calibration

The A10A1 board is referenced in this procedure. Some adjustments are on the A10 board, and others are on the A10A1 piggyback board.

1. On A10, monitor TP3 with a DVM. Check for a voltage of 3.2 V ±0.01 V; adjust pot R48 if necessary.
2. Connect a power sensor to the RF output.
3. Set the UUT to 2.1 GHz. On the A10 board, make the checks and adjustments shown in Table 4-4. Make adjustments within ±0.03 dB.
4. Monitor TP1 on board A10A1 with the scope and check the power levels listed in Table 4-4. Watch for oscillations during calibration. If oscillations occur, turn the LGAIN pot R50 on A10 counter-clockwise until the oscillations stop. Adjust the appropriate pots for proper levels.

Table 4-4. Power Level Calibration

POWER	ENTER 2.1 GHz	ENTER 1 GHz
0 dBm	LIN >2, pot R4	LIN <2, pot R3
10 dBm	GAIN >2, pot R29	GAIN <2, pot R27
-9 dBm	OFFSET >2, pot R30	OFFSET <2, pot R28

Extended Vernier Leveling

The following steps extend the range of leveling from +15 to -9 dBm to +15 to -20 dBm.

1. Select 2.1 GHz. Press SHIFT ATTEN to ON. Enter a LEVEL of -20 dBm.
2. On the A10 board, adjust R30 OFFSET >2 for a reading of -19.8 dBm ±0.1 dB on the power meter.
3. Select 1 GHz. On A10, adjust R28 OFFSET <2 for a reading of 19.8 dBm. Recalibrate the 0 and 10 dB points at both 1 GHz and 2.1 GHz, as required.
4. On the front panel, connect the power meter to RF out. Use data entry functions on front panel to step from +10 dBm to -20 dBm. This checks 1 dB linearity from 10 to -20 dBm. This should be within ±0.3 dBm.

4.3.6 AM/FM Generator Verification

(Option 24 only)

These steps verify that the internal AM and FM function generators perform correctly.

AM Procedure Setup

1. On the rear panel, connect AM SIG OUT to channel 2 on the scope. Connect a frequency counter to Channel 2 Out.
2. Select AM SIN at 100% and a 1 kHz rate. At AM SIG OUT verify that the signal is present at a nominal 2 Vpp into 1 MΩ.
3. Select AM TRI. Verify a clean signal at a nominal 2 Vpp into 1 MΩ.
4. Select AM SQR at 100% and a 1 kHz rate. Verify that the signal is present with a duty cycle of 47% and 53%, and with a nominal 2 Vpp.
5. While the AM SQR is selected, vary the AM rate. Verify that the counter display is same as the frequency display. Turn off AM.

FM Procedure Setup

1. On the rear panel, connect FM SIG OUT to channel 2 on the scope. Connect a frequency counter to Channel 2 Out.
2. Select FM SIN at 10 MHz DEV and a 1 kHz rate. At FM SIG OUT, verify that the signal is present at a nominal 2 Vpp into 1 MΩ.
3. Select FM TRI. Verify a clean signal at a nominal 2 Vpp into 1 MΩ.
4. Select FM SQR at 10 MHz DEV and a 1 kHz RATE. Verify that the signal is present with a duty cycle of 47% and 53% and with a nominal 2 Vpp.
5. While the FM SQR is selected, vary the FM rate. Verify that the counter frequency is the same as the displayed front panel frequency. Turn off FM.

4.3.7 Pulse Generator Verification

These steps verify that the pulse generator performs correctly.

PM Video Out Setup

1. On the rear panel, connect PM VIDEO OUT to Channel 1 on the scope. On the front panel, connect RF OUT through a detector to Channel 2 on the scope. This setup is to verify that RF OUT is aligned with VIDEO OUT.
2. Select an internal pulse at 4 GHz with 0 dBm. Then select a 5.0 micro second pulse width at a rate of 100 kHz and 0 ns delay.
3. Trigger scope on Channel 1. Ensure that the time delay between the PM VIDEO OUT and RF OUT pulses is <10 ns. Verify that PM VIDEO OUT is a nominal 1 Vpp into 50 Ω.

PM Sync Out Setup

1. On the rear panel, connect PM SYNC OUT to Channel 1 on the scope and PM VIDEO OUT to channel 2. This setup is to verify that SYNC OUT is aligned with VIDEO OUT.
2. Trigger scope on Channel 1. Ensure that SYNC OUT is 1 Vpp into 50 Ω and that the sync pulse width is 50 ns wide ±5 ns.
3. Verify that PM VIDEO and SYNC OUT are aligned within ±5 ns.

Delay Test Setup

1. Connect Input A on a Universal counter or equivalent to SYNC OUT and connect Input B to VIDEO OUT.
2. Set the UUT for a 2-second delay.
3. Set the counter to Time Interval (TI) A-B, and set Inputs A and B to 50 Ω. Use a rising edge trigger, dc coupled and a level of 0.5 V. This setup is to set level sensitivity.
4. Verify a 2 second delay ±10 ms on the frequency counter.
5. If required, on A5-A1 adjust C32 for a 2 second delay ±10 ms.

4.3.8 AM Calibration

After verifying the AM/FM generators, use these steps to calibrate the AM output. Parts of the equipment setup can also be used in the FM calibration steps.

Equipment Setup

1. On the front panel connect an external function generator with a BNC tee connector to AM IN. Connect a scope at Channel 1 to the BNC tee. Ensure that the scope displays a clean sine wave.
2. Use the external generator to apply a 2 Vpp, 1 kHz sine wave to AM IN. Measure the sine wave on the scope to ensure accuracy.
3. Connect the mixer/divider to RF OUT on the front panel. Also connect the LO signal generator to the mixer. The LO generator is set for 4.2 GHz at +10 dBm.
4. Connect the mixer IF OUT to the 8902A measuring receiver with filters set at 50 Hz and 15 kHz.
5. Select the AM mode with p-p divide by 2 on the 8902A receiver. Optional: connect the receiver modulation output to channel 2 on the scope.
6. Select 4 GHz and 0 dBm on the UUT.

AM External Procedures

1. Select AM EXT at 50%.
2. On A10, if required, adjust R5 for a 50% reading on the receiver.

AM Internal Procedures

(Option 24 only)

1. Select AM INT SIN at 50% and at a 1 kHz rate.
2. On A6-A1, if required, adjust R4 for a reading of 50% ±0.05%.
3. Select AM INT TRI. Verify that the receiver reads 50% ±0.5%.
4. Select AM INT SQR at 50%.
5. On the receiver, turn off the 50 Hz and 15 kHz filters.
6. On A6-A1, if required, adjust R9 for a receiver reading of 50% ±0.05%.

4.3.9 FM Calibration

After the AM/FM generators are verified use these steps to calibrate the FM output.

Equipment Setup

1. On the front panel, connect an external function generator with a BNC tee connector to FM IN. Connect a scope to the BNC tee at channel 1. Ensure that the scope displays a clean sine wave. A mixer with a divide by 40 output is required. Connect this mixer to RF OUT on the front panel.
2. Then connect the RF output of the LO signal generator to the mixer. The LO generator is set to 4.2 GHz at +5 dBm to provide an offset. Connect the divide by 40 output of the mixer to the 8902A measuring receiver.
3. The divide by 40 function produces readings that are 1/40th of the actual unit deviation. For example, the 25 kHz receiver reading in this procedure is a result of divide by 40.
4. On the 8902 receiver, the filters are set at 50 Hz and 15 kHz. Select the FM mode. Option: Connect Channel 2 on the scope to the modulation output on the receiver.

FM External Procedure

1. Select FM EXT at 1 MHz deviation.
2. Use the external generator to apply a 1 kHz sine with at 2 Vpp to FM IN. Measure the sine wave on the scope to ensure accuracy.
3. Select the frequencies listed in Table 4-5 in order and adjust the specified pot, if required for 25 ±0.05 kHz (the 1 GHz test step is a functional test only).

Table 4-5. FM External Frequencies

Frequency (GHz)	A18 Pots	LO Freq (GHz)
4	R33	4.2
1	none	1.2
12	R34	12.2
22	R35	22.2

FM Internal Procedure

(Option 24 only)

1. Select 4 GHz. Then enter FM INT SIN with a 1 MHz deviation and at a 1 kHz rate. Set the LO generator for 4.2 GHz.
2. On A6-A1, if required, adjust R13 for a reading of 25 kHz ±0.05 kHz.
3. Select the triangle mode. Wait approximately 20 seconds for the signal to settle. Verify that the reading is 25 kHz ±0.05 kHz.
4. Select FM INT SQR at a rate of 8 kHz. On the receiver, enable the 20 kHz filter. On A6-A1, if required, adjust R18 for a receiver reading of 25 ±0.05 kHz.

4.3.10 Spectral Purity

1. Select 2.1 GHz. Connect a spectrum analyzer to RF OUT on the front panel. On board A18, adjust balance pot R8 for minimum 1 MHz sidebands.

4.3.11 Time Base, 10 MHz

The following steps check and calibrate the 10 MHz reference time base. NOTE: This is only a setability test and not an accuracy test.

☞ **NOTE:** The unit must warm up for 72 hours before the high stability oscillator can be checked and calibrated as required.

1. On the scope, connect the output from a frequency standard (10 MHz) to the external trigger input (Channel 1). Adjust the scope to trigger on Channel 1.
2. On the rear panel of the unit, connect a cable to REF OUT. Connect the other end of this cable to the vertical input on the scope. Verify that the 10 MHz signal trace does not drift more than 100 ns in 1 second.
3. If adjustments are required, remove the top cover of the unit. The high stability oscillator is located next to the fan assembly. Remove the screw. Adjust the coarse and fine tune pots so that the signal trace is within the drift specifications.

Model GT 9000S Test Data Sheet, page 1 of 4		
Serial Number:		Under Test Result record measured values (if any). In the case of a function check or range check, write OK to indicate that the unit under test meets specifications.
Date:		
Tested By:		
Quality Assurance:		

Frequency Range, Resolution, Accuracy		**Test Result**
<2 GHz Band Accuracy		
Accuracy at the UUT maximum frequency		
Divide-by-N test frequencies	2.111 GHz	
	2.222 GHz	
	2.444 GHz	
	2.888 GHz	
	2.123 GHz	
	2.987 GHz	
1 Hz Resolution test frequencies (Note: use any frequency for the >100 kHz digits.)	XXXX.000000 MHz	
	XXXX.111111 MHz	
	XXXX.222222 MHz	
	XXXX.444444 MHz	
	XXXX.888888 MHz	
	XXXX.123456 MHz	
	XXXX.987654 MHz	

Spurious Signals Tests		
Frequency (MHz)	**Harmonics**	**Non-Harmonics**
770.550		
1513.425		
3536.171		
9182.433		
17361.522		
23541.349		

Model GT 9000S Test Data Sheet, page 2 of 4			
Serial Number:		Tested By:	
Date:		Quality Assurance:	

Single Sideband Phase Noise (dBc/Hz)					
Frequency (MHz)	**Offset from Carrier**				
	100 Hz	**1 kHz**	**10 kHz**	**100 kHz**	**1 MHz**
1513.425					
3536.171					
9182.433					
17361.522					
23541.349				,	

RF Output Power		Test Result
	Max. Power Level	
	Power Level ±2 dB	
Step Attenuator test frequencies	1.0 GHz	
	4.0 GHz	
	12.0 GHz	
	17.0 GHz	

Pulse Modulation Tests					
Frequency (GHz)	**On/Off (>80 dB)**	**Rise/Fall (<10 ns)**	**Overshoot (≤2 dB)**	**Settling (<100 ns)**	**Accuracy (±.5/±1 dB)**
1.0					
4.0					
12.0					
22.0					

Model GT 9000S Test Data Sheet, page 3 of 4			
Serial Number:		Tested By:	
Date:		Quality Assurance:	

Pulse Generator Tests — Rate		
Rate Set	**Tolerance**	**Measured**
50 Hz	49.98 - 50.2	
500 Hz	499.8 - 500.2	
5 kHz	4.998 - 5.002	
50 kHz	49.98 - 50.02	
500 kHz	499.8 - 500.2	

Pulse Generator Tests — Delay		
Delay Set	**Tolerance**	**Measured**
.5 sec	.495 - .505	
50 ms	49.5 - 50.5	
5 ms	4.95 - 5.05	
.5 ms	.495 - .505	
50 µs	49.5 - 50.5	
5 µs	4.95 - 5.05	
.5 µs	.480 - .520	
50 ns	30 - 70	

Pulse Generator Tests — Width		
Width Set	**Tolerance**	**Measured**
.5 sec	.495 - .505	
50 ms	49.5 - 50.5	
5 ms	4.95 - 5.05	
.5 ms	.495 - .505	
50 µs	49.5 - 50.5	
5 µs	4.95 - 5.05	
.5 µs	.480 - .520	
100 ns	80 - 120	

Model GT 9000S Test Data Sheet, page 4 of 4			
Serial Number:		Tested By:	
Date:		Quality Assurance:	

Frequency Modulation Tests				
Parameter	**@ 1 GHz**	**@ 4 GHz**	**@ 12 GHz**	**@ 20 GHz**
Deviation (5.7-6.3 div)				
Flatness (5-7 div)				
Flatness (4-8 div)				

Internal Modulation Generator Tests (Opt. 24)		Test Result
AM Accuracy test (±.01 Hz)	1 Hz	
	100 Hz	
	1 kHz	
	10 kHz	
	100 kHz	
AM Mode Waveforms: Square, Sine, Triangle		
FM Accuracy test (±.01 Hz)	1 Hz	
	100 Hz	
	1 kHz	
	10 kHz	
	100 kHz	
FM Mode Waveforms: Square, Sine, Triangle		

5

Maintenance

5.1 General Maintenance

Under normal operation, the GT 9000S requires little regular maintenance. It is recommended that the calibration procedure in Chapter 4 be performed at one-year intervals for operational accuracy. The air inlet screen should be cleaned whenever a noticeable amount of dirt has accumulated.

During the warranty period of the instrument, it is recommended that no user-initiated service be performed without first communicating with the factory or our authorized representative. The problem can often be isolated to a particular plug-in module for which a replacement can be sent.

5.2 Troubleshooting Procedure

5.2.1 Introduction

Before any other analysis is attempted, three potential problem areas must be eliminated.

1. Check that all front and rear panel controls are properly set. An apparent malfunction may be the result of an operator error, such as selecting external modulation without furnishing a modulation input.
2. Establish whether the problem exists only under remote control. If it does, the cause could be a malfunctioning controller, an improper bus address, or an erroneous remote control command.
3. Clean the plated edges of the plug-in circuit boards with a rubber eraser and alcohol (malfunctions are often caused by oxidization or an accumulation of dirt on these edges).

Six major areas of potential failure are addressed in this procedure. Each problem area is analyzed with a reference to the troubleshooting notes in Section 5.3 (e.g., see 5.4.1).

5.2.2 Defining the Area of Malfunction

It is important to establish under what circumstances a malfunction does (and does not) occur. Failure may occur in only a portion of the frequency range or level range, or only in a particular operating mode. Explore different settings and modes in order to find the limits of the malfunction. It may be found that a malfunction occurs only during remote control operation (see 5.2.8).

5.2.3 General Failure

Symptoms: The instrument does not respond appropriately to commands given via the front panel controls or IEEE-488 interface; the readouts are blank, erratic, or fixed in one state.

Recommendations

Check the power supplies (see 5.3.1).

Check the computer (see 5.3.2).

5.2.4 Loss of RF Output

Symptoms: No measurable power is present at the output connector, regardless of the RF level setting. The front panel LEVEL indicator may or may not be lit.

Recommendations

1. Check the power supplies (see 5.3.1).
2. If the LOCK LED is not lit, check the YIG oscillator (see 5.3.4).
3. If the LEVEL LED is not lit, check the microwave module (see 5.3.5).
4. If the LEVEL LED is lit, check the 10 dB step attenuator (see 5.3.3).

5.2.5 Incorrect Output Level

Symptoms: Output power is at a level other than that selected by the RF level setting. The front panel LEVEL indicator may or may not be lit.

Recommendations

Before proceeding, be sure that the selected RF level is within the capability of the instrument. Although the instrument must meet a maximum power specification, the actual maximum will be somewhat in excess of this, and will vary for different frequencies. When exceeding the normal power range, the LEVEL indicator may go out and the RF output may fall below the level requested.

1. Check the RF Output connector.
2. Check the power supplies (see 5.3.1).
3. If the level error is a 10 dB multiple (e.g., -20 dBm instead of +10 dBm), check the 10 dB step attenuator (see 5.3.3).
4. Check the microwave module (see 5.3.5).
5. Check the detector (see 5.3.6).
6. Check the level control circuit (see 5.3.7).

5.2.6 Output Frequency Unlocked

Symptoms: The LOCK indicator on the front panel is dark whenever any phase lock loop circuit in the instrument is unlocked. The output frequency will drift; the degree of frequency error depends on where the fault is.

Recommendations

1. Check the power supplies (see 5.3.1).
2. Determine whether the unlock problem is band-related (check the front panel LOCK LED at .5 GHz, 5 GHz, and 15 GHz.
   a. If all bands are unlocked:

      Remove the A18 PC board and check the LOCK LED again.

      1) If the LOCK LED is lit:

         Check the Output PLL (see 5.3.8).

         Check the divide-by-N circuit on the frequency divider board (see 5.3.9).

         Check the reference mixer output (see 5.3.17).

      2) If the LOCK LED is not lit:

         Remove the A16 PC board (A18 is still removed) and check the LOCK LED again.

      3) If the LOCK LED is lit:

         Check the Reference PLL (see 5.3.18).

         Check the Reference YIG (see 5.3.4).

      4) If the LOCK LED is not lit:

         Remove the A15 PC board (A18 and A16 are still removed) and check the LOCK LED again.

      5) If the LOCK LED is lit, check the 1 Hz PLL (see 5.3.14).

      6) If the LOCK LED is not lit:

         Remove the A14 PC board (A18, A16, and A15 are still removed) and check the LOCK LED again.

      7) If the LOCK LED is lit:

         Check the 100 MHz PLL (see 5.3.12).

      8) If the LOCK LED is not lit:

         Check the LOCK LED itself, or the circuit which drives it.

   b. If only one band is unlocked, proceed as described above, unless the unlocked band is the range below .5 GHz. If that range is affected, check the Downconverter PLL (see 5.3.16).

5.2.7 Output Locked, but Frequency Incorrect

Symptoms: The LOCK indicator is illuminated; the output frequency is stable, but incorrect.

Recommendations

The troubleshooting procedure is the same as for the unlocked condition described in Section 5.2.6. The same circuits are likely to be at fault, even if there is no indication of unlock; the problem may be caused by improper control or reference inputs rather than by complete circuit failure.

5.2.8 IEEE-488 Interface Malfunction

Symptoms: The instrument does not respond appropriately to commands sent via the interface, or exhibits a particular malfunction only while under remote control (see Sections 5.2.3 through 5.2.7).

Recommendations

1. Check the power supplies (see 5.3.1).
2. Verify that all commands used are appropriate to this instrument (see Chapter 2 of the manual for a complete listing of valid remote commands), and that the correct bus address is being used.
3. Verify that the controller is operating normally.
4. Check the IEEE-488/Timer circuit (see 5.3.15).

5.3 Troubleshooting Notes

5.3.1 Power Supply

This is the common denominator among malfunctions of all types. Because the instrument has many regulated supplies, and they are not all used by all circuits, it is possible for the failure of a single supply to disable only a part of the system. For this reason power supply voltages should be checked whenever there is a malfunction, even though the malfunction may seem limited or localized.

WARNING

Dangerously high DC voltages are present inside the Switching Power Supply module. Do not attempt to open this module.

Power supplies that originate on the A11 PC board are listed in Table 5-1.

Table 5-1. Power Supplies on the A11 Board

Supply	Origin	Application
Fan (~+22.6 V; divided down from +24 V input from the switching power supply module)	A11-11	cooling fan
The four +12 V switched supplies listed below are all derived from the +15 V input from the switching power supply module; they are dedicated to particular band-related amplifiers within the microwave module, and are switched off when the instrument is not within the frequency range which requires that amplifier.		
20-26.5 +12 V	A11-27	Amplifier in the microwave module that is on in the 20-26.5 GHz range
2-20 +12 V	A11-29	As above, 2-20 range
.01-20 +12 V	A11-31	As above, .01-20 range
.01-2 +12 V	A11-33	As above, .01-2 range
+12 VSB (28-40 +12 V)	A11-15	Reserved for future applications
+12 VSA (20-28 +12 V)	A11-19	Reserved for future applications
+35 V	A11-83	Fluorescent display drivers
Unregulated +20" (~+23.4 V)	A11-85	Relay driver for AC power relay
+15 VB	A11-95	Heater supply for timebase & 100 MHz crystal oscillator (on in standby mode)

Power supplies that originate within the switching power supply module are listed in Table 5-2 (the locations cited are convenient measurement points, not points of origin).

Table 5-2. Switching Power Supply Module

Supply	Measurement Point	Application
+24 V	A13-89	YIG oscillators, analog circuits, relay drivers for the step attenuator
-5 V	A13-95	ECL logic circuits
-15 V	A13-93	Analog circuits
+5 V	A13-97	TTL logic circuits
+15 V	A13-91	Analog circuits

Corrective Action

Measure all of the listed supplies.

1. If all supplies are at 0 volts:

   Check the fuse; if it is open, replace it with a fuse of the correct value.

2. If the fuse fails repeatedly:

   a. Unplug the A11 PC board and the Switching Power Supply input. Apply AC power to the instrument through a variac with an internal current meter. Slowly bring up the variac voltage to the normal line voltage.

   b. If excessive current draw occurs, check the line filter and relay.

   c. Reduce the variac voltage and plug in the A11 PC board. Slowly bring up the variac voltage to the normal line voltage.

   d. If excessive current draw occurs, investigate the A11 PC board, or replace it with a spare.

   e. Reduce the variac voltage and connect the Switching Power Supply input. Slowly bring up the variac voltage to the normal line voltage.

   f. If excessive current draw occurs, replace the Switching Power Supply.

3. If one supply is at an incorrect voltage:

   a. Isolate the supply from its load by disconnecting the supply at its origin. Use a laboratory power supply (with a current meter) as a substitute for the disabled supply.

   b. If excessive current draw occurs:

   c. Remove all plug-in circuit boards except for the A11 PC board. Re-install the boards one at a time, in order to isolate the overload to a particular board.

   d. Load the isolated power supply with a high wattage resistor.

   e. If the supply cannot drive a proper load:

   f. Assuming that the supply originates on the A11 PC board, investigate that board, or replace it with a spare. If the supply comes from the Switching Power Supply module, replace that module.

5.3.2 The Computer

All instrument functions are controlled by the computer, and a general computer failure will lead to a general system failure. The computer is based on the Motorola 68000 microprocessor. It uses a bus architecture which corresponds on a one-to-one basis with the signals from and to the 68000 chip.

Corrective Action

Four circuit boards house the computer:

A1 — This is the Front Panel Interface board, which acts as an interface between the microprocessor and the front panel.

A2 — This is the IEEE-488/Timer board. It includes the interface between the CPU and the remote control bus, as well as the timer circuit for the CPU and driver circuits for the step attenuator.

A3 — This is the Memory board. It holds the ROM devices in which the operating software is stored, as well as the RAM chips used by the computer for temporary data storage.

A4 — This is the CPU board. It houses the microprocessor and the address decoding logic through which it runs the instrument.

When a computer failure is suspected, the best way to troubleshoot the system is to isolate the problem to board level by substituting known good PC boards. If the problem persists with good spares, the problem is most likely on the computer bus board (the motherboard) into which the computer boards are plugged. Many computer problems are caused by dirt on the connections between these boards.

If the computer seems to have become lost, it can be reset either by pressing the reset button on the CPU board (A4) or by turning the power switch off and on.

5.3.3 10 dB Step Attenuator (Option 26)

The programmable attenuator is capable of attenuating the RF output by as much as 110 dB, depending on the frequency range of the instrument; if the output is not at the desired power level, the cause may be that the attenuator is improperly set. Note that the attenuator is outside of the leveling loop, and therefore the leveling system cannot detect, or compensate for, attenuator errors.

Corrective Action

The internal structure of the programmable attenuator includes a series of relays which add or remove lossy elements (10 dB, 20 dB, 40 dB, etc.) in suitable combinations to achieve the desired total attenuation. The relay drivers which select these increments are located on the IEEE/Timer circuit board (A2). Verify that the attenuator is receiving the appropriate drive signals; if not, investigate the drivers on the IEEE/Timer board and the computer logic lines which control them.

5.3.4 YIG Oscillator

All YIG oscillators require +15 V and +24 V supplies; some may also require a -5 V supply. In addition to the power supply requirements, the YIG oscillator must have current supplied to its tuning coil within an appropriate range in order to generate an RF output of any kind. If tuning coil current is excessive or insufficient, there will be no signal, and the front panel LOCK LED will not be lit.

Corrective Action

Table 5-3 shows expected voltages on the positive and negative tuning coil pins of the YIG oscillator (these voltages are approximate). If the measured voltage is wrong, turn off line power and measure the resistance to ground (approximate normal values are shown in Table 5-3).

Table 5-3. Expected Volts on the YIG Tuning Coil

YIG Oscillator	Output Frequency	+ Tune Pin (volts/ohms)	- Tune Pin (volts/ohms)	Power Output
2-8	5 GHz	+4.0 V / 16 Ω	+ 0.7 V / 3 Ω	+18 dBm
8-20	15 GHz	+7.0 V / 8 Ω	+2.4 V / 3 Ω	+16 dBm
1.9-8.7*	5 GHz	+4.0 V / 16 Ω	+0.7 V / 3 Ω	+17 dBm
*The reference YIG, relevant to lock problems only. The FM- pin should have about 0.5 Ω to ground.				

Note

If the coil current is out of range, investigate the NPN transistor and the YIG driver circuit (A19) which drives its base.

5.3.5 Microwave Module

The signal path through the RF module includes a voltage controlled attenuator circuit, or leveler. The level control circuit board (A10) has an output which drives the leveler pin on the outside of the module. The leveler increases attenuation as the control voltage input becomes more positive, and reduces attenuation as the input becomes more negative; sensitivity to the control voltage varies for individual instruments. Several other control biases are required for normal operation.

Corrective Action

Measure the RF output at J11. It should be at least +16 dBm; if not, measure the control biases shown in Table 5-4 (readings are approximate, and are in volts referenced to ground).

Table 5-4. Expected Control BIAS Voltages

Module Pin	Bias Origin	Normal Bias Voltages for Microwave Module Pins (at 0 dBm out, no modulation)		
		(at 1 GHz out)	(at 5 GHz out)	(at 15 GHz out)
P1-1	A14-J1-74	0.8	0.8	-12.2
P1-2	A17-J1-78	14.8	14.8	14.8
P1-3	A14-J1-78	4.6	4.6	4.6
P1-4	A14-J1-73	0.8	0.8	-12.2
P1-5	A19-J1-81	0.8	0.8	0.8
P1-6	A11-J1-29	0.0	15.0	15.0
P1-7	A19-J1-79	0.8	0.8	0.8
P1-8	A19-J1-80	0.8	-10.4	0.8
P1-9	A19-J1-84	14.8	14.8	14.8
P1-10	A17-J1-62	3.2	3.2	3.2
P1-11	A14-J1-64	-12.2	-12.2	0.8
P1-13	A14-J1-70	0.8	0.8	-12.2
P1-14	A14-J1-63	-12.2	-12.2	0.8
P1-15	A17-J1-70	14.8	14.8	14.8
P1-16	A17-J1-66	-9.6	-9.6	0.8
P1-17	A11-J1-31	15.0	15.0	15.0
P1-18	A17-J1-74	-14.4	-14.4	-14.4
P1-19	A14-J1-69	0.8	0.8	-12.4
P1-20	A17-J1-76	14.8	14.8	14.8
P1-21	A14-J1-82	-13.0	3.8	3.8
P1-23	A14-J1-81	3.8	-13.0	-13.0
P1-24	A11-J1-31	15.0	15.0	15.0
P1-25	A19-J1-82	0.8	0.8	0.8
P1-26	A14-J1-65	-12.2	-12.2	0.8
P1-27	A19-J1-83	0.8	0.8	-10.4
P1-28	A19-J1-78	-13.0	0.8	0.8
P1-29	A11-J1-31	15.0	15.0	15.0
P1-33	A17-J1-64	-3.0	-3.0	-3.0
P1-34	A17-J1-68	0.8	0.8	-9.6
P1-35	A14-J1-62	-12.2	-12.2	0.8
P1-36	A14-J1-61	-12.2	-12.2	0.8
P1-37	A14-J1-66	0.8	0.8	-10.8
J4	A10-J1-44	-4.0	0.2	0.4
J7	A5-J1-60	-5.8	-5.8	+0.4
J18	A10-J1-48	-0.2	+0.4	+0.2
J17	A5-J1-64	0.4	0.4	-6.0

5.3.6 Detector

The leveling system requires feedback from the RF path in order to control output power. This is provided by a negative-output diode detector, driven by a signal coupled from the RF output. For output frequencies above 500 MHz, the detector takes its input signal from a coupler in the output path (the coupler is attached to the J11 connector on the microwave module). For output frequencies below 500 MHz (if applicable), a coupled output is available at the J9 connector on the microwave module, and the detector is connected directly to that output.

An external detector can also be used, by attaching the cable from the external detector to the external ALC input on the rear panel.

Corrective Action

1. Be sure that the correct leveling mode is activated (external ALC should not be enabled unless an external detector is in use).
2. A failure of the internal detector is unlikely, but it is important to verify that the detector signal is being received by the level control board (A10). When there is an apparent failure of the leveling system, disconnecting the detector cable and observing the resulting changes is often a revealing experiment.
3. If the problem occurs above 500 MHz, set the output frequency to 5 GHz, and disconnect the coax from J2 on the Detector Buffer board (A200). The front panel output should be approximately +18 dBm.
4. Measure the center conductor of the coax with a voltmeter; it should be at approximately -300 mV.
5. If the problem occurs below 500 MHz, set the output frequency to 400 MHz, and disconnect the coax from J3 on the Detector Buffer board (A200). The front panel output should be approximately +18 dBm.
6. Measure the center conductor of the coax with a voltmeter; it should be at approximately -500** mV.

5.3.7 Level Control Circuit

The level control circuit board (A10) is basically a loop amplifier which must balance a variable input (feedback from the level detector) against a reference signal. The detector can be either the internal detector mounted outside the RF module, or a remote detector (in the external ALC mode). The reference signal is programmed by the system computer, and incorporates level characterization data unique to the instrument in which it is installed. The level control circuit, using its output to drive the leveler in the RF module, adjusts output power in whichever direction will equalize the reference and variable inputs to the loop amplifier. So long as the output is between the extremes of its control range, the output is considered to be leveled and the indicator on the front panel will remain lit.

Corrective Action

1. If the LEVEL indicator on the front panel is off, the leveler output should be at one extreme or the other of its control range. Comparing the control signal with the result will indicate the nature of the problem (see 5.3.6). If the indicator is on, the control signal should be within its control range. If the output power is nevertheless incorrect, it is likely that the level control circuit is receiving a bad input, is defective, or has been incorrectly calibrated.
2. If possible, replace the level control circuit with a spare. Make certain that the potentiometers on the board have not been improperly adjusted (see the calibration procedure in Chapter 4). Check all inputs and control signals to the board, the data lines to the digital/analog converter, the AM input, the AM control line, and the detector input. Be sure that the instrument has not been set to the wrong leveling mode (if an external detector is not being used, external ALC should be off).
3. An excellent way to investigate a problem in the leveling system is to open the loop by disconnecting the detector or the leveler control line, and observe the resulting changes.

5.3.8 Output Phase Lock Loop

This circuit is located on the A18 PC board.

Corrective Action

1. Verify that the coarse tuning of the YIG is not pushing the frequency out of the control range of the PLL. Remove the A18 board and check the RF output with a frequency counter. It should be within 10 MHz of the requested frequency. If not:
   a. Check the YIG driver circuit (see 5.3.10).
   b. Check the YIG oscillator (see 5.3.4).
2. Verify that an appropriate input from the divide-by-N circuit (see A17) is being received.
3. The output from the FM drivers (U20 - U22) goes more negative to increase the YIG output frequency, more positive to decrease frequency; be sure that the PLL output is not driving the YIG oscillator in the wrong direction.
4. Verify continuity between the output of the PLL circuit (there are separate outputs for different frequency ranges) and the YIGs FM- input pin.
5. If possible, replace the circuit with a spare.

5.3.9 Divide-By-N

This circuit is one half of the frequency divider PC board (A17).

Corrective Action

Verify that the circuit is being programmed with the correct divisor, by checking the inputs to the logic level translator ICs at the frequencies listed in Table 5-5 (the inputs to these ICs are at TTL levels).

Table 5-5. Expected Logic Levels

Bit	IC/pin	Expected Logic Levels			
		@10.000 GHz	@10.161 GHz	@10.001 GHz (see note)	@10.033 GHz (see note)
0	U3-5	H	L		
1	U3-10	H	L		
2	U3-7	H	L		
3	U2-11	H	L		
4	U2-10	H	L		
5	U2-7	L	L	H	
6	U2-5	H	L		
7	U1-7	L	L		H
8	U1-5	L	H		

Notes

1. Bits 0 through 8 are tested for different output frequencies to verify that they toggle as expected. Frequencies of 10.000 and 10.161 GHz are sufficient to test all but two of these bits. Bits 5 and 7 do not toggle between those two frequencies, and must be checked at 10.001 and 10.033 GHz, respectively (otherwise the latter frequencies are not needed for this test).
2. If possible, replace the circuit with a spare.

5.3.10 YIG Driver

This circuit is located on the A19 PC board.

Corrective Action

1. If this circuit is tuning the YIG oscillator to the wrong frequency, the error may be too large for the output PLL to correct. The problem sometimes occurs after incorrect adjustment of the MIN and MAX pots, in which case the output loop may be able to lock at some frequencies but not others. If the instrument develops phase lock problems after calibration of the YIG driver, try repeating the adjustment. Be sure to follow the correct calibration procedure as outlined in Chapter 4.
2. If the driver calibration is not to blame for the unlocked condition, attempts to adjust it may only aggravate the problem. Therefore, it is a good idea to determine first whether the driver output is approximately correct for the requested output frequency.
3. The oscillator tuning coil has a sensitivity of about 20 MHz/mA. The NPN transistor (on the Main Tune board, A107) which controls the coil current is driven at its base by a control voltage from the YIG driver (see 5.3.5).
4. If the driver output seems substantially wrong, the cause could be bad control data to the digital/analog converter, or bad calibration. If the driver is properly programmed and calibrated, the approximate voltages listed in Table 5-6 should be present.

Table 5-6. Expected YIG Driver Coil Voltages

YIG	IC/Pin	@1 GHz	@5 GHz	@15 GHz
Reference	U5-7	7.0	5.6	5.6
	U5-1	4.5	5.4	5.4
2-8	U7-7	6.9	5.4	5.4
	U7-1	4.6	5.4	22.1
8-20	U11-7	4.2	4.2	4.2
	U11-1	22.0	22.0	8.7

Note

If possible, replace the circuit with a spare.

5.3.11 100 MHz Module

This circuit board (A201) is encased in an aluminum housing mounted on the underside of the microwave chassis.

Corrective Action

This circuit is not easily accessible for test purposes; the most that can normally be done to investigate it in the field is to verify that the inputs are correct.

5.3.12 100 MHz PLL

This circuit is located on the A14 PC board.

Corrective Action

1. Verify that the 10 MHz master reference input is being received.
2. Verify that the 100 MHz input is being received.
3. If possible, replace the circuit with a spare.

5.3.13 10 MHz Master Reference

The internal timebase is located in the rear left of the unit; the 10 MHz input/output circuit is located on the 100 MHz PLL circuit board (A14).

Corrective Action

1. Verify that the signals from the internal timebase, and from the external timebase (if any), are being received by the 10 MHz input/output circuit.
2. Verify that the 10 MHz signal from the input/output circuit is reaching the various PLL circuits which require it.

5.3.14 1 Hz PLL

This circuit is located on the A15 PC board.

Corrective Action

1. Verify that the 10 MHz input is being received from the master reference.
2. Verify that the 10-12 MHz output is reaching the Ref /DC PLL.
3. If possible, replace the circuit with a spare.

5.3.15 IEEE-488 Interface/Timer Circuit

This circuit is found on the A2 PC board.

Corrective Action

Verify that this circuit's data and control lines have continuity to the rear panel connector and to the CPU. If possible, replace the circuit with a spare.

5.3.16 Downconverter PLL

This circuit is located on the A16 PC board.

Corrective Action

1. First, investigate the coarse tuning output to the downconverter fixed local oscillator, as follows: set the instrument to 1.000 GHz, ground TP2 on the REF/DC PLL board (A16), and verify that the output frequency is accurate within 15 MHz.
2. Verify that the A16 board is receiving the 10 MHz reference input and the DC Sampler IF input from the 100 MHz module (A201). Verify that the fine tuning output (A16 J1-65) is reaching the Output PLL (A18).

5.3.17 Reference Mixer

The mixer is located inside the microwave module. The IF output from the mixer is furnished to the Divide-by-N circuit; the RF and LO inputs to the mixer are also present at measurable levels on this IF output, so all three signals can be checked at the same place.

Corrective Action

Remove the Output PLL PC board, A18 (this disables the YIG FM coil). Disconnect the coaxial cable from J2 on the Divide-by-N PC board (A17), and connect it to the input of a spectrum analyzer, using appropriate adapters. Expected frequencies and levels are shown in Table 5-7. These values are approximate, because the Output PLL is unlocked and cable loss is variable.

Table 5-7. Expected Reference Mixer Signals

Frequency Setting	IF (freq/level)	LO (freq/level)	RF (freq/level)
1 GHz	95 MHz / -43 dBm	7810 MHz / -40 dBm	7905 MHz / -78 dBm
5 GHz	95 MHz / -43 dBm	4905 MHz / -35 dBm	5000 MHz / -80 dBm
15 GHz	295 MHz / -36 dBm	14705 MHz / -53 dBm	15000 MHz / -68 dBm

5.3.18 Reference PLL

This circuit is located on the Ref/DC PLL circuit board (A16).

Corrective Action

1. Verify that the reference sampler input is being received from the 100 MHz reference oscillator (A201).
2. Verify that the 10-12 MHz input is being received from the 1 Hz PLL circuit (A15), or that an external 5-6 MHz input is being received from the rear panel BNC.
3. If possible, replace the circuit with a spare.

6

Parts Lists

6.1 Parts Lists

This chapter contains the individual parts lists for all assemblies in the GT 9000S Synthesized Microwave Sweeper. Section 6-2 lists the component manufacturers.

GT9000S/.01-26 MICROWAVE SWEEPER, Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
	JRDF-00001	3	09769	31-221-RFX	BNC F PANEL MOUNT
1	120AA14300	1	58900	120AA14300	ACCESSORIES ASY
2	120BA14150	1	58900	120BA14150	15 CONN MTG PLATE ASY;GT
3	120DA00501	1	58900	120DA00501	.01-26 GHZ FREQ ASSY
4	120DA00751	1	58900	120DA00751	GT9000S PCB ASSY SET
6	1204206653	1	58900	1204206653	GT9000S FRONT PANEL ASY
7	120DA11251	1	58900	120DA11251	GT9000S BENCH MT DRESS
8	120AA21600	1	58900	120AA21600	GT9000/S SOFTWARE
9	120AT20099	REF	58900	120AT20099	GT9000/S PROCEDURES
10	1201221900	1	58900	1201221900	GT9000/S BASIC SOFT COAX ASY
11	30659	REF	58900	30659	WORK INSTRUCTIONS, GT9000
120	120AM00350	1	58900	120AM00350	MODEL GT9000S MANUAL
A8	120BA09211	1	58900	120BA09211	ANALOG SWEEP 1 PCA

GT9000S/2-20 MICROWAVE SWEEPER, Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
	JRDF-00001	3	09769	31-221-RFX	BNC F PANEL MOUNT
1	120AA14300	1	58900	120AA14300	ACCESSORIES ASY
2	120BA14150	1	58900	120BA14150	15 CONN MTG PLATE ASY;GT
3	120DA00520	1	58900	120DA00520	2-20 GHZ FREQ ASSY
4	120DA00751	1	58900	120DA00751	GT9000S PCB ASSY SET
6	1204206653	1	58900	1204206653	GT9000S FRONT PANEL ASY
7	120DA11251	1	58900	120DA11251	GT9000S BENCH MT DRESS
8	120AA21600	1	58900	120AA21600	GT9000/S SOFTWARE
9	120AT20099	REF	58900	120AT20099	GT9000/S PROCEDURES
10	1201221900	1	58900	1201221900	GT9000/S BASIC SOFT COAX ASY
11	30659	REF	58900	30659	WORK INSTRUCTIONS, GT9000
140	120AM00350	1	58900	120AM00350	MODEL GT9000S MANUAL
A8	120BA09211	1	58900	120BA09211	ANALOG SWEEP 1 PCA

GT9000S/.5-20 MICROWAVE SWEEPER, Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120AA14300	1	58900	120AA14300	ACCESSORIES ASY
2	120BA14150	1	58900	120BA14150	15 CONN MTG PLATE ASY;GT
3	120DA00510	1	58900	120DA00510	.5-20 GHZ FREQ. ASSY
4	120DA00751	1	58900	120DA00751	GT9000S PCB ASSY SET
6	1204206653	1	58900	1204206653	GT9000S FRONT PANEL ASY
7	120DA11251	1	58900	120DA11251	GT9000S BENCH MT DRESS
8	120AA21600	1	58900	120AA21600	GT9000/S SOFTWARE
9	120AT20099	REF	58900	120AT20099	GT9000/S PROCEDURES
10	1201221900	1	58900	1201221900	GT9000/S BASIC SOFT COAX ASY
11	120DA00952	1	58900	120DA00952	GT9000 CHASSIS W/ SW PS
12	JRDF-00001	3	09769	31-221-RFX	BNC F PANEL MOUNT
13	30659	REF	58900	30659	WORK INSTRUCTIONS, GT9000
140	120AM00350	1	58900	120AM00350	MODEL GT9000S MANUAL
A8	120BA09211	1	58900	120BA09211	ANALOG SWEEP 1 PCA

GT9000S/.01-20 MICROWAVE SWEEPER, Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120AA14300	1	58900	120AA14300	ACCESSORIES ASY
2	120BA14150	1	58900	120BA14150	15 CONN MTG PLATE ASY;GT
3	120DA00500	1	58900	120DA00500	.01-20 GHZ FREQ. ASSY
4	120DA00751	1	58900	120DA00751	GT9000S PCB ASSY SET
6	1204206653	1	58900	1204206653	GT9000S FRONT PANEL ASY
7	120DA11251	1	58900	120DA11251	GT9000S BENCH MT DRESS
8	120AA21600	1	58900	120AA21600	GT9000/S SOFTWARE
9	120AT20099	REF	58900	120AT20099	GT9000/S PROCEDURES
10	1201221900	1	58900	1201221900	GT9000/S BASIC SOFT COAX ASY
11	30659	REF	58900	30659	WORK INSTRUCTIONS, GT9000
12	120DA00952	1	58900	120DA00952	GT9000 CHASSIS W/ SW PS
13	JRDF-00001	3	09769	31-221-RFX	BNC F PANEL MOUNT
140	120AM00350	1	58900	120AM00350	MODEL GT9000S MANUAL
A8	120BA09211	1	58900	120BA09211	ANALOG SWEEP 1 PCA

GT9000S/.5-26 MICROWAVE SWEEPER, Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120AA14300	1	58900	120AA14300	ACCESSORIES ASY
2	120BA14150	1	58900	120BA14150	15 CONN MTG PLATE ASY;GT
3	120DA00511	1	58900	120DA00511	.5-26 GHZ FREQ ASSY
4	120DA00751	1	58900	120DA00751	GT9000S PCB ASSY SET
6	1204206653	1	58900	1204206653	GT9000S FRONT PANEL ASY
7	120DA11251	1	58900	120DA11251	GT9000S BENCH MT DRESS
8	120AA21600	1	58900	120AA21600	GT9000/S SOFTWARE
9	120AT20099	REF	58900	120AT20099	GT9000/S PROCEDURES
10	1201221900	1	58900	1201221900	GT9000/S BASIC SOFT COAX ASY
11	120DA00952	1	58900	120DA00952	GT9000 CHASSIS W/ SW PS
12	JRDF-00001	3	09769	31-221-RFX	BNC F PANEL MOUNT
13	30659	REF	58900	30659	WORK INSTRUCTIONS, GT9000
120	120AM00350	1	58900	120AM00350	MODEL GT9000S MANUAL
A8	120BA09211	1	58900	120BA09211	ANALOG SWEEP 1 PCA

GT9000S/2-26 MICROWAVE SWEEPER, Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120AA14300	1	58900	120AA14300	ACCESSORIES ASY
2	120BA14150	1	58900	120BA14150	15 CONN MTG PLATE ASY;GT
3	120DA00521	1	58900	120DA00521	2-26 GHZ FREQ ASSY
4	120DA00751	1	58900	120DA00751	GT9000S PCB ASSY SET
6	1204206653	1	58900	1204206653	GT9000S FRONT PANEL ASY
7	120DA11251	1	58900	120DA11251	GT9000S BENCH MT DRESS
8	120AA21600	1	58900	120AA21600	GT9000/S SOFTWARE
9	120AT20099	REF	58900	120AT20099	GT9000/S PROCEDURES
10	1201221900	1	58900	1201221900	GT9000/S BASIC SOFT COAX ASY
11	30659	REF	58900	30659	WORK INSTRUCTIONS, GT9000
12	120DA00952	1	58900	120DA00952	GT9000 CHASSIS W/ SW PS
13	JRDF-00001	3	09769	31-221-RFX	BNC F PANEL MOUNT
140	120AM00350	1	58900	120AM00350	MODEL GT9000S MANUAL
A8	120BA09211	1	58900	120BA09211	ANALOG SWEEP 1 PCA

120DA00952 GT9000 CHASSIS W/ SW PS, Rev: G

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120DF03700	2	58900	120DF03700	SIDE GUSSET
2	120DF03601	1	58900	120DF03601	COMPUTER CHASSIS 7XXX
3	120CF01700	1	58900	120CF01700	CARD CAGE REAR WALL
4	120CF02100	1	58900	120CF02100	CARD CAGE FRONT WALL
5	120DF02400	1	58900	120DF02400	CHASSIS SUPPORT
6	120CF05000	1	58900	120CF05000	I/O CARD CAGE - REAR WALL
7	120CF05100	1	58900	120CF05100	I/O CARD CAGE -FRONT WALL
8	420BF51301	1	58900	420BF51301	RELAY/FILTER MTG PL;GT9000/S
9	LFA0-05250	1	58900	LFA0-05250	5A RFI POWERLINE FILTER
10	JPS0-20006	1	09769	2-530654-1	12 PIN PC EDGE CONN
11	RW03-08000	1	91637	RS-2B-800-1	800 OHM 2W WIREWOUND
12	4204253000	1	58900	4204253000	GT9000 CHASSIS HARNESS
13	4203253600	1	58900	4203253600	.01-26.5 GHz SUBASSY HARNESS
14	120DA11052	1	58900	120DA11052	GT9000 R/P ASY FOR SW PS
15	HGP1-02500	21	58900	HGP1-02500	2.5 DEEP CARD GUIDE
16	HGP1-04125	17	58900	HGP1-04125	4.125 DEEP CARD GUIDE
17	120BA10300	1	58900	120BA10300	I/O BUSS RIBBON CBL ASY
18	1201222000	1	58900	1201222000	GT9000/S CHASSIS SOFT COAX ASY
20	HIGR-00437	1	06540	1155A	7/16 GROMMET
22	120BF13100	1	58900	120BF13100	MAIN TUNE XSTR MTG. BAR
23	QBNP-06486	4	04713	2N6486	2N6486 15A 40V 75W NPN
24	HQIS-01260	4	55285	7403-09FR-51	TO126 INSULATOR
25	HQWN-02200	4	04713	B51547F019	TO220 SHOULDER WASHER
28	GFU0-00804	1	58900	GFU0-00804	ADH TAPE .5W X .25 THICK
29	HQWC-01260	4	04713	B52200F006	TO126 DOME WASHER
30	WKA0-25000	30	92194	FIT221-1/4 BLACK	1/4 SHRINK TUBING
35	HTM0-00003	5	58900	HTM0-00003	CABLE TIE ANCHOR
36	WKC0-37500	6	92194	FIT221-3/8	3/8 SHRINK TUBE
42	120AW11050	REF	58900	120AW11050	REAR PANEL W/L; GT9000
44	120AW00952	REF	58900	120AW00952	CHASSIS W/L;GT9000 SW P/S
45	120AW01002	REF	58900	120AW01002	COMP BUS BD W/L;GT9000S
102	HBPP-44004	8	26233	NS137CR440R4	4-40 X 1/4 PAN
103	HBPP-44006	1	26233	NS137CR440R6	4-40 X 3/8 PAN
106	HBPP-63206	3	58900	HBPP-63206	6-32 X 3/8 PAN
107	HBPP-63204	11	58900	HBPP-63204	6-32 X 1/4 PAN
108	HBFP-63204	46	58900	HBFP-63204	6-32 X 1/4 FLAT
111	HWSS-40300	10	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
112	HWSS-60400	17	58900	HWSS-60400	#6 X 1/4 SPLIT LOCK
113	HWSS-80400	1	58900	HWSS-80400	#8 X 1/4 SPLIT LOCK

120DA00952 GT9000 CHASSIS W/ SW PS, Rev: G

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
114	HWFS-40400	19	58900	HWFS-40400	#4 X 1/4 FLAT WASHER
115	HWFS-60500	8	58900	HWFS-60500	#6 X 5/16 FLAT WASHER
116	HWFS-80600	1	96906	MS15795-807	#8 X 3/8 FLAT WASHER
117	HNKS-44004	4	96906	MS35649-***	4-40 KEP NUT
118	HTM0-00001	3	06383	TA1S8	ANCHOR MOUNT
119	HTM0-00002	3	06383	TM2S8	TIE MOUNT
120	HNKS-63204	4	58900	HNKS-63204	6-32 KEP NUT
121	HNSS-44004	1	96906	MS35649-244	4-40 HEX NUT
123	HBPP-44009	6	58900	HBPP-44009	4-40 X 9/16 PAN
124	HLLT-60212	1	79963	505-144 # 6	#6 SOLDER LUG
125	HIGP-00090	1	65664	GRNY 085-9-C	FLEXIBLE GROMMET
126	HLLT-40210	2	79963	505-120 # 4	#4 SOLDER LUG
128	HBPP-83205	1	58900	HBPP-83205	8-32 X 5/16 PAN
129	HBPP-44008	2	58900	HBPP-44008	4-40 X 1/2 PAN
131	HBPP-63205	10	58900	HBPP-63205	6-32 X 5/16 PAN
132	HBFP-44005	2	26233	NS139CR440R5	4-40 X 5/16 FLAT
A11	120BA04650	1	58900	120BA04650	POWER SUPPLY PCA
A100	120BA01000	1	58900	120BA01000	COMPUTER BUS PCA
A101	120BA07300	1	58900	120BA07300	I/O BUSS PCA
A107	120BA12900	1	58900	120BA12900	MAIN TUNE PCA
A208	30650	1	58900	30650	GT9000 POWER SUPPLY
RL1	SEW0-00302	1	94696	W388CQX-11	3PDT 24 VDC RELAY

120DA11052 GT9000 R/P ASY FOR SW PS, Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	30246	REF	58900	30246	CHASSIS WIRELIST FOR SW P/S
10	30237	1	58900	30237	REAR PANEL GT9000/S (VDE)
11	21215	1	05245	6EDL4C	AC INPUT MODULE
12	FSAC-00400	1	58900	FSAC-00400	4A SB FUSE 3AG
13	HLLT-K1114	4	79963	761-375	3/8 (BNC) SOLDER LUG
14	BD00-15024	1	58900	BD00-15024	24VDC 4 5/8" FAN
15	BHG0-05000	2	58900	BHG0-05000	5" FAN FINGER GUARD
16	120BA14200	1	58900	120BA14200	IEEE INTERFACE CABLE ASY
17	420BF51800	1	58900	420BF51800	XFMR MTG PLATE;GT9000/S
18	120CC09000	1	0JBU8	120CC09000	HI STAB TRANSFORMER
19	BHS0-03000	1	58900	BHS0-03000	3.3" FAN SCREEN
20	BHG0-03000	1	58900	BHG0-03000	3" FAN FINGER GUARD
21	120BF16900	2	58900	120BF16900	HANDLE
23	HIGR-00437	4	06540	1155A	7/16 GROMMET
24	HSCR-60404	4	06540	9224A140	#6 X 1/4 CLEAR SPACER
101	HBPP-44004	2	26233	NS137CR440R4	4-40 X 1/4 PAN
102	HWSS-40300	2	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
103	HBPP-63208	4	58900	HBPP-63208	6-32 X 1/2 PAN
104	HWSS-60400	4	58900	HWSS-60400	#6 X 1/4 SPLIT LOCK
105	HWFS-60500	4	58900	HWFS-60500	#6 X 5/16 FLAT WASHER
106	HBPP-83208	4	58900	HBPP-83208	8-32 X 1/2 PAN
107	HWSS-80400	4	58900	HWSS-80400	#8 X 1/4 SPLIT LOCK
108	HWFS-60600	16	58900	HWFS-60600	#6 X 3/8 FLAT WASHER
109	HNKS-63204	10	58900	HNKS-63204	6-32 KEP NUT
110	HBPP-63214	4	58900	HBPP-63214	6-32 X 7/8 PAN
112	HBFP-63205	2	58900	HBFP-63205	6-32 X 5/16 FLAT
J1	HPM0-00375	1	2R182	652	3/8 HOLE PLUG
J2	JRDF-00001	1	09769	31-221-RFX	BNC F PANEL MOUNT
J3	JRDF-00001	1	09769	31-221-RFX	BNC F PANEL MOUNT
J4	JRDF-00001	1	09769	31-221-RFX	BNC F PANEL MOUNT
J5	HPM0-00375	1	2R182	652	3/8 HOLE PLUG
J6	HPM0-00375	1	2R182	652	3/8 HOLE PLUG
J7	HPM0-00375	1	2R182	652	3/8 HOLE PLUG

120DA11052 GT9000 R/P ASY FOR SW PS, Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
J8	JRDF-00001	1	09769	31-221-RFX	BNC F PANEL MOUNT

1204206653 GT9000S FRONT PANEL ASSY, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120AW06651	REF	58900	120AW06651	FRONT PANEL W/L
1	120DF04320	1	58900	120DF04320	FRONT SUB PNL. NVFD
2	120CA16450	1	58900	120CA16450	GT9000/S FRONT PANEL OUT
7	HSDH-40504	1	55566	4531-440-SS-0	4-40 X 5/16 M/F SPACER
8	HSDH-40604	2	55566		4-40 X 3/8 M/F SPACER
10	KBR0-12525	1	58900	KBR0-12525	ROUND KNOB W/O INDICATOR
11	120BA09600	2	58900	120BA09600	11 DIG DISP RBN CBL ASY
12	120BA09700	1	58900	120BA09700	5 DIG DISP RBN CABLE ASY
13	120BA09800	1	58900	120BA09800	9 DIG DISP RBN CABLE ASY
15	120BA10000	1	58900	120BA10000	DATA ENTRY RBN CABLE ASY
16	120BA10100	1	58900	120BA10100	DISP DRIVER RBN CBL ASY
17	120BA10201	1	58900	120BA10201	OPT ENCODER HARNESS ASSY
18	JRDF-00001	5	09769	31-221-RFX	BNC F PANEL MOUNT
19	HLLT-K1114	5	79963	761-375	3/8 (BNC) SOLDER LUG
101	HBFP-44005	5	26233	NS139CR440R5	4-40 X 5/16 FLAT
102	HBPP-44005	23	26233	NS137CR440R5	4-40 X 5/16 PAN
103	HWFS-40400	25	58900	HWFS-40400	#4 X 1/4 FLAT WASHER
104	HWSS-40300	23	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
105	HNKS-44004	2	96906	MS35649-***	4-40 KEP NUT
109	HBFP-44007	2	58900	HBFP-44007	4-40 X 7/16 FLAT
A20	1202221000	1	58900	1202221000	GT9000 DISP DRIVER PCA
A103	120BA05520	1	58900	120BA05520	11 DIGIT DISPLY PCA NVFD
A104	120BA05620	1	58900	120BA05620	5&9 DIG DISPLAY PCA NVFD
A105	120BA04801	1	58900	120BA04801	M7200 PUSHBUTTON BD PCA
A106	120BA01511	1	58900	120BA01511	M7300 DATA ENTRY PCA

120CA16450 GT9000/S FRONT PANEL OUT, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	WCAS-18003	1	58900	WCAS-18003	3" 18GHZ SEMI-FLEX COAX
2	107BF01700	1	58900	107BF01700	SMA CONNECTOR MOUNT FLAN
3	107BF01701	1	58900	107BF01701	SMA CONNECTOR MOUNT SPAC
4	JRAB-00200	1	96341	2784-5002-00	SMA F BULK MT CONN
101	HNKS-44004	2	96906	MS35649-***	4-40 KEP NUT
102	HBFP-25602	2	26233	NS139CR256R2	2-56 X 1/8 FLAT

120DA00751 GT9000S PCB ASSY SET, Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	420BA48600	1	58900	420BA48600	LEVEL ASY;GT9000
A1	120BA01300	1	58900	120BA01300	FRONT PANEL I/F PCA
A2	120BA05300	1	58900	120BA05300	IEEE / TIMER PCA
A3	120BA01200	1	58900	120BA01200	MEMORY PCA
A4	120BA01100	1	58900	120BA01100	CPU PCA
A5	120BA09303	1	58900	120BA09303	PULSE DRIVER PCA
A6	120BA09401	1	58900	120BA09401	AM/FM DRIVER PCA
A9	120BA09100	1	58900	120BA09100	DIGITAL RAMP PCA
A14	120BA06951	1	58900	120BA06951	100 MHz PLL PCA
A15	120BA08800	1	58900	120BA08800	1 HZ PLL PCA
A16	120BA07000	1	58900	120BA07000	REF/DC PLL PCA
A17	120BA07150	1	58900	120BA07150	DIVIDE BY N PCA
A18	120BA07215	1	58900	120BA07215	GT9000S OUTPUT PLL PCA
A19	120BA08351	1	58900	120BA08351	GT9000S YIG DRIVER PCA
A21	101BA39101	1	58900	101BA39101	HI STAB OSC PCA
A5 A1	120BA12550	1	58900	120BA12550	GT9000 PULSE GENERATOR

420BA48600 LEVEL ASY; GT9000, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
101	HBPP-44005	3	26233	NS137CR440R5	4-40 X 5/16 PAN
102	HWFS-40400	3	58900	HWFS-40400	#4 X 1/4 FLAT WASHER
103	HWSS-40300	3	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
A10	420BA47500	1	58900	420BA47500	GT9000 LEVEL PCA
A10A1	420BA50500	1	58900	420BA50500	LEVEL DRIVER AM 9000 PCA

120DA00501 .01-26 GHZ FREQ ASSY, Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	420DA46900	1	58900	420DA46900	GT9000 STD MICROWAVE DEC
2	MCD3-00226	1	62331	2616SE	1.7-26.5 GHZ DIRECTIONAL DET
3	420BF41401	1	58900	420BF41401	DIR DETECTOR MT;GT9000/S
4	420CA46800	1	58900	420CA46800	100 MHZ MT ASY;2SAMP;GT9
6	420BA48300	1	58900	420BA48300	DC/FILT CHASSIS HARN ASY
7	MDS0-00002	1	62331	301E	.01-20GHZ SMA DETECTOR
8	004BA34210	1	58900	004BA34210	.01-26.5 GHZ SUBASSY
9	420DA49404	1	58900	420DA49404	.01-26 SEMI-FLEX CABLE ASY
10	420AW49800	REF	58900	420AW49800	.01-2 DOWNC COAX W/L
11	004BA34700	1	58900	004BA34700	GT9000/S .01-2 DOWNC ASY
12	004BA34600	1	58900	004BA34600	GT9000/S .01-2 FILTER AS
15	JRAT-00050	1	96341	2001-6113-00	50 OHM SMA TERMINATION
20	MPFS-01806	1	96341	2082-6142-06	6DB SMA M/F PAD
21	MOYT-L1826	1	24539	Y089-4084	18-26.5 LO NOISE YIG
22	420BF41500	1	58900	420BF41500	OSCILLATOR MOUNT; EXC
23	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
24	RN55-00150	1	91637	RN55C15R0F	15 OHMS 1% MET FILM
25	004BA33101	1	58900	004BA33101	AMP/LVL/MOD ASY 20-26GHZ
26	1202321100	1	58900	1202321100	GT9000/S 20-26GHz MOD MT
27	JRKB-00000	1	98291	030-675-0000-890	BULKHEAD K F-F ADAPTOR
28	120AW00501	REF	58900	120AW00501	26 GHz FREQ ASSY W/L
29	MPFS-01820	1	64671	18A-20dB	20DB SMA M/F PAD
101	HBPP-25604	2	58900	HBPP-25604	2-56 X 1/4 PAN
102	HWSS-20200	14	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
103	HWFS-20300	2	7U905	5710-133-30P	#2 X 3/16 FLAT WASHER
104	HBPP-44004	8	26233	NS137CR440R4	4-40 X 1/4 PAN

120DA00501 .01-26 GHZ FREQ ASSY, Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
105	HWSS-40300	12	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
106	HBPP-44006	4	26233	NS137CR440R6	4-40 X 3/8 PAN
107	HBFP-63218	4	58900	HBFP-63218	6-32 X 1 1/8
108	HBFP-63220	5	58900	HBFP-63220	6-32 X 1 1/8 FLAT
109	HBFP-63204	4	58900	HBFP-63204	6-32 X 1/4 FLAT
110	HBPP-25605	6	26233	NS137CR256R5	2-56 X 1/4 PAN
111	HBFP-25605	6	26233	NS139CR256R5	2-56 X 5/16 FLAT
112	HNSS-25603	6	58900	HNSS-25603	2-56 HEX NUT
R4	RW10-00030	1	91637	PH10-1-3-1%	3 OHM 10 WATT WIREWOUND

120DA00520 2-20 GHZ FREQ ASSY, Rev: J

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
	JRAT-00050	REF	96341	2001-6113-00	50 OHM SMA TERMINATION
0	120AW00500	REF	58900	120AW00500	20 GHz FREQ ASSY W/L
1	420DA46900	1	58900	420DA46900	GT9000 STD MICROWAVE DEC
2	MCD1-00220	1	62331	202020016E	2-20 GHZ DIR DET/REF
3	420BF41401	1	58900	420BF41401	DIR DETECTOR MT;GT9000/S
4	420CA46800	1	58900	420CA46800	100 MHZ MT ASY;2SAMP;GT9
6	420BA48300	1	58900	420BA48300	DC/FILT CHASSIS HARN ASY
8	004BA34210	1	58900	004BA34210	.01-26.5 GHZ SUBASSY
9	420DA49402	1	58900	420DA49402	2-20 SEMI-FLEX CABLE ASY
10	JRAT-00050	2	96341	2001-6113-00	50 OHM SMA TERMINATION
11	JRAT-00000	5	58900	JRAT-00000	SMA CAP
16	MPFS-01806	1	96341	2082-6142-06	6DB SMA M/F PAD
101	HBPP-25604	2	58900	HBPP-25604	2-56 X 1/4 PAN
102	HWSS-20200	2	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
103	HWFS-20300	2	7U905	5710-133-30P	#2 X 3/16 FLAT WASHER
104	HBPP-44004	4	26233	NS137CR440R4	4-40 X 1/4 PAN
105	HWSS-40300	8	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
106	HBPP-44006	4	26233	NS137CR440R6	4-40 X 3/8 PAN
108	HBFP-63220	5	58900	HBFP-63220	6-32 X 1 1/8 FLAT

120DA00510 .5-20 GHZ FREQ ASSY, Rev: H

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120AW00500	REF	58900	120AW00500	20 GHz FREQ ASSY W/L
1	420DA46900	1	58900	420DA46900	GT9000 STD MICROWAVE DEC
2	MCD0-00120	1	62331	200520016E	0.5-20 GHZ DIR DET/REF
3	420BF41401	1	58900	420BF41401	DIR DETECTOR MT;GT9000/S
4	420CA46800	1	58900	420CA46800	100 MHZ MT ASY;2SAMP;GT9
6	420BA48300	1	58900	420BA48300	DC/FILT CHASSIS HARN ASY
8	004BA34210	1	58900	004BA34210	.01-26.5 GHZ SUBASSY
9	420DA49400	1	58900	420DA49400	.5 SEMI-FLEX CABLE ASY
10	420AW49800	REF	58900	420AW49800	.01-2 DOWNC COAX W/L
11	004BA34700	1	58900	004BA34700	GT9000/S .01-2 DOWNC ASY
12	004BA34800	1	58900	004BA34800	GT9000/S .5-2 FILTER ASY
15	JRAT-00050	2	96341	2001-6113-00	50 OHM SMA TERMINATION
20	MPFS-01806	1	96341	2082-6142-06	6DB SMA M/F PAD
21	MPFS-01820	1	64671	18A-20dB	20DB SMA M/F PAD
101	HBPP-25604	3	58900	HBPP-25604	2-56 X 1/4 PAN
102	HWSS-20200	3	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
103	HWFS-20300	3	7U905	5710-133-30P	#2 X 3/16 FLAT WASHER
104	HBPP-44004	4	26233	NS137CR440R4	4-40 X 1/4 PAN

120DA00510 .5-20 GHZ FREQ ASSY, Rev: H

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
105	HWSS-40300	8	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
106	HBPP-44006	4	26233	NS137CR440R6	4-40 X 3/8 PAN
107	HBFP-63218	4	58900	HBFP-63218	6-32 X 1 1/8
108	HBFP-63220	5	58900	HBFP-63220	6-32 X 1 1/8 FLAT

120DA00500 .01-20 GHZ FREQ ASSY, Rev: J

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120AW00500	REF	58900	120AW00500	20 GHz FREQ ASSY W/L
1	420DA46900	1	58900	420DA46900	GT9000 STD MICROWAVE DEC
2	MCD0-00120	1	62331	200520016E	0.5-20 GHZ DIR DET/REF
3	420BF41401	1	58900	420BF41401	DIR DETECTOR MT;GT9000/S
4	420CA46800	1	58900	420CA46800	100 MHZ MT ASY;2SAMP;GT9
6	420BA48300	1	58900	420BA48300	DC/FILT CHASSIS HARN ASY
7	MDS0-00002	1	62331	301E	.01-20GHZ SMA DETECTOR
8	004BA34210	1	58900	004BA34210	.01-26.5 GHZ SUBASSY
9	420DA49401	1	58900	420DA49401	.01 SEMI-FLEX CABLE ASY
10	420AW49800	REF	58900	420AW49800	.01-2 DOWNC COAX W/L
11	004BA34700	1	58900	004BA34700	GT9000/S .01-2 DOWNC ASY
12	004BA34600	1	58900	004BA34600	GT9000/S .01-2 FILTER AS
14	JRAT-00000	1	58900	JRAT-00000	SMA CAP
15	JRAT-00050	1	96341	2001-6113-00	50 OHM SMA TERMINATION
20	MPFS-01806	1	96341	2082-6142-06	6DB SMA M/F PAD
21	MPFS-01820	1	64671	18A-20dB	20DB SMA M/F PAD
101	HBPP-25604	3	58900	HBPP-25604	2-56 X 1/4 PAN
102	HWSS-20200	3	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
103	HWFS-20300	3	7U905	5710-133-30P	#2 X 3/16 FLAT WASHER
104	HBPP-44004	4	26233	NS137CR440R4	4-40 X 1/4 PAN
105	HWSS-40300	8	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
106	HBPP-44006	4	26233	NS137CR440R6	4-40 X 3/8 PAN
107	HBFP-63218	4	58900	HBFP-63218	6-32 X 1 1/8
108	HBFP-63220	5	58900	HBFP-63220	6-32 X 1 1/8 FLAT

120DA00511 .5-26 GHZ FREQ ASSY, Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	420DA46900	1	58900	420DA46900	GT9000 STD MICROWAVE DEC
2	MCD3-00226	1	62331	2616SE	1.7-26.5 GHZ DIRECTIONAL DET
3	420BF41401	1	58900	420BF41401	DIR DETECTOR MT;GT9000/S
4	420CA46800	1	58900	420CA46800	100 MHZ MT ASY;2SAMP;GT9
6	420BA48300	1	58900	420BA48300	DC/FILT CHASSIS HARN ASY
7	MDS0-00002	1	62331	301E	.01-20GHZ SMA DETECTOR
8	004BA34210	1	58900	004BA34210	.01-26.5 GHZ SUBASSY
9	420DA49403	1	58900	420DA49403	.5-26 SEMI-FLEX CBL ASY
10	420AW49800	REF	58900	420AW49800	.01-2 DOWNC COAX W/L
11	004BA34700	1	58900	004BA34700	GT9000/S .01-2 DOWNC ASY
12	004BA34800	1	58900	004BA34800	GT9000/S .5-2 FILTER ASY
15	JRAT-00050	1	96341	2001-6113-00	50 OHM SMA TERMINATION
20	MPFS-01806	1	96341	2082-6142-06	6DB SMA M/F PAD
21	MOYT-L1826	1	24539	Y089-4084	18-26.5 LO NOISE YIG
22	420BF41500	1	58900	420BF41500	OSCILLATOR MOUNT; EXC
23	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
24	RN55-00150	1	91637	RN55C15R0F	15 OHMS 1% MET FILM
25	004BA33101	1	58900	004BA33101	AMP/LVL/MOD ASY 20-26GHZ

120DA00511 .5-26 GHZ FREQ ASSY, Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
26	1202321100	1	58900	1202321100	GT9000/S 20-26GHz MOD MT
27	JRKB-00000	1	98291	030-675-0000-890	BULKHEAD K F-F ADAPTOR
28	120AW00501	REF	58900	120AW00501	26 GHz FREQ ASSY W/L
29	MPFS-01820	1	64671	18A-20dB	20DB SMA M/F PAD
101	HBPP-25604	2	58900	HBPP-25604	2-56 X 1/4 PAN
102	HWSS-20200	14	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
103	HWFS-20300	2	7U905	5710-133-30P	#2 X 3/16 FLAT WASHER
104	HBPP-44004	8	26233	NS137CR440R4	4-40 X 1/4 PAN
105	HWSS-40300	12	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
106	HBPP-44006	4	26233	NS137CR440R6	4-40 X 3/8 PAN
107	HBFP-63218	4	58900	HBFP-63218	6-32 X 1 1/8
108	HBFP-63220	5	58900	HBFP-63220	6-32 X 1 1/8 FLAT
109	HBFP-63204	4	58900	HBFP-63204	6-32 X 1/4 FLAT
110	HBPP-25605	6	26233	NS137CR256R5	2-56 X 1/4 PAN
111	HBFP-25605	6	26233	NS139CR256R5	2-56 X 5/16 FLAT
112	HNSS-25603	6	58900	HNSS-25603	2-56 HEX NUT
R4	RW10-00030	1	91637	PH10-1-3-1%	3 OHM 10 WATT WIREWOUND

120DA00521 2-26 GHZ FREQ ASSY, Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	420DA46900	1	58900	420DA46900	GT9000 STD MICROWAVE DEC
2	MCD3-00226	1	62331	2616SE	1.7-26.5 GHZ DIRECTIONAL DET
3	420BF41401	1	58900	420BF41401	DIR DETECTOR MT;GT9000/S
4	420CA46800	1	58900	420CA46800	100 MHZ MT ASY;2SAMP;GT9
6	420BA48300	1	58900	420BA48300	DC/FILT CHASSIS HARN ASY
8	004BA34210	1	58900	004BA34210	.01-26.5 GHZ SUBASSY
9	420DA49405	1	58900	420DA49405	2-26 SEMI-FLEX CBL ASY
14	JRAT-00000	5	58900	JRAT-00000	SMA CAP
15	JRAT-00050	2	96341	2001-6113-00	50 OHM SMA TERMINATION
20	MPFS-01806	1	96341	2082-6142-06	6DB SMA M/F PAD
21	MOYT-L1826	1	24539	Y089-4084	18-26.5 LO NOISE YIG
22	420BF41500	1	58900	420BF41500	OSCILLATOR MOUNT; EXC
23	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
24	RN55-00150	1	91637	RN55C15R0F	15 OHMS 1% MET FILM
25	004BA33101	1	58900	004BA33101	AMP/LVL/MOD ASY 20-26GHZ
26	1202321100	1	58900	1202321100	GT9000/S 20-26GHz MOD MT
27	JRKB-00000	1	98291	030-675-0000-890	BULKHEAD K F-F ADAPTOR
28	120AW00501	REF	58900	120AW00501	26 GHz FREQ ASSY W/L
101	HBPP-25604	2	58900	HBPP-25604	2-56 X 1/4 PAN
102	HWSS-20200	14	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
103	HWFS-20300	2	7U905	5710-133-30P	#2 X 3/16 FLAT WASHER
104	HBPP-44004	8	26233	NS137CR440R4	4-40 X 1/4 PAN
105	HWSS-40300	12	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
106	HBPP-44006	4	26233	NS137CR440R6	4-40 X 3/8 PAN
108	HBFP-63220	5	58900	HBFP-63220	6-32 X 1 1/8 FLAT
109	HBFP-63204	4	58900	HBFP-63204	6-32 X 1/4 FLAT
110	HBPP-25605	6	26233	NS137CR256R5	2-56 X 1/4 PAN
111	HBFP-25605	6	26233	NS139CR256R5	2-56 X 5/16 FLAT
112	HNSS-25603	6	58900	HNSS-25603	2-56 HEX NUT
R4	RW10-00030	1	91637	PH10-1-3-1%	3 OHM 10 WATT WIREWOUND

420DA46900 GT9000 STD MICROWAVE DEC, Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
2	CE25-R7220	1	0H1N5	CEBSM1E221M	220UF 25V RADIAL
3	LAD0-06470	1	91637	IMS-5 47UH 10%	47 UH INDUCTOR
4	MOYT-00209	2	24539	S080-1342	1.9-8.7 GHZ YIG XSTR OSC
5	MOYT-30820	1	0RN63	MLOS-1165	8-20GHZ YIG XSTR OSC
6	ETST-44036	1	58900	ETST-44036	TURRET TERMINAL
7	RN55-00150	3	91637	RN55C15R0F	15 OHMS 1% MET FILM
8	LFT0-83208	11	09769	92-4068-009-1	FEED-THRU FILTER 15A
9	LFT1-83208	4	09769	92-4068-010-1	FEED-THRU FILTER 15A
10	JRAB-18200	3	98291	50-675-0000-31	SMA F BULK MT CONN
11	DPAB-05391	3	14936	1N5391	1N5391 1.5A 35V DIODE
12	CE16-R7470	1	55680	UVX1C471MPA	470 UF 16V RADIAL LEAD
13	LAD0-07100	1	91637	IMS5 100UH	100 UH INDUCTOR
14	ETIT-44050	2	58900	ETIT-44050	INSULATED TURRET TERM
15	HLLT-80212	4	79963	505-169	#8 SOLDER LUG
16	420AW46900	REF	58900	420AW46900	2-20 FREQ ASY W/L;GT9000
17	120AW07901	REF	58900	120AW07901	DET. BUFFER W/L; GT9000
30	420DF41200	1	58900	420DF41200	MICROWAVE CHASSIS; EXC
33	420BF41500	3	58900	420BF41500	OSCILLATOR MOUNT; EXC
101	HBPP-44004	12	26233	NS137CR440R4	4-40 X 1/4 PAN
102	HWSS-40300	12	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
103	HBFP-63204	12	58900	HBFP-63204	6-32 X 1/4 FLAT
104	HNKS-63204	2	58900	HNKS-63204	6-32 KEP NUT
105	HSCR-40204	4	06540	9222-A-115	#4 X 1/8 CLEAR SPACER
A200	120BA07900	1	58900	120BA07900	DETECTOR BUFFER PCA
R1	RW10-00030	1	91637	PH10-1-3-1%	3 OHM 10 WATT WIREWOUND
R2	RW10-00030	1	91637	PH10-1-3-1%	3 OHM 10 WATT WIREWOUND
R3	RW10-00030	1	91637	PH10-1-3-1%	3 OHM 10 WATT WIREWOUND

420CA46800 100 MHZ MT ASY; 2SAMP; GT9, Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	420CF41300	1	58900	420CF41300	100 MHZ MODULE MT; EXC
2	101BF26001	1	58900	101BF26001	END PLATE, 100 MHz MODULE
3	101BF26100	2	58900	101BF26100	SIDE PLATE 100 MHZ MODUL
4	101CF25801	1	58900	101CF25801	100 MHZ MODULE COVER
5	120AW11501	REF	58900	120AW11501	100MHZ MODULE W/L;GT9000
101	HBPP-44004	4	26233	NS137CR440R4	4-40 X 1/4 PAN
102	HWSS-40300	4	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
103	HWFS-40400	4	58900	HWFS-40400	#4 X 1/4 FLAT WASHER
104	HBPP-25605	2	26233	NS137CR256R5	2-56 X 1/4 PAN
105	HWSS-20200	2	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
106	HBFP-25605	2	26233	NS139CR256R5	2-56 X 5/16 FLAT
107	HBFP-25604	4	58900	HBFP-25604	2-56 X 1/4 FLAT
108	HBFP-25603	35	26233	NS139CR256R3	2-56 X 3/16 FLAT
A201	120CA11502	1	58900	120CA11502	100MHZ MODULE ASY; GT9000

004BA00001 SAMPLER ASSEMBLY, Rev: G

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	005CA00000	1	58900	005CA00000	SAMPLER MODULE
3	004AT00000	REF	58900	004AT00000	TEST PROCEDURE SAMPLER

004BA00101 SAMPLER ASSY REVERSE MTG, Rev: F

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	005CA00100	1	58900	005CA00100	SAMPLER MODULE; INVERTED
3	004AT00000	REF	58900	004AT00000	TEST PROCEDURE SAMPLER

004BA34210 .01-26.5 GHZ SUBASSY, Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	005DA34210	1	58900	005DA34210	.01-26.5 GHZ SUBASSY
2	001BF05006	1	58900	001BF05006	MODULE LABEL 004BA34210
3	420CF40401	1	58900	420CF40401	.01-26.5 SUBASY TOP CVR
4	420CF40500	1	58900	420CF40500	BOT COVER.01-26.5 SUBASY
5	30415	1	17217	30145	EMI GASKET,GT9000 I/O
101	HBFP-25603	76	26233	NS139CR256R3	2-56 X 3/16 FLAT

004BA34700 GT9000/S .01-2 DOWNC ASY, Rev: N

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	420AW47900	REF	58900	420AW47900	.01-2 DOWNC HARNESS W/L
1	005DA34700	1	58900	005DA34700	GT9000/S .01-2 DOWNC ASY
2	420BA47900	1	58900	420BA47900	.01-2 DOWNC HARNESS ASY
3	001BF06001	1	58900	001BF06001	MODULE LABEL 004BA34700
4	HLLT-40210	2	79963	505-120 # 4	#4 SOLDER LUG
5	420AW49800	REF	58900	420AW49800	.01-2 DOWNC COAX W/L
6	HLST-21105	1	79963	341-.093	#2 SOLDER LUG
7	CC50-04100	2	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
101	HBPP-44004	2	26233	NS137CR440R4	4-40 X 1/4 PAN

004BA34600 GT9000/S .01-2 FILTER AS, Rev: J

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	420AW48000	REF	58900	420AW48000	.01-2 FILTER HARNESS W/L
1	005DA34600	1	58900	005DA34600	GT9000/S .01-2 FILTER AS
2	420BA48000	1	58900	420BA48000	.01-2 FILTER HARNESS ASY
3	001BF05001	1	58900	001BF05001	MODULE LABEL 004BA34600
4	HLST-21105	1	79963	341-.093	#2 SOLDER LUG

004BA34800 GT9000/S .5-2 FILTER ASY, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	420AW48200	REF	58900	420AW48200	.5-2 FILTER HARNESS W/L
1	005CA34800	1	58900	005CA34800	GT9000/S .5-2 FILTER ASY
2	420BA48200	1	58900	420BA48200	.5-2 FILTER HARNESS ASY
3	001BF05004	1	58900	001BF05004	MODULE LABEL 004BA34800
4	HLLT-40210	1	79963	505-120 # 4	#4 SOLDER LUG
101	HBPP-44004	1	26233	NS137CR440R4	4-40 X 1/4 PAN

120DA11251 GT9000S BENCH MT DRESS, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120DF04902	1	58900	120DF04902	BEZEL,PAINTED
2	120CF04110	2	58900	120CF04110	SIDE TRIM, PAINTED
3	120CF04450	1	58900	120CF04450	TOP COVER
4	120DA04550	1	58900	120DA04550	BOTTOM COVER ASY
5	120CF11310	2	——-	120CF11310	CAST HANDLE (BEIGE)
7	GFU0-00804	20	58900	GFU0-00804	ADH TAPE .5W X .25 THICK
9	420DF44020	1	58900	420DF44020	GT9000S DEC PANEL NVFD
101	HBFP-44003	20	26233	NS139CR440R3	4-40 X 3/16 FLAT
102	HBFP-83204	6	58900	HBFP-83204	8-32 X 1/4 FLAT
103	HBPP-83208	4	58900	HBPP-83208	8-32 X 1/2 PAN
104	HBFP-63204	6	58900	HBFP-63204	6-32 X 1/4 FLAT
105	HWSS-80400	4	58900	HWSS-80400	#8 X 1/4 SPLIT LOCK
106	HBFP-63204	4	58900	HBFP-63204	6-32 X 1/4 FLAT

120DA04550 BOTTOM COVER ASY, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120CF04550	1	58900	120CF04550	BOTTOM COVER
2	HFFR-63202	2	21604	1S001202	RIGHT FRONT FOOT
3	HFFL-63202	2	21604	1S001201	LEFT FRONT FOOT
4	HFBI-00012	1	21604	MP-40008-4	12 INSIDE MOUNT BAIL
5	HNTU-63206	8	21604	MP40366	#6 TINNERMAN NUT
101	HBFP-63210	8	58900	HBFP-63210	6-32 X 5/8 FLAT

120AA14300 ACCESSORIES ASY, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120BA04700	1	58900	120BA04700	COMPUTER EXTENDER BD PCA
2	120BA09500	1	58900	120BA09500	I/O EXTENDER BD PCA
3	101BF21600	1	58900	101BF21600	PC BOARD PULLER
4	WMP0-03007	1	16428	17250	7.5' IEC POWER CORD
5	101BF21400	REF	58900	101BF21400	CHASSIS NOMENCLATURE LBL
6	001BF01100	REF	58900	001BF01100	FOIL CAL

120BA01300 FRONT PANEL I/F PCA (A1), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120CF01300	1	58900	120CF01300	FRONT PANEL I/F PCB
2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
3	JSP0-10028	2	09769	2-641615-1	28 PIN DIP SOCKET
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

120BA01300 FRONT PANEL I/F PCA (A1), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C13	CC50-00100	1	31433	C315C100J2G5CA	10 PF CERAMIC NPO
C14	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C15	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C16	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
R1	RN55-23320	1	91637	RN55C3322F	33.2 K OHMS 1% MET FILM
R2	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R3	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R4	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R5	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R6	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
R7	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R8	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R9	RN55-?????	REF	58900	RN55-?????	COMPONENT SELECTED IN TEST
U1	UTN0-01542	1	01295	74HC154NT	SN74HC154NT 4 TO 16 MUX
U2	UTN0-00202	1	01295	74HC20N	74HC20 DUAL 4 IN NAND
U3	UGN0-01871	1	58900	UGN0-01871	CDP1871 88 KEY ENCODER
U4	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U5	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U6	UTN0-00742	1	58900	UTN0-00742	74HC74 DUAL D FLIP FLOP
U7	UTN0-01232	1	2M881	CD74HC123	74HC123 RETRIG. MULTI
U8	UTN0-00742	1	58900	UTN0-00742	74HC74 DUAL D FLIP FLOP
U9	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U10	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U11	UTN0-00091	1	01295	SN74LS09N	74LS09 QUAD AND GATES
U12	UMN0-27256	1	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
U13	UMN1-01230	1	0B0A9	DS1230AB-150	DS1230AB-150 NON-VOL RAM
U14	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U15	UTN0-01322	1	01295	MC74HC132E	SN74HC132N 4X SCHMIDT NAN

120BA05300 IEEE / TIMER PCA (A2), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120CF05300	1	58900	120CF05300	IEEE / TIMER PCB
2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
C1	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-00270	1	31433	C315C270J2G5CA	27 PF CERAMIC NPO
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-00270	1	31433	C315C270J2G5CA	27 PF CERAMIC NPO
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C16	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
P1	JIA1-20010	1	58900	JIA1-20010	10 PIN DUAL STRPLN PLUG
R1	RN55-15620	1	91637	RN55C5621B	5.62 K OHMS 1% MET FILM
R2	RN55-15620	1	91637	RN55C5621B	5.62 K OHMS 1% MET FILM
R3	RN55-15620	1	91637	RN55C5621B	5.62 K OHMS 1% MET FILM
R4	RN55-15620	1	91637	RN55C5621B	5.62 K OHMS 1% MET FILM
R5	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R6	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
R7	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R8	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R9	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R10	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R11	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R12	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R13	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R14	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R15	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
U1	UTN0-00022	1	01295	74HC02N	74HC02 QUAD 2 INPUT NOR
U2	UTN0-00091	1	01295	SN74LS09N	74LS09 QUAD AND GATES
U3	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U4	UIN0-01413	1	01295	ULN2003AN	MC1413P X7 DRIVER .5A
U5	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U6	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U7	UIN0-01413	1	01295	ULN2003AN	MC1413P X7 DRIVER .5A
U8	UIN2-01488	1	27014	DS14C88N	DS14C88 RS232 DRIVER
U9	UIN2-01489	1	27014	DS14C89AN	DS14C89 RS232 RECEIVER
U10	UGN0-68901	1	04713	MC68901FN	MC68901 GPIO / TIMER
U11	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U12	UGN1-09914	1	64667	NAT9914APD	WD9914PL00 IEEE-488
U13	UIN0-75160	1	01295	SN75160BN	SN75160N IEEE BUFFER
U14	UIN0-75162	1	01295	SN75162BN	SN75162N IEEE BUFFER
XU10	JSG0-10052	1	58900	JSG0-10052	52 PIN CHIP CARRIER
Y1	Y180-00246	1	58900	Y180-00246	2.4576MHZ CRYSTAL

120BA01200 MEMORY PCA (A3), Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS01200	REF	58900	120BS01200	MEMORY SCH
1	120CF01200	1	58900	120CF01200	MEMORY PCB
2	JSP0-10028	14	09769	2-641615-1	28 PIN DIP SOCKET
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
U1	UMN0-60256	1	0FB81	SRM20256LC10	MCM60L256 CMOS RAM
U2	UMN0-60256	1	0FB81	SRM20256LC10	MCM60L256 CMOS RAM
U3	UMN0-60256	1	0FB81	SRM20256LC10	MCM60L256 CMOS RAM
U4	UMN0-60256	1	0FB81	SRM20256LC10	MCM60L256 CMOS RAM
U5	UMN0-27256	REF	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
U6	UMN0-27256	REF	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
U7	UMN0-27256	REF	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
U8	UMN0-27256	REF	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
U9	UMN0-27256	REF	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
U10	UMN0-27256	REF	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
U11	UMN0-27256	REF	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
U12	UMN0-27256	REF	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE

120BA01100 CPU PCA (A4), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120CF01100	1	58900	120CF01100	CPU PCB
2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
C1	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C2	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C3	CC50-01150	1	31433	C315C151G5CA-9248	150 PF CERAMIC NPO
C4	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C24	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

120BA01100 CPU PCA (A4), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C26	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C27	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C28	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
Q1	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
R1	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R2	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM
R3	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R4	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R5	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM
R6	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R7	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R8	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R9	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R10	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R11	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R12	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R13	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R14	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R15	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R16	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
RM1	RM5S-14700	1	71450	770-61-R4.7K	5 X 4.7K SIP RESISTOR NE
S1	SPP0-00101	1	09353	TP11SHABE	SPST PC MT PUSHBUTTON
U1	UGZB-68000	1	04713	MC68000FN-8	MC68000 8 MHZ PROCESSOR
U2	UTN0-02452	1	01295	74HC245N	74HC245E OCTAL BUS XCVR
U3	UTN0-02452	1	01295	74HC245N	74HC245E OCTAL BUS XCVR
U4	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U5	UTN0-01230	1	01295	SN74123N	SN74123N DUAL ONE SHOT
U6	UTN0-00042	1	01295	SN74HC04N	SN74HC04 HEX INVERTER
U7	UTN0-01481	1	01295	SN74LS148	74LS148 PRIORITY ENCODER
U8	UTN0-00202	1	01295	74HC20N	74HC20 DUAL 4 IN NAND
U9	UTN0-00002	1	04713	MC74HC00N	74HC00 QUAD 2IN NAND GATE
U10	UTN0-00091	1	01295	SN74LS09N	74LS09 QUAD AND GATES
U11	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U12	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U13	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U14	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U15	UTN0-01542	1	01295	74HC154NT	SN74HC154NT 4 TO 16 MUX
U16	UTN0-01542	1	01295	74HC154NT	SN74HC154NT 4 TO 16 MUX
U17	UTN0-01542	1	01295	74HC154NT	SN74HC154NT 4 TO 16 MUX
U18	UTN0-01542	1	01295	74HC154NT	SN74HC154NT 4 TO 16 MUX
U19	UTN0-00022	1	01295	74HC02N	74HC02 QUAD 2 INPUT NOR
U20	UTN0-00002	1	04713	MC74HC00N	74HC00 QUAD 2IN NAND GATE
U21	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
XU1	JSG0-11068	1	58900	JSG0-11068	68 PIN PLCC SOCKET
Y1	Y180-00800	1	71450	MP080A	8.00MHZ FUND XTAL

120BA09303 PULSE DRIVER PCA (A5), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS09303	REF	58900	120BS09303	PULSE DRIVER SCH
1	120CF09303	1	58900	120CF09303	PULSE DRIVER PCB
2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

120BA09303 PULSE DRIVER PCA (A5), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C6	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C7	CC50-01120	1	31433	315C121K1G5CA-9248	120 PF CERAMIC NPO
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C17	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C18	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
C19	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C20	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C24	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C28	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C29	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C30	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C31	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C32	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C35	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C37	CC50-01510	1	58900	CC50-01510	510 PF CERAMIC NPO
C38	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C39	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C40	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C43	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C44	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C46	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C48	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C49	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C50	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C55	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C56	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CX12	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX13	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX14	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX16	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX45	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX47	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX51	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX52	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX53	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX54	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
J3	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
J4	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
J5	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
Q7	QBPS-05771	1	04713	MPS5771	2N5771 15V 850MHZ PNP
Q8	QBNS-04275	1	58900	QBNS-04275	PN4275 .1A 15V .6W NPN
R1	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R2	RN55-11210	1	91637	RN55C1211F	1.21 K OHMS 1% MET FILM
R8	RN55-00562	1	91637	RN55C56R2F	56.2 OHMS 1% MET FILM
R14	RN55-00562	1	91637	RN55C56R2F	56.2 OHMS 1% MET FILM
R20	RN55-00562	1	91637	RN55C56R2F	56.2 OHMS 1% MET FILM
R21	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R22	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R23	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM

120BA09303 PULSE DRIVER PCA (A5), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R24	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R25	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R27	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R28	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R29	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R30	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R31	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R32	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
R34	RN55-06810	1	91637	RN55C6810F	681 OHMS 1% MET FILM
R35	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R36	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R37	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R40	RN55-03920	1	91637	RN55C3920F	392 OHMS 1% MET FILM
R41	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM
R42	RAPD-11000	1	58900	RAPD-11000	1K POT 15T PC MNT
R43	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R44	RAPD-11000	1	58900	RAPD-11000	1K POT 15T PC MNT
R45	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R46	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R47	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R48	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R49	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R53	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R54	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R55	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R56	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R57	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R58	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R59	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
RM1	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM2	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM3	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RX26	RN55-?????	REF	58900	RN55-?????	COMPONENT SELECTED IN TEST
RX50	RN55-?????	REF	58900	RN55-?????	COMPONENT SELECTED IN TEST
RX51	RN55-?????	REF	58900	RN55-?????	COMPONENT SELECTED IN TEST
RX52	RN55-?????	REF	58900	RN55-?????	COMPONENT SELECTED IN TEST
U1	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U2	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U3	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U4	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U5	UEN0-10105	1	04713	MC10105P	MC10105P TRIPLE OR/NOR
U6	UEN0-10125	1	04713	MC10125P	MC10125P QUAD ECL TO TTL
U7	ULN0-02901	1	01295	LM2901N	LM2901N QUAD COMPARATOR
U8	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U9	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U10	UEN0-10125	1	04713	MC10125P	MC10125P QUAD ECL TO TTL
U11	UTN0-01542	1	01295	74HC154NT	SN74HC154NT 4 TO 16 MUX
U12	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U13	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U14	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U15	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U16	UID0-61072	1	92194	A61072P536	A61072P QUAD DRIVER
U18	URG0-00337	1	27014	LM337LZ	LM337 .5A ADJ REGULATOR
U19	UID0-61072	1	92194	A61072P536	A61072P QUAD DRIVER
U20	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
VR1	DZAD-04732	1	58900	DZAD-04732	IN4732A 4.7 V ZENER
VR2	DZAD-04734	1	04713	1N4734	IN4734 6.2V ZENER
W1	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER

120BA12550 GT9000 PULSE GENERATOR (A5A1), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS12550	REF	58900	120BS12550	PULSE GENERATOR; GT9000
1	120CF12500	1	58900	120CF12500	PULSE GENERATOR PCB
2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
3	HSTS-44005	3	55566	3048-B-440-A-0	5/16 ROUND SWAGE SPACER
4	WSTD-24900	1	58900	WSTD-24900	24 GA WHITE TFE WIRE
101	HBFP-44005	3	26233	NS139CR440R5	4-40 X 5/16 FLAT
C1	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C8	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C12	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C13	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C14	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C21	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C24	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C28	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C29	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C31	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C32	CV00-00730	1	72982	DV6PS30A	7-30 PF VARIABLE
C33	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C34	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C35	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C36	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C37	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C38	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C46	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C47	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C48	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C49	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C53	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C54	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C56	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C57	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C58	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C59	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C60	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C61	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
C62	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
CR1	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
P3	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
P4	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
P5	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG

120BA12550 GT9000 PULSE GENERATOR (A5A1), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R1	RN55-14320	1	91637	RN55C4321F	4.32 K OHMS 1% MET FILM
R2	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R3	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R4	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R5	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM
R6	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R7	RN55-15620	1	91637	RN55C5621B	5.62 K OHMS 1% MET FILM
R8	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R9	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R10	RN55-02210	1	91637	RN55C2210F	221 OHMS 1% MET FILM
R11	RN55-02210	1	91637	RN55C2210F	221 OHMS 1% MET FILM
R12	RN55-02210	1	91637	RN55C2210F	221 OHMS 1% MET FILM
R13	RN55-02210	1	91637	RN55C2210F	221 OHMS 1% MET FILM
R15	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R16	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R17	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R18	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R19	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R20	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R23	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R24	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R26	RN55-03920	1	91637	RN55C3920F	392 OHMS 1% MET FILM
RM1	RM7S-03900	1	71450	750-81-R390	390 OHM X 7 SIP NETWRK
RM2	RM7S-03900	1	71450	750-81-R390	390 OHM X 7 SIP NETWRK
RM3	RM7S-03900	1	71450	750-81-R390	390 OHM X 7 SIP NETWRK
RM4	RM7S-03900	1	71450	750-81-R390	390 OHM X 7 SIP NETWRK
RM5	RM7S-03900	1	71450	750-81-R390	390 OHM X 7 SIP NETWRK
RM6	RM7S-03900	1	71450	750-81-R390	390 OHM X 7 SIP NETWRK
U1	UTN0-06241	1	01295	74LS624N	74LS624N 20MHZ VCO
U2	UTN0-00002	1	04713	MC74HC00N	74HC00 QUAD 2IN NAND GATE
U3	UCN0-51460	1	04713	MC145146P2	MC145146P FREQ SYNTH
U4	UCN0-51460	1	04713	MC145146P2	MC145146P FREQ SYNTH
U5	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U6	UEN1-10131	1	04713	MC10H131P	MC10H131P DUAL D F/F
U7	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U8	UEN1-10102	1	04713	MC10H102PC	MC10H102 QUAD NOR GATES
U9	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U10	UEN1-10136	1	04713	MC10H136L	MC10H136P 250MHZ DIV 16
U11	UEN1-10136	1	04713	MC10H136L	MC10H136P 250MHZ DIV 16
U12	UEN1-10102	1	04713	MC10H102PC	MC10H102 QUAD NOR GATES
U13	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U14	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U15	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U16	UTN0-05922	1	61802	TC74HC592AP	74HC592N;8 BIT;COUNTER
U17	UTN0-05922	1	61802	TC74HC592AP	74HC592N;8 BIT;COUNTER
U18	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U19	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U20	UEN0-10125	1	04713	MC10125P	MC10125P QUAD ECL TO TTL
U21	UTN0-00002	1	04713	MC74HC00N	74HC00 QUAD 2IN NAND GATE
U22	LD4S-00050	1	58900	LD4S-00050	4 TAP 5 NS DELAY LINE
U23	UTN0-05922	1	61802	TC74HC592AP	74HC592N;8 BIT;COUNTER
U24	UEN0-10125	1	04713	MC10125P	MC10125P QUAD ECL TO TTL
U25	UTN0-05922	1	61802	TC74HC592AP	74HC592N;8 BIT;COUNTER
U26	UTN0-05922	1	61802	TC74HC592AP	74HC592N;8 BIT;COUNTER
U27	UTN0-05922	1	61802	TC74HC592AP	74HC592N;8 BIT;COUNTER
U28	UTN0-00272	1	01295	SN74HC27N	74HC27N 3X3IN NOR GATES
U33	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR

120BA09401 AM/FM DRIVER PCA (A6), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS09401	REF	58900	120BS09401	AM/FM DRIVER SCH
1	120CF09400	1	58900	120CF09400	AM/FM DRIVER PCB
2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
C1	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C2	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C6	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C7	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C21	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C22	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C23	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C24	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C25	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C27	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C31	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C32	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C33	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C34	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C35	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C36	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C37	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C38	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C42	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C43	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C44	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C46	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C47	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C48	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C49	CE16-R6330	1	55680	UVP1C330MDA	33 UF 16V NON-POL RADIA
C50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C52	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C53	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C54	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C55	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C56	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C57	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C58	CC50-00047	1	31433	C315C479D2G5CA-9248	4.7 PF CERAMIC NPO
C59	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C60	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C61	CC50-00047	1	31433	C315C479D2G5CA-9248	4.7 PF CERAMIC NPO
C62	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C63	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C64	CC50-00047	1	31433	C315C479D2G5CA-9248	4.7 PF CERAMIC NPO
C65	CC50-00047	1	31433	C315C479D2G5CA-9248	4.7 PF CERAMIC NPO
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
J3	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
J4	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
J5	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
J6	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
R1	RN55-06040	1	91637	RN55C6040F	604 OHMS 1% MET FILM
R2	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R3	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R6	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R7	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R8	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R9	RN55-13160	1	91637	RN55C3161F	3.16 K OHMS 1% MET FILM
R10	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R11	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R12	RN55-11210	1	91637	RN55C1211F	1.21 K OHMS 1% MET FILM
R13	RN55-11210	1	91637	RN55C1211F	1.21 K OHMS 1% MET FILM
R14	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R15	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R16	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R17	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R18	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R19	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R20	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R23	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R24	RN55-03010	1	91637	RN55C3010F	301 OHMS 1% MET FILM
R25	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM
R26	RN55-11500	1	91637	RN55C1501F	1.5 K OHMS 1% MET FILM
R27	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R28	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R29	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R30	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R31	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R32	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R33	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R34	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R35	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R36	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R37	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R38	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R39	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R40	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R41	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R42	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R43	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R44	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R45	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R46	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
R47	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R48	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R49	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R50	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R51	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R52	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R53	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R54	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
R55	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R56	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R57	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM

120BA09401 AM/FM DRIVER PCA (A6), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R58	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R59	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R60	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R61	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
R62	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R63	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R64	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R65	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R66	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R67	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R68	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R69	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
U1	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U2	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U3	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U4	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U5	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U6	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U7	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U8	ULN0-00539	1	24355	AD539JD	AD539 LINEAR MULT/DIVIDR
U9	UVNP-00100	1	24355	AD587JK	AD587 10V 20PPM REF
U10	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U11	UON0-00428	1	1ES66	MAX428CPA	MAX428CPA;DUAL OP AMP
U13	UON0-00428	1	1ES66	MAX428CPA	MAX428CPA;DUAL OP AMP
U14	ULN0-00539	1	24355	AD539JD	AD539 LINEAR MULT/DIVIDR
U15	UON0-00842	1	24355	AD842JN	AD842 80 MHZ OP AMP
U16	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U17	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U18	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U19	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U20	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U22	UON0-00428	1	1ES66	MAX428CPA	MAX428CPA;DUAL OP AMP
U23	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U24	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U25	UON0-00428	1	1ES66	MAX428CPA	MAX428CPA;DUAL OP AMP
U26	UON0-00428	1	1ES66	MAX428CPA	MAX428CPA;DUAL OP AMP

120BA09211 ANALOG SWEEP 1 PCA (A8), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS09211	REF	58900	120BS09211	ANALOG SWEEP 1 SCH
1	120CF09210	1	58900	120CF09210	ANALOG SWEEP 1 PCB
2	ETST-06224	2	58900	ETST-06224	TURRET TERMINAL
3	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
101	HBPP-44005	1	26233	NS137CR440R5	4-40 X 5/16 PAN
102	HWFS-40400	1	58900	HWFS-40400	#4 X 1/4 FLAT WASHER
103	HWSS-40300	1	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
A8 A1	120BA11401	1	58900	120BA11401	ANALOG SWEEP #2 PCA
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C3	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C8	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P

120BA09211 ANALOG SWEEP 1 PCA (A8), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C12	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C13	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C14	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C15	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C16	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C19	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C20	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C24	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C25	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C26	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C27	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C28	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C29	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C31	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C32	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C33	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C35	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C36	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C38	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C39	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C40	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C41	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C42	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C43	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C44	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C45	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C46	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C48	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C49	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C50	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C51	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C56	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C57	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C58	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C59	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C60	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C61	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C63	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C64	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C65	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C66	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C67	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C68	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C69	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C70	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C71	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C72	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C73	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C74	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C76	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C77	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C78	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C79	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C81	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C82	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C83	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C84	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

120BA09211 ANALOG SWEEP 1 PCA (A8), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C85	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C87	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C88	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C89	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C90	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C91	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C92	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C93	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
IR1	DZAC-05294	1	58900	DZAC-05294	IN5294 .75MA REG DIODE
IR2	DZAC-05294	1	58900	DZAC-05294	IN5294 .75MA REG DIODE
IR3	DZAC-05294	1	58900	DZAC-05294	IN5294 .75MA REG DIODE
IR4	DZAC-05294	1	58900	DZAC-05294	IN5294 .75MA REG DIODE
IR5	DZAC-05294	1	58900	DZAC-05294	IN5294 .75MA REG DIODE
IR6	DZAC-05294	1	58900	DZAC-05294	IN5294 .75MA REG DIODE
IR7	DZAC-05294	1	58900	DZAC-05294	IN5294 .75MA REG DIODE
IR8	DZAC-05294	1	58900	DZAC-05294	IN5294 .75MA REG DIODE
J3	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
P1	JIA1-03230	1	58900	JIA1-03230	3 PIN STRIPLINE PLUG
R1	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R3	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R5	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R7	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R9	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R10	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R11	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R12	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R13	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R14	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R15	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R16	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R17	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R24	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R25	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R26	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R27	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R28	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R29	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R30	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R31	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R32	RN50-19090	1	91637	RN50C9091F	9.09 K OHMS 1% MET FILM
R33	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R34	RN55-17500	1	91637	RN55C7501F	7.5 K OHMS 1% MET FILM
R35	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R36	RN55-26650	1	91637	RN55C6652F	66.5 K OHMS 1% MET FILM
R37	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R38	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R39	RAPG-41000	1	58900	RAPG-41000	1M 10% 25T .5W TRIM. POT
R40	RN50-22000	1	91637	RN50C2002F	20.0 K OHMS 1% MET FILM
R41	RN50-00200	1	91637	RN50C20R0F	20.0 OHMS 1% METAL FILM
R42	RN50-00200	1	91637	RN50C20R0F	20.0 OHMS 1% METAL FILM
R43	RN50-00200	1	91637	RN50C20R0F	20.0 OHMS 1% METAL FILM
R44	RN50-00200	1	91637	RN50C20R0F	20.0 OHMS 1% METAL FILM
R45	RN50-00200	1	91637	RN50C20R0F	20.0 OHMS 1% METAL FILM
R46	RN50-00200	1	91637	RN50C20R0F	20.0 OHMS 1% METAL FILM
R47	RN50-00200	1	91637	RN50C20R0F	20.0 OHMS 1% METAL FILM
R48	RN50-00200	1	91637	RN50C20R0F	20.0 OHMS 1% METAL FILM
R49	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R50	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R51	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R52	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R53	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R54	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM

120BA09211 ANALOG SWEEP 1 PCA (A8), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R55	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R56	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R57	RN55-34420	1	91637	RN55C4423F	442 K OHMS 1% MET FILM
R58	RAPG-15000	1	32997	3296Z-1-502	5K 10% 25T .5W TRIM. POT
R60	RN50-00100	1	91637	RN50C10R0F	10.0 OHMS 1% METAL FILM
R61	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R62	RN55-02210	1	91637	RN55C2210F	221 OHMS 1% MET FILM
R63	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R64	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R65	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
RM1	RM5S-14700	1	71450	770-61-R4.7K	5 X 4.7K SIP RESISTOR NE
RM2	RM7S-21000	1	71450	770-81-R10K	10K OHM X 7 SIP NETWRK
RX2	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX4	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX6	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX8	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
U1	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U2	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U4	ULN0-00004	1	58900	ULN0-00004	CMP04 QUAD COMPARATOR
U5	UTN0-00862	1	01295	74HC86N	74HC86 QUAD 2 INPUT X OR
U6	UTN0-00862	1	01295	74HC86N	74HC86 QUAD 2 INPUT X OR
U7	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U8	UTN0-00742	1	58900	UTN0-00742	74HC74 DUAL D FLIP FLOP
U11	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U12	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U14	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U15	UTN0-00022	1	01295	74HC02N	74HC02 QUAD 2 INPUT NOR
U16	UTN0-00091	1	01295	SN74LS09N	74LS09 QUAD AND GATES
U17	UVNP-00100	1	24355	AD587JK	AD587 10V 20PPM REF
U18	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U19	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U20	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U21	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U22	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U23	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
U24	UTN0-01232	1	2M881	CD74HC123	74HC123 RETRIG. MULTI
U25	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U26	UTN0-01542	1	01295	74HC154NT	SN74HC154NT 4 TO 16 MUX
U27	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U28	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U29	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U32	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U33	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U34	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U35	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U36	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U37	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U38	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U39	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U40	ULN0-00004	1	58900	ULN0-00004	CMP04 QUAD COMPARATOR
U41	ULN0-00004	1	58900	ULN0-00004	CMP04 QUAD COMPARATOR
U42	ULN0-00004	1	58900	ULN0-00004	CMP04 QUAD COMPARATOR
U43	ULN0-00004	1	58900	ULN0-00004	CMP04 QUAD COMPARATOR
U44	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U45	UCN0-04078	1	01295	SN74HC4078	74HC4078 8 IN NOR GATE
U46	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U47	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP

120BA11401 ANALOG SWEEP #2 PCA (A8A1), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS11401	REF	58900	120BS11401	ANALOG SWEEP #2 SCH
1	120BF11400	1	58900	120BF11400	ANALOG SWEEP #2 PCB
2	HSTS-44005	1	55566	3048-B-440-A-0	5/16 ROUND SWAGE SPACER
C1	CF00-05200	1	58900	CF00-05200	2 UF 100V POLYPROPYLENE
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
CR1	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR2	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CX2	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX3	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
P3	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
Q1	QMPS-00164	1	2M881	3N164	3N164;P CHNL MOS FET
R1	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R2	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R3	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R4	RN55-34990	1	91637	RN55C4993F	499 K OHMS 1% MET FILM
R5	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R6	RN55-34990	1	91637	RN55C4993F	499 K OHMS 1% MET FILM
R7	RN55-34990	1	91637	RN55C4993F	499 K OHMS 1% MET FILM
R8	RN55-24990	1	91637	RN55C4992F	49.9 K OHMS 1% MET FILM
R9	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R10	RN55-24990	1	91637	RN55C4992F	49.9 K OHMS 1% MET FILM
R11	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
R12	RN55-13320	1	91637	RN55C3321F	3.32 K OHMS 1% MET FILM
R13	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R14	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R15	RN55-18250	1	91637	RN55C8251F	8.25 K OHMS 1% MET FILM
R16	RN55-21330	1	91637	RN55C1332F	13.3 K OHMS 1% MET FILM
R17	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
U1	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U2	UON0-00712	1	24355	AD712JN	AD712JN DUAL OP AMP
U3	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U4	UON0-00712	1	24355	AD712JN	AD712JN DUAL OP AMP

120BA09100 DIGITAL RAMP PCA (A9), Rev: G

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120CF09100	1	58900	120CF09100	DIGITAL RAMP PCB
2	ETST-06224	4	58900	ETST-06224	TURRET TERMINAL
3	JJF0-02000	2	58900	JJF0-02000	TWO CONTACT JUMPER
C1	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C2	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C3	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C4	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C5	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C6	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C7	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C8	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C9	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C24	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C28	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C29	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C31	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C32	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C33	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C34	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C36	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C37	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C38	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C42	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C43	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C44	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C46	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C47	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C48	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C49	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C52	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C53	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C54	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C55	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C56	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C57	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C58	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C59	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C60	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C61	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C62	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C63	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C64	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C65	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C66	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C67	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C68	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C69	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C70	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C71	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C72	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C73	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C74	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C75	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C76	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C77	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C78	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR7	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR8	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR9	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR10	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR11	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR12	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR13	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR14	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR15	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
P1	JIA1-03230	1	58900	JIA1-03230	3 PIN STRIPLINE PLUG
P2	JIA1-03230	1	58900	JIA1-03230	3 PIN STRIPLINE PLUG
R1	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R2	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R3	RAPG-11000	1	32997	3296Z-1-102	1K 10% 25T POT
R5	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R6	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R7	RN55-21330	1	91637	RN55C1332F	13.3 K OHMS 1% MET FILM
R8	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R9	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R10	RN50-41000	1	91637	RN50C1004F	1.00 M OHMS 1% MET FILM
R11	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R12	RAPG-11000	1	32997	3296Z-1-102	1K 10% 25T POT
R13	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R14	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R16	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R17	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R18	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R19	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R20	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R21	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R22	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R23	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R24	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R26	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R27	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R28	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R29	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R30	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R31	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R32	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R33	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R34	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R35	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R36	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R37	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R38	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R39	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R40	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R41	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R42	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R43	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R44	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R45	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R46	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R47	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R48	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R49	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R50	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R51	RAPG-31000	1	32997	3296Z-1-104	100K 10% 25T .5W TRM POT
R52	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R53	RN50-24990	1	91637	RN50C4992F	49.9 K OHMS 1% MET FILM
R54	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R55	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R56	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R57	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R58	RN55-21330	1	91637	RN55C1332F	13.3 K OHMS 1% MET FILM
R59	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R60	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R61	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R62	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R63	RN55-21330	1	91637	RN55C1332F	13.3 K OHMS 1% MET FILM
R64	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R65	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R66	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R67	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R68	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R69	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R70	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R71	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R72	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R73	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R74	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R75	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R76	RN50-13320	1	91637	RN50C3321F	3.32 K OHMS 1% MET FILM
R77	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R78	RN50-01620	1	91637	RN50C1620F	162 OHMS 1% METAL FILM
R79	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R80	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R81	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
RX82	RN50-?????	1	58900	RN50-?????	COMPONENT SELECTED IN TEST
U1	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U2	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U3	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U4	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U5	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U6	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U7	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U8	UAN0-00100	1	13919	LOG100JP	LOG 100JP LOG AMP
U9	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U10	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
U11	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U12	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U13	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
U14	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
U15	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U16	UTN0-01542	1	01295	74HC154NT	SN74HC154NT 4 TO 16 MUX
U17	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U18	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U19	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U20	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
U21	UTN0-00022	1	01295	74HC02N	74HC02 QUAD 2 INPUT NOR
U22	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U23	UVNP-00100	1	24355	AD587JK	AD587 10V 20PPM REF
U24	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U25	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U26	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U27	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U28	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U29	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U30	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
U31	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U32	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U33	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW

420BA47500 GT9000 LEVEL PCA (A10), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	420BS47500	REF	58900	420BS47500	LEVEL SCH; GT9000
1	420CF47500	1	58900	420CF47500	LEVEL PCB; GT9000
2	ETST-06224	4	58900	ETST-06224	TURRET TERMINAL
3	HQIP-00180	2	32559	104-020 PERM-O-P	TO18 INSULATOR
4	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
C1	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C2	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C3	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C4	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C5	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C6	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C7	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C8	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C9	CC50-01150	1	31433	C315C151G5CA-9248	150 PF CERAMIC NPO
C10	CC50-01150	1	31433	C315C151G5CA-9248	150 PF CERAMIC NPO
C11	CC50-01200	1	51642	150-100-COG-201J	200 PF CERAMIC NPO
C12	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C13	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C20	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-00150	1	31433	C315C150J2G5CA	15 PF CERAMIC NPO
C24	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C25	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C26	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C27	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C28	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C29	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C30	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C31	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C32	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C33	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C34	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C37	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C38	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C41	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C42	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C46	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C47	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C48	CC50-00150	1	31433	C315C150J2G5CA	15 PF CERAMIC NPO
C49	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C52	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C53	CE16-R6330	1	55680	UVP1C330MDA	33 UF 16V NON-POL RADIA
C54	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C55	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C56	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C57	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C59	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C60	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C61	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C62	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C63	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C64	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C65	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C66	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C67	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C68	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C69	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C70	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C71	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C72	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C73	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C75	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C76	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C77	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C78	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C79	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C85	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C86	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C87	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C88	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C89	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C90	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C91	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C92	CC50-00680	1	31433	C315C680J2G5CA	68 PF CERAMIC NPO
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR3	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CX74	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
DS1	ILRR-10125	1	28480	HLMP-K101	RED LED
J3	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
J4	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
J5	JIB2-20170	1	55322	SLW-110-01-S-D	20 PIN STRIPLINE SOCKET
L1	LAD0-06470	1	91637	IMS-5 47UH 10%	47 UH INDUCTOR
L2	LAD0-06470	1	91637	IMS-5 47UH 10%	47 UH INDUCTOR
L3	LAD0-07100	1	91637	IMS5 100UH	100 UH INDUCTOR
P1	JIA1-03230	1	58900	JIA1-03230	3 PIN STRIPLINE PLUG
Q1	QMNS-00215	1	06049	AD215DE	SD215DE D-MOS FET
Q2	QMNS-00215	1	06049	AD215DE	SD215DE D-MOS FET
R1	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R2	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R3	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R4	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R5	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R6	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R7	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R8	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R10	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R11	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R12	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R13	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R14	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R17	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R18	RN50-03320	1	91637	RN50C3320F	332 OHMS 1% METAL FILM
R19	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R20	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R21	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R22	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R23	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R24	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R25	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R26	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R27	RAPG-15000	1	32997	3296Z-1-502	5K 10% 25T .5W TRIM. POT
R28	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R29	RAPG-15000	1	32997	3296Z-1-502	5K 10% 25T .5W TRIM. POT
R30	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R31	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R32	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R33	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R34	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R35	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R36	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R37	RN50-41000	1	91637	RN50C1004F	1.00 M OHMS 1% MET FILM
R38	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R39	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R40	RN50-11210	1	65940	CRB20FX1211	1.21 K OHMS 1% MET FILM
R41	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R42	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R43	RN50-22000	1	91637	RN50C2002F	20.0 K OHMS 1% MET FILM
R44	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R45	RN50-22000	1	91637	RN50C2002F	20.0 K OHMS 1% MET FILM
R46	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R47	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R48	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R49	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R50	RAPG-25000	1	32997	3296Z-503	50K 10% 25T POT
R51	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
R52	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R53	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R54	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R55	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R56	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R57	RN50-13320	1	91637	RN50C3321F	3.32 K OHMS 1% MET FILM
R58	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R59	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R60	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R61	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R62	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R63	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R64	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R65	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R66	RN50-34020	1	91637	RN50C4023F	402 K OHMS 1% MET FILM
R68	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
R69	RN50-12210	1	91637	RN50C2211F	2.21 K OHMS 1% MET FILM
R71	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
RX9	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX15	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
RX16	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX70	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX72	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX73	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
U1	UTN0-00042	1	01295	SN74HC04N	SN74HC04 HEX INVERTER
U2	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U3	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U5	UON0-00712	1	24355	AD712JN	AD712JN DUAL OP AMP
U6	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U7	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U8	ULN0-00539	1	24355	AD539JD	AD539 LINEAR MULT/DIVIDR
U9	ULN0-00539	1	24355	AD539JD	AD539 LINEAR MULT/DIVIDR
U10	UON0-00842	1	24355	AD842JN	AD842 80 MHZ OP AMP
U13	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U14	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U15	UON0-00027	1	58900	UON0-00027	OP27GN LOW DRIFT OP AMP
U16	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U17	UON0-00712	1	24355	AD712JN	AD712JN DUAL OP AMP
U18	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U19	ULN0-00311	1	01295	LM311P	LM311N COMPARATOR
U20	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U21	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U22	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U23	UTN0-01252	1	01295	SN74HC125AN	MC74HC125N QUAD BUFFER
U24	UIN0-07846	1	24355	AD7846AD	AD7846JN;16 BIT DAC
U25	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U26	UVNP-00050	1	58900	UVNP-00050	REF02 5V 3PPM REFERENCE
U27	UON0-00027	1	58900	UON0-00027	OP27GN LOW DRIFT OP AMP
U28	ULN0-00539	1	24355	AD539JD	AD539 LINEAR MULT/DIVIDR
U29	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U30	UON0-00027	1	58900	UON0-00027	OP27GN LOW DRIFT OP AMP
U31	UIN0-07524	1	1ES66	MX7524JN	AD7524 8 BIT D/A
U32	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
VR1	DRAE-00827	1	04713	1N827A	1N827 6.2V REF. DIODE
VR2	DRAE-00827	1	04713	1N827A	1N827 6.2V REF. DIODE
VR3	DZAD-04728	1	04713	1N4728	IN4728 3.3 V ZENER
Y1	Y180-00246	1	58900	Y180-00246	2.4576MHZ CRYSTAL

420BA50500 LEVEL DRIVER AM 9000 PCA (A10A1), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	420BS50500	REF	58900	420BS50500	LEVEL DRIVER AM 9000 SCH
1	420BF50501	1	58900	420BF50501	LEVEL DRIVER AM 9000 PCB
2	ETSB-06216	1	58900	ETSB-06216	BIFURCATED TERMINAL
3	HSTS-44005	3	55566	3048-B-440-A-0	5/16 ROUND SWAGE SPACER
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C11	CC50-01330	1	31433	C315C331K1G5CA	330 PF CERAMIC NPO
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C20	CC50-01330	1	31433	C315C331K1G5CA	330 PF CERAMIC NPO
C21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C24	CC50-01330	1	31433	C315C331K1G5CA	330 PF CERAMIC NPO
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C28	CC50-01330	1	31433	C315C331K1G5CA	330 PF CERAMIC NPO
C29	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C31	CC50-01330	1	31433	C315C331K1G5CA	330 PF CERAMIC NPO
C32	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C33	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C34	CE16-R6220	1	55680	USA1C220MCA	22UF 16V RADIAL
C35	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C36	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C37	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C38	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C42	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR7	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR9	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR10	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR11	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR12	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR13	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR15	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
K1	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH
K2	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH
K3	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH
K4	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
K5	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH
K6	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH
K7	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH
L1	LAD0-07820	1	91637	IMS 5 820 UH 10%	820UH INDUCTOR
L2	LAD0-07820	1	91637	IMS 5 820 UH 10%	820UH INDUCTOR
L3	LAD0-07820	1	91637	IMS 5 820 UH 10%	820UH INDUCTOR
L4	LAD0-07820	1	91637	IMS 5 820 UH 10%	820UH INDUCTOR
L5	LAD0-07820	1	91637	IMS 5 820 UH 10%	820UH INDUCTOR
L6	LAD0-07820	1	91637	IMS 5 820 UH 10%	820UH INDUCTOR
L7	LAD0-07820	1	91637	IMS 5 820 UH 10%	820UH INDUCTOR
P3	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
P4	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
P5	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
Q1	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
R1	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R2	RN55-00100	1	91637	RN55C10R0F	10 OHMS 1% MET FILM
R3	RN50-11500	1	91637	RN50C1501F	1.50 K OHMS 1% MET FILM
R4	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R5	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R6	RN50-12210	1	91637	RN50C2211F	2.21 K OHMS 1% MET FILM
R7	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R8	RN55-12430	1	91637	RN55C2431F	2.43 K OHMS 1% MET FILM
R9	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R10	RN50-13920	1	91637	RN50C3921F	3.92 K OHMS 1% MET FILM
R11	RN55-00100	1	91637	RN55C10R0F	10 OHMS 1% MET FILM
R12	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R13	RAPD-21000	1	58900	RAPD-21000	10K POT 15T PC MNT
R14	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R15	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R16	RAPD-11000	1	58900	RAPD-11000	1K POT 15T PC MNT
R17	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R18	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R19	RN55-12000	1	91637	RN55C2001F	2.00 K OHMS 1% MET FILM
R20	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R21	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R23	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R25	RAPD-21000	1	58900	RAPD-21000	10K POT 15T PC MNT
R26	RN50-23320	1	91637	RN50C3322F	33.2 K OHMS 1% MET FILM
R27	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R28	RN50-13920	1	91637	RN50C3921F	3.92 K OHMS 1% MET FILM
R29	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R30	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R32	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R33	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R34	RAPD-11000	1	58900	RAPD-11000	1K POT 15T PC MNT
R35	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R36	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R37	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R39	RAPD-21000	1	58900	RAPD-21000	10K POT 15T PC MNT
R40	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R41	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R42	RAPD-11000	1	58900	RAPD-11000	1K POT 15T PC MNT
R43	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R44	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R45	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R46	RAPD-11000	1	58900	RAPD-11000	1K POT 15T PC MNT
R48	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R49	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R50	RAPD-21000	1	58900	RAPD-21000	10K POT 15T PC MNT
R53	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R54	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R55	RAPD-21000	1	58900	RAPD-21000	10K POT 15T PC MNT
R57	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM

420BA50500 LEVEL DRIVER AM 9000 PCA (A10A1), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R58	RAPD-11000	1	58900	RAPD-11000	1K POT 15T PC MNT
R59	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R60	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R61	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R62	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R63	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R64	RAPD-21000	1	58900	RAPD-21000	10K POT 15T PC MNT
R65	RAPD-21000	1	58900	RAPD-21000	10K POT 15T PC MNT
R67	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R68	RN50-12740	1	91637	RN50C2741F	2.74 K OHMS 1% MET FILM
R69	RN50-02740	1	91637	RN50C2740F	274 OHMS 1% METAL FILM
R70	RN50-02740	1	91637	RN50C2740F	274 OHMS 1% METAL FILM
R71	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R72	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R73	RN50-18250	1	91637	RN50C8251F	8.25 K OHMS 1% MET FILM
R74	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R75	RN50-13320	1	91637	RN50C3321F	3.32 K OHMS 1% MET FILM
U1	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U2	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U3	UON0-00827	1	24355	AD827JN	AD827N DUAL OP AMP
U4	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U5	UON0-00844	1	24355	AD844AN	AD844AN;OP AMP
U6	UON0-00844	1	24355	AD844AN	AD844AN;OP AMP
U7	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U8	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U9	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U10	UON0-00844	1	24355	AD844AN	AD844AN;OP AMP
U11	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U12	UON0-00844	1	24355	AD844AN	AD844AN;OP AMP
U13	UON0-00844	1	24355	AD844AN	AD844AN;OP AMP
U14	UON0-00844	1	24355	AD844AN	AD844AN;OP AMP
VR1	DZAD-04732	1	58900	DZAD-04732	IN4732A 4.7 V ZENER
VR2	DZAD-04732	1	58900	DZAD-04732	IN4732A 4.7 V ZENER

120BA04650 POWER SUPPLY PCA (A11), Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS04650	REF	58900	120BS04650	POWER SUPPLY SCH
1	120BF04650	1	58900	120BF04650	POWER SUPPLY PCB
2	HQH1-02200	1	13103	THERMALLOY 6073B	TO220 HEATSINK
3	ETST-06224	4	58900	ETST-06224	TURRET TERMINAL
4	HQH0-02200	2	13103	6106B-14	TO220 HEATSINK
5	HT00-00409	4	53421	T-18R	4 WHITE CABLE TIE
6	ETSB-06224	9	58900	ETSB-06224	BIFURCATED TERMINAL
7	HQIS-00050	1	55285	7403-09FR-33	4 LEAD TO5 INSULATOR
8	WTT0-20000	2	16428	20AWG-TFE/TW	#20 CLEAR TFE SLVNG
101	HBPP-63206	3	58900	HBPP-63206	6-32 X 3/8 PAN
102	HNKS-63204	3	58900	HNKS-63204	6-32 KEP NUT
103	HWFS-60500	3	58900	HWFS-60500	#6 X 5/16 FLAT WASHER
C1	CE35-08220	1	55680	TVX1V222MCA	2200 UF 35V AXIAL LEAD
C2	CE16-08470	1	61058	ECEB1CU472	4700 UF 16V AXIAL LEAD
C3	CE35-08220	1	55680	TVX1V222MCA	2200 UF 35V AXIAL LEAD
C4	CE35-08220	1	55680	TVX1V222MCA	2200 UF 35V AXIAL LEAD
C5	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C6	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C7	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C8	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C9	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C10	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C11	CE63-07220	1	55680	TVX1J221MCA	220 UF 63V ELECT.
C12	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C17	CE63-07220	1	55680	TVX1J221MCA	220 UF 63V ELECT.
CR2	DBMC-00001	1	0RF16	CSB1	1 A DIP BRIDGE
CR3	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
CR4	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
CR5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
DS1	ILRR-10125	1	28480	HLMP-K101	RED LED
P1	JIA1-02230	1	55322	TSW-102-07-S-S	2 PIN STRIPLINE PLUG
P2	JIA1-02230	1	55322	TSW-102-07-S-S	2 PIN STRIPLINE PLUG
Q1	QMPP-D4P05	1	04713	MTD4P05-1	SMU10P05 POWER FET
Q2	QMPP-D4P05	1	04713	MTD4P05-1	SMU10P05 POWER FET
Q3	QMPP-D4P05	1	04713	MTD4P05-1	SMU10P05 POWER FET
Q4	QMPP-D4P05	1	04713	MTD4P05-1	SMU10P05 POWER FET
Q5	QMPP-D4P05	1	04713	MTD4P05-1	SMU10P05 POWER FET
Q6	QMPP-D4P05	1	04713	MTD4P05-1	SMU10P05 POWER FET
R1	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R2	RN55-02210	1	91637	RN55C2210F	221 OHMS 1% MET FILM
R3	RN55-02210	1	91637	RN55C2210F	221 OHMS 1% MET FILM
R4	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R5	RN55-02430	1	91637	RN55C2430F	243 OHMS 1% MET FILM
R6	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R7	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R8	RAPG-11000	1	32997	3296Z-1-102	1K 10% 25T POT
R9	RAPG-11000	1	32997	3296Z-1-102	1K 10% 25T POT
R10	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R11	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R12	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R13	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R14	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R15	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R16	RN50-31500	1	91637	RN50C1503F	150 K OHMS 1% METAL FILM
R17	RN50-27500	1	91637	RN50C7502F	75.0 K OHMS 1% MET FILM
R18	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R19	RN50-31500	1	91637	RN50C1503F	150 K OHMS 1% METAL FILM
R20	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R21	RN50-03320	1	91637	RN50C3320F	332 OHMS 1% METAL FILM

120BA04650 POWER SUPPLY PCA (A11), Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R22	WSB0-20000	1	58900	WSB0-20000	20 GA BUS WIRE
R23	RW03-00060	1	91637	RS-2B-6-1	6 OHM 3W WIREWOUND
R24	WSB0-20000	1	58900	WSB0-20000	20 GA BUS WIRE
R25	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R26	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R27	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R28	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R29	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R30	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
U1	URC0-00317	1	66958	LM317T	LM317C ADJ 3 TERM REG
U2	URC0-00317	1	66958	LM317T	LM317C ADJ 3 TERM REG
U3	URC0-07815	1	01295	L7815C	MC7815CT 1A 15V REG
U4	URG0-00317	1	27014	LM317H	LM317HVH 1A ADJ REGULATR
U5	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U6	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U7	UIN0-01413	1	01295	ULN2003AN	MC1413P X7 DRIVER .5A
U8	ULN0-00311	1	01295	LM311P	LM311N COMPARATOR
W1	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
W2	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER

120BA06951 100 MHz PLL PCA (A14), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120BS06951	REF	58900	120BS06951	100 MHz PLL SCH
3	120BF06951	1	58900	120BF06951	100 MHz PLL PCB
4	ETST-06224	5	58900	ETST-06224	TURRET TERMINAL
5	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C8	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C9	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C11	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C12	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C13	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C14	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C15	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C16	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C17	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C21	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C22	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C23	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C24	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C29	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C31	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C32	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C33	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C34	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C35	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C36	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C37	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C38	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C41	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C42	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C43	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C44	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C46	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C47	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C48	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C49	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C52	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C53	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C54	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C55	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C56	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C57	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C58	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C59	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C60	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C61	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C62	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U

120BA06951 100 MHz PLL PCA (A14), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C63	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C64	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C65	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR1	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR2	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR7	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR8	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CX28	CC50-00100	REF	31433	C315C100J2G5CA	10 PF CERAMIC NPO
CX30	CC50-00100	REF	31433	C315C100J2G5CA	10 PF CERAMIC NPO
DS1	ILRR-10125	1	28480	HLMP-K101	RED LED
J2	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J3	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J4	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J5	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J6	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J7	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J8	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
L1	LAD0-06220	1	91637	IMS5-22UH-10%	22 UH INDUCTOR
L2	LAD0-08120	1	91637	IMS 5 1200 UH 10	1200 UH INDUCTOR
L3	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
P1	JIA1-03230	1	58900	JIA1-03230	3 PIN STRIPLINE PLUG
P2	JIA1-02230	1	55322	TSW-102-07-S-S	2 PIN STRIPLINE PLUG
P3	JIA1-02230	1	55322	TSW-102-07-S-S	2 PIN STRIPLINE PLUG
Q1	QBNS-04275	1	58900	QBNS-04275	PN4275 .1A 15V .6W NPN
Q2	QBNS-03643	1	66958	PN3643	PN3643 .5A 30V .6W NPN
Q3	QBPS-02907	1	58900	QBPS-02907	PN2907 .5A 40V .6W PNP
Q4	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
Q5	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
Q6	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
R1	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R2	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R3	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R4	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R5	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R6	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R7	RN50-14750	1	91637	RN50C4751F	4.75 K OHMS 1% MET FILM
R8	RN50-04750	1	91637	RN50C4750F	475 OHMS 1% METAL FILM
R9	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R10	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R11	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R12	RN50-24750	1	91637	RN50C4752F	47.5K OHMS 1% MET FILM
R13	RN50-24750	1	91637	RN50C4752F	47.5K OHMS 1% MET FILM
R14	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R15	RN50-32740	1	91637	RN50C2734F	274 K OHMS 1% MET FILM
R16	RN50-22000	1	91637	RN50C2002F	20.0 K OHMS 1% MET FILM
R17	RN50-22000	1	91637	RN50C2002F	20.0 K OHMS 1% MET FILM
R18	RN50-34990	1	91637	RN50C4993F	499 K OHMS 1% MET FILM
R19	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R20	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R21	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R22	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R23	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R24	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R25	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R26	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R27	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R28	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R29	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R30	RN50-32740	1	91637	RN50C2734F	274 K OHMS 1% MET FILM

120BA06951 100 MHz PLL PCA (A14), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R31	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R32	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R33	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R34	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R35	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R36	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R37	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R38	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R39	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R40	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R41	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R42	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R43	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R44	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R45	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R46	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R47	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R48	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R49	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R50	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R51	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R52	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R53	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R54	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R55	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R56	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R57	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R58	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R59	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R60	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R61	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R62	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R63	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R64	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
U1	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U2	UTN0-01252	1	01295	SN74HC125AN	MC74HC125N QUAD BUFFER
U3	URP0-78150	1	04713	MC78L15ACP	MC78L15 .1A 15V REG
U4	UEN0-10138	1	04713	MC10138P PLASTIC	MC10138P BI-QUINARY CTR
U5	UEN0-12040	1	04713	MC12040P	MC12040P PHASE/FREQ DET
U6	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U7	ULN0-00311	1	01295	LM311P	LM311N COMPARATOR
U8	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U9	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U10	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U11	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U12	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U13	ULN0-00311	1	01295	LM311P	LM311N COMPARATOR
U14	ULN0-00311	1	01295	LM311P	LM311N COMPARATOR
U15	UEN1-10113	1	04713	MC10H113L	MC10H113P QUAD OR GATE
U16	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U17	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U18	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U19	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U20	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U21	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U22	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U23	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U24	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U25	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U26	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
VR1	DZAD-04732	1	58900	DZAD-04732	IN4732A 4.7 V ZENER

120BA08800 1 HZ PLL PCA (A15), Rev: J

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120CF08800	1	58900	120CF08800	1 HZ PLL PCB
2	101CF38200	1	58900	101CF38200	1 HZ BOTTOM SHIELD
3	101CF38100	1	58900	101CF38100	1 HZ TOP SHIELD
4	101BF38000	1	58900	101BF38000	1 HZ TOP SHIELD COVER
5	WJIB-02022	3	58900	WJIB-02022	.2 INSULATED JUMPER
101	HBFP-25603	15	26233	NS139CR256R3	2-56 X 3/16 FLAT
102	HBFP-25607	15	58900	HBFP-25607	2-56 X 7/16 FLAT
103	HQIP-00180	5	32559	104-020 PERM-O-P	TO18 INSULATOR
C1	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C2	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C3	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C4	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C5	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C6	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C7	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C10	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C11	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C12	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C13	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C14	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C15	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C16	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C17	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C18	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C19	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C20	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C21	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C22	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C23	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C24	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C25	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C26	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C27	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C28	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C29	CC50-00680	1	31433	C315C680J2G5CA	68 PF CERAMIC NPO
C30	CC50-00047	1	31433	C315C479D2G5CA-9248	4.7 PF CERAMIC NPO
C31	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C32	CC50-00390	1	31433	C315C390J2G5CA	39 PF CERAMIC NPO
C33	CE16-R7470	1	55680	UVX1C471MPA	470 UF 16V RADIAL LEAD
C34	CE16-R7470	1	55680	UVX1C471MPA	470 UF 16V RADIAL LEAD
C35	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C36	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C37	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C38	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C39	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C40	CC50-00680	1	31433	C315C680J2G5CA	68 PF CERAMIC NPO
C41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C42	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C43	CC50-00047	1	31433	C315C479D2G5CA-9248	4.7 PF CERAMIC NPO
C44	CC50-00390	1	31433	C315C390J2G5CA	39 PF CERAMIC NPO
C45	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C46	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C47	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C48	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C49	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C50	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C51	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C52	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C53	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C54	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C55	CC50-00220	1	31433	C315C220J2G5CA	22 PF CERAMIC NPO

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C56	CC50-00220	1	31433	C315C220J2G5CA	22 PF CERAMIC NPO
C57	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C58	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C59	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C60	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C61	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C62	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C63	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C64	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C65	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C66	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C67	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C68	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C69	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR1	DVA0-00109	1	26629	KV3901	MV109 6-30 PF DIODE
CR2	DVA0-00109	1	26629	KV3901	MV109 6-30 PF DIODE
CR3	DVA0-00109	1	26629	KV3901	MV109 6-30 PF DIODE
CR4	DVA0-00109	1	26629	KV3901	MV109 6-30 PF DIODE
CR6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR7	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR8	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR9	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR11	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR12	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR13	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR14	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
DS1	ILRR-10125	1	28480	HLMP-K101	RED LED
GND1	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
J2	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J3	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
L1	LAD0-04100	1	91637	IMS 5 .10 UH 10%	.10UH INDUCTOR
L2	LAB0-03820	1	99800	1026-1	.082 UH INDUCTOR
L3	LAD0-06220	1	91637	IMS5-22UH-10%	22 UH INDUCTOR
L4	LAD0-06220	1	91637	IMS5-22UH-10%	22 UH INDUCTOR
L5	LAD0-06220	1	91637	IMS5-22UH-10%	22 UH INDUCTOR
L6	LAD0-06220	1	91637	IMS5-22UH-10%	22 UH INDUCTOR
L7	LAB0-03820	1	99800	1026-1	.082 UH INDUCTOR
L8	LAD0-04330	1	91637	IMS 5 .33 UH 10%	.33 UH INDUCTOR
L9	LAD0-04330	1	91637	IMS 5 .33 UH 10%	.33 UH INDUCTOR
L10	LAD0-05270	1	91637	IMS 5 2.7uH 5%	2.7 UH INDUCTOR
Q1	QBNS-06304	1	04713	2N2857	2N6304 15V 1400MHZ NPN
Q2	QBNS-06304	1	04713	2N2857	2N6304 15V 1400MHZ NPN
Q3	QBNS-06304	1	04713	2N2857	2N6304 15V 1400MHZ NPN
Q4	QBNS-06304	1	04713	2N2857	2N6304 15V 1400MHZ NPN
Q5	QBNS-06304	1	04713	2N2857	2N6304 15V 1400MHZ NPN
Q6	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
R1	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R2	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R3	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R4	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R5	RN50-24990	1	91637	RN50C4992F	49.9 K OHMS 1% MET FILM
R6	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R7	RN50-24990	1	91637	RN50C4992F	49.9 K OHMS 1% MET FILM
R8	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R9	RN50-26980	1	91637	RN50C6982F	69.8 K OHMS 1% MET FILM
R10	RN50-26980	1	91637	RN50C6982F	69.8 K OHMS 1% MET FILM
R11	RN50-22000	1	91637	RN50C2002F	20.0 K OHMS 1% MET FILM
R12	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R13	RN50-24990	1	91637	RN50C4992F	49.9 K OHMS 1% MET FILM
R14	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R15	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R16	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R17	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R18	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R19	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R20	RN50-01300	1	91637	RN50C1300F	130 OHMS 1% METAL FILM
R21	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R22	RN50-31500	1	91637	RN50C1503F	150 K OHMS 1% METAL FILM
R23	RN50-23320	1	91637	RN50C3322F	33.2 K OHMS 1% MET FILM
R24	RN50-23320	1	91637	RN50C3322F	33.2 K OHMS 1% MET FILM
R25	RN50-23320	1	91637	RN50C3322F	33.2 K OHMS 1% MET FILM
R26	RN50-23320	1	91637	RN50C3322F	33.2 K OHMS 1% MET FILM
R27	RN50-22000	1	91637	RN50C2002F	20.0 K OHMS 1% MET FILM
R28	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R29	RN50-00221	1	91637	RN50C22R1F	22.1 OHM 1% METAL FILM
R30	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R31	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R32	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R33	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R34	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R35	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R36	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R37	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R38	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R39	RN50-03320	1	91637	RN50C3320F	332 OHMS 1% METAL FILM
R40	RN50-03320	1	91637	RN50C3320F	332 OHMS 1% METAL FILM
R41	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R42	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R43	RN50-16980	1	91637	RN50C6981F	6.98 K OHMS 1% MET FILM
R44	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R45	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R46	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R47	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R48	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R49	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R50	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R51	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R54	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R55	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R56	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R57	RN50-16190	1	91637	RN50C6191F	6.19 K OHMS 1% MET FILM
R58	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R59	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R60	RN50-01300	1	91637	RN50C1300F	130 OHMS 1% METAL FILM
R61	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R62	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R63	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R64	RN50-33320	1	91637	RN50C3323F	332 K OHMS 1% MET FILM
R65	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R66	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R67	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R68	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R69	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R70	RN50-00825	1	91637	RN50C82R5F	82.5 OHMS 1% METAL FILM
R71	RN50-00825	1	91637	RN50C82R5F	82.5 OHMS 1% METAL FILM
RX52	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX53	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
TP1	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
TP2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
U1	UCN0-51460	1	04713	MC145146P2	MC145146P FREQ SYNTH
U2	UIN0-08793	1	58900	UIN0-08793	SP8793 DIVIDE BY 40/41
U3	UIN0-08793	1	58900	UIN0-08793	SP8793 DIVIDE BY 40/41
U4	UTN0-03901	1	01295	SN74LS390N	SN74LS390N DUAL COUNTER
U5	UCN0-51460	1	04713	MC145146P2	MC145146P FREQ SYNTH
U6	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U7	UIN0-08793	1	58900	UIN0-08793	SP8793 DIVIDE BY 40/41

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
U8	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U9	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U10	UTN0-01252	1	01295	SN74HC125AN	MC74HC125N QUAD BUFFER
U11	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U12	UEN0-12040	1	04713	MC12040P	MC12040P PHASE/FREQ DET
U13	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U14	UEN0-12013	1	04713	MC12013P	MC12013 DIV 10/11 600MHZ
U15	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U16	UEN0-10231	1	04713	MC10231P	MC10231P DUAL D F/F
U17	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U18	UTN0-00042	1	01295	SN74HC04N	SN74HC04 HEX INVERTER
VR1	DZAD-04734	1	04713	1N4734	IN4734 6.2V ZENER

120BA07000 REF/DC PLL PCA (A16), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS07000	REF	58900	120BS07000	REF/DC PLL SCH
1	120CF07000	1	58900	120CF07000	REF/DC PLL PCB
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-01100	1	04222	SR151A101JAA	100 PF CERAMIC NPO
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C6	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C12	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C13	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C14	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C15	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C20	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C21	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C24	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C28	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C29	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C32	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C34	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C35	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C36	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C37	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C38	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C42	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C46	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C54	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C55	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C61	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C62	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C63	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C64	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C65	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C66	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C67	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C68	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C69	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C70	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C71	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR1	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR2	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR3	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR4	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR8	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR9	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR10	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR11	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR12	DSA0-00300	1	27014	FDH300	FDH300 LOW LEAK DIODE
CR13	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR14	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR16	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
DS1	ILRR-10125	1	28480	HLMP-K101	RED LED
DS2	ILRR-10125	1	28480	HLMP-K101	RED LED
GND1	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
J2	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J3	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J4	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J5	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
L1	LAD0-08120	1	91637	IMS 5 1200 UH 10	1200 UH INDUCTOR
L2	LAD0-06100	1	91637	IMS-5 10UH 10%	10 UH INDUCTOR
Q1	QBPS-02907	1	58900	QBPS-02907	PN2907 .5A 40V .6W PNP
Q2	QBPS-02907	1	58900	QBPS-02907	PN2907 .5A 40V .6W PNP
R2	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R3	RN55-00562	1	91637	RN55C56R2F	56.2 OHMS 1% MET FILM
R4	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R5	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R7	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R18	RN55-23830	1	91637	RN55C3832F	38.3 K OHMS 1% MET FILM
R19	RN55-23830	1	91637	RN55C3832F	38.3 K OHMS 1% MET FILM
R20	RN55-17500	1	91637	RN55C7501F	7.5 K OHMS 1% MET FILM
R21	RN55-17500	1	91637	RN55C7501F	7.5 K OHMS 1% MET FILM
R22	RN55-23830	1	91637	RN55C3832F	38.3 K OHMS 1% MET FILM
R23	RN55-00100	1	91637	RN55C10R0F	10 OHMS 1% MET FILM
R24	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R25	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R27	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R28	RN55-32000	1	91637	RN55C2003F	200 K OHMS 1% MET FILM
R29	RN55-32000	1	91637	RN55C2003F	200 K OHMS 1% MET FILM
R30	RN55-13920	1	91637	RN55C3921F	3.92 K OHMS 1% MET FILM
R31	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R32	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R33	RN55-15620	1	91637	RN55C5621B	5.62 K OHMS 1% MET FILM
R34	RN55-41000	1	91637	RN55C1004F	1 M OHMS 1% MET FILM
R35	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R36	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R37	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R38	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R39	RN55-17500	1	91637	RN55C7501F	7.5 K OHMS 1% MET FILM
R40	RN55-17500	1	91637	RN55C7501F	7.5 K OHMS 1% MET FILM
R41	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R42	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R43	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R44	RN55-03010	1	91637	RN55C3010F	301 OHMS 1% MET FILM
R45	RN55-03010	1	91637	RN55C3010F	301 OHMS 1% MET FILM
R46	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R52	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R55	RN55-21780	1	91637	RN55C1782F	17.8 K OHMS 1% MET FILM
R56	RN55-21780	1	91637	RN55C1782F	17.8 K OHMS 1% MET FILM
R57	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R58	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R59	RN55-21780	1	91637	RN55C1782F	17.8 K OHMS 1% MET FILM
R60	RN55-00100	1	91637	RN55C10R0F	10 OHMS 1% MET FILM
R61	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R62	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R63	RN55-29090	1	91637	RN55C9092F	90.9 K OHMS 1% MET FILM
R64	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R65	RN55-13920	1	91637	RN55C3921F	3.92 K OHMS 1% MET FILM
R66	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R67	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R68	RN55-15620	1	91637	RN55C5621B	5.62 K OHMS 1% MET FILM
R69	RN55-41000	1	91637	RN55C1004F	1 M OHMS 1% MET FILM
R70	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R71	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R72	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R73	RN55-31000	1	91637	RN55C1003F	100 K OHMS 1% MET FILM
R74	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R75	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R76	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R77	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R78	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R79	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
R80	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R81	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
R82	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R83	RN55-03010	1	91637	RN55C3010F	301 OHMS 1% MET FILM
RM1	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM2	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM3	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
TP1	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
TP2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
U1	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U2	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U3	UEN0-10131	1	04713	MC10131L	MC10131P DUAL D F/F
U4	UEN0-10131	1	04713	MC10131L	MC10131P DUAL D F/F
U5	UEN0-12040	1	04713	MC12040P	MC12040P PHASE/FREQ DET
U6	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U7	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U8	ULN0-00311	1	01295	LM311P	LM311N COMPARATOR
U9	UON0-00842	1	24355	AD842JN	AD842 80 MHZ OP AMP
U10	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U11	UEN0-12040	1	04713	MC12040P	MC12040P PHASE/FREQ DET
U12	UEN0-10131	1	04713	MC10131L	MC10131P DUAL D F/F
U13	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U14	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U15	ULN0-00311	1	01295	LM311P	LM311N COMPARATOR
U16	ULN0-00311	1	01295	LM311P	LM311N COMPARATOR
U17	UTN0-01542	1	01295	74HC154NT	SN74HC154NT 4 TO 16 MUX
U18	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U19	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP

120BA07000 REF/DC PLL PCA (A16), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
U20	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U21	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U22	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U23	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U24	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U25	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U26	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U27	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U28	UTN0-01252	1	01295	SN74HC125AN	MC74HC125N QUAD BUFFER
U29	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
VR1	DZAD-04734	1	04713	1N4734	IN4734 6.2V ZENER

120BA07150 DIVIDE BY N PCA (A17), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS07150	REF	58900	120BS07150	DIVIDE BY N SCH
1	120CF07100	1	58900	120CF07100	DIVIDE BY N PCB
2	304BF09200	2	58900	304BF09200	PC BD SHIELD COVER
3	304CF09100	1	58900	304CF09100	TOP PC SHEILD 1.25 X 2.5
4	304CF09500	1	58900	304CF09500	BOTTOM PC BD SHIELD 1.25
5	HBCH-A3204	1	58900	HBCH-A3204	10-32 X 1/4 CAP
6	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
7	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
8	HWSS-A0500	1	58900	HWSS-A0500	#10 X 3/16 SPLIT LOCK
101	HBFP-25606	10	26233	NS139CR256R6	2-56 X 3/8 FLAT
102	HBFP-25603	10	26233	NS139CR256R3	2-56 X 3/16 FLAT
AR1	MA23-00006	1	28480	MSA-0835X	0-6 GHZ +12.5DBM AMP
AR2	MA23-00006	1	28480	MSA-0835X	0-6 GHZ +12.5DBM AMP
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C6	CC50-01510	1	58900	CC50-01510	510 PF CERAMIC NPO
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C18	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C19	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C20	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C21	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C22	CK50-00150	1	54583	CC0805HNP0150150JT	15 PF NPO CHIP
C23	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C24	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C25	CK50-00150	1	54583	CC0805HNP0150150JT	15 PF NPO CHIP
C26	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C27	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C28	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C29	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C30	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C32	CK50-03100	1	31433	C0805C103K5RAC	.01 UF X7R CHIP
C34	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C35	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

120BA07150 DIVIDE BY N PCA (A17), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C36	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C38	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C44	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C52	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C53	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C54	CK50-00100	1	54583	CC0805HNPO15150J	10 PF NPO CHIP
C55	CK50-00100	1	54583	CC0805HNPO15150J	10 PF NPO CHIP
C56	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C57	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C58	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C59	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR1	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR2	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR3	DAA0-03401	1	28480	5082-3080	MPN3401 PIN DIODE
CR4	DAA0-03401	1	28480	5082-3080	MPN3401 PIN DIODE
CR7	DAA0-03401	1	28480	5082-3080	MPN3401 PIN DIODE
CR8	DAA0-03401	1	28480	5082-3080	MPN3401 PIN DIODE
J2	JRBM-00000	1	58900	JRBM-00000	SMB M BULK MOUNT
J3	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
L1	LAB0-03220	1	99800	1026-00	.022 UH INDUCTOR
L2	LAD0-06220	1	91637	IMS5-22UH-10%	22 UH INDUCTOR
L3	LAB0-03330	1	99800	1026-04	.033 UH INDUCTOR
Q1	QBPS-02907	1	58900	QBPS-02907	PN2907 .5A 40V .6W PNP
R1	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
R6	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R7	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R10	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R11	RN55-13920	1	91637	RN55C3921F	3.92 K OHMS 1% MET FILM
R12	RN55-34750	1	91637	RN55C4753F	475 K OHMS 1% MET FILM
R13	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R14	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R15	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R16	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R17	RN55-00825	1	91637	RN55C82R5F	82.5 OHMS 1% MET FILM
R18	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R19	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R21	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
R22	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R23	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R24	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R25	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R26	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R27	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R28	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R29	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R30	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R31	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R32	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R33	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
R34	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R35	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R36	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R37	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R38	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R39	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R40	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R41	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R42	RN50-00562	1	65940	CRB20FX5622B	56.2 OHMS 1% METAL FILM

120BA07150 DIVIDE BY N PCA (A17), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
RM1	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM2	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM3	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM4	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM5	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM6	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
U1	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U2	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U3	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U4	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U5	UEN0-10136	1	04713	MC10136P	MC10136P HEX COUNTER
U6	UEN0-10136	1	04713	MC10136P	MC10136P HEX COUNTER
U7	UEN0-10131	1	04713	MC10131L	MC10131P DUAL D F/F
U8	UEN0-10109	1	04713	MC10109L	MC10109P DUAL OR/NOR
U9	UEN0-10131	1	04713	MC10131L	MC10131P DUAL D F/F
U10	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U11	UEN0-12011	1	04713	MC12011L CERAMIC	MC12011 DIV BY 8/9 600MH
U12	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U13	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U14	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U15	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U16	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U17	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U18	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U19	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U20	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U21	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U22	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U23	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U24	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
W1	JIA1-02230	1	55322	TSW-102-07-S-S	2 PIN STRIPLINE PLUG

120BA07215 GT9000S OUTPUT PLL PCA (A18), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS07215	REF	58900	120BS07215	OUTPUT PLL SCH;GT9000S
1	120CF07210	1	58900	120CF07210	OUTPUT PLL PCB
2	ETST-06224	5	58900	ETST-06224	TURRET TERMINAL
C1	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C2	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C3	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C8	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C10	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C12	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C15	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C17	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C24	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

120BA07215 GT9000S OUTPUT PLL PCA (A18), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C28	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C32	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C33	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C34	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C35	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C42	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C43	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C44	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C45	CC50-01150	1	31433	C315C151G5CA-9248	150 PF CERAMIC NPO
C46	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C47	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C48	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C49	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C50	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C51	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C52	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C53	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C54	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C55	CC50-00100	1	31433	C315C100J2G5CA	10 PF CERAMIC NPO
C56	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C57	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C58	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C59	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C60	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C61	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C62	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C63	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C64	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C65	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C66	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C67	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C68	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C69	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C70	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C71	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C72	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C73	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C74	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C75	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C76	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C77	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C78	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C79	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C80	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C81	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C83	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C84	CC50-04220	1	31433	C322C224M5U5CA	.22 UF CERAMIC Z5U
C85	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C86	CC50-00100	1	31433	C315C100J2G5CA	10 PF CERAMIC NPO
C87	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C88	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C89	CC50-01330	1	31433	C315C331K1G5CA	330 PF CERAMIC NPO
C90	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C91	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C92	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C93	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C94	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C95	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C96	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
CR3	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR4	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE

120BA07215 GT9000S OUTPUT PLL PCA (A18), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
CR6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CRX1	DSA0-02810	REF	28480	5082-2800	5082-2810 SCHOT. DIODE
CRX2	DSA0-02810	REF	28480	5082-2800	5082-2810 SCHOT. DIODE
CX13	CC50-?????	1	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX16	CC50-?????	1	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX21	CC50-?????	1	58900	CC50-?????	COMPONENT SELECTED IN TEST
DS1	ILRR-10125	1	28480	HLMP-K101	RED LED
J2	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
J3	JRBM-00101	1	09769	903-373J-51A	SMB M RTANG PC MOUNT
K1	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH
K2	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH
K3	SEP0-00101	1	58900	SEP0-00101	5V DIP REED SWITCH
L1	LAD0-08120	1	91637	IMS 5 1200 UH 10	1200 UH INDUCTOR
L2	LAD0-08120	1	91637	IMS 5 1200 UH 10	1200 UH INDUCTOR
L3	LAD0-06270	1	91637	IMS 5 27 UH 5%	27 UH INDUCTOR
L4	LAD0-05470	1	91637	IMS 5 4.7 UH 5%	4.7 UH INDUCTOR
L5	LAD0-07820	1	91637	IMS 5 820 UH 10%	820UH INDUCTOR
L6	LAD0-07820	1	91637	IMS 5 820 UH 10%	820UH INDUCTOR
L7	LAD0-07150	1	24759	MR-150 5%	150 UH INDUCTOR
R1	RN50-02740	1	91637	RN50C2740F	274 OHMS 1% METAL FILM
R2	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R3	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R4	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R5	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R6	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R7	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R10	RN50-34990	1	91637	RN50C4993F	499 K OHMS 1% MET FILM
R11	RN50-13920	1	91637	RN50C3921F	3.92 K OHMS 1% MET FILM
R12	RN50-13920	1	91637	RN50C3921F	3.92 K OHMS 1% MET FILM
R13	RN50-16810	1	91637	RN50C6811F	6.81 K OHMS 1% MET FILM
R14	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R15	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R16	RN50-34990	1	91637	RN50C4993F	499 K OHMS 1% MET FILM
R17	RN50-34990	1	91637	RN50C4993F	499 K OHMS 1% MET FILM
R18	RN50-23740	1	91637	RN50C3742F	37.4 K OHMS 1% MET FILM
R19	RN50-16810	1	91637	RN50C6811F	6.81 K OHMS 1% MET FILM
R20	RN50-23740	1	91637	RN50C3742F	37.4 K OHMS 1% MET FILM
R21	RN50-13920	1	91637	RN50C3921F	3.92 K OHMS 1% MET FILM
R23	RN50-16810	1	91637	RN50C6811F	6.81 K OHMS 1% MET FILM
R24	RN50-34990	1	91637	RN50C4993F	499 K OHMS 1% MET FILM
R25	RN50-23740	1	91637	RN50C3742F	37.4 K OHMS 1% MET FILM
R26	RN50-26980	1	91637	RN50C6982F	69.8 K OHMS 1% MET FILM
R27	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R28	RN50-26980	1	91637	RN50C6982F	69.8 K OHMS 1% MET FILM
R29	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R30	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R31	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R33	RAPG-11000	1	32997	3296Z-1-102	1K 10% 25T POT
R34	RAPG-11000	1	32997	3296Z-1-102	1K 10% 25T POT
R35	RAPG-11000	1	32997	3296Z-1-102	1K 10% 25T POT
R39	RN50-02210	1	91637	RN50C2210F	221 OHMS 1% METAL FILM
R40	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R41	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R42	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R43	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R44	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R45	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R46	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R47	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R48	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R49	RN50-21500	1	91637	RN50C1502F	15.0 K OHMS 1% MET FILM
R50	RN50-18250	1	91637	RN50C8251F	8.25 K OHMS 1% MET FILM
R51	RN50-13320	1	91637	RN50C3321F	3.32 K OHMS 1% MET FILM

120BA07215 GT9000S OUTPUT PLL PCA (A18), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R52	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R53	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R54	RN50-11500	1	91637	RN50C1501F	1.50 K OHMS 1% MET FILM
R55	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R56	RN55-11820	1	91637	RN55C1821F	1.82 K OHMS 1% MET FILM
R57	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R58	RN50-14120	1	91637	RN50C4121F	4.12 K OHMS 1% MET FILM
R59	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R60	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R61	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R62	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R63	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R64	RN50-13320	1	91637	RN50C3321F	3.32 K OHMS 1% MET FILM
R65	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R66	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R67	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R68	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R69	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R70	RN50-17500	1	91637	RN50C7501F	7.50 K OHMS 1% MET FILM
R71	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R72	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R73	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R74	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R75	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R76	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R77	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R78	RN50-02740	1	91637	RN50C2740F	274 OHMS 1% METAL FILM
R79	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R80	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R82	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R83	RN50-21470	1	91637	RN50C1472F	14.7 K OHMS 1% MET FILM
R84	RN50-13320	1	91637	RN50C3321F	3.32 K OHMS 1% MET FILM
R85	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
R86	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R87	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R88	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R89	RN50-14750	1	91637	RN50C4751F	4.75 K OHMS 1% MET FILM
R90	RN50-14750	1	91637	RN50C4751F	4.75 K OHMS 1% MET FILM
R91	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
RX22	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX81	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
RX92	RN50-?????	REF	58900	RN50-?????	COMPONENT SELECTED IN TEST
U1	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U2	UEN0-12040	1	04713	MC12040P	MC12040P PHASE/FREQ DET
U3	UEN0-10138	1	04713	MC10138P PLASTIC	MC10138P BI-QUINARY CTR
U4	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U5	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U6	ULN0-00311	1	01295	LM311P	LM311N COMPARATOR
U7	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
U8	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U9	UTN0-01252	1	01295	SN74HC125AN	MC74HC125N QUAD BUFFER
U10	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U11	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U12	UIN0-07868	1	24355	AD7868AN	AD7868AN 12 BIT ADC/DAC
U14	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U15	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U16	UON0-00842	1	24355	AD842JN	AD842 80 MHZ OP AMP
U17	UON0-00842	1	24355	AD842JN	AD842 80 MHZ OP AMP
U18	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U19	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U20	UON0-00842	1	24355	AD842JN	AD842 80 MHZ OP AMP
U21	UON0-00842	1	24355	AD842JN	AD842 80 MHZ OP AMP
U22	UON0-00842	1	24355	AD842JN	AD842 80 MHZ OP AMP

120BA07215 GT9000S OUTPUT PLL PCA (A18), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
U23	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
W1	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER

120BA08351 GT9000S YIG DRIVER PCA (A19), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS08351	REF	58900	120BS08351	YIG DRIVER SCH; GT9000S
1	120CF08300	1	58900	120CF08300	YIG DRIVER PCB
2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
3	WJIB-02022	2	58900	WJIB-02022	.2 INSULATED JUMPER
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C3	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C8	CT25-R6100	1	31433	T356E106K025AS	10 UF 25V RADIAL LEAD
C9	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C12	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C18	CT25-R6100	1	31433	T356E106K025AS	10 UF 25V RADIAL LEAD
C19	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C22	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C23	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C24	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C25	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C26	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C27	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C28	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C29	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C30	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C31	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C32	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C33	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C34	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C35	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C36	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C37	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C38	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C39	CT25-R6100	1	31433	T356E106K025AS	10 UF 25V RADIAL LEAD
C40	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C41	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C42	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C43	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C44	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C45	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C46	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C47	CC50-03220	1	31433	C315C223K5R5CA	.022 UF CERAMIC X7R
C48	CT25-R6100	1	31433	T356E106K025AS	10 UF 25V RADIAL LEAD
C49	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U

120BA08351 GT9000S YIG DRIVER PCA (A19), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C50	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C52	CE50-R6100	1	55680	UVX1H100MDA	10 UF 50V RADIAL LEAD
C53	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C54	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C55	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C56	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C57	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C58	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C59	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C60	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C61	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C62	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C63	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C64	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C65	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C66	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C67	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C68	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C69	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C70	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C71	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C72	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
Q1	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
Q2	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
Q3	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
Q4	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
Q5	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
Q6	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
Q7	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
Q8	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
R1	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R2	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R3	RN56-24750	1	58900	RN56-24750	47.5 K OHMS 1% METAL FILM
R4	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R5	RN56-23920	1	91637	RN55E3922F	39.2 K OHMS 1% METAL FILM
R6	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R7	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R8	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R9	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R10	12449-026	1	58900	12449-026	5.00 KOHM .1% MET FILM
R11	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R12	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R13	RAPG-15000	1	32997	3296Z-1-502	5K 10% 25T .5W TRIM. POT
R14	RN56-24750	1	58900	RN56-24750	47.5 K OHMS 1% METAL FILM
R15	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R16	RN56-23920	1	91637	RN55E3922F	39.2 K OHMS 1% METAL FILM
R17	RN55-21020	1	91637	RN55C1022F	10.2 K OHMS 1% MET FILM
R18	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R19	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R20	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R21	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R22	12449-026	1	58900	12449-026	5.00 KOHM .1% MET FILM
R23	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R24	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R25	RAPG-15000	1	32997	3296Z-1-502	5K 10% 25T .5W TRIM. POT
R26	RN56-22490	1	91637	RN55E24992F	24.9 K OHMS 1% METAL FILM
R27	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R28	RN56-21500	1	91637	RN55E1502F	15 K OHMS 1% METAL FILM

120BA08351 GT9000S YIG DRIVER PCA (A19), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R29	RN55-21400	1	91637	RN55C1402F	14 K OHMS 1% MET FILM
R30	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R31	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R32	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R33	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R34	12449-026	1	58900	12449-026	5.00 KOHM .1% MET FILM
R35	RAPG-15000	1	32997	3296Z-1-502	5K 10% 25T .5W TRIM. POT
R36	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R37	RAPG-15000	1	32997	3296Z-1-502	5K 10% 25T .5W TRIM. POT
R38	RN56-26650	1	91637	RN55E6652F	66.5 K OHMS 1% METAL FILM
R39	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R40	RN56-21690	1	58900	RN56-21690	16.9 K OHMS 1% METAL FILM
R41	RN55-22260	1	91637	RN55C2262F	22.6 K OHMS 1% MET FILM
R42	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R43	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R44	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R45	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R46	12449-026	1	58900	12449-026	5.00 KOHM .1% MET FILM
R47	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R48	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R49	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R50	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R51	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R52	RN50-41000	1	91637	RN50C1004F	1.00 M OHMS 1% MET FILM
R53	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R54	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R55	RN50-41000	1	91637	RN50C1004F	1.00 M OHMS 1% MET FILM
R56	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R57	RN50-41000	1	91637	RN50C1004F	1.00 M OHMS 1% MET FILM
R58	RN50-41000	1	91637	RN50C1004F	1.00 M OHMS 1% MET FILM
R59	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R60	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R61	RN55-32320	1	65940	RN55C2323F	232 K OHMS 1% MET FILM
R62	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R63	RN55-13920	1	91637	RN55C3921F	3.92 K OHMS 1% MET FILM
R64	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R65	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R66	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R67	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R68	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R69	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R70	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R71	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R72	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R73	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R74	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R75	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R76	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R77	RN50-02000	1	91637	RN50C2000F	200 OHMS 1% METAL FILM
R78	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R79	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R80	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R81	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R82	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R83	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
TC1	120BA17105	1	58900	120BA17105	TEMP COMP RES ASSY 750K
TC2	120BA17105	1	58900	120BA17105	TEMP COMP RES ASSY 750K
TC3	120BA17104	1	58900	120BA17104	TEMP COMP RES ASSY 475K
TC4	120BA17102	1	58900	120BA17102	TEMP COMP RES ASSY 402K
U1	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U2	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U3	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U4	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC

120BA08351 GT9000S YIG DRIVER PCA (A19), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
U5	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U6	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
U7	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U8	UVNP-00100	1	24355	AD587JK	AD587 10V 20PPM REF
U9	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U10	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U11	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U12	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
U13	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U14	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U15	ULN0-02901	1	01295	LM2901N	LM2901N QUAD COMPARATOR
U16	UVNP-00100	1	24355	AD587JK	AD587 10V 20PPM REF
U17	UTN0-00862	1	01295	74HC86N	74HC86 QUAD 2 INPUT X OR
U18	UTN0-01232	1	2M881	CD74HC123	74HC123 RETRIG. MULTI
U19	UTN0-00742	1	58900	UTN0-00742	74HC74 DUAL D FLIP FLOP
U20	UTN0-00862	1	01295	74HC86N	74HC86 QUAD 2 INPUT X OR
U21	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U22	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U23	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U24	UTN0-01232	1	2M881	CD74HC123	74HC123 RETRIG. MULTI
U25	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U26	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U27	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U28	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U29	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U30	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP

1202221000 GT9000 DISP DRIVER PCA (A20), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS21000	REF	58900	120BS21000	DISPLAY DRIVER SCH;GT900
1	1203321000	1	58900	1203321000	DISPLAY DRIVER PCB, GT9000
2	HQH1-02200	1	13103	THERMALLOY 6073B	TO220 HEATSINK
101	HBPP-44006	1	26233	NS137CR440R6	4-40 X 3/8 PAN
102	HWFN-40400	1	58900	HWFN-40400	#4 X 1/4 NYLON WASHER
103	HNSS-44004	1	96906	MS35649-244	4-40 HEX NUT
104	HQWC-01260	1	04713	B52200F006	TO126 DOME WASHER
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

1202221000 GT9000 DISP DRIVER PCA (A20), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C21	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C23	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C24	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C25	CE16-R7470	1	55680	UVX1C471MPA	470 UF 16V RADIAL LEAD
C27	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C28	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C29	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C30	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
P1	JIA1-05295	1	27264	22-11-2052	5 PIN LOCKING STRIP PLUG
P2	JIR1-10260	1	27264	22-12-2104	10 PIN LOCKING STRIP PLG
P5	JIA2-26460	1	52072	CA-D26-23B-46	26 PIN STRIPLINE PLUG
P9	JIR1-20034	1	58900	JIR1-20034	34 PIN STRPLN PLG RT ANG
P11	JIR1-20034	1	58900	JIR1-20034	34 PIN STRPLN PLG RT ANG
P34	JIA2-34460	1	52072	CA-D34-23B-46	34 PIN STRIPLINE PLUG
P60	JIR1-20060	1	58900	JIR1-20060	60 PIN STRPLN PLG RT ANG
R1	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R2	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R3	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R4	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R5	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R6	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R7	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R8	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R9	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R10	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
R11	RN55-00150	1	91637	RN55C15R0F	15 OHMS 1% MET FILM
R12	RN55-00221	1	91637	RN55C22R1F	22.1 OHMS 1% MET FILM
R13	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
R14	RW05-00100	1	91637	RS-5,10ohm , 1%	10 OHM 5W WIREWOUND
U1	UTN0-01322	1	01295	MC74HC132E	SN74HC132N 4X SCHMIDT NAN
U2	UTN0-01971	1	01295	SN74LS197N	74LS197 PRESETTABLE DECA
U3	UMN0-02128	1	4W070	LH5116-10	TMM2016 2K X 8 RAM
U4	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U5	UTN0-45142	1	01295	SN74HC4514NT	74HC4514 DECODERS/DEMULT
U6	UMN0-02128	1	4W070	LH5116-10	TMM2016 2K X 8 RAM
U7	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U8	UTN0-45142	1	01295	SN74HC4514NT	74HC4514 DECODERS/DEMULT
U9	UIN0-00594	1	58900	UIN0-00594	NE594 8X DISP DRIVE
U10	UIN0-00594	1	58900	UIN0-00594	NE594 8X DISP DRIVE
U11	UIN0-00594	1	58900	UIN0-00594	NE594 8X DISP DRIVE
U12	UIN0-00594	1	58900	UIN0-00594	NE594 8X DISP DRIVE
U13	UMN0-02128	1	4W070	LH5116-10	TMM2016 2K X 8 RAM
U14	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U15	UTN0-45142	1	01295	SN74HC4514NT	74HC4514 DECODERS/DEMULT
U16	UMN0-02128	1	4W070	LH5116-10	TMM2016 2K X 8 RAM
U17	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U18	UTN0-45142	1	01295	SN74HC4514NT	74HC4514 DECODERS/DEMULT
U19	UIN0-00594	1	58900	UIN0-00594	NE594 8X DISP DRIVE
U20	UIN0-00594	1	58900	UIN0-00594	NE594 8X DISP DRIVE
U21	UIN0-00594	1	58900	UIN0-00594	NE594 8X DISP DRIVE
U22	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U23	UTN0-02442	1	01295	SN74HC244N	74HC244 8X DRIV/RECV
U24	URC0-07805	1	04713	MC7805CT	MC7805CT 1A 5V REG

101BA39101 HI STAB OSC PCA (A21), Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	101BS39101	REF	58900	101BS39101	HI STAB OSC
1	101BF39101	1	58900	101BF39101	HI STAB OSC PCB
C1	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C2	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
R1	RAPD-31000	1	58900	RAPD-31000	100K POT 15T PC MNT
Y1	OXO0-00010	1	6Y341	250-0578	10MHZ OVEN OSCILATOR

120BA01000 COMPUTER BUS PCA (A100), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120CF01000	1	58900	120CF01000	COMPUTER BUS PCB
2	JPS0-20036	20	58900	JPS0-20036	72 PIN PC EDGE CONN
3	JIA2-60460	1	52072	CA-D60-23B-46	60 PIN STRIPLINE PLUG
4	JIA2-50460	1	52072	CA-D50-23B-46	50 PIN STRIPLINE PLUG
5	JIA2-26460	1	52072	CA-D26-23B-46	26 PIN STRIPLINE PLUG
6	JSP0-10014	1	09769	2-641609-1	14 PIN DIP SOCKET
7	ETSB-06216	130	58900	ETSB-06216	BIFURCATED TERMINAL
8	WSB0-26000	2	16428	8023	26 GA BUS WIRE
L1	LAD0-06330	1	91637	IMS-5 33UH 10%	33 UH INDUCTOR
L2	LAD0-06330	1	91637	IMS-5 33UH 10%	33 UH INDUCTOR
L3	LAD0-06330	1	91637	IMS-5 33UH 10%	33 UH INDUCTOR
L4	LAD0-06330	1	91637	IMS-5 33UH 10%	33 UH INDUCTOR

120BA07300 I/O BUSS PCA (A101), Rev: F

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120CF07300	1	58900	120CF07300	I/O BUSS PCB
2	JPS0-20050	9	58900	JPS0-20050	100 PIN PC EDGE CONN
3	JIA2-60460	1	52072	CA-D60-23B-46	60 PIN STRIPLINE PLUG
4	ETSB-06216	148	58900	ETSB-06216	BIFURCATED TERMINAL

120BA05520 11 DIGIT DISPLY PCA NVFD (A103), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120BF05520	1	58900	120BF05520	11 DIGIT DISPLY PCB NVFD
2	HSTS-44005	1	55566	3048-B-440-A-0	5/16 ROUND SWAGE SPACER
3	HSTX-44004	2	58900	HSTX-44004	4-40 CORNR BLOCK 1/16 MT
4	GFU0-00004	8	58900	GFU0-00004	1/4 X 1/8 FOAM TAPE
5	GFU0-00201	16	58900	GFU0-00201	1/8 X 1/16 FOAM TAPE
6	GFU0-00001	4	58900	GFU0-00001	1/4 X 1/16 FOAM TAPE
DS1	IMF0-10110	1	0LU72	FG1113RE1	11 DIGIT FLUOR DISPLAY
P11	JIA2-34460	1	52072	CA-D34-23B-46	34 PIN STRIPLINE PLUG

120BA05620 5&9 DIG DISPLAY PCA NVFD (A104), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120BF05620	1	58900	120BF05620	5&9 DIG DISPLAY PCB NVFD
2	HSTS-44005	2	55566	3048-B-440-A-0	5/16 ROUND SWAGE SPACER
3	HSTX-44004	3	58900	HSTX-44004	4-40 CORNR BLOCK 1/16 MT
4	GFU0-00004	14	58900	GFU0-00004	1/4 X 1/8 FOAM TAPE
5	GFU0-00201	28	58900	GFU0-00201	1/8 X 1/16 FOAM TAPE
6	GFU0-00001	8	58900	GFU0-00001	1/4 X 1/16 FOAM TAPE
7	4202355600	1	58900	4202355600	FILTER 5 DIGIT DISPLAY NVFD
DS1	IMF0-10090	1	0LU72	FG913S6	9 DIGIT FLUOR DISPLAY
DS2	IMF0-10050	1	0LU72	FG512J6	5 DIGIT FLUOR DISPLAY
P5	JIA2-26460	1	52072	CA-D26-23B-46	26 PIN STRIPLINE PLUG
P9	JIA2-34460	1	52072	CA-D34-23B-46	34 PIN STRIPLINE PLUG

120BA04801 M7200 PUSHBUTTON BD PCA (A105), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS04801	REF	58900	120BS04801	PUSHBUTTON BD SCH M7200
1	120CF04800	1	58900	120CF04800	PUSHBUTTON BD PCB
2	SPPL-K0102	1	04426	80-390102	LT GRY KEYCAP W/LIGHT
3	SPPL-K0110	14	04426	80-390110	.25 LT GRY KEYCAP W/LITE
4	SPPL-K0112	1	04426	80-390112	.25 LT GRY KEYCAP W/O LT
5	HWFN-80401	15	32559	912	#8 X 1/4 NYLON WASHER
6	SPPL-L0100	15	04426	80-390100	LIGHT PIPE
DS1	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS2	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
P34	JIR1-20034	1	58900	JIR1-20034	34 PIN STRPLN PLG RT ANG
S1	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S2	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S3	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S5	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S6	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S7	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S8	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S9	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S10	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S11	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S12	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S13	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S15	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S16	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S17	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S18	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY

120BA01511 M7300 DATA ENTRY PCA (A106), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS01511	REF	58900	120BS01511	DATA ENTRY M7300 SCH
1	120CF01500	1	58900	120CF01500	DATA ENTRY PCB
2	SPPL-K0112	7	04426	80-390112	.25 LT GRY KEYCAP W/O LT
3	SPPL-K0110	2	04426	80-390110	.25 LT GRY KEYCAP W/LITE
4	120BF05800	1	58900	120BF05800	PROGRAM KEY CAP
5	SPPL-K9027	3	58900	SPPL-K9027	RECTANGULAR KEYCAP
6	120BF05900	2	58900	120BF05900	ARROW KEY CAP
7	120BF05700	1	58900	120BF05700	SHIFT KEY CAP
8	120BF06000	1	58900	120BF06000	KEY PAD 0
9	120BF06001	1	58900	120BF06001	KEY PAD 1
10	120BF06002	1	58900	120BF06002	KEY PAD 2
11	120BF06003	1	58900	120BF06003	KEY PAD 3
12	120BF06004	1	58900	120BF06004	KEY PAD 4
13	120BF06005	1	58900	120BF06005	KEY PAD 5
14	120BF06006	1	58900	120BF06006	KEY PAD 6
15	120BF06007	1	58900	120BF06007	KEY PAD 7
16	120BF06008	1	58900	120BF06008	KEY PAD 8
17	120BF06009	1	58900	120BF06009	KEY PAD 9
18	120BF06010	1	58900	120BF06010	KEY PAD DECIMAL POINT
19	120BF06011	1	58900	120BF06011	KEY PAD MINUS & BACKSPACE
20	SPPL-K0106	4	04426	80-390106	LT GRY KEYCAP W/O LIGHT
21	SPPL-K9027	1	58900	SPPL-K9027	RECTANGULAR KEYCAP
22	HWFN-80401	9	32559	912	#8 X 1/4 NYLON WASHER
23	SPPL-L0100	2	04426	80-390100	LIGHT PIPE
C1	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C2	CC50-03680	1	31433	C320C683K5R5CA	.068 UF CERAMIC X7R
C3	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C4	CC50-03680	1	31433	C320C683K5R5CA	.068 UF CERAMIC X7R
C5	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C6	CC50-03680	1	31433	C320C683K5R5CA	.068 UF CERAMIC X7R
C7	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C8	CC50-03680	1	31433	C320C683K5R5CA	.068 UF CERAMIC X7R
DS1	IML0-00080	1	28480	HDSP-2113 (clear)	8 DIGIT GREEN LED
DS2	IML0-00080	1	28480	HDSP-2113 (clear)	8 DIGIT GREEN LED
DS3	IML0-00080	1	28480	HDSP-2113 (clear)	8 DIGIT GREEN LED
DS4	IML0-00080	1	28480	HDSP-2113 (clear)	8 DIGIT GREEN LED
DS5	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS6	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS7	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS8	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS9	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS10	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS11	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS12	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS13	ILGR-01660	1	3T059	E166	CLEAR GREEN LED
DS14	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS15	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS16	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS17	ILGR-01540	1	28480	HLMP 1540	CLEAR GREEN LED
DS18	ILYR-01440	1	28480	HLMP-1440	CLEAR YELLOW LED
P2	JIA1-04295	1	27264	22-11-2042	4 PIN LOCKING STRIP PLUG
P60	JIR1-20060	1	58900	JIR1-20060	60 PIN STRPLN PLG RT ANG
R1	RN55-15110	1	91637	RN55C5111F	5.11 K OHMS; METAL FILM
S1	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S2	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S3	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S4	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S5	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S6	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S7	120BA06700	1	58900	120BA06700	PUSHBUTTON SW MOM/LED ASY
S8	120BA06711	1	58900	120BA06711	PUSHBUTTON SW ASY MNT
S11	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S12	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY

120BA01511 M7300 DATA ENTRY PCA (A106), Rev: E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
S13	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S14	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S15	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S16	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S17	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S18	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S19	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S20	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S21	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S22	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S23	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S24	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S25	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S26	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S27	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S28	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S29	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S30	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S31	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S32	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S33	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S34	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
S35	120BA06701	1	58900	120BA06701	PUSHBUTTON SW ASY
XDS1	JSE0-20028	1	51167	28-8675-610-C	28 PIN ELEVATOR SOCKET
XDS2	JSE0-20028	1	51167	28-8675-610-C	28 PIN ELEVATOR SOCKET
XDS3	JSE0-20028	1	51167	28-8675-610-C	28 PIN ELEVATOR SOCKET
XDS4	JSE0-20028	1	51167	28-8675-610-C	28 PIN ELEVATOR SOCKET

120BA12900 MAIN TUNE PCA (A107), Rev: A1

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120BF12900	1	58900	120BF12900	MAIN TUNE PCB
2	ETSB-06216	22	58900	ETSB-06216	BIFURCATED TERMINAL
3	HSCS-40304	2	05791	AL6311B-0.187	#4 X 3/16 SWG CLR SPACER
C1	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C2	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C3	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C4	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
CR1	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
CR2	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
CR3	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
CR4	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
CR5	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
CR6	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
CR7	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
CR8	DPAB-05391	1	14936	1N5391	1N5391 1.5A 35V DIODE
R1	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM
R2	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM
R3	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM
R4	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM

120BA07900 DETECTOR BUFFER PCA (A200), Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS07900	REF	58900	120BS07900	DETECTOR BUFFER SCH
1	120CF07900	1	58900	120CF07900	DETECTOR BUFFER PCB
2	120CF08500	1	58900	120CF08500	DETECTOR BUFFER HOUSING
3	120BF08600	1	58900	120BF08600	DETECTOR BUFFER COVER
4	120BF08700	1	58900	120BF08700	DETECTOR BUFFER BASE
5	ETSB-06216	14	58900	ETSB-06216	BIFURCATED TERMINAL
6	HSFH-60204	2	55566	RAF 4728-B-12	6-32 X 1/8 M/M SPACER
7	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
8	WSB0-26000	20	16428	8023	26 GA BUS WIRE
9	HBPP-44004	4	26233	NS137CR440R4	4-40 X 1/4 PAN
10	HWSS-40300	4	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
11	HWFS-40400	4	58900	HWFS-40400	#4 X 1/4 FLAT WASHER
12	HBPP-25603	32	26233	NS137CR0256R3	2-56 X 3/16 PAN
13	HWSS-20200	32	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
C1	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C2	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C3	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C4	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C5	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C6	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C7	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C8	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C9	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C10	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C13	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C14	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C15	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C16	CC50-02150	1	31433	C320C152J1G5CA-9248	1500 PF CERAMIC
C18	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C19	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C20	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C21	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C22	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
CX17	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
J1	JRBM-00000	1	58900	JRBM-00000	SMB M BULK MOUNT
J2	JRBM-00000	1	58900	JRBM-00000	SMB M BULK MOUNT
J3	JRBM-00000	1	58900	JRBM-00000	SMB M BULK MOUNT
J4	JRBM-00000	1	58900	JRBM-00000	SMB M BULK MOUNT
J5	JRBM-00000	1	58900	JRBM-00000	SMB M BULK MOUNT
J6	JRBM-00000	1	58900	JRBM-00000	SMB M BULK MOUNT
J7	JRBM-00000	1	58900	JRBM-00000	SMB M BULK MOUNT
L1	LAD0-08120	1	91637	IMS 5 1200 UH 10	1200 UH INDUCTOR
L2	LAD0-08120	1	91637	IMS 5 1200 UH 10	1200 UH INDUCTOR
L3	LAD0-06100	1	91637	IMS-5 10UH 10%	10 UH INDUCTOR
L4	LAD0-06100	1	91637	IMS-5 10UH 10%	10 UH INDUCTOR
P1	LFT0-83208	1	09769	92-4068-009-1	FEED-THRU FILTER 15A
P2	LFT0-83208	1	09769	92-4068-009-1	FEED-THRU FILTER 15A
P3	LFT0-83208	1	09769	92-4068-009-1	FEED-THRU FILTER 15A
P4	LFT0-83208	1	09769	92-4068-009-1	FEED-THRU FILTER 15A
P5	LFT0-83208	1	09769	92-4068-009-1	FEED-THRU FILTER 15A
P6	LFT0-83208	1	09769	92-4068-009-1	FEED-THRU FILTER 15A
P7	LFT0-83208	1	09769	92-4068-009-1	FEED-THRU FILTER 15A
Q1	QMNS-00214	1	06049	SD214DE	SD214DE,5V VGS
Q2	QMNS-00214	1	06049	SD214DE	SD214DE,5V VGS
Q3	QMNS-00214	1	06049	SD214DE	SD214DE,5V VGS
Q4	QMNS-00214	1	06049	SD214DE	SD214DE,5V VGS
Q5	QMNS-00214	1	06049	SD214DE	SD214DE,5V VGS
R1	RN55-21910	1	91637	RN55C1912F	19.1 K OHMS 1% MET FILM
R2	RN50-22000	1	91637	RN50C2002F	20.0 K OHMS 1% MET FILM
R3	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R4	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM

120BA07900 DETECTOR BUFFER PCA (A200), Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R5	RN50-05620	1	91637	RN50D5620F	562 OHMS 1% METAL FILM
R6	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R7	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R8	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R9	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R10	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R11	RN50-19090	1	91637	RN50C9091F	9.09 K OHMS 1% MET FILM
R12	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R13	RN50-04020	1	91637	RN50C4020F	402 OHMS 1% METAL FILM
R14	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R15	RN55-22000	1	91637	RN55C2002F	20 K OHMS 1% MET FILM
R16	RN55-06650	1	91637	RN55C6650F	665 OHMS 1% MET FILM
R18	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R19	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R20	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R21	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R22	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R23	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
U1	UON0-00840	1	24355	AD 840JN	AD840 OP AMP
U2	UON0-00845	1	24355	AD845AQ	AD845 OP AMP
U3	UON0-00420	1	1ES66	MAX420CPA	LM420 CMOS OP AMP
U4	ULN0-02901	1	01295	LM2901N	LM2901N QUAD COMPARATOR
U5	UON0-00037	1	58900	UON0-00037	ADOP37 OP AMP

120CA11502 100MHZ MODULE ASY; GT9000 (A201), Rev: D

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	004BA00001	1	58900	004BA00001	SAMPLER ASSEMBLY
2	101BF04300	2	58900	101BF04300	SAMPLER IF WALL
3	101BF04400	1	58900	101BF04400	SAMPLER DRIVER WALL
4	101BF04500	1	58900	101BF04500	SAMPLER DRIVER SUPPORT
5	101BF04600	2	58900	101BF04600	SAMPLER IF SUPPORT
6	101BF25901	1	58900	101BF25901	CONNECT.MTG PLATE 100MHZ
7	WSIB-242XX	4	58900	WSIB-242XX	24 GA PVC COLOR 2
9	LFT0-83208	8	09769	92-4068-009-1	FEED-THRU FILTER 15A
10	JRBM-00000	4	58900	JRBM-00000	SMB M BULK MOUNT
11	LFT1-83208	1	09769	92-4068-010-1	FEED-THRU FILTER 15A
12	URC0-07905	1	01295	UA7952CKC	MC7905.2CT 1A -5.2V REG
13	WSIB-245XX	4	58900	WSIB-245XX	24 GA PVC COLOR 5
14	HQWN-02200	1	04713	B51547F019	TO220 SHOULDER WASHER
15	HQIS-01260	1	55285	7403-09FR-51	TO126 INSULATOR
16	ETI0-07555	2	58900	ETI0-07555	FEED THRU TERMINAL
23	RN55-01300	1	91637	RN55C1300F	130 OHMS 1% MET FILM
24	RN55-00825	1	91637	RN55C82R5F	82.5 OHMS 1% MET FILM
25	101CA04203	1	58900	101CA04203	100 MHz MODULE PCA; GT9000
26	GELS-26125	REF	58900	GELS-26125	LS26 ECCOSORB
27	004BA00101	1	58900	004BA00101	SAMPLER ASSY REVERSE MTG
32	4202352100	2	58900	4202352100	SAMPLER GASKET
101	HBPP-44005	1	26233	NS137CR440R5	4-40 X 5/16 PAN
102	HQWC-01260	1	04713	B52200F006	TO126 DOME WASHER
103	HWFS-40400	1	58900	HWFS-40400	#4 X 1/4 FLAT WASHER
104	HBFP-25605	8	26233	NS139CR256R5	2-56 X 5/16 FLAT
105	HBPP-25605	6	26233	NS137CR256R5	2-56 X 1/4 PAN
106	HWSS-20200	10	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
107	HWFS-20300	4	7U905	5710-133-30P	#2 X 3/16 FLAT WASHER
108	HBPP-25604	4	58900	HBPP-25604	2-56 X 1/4 PAN
109	WRTE-249XX	18	92194	2844/1-1	#24 SOLID TEFLON
110	WSB0-24000	1	58900	WSB0-24000	24 GAUGE BUS WIRE
111	WKAC-12508	1	92194	FIT221-1/8D X 1/	1/8 X 1/2 SHRINK TUB
112	WTT0-22001	1	16428	#22AWG-TFE/TW	#22 CLEAR TFE SLVNG
C1	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C65	CC50-01120	1	31433	315C121K1G5CA-9248	120 PF CERAMIC NPO
L6	LAD0-06270	1	91637	IMS 5 27 UH 5%	27 UH INDUCTOR
L7	LAD0-04150	1	91637	IMS 5.15UH 5%	.15 UH INDUCTOR
L8	LAD0-04150	1	91637	IMS 5.15UH 5%	.15 UH INDUCTOR

101CA04203 100 MHz MODULE PCA; GT9000, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	101DS04203	REF	58900	101DS04203	100 MHz MODULE SCH; GT9000
1	101CF04200	1	58900	101CF04200	100MHZ MODULE PCB
2	ETSB-06216	24	58900	ETSB-06216	BIFURCATED TERMINAL
3	WRTE-249XX	1	92194	2844/1-1	#24 SOLID TEFLON
C1	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C2	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C3	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C4	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C5	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C6	CT20-06100	1	31433	T110B106K020AS	10 UF 20V TANTALUM
C7	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C8	CC50-00120	1	31433	C315C120J2G5CA	12 PF CERAMIC NPO
C9	CC50-00120	1	31433	C315C120J2G5CA	12 PF CERAMIC NPO
C10	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
C11	CT20-06100	1	31433	T110B106K020AS	10 UF 20V TANTALUM

101CA04203 100 MHz MODULE PCA; GT9000, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C12	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C13	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CT20-06100	1	31433	T110B106K020AS	10 UF 20V TANTALUM
C17	CT20-06100	1	31433	T110B106K020AS	10 UF 20V TANTALUM
C18	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C19	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C20	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C21	CC50-00150	1	31433	C315C150J2G5CA	15 PF CERAMIC NPO
C22	CC50-00330	1	31433	C315C330J2G5CA C9248	33 PF CERAMIC NPO
C23	CV00-01012	1	18736	EF14	1-14 PF VARIABLE
C24	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C25	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C26	CC50-00047	1	31433	C315C479D2G5CA-9248	4.7 PF CERAMIC NPO
C27	CC50-00100	1	31433	C315C100J2G5CA	10 PF CERAMIC NPO
C28	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C29	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C30	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C31	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C32	CV00-09035	1	59660	538-011D-9-35	9-35 PF VARIABLE
C33	CV00-09035	1	59660	538-011D-9-35	9-35 PF VARIABLE
C34	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C35	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C36	CT20-06100	1	31433	T110B106K020AS	10 UF 20V TANTALUM
C37	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C38	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C39	CC50-00680	1	31433	C315C680J2G5CA	68 PF CERAMIC NPO
C40	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C41	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C42	CC50-00680	1	31433	C315C680J2G5CA	68 PF CERAMIC NPO
C43	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C44	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C45	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C46	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C47	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C48	CT20-06100	1	31433	T110B106K020AS	10 UF 20V TANTALUM
C49	CC50-00150	1	31433	C315C150J2G5CA	15 PF CERAMIC NPO
C50	CC50-00180	1	31433	C315C180J2G5CA	18 PF CERAMIC NPO
C51	CT20-06100	1	31433	T110B106K020AS	10 UF 20V TANTALUM
C52	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C53	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
C54	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C55	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C57	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
C58	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
C59	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C60	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C61	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C62	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C63	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C66	CC50-00018	1	51642	100-100-NPO-189B	1.8 PF CERAMIC NPO
CR1	DVA0-00109	1	26629	KV3901	MV109 6-30 PF DIODE
CR2	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
HR1	Y35H-00150	1	12020	T05M-2D	15V H-35/U CRYSTAL OVEN
L1	LAD0-05150	1	91637	IMS 5.15UH 5%	1.5 UH INDUCTOR
L2	LAD0-05270	1	91637	IMS 5 2.7uH 5%	2.7 UH INDUCTOR
L3	420BA18006	1	58900	420BA18006	HANDWOUND INDUCTOR, 6 1/2 T
L4	420BA18006	1	58900	420BA18006	HANDWOUND INDUCTOR, 6 1/2 T
Q1	QBNS-06304	1	04713	2N2857	2N6304 15V 1400MHZ NPN
Q2	QBNS-06304	1	04713	2N2857	2N6304 15V 1400MHZ NPN
Q3	QBNS-04275	1	58900	QBNS-04275	PN4275 .1A 15V .6W NPN
Q4	QBNS-04275	1	58900	QBNS-04275	PN4275 .1A 15V .6W NPN
Q5	QBNS-04275	1	58900	QBNS-04275	PN4275 .1A 15V .6W NPN

101CA04203 100 MHz MODULE PCA; GT9000, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
Q6	QBNS-04275	1	58900	QBNS-04275	PN4275 .1A 15V .6W NPN
Q7	QBNS-06304	1	04713	2N2857	2N6304 15V 1400MHZ NPN
R1	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R2	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R3	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R4	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R5	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R6	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R7	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R8	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R9	RN55-15620	1	91637	RN55C5621B	5.62 K OHMS 1% MET FILM
R10	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R11	RN55-00100	1	91637	RN55C10R0F	10 OHMS 1% MET FILM
R12	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R14	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R15	RN55-22210	1	91637	RN55C2212F	22.1 K OHMS 1% MET FILM
R16	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R17	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R18	RN55-21000	1	91637	RN55C1002F	10 K OHMS 1% MET FILM
R19	RN55-16810	1	91637	RN55C6811F	6.81 K OHMS 1% MET FILM
R20	RN55-13920	1	91637	RN55C3921F	3.92 K OHMS 1% MET FILM
R21	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R22	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R23	RN55-11300	1	91637	RN55C1301F	1.3 K OHMS 1% MET FILM
R24	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R25	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R26	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R27	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R28	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R29	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R30	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R31	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R32	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R33	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R34	RN55-03320	1	91637	RN55C3320F	332 OHMS 1% MET FILM
R35	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R36	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R37	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R38	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R39	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R40	RN55-15620	1	91637	RN55C5621B	5.62 K OHMS 1% MET FILM
R41	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R42	RN55-00100	1	91637	RN55C10R0F	10 OHMS 1% MET FILM
R43	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
U1	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U2	UANP-00733	1	01295	UA733CN	UA733DC VIDEO AMP
U3	URP0-78120	1	04713	MC78L12ACP	MC78L12CP .1A 12V REG
U4	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U5	UEN0-10216	1	04713	MC10216PC	MC10216P TRIPLE RCVR
U6	UANP-00733	1	01295	UA733CN	UA733DC VIDEO AMP
Y1	Y351-10000	1	58900	Y351-10000	100MHz CRYSTAL HC35U

6.2 List of Manufacturers

The names and addresses of manufacturers cited in the preceding parts lists are shown in Table 7-1. Each manufacturer is listed under its CAGE number (COMMERCIAL AND GOVERNMENT ENTITY), as noted in the parts lists. In a few cases, no CAGE number has been assigned; these manufacturers are referenced by Giga-tronics codes which are shown at the end of the list.

Table 6-1. List of Manufacturers

CAGE	NAME	ADDRESS
0ABX4	Comptec Inc	7837 Custer School Rd Custer WA 98240
0AG18	Hirose Electric USA Inc	Chatsworth CA
0AX52	Ditom Microwave Inc	1180 Coleman Ave #103 San Jose CA 95110
0BE81	Aerovox-Mallory	20 Aberdeen Dr Glasgow KY 42141
0B0A9	Dallas Semiconductor Corp	6350 Beltwood Pky S Dallas TX 75244
0B549	Siemens Components Inc Semiconductor Group	2191 Laurelwood Rd Santa Clara CA 95054
0D2A6	Mitsubishi Electronics Inc	1050 East Arques Ave Sunnyvale CA 94086
0D3V2	Menlo Industries Inc	44060 Old Warm Springs Blvd Fremont CA 94538
0EUK7	All American Transistor of California Inc	369 Van Ness Way Suite 701 Torrance CA 90501
0GP12	Radiall Inc	150 Long Beach Blvd Stratford CT 06497
0GYA7	Signal Transformer Co	500 Bayview Ave Inwood NY 11696
0HS44	Pacific Millimeter	189 Linbrook Dr San Diego CA 92111
0HFH6	Futaba Corporation of America	555 West Victoria St Compton CA 90220
0HFJ2	Microplastic	9180 Gazette Ave Chatsworth CA 91311
0HIN5	Marcon America Corp	998 Forest Edge Dr Vernon Hills IL 60061
0H379	Aerowave Inc	344 Salem St Medford MA 02155
0J7V3	Amp Inc	19200 Stevens Creek Blvd Suite 1 Cupertino CA 95014
0JNR4	Dupont Eelectronics Customer Service Center	825 Old Trail Rd PO Box 80019 Wilmington DE 19880-0019
0KA21	Stetco Inc	3344 Schierhorn Ct Franklin Park IL 60131
00443	Waveline Inc	160 Passaic Ave West Caldwell NJ 07006
00656	Aerovox Inc	740 Belleville Ave New Bedford MA 02745
00750	Air Track Mfg Corp	College Park MD
00809	Croven Crystals	500 Beech St Whitby Ontario CAN L1N5S5
00815	Midland - Ross	357 Beloit St Burlington WI 53105
01121	Allen-Bradley Co	1201 South 2nd St Milwaukee WI 53204
01295	Texas Instruments Inc	13500 N Central Expwy Dallas TX 75265
01963	Cherry Electrical Products Corp	3600 Sunset Ave Waukegan IL 60087
02113	Coilcraft Inc	1102 Silver Lake Dr Cary IL 60013-1658
02490	Electronic Devices Inc	Hampden MA
02660	Amphenol Corp	358 Hall Ave Wallingford CT 06492
02735	RCA Corp	Route 202 Somerville NJ 08876
03614	Bussman Mfg	114 Old St Rd PO Box 144 St Louis MO 63178
04222	AVX Ceramics Div of AVX Corp	19th Ave South PO Box 867 Myrtle Beach SC 29577
04426	ITW Switches	6615 West Irving Park Rd Chicago IL 60634
04552	Grace W R and Co	869 Washington St Canton MA 02021
04713	Motorola Inc	5005 East McDowell Rd Phoenix AZ 85008
05236	Jonathan Manufacturing Corp	1101 South Acacia Ave Fullerton CA 92631
05245	Corcom Inc	1600 Winchester Rd Libertyville IL 60048
05276	ITT Pomona Electronics Div	1500 E 9th St PO Box 2767 Pomona CA 91766
05791	Lyn-Tron Inc	3150 Damon Way Burbank CA 91505
05820	EG and G Wakefield Engineering	60 Audubon Rd Wakefield MA 01880

CAGE	NAME	ADDRESS
05905	Jerobee Industries Inc	Redmond WA
06049	Topaz Inc	9192 Topaz Way San Diego CA 92123
06090	Raychem Corp	300 Constitution Dr Menlo Park CA 94025-1111
06349	Cam-Lok Div Empire Product Inc	10540 Chester Rd Cincinnati OH 45215
06383	Panduit Corp	17301 Ridgeland Tinley Park IL 60477
06540	New Haven Mfg Corp Amatom Div	446 Blake St New Haven CT 06515
06776	Robinson Nugent Inc	800 East 8th St New Albany IN 47150
06915	Richco Plastics Co	5825 N Tripp Ave Chicago IL 60646-6013
07115	Corning Glass Works	Houghton Pk Corning NY 14830
07180	Sage Laboratories Inc	East Natick Industrial Park 3 Huron Dr Natick MA 01760
07263	Fairchild Semiconductor Corp	Cupertino CA
07512	Oak Materials Group Inc	McCaffery St Hoosick Falls NY 12090
07556	Calabro Industries Inc	1372 Enterprise Dr West Chester PA 19380
09022	Cornell-Dubilier Electronics	1605 East Rodney French Blvd New Bedford MA 02741
09353	C and K Components Inc	15 Riverdale Ave Newton MA 02158
09922	Burndy Corp	1 Richards Ave Norwalk CT 06856
09969	Dale Electronics Inc	East Highway 50 PO Box 180 Yankton SD 57078
1AU47	Lucas Weinschel Inc	1 Weinschel Ln PO Box 6001 Gaithersburg MD
1BH13	Fenwall Electronics Inc	64 Fountain St Framingham MA 01701-6211
1BR23	CW Industries Inc	Atlanta GA 04000
1CY63	Sierra Microwave Technology	11295-B Sunrise Gold Circle Rancho Cordova CA 95670
1DS68	Sumner Mfg Inc	Hwy 411 S-Sumner Dr PO Drawer A Rome GA 30162
1ES66	Maxim Intergrated Products	510 North Pastoria Ave Sunnyvale CA 94086
1E584	Electrical Wire Products Bay Associates Inc	150 Jefferson Dr Menlo Park CA 94025-1115
1FN41	Atmel Corp	2125 Onel Dr San Jose CA 95131
1JJ60	Applied Tooling and Mfg Inc	1115 Industrial Ave Escondido CA 92025
1W232	Spacek Labs	528 Santa Barbara St Santa Barbara CA 93101
1Y147	Virtech	805 G University Ave Los Gatos CA 95030
11532	Teledyne Relays	12525 Daphne Ave Hawthorne CA 90250
11769	Elco/Dyntech Div of Elco Corp	1225 East Wakeham Ave Santa Ana CA 92702
12020	Ovenaire Div of Electronic Tech	706 Forrest St Charlottesville VA 22901
12457	Merrimac Industries Inc	41 Fairfield Pl West Caldwell NJ 07006
13103	Thermalloy Co Inc	2021 W Valley View Lane PO Box 810839 Dallas TX 75381
13511	Amphenol Cadre Div Bunker Ramo Corp	Los Gatos CA
13708	Allied Components	Inglewood CA
13919	Burr-Brown Corp	6730 S Tucson Blvd Tucson AZ 85734
14482	Watkins-Johnson Co	3333 Hillview Ave Palo Alto CA 94304
14552	Microsemi Corp	2830 S Fairview St Santa Ana CA 92704-5948
14604	Elmwood Sensors Inc	500 Narragansett Park Dr Pawtucket RI 02861
14936	General Instrument Corp Power Semiconductor Div	600 West John St Hicksville NY 11802
15268	RHG Electronics Laboratory Inc	161 East Industry Ct Deer Park NY 11729
15450	Erie Specialty Products Inc	645 W 11th Street Erie PA 16512
15542	Mini-Circuits Laboratory	2625 East 14th St Brooklyn NY 11235
15915	Tepro of Florida Inc	2608 Enterprise Rd Clearwater FL 33517
16179	M/A-Com Omni Spectra Inc	21 Continental Blvd Merrimack NH 03054
16352	Codi Semiconductor Inc	144 Market Street Kenilworth NJ 07033
16428	Cooper Industries Inc	350 NW N St Richmond IN 47374
16453	Western Microwave Inc	495 Mercury Dr Sunnyvale CA 94086
16508	Aerovox Corp	19th Ave S PO Box 867 Myrtle Beach SC 29577

CAGE	NAME	ADDRESS
16733	Radio Frequency Systems Inc Cablewave Systems Div	60 Dodge Ave North Haven CT 06473
17217	Gore W L and Associates Inc	555 Paper Mill Rd Newark DE 19714
17540	Alpha Industries Inc	20 Sylvan Rd Woburn MA 01801
17856	Siliconix Inc	2201 Laurelwood Rd Santa Clara CA 95054
18041	Diodes Inc Power Components Div	21243 Ventura Blvd Woodland Hills CA 91364-2109
18310	Concord Electronics Corp	30 Great Jones St New York NY 10012
18324	Signetics Corp	4130 South Market Ct Sacramento CA 95834
18364	Mag-Tool Co	940 American St San Carlos CA 94070
18714	RCA Corp Findlay Plant	1700 Fostoria Rd Findlay OH 45840
18736	Voltronics Corp	West St East Hanover NJ 07936
19701	Mepco/Electra Inc	PO Box 760 Mineral Wells TX 76067
2J873	Celeritex Inc	617 River Oaks Pky San Jose CA 95134
2J899	Dynawave Inc	94 Searle St PO Box 938 Georgetown MA 01833
2M734	Panasonic Co	PO Box 1502 Secaucus NJ 07094
2M881	Harris Corp Harris Semiconductor	883 Stierling Rd Suite 8120 Mountain View CA 94043-1930
2R182	Smith H H Co	325 N Illinois St Indianapolis IN 46204-1703
2V941	Microsource Inc	1269 Corporate Ctr Pky Santa Rosa CA 95407
20550	Engineering Mfg Co	Sheboygan WI
20944	Wiltron Co	805 East Middlefield Rd Mountain View CA 94042
20999	Minnesota Mining and Mfg Co	3M Center St Paul MN 55101
21604	Buckeye Stamping Co	555 Marion Rd Columbus OH 43207
21847	TRW Microwave Inc	825 Stewart Dr Sunnyvale CA 94086
22519	Data Delay Devices	385 Lakeview Ave Clifton NJ 07011
23499	Judd Wire Inc	870 Los Vallecitos Blvd San Marcos CA 92069
23899	Van Petty Mfg Inc	1168 Tourmaline Dr Newbury Park CA 91320
23936	Pamotor	770 Airport Blvd Burlingame CA 94010
24355	Analog Devices Inc	Rt 1 Industrial Park Norwood MA 02062
24539	Avantek Inc	3175 Bowers Ave Santa Clara CA 95054
24759	Lenox-Fugle Electronics Inc	100 Sylvania Place South Plainfield NJ 07080-1448
24931	Specialty Connector Co Inc	2100 Earlywood Dr PO Box 547 Franklin IN 46131
24995	Environmental Container System	3560 Rouge River Hwy Grants Pass OR 97526
26066	Minnesota Mining and Mfg. Co	3M Center St Paul MN 55101
26629	Frequency Sources Inc	16 Maple Rd Chelmsford MA 01824
26692	B and S Tool & Die Company	2300 Sulphur Spring Rd Baltimore MD 21227
26922	Cetec Corp	9900 Baldwin Place El Monte CA 91731
26923	Control Master Products Inc	1062 Shary Circle Concord CA 94518
27014	National Semiconductor Corp	2900 Semiconductor Dr Santa Clara CA 95051
27264	Molex Inc	2222 Wellington Ct Lisle IL 60532
27802	Vectron Laboratories Inc	166 Gover Ave Norwalk CT 06850
27851	Film Microelectronics	17 A St Burlington MA 01803
28480	Hewlett Packard Co	3000 Hanover St Palo Alto CA 94304
28520	Heyco Molded Products	750 Boulevard PO Box 160 Kenilworth NJ 07033
29005	Storm Products Co	112 South Glasglow Ave Inglewood CA 90301
29111	Trak Microwave Corp	735 Palomar Ave Sunnyvale CA 94086
29990	American Technical Ceramics	One Nordon Lane Huntington Stn NY 11746
3A054	McMaster-Carr Supply Co	9630 Norwalk Blvd Santa Fe Springs CA 90670
3E364	Vemaline	333 Strawberry Field Rd Warwick RI 02887
3W023	Philips Components Discrete Product Div	5083 Kings Hwy Saugerties NY 12477
3Z990	Tech Pro Inc	6243 E US Hwy 98 Panama City FL 32404-7434

CAGE	NAME	ADDRESS
30035	Jolo Industries Inc	13921 Nautilus Dr Garden Grove CA 92643-4026
30817	Instrument Specialties Co Inc	Exit 53 Route 80 PO Box A Delaware Water Gap PA 18327
31433	Kemet Electronics Corp	2835 Kemet Way Simpsonville SC 29681
31703	Gudrun Frederickson Co	Oakland CA
31757	Micrpac Industries Inc	905 E Walnut St Garland TX 75040
31781	Edac Inc	40 Tiffield Rd Scarborough Ont CAN M1V 5B6
31918	ITT Schadow Inc	8081 Wallace Rd Eden Prarie MN 55344
32293	Intersil Inc	2450 Walsh Ave Santa Clara CA 95051
32559	Bivar Inc	4 Thomas St Irvine CA 92718
32767	Griffith Plastics Corp	1027 California Dr Burlingame CA 94010
32997	Bourns Inc Trimpot Division	1200 Columbia Ave Riverside CA 92507
33592	Miteq Inc	100 Davids Dr Huappauge NY 11787
34031	Analog Devices	7810 Success Rd Greensboro NC 27409
34078	Midwest Microwave Inc	3800 Packard Rd Ann Arbor MI 48104
34335	Advanced Micro Devices Inc	901 Thompson Place Sunnyvale CA 94086
34553	Amperex Electronic Corp	Hauppauge NY 32732
34576	Rockwell International Corp	4311 Jamboree Rd Newport Beach CA 92660
34781	MCW Industries	129 Southside Drive Charlotte NC 28210
34785	Dek Inc	3480 Swenson Ave St Charles IL 60174
36437	Star Stainless Products Ltd	Montreal Que CAN H4T1N8
4F708	Hammond Mfg Co US Inc	1690 Walden Drive Buffalo NY 14225
4R125	Magnetec Corp	61 W Dudleytown Rd Bloomfield CT 06002
4S028	Brady W M Co Industrial Products Div	Milwaukee WI
4T165	NEC Electronics USA Inc Electron Div	401 Ellis St P.O. Box 7241 Mountain View CA 94039
4U402	Roederstein Electronics Inc	2100 W Front St Statesville NC 28677-3651
4U751	Advanced Semiconductors Inc	7525 Etmel Ave Unit 6 North Hollywood CA 91605-1912
46384	Penn Engineering & Mfg Corp	Old Easton Rd PO Box 1000 Danboro PA 18916
5H281	Allmetal Screw Products	Arlington TX
5J927	Interface Technology Div of Dynatech Corp	2100 E Alcosta Ave Glendora CA 91740
50721	Datel Inc	11 Cabot Blvd Mansfield MA 02048
51167	Aries Electronics Inc	62 Trenton Ave Frenchtown NJ 08825
51284	Mos Technology Inc	950 Rittenhouse Rd Norristown PA 19401
51642	Centre Engineering Inc	2820 East College Ave State College PA 16801
51705	Ico-Rally Corp	2575 East Bayshore Rd Palo Alto CA 94303
52063	Exar Integrated Systems	2222 Gume Dr PO Box 49007 San Jose CA 95161-9007
52072	Circuit Assembly Corp	18 Thomas St Irvine CA 92718
52648	Plessey Trading Corp	1641 Kaiser Ave Irvine CA 92714
52683	Baytron Co Inc	344 Salem St Medford MA 02155
52763	Stettner Electronics Inc	6135 Airways Blvd Chattanooga TN 37421
52840	Western Digital Corp	3128 Red Hill Ave Costa Mesa CA 92626
53387	Minnesota Mining & Mfg Co Electronic Products Div 3M	Austin TX
53421	Tyton Corp	7930 N Faulkner Rd PO Box 23055 Milwaukee WI 53223
53673	Thomson-CSF Components Corp	6660 Variel Ave Canoga Park CA 91304
54186	Micro Power Systems Inc	3100 Alfred St Santa Clara CA 95050
54343	Riedel M W and Co	300 Cypress Ave Alhambra CA 91801
54487	Micronetics Inc	36 Oak St Norwood NJ 07648
54516	National Cable Molding Corp	136 San Fernando Rd Los Angeles CA 90031
54558	SDI Inc	North Billerica MA
54583	TDK Electronics Corp	12 Harbor Park Dr Port Washington NY 11550

CAGE	NAME	ADDRESS
55153	Dielectric Laboratories Inc	69 Albany St Cazenovia NY 13035
55261	LSI Computer Systems Inc	1235 Walt Whitman Rd Melville NY 11747
55285	Bergquist Co Inc	5300 Edina Industrial Blvd Minneapolis MN 55435
55322	Samtec Inc	810 Progress Blvd PO Box 1147 New Albany IN 47150
55387	Pamtech	8030 Remmet Ave Canoga Park CA 91304
55566	RAF Electronic Hardware Inc	95 Silvermine Rd Seymour CT 06483-3915
55576	Synertek	3001 Stender Way Santa Clara CA 95051
55680	Nichicon America Corp	927 E State Pky Schaumburg IL 60195
55801	Compensated Devices Inc	166 Tremont St Melrose MA 02176-2204
55989	Semicon Inc Div of the Lorvic Corp	8810 Frost Ave St. Louis MO 63134-1002
56248	Consolidated Refining Co	115 Hoyt Ave Mamaroneck NY 10543
56289	Sprague Electric Co	87 Marshall St North Adams MA 01247
56501	Thomas & Betts Corp	1001 Frontier Rd Bridgewater NJ 08807
56563	Alatec Products	12747 Saticoy St North Hollywood CA 91605
56866	Quality Thermistor Inc	2147 Centurion Pl Boise ID 83709
57032	Daden Associates Inc	23011 Moulton Pky A-12 Laguna Hills CA 92653
57793	United Microwave Products Inc	185 West 205th St Torrance CA 90503
57834	Brim Electronics Inc	120 Home Pl Lodi NJ 07644-1514
58090	Thermometrics Inc	808 Rt 1 Edison NJ 08817-4624
58202	Innowave Inc	15555 Concord Circle Morgan Hill CA 95037
58361	General Instrument Corp Optoelectronics Div	3400 Hillview Ave Palo Alto CA 94304
58377	National Electronics	11731 Markon Dr Garden Grove CA 92641
58684	Magnetec Corp	61 W Dudleytown Rd Bloomfield CT 06002
58756	CTS Corp Electromechanical Div	1142 W Beardsley Ave Elkhart IN 46514
58758	Zambre Co Inc	2134M Old Middlefield Way Mountain View CA 94043-2404
58900	Giga-tronics Inc	4650 Norris Canyon Road San Ramon CA 94583
59124	KOA Speer Electronics Inc	Bolivar Dr PO Box 547 Bradford PA 16701
59365	Metelics Corp	975 Stewart Dr Sunnyvale CA 94086
59660	Tusonix Inc	2155 N Forbes Blvd #107 Tucson AZ 85745
59942	AVX Filters Corp	11144 Penrose St Sun Valley CA 91352
59980	Midwest Polychem Ltd	1502 N 25th Ave Melrose Park IL 60160
6A566	Tecknit Corp	320 North Nopal St Santa Barbara CA 93103
6V806	Frammar Mfg Inc (formerly Omni Spectra Corp)	6859 Tujunga Ave North Hollywood CA 91605
6Y341	Microwave Technology Inc	4268 Solar Way Fremont CA 94538
60393	Precision Resistive Products	655 Main St Mediapolis IA 52637
60395	Xicor Inc	851 Buckeye Ct Milpitas CA 95035
60450	Microwave Components Inc	7 Meehan Dr Chelmsford MA 01824
60583	Narda Microwave Corp	11040 White Rock Rd Suite 200 Rancho Cordova CA 95670
60644	CSDC	PO Box 2116 Wayne NJ 07470
61104	Aris Engineering Corp	30 Bond St Haverhill MA 01830
61429	Fox Electronics Inc	5570 Enterprise Pky Ft. Myers FL 33905
61485	Hitachi Denshi America Ltd	175 Crossways Park W Woodbury NY 11797
61529	Aromat Corp	629 Central Ave New Providence NJ 07974
61638	Advanced Interconnections	5 Energy Way West Warwick RI 02893
61772	Integrated Device Technology	3236 Scott Blvd PO Box 58015 Santa Clara CA 95052
61802	Toshiba International	13131 West Little York Rd Houston TX 77041
61964	Omron Electronics Inc	1E Commerce Schaumburg IL 60173
62277	Atlas Wire and Cable Corp	133 S Van Norman Rd Montebello CA 90640
62331	Krytar Inc	1292 Anvilwood Ct Sunnyvale CA 94086

CAGE	NAME	ADDRESS
62559	Schroff Inc	170 Commerce Dr Warwick RI 02886
62643	United Chemicon Inc	9806 Higgins St Rosemont IL 60018
63058	McKenzie Socket Technology Inc	44370 Old Warm Springs Blvd Fremont CA 94538
63132	Time Microwave	398 Martin Ave Santa Clara CA 95050
63345	Overland Products Co Inc	1687 Airport Rd Fremont NE 68025
63468	Electro Dynamics	5625 Foxridge Dr Shawnee Mission KS 66201
63542	Hall-Mark Electronics Corp	11333 Pagemill Rd Dallas TX 75243
64135	Filter Concepts	2624 S Rousselle St Santa Ana CA 92707
64155	Linear Technology Corp	1630 McCarthy Blvd Milpitas CA 95035
64671	Inmet Corp	300 Dino Dr Ann Arbor MI 48103
64859	AP Products Inc	9325 Progress Parkway Mentor OH 44061
65032	Rogers Corp	PO Box 700 Chandler AZ 85224
65449	Amtex Intl Inc	1878 Star Batt Rochester MI 48063
65517	Ayer Engineering Co	1250 West Roger Rd Tucson AZ 85705
65664	Catamount Mfg Inc	158 Governor Dr PO Box 720 Orange MA 01364
65940	Rohm Corp	8 Whatney Irvine CA 92714
65964	EVOX-RIFA Inc	100 Tri-State Intl. Suite 290 Lincolnshire IL 60069
66039	Kaycor International	1732 Central St Evanston IL 60201
66148	Fairlane Fluid/Air Products	23435 Industrial Park Dr Farmington MI 48024
66449	Microsource Inc	1269 Corporate Center Pky Santa Rosa CA 95407
66466	Standard Instrumentation Inc	3322 Pennsylvania Ave Charleston WV 25302
66544	Continental Microwave & Tool Co	10 Merrill Industrial Dr Hampton NH 03842-0998
66579	Waferscale Intergraton	47280 Kato Rd Fremont CA 94538
66958	SGS Semiconductor Corp	7117 E 3rd Ave Scottsdale AZ 52251
67297	Herotek Inc.	222 N Wolfe Rd Sunnyvale CA 94086
68459	River Run Enterprises Inc	2001 Jefferson Davis Ave Selma AL 36701
68630	Tadiran Electronics Industries Inc	3000 Dundee Rd Northbrook IL 60062
7E222	Littlefuse Tracor Inc	800 E Northwest Hwy Des Plaines IL 60016
7E585	Zero Mfg	777 Front St Burbank CA 91303
7M800	Analog Devices Inc	2444 Moorpark Ave San Jose CA 95128
7U905	Seastrom Inc	2351 Kentucky Ave Indianapolis IN 46241-4827
7W263	Huber and Suhner Ltd	Tumbleinstrass 20 Pfaffikon Switz CH-8330
70364	American Electric Switch Corp	Route 4 Rocky Hill Hwy Lancaster SC 29720
70903	Belden Corp	200 South Batavia Ave Geneva IL 60134
71034	Bliley Electric Co	2545 W Grandview Blvd Erie PA 16508
71218	Bud Industries	4605 E 355th St Willoughby OH 44094
71450	CTS Corp	1201 Cumberland Ave West Lafayette IN 47906
71468	ITT Corp ITT Cannon Div	666 E Dyer Rd Santa Ana CA 92702
71785	Labinal Components and Systems Inc	1521 Morse Ave Elk Grove Village IL 60007
72259	Nytronics Inc	475 Park Ave South New York NY 10016
72982	Murata Erie North America Inc	645 West 11th St Erie PA 16512
73138	Beckman Industrial	4141 Palm St Fullerton CA 92635
73734	Federal Screw Products Inc	3917 N Kedzie Ave Chicago IL 60618-3415
74840	Illinois Capacitor Inc	3757 W Touhy Ave Lincolnwood IL 60645
74970	Johnson E F Co	299 10th Ave South West Waseca MN 56093
75263	Keystone Carbon Co Inc	1935 State St St Marys PA 15857
75332	Kings Electronics Co Inc	Brooklyn NY (relocated; see CAGE 91836)
75378	CTS Knights Inc	400 Reimann Ave Sandwich IL 60548
75915	Tracor Littlefuse Inc	800 East Northwest Hwy Des Plains IL 60016

CAGE	NAME	ADDRESS
78553	Eaton Corp Engineered Fasteners Div	14701 Detroit Ave Lakewood OH 44107-4101
79963	Zierick Mfg Co	Radio Circle Mt Kisko NY 10549
8B649	Intel Corp	3065 Bowers Ave Santa Clara CA 95051
8E631	Solitron-MIC	Port Salerno FL (relocated; see CAGE 95077)
8G639	Wavecom	Sunnyvale CA 94086
8K805	Omni Spectra Inc	Los Altos CA
8Z313	LMS Electronics	34101 Monroe Rd Charlotte NC 28205
81073	Grayhill Inc	561 Hillgrove Ave La Grange IL 60525
81312	Winchester Electronics	400 Park Rd Watertown CT 06795
81349	Military specification promulgated by military departments/agencies under authority of Defense Standardization Manual 4120 3-M	
81703	Mulberry Metal Products Inc	2199 Stanley Terrace Union NJ 07083
81774	Carol Wire and Cable Corp	249 Roosevelt Ave Pawtucket RI 02860
82152	Transco Products Inc	4241 Glenco Ave Marina Del Ray CA 90295
82199	Polarad Electronics Inc	5 Delaware Drv Lake Success NY 11042
82877	Rotron Inc	7 Hasbrouck Lane Woodstock NY 12498
83330	Kulka Smith Inc	1913 Atlantic Ave Manasquan NJ 08736
84084	American Iron and Machine Work	720 Industrial Blvd Oklahoma City OK
84171	ARCO Electronics	400 Moreland Rd Commack NY 11725-5707
84411	American Shizuki Corp	301 W O St Ogallala NE 69153
86797	Rogan Corp	3455 Woodhead Dr Northbrook IL 60062
88245	Winchester Electronics	13536 Saticoy St Van Nuys CA 91409
89110	Amp Inc	1595 South Mt Joy St Elizabethtown PA 17022
9B003	Dynamics Corp of America Electronics Systems Div	Encino CA
9W826	EZ Form Cable Corp	315 Peck St Bldg 24 New Haven CT 06513
9Z397	Fujitsu Component of America Inc	3320 Scott Blvd Santa Clara CA 95054-3101
90201	Mallory Capacitor Co	4760 Kentucky Ave Indianapolis IN 46206
91303	KOL Inc	St Paul MN
91506	Augat Inc	452 John Dietsch Blvd Attleboro Falls MA 02763
91637	Dale Electronics Inc	1122 23rd St Columbus NE 68601-3632
91662	Elco Corp	Industrial Park Huntington PA 16652
91833	Keystone Electronics Corp	31-07 20th Rd Astoria NY 11105
91836	Kings Electronics Co Inc	40 Marbledale Road Tuckahoe NY 10707-3420
92194	Alpha Wire Corp	711 Lidgerwood Ave Elizabeth NJ 07207
93459	Weinschel Engineering Co	1 Weinschel Lane Gaithersburg MD 20877
94696	Magnecraft	1910 Techny Rd Northbrook IL 60062
95054	Sermax Corp	Milwaukee WI
95077	Solitron Devices Inc Solitron/Microwave Div	1177 Blue Heron Blvd Bldg 2 Riviera Beach FL 33404
95146	Alco Electronics Products Inc	1551 Osgood St North Andover MA 01845
95275	Vitramon Inc	Box 544 Bridgeport CT 06601
95348	Gordos Arkansas Inc	1000 N 2nd St PO Box 824 Rogers AR 72757
95987	Weskesser Co Inc	727 West Glendale Ave Milwaukee WI 53209
96341	Microwave Associates Inc	NW Industrial Park S Ave Burlington MA 01803
96733	San Fernando Electric Mfg Co	1501 First St San Fernando CA 91341
98291	ITT Sealectro	585 E Main St New Britain CT 06051
99800	American Precision Industries Inc Delevan Div	270 Quaker Rd East Aurora NY 14052-2114
99899	Narda Microwave/Loral Corp	435 Moreland Rd Hauppage NY 11788

7

Diagrams

7.1 Introduction

This chapter contains assembly drawings and circuit schematics for the Model GT 9000S Synthesized Microwave Sweeper.

Parts lists for all assemblies are contained in Chapter 6.

A

Accessories and Options

A.1 Introduction

The following accessories and options are available for the Model GT 9000S Synthesized Microwave Sweeper. Each accessory and option is described under its respective heading in this appendix.

Table A-1. Accessories and Options

Accessory/ Option No.	Description	Part Number	Field Installable
A001	Cable Kit (SMA)	29847	N/A
A002	Rack Mount with Slides	29861	Yes
A003	Rack Mount without Slides	29862	Yes
A006	Extender Board Service Kit	29813	N/A
A010	Extra Operating and Maintenance Manual	31285	N/A
A011	Instrument Carrying Case	29855	N/A
16	1 Hz Resolution	29849	No
20A	High Power RF Output	29853	No
20B	High Power RF Output	29860	No
22	Rear Panel RF Output Connector	29848	No
22A	Rear Panel RF Output Connector	29858	No
22B	Rear Panel RF Output Connector	29859	No
23	Type-N RF Output Connector[1]	29818	Yes
24	Internal Modulation, AM & FM Modes	29820	No
25	Planar Crown RF Output Connector	29823	Yes
	Type N Female Crown[2]	29824	Yes
	Type N Male Crown[2]	29825	Yes
	Type GP-7 Crown[2]	29826	Yes
	Type SMA Female Crown	29827	Yes
	Type SMA Male Crown	29828	Yes
	Type TNC Female Crown[2]	29829	Yes
	Type TNC Male Crown[2]	29830	Yes
	Type 3.5mm Female Crown	29831	Yes
	Type 3.5mm Male Crown	29832	Yes
	Type 2.9mm Female Crown	29833	Yes
	Type 2.9mm Male Crown	29834	Yes
26A	Step Attenuator (20 GHz Instruments)	29821	No
26C	Step Attenuator (26 GHz Instruments)	29856	No
27	60 dB Scan Modulation (without Option 26)	29822	No

Accessory/ Option No.	Description	Part Number	Field Installable
27A	60 dB Scan Modulation (with Option 26)	29866	No
28	5 x 10^{-10}/day Time Base	29810	Yes
30	"CE" Mark Power Supply	29874	No

[1] Not available if the upper frequency exceeds 20 GHz.
[2] Not recommended if the upper freqency exceeds 20 GHz.

A.2 Accessory A001: Cable Kit (SMA), P/N 29847

This accessory kit furnishes two coaxial cables (18 and 72-inches) with connectors for interfacing to user-supplied signal sources.

29847 A001 Cable Kit (SMA), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	JRAB-26200	1	58900	JRAB-26200	SMA F-SMA F 26G ADAPTER
2	JRAC-26200	1	58900	JRAC-26200	SMA M-SMA F 26G ADAPTER
3	WCA0-26015	1	17217	0RD01D01018.0	18 26GHZ COAX ASSY
4	WCA0-26060	1	17217	0RD01D01072.0	72 26GHZ COAX ASSY

A.3 Accessory A002: Rack Mount With Slides, P/N 29861

This is a field kit for mounting the Model GT 9000S in a standard equipment rack. The kit includes mounting slides. The kit is available from Giga-tronics with part number 29861. The components included are listed below.

29861 A002 RACK MOUNT WITH SLIDES, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
6	120BF12701	2	58900	120BF12701	RACK MOUNT FLANGE
7	HRSA-20001	1	05236	1201723-L	20 RACK SLIDE
8	HRSA-20002	1	05236	1201723-R	20 RACK SLIDE
10	420CF16200	2	58900	420CF16200	SLIDE MTG SPACER M7XXX3
11	420BF16300	2	58900	420BF16300	FRONT SLIDE MTG BKT
12	420CF16400	2	58900	420CF16400	REAR SLIDE MTG BKT
102	HBFP-83210	4	26233	NS139CR832R10	8-32 X 5/8 FLAT
104	HBPP-A3206	6	58900	HBPP-A3206	10-32 X 3/8 PAN
105	HBPP-83206	2	58900	HBPP-83206	8-32 X 3/8 PAN

A.4 Accessory A003: Rack Mount Without Slides, P/N 29862

This is a field kit for mounting the Model GT 9000S in a standard equipment rack. The kit does not include mounting slides. The kit is available from Giga-tronics with part number 29862. The components included are listed below.

29862 A003 RACK MOUNT W/O SLIDES, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
6	120BF12701	2	58900	120BF12701	RACK MOUNT FLANGE
102	HBFP-83210	4	26233	NS139CR832R10	8-32 X 5/8 FLAT
103	HBFP-63205	2	58900	HBFP-63205	6-32 X 5/16 FLAT

A.5 Accessory A006: Extender Board Service Kit, P/N 29813

Designed to extend PC assemblies for maintenance and testing. The components included are listed below.

29813 A006 EXTENDER BOARD SVC KIT, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120BA04700	1	58900	120BA04700	COMPUTER EXTENDER BD PCA
2	120BA09500	1	58900	120BA09500	I/O EXTENDER BD PCA
3	101BF21600	1	58900	101BF21600	PC BOARD PULLER

A.6 Accessory A010: O&M Manual, P/N 120AM00350

Use this part number to order additional copies of the instrument's Opration and Maintenance manual.

A.7 Accessory A011: Instrument Carrying Case, P/N 29855

This is a special ruggedized carrying case for transporting the instrument between work sites. It can be ordered from Giga-tronics with part number 29855.

A.8 Option 16: 1 Hz Resolution

If Option 16 is installed, the frequency resolution of the instrument is 1 Hz.

The components required for Option 16 are listed below.

29849 OPT 16 1 Hz FREQ, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
A1 U12	UMN0-27256	REF	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE

A.9 Option 20: High Power RF Output

Option 20 provides a higher power output than is normally available. Option 20A uses PIN diodes and can operate with frequency sweep while the option is installed. Option 20B uses a mechanical relay to switch 2 GHz or less. The instrument cannot be used for frequency sweep with option 20B because it would wear out the mechanical relay.

Option 20A changes the specification for Maximum Leveled Output Power +20 dBm; Option 20B changes the output power to +22 dBm.

The components required for Options 20A and 20B are listed at the end of this section.

A.9.1 Implementation of Option 20

With Option 20 installed, an amplifier module is added. As shown in Figure A-1, the amplifier module is switched into the RF output path when this option is activated. The amplifier module contains separate amplifiers for frequencies above and below 2 GHz.

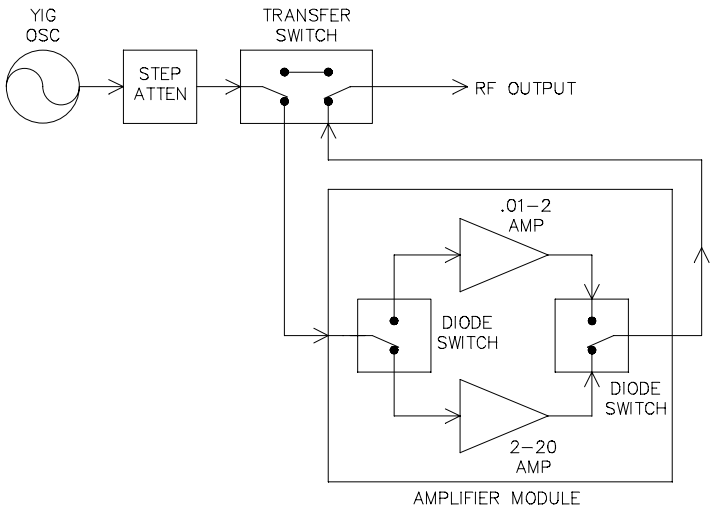

Figure A-1. Switches & Amplifiers for Option 20

Activating & Deactivating Option 20

From the front panel, Option 20 is controlled by selecting Special Function 29, and pressing [ON] or [OFF] to activate or deactivate the option.

During remote control operation, Option 20 is activated by the command PH1 and deactivated by the command PH0.

Special Characteristics of Option 20

Although Option 20 makes possible a much higher power output, the required modifications of the RF output path have two effects which should be noted. First, maximum output power with the option deactivated is slightly lower than it would be if the option were not installed. Second, the operation of the high power option is incompatible with low power settings. If the option has been selected, and a power level of less than +8 dBm is requested, the option will be disabled, and will not activate itself until a level setting is changed to +8 dBm or greater.

During a digital power sweep across 8 dBm, the high power option is activated or deactivated (as needed) when the power level crosses 8 dBm.

During an analog power sweep across 8 dBm, the high power option remains in its initial state during the entire sweep. An analog power sweep which begins below 8 dBm will have the high-power option deactivated during the entire sweep; an analog power sweep which begins at or above 8 dBm will have the high power option activated during the entire sweep. Analog power sweeping from at or above 8 dBm to below 8 dBm is not recommended; the high power option was not designed for operation below 8 dBm.

High Power Indications

Because the high power option can activate or deactivate itself in some situations, without a direct request from the user, the front panel is set up to warn the user when the option is active and when it is not. The decimal point in the power display window flashes when the high power option is active, and ceases to flash when the option is deactivated. If the instrument's RF output power is turned off while the option is selected, a flashing decimal in the power display window warns that the instrument will be in high power mode when RF is turned back on. In maximum power mode with the option selected, the power window displays ——-. with the decimal point blinking.

If the instrument is turned off while the high power option is selected, and then turned back on, the instrument will wake up with the RF power turned off, and the message HIGH POWER ON / LEVEL = *n.nn* dBm displayed in the entry menu window to warn that the instrument will be in high power mode when RF is turned back on. The power level shown will be the current CW power level or, for a power sweep, the maximum power of the sweep.

Specification Changes for Option 20

Maximum Leveled Output Power (with option inactive):	Maximum output power is reduced by 1.5 dB from the standard specification.
Maximum Leveled Output Power (with option active):	(Option 20A): .01-20 = +20 dBm (-4 dBm min w/o atten, -60 dBm min w/atten) (Option 20B); .01-20 = +22 dBm (-4 dBm min w/o atten, -60 dBm min w/atten)
Output Flatness (with option active):	±2.5 dB (not specified in Analog Frequency Sweep mode)
Harmonics (with option active):	(Option 20A): .01-20 = >5 dBc; .5-20 = >20 dBc (Option 20B): .01-20 = >20 dBc; .5-20 = >20 dBc
Pulse On/Off Ratio (with option active):	≥60 dB
AM Performance (with option active):	Not specified (however, AM is functional).

Option 20 Components

29853 OPT 20A HIGH POWER RF OUTPUT, Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	002CI05900	REF	58900	002CI05900	INSTRUCTIONS FOR
1	0042235200	1	58900	0042235200	.01-20 GHz POWER AMP ASY
2	30091	1	58900	30091	OPTION 20 MTG PLATE, GT9000/S
3	MRTL-22020	1	58900	MRTL-22020	COAX TRANS SWITCH
5	30120	REF	58900	30120	OPTION 20 HIGH POWER WIRELIST
6	BD00-02012	1	58900	BD00-02012	12VDC MINI FAN
7	30090	1	58900	30090	MINI FAN MOUNT; OPTION 20
8	HSTH-41203	4	58900	HSTH-41203	4-40 X 3/4 SPACER
9	HSDH-41303	4	05791	SS6979-0.812-01	4-40 X 13/16 M/F HEX SPACER
10	WCAS-18003	1	58900	WCAS-18003	3" 18GHZ SEMI-FLEX COAX
11	WCAS-18006	1	58900	WCAS-18006	6" 18GHZ SEMI-FLEX COAX
12	WCAS-18107	1	58900	WCAS-18107	7" 18 GHz SEMI-FLEX COAX
13	HIGP-00131	1	58900	HIGP-00131	MOLDED GROMMET
14	HICP-01216	1	58900	HICP-01216	1/8 WIRE HOLD DOWN
15	HLLT-40210	1	79963	505-120 # 4	#4 SOLDER LUG
16	30479	1	58900	30479	PWR SUPPLY SW RELAY PCA
17	30482	REF	58900	30482	OPT20 HIGH PWR OUT W/L
103	HNKS-44004	3	96906	MS35649-***	4-40 KEP NUT
107	HWSS-40300	8	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
108	HBPP-44004	3	26233	NS137CR440R4	4-40 X 1/4 PAN
109	HBPP-44008	4	58900	HBPP-44008	4-40 X 1/2 PAN
111	WCAS-18109	1	58900	WCAS-18109	9" 18 GHz SEMI-FLEX COAX
112	HWFS-40500	2	58900	HWFS-40500	#4 X 5/16 FLAT WASHER
113	HBPP-44008	4	58900	HBPP-44008	4-40 X 1/2 PAN
114	HBPP-25605	1	26233	NS137CR256R5	2-56 X 1/4 PAN
115	HBPP-44007	4	26233	NS137CR440R7	4-40 X 7/16 PAN
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE

29860 OPT 20B HIGH POWER RF OUTPUT, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	002CI05900	REF	58900	002CI05900	INSTRUCTIONS FOR
1	0042235200	1	58900	0042235200	.01-20 GHz POWER AMP ASY
2	30091	1	58900	30091	OPTION 20 MTG PLATE, GT9000/S
3	MRTF-22020	1	58900	MRTF-22020	COAX TRANS SWITCH
5	30119	REF	58900	30119	OPTION 20B HIGH POWER WIRELIST
6	BD00-02012	1	58900	BD00-02012	12VDC MINI FAN
7	30090	1	58900	30090	MINI FAN MOUNT; OPTION 20
8	HSTH-41203	4	58900	HSTH-41203	4-40 X 3/4 SPACER
9	HSDH-41404	4	55566	4540-440-SS-0	4-40 X 7/8 M/F SPACER
10	MRSF-12018	1	11532	CR33S10	SPDT COAX SWITCH
11	WCAS-18001	1	58900	WCAS-18001	1" 18GHZ SEMI-FLEX COAX
12	WCAS-18003	1	58900	WCAS-18003	3" 18GHZ SEMI-FLEX COAX
13	WCAS-18006	1	58900	WCAS-18006	6" 18GHZ SEMI-FLEX COAX
14	WCAS-26004	1	58900	WCAS-26004	4" 26 GHz SEMI-FLEX COAX
15	WCAS-26005	1	58900	WCAS-26005	5" 26 GHz SEMI-FLEX COAX
103	HNKS-44004	11	58900	HNKS-44004	4-40 KEP NUT
107	HWSS-40300	12	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
108	HBPP-44004	8	26233	NS137CR440R4	4-40 X 1/4 PAN
109	HBPP-44009	4	58900	HBPP-44009	4-40 X 9/16 PAN
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE

A.10 Option 22: Rear Panel RF Output Connector

If Option 22 is installed, the RF output connector is relocated to the rear panel of the Model GT 9000S. This option can reduce RF output power by as much as 2 dB. Option 22 can be installed with or without Option 26. Option 22A is with Option 26; Option 22B is without Option 26.

The components required for Option 22 are listed below.

29858 OPT 22A R/P RF W/OPT 26, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	WCAS-18124	1	0DJ29	P-3636-601-5224	24" 18 GHz SEMI-FLEX
2	JRAB-00200	1	96341	2784-5002-00	SMA F BULK MT CONN
3	HPM0-00375	1	2R182	652	3/8 HOLE PLUG
4	107BF01700	-1	58900	107BF01700	SMA CONNECTOR MOUNT FLAN
5	107BF01701	-1	58900	107BF01701	SMA CONNECTOR MOUNT SPAC

29859 OPT 22B R/P RF W/O OPT 26, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	120CA15314	1	58900	120CA15314	.141 CABLE #14 ASY
2	JRAB-00200	1	96341	2784-5002-00	SMA F BULK MT CONN
3	HPM0-00375	1	2R182	652	3/8 HOLE PLUG
4	107BF01700	-1	58900	107BF01700	SMA CONNECTOR MOUNT FLAN
5	107BF01701	-1	58900	107BF01701	SMA CONNECTOR MOUNT SPAC

A.11 Option 23: Type-N RF Output Connector

If Option 23 is installed, the RF output connector is changed to Type N. This option is not available if the upper frequency exceeds 20 GHz.

The components required for Option 23 are listed below.

29818 OPT 23 TYPE N RF OUTPUT, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	JRXA-00200	1	95077	SF1132-6001	N TO SMA ADAPTER
101	HNKS-44004	4	58900	HNKS-44004	4-40 KEP NUT

A.12 Option 24: Internal Modulation, AM and FM Modes

This option provides two built-in function generators for creating AM and FM envelopes (the built-in pulse generator for pulse modulation is standard equipment in Model GT 9000S).

This option has been incorporated into the main body of the manual; where a procedure or specification applies only to instruments with Option 24, a note to that effect is included.

The components required for Option 24 are listed below.

29820 OPT 24 INTERNAL AM/FM, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
101	HBPP-44005	3	26233	NS137CR440R5	4-40 X 5/16 PAN
102	HWSS-40300	3	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
A6 A1	120BA12601	1	58900	120BA12601	FUNCTION GENERATOR PCA

120BA12601 FUNCTION GENERATOR PCA (A6A1), Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS12601	REF	58900	120BS12601	FUNCTION GENERATOR SCH
1	120CF12600	1	58900	120CF12600	FUNCTION GENERATOR PCB
2	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
3	HSTS-44005	3	55566	3048-B-440-A-0	5/16 ROUND SWAGE SPACER
101	HBPP-44005	3	26233	NS137CR440R5	4-40 X 5/16 PAN
102	HWSS-40300	3	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C6	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C7	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C8	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C9	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C10	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C20	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C21	CC50-02270	1	31433	C315C272K1R5CA C9248	2700 PF CERAMIC X7R
C22	CC50-02470	1	31433	C315C472K1R5CA	4700 PF CERAMIC X7R
C23	CC50-02270	1	31433	C315C272K1R5CA C9248	2700 PF CERAMIC X7R
C24	CE16-R6330	1	55680	UVP1C330MDA	33 UF 16V NON-POL RADIA
C25	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C26	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C27	CE16-R6330	1	55680	UVP1C330MDA	33 UF 16V NON-POL RADIA
C28	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C29	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C30	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C31	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C32	CC50-02270	1	31433	C315C272K1R5CA C9248	2700 PF CERAMIC X7R
C33	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C34	CE16-R6330	1	55680	UVP1C330MDA	33 UF 16V NON-POL RADIA
C35	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C36	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C37	CE16-R6330	1	55680	UVP1C330MDA	33 UF 16V NON-POL RADIA
C38	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C40	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C42	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C43	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C44	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C45	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C46	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C47	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C48	CC50-03470	1	31433	C320C473K5R5CA	.047 UF CERAMIC X7R
C49	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C52	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C53	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C54	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C55	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
L1	LAD0-06100	1	91637	IMS-5 10UH 10%	10 UH INDUCTOR
L2	LAD0-06100	1	91637	IMS-5 10UH 10%	10 UH INDUCTOR
L3	LAD0-06100	1	91637	IMS-5 10UH 10%	10 UH INDUCTOR
L4	LAD0-06100	1	91637	IMS-5 10UH 10%	10 UH INDUCTOR
P3	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
P4	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
P5	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
P6	JIA2-20105	1	55322	TSW-110-05-G-D	20 PIN STRIPLINE PLUG
Q1	QBNS-04275	1	58900	QBNS-04275	PN4275 .1A 15V .6W NPN
Q2	QBNS-04275	1	58900	QBNS-04275	PN4275 .1A 15V .6W NPN
R1	RN55-17500	1	91637	RN55C7501F	7.5 K OHMS 1% MET FILM
R2	RN55-00182	1	91637	RN55C18R2F	18.2 OHMS 1% MET FILM
R3	RN55-00825	1	91637	RN55C82R5F	82.5 OHMS 1% MET FILM
R4	RAPD-25000	1	58900	RAPD-25000	50K POT 15T PC MNT
R5	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R6	RN50-13320	1	91637	RN50C3321F	3.32 K OHMS 1% MET FILM
R9	RAPD-25000	1	58900	RAPD-25000	50K POT 15T PC MNT
R10	RN55-17500	1	91637	RN55C7501F	7.5 K OHMS 1% MET FILM
R11	RN55-00182	1	91637	RN55C18R2F	18.2 OHMS 1% MET FILM
R12	RN55-00825	1	91637	RN55C82R5F	82.5 OHMS 1% MET FILM
R13	RAPD-25000	1	58900	RAPD-25000	50K POT 15T PC MNT
R14	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R15	RN50-13320	1	91637	RN50C3321F	3.32 K OHMS 1% MET FILM
R18	RAPD-25000	1	58900	RAPD-25000	50K POT 15T PC MNT
R19	RN55-00825	1	91637	RN55C82R5F	82.5 OHMS 1% MET FILM
R20	RN55-00825	1	91637	RN55C82R5F	82.5 OHMS 1% MET FILM
R21	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R22	RN55-02210	1	91637	RN55C2210F	221 OHMS 1% MET FILM
R23	RN55-02210	1	91637	RN55C2210F	221 OHMS 1% MET FILM
R24	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R25	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R26	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R27	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R28	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R29	RN50-12000	1	91637	RN50C2001F	2.00 K OHMS 1% MET FILM
R30	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R31	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R32	RN55-13010	1	91637	RN55C3011F	3.01 K OHMS 1% MET FILM
R33	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R34	RN55-11000	1	91637	RN55C1001F	1 K OHMS 1% MET FILM
R35	RN55-13010	1	91637	RN55C3011F	3.01 K OHMS 1% MET FILM
R36	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R37	RN55-31100	1	91637	RN55C1103F	110 K OHMS 1% MET FILM

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R38	RN55-31100	1	91637	RN55C1103F	110 K OHMS 1% MET FILM
U1	UGZ0-02334	1	1DN14	Q2334C-50N	Q2334I-Z0 DUAL DDS
U2	UTN0-01572	1	01295	SN74HC157	74HC157 QUAD DATA SELECT
U3	UTN0-01572	1	01295	SN74HC157	74HC157 QUAD DATA SELECT
U4	UTN0-01572	1	01295	SN74HC157	74HC157 QUAD DATA SELECT
U5	UTN0-01572	1	01295	SN74HC157	74HC157 QUAD DATA SELECT
U6	UTN0-01572	1	01295	SN74HC157	74HC157 QUAD DATA SELECT
U7	UTN0-01572	1	01295	SN74HC157	74HC157 QUAD DATA SELECT
U8	UMN0-71681	1	58900	UMN0-71681	IDT71681;4K X 4 RAM
U9	UMN0-71681	1	58900	UMN0-71681	IDT71681;4K X 4 RAM
U10	UMN0-71681	1	58900	UMN0-71681	IDT71681;4K X 4 RAM
U11	UMN0-71681	1	58900	UMN0-71681	IDT71681;4K X 4 RAM
U12	UMN0-71681	1	58900	UMN0-71681	IDT71681;4K X 4 RAM
U13	UMN0-71681	1	58900	UMN0-71681	IDT71681;4K X 4 RAM
U14	UTN0-01322	1	01295	MC74HC132E	SN74HC132N 4X SCHMIDT NAN
U15	UIN0-09713	1	24355	AD9713BAN	AD9713JN;DAC;12 BIT
U16	UON0-00428	1	1ES66	MAX428CPA	MAX428CPA;DUAL OP AMP
U17	UEN0-10125	1	04713	MC10125P	MC10125P QUAD ECL TO TTL
U18	UIN0-09713	1	24355	AD9713BAN	AD9713JN;DAC;12 BIT
U19	UON0-00428	1	1ES66	MAX428CPA	MAX428CPA;DUAL OP AMP
U20	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
U21	ULN0-05043	1	1ES66	IH5043CPE	IH5043CPA DUAL SPDT SW
XU1	JSG0-11068	1	58900	JSG0-11068	68 PIN PLCC SOCKET

A.13 Option 25: Planar Crown RF Output Connector

If Option 25 is installed, the RF output connector is replaced by a Planar Crown Universal Connector, manufactured by Lucas Weinschel. This is a two-part connector; the components are referred to as the planar bulkhead and the planar crown. The bulkhead is a 2.9 mm female connector, mounted inward of the front panel, which is common to all implementations of Option 25 (see the Option 25 parts list at the end of this section). The crown is attached to the bulkhead on the outward side of the front panel, and is available in a variety of versions, as shown in Table A-2:

Table A-2. Planar Connector Bulkhead Versions

Giga-tronics Part#	Weinschel Part#	Connector Type	Frequency Range
JRWC-00030	7005-3	Type N Female Crown	DC to 18 GHz
JRWC-00040	7005A-4	Type N Male Crown	DC to 18 GHz
JRWC-00050	7005A-5	Type GPC-7 Crown	DC to 18 GHz
JRWC-00080	7005A-8	Type TNC Female Crown	DC to 18 GHz
JRWC-00090	7005A-09	Type TNC Male Crown	DC to 18 GHz
JRWC-00010	7005A-1	Type SMA Female Crown	DC to 26.5 GHz
JRWC-00020	7005A-2	Type SMA Male Crown	DC to 26.5 GHz
JRWC-00060	7005A-6	3.5 mm Female Crown	DC to 34 GHz
JRWC-00070	7005A-7	3.5 mm Male Crown	DC to 34 GHz
JRWC-00100	7005A-10	2.92 mm Female Crown	DC to 40 GHz
JRWC-00110	7005A-11	2.92 mm Male Crown	DC to 40 GHz

29823 OPT 25 PLANAR CROWN RF OUTPUT, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	JRWF-00010	1	93459	7004-1	2.9MM F BULKHEAD CROWN
2	420BF37900	1	58900	420BF37900	PLATE;MTG;CONN;PLANAR CROWN
101	HNKS-44004	4	96906	MS35649-***	4-40 KEP NUT
102	HWIS-K0801	1	58900	HWIS-K0801	3/8 INCH LOCK WASHER
103	HWFS-K0901	2	55566	5710-320-60	3/8 INCH FLAT WASHER

A.14 Option 26: 10 dB Step Attenuator

Under this option, an attenuator is placed in the RF output path of the instrument, which provides up to 110 dB of attenuation in 10 dB increments.

This option has been incorporated into the main body of the manual. Where a procedure or specification applies only to instruments with Option 26, a note to that effect is included.

The components required for Option 26 are listed below.

29821 OPT 26 20 GHZ STEP ATTENUATOR, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	MPB0-02001	1	28480	33322H	PGM ATTEN;0-110DB;20GHZ
2	420BF41600	1	58900	420BF41600	ATTENUATOR MOUNT; EXC
101	HBPP-44004	2	26233	NS137CR440R4	4-40 X 1/4 PAN
102	HWSS-40300	2	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
103	HBPP-63204	2	58900	HBPP-63204	6-32 X 1/4 PAN
104	HWSS-60400	2	58900	HWSS-60400	#6 X 1/4 SPLIT LOCK
105	WCAS-18011	-1	58900	WCAS-18011	11" 18 GHZ SEMI-FLEX COAX
106	WCAS-26103	1	58900	WCAS-26103	3" 26 GHz SEMI-FLEX COAX
107	WCAS-26106	1	58900	WCAS-26106	6" 26 GHz SEMI-FLEX COAX

29856 OPT 26 26 GHZ STEP STEP ATTENUATOR, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	MP90-02603	1	28480	3323K	90DB 26GHZ 10DB STEP ATT
2	420BF41600	1	58900	420BF41600	ATTENUATOR MOUNT; EXC
70	WCAS-18011	-1	58900	WCAS-18011	11" 18 GHZ SEMI-FLEX COAX
80	WCAS-26103	1	58900	WCAS-26103	3" 26 GHz SEMI-FLEX COAX
90	WCAS-26106	1	58900	WCAS-26106	6" 26 GHz SEMI-FLEX COAX
101	HBPP-44004	2	26233	NS137CR440R4	4-40 X 1/4 PAN
102	HWSS-40300	2	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
103	HBPP-63204	2	58900	HBPP-63204	6-32 X 1/4 PAN
104	HWSS-60400	2	58900	HWSS-60400	#6 X 1/4 SPLIT LOCK

A.15 Option 27: Scan Modulation/Linear AM

In instruments with Option 27, a scan modulator (an FET-based variable attenuator) is placed in the RF path, between the level control system and the output step attenuator. This modulator is digitally controlled and linearized, and can operate in Scan mode (DC coupled, with depth specified in dB) or Linear AM mode (AC coupled, with depth specified in per cent).

The modulator can also be used as a variable attenuator; attenuation values entered (in dB) are relative to the power level set by the instrument's level control system (if the instrument's level is set to -10 dBm, and a variable attenuation value of -12 dB is specified, the instrument's actual output level will be -22 dBm).

All modes of scan modulation can be operated simultaneously with pulse modulation and frequency modulation.

Installation of Option 27 can degrade the maximum output level by as much as 2 dB when not activated, by as much as 8 dB when activated in scan mode or variable attenuation mode, and by as much as 14 dB when activated in linear AM mode. Also, standard amplitude modulation (the specifications for which are given in Chapter 1 of this manual) is not available in instruments with Option 27. All attenuation specifications are relative to the instrument's unmodulated output level with the attenuator set to 0 dB.

Specifications (General)

Frequency Of Operation:	100 MHz to 20 GHz.
RF Carrier Harmonics:	Not specified.

Specifications (DC Coupled Scan mode, or Variable Attenuator mode)

Max Power Degradation:	≤8 dB
Range:	0 to 60 dB (>1 GHz); 0 to 55 dB (.5 to 1 GHz); 0 to 55 dB typical (<.5 GHz)
Frequency Response:	DC to 150 kHz, sine wave
Step Response:	<1 μs, for 50 dB change
Linearity (at cal points):	±.6 dB (0 to 20 dB); ±1 dB (20 to 60 dB).
Sensitivity:	-10 dB/V
Input Impedance:	50 Ω, nominal

Specifications (AC Coupled Linear AM Mode)

Max Power Degradation:	≤14 dB
Modulation Depth:	0 to 90%
Modulation Bandwidth:	10 Hz to 50 kHz, ±3dB
Input Sensitivity:	1 Vpp, for 50% depth ±10% depth, at 1 kHz
Input Impedance:	50 Ω, nominal

Internally Generated Scan/AM Envelope

Waveform:	sine, square, or triangle wave
Rate:	1 Hz to 100 kHz
Resolution:	1 Hz
Accuracy:	±0.01 Hz

Option 27 Front Panel Operation

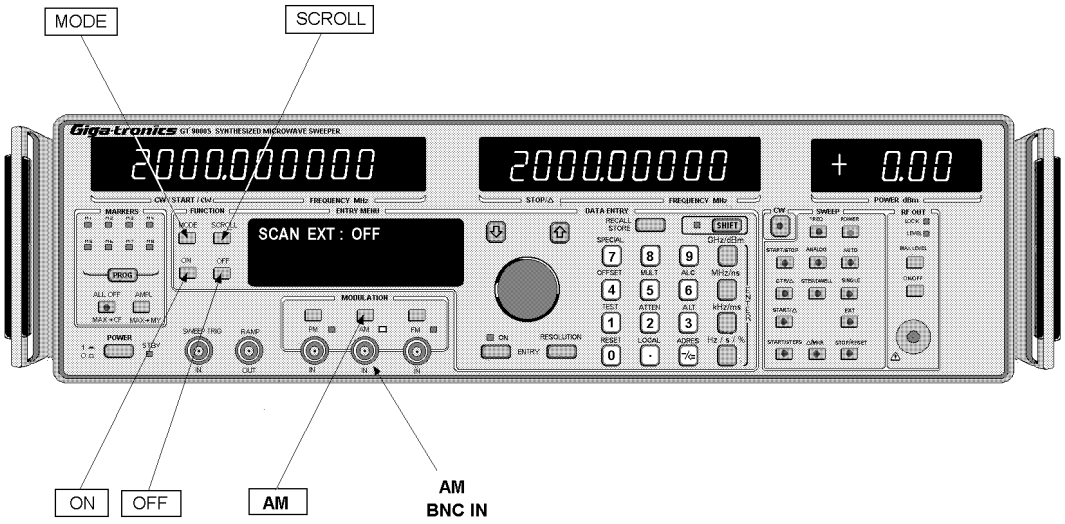

Figure A-2. Scan/AM Modes

To select any of the modulation modes provided under Option 27, press [AM] (see Figure A-2). The entry menu display should read SCAN EXT: OFF. This indicates that Scan mode is selected but is presently turned off; use the [ON] button to activate this mode. Scan modulation requires an external input, which must be supplied to the AM input BNC connector on the front panel.

To select any of the Scan modes, press the [MODE] button until the desired mode is displayed. The choices are:

SCAN EXT = scan modulation, external
LIN AM EXT = linear AM, external
VAR ATTN = variable attenuation

If Option 24 (internal modulation) is also installed, there are six additional modes:

SCAN SIN = scan modulation, internal, sine wave
SCAN SQR = scan modulation, internal, square wave
SCAN TRI = scan modulation, internal, triangle
LIN AM SIN = linear AM, internal, sine wave
LIN AM SQR = linear AM, internal, square wave
LIN AM TRI = linear AM, internal, triangle

Having reached the desired mode, you can set parameters under that mode. Press the [SCROLL] button if necessary until the desired parameter is displayed. Parameter settings can be entered with the numeric keypad, and adjusted with the digi-dial or the up/down arrow keys.

No parameters can be set under external modulation. Depth (in dB) can be set under variable attenuation. Under all six of the internal modulation modes, rate can be set in Hz; depth can be set in dB (for scan modulation) or in per cent (for linear AM).

Option 27 Theory of Operation

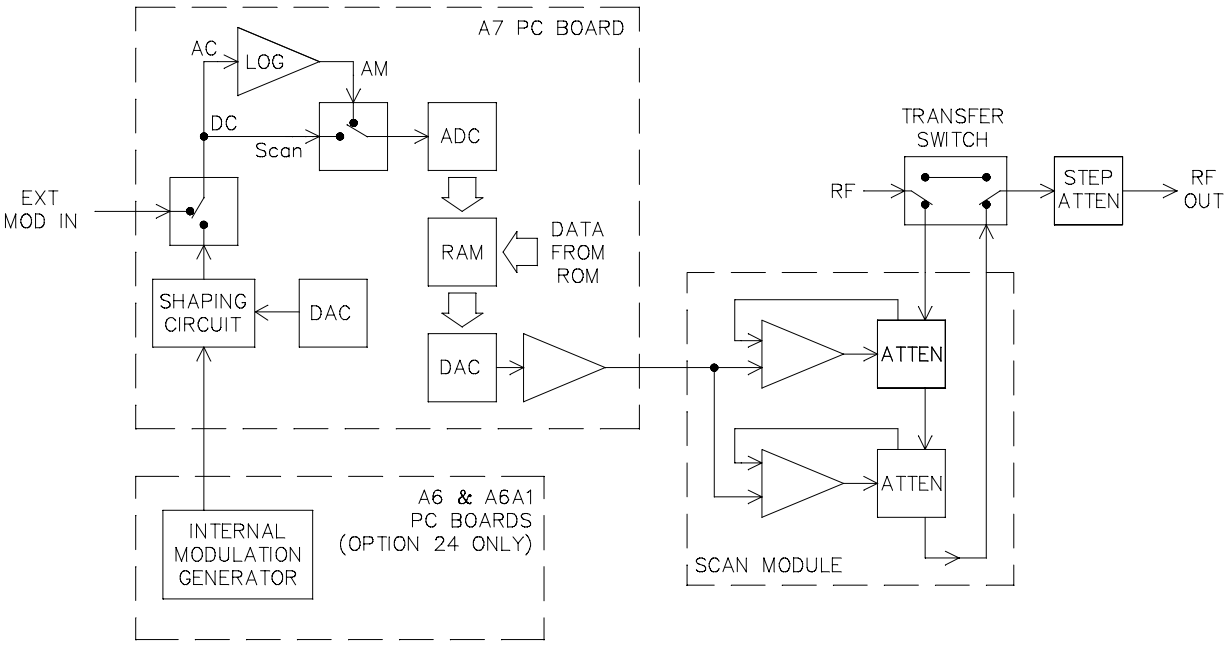

Figure A-3. Scan Modulation

The modulating waveform can be applied from an external source, or (if Option 24 is installed) generated internally. Internal modulating signals are transmitted through a shaping circuit which adapts them to the input requirements of the scan circuit. The modulating signal is then applied, through a switch, to either of two input paths: a DC-coupled path for the scan mode or variable attenuator mode, and an AC-coupled path (including a logarithmic amplifier) for the linear AM mode.

The modulation input is applied to an analog-to-digital converter, and converted to a binary number (see Figure A-3). This number (in the form of a set of parallel data lines) is applied to the address bus of a RAM. The RAM is loaded with correction data stored in ROM (there are several tables of correction data in ROM, for different frequency ranges; the appropriate table is loaded into RAM when Scan modulation is selected or when the frequency changes). When the RAM is addressed by the output of the ADC, the data stored at the relevant address is furnished to the input of a digital-to-analog converter. The DAC converts this correction data to an analog signal which drives the scan module. As the input waveform changes, different storage areas in the RAM are addressed, so that the correction factors retrieved from memory constantly track the input. The correction data is tailored to the individual scan module installed in the instrument; it is needed to linearize the response of that module to the modulation input.

The scan module contains a pair of voltage controlled attenuator circuits; each has a dynamic range of 30 dB, and since they are placed in series, the dynamic range of the whole is 60 dB. Each attenuator is driven by a loop amplifier, which provides correction of its attenuator's response (the first corrects for linearity, the second for input/output impedance matching).

During modulation, the two variable attenuators of the scan module are switched into the RF output path of the instrument. The modulating input to the scan module controls the attenuation, and therefore the RF output level. When modulation is deactivated, this module is switched out of the RF path.

Option 27 Acceptance Test Procedure (Scan Mode)

1. Apply a 0 to 1 V (10 dB depth) sine wave to the AM input BNC.
2. Select SCAN EXT: ON.
3. Connect a detector to the Model GT 9000S RF output, and connect the output of the detector to the oscilloscope (channel B, 50 Ω on). Set the oscilloscope to 2 mV, 200 µsec, and adjust the channel B input vernier for a display of the waveform that spans six vertical divisions.
4. Vary the external modulation rate between 1 Hz and 150 kHz; verify that the displayed waveform maintains a minimum amplitude of four vertical divisions.
5. Connect the Model GT 9000S RF output to the spectrum analyzer. Set the RF output frequency to 1 GHz. Set the analyzer span to 5 MHz, and center the 1 GHz signal on the screen. Set the span to 0 Hz. Apply a 0 to 4 V sine wave at 100 Hz to the AM input BNC. Verify a 0 to -40 dB (±2 dB) sine wave on the analyzer. Change the input sine wave to 0 to 2 V; verify a 0 to -20 dB (±2 dB) sine wave on the analyzer. Change the input sine wave to a triangle wave and square wave; verify clean waveforms on the analyzer screen from 0 to -20 dB (±2 dB). Change the input square wave to 0 to 6 V; verify a clean 0 to -60 dB (±2 dB) square wave on the spectrum analyzer.
6. Repeat Step 5 at 5 GHz, 10 GHz, and 20 GHz.
7. Select VAR ATTN: ON; change the depth setting from 0 to -60 dB in 10 dB steps, and verify 10 dB steps ±2 dB on the analyzer. The following steps only apply if Option 24 is installed.
8. At 5 GHz, with the spectrum analyzer still connected, select SCAN SIN: ON, with a rate of 100 Hz and a depth of -60 dBm. Verify a 60 dB sine wave ±2 dB on the analyzer.
9. Repeat step 8 in the SCAN SQR and SCAN TRI modes.

Option 27 Acceptance Test Procedure (Linear AM Mode)

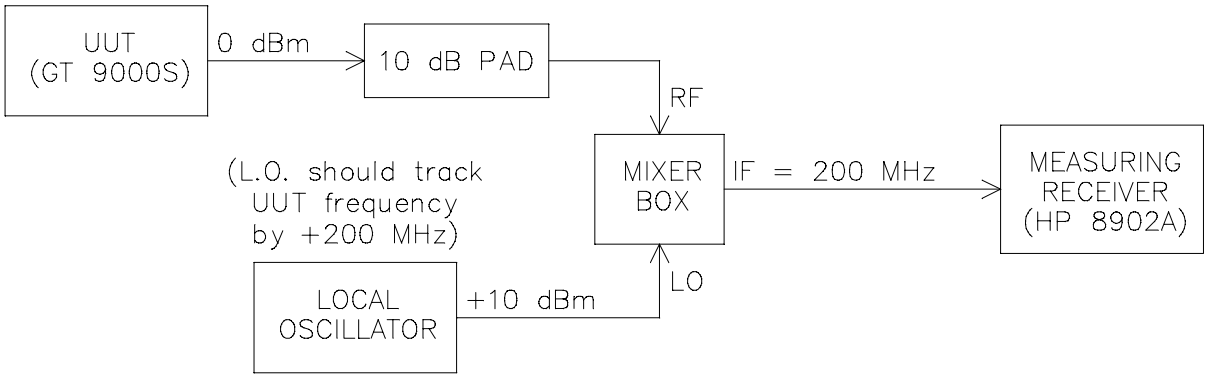

Figure A-4. Option 27 Calibration/Test Setup

1. Select LIN AM EXT: ON.

2. With an ohmmeter, measure the resistance of the AM input BNC to ground; it should read 50 Ω, ±3 Ω.
3. Connect the GT 9000S RF output to a mixer box, as shown in Figure A-4. On the HP 8902A, select 50 Hz and 15 kHz filters, AM mode. Set the GT 9000S RF output frequency to 5 GHz. Using a BNC T connector and oscilloscope, apply a 1.0 Vpp, 1 kHz sine wave to the AM input BNC on the GT 9000S front panel.
4. Measure the percentage of distortion at 1 kHz; verify that the distortion is $\leq$ 10% (typical).
5. Disconnect external modulation. Select LIN AM SIN: ON, at a 1 kHz rate and 50% depth. Using the HP 8902A, measure AM%. Verify a modulation reading of 45 to 55%. Re-check at 20% depth; verify a modulation reading of 15 to 25%. Re-check at 80% depth; verify a modulation reading of 75 to 85%.
6. Select LIN AM SQR: ON, 50% depth. Turn off all filters on HP 8902A. Verify an AM% reading of 45 to 55% on the HP 8902A.
7. Select LIN AM TRI: ON, 50% depth. Turn on 50 Hz and 15 kHz filters on HP 8902A. Verify an AM% reading of 45 to 55% on the HP 8902A.
8. Connect a detector to Model GT 9000S RF out. Connect the detector output to the oscilloscope (channel B, 50 Ω on). Set the scope to 2 mV and 200 µsec.
9. Select LIN AM EXT: ON.
10. Apply a 1 Vpp, 1 kHz sine wave to the AM input BNC. Adjust the channel B input vernier for a display of the waveform that spans six vertical divisions.
11. Adjust the external modulation rate for 10 Hz; verify that the displayed waveform has an amplitude of >4 divisions on the scope. Vary the rate from 10 Hz to 50 kHz, and verify that the waveform amplitude maintains an amplitude of $\geq$4 divisions.

Option 27 Linear AM Calibration

1. Select LIN AM EXT: ON but *do not* apply a modulating signal.
2. Measure TP3 on the Scan Modulation PC board (A7) and verify a DVM reading of +2.5 V ±.05 V.
3. Move the jumper on P1-1 and P1-6 to P1-2 and P1-5.
4. Adjust the Zero pot (R14) for a DVM reading of 0.0 VDC on TP1.
5. Move the jumper on P1-2 and P1-5 to P1-3 and P1-4.
6. Adjust the Gain pot (R19) for a DVM reading of +6.0 VDC on TP1.
7. Move the jumper on P1-3 and P1-4 to P1-1 and P1-6.
8. Adjust the Level pot (R25) for a DVM reading of +0.65 VDC on TP1.
9. Connect the Model GT 9000S and test equipment as shown in Figure A-4. On the HP 8902, select 50 Hz and 15 kHz filers, AM mode. Set the GT 9000S RF output to 5 GHz.
10. Using a BNC T-connector and oscilloscope, apply a 1.0 Vpp, 1 kHz sine wave to the AM input BNC on the Model GT 9000S front panel.
11. Adjust the Sense pot (R4) for a 50.0% reading on the HP 8902A.
12. Measure the distortion at 1 kHz
13. Check the distortion at the RF output frequencies shown in Table A-3.

Table A-3. AM Calibration Points

RF Frequency	Distortion at 50%
1 GHz	<10%, typical
5 GHz	<10%, typical
15 GHz	<10%, typical
20 GHz	<10%, typical

14. Select LIN AM SIN: ON and repeat step 13.
15. Select LIN AM SQR: ON, depth 50%. Turn off all filters on HP 8902A, and verify an AM% reading of 45 to 55% on the HP 8902A.
16. Select LIN AM TRI: ON, depth 50%. Turn on 50 Hz and 15 kHz filters on the HP 8902A, and verify an AM% reading of 45-55% on the HP 8902A.

Option 27 Scan Calibration

1. Set the UUT to 1 GHz, 0.0 dBm. Select VAR ATTN: ON.
2. Using a Giga-tronics 8540 power meter (or equivalent), measure the RF output power of the UUT (see the 8540 frequency value equal to the frequency being measured). Verify a reading of 0.0 dBm ±2 dB.
3. Select relative mode on the 8540 power meter. Turn the UUT's power off. Zero the power meter, then turn the UUT's power on.
4. Set VAR ATTN to -50 dB. Adjust R65 on the A7 PC board for a reading of -50.0 dBm (±2 dB).
5. Set VAR ATTN to -10 dB. Adjust R9 on the A7 PC board for a reading of -10.0 dBm (±2 dB).
6. Repeat steps 4 and 5 until both readings are within specification.
7. Step the VAR ATTEN depth from 0 to -60 dB in 10 dB steps, and verify that all readings are within specification.

NOTE: The power meter must be accurate to -65 dBm. Zeroing the power meter every two minutes with the UUT's RF power off is recommended.)

8. With the UUT's frequency set to 5, 10, and 20 GHz, verify that readings at -10 dB and -50 dB are within specification.

The components required for Option 27 are listed below.

Diagrams for Option 27 are contained in Chapter 7.

29822 OPT 27 60 dB SCAN W/O OPT 26, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	004BA34300	1	58900	004BA34300	.01-20 GHZ SCAN
2	420CF41700	1	58900	420CF41700	CTR/SCAN MOUNT; GT9000/S
3	MRTL-22020	1	58900	MRTL-22020	COAX TRANS SWITCH
4	003AW02700	REF	58900	003AW02700	OPT 27; SCAN MOD W/L
5	WCAS-26004	1	58900	WCAS-26004	4" 26 GHz SEMI-FLEX COAX
6	WCAS-26005	1	58900	WCAS-26005	5" 26 GHz SEMI-FLEX COAX
8	WCAS-26008	1	58900	WCAS-26008	8" 26 GHz SEMI-FLEX COAX
9	WCAS-18104	1	58900	WCAS-18104	4" 18 GHz SEMI-FLEX COAX
11	WCAS-18001	-1	58900	WCAS-18001	1" 18GHZ SEMI-FLEX COAX
101	HBPP-25605	7	26233	NS137CR256R5	2-56 X 1/4 PAN
102	HBPP-44010	2	58900	HBPP-44010	4-40 X 5/8 PAN
103	HNKS-44004	3	96906	MS35649-***	4-40 KEP NUT
104	HWSS-20200	7	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
105	HWSS-40300	3	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
106	HBPP-44005	2	26233	NS137CR440R5	4-40 X 5/16 PAN
107	HLLT-40210	1	79963	505-120 # 4	#4 SOLDER LUG
A7	120BA15650	1	58900	120BA15650	SCAN MODULATION PCA;GT9000
A109	420BA41900	1	58900	420BA41900	SCAN MODULE I/F PCA
A3 U13	UMN0-27256	1	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
A3 U14	UMN0-27256	1	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE

29866 OPT 27 60 dB SCAN W/OPT26, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	004BA34300	1	58900	004BA34300	.01-20 GHZ SCAN
2	420CF41700	1	58900	420CF41700	CTR/SCAN MOUNT; GT9000/S
3	MRTF-22020	1	58900	MRTF-22020	COAX TRANS SWITCH
4	003AW02700	REF	58900	003AW02700	OPT 27; SCAN MOD W/L
5	WCAS-18104	2	58900	WCAS-18104	4" 18 GHz SEMI-FLEX COAX
6	WCAS-26006	1	58900	WCAS-26006	6" 26 GHz SEMI-FLEX COAX
8	WCAS-18109	1	58900	WCAS-18109	9" 18 GHz SEMI-FLEX COAX
9	WCAS-18108	1	58900	WCAS-18108	8" 18 GHz SEMI-FLEX COAX
11	WCAS-18106	-1	58900	WCAS-18106	6" 18 GHz SEMI-FLEX COAX
101	HBPP-25605	7	26233	NS137CR256R5	2-56 X 1/4 PAN
102	HBPP-44012	2	58900	HBPP-44012	4-40 X 3/4 PAN
103	HNKS-44004	3	58900	HNKS-44004	4-40 KEP NUT
104	HWSS-20200	7	58900	HWSS-20200	#2 X 1/8 SPLIT LOCK
105	HWSS-40300	4	58900	HWSS-40300	#4 X 3/16 SPLIT LOCK
106	HBPP-44005	2	26233	NS137CR440R5	4-40 X 5/16 PAN
A7	120BA15650	1	58900	120BA15650	SCAN MODULATION PCA;GT9000
A109	420BA41900	1	58900	420BA41900	SCAN MODULE I/F PCA
A3 U13	UMN0-27256	1	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
A3 U14	UMN0-27256	1	01295	TMS 27C256-15JL	AT27C256 PROM ERASABLE
CR1	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE

120BA15650 SCAN MODULATION PCA (A7); GT9000, Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	120BS15650	REF	58900	120BS15650	SCAN MODULATION SCH;GT9000
1	120CF15650	1	58900	120CF15650	SCAN MODULATION PCB;GT9000
2	ETST-06224	10	58900	ETST-06224	TURRET TERMINAL
C1	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C2	CE25-R6330	1	74840	336BPR025M	33 UF 25V NON-POL RADIAL
C3	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C4	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C5	CC50-00047	1	31433	C315C479D2G5CA-9248	4.7 PF CERAMIC NPO
C7	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C8	CC50-02100	1	04222	SR155C122MAT	.001 UF CERAMIC Y5P
C10	CC50-01150	1	31433	C315C151G5CA-9248	150 PF CERAMIC NPO
C11	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C12	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C13	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C14	CC50-01220	1	31433	C315C221K1G5CA	220 PF CERAMIC NPO
C15	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C16	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C17	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C18	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C19	CC50-04220	1	31433	C322C224M5U5CA	.22 UF CERAMIC Z5U
C22	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C23	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C38	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C39	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C40	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C41	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C42	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C43	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C44	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C48	CC50-00100	1	31433	C315C100J2G5CA	10 PF CERAMIC NPO
C49	CC50-04220	1	31433	C322C224M5U5CA	.22 UF CERAMIC Z5U
C51	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C53	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R

120BA15650 SCAN MODULATION PCA (A7); GT9000, Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
C61	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C62	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C63	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C64	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C65	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C66	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C69	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C70	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C71	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C72	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C75	CC50-04220	1	31433	C322C224M5U5CA	.22 UF CERAMIC Z5U
C76	CC50-04220	1	31433	C322C224M5U5CA	.22 UF CERAMIC Z5U
C77	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C78	CC50-00470	1	31433	C315C470J2G5CA	47 PF CERAMIC NPO
C80	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C81	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C82	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C83	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C84	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C85	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C88	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C89	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C92	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C93	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C94	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C95	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C98	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C99	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
C100	CE16-R6330	1	55680	UVP1C330MDA	33 UF 16V NON-POL RADIA
CR1	DSA0-02810	1	28480	5082-2800	5082-2810 SCHOT. DIODE
CR2	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR3	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR4	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR5	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CR6	DSA0-04148	1	58900	DSA0-04148	1N4148 G.P. DIODE
CX79	CC50-01750	REF	51642	200-100-NPO-751J	750 PF CERAMIC NPO
L3	LAD0-06220	1	91637	IMS5-22UH-10%	22 UH INDUCTOR
L5	LAD0-06220	1	91637	IMS5-22UH-10%	22 UH INDUCTOR
LX6	LAD0-06220	REF	91637	IMS5-22UH-10%	22 UH INDUCTOR
P1	JIA2-06235	1	58900	JIA2-06235	6 PIN STRIPLINE PLUG
P2	JIR2-02230	1	55322	TSW-101-08-S-D-R	2 PIN STRIPLINE PLUG
P3	JIR2-02230	1	55322	TSW-101-08-S-D-R	2 PIN STRIPLINE PLUG
P4	JIA1-03230	1	58900	JIA1-03230	3 PIN STRIPLINE PLUG
P5	JIA1-03230	1	58900	JIA1-03230	3 PIN STRIPLINE PLUG
P6	JIA1-03230	1	58900	JIA1-03230	3 PIN STRIPLINE PLUG
P7	JIA1-03230	1	58900	JIA1-03230	3 PIN STRIPLINE PLUG
Q1	QBNS-02222	1	04713	2N2222A	PN2222 .5A 30V NPN
R1	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R2	RN50-21500	1	91637	RN50C1502F	15.0 K OHMS 1% MET FILM
R3	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R4	RAPG-25000	1	32997	3296Z-503	50K 10% 25T POT
R5	RN55-31870	1	91637	RN55C1873F	187 K OHMS 1% MET FILM
R6	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R7	RN50-41000	1	91637	RN50C1004F	1.00 M OHMS 1% MET FILM
R8	RN50-23320	1	91637	RN50C3322F	33.2 K OHMS 1% MET FILM
R9	RAPG-15000	1	32997	3296Z-1-502	5K 10% 25T .5W TRIM. POT
R10	RN50-19090	1	91637	RN50C9091F	9.09 K OHMS 1% MET FILM
R11	RN50-31000	1	91637	RN50C1003F	100 K OHMS 1% MET FILM
R13	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R14	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R15	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R16	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R17	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM

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Item	Part Number	Qty	Cage	Mfr's Part Number	Description
R19	RAPG-15000	1	32997	3296Z-1-502	5K 10% 25T .5W TRIM. POT
R20	RN50-23320	1	91637	RN50C3322F	33.2 K OHMS 1% MET FILM
R21	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R22	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R24	RN50-18250	1	91637	RN50C8251F	8.25 K OHMS 1% MET FILM
R25	RAPG-31000	1	32997	3296Z-1-104	100K 10% 25T .5W TRM POT
R27	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R29	RN50-13320	1	91637	RN50C3321F	3.32 K OHMS 1% MET FILM
R30	RN50-11100	1	91637	RN50C1101F	1.10 K OHMS 1% MET FILM
R32	RN50-22260	1	91637	RN50C2262F	22.6 K OHMS 1% MET FILM
R33	RN50-17500	1	91637	RN50C7501F	7.50 K OHMS 1% MET FILM
R40	RN50-01000	1	91637	RN50C1000F	100 OHMS 1% METAL FILM
R41	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R42	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R43	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R44	RN50-21500	1	91637	RN50C1502F	15.0 K OHMS 1% MET FILM
R52	RN50-00200	1	91637	RN50C20R0F	20.0 OHMS 1% METAL FILM
R53	RN50-00825	1	91637	RN50C82R5F	82.5 OHMS 1% METAL FILM
R54	RN50-17500	1	91637	RN50C7501F	7.50 K OHMS 1% MET FILM
R55	RN50-00511	1	91637	RN50C51R1F	51.1 OHMS 1% METAL FILM
R56	RN50-00825	1	91637	RN50C82R5F	82.5 OHMS 1% METAL FILM
R63	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R64	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R65	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R67	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R68	WJIB-02022	1	58900	WJIB-02022	.2 INSULATED JUMPER
R74	RN55-00511	1	91637	RN55C51R1F	51.1 OHMS 1% MET FILM
R75	RN50-17500	1	91637	RN50C7501F	7.50 K OHMS 1% MET FILM
R76	RN50-11820	1	65940	CRB20FX1821B	1.82 K OHMS 1% MET FILM
R77	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R78	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R79	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R80	RAPG-12000	1	32997	3296Z-1-202	2K 10% 25T .5W POT.
R81	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R82	RN50-14990	1	91637	RN50C4991F	4.99 K OHMS 1% NET FILM
R83	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R84	RN50-23320	1	91637	RN50C3322F	33.2 K OHMS 1% MET FILM
R85	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R86	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R87	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R88	RN50-22490	1	91637	RN50C2492F	24.9 K OHMS 1% MET FILM
R89	RN50-21620	1	91637	RN50D1622F	16.2 K OHMS 1% MET FILM
R90	RN50-21620	1	91637	RN50D1622F	16.2 K OHMS 1% MET FILM
R91	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R92	RN50-21000	1	91637	RN50C1002F	10.0 K OHMS 1% MET FILM
R93	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R94	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R95	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R96	RN55-01500	1	91637	RN55C1500D	150 OHMS 1% MET FILM
R97	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R98	RN55-19090	1	91637	RN55C9091F	9.09 K OHMS 1% MET FILM
R100	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R101	RN50-17500	1	91637	RN50C7501F	7.50 K OHMS 1% MET FILM
R102	RN50-06980	1	65940	CRB20FX6980	698 OHMS 1% METAL FILM
R103	RN50-41000	1	91637	RN50C1004F	1.00 M OHMS 1% MET FILM
RX28	RN50-13160	REF	91637	RN50C3161F	3.16 K OHMS 1% MET FILM
RX99	RN50-11000	REF	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
U1	UOG0-00111	1	13919	OPA 111AM	OPA111BM JFET OPAMP
U2	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U3	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U4	UAN0-08048	1	2M881	ICL8048BCJE	ICL8048 LOG AMPLIFIER
U5	UON0-00844	1	24355	AD844AN	AD844AN;OP AMP
U6	UVNP-00100	1	24355	AD587JK	AD587 10V 20PPM REF

120BA15650 SCAN MODULATION PCA (A7); GT9000, Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
U7	UIN0-75453	1	01295	SN75453BP	SN75453BP DUAL DRIVER
U8	UTN0-01382	1	01295	74HC138N	74HC138 DECODER/DEMULTIP
U9	UTN0-01322	1	01295	MC74HC132E	SN74HC132N 4X SCHMIDT NAN
U10	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U11	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U12	UIN0-00872	1	24355	AD872JD	AD872JD 12 BIT CMOS A/D
U19	UTN0-01572	1	01295	SN74HC157	74HC157 QUAD DATA SELECT
U20	UTN0-01572	1	01295	SN74HC157	74HC157 QUAD DATA SELECT
U21	UTN0-01572	1	01295	SN74HC157	74HC157 QUAD DATA SELECT
U22	UMN0-71681	1	58900	UMN0-71681	IDT71681;4K X 4 RAM
U23	UMN0-71681	1	58900	UMN0-71681	IDT71681;4K X 4 RAM
U24	UMN0-71681	1	58900	UMN0-71681	IDT71681;4K X 4 RAM
U29	UIN0-09713	1	24355	AD9713BAN	AD9713JN;DAC;12 BIT
U33	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U34	UTN0-00042	1	01295	SN74HC04N	SN74HC04 HEX INVERTER
U35	UTN0-02732	1	01295	74HC273N	74HC273;OCTAL D-TYPE F-F
U36	UTN0-00322	1	01295	74HC32N	74HC32 QUAD 2 INPUT OR
U37	ULN0-05053	1	1ES66	DG412DJ	IH5053 QUAD ANALOG SWITC
U38	UON0-00746	1	24355	AD746AQ	AD746JN DUAL OP AMP
U39	UIN0-07547	1	1ES66	AD7547KN	AD7547KN DUAL 12 BIT DAC
U40	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U41	UON0-00708	1	24355	AD708JN	AD708JN DUAL OP AMP
U42	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U43	UON0-05532	1	58900	UON0-05532	NE5532 DUAL OP AMP
U44	UON0-00844	1	24355	AD844AN	AD844AN;OP AMP
U45	UON0-00844	1	24355	AD844AN	AD844AN;OP AMP
W1	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
W2	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
W4	WJIB-05022	1	58900	WJIB-05022	.5 INSULATED JUMPER
W5	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
W6	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
W7	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER
W8	JJF0-02000	1	58900	JJF0-02000	TWO CONTACT JUMPER

A.16 Option 28: High Stability Timebase

When Option 28 is installed, a special timebase oscillator having an aging rate of 5×10^{-10}/day is substituted for the standard timebase oscillator.

The components required for Option 28 are listed in below.

Diagrams for Option 28 are contained in Chapter 7.

29810 OPT 28 5 X 10^{-10}/DAY TIME BASE, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	101BA39103	1	58900	101BA39103	HI STAB OSC PCA 5X10-10
2	101BA39101	-1	58900	101BA39101	HI STAB OSC PCA

101BA39103 HI STAB OSC PCA 5X10^{-10} (A21), Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	101BS39103	REF	58900	101BS39103	HI-STAB OSC 5X10-10 SCH
1	101BF39101	1	58900	101BF39101	HI STAB OSC PCB
C1	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C2	CC50-05100	1	04222	SR305E105MAA	1 UF CERAMIC Z5U
C3	CC50-03100	1	54583	RD30HX7R103K	.01 UF CERAMIC X7R
R1	RAPD-31000	1	58900	RAPD-31000	100K POT 15T PC MNT
Y1	OXO5-00010	1	6Y341	250-0682	10MHZ OVEN OSCILLATOR

A.17 Option 30: Switching Power Supply

This is a factory-installed option to provide a CE-approveed Switching Power Supply. This option is not field-installable. The components required for Option 30 are listed below.

29874 OPT 30 'CE' POWER SUPPLY, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	30796	1	58900	30796	OPT 30 SWITCHING PWR SUP

30796 OPT 30 SWITCHING PWR SUP, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	420AW48800	REF	58900	420AW48800	GT9000/S SW P/S ASSY W/L
1	420DF50200	1	58900	420DF50200	GT9000/S SW P/S COVER
2	HIGR-00375	1	2R182	2170	3/8 GROMMET
3	HSTH-62404	4	55566	2120-632-A	6-32 X 1 1/2 HEX SPACER
4	HSTH-61804	4	58900	HSTH-61804	6-32 X 1 1/8 HEX SPACER
5	HTM0-00001	2	06383	TA1S8	ANCHOR MOUNT
6	1202221200	1	58900	1202221200	GT9000/S SW P/S HARNESS A
7	420DF50100	1	58900	420DF50100	GT9000/S SW P/S BASE
8	420CF49200	2	58900	420CF49200	GT9000/S SW P/S MTG PLATE
9	HT00-00409	5	53421	T-18R	4 WHITE CABLE TIE
10	HTM0-00002	1	06383	TM2S8	TIE MOUNT
11	GFU0-00002	3	58900	GFU0-00002	1/2 X 1/8 FOAM TAPE
12	HSCR-40204	2	06540	9222-A-115	#4 X 1/8 CLEAR SPACER
13	HSTX-44004	4	58900	HSTX-44004	4-40 CORNR BLOCK 1/16 MT
101	HNKS-63204	56	58900	HNKS-63204	6-32 KEP NUT
102	HWFS-60400	57	7U905	5710-23-15-P	#6 X 1/4 FLAT WASHER
103	HBFP-63204	22	58900	HBFP-63204	6-32 X 1/4 FLAT
104	HBPP-63204	12	58900	HBPP-63204	6-32 X 1/4 PAN
105	HWSS-60400	13	58900	HWSS-60400	#6 X 1/4 SPLIT LOCK
106	HBFP-63203	10	58900	HBFP-63203	6-32 X 3/16 FLAT
107	HBFP-44003	2	26233	NS139CR440R3	4-40 X 3/16 FLAT
108	HBFP-44005	2	26233	NS139CR440R5	4-40 X 5/16 FLAT
109	HBPP-63209	1	58900	HBPP-63209	6-32 X 9/16 PAN
A208A1	30708	1	58900	30708	OPT 30 SW PWR SPLY PCA
A208A2	30712	1	58900	30712	OPT 30 SW PWR SPLY PCA
A208A3	30717	1	58900	30717	OPT 30 SW PWR SPLY PCA
C2	CE00-R7560	1	55680	LLQ2G561MHSC	560 UF 400 V ELECTROLYTC
C3	CE00-R7560	1	55680	LLQ2G561MHSC	560 UF 400 V ELECTROLYTC

30708 OPT 30 SW PWR SPLY PCA, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	30707	1	58900	30707	SWITCHING PWR SUPPLY PCB
1	30709	REF	58900	30709	SWITCHING PWR SUPPLY SCHEM
4	30710	REF	58900	30710	SWITCHING PWR SUPPLY TP
C1	CF00-R4470	1	55680	QXW2E474KTPT	.47UF 250VAC PLASTIC
C4	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C5	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C8	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
CR1	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
F1	FFDC-00700	1	58900	FFDC-00700	7A FB WIRE LEAD FUSE

30708 OPT 30 SW PWR SPLY PCA, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
F2	FFCC-00250	1	58900	FFCC-00250	2.5A PC-TRON FUSE
P2	JIA1-06450	1	27264	26-48-2065	6 PIN LOCKING STRIP PLUG
P3	JIA1-06450	1	27264	26-48-2065	6 PIN LOCKING STRIP PLUG
R1	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
R2	RN55-14320	1	91637	RN55C4321F	4.32 K OHMS 1% MET FILM
R3	RN55-24020	1	91637	RN55C4022F	40.2 K OHMS 1% MET FILM
R4	RAPD-21000	1	58900	RAPD-21000	10K POT 15T PC MNT
R5	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
TP1	ETST-06224	1	58900	ETST-06224	TURRET TERMINAL
U1	ZP00-00001	1	58900	ZP00-00001	UNIVERSAL AC INPUT MOD
U2	ZP00-00002	1	58900	ZP00-00002	RIPPLE ATTEN MODULE
U3	ZP00-00270	1	58900	ZP00-00270	5V 50W DC-DC CONVERTER

30712 OPT 30 SW PWR SPLY PCA, Rev: B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	30713	REF	58900	30713	SWITCHING PWR SUPPLY SCHEM
1	30711	1	58900	30711	SWITCHING PWR SUPPLY PCB
4	30714	REF	58900	30714	SWITCHING PWR SUPPLY TP
C1	CC00-B1470	1	58900	CC00-B1470	470PF Z5F CERAMIC DISC
C2	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C3	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C4	CC00-B1470	1	58900	CC00-B1470	470PF Z5F CERAMIC DISC
C5	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C6	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C8	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C10	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C13	CE35-R7100	REF	55680	UVX1V101MPA	100 UF 20% ELECTROLYTIC
C15	CE35-R7100	1	55680	UVX1V101MPA	100 UF 20% ELECTROLYTIC
CR1	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR2	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR3	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR4	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR5	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR6	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CX11	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX14	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
F1	FFCC-00250	1	——-	PCB-2 1/2	2.5A PC-TRON FUSE
F2	FFCC-00250	1	——-	PCB-2 1/2	2.5A PC-TRON FUSE
P1	WSB0-20000	1	58900	WSB0-20000	20 GA BUS WIRE
P3	WSB0-20000	1	58900	WSB0-20000	20 GA BUS WIRE
R1	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
R2	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
R3	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
R4	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
R5	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R6	RN55-14320	1	91637	RN55C4321F	4.32 K OHMS 1% MET FILM
R7	RN55-24020	1	91637	RN55C4022F	40.2 K OHMS 1% MET FILM
R8	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R9	RN55-24020	1	91637	RN55C4022F	40.2 K OHMS 1% MET FILM
R10	RN55-23160	1	91637	RN55C3162F	31.6 K OHMS 1% MET FILM
U1	ZP00-00270	1	58900	ZP00-00270	5V 50W DC-DC CONVERTER
U2	ZP00-10272	1	58900	ZP00-10272	15V 100W DC-DC CONVERTER
U3	ZP00-00002	1	58900	ZP00-00002	RIPPLE ATTEN MODULE
U4	ZP00-00002	1	58900	ZP00-00002	RIPPLE ATTEN MODULE

30717 OPT 30 SW PWR SPLY PCA, Rev: C

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
0	30718	REF	58900	30718	SWITCHING PWR SUPPLY SCH
1	30711	1	58900	30711	SWITCHING PWR SUPPLY PCB
4	30719	REF	58900	30719	SWITCHING PWR SUPPLY TP
C1	CC00-B1470	1	58900	CC00-B1470	470PF Z5F CERAMIC DISC
C2	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C3	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C4	CC00-B1470	1	58900	CC00-B1470	470PF Z5F CERAMIC DISC
C5	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C6	CF99-02100	1	68919	MP3-Y2-1000/250/10	1000PF CLASS Y FILM CAP
C8	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C10	CC50-04100	1	31433	C322C104M5U5CA C9248	.1 UF CERAMIC Z5U
C13	CE35-R7100	1	55680	UVX1V101MPA	100 UF 20% ELECTROLYTIC
C15	CE35-R7100	1	55680	UVX1V101MPA	100 UF 20% ELECTROLYTIC
CR1	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR2	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR3	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR4	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR5	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CR6	DPAC-04006	1	18041	IN4006	1N4006 1A 800V DIODE
CX11	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
CX14	CC50-?????	REF	58900	CC50-?????	COMPONENT SELECTED IN TEST
F1	FFCC-00250	1	——-	PCB-2 1/2	2.5A PC-TRON FUSE
F2	FFCC-00250	1	——-	PCB-2 1/2	2.5A PC-TRON FUSE
P2	WSB0-20000	1	58900	WSB0-20000	20 GA BUS WIRE
P4	WSB0-20000	1	58900	WSB0-20000	20 GA BUS WIRE
R1	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
R2	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
R3	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
R4	RN55-00010	1	91637	RN55C1R00F	1.0 OHMS 1% MET FILM
R5	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R6	RN55-14320	1	91637	RN55C4321F	4.32 K OHMS 1% MET FILM
R7	RN55-24020	1	91637	RN55C4022F	40.2 K OHMS 1% MET FILM
R8	RAPG-21000	1	32997	3296Z-1-103	10K 10% 25T .5W TRIM POT
R9	RN55-24020	1	91637	RN55C4022F	40.2 K OHMS 1% MET FILM
R10	RN55-23160	1	91637	RN55C3162F	31.6 K OHMS 1% MET FILM
U1	ZP00-00272	1	58900	ZP00-00272	15V 75W DC-DC CONVERTER
U2	ZP00-00273	1	58900	ZP00-00273	24V 75W DC-DC CONVERTER
U3	ZP00-00002	1	58900	ZP00-00002	RIPPLE ATTEN MODULE
U4	ZP00-00002	1	58900	ZP00-00002	RIPPLE ATTEN MODULE

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