电子元器件系列(中国.厦门)

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PRODUCT INDEX

Maury Microwave products range in complexity from simple, passive transmission components, such as waveguide straight sections, to the sophisticated, computer-driven automated tuner systems used for fast, efficient noise, power and network characterization of active devices. These products, categorized as instruments, include vector network analyzer (VNA) calibration kits, and coaxial and waveguide components. The organization of this catalog generally reflects these classifications.

The instrument category is comprised of calibration kits for all popular VNAs in rectangular waveguide covering 1.12 to 110 GHz and coaxial line (all standard connector types, including BNC and TNC, covering DC to 50 GHz), measurement instruments for noise figure and related quantities, noise calibration systems and standards, and automated tuner systems including accessories such as bias supplies and transistor test fixtures.

The coaxial component section includes metrology components such as precision Air lines, two- port standards, sliding shorts and VNA calibration kit components (opens, shorts, terminations - both fixed and sliding), tuners, directional couplers and power standard sets, and a full line of in-series and between-series adapters. All standard connector types are represented and some components are available with EIA rigid line connectors.

The Maury waveguide line also includes metrology components as well as tuners, isolators, directional couplers and transmission components (straight sections, bends etc.). Most waveguide components are available in all standard rectangular waveguide sizes from WR430 (1.7 to 2.6 GHz) through WR10 (75 to 110 GHz) – some are available in WR650 (1.12 to 1.7 GHz).

Although this catalog covers a wide range of products, please contact our Sales Department if you cannot find exactly what you need. We are very active in the design and manufacture of special devices and instruments to customer requirements as well as modifying existing items for specific applications. Please visit our web site at http://www.maurymw.com for the most current product information.

MODEL INDEX

[1] Waveguide models are preceded by alpha characters which indicate band width. See page 173 for band designations.

How to Order

Orders may be placed directly with the factory or in care of your nearest Maury sales representative. For orders originating outside the United States, we recommend placing the order with your local Maury sales representative. Maury maintains an extensive network of sales representatives throughout the world. A list of Maury sales offices and representatives can be found on pages viii and ix. [1]

Pricing and Quotations

The prices for an order are those prevailing at the time the order is placed except in those instances where the price is established by a formal quotation. Maury Microwave reserves the right to change prices at any time without notice. Price and availability of products with custom or special features must be verified by a valid, formal factory quotation. Maury quotations are valid for a maximum of 30 days. Extensions of quotation validity beyond 30 days can be granted only by the factory.

Terms of Sale

Domestic

Terms are net 30 days from the date of invoice for customers with established credit F.O.B. Ontario, California. Please refer to Maury Form 228 [2] for complete terms and conditions.

International

Please refer to Maury Form 250 [2]. Sales to Canada are covered by Maury Form 251 [2].

Shipment

All shipments are at the buyer's expense. Shipments are normally made using methods and carriers specified by the customer. In the absence of specific instructions, Maury will ship at our discretion by the most advantageous method. All shipments are F.O.B. the Maury Microwave factory in Ontario, California and, unless otherwise specified, will be insured at full value at the customer's expense. Shipments are packed to provide ample safety margin against transit damage, and there is no charge for regular packing requirements. Additional charges are applicable to MIL-SPEC preservation, packaging, packing and marking.

Product and Specifications Changes

The information, illustrations and specifications contained in this catalog were current at the time of publication [1]. Maury Microwave is continually striving to upgrade and improve our product offering and therefore, reserves the right to change specifications, designs and models without notice and without incurring any obligation to incorporate new features on products previously sold.

Because products are changed or improved with time, we recommend that you consult with your local Maury representative, or our factory Sales Department staff for current pricing and product data before placing your order [1].

[1] Visit our web site at http://www.maurymw.com for the most current information.

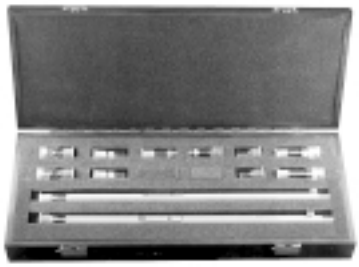
[2] Copies of these forms are available on request, or may be downloaded from our web site in ".pdf" format.

PRECISION MEASUREMENT EQUIPMENT

Maury Microwave Manufactures:

Calibration Kits for Vector Network Analyzers (VNAs)

For accurate and precise calibration of all popular Agilent and Anritsu VNAs from 0.045 to 110 GHz in a wide range of coaxial and waveguide test device interfaces.



Automated Tuner Systems

For precise determination of the noise, power, intermodulation distortion, adjacent channel power and network parameters of devices from 250 MHz to 110 GHz. These systems feature efficient, software driven, highly repeatable automated tuners which can also be used for other applications such as power and noise matching.

Receiver Noise Measurement Instrumentation

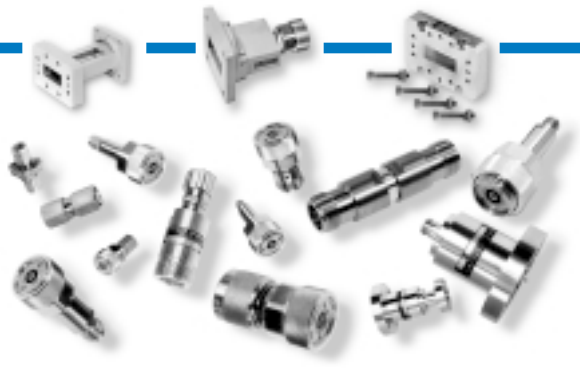
For accurate evaluation of the noise performance of receiver systems and related components (amplifiers, mixers, etc.) with a range of cost/performance alternatives. This line also includes frequency extenders and solid state noise generators.

Thermal Noise Terminations and Noise Calibration Systems

For highly accurate noise figure and noise temperature measurements and the calibration of solid state noise generators.

Coaxial and Waveguide Components, Adapters and Connectors

For precision measurements using adapters and components in all common connectors and waveguide sizes, Maury offers a wide range of coaxial and waveguide components. Precision measurement components include sliding and fixed terminations, short circuits, precision mismatches, two-port standards, air lines and much more.



VNA CALIBRATION KITS

- Broad VNA Coverage
- Accurate VNA Calibration
- 0.045 to 110 GHz
- All Popular Coaxial Connectors
- Cost/Performance Range

General

When properly calibrated against known standards, Vector Network Analyzers (VNAs), provide the most accurate means of determining the one- and two-port network characteristics of RF and microwave devices. Calibration effectiveness (a VNA's ability to reduce error terms to negligible values) critically and ultimately depends on the quality and integrity of the calibration standards used.

To help maximize calibration effectiveness, Maury produces a comprehensive line of coaxial and waveguide VNA calibration kits which incorporate accurate, stable, and precise calibration standards for a broad range of VNA models. When properly used, these kits ensure a true evaluation of VNA performance.

Maury kits offer a range of performance and cost options which provide users with choices that are both technically and economically suitable for a variety of intended application.

Coaxial kits are available for testing VNAs fitted with any of the modern, popular connectors.
Including:

- 2.4mm
- 2.92mm (K)
- 3.5mm (also used for SMA testing)
- Type N
- TNC (and AFTNC)
- BNC
- 7-16
- 14mm (formerly GR900)
- 7mm

Maury also produces kits for OSP™ [1] , C, SC, HN and EIA connectors (7/8, 1-5/8, and 3-1/8). Please contact our Sales Department if you have a requirement in any of these connector series.

Waveguide kits are available in all common, standard rectangular sizes from WR430 (1.7 to 2.6 GHz) through WR10 (75 to 110 GHz). Maury has also produced kits in less common rectangular size such as WR102 (7 to 11 GHz) and in half-height waveguide. If you require a calibration kit in a nonstandard or rarely used waveguide type –including circular guide –please contact our Sales Department.

Methodology

Most coaxial kits are designed for the Open-Short-Load-Thru (OSLT) calibration technique using sliding loads. However, some low frequency and economy kits utilize fixed loads. Maury waveguide kits are primarily designed for the Short-Short-Load-Thru (SSLT) calibration method using 1/8 and 3/8λ offset shorts and sliding loads. Some economy kits are available with fixed shorts and 1/4-wavelength shims. Thru-Reflect-Line (TRL) kits are also available. Since TRL kits contain a fixed load, they can also be used for an offset load calibration where this method is supported by the VNA.

[1] "OSP™" is the M/A-Com Omni-Spectra designation. See Maury data sheet 5E-065 for interface details.

SPECIAL CALIBRATION KITS

CONFIGURATION AND PACKAGING

Briefcase

Jeweler's Case

Molded Plastic Case

Maury frequently configures unique or highly specialized calibration kits based on customer-specified component lists. Whether in coax or waveguide, Maury can provide custom calibration kits to meet your exact needs. Customizing may include special packaging; addition, deletion or substitution of components; single sex coaxial kit configurations; and special waveguide flanges. Maury also offers several coaxial and waveguide kits that are configured in economy versions, made up of the minimum number of components necessary to provide an accurate calibration of specified VNA. If your calibration needs are not covered by our standard or expanded kits, our sales department can assist you in defining a special configuration.

Single Sex Coaxial Kits

Most of Maury's standard or expanded calibration kits include male and female components. Maury also offers single sex kits which are very economical alternatives for production line calibrations that require only a single sex version of a particular connector.

Special Waveguide Flanges

European designation, half-height or special index pin/bolt pattern waveguide flanges can be incorporated into a special kit. Please provide a flange drawing that describes your special flange when requesting a price quote.

If you do not find a kit to meet your calibration needs, please contact our Sales Department or your local Maury representative for assistance in providing a solution.

Special Packaging

Most of our calibration kits are housed in foam-lined wooden instrument cases. In some applications, more rugged or specialized packaging may be required. Maury offers special packaging options which include a molded plastic case for “assembly line” use, extremely small cases for single sex coaxial kits, and a briefcase configuration for field use.

Component Changes

Calibration kits can be configured to include the exact components needed for your VNA calibration. Coax-to-coax and waveguide-to-coax adapters can be changed to meet your interface needs. Reference air lines, sliding loads, gage kits, etc., can also be added or deleted.

VNA CALIBRATION KITS – QUICK REFERENCE

COAXIAL VNA CALIBRATION KIT CHART

DUT Connector	Calibration Kit Type	Test Port or Cable	Vector Network Analyzer					
			Agilent				Anritsu	
			8510A/B	8510C	8719/20/22	8753	360	37000 Series
2.4mm page 6	Standard	—	7950A03	7950A04	7950A05	—	7950A08	7950A09
		2.4mm	7950A13	7950A14	7950A15	—	7950A18	7950A19
		2.92mm	7950A23	7950A24	7950A25	—	7950A28	7950A29
2.92mm (K) pages 20-21	Standard	7mm	8770C23	8770C24	8770C25	—	8770C28	8770C29
		3.5mm	8770C13	8770C14	8770C15	—	8770C18	8770C19
		2.92mm	8770C13	8770C14	8770C15	—	8770C18	8770C19
		2.4mm	8770C33	8770C34	8770C35	—	—	—
3.5mm page 7 page 8	Expanded	7mm	8050H05	8050J05	8050M05	—	8050W05	8050X05
		3.5mm	8050H	8050J	8050M	—	8050W	8050X
	Standard	3.5mm	8050C13	8050C14	8050C15	—	8050C28	8050C29
page 9	Fixed Term.	7mm	8050G10	—	—	8050P16	—	—
		3.5mm	8050G13	8050G14	8050G15	—	8050G18	8050G19
page 29	Economy	3.5mm	8050Q	8050Q	8050Q	8050Q	8050Q	8050Q
Type N page 12	Standard	7mm	8850C23	8850C24	8850C25	—	8850C28	8850C29
		3.5mm	8850C13	8850C14	8850C15	—	8850C18	8850C19
		2.4mm	8850C33	8850C34	8850C35	—	—	—
		Type N	8850C03	8850C04	8850C05	—	8850C08	—
page 14	Fixed Term.	7mm	—	—	—	8850P16	—	—
page 15	75 ohm	Type N	8880A/B	8880A/B	8880A/B	8880A/B	8880A/B	8880A/B
page 29	Economy	Type N	8850Q	8850Q	8850Q	8850Q	8850Q	8850Q
TNC page 16	Standard	7mm	8650E	8650E14	8650E15	8650E16	8650E28	8650E29
		3.5mm	8650H	8650J	8650M	—	8650W	8650X
page 17	Fixed Term.	7mm	—	—	—	8650P16	—	—
page 29	Economy	TNC	8650Q	8650Q	8650Q	8650Q	8650Q	8650Q
AFTNC pages 10-11	Standard	7mm	8680A13	8680A14	8680A15	8680A16	8680A18	8680A19
		Type N	8680A23	8680A24	8680A25	8680A26	8680A28	8680A29
		3.5mm	8680A33	8680A34	8680A35	8680A36	8680A38	8680A39
	Economy	7mm	8680B13	8680B14	8680B15	8680B16	8680B18	8680B19
		Type N	8680B23	8680B24	8680B25	8680B26	8680B28	8680B29
		3.5mm	8680B33	8680B34	8680B35	8680B36	8680B38	8680B39
BNC pages 18-19	Fixed Term.	7mm	8550E13	8550E14	—	8550E16	8550E28	8550E29
		3.5mm	8550F13	8550F14	8550F15	—	8550F28	8550F29
	75 ohm	BNC	8580A	8580A	8580A	8580A	8580A	8580A
page 29	Economy	BNC	8550Q	8550Q	8550Q	8550Q	8550Q	8550Q
7mm pages 22-23	Expanded	7mm	2650F	—	—	—	—	—
		3.5mm	2650H	2650J	2650M	—	2650W	2650X
	Standard	7mm	2650F02	—	—	—	—	—
	Fixed Term.	7mm	2650F08	—	—	2650P16	—	—
OSP pages 24-25	Standard	N/A	8780A03	8780A04	8780A05	8780A06	8780A08	8780A09
		7mm	8780A13	8780A14	8780A15	8780A16	8780A18	8780A19
		3.5mm	8780A23	8780A24	8780A25	8780A26	8780A28	8780A29
	Fixed Term.	N/A	8780B03	8780B04	8780B05	8780B06	8780B08	8780B09
		7mm	8780B13	8780B14	8780B15	8780B16	8780B18	8780B19
		3.5mm	8780B23	8780B24	8780B25	8780B26	8780B28	8780B29
	Fixed Single Sex	7mm	8780F13/M13	8780F14/M14	8780F15/M15	8780F16/M16	8780F18/M18	8780F19/M19
		3.5mm	8780F23/M23	8780F24/M24	8780F25/M25	8780F26/M26	8780F28/M28	8780F29/M29
14mm page 28	Expanded	7mm	2450F20	—	—	2450F26	2450W20	2450X20
		3.5mm	2450F	2450F14	—	—	2450W	2450X
7-16 pages 26-27	Standard	—	2750B03	2750B04	2750B05	2750B06	2750B08	2750B09
		7mm	2750B13	2750B14	2750B15	2750B16	2750B28	2750B29
		Type N	2750B23	2750B24	2750B25	2750B26	2750B28	2750B29
	Economy	7mm	2750F33/M33	2750F34/M34	2750F35/M35	2750F36/M36	2750F38/M38	2750F39/M39
			2750F63/M63	2750F64/M64	2750F65/M65	2750F66/M66	2750F68/M68	2750F69/M69
			2750F13/M13	2750F14/M14	2750F15/M15	2750F16/M16	2750F18/M18	2750F19/M19
			2750F23/M23	2750F24/M24	2750F25/M25	2750F26/M26	2750F28/M28	2750M29/M29
			2750F43/M43	2750F44/M44	2750F45/M45	2750F46/M46	2750F48/M48	2750F49/M49
			2750F53/M53	2750F54/M54	2750F55/M55	2750F56/M56	2750F58/M58	2750M59/M59

COAXIAL TRL VNA CALIBRATION KIT CHART

DUT Connector	Calibration Kit Type	Test Port or Cable	Vector Network Analyzer					
			Agilent				Anritsu	
			8510A/B	8510C	8719/20/22	8753	360	37000 Series
7mm page 33	TRL Tri-Kits	—	2660B03	2660B04	2660B05	—	—	—
		NMD 3.5mm	2660B13	2660B14	2660B15	—	—	—
		3.5mm	2660B23	2660B24	2660B25	—	—	—
		NMD 2.4mm	2660B33	2660B34	2660B35	—	—	—
		2.4mm	2660B43	2660B44	2660B45	—	—	—
3.5mm page 31	TRL Tri-Kits	3.5mm	8060A13	8060A14	8060A15	—	—	—
		2.4mm	8060A23	8060A24	8060A25	—	—	—
Type N page 32	TRL Tri-Kits	—	8860A03	8860A04	8860A05	—	—	—
		3.5mm	8860A13	8860A14	8860A15	—	—	—
		2.4mm	8860A23	8860A24	8860A25	—	—	—
		7mm	8860A33	8860A34	8860A35	—	—	—
7-16 pages 34-35	TRL Tri-Kits	—	2760B03	2760B04	2760B05	—	—	—
		7mm	2760B13	2760B14	2760B15	—	—	—
		Type N	2760B23	2760B24	2760B25	—	—	—
2.4mm page 30	TRL Tri-Kits	—	7960A03	7960A04	7960A05	—	—	—
		2.4mm	7960A13	7960A14	7960A15	—	—	—
		2.92mm	7960A23	7960A24	7960A25	—	—	—

Waveguide Bands

The model numbers shown for waveguide calibration kits in the chart below are each preceded by an asterisk (*). This represents the band letter designator which describes the frequency range and the waveguide size in accordance with EIA accepted standards.

Maury waveguide band letter designations are listed with the individual calibration kit series and in the reference section at the end of this catalog (see page 194).

WAVEGUIDE VNA CALIBRATION KIT CHART

DUT Connector	Calibration Kit Type	Test Port or Cable	Vector Network Analyzer					
			Agilent				Anritsu	
			8510A/B	8510C	8719/20/22	8753	360	37000 Series
Rectangular Waveguide 1.7 – 50 GHz pages 36-37	Standard	7mm [1]	*7005E13	*7005E14	*7005E15	*7005E16	*7005E18	*7005E19
		3.5mm/K [2]	*7005E33	*7005E34	*7005E35	*7005E36	*7005E38	*7005E39
		2.4mm	*7005E53	*7005E54	*7005E55	*7005E56	*7005E58	*7005E59
pages 38-39	Economy	3.5mm/K [2]	*7006A13	*7006A14	*7006A15 [3]	—	*7006A18	*7006A19
pages 40-41	TRL	7mm [1]	*7007H13	*7007H14	*7007H15 [3]	—	*7007H18	*7007H19
		3.5mm [3]						
		2.4mm						
Millimeter Waveguide 26.5 – 110 GHz pages 42-45	Optimized	Waveguide	*7005G13	*7005G14	—	—	*7005G18	*7005G19
	Economy	Waveguide	*7005M13	*7005M14	—	—	*7005N	*7005X

[1] For use up to 18 GHz.

[2] Kits for use above 26.5 GHz use 2.4mm adapters for Agilent VNAs and 2.92mm connectors for Anritsu VNAs.

[3] For use up to 26.5 GHz.

2.4mm VNA CALIBRATION KITS

7950A SERIES

Features

- Broad VNA Coverage
- 2.4mm Connectors
- 0.04 to 50 GHz

7950B Economy Kit
with Case Lid Removed.

Description

These 2.4mm calibration kits are designed for use with a broad range of Vector Network Analyzers (VNAs). The components in the kits are configured for use in making error-corrected measurements of devices supplied with 2.4mm connectors [1], from 40 MHz to 50 GHz.

Each kit includes a full complement of calibration standards (as listed at right) and can be configured for any combination of VNA or test set/cable connectors. All components (standards, adapters, accessories, and software medium on cartridge or 3-1/2" disk) and operating instructions, are supplied in an attractive foam-lined wooden instrument case.

Connector Description

The precision 2.4mm connectors are miniature, instrument grade, air-interface connectors that operate mode free up to 50 GHz, and comply with IEEE standard 287 general precision connector, instrument grade—GPC2.4.

Equipment Provided in Kits

Quantity	Description
1 ea.	Fixed short, 2.4mm female
1 ea.	Fixed short, 2.4mm male
1 ea.	Open circuit, 2.4mm female
1 ea.	Open circuit, 2.4mm male
1 ea.	Fixed termination, 2.4mm female
1 ea.	Fixed termination, 2.4mm male
1 ea.	Sliding termination, 2.4mm female [2]
1 ea.	Sliding termination, 2.4mm male [2]
1 ea.	Torque wrench, 0.312" hex 8 in/lb
1 ea.	Open end wrench, 5/16"
1 ea.	Open end wrench, 7/16"
1 ea.	Operating instructions
1 ea.	Instrument case

Ordering Options

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers (from the chart below) at the end of the kit model number, as shown in the example at right.

Example: Kit with adapter option 1 (2.4mm adapters) and VNA option 4 (Agilent 8510C)

Kit Model No. 7950A14 — Software option; Adapter set option

Software and Adapter Set Options

Test Set or Cable Connectors	Software Provided for VNA (by model)						Adapter Set Options		
	Agilent			Anritsu		No Software Provided			
	8510A/B	8510C	8719/20/22	360	37000 Series		7950A/B	7950F/M [3]	Number
—	03	04	05	08	09	N/A	—	—	0
2.4mm	13	14	15	18	19	10	7950Z3	7950Z7	1
2.92mm	23	24	25	28	29	20	7950Z4	7950Z8	2

[1] Precision gold plated beryllium copper 2.4mm per Maury data sheet 5E-064.

[2] Not provided in 7950B, 7950F, or 7950M economy kits.

[3] 7950F and 7950M are fixed single sex kits.

Key literature — Maury data sheets 2Z-050, 5E-064.

3.5mm VNA CALIBRATION KITS

8050H, J, M, W, X

Expanded Kits

- Broad VNA Coverage
- Includes Connector Gages, Torque Wrench and Test Port Adapters
- Improved Opens
- Sliding Terminations
- In-Series Phase Matched Adapters

8050J

Description

These 3.5mm calibration kits are designed for use with vector network analyzers (VNAs) equipped with 3.5mm, 2.92mm, or 7mm test set connectors and cables. With these kits, you can make error-corrected measurements of devices supplied with either 3.5mm or SMA connectors from 45 MHz to 26.5 GHz (18 GHz with 7mm adapters).

Each kit includes: a full complement of calibration standards (shorts, opens, sliding and fixed loads); rugged test port adapters and 3.5mm in-series phase matched adapters; connector gages for checking contact pin locations prior to making measurements and a torque wrench for accurately tightening connector junctions; all required calibration standards, adapters and accessories; and the applicable software medium (cartridge or 3-1/2" disk) containing the calibration constants and operating instructions. All of these components are supplied in an attractive foam-lined wooden instrument case.

Model Number Chart

Select the model appropriate for the VNA and test set/cable connectors.

Model	VNA	Test Set and Cable Connectors	Software Medium
8050H	Agilent 8510A/B	3.5mm	Cartridge
8050H05		7mm	
8050J	Agilent 8510C	3.5mm	3-1/2" disk
8050J05		7mm	
8050M	Agilent 8720	3.5mm	
8050M05		7mm	
8050W	Anritsu 360	2.92mm (K) [1]	
8050W05		7mm	
8050X	Anritsu 37000	2.92mm (K) [1]	
8050X05		7mm	

Connector Description

3.5mm connectors are air interfaced and mating compatible with SMA and K connectors. They have an air line size of 0.0598 inner diameter and 0.1378 outer diameter.

Equipment Provided in Kits [2]

1 ea. Fixed short, 3.5mm female
1 ea. Fixed short, 3.5mm male
1 ea. Open circuit, 3.5mm female
1 ea. Open circuit, 3.5mm male
1 ea. Fixed termination, 3.5mm female
1 ea. Fixed termination, 3.5mm male
1 ea. Sliding termination, converts between 3.5mm female and male
1 ea. Adapter, 3.5mm female to female*
1 ea. Adapter, 3.5mm male to male*
1 ea. Adapter, 3.5mm female to male*
1 ea. Test port adapter, NMD 3.5mm female to 3.5mm female [3]
1 ea. Test port adapter, NMD 3.5mm female to 3.5mm male [3]
2 ea. Adapter, 7mm to 3.5mm female** [4]
2 ea. Adapter, 7mm to 3.5mm male ** [4]
1 ea. Connector gage, 3.5mm
1 ea. Torque wrench, 0.312", 8 in/lbs
2 ea. Double ended wrench, 5/16"
1 ea. Software configuration medium

*, ** Phase matched sets.

[1] 3.5mm connectors mate directly with 2.92mm (K) connectors. The resulting junction is calibrated out and is not critical.
[2] Option 05 kits are configured for 7mm test sets and cables.
[3] Not included in Option 05 configuration.
[4] Included in Option 05 configuration.

Key literature — Maury data sheets 2Z-031H, 2Z-031J, 2Z-031M, 2Z-031W, 2Z-031X.

3.5mm VNA CALIBRATION KITS

8050C SERIES

Standard Kits

- Broad VNA Coverage
- Improved Opens
- Sliding Terminations
- In-Series Phase Matched Adapters

8050C

Description

These 3.5mm calibration kits are designed for use with Vector Network Analyzers (VNAs) equipped with 3.5mm or 2.92mm test set connectors and cables. With these kits, you can make error-corrected measurements of devices supplied with either 3.5mm or SMA connectors from 45 MHz to 26.5 GHz.

Each kit includes a full complement of calibration standards (shorts, opens, sliding and fixed loads); a full set of 3.5mm in-series phase matched adapters; all required calibration standards, adapters and accessories; and the applicable software medium (cartridge or 3-1/2" disk) containing the calibration constants and operating instructions. All of these components are housed in an attractive foam-lined wooden instrument case.

Connector Description

3.5mm connectors are air interface connectors that are mating compatible with SMA and K connectors. They have an air line size of 0.0598 inner diameter and 0.1378 outer diameter.

Model Chart

Select the model appropriate for your VNA and test set/cable connectors.

Model	VNA	Test Set and Cable Connectors	Software Medium
8050C13	Agilent 8510A/B	3.5mm [1]	Cartridge
8050C14	Agilent 8510C		3-1/2" disk
8050C15	Agilent 8719/20/22		
8050C28	Anritsu 360	2.92mm (K) [1]	
8050C29	Anritsu 37000		

[1] 3.5mm connector mates directly with 2.92mm (K) connector. The resulting junction is calibrated out and is not critical.

Equipment Provided in Kits

1 ea. Fixed short, 3.5mm female
1 ea. Fixed short, 3.5mm male
1 ea. Open circuit, 3.5mm female
1 ea. Open circuit, 3.5mm male
1 ea. Fixed termination, 3.5mm female
1 ea. Fixed termination, 3.5mm male
1 ea. Sliding termination, converts between sexes
1 ea. Adapter, 3.5mm female to female*
1 ea. Adapter, 3.5mm male to male*
1 ea. Adapter, 3.5mm female to male*
2 ea. Double ended wrench, 5/16"
1 ea. Software configuration medium
1 ea. Instrument case
1 ea. Operating instructions

* Phase matched set.

Available Accessories (not provided)

Connector Gages:

a) Push-on type – A034B or A034C
b) Thread-on type – A034E

Torque Wrench:

5/16", 8 in/lbs – 8799A1

Key literature — Maury data sheet 2Z-031C.

3.5mm VNA CALIBRATION KITS

8050D, G, P SERIES

Fixed Termination Kits

- Simple Fixed Load Calibration
- Precision 3.5mm Connectors
- Phase Matched Adapters

8050P

Description

These 3.5mm fixed termination calibration kits are designed for use in calibrating Vector Network Analyzers (VNAs) with the test set connectors or test cables noted below. The kits can be used to make error-corrected measurements of devices with 3.5mm, SMA, or 2.92mm (K) connectors at frequencies up to 18 GHz (depending upon the upper frequency limit of the VNA). With the possible exception of the adapters needed to mate with the test port, the kits are configured for use with a variety of VNAs. The calibration constants are provided by the included software, or may be manually entered.

Connector Description

3.5mm connectors are air interface connectors that are mating compatible with SMA and 2.92mm (K) connectors. They have an air line size of 0.0598 inner diameter and 0.1378 outer diameter.

Model Chart

Select the model appropriate for your VNA and test set/cable connectors. [1]

Model	Upper Freq. Limit Test (GHz)	VNA	Test Set and Cable Connectors	Software Medium
8050D	6.0	Agilent 8752A	Type N	—
8050G13	26.5	Agilent 8510A/B	3.5mm	Cartridge
8050G10			7mm	
8050G14	26.5	Agilent 8510C	3.5mm	3-1/2" disk
8050G15	20.0	Agilent 8720		
8050G18	26.5	Anritsu 360		
8050G19		Anritsu 37000		
8050P16	6.0	Agilent 8753A/B/C/D	7mm	

[1] Insert one of the following option numbers; 13, 14, 15, 18, or 19. See *Model Chart* for description of VNA, connector, etc.

Equipment Provided in Kits

Component	Quantity Per Kit			
	8050D	8050G([1])	8050G10	8050P16
Fixed short, 3.5mm female	1	1	1	1
Fixed short, 3.5mm male	1	1	1	1
Open circuit, 3.5mm female	1	1	1	1
Open circuit, 3.5mm male	1	1	1	1
Fixed termination, 3.5mm female	1	1	1	1
Fixed termination, 3.5mm male	1	1	1	1
Adapter, 7mm – 3.5mm female*	—	—	2	2
Adapter, 7mm – 3.5mm male*	—	—	2	2
Adapter, type N (f) – 3.5mm (f)**	1	—	—	—
Adapter, type N (m) – 3.5mm (f)**	1	—	—	—
Adapter, type N (f) – 3.5mm (m)**	1	—	—	—
Adapter, type N (m) – 3.5mm (m)**	1	—	—	—
Software configuration medium	—	1	1	1
Instrument case	1	1	1	1
Operating instructions	1	1	1	1

*, ** Phase matched sets.

Available Accessories (not provided)

Connector Gage:

Push-on type – A034B

Torque Wrench:

5/16", 8 in/lbs – 8799A1

Key literature — Maury data sheets 2Z-031D, 2Z-031G, 2Z-031P.

AFTNC (MIL-C-87104/2) VNA CALIBRATION KITS

8680 SERIES

- MIL-C-87104/2 AFTNC Interface
- Rated to 20 GHz
- Sliding Load and Economy Kits
- Multiple Network Analyzer Support

8680A14

Description

Maury 8680 calibration kits provide the necessary standards and accessories required to accurately calibrate network analyzers up to 20 GHz for error-corrected measurements of devices equipped with AFTNC connectors.

The Maury AFTNC connectors supplied in this kit fully comply with the interface requirements of MIL-C-87104/2. The male connector utilizes a solid outer conductor configuration to provide consistent measurement results. All connector bodies are fabricated from stainless steel for strength and wear resistance. These connectors were developed using optimized HFSS simulation to provide extremely low VSWR, and they are rated to 20 GHz. For interface specifications on these connectors, please refer to Maury data sheet 5E-056.

The 8680 kits are available in configurations for all popular analyzer and test port cable and connector combinations. The "A" model full kits include both sliding and fixed terminations while the "B" model economy kits include only fixed terminations.

Each kit is supplied in an attractive foam-lined wooden instrument case with operation instructions.

8680A Full (Sliding Load) and 8680B Economy (Fixed Load) Calibration Kits

These kits include both female and male standards, as listed below. The 8680A includes sliding loads for excellent calibration accuracy. The 8680B economy (fixed load) kits do not include sliding terminations.

Equipment Provided in 8680A/B Kits

Quantity	Description
1	Sliding termination, AFTNC female [1]
1	Sliding termination, AFTNC male [1]
1	Fixed termination, AFTNC female
1	Fixed termination, AFTNC male
1	Open circuit, AFTNC female
1	Open circuit, AFTNC male
1	Fixed short, AFTNC female
1	Fixed short, AFTNC male
1	Instrument case
1	Operating instructions

[1] Not included in 8680B economy kits.

Key literature — Maury data sheet 2Z-038.

AFTNC (MIL-C-87104/2) VNA CALIBRATION KITS

8680 SERIES

Software and Adapter Options

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers (from the chart below) at the end of the kit model number, as shown in the example at right.

Example: Kit with adapter option 1 (7mm adapters) and VNA option 4 (Agilent 8510C)

Kit Model No. 8680A14 — A: Software option; 14: Adapter set option

Test Set or Cable Connectors	Software Provided for VNA (by model)							Includes Adapter Set
	Agilent				Anritsu		None	
	8510A/B	8510C	8719/20/22	8753	360	37000		
—	03	04	05	06	08	09	N/A	None
7mm	13	14	15	16	18	19	10	1
Type N	23	24	25	26	28	29	20	2
3.5mm	33	34	35	36	38	39	30	3

Adapter Sets

Adapter Set Number	Quantity	Model	Description [2]
1 (7mm)	2	8692A	7mm to AFTNC female
	2	8692B	7mm to AFTNC male
2 (Type N)	1	8694A	Type N female to AFTNC female
	1	8694B	Type N female to AFTNC male
	1	8694C	Type N male to AFTNC female
	1	8694D	Type N male to AFTNC male
3 (3.5mm)	1	8691A	NMD3.5mm female to AFTNC female (test port) [3]
	1	8691B	NMD3.5mm female to AFTNC male (test port) [3]
	1	8682A	3.5mm female to AFTNC female
	1	8682B	3.5mm female to AFTNC male
	1	8682C	3.5mm male to AFTNC female
	1	8682D	3.5mm male to AFTNC male

Available Accessories (not provided)

Connector Gage: Model A012E

Adapters: The following in-series phase matched adapters are also available:

a) Model 8688A, AFTNC in-series adapter, female to female

b) Model 8688B, AFTNC in-series adapter, male to male

c) Model 8688C, AFTNC in-series adapter, female to male

Torque Wrench: Model 2698G1 (0.562 hex, 12 in/lbs)

[2] All adapters (except test port) are phase matched within their series.

[3] The ruggedized 3.5mm female (NMD3.5mm) connector provided on the 8691A and B mates directly with the ruggedized male 3.5mm connectors (NMD3.5mm) on the Agilent 8513, 8515 and some Anristu test sets, and the ruggedized 2.92mm connectors also used on some Anritsu test sets. The 8691A and B are not phase matched.

Key literature — Maury data sheet 2Z-038.

TYPE N VNA CALIBRATION KITS

8850C SERIES

Standard Kits

- Broad VNA Coverage
- Improved Opens
- Sliding Terminations

8850C

Description

These precision type N calibration kits are designed for use with a broad range of Vector Network Analyzers (VNAs). With these kits, you can make error-corrected measurements of devices equipped with type N connectors from 45 MHz to 18.0 GHz.

Each kit includes a full complement of calibration standards (shorts, opens, sliding and fixed loads) and can be configured for any combination of VNA or test set/cable connectors. By selecting the appropriate option number, you can specify the adapter set and software medium you want included in the kit. All required calibration standards, adapters (as applicable) and accessories, along with the software medium (cartridge or 3-1/2" disk) containing the calibration constants and operating instructions, are housed in an attractive foam-lined wooden instrument case.

Connector Description

The precision type N connectors supplied on the components in this kit are precision stainless steel connectors that mate with most precision type N connectors in use today, including connectors per MIL-C-39012 and MIL-T-81490. They are low VSWR connectors rated from DC to 18 GHz.

Ordering Options

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers (from the chart below) at the end of the kit model number, as shown in the example at right.

Example: Kit with adapter option 3 (2.4mm adapters) and VNA option 4 (Agilent 8510C)

Kit Model No. **8850C34**
- 34 — Software option
- 8850C3 — Adapter set option

Test Set and Cable Connector	VNA					Adapter Set
	Agilent			Anritsu		
	8510A/B	8510C	8719A/C, 8720A/B/C and 8722A	360	37000	
Type N [1]	03	04	05	08	09	—
3.5mm or K [2]	13	14	15	18	19	8850Z8
7mm	23	24	25	28	29	8850Z9
2.4mm	33	34	35	—	—	8850Z10

[1] Basic kit, no adapters are provided when one of these options is specified.

[2] 3.5mm connectors are mating compatible with 2.92mm (K). The resulting junction is calibrated out and is not critical.

TYPE N VNA CALIBRATION KITS

8850C SERIES

Equipment Provided in Kits

1 ea. Precision fixed termination, type N female
1 ea. Precision fixed termination, type N male
1 ea. Fixed short, type N female
1 ea. Fixed short, type N male
1 ea. Open circuit, type N female
1 ea. Open circuit, type N male
1 ea. Sliding termination, converts between type N female and male
1 ea. Configuration medium
1 ea. Instrument case
1 ea. Operating instructions

Available Accessories (not provided)

Adapters (phase matched):

Type N female to female – 8828A
Type N male to male – 8828B
Type N female to male – 8828C

Connector Gages:

Push-on type – A020A
Thread-on type – A020D

Torque wrench:

3/4" hex, 12 in/lbs – 2698C1

Software Medium Provided

Agilent 8510A/B	Cartridge
Agilent 8510C Agilent 8719 Agilent 8720	3-1/2" disk
Anritsu 360	3-1/2" disk
Anritsu 37000	3-1/2" disk

Adapter Set Provided

When the appropriate option number is specified, one of the following adapter sets is provided:

- 3.5mm Adapter Set, 8850Z8
  (supplied with options 13,14, 15, 18 and 19)
  1 ea. Test port adapter, NMD3.5mm female to type N female
  1 ea. Test port adapter, NMD3.5mm female to type N male
  1 ea. Adapter, type N female to 3.5mm female*
  1 ea. Adapter, type N male to 3.5mm female*
  1 ea. Adapter, type N female to 3.5mm male*
  1 ea. Adapter, type N male to 3.5mm male*

- 7mm Adapter Set, 8850Z9
  (supplied with options 23, 24, 25, 28 and 29)
  2 ea. Adapter, 7mm to type N female**
  2 ea. Adapter, 7mm to type N male**

- 2.4mm Adapter Set, 8850Z10
  (supplied with options 33, 34 and 35)
  1 ea. Test port adapter, NMD2.4mm female to type N female
  1 ea. Test port adapter, NMD2.4mm female to type N male
  1 ea. Adapter, type N female to 2.4mm female***
  1 ea. Adapter, type N male to 2.4mm female***
  1 ea. Adapter, type N female to 2.4mm male***
  1 ea. Adapter, type N male to 2.4mm male***

Adapter sets or single adapters may be ordered separately.

*, **, *** Phase matched sets.

Key literature – Maury data sheet 2Z-025C.

TYPE N VNA CALIBRATION KITS

8850P

Fixed Termination Kit

- Simple Fixed Load Calibration
- Phase Matched Adapters
- Improved Opens

The 8850P calibration kit (with precision type N connectors) is designed for calibrating Agilent 8753A/B/C/D Vector Network Analyzers (VNAs) from 300 KHz to 6 GHz utilizing 7mm test port test sets and cables. This kit can be used to make error-corrected measurements of devices supplied with type N connectors.

Each kit is provided with all required calibration hardware as listed below and is housed in an attractive foam-lined wooden instrument case. Operating instructions are provided with the calibration kit constants so they can be keyed in through the front panel.

Equipment Provided in Kits

1 ea. Fixed short, type N female
1 ea. Fixed short, type N male
1 ea. Open circuit, type N female
1 ea. Open circuit, type N male
1 ea. Fixed termination, type N female
1 ea. Fixed termination, type N male
2 ea. Adapter, 7mm to type N female*
2 ea. Adapter, 7mm to type N male*
1 ea. Instrument case
1 ea. Operating instructions

* Phase matched set

Connector Description

The precision type N connectors supplied on the components of this kit are precision stainless steel connectors that mate with most precision type N connectors in use today, including connectors per MIL-C-39012 and MIL-T-81490. They are low VSWR connectors rated from DC to 18 GHz.

8850P

Option

Option 16:
Provided with software for the calibration constants on 3-1/2" disk for Agilent 8753C. This is a convenient and reliable method of entering the calibration kit constants.

Available Accessories (not provided)

Adapters:

Type N in-series female to female – 8828A
Type N in-series male to male – 8828B
Type N in-series female to male – 8828C

NOTE: All three adapters have equal electrical length so they can be readily interchanged for measurements of non-insertable devices.

Connector Gages:

Push-on type – A020A
Thread-on type – A020D

Torque wrench:

3/4" hex, 12 in/lbs – 2698C1

Key literature – Maury data sheet 2Z-025P.

75 ohm TYPE N VNA CALIBRATION KITS

8880A/B

Fixed Termination Kit

- 75 ohm Kit
- Simple Fixed Load Calibration

Maury's 8880 series calibration kits are designed for calibrating Vector Network Analyzers (VNAs) that will be used to make 75 ohm type N connector measurements.

These kits are ideal for calibrating the Agilent 8752B or 8753C/D (with 85046B, 85044B test sets, or 11850D splitter) 75 ohm VNAs from 300 KHz to 2 GHz. With appropriate adapters, they can also be used on 50 ohm VNAs such as the 8510A/B/C, 8719, 8720 and Anritsu 360/37000 series (as well as other network analyzers) to make 75 ohm measurements.

The connectors in these kits are a precision version of type N 75 ohm connectors. A full complement of calibration standards (opens, shorts and fixed terminations, female and male) are included in the 8880A and 8880B kits. In addition, the 8880B kit includes three (3) in-series adapters that are phase matched for accurate measurements of non-insertable devices.

Each kit (components, standards, and customer-specified software media) is housed in a foam-lined wooden instrument case. Operating instructions are included with the calibration standard constants so that they can be keyed in from the VNA's front panel.

Connector Description

The type N 75 ohm connectors provided on the various components in these kits and accessories are a precision version developed by Maury which meets all applicable requirements of IEC169-16. They exhibit extremely low VSWR, and although currently specified to 2 GHz, they can be used at much higher frequencies. The male connectors are provided with a 3/4" hex coupling nut so the junctions can be properly torqued to 12 in/lbs (use torque wrench 2698C1).

Warning: Do not mate a 75 ohm type N connector to a 50 ohm type N connector.

8880B

Equipment Provided in Kits

8880A, Basic Kit: provides all the calibration standards as follows:

1 ea. Fixed termination, type N 75 ohm female
1 ea. Fixed termination, type N 75 ohm male
1 ea. Fixed short, type N 75 ohm female
1 ea. Fixed short, type N 75 ohm male
1 ea. Open circuit, type N 75 ohm female
1 ea. Open circuit, type N 75 ohm male
1 ea. Instrument case
1 ea. Operating instructions

8880B, Expanded Kit: provides all the items in the basic kit plus the following in-series phase matched adapters:

1 ea. Adapter, type N 75 ohm female to female
1 ea. Adapter, type N 75 ohm male to male
1 ea. Adapter, type N 75 ohm female to male

Key literature – Maury data sheet 2Z-035.

TNC VNA CALIBRATION KITS

8650 SERIES

Standard Kits

- Broad VNA Coverage
- Sliding Terminations

Description

These precision TNC calibration kits are designed for use with a broad range of Vector Network Analyzers (VNAs) and are used to make error-corrected measurements of devices supplied with TNC connectors from 45 MHz to 18 GHz.

Each kit is supplied with a full complement of calibration standards (shorts, opens, sliding and fixed loads) and can be configured for any combination of VNA or test set/cable connectors. By indicating the appropriate option number with your order, you can specify the desired adapter set and software medium to be included in the kit. All required calibration standards, applicable adapters and accessories, along with the software medium (cartridge or 3-1/2" disk) containing the calibration constants and operating instructions, are housed in an attractive foam-lined wooden instrument case.

Model Chart

Select the model number appropriate for your VNA and test set/cable connectors.

Model	VNA	Test Set and Cable Connectors	Software Medium
8650E(1)	1	7mm	3-1/2" disk
8650H	Agilent 8510A/B	3.5mm	Cartridge
8650J	Agilent 8510C		3-1/2" disk
8650M	Agilent 8720		
8650W	Anritsu 360	2.92mm (K)**	
8650X	Anritsu 37000	2.92mm (K)**	

** 3.5mm connectors are mating compatible with 2.92mm (K). The resulting junction is calibrated out and is not critical.

1 Fill in option number:
14 – Agilent 8510C; 15 – Agilent 8720; 16 – Agilent 8753;
28 – Anritsu 360; 29 – Anritsu 37000.

2 On kit 8650E, these adapters are deleted and replaced by 2 each TNC female to 7mm and 2 each TNC male to 7mm.

Key literature – Maury data sheets 2Z-023E, 2Z-023H.

8650E

Connector Description

The TNC connectors (MPC/TNC) on the components in this kit are precision stainless steel connectors that mate with MIL-C-39012 and MIL-T-81490 connectors. They are low VSWR connectors rated from DC to 18 GHz.

Equipment Provided in Kit

1 ea. Precision fixed termination, TNC female
1 ea. Precision fixed termination, TNC male
1 ea. Fixed short, TNC female
1 ea. Fixed short, TNC male
1 ea. Open circuit, TNC female
1 ea. Open circuit, TNC male
1 ea. Sliding termination, TNC female
1 ea. Sliding termination, TNC male
1 ea. Test port adapter, NMD3.5mm female to TNC female 2
1 ea. Test port adapter, NMD3.5mm female to TNC male 2
1 ea. Adapter, TNC female to 3.5mm female* 2
1 ea. Adapter, TNC male to 3.5mm female* 2
1 ea. Adapter, TNC female to 3.5mm male* 2
1 ea. Adapter, TNC male to 3.5mm male* 2
1 ea. Configuration medium (contains circuit constants)
1 ea. Instrument case
1 ea. Operating instructions

* Phase matched set

Available Accessories (not provided)

In-series Adapters:
TNC female to female – 232A2
TNC male to male – 232B2
TNC female to male – 232C2

Connector Gage – A012A

Torque Wrench:
0.562" hex, 12 in/lb – 2698G1

TNC VNA CALIBRATION KITS

8650P SERIES


8650P

Fixed Termination Kits

- Single Fixed Load Calibration
- Precision TNC Connectors
- Phase Matched Adapters

Description

Maury's 8650P calibration kits are designed for calibrating Agilent 8753 Vector Network Analyzers (VNAs) equipped with 7mm test ports, for measuring equipped devices with TNC connectors from DC to 6 GHz. Each kit is provided with all required calibration hardware as listed on this page, and is supplied in an attractive foam-lined wooden instrument case. Operating instructions are provided with the calibration kit constants so they can be keyed in through the front panel.

Connector Description

The TNC connectors (MPC/TNC) on the components in this kit are precision stainless steel connectors that mate with MIL-C-39012 and MIL-T-81490 connectors. They are low VSWR connectors rated from DC to 18 GHz.

Option

Option 16:

This option adds the calibration constants on a 3-1/2" data disk for Agilent 8753*; this is a convenient and reliable method of entering the calibration kit constants.

***NOTE:** An Agilent 9122C, single or dual, external disk drive is required to read this disk.

Key literature – Maury data sheet 2Z-023P.

Equipment Provided in Kits

1 ea.	Precision fixed termination, TNC female
1 ea.	Precision fixed termination, TNC male
1 ea.	Fixed short, female
1 ea.	Fixed short, male
2 ea.	Adapter, 7mm to TNC female*
2 ea.	Adapter, 7mm to TNC male*
1 ea.	Open circuit, TNC female
1 ea.	Open circuit, TNC male
1 ea.	Instrument case
1 ea.	Operating instructions

* Phase matched set

Available Accessories (not provided)

In-series Adapters:

TNC female to female – 232A2
TNC male to male – 232B2
TNC female to male – 232C2

Connector Gage – A012A

Torque wrench:

0.562" hex, 12 in/lb – 2698G1

BNC VNA CALIBRATION KITS

8550 SERIES (50 ohm) AND 8580 SERIES (75 ohm)

Fixed Termination Kits

Description

These BNC calibration kits provide a convenient, accurate means of calibrating Vector (VNA) and Scalar (SNA) Network Analyzers for measuring devices with BNC connectors at 50 or 75 ohm reference impedance. These kits are provided with fixed terminations and are generally used at frequencies up to 2 GHz.

Each kit includes the basic standards necessary for calibrating a vector or scalar network analyzer. In-series and test port adapters to type N and 7mm are also available.

50 ohm Model Chart

Select the calibration kit model number for the appropriate VNA test set and cable connector.

Model	VNA	Test Set and Cable Connector
8550E	Agilent 8510A/B/C Agilent 8753A/B/C/D	7mm
8550F	Agilent 8510A/B/C Agilent 8720*	3.5mm
	Anritsu 360/37000	2.92mm (K)
8550G	Agilent 8752A	Type N

*Can also be used with Agilent 8719.

75 ohm Models

Please see the chart (on page 19) for a list of items included in each kit. The 8580A contains both female and male standards. The 8580A01 contains only female standards and the 8580A02 only male standards.

8550F

Optional Software Media

The calibration data (on disk or cartridge) is in a format compatible with a variety of VNAs to simplify loading the calibration constants into the analyzer.

Options for 50 ohm Kits

Option 13 Provided with cartridge containing calibration constants for Agilent 8510A/B.

Option 14 Provided with 3-1/2″ disk containing calibration constants for Agilent 8510C.

Option 15 Provided with 3-1/2″ disk containing calibration constants for Agilent 8720.

Option 16 Provided with 3-1/2″ disk containing calibration constants for Agilent 8753C. (**NOTE:** 9122C single, or dual, external disk drive is also required.)

Option 28 Provided with 3-1/2″ disk containing calibration constants for Anritsu 360.

Option 29 Provided with 3-1/2″ disk containing calibration constants for Anritsu 37000.

BNC VNA CALIBRATION KITS

Equipment Provided in Kits

Components	50 ohm Kits			75 ohm Kits		
	8550E	8550F	8550G	8580A	8580A01	8580A02
Fixed termination, female	1	1	1	1	1	—
Fixed termination, male	1	1	1	1	—	1
Fixed short, female	1	1	1	1	1	—
Fixed short, male	1	1	1	1	—	1
Open circuit, female	1	1	1	1	1	—
Open circuit, male	1	1	1	1	—	1
Adapter, Type N female to BNC female *	—	—	1	—	—	—
Adapter, Type N female to BNC male *	—	—	1	—	—	—
Adapter, Type N male to BNC female *	—	—	1	—	—	—
Adapter, Type N male to BNC male *	—	—	1	—	—	—
Adapter, 3.5mm female to BNC female **	—	1	—	—	—	—
Adapter, 3.5mm female to BNC male **	—	1	—	—	—	—
Adapter, 3.5mm male to BNC female **	—	1	—	—	—	—
Adapter, 3.5mm male to BNC male **	—	1	—	—	—	—
Adapter, 7mm to BNC female ***	2	—	—	—	—	—
Adapter, 7mm to BNC male ***	2	—	—	—	—	—
Instrument case	1	1	1	1	1	1
Operating instructions	1	1	1	1	1	1

*, **, ***Phase matched sets.

Key literature – Maury data sheets 2Z-029B, 2Z-036.

2.92mm (K) VNA CALIBRATION KITS

8770C SERIES

Standard Kits

- Broad VNA Coverage
- 0.04 to 40 GHz
- Includes Phase Matched Adapters
- Verified Kit Performance
- High Precision Female and Male Sliding Terminations

Description

These precision K (2.92mm) connector calibration kits are designed for use with a broad range of Vector Network Analyzers (VNAs). With these kits, you can make error-corrected measurements of devices equipped with K connectors from 40 MHz to 40 GHz.

Each kit includes a full complement of calibration standards (shorts, opens, sliding and fixed loads) and can be configured for any combination of VNA or test set/cable connectors. By indicating the appropriate option number on your order, you can specify the adapter set and software medium to be included in the kit. All required calibration standards, applicable adapters and accessories, along with the software medium (cartridge or 3-1/2" disk) containing the calibration constants and operating instructions, are housed in an attractive foam-lined wooden instrument case. All kits are 100% tested for compliance to kit specifications and a performance verification report is provided with each kit.

Software Medium Provided

Agilent 8510A/B	Cartridge
Agilent 8510C	3-1/2" disk
Agilent 8719 Agilent 8720 Agilent 8722	3-1/2" disk
Anritsu 360 Anritsu 37000	3-1/2" disk

8770C

Connector Description

The K connector is a precision miniature 2.92mm air line interface connector that operates mode free to 40 GHz. It has a mechanically compatible interface that mates with SMA and 3.5mm connectors. This interface was originally introduced by Maury in 1974 as the MPC3 connector and was reintroduced as the K connector by Wiltron in 1984.

Equipment Provided in Kits

1 ea.	Fixed short, K female
1 ea.	Fixed short, K male
1 ea.	Open circuit, K female
1 ea.	Open circuit, K male
1 ea.	Precision fixed termination, K female
1 ea.	Precision fixed termination, K male
1 ea.	Precision sliding termination, K female
1 ea.	Precision sliding termination, K male
1 ea.	Open end wrench, 5/16"
1 ea.	Open end wrench, 7/16"
1 ea.	Torque wrench, 5/16", 8 in/lbs
1 ea.	Software configuration medium*
1 ea.	Adapter set*
1 ea.	Instrument case
1 ea.	Operating instructions

* See adapter chart on page 21.

Calibration Kit Specifications

Frequency Range ..... 0.040 – 40 GHz

Directivity ..... 42 dB minimum, 0.040 – 20 GHz
40 dB minimum, 20 – 40 GHz

Source Match ..... 40 dB minimum, 0.040 – 20 GHz
35 dB minimum, 20 – 40 GHz

Nominal Impedance ..... 50 ohms

2.92mm (K) VNA CALIBRATION KITS

8770C SERIES

Adapter Set Provided

When the applicable option number is specified, one of the following adapter sets is provided:

- 2.92mm Adapter Set, 8770Z1
  (supplied with options 13, 14, 15, 18 and 19)

  a) 1 ea. – Test port adapter, NMD2.92mmf to K female
  b) 1 ea. – Test port adapter, NMD2.92mmf to K male
  c) 1 ea. – Adapter, K female to female*
  d) 1 ea. – Adapter, K male to male*
  e) 1 ea. – Adapter, K female to male*

  * Phase matched set

  NOTE: This adapter set will work with both K (2.92mm) and 3.5mm test set/cable connectors [1].

- 7mm Adapter Set, 8770Z2
  (supplied with options 23, 24, 25, 28 and 29)

  a) 2 ea. – Adapter, 7mm to K female**
  b) 2 ea. – Adapter, 7mm to K male**

  ** Phase matched set

- 2.4mm Adapter Set, 8770Z3
  (supplied with options 33, 34, 35)

  a) 1 ea. – Test port adapter, NMD2.4mmf to K female
  b) 1 ea. – Test port adapter, NMD2.4mmf to K male
  c) 1 ea. – Adapter, K female to 2.4mm female***
  d) 1 ea. – Adapter, K male to 2.4mm female***
  e) 1 ea. – Adapter, K female to 2.4mm male***
  f) 1 ea. – Adapter, K male to 2.4mm male***

  *** Phase matched set

Adapter sets or single adapters may also be ordered separately.

Available Accessories (not provided)

Connector Gages:

a) Push-on type – A034B
b) Thread-on type – A034E

Option Chart

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers (from the chart below) at the end of the kit model number, as shown in the example at right.

Example: Kit with adapter option 3 (2.4mm adapters) and VNA option 4 (Agilent 8510C)

Kit Model No. 8770C34 — Software option; Adapter set option

Test Set and Cable Connector	Upper Frequency Limit Test (GHz) [2]	VNA					Adapter Set
		Agilent			Anritsu		
		8510A/B	8510C	8719/20/22	360	37000	
2.92mm (K)	40.0	No software in this kit					None
2.92mm	40.0	03	04	05	08	09	None
2.92mm (K)	40.0	13	14	15	18	19	8770Z1
3.5mm	26.5	13	14	15	18	19	8770Z1 [1]
7mm	18.0	23	24	25	28	29	8770Z2
2.4mm	40.0	33	34	35	N/A	N/A	8770Z3

[1] K connectors (2.92mm) are mating compatible with 3.5mm. The resulting junction is calibrated out and is not critical.

[2] Upper frequency limit is determined by the test set/cable connectors.

Key literature – Maury data sheet 2Z-034C.

7mm VNA CALIBRATION KITS

2650 SERIES

Fixed Termination Kits

- Simple, Economical

Standard Kits

- Broad VNA Coverage
- Includes Applicable Test Port Adapters, Spare Collets and Extractor

Expanded Kits Add

- Sliding Termination
- Connector Gage

2650F21

Description

These 7mm calibration kits are designed for use with Vector Network Analyzers (VNAs) equipped with 7mm, 3.5mm or 2.92mm test set connectors and cables. With these kits, you can make error corrected measurements of devices supplied with 7mm connectors from 45 MHz to 18 GHz.

Each kit includes:

- A full complement of calibration standards (shorts, opens, fixed and sliding loads*)
- Rugged test port adapters
- 7mm to 3.5mm phase matched adapters (where applicable)
- A connector gage* for checking contact pin locations prior to making connections
- A torque wrench* for accurately tightening connector junctions
- All required calibration standards, adapters and accessories
- Customer-specified software medium (cartridge or 3-1/2" disk) containing the calibration constants
- Operating instructions

These components are supplied in an attractive foam-lined wooden instrument case.

*Not provided in fixed termination kits.

Connector Description

7mm connectors are precision air interface hermaphroditic connectors that are rated from DC to 18 GHz. They have an air line size of 0.1197 inner diameter and a 0.2756 outer diameter. There are basically two configurations; 1) GPC7 (commonly referred to as APC7) which incorporates a bead support and, 2) LPC7A which is a beadless connector.

Model Chart

Select the model number appropriate for the VNA and test set/cable connectors.

Model	VNA	Test Set and Cable Connectors	Kit Type	Software Medium
2650F08	Agilent 8510A/B	7mm	Fixed Term.	Cartridge
2650F		7mm	Expanded	
2650H		3.5mm		
2650J	Agilent 8510C	3.5mm	Expanded	3-1/2"disk
2650M	Agilent 8720			
2650P	Agilent 8753	7mm	Fixed Term.	
2650W	Anritsu 360	2.92mm (K) [1]	Expanded	
2650X	Anritsu 37000			

[1] 3.5mm connectors are mating compatible with 2.92mm (K). The resulting junction is calibrated out and is not critical.

7mm VNA CALIBRATION KITS

2650 SERIES

Equipment Provided in Kits 2650F, H, J, M, W, X

1 ea. Fixed short, 7mm
1 ea. Open circuit, 7mm
2 ea. Fixed termination, 7mm
1 ea. Sliding termination
2 ea. 7mm test port to NMD3.5mm female adapters*
1 ea. 3.5mm female to 7mm test port adapter* **
1 ea. 3.5mm male to 7mm test port adapter* **
1 ea. 7mm connector gage kit (push-on type)
1 ea. Torque wrench, 0.750" hex, 12 in/lbs
1 ea. Software configuration medium (contains circuit constants)
1 ea. Collet extractor
4 ea. 7mm six-slot collets (spare parts)
1 ea. Instrument case
1 ea. Operating instructions

* Not provided in 2650F, 2650F02, or 2650F08 kits
** Phase matched set

Options

Option 01 adds air line 2653S30 to 2650F, H, J, M, X, and W kits.

2650F02 is a sliding load kit with the connector gage and torque wrench deleted.

2650F08 is a fixed termination kit with the adapters, sliding termination and connector gage deleted.

2650P16 provided with data disk for Agilent 8753A/B/C.

Equipment Provided in Kit 2650P

1 ea. Fixed short, 7mm
1 ea. Open circuit, 7mm
2 ea. Fixed termination, 7mm
1 ea. Instrument case
1 ea. Operating instructions

Available Accessories (not provided)

Offset Shorts:
Series 2049

Precision Mismatches:
Series 2611 in values up to 2:1 VSWR

Precision Two-Port Standard Set:
2654B

Key literature – Maury data sheets 2Z-022F, 2Z-022H, 2Z-022P.

OSP™ [1] VNA CALIBRATION KITS

8780 SERIES

- OSP™ Connector
- Up to 18 GHz
- Precision Coupling
- Expanded and Economy Kits

Description

The Maury 8780 series of calibration kits provide the standards required to accurately calibrate vector network analyzers up to 18 GHz for error-corrected measurements of devices with OSP™ blind-mate connectors.

These kits feature a positive coupling system which permits the standards to be mated to the test ports using a calibrated torque wrench. This provides precise repeatability of the calibration interface with each standard and significantly improves accuracy compared to simple, non-captivated, blind mate interfaces.

The series consists of the 8780A and B, which include female and male connectors, sliding loads [2], torque wrenches and computer media [3] formated for specific VNA; and the 8780F and M single-sex kits which do not include sliding loads or computer media. Each kit comes in a wooden instrument case with operating instructions. Options (on page 25) allow you to configure a calibration kit to best fit your needs and budget.

Model Chart

Basic kits are shown below. To add capability, select options from the appropriate chart on page 25.

Model	Torque and Open End Wrenches	Sliding Load	Computer Medium with Calibration Constants	Connector Type
8780A/B [4]	Yes	[2]	Yes	female & male
8780F [4]	No	No	No	female
8780M [4]	No	No	No	male

[1] "OSP™" is the M/A-Com Omni-Spectra designation. See Maury data sheet 5E-065 for interface details.

[2] 8780A includes a sliding load, 8780B does not.

[3] Data cartridge or diskette as appropriate for a specific VNA.

[4] Add option suffix from the charts on the next page to upgrade.

8780A13

8780A/B Full Calibration Kits Equipment Provided:

1 ea. Open circuit, OSP™ female
1 ea. Open circuit, OSP™ male
1 ea. Short circuit, OSP™ female
1 ea. Short circuit, OSP™ male
1 ea. Fixed termination, OSP™ female
1 ea. Fixed termination, OSP™ male
1 ea. Sliding termination,OSP™ female and male [2]
1 ea. Torque wrench, 1/2", 8 in/lb
1 ea. Open-end wrench, 7/16"
1 ea. Instrument case
1 ea. Operating instructions

8780F Economy Calibration Kits Equipment Provided:

1 ea. Open circuit, OSP™ female
1 ea. Short circuit, OSP™ female
1 ea. Fixed termination,OSP™ female
1 ea. Instrument case
1 ea. Operating instructions

8780M Economy Calibration Kits Equipment Provided:

1 ea. Open circuit, OSP™ male
1 ea. Short circuit, OSP™ male
1 ea. Fixed termination, OSP™ male
1 ea. Instrument case
1 ea. Operating instructions

OSP™ [1] VNA CALIBRATION KITS

Option Charts

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers (from the chart below) at the end of the kit model number, as shown in the example at right.

Example: Kit with adapter option 1 (7mm adapters) and VNA option 4 (Agilent 8510C)

Kit Model No. 8780B14 — Software option; Adapter set option

8780A/B

Test Set and Cable Connector	VNA						None	Adapter Set
	Agilent				Anritsu			
	8510A/B	8510C	8719/20/22	8753	360	37000		
—	03	04	05	06	08	09	N/A	None
7mm	13	14	15	16	18	19	10	8780Z5
3.5mm	23	24	25	26	28	29	20	8780Z6

8780F AND 8780M

Test Set and Cable Connector	Option	Adapters Provided [4]	
		8780F	8780M
7mm	10	2 each, 7mm to OSP™ male 1 each, 7mm to OSP™ female	2 each, 7mm to OSP™ female 1 each, 7mm to OSP™ male
7mm	11	1 each, 7mm to OSP™ male	1 each, 7mm to OSP™ female
3.5mm	20	2 each, 3.5mm female to OSP™ male 1 each, 3.5mm female to OSP™ female	2 each, 3.5mm female to OSP™ female 1 each, 3.5mm female to OSP™ male
3.5mm	21	1 each, 3.5mm female to OSP™ male	1 each, 3.5mm female to OSP™ female
Type N	30	2 each, type N male to OSP™ male 1 each, type N male to OSP™ female	2 each, type N male to OSP™ female 1 each, type N male to OSP™ male
Type N	31	1 each, type N male to OSP™ male	1 each, type N male to OSP™ female

ADAPTER SETS FOR 8780A/B

Adapter Set	Quantity	Description [4]
8780Z5	2 each	Adapter, 7mm to OSP™ female
	2 each	Adapter, 7mm to OSP™ male
8780Z6	1 each	Adapter, 3.5mm male to OSP™ female
	1 each	Adapter, 3.5mm male to OSP™ male
	1 each	Adapter, 3.5mm female to OSP™ female
	1 each	Adapter, 3.5mm female to OSP™ male

[4] Adapters from OSP™ to the same connector series are phase matched (same electrical length) so that they may be interchanged for measurement of non-insertable devices.

Key literature – Maury data sheet 2Z-037.

7-16 VNA CALIBRATION KITS

2750 SERIES

- Up to 7.5 GHz
- Low Torque Coupling
- Expanded and Economy Kits

2750B10

Description

The 2750 series calibration kits operate up to 7.5 GHz for error-corrected measurements of devices with 7-16 connectors [1]. They feature the use of wear-resistant materials for long-term reliability; thicker dielectric beads to eliminate deflection; retracted threads on female connectors to eliminate the need for excessive torque during use; and tighter tolerance control to reduce uncertainties.

The 2750 series consists of the 2750B, containing female and male standards with calibration constants on 3-1/2" disk or cartridge, and the 2750F and 2750M which are single-sex kits without software. Each kit can be expanded by adding options from the charts on page 27. Each is supplied with operating instructions in a foam-lined wooden instrument case.

Model Chart

Select the appropriate calibration kit number for your VNA test set and cable connector.

Model	Includes Torque and Open End Wrenches	Connector Type
2750B [2]	Yes	female & male
2750F [2]	No	female
2750M [2]	No	male

2750B Full Calibration Kits:

1 ea. Open circuit, 7-16 female
1 ea. Open circuit, 7-16 male
1 ea. Short circuit, 7-16 female
1 ea. Short circuit, 7-16 male
1 ea. Fixed termination, 7-16 female
1 ea. Fixed termination, 7-16 male
1 ea. Torque wrench, 1-1/16"
1 ea. Open-end wrench, 1-1/16"
1 ea. Instrument case
1 ea. Operating instructions

2750F Economy Calibration Kits:

1 ea. Open circuit, 7-16 female
1 ea. Short circuit, 7-16 female
1 ea. Fixed termination, 7-16 female
1 ea. Instrument case
1 ea. Operating instructions

2750M Economy Calibration Kits:

1 ea. Open circuit, 7-16 male
1 ea. Short circuit, 7-16 male
1 ea. Fixed termination, 7-16 male
1 ea. Instrument case
1 ea. Operating instructions

Available Accessories (not provided)

Connector Gage Kit:

Model A041A – Includes female and male push-on gages with a master setting gage, housed in a foam-lined wooden instrument case.

TRL/LRL Air Line Set:

Model 2735 – For performing full 2-port TRL/LRL calibrations (see Maury data sheet 2Z-041A).

In-Series Adapters [3]:

Model 2712A, 7-16 female / 7-16 female through adapter
Model 2712B, 7-16 male / 7-16 male through adapter
Model 2712C, 7-16 Female / 7-16 male through adapter

Key literature – Maury data sheets 2Z-041, 2Z-041A.

[1] Maury 7-16 connectors are rugged calibration grade connectors that exceed IEC169-4 reference grade requirements and BSEN122190 grade 0 specifications.

[2] Add option suffix from the charts on page 27 to upgrade the kit capability from the basic model.

[3] Adapters within each series are phase matched.

7-16 VNA CALIBRATION KITS

Option Charts

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers (from the chart below) at the end of the kit model number, as shown in the example at right.

Example: Kit with adapter option 1 (7mm adapters) and VNA option 4 (Agilent 8510C)

Kit Model No. 2750B14
- 4 — Software option
- 1 — Adapter set option

2750B

Test Set and Cable Connector	VNA							Adapter Set
	Agilent				Anritsu		None	
	8510A/B	8510C	8719/20/22	8753	360	37000		
—	03	04	05	06	08	09	N/A	None
7mm	13	14	15	16	18	19	10	2750Z4
Type N	23	24	25	26	28	29	20	2750Z5

2750F AND 2750M

Test Set and Cable Connector	VNA							Adapter Set
	Agilent				Anritsu		None	
	8510A/B	8510C	8719/20/22	8753	360	37000		
—	03	04	05	06	08	09	N/A	None
Type N female	13	14	15	16	18	19	10	1
Type N male	23	24	25	26	28	29	20	2
7mm	33	34	35	36	38	39	30	3
Type N female	43	44	45	46	48	49	40	4
Type N male	53	54	55	56	58	59	50	5
7mm	63	64	65	66	68	69	60	6

ADAPTER SETS FOR 2750B

Adapter Set	Quantity	Description
2750Z4	2 each	Adapter, 7mm to 7-16 female
	2 each	Adapter, 7mm to 7-16 male
2750Z5	1 each	Adapter, type N female to 7-16 female
	1 each	Adapter, type N male to 7-16 female
	1 each	Adapter, type N female to 7-16 male
	1 each	Adapter, type N male to 7-16 male

ADAPTER SETS FOR 2750F AND 2750M

Adapter Set	Test Set or Cable Connectors	Number of Test Ports	2750F	2750M
1	Type N (female)	2	2 each, type N male to 7-16 male 1 each, type N male to 7-16 female	2 each, type N male to 7-16 female 1 each, type N male to 7-16 male
2	Type N (male)	2	2 each, type N female to 7-16 male 1 each, type N female to 7-16 female	2 each, type N female to 7-16 female 1 each, type N female to 7-16 male
3	7mm	2	2 each, 7mm to 7-16 male 1 each, 7mm to 7-16 female	2 each, 7mm to 7-16 female 1 each, 7mm to 7-16 male
4	Type N (female)	1	1 each, type N male to 7-16 male	1 each, type N male to 7-16 female
5	Type N (male)	1	1 each, type N female to 7-16 male	1 each, type N female to 7-16 female
6	7mm	1	1 each, 7mm to 7-16 male	1 each, 7mm to 7-16 female

14mm (MPC14) VNA CALIBRATION KITS

2450 SERIES

- Expanded Kits
- Connector Gage
- Torque Wrench
- Test Port Adapters

2450W01

Description

These calibration kits are designed for calibrating Vector Network Analyzers (VNAs) equipped with 3.5mm, 2.92mm or 7mm test set connectors and cables, which will be used in making error-corrected measurements of devices with 14mm connectors from 45 MHz to 8.5 GHz.

Each kit includes a full complement of calibration standards and accessories (shorts, opens, sliding and fixed loads, torque wrench, connector gages, 3.5mm to 14mm adapters, and a 14mm contact installation/extraction tool with spare contacts). The software (3-1/2″ disk or cartridge) needed to easily load the calibration constants into your VNA is also included.

Connector Description

The MPC14 precision 14mm connector is essentially equivalent to, and mating compatible with, GR900 type connectors. It features an improved hex knurl coupling nut and an improved center conductor inner contact (model 2481A). The coupling nut has a 1.00 inch hex for accurate tightening with a torque wrench, and the knurled knob provides a positive grip for finger tightening.

Model Chart

Select the calibration kit number appropriate for your VNA test set and cable connector.

Model	VNA	Test Set and Cable Connector	Software Medium
2450F	Agilent 8510A/B	3.5mm	Cartridge
2450F14	Agilent 8510C	3.5mm	3-1/2” disk
2450F26	Agilent 8753C/D	7mm	3-1/2” disk [2]
2450W	Anritsu 360	2.92mm (K) [1]	3-1/2” disk
2450W20		7mm	
2450X	Anritsu 37000	2.92mm (K) [1]	3-1/2” disk
2450X20		7mm	

[1] The 3.5mm female (NMD3.5f) connector on the 14mm adapter mates directly with the NMD3.5m on Agilent 8513A, 8514B, and 8515A test sets, and the male K connector on Anritsu VNAs.

[2] An external disk drive is needed to use the 3-1/2” disk with the Agilent 8753C. Constants may also be manually keyed.

Equipment Provided:

1 ea.	Fixed short, 14mm
1 ea.	Open circuit, 14mm
2 ea.	Fixed termination, 14mm
1 ea.	Sliding termination, 14mm
1 ea.	Adapter, 14mm to 3.5mm, female
1 ea.	Adapter, 14mm to 3.5mm, male
1 ea.	Adapter, 14mm to NMD3.5mm, female
1 ea.	14mm connector gage kit (push-on type)
1 ea.	Torque wrench 1.00 hex, 12 in/lb
1 ea.	Configuration cartridge or disk
1 ea.	Contact installation/extraction tool
2 ea.	14mm contacts (spare parts)
1 ea.	Instrument case
1 ea.	Operating instructions

Options

Option 01: Adds 2453A 30cm reference air line.

Option 20: Replaces the NMD and 3.5mm to 7mm adapters with two 14mm to 7mm adapters (2607A1).

Option 21: Option 01 and option 20 combined.

Available Accessories (not provided)

Offset Shorts: Series 2449 can be used as verification or calibration standards.

Precision Mismatches: Series 2411 are resistive mismatches DC to 8.5 GHz in values up to 2:1 VSWR.

Precision Two-Port Standard Set: Model 2454.

Key literature – Maury data sheet 2Z-021.

ECONOMY VNA CALIBRATION KITS

Fixed Termination Kits

- Fixed Load Calibration
- Precision 3.5mm, Type N, and BNC Connectors
- Rugged Instrument Case
- Single Sex or Both Sexes

8550Q02

8550Q03

Description

This series of low cost fixed load calibration kits covers frequencies from DC to 26.5 GHz [1]. The kits contain the standards needed to calibrate scalar or vector network analyzers and are housed in rugged, molded plastic cases. The increased durability of the cases makes these kits ideal for field service use. The calibration constants provided in the kits can be keyed in from the front panel of the analyzer. The kits are available in female/male configurations or in single sex configurations.

Model Chart

Select the calibration kit number for the appropriate VNA test set and cable connector.

Connector Type	Model		
	Female Only	Male Only	Female and Male
3.5mm	8050Q01	8050Q02	8050Q03
Type N	8850Q01	8850Q02	8850Q03
BNC	8550Q01	8550Q02	8550Q03
TNC	8650Q01	8650Q02	8650Q03

Equipment Provided In Kits [2]

1 ea. Precision fixed termination, female
1 ea. Precision fixed termination, male
1 ea. Fixed short, female
1 ea. Fixed short, male
1 ea. Open circuit, female
1 ea. Open circuit, male
1 ea. Instrument case
1 ea. Operating instructions

Available Accessories (not provided)

Phase Matched Adapters:

3.5mm female to type N male	8023B1
3.5mm male to type N male	8023D1
3.5mm female to 7mm	8022A2
3.5mm male to 7mm	8022B2
Type N female to female	8828A
Type N male to male	8828B
Type N female to male	8828C
BNC female to type N male	8821C
BNC male to type N male	8821D

In-series Adapters:

TNC female to female	232A2
TNC male to male	232B2
TNC female to male	232C2

Connector Gages [3]:

3.5mm push-on type	A034B
3.5mm thread-on type	A034E
Type N push-on type	A020A
Type N thread-on type	A020D
BNC push-on type	A012A

Torque Wrenches [4]:

3.5mm, 5/16", 8 in/lbs	8799A1
Type N, 3/4" hex, 12 in/lbs	2698C2

[1] 3.5mm operates to 26.5 GHz, type N/TNC to 18 GHz and BNC to 10 GHz.

[2] Single sex kits include only female or male components.

[3] See page 171 for more information on connector gages.

[4] See page 172 for more information on torque wrenches.

2.4mm TRL/LRL VNA CALIBRATION KITS

7960A SERIES TRI-KITS

- TRL/LRL Calibrations
- SOLT (Short-Open-Load-Thru)
- Gated Air Line
- DC to 50 GHz
- Agilent VNAs

Description

These 2.4mm Vector Network Analyzer (VNA) calibration kits are designed for use with a range of Agilent VNAs. The components in the kits are configured for use in making error-corrected TRL/LRL measurements of devices supplied with 2.4mm connectors, from DC to 50 GHz.

TRM/TRL/LRL Calibration

Maury TRL/LRL calibration kits are tri-kits containing the components needed to perform three types of calibrations (TRM/TRL/LRL, SOLT, and short-open-(air line + load) [1] . Source match can also be measured using the 6.25cm air line and provided short circuit.

Equipment Provided in 7960A Kits

Quantity	Description
1	2.4mm female to male air line
1	2.4mm female to male air line
1	2.4mm female to male air line
1	2.4mm female fixed short
1	2.4mm male fixed short
1	2.4mm female open circuit
1	2.4mm male open circuit
1	2.4mm female fixed termination
1	2.4mm male fixed termination
2	5/16" double end wrench
1	Calibration constants disk
1	Instrument case
1	Operating instructions

Recommended Accessories

(Not Provided in Kits)

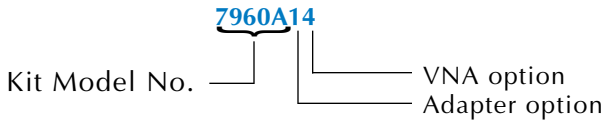
A035E Connector gage (thread-on type)
8799A1 Torque wrench 8 in/lbs

7960A

Ordering Options

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers at the end of the kit model number.

Example: Kit with adapter option 1 (2.4mm adapters) and VNA option 4 (Agilent 8510C)



2.4mm TRL Adapter Options

Option No.	Description and Model	Quantity
1	NMD 2.4mm female to 2.4mm female	1
	NMD 2.4mm female to 2.4mm male	1
	2.4mm female to 2.4mm female	1
	2.4mm male to 2.4mm male	1
	2.4mm female to 2.4mm male	1
2	NMD 2.92mm female to 2.4mm female	1
	NMD 2.92mm female to 2.4mm male	1
	2.4mm female to 2.4mm female	1
	2.4mm male to 2.4mm male	1
	2.4mm female to 2.4mm male	1

Network Analyzer Options

Option No.	VNA
3	Agilent 8510A/B
4	Agilent 8510C
5	Agilent 8719/20/22

[1] Maury data sheet 2Z-051 explains these types of calibrations, with complete specifications for the components listed on this page.

3.5mm TRL/LRL VNA CALIBRATION KITS

8060A SERIES TRI-KITS

- TRL/LRL Calibrations
- SOLT (Short-Open-Load-Thru)
- Gated Air Line
- DC to 34 GHz
- Agilent VNAs

8060A

Description

These 3.5mm Vector Network Analyzer (VNA) calibration kits are designed for use with a range of Agilent VNAs. The components in the kits are configured for use in making error-corrected TRL/LRL measurements of devices supplied with 3.5mm connectors, from DC to 34 GHz.

TRM/TRL/LRL Calibration

Maury TRL/LRL calibration kits are tri-kits containing the components needed to perform three types of calibrations: TRM/TRL/LRL, SOLT, and short-open-(air line + load) [1] . Source match can also be measured using the 15cm air line and provided short circuit.

Equipment Provided in 8060A Kits

Quantity	Description
1	3.5mm female to male air line
1	3.5mm female to male air line
1	3.5mm female to male air line
1	3.5mm female to male air line
1	3.5mm female fixed short
1	3.5mm male fixed short
1	3.5mm female open circuit
1	3.5mm male open circuit
1	3.5mm female fixed termination
1	3.5mm male fixed termination
2	5/16" double end wrench
1	Calibration constants disk
1	Instrument case
1	Operating instructions

Recommended Accessories

(Not Provided in Kits)

A034B	Connector gage (push-on type)
A034E	Connector gage (thread-on type)
8799A1	Torque wrench 8 in/lbs

Ordering Options

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers at the end of the kit model number.

Example: Kit with adapter option 1 (3.5mm adapters) and VNA option 4 (Agilent 8510C)

8060A14

Kit Model No. — VNA option — Adapter option

3.5mm TRL Adapter Options

Option No.	Description and Model	Quantity
1	3.5mm female to female	1
	3.5mm male to male	1
	3.5mm male to female	1
2	2.4mm female to 3.5mm female	1
	2.4mm female to 3.5mm male	1
	2.4mm male to 3.5mm female	1
	2.4mm male to 3.5mm male	1

Network Analyzer Options

Option No.	VNA
3	Agilent 8510A/B
4	Agilent 8510C
5	Agilent 8719/20/22

[1] Maury data sheet 2Z-045 explains these types of calibrations, with complete specifications for the components listed on this page.

TYPE N TRL/LRL CALIBRATION KITS

8860 SERIES TRI-KITS

- TRL/LRL Calibrations
- SOLT (Short-Open-Load-Thru)
- Gated Air Line
- DC to 18 GHz
- Agilent VNAs

8860G14

Description

This Maury tri-kit is capable of performing three types of calibrations: 1) TRM, TRL, and LRL two-port from 0 to 18 GHz; 2) SOLT (Short-Open-Load-Thru) 1-port or 2-port; and 3) Short-open-(air line + load) 1-port calibration for gated measurements.

TRM/TRL/LRL Calibration

Maury TRL/LRL calibration kits are tri-kits containing the components needed to perform three types of calibrations: TRM/TRL/LRL, SOLT, and short-open-(air line + load) [1]. Source match can also be measured using the 15cm air line and provided short circuit.

Equipment Provided in 8860 Kits

Quantity	Description
1	Air line, 3.12cm
1	Air line, 3.82cm
1	Air line, 15cm
1	Short circuit female
1	Short circuit male
1	Open circuit female
1	Open circuit male
1	Fixed termination female
1	Fixed termination male
1	Disk with cal constants
1	Instrument case
1	Operating instructions

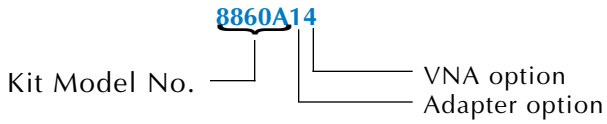
Recommended Accessories

A020A	Connector gage (push-on type)
A020D	Connector gage (thread-on type)
2698C1	Torque wrench 12 in/lbs

Ordering Options

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers at the end of the kit model number.

Example: Kit with adapter option 1 (3.5mm adapters) and VNA option 4 (Agilent 8510C)



Type N TRL Adapter Options

Option No.	Description	Quantity
0	No adapters	—
1	3.5mm (f) to Type N (f)	1
	3.5mm (f) to Type N (m)	1
	3.5mm (m) to Type N (f)	1
	3.5mm (m) to Type N (m)	1
2	2.4mm (f) to Type N (f)	1
	2.4mm (f) to Type N (m)	1
	2.4mm (m) to Type N (f)	1
	2.4mm (m) to Type N (m)	1
3	7mm to Type N (f)	2
	7mm to Type N (m)	2

Network Analyzer Options

Option No.	Agilent Analyzer
3	8510A/B
4	8510C
5	8719/20/22

[1] Maury data sheet 2Z-043 explains these types of calibrations, with complete specifications for the components listed on this page.

7mm TRL CALIBRATION KITS

2660 SERIES TRI-KITS

- DC to 18 GHz
- TRL Calibrations
- SOLT (Short-Open-Load-Thru)
- Gated Air Line
- Agilent VNAs

2660B24

Description

This Maury tri-kit is capable of performing three types of calibrations: 1) TRM, TRL, and LRL two-port from 0 to 18 GHz; 2) SOLT (short-open-load-thru) 1-port or 2-port; and 3) Short-open-(air line + load) 1-port calibration for gated measurements.

TRM/TRL/LRL Calibration

Maury TRL/LRL calibration kits are tri-kits containing the components needed to perform three types of calibrations: TRM/TRL/LRL, SOLT, and short-open-(air line + load) [1]. Source match can also be measured using the 15cm air line and provided short circuit.

Ordering Options

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers at the end of the kit model number.

Example: Kit with adapter option 1 (NMD 3.5mm (f) to 7mm) and VNA option 4 (Agilent 8510C)

2660B14

Kit Model No. — VNA option — Adapter option

Equipment Provided in 2660B Kits

Quantity	Description
1	Air line, 3.12cm
1	Air line, 0.69cm
1	Air line, 15cm
1	Short circuit
1	Open circuit
1	Fixed termination
1	Disk with calibration constants
1	Instrument case
1	Operating instructions

7mm TRL Adapter Options

Option No.	Description	Quantity
0	No adapters	—
1	NMD 3.5mm (f) to 7mm	2
2	3.5mm (f) to 7mm	1
	3.5mm (m) to 7mm	1
3	NMD 2.4mm (f) to 7mm	2
4	2.4mm (f) to 7mm	1
	2.4mm (m) to 7mm	1

Recommended Accessories

A028	Connector gage (push-on type)
A028D	Connector gage (thread-on type)
2698C2	Torque wrench 12 in/lbs

Network Analyzer Options

Option No.	Agilent Analyzer
3	8510A/B
4	8510C
5	8719/20/22

[1] Maury data sheet 2Z-042 explains these types of calibrations, with complete specifications for the components listed on this page.

7-16 TRL/LRL VNA CALIBRATION KITS

2760B SERIES TRI-KITS

- TRL/LRL Calibrations
- SOLT (Short-Open-Load-Thru)
- Gated Air Line
- Rated to 7.5 GHz (Usable to 8.0 GHz)
- Agilent VNAs

2735A
7-16 Air Line Set
(See page 152)

2760B

Description

These kits feature both female and male standards, a torque wrench and an open-end wrench for precise, repeatable connections, and adapter sets and calibration constants on computer media. The components are shown in the ***Equipment Provided in 2760B Kits*** chart . Air lines come as a set (2735A) in a separate wooden instrument case (as shown in photo above). See page 152 for air line specifications.

This set of air lines provides the user with the capability of performing full 2-port TRL/LRL (Through-Reflect-Line, Line-Reference-Line) calibrations to 8.0 GHz. The air line set consists of three high precision air lines of various lengths that meet NIST and Agilent's recommendation of 30 degrees phase margin. Test port adapter and software options are listed on page 35.

TRM/TRL/LRL Calibration

Maury TRL/LRL calibration kits are tri-kits containing the components needed to perform three types of calibrations (TRM/TRL/LRL, SOLT, and short-open-(air line + load) [1] . Source match can also be measured using the 6.25cm air line and provided short circuit.

Connector Description

The Maury 7-16 connectors utilized in these kits are rugged calibration grade connectors that exceed the requirements for IEC169-4 reference grade and BSEN 122190 grade 0 specifications. Although they are rated for a frequency range of DC to 7.5 GHz, they are useable up to 8.0 GHz.

Equipment Provided in 2760B Kits

Quantity	Description
1	Air line, 6cm
1	Air line, 7.5cm
1	Air line, 30cm
1	Fixed termination, 7-16 female
1	Fixed termination, 7-16 male
1	Open circuit, 7-16 female
1	Open circuit, 7-16 male
1	Short circuit, 7-16 female
1	Short circuit, 7-16 male
1	Torque wrench, 1-1/16"
1	Open-end wrench, 15/16"
1	Operating instructions
1	Instrument case

[1] Maury data sheet 2Z-044 explains these types of calibrations, with complete specifications for the components listed on this page.

7-16 TRL/LRL VNA CALIBRATION KITS

Optional Accessories

Connector Gage Kit:

Model A041A - Includes female and male push-on gages with a master setting gage housed in a foam-lined instrument case.

In-Series Adapters:

7-16 (f) to 7-16 (f) adapter
7-16 (m) to 7-16 (m) adapter
7-16 (f) to 7-16 (m) adapter
VSWR (maximum) 1.025

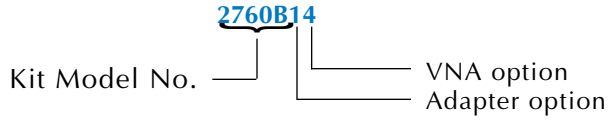
3.5mm to 7-16:

3.5mm (f) to 7-16 (f) adapter
3.5mm (m) to 7-16 (f) adapter
3.5mm (f) to 7-16 (m) adapter
3.5mm (m) to 7-16 (m) adapter
VSWR (maximum) 1.04
A035E Connector gage (thread-on type)
8799A1 Torque wrench 8 in/lbs

Ordering Options

To order a kit configured to match your VNA model and specific application, add the appropriate option numbers at the end of the kit model number.

Example: Kit with adapter option 1 (7mm adapters) and VNA option 4 (Agilent 8510C)



7-16 TRL Adapter Sets

Option No.	Description and Model	Quantity
1	Adapter, 7mm to 7-16 female	2
	Test port adapter, 7mm to 7-16 male [2]	2
2	Adapter, type N female to 7-16 female	1
	Adapter, type N male to 7-16 female	1
	Test port adapter, type N female to 7-16 male [2]	1
	Test port adapter, type N male 7-16 male [2]	1

Software and Adapter Set Options

Test Set or Cable Connectors	Software Provided for VNA (by model)				Adapter Set Options
	Agilent			No Software Provided	
	8510A/B	8510C	8719/20/22		
—	03	04	05	—	—
7mm	13	14	15	10	1
Type N	23	24	25	20	2

[2] The Maury 7-16 connectors utilized in these kits are rugged calibration grade connectors that exceed the requirements for IEC169-4 reference grade and BSEN122190 grade 0 specifications.

WAVEGUIDE VNA CALIBRATION KITS

7005E SERIES

Standard Kits

- Agilent 8510A/B/C
- Agilent 8719/20/22
- Agilent 8753
- Anritsu 360/37000
- 7mm, 3.5mm, 2.92mm and 2.42mm Connector Test Ports/Cables

K7005E34

Description

The 7005E series are standard kits designed to provide accurate calibration of the most common Agilent and Anritsu Vector Network Analyzers (VNAs) for measurements in rectangular waveguide at frequencies from 1.7 to 50 GHz (WR430 through WR22).

Kit Composition

The 7005E series calibration kits provide all the necessary devices for accurately calibrating most Agilent and Anritsu VNAs. Kits for standard rectangular waveguide include a variety of adapter combinations for convenience in connecting to the test set, and a high precision sliding termination featuring a machined housing to ensure high effective directivity after calibration. Precision straight sections and a fixed (reference plane) short are also provided and can be used as verification standards.

All component flanges have precision indexing holes for excellent measurement repeatability (indexing pins are provided with the kit).

Equipment Provided in Kits

Quantity	Description
3	Adapters (see chart on next page)
1	Sliding termination, high precision, model 314 series
1	Precision fixed termination
1	Straight section [1]
1	Offset short, 1/8λ
1	Offset short, 3/8λ
1	Fixed (reference plane) short
1	Flange hardware including indexing pins (set)
1	Data medium containing the calibration constants
1	Instrument case
1	Operating instructions

Test Port and Cable Connectors

These kits are configured for use with VNA test sets and test cables utilizing 7mm, 3.5mm, 2.92mm (K connector) and 2.4mm connectors as appropriate for the various waveguide bands. The chart on the next page shows which adapter options are available for each waveguide band.

[1] Not included in R band kits.

WAVEGUIDE VNA CALIBRATION KITS

7005E SERIES

Available Models

Model	Waveguide Designation	Frequency Range (GHz)	Adapters and Straight Section		Equivalent Flange for All Other Items	Adapter Options Available
			Flange	Mates With		
R7005E(*)(*)	WR430	1.70 – 2.60	MPF430	UG435/U & CPR	UG435/U [2]	1, 2
S7005E(*)(*)	WR284	2.60 – 3.95	MPF284	UG53/U & CPR	UG53/U [2]	1, 2, 3
E7005E(*)(*)	WR229	3.30 – 4.90	MPF229	CPR & CMR	CPR229F	1, 2, 3
G7005E(*)(*)	WR187	3.95 – 5.85	MPF187	UG149A/U & CPR	UG149A/U [2]	1, 2, 3
F7005E(*)(*)	WR159	4.90 – 7.05	MPF159	CPR & CMR	CPR159F	1, 2, 3
C7005E(*)(*)	WR137	5.85 – 8.20	MPF137	UG344/U & CPR	UG344/U [2]	1, 2, 3
H7005E(*)(*)	WR112	7.05 – 10.00	MPF112B	UG51/U	UG51/U [2]	1, 2, 3
X7005E(*)(*)	WR90	8.20 – 12.40	MPF90B	UG39/U	UG39/U [2]	1, 2, 3
M7005E(*)(*)	WR75	10.00 – 15.00	MPF75B	[3]	MPF75	1, 2, 3
P7005E(*)(*)	WR62	12.40 – 18.00	MPF62	UG419/U	UG419/U [2]	1, 2, 3
N7005E(*)(*)	WR51	15.00 – 22.00	MPF51	[3]	MPF51	3, 5
K7005E(*)(*)	WR42	18.00 – 26.50	MPF42	UG595/U	UG595/U [2]	3, 5
U7005E(*)(*)	WR28	26.50 – 40.00	MPF28	UG599/U	UG599/U [2]	4, 5
J7005E(*)(*) [4]	WR22	33.00 – 50.00	MPF22	UG383/U	UG383/U [2]	5

(*) Insert the appropriate single-digit numbers from the chart below to designate the adapter set and VNA options needed.

Adapter Set Option — *VNA Code*

EXAMPLE: to order a WR75 kit for the Agilent 8510C with adapter set option 1 the correct model number is M7005E14

Adapter Set Option	Description	VNA Code
1	2 each, 7mm Right Angle Launch (RAL); 1 ea. 7mm End Launch (EL)	3 – Agilent 8510A/B
2	1 each, 7mm RAL; 2 ea. 7mm EL	4 – Agilent 8510C
3	1 each, 3.5mm (f) RAL; 1 ea. 3.5mm (m) RAL; 1 ea. 3.5mm (f) EL (NMD F thru K Bands)	5 – Agilent 8719/20/22
4	1 each, 2.92mm (f) RAL; 1 ea. 2.92mm (m) RAL; 1 ea. 2.92mm (f) EL (NMD F thru K Bands)	6 – Agilent 8753
5	1 each, 2.4mm (f) RAL; 1 ea. 2.4mm (m) RAL; 1 ea. 2.4mm (f) EL	8 – Anritsu 360
NMD mates with the ruggedized test ports on most popular VNAs. 2.92mm is also known as the "K" connector.		9 – Anritsu 37000

[2] These precision flanges (which include indexing holes) are otherwise equivalent to the military or commercial flanges indicated.

[3] Equivalent to industry standards in these bands.

[4] Optimized kit.

WAVEGUIDE VNA CALIBRATION KITS

7006A/B SERIES

Economy kits

- Agilent 8510A/B/C
- Agilent 8719/20/22
- Anritsu 360
- Anritsu 37000
- 3.5mm and 2.92mm (K) Connector Test Ports/Cables

P7006A

Description

The 7006A/B series are economical, cost effective kits designed to provide accurate calibration of a wide range of vector network analyzers for measurements in rectangular waveguide at frequencies from 2.6 to 40.0 GHz (WR284 through WR28). The 7006 series calibration kits are applicable to the Agilent 8510A/B/C, 8719/20/22, and the Anritsu 360/37000 series analyzers.

Test Port and Cable Connectors

These kits are configured for use with VNA test sets and test cables utilizing 3.5mm or 2.4mm connectors.

Quantity	Description
1	Adapter, end launch, NMD 3.5mm female [1]
1	Adapter, right angle launch, 3.5mm male [1]
1	Sliding termination
1	1/4λ Waveguide section (shim)
1	Fixed (reference plane) short [2]
1	Flange hardware including indexing pins (set)
1	Data medium containing the calibration constants [3]
1	Instrument case
1	Operating instructions

Kit Composition

As shown in the adjacent table, the 7006 model series calibration kits provide all the necessary devices for accurately calibrating the listed VNA. Kits for use in standard rectangular waveguide are supplied with an end launch adapter for convenience in connecting to the test set [1]. The sliding terminations used in these kits are the precision 313 series.

These terminations, combined with the 1/4λ shim approach, provide a cost effective means of achieving an accurate calibration.

All kit component flanges have precision indexing holes for excellent measurement repeatability (indexing pins are provided).

[1] WR34 and WR28 are supplied with 2.4mm female right angle launch adapters.

[2] Two (2) fixed shorts are provided with Anritsu kits.

[3] Tape cartridge for the Agilent 8510A/B; 3-1/2" disk for the Agilent 8510C, 8719/20/22, and Anritsu 360/3700.

WAVEGUIDE VNA CALIBRATION KITS

7006A/B SERIES

Available Models

Model	Waveguide Designation	Frequency Range (GHz)	Flange Data	
			Designation	Mates With
S7006A(*)	WR284	2.60 – 3.95	MPF284C	UG53/U
E7006A(*)	WR229	3.30 – 4.90	MPF229B	CPR
G7006A(*)	WR187	3.95 – 5.85	MPF187C	UG149A/U
F7006A(*)	WR159	4.90 – 7.05	MPF159B	CPR
C7006A(*)	WR137	5.85 – 8.20	MPF137C	UG344/U
H7006A(*)	WR112	7.05 – 10.00	MPF112B	UG51/U
X7006A(*)	WR90	8.20 – 12.40	MPF90B	UG39/U
M7006A(*)	WR75	10.00 – 15.00	MPF75B	[4]
P7006A(*)	WR62	12.40 – 18.00	MPF62	UG419/U
K7006A(*)	WR42	18.00 – 26.50	MPF42	UG595/U
Q7006A(*)	WR34	22.00 – 33.00	MPF34	UG1530/U
U7006A(*)	WR28	26.50 – 40.00	MPF28	UG599/U

(*) Insert option number to designate VNA as follows:

13 – Agilent 8510A/B
14 – Agilent 8510C
15 – Agilent 8719/20/22
18 – Anritsu 360
19 – Anritsu 37000

[4] Equivalent to industry standards in these bands.

Key literature – Maury data sheet 3H-057.

TRL VNA CALIBRATION KITS

7007H SERIES

- Agilent 8510A/B/C
- Agilent 8719/20/22
- Anritsu 360/37000

P7007H

Description

The 7007H model series are waveguide kits designed to provide accurate Thru-Reflect-Line (TRL) calibrations of vector network analyzers for measurements in rectangular waveguide at frequencies from 1.7 to 50.0 GHz (WR430 through WR22).

Test Port and Cable Connectors

These kits are configured for use with VNA test sets or test cables utilizing 7mm, 3.5mm and 2.4mm [1] connectors. Other adapter or test port configurations are available upon request.

Kit Composition

As shown in the adjacent table, the 7007H series calibration kits provide all the necessary devices for an accurate TRL calibration of the appropriate VNA. In addition to TRL calibrations, the 7007 series can also make Short-Short-Load-Thru (SSLT) and offset load calibrations.

All kit component flanges have precision indexing holes for excellent measurement repeatability (indexing pins are provided with the kit).

Equipment Provided in KIts

Quantity	Description
2	Adapter, right angle launch [1]
2	Precision fixed terminations
1	1/4 wavelength high precision straight section
1	Fixed (reference plane) short [2]
1	Flange hardware including indexing pins (set)
1	Data medium containing the calibration constants
1	Instrument case
1	Operating instructions

[1] 7mm, WR430 — WR62
3.5mm female, WR51 — WR42
2.4mm female, WR34 — WR22

[2] Kits configured for Anritsu VNAs require two shorts.

TRL VNA CALIBRATION KITS

7007H SERIES

Available Models

Model	Waveguide Designation	Frequency Range (GHz)	Adapters And Straight Section		Equivalent Flange For All Other Items
			Flange	Mates With	
R7007H(*)	WR430	1.70 — 2.60	MPF430	UG435/U & CPR	UG435/U [4]
S7007H(*)	WR284	2.60 — 3.95	MPF284	UG53/U & CPR	UG53/U [4]
E7007H(*)	WR229	3.30 — 4.90	MPF229	CPR & CMR	CPR229F
G7007H(*)	WR187	3.95 — 5.85	MPF187	UG149A/U & CPR	UG149A/U [4]
F7007H(*)	WR159	4.90 — 7.05	MPF159	CPR & CMR	CPR159F
C7007H(*)	WR137	5.85 — 8.20	MPF137	UG344/U & CPR	UG344/U [4]
H7007H(*)	WR112	7.05 — 10.00	MPF112B	UG51/U	UG51/U [4]
X7007H(*)	WR90	8.20 — 12.40	MPF90B	UG39/U	UG39/U [4]
M7007H(*)	WR75	10.00 — 15.00	MPF75	[3]	MPF75
P7007H(*)	WR62	12.40 — 18.00	MPF62	UG419/U	UG419/U [4]
N7007H(*)	WR51	15.00 — 22.00	MPF51	[3]	MPF51
K7007H(*)	WR42	18.00 — 26.50	MPF42	UG595/U	UG595/U
Q7007H(*)	WR34	22.00 — 33.00	MPF34	UG1530/U	UG1530/U
U7007H(*)	WR28	26.80 — 40.00	MPF28	UG599/U	UG599/U
J7007H(*)	WR22	33.00 — 50.00	MPF22	UG383/U	UG383/U

(*) Insert option for appropriate VNA:

Option	Vector Network Analyzer
13	Agilent 8510A/B
14	Agilent 8510C
15	Agilent 8719/20/22
18	Anritsu 360
19	Anritsu 37000 Series

[3] Equivalent to industry standards in this band.

[4] Equivalent to the military or commercial flanges indicated; however, these are precision flanges which include indexing holes.

Key literature – Maury data sheet 3H-058.

OPTIMIZED MILLIMETER WAVEGUIDE VNA CALIBRATION KITS

7005G SERIES

Optimized Kits

- Agilent 8510A/B/C
- Anritsu 360
- Anritsu 37000

J7005G

Description

The 7005G series high precision vector network analyzer (VNA) calibration kits, featuring optimized standards and calibration constants, are designed to provide highly accurate calibration of Agilent 8510A/B/C, Anritsu 360/37000 vector network analyzers for measurements in rectangular waveguide. Kits are available for the Agilent 8510 VNA from 26.5 to 110 GHz (WR28 through WR10), while the kits for use with the Anritsu VNAs cover 33 to 110 GHz (WR22 through WR10).

Test Port and Cable Connectors

These kits are configured for use with VNAs utilizing external millimeter waveguide test heads or modules.

Optimized Directivity and Source Match

The 7005G series VNA calibration kits are configured for the Short-Short-Load-Thru (SSLT) calibration method using offset shorts and a sliding termination. The sliding termination housings are calibrated for return loss and then selected for compliance with directivity specification. The offset shorts are calibrated and the calibration coefficients are optimized for compliance with the source match specification. The calibration data is provided in a calibration report supplied with each kit. Since the constants are optimized, the data medium supplied is unique to each specific calibration kit.

Flange Information

All kit component flanges are provided with precision indexing holes for excellent measurement repeatability (indexing pins are provided with the kit). Kit components are provided in a foam-lined wooden instrument case. Millimeter waveguide flanges for use on WR22 and smaller sizes are of a unique Maury- pioneered design. This design features a raised outer rim to prevent the flanges from cocking during connection, and removable four-pin alignment pattern pins to permit servicing of the flanges. These flanges will mate with corresponding UG( )/U flanges.

OPTIMIZED MILLIMETER WAVEGUIDE VNA CALIBRATION KITS

7005G SERIES

Kit Composition

As shown in the adjacent table, the 7005G series calibration kits provide all the necessary devices for accurately calibrating the appropriate VNA. These kits are provided with a high precision sliding termination featuring a machined housing to ensure high effective directivity after calibration. The sliding terminations for use in WR22 waveguide and smaller sizes are equipped with a micrometer drive so that load positions can be easily and smoothly set.

Precision straight sections and a fixed (reference plane) short are also provided and can be used as verification standards.

Equipment Provided in Kits

Quantity	Description
2	Test port adapter
1	Sliding termination, high precision
1	Precision fixed termination
1	Precision straight section
1	High precision offset short, 1/8λ
1	High precision offset short, 3/8λ
1	Fixed (reference plane) short
1	Flange tools (set)
1	Flange hardware including indexing pins (set)
1	Data medium containing the calibration constants [1]
1	Instrument case
1	Operating Instructions

Available Models

Model	Waveguide Designation	Frequency Range (GHz)	Mating Flange	Directivity (minimum – dB)	Source Match (minimum – dB)
U7005G(*)	WR28	26.5 – 40.0	UG599/U	54	48
J7005G(*)	WR22	33.0 – 50.0	UG383/U	54	48
T7005G(*)	WR19	40.0 – 60.0	UG383/U	54	44
V7005G(*)	WR15	50.0 – 75.0	UG385/U	54	42
Y7005G(*)	WR12	60.0 – 90.0	UG587/U	50	40
Z7005G(*)	WR10	75.0 – 110.0	UG387/U	50	40

(*)Insert option number to designate VNA as follows:

13 – Agilent 8510A/B

14 – Agilent 8510C

18 – Anritsu 360

19 – Anritsu 37000

[1] Tape cartridge for the Agilent 8510A/B; 3-1/2" disk for the 8510C and Anritsu 360/37000 series.

Key literature – Maury data sheet 3H-068.

MILLIMETER WAVEGUIDE VNA CALIBRATION KITS

7005M/N/X SERIES

Economy Kits

- Agilent 8510A/B/C
- Anritsu 360
- Anritsu 37000

J7005N

Description

The 7005M/N/X series are economical, cost effective kits designed to provide accurate calibration of network analyzers from 26.5 GHz (Agilent 8510 series) or 33 GHz (Anritsu 360 and 37000 series) through 110 GHz in rectangular waveguide sizes WR28 through WR10.

Test Port and Cable Connectors

These kits are configured for use with VNAs utilizing external millimeter waveguide test heads or modules.

Calibration Method

The 7005M series VNA calibration kits for Agilent 8510 VNAs are configured for the Short-Short-Load-Load-Thru (SSLLT) calibration method using a fixed short, a fixed precision termination, and a 1/4λ shim.

The 7005N/X series calibration kits for the Anritsu 360 and 37000 VNAs are configured for the Short-Short-Load-Thru (SSLT) calibration method using sliding terminations.

Flange Information

All kit component flanges are provided with precision indexing holes for excellent measurement repeatability (indexing pins are provided with the kit). Millimeter waveguide flanges for use on WR22 and smaller sizes are of a unique Maury-pioneered design. This design features a raised outer rim to prevent the flanges from cocking during connection, and removable four-pin alignment pattern pins to permit servicing of the flanges. These flanges will mate with corresponding UG( )/U flanges.

MILLIMETER WAVEGUIDE VNA CALIBRATION KITS

7005M/N/X SERIES

Kit Composition

As shown in the table below, the 7005M/N/X model series calibration kits provide all the necessary devices for accurately calibrating the appropriate VNA. The 7005M kits are provided with a precision fixed termination. The 7005N/X kits are provided with a precision sliding termination featuring a micrometer drive so that load positions can be easily and smoothly set. Both kit series are provided with flange hardware, including index pins, and flange tools. Precision straight sections are also provided and can be used as verification standards.

Quantity	Description
1	Sliding termination, high precision
1	Precision fixed termination
1	Precision straight section
1	1/4λ waveguide section (shim)
1	Fixed (reference plane) short (2 each for Anritsu kits)
1	Flange tools (set)
1	Flange hardware including indexing pins (set)
1	Data medium containing the calibration constants [1]
1	Instrument case
1	Operating Instructions

Available Models

Model	Waveguide Designation	Frequency Range (GHz)	Mating Flange	Directivity (minimum – dB)	Source Match (minimum – dB)
U7005M(*)	WR28	26.5 – 40.0	UG599/U	50	45
J7005x(*)	WR22	33.0 – 50.0	UG383/U	50	45
T7005x(*)	WR19	40.0 – 60.0	UG383/U	50	40
V7005x(*)	WR15	50.0 – 75.0	UG385/U	50	37
Y7005x(*)	WR12	60.0 – 90.0	UG387/U	46	36
Z7005x(*)	WR10	75.0 – 110.0	UG387/U	46	36

x Insert model letter (M, N or X) to designate VNA manufacturer as follows:

M – Agilent

N – Anritsu 360

X – Anritsu 37000

(*)Insert option number to designate Agilent VNA as follows:

13 – Agilent 8510A/B

14 – Agilent 8510C

[1] Tape cartridge for the Agilent 8510A/B; 3-1/2” disk for the 8510C, Anritsu 360 and 37000.

Key literature – for 7005M series: Maury data sheet 3H-071; for 7005N/X series: Maury data sheet 3H-072.

TEST PORT ADAPTERS

COAXIAL CONNECTORS

8009B 2633C 8009F 8829B

General

Maury produces a complete line of test port adapters that allow for direct and convenient connection to the ruggedized test port connectors found on most of the popular VNA and high performance cable assemblies. Please see page 104 for detailed information on our panel mount test ports.

Model	From	To	Frequency Range (GHz)	VSWR (maximum)	Length (inches)
2633A	7mm female	7mm	DC — 18.0	1.004 + 0.003*f* GHz, 1.38	1.62
2633C	NMD3.5mm female	7mm		1.018 + 0.003*f* GHz, 1.38	1.86
8009A [1]	NMD3.5mm female	3.5mm female	DC — 26.5	DC — 18.0 GHz, 1.08	1.45
8009B [1]	NMD3.5mm female	3.5mm male		18.0 — 26.5 GHz, 1.12	1.49
8009F	NMD3.5mm female	NMD3.5mm male	DC — 26.5	DC — 18.0 GHz, 1.08 18.0 — 26.5 GHz, 1.12	1.49
8829A	NMD3.5mm female	Precision N female	DC — 18.0	DC — 6.0 GHz, 1.04	2.04
8829B	NMD3.5mm female	Precision N male		6.0 — 18.0 GHz, 1.08	2.20
8619A	NMD3.5mm female	Precision TNC female	DC — 18.0	DC — 3.5 GHz, 1.06	2.05
8619B	NMD3.5mm female	Precision TNC male		3.5 — 7.0 GHz, 1.10 7.0 — 18.0 GHz, 1.16	2.00
8691A	NMD3.5mm female	AFTNC female [2]	DC — 20.0	DC — 4.0 GHz, 1.04	1.92
8691B	NMD3.5mm female	AFTNC male [2]		4.0 — 20.0 GHz, 1.10	1.54
2433A1	NMD3.5 female	MPC14 (GR 900 Equiv)	DC — 8.5	1.01 + 0.008*f* GHz 2.32	2.32
8719A	NMD2.92mm female	2.92mm (K) female	DC — 40.0	DC — 4.0 GHz, 1.05	1.38
8719B	NMD2.92mm female	2.92mm (K) male		4.0 — 20.0 GHz, 1.08 20.0 — 40.0 GHz, 1.12	1.42
8719E	NMD2.92mm female	NMD2.4mm male	DC — 40.0	DC — 10.0 GHz, 1.08	1.58
8719F	NMD2.92 female	NMD2.92mm male		10.0 — 20.0 GHz, 1.08 20.0 — 40.0 GHz, 1.12	1.47
7909A1	NMD2.4mm female	2.4mm female	DC — 50.0	DC — 26.5 GHz, 1.10	1.48
7909A2	NMD2.4mm female	2.4mm male		26.5 — 40.0 GHz, 1.15 40.0 — 50.0 GHz, 1.20	1.51
7909B1	NMD2.4mm female	3.5mm female	DC — 34.0	DC — 10.0 GHz, 1.06	1.26
7909B2	NMD2.4mm female	3.5mm male		10.0 — 20.0 GHz, 1.10 20.0 — 34.0 GHz, 1.12	
7909C	NMD2.4mm female	7mm	DC — 18.0	DC — 4.0 GHz, 1.05 4.0 — 12.0 GHz, 1.07 12.0 — 18.0 GHz, 1.10	2.16
7909D1	NMD2.4mm female	Precision N female	DC — 18.0	DC — 4.0 GHz, 1.08	1.80
7909D2	NMD2.4mm female	Precision N male		4.0 — 12.0 GHz, 1.12 12.0 — 18.0 GHz, 1.12	1.84
7909F1	NMD2.4mm female	2.92mm (K) female	DC — 40.0	DC — 20.0 GHz, 1.10	1.44
7909F2	NMD2.4mm female	2.92mm (K) male		20.0 — 40.0 GHz, 1.16	1.48
7909H	NMD2.4mm female	NMD3.5mm male	DC — 34.0	DC — 10.0 GHz, 1.06 10.0 — 20.0 GHz, 1.10 20.0 — 34.0 GHz, 1.14	1.49

[1] Models 8009A and B are phase matched.

[2] Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.

TEST PORT ADAPTERS

WAVEGUIDE CONNECTORS

U233E K230K6 P230K1

U233E and 8009B Test Port Adapters on an Anritsu 3611 Reversing Test Set

Specifications

Frequency Range ..... 1.7 to 40 GHz (see chart)

VSWR ..... See chart

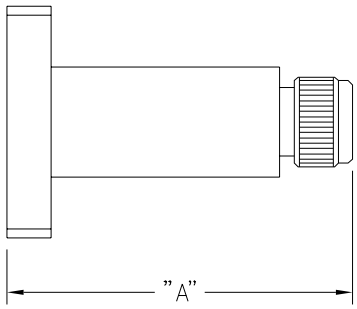
Insertion Loss ..... 0.15 dB maximum (typical)

Coaxial Connector ..... NMD3.5 female [1]

Waveguide Flange ..... See chart

Size and Weight ..... See chart

Dimensions



Model	Frequency Range (GHz)	VSWR (maximum)	Waveguide Size (EIA)	Equivalent Flange [2]	Dimension "A" (inches)	Approximate Net Weight (oz.)
R230K1 [3]	1.7 — 2.6	1.10	WR430	CPR430F	6.19	32
S230K1 [3]	2.6 — 3.95	1.10	WR284	UG584/U	4.13	21
E230K1 [3]	3.3 — 4.9	1.10	WR229	CPR229F	3.88	8
G230K1 [3]	3.95 — 5.85	1.10	WR187	UG149/U	3.88	8-1/2
F230K1	4.9 — 7.05	1.10	WR159	CPR159F	3.40	7
C230K1	5.85 — 8.20	1.10	WR137	UG344/U	3.13	6
H230K1	7.05 — 10.0	1.10	WR112	UG51/U	2.98	4
X230K1	8.20 — 12.4	1.10	WR90	UG39/U	2.73	2
M230K1	10.0 — 15.0	1.10	WR75	MPF75	2.63	1-1/2
P230K1	12.4 — 18.0	1.10	WR62	UG419/U	2.38	1
N230K3	15.0 — 22.0	1.20	WR51	MPF51	2.00	1-1/2
K230K6	18.0 — 26.5	1.15	WR42	UG595/U	1.80	1
U233E [4]	26.5 — 40.0	1.30	WR28	UG599/U	1.80	1

[1] Mating compatible with the NMD3.5 connector found on some Agilent VNA test sets and the special 2.92mm (K) connector on some Anritsu test sets.

[2] Flanges are provided with precision indexing holes. Interface information will be provided upon request.

[3] We recommend that larger waveguide adapters (R, S, E, and G bands) not be connected directly to test sets without support.

[4] Uses a ruggedized 2.92mm (K) connector that mates with the special (K) connector provided on the Anritsu 360 VNA.

CALIBRATION SERVICES

At Maury Microwave, our commitment to quality doesn't end with the sale of a product. In our state-of-the-art microwave laboratory, we offer both ANSI/NCSL Z540-1 (MIL-STD-45662A) calibration and commercial level calibration services for every product we produce. Our laboratory is ANSI/NCSL Z540-1 ISO 10012 compliant with traceability to NIST (National Institute of Standards and Technology).

Each Maury Microwave product is shipped with a certificate of conformance which assures that it has been tested and found to be within operational tolerances. As these products are used, changes can occur which may result in an out of tolerance condition. Periodic calibrations are therefore recommended to maintain functional integrity. We are happy to perform the calibrations you need at a reasonable cost.

Please contact our Customer Service Department to obtain quotations for the specific calibration services you require. Quoted prices will cover the cost of all applicable measurements and include written calibration reports documenting the mechanical and electrical data. If parts are out of tolerance, the cost of repair or replacement will be quoted for your approval prior to the start of any additional work.

It is recommended that the following items be placed on a 12-month calibration cycle:

Microwave Products

- Calibration Kits
- Verification Kits
- Coaxial Components for Laboratory Use
- Waveguide Components for Laboratory Use
- Automated Tuner Systems

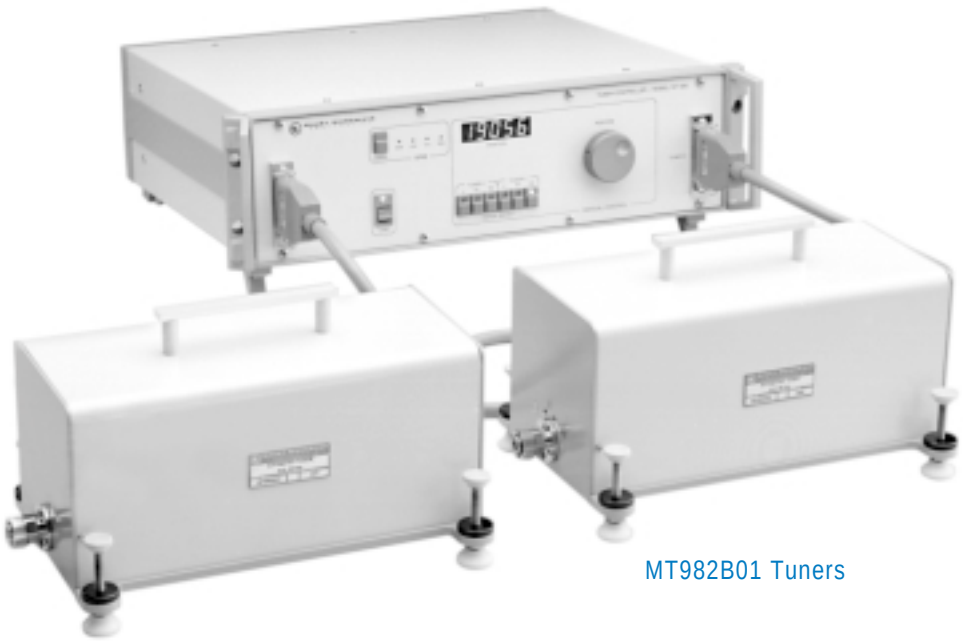
Noise Products

- Noise Calibration Systems (Cryogenic, Thermal and Ambient Terminations)
- Noise Source Equipment
- Noise Measurement Instruments

Mechanical Products

- Torque Wrenches
- Connector Gages

AUTOMATED TUNER SYSTEM



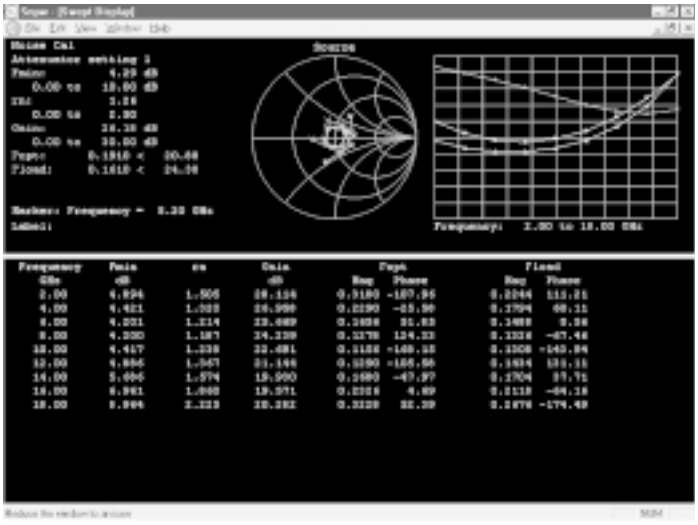
MT986 Tuner Controller

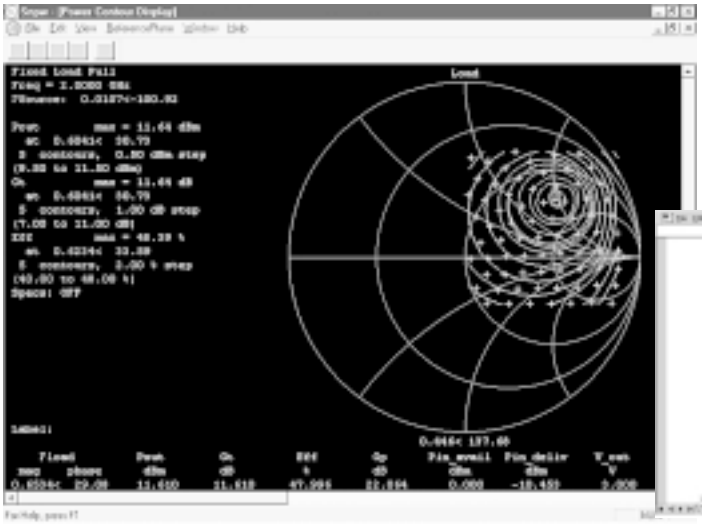
MT982B01 Tuners

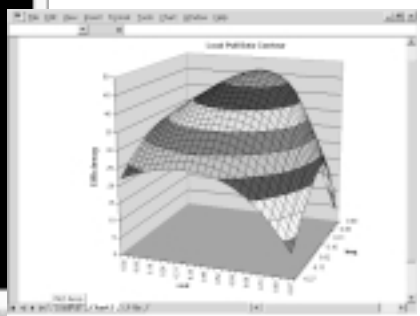
Introduction

Maury's Automated Tuner System (**ATS**) is a fast broadband, automated impedance control system that permits the introduction of a wide range of known source and load impedances into device measurement systems for determination of various parameters under actual operating conditions.

The **ATS** is primarily used for accurate de-embedded performance evaluation of the power, intermodulation distortion, adjacent channel power, noise and network (S-parameter) characteristics of packaged or on-wafer devices under various conditions of impedance matching.

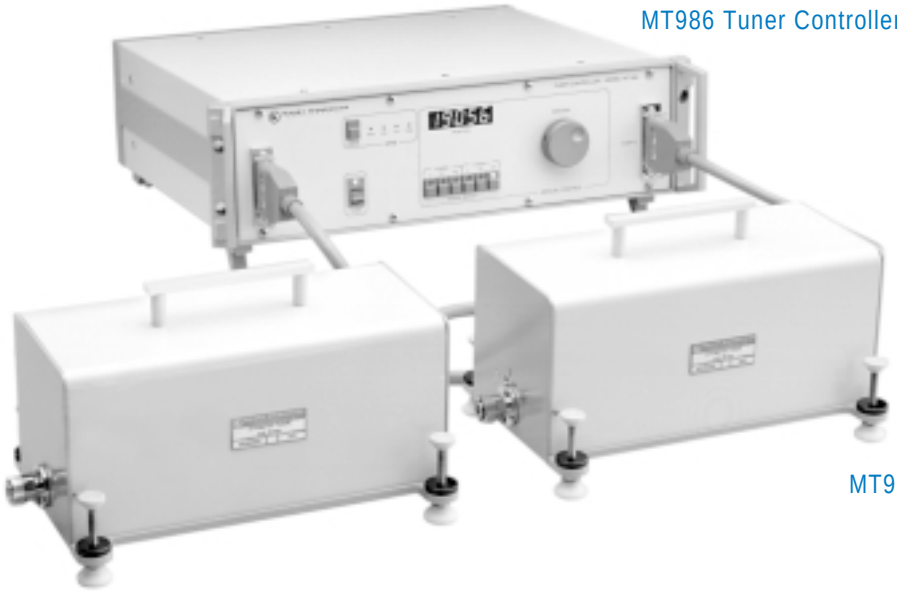






Complete systems consist of Windows® 95/98/NT compatible application software, two automated slide screw tuners, and a GPIB compatible tuner controller. System components are also available separately. Please contact our Sales Department or your local Maury Representative for assistance in tailoring a system to your specific applications.

AUTOMATED TUNER SYSTEM



MT986 Tuner Controller

MT982B01 Tuners

Applications

Noise applications include determination of noise and gain parameters (minimum noise figure, maximum gain, optimum source impedances, etc.), development of constant noise figure and gain circles, and noise figure and gain at user-selected source impedances. Noise and gain parameters can be determined at a single frequency or over a range in the swept mode.

Power parameters include power output, transducer gain, power gain, power added efficiency, and up to 35 user-defined functions. Measurement modes include load and source pull for determination of optimum termination conditions, single input power measurements at user-selected impedances, and swept power measurements at user-selected impedances. A user option permits measurement and recording of harmonic impedances at each tuner setting. The Windows® compatible software also has the capability of translating contour data resulting from load/source pull measurements into a spreadsheet compatible format. The spreadsheet graphics functions can then be used to develop three-dimensional contours.

Intermodulation Distortion (IMD) and **Adjacent Channel Power (ACP)** measurements are a subset of the power application software and must be purchased separately (Model MT993D). This Windows® compatible software package provides for determination of third, fifth, and seventh order IMD and integrated ACP in all power measurement modes – contours, single impedance point, and swept power.

Both basic application software products include a general purpose , S-parameter measurement function that supports a variety of vector network analyzers (VNA).

High Performance – Broad Frequency Coverage

The precision measurement capability of the **ATS** is based on the repeatability and stability of the automated slide screw tuners. These tuners are available in frequency ranges from 0.25 to 110 GHz typically spanning a decade. Units are also available with higher matching capability over smaller frequency ranges.

Support and Upgrades

The Maury **ATS** is continually being improved and upgraded. At least one formal software upgrade is produced each year. A software support agreement is available to ensure that your system remains current with the latest features and improvements in measurement capability.

AUTOMATED TUNER SYSTEM

ATS Complete Systems

ATS complete systems consist of two tuners, software, a **MT986B02** tuner controller (or **MT986B24/26** harmonic tuner controller), a serialized hardware key (which allows the software to run on a PC), and an instruction manual. The tuner models listed may also be used in any automated or manual application requiring impedance matching of a microwave circuit element or to establish specific impedances at a terminal interface.

	Frequency Range (GHz)	System Models: Power	System Models: Noise	System Models: Noise and Power	Tuner Model
Coaxial	0.25 — 2.5	MT980G17 [1]	MT980G18 [1]	MT980G19 [1]	MT981A01 (page 67)
	0.40 — 4.0	MT980G27 [1]	MT980G28 [1]	MT980G29 [1]	MT981B (page 67)
	0.80 — 6.5	MT980G37 [1]	MT980G38 [1]	MT980G39 [1]	MT981D (page 68)
	0.80 — 8.0	MT980F11 [1]	MT980F12 [1]	MT980F13 [1]	MT982E (page 69)
	0.80 — 8.0	MT980F31 [1]	MT980F32 [1]	MT980F33 [1]	MT982E30 (page 69)
	0.80 — 18.0	MT980K [2]	MT980L04 [2]	MT980M [2]	MT982B01 (page 69)
	1.80 — 18.0	MT980A [2]	MT980B04 [2]	MT980C [2]	MT982A01 (page 69)
	4.00 — 26.5	MT980D [2]	MT980E04 [2]	MT980F [2]	MT983A01 (page 70)
	8.00 — 50.0	MT980R17 [2]	MT980R18 [2]	MT980R19 [2]	MT984A (page 71)
Millimeter Waveguide	33.00 — 50.0	MT970J01	MT970J02	MT970J03	MT975A (page 72)
	40.00 — 60.0	MT970U01	MT970U02	MT970U03	MT976A (page 72)
	50.00 — 75.0	MT970V01	MT970V02	MT970V03	MT977A (page 72)
	60.00 — 90.0	MT970Y01	MT970Y02	MT970Y03	MT978A (page 72)
	75.00 — 110.0	MT970Z01	MT970Z02	MT970Z03	MT979A (page 72)
	Software Model	MT993A (page 54)	MT993B (page 56)	MT993C (page 54, 56)	

Training and Installation

Maury holds periodic, two-day training seminars at the factory in Ontario, California. Purchasers of complete systems may send two attendees to one of these seminars (transportation and housing at the customers's expense). Each seminar includes comprehensive, hands-on training in **ATS** theory and operation for all applications and measurement modes. After delivery, and when all support equipment is in place, a Maury engineer will travel to the purchaser's site to install and ensure proper operation of the **ATS**.

How To Order Optional Features

Order **MT993D** to add intermodulation distortion with adjacent channel power measurement capability, **MT993H** to add harmonic load pull, and **MT993D01** to add the Signal Synthesis module to systems listed in the "Power" and "Noise and Power" columns. Other options can be ordered separately (see page 61).

Computer Hardware

All Maury **MT993** series application software is compatible with Windows® 95/98/NT operating systems (Windows is a registered trademark of Microsoft Corporation). Minimum and recommended hardware requirements are as follows:

- 80486DX (Pentium® processor, or higher, recommended)
- 64 megabytes RAM (128MB recommended)
- 40 megabytes free disk space
- VGA graphics (16-bit color minimum)
- Microsoft® compatible mouse
- National Instruments GPIB interface card (AT-GPIB/TNT PNP recommended)

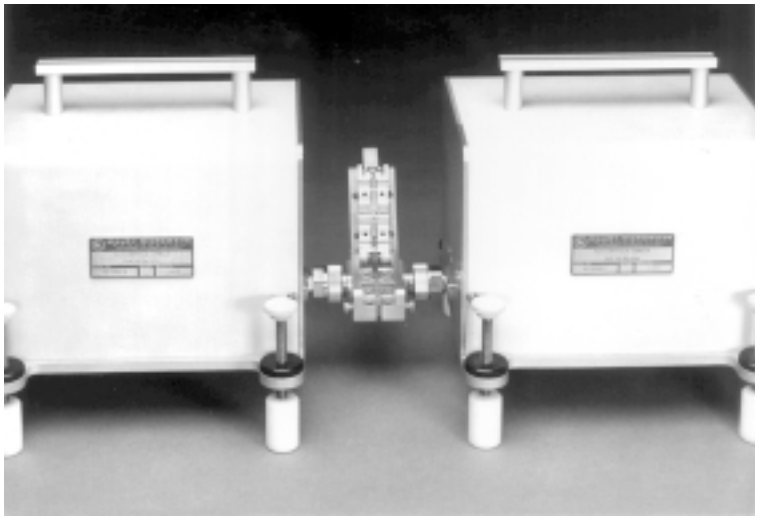
[1] To include a properly configured, compatible computer with the software pre-installed, add the suffix "E" to the model number.

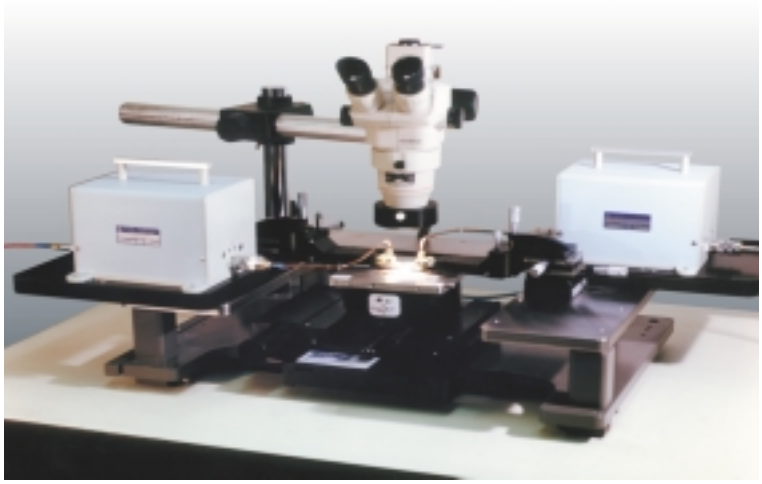
[2] To include a properly configured, compatible computer with the software pre-installed, add the suffix "05" to the model number.

TYPICAL SYSTEM SETUPS

Noise/Power Characterization of Packaged Devices

The photo at right shows a typical mounting arrangement for two Maury MT982A automated tuners with the Device Under Test (DUT) mounted on a test fixture (MT950B2) in preparation for noise or power characterization of a packaged device in a test fixture.





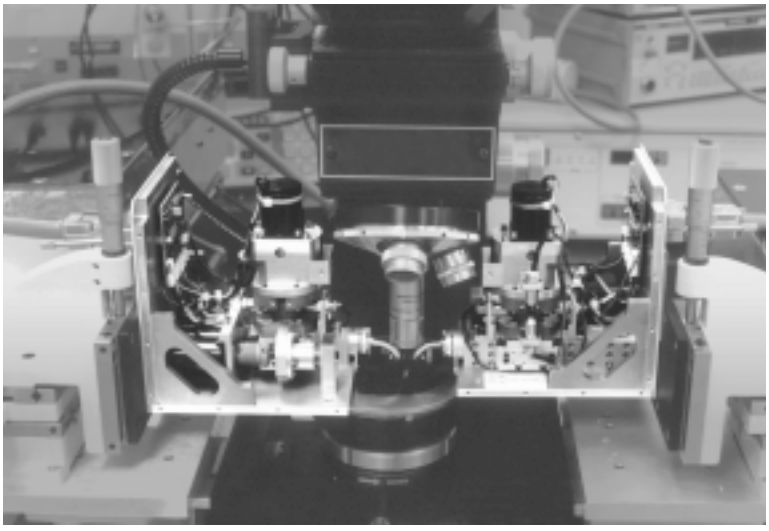
On-Wafer Load Pull Setup

The photo at left shows a typical mounting arrangement for two Maury MT982A automated tuners mounted on a coaxial probe station in preparation for on-wafer device characterization.

Millimeter Wave On-Wafer Load Pull Setup

The photo at right shows two Maury MT979A millimeter wave automated tuners (with covers removed for clarity) mounted on a millimeter wave probe station in preparation for on-wafer device characterization.

U. S. PATENT NO. 5,910,754



ATS EQUIPMENT CHECKLIST

The following is a checklist of all of the devices typically required to perform the noise, power, intermodulation distortion, adjacent channel power, and harmonic load pull measurements described in this section. The highlighted (blue) items are available from Maury Microwave. Detailed information for each of these items will be found in this catalog on the pages noted. Full systems (including tuners, controller and software) for each type of measurement are shown on page 51.

Noise Characterization

- Tuner Controller ❑ (page 75)
- Source Tuner ❑ (page 66)
- Load Tuner ❑ (page 66)
- Bias Supply (Single) ❑
  - Input ❑
  - Output ❑
- Input Bias T ❑
- Noise Figure Meter ❑
- Noise Generator ❑ (page 90)
- Frequency Extender ❑ (page 82)
- Signal Generator (LO) ❑
- Input Bias Meter (optional) ❑
- Output Bias Meter (optional) ❑
- Output Bias T ❑

Power Characterization

- Tuner Controller ❑ (page 75)
- Source Tuner ❑ (page 66)
- Load Tuner ❑ (page 66)
- Bias Supply (Single) ❑
  - Input ❑
  - Output ❑
- Input Bias Meter (optional) ❑
- Output Bias Meter (optional) ❑
- Input Power Meter [1] ❑
- Output Power Meter ❑
- Input Directional Coupler [1] ❑
- Signal Generator ❑
- Amplifier [2] ❑
- Input Bias T ❑
- Output Bias T ❑

Intermodulation Distortion [3]

- Signal Generator ❑
- Spectrum Analyzer ❑
- Output Directional Coupler ❑
- Power Splitter/Combiner ❑

Adjacent Channel Power [3]

- Digitally Modulated Source [4] ❑
- ACP Analyzer [5] ❑

Harmonic Load Pull

- Tuner Controller ❑
- 2nd Harmonic Load Tuner ❑
- 3rd Harmonic Load Tuner ❑

[1] Required for power-added efficiency measurements.

[2] If necessary to boost signal generator output to the level required by the DUT.

[3] Add to power characterization set up.

[4] Can replace a standard signal source.

[5] Some spectrum analyzers can be used for ACP measurements.

POWER CHARACTERIZATION APPLICATION SOFTWARE (MT993A, MT993C)

General

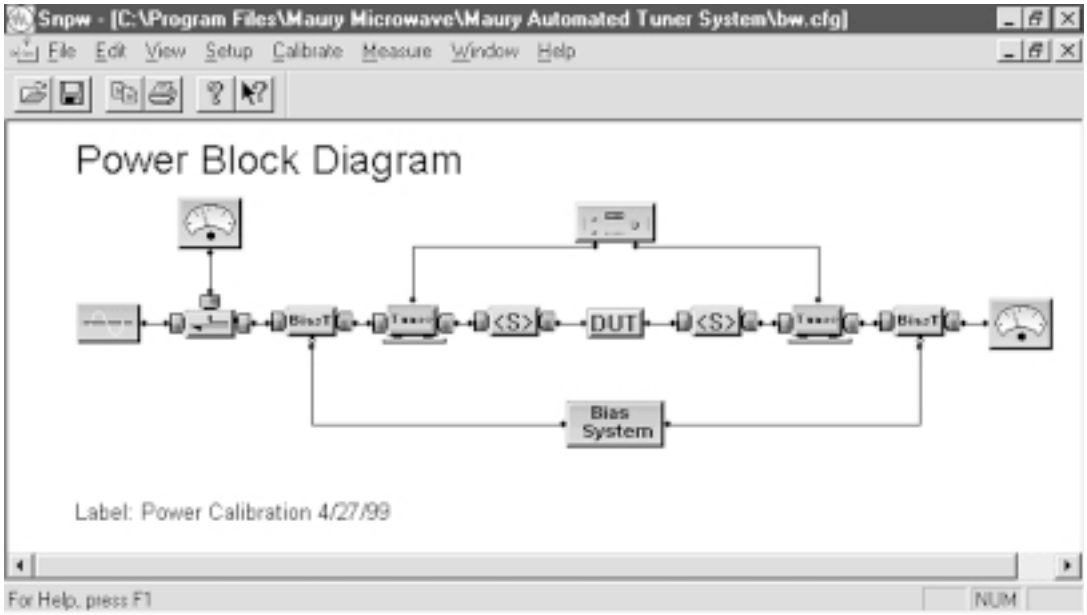
The Maury power characterization application software is designed to operate with the **ATS** and determine the optimum load and source termination conditions for optimizing device performance. If the fixture or probe station network characteristics (S2P) are known, the measured functions are de-embedded to the device input plane. The software is provided as part of an **ATS** system specified for power characterization (see page 51), separately as model **MT993A**, or combined with the noise characterization software as model **MT993C**.

Power Parameters

In large signal amplifier design power output is a complex function of the input power level, terminating impedances, and DC bias conditions.

An **ATS**, operating with the Maury power application software, can provide fast accurate measurements of **power output**, **transducer gain**, **power gain**, **power added efficiency** and measured **input and output voltages and currents**. The program also permits display of **2nd and 3rd harmonic source and load impedances**. A unique feature of the Maury software allows the **user to define up to 35 output functions**. These functions can be used to develop specific output parameters (e.g., simple efficiency, VSWR) or even control instruments (e.g., to control the turn-on/turn-off sequence of a high power signal source). The program also has a built-in general purpose **S-parameter** measurement program that allows for fixed or swept bias conditions. The software provides for both data and graphical hard copy outputs.

The block diagram below illustrates a typical measurement setup, while sample output displays are shown on the adjacent page. Computer hardware requirements are detailed on page 51, and the measurement equipment supported is listed on page 65. A unique feature of Maury **ATS** software is the availability of the equipment driver source code which facilitates development of custom instrument drivers by the user.

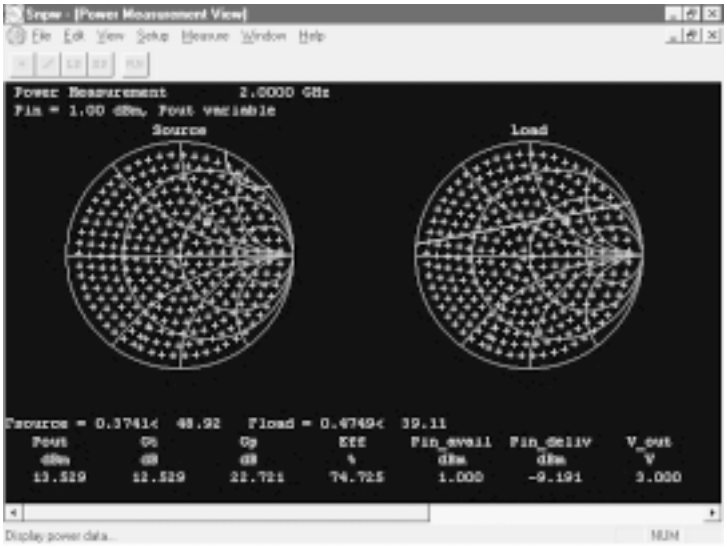


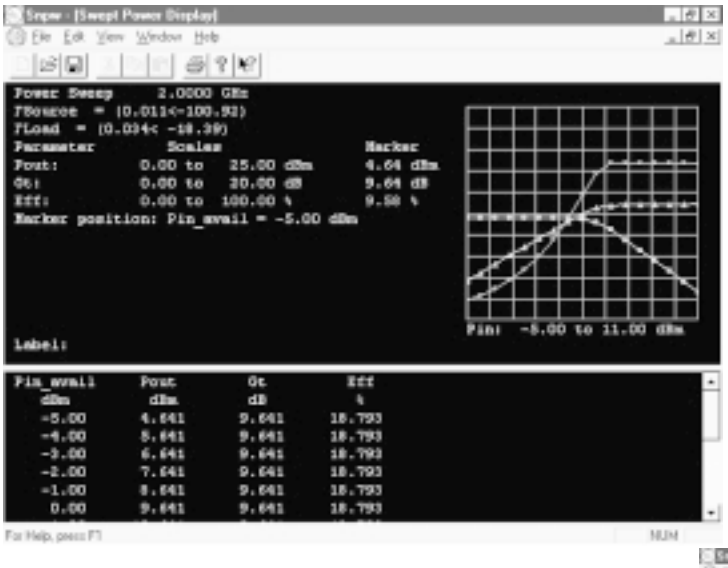
Typical Setup for Performing Simultaneous Load Pull and Source Pull Measurements

POWER CHARACTERIZATION APPLICATION SOFTWARE

Power Measurement Mode

This is a single frequency display that permits the user to select the measured device parameters at a single input power or over a range of powers at any available source or load impedance. The frequency and impedances for load or source pull and sweep plan measurements can also be selected from this display. This is an active measurement screen which allows the operator to move the source and/or load tuners to any available position, and measure all active parameters. If the S-parameter option is exercised, stability circles S11* and S22* are also displayed.



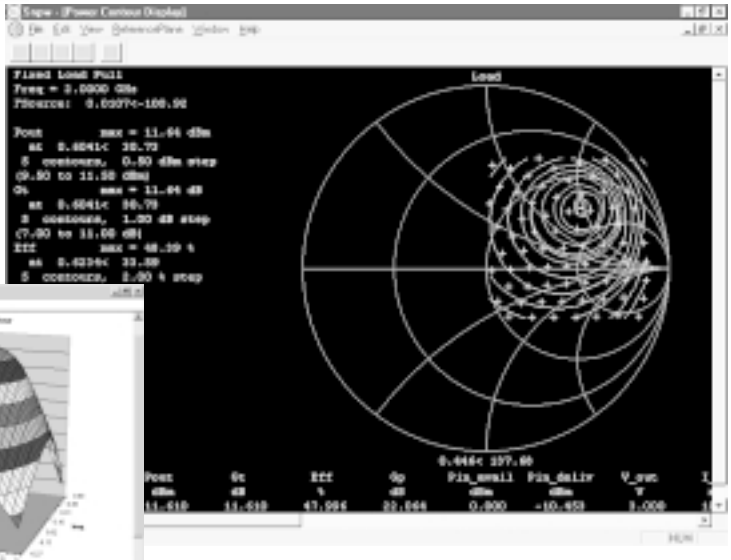


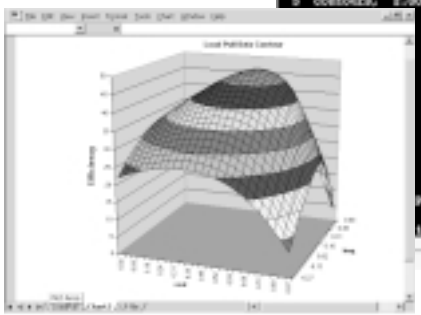
Swept Power Display

Up to five of the measured parameters can be simultaneously displayed versus available input power. A mouse or cursor key controlled marker provides for readouts at measured or interpolated points. Graphics scales are user-controlled. All measured parameters are tabulated below the plots and are available for printout.

Load/Source Pull Display

This single frequency display plots constant measured parameter contours on the impedance plane and the impedance(s) for maximum or minimum values. Contours of up to three parameters can be simultaneously displayed. The number of contours displayed, as well as the increment between contours, are user controlled. Output data at any tuner position can also be user controlled. The contour data can be converted to spreadsheet format with a single keystroke.





NOISE CHARACTERIZATION APPLICATION SOFTWARE (MT993B, MT993C)

General

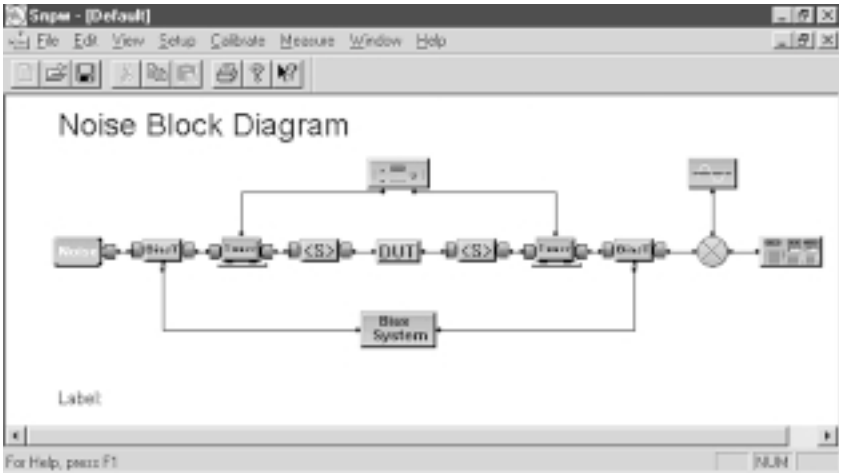
The Maury noise characterization application software is designed to operate with the **ATS** and determine the noise parameters of a linear device, module or sub-assembly. If the fixture or probe station network characteristics are known, these parameters are de-embedded to the device input plane. The program is provided as part of an **ATS** system specified for noise characterization (see page 51), separately as model **MT993B**, or combined with the power characterization software as model **MT993C**.

Noise Parameters

Good noise performance is a critical element of most receiving systems. Low noise can mean lower transmitter power requirements with savings in size, weight, battery life, and cost. Knowledge of the noise parameters which define the noise performance of a device can be an invaluable aid to the receiver/amplifier designer by saving hours of design time and reducing, or even eliminating "cut-and-try" iterations.

An **ATS**, operating with the Maury noise application software, can provide fast accurate measurements of **minimum noise figure**, **optimum source reflection coefficient**, and **equivalent noise resistance**. The program will also provide the **gain parameters** of the device and has a built-in general purpose **S-parameter** measurement program. All measurements can be de-embedded to the device input and output planes. The software provides for both data and graphical hard copy outputs.

The block diagram below illustrates a typical measurement setup, while sample output displays are shown on the adjacent page. Computer hardware requirements are detailed on page 51, and the measurement equipment supported is listed on page 65. A unique feature of Maury **ATS** software is the availability of the equipment driver source code which facilitates development of custom instrument drivers by the user.



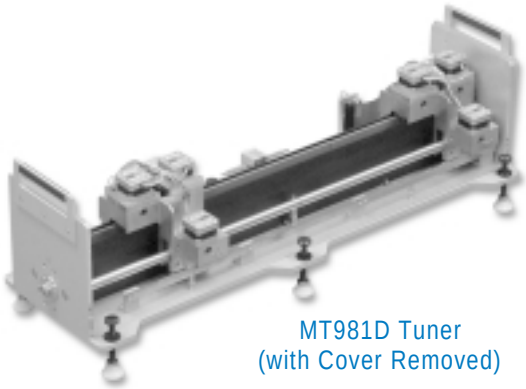
Typical Equipment Setup for Performing Noise Characterization

1 External mixer required with the MT868B. Refer to Maury data sheet 4S-068 for additional information.

2 Not required for measurements below 2.0 GHz.

DYNAMIC PRE-MATCHING FUNCTION

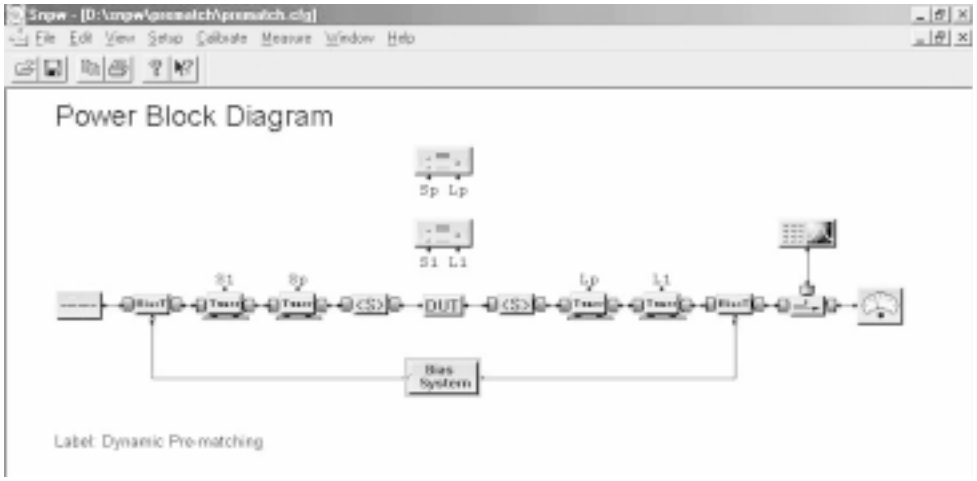
MT993 SERIES



MT981D Tuner
(with Cover Removed)

General

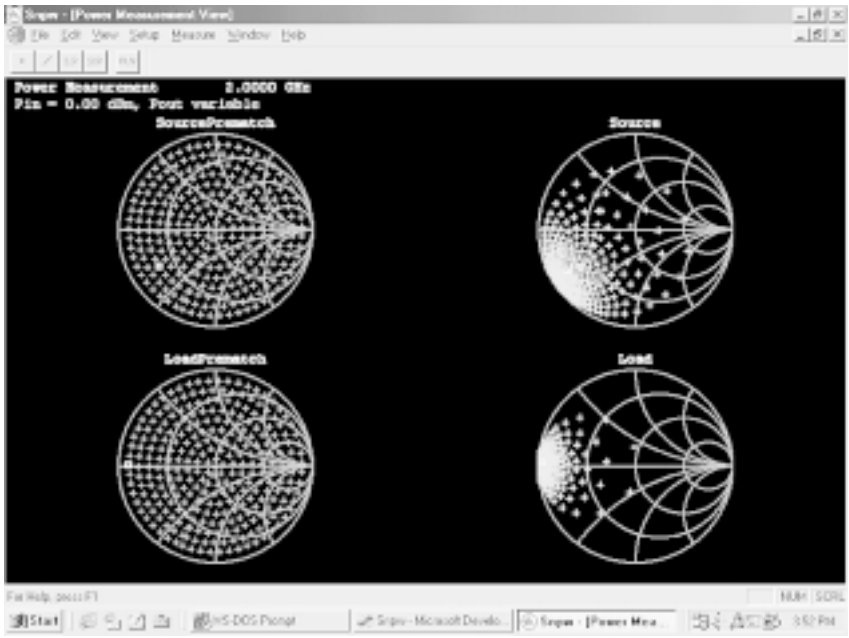
The **MT993** series software includes a dynamic pre-matching function for Maury's standard automated tuners. With this function, one tuner transforms the lowest impedance to a higher value, and the second tuner brings it to 50 ohms. The combination of the two tuners will generate a reflection factor of almost unity at the reference plane of the tuner connector (provided that there is very small loss between the connector and the first probe of the tuner). Obtaining the near unity reflection factor allows accurate measurement of devices with less than 0.5 ohms impedance. This technique permits tuning to any phase. The absence of phase tuning capability is the main limitation of standard 1/4-λ transformers or pre-matched probes.



The Block Diagram (at left) Shows a Typical Setup for Dynamic Pre-matching.

A secondary benefit of this technique is that the two tuners can be operated at increasingly lower VSWR as their combined reflection factor approaches near unity. This allows higher power measurements to be made from the same setup.

Dual tuners are also available which provide the pre-matching and standard tuners in one unit. For example, Maury's MT981D is a dual tuner covering the frequency range 0.8 GHz to 8.0 GHz.



Because dynamic pre-matching is an added feature of the MT993 series software, older systems can be upgraded to include this function.

OPTIONAL SOFTWARE FEATURES

General

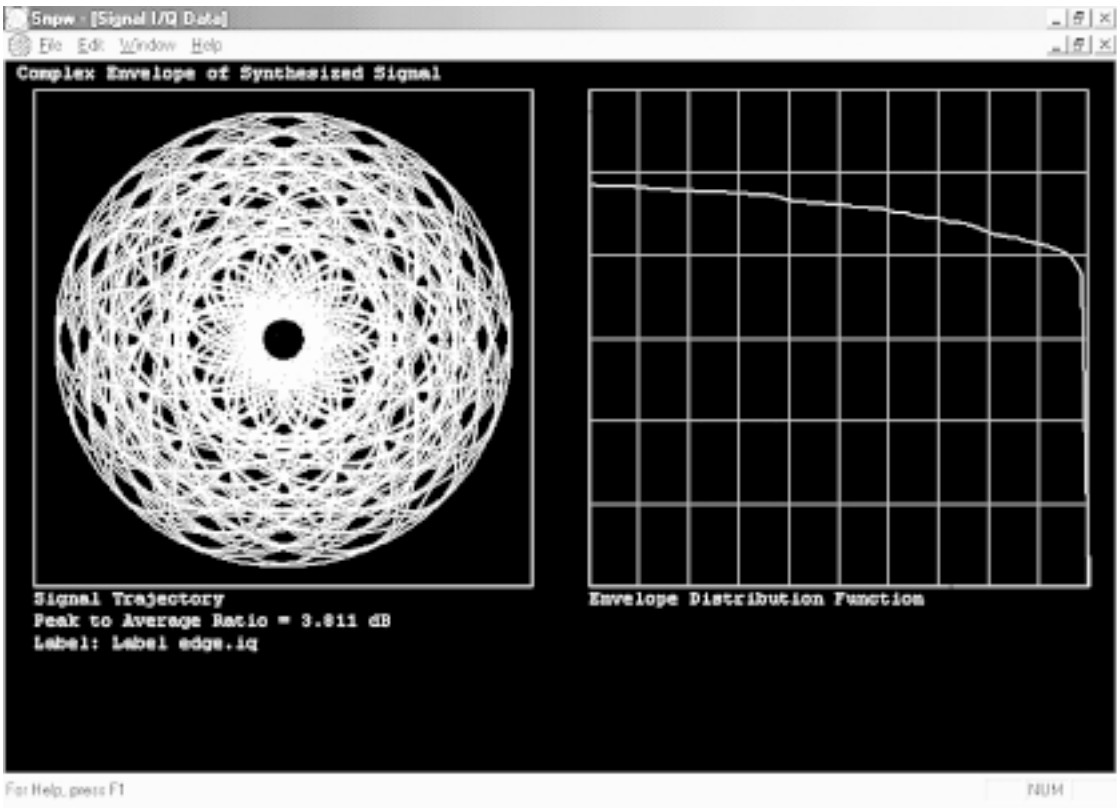
The **ATS** software can be made even more effective with one or more of the following optional software additions. These options are applicable to all MT993 series application software models.

Signal Synthesis Software Module Option (MT993D01)

Maury's optional **MT993D01** signal synthesis software module adds an important new feature to our basic **ATS** device characterization software. This option provides users with the ability to simulate all of the latest digital modulation techniques used in wireless communication systems including **EDGE modulation, cdmaOne_Fwd, cdmaOne_Rev, GSM, WGN,** and others. These same digitally generated signals can be used with RF simulation tools where comparisons between measured data and simulations can be made. The signal synthesis software can also be used to create signals that previously required additional equipment. **Two-tone intermodulation** can be done using a single RF source and **WGN (White Gaussian Noise)** can be created without a noise source and filters. These features allow **ATS** users to simplify their measurement setup. With simplified setups, you save connection time and spend less money on capital equipment.

The **MT993D01** signal synthesis module expands the capability of the **ATS** and provides the best and most reliable tool available for performing device characterization measurements using the latest digital modulation techniques.

MT993D01 Signal Synthesis Software Module Operates from a Pull-down Menu which Simplifies Selection of the Modulation Technique to be Simulated. The Screen Below Shows a Typical Display of the EDGE Modulation Mode.



OPTIONAL SOFTWARE FEATURES

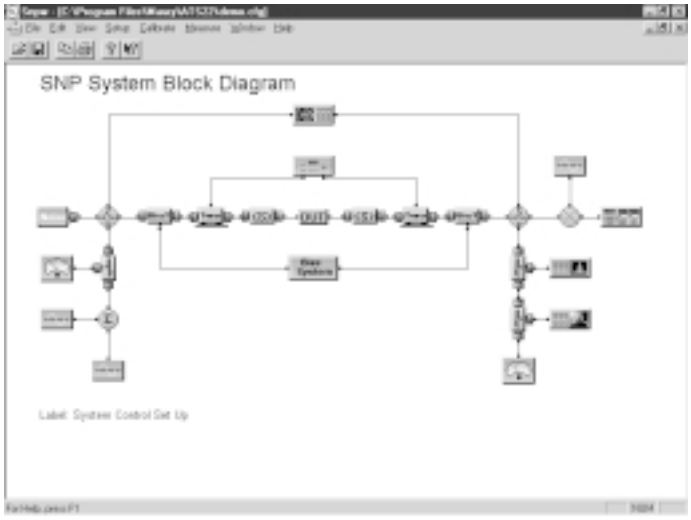
System Control Option (MT993F)

The **MT993F** is an option that provides for automated switching between noise, power, Intermodulation Distortion (IMD), Adjacent Channel Power (ACP), DC I-V curves, and s-parameter measurements from a single setup. A special S-parameters, noise, and power (SNP) calibration is also possible with this option.

Using RF switches to connect the equipment for these different measurements allows a system to be set up once and then all tuner characterizations, noise calibrations, power calibrations, and measurements can be done in-place, without disturbing the setup. Thus, all user interactions are done at the start of a procedure, and time consuming measurement operations can run unattended.

A further advantage of this option is that the RF switching reduces system cost by allowing sharing of equipment. This can save the cost of up to two RF sources.

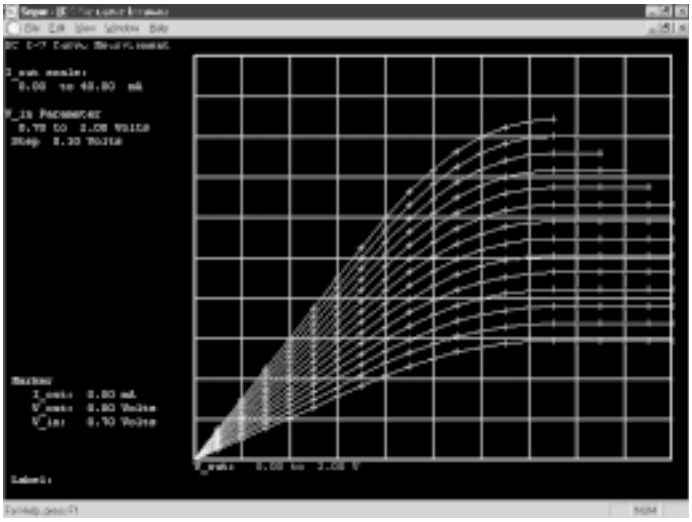
A typical SNP setup is shown below. It can be expanded to add intermod or ACP (see Maury data sheet 4T-057F).



System Control Block Diagram for Measuring S-Parameters, Noise Parameters, and Power in One Setup.

DC I-V Curve Option (MT993G)

The **MT993G** provides for automatic measurement and display of device DC current-voltage curves. For FET devices, the measurement display is a family of output current versus output voltage curves with input voltage as the parameter. For bipolar devices, the measured display is a family of output current versus output voltage curves with input current as the parameter. A maximum dissipation value can be entered which will cause each sweep to terminate when that condition is reached.



OPTIONAL SOFTWARE FEATURES

Harmonic Source/Load Pull Option (MT993H)

Typical source/load pull measurements determine device performance of power parameters as a function of source and load impedances at the frequency of interest. Matching circuit design can then be a trade off between various parameters.

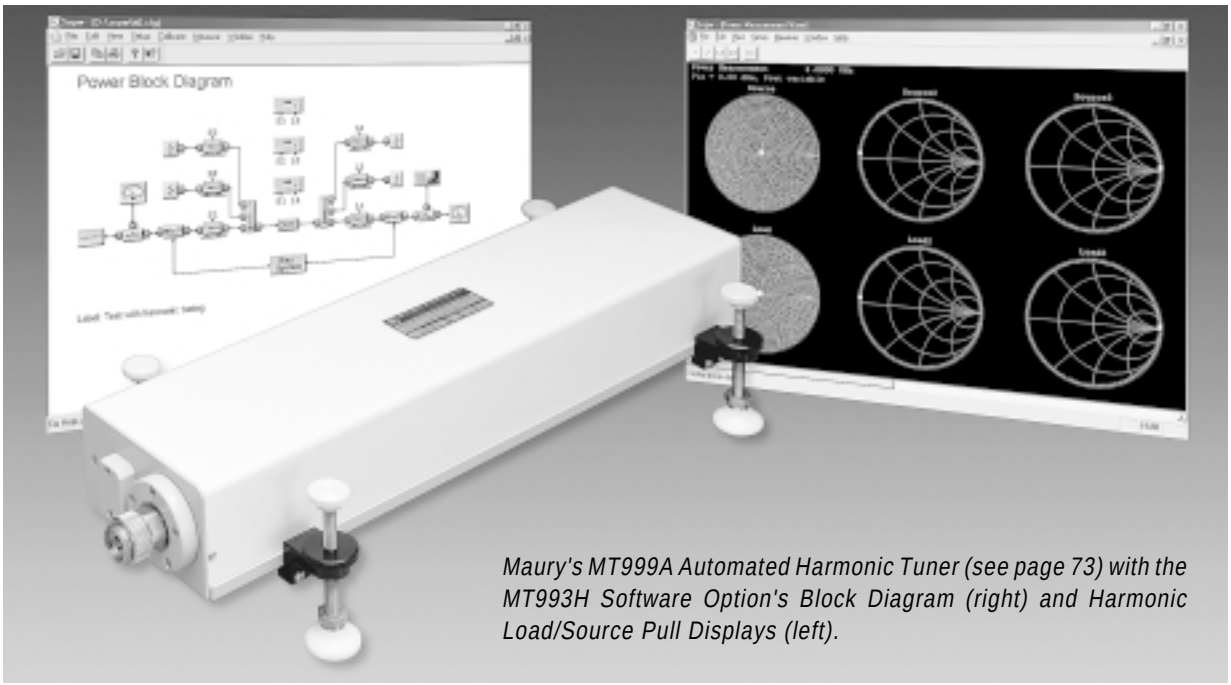
Harmonic load pull allows these same measurements to be made as a function of harmonic load tuning. In particular, linearity and efficiency at the fundamental frequency may be significantly affected by the harmonic tuning. Measured data also shows that harmonic source tuning (which is critically dependent on device saturation levels, frequency, and bias values) can sometimes have an equal – or even greater – effect on a device's efficiency and linearity than harmonic load tuning does. One of the most critical factors in harmonic tuning is the "isolation" between the fundamental and each harmonic and also between the harmonics themselves. In other words, tuning of the 2nd harmonic is less sensitive than tuning the fundamental, so it follows that the tuning of the 2nd harmonic must have **ZERO EFFECT** on the fundamental tuning. The best way to realize this is by using a triplexer to provide very high isolation between the signals. Maury's **ATS** incorporates this technique.

The **MT993H** harmonic source/load pull option to the Maury **ATS** software allows load pull measurements to be done independently at the fundamental, 2nd harmonic, and 3rd harmonic frequencies. Matching networks optimized for both the fundamental and harmonic impedances can yield the best possible performance.

Harmonic tuning can be extended to include the 3rd harmonic, as shown in the picture below. Here, a triplexer is used on both the input and output of the DUT to separate signal paths at the fundamental, 2nd harmonic and 3rd harmonic frequencies. Separate tuners are connected to each triplexer output, so all three frequencies can be tuned independently.

NOTE: The same power parameters will be measured at the fundamental frequency even while tuning the harmonic frequencies. The goal is to find the impedances at all of the frequencies which optimize the fundamental performance. Once these are determined, the matching networks can be designed for the best possible operation.

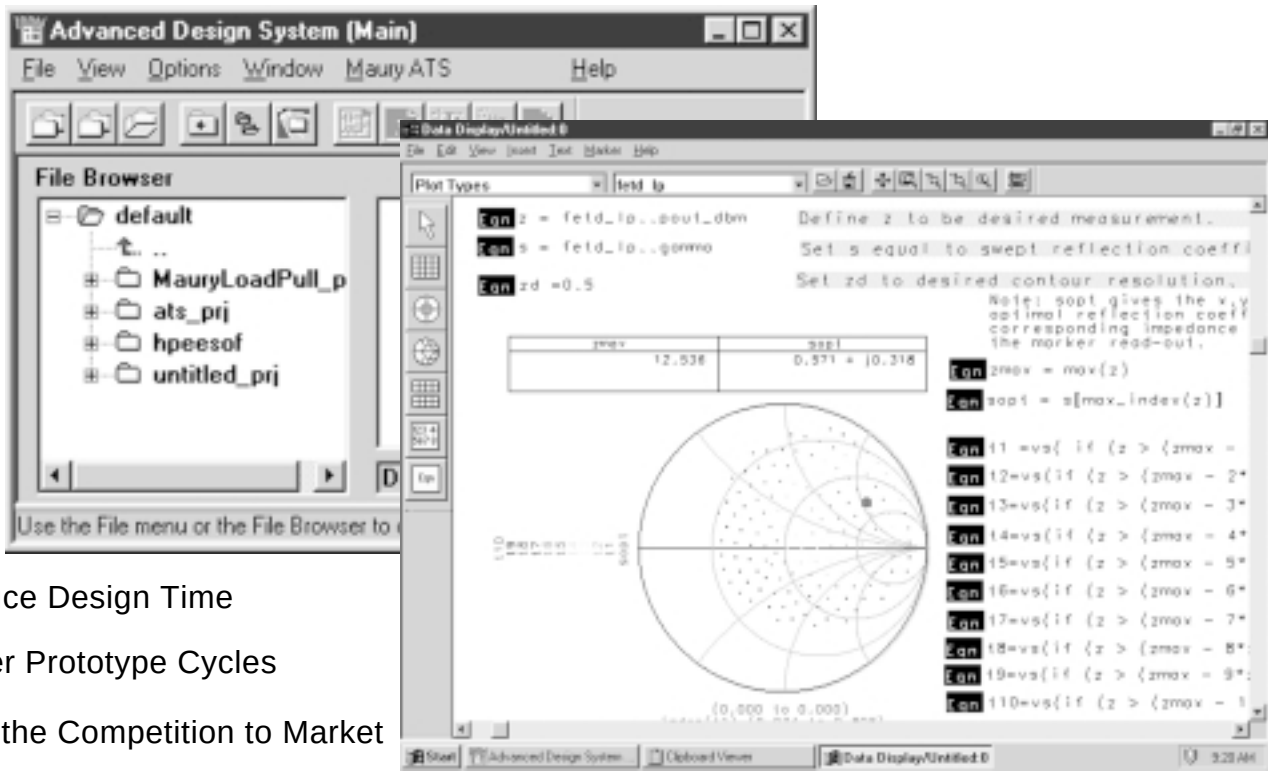
Like fundamental tuning, passive harmonic tuning is limited in matching range. It is also affected by any losses in the diplexer or triplexer. Since any harmonic power absorbed by the load is wasted, complete reflection is desirable, so the only design question is what reflection phase is needed. Even with a matching range limit, harmonic load pull will still show the optimum phase of harmonic tuning.



Maury's MT999A Automated Harmonic Tuner (see page 73) with the MT993H Software Option's Block Diagram (right) and Harmonic Load/Source Pull Displays (left).

LOAD PULL DATA MODULE

FOR AGILENT'S ADVANCED DESIGN SYSTEM SOFTWARE



- Reduce Design Time
- Fewer Prototype Cycles
- Beat the Competition to Market

Description

The MT993Q1 software allows device characterization data from Maury's Automated Tuner System (**ATS**) to be easily imported into Agilent EEsof Advanced Design System (ADS). This data can then be used for design simulation and analysis of circuits and systems.

The MT993Q1 load pull data module automatically translates **ATS** data files into **ADS** data sets. This allows **ATS** device characterization data to be imported into **ADS** for device model verification and circuit design. The following **ATS** data files can be translated into **ADS** data sets.

- Fundamental Source Pull
- 2nd and 3rd Harmonic Source Pull
- Fundamental Load Pull
- 2nd and 3rd Harmonic Load Pull
- Sweep Plan Data
- Swept Power
- DC IV Curves
- Swept Bias Noise Measurements
- Swept Bias 2-port S-parameter
- Swept Frequency Noise Measurements
- Fixture Characterization

This direct link between Maury's Automated Tuner System (**ATS**) and Agilent's Advanced Design System (**ADS**) adds a new and powerful dimension to the microwave circuit designer's capabilities. Measured parameters can now be added to schematic and physical simulations offering a complete environment for analysis and design.

ATS SOFTWARE SUPPORTED EQUIPMENT

General

The Maury **ATS** software supports all MT986 and MT98x series tuner controllers and automated tuners, respectively. The software also includes de-embedding models for inserts used in the Maury MT950B2 transistor test fixture (see page 77). In addition, the **ATS** programs support a wide range general purpose test equipment required for the various measurements. The equipment list changes frequently since new equipment drivers are being added almost continuously. The following list, therefore, is meant only to be representative. A complete listing of supported test equipment can be found in the Maury data sheets or operating manual(s) for your application.

Vector Network Analyzers:

Agilent 8510 series, 8719/20/22, 8753; Anritsu 360 series, 37000 series.

Signal Sources:

Anritsu MG3671 series [1]; Gigatronics 1026; Marconi 6203 test set; Agilent 8340/41, 8350, 8360 series, 8642, 8644A, 8657A/B, 8672A, 8673G, 83700 series [2]; Anritsu 6700 series, 68xxx series.

Bias Supplies and Meters:

Agilent 6625A/26A, 4142, 4245, 6623A with two each Advantest TR6848 meters, 6632A and 6653A with two each Agilent 34401 meters, manual supply with 3478A current meter; Maury MT960A.

Noise Instruments:

Agilent 8907B noise figure meter, 8971B/C noise figure test set; Maury MT2075 series noise gain analyzer, MT868 frequency extenders, MT755x frequency extenders.

Spectrum Analyzers:

Anritsu MS8604A [3]; Agilent 8560A, 8563E, 8566B, 8568B, 8592B, 8593E; Tektronix 2784, 2794.

Power Meters:

Boonton 4220; Gigatronics 8542; Agilent 436A, 437B, 438A; Marconi 6960B, 6203 test set.

Custom Instrument Drivers

A unique feature of the Maury **ATS** software is the availability of the instrument driver source code. A user faced with the need to use a non-supported piece of equipment can open and copy a file for a similar instrument and modify the copied version (under a different file name) for his specific instrument. The **ATS** software is written in Microsoft C®, so some familiarity with C programming is helpful, and a C compiler is required.

Software Support

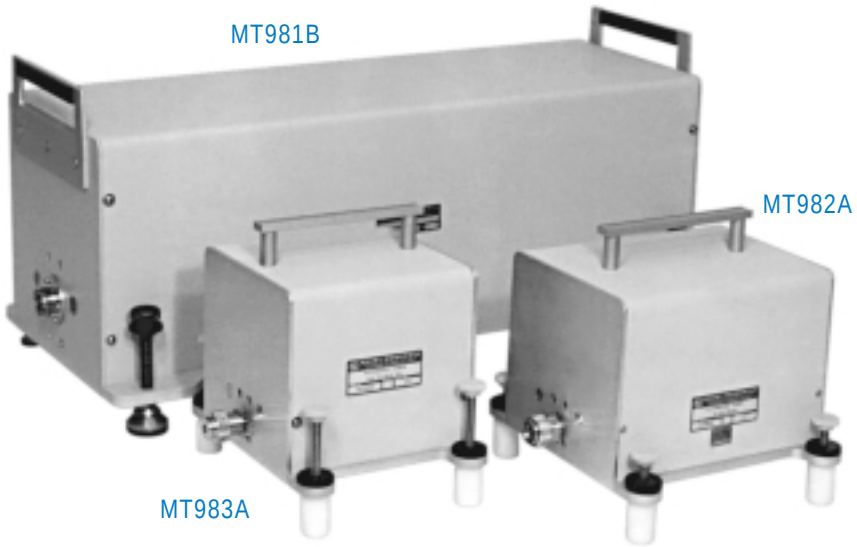
Maury offers six and twelve month support agreements which entitle the user to automatic upgrades and applications support. Please consult our Sales Department for more information.

[1] Digitally modulated source that can also be used for adjacent channel power measurements.

[2] If the Agilent 8970B noise figure meter is used for the noise application, any of the SIB supported sources can be used as the LO for the noise down conversion.

[3] Analyzer-detector used for adjacent channel power measurements.

AUTOMATED TUNERS



General

The MT97x and MT98x series automated tuners are precision electro-mechanical instruments capable of matching a wide range of impedances over broad frequency ranges (typically, greater than a decade). The tuners have proven valuable in computer driven applications requiring multiple, repeatable impedances covering wide areas of the impedance plane. The following table is a quick reference chart of Maury tuners showing frequency range and minimum matching range in terms of equivalent VSWR.

The tuners are a key element in the **ATS** described in the previous pages; however, they may also be used in any automated or manual application requiring the ability to match the impedance of a microwave circuit element or to establish specific impedances at a terminal interface.

The tuner design is based on the slide-screw concept using the inherently broadband slab-line transmission structure. Each unit has two probes to optimize performance over a broad frequency range. The design permits the probes to be fully retracted leaving a low loss, well matched transmission line. This feature is very valuable in power related applications which, for good performance, require two-port tuners capable of handling large amounts of power.

All Maury MT97x and MT98x series tuners are compatible with the MT986B01/02 GPIB compatible tuner controllers (see page 75).

[1] Minimum at band edges. Performance at mid-range is significantly better. Contact our Sales Department for details.

Millimeter Wave Tuners

Frequency Range (GHz)	Matching Range [1] (VSWR minimum)	Model	Page
75.0 — 110.0	20:1	MT979A	72
60.0 — 90.0	20:1	MT978A	72
50.0 — 75.0	20:1	MT977A	72
40.0 — 60.0	20:1	MT976A	72
33.0 — 50.0	20:1	MT975A	72

Coaxial Tuners

Frequency Range (GHz)	Matching Range [1] (VSWR minimum)	Model	Page
0.25 — 2.5	15:1	MT981A01	67
0.4 — 4.0	15:1	MT981B	67
0.4 — 2.5	30:1*	MT981B05	67
0.4 — 2.5	40:1*	MT981B06	67
0.8 — 8.0	130:1	MT981D	68
0.8 — 8.0	15:1	MT982E	69
0.8 — 8.0	30:1	MT982E30	69
0.8 — 18.0	10:1	MT982B01	69
1.8 — 18.0	10:1	MT982A01	69
1.8 — 18.0	15:1	MT982A02	69
4.0 — 26.5	10:1	MT983A01	70
8.0 — 50.0	10:1	MT984A01	71

* Request the applicable Maury data sheets for complete specifications on these models.

AUTOMATED TUNERS MT981 SERIES

General

The MT981 series automated tuners are precision electro-mechanical instruments capable of matching a wide range of impedances over broad frequency ranges (typically, greater than a decade). The tuners are designed for use in automated applications requiring the ability to match the impedance of a microwave circuit element or to repeatably establish a specific impedance. They have proven valuable in computer driven applications requiring multiple, repeatable impedances covering wide areas of the impedance plane. These tuners are a key element in the Maury **ATS** for device characterization.

MT981B

Specifications

Frequency Range ..... See chart

VSWR Matching Range ..... See chart [1]

VSWR (maximum) ..... 1.05 [2]

Insertion Loss (maximum) ..... 0.3 dB [3]

Step Size (probes) ..... 62.5 microinches

Step Size (carriage) ..... 786 microinches

Position Accuracy ..... ±1 step

Power Handling ..... 100 W CW, 2.5 kW peak [4]

Connectors ..... Precision 14mm (Maury MPC14) [2]

Size ..... See *Dimensions*

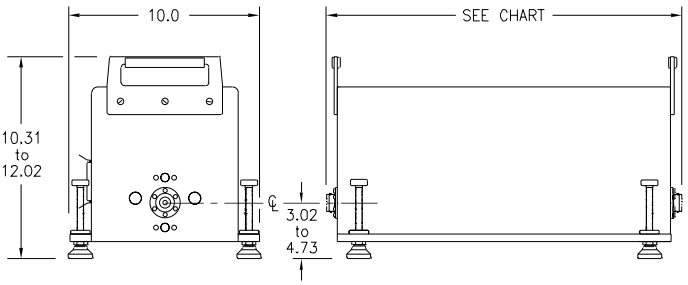
Accessories Provided

One each – MT982C, tuner control cable

Two each – 2607A 7mm to 14mm adapters

One each – operating manual

Dimensions



Frequency Range (GHz)	Model	Matching Range (VSWR minimum)	Overall Length inches (cm)
0.25 — 2.50	MT981A01	15:1	36.85 (93.60)
0.40 — 4.00	MT981B		23.03 (58.60)
0.40 — 2.50	MT981B05	30:1	
0.40 — 0.50	MT981B06		
0.50 — 2.20		40:1	
2.20 — 2.50		30:1	

[1] Minimum at band edges. Performance at mid-range is significantly better. Contact our Sales Department for details.

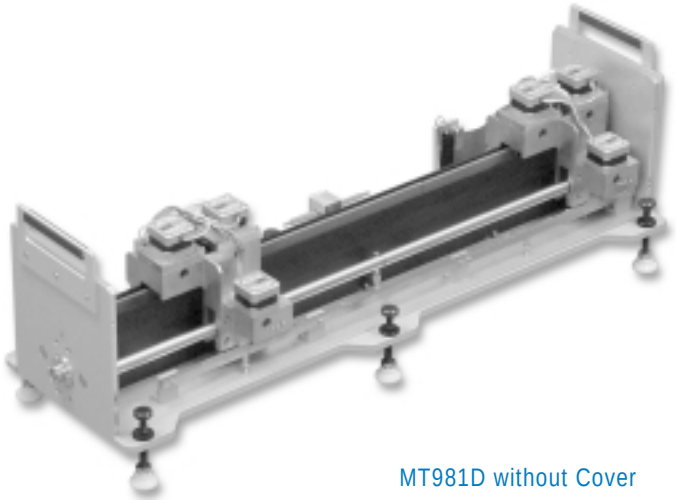
[2] Mating compatible and equivalent to the GR900.

[3] Probes retracted.

[4] At 10:1 matching range.

PRE-MATCHING AUTOMATED TUNER

MT981D with Cover



MT981D without Cover

Features

- 130:1 Matching Range
- Ideal for Cellular and PCS Applications
- High Power
- Excellent Repeatability

Description

The MT981D is a precision electro-mechanical automated tuner utilizing a dual carriage design optimized to provide a very high matching range over the cellular and PCS frequency bands. One carriage and probe provide the pre-matching (transforming the lowest impedance to a higher value) and the second carriage and probe bring it to 50 ohms. The tuner operates with the Maury Automated Tuner System (**ATS**) and is primarily used for device characterization and circuit design.

Accessories Provided

One each	—	MT982C tuner control cable
One each	—	Operating manual
Two each	—	2607A 7mm to 14mm adapters

Specifications

Frequency Range	0.8 to 6.5 GHz [1]
VSWR Matching Range	130:1
VSWR	1.05 maximum [2]
Loss	0.3 dB maximum [2]
Repeatability	50 dB minimum [3]
Step Size (probes)	62.5 microinches [4]
Step Size (carriages)	786 microinches [4]
Position Accuracy	± 1 step
Power Handling	100 W CW, 1 kW peak
Connectors	Precision 14mm (Maury MPC14)

[1] Useable to 8.0 GHz.

[2] Probes retracted.

[3] Between any two measurements at any position within the specified matching range.

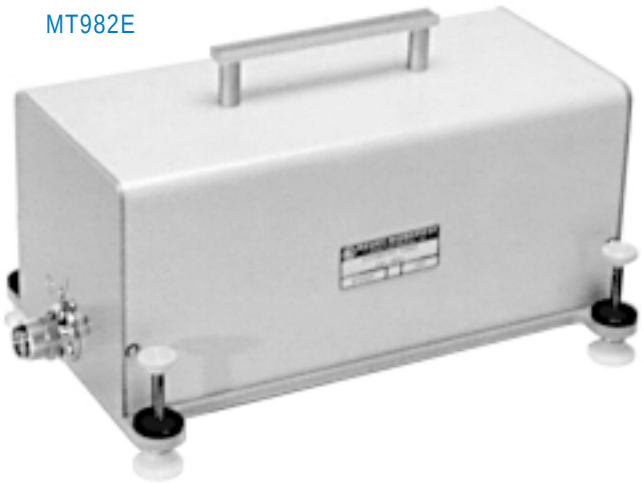
[4] Based on 1/2 stepping the drive motors.

AUTOMATED TUNERS MT982 SERIES

General

The MT982 series automated tuners are precision electro-mechanical instruments capable of matching a wide range of impedances over broad frequency ranges (typically, greater than a decade). The tuners are designed for use in automated applications requiring the ability to match the impedance of a microwave circuit element or to repeatably establish a specific impedance. They have proven valuable in computer driven applications requiring multiple, repeatable impedances covering wide areas of the impedance plane. These tuners are a key element in the Maury **ATS** for device characterization. The MT982A02 through A13 have been **optimized for even higher than typical matching ranges over limited frequency bands.**

MT982E



Specifications

Frequency Range ..... See chart

VSWR Matching Range ..... See chart [1]

VSWR (maximum) ..... 1.05 [2]

Insertion Loss (maximum) ..... 0.4 dB [2]

Step Size (probes) ..... 62.5 microinches

Step Size (carriage) ..... 355 microinches

Position Accuracy ..... ±1 step

Power Handling ..... 50 W CW, 0.5 kW peak [3]

Connectors ..... Precision 7mm

Size ..... See ***Dimensions***

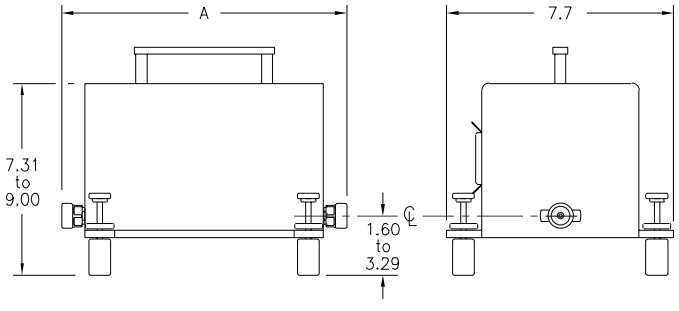
Frequency Range (GHz)	Model	Matching Range [1] (VSWR minimum)	Overall Length (A) inches (cm)
0.8 — 8.0	MT982E	15:1	14.0 (35.56)
0.8 — 18.0	MT982B01	10:1	
1.8 — 4.2	MT982A11	20:1	9.2 (23.37)
1.8 — 18.0	MT982A01	10:1	
	MT982A02	15:1	
3.7 — 4.2	MT982A12	20:1	
8.2 — 18.0	MT982A13	20:1	
0.8 — 2.0	MT982E30	30:1	14.0 (35.56)
2.0 — 8.0		15:1	

Accessories Provided

One each – MT982C tuner control cable

One each – operating manual

Dimensions



[1] Minimum at band edges. Performance at mid-range is significantly better. Contact our Sales Department for details.

[2] Probes retracted.

[3] At 10:1 matching range.

AUTOMATED TUNER MT983A01

MT983A01

General

The MT983A01 automated tuner is a precision electro-mechanical instrument capable of matching a wide range of impedances over a broad frequency range. The tuner is designed for use in automated applications requiring the ability to match the impedance of a microwave circuit element or to repeatably establish a specific impedance. It has proven valuable in computer driven applications requiring multiple, repeatable impedances covering wide areas of the impedance plane. This tuner is a key element in the Maury **ATS** for device characterization.

Specifications

Frequency Range ..... 4.0 to 26.5 GHz

Matching Range (VSWR minimum) ..... 10:1 [1]

VSWR:

Maximum ..... 1.10 [2]

Typical ..... 1.08 [2]

Insertion Loss (maximum) ..... 0.6 dB [2]

Step Size (probes) ..... 62.5 microinches

Step Size (carriage) ..... 355 microinches

Position Accuracy ..... ±1 step

Power Handling ..... 10 W CW, 0.5 kW peak [3]

Connectors ..... NMD3.5mm (male)

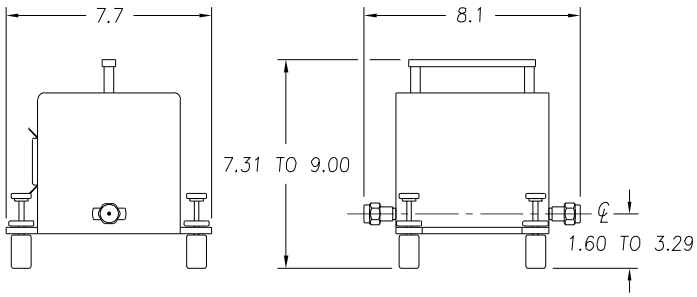
Size ..... See ***Dimensions***

Accessories Provided

One each – MT982C tuner control cable

One each – operating manual

Dimensions



[1] Minimum at band edges. Performance at mid-range is significantly better. Contact our Sales Department for details.

[2] Probes retracted.

[3] At 10:1 matching range.

2.4mm AUTOMATED TUNER MT984A01

General

The Maury MT984A01 automated tuner is a precision electro-mechanical instrument for the full band width of 8.0 GHz to 50.0 GHz. This precision slide screw tuner features wide matching range and the capability of fully retracting the pair of probes to achieve a matched condition with low VSWR. High precision stepper motors are linked to the two probes and the linear drive, via precision anti-backlash mechanical assemblies, to achieve high resolution and exceptional repeatability and resetability. Each end of the tuner is equipped with an opto-electronic limit switch to define the end stops for the linear travel. Additional photo sensors are provided to detect when the probes are either fully inserted or completely retracted. The repeatability with which the tuning elements can be repositioned is of the utmost importance in the measurement system. The automated tuner is supplied with precision 2.4mm connectors to ensure an accurate, repeatable interface.

The MT984A01 automated tuner is calibrated by measuring its scattering parameters at various probe positions and linear locations using a vector network analyzer. Characterization data is subsequently stored on the host computer for utilization at the user's convenience.

MT984A01

Model	Description
MT984A01	Automated tuner 2.4mm connectors 8.0 to 50.0 GHz

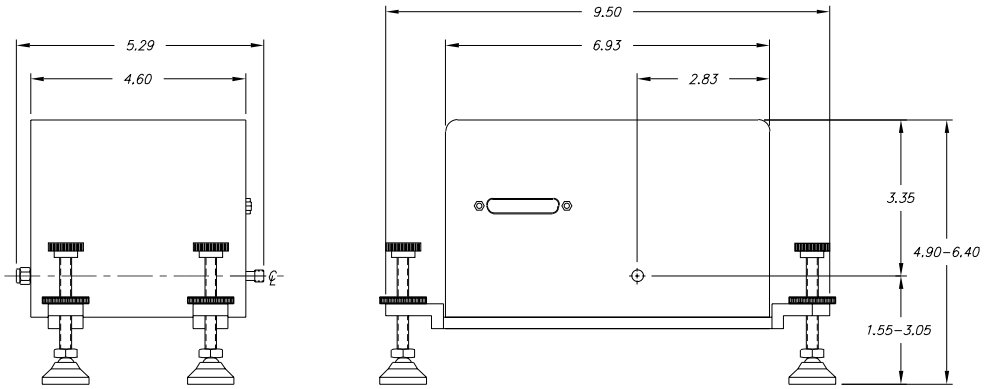
Specifications

Frequency Range ..... 8.0 to 50.0 GHz
VSWR Range ..... 10:1 minimum
Loss (probes retracted) ..... 0.6 dB maximum
Repeatability ..... 40 dB minimum [2]
Step Size (probes) ..... 31 microinches
Step Size (linear) ..... 50 microinches
Power Handling ..... 5 W average, 0.2 kW peak
Connectors ..... 2.4mm female
2.4mm male

Accessories Provided

One (1) model MT982C cable [1] and operating manual.

Dimensions



[1] Connects tuner to controller (model MT986B02), 1 meter long.

[2] Between any two measurements at any position within the specified matching range.

MILLIMETER WAVE AUTOMATED TUNERS

Features

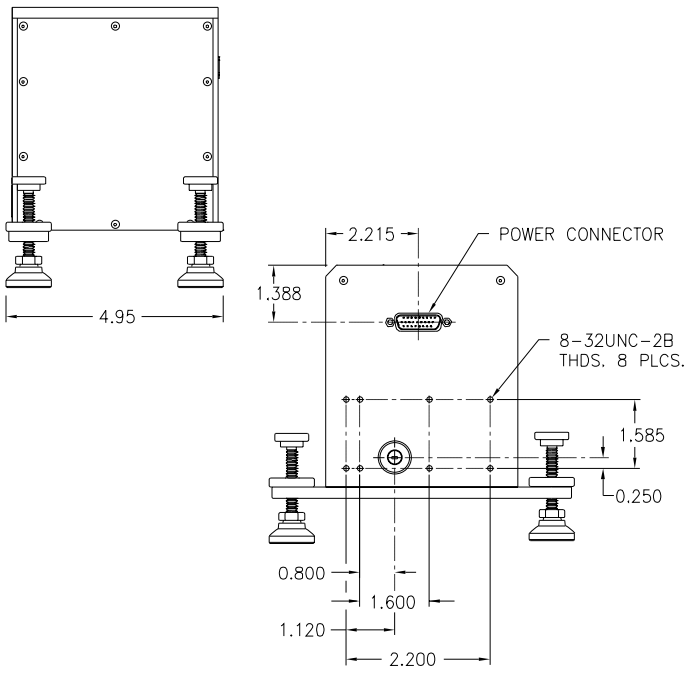
- 33 — 110 GHz
- High Matching Range
- Wafer Probing Applications

MT979A shown without feet

Description

The Maury MT97x series of millimeter wave automated tuners are precision electromechanical instruments capable of matching a wide range of impedances covering the millimeter waveguide frequencies from 33 to 110 GHz. These precision tuners feature an extremely wide matching range with superb repeatability. The tuners come with Maury precision flanges which ensure an accurate and repeatability interface. Automated tuners have proven to be invaluable tools in making precise and repeatable load- and source-pull power and noise measurements. These tuners are key elements in the Maury Automated Tuner System (**ATS**) used for device characterization. The tuners are designed with removable feet and mounting holes for adapting to wafer probe stations.

Dimensions



Preliminary Specifications [1]

Matching Range (VSWR minimum) ..... 20:1 [1]

VSWR (maximum) ..... 1.06 [2]

Insertion Loss (maximum) ..... 0.65 [2]

Repeatability (worst case) ..... >50 dB

Step Size (probes) ..... 0.5 micron

Step Size (carriage) ..... 0.5 micron

Power Handling ..... 20 W CW , 200 W peak

Model	Frequency Range (GHz)	EIA WR No.	Designation	Mates With
MT979A	75.0 — 110.0	10	MPF10	UG385/U
MT978A	60.0 — 90.0	12	MPF12	UG385/U
MT977A	50.0 — 75.0	15	MPF15	UG385/U
MT976A	40.0 — 60.0	19	MPF19	UG383/U
MT975A	33.0 — 50.0	22	MPF22	UG383/U

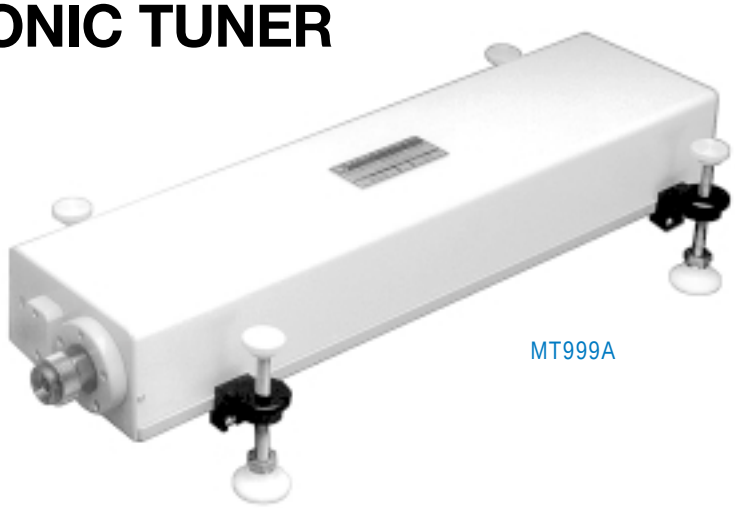
[1] Minimum at band edges. Performance at mid-range is significantly better. Contact our Sales Department for details.

[2] Equivalent VSWR.

[3] Probe retracted.

U. S. PATENT NO. 5,910,754

AUTOMATED HARMONIC TUNER



Features

- Low Cost
- 50:1 VSWR
- High Repeatability

Description

The MT999A automated harmonic tuner is a precision electromechanical instrument capable of presenting a very high mismatch over a broad frequency range. Designed to work with the MT980 series of **ATS** (Automated Tuner Systems), the MT999A tuner is designed for harmonic load pull or tuning measurements where a high mismatch is required. When used with the proper triplexer or diplexer, the MT999A harmonic tuner provides the capability for making the most accurate and reliable harmonic measurements possible. The accuracy is maintained by the high level of isolation between the fundamental tuners and the harmonic tuners provided by the multiplexers. The harmonic tuner works with the MT986B24/26 harmonic tuner controllers and provides a cost effective means for performing accurate and reliable harmonic measurements.

Specifications

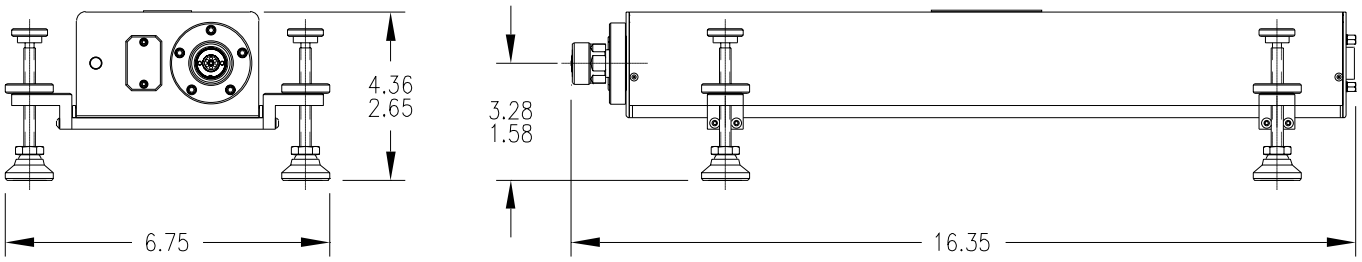
Frequency Range	0.8 - 7.5 GHz
Matching Range (VSWR minimum)	50:1 [1]
Carriage Step Size	625 microinches
Position Accuracy	±1 step
Power Handling	10W CW, 0.5 kW peak
Connectors	7mm
Size	See ***Dimensions***

Accessories Provided

One each — tuner control cable

One each — operating manual

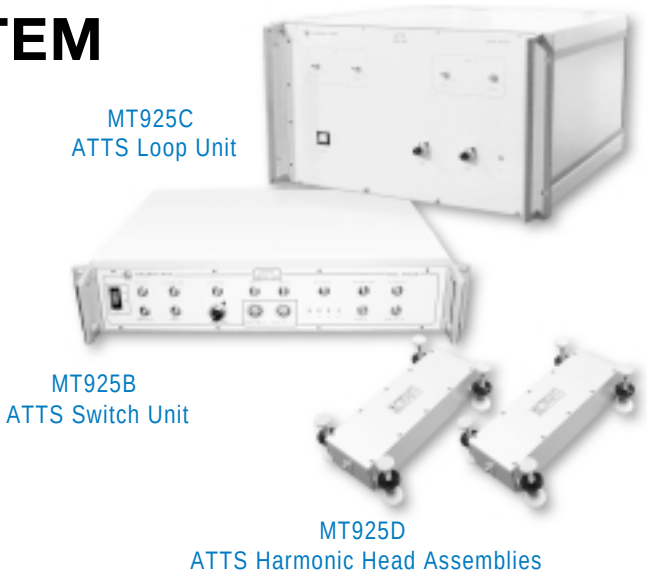
Dimensions



[1] Minimum at band edges. Performance at mid-range is significantly better. Contact our Sales Department for details.

ACTIVE LOAD PULL SYSTEM

A MAURY/PAF JOINT VENTURE



Features

- Optional 0.5 – 18.0 GHz
- Real Time Measurements
- Highest Gamma Attainable
- Absolute Loop Stability (Proprietary Design)
- Independent Control of Harmonics
- Gamma-In Measurement Capability
- High Speed and Suitable for Package or On-Wafer Device Characterization

Active Tuning Test Sets (ATTS)

Units within the MT925 series of Active Tuning Test Sets (ATTS) are available in one- or two-loop configurations. The active loop is common to all models and is the main feature of each unit. Then proprietary design of the loop keeps it absolutely stable up to a higher reflection coefficient irrespective of the Device-Under-Test (DUT) output gamma.

Software

The Maury/PAF **ATTS** is driven by PoliPull2000, a Windows® NT, 2000 compatible software developed by **Politecnico di Torino**, Italy, which allows for the calibration of load pull and S-parameter measurements with a unified and simple standard sequence.

Setup

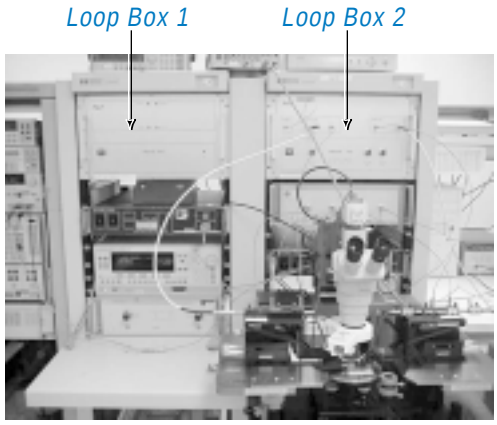
Each loop may be used on either the source or load, and may be operated at the fundamental of harmonic frequency.

Examples:

a.) 2-loop system for F_0 source pull and F_0 load pull

b.) 2-loop system for F_0 load pull and F_0 load pull

c.) 4-loop system for F_0 source pull, F_0 load pull, $2F_0$ load pull, and $3F_0$ load pull



Maury/PAF ATTS (4 Loop Version)

Available Models

Model	Frequency Range (GHz)	Description
MT925Axx	0.5 — 12.0	ATTS system
MT925B	0.5 — 12.0	Switch box
MT925D	0.5 — 12.0	Harmonic head
MT925C11	0.5 — 4.5 1st Loop 0.5 — 4.5 2nd Loop	Loop unit
MT925C12	0.5 — 4.5 1st Loop 1.8 — 12.0 2nd Loop	Loop unit
MT925C22	1.8 — 12.0 1st Loop 1.8 — 12.0 2nd Loop	Loop unit

Power Handling

Power handling is rated at 30 watts at the probe tips for standard units in this series, and higher power options are available. External amplifiers are required in all areas.

For More Information Contact

At Maury Microwave

Surinder Bali - E-mail: sbali@maurymw.com

At Progettazione ed Alta Frequenza (PAF)

Prof. Andrea Ferrero - E-mail: Pafmicro@uol.it

AUTOMATED TUNER CONTROLLER MT986B01/02

MT986B02

General

The MT986 automated tuner controllers are designed to provide computer and local control of the MT97x and MT98x series of automated tuners. The controllers are fully GPIB compatible and also provide for manual control by means of front panel motor selection switches and a rotary position control. The **MT986B01** will control a single tuner, while the **MT986B02** will control two tuners which can be the same or different models. The MT986B01 can be upgraded to drive two tuners by the addition of the **MT986M03** motor drive card set. This upgrade can be done in the field.

For harmonic load pull, a multi-tuner harmonic controller is available. Model MT986B24 can control two harmonic tuners and model MT986B26 can control up to four harmonic tuners.

Specifications

Stepping Rate ..... 250 to 8795 steps/second

Position Accuracy ..... ±1 step

AC Power..... 115/230 VAC ±10%, 48-62 Hz, 150 W

Accessories Provided

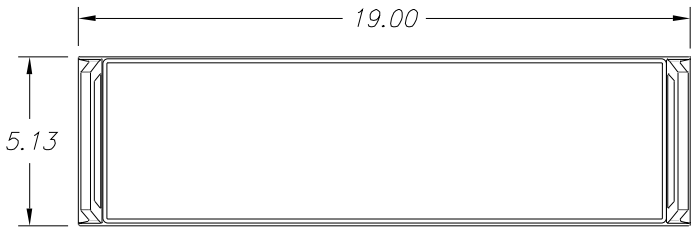
One each – MT960D GPIB cable, two meters long

One each – operating manual

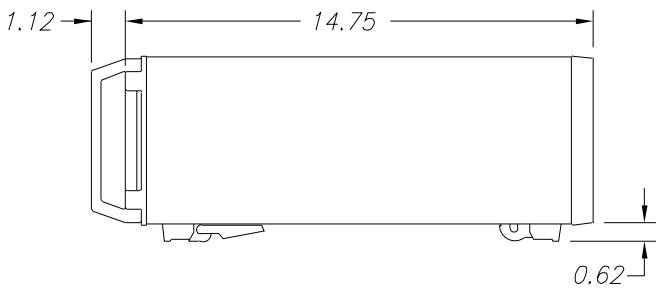
One each – AC power cord

These instruments have been tested and were found to be in conformance with the applicable provisions of 89/336/EEC/EMC.

Dimensions



FRONT VIEW



SIDE VIEW

SYSTEM CONTROL UNIT (MT998C)

Description

Maury Microwave's system control unit, when used in conjunction with Maury's **ATS** (Automated Tuner System) MT980 series and system control software MT993F, provides for automated switching between S-parameters, Noise, Power, Intermodulation Distortion (IMD), Adjacent Channel Power (ACP) measurements and DC/I-V curves. As illustrated in the block diagram shown in **Figure 1**, each system control unit contains RF switches and control circuitry. **Figure 2** shows the configuration setup for the system control option as displayed by the **ATS** software setup screen. All switching is contained in a single unit with full GPIB control. This means that one easy RF setup can be made to automatically switch to any measurement function and permits a complete calibration and device testing to be done with only one connection. Complete specifications are shown below.

Specifications

Frequency Range ..... 0.020 to 18.0 GHz

Control ..... GPIB

Connectors:

- Input Tuner ..... 3.5mm female
- Output Tuner ..... 3.5mm female
- VNA Port 1 ..... 3.5mm female
- VNA Port 2 ..... 3.5mm female
- Input Power ..... 3.5mm female
- Output to Noise Figure Meter ..... 3.5mm female
- Noise Source 7mm
- Power Sensor 7mm

VSWR RF Input ..... 1.5:1(Maximum)

A.C. Power ..... 100 to 120, 220 to 240 VAC ± 10%, 75 VA, 47 to 63 Hz

Size ..... 19W x 3.5H x 14.75D

Available Models

Model	Description	Frequency Range (GHz)
MT998C	S-parameters, Noise and Power	0.020 — 18.0

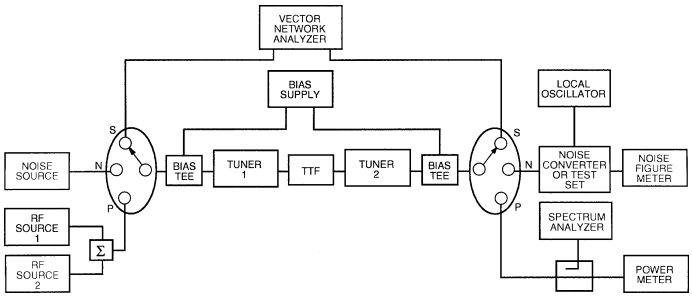


Figure 1. Block Diagram for Measuring S-Parameters, Noise Parameters, Power, and Intermod in One Setup

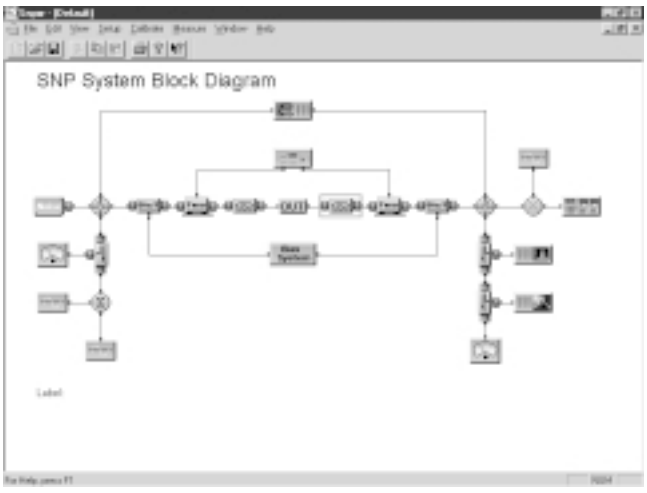


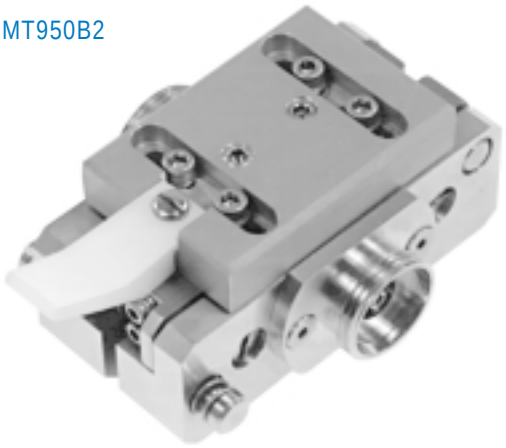
Figure 2. Automated Tuner System (ATS) With System Control Configuration

TRANSISTOR TEST FIXTURE MT950 SERIES

General

The MT950 transistor test fixture (TTF) is a comprehensive measurement system for convenient and accurate characterization of packaged microwave transistors for DC to 18 GHz. The system consists of the basic test fixture, MT950B2 or MT950G (short lead version), transistor package inserts (MT951 series) and check devices (MT953 series). A number of useful accessories are also offered with the TTF. These include an adjustable height stand (MT950R) to support the fixture when it is connected to a vector network analyzer such as the Agilent 8510, tools for assembling the inserts to the fixture body, tweezers for handling the devices, and spare parts.

MT950B2



De-embedding

The basic TTF and inserts manuals include circuit models which can be used to develope de-embedding parameters that allow measurements to be referenced to the device input and output planes. For S-parameter measurements, we recommend Maury's Windows® 95/98/NT compatible MT956D software (page 80). Because this application includes the TTF and insert circuit models, it can be used to de-embed S-parameter measurements made on devices in the fixture, and to develope the de-embedding parameters of other fixtures. Maury's automated tuner system software also includes these TTF de-embedding models, so all noise, power, adjacent channel power, and intermodulation distortion measurements can be de-embedded.

Specifications

Frequency Range ..... DC to 18 GHz

Nominal Impedance ..... 50 ohm

Connectors..... 7mmS (mating compatible with 7mm)

Inserts and Check Devices

The table shown below lists the available inserts, applicable transistor packages and the check devices.

Generic Package	Typical Device Package	Insert	Check Device
70 mil	NEC 83	MT951A2	MT953A
80 mil	NEC 89	MT951B2	MT953B
Micro-X	Avantek 35	MT951C2	MT953C
100 mil	HPAC-100	MT951D2	MT953D
50 mil	Avantek 50	MT951E	MT953E
80 mil	NEC S01	MT951G1*	MT953G*
70 mil	NEC 84D	MT951G2*	MT953G*
85 mil	HP 85	MT951G3*	MT953G*
100 mil flange	Fujitsu WF	MT951J	MT953J

*All of the inserts and check devices shown here are compatible with the MT950G. The MT951G series and MT953G series are designed for short lead applications and are incompatible with the MT950B2.

SHORT LEAD TRANSISTOR TEST FIXTURE MT950

General

The MT950G transistor test fixture, when used with the appropriate inserts, is designed to work with short lead transistor designs. In addition to the short lead inserts, it can also work with all the existing Maury transistor inserts. The manuals for the short lead TTF and inserts include circuit models which can be used to develop de-embedding parameters. For S-parameter measurements, we recommend using the MT956D software (pages 80-81). The MT956D software package (Maury data sheet 5C-038) includes TTF and insert circuit models for de-embedded S-parameter measurements. The TTF and insert circuit models are also included in the Maury automated tuner system software (Maury data sheet 4T-050F).

MT950G

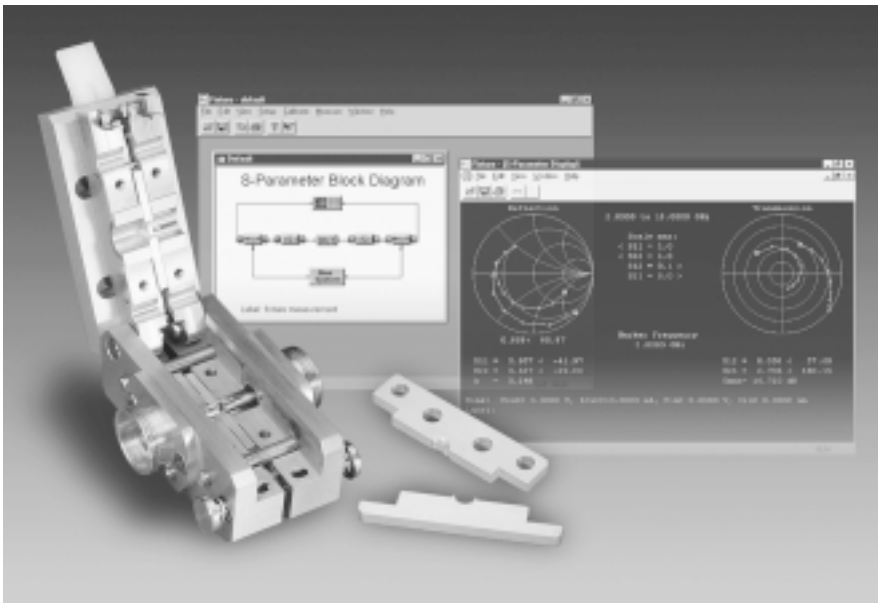
The Maury MT950G Transistor Test Fixture With Stand

Inserts and Check Devices

The table on page 77 lists the available inserts, applicable transistor packages and the check devices.

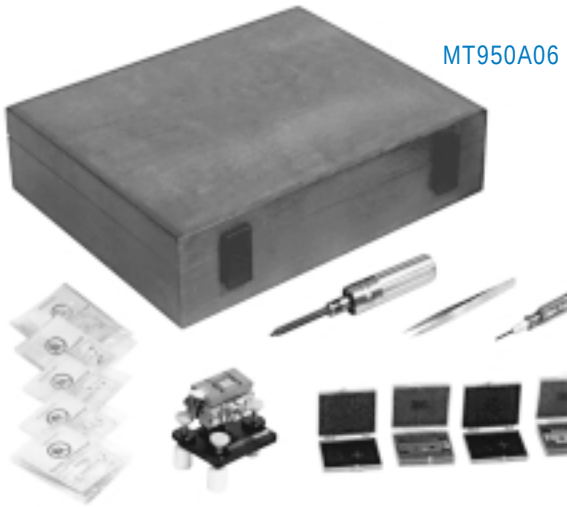
TTF Kit

The table on page 79 lists the contents of the MT950H04. Please refer to Maury data sheets 4T-002A and 4T-002B for a description of the inserts we have available.



Maury's MT950 Series Transistor Test Fixtures Work with MT956D Fixture Characterization and S-Parameter Software.

TRANSISTOR TEST FIXTURE
MT950 SERIES


MT950A06

TTF Kits

Maury offers kits containing various elements of the TTF product line. The following are typical samples of the available kits.

MT950A04 Basic Kit (inserts not included)

Item	Quantity	Description	Model
1	1	Transistor test fixture	MT950B2
2	1	Stand for the Agilent 8510	MT950R
3	1	Torque socket tool	MT950T1
4	1	Tweezers	MT950T2
5	1	Lid assembly tool	MT950T3
6	1	Instrument case	—
7	1	Operating instructions	—


MT953

MT951

MT950A06 Expanded Kit

Includes all items listed under the MT950A04 plus the following:

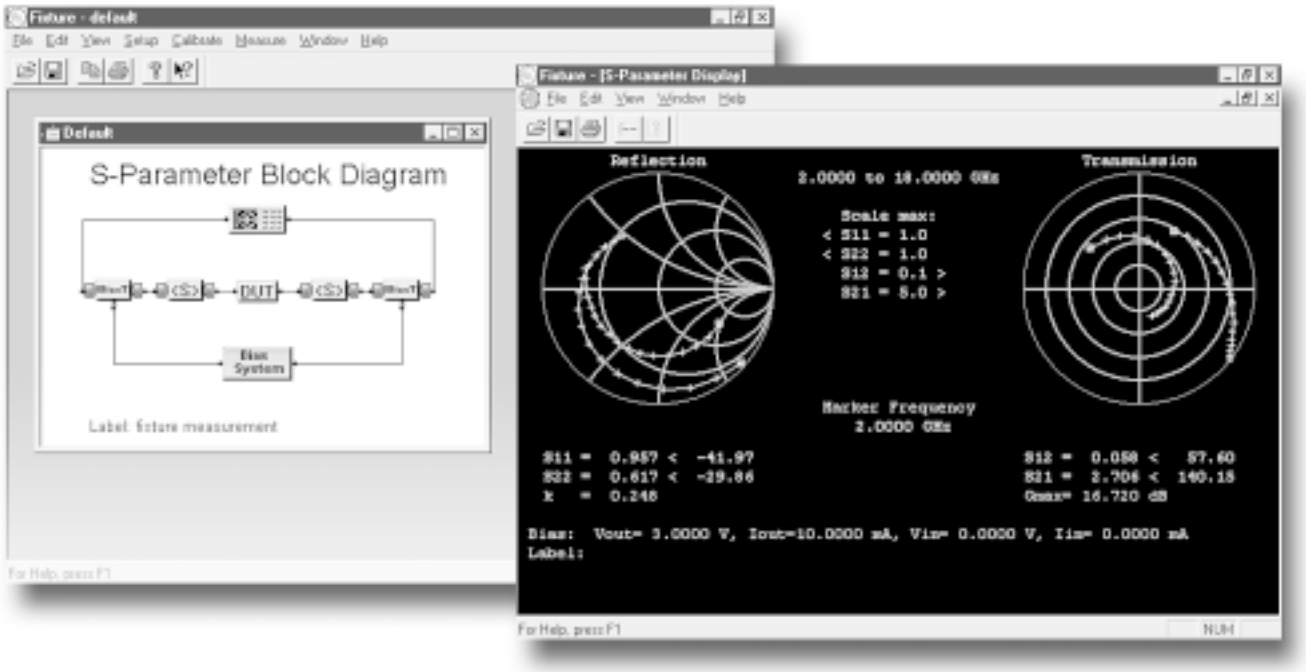
Item	Quantity	Description	Model
8	2	Upper dielectric rod kit	MT950E1
9	2	Lower dielectric rod kit	MT950E6
10	1	Latch kit	MT950E3
11	1	70 mil transistor insert (top and bottom)	MT951A2
12	1	70 mil check devices	MT953A
13	1	100 mil transistor insert (top and bottom)	MT951D2
14	1	100 mil check devices	MT953D
15	1	TTF bolt kit	MT950E5
16	1	TTF gasket kit	MT950E4
17	2	Spare collets (6 slot) for the 7mm connectors	2680S2
18	1	TTF handle	MT950E7

MT950H04 TTF Kit (inserts not included)

Item	Quantity	Description	Model
1	1	Transistor test fixture	MT950G
2	1	Stand for the Agilent 8510	MT950R
3	1	Torque socket tool	MT950T1
4	1	Tweezers	MT950T2
5	1	Lid assembly tool	MT950T3
6	1	Instrument case	—
7	1	Operating instructions	—
8	2	Upper dielectric rod kit	MT950E1
9	2	Lower dielectric rod kit	MT950E6
10	1	TTF bolt kit	MT950E5
11	1	TTF gasket kit	MT950E4
12	2	Spare collets (6 slot) for the 7mm connectors	2680S2

FIXTURE CHARACTERIZATION AND S-PARAMETER MEASUREMENT SOFTWARE, MT956D

A SOFTWARE DE-EMBEDDING TOOL



S-Parameter Measurements as Displayed by the Maury MT956D Fixture Characterization Software.

Introduction

Improved and expanded S-parameter measurements using most popular vector network analyzers is now possible with the simple addition of Maury Microwave's Windows® 95/98/NT compatible S-parameter software model MT956D.

Test fixture characterization is easy and simple, and calibrations can be de-embedded to the device reference plane. This is particularly useful when using an automated tuner system or any other device characterization method.

Adapter removal measurement techniques can be applied to most network analyzers. Swept bias S-parameter measurements can be made using automated bias supplies. Fixture and adapter S-parameter data files can be stored on disk for future use.

While some of these features are found in some network analyzer models, they can now be applied to most popular network analyzers currently being used. In addition, in most cases, these features are simpler and easier to use than the built-in capabilities of the newer network analyzers.

Description

Maury's MT956D software works as a network analyzer control program that can automatically measure general purpose network parameters. It may also be used to characterize network parameters of the input and output halves of test fixtures or probe stations for use in de-embedding device measurements.

FIXTURE CHARACTERIZATION AND S-PARAMETER MEASUREMENT SOFTWARE, MT956D

Fixture Characterization and De-embedding

The **MT956D** software can, depending upon the features of the fixture, measure or calculate the network characteristics of the input and output halves of a test fixture or probe station. Fixture characterization can be done using a full 2-port calibration or two 1-port calibrations. The S-parameters of a "non-insertable" device can be conveniently and rigorously determined using any of the commonly used Agilent or Anritsu vector network analyzers. 1-port or 2-port S-parameter blocks can also be cascaded, allowing the embedding or de-embedding of the S-parameter blocks.

Test fixtures with impedance transformer sections can be characterized and the S-parameters can be re-normalized to 50 ohms. This is an important and useful feature for TRL calibrations where low impedance transmission lines and impedance transformers are used. Once these parameters are known, measurements at the coaxial planes of the fixture of a device using an automated tuner system (see page 49) or other measurement techniques can then be referenced to the device input and output planes (de-embedded). If the fixture in use is the Maury TTF (see page 77), then you need only to specify the TTF insert in use as the de-embedding option. The circuit models of the TTF and all standard inserts are included in the MT956D software as well as the **ATS** software.

S-Parameter Measurement and Display

The software can be used to measure 1- or 2-port S-parameters using GPIB control of the vector network analyzer (VNA). S-parameter measurements can also be made over a range of bias settings. The measured data can be read back over the GPIB. All four measured S-parameters can be displayed directly in a wide variety of polar and rectangular formats, or compared to memory using one of four mathematical functions (data minus memory, etc.). Data files can be saved and recalled from memory using a Touchstone™ compatible format (Touchstone is a trademark of Agilent/EEsof, Westlake Village, California).

Bias Control

With appropriate bias instruments on the bus, the DC bias can be turned on and off and read back automatically. The bias setup is very flexible: it provides for three DUT types, four bias modes, voltage and current limits, and setting of default bias values. Alternatively, if the bias instrument is not GPIB compatible, it may be controlled manually.

GPIB Instrument Control

The VNA and bias instruments are controlled using small driver modules separate from the main program. The source code for these drivers is provided so a user can easily modify and re-compile a driver for an instrument not currently supported by the software. These modules are written in Microsoft C®, and an appropriate compiler is required. The VNA, bias instruments supported by the MT956D software and the computer requirements, are the same as those listed for the **ATS** software shown on page 51.

Automated Tuner System Compatibility

The format of the fixture files developed by the MT956D software is fully compatible with the **ATS** software and may be copied into the **ATS** fixture files.

FREQUENCY EXTENDERS/ATS

1.8 TO 26.5 GHz

Features

- Low Noise Amplification
- Broad Frequency Range
- Improves Noise Characterization Accuracy

MT868C

Description

The Maury MT868C/F is a packaged, broad band, microwave amplifier followed by a double sideband mixer which provides low noise amplification of signals in the 1.8 to 18.0 GHz frequency range and down-conversion of these signals to a fixed intermediate frequency. This instrument is designed to provide a low noise second stage (with frequency conversion) for the Maury automated tuner system (**ATS**) [1] when used in a Noise Characterization application.

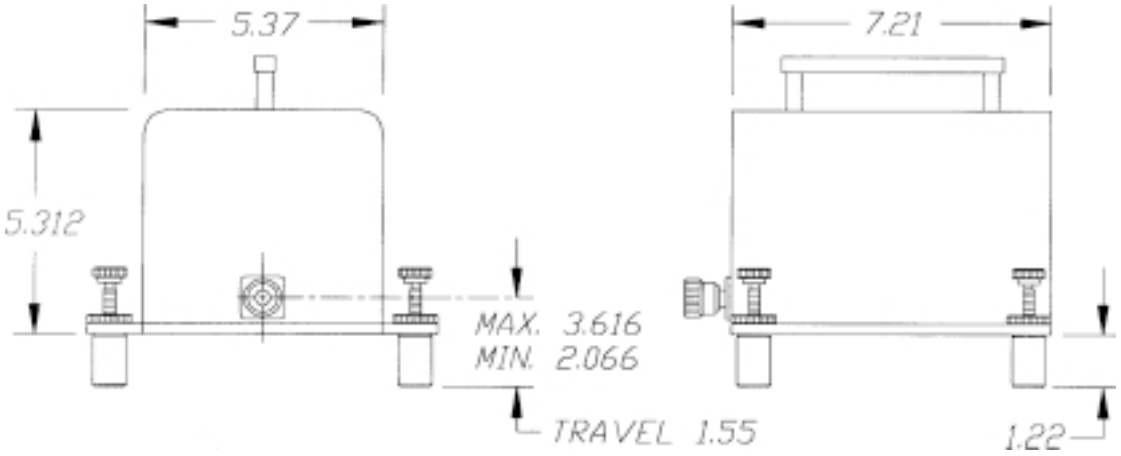
The MT868C is packaged in an enclosure which is mechanically compatible with the Maury **ATS** to simplify connection into the system while maintaining the primary characteristic, i.e.: low noise performance. The electrical performance is the same as the MT7551B/52B (see page 85).

Specifications

Model	MT868C
Frequency Range	1.8 to 18.0 GHz
LO Input Connector	SMA (female)
RF Input Connector	7mm
IF Output Connector	SMA (female)

Model	MT868F
Frequency Range	1.8 to 26.5 GHz
LO Input Connector	SMA (female)
RF Input Connector	NMD3.5 (male)
RF/IF Output Connector	SMA (female)

Dimensions



[1] See Maury data sheets 4T-050F, 4T-054 and 4T-057 for system and software details.

NOISE FIGURE MEASUREMENT

Introduction

Noise is a natural phenomenon that affects most microwave and RF systems. Because noise masks desired signals, it is important to understand and minimize its effects on the performance of microwave and RF devices. The noise figure of a given device usually varies as the source reflection varies. To minimize the effects of device noise figure, the relationship between noise figure and source impedance (or source reflection coefficient) must be known. Maury Microwave's MT993A noise characterization software (see pages 56-57) is designed to find the complete set of noise parameters.

Maury also produces a line of precision measurement equipment designed to facilitate accurate noise figure measurement. This line includes system noise monitors, thermal and cryogenic noise standards and calibration systems, frequency extenders, and noise generators.

Noise Characterization

Noise characterization also requires the parameters of the Device-Under-Test (DUT) to be separated from the parameters of the measuring system to which the DUT is connected. To do this, the system must be calibrated to learn the system parameters. The noise contribution of the system (often called the second stage since it follows the DUT) will vary with its source impedance.

Therefore, the complete noise and gain parameters of the system must be known to determine the system noise contribution when a particular DUT is connected.

Maury produces highly accurate self-contained noise calibration systems for use wherever noise source accuracy is critical (see pages 100-101).

System Noise Monitors MT7300 Series

- Economical noise figure meters
- Simplified operation – minimal front panel controls
- Can be customized for specific applications
- GPIB compatibility available
- Compatible with the MT755xx frequency extenders

Thermal/Cryogenic Noise Standards and Systems

- Accurate, low VSWR noise sources for high accuracy noise figure measurements and as noise standards
- Available as individual terminations, or
- As single output systems with two or three noise temperatures

Frequency Extenders MT755XX Series

- Extends noise figure meter frequency range
- *No* accuracy degradation
- Units available up to 26.5 GHz
- Compatible with all commercial noise figure meters

Noise Generators MT7600 Series

- Broadband - 10 MHz to 1.5, 3, 18, and 26.5 GHz
- Connect options available
- 15 dB and 6 dB (high isolation) ENR available

FREQUENCY EXTENDERS

- Extends Noise Figure Meter Measurement Range to 26.5 GHz
- Maintains Noise Figure Instrumentation Uncertainty
- Cost Effective
- Compatible with Most Commercial Noise Figure Meters

MT7551B

Description

Maury frequency extenders are used to expand the measurement capability of noise figure meters to the microwave region. These instruments are low cost alternatives to expensive, error-prone noise figure test sets employing tracking preselectors. When used in conjunction with a noise figure meter and suitable signal source (local oscillator), the frequency extenders provide for noise figure measurements at microwave frequencies **with no degradation of the instrumentation uncertainty of the noise figure meter** due to tracking errors between a swept preselector and the signal source.

The frequency extenders are low noise downconverters with a dynamic range tailored for compatibility with most laboratory noise figure instruments (noise gain analyzers, system noise monitors, etc.). They are used to translate microwave noise signals to 30 MHz (actual IF range may be wider depending upon model). This permits accurate measurement and display of the noise figure of amplifiers, receivers, etc. at frequencies up to 26.5 GHz.

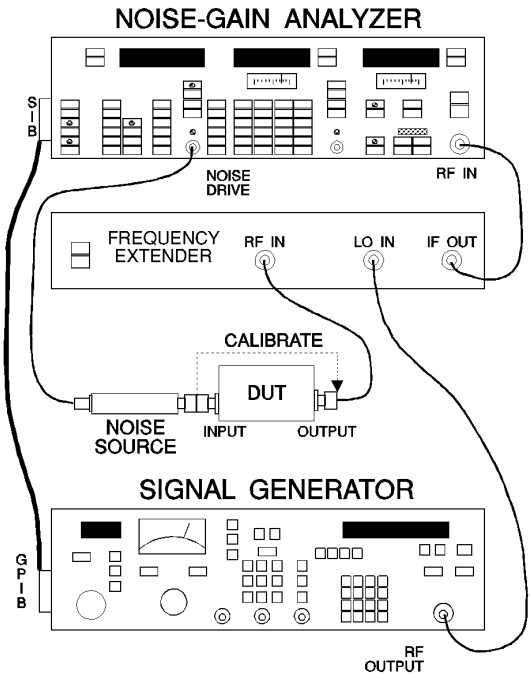
An important feature of the MT755xx series frequency extenders is that they are GPIB passive; that is, they do not require external frequency control signals. **This means that these economical units can be used with any noise figure meter capable of operating at 30 MHz** – even analog units such as the MT7300 system noise monitor.

Cost-Performance Selection

Maury offers a selection of frequency extenders in three frequency ranges. Two are double sideband converters, while the MT7550A is a single sideband converter. The purpose is to offer units which can be cost effective for specific applications, yet provide performance consistent with the measurement requirements.

Application

The Maury frequency extenders are intended as the input stage of a microwave measurement system. The block diagram below shows a typical setup. For measurements within the direct range of the noise gain analyzer, the extender is bypassed.

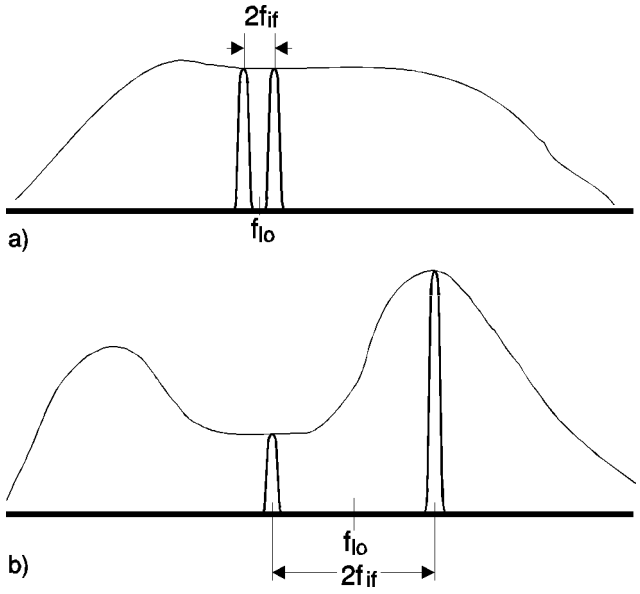


FREQUENCY EXTENDERS

Conversion Mode

Frequency conversion of broadband noise signals can be either single sideband, if one of the two RF responses is eliminated, or double sideband, if both are allowed to be mixed down to the IF. When the IF is small relative to the RF and the DUT passband is relatively flat, the two sidebands are close together and, effectively, are a virtual, single spectral line – see a) in the adjacent diagram. At lower frequencies where the IF may be a sizable percentage of the RF and the DUT passband may vary rapidly with frequency, single sideband may be the more accurate choice – see b) in the adjacent diagram.

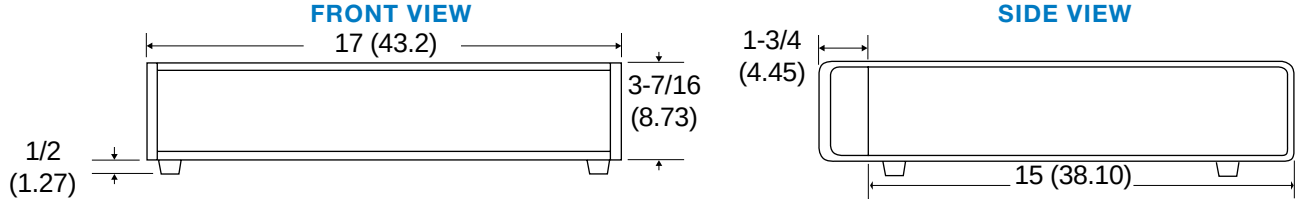
Maury offers a selection of frequency extenders which take advantage of these conditions: cost effective, double sideband units for use over wide frequency ranges and at the higher microwave frequencies, and a single sideband extender for the lower microwave region.



Specifications

Model		MT7550A	MT7551B	MT7552B
Frequency Range		1.6 to 4.2 GHz	1.8 to 18.0 GHz	1.8 to 26.5 GHz
Noise Figure	typical	4.5 dB	4.0 dB	6.0 dB
	maximum	6.0 dB	5.0 dB	7.0 dB
Conversion Gain	nominal	6.0 dB	9.0 dB	8.0 dB
VSWR (RF Input)	maximum	2.0	2.5	3.0
Gain Flatness	typical	±2.0 dB	±2.5 dB	±3.0 dB
RF Input Power	1 dB compression	-20.0 dBm	-25.0 dBm	-25.0 dBm
	maximum	-15.0 dBm	-10.0 dBm	-10.0 dBm
Local Oscillator Input Power		0 dBm		+10.0 dBm
Output Frequency	specified	30 MHz		
	usable	30 MHz	10 to 500 MHz	10 to 500 MHz
Conversion Mode		Single Sideband	Double Sideband	
Connectors	RF Input	Type N female		3.5mm male NMD
	LO Input			3.5mm female
	IF Output			Type N female
Size		See ***Dimensions***		
Weight	net	15 lb (6.8 kg)		
	shipped	18 lb (8.2 kg)		
A.C. Power		100, 120, 220, 230, 240 VAC ± 10%, 75 VA, 47-440 Hz		

Dimensions – Inches (cm)



SYSTEM NOISE MONITORS

- Cost Effective Noise Figure Measurements
- Operational Simplicity
- Adaptable to Specific Applications

MT7370

Description

The Maury MT7300 series of System Noise Monitors (SNM) are single frequency noise meters designed to meet the needs of field and production applications that demand simplicity of operation and economy in the instrumentation.

The SNM offer simplified, uncluttered front panels with only those controls required for the basic measurement and calibration functions; an indicator that tells the operator when there is sufficient signal level for a valid measurement, and a thumbwheel switch that sets the calibration of the unit for the noise generator in use (ENR). All connections are via the rear panel. These units are available with either analog or digital noise figure indicators and in either bench or rack mountable configuration. The available units are shown in the chart below:

MT7310

Operating Frequency

The MT7300 series are fixed frequency units designed to operate at one of seven common intermediate frequencies designated by a model number suffix as shown below (special frequencies are available at an additional cost).

Model [1]	Readout Type	Mechanical Configuration
MT7310	Analog	Bench mount
MT7320	Analog	Rack mount
MT7360	Digital	Bench mount
MT7370 [2]	Digital	Rack mount

Model Suffix	Frequency	Model Suffix	Frequency
A	10.7 MHz	E	45.0 MHz
B	21.4 MHz	F	60.0 MHz
C	30.0 MHz	G	70.0 MHz
D	36.0 MHz		

[1] Add frequency designation letter to complete the model number.

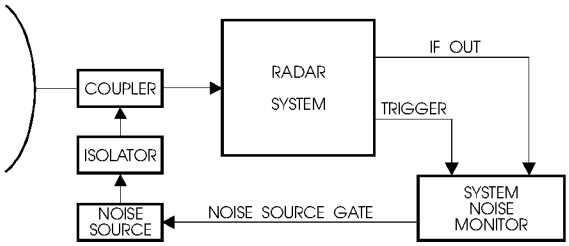
[2] Includes GPIB (IEEE-488) interface.

SYSTEM NOISE MONITORS

Radar Noise Monitors (MT7321 and MT7371)

The MT7321 and MT7371 are the same as the MT7320 (analog) and MT7370 (digital) SNM, respectively, except that they can also be used to monitor the noise figure of an operating radar. These units sample the IF noise output during the radar dead time. A noise generator connected to the system input (see diagram below) is energized on alternate radar pulse repetition periods to develop the measurement signal (Y-factor).

The radar SNM must operate synchronously with the radar so that it does not interfere with its operation. This requires a trigger derived from the system under test. If the trigger is available just preceding or during the dead time, the SNM can be used in the "non-delay" mode. The noise sample is taken immediately upon application of the trigger. In the "delay" mode, the trigger is usually derived from the main RF trigger or pre-trigger, and the sampling is delayed until the dead time occurs.



Typical Radar Noise Monitor Installation

In a typical installation (see the diagram above), high level noise (35 dB ENR, typical) is injected into the main antenna feed of the radar via a directional coupler, and the isolator is used to protect the noise source from the coupled transmitter power.

Extended Range Units

The noise figure measurement range of the MT7370 is 0 to 19.9 dB. The MT7372 is operationally identical except that a front panel switch shifts the range to 10 to 29.9 dB at reduced accuracy. The switch closure is also brought out to a rear panel connector.

Optional Features

Additional functions and enhanced performance can be provided by the options listed below.

03 **Noise Figure Alarm**: relay closure when the noise figure exceeds a variable, internally preset value.

04 **Frequency Converter**: fixed frequency, double sideband converter with LO frequency factory preset to a user-specified value between 180 and 225 MHz.

07 **High Sensitivity**: internally mounted preamplifier provides a nominal 20 dB sensitivity improvement.

12 **10 volt Recorder Output**: analog output provides 10 volts for full scale (MT7310/20) or 0 dB (MT7360/70) indication.

13 **Front Panel Connections**: IF input and noise source output connectors are on the front panel.

15 **Slide Mounting**: a kit which includes chassis slides and hardware for use with the MT7320/70.

SYSTEM NOISE MONITORS

Specifications

- Input Specifications

Input Frequency: 10.7, 21.4, 30, 36, 45, 60, or 70 MHz

Bandwidth: 10% of the center frequency (nominal)

Sensitivity: -70 dBm (minimum)

Input Signal Level Range: 40 dB (minimum)

Input Impedance: 50 ohm (nominal)

- Noise Measurement

Noise Figure Display Range:

MT7310/20/21: 0 and 6 dB full scale with extension to infinity in two ranges

MT7360/70/71: 0 to 19.9 dB

MT7372: 0 to 19.9 dB and 10 to 29.9 dB in two ranges

Noise Figure Instrumentation Uncertainty:

MT7310/20/21: ±0.25 dB, full to half-scale; ±0.5 dB, half to quarter-scale

MT7360/70/71/72: ±0.25 dB, 0 to 6 dB; ±0.5 dB, 6 to 12 dB; ±1.0 dB, 12 to 23 dB; ±2.0 dB, 23 to 29.9 dB

ENR Calibration Range: 6 to 15.9 dB in 0.1 dB steps

- Miscellaneous

Noise Generator Gate Output: +28 volts, "noise on"; <0.25 volts, "noise off"

Recorder Output (rear panel):

MT7310/20/21: 1.0 volt (nominal) across 1 kΩ at full-scale deflection

MT7360/70/71/72: 7.5 volts (nominal) across 1 kΩ at 0 dB indication

Connectors (rear panel):

IF Input: BNC female

Noise Source: BNC female

Auxiliary Outputs: Cinch 57-4024

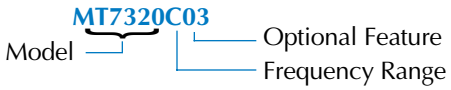
- Supplemental Characteristics

Operating Temperature: +5 to +50° C

Input Power: 115/230 VAC ±15%, 50 to 400 Hz, 10 watts

Ordering Information

When ordering a system noise monitor, please specify the basic model number (MT7310, MT7320, etc.), the letter suffix designating the operating frequency (i.e.: A-10.7 MHz, B-21.4 MHz, etc.) as detailed on the previous page, and any options, if applicable (options are also listed on page 87). For example: MT7320C03 designates an analog system noise monitor operating at 30 MHz with the noise figure alarm option. Your complete model number will look like this:



If you are ordering a radar system noise monitor, you will also need to specify the radar PRF or PRT, the measurement gate width (typically, the dead time interval), the trigger mode-delay or non-delay, and the trigger level and polarity – the standard units accept CMOS (+12 volts) positive trigger; however, TTL (+5 volts) positive triggers can also be accommodated.

Dimensions

Model	Height inches (cm)	Width inches (cm)	Depth inches (cm)	Weight lbs (kg)	Shipping Weight lbs (kg)
MT7310	5.25 (13.3)	7.4375 (18.9)	13.25 (33.7)	10 (4.5)	14 (6.3)
MT7320	5.25 (13.3)	17.125 (43.5)	13.25 (33.7)	15 (6.8)	19 (8.5)
MT7321	5.25 (13.3)	17.125 (43.5)	13.25 (33.7)	15 (6.8)	19 (8.5)
MT7360	5.25 (13.3)	7.4375 (18.9)	13.25 (33.7)	10 (4.5)	14 (6.3)
MT7370	5.25 (13.3)	17.125 (43.5)	13.25 (33.7)	15 (6.8)	19 (8.5)

PRECISION HIGH LEVEL NOISE GENERATORS

10 MHz to 18 GHz

- Up to 35 dB ENR
- 15% Bandwidth
- Traceable Calibration

Description

The MT7650B and MT7660A series are high level, solid state noise generators designed for receiver noise figure or noise temperature monitoring applications which require significant decoupling at the point of noise injection. Use of high value couplers reduces noise degradation of the receivers when the monitoring function is not active.

These generators operate over a 15% bandwidth in the frequency range from 10 MHz to 18 GHz with up to 35 dB Excess Noise Ratio (ENR). The high ENR permits noise injection into a receiver system through a coupler while maintaining an injected noise level compatible with typical noise measuring instruments.

Specifications

Frequency Range ..... 0.01 to 18 GHz

Bandwidth ..... 15% of center frequency

Maximum ENR ..... See chart

VSWR (typical, noise on) 6:1

Calibration Frequencies ..... Center frequency plus band edges

Output Connector ..... See chart

Input Connector ..... BNC female

Power Required ..... +28 volts @ < 20 mA

Model	Output Connector	Overall Length (inches) [1]	Former Eaton Model Number
MT7650B [2]	Type N male	4.50	7650-xxx
MT7660A [2]	SMA female	4.25	7660-xxx

Ordering Information

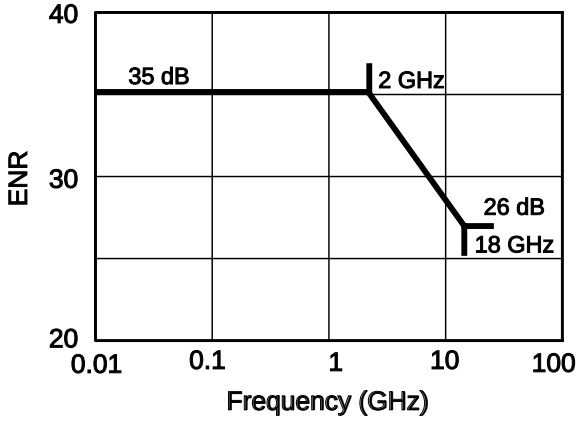
Please specify:

Basic model (MT7650B or MT7660A)

Frequency range

ENR (see graph for maximum ENR versus frequency)

Maximum ENR Versus Frequency



[1] Cross-section is the same as the MT7615A on page 91.

[2] Version number is assigned by the Sales Department at the time of quotation.

SOLID STATE NOISE GENERATORS

MT7618N

MT7618E

MT7626A

MT7600 SERIES

- Stable, Accurately Calibrated Noise Sources
- Broadband or Abbreviated Frequency Ranges
- Nominal 15 dB and 6 dB ENR [1]
- Type N or SMA Connectors

Description

The Maury MT7600 series noise generators provide the calibrated noise levels required for evaluation of the noise performance of receivers, amplifiers and other linear transducers.

Fast on-off switching along with stable repeatable noise output and low power requirements makes the MT7600 series ideal companions to direct reading noise figure meters such as the MT7300 series, described on the preceding pages.

The Maury line offers a range of band coverages allowing you to select the most economical unit for your application. Two high isolation units with 6 dB nominal ENR are available for applications sensitive to changing mismatch, and units are offered with either type N or SMA output connectors.

The chart below outlines the available models.

Specifications

Frequency Range, Nominal ENR, and Output Connector ..... See the chart on this page

Calibration Frequencies, Calibration Accuracy, and Dimensions ..... See the charts on the next page

Input Connector ..... BNC female

Input Power ..... +28 volts at <30mA

ENR Variation with Temperature ...0.01 dB/°C (maximum)

ENR Variation with Voltage .....0.1 dB/% ΔV (maximum)

Switching Time ..... <5 microseconds

Model	Frequency Range (GHz)	Nominal ENR (dB)	Output Connector	Maximum VSWR (GHz)
MT7615A	0.01 — 1.5	15.5	Type N male	1.20
MT7619A	0.01 — 3.0	15.0	Type N male	
MT7619B			SMA male	
MT7616A	1.00 — 12.4		Type N male	1.40
MT7618E	0.01 — 18.0		SMA male	1.2 [2], 0.01 — 12.4 1.3 [3], 12.40 — 18.0
MT7618F			SMA female	
MT7618L			SMA male	
MT7618N			Type N male	
MT7620A			7mm	
MT7618M		6.0	Type N male	
MT7626A	0.01 — 26.5	15.0, 0.01 — 12.4 GHz 14.0, 12.4 — 26.5 GHz	SMA male	1.10 + 0.02f (GHz) 1.25 maximum

[1] Excess Noise Ratio (ENR) is defined as $10\text{Log}_{10}[(T_h/290)-1]$ where T_h is the equivalent hot noise temperature of the generator.

[2] 1.4 for the MT7618N.

[3] 1.46 for the MT7618N.

SOLID STATE NOISE GENERATORS

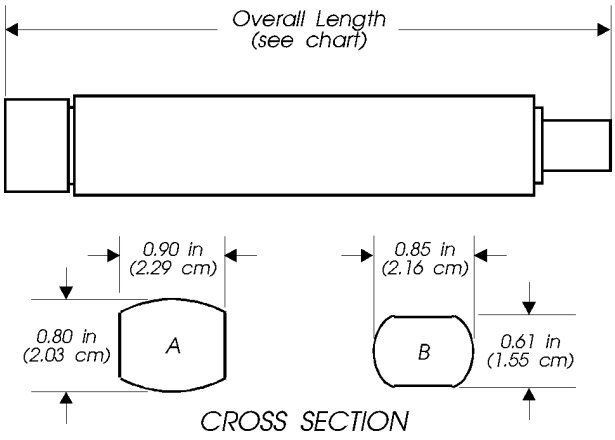
MT7600 SERIES (continued)

Calibration Frequencies

The following table shows the frequencies at which the individual noise generators in the MT7600 series are calibrated.

Model	Calibration Frequencies (GHz)
MT7615A	0.01, 0.03, 0.3, 1.0, 1.5
MT7619A/B	0.01, 0.03, 0.3, 1.0, 2.0, 3.0
MT7616A	1.0, 2.0, 3.95, 8.2, 9.0, 9.8, 12.4
MT7618x [1]	0.01, 0.03, 0.3, 1.0 plus every GHz through 18.0
MT7620A	
MT7626A	0.01, 0.03, 0.3, 1.0 plus every GHz through 26.5

Outline Dimensions



Model	Cross Section	Overall Length inches	(cm)
MT7615A	A	4.6	(11.7)
MT7619A	A	4.6	(11.7)
MT7619B	A	4.5	(11.4)
MT7616A	A	4.6	(11.7)
MT7618E	A	4.5	(11.4)
MT7618F	A	4.4	(11.2)
MT7618L	A	4.5	(11.4)
MT7618M	A	4.5	(11.4)
MT7620A	A	4.5	(11.4)
MT7618N	A	4.5	(11.4)
MT7626A	B	3.5	(8.9)

Calibration Accuracy

The major contributor to measurement uncertainty in most noise performance measurements at RF and microwave frequencies is the calibration uncertainty of the noise generator ENR [2]. All Maury noise generators are shipped with an individual calibration data sheet showing the ENR at each calibration frequency. All ENR calibrations are traceable to a national standards laboratory or a natural physical standard.

The chart below shows the worst case and RSS (Root-Sum-Squares) uncertainty and the traceability at all Maury ENR calibration frequencies.

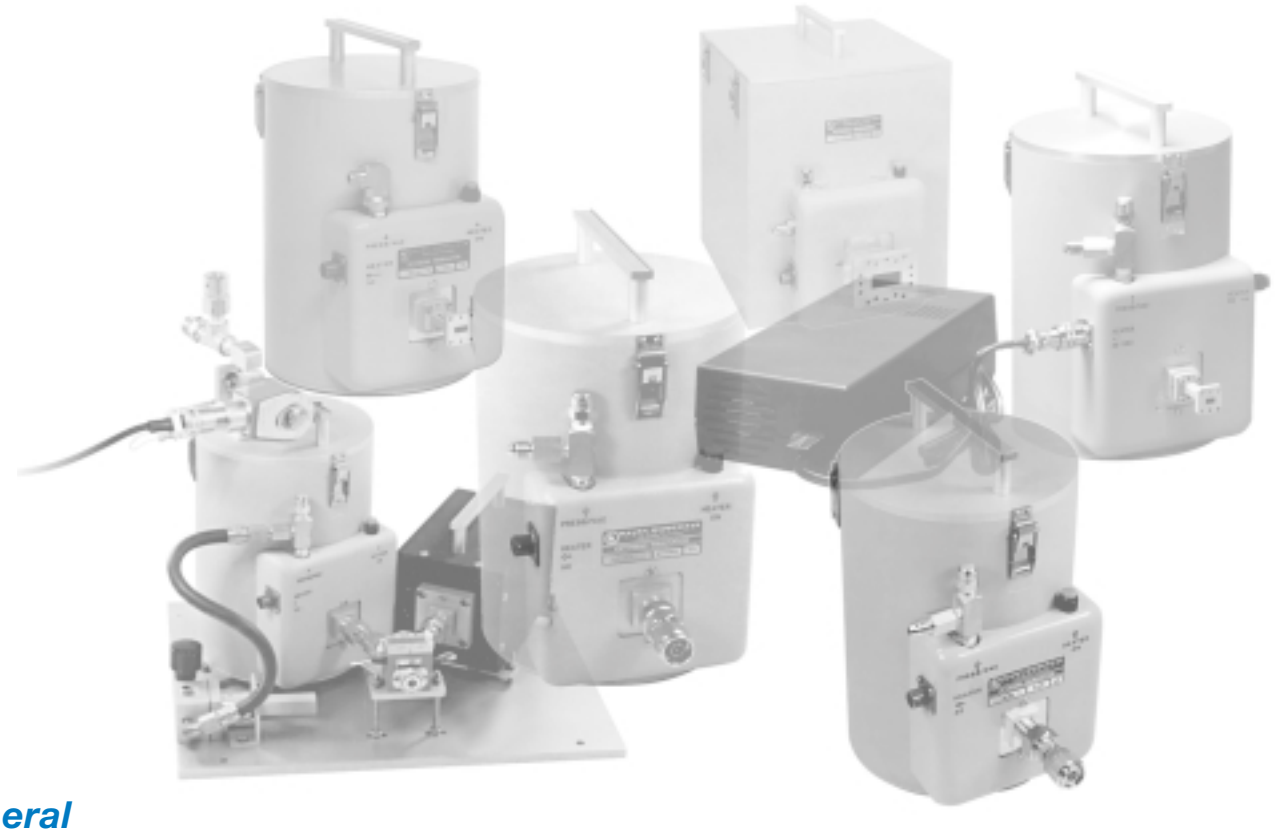
Frequency (GHz)	RSS Uncertainty (dB)	Worst Case Uncertainty (dB)	Traceability [3]
0.01	0.14	0.30	H/C
0.03	0.14	0.30	EQD
0.3	0.14	0.30	EQD
1.0	0.14	0.30	EQD
2.0	0.14	0.30	EQD
3.0	0.13	0.28	NIST
4.0	0.13	0.28	NIST
5.0	0.14	0.30	H/C
6.0	0.14	0.30	EQD
7.0	0.14	0.30	EQD
8.2	0.10	0.25	NIST
9.0	0.10	0.25	NIST
10.0	0.11	0.25	NIST
11.0	0.11	0.25	NIST
12.0	0.11	0.25	NIST
13.0	0.11	0.25	NIST
14.0	0.11	0.25	NIST
15.0	0.11	0.25	NIST
16.0	0.11	0.25	NIST
17.0	0.12	0.25	NIST
18.0	0.12	0.25	NIST
19.0	0.13	0.40	G
20.0	0.13	0.40	G
21.0	0.13	0.40	G
22.0	0.14	0.40	G
23.0	0.14	0.40	G
24.0	0.14	0.40	G
25.0	0.14	0.40	G
26.0	0.14	0.40	G

[1] Includes all generators in the MT7618 model series.

[2] Excess Noise Ratio (ENR) is defined as $10Log_{10}[(T_h/290)-1]$ where T_h is the equivalent hot noise temperature of the generator.

[3] Traceability: H/C, Hot/Cold Thermal Standard; EQD, Electronic Quality Assurance Directorate, UK; NIST, National Institute of Standards and Technology; G, Internal Gas Standard.

CRYOGENIC NOISE TERMINATIONS



General

Maury cryogenic terminations are liquid nitrogen cooled loads which provide accurately known noise power at a well matched output port. Used with ambient and/or heated terminations and a noise figure meter, these terminations provide cold reference temperatures needed for highly accurate noise figure or effective input noise temperature measurements. Because of the accuracy of their noise output, cryogenic terminations are often used as a noise standard for calibration of solid state noise generators such as those in Maury's MT7600 series (page 89).

The accuracy achieved by these terminations is possible because they utilize the known temperature of boiling liquid nitrogen as a constant for calculating noise temperature. This mirrors the conceptual foundation of the noise standards used in virtually all national standards laboratories world-wide (e.g.: NIST). Because of this, measurements made with these terminations are traceable to the fundamental quantity, temperature and NIST via temperature and network calibration standards. Each unit is provided with a calibration report which includes VSWR and available output noise temperature data at specific frequencies. **Options for additional user-selected frequencies are available.**

The cryogenic terminations require user-provided liquid nitrogen and dry helium gas at 2 psi. Maury's MT152A pressurization system is available as an optional accessory to regulate the helium pressure (see page 95). The terminations include a heater circuit which operates on 115 VAC to prevent ice from forming on the output connector and to prevent the heat load of the device under test from affecting the output temperature. On some models, operation at 230 VAC requires the addition of the Maury MT154A power adapter (see page 95).

CRYOGENIC NOISE TERMINATIONS

COAXIAL CRYOGENIC TERMINATION, MT7118J

Description

The MT7118J cryogenic termination is a liquid nitrogen cooled noise source that provides accurately known noise temperatures at specified calibration frequencies and low VSWR over the full frequency range. It is used for performing accurate noise temperature measurements in 7mm applications such as certification of the noise performance of low noise earth stations. It is also used for general purpose, low noise figure/temperature measurements and calibration of solid state noise generators.

The MT7118J comes with a universal input power supply that operates on line voltages of 100 – 240 VAC and 47 – 63 Hz, while supplying 48 VDC to the device power input.

The MT7118J can be packaged with an extensive complement of options and accessories, including calibrated adapters to other coaxial connector series and waveguide, and user specified calibration frequencies. Our sales staff will be happy to assist in tailoring the best package for your application.

MT7118J

Pressurizing System

Maury cryogenic terminations require helium gas pressurization at 2 psi. The optional MT152A pressurizing system provides the valves, gages, and hardware necessary to connect an external helium gas supply to Maury cryogenic terminations (helium gas supply is not provided).

Specifications

Frequency Range. ..... DC to 18.0 GHz

Maximum VSWR: ..... 1.06, DC to 4.0 GHz
1.10, 4.0 to 12.0 GHz
1.15, 12.0 to 18.0 GHz

Operating Temperature (Load)..... 77.36°K (liquid nitrogen cooled)

Calibration Frequencies and
Noise Temperature Uncertainty [1]:

- 3.95 GHz ..... ±0.7 K
- 7.50 GHz ..... ±1.0 K
- 12.4 GHz ..... ±1.2 K
- 18.0 GHz ..... ±1.5 K

Connector 7mm

Operating Orientation ..... Horizontal

Operating Life ..... 2 hours minimum (one fill)

Dewar Capacity ..... 1 liter

Weight ..... 7 lbs approximate (empty)

Pressurization .... 2 psi helium gas (external supply)

AC Power ..... 100 to 240 VAC, 47 to 63Hz
6.0 amps maximum

Accessories (provided)..... One (1) two meter power cord and a wooden instrument case

The MT7118J can be optimized for VSWR and input noise temperature over other bandwidths, additional calibration points or with calibrated bends for other operating orientations.

[1] For calibration at additional or other frequencies, please consult our Sales Department. Note: The noise temperature at other points can also be estimated to a fair degree of accuracy by connecting the calibration points with a straight line.

WAVEGUIDE CRYOGENIC TERMINATIONS

MT70xx SERIES

MT7040D

MT7021J

Description

Maury offers waveguide cryogenic terminations in several styles and a wide range of waveguide sizes from WR430 through WR15. The chart below represents a typical sample of the available terminations.

Model	Frequency Range (GHz)	EIA Waveguide Size	VSWR (maximum)	Calibration Uncertainty
MT7071B	2.2 — 2.3	WR430 [1]	1.05	±0.75 K
MT7033A	3.7 — 4.2	WR229 [1] [2]	1.07	±0.75 K
MT7035A	5.9 — 6.4	WR159 [1] [2]	1.08	±0.75 K
MT7040D	7.05 — 10.0	WR112 [1] [3]	1.08	±0.60 K
MT7041A	10.0 — 12.4	WR90 [3]	1.10	±1.0 K
MT7042A	10.0 — 15.5	WR75 [4]	1.08	±0.75 K
MT7043D	13.0 — 15.0	WR62 [3]	1.10	±1.0 K
MT7044B	15.0 — 22.0	WR51 [4]	1.10	±1.0 K
MT7021J	18.0 — 26.5	WR42 [3]	1.08	±0.8 K
MT7022A	26.5 — 40.0	WR28 [3]	1.10	±1.0 K
MT7023A	33.0 — 50.0	WR22 [3]	1.10	±1.5K
MT7025B	50.0 — 75.0	WR15 [3]	1.15	±1.5K
MT7027J	75.0 — 110.0	WR10 [3]	1.20	±1.5K

Waveguide terminations are generally calibrated at three frequencies – high, low and arithmetic center – within the applicable frequency range; however, they can be calibrated at any user-specified frequency within the waveguide band. Additional user-specified calibration frequencies are also available as an option.

In addition to liquid nitrogen, these terminations require pressurization with helium gas (not provided) at 2 psi. The MT152A pressurizing system (see the following page) is available to provide proper regulation of the helium supply.

The flange temperature of the waveguide terminations is controlled by means of a proportional control heater which operates on 115 VAC. Operation at 230 VAC requires the MT154A power adapter (see page 95).

[1] Flange mates with the applicable CPR flange.

[2] Flange mates with the applicable CMR flange.

[3] Flange mates with the applicable military (UG) flange.

[4] Flange mates with most applicable military and industrial flanges.

CRYOGENIC TERMINATION ACCESSORIES

Helium Pressurizing System (MT152A)

Maury cryogenic terminations must be supplied with helium gas at about 2 psi to purge contaminants (air, carbon dioxide, etc.) from the coaxial or waveguide transmission line (connecting the cooled termination to the output connector) before the dewar is filled with liquid nitrogen. The **MT152A** regulates the helium supply by use of a two-stage pressure regulator preset to provide 2 to 3 psi output pressure and a safety pressure relief valve set to 4 psi. These are included with an 8 foot hose and the fittings needed to connect your helium supply to the termination.

MT152A

Power Adapter (MT154A)

The **MT154A** power adapter is used to convert 50/60 Hz power at 230 VAC for use by devices requiring 115 VAC. Typical application is to provide power for the 115 VAC heater circuit used in the Maury cryogenic terminations when the main supply is 220/240 VAC. The power adapter is rated at 200 VA output.

MT154A

Calibrated Adapters Sets

Maury offers a wide range of calibrated adapters and adapter sets that are used with the **MT7118J** cryogenic termination and the **MT7108B** thermal termination to adapt the precision 7mm output port to other coaxial series or to waveguide at specific frequencies. They are calibrated for VSWR and insertion loss to allow their input noise temperature to be calculated.

The chart at right lists the available models and sets. These are also available separately; however, since the use of adapters affects measurement accuracy and limits stability or repeatability in waveguide applications, better accuracy is achieved (and operation of the termination is simpler) when they are purchased and calibrated with your instrument. (Maury recommends purchase of your instrument with the connector type or waveguide flange needed.)

Maury also offers cryogenic and thermal terminations calibrated at user-specified or standard frequencies. Please consult our Sales Department for more information.

Key literature – Maury data sheet 4A-008A.

Model	Connector Type	Description
2606M	Type N	One (1) each female and male adapter calibrated at 3.95, 7.5, 12.4, and 18.0 GHz. [1]
8022M	3.5mm	One (1) each female and male adapter calibrated at 3.95, 7.5, 12.4, and 18.0 GHz.
2607M	GR900	One (1) adapter calibrated at 3.95, 7.5, 12.4, and 18.0 GHz. [1]
R299E	WR430	One (1) waveguide to 7mm end launch adapter.
E229D	WR229	
F229D	WR159	
H229D	WR112	
X229D	WR90	
M229D	WR75	
P229D	WR62	
H229D	WR112	

[1] See page 119 for the VSWR.

AMBIENT TERMINATIONS

Description

Maury ambient terminations are room temperature noise sources consisting of a stable termination in a massive copper housing to provide thermal stability and to reduce the effects of thermal transients.

These terminations are used as a reference temperature noise source for highly accurate noise figure or effective input noise temperature measurements, as an "on-line" standard for calibrating the operating noise temperature of low noise receiving systems, and in the calibration of solid state noise generators.

Each unit is provided with a direct reading dial thermometer calibrated from -5° to 45°C with better than 0.5° resolution and accuracy. The thermometer receptacle in the housing will also accept a quartz thermometer probe which, when connected to an appropriate unit, will provide for a remote temperature readout.

The units listed below are typical of those available. Please consult the factory for terminations in waveguide sizes, connector types or frequency ranges not shown here.

Model	Frequency Range (GHz)	VSWR (maximum)	Connector or EIA Waveguide Size
2459A	DC — 8.5	1.02, DC — 1.0 1.04, 1.0 — 4.0 1.06, 4.0 — 8.5	14mm (GR900)
2659A	DC — 18.0	1.04, DC — 4.0 1.08, 4.0 — 12.0 1.10, 12.0 — 18.0	7mm
R309B	2.2 — 2.3	1.05	WR430 [1]
E309A	3.7 — 4.2	1.05	WR229 [1]
X309A	8.2 — 12.4	1.05	WR90 [2]
M309A	10.0 — 15.0	1.05	WR75 [3]
P309A	12.4 — 18.0	1.05	WR62 [2]
K309B	21.0 — 23.0	1.05	WR42 [2]
J309A	33.0 — 50.0	1.05	WR22 [2]
U309B	36.0 — 38.0	1.05	WR28 [2]

[1] Flange mates with the applicable CPR flange.
[2] Flange mates with the applicable military (UG) flange.
[3] Flange mates with most applicable standard military and industrial flanges.

HOT THERMAL NOISE TERMINATIONS

General

Maury thermal terminations are low-mismatch, heated loads in a precisely controlled thermal environment which provide an accurately known noise power. Used with ambient and/or cryogenic terminations and a noise figure meter, these terminations provide the hot termination temperature needed for highly accurate noise figure or effective input noise temperature measurements. Because of the accuracy of the noise output, thermal terminations are often used as a noise standard for calibration of solid state noise generators such as those in Maury's MT7600 series (page 89).

The accuracy achieved by these terminations is possible because they utilize the proven concept of thermal (Johnson) noise operating in a precision thermal environment provided by the MT151C temperature controller. (The MT151C is a highly stable, proportional temperature controller that is accurately calibrated against NIST-traceable temperature measuring equipment.) This is the same concept used in several national standards laboratories and NIST at the higher microwave frequencies.

The termination and the controller are matched during calibration; therefore, the two instruments must be purchased as a unit. In addition, a line voltage option must be specified. Each unit is provided with a calibration report which includes VSWR and available output noise temperature at specific frequencies.

Options for additional or alternative user-selected frequencies are available as are accessories such as an instrument case and calibrated adapters to other coaxial series or waveguide.

COAXIAL THERMAL TERMINATION, MT7108B

General

The MT7108B is designed to operate from DC to 18 GHz and is provided with a precision 7mm output connector. This compact, reliable instrument is equally suited for both field measurements and laboratory use. It is generally utilized for accurate low noise figure/temperature measurements and calibration of solid state noise generators.

The termination is maintained at 373.1 kelvins (100°C) by the MT151C controller. The physical temperature of the termination is maintained by a heater coil controlled by a proportional controller in the control unit responding to sensors in physical proximity to the termination. The entire termination assembly is heavily insulated to minimize the effects of the external environment. The controller and the termination are matched during calibration and are provided as a unit, and a line voltage option must be specified at time of order.

VSWR and noise temperature data are provided at four frequencies as shown in the specifications below. **Options for additional or alternate user-specified frequencies are available** [1]. A calibration report is provided with each unit.

The flexibility and versatility of the MT7108A are enhanced by an extensive complement of options and accessories [1]. These include calibrated adapters to other coaxial connector series and waveguide, and user specified calibration frequencies.

Specifications

Frequency Range ..... DC to 18 GHz

Nominal Physical Load Temperature ..... 373.1 K

Load Temperature Stability ..... ±0.2 K

VSWR (maximum):
- DC to 4 GHz 1.06
- 4 to 12 GHz 1.10
- 12 to 18 GHz 1.15

AC Power [2]:
- Option 22 ..... 100/120 VAC, 50/60 Hz
- Option 32 ..... 220/240 VAC, 50/60 Hz

Calibration Frequencies and Noise Temperature Uncertainty [1]:
- 3.95 GHz ..... ±0.7 K
- 7.50 GHz ..... ±1.0 K
- 12.4 GHz ..... ±1.2 K
- 18.0 GHz ..... ±1.5 K

Connector ..... Precision 7mm

Accessories Provided ..... MT151C controller, MT7005P controller cable, instrument case

[1] See page 95 for available options and accessories.

[2] Option must be specified.

WAVEGUIDE THERMAL TERMINATIONS, MT70xx SERIES

MT151C MT7005A

Description

Maury offers waveguide thermal terminations in several styles and a wide range of waveguide sizes, from WR430 through WR10. The chart below represents a typical sample of the available terminations.

Model	Frequency Range (GHz)	EIA Waveguide Size	VSWR (maximum)	Calibration Uncertainty
MT7005A	3.7 — 4.2	WR229 [1]	1.07	±0.75 K
MT7081A	10.0 — 12.4	WR90 [2]	1.10	±1.00 K
MT7082A	10.0 — 15.0	WR75 [2]	1.08	±0.75 K
MT7009B	15.0 — 22.0	WR51	1.10	±1.00 K
MT7084A	18.0 — 26.5	WR42 [2]	1.08	±0.80 K
MT7085A	26.5 — 40.0	WR28 [2]	1.10	±1.00 K
MT7086A	33.0 — 50.0	WR22 [2]	1.10	±2.00 K
MT7088B	50.0 — 75.0	WR15 [2]	1.20	±1.00 K
MT7090J	75.0 — 110.0	WR10 [2]	1.15	±1.00 K

Waveguide terminations are generally calibrated at three frequencies – high, low, and arithmetic center – within the applicable frequency range; however, they can be calibrated at any user-specified frequency within the waveguide band. Additional user-specified calibration frequencies are also available as an option.

The physical temperature of the waveguide terminations is 350 kelvins with a stability of ±0.2 kelvins. These terminations are calibrated with a specific temperature controller, and the two instruments are provided as a unit. A line voltage option must be specified at the time of order.

THERMAL TERMINATIONS – OPTIONS AND ACCESSORIES

Temperature Controller, MT151C

A temperature controller is provided with each termination. The controller and the termination are calibrated together and are sold as a unit. A line voltage option must be specified at time of order:

Option 22	100/120 VAC
Option 32	220/240 VAC

Additional Calibration Frequencies

Please contact our Sales Department for more information on units calibrated at user-specified frequencies in addition to or in place of the standard calibration frequencies listed.

Instrument Case

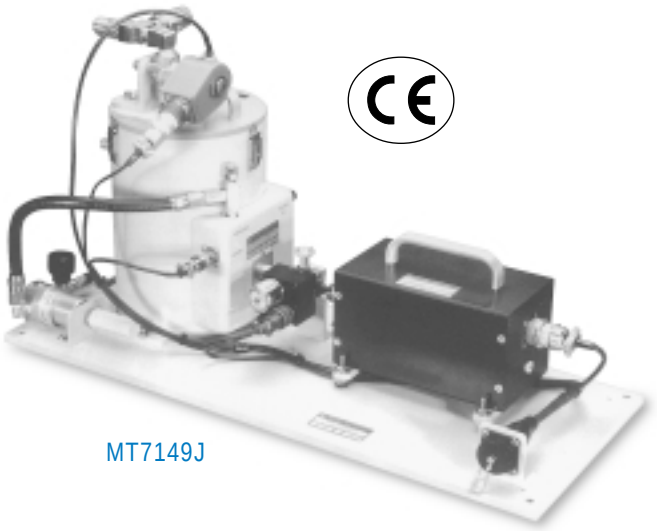
Most Maury heated terminations are supplied in foam-lined instrument cases. Please contact our Sales Department for details.

Calibrated Adapters

Maury offers a wide range of calibrated adapters for use with these thermal termination units. Please consult our Sales Department for prices, model numbers, and to request Maury data sheet 4A-008A. See page 95 for additional information.

[1] Flange mates with applicable CPR and CMR flanges.
[2] Flange mates with the applicable military (UG) flange.

NOISE CALIBRATION SYSTEMS

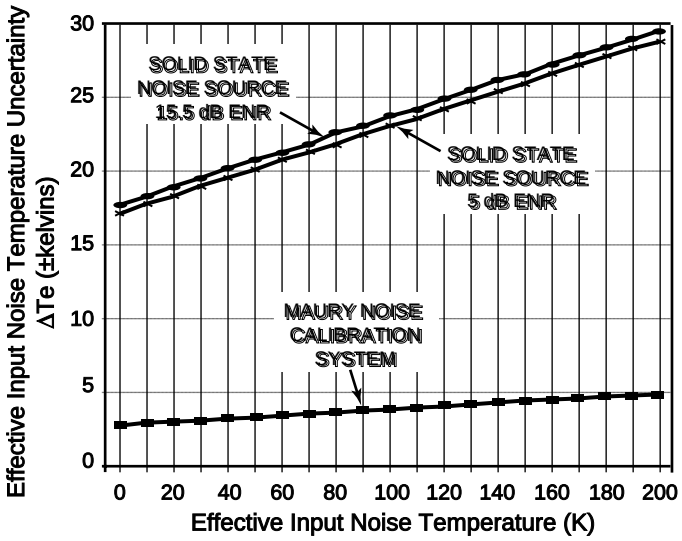


MT7149J

Introduction

The Maury Noise Calibration Systems (NCS) are self-contained, highly accurate sources of RF and microwave noise power. These systems are used wherever noise source accuracy is critical. Examples are: receiver noise measurements such as noise figure and effective input noise temperature; calibration of solid state noise sources; evaluation and verification of earth station receivers; and as radiometer reference sources.

Each NCS consists of two (hot/cold) or three (hot/ambient/cold) thermal noise sources whose outputs can be conveniently switched into a single calibrated output port. This capability makes for a unique combination of accuracy and convenience. The incorporation of the output switch makes the operation of the NCS in a noise performance measurement as convenient as a solid state noise generator – without the accuracy penalty associated with the latter. The plot shown illustrates the improvement in accuracy that can be gained by the use of an NCS in a typical measurement application (effective input noise temperature).



The cold noise source is a liquid nitrogen (LN_2) cooled termination similar to those shown on pages 92 through 94. A liquid nitrogen level sensor and an automatic fill system maintains the proper nitrogen level. The user must provide a suitable liquid nitrogen reservoir. The cold termination is also pressurized with helium at 2 psi. Pressure is maintained by a regulator that requires 20 psi maximum from an external user-supplied source. Since most helium bottles are pressurized to about 1,000 psi or more, the MT152A pressurizing system (see page 95) is recommended as an accessory.

The hot noise source is a heated termination similar to those shown on pages 97 through 99 whose temperature is maintained by proportional control to better than ±0.2K by the MT155A controller. Actual temperature is indicated by a digital readout on the controller front panel.

The NCS consists of three assemblies:

A. A component mounting plate which holds the cryogenic and heated termination assemblies, the hot/cold or hot/ambient/cold remotely controlled relay(s) and output assembly, and the helium pressure regulator. The LN_2 level sensor and fill solenoid are mounted on the cover of the dewar flask.

B. The MT155J controller (see photo on the following page) which contains the temperature control circuitry and a digital temperature readout for the thermal termination, the automatic or manual LN_2 fill control circuitry and the remote noise temperature output switch.

C. The MT155B control cable, 25 feet in length, which connects the controller to the mounting plate.

NOISE CALIBRATION SYSTEMS

MT155J

The MT155J controller can be located up to 25 feet (7.6 meters) away from the mounting plate.

Calibration of the hot/cold noise temperatures at the output connector of the NCS is provided at a number of frequencies. Each NCS model is calibrated at specific standard frequencies. Typically, waveguide units will be calibrated at the band edges and the arithmetic center frequency of the waveguide. Coaxial units are generally calibrated at four frequencies as indicated in the table that follows. The user has the option of specifying substitute or additional calibration frequencies at additional cost. Note that the noise temperatures are not critical as long as they are accurately known.

The table to the right shows the typical output temperatures and noise temperature uncertainties of the MT7098J dual-load, 7mm coaxial NCS.

Calibration Frequency	Hot Noise [1] Temperature	Cold Noise [1] Temperature	Temperature Uncertainty
3.95 GHz	371K	83K	±1.0K
7.50 GHz	369K	88K	±1.2K
12.40 GHz	366K	95K	±1.5K
18.00 GHz	365K	98K	±2.0K

Typical Models

The chart below shows a sample of the NCS available from Maury. Each model is a complete system made up of the appropriate terminations assembled on a mounting plate, the MT155J controller and the interconnecting cable. All dual-load systems shown consist of cold (LN_2) and heated terminations. The tri-load system (MT7208J) includes an ambient termination as well.

Model	Frequency Range (GHz)	Transmission Line	Output Connector or Flange	Type
MT7092C	3.7 — 4.2	WR229	MPF229 [2]	Dual-load
MT7091B	10.0 — 12.4	WR90	MPF90 [3]	Dual-load
MT7093B	10.0 — 15.0	WR75	MPF75B [4]	Dual-load
MT7094B	15.0 — 22.0	WR51	MPF51B [4]	Dual-load
MT7095J	18.0 — 26.5	WR42	UG595/U	Dual-load
MT7097	33.0 — 50.0	WR22	UG383/U	Dual-load
MT7149J	75.0 — 110.0	WR10	UG385/U	Dual-load
MT7098J	DC — 18.0	Coaxial	7mm	Dual-load
MT7208J [5]	DC — 18.0	Coaxial	7mm	Tri-load

Please consult our Sales Department if you do not see a noise calibration system in the table suitable for your application or if you would like more detailed information on any of these systems.

[1] Nominal, these will vary from unit to unit.

[2] Mates with the appropriate CPR and CMR flanges.

[3] Mates with the appropriate military (UG) and CPR flanges.

[4] Mates with most standard military and industrial flanges in this band.

[5] CE certified.

COAXIAL ADAPTER REFERENCE CHART

The chart below shows the page numbers on which the various coaxial adapters can be found.

	7mm	Type N	Type N, 75 ohm	TNC	AFTNC	3.5mm	2.92mm (K)	2.4mm (Q)	MPC8 (SSMA, OSSM)	BNC	BNC, 75 ohm	SC	C	HN	SMA	EIA	14mm (GR900)	7-16	LPC, OSP™
7mm		119	108	119	119	109 112 [1] 113	114	116	118	119	124	119	119	119	119	119	119	121	122
Type N	119	106 107	108	105	105	109 112 [1]	114	116	118	105		124	105	105	105	123	120	121	122
Type N, 75 ohm	108	108	108			108													
TNC	119	105		123	123	109													
AFTNC	119	105		123	123														
3.5mm	109 112 [1] 113	109 112 [1]	108	109	109	113		116									120	121	122
2.92mm (K)	114	114					115	116	118										
2.4mm (Q)	116	116				116	116	117											
MPC8 (SSMA, OSSM)	118	118					118												
BNC	119	105																	
BNC, 75 ohm	124																		
SC	119	124										124							
C	119	105																	
HN	119	105																	
SMA	119	105																	
EIA	119	123														123	120		
14mm (GR900)	119	120				120										120			
7-16	121	121				121												121	
LPC, OSP™	122	122				122													

[1] Panel mount or bulkhead feedthru.

PRECISION ADAPTERS

General

Maury Microwave produces a comprehensive line of both in-series and between-series coaxial adapters. Adapters are available for all precision laboratory measurement connectors – 2.4mm, 2.92mm (K), 3.5mm, 7mm, 14mm, etc.; all common systems connectors – type N, TNC, etc.; and several special purpose connector series such as EIA rigid line connectors.

Maury also manufactures adapters in other less common connector series not shown in this catalog due to the many varieties and space limitations.

If you have a specific need, please contact our Sales Department for assistance.

Test Port Adapters

Test port adapters are specifically designed to mate with the special ruggedized connectors used on commercial VNA test sets, such as those used with the Agilent 8510 and Anritsu 360. The test port adapters can convert those connectors to a more common coaxial connector series. These adapters can offer significant cost savings in terms of less VNA down time and repair costs. Because of the special purpose and design of these adapters, they will be found grouped together for easier reference on pages 46 and 47 in the section on precision measurement equipment.

Phase Matched Adapters

Phase matched adapters are used in two-port VNA calibrations when the devices have same sex input and output connectors that must be tested. Through connection for calibration is made using adapters with female and male connectors. One adapter is then replaced to permit mating to the test device. With phase matched adapters, this can be done without significantly degrading the VNA error correction capability. Phase matched in-series and between-series adapters are noted as such in the following pages.

Connector Interfaces

All industry standard connectors used on Maury adapters are mating compatible with connectors conforming to the applicable MIL-C or MIL-T specifications. However, because of the need for precision in many applications, most Maury connectors are manufactured to even more exacting requirements. Applicable interface specifications are available upon request.

To calculate the overall length of the adapters, add the dimensions shown in the chart below to each connector type:

Adapter:	Type N	TNC	BNC	C	SC	HN	3.5mm	SMA	2.92mm/ MPC3	SSMA/ MPC8	2.4mm	7mm	14mm
Male	+ 0.038	0	+ 0.035	+ 0.064	+ 0.040	0	+ 0.120	+ 0.117	+ 0.117	+ 0.102	+ 0.087	–	–
Female	+ 0.359	+ 0.331	+ 0.331	+ 0.335	+ 0.515	+ 0.519	+ 0.076	+ 0.076	+ 0.076	+ 0.076	+ 0.120	–	–
No Sex	–	–	–	–	–	–	–	–	–	–	–	0	+ 0.053

PRECISION ADAPTERS

50 ohm TYPE N BETWEEN-SERIES ADAPTERS

- Precision Connectors
- Low VSWR
- Low Insertion Loss
- Rugged Durable Construction

8816A 8816C 8817B 8816D

Maury precision type N between-series adapters are available for both general purpose laboratory use and high precision measurement applications.

The chart on the following page lists those adapters in the 8800 model series which cover type N adapters to general purpose systems and laboratory connectors such as TNC, AFTNC, BNC, etc. Adapters to SMA connectors are ideally replaced by type N adapters to 3.5mm connectors (see 8023 model series on page 109) which are fully mating compatible with SMA and 2.92mm (K) and provide a more rugged, durable and repeatable interface than SMA.

Type N adapters to **2.4mm, 3.5mm, 7mm** and other precision connectors are covered under other model series and are not shown in the following chart; however, the catalog pages containing the description of these units will be found at the end of the chart. Many of these are **phase matched** (same electrical length). Such units can be very valuable for two-port scalar or vector network measurements of non-insertable devices, i.e., devices with the same sex connectors at both ends.

In-series type N adapters for general purpose, precision laboratory use, including air dielectric, beadless adapters are on page 107.

Phase matched in-series adapters are described on page 106.

75 ohm adapters are shown on page 108.

Test port adapters will be found on page 46.

PRECISION ADAPTERS

50 ohm TYPE N BETWEEN-SERIES ADAPTERS

PRECISION TYPE N ADAPTER REFERENCE CHART

Model	Adapts From		Adapts To		Insertion Length inches	Insertion Length (cm)	Frequency Range VSWR (maximum)
8694A	Type N female	[1]	AFTNC female	[3]	1.82	(4.63)	
8694B	Type N female	[1]	AFTNC male	[3]	1.77	(4.48)	DC – 4.0 GHz, 1.04
8694C	Type N male	[1]	AFTNC female	[3]	2.18	(5.54)	4.0 – 8.0 GHz, 1.06
8694D	Type N male	[1]	AFTNC male	[3]	2.13	(5.90)	8.0 – 18.0 GHz, 1.08
8816A	Type N female	[1]	SMA female	[4]	1.59	(4.04)	
8816B	Type N female	[1]	SMA male	[4]	1.59	(4.04)	DC – 4.0 GHz, 1.05
8816C	Type N male	[1]	SMA female	[4]	1.95	(4.95)	4.0 – 10.0 GHz, 1.10
8816D	Type N male	[1]	SMA male	[4]	1.95	(4.95)	10.0 – 18.0 GHz, 1.16
8817A	Type N female	[1]	TNC female	[5]	1.17	(2.97)	
8817B	Type N female	[1]	TNC male	[5]	1.50	(3.81)	
8817C	Type N male	[1]	TNC female	[5]	1.53	(3.89)	DC – 4.0 GHz, 1.065
8817D	Type N male	[1]	TNC male	[5]	1.86	(4.72)	4.0 – 8.0 GHz, 1.10
8817E	EWN female	[2]	EWTNC female	[2]	1.17	(2.97)	8.0 – 12.0 GHz, 1.12
8817F	EWN female	[2]	EWTNC male	[2]	1.50	(3.81)	12.0 – 18.0 GHz, 1.14
8817G	EWN male	[2]	EWTNC female	[2]	1.53	(3.89)	
8817H	EWN male	[2]	EWTNC male	[2]	1.86	(4.72)	
8820A	Type N female	[1]	HN female	[6]	1.93	(4.90)	
8820B1	Type N female	[1]	HN male	[6]	2.64	(6.71)	DC – 4.0 GHz, 1.08
8820C	Type N male	[1]	HN female	[6]	2.39	(6.07)	4.0 – 8.5 GHz, 1.12
8820D1	Type N male	[1]	HN male	[6]	2.00	(5.08)	
8821A1 *	Type N female	[1]	BNC female		2.10	(5.33)	
8821B *	Type N female	[1]	BNC male		2.01	(5.11)	DC – 4.0 GHz, 1.08
8821C1 *	Type N male	[1]	BNC female		2.46	(6.25)	4.0 – 10.0 GHz, 1.20
8821D *	Type N male	[1]	BNC male		2.37	(6.02)	
8822A	Type N female	[1]	C female		1.77	(4.50)	
8822B	Type N female	[1]	C male		2.13	(5.41)	DC – 4.0 GHz, 1.08
8822C	Type N male	[1]	C female		2.13	(5.41)	4.0 – 8.0 GHz, 1.12
8822D	Type N male	[1]	C male		2.49	(6.32)	

2.4mm	see page 116
2.92mm (K)	see page 114
3.5mm	see page 109
7mm	see page 119
In-series	see page 107
In-series phase matched	see page 106
MPC8 (OSSM)	see page 118
EIA	see page 123
14mm (GR900)	see page 120

* 8821A1 & 8821B are phase matched. 8821C1 & 8821D are phase matched for VNA applications.

[1] Precision stainless steel type N per Maury data sheet 5E-049.
[2] Precision stainless steel per MIL-T-81490.
[3] Precision TNC per MIL-C-87104/2 per Maury data sheet 5E-056.
[4] Precision stainless steel SMA per MIL-C-39012.
[5] Precision stainless steel TNC per Maury data sheet 5E-053.
[6] Precision stainless steel HN per Maury data sheet 5E-051.

PRECISION ADAPTERS

50 ohm PHASE MATCHED TYPE N IN-SERIES ADAPTERS

Description

These units are precision type N in-series adapters which feature low VSWR and insertion loss. They are "phase matched" (all have the same electrical insertion length) so the adapters can be readily interchanged in network analyzer measurement applications. They are constructed with aluminum bodies and gold-plated copper alloy center conductors. The chart below shows various models which are available.

Specifications

Frequency Range ..... DC to 18 GHz

VSWR (maximum):

DC to 4 GHz ..... 1.03 (<1.02 typical)

4 to 10 GHz ..... 1.05 (<1.03 typical)

10 to 18 GHz ..... 1.09 (<1.06 typical)

Insertion Loss ..... 0.08 + 0.01f (GHz)

Impedance (nominal) ..... 50 ohms

Connectors ..... See chart [1]

Dimensions ..... See Figures 1 through 3

Model Chart

Model	Adapts From	Adapts To	Figure
8828A	Type N female	Type N female	1
8828B	Type N male	Type N male	2
8828C	Type N female	Type N male	3

Dimensions – Inches

Figure 1 – Model 8828A

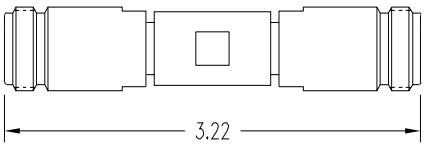


Figure 2 – Model 8828B

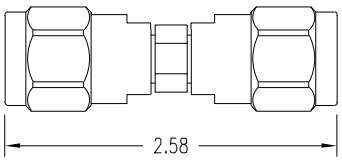


Figure 3 – Model 8828C

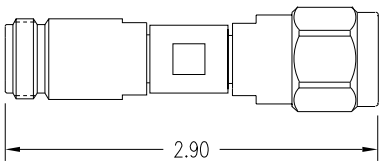
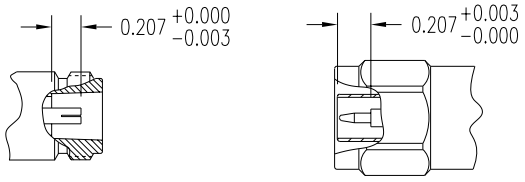


Figure 4 – Contact Pin Location



[1] Precision stainless steel type N per Maury data sheet 5E-049.

PRECISION ADAPTERS

50 ohm TYPE N IN-SERIES ADAPTERS


8801K

Description

Maury precision, in-series type N adapters are available in two configurations; a) series 8801 which are beadless (*air dielectric*), and b) series 8803 which have a low reflection teflon bead support. Both types are offered in all possible combinations; female to female, male to male and female to male. They are furnished with precision 7mm type N connectors which feature stainless steel outer conductors for long wearing characteristics and either hardened beryllium copper or brass gold-plated center conductors for low loss. These units exhibit low VSWR and insertion loss from DC to 18 GHz and are useful in a variety of precision measurement applications as well as for general laboratory use. They are also available in convenient kits where a selection of these adapters are supplied in an attractive instrument case; these kits are described below.

Specifications

Frequency Range ..... DC to 18 GHz
VSWR ..... See chart
Insertion Loss ..... See chart
Impedance ..... 50 ohms nominal
Transmission Line Size ..... 7mm (0.1197 I.D. × 0.2756 O.D.)
Connectors ..... Precision type N, stainless steel connector per Maury data sheet 5E–049 (see Figure 4).

Dimensions – Inches

Figure 1

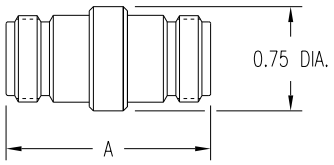


Figure 2

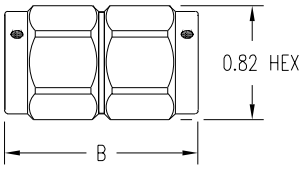


Figure 3

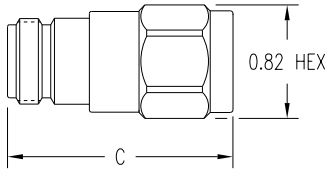
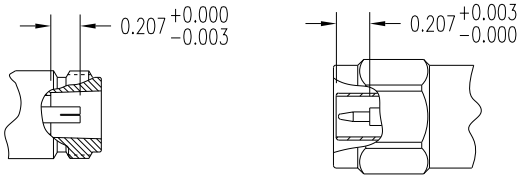


Figure 4 – Contact Pin Location



Model	Type N	Dielectric	Figure	Length (inches)	VSWR (maximum) DC–4GHz	4–10GHz	10–18GHz	Insertion Loss (maximum) DC–4GHz	4–10GHz	10–18GHz
8801A	female to female	Air (Beadless)	1	1.37	1.02	1.04	1.06	0.030 dB	0.050 dB	0.15 dB
8801B	male to male		2	1.37						
8801C	female to male		3	1.63						
8803A	female to female	Teflon (Bead Supported)	1	1.55	1.05 (<1.03 typ.)	1.08 (<1.05 typ.)	1.12 (<1.08 typ.)	0.1 dB	0.15 dB	0.25 dB
8803B	male to male		2	1.80						
8803C	female to male		3	1.70						
8803D	female to female *		*	1.55						
8801K	Kit consisting of one each 8801A, 8801B, 8803A and 8803B.									
8801L	Kit consisting of one each of all models listed, except the 8803D.									

* This is a precision pressurized bulkhead feedthru adapter similar to UG30/U. Outline drawing on request.

PRECISION ADAPTERS

75 ohm TYPE N COAXIAL ADAPTERS (8882 SERIES)

Maury type N, 75 ohm adapters use a precision version of the connector interface. These connectors are identified by a black band on the male coupling nut or just behind the female coupling threads to warn users **not** to mate these with 50 ohm connectors. The center conductors on 75 ohm N connectors are smaller than the 50 ohm versions, and mating a 50 ohm male with a 75 ohm female will destroy the female contact, while mating a 75 ohm male with a 50 ohm female will result in a poor electrical connection.

8882E1 8882E2 8882G12 8882G22

75 ohm PRECISION TYPE N ADAPTER REFERENCE CHART

Between-Series

Model		Adapts From	Adapts To	Frequency Range and VSWR (maximum)
8882D1	[1]	Type N 75 ohm female	7mm 50 ohm	These adapters exhibit a typical VSWR of 1.5 (75/50 ohm) which is calibrated out during the calibration process.
8882D2	[1]	Type N 75 ohm male	7mm 50 ohm	
8882E1	[1]	Type N 75 ohm female	NMD3.5F 50 ohm	
8882E2	[1]	Type N 75 ohm male	NMD3.5F 50 ohm	
8882F11	[1]	Type N 75 ohm female	Type N 50 ohm female	
8882F12	[1]	Type N 75 ohm female	Type N 50 ohm male	
8882F21	[1]	Type N 75 ohm male	Type N 50 ohm female	
8882F22	[1]	Type N 75 ohm male	Type N 50 ohm male	
8882G11	[1]	Type N 75 ohm female	3.5mm (50 ohm) female	
8882G12	[1]	Type N 75 ohm female	3.5mm (50 ohm) male	
8882G21	[1]	Type N 75 ohm male	3.5mm (50 ohm) female	
8882G22	[1]	Type N 75 ohm male	3.5mm (50 ohm) male	

In-Series

Model		Adapts From	Adapts To	Frequency Range and VSWR (maximum)
8882A	[2]	Type N 75 ohm female	Type N 75 ohm female	DC – 2.0 GHz, 1.03
8882B	[2]	Type N 75 ohm male	Type N 75 ohm male	
8882C	[2]	Type N 75 ohm female	Type N 75 ohm male	
8882K1	[3]	Type N 75 ohm female	Type N 75 ohm female	
8882K2	[3]	Type N 75 ohm male	Type N 75 ohm male	

[1] Female and male adapters in the same connector series are phase matched for VNA applications.

[2] The 8882A, B, and C have equal electrical length (phase matched) so they can be readily interchanged for accurate measurements of non-insertable devices.

[3] The 8882K1 and K2 are minimum length adapters which can be used for through calibration. They are not phase matched.

PRECISION ADAPTERS

3.5mm BETWEEN-SERIES ADAPTERS

Description

The precision 3.5mm connectors used on these adapters are mating compatible with both SMA and 2.92mm (K) connectors. Because the 3.5mm connector is more rugged and durable than SMA, it is often used in laboratory and test applications requiring repeated connections of test devices with SMA connectors. 3.5mm adapters are also used to adapt from K connectors to lower frequency connector series (e.g.: 7mm, type N, etc.).

Model	Adapts From	Adapts To	Insertion Length inches	Insertion Length (cm)
8022A1 [1] [2]	3.5mm female	7mm	1.67	(4.24)
8022B1 [1] [2]	3.5mm male	7mm	1.67	(4.24)
8022A2 [1] [2]	3.5mm female	7mm	1.67	(4.24)
8022B2 [1] [2]	3.5mm male	7mm	1.67	(4.24)
8023A [1]	3.5mm female	Type N female	1.62	(4.11)
8023B1 [1]	3.5mm female	Type N male	1.97	(5.00)
8023C [1]	3.5mm male	Type N female	1.62	(4.11)
8023D1 [1]	3.5mm male	Type N male	1.97	(5.00)
8025A1 [1]	3.5mm female	TNC female [3]	1.62	(4.11)
8025B1 [1]	3.5mm female	TNC male [3]	2.08	(5.28)
8025C1 [1]	3.5mm male	TNC female [3]	1.62	(4.11)
8025D1 [1]	3.5mm male	TNC male [3]	2.08	(5.28)
8682A [1]	3.5mm female	AFTNC female [4]	1.34	(3.40)
8682B [1]	3.5mm female	AFTNC male [4]	1.29	(3.28)
8682C [1]	3.5mm male	AFTNC female [4]	1.34	(3.40)
8682D [1]	3.5mm male	AFTNC male [4]	1.29	(3.28)
8028A1 [1]	3.5mm female	BNC female	2.00	(5.08)
8028B1 [1]	3.5mm female	BNC male	1.91	(4.85)
8028C1 [1]	3.5mm male	BNC female	2.00	(5.08)
8028D1 [1]	3.5mm male	BNC male	1.91	(4.85)

[1] Adapters in a model series are phase matched for VNA applications.

[2] 7mm connectors are provided with a six-slot center conductor contact design for improved repeatability and durability.

General

Maury 3.5mm adapters in the 8000 model series adapt to 7mm, type N, TNC, AFTNC, and BNC. Panel mount adapters to 7mm and type N are shown on page 112. Adapters to 14mm (MPC14, compatible with GR900) are shown on page 120 in the 2400 model series.

VSWR specifications for the adapters on this page are shown in the table below.

VSWR Specifications

Model Series	VSWR (maximum) DC – 4 GHz	4 – 8 GHz	8 – 18 GHz
8022	1.04	1.08	1.08
8023	1.065	1.13	1.13
8025	1.06 (<1.03 typ)	1.14 (<1.07 typ)	1.20 (<1.15 typ)
8028	1.10	1.20 [5]	N/A

Model Series	VSWR (maximum) DC – 4 GHz	4 – 12 GHz	12 – 20 GHz
8682	1.04	1.04	1.08

[3] Precision stainless steel TNC per Maury data sheet 5E-053.

[4] Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.

[5] 4 to 10 GHz.

PRECISION ADAPTERS

"QUICK TEST" 3.5mm (QT3.5mm™) CONNECTOR

Features

- Quick and Easy Push On/Pull Off Design
- Designed For Long Life (3000 Connect/Disconnect Cycles)
- Excellent Repeatability/Low VSWR
- Guide Sleeve Design For Automated Applications

8006E1
No Nut

8006E11
3/8" Nut

8006E21
9/16" Nut

8006Q1
Guide Sleeve

Description

The QT3.5mm™ male connector incorporates a quick connect design that provides for a push on/pull off capability that mates with any commercially available SMA, 3.5mm, and 2.92mm female connectors. The optional quick 1-1/2 turn twist nut creates the best of both worlds allowing quick connect or disconnect and the increased accuracy of a thread on connector. In addition to the no nut and quick turn nut design, a guide sleeve configuration is available to provide for self aligning required in automated test stations.

The push on connector offers excellent repeatability and long life making them ideal for use in a production environment. The nut can also be torqued to 8 in/lbs making them suitable for test port applications where a calibration is required. The connectors come in four configurations: no nut, a 3/8" diameter nut, a 9/16" diameter nut, and a guide sleeve configuration.

Please call your Maury representative for a demonstration.

U. S. PATENT NO. 6,210,221

PRECISION ADAPTERS

"QUICK TEST" 3.5mm (QT3.5mm™) CONNECTOR

Electrical Specifications Chart

Model	From	To	Frequency Range (GHz)	VSWR (GHz)
8006B1	QT3.5mm™ (m) with no nut	7mm	DC — 18.0	DC — 4.0, 1.04 4.0 — 18.0, 1.08
8006B11	QT3.5mm™ (m) with 3/8" diameter nut			
8006B21	QT3.5mm™ (m) with 9/16" diameter nut			
8006C1	QT3.5mm™ (m) with no nut	NMD3.5mm (f)	DC — 26.5*	DC — 16.0, 1.08 16.0 — 26.5, 1.12
8006C11	QT3.5mm™ (m) with 3/8" diameter nut			
8006C21	QT3.5mm™ (m) with 9/16" diameter nut			
8006E1	QT3.5mm™ (m) with no nut	3.5mm (f)	DC — 26.5*	DC — 16.0, 1.05 16.0 — 26.5, 1.08
8006E11	QT3.5mm™ (m) with 3/8" diameter nut			
8006E21	QT3.5mm™ (m) with 9/16" diameter nut			
8006F1	QT3.5mm™ (m) with no nut	3.5mm (m)	DC — 26.5*	DC — 16.0, 1.05 16.0 — 26.5, 1.08
8006F11	QT3.5mm™ (m) with 3/8" diameter nut			
8006F21	QT3.5mm™ (m) with 9/16" diameter nut			
8006G1	QT3.5mm™ (m) with no nut	Type N (f)	DC — 18.0	DC — 4.0, 1.05 4.0 — 18.0, 1.08
8006G11	QT3.5mm™ (m) with 3/8" diameter nut			
8006G21	QT3.5mm™ (m) with 9/16" diameter nut			
8006H1	QT3.5mm™ (m) with no nut	Type N (m)	DC — 18.0	DC — 4.0, 1.05 4.0 — 18.0, 1.08
8006H11	QT3.5mm™ (m) with 3/8" diameter nut			
8006H21	QT3.5mm™ (m) with 9/16" diameter nut			
8006K1	QT3.5mm™ (m) with no nut	NMD2.4mm (f)	DC — 26.5*	DC — 16.0, 1.08 16.0 — 26.5, 1.12
8006K11	QT3.5mm™ (m) with 3/8" diameter nut			
8006K21	QT3.5mm™ (m) with 9/16" diameter nut			
8006Q1	QT3.5mm™ (m) guide sleeve	3.5mm (f)	DC — 26.5*	DC — 16.0, 1.05 16.0 — 26.5, 1.08

* Slightly reduced VSWR specs to 34 GHz.

Repeatability Specifications Chart

Repeatability [1]	DC — 18 GHz	18 — 26.5 GHz
Push on mode	> 45 dB	> 40 dB
Torque mode	> 50 dB	> 50 dB
Hand torque	> 50 dB	> 50 dB

[1] Repeatability specifications are for a minimum of 3000 connect/disconnect cycles.

PRECISION ADAPTERS

3.5mm, 7mm, TYPE N, AND NMD PANEL MOUNT

8022N 8022P 8023P1 8023P2

Description

The 8022N/P and 8023P/T are precision panel mount adapters designed for OEM applications, special test fixturing, and custom designs. These units adapt 3.5mm female or male to 7mm or type N female or male.

Model	Adapts From	Adapts To	Outline*
8022N	3.5mm female	7mm	Figure 1
8022P	3.5mm male	7mm	Figure 2
8023P1	3.5mm male	Type N female	Figure 3
8023P2	3.5mm male	Type N male	Figure 4
8023T1	3.5mm female	Type N female	Figure 5
8023T2	3.5mm female	Type N male	Figure 6
8009D	3.5mm male	NMD male	not shown [1]
8009E	3.5mm male	NMD male	not shown [1]
8009E1	3.5mm male	NMD male	not shown [1]

*See Figure 7 for flange outline layout.

Specifications

Frequency Range ..... DC to 18 GHz

Nominal Impedance ..... 50 ohm

Model Series	VSWR (maximum) DC — 4 GHz	VSWR (maximum) 4 — 18 GHz
8022	1.040	1.08
8023	1.065	1.13

Model Series	VSWR (maximum) DC — 18 GHz	VSWR (maximum) DC — 26 GHz
8009	1.060	1.10

[1] Request Maury data sheet 2B-034B for detailed specifications.

Figure 1

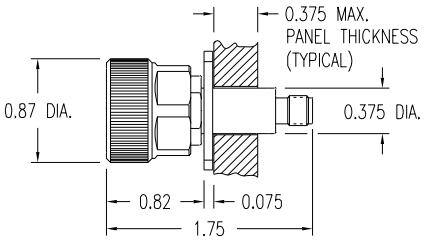


Figure 2

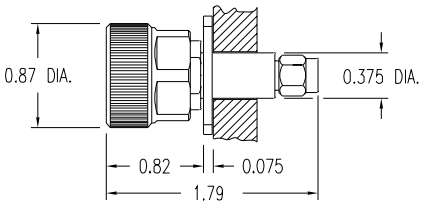


Figure 3

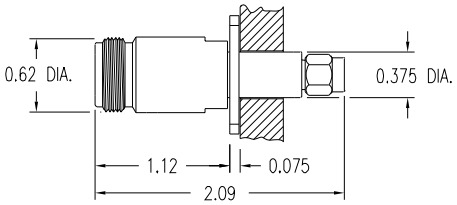


Figure 4

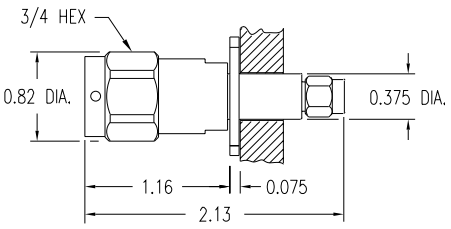


Figure 5

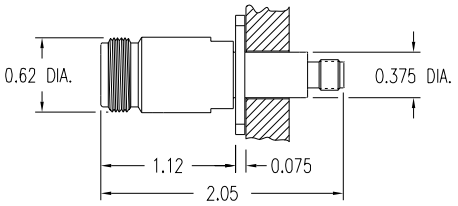


Figure 6

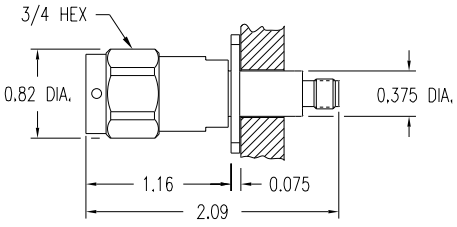
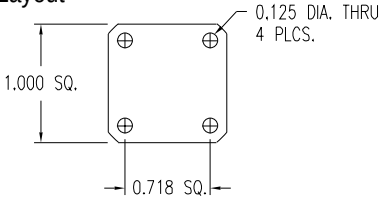


Figure 7 – Flange Layout



PRECISION ADAPTERS

3.5mm IN-SERIES ADAPTERS


8021A2


8021B2


8021D1


8021E1


8021P

TEST PORT SAVER


8021C2

General

These adapters are low loss, low VSWR devices that operate from DC to 34 GHz. The 8021A, B and C models are phase matched for VNA applications.

Model		Adapts From	Adapts To	Insertion Length inches (cm)
8021A2	[1]	3.5mm female	3.5mm female	0.65 (1.65)
8021B2	[1]	3.5mm male	3.5mm male	0.65 (1.65)
8021C2	[1]	3.5mm female	3.5mm male	0.65 (1.65)
8021D1	[2]	3.5mm female	3.5mm female	(See Fig. 1)
8021E1	[3]	3.5mm female	3.5mm female	(See Fig. 2)
8021P	[4]	3.5mm female	3.5mm male	0.95 (2.41)
8021K1	[5]	3.5mm male	3.5mm female	(See Fig. 3)
8021L1	[5]	3.5mm female	3.5mm female	(See Fig. 4)

Specifications

Frequency Range ..... DC to 34 GHz

Maximum VSWR ..... DC to 18 GHz, 1.05
18 to 26.5 GHz, 1.08
26.5 to 34 GHz, 1.12

Reference Impedance ..... 50 ohm

Connectors ..... Precision 3.5mm per Maury data sheet 5E-062

[1] Adapters in a model series are phase matched for VNA applications.

[2] Bulkhead feedthru adapter.

[3] Panel mount adapter.

[4] Barrel design.

[5] Panel mount for instruments.

Figure 1 – Model 8021D1 Dimensions

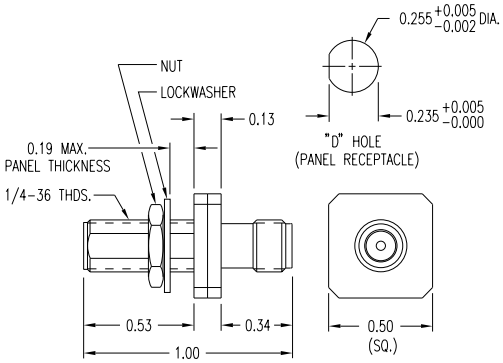


Figure 2 – Model 8021E1 Dimensions

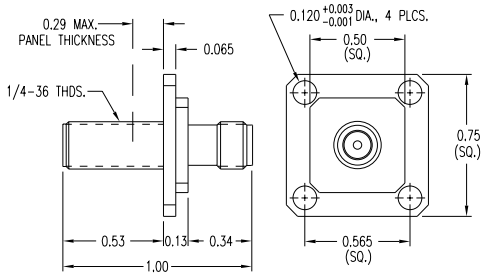


Figure 3 – Model 8021K1 Dimensions

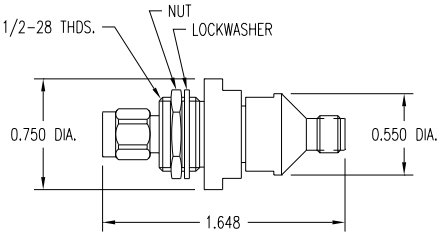
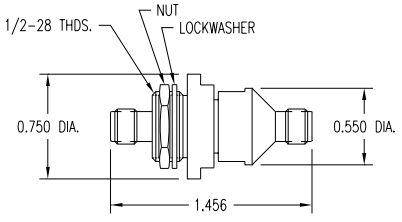


Figure 4 – Model 8021L1 Dimensions



PRECISION ADAPTERS

2.92mm (K) BETWEEN-SERIES ADAPTERS

8725A

8725B

8723A

8723D

Introduction

The K connector is a precision 2.92mm coaxial interface [1] that operates to 40 GHz. These connectors are mating compatible with both SMA and 3.5mm; consequently, **adapting from 2.92mm to lower frequency connectors such as type N, TNC, etc. can also be handled with 3.5mm adapters.**

Most adapters in the same model series are phase matched so that they can be readily interchanged for VNA measurement of non-insertable devices.

PRECISION 2.92mm (K) COAXIAL ADAPTER REFERENCE CHART

Model	Adapts From	Adapts To	Insertion Length inches	Insertion Length (cm)	Frequency Range VSWR (maximum)
8723A [2]	2.92mm (K) female	Type N female [3]	1.59	(4.04)	DC — 4 GHz, 1.07 4 — 12 GHz, 1.10 12 — 18 GHz, 1.15
8723B [2]	2.92mm (K) female	Type N male [3]	1.95	(4.95)	
8723C [2]	2.92mm (K) male	Type N female [3]	1.59	(4.04)	
8723D [2]	2.92mm (K) male	Type N male [3]	1.95	(4.95)	
8725A [2]	2.92mm (K) female	7mm	1.67	(4.24)	DC — 4 GHz, 1.05 4 — 12 GHz, 1.07 12 — 18 GHz, 1.10
8725B [2]	2.92mm (K) male	7mm	1.67	(4.24)	

[1] Precision gold plated beryllium copper 2.92mm (K) per Maury data sheet 5E-063.

[2] Phase matched.

[3] Precision stainless steel type N per Maury data sheet 5E-049.

PRECISION ADAPTERS

2.92mm (K) IN-SERIES ADAPTERS

8714A2 8714B2 8714D1 8714E1

- Low VSWR
- VNA Test Port Savers
- Square-Flange Body Design

8714C2

Description

Maury precision 2.92mm (K) in-series adapters are low VSWR and low loss devices that operate from DC to 40 GHz. The models 8714A2, B2 and C2 offer all combinations for adapting and are ideal for using with precision measurement applications. These adapters are minimum length, phase matched and feature a square-flange body for ease of connecting and prevents rolling off tables. They are useful as "test port savers" when used with vector network analyzers such as the Agilent 8510, etc. The 8714D1 and 8714E1 are bulkhead and panel mount feedthru adapters respectively, designed for instrumentation applications.

Specifications

Frequency Range ..... DC to 40 GHz
Maximum VSWR ..... DC to 4 GHz, 1.05
4 to 20 GHz, 1.08
20 to 40 GHz, 1.12
Impedance..... 50 ohm
Connectors ..... 2.92mm (K) per Maury data sheet 5E-063

Dimensions – Inches

Figure 1 – Model 8714A2

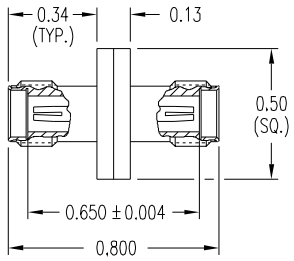


Figure 2 – Model 8714B2

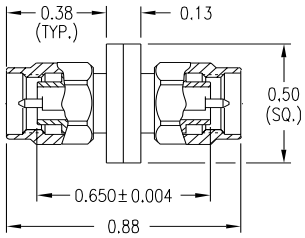


Figure 3 – Model 8714C2

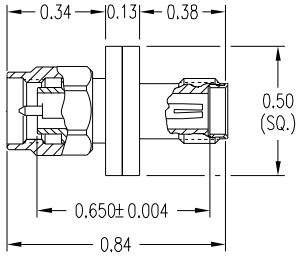


Figure 4 – Model 8714D1

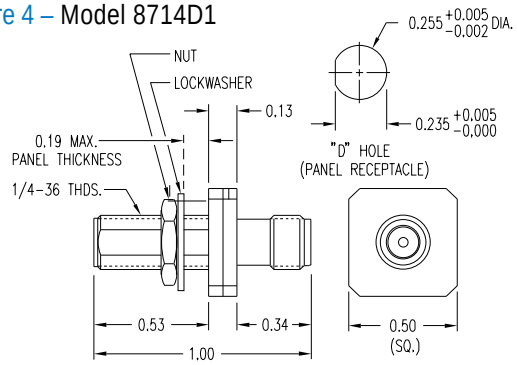
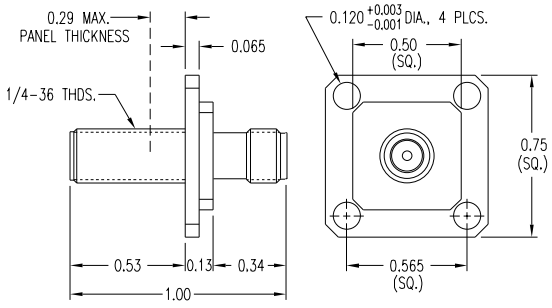


Figure 5 – Model 8714E1



PRECISION ADAPTERS

2.4mm (Q) BETWEEN-SERIES ADAPTERS

7922A

7922B

7923A

7923D

Introduction

Maury precision 2.4mm [1] adapters utilize a precision 50 GHz interface described in Maury data sheet 5E-064. These adapters feature low VSWR and insertion loss through the maximum frequency range of the adapted connector.

Model	Adapts From	Adapts To	Insertion Length inches	Insertion Length (cm)	Frequency Range VSWR (maximum)
7922A *	2.4mm female	7mm [2]	1.28	(3.25)	DC — 4.0 GHz, 1.03 4.0 — 12.0 GHz, 1.07 12.0 — 18.0 GHz, 1.08
7922B *	2.4mm male	7mm [2]	1.28	(3.25)	
7923A *	2.4mm female	Type N female [3]	1.22	(3.10)	DC — 4.0 GHz, 1.07 4.0 — 18.0 GHz, 1.12
7923B *	2.4mm female	Type N male [3]	1.58	(4.02)	
7923C *	2.4mm male	Type N female [3]	1.20	(3.05)	
7923D *	2.4mm male	Type N male [3]	1.56	(3.96)	
7926A *	2.4mm female	2.92mm (K) female [4]	0.65	(1.65)	DC — 4.0 GHz, 1.05 4.0 — 20.0 GHz, 1.08 20.0 — 40.0 GHz, 1.12
7926B *	2.4mm female	2.92mm (K) male [4]	0.65	(1.65)	
7926C *	2.4mm male	2.92mm (K) female [4]	0.65	(1.65)	
7926D *	2.4mm male	2.92mm (K) male [4]	0.65	(1.65)	
7927A *	2.4mm female	3.5mm female [5]	0.65	(1.65)	DC — 18.0 GHz, 1.06 18.0 — 26.5 GHz, 1.08 26.5 — 34.0 GHz, 1.12
7927B *	2.4mm female	3.5mm male [5]	0.65	(1.65)	
7927C *	2.4mm male	3.5mm female [5]	0.65	(1.65)	
7927D *	2.4mm male	3.5mm male [5]	0.65	(1.65)	

* Phase matched

[1] Precision gold plated beryllium copper 2.4mm per Maury data sheet 5E-064.

[2] Precision 7mm per Maury data sheet 5E-060.

[3] Precision stainless steel type N per Maury data sheet 5E-049.

[4] Precision gold plated beryllium copper 2.92mm per Maury data sheet 5E-063.

[5] Precision gold plated beryllium copper 3.5mm per Maury data sheet 5E-062.

PRECISION ADAPTERS

2.4mm (Q) IN-SERIES ADAPTERS

7921C

7921A 7921B 7921D 7921E

Description

Maury precision 2.4mm (Q) in-series adapters are low VSWR and low loss devices that operate from DC to 50 GHz. The models 7921A, B and C offer all combinations for adapting and are ideal for use in precision measurement applications. These adapters are minimum length, phase matched and feature square-flanged body for ease of connecting that also prevents rolling off tables. They are useful as "test port savers" when used with automated network analyzers such as the Agilent 8510, etc. The models 7921D and E are bulk-head and panel mount feedthru adapters, respectively, designed for instrumentation applications.

Specifications

Frequency Range ..... DC to 50 GHz

Maximum VSWR ..... DC to 26.5 GHz, 1.06
26.5 to 40.0 GHz, 1.10
40.0 to 50.0 GHz, 1.15

Impedance ..... 50 ohm

Connectors ..... 2.4mm (Q) per Maury data sheet 5E-064

Model	Adapts From	Adapts To	Figure
7921A	2.4mm (Q) female	2.4mm (Q) female	1
7921B	2.4mm (Q) male	2.4mm (Q) male	2
7921C	2.4mm (Q) female	2.4mm (Q) male	3
7921D	2.4mm (Q) female	2.4mm (Q) female [1]	4
7921E	2.4mm (Q) female	2.4mm (Q) female [2]	5

[1] Bulkhead feedthru. [2] Panel mount feedthru.

Dimensions – Inches

Figure 1

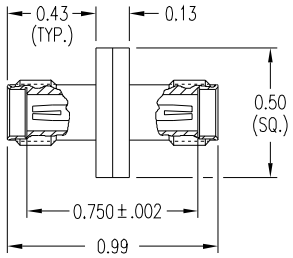


Figure 2

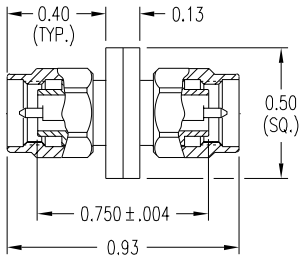


Figure 3

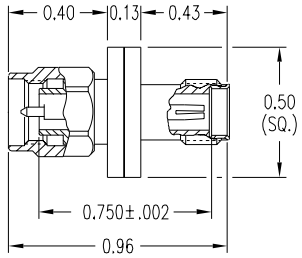


Figure 4

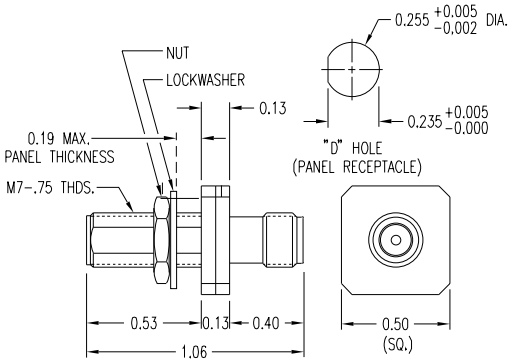
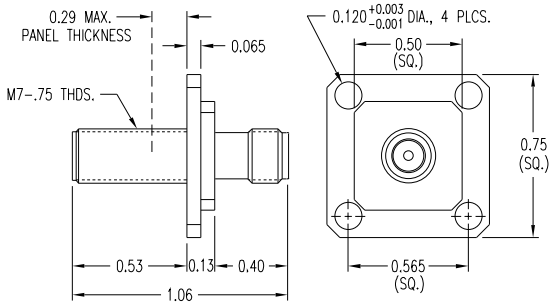


Figure 5



PRECISION ADAPTERS

MPC8 (OSSM) BETWEEN-SERIES ADAPTERS

8122A

8122B

8123A

8123D

Introduction

The Maury MPC8 [1] is a precision connector that is mode-free to 40 GHz. This connector is fully mating compatible with **SSMA** or **OSSM** (M/A-Com Omni-Spectra designation). These adapters feature low loss and VSWR through the frequency range of the adapted connector.

PRECISION MPC8 (OSSM) COAXIAL ADAPTER REFERENCE CHART

Model	Adapts From	Adapts To	Insertion Length inches	Insertion Length (cm)	Frequency Range (GHz)	VSWR (maximum)
8122A *	MPC8 female	7mm [2]	1.68	(4.27)	DC — 4	1.05
8122B *	MPC8 male	7mm [2]	1.68	(4.27)	4 — 12	1.07
					12 — 18	1.10
8123A *	MPC8 female	Type N female [3]	1.59	(4.04)	DC — 4	1.07
8123B *	MPC8 female	Type N male [3]	1.95	(4.95)	4 — 12	1.10
8123C *	MPC8 male	Type N female [3]	1.59	(4.04)	12 — 18	1.15
8123D *	MPC8 male	Type N male [3]	1.95	(4.95)		
8125A *	MPC8 female	2.92mm (K) female [4]	0.65	(1.65)	DC — 4	1.05
8125B *	MPC8 female	2.92mm (K) male [4]	0.65	(1.65)	4 — 8	1.10
8125C *	MPC8 male	2.92mm (K) female [4]	0.65	(1.65)	8 — 40	1.15
8125D *	MPC8 male	2.92mm (K) male [4]	0.65	(1.65)		

* Phase matched

[1] MPC8 is a SSMA mateable connector that is mode-free to 40 GHz.

[2] Precision 7mm per Maury data sheet 5E-060.

[3] Precision stainless steel type N per Maury data sheet 5E-049.

[4] Precision 2.92mm per Maury data sheet 5E-060.

PRECISION ADAPTERS

7mm COAXIAL ADAPTERS

Maury offers an extensive line of coaxial adapters from precision 7mm to all common laboratory and systems coaxial connectors. 7mm adapters are also available for special purpose connectors such as EIA rigid line connectors. The chart below lists the 7mm adapters to other coaxial connector series available from Maury. **If you cannot find the adapter you require, please consult our Sales Department or your local representative for more information.**

NOTE: For 7mm to 2.4mm (Q) connectors, see page 116. For 7mm to 3.5mm, see pages 109 and 112. For 7mm to 2.92mm (MPC3, K) [1] connectors, see page114. For 7mm to MPC8 (OSSM) [2] connectors, see page 118.

PRECISION 7mm ADAPTER REFERENCE CHART

Model	Connector Adapted To	Insertion Length inches	(cm)	VSWR (maximum)	Frequency Range
2606C *	Type N female [3]	1.51	(3.84)	DC — 4.0 GHz, 1.03 4.0 — 9.0 GHz, 1.04 9.0 — 18.0 GHz, 1.07	DC — 18.0 GHz
2606D *	Type N male [3]	1.51	(3.84)		
2607A1	14mm (GR900BT)	2.01	(5.10)	1.004 + 0.004f (GHz)	DC — 8.5 GHz
2617	7/8 EIA	2.68	(6.81)	DC — 1.0 GHz, 1.02 1.0 — 2.0 GHz, 1.05 2.0 — 3.0 GHz, 1.10 3.0 — 4.0 GHz, 1.15	DC — 4.0 GHz
2621A1 *	BNC female	2.16	(5.48)	DC — 4.0 GHz, 1.05 4.0 — 10.0 GHz, 1.15	DC — 10.0 GHz
2621B1 *	BNC male	2.07	(5.25)		
2622A1 *	TNC female [4]	1.68	(4.26)	DC — 4.0 GHz, 1.05 4.0 — 18.0 GHz, 1.15	DC — 18.0 GHz
2622B *	TNC male [4]	1.55	(3.94)		
2623A *	C female	2.37	(6.02)	DC — 4.0 GHz, 1.05 4.0 — 10.0 GHz, 1.10	DC — 10.0 GHz
2623B *	C male	2.22	(5.64)		
2624A *	SC female [5]	2.36	(5.99)	DC — 4.0 GHz, 1.04 4.0 — 8.0 GHz, 1.08 8.0 — 10.0 GHz, 1.12	DC — 8.0 GHz
2624B *	SC male [5]	2.22	(5.64)		
2625A *	SMA female [6]	1.67	(4.24)	DC — 4.0 GHz, 1.05 4.0 — 10.0 GHz, 1.08 10.0 — 18.0 GHz, 1.15	DC — 18.0 GHz
2625B *	SMA male [6]	1.67	(4.24)		
2657A *	HN female [7]	3.00	(7.62)	DC — 4.0 GHz, 1.05 4.0 — 8.5 GHz, 1.12	DC — 8.5 GHz
2657B *	HN male [7]	2.70	(6.86)		
8692A	AFTNC female [8]	1.88	(4.78)	DC — 4.0 GHz, 1.04 4.0 — 18.0 GHz, 1.06	DC — 18 GHz
8692B	AFTNC male [8]	1.82	(4.62)		

* Female and male adapters in the same connector series are phase matched for VNA applications.

[1] MPC3 is an SMA mateable connector that is mode free to 40 GHz.
[2] MPC8 is an OSSM mateable connector that is mode free to 40 GHz.
[3] Precision stainless steel type N per Maury data sheet 5E-049.
[4] Precision stainless steel TNC per 5E-053.
[5] Precision stainless steel SC per Maury data sheet 5E-050.
[6] Precision stainless steel SMA per MIL-C-39012.
[7] Precision stainless steel HN per Maury data sheet 5E-051.
[8] Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.

PRECISION ADAPTERS

14mm (MPC14) COAXIAL ADAPTERS (2406 AND 2407 SERIES)

2406C1 2406D1

2407A1 2407B1

General

Maury 14mm coaxial adapters utilize a precision air dielectric connector that is fully mating compatible with and equivalent to the GR900BT connector. These connectors are often used in highly critical laboratory applications at frequencies up to 8.5 GHz. The Maury adapters feature an improved connector with a one-inch hexagonal coupling nut so that the connectors may be tightened with a calibrated [1] torque wrench (see page 172) for excellent connection repeatability.

In addition to coaxial adapters, Maury also offers a full line of components utilizing the 14mm precision interface. Many of these are direct replacement for the original GR models. Please contact our Sales Department for a cross reference to the original GR model numbers. Maury 14mm products also include VNA calibration kits, power standard sets, directional couplers (page 159) and noise terminations.

The adapters described below are in the model 2400 series which covers adapters to 3.5mm, type N and EIA rigid line connectors. The 3.5mm adapters can also be used for connection to SMA and 2.92mm (the frequency range is limited to 8.5 GHz by the 14mm connector). If it is required to adapt to 7mm, please see model 2607A1 (page 119).

Specifications

Model	Adapts To	Insertion Length inches (cm)	VSWR (Maximum)
2406C1	Type N female	1.95 (4.95)	1.006 + 0.006f GHz
2406D1	Type N male	2.03 (5.16)	1.005 + 0.006f GHz
2407A1*	3.5mm female	2.01 (5.11)	1.020 + 0.006f GHz
2407B1*	3.5mm male	2.01 (5.11)	1.020 + 0.008f GHz
2417B	7/8 EIA	3.04 (7.72)	1.012 + 0.008f GHz
2418	1-5/8 EIA	3.90 (9.91)	DC — 1.0 GHz, 1.02 1.0 — 2.5 GHz, 1.03

* Phase matched

Frequency Range:

Type N adapters ..... DC to 8.5 GHz

3.5mm adapters ..... DC to 8.5 GHz

7/8 EIA adapters ..... DC to 5.0 GHz

1-5/8 EIA adapters ..... DC to 2.5 GHz

[1] The torque wrenches listed are non-calibrated models. Additional fees apply for calibration.

PRECISION ADAPTERS

7-16 ADAPTERS (2706 AND 2707 SERIES)


2706A


2706D


2707A


2707B

Description

These adapters utilize precision 7-16 [1] to type N or 7mm connectors which cover the frequency ranges from DC to 7.5 GHz. They are fabricated from stainless steel and beryllium copper alloy to provide a rugged, long-wearing and highly repeatable interface with very low VSWR. These characteristics make the Maury 7-16 adapters ideal for laboratory measurements in wireless applications.

Most adapters in the same model series are phase matched so that they can be readily interchanged for VNA measurement of non-insertable devices. The chart below shows the available models.

Maury also supplies these adapters in sets, together with a full complement of calibration standards in the 2750 series VNA calibration kits (see page 26).

PRECISION 7-16 COAXIAL ADAPTER REFERENCE CHART

Model	Adapts From	Adapts To	Insertion Length inches	Insertion Length (cm)	Frequency Range Maximum VSWR
2705A	7-16 female	3.5mm female [2]	2.45	(6.21)	DC — 7.5 GHz, 1.040
2705B	7-16 female	3.5mm male [2]	2.45	(6.21)	
2705C	7-16 male	3.5mm female [2]	2.45	(6.21)	
2705D	7-16 male	3.5mm male [2]	2.45	(6.21)	
2706A	7-16 female	Type N female [3]	2.86	(7.26)	DC — 7.5 GHz, 1.03
2706B	7-16 female	Type N male [3]	2.86	(7.26)	
2706C	7-16 male	Type N female [3]	2.86	(7.26)	
2706D	7-16 male	Type N male [3]	2.86	(7.26)	
2706E	7-16 male	Type N female [3] [5]	2.86	(7.26)	
2706F	7-16 male	Type N male [3] [5]	2.86	(7.26)	
2707A	7-16 female	7mm [4]	2.56	(6.50)	DC — 7.5 GHz, 1.03
2707B	7-16 male	7mm [4]	2.56	(6.50)	
2707C	7-16 male	7mm [4] [5]	2.56	(6.50)	
2712A	7-16 female	7-16 female	1.83	(4.65)	DC — 7.5 GHz, 1.025
2712B	7-16 male	7-16 male	1.83	(4.65)	
2712C	7-16 female	7-16 male	1.83	(4.65)	

[1] The Maury 7-16 connectors are rugged calibration grade connectors that exceed the requirements for IEC169-4 reference grade and BSEN122190 grade 0 specifications.

[2] Precision 3.5mm per Maury data sheet 5E-062.

[3] Precision stainless steel type N per Maury data sheet 5E-049.

[4] Precision 7mm per Maury data sheet 5E-060.

[5] Test port adapter for use with precision 7-16 air lines.

PRECISION ADAPTERS

LPC/OSP™ ADAPTERS (8787x SERIES)

8787R

8787T

8787G

8787H

Description

The LPC/OSP™ [1] connectors are designed to provide a precisely repeatable mated interface for calibration purposes and for test of production components which use the standard OSP™ series blind-mate connectors.

Interface dimensions of the LPC/OSP™ connectors are tightly controlled, and a threaded coupling mechanism utilizing a retractable, hexagonal coupling nut on the male connector, permit the use of a calibrated torque wrench (8 in/lbs) to further improve the repeatability of the electrical performance of the mated pair. Both the female and male LPC/OSP™ connectors are fully mating compatible with the standard OSP™ [2] series and with Dynawave's Dynamate™ series [3] blind-mate connectors.

Most adapters in the same model series are phase matched so that they can be readily interchanged for VNA measurement of non-insertable devices.

PRECISION LPC/OSP™ COAXIAL ADAPTER REFERENCE CHART

Model	Adapts From	Adapts To	Insertion Length inches	Insertion Length (cm)	Frequency Range Maximum VSWR
8787Q [4]	LPC/OSP™ female	3.5mm female [5]	1.50	(3.81)	
8787R [4]	LPC/OSP™ female	3.5mm male [5]	1.50	(3.81)	DC — 4.0 GHz, 1.040
8787S [4]	LPC/OSP™ male	3.5mm female [5]	1.50	(3.81)	4.0 — 19.0 GHz, 1.080
8787T [4]	LPC/OSP™ male	3.5mm male [5]	1.50	(3.81)	
8787G [4]	LPC/OSP™ female	7mm [6]	2.10	(5.32)	DC — 4.0 GHz, 1.040
8787H [4]	LPC/OSP™ male	7mm [6]	2.10	(5.32)	4.0 — 18.0 GHz, 1.080
8787J [4]	LPC/OSP™ female	Type N male [1]	2.40	(6.08)	DC — 18.0 GHz, 1.065
8787K [4]	LPC/OSP™ male	Type N male [1]	2.40	(6.08)	4.0 — 18.0 GHz, 1.130

[1] Precision LPC/OSP™ per Maury data sheet 5E-065.
[2] OSP™ is a trademark of M/A-Com, Inc.
[3] Dynamate™ is a trademark of Dynawave, Inc.
[4] Phase matched.
[5] Precision 3.5mm per Maury data sheet 5E-002.
[6] Precision 7mm per Maury data sheet 5E-060.
[7] Precision stainless steel type N per Maury data sheet 5E-049.

PRECISION ADAPTERS

RIGID LINE EIA ADAPTERS

2013

2111B

Model	Adapts From	Adapts To	Frequency Range	VSWR (maximum)
2011B	7/8 EIA	Type N female [1]	DC — 1.0 GHz	1.03
2012B	7/8 EIA	Type N male [1]	1.0 — 2.5 GHz	1.05
2013	7/8 EIA	1-5/8 EIA	DC — 2.5 GHz	1.05
2111B	1-5/8 EIA	Type N female [1]	DC — 1.0 GHz	1.03
2112B	1-5/8 EIA	Type N male [1]	1.0 — 2.5 GHz	1.05

IN-SERIES TNC ADAPTERS

232B2

8688A

8688B

Model	Adapts From	Adapts To	Frequency Range	VSWR (maximum)
232A2 [2] [3]	TNC female	TNC female [4]	DC — 4.0 GHz	1.06
232B2 [2] [3]	TNC male	TNC male [4]	4.0 — 7.0 GHz	1.10
232C2 [2] [3]	TNC female	TNC male [4]	7.0 — 18.0 GHz	1.14
8688A [5]	AFTNC female	AFTNC female	DC — 4.0 GHz	1.04
8688B [5]	AFTNC male	AFTNC male	4.0 — 8.0 GHz	1.08
8688C [5]	AFTNC female	AFTNC male	8.0 — 20.0 GHz	1.12

[1] Precision stainless steel type N per Maury data sheet 5E-049.
[2] Improved versions of models 232A, B, and C.
[3] Phase matched.
[4] Precision stainless steel TNC per Maury data sheet 5E-053.
[5] Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.

PRECISION ADAPTERS

SC ADAPTERS

IN-SERIES AND BETWEEN-SERIES (TYPE N)

8451A 8451B1 8451C 8453A 8453B1 8453C 8453D

Model	Adapts From	Adapts To	Frequency Range (GHz)	VSWR (maximum)
8451A	SC female	SC female	DC — 4.0	1.04
8451B1	SC male	SC male	4.0 — 8.0	1.08
8451C	SC female	SC male	8.0 — 10.0	1.12
8453A	SC female	Type N female		
8453B1	SC male	Type N female	DC — 4.0	1.06
8453C	SC female	Type N male	4.0 — 8.0	1.10
8453D	SC male	Type N male	8.0 — 11.0	1.15

75 ohm BNC ADAPTERS

General

The 8582D1 and D2 adapters convert a 75 ohm BNC connection to 7mm. These are connector adapters only, so the VSWR measured from either port will be at least 1.50. In general, this is not significant, as the primary purpose of these adapters is connection to a network analyzer and the junction mismatch is calibrated out.

Model	Adapts From	Adapts To	Frequency Range (GHz)
8582D1	75 ohm BNC female	7mm	DC — 2
8582D2	75 ohm BNC male	7mm	

PRECISION FIXED TERMINATIONS

TYPE N CONNECTORS (2510 SERIES)

Description

The 2510 series fixed terminations (utilizing type N connectors) are precision, broadband, low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. Depending upon the frequency range and required calibration effectiveness of a vector or scalar network analyzer (VNA or SNA, respectively), specific models can be used for full or lowband one-port Z_0 calibration and full two-port, isolation calibration.

2510A6 2510B6

Specifications

Frequency Range, VSWR ..... See chart

Power Rating ..... 1 watt CW, 1 kW peak

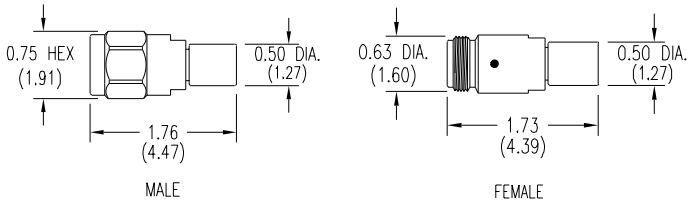
Impedance ..... 50 ohm (nominal)

Connectors:

2510 series ..... Type N [1]

Size ..... See ***Dimensions***

Dimensions – Inches (cm)



Available Models

Model		Frequency Range (GHz)	VSWR (maximum)	Connector
Female	Male			
2510A4	2510B4	DC — 4 4 — 12 12 — 18	1.04 1.10 1.15	Type N [1]
2510A5	2510B5	DC — 4 4 — 18	1.04 1.10	Type N [1]
2510A6	2510B6	DC — 2 2 — 4 4 — 18	1.02 1.04 1.06	Type N [1]
2510A7	2510B7	DC — 2 2 — 4 4 — 18	1.01 1.04 1.12	Type N [1]
2510A8	2510B8	DC — 3 3 — 6	1.01 1.02	Type N [1]

[1] Precision type N per Maury data sheet 5E-049.

PRECISION FIXED TERMINATIONS

TNC CONNECTORS (332 SERIES)

AFTNC CONNECTORS (8684 SERIES)

332A

332B

8684A

8684B

Description

The 332 series and 8684 series fixed terminations (utilizing TNC and AFTNC connectors respectively) are precision, broadband, low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. Depending upon the frequency range and required calibration effectiveness of a vector or scalar network analyzer (VNA or SNA, respectively), specific models can be used for full or lowband one-port Z_0 calibration and full two-port, isolation calibration.

Specifications

Frequency Range, VSWR ..... See chart

Power Rating ..... 1 watt CW, 1 kW peak

Impedance ..... 50 ohm (nominal)

Connectors:

332 series ..... TNC [1]

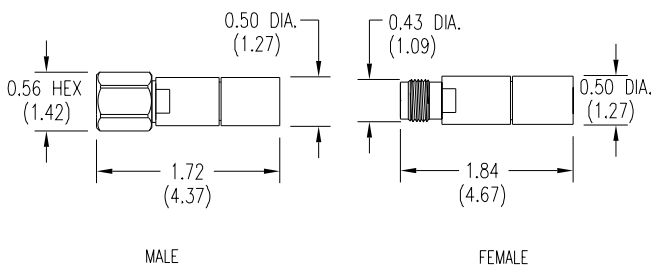
8684 series ..... AFTNC [2]

Size ..... See ***Dimensions***

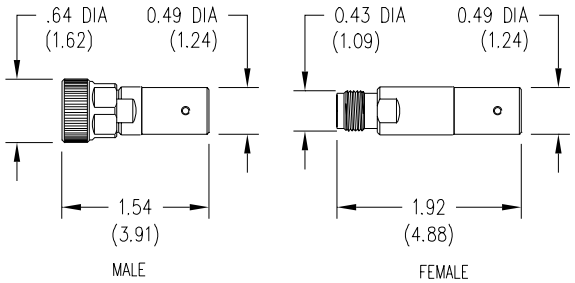
Available Models

Model		Frequency Range (GHz)	VSWR (maximum)	Connector
Female	Male			
332A	332B	DC — 4 4 — 12 12 — 18	1.10 1.15 1.20	TNC [1]
332E	332F	DC — 4 4 — 12 12 — 18	1.06 1.10 1.15	TNC [1]
332A3	332B3	DC — 3 3 — 6	1.02 1.04	TNC [1]
8684A	8684B	DC — 4 4 — 12 12 — 20	1.04 1.08 1.10	AFTNC [2]

Dimensions – Inches (cm)



Model 332 Series



Model 8684 Series

[1] Precision TNC per Maury data sheet 5E-053

[2] Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.

PRECISION FIXED TERMINATIONS

3.5mm CONNECTORS (8031 SERIES), DC TO 34 GHz

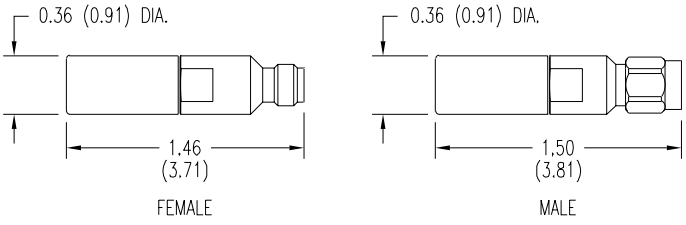
2.92mm (K) CONNECTORS (8775 SERIES), DC TO 40 GHz

8031A 8031B

Description

The 8031 and 8775 series fixed terminations (utilizing 3.5mm and 2.92mm connectors respectively) are precision, broadband, low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. Depending upon the frequency range and required calibration effectiveness of a vector or scalar network analyzer (VNA or SNA, respectively), specific models can be used for full or lowband one-port Z_0 calibration and full two-port isolation calibration. The connectors on both model series are fully mating compatible with SMA and can be used in test applications requiring a low VSWR termination with that connector. They are also mating compatible with each other and can be interchanged in applications where the frequency range is compatible.

Dimensions – Inches (cm)



Specifications

Frequency Range, VSWR ..... See chart
Power Rating ..... 0.5 watt CW, 0.25 kW peak
Impedance ..... 50 ohm (nominal)
Connectors:
8031 series ..... 3.5mm [1]
8775 series ..... 2.92mm (K) [2]
Size ..... See ***Dimensions***

Model		Frequency Range (GHz)	VSWR (maximum)	Connector
Female	Male			
8031A2	8031B2	DC — 4.0	1.05	3.5mm [1]
		4.0 — 12.0	1.10	
		12.0 — 18.0	1.15	
		18.0 — 26.5	1.20	
		26.5 — 34.0	1.25	
8031A4	8031B4	DC — 2.0	1.02	3.5mm [1]
		2.0 — 4.0	1.04	
		4.0 — 18.0	1.10	
		18.0 — 26.5	1.15	
8031A5	8031B5	DC — 3.0	1.02	3.5mm [1]
		3.0 — 6.0	1.032	
		6.0 — 20.0	1.052	
		20.0 — 26.5	1.083	
8775A2	8775B2	DC — 4.0	1.016	2.92mm [2]
		4.0 — 40.0	1.12	

[1] Precision 3.5mm per Maury data sheet 5E-062.
[2] Precision 2.92mm per Maury data sheet 5E-063.

PRECISION FIXED TERMINATIONS

7mm CONNECTORS (2610 SERIES)

14mm (GR900) CONNECTORS (2410 SERIES)

2610C

2410A

Description

The 2610 and 2410 series fixed terminations (utilizing 7mm and 14mm connectors respectively) are precision, broadband, low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. Depending upon the frequency range and required calibration effectiveness of a vector or scalar network analyzer (VNA or SNA, respectively), specific models can be used for full or lowband one-port Z_0 calibration and full two-port isolation calibration. The precision 14mm connector used on the 2410 series – also known as the MPC14 – is fully compatible with connectors in the GR900 series.

Specifications

Frequency Range, VSWR ..... See chart

Power Rating:

2610 series ..... 1 watt CW, 1 kW peak

2410 series ..... 3 watts CW, 1 kW peak

Impedance ..... 50 ohm (nominal)

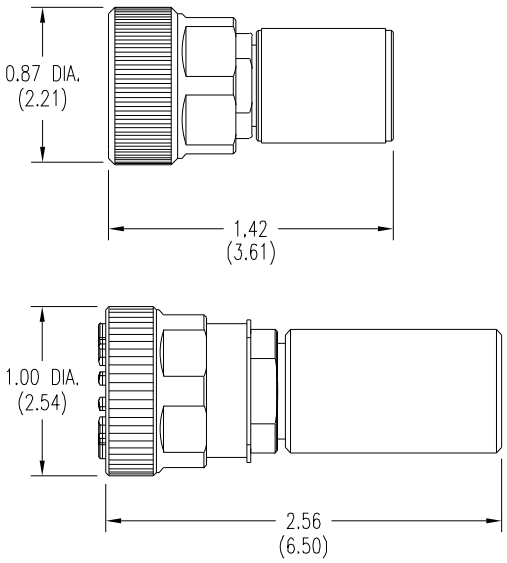
Connectors:

2610 series ..... 7mm [1]

2410 series ..... 14mm (MPC14) [2]

Size ..... See ***Dimensions***

Dimensions – Inches (cm)



Model	Frequency Range (GHz)	VSWR (maximum)	Connector
2610C	DC — 4.0 4.0 — 18.0	1.04 1.08	7mm [1]
2610D	DC — 18.0	1.04	7mm [1]
2610F	DC — 1.0 1.0 — 2.0 2.0 — 8.0 8.0 — 18.0	1.005 1.01 1.03 1.06	7mm [1]
2610G	DC — 18.0	1.025	7mm [1]
2410A	DC — 8.5	1.005 + .004 (GHz)	14mm [2]

[1] Precision 7mm per Maury data sheet 5E-060.

[2] Precision 14mm connector fully mating compatible with the GR900 series.

PRECISION FIXED TERMINATIONS

7-16 CONNECTORS (2710 SERIES)

Description

The 2710 series fixed terminations are precision, broadband, low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. They can be used for full band one-port Z_0 calibration and full two-port isolation calibration.

Specifications

Frequency Range, VSWR ..... DC – 7.5 GHz, 1.02 max.
Impedance ..... 50 ohm (nominal)
Connectors ..... Precision 7-16 [1]

FIXED TERMINATIONS

General Purpose

Description

Maury produces a line of terminations which feature low VSWR and precision connectors for general laboratory usage. Most of these terminations are sufficiently well matched for low frequency VNA Z_0 calibrations and all can be used for isolation calibrations within the appropriate frequency range.

Model		Connector	Frequency Range (GHz)	VSWR (maximum)	Power Rating
Female	Male				
335A	335B1	HN [2]	DC — 1.0 1.0 — 4.0 4.0 — 8.0	1.05 1.10 1.20	1 watt CW 1 kW peak
336A	336B	SC [3]	DC — 1.0 1.0 — 4.0 4.0 — 10.0	1.03 1.07 1.20	
351A2	351B2	BNC	DC — 2.0 2.0 — 4.0 4.0 — 10.0	1.04 1.10 1.20	2 watts CW 1 kW peak
354A	354B	C	DC — 1.0 1.0 — 4.0 4.0 — 10.0	1.15 1.15 1.30	

[1] The Maury 7-16 connectors are rugged calibration grade connectors that exceed the requirements for IEC169-4 reference grade and BSEN122190 grade 0 specifications.

[2] Precision stainless steel connector per Maury data sheet 5E-051.

[3] Precision stainless steel SC per Maury data sheet 5E-050.

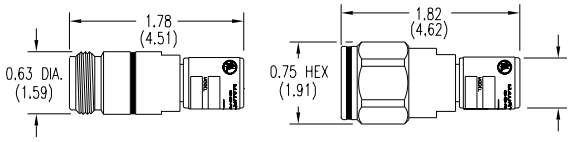
PRECISION FIXED TERMINATIONS

75 ohm TYPE N CONNECTORS (8883 SERIES)
75 ohm BNC CONNECTORS (8583 SERIES)

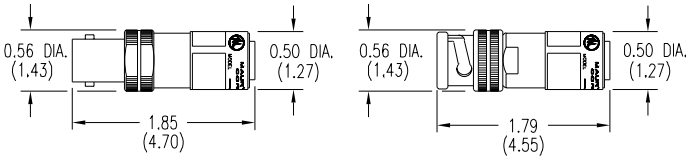
Description

The 8883 and 8583 series fixed terminations are precision, broadband, low VSWR, 75 ohm terminations utilizing type N and BNC connectors, respectively. These terminations are suited to a wide variety of general purpose and precision laboratory applications; however, the primary usage is for 75 ohm reference Z_0 calibration of network analyzers at frequencies up to 2 GHz. All Maury 75 ohm components are identifiable by a black ring encircling the body of the component. Type N 75 ohm connectors, in particular, should never be mated to their 50 ohm counterparts as that could result in damage to the 50 ohm female connector and/or poor, erratic electrical performance.

Dimensions – Inches (cm)



75 ohm Type N (Series 8883)



75 ohm BNC (Series 8583)

Specifications

Frequency Range ..... DC to 2 GHz
VSWR:
- 8883 series (type N) ..... 1.01 maximum
- 8583 series (BNC) ..... 1.02 maximum

Power Rating ..... 1 watt CW
Impedance ..... 75 ohm (nominal)
Connectors:
- 8883A ..... Precision 75 ohm type N female [1]
- 8883B ..... Precision 75 ohm type N male [1]
- 8583A ..... Precision 75 ohm BNC female
- 8583B ..... Precision 75 ohm BNC male

Size ..... See ***Dimensions***

[1] Connector interface per Maury data sheet 5E-054.

SLIDING TERMINATIONS

General

A sliding termination (or sliding load) consists of a precision, movable, tapered termination in a highly accurate, air dielectric transmission line.

These instruments are basic tools for precision microwave measurements. One general application is "load separation" measurements in which the reflection from the terminating element can be separated from that of the test device. Load separation using sliding loads is a key element in the calibration of vector network analyzers (VNAs). The technique is also used in the measurement of the reflection from two-port devices, particularly "non-insertable", (e.g., waveguide-to-coax adapters, and the directivity of directional couplers).

We manufacture sliding terminations which offer a range of performance and convenience features. These include metrology grade and high precision units with integral, dedicated connectors; precision units which permit changing the sex of the connector within the same connector series; and true, modular instruments which permit changing the connector type.

SLIDING TERMINATIONS

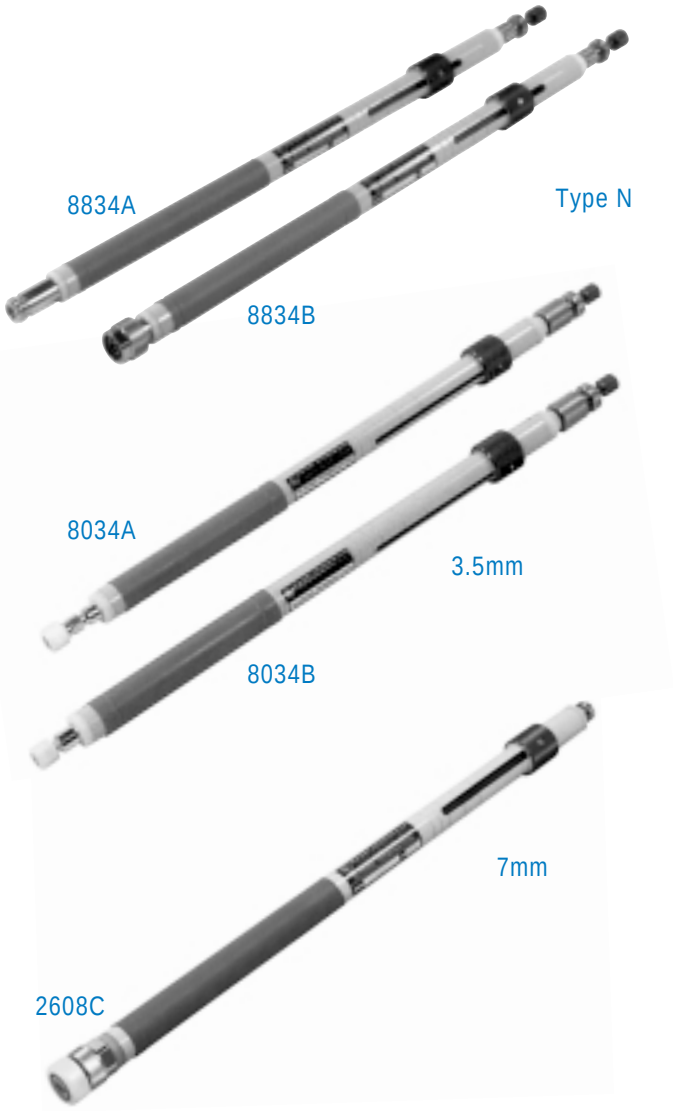
METROLOGY GRADE

Description

These metrology grade sliding terminations achieve a high level of accuracy, stability and repeatability as impedance standards for calibrating vector network analyzers (VNAs) and in other critical, precision measurement applications.

These instruments feature a one-piece inner and outer conductor with a seamless, integral, beadless (air dielectric) connector that provides an extremely accurate impedance reference. An external jacket enhances thermal stability by insulating the transmission line. When used with "thread-on" connector gages, a "flush set" mechanism allows center conductor adjustment for a coplanar inner and outer conductor interface at the connector mating plane. The 8034( ), 8777( ), and 8834( ) terminations (3.5mm and type N, respectively) feature a "pull back" mechanism which automatically locks the center conductor to a previously set flush condition, and thereby aids in achieving a flush connection.

Terminations with sexed connectors are available in female and male versions, or as a set. The 8034A 3.5mm and the 8834A type N female termination also features a precision slotless center conductor contact for optimum accuracy.



Specifications

Model	Connector Type	Maximum VSWR [1] and Frequency Range	Air line Accuracy [2]	Power Handling
2608C [3]	LPC7 [4]	1.035, 1.8 — 18.0 GHz	62 dB	1.0 watt CW, 1.0 kW peak
8034A	3.5mm female	1.090, 2.0 — 4.0 GHz	50 dB	
8034B	3.5mm male	1.050, 4.0 — 34.0 GHz		
8034C [3]	Set consisting of 1 ea. 8034A and 1 ea. 8034B			
8777A	2.92mm female	1.080, 4.0 — 8.0 GHz	42 dB (4 — 20 GHz)	0.5 watt CW, 0.5 kW peak
8777B	2.92mm male	1.040, 8.0 — 40.0 GHz	40 dB (20 — 40 GHz)	
8834A	Type N female	1.035, 2.0 — 18.0 GHz	54 dB	1.0 watt CW, 1.0 kW peak
8834B	Type N male			
8834C [3]	Set consisting of 1 ea. 8834A and 1 ea. 8834B			

[1] Max. VSWR (50 ohm reference) of the terminating element alone.

[2] Equivalent return loss of the air line impedance (50 ohm reference).

[3] Supplied in a foam-lined wooden instrument case.

[4] Air interface connector with a spring-loaded, self-centering, center pin that mates with standard 7mm connectors per Maury data sheet 5E-061.

SLIDING TERMINATIONS

2.92mm (K) AND 3.5mm CONNECTORS

481C

Description

These precision sliding terminations have interchangeable female and male connectors, eliminating the need for separate female and male loads for each connector. The 481C has a center conductor and connector body for the female and male interfaces. The 8035A has a single center conductor and interchangeable female and male center contacts and connector bodies. Each model comes in a foam-lined wooden instrument case.

The 481C and 8035A are characterized by highly accurate, 50 ohm air line impedance and low terminating element VSWR. The connectors are beadless (air dielectric), and the movable center conductors can be set to the correct connector interface conditions with the aid of an appropriate connector gage.

The travel of the movable loads is at least 1/2 wavelength (at the lowest rated frequency) so that frequencies within the rated phase range of the load reflection can be reversed and separated from other in-system reflections.

Specifications

Model	Connectors (Female & Male)	Frequency Range (GHz)	Maximum VSWR (Terminating Element)	Air line Accuracy [1]	Power Handling
481C	MPC3 [2]	8.2 — 40.0	1.06, 8.2 — 12.4 GHz	46 dB	0.5 watt CW, 0.25 kW peak
481D	MPC8 (OSSM)		1.04, 12.4 — 40.0 GHz	56 dB	0.5 watt CW, 1.0 kW peak
8035A	3.5mm [3]	2.0 —34.0	1.09 (<1.06 typ), 2.0 — 4.0 GHz 1.05(<1.03 typ), 4.0 — 34.0 GHz	44 dB	1.0 watt CW, 1.0 kW peak

[1] Equivalent return loss of the air line impedance (50 ohm reference).

[2] MPC3 is SMA, 3.5mm, and 2.92mm (K) mateable and mode free to 40 GHz.

[3] See Maury data sheet 5E-062 for interface specifications.

SLIDING TERMINATIONS

DEDICATED CONNECTORS

Description

The singular characteristic of this group of sliding terminations is that they feature dedicated connectors. Terminations with sexed connectors (e.g., type N), are available in two models; one each with female and male connectors. Except as noted below, the terminating elements are also capable of handling higher power than typical laboratory sliding loads.

TNC and SMA terminations consist of precision air lines with low-reflection transformers to the dielectrically loaded connectors. Those terminations employing air dielectric connectors also have movable center conductors to permit precision setting of the connector interface condition using an appropriate connector gage.

Specifications

Frequency Range ..... See chart

VSWR (terminating element) ..... See chart

Power Rating ..... See chart

Nominal Impedance ..... 50 ohm

Air Line Accuracy ..... See chart

Travel .....>1/2 wavelength at lowest rated frequency

Connectors ..... See chart

Instrument cases provided with many units or available as optional accessories.

SLIDING TERMINATIONS

DEDICATED CONNECTORS

2517H

Specifications

Model	Connector Type	Frequency Range (GHz) and VSWR (maximum) [1]	Air line Accuracy [2]	Power Handling
2517H	LPC7A [3]	2.0 — 18.0 1.04	52 dB	1.0 watt CW, 5.0 kW peak
2601A	7mm [4]	0.9 — 1.5 1.08 1.5 — 2.0 1.05 2.0 — 18.0 1.03		1.0 watt CW, 2.0 kW peak
453A1	N female [5]	1.8 — 18.0 1.05		5.0 watt CW, 1.0 kW peak
453B1	N male [5]			
493A	N female [5]	0.9 — 1.8 1.10	56 dB	
493B	N male [5]	1.8 — 18.0 1.05		
452A1	TNC female [6]	1.8 — 18.0 1.05		
452B1	TNC male [6]			
487A	SMA female [7]	0.9 — 1.8 1.10		
487B	SMA male [7]	1.8 — 18.0 1.05		
2408A1 [8]	LPC14	0.9 — 1.5 1.08 1.5 — 2.0 1.04 2.0 — 8.5 1.03	69 dB	2.0 watt CW, 2.0 kW peak
2023B [8] [9]	7/8 EIA	0.9 — 1.5 1.08 1.5 — 6.0 1.04	56 dB	5.0 watt CW, 5.0 kW peak
2123 [8] [9]	1-5/8 EIA	0.9 — 1.5 1.06 1.5 — 3.0 1.03	65 dB	
8683A	AFTNC female [10]	2.0 — 4.0 1.04	56 dB	5.0 watt CW, 1.0 kW peak
8683B	AFTNC male [10]	4.0 — 20.0 1.05		

[1] Maximum VSWR (50 ohm reference) of the terminating element alone.

[2] Equivalent return loss of air line impedance (50 ohm reference).

[3] Air interface connector per Maury data sheet 5E-061 with a spring-loaded, self-centering, center pin that mates with standard 7mm connectors.

[4] Precision 7mm per Maury data sheet 5E-060.

[5] Precision stainless steel type N per Maury data sheet 5E-049.

[6] Precision stainless steel TNC per ES-2047.

[7] Precision stainless steel SMA per MIL-C-39012.

[8] Movable center conductor permits setting connector interface conditions.

[9] Supplied in a foam-lined wooden instrument case.

[10] Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.

SLIDING TERMINATIONS

MODULAR CONNECTORS

2517A

Description

The 2507 and 2517A are high precision, movable, low-reflection, broadband terminations for making precision measurements covering the frequency range of 0.9 to 18 GHz. They are true modular instruments since they are provided with interchangeable LPC7 and type N (female and male) connectors. Optional precision adapters for other connectors are also available.

Both terminations are provided with beadless (air dielectric) connectors and feature movable center conductors which can, with the aid of an appropriate connector gage, be set for a flush interface condition.

Both models are provided in foam-lined wooden instrument cases.

Specifications

Frequency Range ..... See chart

Terminating Element VSWR [1]:

0.9 to 1.5 GHz .....1.08 maximum

1.5 to 2.0 GHz .....1.05 maximum

2.0 to 18.0 GHz .....1.03 maximum

Impedance (nominal) ..... 50±0.15 ohm

Transmission Line Size .....7mm (0.1197±0.0001/0....2756±0.0003 dia.)

Power Rating ..... See chart

Travel .....>1/2 wavelength at lowest frequency

Connectors .....Three (3) precision air adapters LPC7 [2], type N female and male [3]

Center Conductor ..... Silver plated stainless steel

Accessories (provided) ..... Instrument case and operating instructions

Available Models

Model	Frequency Range	Air line Accuracy [4]	Power Handling	Connectors Provided
2507	0.9 — 18.0 GHz	56 dB	1.0 watt CW, 5.0 kW peak	Beadless LPC7
2517A	1.8 — 18.0 GHz	54 dB	1.0 watt CW, 1.0 kW peak	Type N (f & M)

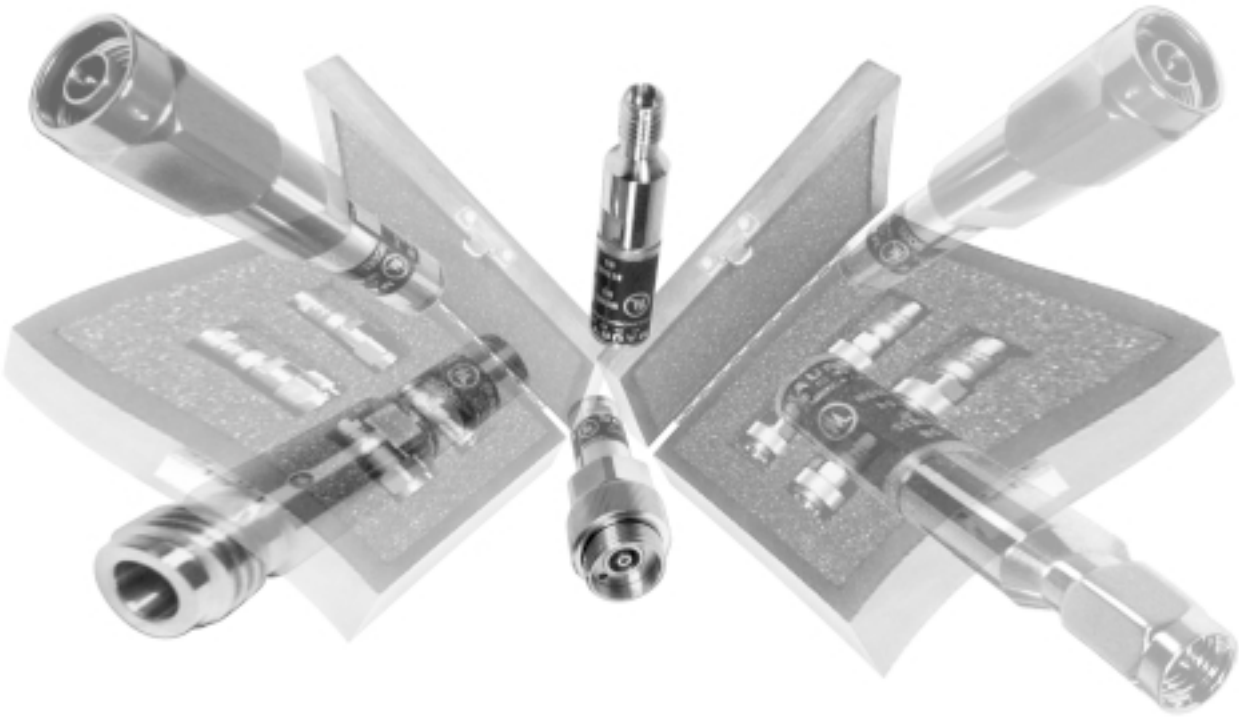
[1] Maximum VSWR (50 ohm reference) of the terminating element alone.

[2] Air interface connector with a spring-loaded, self-centering center contact that mates with standard 7mm connectors per Maury data sheet 5E-061.

[3] Precision stainless steel N per Maury data sheet 5E-049.

[4] Equivalent return loss of the air line impedance (50 ohm reference).

PRECISION MISMATCHES



General

Precision standard mismatches are fixed coaxial terminations which are used to introduce a known VSWR into a 50 ohm transmission system. These mismatches are extremely useful in a wide variety of applications and are quick and easy to use. They can be used to calibrate swept reflectometers, verify network analyzer calibration, establish impedance references in TDR measurements, etc.

Maury standard mismatches are quality constructed using thin film resistors and a unique grounding method that ensures stable operation. For ease of identification, the VSWR value of the mismatch is engraved on the end cap. Calibration data is provided for all units at 1 GHz intervals from 2 GHz to the applicable upper frequency limit.

The standard units shown in this section are fitted with 7mm, 14mm, type N, TNC, 3.5mm, 2.92mm, and 2.4mm connectors. We also produce mismatches in other connector series such as SMA. Please consult with our sales staff for application assistance. The units are also available as sets or kits packaged in foam-lined wooden instrument cases.

PRECISION MISMATCHES

7mm, 14mm, TYPE N, AND TNC CONNECTORS

2561A 2562A 2611D

Specifications

Frequency Range ..... DC to 18 GHz
Nominal VSWR ..... See charts
VSWR Accuracy ..... See charts

Calibration
Data Provided ..... 2 to 18 GHz, 1 GHz steps
Calibration Impedance Reference ..... 50 ohms
Power Handling ..... 1 watt average, 1 kW peak

7mm Standard Mismatches

Nominal VSWR	Model	Accuracy			Resistance (ohms)
		DC — 8.0 GHz	8.0 — 12.4 GHz	12.4 — 18.0 GHz	
1.05	2611A	±0.05	±0.05	±0.07	47.6
1.10	2611B	±0.05	±0.05	±0.07	45.5
1.20	2611C	±0.05	±0.06	±0.09	41.7
1.30	2611D	±0.05	±0.07	±0.10	38.5
1.50	2611E	±0.06	±0.08	±0.15	33.3
1.75	2611F	±0.08	±0.10	±0.17	28.6
2.00	2611G	±0.10	±0.12	±0.20	25.0

14mm Standard Mismatches

Nominal VSWR	Model	Accuracy			Resistance (ohms)
		DC — 1.0 GHz	1.0 — 4.0 GHz	4.0 — 8.5 GHz	
1.10	2411B	±0.02	±0.03	±0.04	45.5
1.20	2411C	±0.03	±0.04	±0.05	41.7
1.30	2411D	±0.04	±0.05	±0.06	38.5
1.50	2411E	±0.05	±0.06	±0.07	33.3

Type N Standard Mismatches

Nominal VSWR	Model		Accuracy			Resistance (ohms)
	Female	Male	DC — 8.0 GHz	8.0 — 12.4 GHz	12.4 — 18.0 GHz	
1.05	2561A	2562A	±0.05	±0.05	±0.08	47.6
1.10	2561B	2562B	±0.06	±0.06	±0.08	45.5
1.20	2561C	2562C	±0.06	±0.07	±0.10	41.7
1.30	2561D	2562D	±0.06	±0.08	±0.12	38.5
1.50	2561E	2562E	±0.08	±0.09	±0.17	33.3
1.75	2561F	2562F	±0.10	±0.11	±0.19	28.6
2.00	2561G	2562G	±0.12	±0.12	±0.22	25.0

TNC Standard Mismatches

Nominal VSWR	Model		Accuracy		Resistance (ohms)
	Female	Male	DC — 10 GHz	10 — 18 GHz	
1.20	8611C	8612C	±0.08	±0.15	41.7
1.30	8611D	8612D	±0.09	±0.15	38.5
1.50	8611E	8612E	±0.10	±0.18	33.3
1.75	8611F	8612F	±0.13	±0.20	28.6
2.00	8611G	8612G	±0.15	±0.25	25.0

PRECISION MISMATCHES

3.5mm, 2.92mm AND 2.4mm CONNECTORS

3.5mm Standard Mismatches

Specifications

Frequency Range ..... DC to 26.5 GHz
Nominal VSWR ..... See chart
VSWR Accuracy ..... See chart
Calibration
Data Provided ..... VNA data 2 to 26.5 GHz
Calibration Impedance Reference ..... 50 ohms
Power Handling ..... 0.5 watt average, 0.5 kW peak

Model		Nominal VSWR	Accuracy	
Female	Male		DC — 12 GHz	12 — 26.5 GHz
8033A1.10	8033B1.10	1.10	±0.06	±0.08
8033A1.20	8033B1.20	1.20	±0.07	±0.10
8033A1.30	8033B1.30	1.30	±0.08	±0.12
8033A1.50	8033B1.50	1.50	±0.09	±0.17
8033A1.75	8033B1.75	1.75	±0.11	±0.19
8033A2.00	8033B2.00	2.00	±0.12	±0.22
8033A2.50	8033B2.50	2.50	±0.13	±0.23
8033A3.00	8033B3.00	3.00	±0.15	±0.25

2.92mm Standard Mismatches

Specifications

Frequency Range ..... DC to 40.0 GHz
Nominal VSWR ..... See chart
VSWR Accuracy ..... See chart
Calibration
Data Provided ..... VNA data 2 to 40.0 GHz
Calibration Impedance Reference ..... 50 ohms nominal
Power Handling ..... 0.5 watt average, 0.5 kW peak

Model		Nominal VSWR	Accuracy	
Female	Male		DC — 10 GHz	10 — 40 GHz
8778A1.10	8778B1.10	1.10	±0.08	±0.13
8778A1.15	8778B1.15	1.15	±0.08	±0.13
8778A1.20	8778B1.20	1.20	±0.09	±0.13
8778A1.25	8778B1.25	1.25	±0.10	±0.13
8778A1.30	8778B1.30	1.30	±0.09	±0.17
8778A1.50	8778B1.50	1.50	±0.10	±0.20
8778A1.75	8778B1.75	1.75	±0.12	±0.22
8778A2.00	8778B2.00	2.00	±0.14	±0.25

2.4mm Standard Mismatches

Specifications

Frequency Range ..... DC to 50 GHz
Nominal VSWR ..... See chart
VSWR Accuracy ..... See chart
Calibration
Data Provided ..... 2 to 50 GHz
Calibration Impedance Reference ..... 50 ohms
Power Handling ..... 0.5 watt average, 0.5 kW peak

Model		Nominal VSWR	Accuracy	
Female	Male		DC — 12 GHz	12 — 50 GHz
7933A1.10	7933B1.10	1.10	±0.08	±0.13
7933A1.20	7933B1.20	1.20	±0.09	±0.13
7933A1.30	7933B1.30	1.30	±0.09	±0.17
7933A1.50	7933B1.50	1.50	±0.10	±0.20
7933A1.75	7933B1.75	1.75	±0.12	±0.22
7933A2.00	7933B2.00	2.00	±0.14	±0.25

PRECISION MISMATCHES

MISMATCH SETS

Maury offers standard mismatches in sets containing a selection of mismatch values including the nominal matched load (typically, 1.05 VSWR). These sets, available with 7mm, type N female or male, 3.5mm, 2.92mm, 2.4mm, and TNC connectors, are packaged in foam-lined wooden instrument cases. Each mismatch is provided with an individual calibration report.

7mm and Type N Mismatch Sets

Two types of sets are offered in these connector styles: sets with model suffix "L" contain one each of four mismatch values – a nominally matched load, 1.20, 1.50 and 2.00 VSWR. Sets with the model suffix "M" contain one each of all mismatch values indicated on page 139. The basic model follows those noted on page 138, i.e.: 2611L/M, 7mm; 2561L/M, type N female; 2562L/M, type N male. For example: 2562L describes a mismatch set with type N male connectors containing the four mismatches noted above.

3.5mm Mismatch Sets

The 8033K mismatch set is made up of all six each female and male of the 3.5mm mismatches from 1.10 through 2.00 VSWR shown on page 139. The set is packaged in a foam-lined wooden instrument case, and each mismatch value is provided with an individual calibration report.

TNC, 2.92mm and 2.4mm Mismatch Sets

Please consult our Sales Department for availability of mismatch sets with TNC, 2.92mm and 2.4mm connectors.

Special Kits

Custom mismatch kits, combining different connector types and values, can be configured. Please consult our Sales Department and reference model 9476(x).

2611L

2562L

Instrument Cases

As noted on pages 138 and 139, standard mismatches in the various connector styles and mismatch values are available as individual units. Should you wish to purchase individual units and configure a custom set, Maury can offer the following foam-lined wooden instrument cases to provide suitable laboratory storage.

2611S1	houses 4 units
2611S2	houses 8 units
2611S3	houses 12 units
8650Z1	houses 24 units

FIXED AND OFFSET SHORT CIRCUITS

Introduction

Fixed and offset short circuit terminations are used to establish reference planes in transmission systems and as key elements in the calibration of vector and scalar network analyzers (VNA and SNA, respectively). Short circuits with an offset of 2.498cm are often used to evaluate the calibration effectiveness of a VNA.

In general, the shorting plane of fixed shorts is at the connector reference plane or at some offset established by another component, typically an open circuit termination. The shorting plane of some offset shorts can also be relative to that established by another short with a nominal zero offset (e.g.: see the 8046 and the 8047 model series shown on page 142).

Many of the shorts listed here are the components of the Maury coaxial calibration kits described on pages 6 through 35 of this catalog.

GENERAL PURPOSE FIXED SHORT CIRCUITS

361P2

8615A

364C

[1] Precision stainless steel TNC per Maury data sheet 5E-053.

[2] Precision TNC per MIL-C-87104/2 per Maury data sheet 5E-056.

Specifications

Model	Connector	Frequency Range (GHz)
361N2	BNC female	DC — 12.4
361P2	BNC male	
8615A [1]	TNC female	DC — 18.0
8615B [1]	TNC male	
8771F1	2.92mm female	DC — 40.0
8772F1	2.92mm male	
8806C	N female	DC — 18.0
8807C	N male	
364C	C female	DC — 18.0
364D	C male	
8445A	HN female	DC — 8.0
8445B1	HN male	
8455A	SC female	DC — 10.0
8455B1	SC male	
8584A	BNC 75Ω female	DC — 2.0
8584B	BNC 75Ω male	
8686A [2]	AFTNC female	DC — 20.0
8687A [2]	AFTNC male	
8884A	N 75Ω female	DC — 2.0
8884B	N 75Ω male	

FIXED AND OFFSET SHORT CIRCUITS

PRECISION 3.5mm/SMA REFERENCE PLANE FIXED SHORT CIRCUITS

- DC to 40 GHz
- Mates with 3.5mm, SMA and 2.92mm

360B

360D

Description

The 360D (female) and 360B (male) are true coplanar, reference plane shorts that mate with 3.5mm, SMA and 2.92mm (K) connectors and can be used at frequencies up to 40 GHz. The 360D, in particular, represents a true advance in the state-of-the-art. Prior to its introduction, the typical SMA mateable female short would exhibit a return loss in excess of 4 dB at 18 GHz. The return loss of the 360D at 18 GHz is generally less than 0.02 dB with a phase offset of less than 0.2 degrees.

Specifications

Model 360D ..... Female reference plane short

Model 360B ..... Male reference plane short

Frequency Range ..... DC to 40 GHz

Connector Mating
Compatibility ..... 3.5mm, SMA, 2.92mm (K)

PRECISION 3.5mm FIXED SHORT CIRCUITS

Description

The 8046F and 8047F are precision 3.5mm fixed shorts designed to operate from DC to 34 GHz. These shorts, although classified as "fixed", establish a measurement plane of 0.500cm offset from the connector reference plane for compatibility with the companion 8048 series open circuits (see page 148). The 8046 and 8047 series of offset shorts are referenced to this offset. The 8046F and 8047F are used in several popular 3.5mm VNA calibration kits in use today.

8046F

8047F

Specifications

Model 8046F ..... Female 3.5mm fixed short

Model 8047F ..... Male 3.5mm fixed short

Reflection Coefficient ..... 0.98 (minimum)

Frequency Range ..... DC to 34 GHz

Offset Length 0.500cm

Offset Length Accuracy ..... +0.001 inches (0.003cm)

FIXED AND OFFSET SHORT CIRCUITS

PRECISION 7mm AND 14mm FIXED SHORT CIRCUITS

2615A3

2615B3

2415A1

2415B1

Description

Three models are available in each of these precision, sexless connector series. The "A" models are flat plane shorts. The "B" models have a standard contact (collet) in the short plane (in the 7mm short, this is a new, high performance 6-slot collet). The "D" models are similar to the flat plane shorts except for a precision hole in the center of the shorting surface to support beadless air lines. These last are the shorts most often found in precision VNA calibration kits.

Model	Connector	Frequency Range (GHz)
2615A3 [1] 2615B3 [2] 2615D3 [3]	7mm [4]	DC — 18.0
2415A1 [1] 2415B1 [2] 2415D1 [3]	14mm [4]	DC — 8.5

PRECISION 7-16 FIXED SHORT CIRCUITS

Description

The 2714A and 2714B are precision 7-16 fixed shorts designed to operate from DC to 7.5 GHz. These shorts, although classified as "fixed", establish a measurement plane of 2.00cm offset from the connector reference plane for compatibility with the companion 2716 series open circuits (see page 148).

2714A

2714B

Specifications

Model 2714A ..... Female 7-16 fixed short

Model 2714B ..... Male 7-16 fixed short

Reflection Coefficient ..... 0.99 (minimum)

Frequency Range ..... DC to 7.5 GHz

Offset Length 2.00cm

Offset Length Accuracy ..... +0.001 inches (0.003cm)

[1] Flat plane short.

[2] Center contact in short plane.

[3] Air line support hole in short plane.

[4] Mating compatible with GR900.

FIXED AND OFFSET SHORT CIRCUITS

OFFSET SHORT CIRCUITS

8606D

8607D

8806C

8807C

Description

Offset shorts are used for banded calibrations of VNA. Those with 2.498cm offsets are also used to measure the effective source match of a VNA after calibration (see Maury data sheet 5C-027).

	Maury Offset Shorts					
Offset Length (cm)	2.498	1.249	0.735	0.526	0.337	0.225
λ/4 Frequency (GHz)	3.00	6.00	10.20	14.25	22.24	33.25
Connector 14mm [1]	2449A1	2449B1	–	–	–	–
Connector 7mm [2]	2649A	2649B	2649C	2649D	–	–
Connector 3.5mm (f) [3]	8046A [7]	8046B [7]	8046C [7]	8046D [7]	8046E [7]	–
Connector 3.5mm (m) [3]	8047A [7]	8047B [7]	8047C [7]	8047D [7]	8047E [7]	–
Connector SC (f) [4]	8456A	8456B	8456C	–	–	–
Connector SC (m) [4]	8457A	8457B	8457C	–	–	–
Connector TNC (f) [5]	8606A	8606B	8606C	8606D	–	–
Connector TNC (m) [5]	8607A	8607B	8607C	8607D	–	–
Connector N (f) [6]	8806A	8806B	8806C	8806D	–	–
Connector N (m) [6]	8807A	8807B	8807C	8807D	–	–
Connector 2.92mm (K) female	8771A1	8771B1	8771C1	8771D1	8771E1	8771G1
Connector 2.92mm (K) male	8772A1	8772B1	8772C1	8772D1	8772E1	8772G1
	Models					

[1] Precision 14mm connector, mating compatible with GR900.
[2] Precision 7mm connector per Maury data sheet 5E-060.
[3] Precision stainless steel connector per Maury data sheet 5E-053.
[4] Precision stainless steel SC per Maury data sheet 5E-050.
[5] Precision stainless steel TNC per ES-2047.
[6] Precision stainless steel type N per Maury data sheet 5E-049.
[7] Length is relative to 8046F and 8047F (see page 142).

SLIDING SHORT CIRCUITS

General

A sliding short is a movable short circuited termination in a precision air line which is used in a variety of laboratory measurement applications. These devices are used to establish a reference plane in a transmission system, as tuning elements in the development of microwave components (mixers, amplifiers, etc.), and tuning high precision CW reflectometer systems. An important application is the calibration of vector network analyzers (VNA). The use of a sliding short for such a calibration is particularly effective when the VNA is to be used for the measurement of highly reflective devices.

The primary criteria for a quality coaxial sliding short are a) a precision transmission structure (air line), b) consistent low noise contacts on the inner and outer conductors and c) a precision connector. Maury manufactures coaxial sliding shorts with a range of performance and operational convenience features. Among the classes available are modular units with interchangeable connectors, high precision devices with dedicated connectors, and rugged general purpose units.

MODULAR

Description

The 2508A, 2518A, and 8036A sliding shorts are true modular instruments. These units are provided with interchangeable connector bodies and center conductors so that measurements may be made in type N (female or male), or 7mm with the 2508A and 2518A, or 3.5mm (female or male) with the 8036A.

The connectors used on these units are air-dielectric (beadless) and the center conductor is movable; therefore, with the aid of an appropriate connector gage, the center pin of the connector can be set to the desired interface condition.

Model	Frequency Range (GHz)	Connector	Air Line Accuracy [1]
2508A	0.9 – 18.0	LPC7 [2], Type N female and male	56 dB
2518A	1.8 – 18.0		
8036A	2.0 – 34.0	3.5mm female and male	44 dB
8779A	4.0 – 20.0	2.92mm female	42 dB
	20.0 – 40.0		40 dB
8779B	4.0 – 20.0	2.92mm male	42 dB
	20.0 – 40.0		40 dB

2508A

[1] Equivalent return loss of the air line impedance (50 ohm reference).

[2] Air interface connector with a spring loaded, self-centering center pin that mates with standard 7mm connectors.

SLIDING SHORT CIRCUITS

HIGH PRECISION

Description

These models are movable short circuits with dedicated connectors in precision air lines. The inherent low reflection and accurate transmission line of these instruments, coupled with efficient beryllium copper inner and outer conductor contacting fingers, provide an excellent short circuit. The travel of the shorting plane of these instruments is at least 1/2 wavelength at the lowest rated frequency to permit reversal of the reflection phase.

Specifications

Model	Connector	Frequency Range (GHz)	Air line Accuracy [1]
1959A	SMA female	1.8 — 18.0	56 dB
1959B	SMA male		
2604A	7mm	0.9 — 18.0	

GENERAL PURPOSE

Specifications

Frequency Range ..... See chart

Nominal Impedance ..... 50 ohm

Travel ..... 1/2 wavelength at lowest frequency

Connectors ..... See chart

Frequency Range	0.2 to 0.5 GHz	0.4 to 1.0 GHz	0.8 to 4.0 GHz	2.0 to 12.0 GHz
Short Travel (in.)	30.0	15.0	7.5	3.0
Length-Closed (in.)	32.6	17.6	10.1	5.6

Connector	Model			
SMA	1909A(*)	1909B(*)	1909C(*)	1909D(*)
Precision N	1978A(*)	1978B(*)	1978C(*)	1978D(*)
7mm	2647A	2647B	2647C	2647D

(*) Insert "1" for female, "2" for male connector.

[1] Equivalent return loss of the air line impedance (50 ohm reference).

OPEN CIRCUIT TERMINATIONS

General

Shielded, coaxial open circuit terminations ("opens") are used in the calibration of both scalar and vector network analyzers (SNA and VNA, respectively). In both applications, they are used to provide a nominal 180 degree phase offset from a compatible reference short circuit over a broad range of frequencies.

In SNA applications, the open is used in conjunction with a short to establish an average for a 100% reflection effectively halving the error due to reflection phase interactions. It is a practical impossibility to build a perfect open circuit at microwave frequencies. Shielding the open essentially eliminates radiation losses; however, this creates a residual frequency-sensitive capacitance. For VNA applications, an accurate knowledge of the open circuit effective capacitance is essential to an accurate calibration of the analyzer.

Maury opens are generally characterized for effective capacitance versus frequency by means of a fourth order polynomial curve fit, and the nominal capacitance coefficients are provided with each unit. We offer several innovative designs that improve the consistency and repeatability of the open circuit termination capacitance coefficients resulting in improved effective source match of the calibrated VNA [1].

HIGH PRECISION 7mm, 14mm (GR900) CONNECTORS

The Maury 2416D1 and 2616D3 are precision open circuits for use in calibrating scalar (SNA) and vector (VNA) network analyzers for measurement of devices with 14mm and 7mm connectors.

These units are beadless, shielded open circuits which incorporate a captivated dielectric rod in place of the center conductor contact. The purpose of the rod is to depress the spring-loaded contact of the VNA or SNA test port connector so that it is flush with the outer conductor mating plane. This feature represents a major improvement in performance over earlier units by creating accurate, precisely repeatable open circuit characteristics which, in turn, improves the calibration effectiveness and measurement accuracy.

As with all Maury open circuits, these units are provided with generic, fourth order polynomial capacitance coefficients suitable for entry into Agilent, Anritsu and other network analyzers.

2416D1

2616D3

Model	Frequency Range (GHz)	Reflection Coefficient	Phase Accuracy	Reference Impedance	Connector
2416D1	DC — 8.5	0.997 (minimum)	± 0.2 degrees	50 ohms	14mm
2616D3	DC — 18.0	0.995 (minimum)	± 0.3 degrees	50 ohms	7mm

[1] See Maury data sheet note 5C-027.

OPEN CIRCUIT TERMINATIONS

HIGH PRECISION – TYPE N, TNC, AFTNC, 3.5mm, 2.92mm (K), AND 7-16 CONNECTORS

Description

This series of open circuit terminations with sexed connectors (3.5mm, type N, etc.) feature captivated center conductor contacts that significantly improve VNA calibration effectiveness. Earlier open circuits utilized a two piece design consisting of an outer conductor shell and an inner contact mounted on a dielectric rod. The position of the open plane was, therefore, dependent upon the center conductor setback of the mating test port connector.

In the units described here, the center contact is captivated and set at the factory to be essentially flush with the outer conductor mating plane. This condition eliminates the dependence on test port connector tolerances providing a high degree of performance consistency.

Specifications

Model		Connector	Frequency Range (GHz)	Phase Accuracy	Reflection Coefficient (minimum)
Female	Male				
8048A1	8048B1	3.5mm	DC — 26.5	± 1.4 degrees	0.98
8609B	8610B	TNC [1]	DC — 18.0	± 2.0 degrees	0.98
8685A	8685B	AFTNC [2]	DC — 20.0	± 2.0 degrees	0.98
8809B1	8810B1	Type N	0.1 — 18.0	± 2.0 degrees	0.99
8773A1	8773B1	2.92mm	DC — 40.0	± 2.0 degrees	0.99
2716A	2716B	7-16	DC — 7.5	± 2.0 degrees	0.99

GENERAL PURPOSE — BNC, HN, C, SC, EIA, 75 ohm CONNECTORS

The adjacent chart lists open circuits for calibration of network analyzers to be used to test devices with "systems" connectors. In general, these units are designed for limited frequency ranges as determined by the connector type; consequently, most will consist of just the shielded shell with no center conductor or supporting dielectric rods.

Note that the 8585 and 8883 series are for use in 75 ohm calibrations. Such units, type N in particular, should never be mated to 50 ohm connectors. This could result in damage to the 75 ohm female center conductor contact or unreliable, unstable electrical connection. Maury 75 ohm connectors are identified by a black band on the body of the component.

Model		Connector	Frequency Range (GHz)
Female	Male		
371N1	371P1	BNC	DC — 10.0
2027B		7/8 EIA	0.1 — 6.0
2127B		1-5/8 EIA	0.1 — 3.5
8444A	8444B1	HN	0.1 — 10.0
8459B	8460B1	SC	
8491A	8491B	C	
8585A	8585B	75 ohm BNC	DC — 2.0
8885A	8885B	75 ohm Type N	DC — 2.0

[1] Interface per Maury data sheet 5E-053.

[2] Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.

PRECISION/REFERENCE AIR LINES

General

Precision or reference air lines are air-dielectric transmission lines with highly accurate dimensions that can be used in measurement and calibration applications as fundamental impedance standards and to establish reference positions for measurements.

Maury offers bead supported and beadless connectors in air lines using 3.5mm, 7mm, 14mm and type N connectors. Beadless lines offer better impedance and electrical length accuracies and lower VSWR, while beaded lines offer greater convenience.

REFERENCE AIR LINES – 14mm CONNECTORS

Description

The 2453 series are beadless, virtually reflectionless, coaxial 14mm reference air lines with spring-loaded tips on the ends of the inner conductor to mate with 14mm connectors [1]. VSWR is <1.006 at 8.5 GHz. The lines are fabricated from beryllium copper and are gold-plated to prevent tarnishing.

Specifications

Frequency Range ..... DC to 8.5 GHz
VSWR ..... $<1.001 + 0.0005f$ (GHz)
Characteristic Impedance ..... 50 ± 0.05 ohms where skin depth is negligible
Electrical Length ..... See chart
Accuracy of Electrical Length ..... ±0.005cm
Connector ..... LPC14 [2]

Model	Electrical Length (cm)	Odd 1/4-Wavelength Frequency (GHz) [3]
2453A	29.979	(2n + 1) 0.25
2453B	19.986	(2n + 1) 0.375
2453C	14.990	(2n + 1) 0.50
2453D	9.993	(2n + 1) 0.75
2453E	7.495	(2n + 1) 1.00
2453F	5.996	(2n + 1) 1.25
2453G	4.997	(2n + 1) 1.50
2453H	2.998	(2n + 1) 2.50

PRECISION AIR LINES – 14mm CONNECTORS

Description

The 2403 series are precision 14mm reference air lines fabricated from beryllium copper with gold plating to prevent tarnishing. Center conductor support is provided by a low loss bead structure which results in a VSWR <1.02 at 8.5 GHz.

Specifications

Frequency Range ..... DC to 8.5 GHz
VSWR ..... 1.02 maximum
Characteristic Impedance ..... 50 ± 0.06 ohms
Electrical Length ..... See chart
Accuracy of Electrical Length ..... ±0.02cm
Connector ..... LPC14 [4]

Model	Electrical Length (cm)	Odd 1/4-Wavelength Frequency (GHz) [3]
2403A	29.979	(2n + 1) 0.25
2403B	19.986	(2n + 1) 0.375
2403C	14.990	(2n + 1) 0.50
2403D	9.993	(2n + 1) 0.75
2403E	7.495	(2n + 1) 1.00
2403F	5.996	(2n + 1) 1.25
2403G	4.997	(2n + 1) 1.50

14mm Reference Air Line Kits

The 2453K consists of one (each) of 2453C, D, E, F, G and H. The 2403K consists of one (each) 2403A, C, D, E, and G to which the 2403L adds one (each) 2403B and F. All kits are provided in foam-lined wooden instrument cases.

[1] Precision 14mm connector that is mating compatible with GR900.

[2] A beadless 14mm connector that mates with GR900 connectors.

[3] Frequencies at which the electrical length is an odd multiple of a 1/4 wavelength where n is zero or an integer.

[4] A beaded 14mm connector that mates with GR900 connectors.

HIGH PRECISION/REFERENCE AIR LINES

REFERENCE AIR LINES – 7mm CONNECTORS

Description

The 2653 series reference air lines are beadless, virtually reflectionless, coaxial 7mm air lines. Spring-loaded tips on the ends of the center conductors mate with standard 7mm connectors.

Specifications

Frequency Range ..... DC to 18 GHz
VSWR ..... DC to 3.0 <1.002 + 0.001f (GHz)
3.0 to 18.0 <1.005 maximum
Characteristic Impedance ..... 50 ± 0.1 ohm [1]
where skin depth is negligible
Electrical Length ..... See chart
Accuracy of Electrical Length ..... ±0.005cm
Connector ..... LPC7 [2]

Model	Electrical Length (cm)	Odd 1/4-Wavelength Frequency (GHz) [3]
2653S30	29.969	(2n + 1) 0.25
2653S20	19.980	(2n + 1) 0.375
2653S15	14.983	(2n + 1) 0.50
2653S10	9.988	(2n + 1) 0.75
2653S9.2	9.239	(2n + 1) 0.81
2653S7.5	7.493	(2n + 1) 1.00
2653S6	5.993	(2n + 1) 1.25
2653S5	4.994	(2n + 1) 1.50
2653S4	3.994	(2n + 1) 1.875
2653S3	2.9969	(2n + 1) 2.50

7mm Reference Air Line Kits

The 2653K is a kit consisting of six reference air lines from the chart above provided in an attractive foam-lined wooden instrument case.

PRECISION AIR LINES – 7mm CONNECTORS

Description

The 2603 precision air lines are 7mm coaxial line sections with 7mm connectors [4] in which the center conductor is supported by a low-loss dielectric bead. The air lines are held to extremely close tolerances to provide an accurate 50 ohm impedance standard, and are fabricated from copper alloys with a gold-flash protective coating (except those over 15cm which have a silver-layered stainless steel center conductor to eliminate sag).

Specifications

Frequency Range ..... DC to 18 GHz
VSWR ..... <1.004 + 0.003f (GHz)
Characteristic Impedance ..... 50 ± 0.12 ohm
where skin depth is negligible
Electrical Length ..... See chart
Accuracy of Electrical Length ..... ±0.015cm
Connector ..... Precision 7mm [4]

Model	Electrical Length (cm)	Odd 1/4-Wavelength Frequency (GHz) [3]
2603A	29.979	(2n + 1) 0.25
2603B	19.986	(2n + 1) 0.375
2603C	14.990	(2n + 1) 0.50
2603D	9.993	(2n + 1) 0.75
2603E	7.495	(2n + 1) 1.00
2603F	5.996	(2n + 1) 1.25
2603G	4.997	(2n + 1) 1.50

7mm Precision Air Line Kits

Air lines are available in the following kits and are supplied in an attractive foam-lined wooden instrument case.

Model	Consisting of
2603K	2603A, C, D, E, G
2603L	2603A, B, C, D, E, F, G

[1] Impedance = 49.987 ohms based on nominal dimensions and tolerances of the conductors, and the equation: Z = 59.939 Log_e D/d, D = I.D. inner conductor, d = O.D. outer conductor.

[2] Beadless 7mm connector that mates with standard precision 7mm.

[3] Frequencies at which the electrical length is an odd multiple of a 1/4-wavelength where n = zero or an integer.

[4] Precision 7mm connector per Maury data sheet 5E-060.

PRECISION/REFERENCE AIR LINES

REFERENCE AIR LINES – TYPE N CONNECTORS

2553T

Description

The 2553 series reference air lines utilize beadless type N connectors which are integral to the air lines, thereby producing extremely low reflection transmission lines. The complete air lines (inner and outer conductor) are fabricated from gold-plated, low-loss copper alloys.

Specifications

Frequency Range ..... DC to 18 GHz
VSWR ..... $<1.02 + 0.002f$ (GHz)
Characteristic Impedance ..... 50 ± 0.2 ohm where skin depth is negligible
Electrical Length ..... See chart
Accuracy of Electrical Length ..... ±0.01cm
Connector ..... Beadless precision type N (one female, one male)

Model	Electrical Length (cm)	Odd 1/4-Wavelength Frequency (GHz) [2]
2553T30	29.969	(2n + 1) 0.25
2553T15	14.983	(2n + 1) 0.50
2553T10	9.988	(2n + 1) 0.75
2553T7.5	7.493	(2n + 1) 1.00
2553T6	5.993	(2n + 1) 1.25
2553T5	4.994	(2n + 1) 1.50
2553T3	2.9969	(2n + 1) 2.50

Type N Reference Air Line Kit

Model 2553K2 is a kit consisting of six reference air lines listed in the chart above. The lines are provided in an attractive foam-lined wooden instrument case.

PRECISION AIR LINES – TYPE N CONNECTORS

Description

The 2503 series precision air lines utilize stainless steel type N connectors in which the center conductor is supported by a low-loss dielectric bead. The air lines (inner and outer conductor) are fabricated from gold-plated, low-loss copper alloys.

Specifications

Frequency Range ..... DC to 18 GHz
VSWR ..... $<1.03 + 0.003f$ (GHz)
Characteristic Impedance ..... 50 ± 0.2 ohm where skin depth is negligible
Electrical Length ..... See chart
Accuracy of Electrical Length ..... ±0.02cm
Connector ..... Precision type N [1] (one female, one male)

Model	Electrical Length (cm)	Odd 1/4-Wavelength Frequency (GHz) [2]
2503A	29.979	(2n + 1) 0.25
2503B	19.986	(2n + 1) 0.375
2503C	14.990	(2n + 1) 0.50
2503D	9.993	(2n + 1) 0.75
2503E	7.495	(2n + 1) 1.00
2503F	5.996	(2n + 1) 1.25
2503G	4.997	(2n + 1) 1.50

Type N Precision Air Line Kits

Air lines are available in the following kits and are supplied in an attractive foam-lined wooden instrument case.

Model	Consisting of
2503K	2503A, C, D, E, G
2503L	2503A, B, C, D, E, F, G

[1] Precision stainless steel type N per 5E-049.

[2] Frequencies at which the electrical length is an odd multiple of a 1/4-wavelength where n is zero or an integer.

PRECISION/REFERENCE AIR LINES

REFERENCE AIR LINES – 3.5mm CONNECTORS

The 8043 series are beadless, precision, coaxial 3.5mm air lines with spring-loaded tips on the ends of the inner conductor to mate with 3.5mm connectors. These air lines provide a highly accurate, 50 ohm impedance standard. Fabricated from beryllium copper, they are gold-plated to prevent tarnishing.

Specifications

Frequency Range ..... DC to 26.5 GHz
VSWR (R.L.) ..... 48 dB minimum
(excluding connector interfaces)
Characteristic Impedance ..... 50 ohm nominal
Accuracy of Electrical Length ..... ±0.0025cm
Connector ..... Beadless precision 3.5mm
8043S ..... One male end and one female end
8043M ..... Both ends male

Model	Electrical Length (cm)	Odd 1/4-Wavelength Frequency (GHz) [1]	
8043S15	14.990	(2n + 1)	0.50
8043S10	9.993	(2n + 1)	0.75
8043S7.5	7.495	(2n + 1)	1.00
8043S5	4.997	(2n + 1)	1.50
8043M10	9.993	(2n + 1)	0.50
8043M7.2	7.195	(2n + 1)	1.04
8043M6.8	6.795	(2n + 1)	1.10

M = male to male retractable S = male to female

PRECISION AIR LINES – 3.5mm CONNECTORS

The 8042 series precision air lines utilize 3.5mm connectors in which the center conductor is supported by a low-loss dielectric bead. The air lines are fabricated from gold-plated, copper alloys.

Specifications

Frequency Range ..... DC to 18 GHz
VSWR (typical) ..... <1.004 + 0.0035f(GHz)
Characteristic Impedance (nominal) ..... 50 ohm
Accuracy of Electrical Length ..... ±0.02cm
Connectors ..... 3.5mm (one each female and male)

Model	Electrical Length (cm)	Odd 1/4-Wavelength Frequency (GHz) [1]	
8042C	14.990	(2n + 1)	0.50
8042D	9.993	(2n + 1)	0.75
8042E	7.495	(2n + 1)	1.00
8042G	4.997	(2n + 1)	1.25

REFERENCE AIR LINES – 7-16 CONNECTORS

The 2735A series are beadless, virtually reflectionless, coaxial 7-16 reference air lines.

Specifications

Frequency Range ..... DC to 7.5 GHz
VSWR ..... <1.004 + 0.0035f(GHz)
Characteristic Impedance ..... 50 ± 0.05 ohm
Accuracy of Electrical Length ..... ±0.005cm
Connectors 7-16

The lines are fabricated from beryllium copper and are gold-plated to prevent tarnishing.

Model	Electrical Length (cm)	Odd 1/4-Wavelength Frequency (GHz) [1]	
2735A30	29.979	(2n + 1)	0.25
2725A7.5	7.495	(2n + 1)	1.00
2735A6	3.996	(2n + 1)	1.25

7-16 TRL/LRL Precision Air Line Kits

The 2735A kits consist of the reference air lines listed in the chart above provided in an attractive foam-lined wooden instrument case. See Maury data sheet 2Z-041A for test port adapter options.

[1] Frequencies at which the electrical length is an odd multiple of a 1/4 wavelength where n is zero or an integer.

PRECISION/REFERENCE AIR LINES

REFERENCE AIR LINES – 2.92mm CONNECTORS

Description

The Maury 8774C/B series reference air lines are beadless precision 2.92mm coaxial transmission lines which are held to extremely tight tolerances to provide a highly accurate 50 ohm impedance standard, utilizing precision 2.92mm connectors. Fabricated from beryllium copper, these air lines are gold plated for low loss and to prevent tarnishing.

Specifications

Frequency Range ..... DC to 40.0 GHz
Impedance ..... 50 ohm nominal
VSWR (R.L) ..... 48 dB minimum [1]
Electrical Length ..... See chart
Electrical Length Accuracy ..... ±0.0025cm
Connectors ..... 2.92mm male with retractable coupling nut and 2.92mm female

Model	Electrical Length (cm)	Odd 1/4 Wavelength Frequency (GHz)		Connectors
8774C15	14.990	(2n+1)	0.50	Female to male
8774C10	9.993	(2n+1)	0.75	Female to male
8774C7.5	7.495	(2n+1)	1.00	Female to male
8774C5	4.997	(2n+1)	1.50	Female to male
8774C3	2.998	(2n+1)	2.50	Female to male
8774B15	14.990	(2n+1)	0.50	Male to male
8774B10	9.993	(2n+1)	0.75	Male to male
8774B7.2	7.195	(2n+1)	1.04	Male to male
8774B6.8	6.795	(2n+1)	1.10	Male to male

PRECISION AIR LINES – 2.4mm CONNECTORS

Description

The Maury 7943 series reference air lines are beadless 2.4mm coaxial transmission lines which are held to extremely tight tolerances to provide a highly accurate 50 ohm impedance standard utilizing precision 2.4mm connectors.

These air lines are fabricated from beryllium copper and are gold plated for low loss and to prevent tarnishing.

Model	Electrical Length (cm)	1/4-wavelength Frequency (GHz)
7943H	2.998	2.5
7943G	4.997	1.5

Specifications

Frequency Range ..... DC to 50 GHz [2]
Impedance ..... 50 ohm nominal
VSWR (R.L) ..... 48 dB minimum [1]
Electrical Length ..... See chart
Electrical Length Accuracy ..... ±0.0025cm
Connectors ..... 2.4mm male with retractable coupling nut and 2.4mm female

[1] Excluding connector interfaces.

[2] Useable to 54 GHz.

TWO-PORT MISMATCH STANDARDS

General

Mismatch air line sets are two-port, 1/4-wavelength VSWR standards consisting of coaxial air lines employing a precision outer conductor with beadless connectors and a set of inner conductors with increasing diameters. These produce accurately known reflection coefficents which are directly calculable from and traceable to air line dimensions [1].

Air line standard sets are extremely stable and easy to use for a variety of applications. The simple geometry allows direct calculation of reflection, loss, transfer and group delay characteristics, making them ideally suited for checking the performance and accuracy of network analyzers.

The sets described here utilize beadless connectors and rely on the mating connectors for center conductor support.

2654A

MISMATCH AIR LINE STANDARD SETS

Description

The 2454A and 2654A are for use in coaxial systems employing 14mm and 7mm connectors, respectively. The air line connectors are beadless and rely on the mating connector for center conductor support. Each set consists of:

A) One (1) outer conductor.

B) Five (5) inner conductors (see specification for corresponding VSWR's).

C) A foam-lined, wooden instrument case for protection and storage.

Model	Line Size	Connector	Frequency Range (GHz)	Actual Nominal Impedance (ohm)
2454A	14mm	LPC14 [2]	DC — 8.5	50.001
2654A	7mm	LPC7 [3]	DC — 18.0	49.987

Specifications

Frequency Range ..... See chart

Nominal Impedance ..... See chart for actual nominal impedance for 1.00 VSWR

Mismatch Values (VSWR) ..... 1.00, 1.10, 1.25, 1.50, 2.00 (based on actual nominal impedance)

Electrical Length 7.495cm

Odd 1/4 Wavelength Frequencies ..... 1, 3, 5, 7, 9, 11, 13, 15, 17 GHz

[1] Beatty, R.W., "Calculated and Measured S_{11}, S_{21}, and Group Delay for Simple Types of Coaxial and Rectangular Waveguide 2-port Standards", NBS Technical Note No. 657, Dec. 1974.

[2] Beadless 14mm connector that mates with GR900BT.

[3] Beadless 7mm connector that mates with standard 7mm.

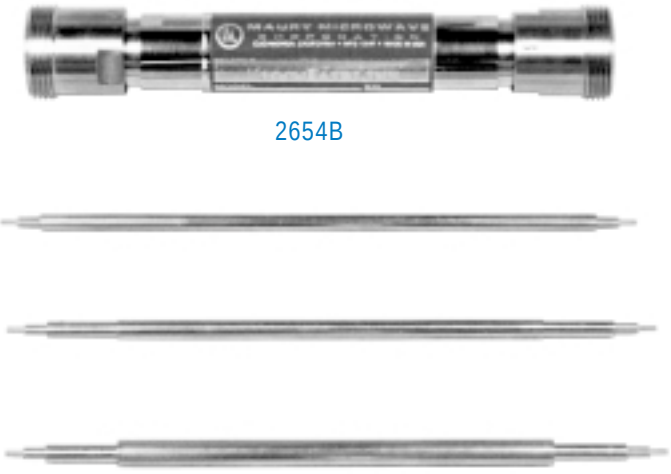
PRECISION TWO-PORT STANDARD SET – 7mm

Description

The Maury 2654B precision air line standard set contains calculable two-port 7mm coaxial air lines [1]. These standards are provided with the step discontinuity separated from the connector interface for better accuracy [2].

The set consists of a precision outer conductor with beadless 7mm connectors and three center conductors. Each center conductor has a different diameter to produce an accurately known VSWR which is directly calculable from the mechanical dimension. They employ self-centering, spring-loaded pins to allow connection easily without tools.

Also available are the Maury 2654S15 and 2654S60 which are individual two-port standards with Γ = 0.15 and 0.60, respectively.



2654B

Specifications

Frequency Range ..... DC to 18 GHz

Reference Impedance ..... 50 ohm

Nominal Overall
Electrical Length 10cm

Nominal Mismatch Section
Electrical Length 7.5cm

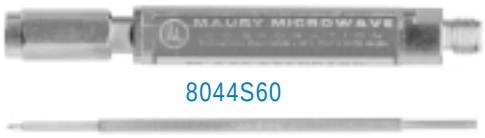
Odd 1/4
Wavelength Frequencies ..... 1, 3, 5, 7, 9, 11, 13, 15, 17 GHz

Connector ..... LPC7 [3]

	Γ = 0	Γ = 0.15	Γ = 0.60
VSWR	1.005 (max.)	1.350 ± 0.025	4.00 ± 0.25

PRECISION TWO-PORT STANDARDS – 3.5mm

Maury also offers two individual two-port mismatch standards in 3.5mm line size and connectors. These are the 8044S15 and the 8044S60 which have the same electrical specifications as the 2654S15 and 2654S60, respectively, except that the frequency range is DC to 26.5 GHz.



8044S60

[1] Beatty, R.W., "Calculated and Measured S_{11}, S_{21}, and Group Delay for Simple Types of Coaxial and Rectangular Waveguide 2-port Standards", NBS Technical Note No. 657, Dec. 1974.

[2] Maury, M.A. Jr., and Simpson, G.R., "Two-Port Verification Standards in 3.5mm and 7mm for Vector Automatic Network Analyzers", Microwave Journal, June, 1984; pp. 101-110.

[3] Beadless precision 7mm connector, mates with 7mm connector.

TUNERS

General

Tuners are used both in the laboratory and as system components to either establish or transform impedances for a number of applications. They can be used to establish optimum source or load terminations for device characterization, normalize a source or load for precision laboratory measurements and/or calibrations (noise, power, etc.), and act as a matching transformer between a mismatched source and a mismatched load. Maury produces several types of manual and mechanical units, each suited to one or more of these general applications.

SLIDE SCREW TUNERS – STANDARD MATCHING RANGE

Description

Slide screw tuners are particularly suited to establishing impedances for device characterization or any other application requiring a precisely repeatable mismatch condition. This is due to the precision with which a specific matching condition can be repeated if the tuner has calibrated position indicators. The models described here feature a guaranteed minimum matching range of 6:1 (equivalent VSWR). **For higher matching ranges, please see the following page.** These units are provided with micrometer driven probes and, except as noted, vernier readout of carriage position (the 3.5mm tuner has a micrometer driven carriage).

Position locks are provided on both the probe micrometers and the carriage mechanism. Units with sexed connectors have a female connector on one end and a male on the other.

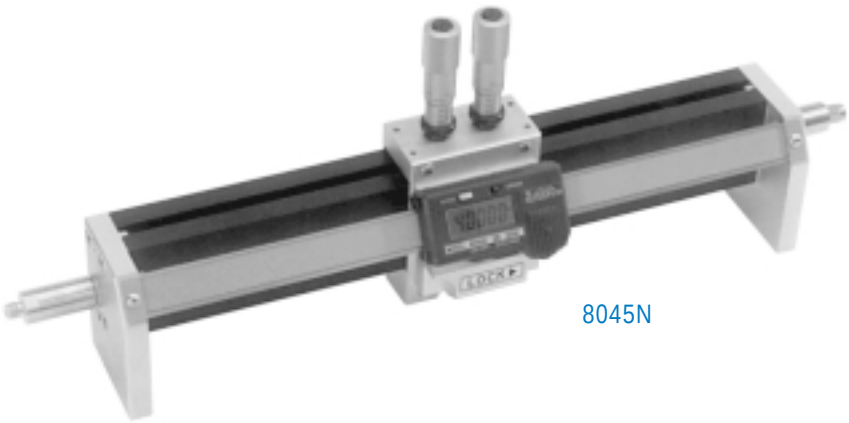
Frequency Range (GHz)	Matching Range [1]	Connector — Model			Body Length
		Type N [2]	7mm [3]	3.5mm [4]	
0.9 — 12.4	6:1 (minimum)	1643C	2640C	8045C	10.5 in (26.7cm)
1.8 — 18.0	6:1 (minimum)	1643D	2640D	8045D	7.5 in (19.1cm)
12.0 — 34.0	6:1 (minimum)	—	—	8041B	2.9 in (7.4cm)
Power Handling [5]	CW	50 watts		25 watts	
	Peak	0.5 kW		0.25 kW	

[1] Equivalent VSWR.
[2] Precision stainless steel type N per Maury data sheet 5E-049.
[3] Precision 7mm per Maury data sheet 5E-060.
[4] Precision 3.5mm per Maury data sheet 5E-062.
[5] Within rated matching range.

TUNERS

SLIDE SCREW TUNERS – WIDE MATCHING RANGE

- Slab-line Transmission Structure
- Dual Probes Improve Matching
- LCD Readout for Carriage Position



8045N

Description

The tuners in this series are similar to those described on the previous page; however, the mechanical characteristics are optimized for increased matching ranges. These tuners also utilize the slab-line transmission structure for broad frequency range. The probes are designed to be very close to one-quarter wavelength in the linear dimension at the mid-band of each range. Since each tuner has two probes, this results in improved matching characteristics for each unit. An additional feature of this series of tuners is the use of a LCD position readout of the carriage position on those units operating below 18 GHz. Higher frequency tuners utilize a micrometer carriage drive. These are noted in the model chart below.

The positional repeatability and high matching range of these tuners are ideally suited to applications like device characterization. Such measurements depend upon the ability of the tuner to establish impedances out near the edge of the Smith chart and to reproduce the electrical characteristics as a function of mechanical position. Slide screw tuners are also easy to use due to the almost independent electrical results of the mechanical motions. The depth of penetration of the probe into the transmission line determines the magnitude of the reflection, while the position of the probe along the line determines the phase. While there is some interaction, the effects are almost independent of each other.

Frequency Range (GHz)	Matching Range [1]	Connector – Model			
		Type N [2]	7mm [3]	3.5mm [4]	2.4mm [5]
0.8 — 2.5	25:1 (nominal)	1643N	2640N	8045N	—
2.5 — 8.0	18:1 (nominal)				
0.8 — 18.0	10:1 (nominal)	1643P	2640P	8045P	—
1.8 — 18.0	12:1 (nominal)	1643D1	2640D1	8045D1	—
12.0 — 34.0	10:1 (nominal)	—	—	8041C [6]	—
12.0 — 40.0	10:1 (nominal)	—	—	—	—
12.0 — 50.0	10:1 (nominal)	—	—	—	7941A [6]
Power Handling [7]	CW	50 watts		25 watts	15 watts
	Peak	0.50 kW		0.25 kW	0.15 kW

[1] Equivalent VSWR.

[2] Precision stainless steel type N per Maury data sheet 5E-049.

[3] Precision 7mm per Maury data sheet 5E-060.

[4] Precision 3.5mm per Maury data sheet 5E-062.

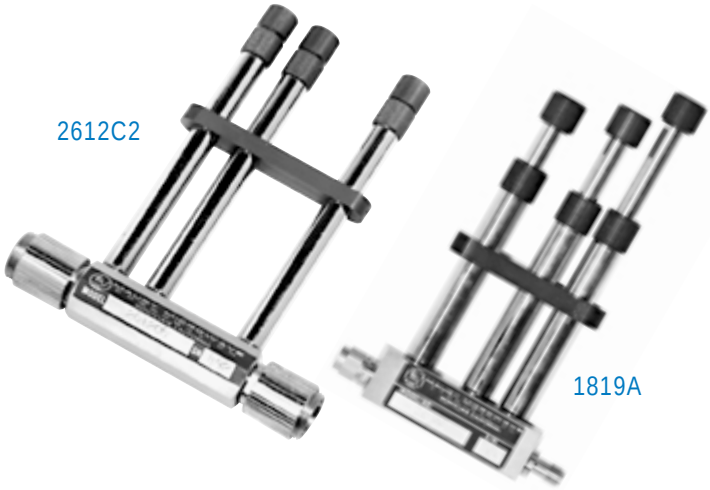
[5] Precision 2.4mm per Maury data sheet 5E-064.

[6] Micrometer carriage drive.

[7] Within rated matching range.

TUNERS

STUB TUNERS



Description

Stub tuners are basic laboratory tools used for matching load impedances to provide for maximum power transfer between a generator and a load, and introducing a mismatch into an otherwise matched system. Typical applications include power and attenuation measurements, tuned reflectometer systems and providing a DC return for single-ended mixers and detectors.

Stub tuners are impedance transformers that are designed to introduce a variable shunt susceptance into a coaxial transmission line. They consist of one or more short-circuited, variable length lines (stubs) connected at right angles to the primary transmission line. Each stub must be movable over one-half wavelength at the lowest frequency of operation in order to provide all possible shunt susceptances; therefore, the low frequency limit of a tuner is determined by the frequency at which the maximum stub travel equals one-half wavelength. Tuners, particularly multiple-stub models, are still usable below this limit. Other than the limitation of the connectors, there is no higher frequency limit; however, various models are offered for size convenience.

The spacing between the stubs of multiple-stub tuners determines the range of impedances that can be matched and the ease of tuning . The stub spacing of Maury double- and triple-stub tuners has been selected for general broadband applications. Triple-stub tuners are more convenient to use since tuning sensitivity is relatively independent of stub spacing.

Maury produces a comprehensive line of broadband stub tuners designed to satisfy the majority of applications. These tuners are available in double- and triple-stub configurations with frequency ranges extending from 0.2 to 18.0 GHz.

STUB TUNER REFERENCE CHART

Type	Frequency Range (GHz)	Connector — Model Type N [1]	7mm [2]	SMA [3]	Stub Travel inches	(cm)	Stub Spacing inches	(cm)
Double-Stub	0.2 — 0.5	1778G	2612B7	—	30.0	(76.2)	4.6	(11.7)
	0.4 — 1.0	1778A	2612B1	1719A	15.0	(38.1)	4.6	(11.7)
	0.8 — 4.0	1778B	2612B2	1719B	7.5	(19.1)	2.0	(5.1)
	2.0 — 12.0	1778C	2612B3	1719C	3.0	(7.6)	0.75	(1.9)
	2.0 — 18.0	1778E	—	—	3.0	(7.6)	0.5	(1.3)
	4.0 — 18.0	1778D	2612B4	1719D	1.75	(4.4)	0.5	(1.3)
Triple-Stub	0.2 — 0.5	1878G	2612C7	—	30.0	(76.2)	4.6 (11.7) / 2.0	(5.1)
	0.4 — 1.0	1878A	2612C1	1819A	15.0	(38.1)	4.6 (11.7) / 2.0	(5.1)
	0.8 — 4.0	1878B	2612C2	1819B	7.5	(19.1)	1.0 (2.5) / 0.75	(1.9)
	2.0 — 18.0	1878C	2612C3	1819C	3.0	(7.6)	0.75 (1.9) / 0.5	(1.3)
	4.0 — 18.0	1878D	2612C4	1819D	1.75	(4.4)	0.75 (1.9) / 0.5	(1.3)

[1] Precision stainless steel type N per Maury data sheet 5E-049.

[2] Precision 7mm connector per Maury data sheet 5E-060.

[3] Precision stainless steel SMA per MIL-C-39012.

DIRECTIONAL COUPLERS

PRECISION HIGH DIRECTIVITY

- Features
- High Directivity
- Broadband Operation
- Precision Connectors
- Low VSWR
- High Tracking Accuracy

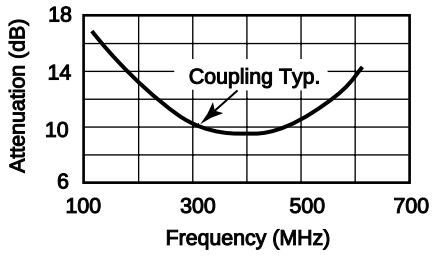
Description

The 4030 and 4090 series of precision directional couplers are designed to provide high directivity and an accurate sample of forward or reflected power over octave bandwidths or greater. They are primarily intended for laboratory type applications where an extremely stable and rugged device is required.

The couplers, when used singly or in pairs, are ideally suited for high accuracy swept frequency measurements or reflection coefficient and insertion loss. The use of precision couplers has numerous advantages and applications such as when used with network analyzer systems and in power level measurements.

Units are available with either 7mm [1] or 14mm (MPC14) [2] connectors on the mainline with a precision stainless steel type N female connector on the secondary line input.

Figure A. Coupling Curve for 0.1 to 0.6 GHz Couplers



Units are provided calibrated at five frequencies.

[1] Precision 7mm connector per Maury data sheet 5E-060.
[2] Precision 14mm connector, mating compatible with GR900.
[3] Typical > 45 dB.
[4] Typical > 43 dB.
[5] Typical > 38 dB.

Specifications

Frequency Range ..... Octave bands or greater, see chart
Coupling ..... 10 dB nominal
Tracking (unit to unit when paired) ..... 0.03 dB
Directivity ..... Generally >40 dB, see chart
VSWR ..... See chart
Nominal Impedance ..... 50 ohm
Power Handling ..... 30 watts
Connectors:
Main Line ..... 7mm (model 4030 series)
14mm (model 4090 series)
Coupled Line ..... Type N female

Frequency Range (GHz)	Model	Directivity dB	Coupling Frequency Sensitivity dB	VSWR		Overall Length (inches)
				Main	Sec	
0.25 — 0.5	4036	40 [3]	±1.0	1.10 [6]	1.15 [7]	10.70
0.50 — 1.0	4037	40 [3]	±1.0	1.10 [6]	1.15 [7]	6.69
0.95 — 2.2	4031	40 [3]	±1.0	1.10	1.15	4.59
1.7 — 4.2	4032	40 [4]	±1.2	1.15	1.20	3.70
3.7 — 8.3	4033	35 [5]	±1.2	1.20	1.25	6.35

Frequency Range (GHz)	Model	Directivity dB	Coupling Frequency Sensitivity dB	VSWR		Overall Length (inches)
				Main	Sec	
0.10 — 0.6	4096A	46 [8]	[9]	1.05	1.08	13.15
0.50 — 1.0	4097	46 [8]	±1.0	1.05	1.10	9.14
0.75 — 1.5	4094	45	±1.0	1.05	1.10	7.88
0.95 — 2.2	4091	45	±1.2	1.05	1.10	7.04
1.50 — 3.0	4095	42	±1.0	1.07	1.10	6.51

[6] 1.05 typical.
[7] Directivity from 8.3 to 8.5 GHz is 34 dB minimum.
[8] Typical > 50 dB.
[9] See Figure A.

DIRECTIONAL COUPLERS

EIA RIGID LINE – HIGH DIRECTIVITY

Description

These precision directional couplers are designed utilizing EIA rigid coaxial transmission line connectors in 7/8 and 1-5/8 line sizes on the mainline with a type N female secondary line output. They provide the ability to perform precision swept frequency measurements in the larger coaxial line sizes. These units offer high directivity and an accurate sample of forward or reflected power for use in variety of measurement applications.

For optimum accuracy, Maury precision bullets (inner conductor connectors) noted in the chart are recommended for use with these couplers. Individual support stands are available, also as noted in the chart, for convenient bench mounting.

2049M

Frequency Range (GHz)	Model		"A" Dim.
	7/8 EIA	1-5/8 EIA	
0.75 — 1.5	2049C	2149C	7.88
1.0 — 2.0	2049D	2149D	7.04
1.5 — 3.0	2049E	2149E	6.51
1.7 — 2.3	2049M	2149M	6.51
Support Stand	2149G	2149G	—
Bullet	2002A	2102A	—
"B" Dimension	2.31	3.42	—

Specifications

Frequency Range ..... See chart

Coupling ..... 10 dB nominal

Frequency Sensitivity ..... ±1.0 dB [1]

Tracking (unit to unit when paired) ..... 0.3 dB

Directivity ..... 40 dB minimum [2]

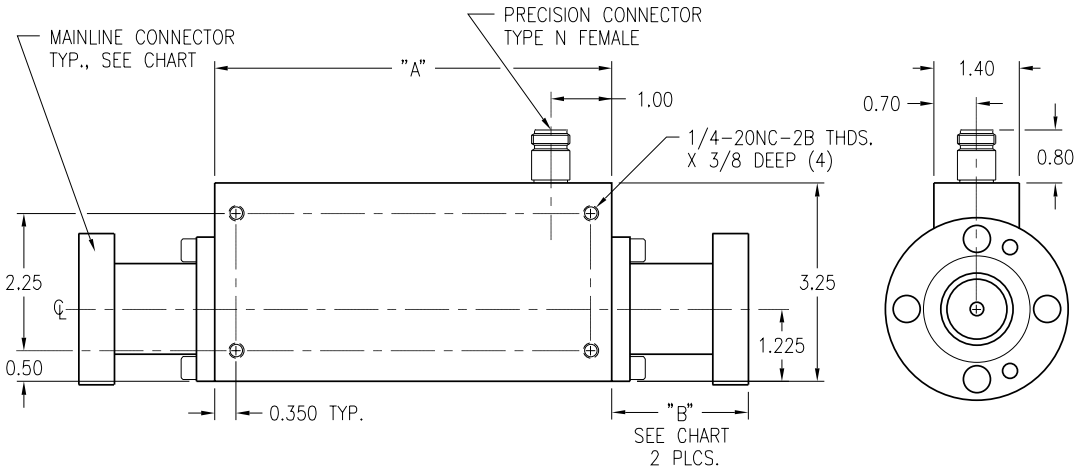
VSWR (maximum) ..... 1.10 primary, 1.15 secondary [3]

Nominal Impedance ..... 50 ohm

Power Handling ..... 30 watts [4]

Connectors ..... Primary line – see chart; secondary line – type N female

Dimensions



[1] See Figure A, page 159 for coupling curve; frequency sensitivity spec does not apply.

[2] 46 dB minimum, >50 dB typical for models 2049M and 2149M.

[3] Maximum VSWR for models 2049E and M, 2149 E and M is 1.15 primary, 1.20 secondary.

[4] Conservatively rated, consult us on higher power applications.

CABLE ASSEMBLIES

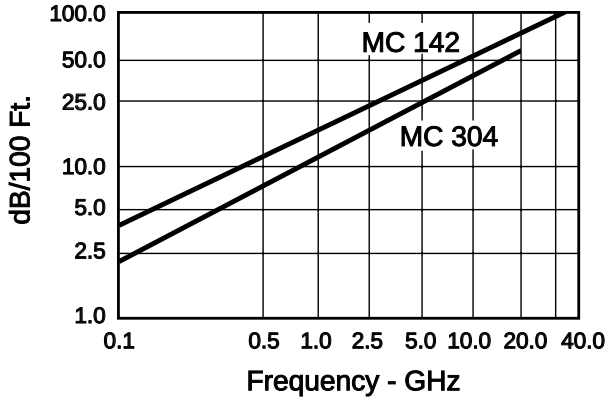
FLEXIBLE CABLE

Maury produces an extensive line of flexible cable assemblies that feature improved cable to connector transition designs. The graphs below show the loss characteristics and power handling capability of the various types of cables that are available.The following pages show our semi-rigid cable assemblies and our test port cable and adapter kits. Please consult our Sales Department for application assistance.

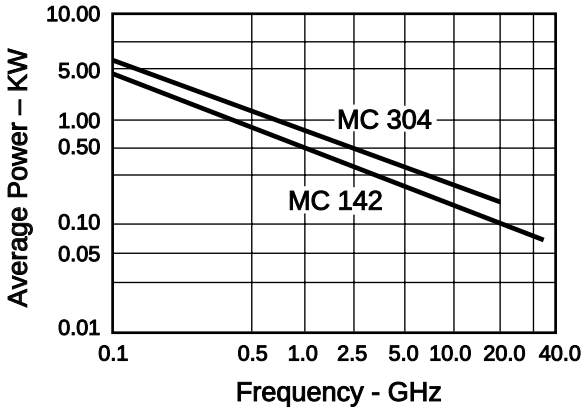
Connector Arrangement

A	—	female to female
B	—	male to male
C	—	female to male
D	—	female bulkhead to male

Nominal Loss Characteristics [1]



Maximum Power Handling Capability [2]



Available Models

To order, find the model number of the desired cable type, add a letter (from the chart above right) to designate the connector arrangement needed, followed by the length needed (in inches). Example: model 8918B36 is a 36-inch DC – 18.0 GHz MC304 assembly with precision N connectors (male to male).

Model	Frequency Range (GHz)	Cable Type	Connector	VSWR (maximum) [3]	Jacket O.D. [4]	Bend Radius (minimum) [4]
8913 (*)(**)	DC — 10.0	RG214/U	N	1.30	0.42	2.0
8922A (*)(**)	DC — 18.0	MC304	7mm	1.35	0.30	1.5
8918 (*)(**)	DC — 18.0	MC304	Precision N	1.40	0.30	1.5
8015 (*)(**)	DC — 26.5	MC142	3.5mm	1.60	0.20	1.0
8926 (*)(**)	DC — 12.4	RG142B/U	SMA	1.50	0.19	1.0
	12.4 — 18.0	RG142B/U	SMA	1.75	0.19	1.0

(*) Insert the appropriate letter to indicate the connector arrangement needed.
(**) Insert the length needed (in inches).

[1] Cable only. Does not include mismatch or connector losses which are additive.

[2] Cable only. Will have to be derated for specific connector type.

[3] VSWR specification is extremely conservative in most cases.

[4] Dimensions in inches.

CABLE ASSEMBLIES

SEMI-RIGID CABLE

Maury produces an extensive line of semi-rigid cable assemblies which are normally supplied in straight lengths as summarized below. Please contact us for additional information.

Precision Connectors

The assemblies in this model series are used in critical measurement applications requiring high stability and durability.

To order, find the model number, replace (X) with the letter indicating the desired connector arrangement (from the chart on page 161) and replace (L) with the desired cable length in inches.

Model	Frequency Range (GHz)	Connector	Cable Type	Typical VSWR [1]
8917A (L)	DC—18.0	7mm	0.141	1.35
8917B (L)	DC—18.0	7mm	0.250	1.25
8950 (X) (L)	DC—18.0	Precision N	0.141	1.40
8951 (X) (L)	DC—18.0	Precision N	0.250	1.30

SMA Connectors – 0.141 Cable Size

The 8921 series semi-rigid cable assemblies have precision SMA connectors per MIL-C-39012 and are ideal for general purpose laboratory or systems applications.

To order, find the model number and replace (L) with the desired cable length in inches.

Model	Frequency Range (GHz)	Connector Arrangement	Typical VSWR
8921A (L)	DC—18.0	SMA female to female	<1.30
8921B (L)	DC—26.5	SMA male to male	<1.40
8921C (L)	DC—18.0	SMA female to male	<1.30
8921D(L)	DC—18.0	SMA female bulkhead to male	<1.30

Type N General Purpose – DC-10 GHz

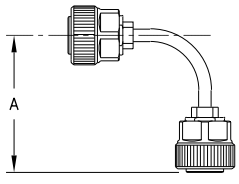
The 8910 series semi-rigid cable assemblies have general purpose type N connectors per MIL-C-39012 and are ideal for measurements and systems use.

To order, find the model number and replace (L) with the required cable length in inches.

Model 0.141 [2]	Model 0.250 [2]	Description
8910A (L)	8911A (L)	female to female
8910B (L)	8911B (L)	male to male
8910C (L)	8911C (L)	female to male
8910D (L)	8911D (L)	female bulkhead to female
8910E (L)	8911E (L)	female bulkhead to male

Precision Semi-Rigid Assemblies

These units are precision semi-rigid cable assemblies configured in a 90° bend. Three line sizes are offered: 0.0865" with 2.4mm connectors, 0.141" with 3.5mm connectors [3] and 0.250" with 7mm connectors [4]. Sexed connectors are offered in all combinations.

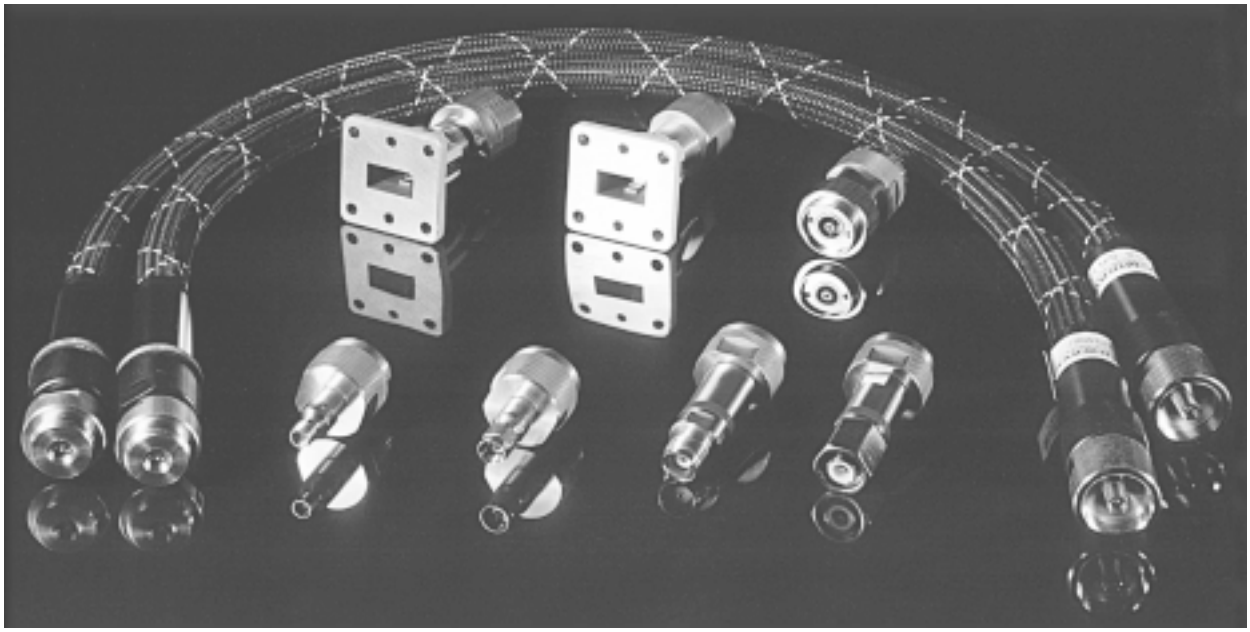


9526C

Model	Connector	Frequency Range (GHz)	VSWR (maximum)	"A" Dimension (inches)
8011A1 [5] 8011B1 [5] 8011C1 [5]	3.5mm f – f 3.5mm m – m 3.5mm f – m	DC – 26.5	1.25	2.00
9526C	7mm	DC – 8.0 8.0 – 18.0	1.10 1.25	1.75
7911A [5] 7911B [5] 7911C [5]	2.4mm f – f 2.4mm m – m 2.4mm f – m	DC – 50.0	1.5	1.90

[1] VSWR specification is extremely conservative in most cases.
[2] Semi-rigid cable size.
[3] Precision 3.5mm per Maury data sheet 5E-062.
[4] Precision 7mm per Maury data sheet 5E-060.
[5] Phase matched.

TEST PORT CABLE /ADAPTER KITS



Features

- VNA Applications
- Ruggedized Test Port Connectors
- 3.5mm and 2.92mm Test Ports
- Coaxial Test Port to Waveguide Adapters

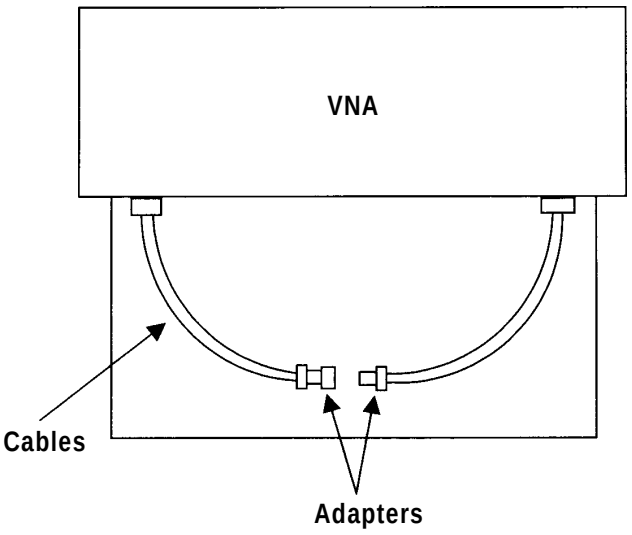
General

The 8944 cable and adapter sets are configured to be versatile and cost effective. The cable assemblies extend the test ports of Agilent and Anritsu network analyzers using rugged test port connectors on both ends of the cables. The adapters (which are also equipped with rugged test port connectors) allow the user to adapt the cables for other connector types. This eliminates the need to purchase multiple cables with different connectors; a single set of cables with additional adapters is all you need.

Description

The cables come in standard lengths of 25 inches and 38 inches with a rugged female test port connector on one end and a rugged male test port on the other. They are extremely flexible while still maintaining excellent phase and amplitude stability. The adapters have rugged female test ports and adapt to most popular connector types such as; 3.5mm, 7mm, N, TNC and 2.92mm. Waveguide to 3.5mm test port adapters are available in waveguide bands WR430 to WR42. A WR28 to 2.92mm test port adapter is also available.

Sets can be purchased with one or two cables and up to three adapter sets. Individual adapters can also be purchased. Kits with more than three adapter sets can be configured to the customer's specifications.



TEST PORT CABLE /ADAPTER KITS

8944 Series 3.5mm Cable and Adapter Sets

Model	Description
8944A25 (*) (*) (*)	1 cable, 3.5mm, 25 inches, plus adapters
8944B25 (*) (*) (*)	2 cables, 3.5mm, 25 inches, plus adapters
8944A38 (*) (*) (*)	1 cable, 3.5mm, 38 inches, plus adapters
8944B38 (*) (*) (*)	2 cables, 3.5mm, 38 inches, plus adapters

(*) Insert adapter option from table below.

Adapters Available

Adapter Model	Connectors	Quantity	Standard Adapter Options
8009A	NMD 3.5mm (f) 3.5mm (f)	1	A
8009B	NMD 3.5mm (f) 3.5mm (m)	1	
8009G	NMD 3.5mm (f) 7mm	2	B
8829A	NMD 3.5mm (f) N (m)	1	C
8829B	NMD 3.5mm (f) N (f)	1	
8619A	NMD 3.5mm (f) TNC (f)	1	D
8619B	NMD 3.5mm (f) TNC (m)	1	
2433A1	NMD 3.5mm (f) 14mm	2	E
H230K1	NMD 3.5mm (f) WR112	2	F
X230K1	NMD 3.5mm (f) WR90	2	G
M230K1	NMD 3.5mm (f) WR75	2	H
P230K1	NMD 3.5mm (f) WR62	2	J
N230K3	NMD 3.5mm (f) WR51	2	K
K230K6	NMD 3.5mm (f) WR42	2	L

Optional Adapters

8909F NMD 3.5mm (f) to NMD 3.5mm (m)
7909H NMD 2.4mm (f) to NMD 3.5mm (m)
U233E NMD 2.92mm (f) to WR28

25" Cable Length Specifications

Model 8944C25

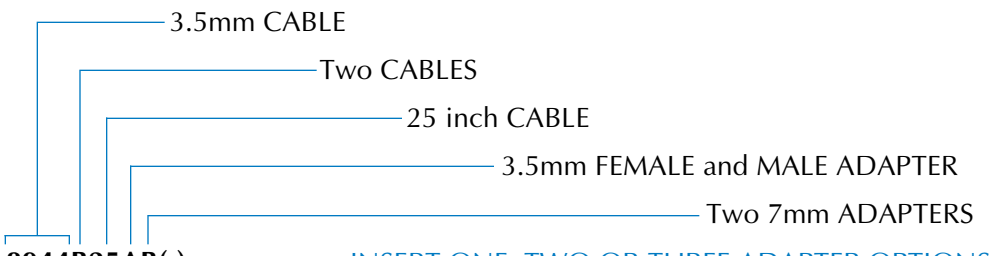
Frequency Range ..... 26.5 GHz
Insertion Loss, dB
  Typical ..... $0.05 + 0.30(f) + 0.010(f)$
  Guarantee ..... $0.25 + 0.35(f) + 0.015(f)$
Return Loss, dB 18
Overall Phase Stability, degrees
  Typical ..... $0.05(f)$
  Guarantee ..... $0.5 + 0.08(f)$
Overall Amplitude Stability, dB
  Typical ..... ≤0.03
  Guarantee ..... ≤0.08
Return Loss Stability, dB ..... ≥40
Outer Diameter (inches, nom.) 0.6
Minimum Bend Radius (inches, nom.) 2.5

38" Cable Length Specifications

Model 8944C38

Frequency Range ..... 26.5 GHz
Insertion Loss, dB
  Typical ..... $0.044 + 0.47(f) + 0.014(f)$
  Guarantee ..... $0.290 + 0.51(f) + 0.017(f)$
Return Loss, dB 18
Overall Phase Stability, degrees
  Typical ..... $0.10(f)$
  Guarantee ..... $0.5 + 0.17(f)$
Overall Amplitude Stability, dB
  Typical ..... ≤0.05
  Guarantee ..... ≤0.15
Return Loss Stability, dB ..... ≥40
Outer Diameter (inches, nom.) 0.6
Minimum Bend Radius (inches, nom.) 2.5

Ordering Information



Model number example: 8944B25AB( )

TEST PORT CABLE /ADAPTER KITS

Coaxial Adapter Specifications

Model	To	From	Frequency Range (GHz)	Maximum VSWR (GHz)	Length (inches)
8009A	NMD 3.5mm (f)	3.5mm (f)	DC — 26.5	DC — 18.0 1.08	1.45
8009B	NMD 3.5mm (f)	3.5mm (m)		18.0 — 26.5 1.12	1.49
8009G	NMD 3.5mm (f)	7mm	DC — 18.0	1.018 + 0.003f	2.18
8009F	NMD 3.5mm (f)	NMD 3.5mm (m)	DC — 26.5	DC — 18.0 1.08	1.49
				18.0 — 26.5 1.12	
8829A	NMD 3.5mm (f)	Precision N (f)	DC — 18.0	DC — 6.0 1.04	2.04
8829B	NMD 3.5mm (f)	Precision N (m)		6.0 — 18.0 1.08	2.20
8619A	NMD 3.5mm (f)	Precision TNC (f)	DC — 18.0	DC — 3.5 1.06	2.05
				3.5 — 7.0 1.10	
8619B	NMD 3.5mm (f)	Precision TNC (m)		7.0 — 18.0 1.16	2.00
2433A1	NMD 3.5mm (f)	MPC14 (GR900 equiv.)	DC — 8.5	1.01 + 0.008f	2.32
7909H	NMD 2.4mm (f)	NMD 3.5mm (m)	DC — 34.0	DC — 10.0 1.06	1.49
				10.0 — 20.0 1.10	
				20.0 — 34.0 1.14	

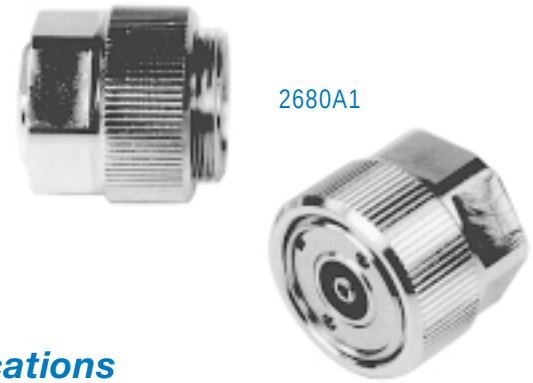
Waveguide Adapter Specifications

Model	Frequency Range (GHz)	Maximum VSWR (GHz)	Waveguide Size (EIA)	Equivalent Flange	Approximate Length (inches)
R230K1	1.7 — 2.6	1.10	WR430	CPR430F	6.19
S230K1	2.6 — 3.95	1.10	WR284	UG584/U	4.13
E230K1	3.3 — 4.9	1.10	WR229	CPR229F	3.88
G230K1	3.95 — 5.85	1.10	WR187	UG149/U	3.88
F230K1	4.9 — 7.05	1.10	WR159	CPR159F	3.40
C230K1	5.85 — 8.20	1.10	WR137	UG344/U	3.13
H230K1	7.05 — 10.0	1.10	WR112	UG51/U	2.98
X230K1	8.20 — 12.4	1.10	WR90	UG39/U	2.73
M230K1	10.0 — 15.0	1.10	WR75	MPF75	2.63
P230K1	12.4 — 18.0	1.10	WR62	UG419/U	2.38
N230K3	15.0 — 22.0	1.20	WR51	MPF51	2.00
K230K6	18.0 — 26.5	1.15	WR42	UG595/U	1.80
U233E [1]	26.5 — 40.0	1.30	WR28	UG599/U	1.80

[1] Uses a ruggedized 2.92mm connector.

PRECISION CONNECTORS

7mm Rigid Line Connectors



2680A1

The 2680A1 is a precision 7mm coaxial connector designed primarily for use with rigid air dielectric transmission lines (principal dimensions: 0.2756/ 0.01197 in.) and is equivalent to 7mm. These connectors provide superior electrical and mechanical performance for precision laboratory instruments.

The sexless coupling mechanism permits any two 7mm connectors to be mated directly. The outer coupling nut can be removed and other coupling mechanisms substituted without disturbing the air line assembly. The connector barrel configuration complies with IEEE requirements for 7mm general precision connectors. Because electrical and mechanical mating are accomplished in the same plane, the reference plane is clearly defined and permits accurate determination of electrical lengths.

All movable components of the connector are captivated. Assembly instructions with air line preparation dimensions are provided with each connector. The coupling unit is a 3/4" hex fabricated from stainless steel.

Specifications

Frequency Range ..... DC to 18 GHz

Characteristic Impedance ..... 50 ohm ±0.2%

VSWR ..... 1.003 +0.002 (F GHz)

Insertion Loss ..... Less than 7 x 10^{-3} F GHz per pair

Leakage (up to 6 GHz) ..... Better than 120 dB below signal

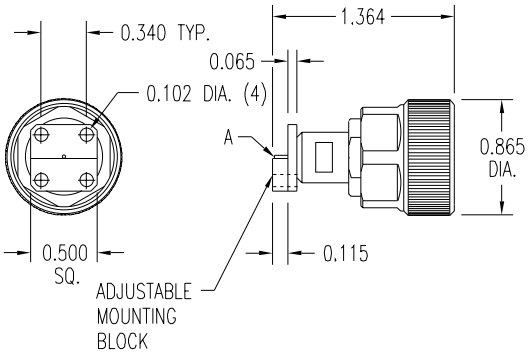
DC Contact Resistance ..... Inner: <1.0 milliohm; Outer: <0.1 milliohm

Model	Description
2680A1	7mm sexless

Micro-Strip Connectors

These connectors are designed for mounting on miniature micro-strip packages. They provide a well matched transition from DC to 18 GHz with a typical VSWR of 1.10, with a nominal impedance of 50 ohm.

Model	"A" (inches)
2683A1	0.010 diameter pin
2683B1	0.006 thick x 0.020 wide tab



Accessories

Precision connectors require precision assembly and gaging techniques in order to produce optimum performance. The following accessories are recommended for assembly or disassembly of the MPC7 connector.

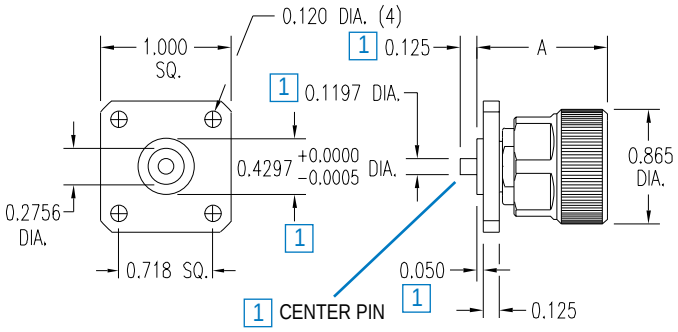
Model	Description
A028	Connector gage
2697A	Tool kit
2698C1	Torque wrench; 3/4" hex; 12 in/lbs

PRECISION CONNECTORS

7mm Panel Mount Connectors

Two flanged connectors are available. Model 2680C1 has a removable flange and center pin with a 0.093 hole solder pot. Model 2680B1 is essentially a rigid line type connector with an integral flanged body that receives an air line like model 2680A1. Both models exhibit the same basic electrical characteristics as model 2680A1.

Model	Description	"A" (inches)
2680B1	Integral flange	1.200
2680C1	Removable flange and contact pin	0.950



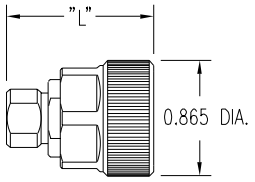
1 Dimensions shown apply to 2680C only.

Semi-Rigid Cable Connectors

These connectors are designed for ease of assembly, reliability and low VSWR performance.

Model	Description	VSWR Max. DC — 12.4 GHz*	"L" (inches)
2681C1	For use with 0.141 dia. copper coaxitube, solder type	1.15	1.50
2681D1	For use with 0.250 dia. copper coaxitube, solder type	1.12	1.50
2681E1	For use with 0.325 dia. copper coaxitube, solder type	1.10	1.50

* All models are usable to 18 GHz.

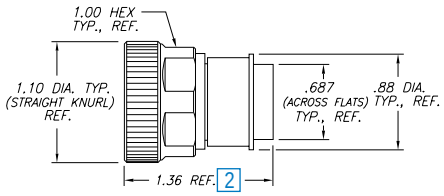


MPC14 Rigid Line Connectors

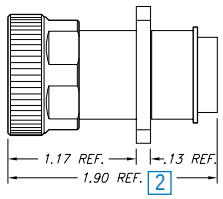
These connectors are essentially equivalent to GR900 connectors and are designed for use with 14mm rigid lines. The sexless coupling mechanism allows any two MPC14 (GR900) connectors to be mated.

The connector body and center conductor are fabricated from beryllium copper and gold plated. They employ a simplified eight tooth gear ring and a 1.00 hexagonal coupling to permit the junction to be accurately torqued. The integrated flange on panel mount connectors prevents accidental unscrewing.

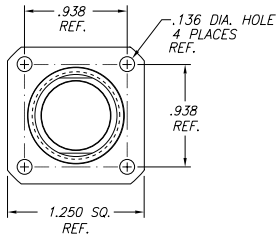
Model	Description
2480A1	Rigid line connector (equivalent to GR900BT)
2480B1	Panel mount with nut — rigid line
2480C1	Panel mount without nut — rigid line



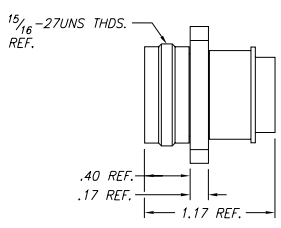
Model 2480A1



Model 2480B1



Model 2480B1 & 2480C1

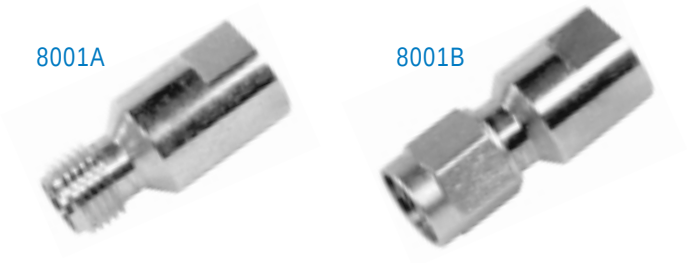


Model 2480C1

2 Shown with nut extended.

3.5mm COAXIAL CONNECTORS

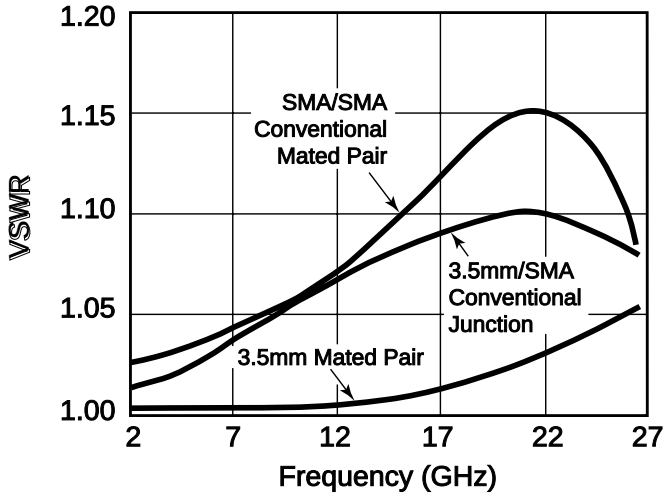
- SMA and 2.92mm (K) Mating Compatible
- Resonance Free to 34 GHz
- Low VSWR and Insertion Loss



Description

The 3.5mm connector utilizes a 50 ohm, high performance, air dielectric interface that is mode-free through 34 GHz with very low VSWR and insertion loss. The Maury connectors comply with the proposed USNC/IEC/SC46D standards: general precision connector, instrument grade – GPC3.5. Mechanical interface details can be found in Maury data sheet 5E-062. This connector is mating compatible with both SMA and 2.92mm (K) and is designed for durability and good connection repeatability in applications requiring multiple mating and disconnection (test instrumentation, test cables, etc.). The Maury line includes connectors for air lines, semi-rigid and flexible cables, panel mount and micro-strip launchers. Tool kits, torque wrenches and other accessories are also available.

Typical Performance



Electrical Specifications

The following specifications are for a mated pair of 3.5mm air line connectors (models 8001A & B) and may not apply to all connectors.

Frequency Range ..... DC to 34 GHz

Nominal Impedance ..... 50 ohm

VSWR ..... $1.01 + 0.004\sqrt{f}$ (GHz)

Insertion Loss (dB) ..... $0.015 - \sqrt{f}$ (GHz)

R. F. Leakage ..... <-100 dB at 26.5 GHz

Contact Resistance:

Inner Conductor ..... <2.0 milliohm

Outer Conductor ..... <0.4 milliohm

Voltage Rating ..... 500 volts RMS

Dielectric Insulation Rating ..... 1500 volts RMS

Power Handling ..... $2.5\ kW\sqrt{f}$ (MHz) above 16 Hz

Environmental Specifications

Thermal Limits ..... -65 to +85° C

Humidity ..... 20 to 80% RH

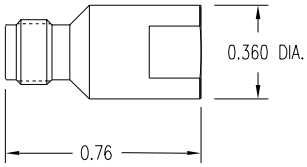
Pressure ..... 590 to 780mm Hg

3.5mm COAXIAL CONNECTORS

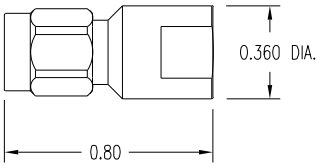
Rigid Air Line Connectors

Maury 3.5mm rigid air line connectors are designed for use with air dielectric coaxial line with 0.0598 inch (1.52mm) inner conductor diameter and 0.1378 inch (3.5mm) outer conductor inner diameter. A female panel mount version, model 8001C, is also available. Materials and instructions for fabricating the air line can be provided as well as a connector tool kit.

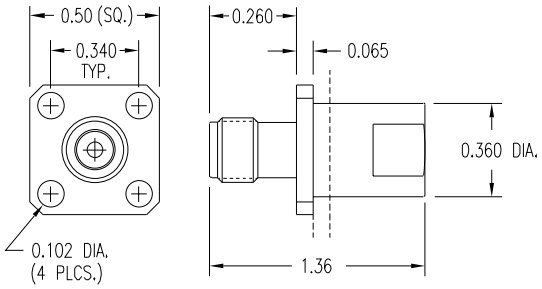
8001A Female



8001B Male



8001C Female Panel Mount



8001G Inner Conductor Rod: unfinished beryllium copper, 0.0598±0.0003 inch diameter, 6.00 inch length.

8001H Outer Conductor Tubing: unfinished, gun drilled and honed aluminum tubing, 0.1378±0.0003 inch inner diameter, 0.375 inch outer diameter, 6.00 inch length.

8001K Tool Kit

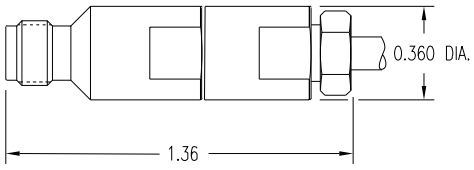
Tool kit for assembling rigid air line connectors consisting of:

1 each	center conductor pin vise
1 each	center conductor torque pin vise
1 each	3/16" open end wrench
1 each	5/16" torque wrench
1 each	wooden case and assembly instructions

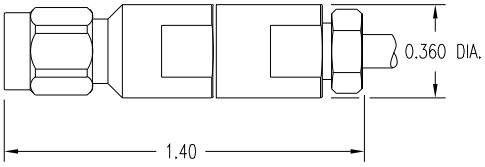
Semi-Rigid Cable Connectors

Maury manufactures precision 3.5mm connectors for use with 0.141 inch semi-rigid, copper jacketed cable.

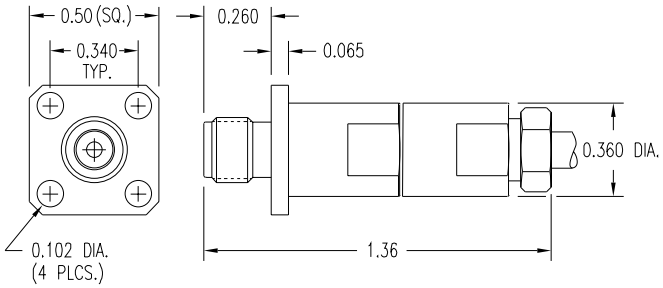
8003A Female Connector for 0.141 inch Cable



8003B Male Connector for 0.141 inch Cable



8003C Female Panel Mount Connector for 0.141 inch Cable



8003K1 Tool Kit

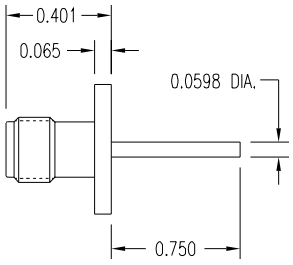
8003K1: provides the tools and instructions for assembling 0.141 inch semi-rigid cable connectors.

3.5mm COAXIAL CONNECTORS

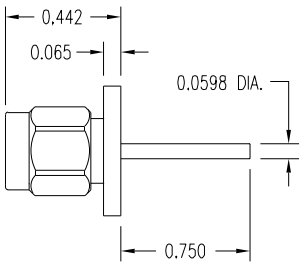
Panel Mount Connectors

The **8002A** [1] and **8002B** [1] are panel mount connectors in a four-hole mounting configuration. Option 1 converts these to two-hole mounting. The rear part of the center conductor can be removed for machining and a set of five spare center conductors, **8002C**, is available.

8002A Female



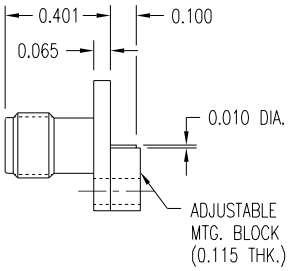
8002B Male



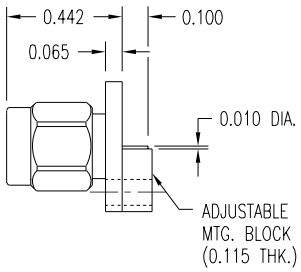
Micro-Strip Launch Connectors

The **8004** [1] series connectors are designed for use with micro-strip circuits and include a transformer from 3.5mm to a 0.01 inch pin diameter launch. Three basic panel mount models are available in a four-hole mounting configuration.

8004A Female



8004B Male

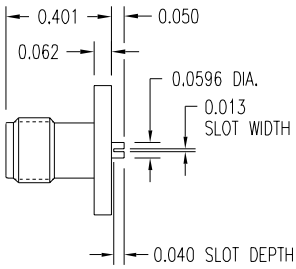


With Mounting Block

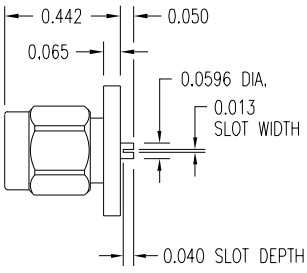
Suspended Stripline Connectors

The 8002D and 8002E are designed for use with suspended stripline circuits utilizing 0.010 thick dielectric with 1/2 ounce copper on both sides (0.012 inch nominal thickness).

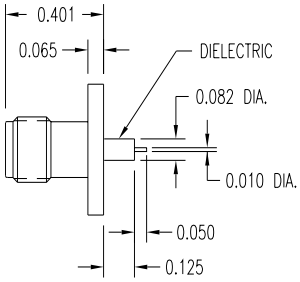
8002D Female



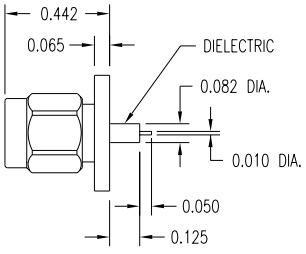
8002E Male



8004C [1] Female



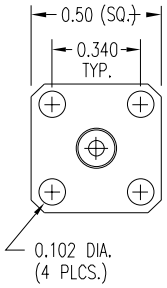
8004D [1] Male



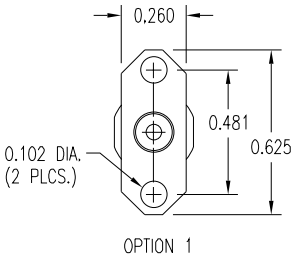
With Dielectric Feed Thru

Flange Configuration

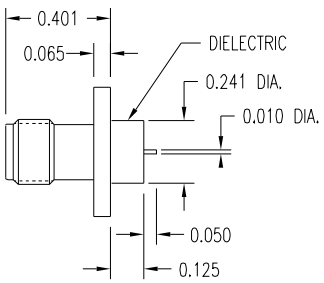
4-Hole



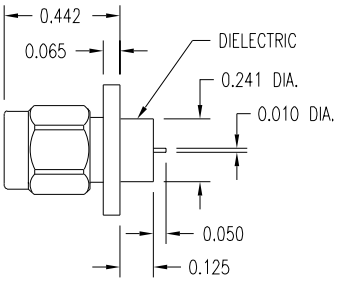
2-Hole (Option 1)



8004E Female



8004F Male



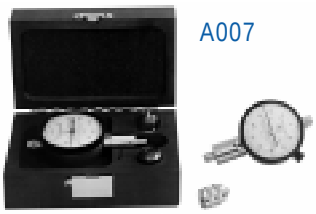
With Bushing Feed Thru

[1] Available with option 1, 2-hole mounting.

CONNECTOR GAGE KITS

- Direct Reading
- Self Checking
- Accurate
- Easy to Use

A027A



A007

Description

Maury's connector gage kits provide an easy to use, direct reading, self-checking, and accurate way to measure the critical linear interface dimensions of most coaxial connectors. These kits consist of gages with specially adapted dial indicators, plus the correct bushings and pins needed to mate with specified connectors. A master setting gage is used to adjust the dial indicator to zero, before a push-on or thread-on gage is mated with a connector to measure the distance from a given interface (male shoulder, etc.) to the outer conductor mating plane. The table below lists available models. Additional information on specific gages can be supplied on request.

Connector Type(s)	Dial Resolution (inches)	Style	Gages Per Kit	Model	Application	Maury Data Sheet
N	0.001	Push-On	1	A007A	Measures contact pin location.	2Y-002
N	0.00025	Push-On	1	A020A	Measures contact pin location.	2Y-003
N	0.0001	Thread-On	2	A020D	Metrology grade gages measure contact pin location.	2Y-003A
N (75 ohms)	0.0001	Push-On	1	A020G	Measures contact pin location.	2Y-003G
N, BNC, TNC, C, SC	0.00025	Push-On	1	A025A	Measures contact pin location.	2Y-016
SMA	0.0005	Push-On	2	A027	Measures contact pin location.	2Y-004
SMA	0.0005	Push-On	4	A027A	Measures contact pin and dielectric interface location.	2Y-004
SMA	0.0005	Push-On	2	A027G	Measures contact pin and dielectric interface location.	2Y-004
SMA	0.0005	Push-On	3	A027M	Measures standard male contact pin and dielectric interface locations, and the 0 .085 inch male coaxiatube pin dimension.	2Y-004
BNC,TNC	0.0005	Push-On	2	A012A	Measures contact pin and dielectric interface location.	2Y-009
AFTNC,TNC	0.0001	Push-On	6	A012E	Measures contact pin and dielectric interface locations of all MIL-STD, IEC and commercial TNC connectors. Measures all parameters.	2Y-028
3.5mm 2.92mm (K)	0.00025	Push-On	2	A034B	Measures female and male contact pin interface locations.	2Y-020
3.5mm 2.92mm (K)	0.0001	Thread-On	2	A034E	Metrology grade gages measure contact pin interface locations.	2Y-022A
2.4mm	0.0001	Push-On	2	A035C	Measures contact pin location of precision connectors.	2Y-022
2.4mm	0.0001	Thread-On	2	A035E	Metrology grade gages measure contact pin location of precision connectors.	2Y-022A
7mm	0.0001	Push-On	1	A028	Measures planar contact location.	2Y-005
7mm	0.0001	Thread-On	1	A028D	Metrology grade gage measures planar contact location.	2Y-005A
OSP™	0.00025	Push-On	1	A039C	Measures contact pin location.	2Y-026
7-16	0.00025	Push-On	1	A041A	Measures contact pin location.	2Y-027
SMP/GPO™ [1]	0.0005	Push-On	3	A042A	Measures contact pin and dielectric interface locations of SMP connectors.	2Y-031
Multiport	0.0005	Push-On	6	A045A	Measures contact pin and dielectric locations of multiport connectors.	2Y-029
ZMA/BZ	0.0005	Push-On	6	A046A	Measures contact pin and dielectric locations of multiport connectors.	2Y-030

[1] GPO™ is a trademark of the Gilbert Engineering Co., Inc.

TORQUE WRENCHES

Description

Maury's torque wrenches are recommended tightening coaxial connectors in order to obtain optimum repeatability and prolong connector life. They employ a "break" design so it is impossible to over-torque a coupled junction, and torque can be applied in either direction. Each Maury torque wrench is factory preset to the proper in/lbs for tightening its coaxial connector type, and the color coded handles make it easy to select the correct wrench from your toolbox at a glance.

Maury torque wrenches are included in many of our VNA calibration kits, and can be ordered separately by the model numbers listed below. If the wrench you need isn't showing, please contact our Sales Department or your local Maury representative for assistance.

2698G1 8799A1 2698C2

Model	For Use With Connector	Wrench Size (inches)	Preset Torque (in/lbs)	Handle Color [4]
2498T1	MPC14, LPC14 [1]	1.000 hex	12 ± 0.4	Blue
2698C2	7mm, LPC7, Type N [2], NMD3.5, NMD2.92, NMD2.4	0.750 hex	12 ± 0.4	Blue
2698G1	TNC [3], MPC6	0.562 hex	12 ± 0.4	Blue
2698H1	LPC/OSP™ [5]	0.562 hex	8 ± 0.3	Red
2698J1	SC	0.812 hex	12 ± 0.4	Blue
2698K1	7-16	1.062 hex	20 ± 0.5	Green
8799A1 [6]	3.5mm, MPC3, K (2.92mm), Q (2.4mm)	0.312 hex	8 ± 0.3	Red
8799D1	SMA, OSM	0.312 hex	5 ± 0.3	Black
8799E1	OSSM, MPC8	0.250 hex	5 ± 0.3	Black

[1] MPC14 and LPC14 connectors are precision 14mm connectors, essentially the same as GR900 connectors and are supplied with 1.0 hex nuts.

[2] Precision type N connectors supplied with 3/4 hex nuts.

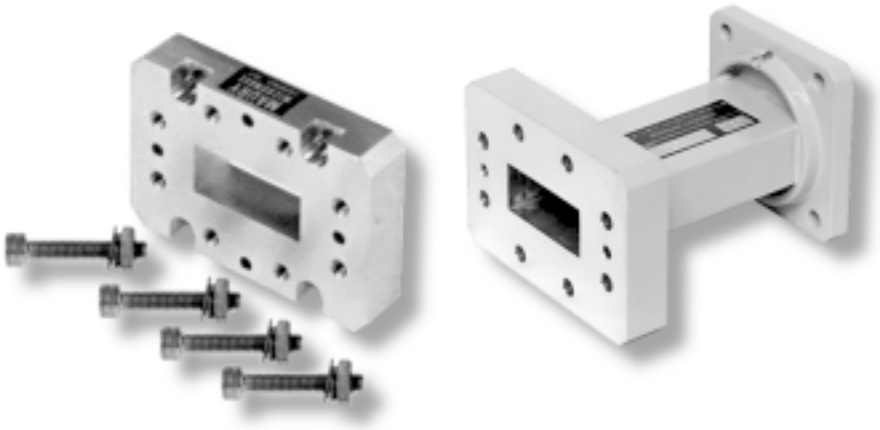
[3] Precision TNC connectors supplied with 9/16 hex nuts.

[4] Handle color represents torque value: blue = 12 in/lbs; red = 8 in/lbs; black = 5 in/lbs; green = 20 in/lbs (unless otherwise marked on the nameplate).

[5] Precision LPC/OSP™ per Maury data sheet 5E-065.

[6] Do not use on SMA connectors, damage can result.

TRANSMISSION LINE COMPONENTS



GENERAL

Maury produces waveguide components in all waveguide sizes. A comprehensive line of standard products is available in standard rectangular waveguide sizes shown in the chart below. They are generally supplied with cover flanges. Units from R through P bands are normally aluminum construction with irridite finish; K band and above are copper alloy with a plated finish. All units are painted with highly durable paint.

We also produce standard and special waveguide devices in millimeter sizes from 18 through 140 GHz (WR62 to WR8), large waveguides (WR430), and in many special configurations such as: flatguide, reduced height, round, etc. Maury can provide waveguide devices with any flange type, material or finish you require. Consult us on your specific requirement. (See pages 195–197 for additional flange details.)

Standard Rectangular

Maury Band	Frequency Range (GHz)	EIA WR Number	Equivalent Flange
R	1.70 — 2.60	430	CPR430F
D	2.20 — 3.30	340	CPR340F
S	2.60 — 3.95	284	UG584/U
E	3.30 — 4.90	229	CPR229F
G	3.95 — 5.85	187	UG149/U
F	4.90 — 7.05	159	CPR159F
C	5.85 — 8.20	137	UG344/U
H	7.05 — 10.00	112	UG51/U
X	8.20 — 12.40	90	UG39/U
M	10.00 — 15.00	75	MPF75
P	12.40 — 18.00	62	UG419/U
N	15.00 — 22.00	51	MP51
K	18.00 — 26.50	42	UG595/U
U	26.50 — 40.00	28	UG599/U

Millimeter

Maury Band	Frequency Range (GHz)	EIA WR Number	Equivalent Flange
Q	22.0 — 33.0	34	UG1530/U
J	33.0 — 50.0	22	UG383/U
T	40.0 — 60.0	19	UG383/U
V	50.0 — 75.0	15	UG385/U
Y	60.0 — 90.0	12	UG387/U
Z	75.0 — 110.0	10	UG387/U

TRANSMISSION LINE COMPONENTS

STRAIGHT SECTIONS

Rectangular (Fabricated)

Model	Frequency Range (GHz)	Length [3] inches	(cm)
R102A12 [1]	1.70 — 2.60	12.00	(30.5)
D102A12 [1]	2.20 — 3.30	12.00	(30.5)
S102A12 [1]	2.60 — 3.95	12.00	(30.5)
E102A8 [1]	3.30 — 4.90	8.00	(20.3)
G102A8 [1]	3.95 — 5.85	8.00	(20.3)
F102A8 [1]	4.90 — 7.05	8.00	(20.3)
C101A8 [2]	5.85 — 8.20	8.00	(20.3)
H101A6 [2]	7.05 — 10.00	6.00	(15.2)
X101A6 [2]	8.20 — 12.40	6.00	(15.2)
M102A6 [1]	10.00 — 15.00	6.00	(15.2)
P101A6 [2]	12.40 — 18.00	6.00	(15.2)
N102A4 [1]	15.00 — 22.00	4.00	(10.2)
K101A4 [2]	18.00 — 26.50	4.00	(10.2)
U101A4 [2]	26.50 — 40.00	4.00	(10.2)
Q102A4 [1]	22.00 — 33.00	4.00	(10.2)

Millimeter (Fabricated)

Model	Frequency Range (GHz)	Length [3] inches	(cm)
J103A3 [2]	33.0 — 50.0	3.00	(7.6)
V103A2 [2]	50.0 — 75.0	2.00	(5.1)
Z103A2 [2]	75.0 — 110.0	2.00	(5.1)

TWISTS

Model		Frequency Range (GHz)	Insertion Length (inches)
45° Twist	90° Twist		
R142A	R145A	1.70 — 2.60	15.00
—	D145A	2.20 — 3.30	12.50
—	S145A	2.60 — 3.95	10.00
—	E145A	3.30 — 4.90	9.00
—	G145	3.95 — 5.85	8.00
—	F145	4.90 — 7.05	7.50
—	C145	5.85 — 8.20	7.00
H142	H145	7.05 — 10.00	6.00
X142	X145	8.20 — 12.40	5.25
M142	M145	10.00 — 15.00	5.25
P142	P145	12.40 — 18.00	5.25
N142	N145	15.00 — 22.00	4.00
K142	K145	18.00 — 26.50	4.00
U142	U145	26.50 — 40.00	3.00

U101A4

H103C5

Test Port Adapters – Millimeter (Fabricated)

Model	Frequency Range (GHz)	Length [3] inches	(cm)
J106B [4]	33.0 — 50.0	1.96	(5.0)
V106B [4]	50.0 — 75.0	1.96	(5.0)
T106B [5]	40.0 — 60.0	1.96	(5.0)
Y106B [5]	60.0 — 90.0	1.96	(5.0)
Z106B [5]	75.0 — 110.0	1.96	(5.0)

G145

X145

[1] Aluminum construction.

[2] Brass plated construction.

[3] Straight sections can be provided in other lengths. Please specify length desired.

[4] Precision aluminum straight sections.

[5] To request straight sections made out of solid aluminum, specify band, length and 104 series.

WAVEGUIDE TRANSITIONS

RECTANGULAR TO RECTANGULAR OVERLAPPING BANDS

- 1.05 Maximum VSWR

E160A

160 Series
Tapered Transition

X161

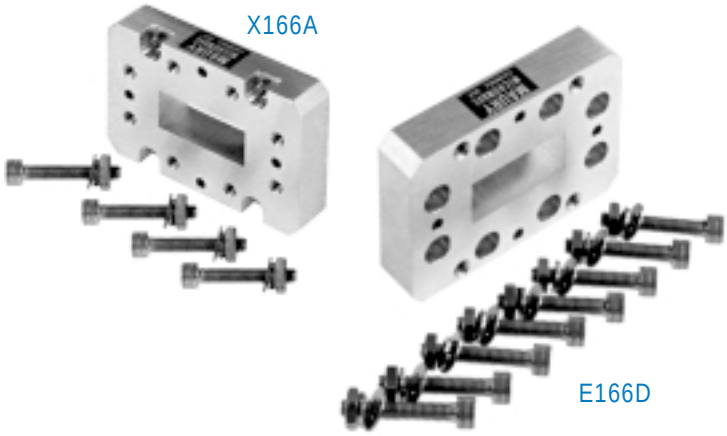
161 Series
Step Transition

Model	Frequency Range (GHz)	EIA Waveguide Size		Equivalent Flange		Length	
		From	To	From	To	inches	(cm)
D160B	2.60 — 3.30	340	284	CPR340F	UG53/U	13.0	(33.0)
E160A	3.95 — 4.90	229	187	CPR229F	UG149A/U	8.0	(20.3)
F160	5.85 — 7.05	159	137	CPR159F	UG344/U	6.0	(15.2)
C160	7.05 — 8.20	137	112	UG344/U	UG51/U	5.0	(12.7)
H161	8.20 — 10.00	112	90	UG51/U	UG39/U	1.5	(3.8)
H161C	8.20 — 10.00	112	90	CPR112F	UG39/U	1.5	(3.8)
X161	10.00 — 12.40	90	75	UG39/U	MPF75	2.4	(6.1)
M161	12.40 — 15.00	75	62	MPF75	UG419/U	2.4	(6.1)
P160A	15.00 — 18.00	62	51	UG419/U	MPF51	2.4	(6.1)
N160A	18.00 — 22.00	51	42	MPF51	UG595/U	2.4	(6.1)

WAVEGUIDE FLANGE ADAPTERS

IN-BAND – MINIMUM LENGTH

- Converts One Flange Type to Another in the Same Band, with Minimum Length
- 1.01 Typical VSWR
- Mounting Hardware and Assembly Instructions are Provided



Model	Converts (Equivalent Flange)		Frequency Range (GHz)	EIA WR Number	Length inches	(cm)
	From	To				
S166B	CPR284F	UG53/U	2.60 — 3.95	284	0.50	(1.3)
E166C	CPR229F	CMR229	3.30 — 4.90	229	0.50	(1.3)
E166D	CMR229	CPR229				
G166A	UG149A/U	CPR187F	3.95 — 5.85	187	0.50	(1.3)
F166C	CPR159	CPR159	4.90 — 7.05	159	0.75	(1.9)
F166D	CMR159	CPR159F				
C166A	UG344/U	CPR137F	5.85 — 8.20	137	0.50	(1.3)
C166B	CPR137F	UG344/U				
C166D	CMR137	CPR137F			0.75	(1.9)
C166E	UG344/U	CMR137			0.50	(1.3)
H166A	UG51/U	CPR112F	7.05 — 10.00	112	0.50	(1.3)
H166B	CPR112F	UG51/U				
H166C	CPR112F	CMR112			0.75	(1.9)
H166D	CMR112	CPR112F				
H166E	UG51/U	CMR112			0.50	(1.3)
H166F	CMR112	UG51/U				
X166A	UG39/U	CPR90F	8.20 — 12.40	90	0.50	(1.3)
X166B	CPR90F	UG39/U				
X166D	CMR90	CPR90F			0.75	(1.9)
X166E	UG39/U	CMR90			0.50	(1.3)
X166F	CMR90	UG39/U				
K166G	UG595U	UG425U	18.00 — 26.50	42	0.50	(1.3)
U166G	UG599/U	UG381/U	26.50 — 40.00	28	0.50	(1.3)

WAVEGUIDE TO COAXIAL ADAPTERS

General

Maury Microwave produces one of the most comprehensive lines of waveguide to coaxial connector adapters available in the industry. Our adapters have become known as the standards for high precision laboratory test and measurement applications as well as systems applications where precision and durability are important. Such features as precision index holes and lapped flanges provide the degree of performance required for the most exacting measurement tasks.

Our standard line of adapters includes right angle and end launch configurations in all common rectangular waveguide sizes covering frequencies from 1.7 to 50 GHz. Right angle launch adapters are also available in double ridged waveguide covering 3.5 to 40 GHz. Standard units adapt to all common coaxial connector types (7mm, type N, 3.5mm, etc.).

Maury has also produced special adapters in large waveguide sizes such as WR650 (1.12 to 1.7 GHz) and WR975 (0.76 to 1.15 GHz), adapters in uncommon sizes (e.g.: WR102), and in half-height waveguide. We have also provided units with less common connectors such as SC, 14mm (GR900) and EIA rigid line (7/8, 1-5/8, etc.).

Special adapters have been built for space flight environments.

If you require an adapter not listed in the following pages, please do not hesitate to contact the factory or your local Maury representative.

WAVEGUIDE TO COAXIAL ADAPTERS

RIGHT ANGLE LAUNCH

Description

Maury right angle launch adapters feature low VSWR and insertion loss. Except where noted, flanges are in accordance with the listing on page 163. Most of the adapters shown incorporate precision index holes in the flange for precise mating alignment and connection repeatability. Please consult the factory for detailed flange interface information.

Specifications

Frequency Range .....1.7 to 50 GHz (in waveguide bands)

VSWR .....1.25 maximum (<1.15 typical)

Flanges .....Cover type, see page 173

VSWR Options

Improved VSWR is provided on adapters with a model suffix (e.g.: X200A2). The VSWR suffixes are shown below.

Model Suffix	VSWR (maximum)
2	1.05
8	1.07
1	1.10
6	1.15
3	1.20
7	1.25

Many units can be provided with improved VSWR over the full or partial waveguide bands. Please consult our Sales Department for applications assistance.

Additional information on specific models such as loss, power handling and dimensions can be provided on request.

Type N
C213D2

7mm
X209D2

SMA
P211D

2.92mm
K210C1

WAVEGUIDE TO COAXIAL ADAPTERS

RIGHT ANGLE LAUNCH

Frequency Range (GHz)	EIA WR Number	Coaxial Connectors						
		Type N		TNC		7mm	SMA [1]	
		Female	Male	Female	Male		Female	Male
1.12 — 1.70	650	L213A1	L214A1	—	—	L209D1	—	—
1.70 — 2.60	430	R213A2	R214A2	—	—	R209A2	—	—
2.20 — 3.30	340	D213A1	D214A1	—	—	D209A2	—	—
2.60 — 3.95	284	S213D2	S214D2	—	—	S209D2	—	—
3.30 — 4.90	229	E213A2	E214A2	—	—	E209A2	—	—
3.95 — 5.85	187	G213D2	G214D2	—	—	G209D2	—	—
4.90 — 7.05	159	F213A2	F214A2	—	—	F209A2	—	—
5.85 — 8.20	137	C213D2	C214D2	—	—	C209D2	C210D	C211D
7.05 — 10.00	112	H213D2	H214D2	—	—	H209D2	H210D	H211D
8.20 — 12.40	90	X213D2	X214D2	—	—	X209D2	X210D	X211D
10.00 — 15.00	75	M213D2	M214D2	M215D1	M216D1	M209D2	M210D1	M211D1
12.40 — 18.00	62	P213D2	P214D2	P215D	P216D	P209D2	P210D	P211D
15.00 — 22.00	51	—	—	—	—	—	N210D	N211D
18.00 — 26.50	42	—	—	—	—	—	—	—
26.50 — 40.00	28	—	—	—	—	—	—	—

Frequency Range (GHz)	EIA WR Number	Coaxial Connectors							
		3.5mm		2.92mm (K)		MPC8 [2]		2.4mm (Q)	
		Female	Male	Female	Male	Female	Male	Female	Male
1.70 — 2.60	430	R200A1	R200B1	—	—	—	—	—	—
2.20 — 3.30	340	—	—	—	—	—	—	—	—
2.60 — 3.95	284	S200A1	S200B1	—	—	—	—	—	—
3.30 — 4.90	229	E200A1	E200B1	—	—	—	—	—	—
3.95 — 5.85	187	G200A1	G200B1	—	—	—	—	—	—
4.90 — 7.05	159	F200A1	F200B1	—	—	—	—	—	—
5.85 — 8.20	137	C200A1	C200B1	—	—	—	—	—	—
7.05 — 10.00	112	H200A1	H200B1	—	—	—	—	—	—
8.20 — 12.40	90	X200A2	X200B2	—	—	—	—	X236A1	X236B1
10.00 — 15.00	75	M200A2	M200B2	—	—	—	—	M236A1	M236B1
12.40 — 18.00	62	P200A2	P200B2	—	—	—	—	P236A1	P236B1
15.00 — 22.00	51	N200A2	N200B2	—	—	—	—	N236A1	N236B1
18.00 — 26.50	42	K200A1	K200B1	K210C1	K211C1	K207A1	K207B1	K236A1	K236B1
22.00 — 33.00	34	Q200A3	Q200B3	—	—	—	—	Q236A1	Q236B1
26.50 — 40.00	28	U200A1 [3]	U200B1 [3]	U210C6	U211C6	U207A7	U207B7	U236A6	U236B6
33.00 — 50.00	22	—	—	—	—	—	—	J236A3	J236B3

[1] Use 3.5mm adapters in bands not covered.

[2] MPC8 is mating compatible with SSMA/OSSM.

[3] 3.5mm WR28 models are rated to 34 GHz. Use 2.92mm adapters, which are mating compatible, for full band coverage.

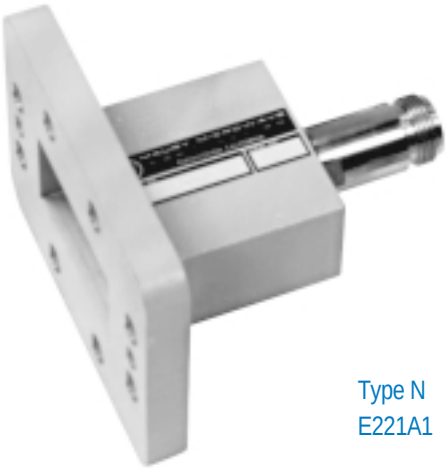
WAVEGUIDE TO COAXIAL ADAPTERS

END LAUNCH

Description

Maury end launch adapters feature low VSWR and insertion loss. The in-line configuration of these units is advantageous in both systems and measurement applications where multiple cable bends are to be avoided.

Except where noted, flanges are in accordance with the listing on page 173. Most of the adapters shown incorporate precision index holes in the flange for precise mating alignment and connection repeatability. Please consult the factory for detailed flange interface information.



Type N
E221A1

Specifications

Frequency Range ..... 1.7 to 50 GHz
(in waveguide bands)

VSWR ..... 1.25 maximum (< 1.15 typical) to 18 GHz
1.30 maximum (< 1.20 typical) to 50 GHz

Flanges ..... Cover type, see page 163

7mm
X229A2

VSWR Options

Improved VSWR is provided on adapters with a model suffix (e.g.: X200A2). The VSWR suffixes are shown below.

Model Suffix	VSWR (maximum)
2	1.05
8	1.07
1	1.10
6	1.15
3	1.20
7	1.25

3.5mm
K230B6

Many units can be provided with improved VSWR over the full or partial waveguide bands. Please consult our Sales Department for applications assistance.

Additional information on specific models such as loss, power handling and dimensions can be provided on request.

2.4mm
U237A1

WAVEGUIDE TO COAXIAL ADAPTERS

END LAUNCH

Frequency Range (GHz)	EIA WR Number	Coaxial Connectors				
		Type N		7mm	SMA [1]	
		Female	Male		Female	Male
1.70 — 2.60	430	R221A	R221B	R229A1	—	—
2.60 — 3.95	284	S221A1	S221B1	S229A1	—	—
3.30 — 4.90	229	E221A1	E221B1	E229A1	—	—
3.95 — 5.85	187	G221A1	G221B1	G229C1	—	—
4.90 — 7.05	159	F221A1	F221B1	F229C1	—	—
5.85 — 8.20	137	C221A1	C221B1	C229A1	—	—
7.05 — 10.00	112	H221A	H221B	H229A2	—	—
8.20 — 12.40	90	X221A2	X221B2	X229A2	X223A	X223B
10.00 — 15.00	75	M221A2	M221B2	M229A2	—	—
12.40 — 18.00	62	P221A2	P221B2	P229A2	P223A	P223B
15.00 — 22.00	51	—	—	—	—	—

Frequency Range (GHz)	EIA WR Number	Coaxial Connectors							
		3.5mm		2.92mm (K)		MPC8 [2]		2.4mm (Q)	
		Female	Male	Female	Male	Female	Male	Female	Male
1.70 — 2.60	430	—	—	—	—	—	—	—	—
2.60 — 3.95	284	S230A1	S230B1	—	—	—	—	—	—
3.30 — 4.90	229	E230A1	E230B1	—	—	—	—	—	—
3.95 — 5.85	187	G230A1	G230B1	—	—	—	—	—	—
4.90 — 7.05	159	—	—	—	—	—	—	—	—
5.85 — 8.20	137	C230A1	C230B1	—	—	—	—	—	—
7.05 — 10.00	112	H230A1	H230B1	—	—	—	—	—	—
8.20 — 12.40	90	X230A1	X230B1	—	—	—	—	—	—
10.00 — 15.00	75	M230A1	M230B1	—	—	—	—	—	—
12.40 — 18.00	62	P230A2	P230B2	—	—	—	—	—	—
15.00 — 22.00	51	N230A3	N230B3	—	—	—	—	—	—
18.00 — 26.50	42	K230A6	K230B6	K233A8	K233B8	K225A	K225B	K237A2	K237B2
22.00 — 33.00	34	—	—	—	—	—	—	Q237A2	Q237B2
26.50 — 40.00	28	U230A7 [3]	U230B7 [3]	U233A1	U233B1	U225A	U225B	U237A1	U237B1
33.00 — 50.00	22	—	—	—	—	—	—	J237A6	J237B6

[1] Use 3.5mm adapters in bands not covered.

[2] MPC8 is mating compatible with SSMA/OSSM.

[3] 3.5mm WR28 models are rated to 34 GHz. Use 2.92mm adapters, which are mating compatible, for full band coverage.

FIXED TERMINATIONS

- Low VSWR
- Moderate Power Handling

K301

P301A

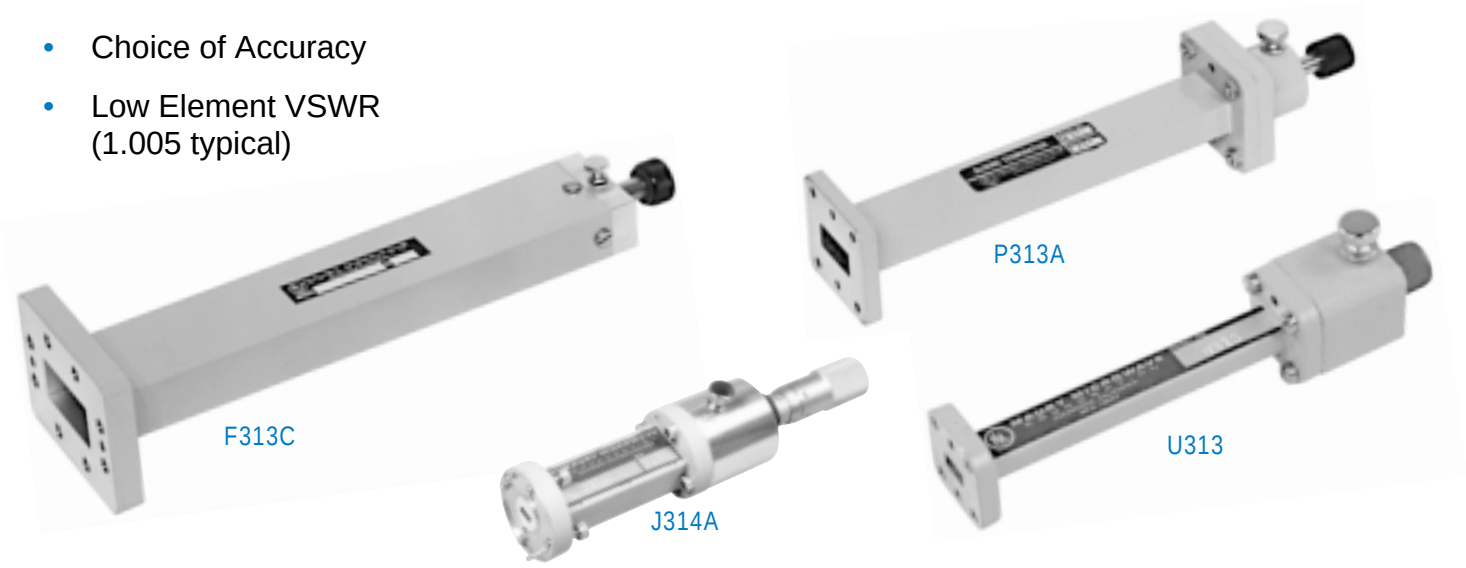
R301A

Model	Frequency Range (GHz)	EIA WR Number	Equivalent Flange	VSWR (maximum)	Power Rating		Length	
					Ave (W)	Peak (kW)	inches	(cm)
R301A	1.70 — 2.60	430	UG435/U	1.025	12.0	5.0	14.8	(37.6)
D301A	2.20 — 3.30	340	CPR340F	1.025	10.0	4.0	9.8	(24.9)
S301A	2.60 — 3.95	284	UG584/U	1.025	6.0	3.0	10.4	(26.4)
E301F	3.30 — 4.90	229	CPR229F	1.020	5.0	2.0	7.4	(18.8)
G301	3.95 — 5.85	187	UG149A/U	1.020	5.0	2.0	6.4	(16.3)
F301C	4.90 — 7.05	159	CPR159F	1.020	4.0	1.0	5.8	(14.7)
C301	5.85 — 8.20	137	UG344/U	1.020	3.0	1.0	5.2	(13.2)
H301A	7.05 — 10.00	112	UG51/U	1.015	2.0	1.0	5.0	(12.7)
X301A	8.20 — 12.40	90	UG39/U	1.015	1.0	1.0	5.0	(12.7)
M301A	10.00 — 15.00	75	MPF75	1.020	1.0	1.0	5.0	(12.7)
P301A	12.40 — 18.00	62	UG419/U	1.020	1.0	1.0	4.0	(10.2)
N301	15.00 — 22.00	51	MPF51	1.025	0.5	0.2	3.1	(07.9)
K301	18.00 — 26.50	42	UG595/U	1.025	0.5	0.2	2.8	(07.1)
U301	26.50 — 40.00	28	UG599/U	1.025	0.5	0.2	2.2	(05.6)
J301A	33.00 — 50.00	22	UG383 [1]	1.040	0.5	0.1	1.6	(04.1)
V301B	50.00 — 75.00	15	UG385 [1]	1.025	0.3	0.05	1.5	(03.8)
Y301	60.00 — 90.00	12	UG387/U	1.030	0.2	0.03	1.5	(03.8)
Z301B	75.00 — 110.00	10	UG387 [1]	1.030	0.2	0.03	1.5	(03.8)

[1] Units are supplied with Maury precision MPF flanges which mate with the UG flanges shown.

SLIDING TERMINATIONS

- Choice of Accuracy
- Low Element VSWR (1.005 typical)



Frequency Range (GHz)	EIA WR Number	Equivalent Flange	Element VSWR (maximum)	Power Handling Watts (w)	Precision		High Precision [1]	
					Model	Housing VSWR (maximum)	Model	Housing VSWR (maximum)
1.7 — 2.6	430	UG435/U	1.01 [2]	8.0	R313A	1.01	R314	1.005
2.2 — 3.3	340	CPR340F	1.01	7.0	D313A	1.01	—	—
2.6 — 3.95	284	UG584/U	1.01	6.0	S313A	1.01	S314	1.005
3.3 — 4.9	229	CPR229F	1.01	5.0	E313F	1.01	E314	1.005
3.95 — 5.85	187	UG149A/U	1.01	5.0	G313	1.01	G314	1.005
4.90 — 7.05	159	CPR159F	1.01	4.0	F313C	1.01	F314	1.005
5.85 — 8.2	137	UG344/U	1.01	3.0	C313	1.01	C314	1.005
7.05 — 10.0	112	UG51/U	1.01	2.0	H313	1.01	H314	1.005
8.2 — 12.4	90	UG39/U	1.01	2.0	X313	1.012	X314	1.005
10.0 — 15.0	75	MPF75	1.01	1.5	M313	1.013	M314	1.006
12.4 — 18.0	62	UG419/U	1.01	1.0	P313A	1.015	P314	1.006
15.0 — 22.0	51	MPF51	1.01	0.5	N313	1.02	N314	1.008
18.0 — 26.5	42	UG595/U	1.01	0.5	K313	1.02	K314	1.010
22.0 — 33.0	34	UG1530/U [3]	1.015	0.5	Q314A	1.01	—	—
26.5 — 40.0	28	UG599/U	1.015	0.5	U313	1.025	U314	1.013
33.0 — 50.0	22	UG383 [3]	1.015	—	—	—	J314A	1.015
50.0 — 75.0	15	UG385/U [3]	1.02	—	—	—	V314B	1.004
60.0 — 90.0	12	UG387/U [3]	1.025	—	—	—	Y314B	1.008
75.0 — 110.0	10	UG387/U [3]	1.025	—	—	—	Z314A	1.008

[1] Housings are machined.

[2] 1.02 maximum 1.7 to 2.1 GHz.

[3] Units are provided with Maury MPF series flanges with index holes which mate with the UG flanges shown.

SLIDING MISMATCHES

- Accurate VSWR Standard
- Movable Termination Element

K320A

H320A

J320A

Specifications

VSWR Accuracy .....±0.01 max. (< ±.005 typical) [1]

Element VSWR..... 1.01 max. (< 1.005 typical) [2]

Code Letter	VSWR	Reflection Coefficient
A	1.05	0.0244
B	1.10	0.0476
C	1.15	0.0698
D	1.20	0.0909

Other VSWR values can be provided upon request as well as units to a specific reflection coefficient value. Contact us for application assistance.

Model	Frequency Range (GHz)	EIA WR Number	Equivalent Flange
S320(*)	2.6 — 3.95	284	UG584/U
E320(*)	3.3 — 4.9	229	CPR229F
G320(*)	3.95 — 5.85	187	UG149A/U
C320(*)	5.85 — 8.2	137	UG344/U
H320(*)	7.05 — 10.0	112	UG51/U
X320(*)	8.2 — 12.4	90	UG39/U
M320(*)	10.0 — 15.0	75	MPF75
P320(*)	12.4 — 18.0	62	UG419/U
N320(*)	15.0 — 22.0	51	MPF51
K320(*)	18.0 — 26.5	42	UG595/U
U320(*)	26.5 — 40.0	28	UG599/U
J320(*)	33.0 — 50.0	22	UG383/U

(*) Insert code letter from the adjacent chart for desired mismatch value to complete the model number.

[1] K band is ±0.015 maximum, U band is ±.020 maximum.

[2] U band is 1.015 maximum.

FIXED SHORT CIRCUITS


F344B


C344A


X344A


P344A


U344A


V344D

Model	Mates With Equivalent Flange	EIA WR Number	Frequency Range (GHz)
B344B	CPR975F	975	0.75 — 1.12
BS344B	CPR770F	770	0.96 — 1.45
L344B	CPR650F	650	1.12 — 1.70
LS344B	CPR510F	510	1.45 — 2.20
R344B	CPR430F / UG435A/U	430	1.7 — 2.6
D344B	CPR340F	340	2.2 — 3.3
S344A	UG53/U	284	2.6 — 3.95
S344B	CPR284F		
S344C	CMR284		
E344B	CPR229F	229	3.3 — 4.9
E344C	CMR229		
G344A	UG149A/U	187	3.95 — 5.85
G344B	CPR187F		
G344C	CMR187		
F344B	CPR159F	159	4.9 — 7.05
F344C	CMR159		
C344A	UG344/U	137	5.85 — 8.2
C344B	CPR137F		
C344C	CMR137		
H344A	UG51/U	112	7.05 — 10.0
H344B	CPR112F		
H344C	CMR112		
X344A	UG39/U	90	8.2 — 12.4
X344B	CPR90F		
X344C	CMR90		
M344A	MPF75	75	10.0 — 15.0
P344A	UG419U	62	12.4 — 18.0
N344A	MPF51	51	15.0 — 22.0
K344A	UG595/U	42	18.0 — 26.5
K344D	UG425/U		
K344E	UG595/U [1]	42	18.0 — 26.5
[3]	—	34	22.0 — 33.0
U344A	UG599/U	28	26.5 — 40.0
[3]	UG381/U		
[3]	UG383/U	22	33.0 — 50.0
[3]	—	19	40.0 — 60.0
V344D	UG385/U	15	50.0 — 75.0
V344E	UG385/U [2]	15	50.0 — 75.0
[4]	UG387U	12	60.0 — 90.0
[4]	—	10	75.0 — 110.0

[1] Same as K344D with index holes.
[2] Same as V344D with index holes.
[3] Use K344D instead.
[4] Use V344D instead.

OFFSET SHORT CIRCUITS

Description

Offset shorts with 1/8 and 3/8 wavelength offsets are considered one of the more accurate means of obtaining a 180° phase difference in waveguide. Using these single-piece devices will reduce the number of flange interfaces during calibration. This helps to maintain an essentially constant magnitude of current flow across the calibration plane.

The following chart lists the available offset shorts. Those in rectangular guide are nominally 1/8 and 3/8 wavelength offset at a frequency near the waveguide band center. These will not be the exact band center as the frequency is chosen to equalize the phase differences at the band edges.

Rectangular Waveguide

Band	EIA Waveguide Size	Frequency Range (GHz)	Model	Offset (cm)	Delay (ps) [1]	Model	Offset (cm)	Delay (ps) [1]
L	WR650	1.12 — 1.7	L340A1	3.581	119.488	L340A3	10.744	358.497
R	WR430	1.7 — 2.6	R340F1	2.336	77.946	R340F3	7.010	233.904
S	WR284	2.6 — 3.95	S340B1	1.524	50.852	S340B2	4.572	152.555
E	WR229	3.3 — 4.9	E340B3	1.359	45.346	E340B4	4.077	136.038
G	WR187	3.95 — 5.85	G340B1	1.212	40.441	G340B3	3.078	102.704
F	WR159	4.9 — 7.05	F340C1	0.815	27.194	F340C3	2.446	81.616
C	WR137	5.85 — 8.2	C340F1	0.686	22.890	C340F3	2.058	68.670
H	WR112	7.05 — 10.0	H340B1	0.571	19.067	H340B3	1.714	57.191
HS	WR102	7.0 — 11.0	HS340A	0.558	16.684	HS340B	1.676	55.923
X	WR90	8.2 — 12.4	X340B1	0.483	16.116	X340B3	1.448	48.316
M	WR75	10.0 — 15.0	M340C1	0.396	13.213	M340C3	1.189	39.674
P	WR62	12.4 — 18.0	P340A1	0.352	11.745	P340A2	1.055	35.202
N	WR51	15.0 — 22.0	N340A	0.267	8.909	N340B	0.800	26.694
K	WR42	18.0 — 26.5	K340A1	0.251	8.365	K340A2	0.752	25.095
U	WR28	26.5 — 40.0	U340B	0.150	5.005	U340C	0.450	15.015
J	WR22	33.0 — 50.0	J340A1	0.120	4.007	J340B1	0.360	12.022
V	WR15	50.0 — 75.0	V340A1	0.080	2.669	V340A3	0.240	8.008
Z	WR10	75.0 — 110.0	Z340A1	0.054	1.802	Z340A3	0.162	5.405

[1] Offset delay is calculated without consideration for the dispersive effect of waveguide, that is, assuming the short is in air dielectric coaxial line. This is in accordance with the convention established for Agilent network analyzers. Anritsu analyzers use the actual mechanical offset in centimeters.

SLIDING SHORT CIRCUITS

- Non-Contacting
- VSWR 100:1 Minimum


U345


F341B


K345

GENERAL

Maury waveguide sliding short circuits are convenient, low loss, movable shorts for use in a variety of microwave techniques. They can be used with waveguide tees as a variable shunt for tuning or impedance matching applications and they are a necessary device for tuning high performance tuned reflectometer systems. They are valuable for establishing a reference impedance for the calibration and error analysis of waveguide measurement systems.

Model			EIA WR Number	Frequency Range (GHz)	Equivalent Flange
Uncalibrated Drive [1]	Calibrated Drive [2]	High Precision			
R341B	—	—	430	1.7 — 2.6	CPR430F
S341	—	S347 [3]	284	2.6 — 3.95	UG53/U
E341B	—	—	229	3.3 — 4.9	CPR229F
G341	—	—	187	3.95 — 5.85	UG149A/U
F341B	—	—	159	4.90 — 7.05	CPR159F
—	C345	C347 [3]	137	5.85 — 8.2	UG344/U
—	H345	H347 [3]	112	7.05 — 10.0	UG51/U
—	X345	X347A [3]	90	8.2 — 12.4	UG39/U
—	M345	M347 [3]	75	10.0 — 15.0	MPF75
—	P345	P347A [3]	62	12.4 — 18.0	UG419/U
—	K345	K347 [2]	42	18.0 — 26.5	UG595/U
—	U345	U347 [2]	28	26.5 — 40.0	UG599/U
—	—	J347A [2]	22	33.0 — 50.0	UG383/U

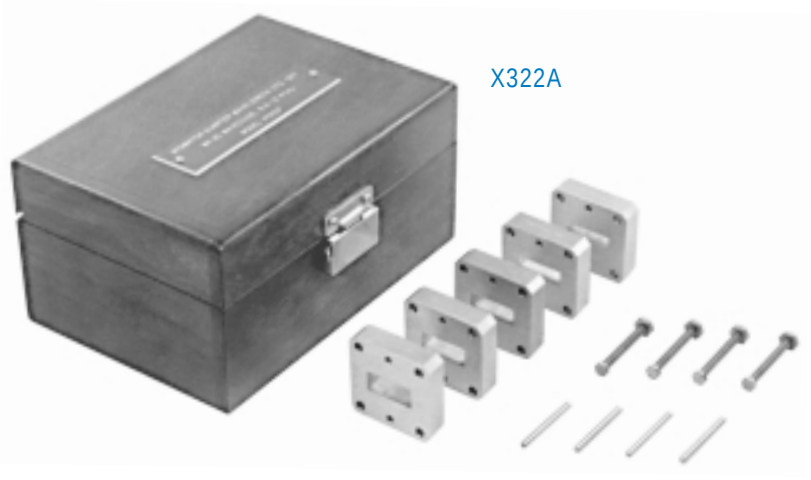
[1] Uncalibrated sliding shaft with a position lock.

[2] Micrometer drive, 0.001 inch resolution.

[3] Sliding shaft with a position lock for rapid adjustment, plus a 0.001 inch resolution for fine adjustment.

TWO-PORT STANDARDS

- Two-Port Calculable Standards
- Reduced Height
  1.00, 1.10, 1.25, 1.50,
  2.00 VSWR Spacers
- Length is Quarter Wavelength
  at Midband



Description

The Maury series 322 are two-port calculable waveguide standard sets. The sets consist of five reduced height spacers which provide an accurately known VSWR which is directly calculable from the mechanical dimensions. The spacers are fabricated from aluminum and are provided with precision indexing holes for excellent flange alignment. Indexing pins and mounting hardware are also provided. The sets are packaged in foam-lined wooden instrument cases.

These two-port standard sets are extremely stable and easy to use for a variety of calibration applications. Their simple geometry allows direct calculation of reflection, loss, transfer and group delay characteristics and makes them ideally suited for quickly checking the performance and accuracy of automated network analyzers.

To order the 1.00 VSWR shim by itself, please add "1.00" to the model number. (Example: X322A1.00)

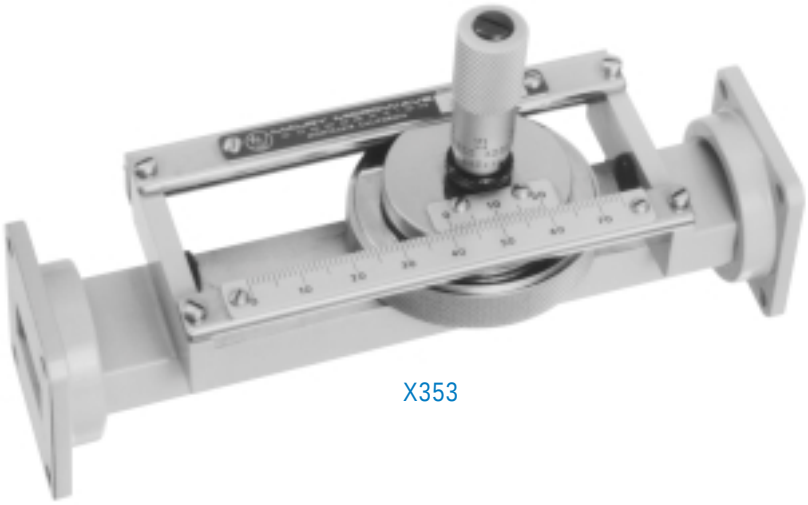
Model	Frequency Range (GHz)	EIA WR Number	Equivalent Flange
R322A	1.7 — 2.6	430	UG435/U
D322A	2.2 — 3.3	340	CPR340F
S322A	2.6 — 3.95	284	UG584/U
E322A	3.3 — 4.9	229	CPR229F
G322A	3.95 — 5.85	187	UG149A/U
F322A	4.90 — 7.05	159	CPR159F
C322A	5.85 — 8.2	137	UG344/U
H322A	7.05 — 10.0	112	UG51/U
X322A	8.2 — 12.4	90	UG39/U
M322A	10.0 — 15.0	75	MPF75
P322A	12.4 — 18.0	62	UG419/U
N322A	15.0 — 22.0	51	MPD51
K322A	18.0 — 26.5	42	UG595/U
U322A	26.5 — 40.0	28	UG599/U
J322A	33.0 — 50.0	22	UG383/U [1]
T322A	40.0 — 60.0	19	UG1529/U [1]
V322A	50.0 — 75.0	15	UG385/U [1]
Y322A	60.0 — 90.0	12	UG387/U [1]
Z322A	75.0 — 110.0	10	UG1528/U [1]

[1] Provided with Maury "MPF" precision type flanges with indexing holes.

TUNERS

SLIDE SCREW

- VSWR of 20:1 Correctable to 1.02 at Any Phase
- Easy to Use



X353

The Maury series 353 tuners consist of waveguide slotted sections each with a movable carriage supporting a micrometer driven probe which extends down into the waveguide. Such tuners are valuable tools for optimizing a mismatched load and/or source for maximum power transfer or for establishing a specific source or load termination condition for device characterization. A major advantage of slide screw tuners over other types is the ability to independently set magnitude and phase of the reflection. Although there is some interaction, reflection phase is set by the position of the probe along the waveguide, while the magnitude is set by the depth of penetration of the probe.

Probe depth of penetration is controlled by a micrometer drive with 0.001 inch resolution and a friction lock to prevent movement after adjustment. The carriage is held in constant tension to provide smooth movement and to eliminate the need for a position lock.

Specifications

Frequency Range ..... 1.7 to 50.0 GHz (in wavelength bands)

Waveguide and Flange Size ..... See chart

Matching Range ..... VSWR up to 20:1 correctable to less than 1.02

Insertion Loss ..... 2 dB maximum at VSWR of 20:1 (3 dB maximum for K and U bands)

Probe Travel ..... At least one-half wavelength at low frequency end of guide band

Model	Frequency Range (GHz)			EIA WR Number	Equivalent Flange	Length inches	(cm)
X353	8.2	—	12.4	90	UG39/U	6.00	(15.2)
P353	12.5	—	18.0	62	UG419/U	6.00	(15.2)
K353	18.0	—	26.5	42	UG595/U	4.38	(11.1)
U353	26.5	—	40.0	28	UG599/U	4.38	(11.1)
J353A	33.0	—	50.0	22	UG383/U	4.75	(12.1)

COAXIAL CONNECTORS

PRECISION COAXIAL CONNECTOR SPECIFICATION CHART

Type	Frequency Range (GHz)	Mates With	Maury Data Sheet
N	DC — 18.0	MIL-C-71, MIL-C-39012, MIL-T-81490	5E-049
SC	DC — 10.0	MIL-C-39012/35/36, MIL-T-81490	5E-050
HN	DC — 8.5	MIL-C-3643A	5E-051
TNC	DC — 18.0	MIL-C-39012/26/27, MIL-T-81490	5E-053
N-75	DC — 2.0	IEC 169-16	5E-054
7mm	DC — 18.0	(Beaded) 7mm, LPC7	5E-060
LPC7A	DC — 18.0	(Beadless) 7mm	5E-061
3.5MM	DC — 34.0	USNC/IEC/SC 46D (GPC3.5B)	5E-062
2.92/K	DC — 40.0	Maury MPC3	5E-063
2.4mm	DC — 50.0	Agilent 2.4mm	5E-064
OSP™	DC — 18.0	M/A-Com OSP™ and Dynawave Dynamate™ [1]	5E-065
7-16	DC — 8.0	IEC169-4, EN122190, BSEN122190	5E-066
AFTNC	DC — 20.0	MIL-C-87104/2	5E-056

This chart lists some of the coaxial connector types used at Maury. For a complete technical description of a particular connector, please request a copy of the appropriate Maury data sheet.

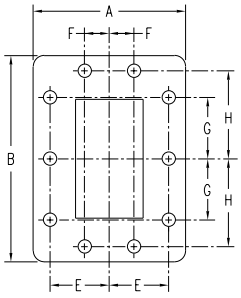
[1] OSP™ is a trademark of M/A-Com, Inc.
Dynamate™ is a trademark of Dynawave, Inc.

WAVEGUIDE FLANGES

MAURY PRECISION FLANGE ("MPF") CHART

Band	EIA WR Number	Designation	Mates With	Maury Data Sheet
R	430	MPF430	UG435/U	5E-031
S	284	MPF284	UG53/U, UG54A/U, CPR284	5E-002
S	284	MPF284B	UG53/U, UG54A/U, CPR284, CMR284	5E-002A
S	284	MPF284C	UG53/U, UG54A/U	5E-002B
E	229	MPF229	CPR229, CMR229	5E-003
E	229	MPF229B	CPR229	5E-003A
G	187	MPF187	UG149A/U, UG148B/U, CPR187	5E-004
G	187	MPF187C	UG149A/U, UG148B/U	5E-004A
F	159	MPF159	CPR159, CMR159	5E-011
F	159	MPF159B	CPR159	5E-011A
C	137	MPF137	UG344/U, UG343A/U, CPR137	5E-005
C	137	MPF137C	UG344/U, UG343A/U	5E-005A
H	112	MPF112	UG51/U, UG138/U, CPR112F & G	5E-001
H	112	MPF112B	UG51/U, UG52/U	5E-001A
H	112	MPF112C	UG51/U, UG52/U, CMR112	5E-001C
HS	102	MPF102	UG1493	5E-014
X	90	MPF90	UG39/U, UG40A/U, CPR90	5E-006
X	90	MPF90A	UG39/U, UG40A/U, CMR90	5E-006
X	90	MPF90B	UG39/U, UG40A/U	5E-006A
X	WR90-1/2	MPF90-1/2A	UG39/U	5E-015
X	WR90-1/2	MPF90-1/2B	Small Profile	5E-015
X	WR90-1/2	MPF90-1/2D	DG39/U, MPF90-1/2B	5E-015
M	75	MPF75A & B	M3922/70-004 & -005	5E-007
P	62	MPF62	UG419/U, UG541A/U	5E-008
N	51	MPF51A & B	M3922/70-010, -011, -012, -022, -023, -024	5E-012
N	51	MPF51C	Agilent Type, UBR180	5E-013
K	42	MPF42	UG595/U, UG596/U	5E-009
Q	34	MPF34	UG595U, UG596/U, UG1530/U	5E-019
U	28	MPF28	UG599/U, UG600/U	5E-010
J	22	MPF22	UG383/U	5E-030
T	19	MPF19	UG383/U	5E-030
V	15	MPF15	UG385	5E-031
Y	12	MPF12	UG385	5E-031
Z	10	MPF10	UG385	5E-031

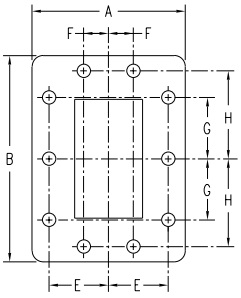
STANDARD FLANGE DETAILS



WR650 WG6 R14

UG417A/U (without groove)

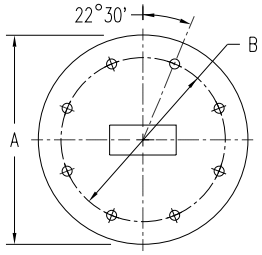
Dim.	inches	mm
A	5.44	138.18
B	8.69	220.73
E	2.31	58.69
F	1.25	31.73
G	2.37	60.30
H	3.94	100.00
Hole Dia.	0.330 [1]	8.20



WR430 WG8 R22

UG435B/U (without groove)

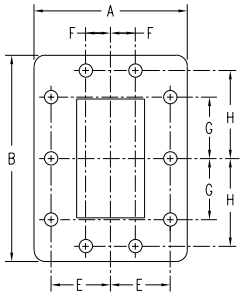
Dim.	inches	mm
A	4.19	106.38
B	6.34	161.04
E	1.72	43.69
F	0.94	23.83
G	1.79	45.39
H	2.79	70.99
Hole Dia.	0.257 [1]	6.71



WR284 WG10 R32

UG53/U

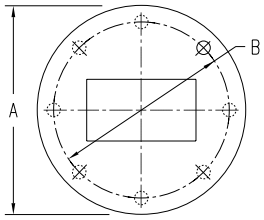
Dim.	inches	mm
A	5.31	134.87
B	4.75	120.65
Hole Dia.	0.257 [1]	6.50



WR229 WG11A R40

CPR229F UDR40

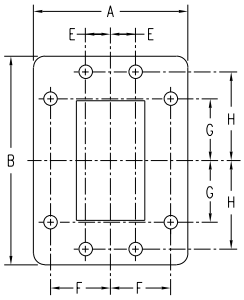
Dim.	inches	mm
A	2.76	70.20
B	3.89	98.73
E	1.05	26.67
F	0.50	12.70
G	1.07	27.18
H	1.62	41.15
Hole Dia.	0.257 [1]	6.50



WR187 WG12 R48

UG149/U UAR48

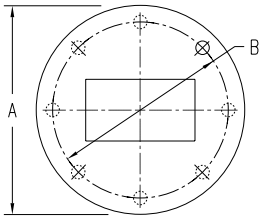
Dim.	inches	mm
A	3.64	92.33
B	3.25	82.55
Hole Dia.	0.199 [1]	5.13



WR159 WG13 R58

CPR159 UDR58

Dim.	inches	mm
A	2.44	61.98
B	3.18	80.77
E	0.88	22.35
F	0.38	9.53
G	0.50	12.70
H	1.27	32.26
Hole Dia.	0.257 [1]	6.50



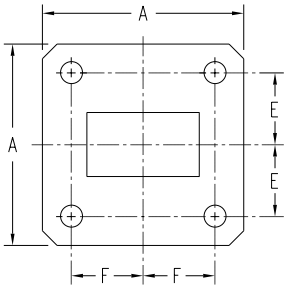
WR137 WG14 R70

UG344/U UAR70

Dim.	inches	mm
A	3.13	79.50
B	2.75	69.85
Hole Dia.	0.199 [1]	5.16

[1] English and metric hole sizes may differ slightly.

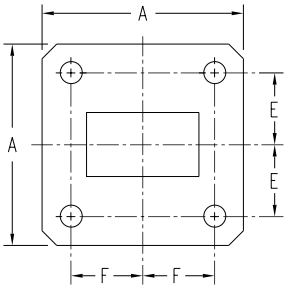
STANDARD FLANGE DETAILS



WR112 WG15 R84

UG51/U UBR84

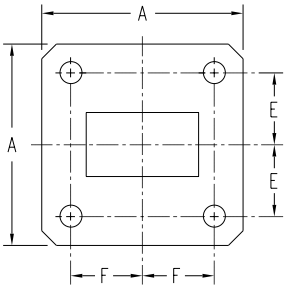
Dim.	inches	mm
A	1.875 [1]	47.90
E	0.737	18.72
F	0.676	17.17
Hole Dia.	0.169 [1]	4.255



WR90 WG16 R100

UG39/U UBR100

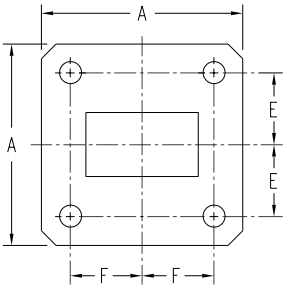
Dim.	inches	mm
A	1.625 [1]	41.40
E	0.640	16.26
F	0.610	15.49
Hole Dia.	0.169 [1]	4.255



WR75 WG17 R120

COM'L UBR120

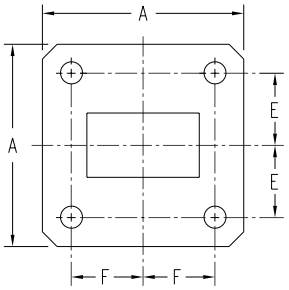
Dim.	inches	mm
A	1.50 [1]	38.83
E	0.561	14.25
F	0.520	13.21
Hole Dia.	0.144 [1]	4.085



WR62 WG18 R140

UG419/U UBR140

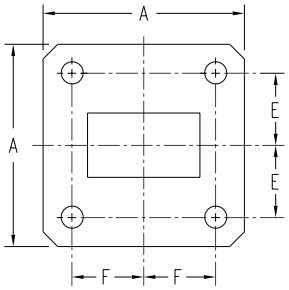
Dim.	inches	mm
A	1.31	33.30
E	0.478	12.14
F	0.497	12.63
Hole Dia.	0.144 [1]	4.085



WR51 WG19 R180

COM'L

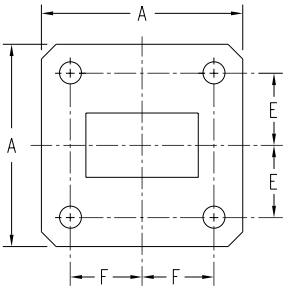
Dim.	inches	mm
A	1.31 [1]	33.27
E	0.497 [1]	12.62
F	0.478 [1]	12.14
Hole Dia.	0.144 [1]	3.658



WR42 WG20 R220

UG595/U UBR220

Dim.	inches	mm
A	0.875 [1]	22.41
E	0.335	8.51
F	0.320	8.13
Hole Dia.	0.116 [1]	3.07



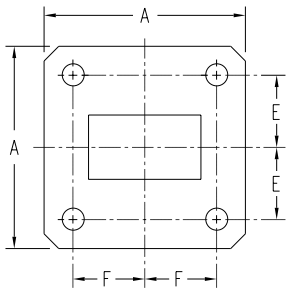
WR34 WG21 R260

UG1530

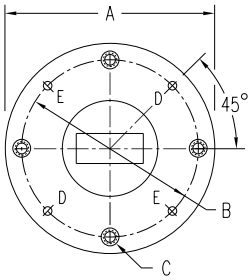
Dim.	inches	mm
A	0.875 [1]	22.41
E	0.335 [1]	8.51
F	0.320 [1]	8.13
Hole Dia.	0.116 [1]	3.07

[1] **CAUTION:** U.S. MIL and commercial flange dimensions differ from IEC flanges.

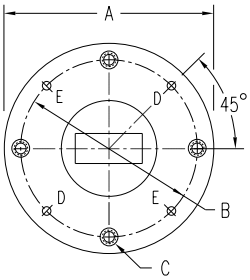
STANDARD FLANGE DETAILS



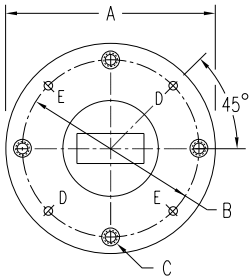
WR28	WG22	R320
UG599/U		
Dim.	inches	mm
A	0.75	19.05
E	0.265	6.73
F	0.250	6.35
Hole Dia.	0.116	2.98



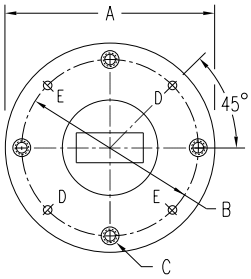
WR22	WG23	R400
UG383/U		
Dim.	inches	mm
A	1.13	28.85
B	0.94	23.81
C Holes	4-40 UNC-2B	
D Holes	0.063	1.613
E Dowels	0.061	1.555



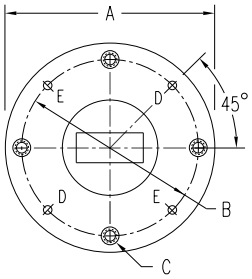
WR19	WG24	R500
UG383/U		
Dim.	inches	mm
A	1.13	28.85
C Holes	4-40 UNC-2B	
D Holes	0.063	1.613
E Dowels	0.061	1.555
All Holes	0.938	23.81



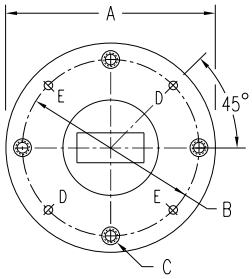
WR15	WG25	R620
UG385/U		
Dim.	inches	mm
A	0.750	19.05
B	0.563	14.29
C Holes	4-40 UNC-2B	
D Holes	0.063	1.613
E Dowels	0.061	1.555



WR12	WG26	R740
UG387/U		
Dim.	inches	mm
A	0.750	19.05
B	0.563	14.29
C Holes	4-40 UNC-2B	
D Holes	0.063	1.613
E Dowels	0.061	1.555
All Holes	0.563	14.29



WR10	WG27	R900
UG387/U		
Dim.	inches	mm
A	0.750	19.05
B	0.563	14.29
C Holes	4-40 UNC-2B	
D Holes	0.063	1.613
E Dowels	0.061	1.555
All Holes	0.563	14.29



WR8	WG28	R1200
UG387/U		
Dim.	inches	mm
A	0.750	19.05
B	0.563	14.25
C Holes	4-40 UNC-2B	
D Holes	0.063	1.613
E Dowels	0.061	1.555
All Holes	0.563	14.29