COMMUNICATIONS SERVICE MONITORS

2945A, 2945B, 2946A, 2948, 2948B

for EDACS Radios

Operating Manual Supplement

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About this manual

This manual explains how to use the EDACS Radio option of the Communications Service Monitor, 2945A, 2945B, 2948, 2948B and Avionics Communication Service Monitor 2946A. It applies to service monitors fitted with System software version 4.01 and greater.

Intended audience

People who need to test the performance of EDACS Radios. It is assumed that the reader has either a working knowledge of the Service Monitor mentioned above or access to the appropriate Operating Manuals, and is familiar with EDACS telecommunication terms.

Structure

Chapter 1

Introduction, overview and performance data

Chapter 2

Operating instructions for the EDACS Radio option

Appendix A

Autotest error codes with definitions

Document conventions

The following conventions apply throughout this manual:-

Hard key titles are shown verbatim, using normal lettering in square brackets.	[Tx TEST]
Soft key titles are shown verbatim using italic lettering in italic square brackets.	*[Tx freq]*
Titles shown on the instrument panel are shown verbatim using capital letters.	RF IN/OUT
Text displayed on screen.	See below†

† References to text displayed on the screen of the Service Monitor are given verbatim, using a font that resembles the displayed text. e.g. GEN FREQ: , Ref Level: , Ref.Level: .

Associated publications

Each service monitor is supplied at the time of delivery with the following manuals:

- Operating manual: 46882/311 (2945A), 46882/682 (2945B), 46882/312T (2946A) 46882/341 (2948), 46882/692 (2948B).
- Programming manual: 46882/318 (2945A, 2946A, 2948), 46882/683 (2945B, 2948B).
- Operating manual supplements for all installed systems:

  EDACS Repeater (46882/300)
  AMPS Supplement (46882/313)
  PMR Supplement (46882/315)
  MPT1327 Supplement (46882/317)
  EDACS Radio Supplement (46882/301)
  TACS Supplement (46882/314)
  NMT Supplement (46882/316)

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Precautions

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GENERAL INFORMATION

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Introduction

EDACS is a trunked private radio system, used mostly in emergency services and utilities. The system uses either 9600 or 4800 bits/s signaling on the control channel, and 150 bits/s on the working channel, transmitted using FSK data. The system is proprietary to Ericsson GE. The EDACS system test software, for Service Monitors 2945A, 2945B, 2946A, 2948 and 2948B, is produced by Aeroflex under licence from Ericsson GE Mobile Communications Inc.

The systems mode of the Service Monitor provides a means of testing radio communication equipment, such as cellular radio telephones and trunked system mobile radios.

To test a radio, the Service Monitor simulates signaling transmitted by a repeater, which is received by the radio under test. Signaling transmitted by the radio is received by the Service Monitor for measurement or analysis.

This manual refers to the use of the Service Monitor to test the performance of mobile radios designed to operate on the EDACS system. 'Radio' in this manual means any hand-held portable unit or a mobile unit fitted to a vehicle.

The Service Monitor and the radio are connected using suitable RF cables for connecting to the antenna socket of the radio. AF connections are made to the audio input and output circuits of the radio for tests such as signal-to-noise, modulation distortion etc.

Auto and manual testing

The AUTO mode allows you to run test programs that are resident within the Service Monitor and test the operational performance of the radio for use on a EDACS system. User-defined programs can be loaded into the Service Monitor and run in the same way. The MANUAL mode offers manual control of the Service Monitor repeater simulation. This is useful for fault finding or adjusting of the radio under test.

Auto

The AUTO mode provides a selection of four built-in test programs that are run on a selection of channels to test the performance of the radio.

The four test programs vary in content so as to give you a wide choice of tests to suit their particular requirement. A channel plan to determine which channels are used for the tests is set up by you.

The progress of tests and the results obtained from them are displayed on the screen and stored in memory within the Service Monitor for later analysis. Results can be printed on a suitable printer while the test program is running, or at the end of the test program. The set-up menus allow many combinations of data presentation, storage, retrieval and printing. The use of the memory cards and remote control facilities extends this further.

Manual testing

MANUAL testing allows the user the means of testing any part of the radios operation. The required signaling is generated as for the AUTO mode, but tests are allowed to run manually under the control of the user.

Test programs

The built-in test programs are described as follows:

Call processing only

Tests call from the radio and then clears the call from the radio. Places a number of calls to the radio, clears each call from the repeater.

An RF connection is required between the 'N type' RF connector on the Service Monitor and the ANTENNA connector of the radio.

Call and RF testing

Performs all the above tests and in addition, tests the RF power and frequency from the radio.

An RF connection is required as for the 'Call Processing Only' program.

Brief testing

Performs all of the above tests and in addition tests the AF distortion produced by the radio receiver and by the radio transmitter, the sensitivity of the radio receiver and the modulation level limiting action of the radio transmitter.

An RF connection is required as for both the previous programs. AF connections are required from the AF GEN OUT connector of the Service Monitor to the audio input of the radio and from the audio output of the radio to the AF INPUT of the Service Monitor.

Comprehensive testing

Performs all of the tests carried out in the 'Brief testing' program above, tests the expansion characteristics of the receiver and the compression and noise characteristics of the transmitter.

RF and AF connections are required as for the 'Brief Testing' program.

User defined test

Allows you to determine what tests and measurements you wish to perform using the Service Monitor. This program is downloaded into the instrument via the GPIB or RS232 interface.

Pause facility

A feature of the AUTO mode is the pause facility. This allows you to select the conditions under which the test program will pause. The options are:

After every individual test in the program;

Following an individual test that fails;

At the end of any test, following a request by you.

When in the paused condition, the current parameters and results are displayed. Conversation is maintained between the Service Monitor and the radio if applicable.

You can select other operating modes of the Service Monitor in order to carry out detailed analysis of radios performance.

The test program can be resumed at any time.

Data displays

The data that passes between the Service Monitor and the radio in either direction can be decoded, displayed and examined for content or errors.

Connections

The connections required between the Service Monitor and the radio are mentioned in each of the test program descriptions earlier in this chapter. A more detailed explanation of the requirements is given later.

Performance Data

General EDACS system information

Since EDACS systems have no common frequency plan, four user-defined variants are provided. These are configurable, as described in Chapter 2.

FM voice deviation	5.0 kHz
Data type	non return to zero FSK
Data rate	9600 or 4800 bits per second
Data deviation	3.0 kHz

System parameter settings

System type	As selected.	Default EDACS.
Site ID	0 to 31	Default 1
Control channel	1 to 24 (system dependent).	Default 1.
First working channel	1 to 24 (system dependent).	Default 2.
Last working channel	1 to 24 (system dependent).	Default 2.
Channel increment	1 to 24 (system dependent).	Default 1.
Tx polarity	AUTO, NORMAL or INVERTED	Default AUTO

Radio parameter settings

Radio logical ID	Format xxxx	Default 0001
Testset logical ID	Format xxxx	Default 0001
Group ID	Format xxx	Default 001
Radio power type	MOBILE or PORTABLE	Default MOBILE

Display format settings

Display format	SUMMARY or FULL.	Default SUMMARY.
Pause mode	ALWAYS, MANUAL ONLY or ON FAILURE.	Default MANUAL ONLY.
Print	ON, OFF	Default OFF

Program settings

Test programs	CALL PROCESSING ONLY CALL & RF TESTING BRIEF TESTING COMPREHENSIVE TESTING USER DEFINED TEST	Default CALL PROCESSING ONLY

Autorun parameter settings

These are the default parameters for all of the available auto tests for EDACS. These parameters are used by the tests (called from BASIC), or they can be accessed directly by BASIC. The list on the right-hand side of the page shows the equivalent BASIC commands for the parameters. If you modify these parameters, these defaults can be restored by using the appropriate command in the HELP/SETUP menu.

Note that deviations returned in automatic tests are **peak** measurements only. Manual measurements can return peak or RMS results.

Place call		**TEST PLACECALL**	
Status	ON	STATUS	{ON/OFF}
RF generator level	-80 dBm	RFGENLEVEL	<expr> [<units>]
Timeout	30s	TIMEOUT	<expr> [<units>]
Use accessory port	ON	USEACCPORT	{ON/OFF}
Set accessory port logic	0	ACCPORT	{LOGIC0/1/2/3}
DTMF Decode		**TEST DTMFDECODE**	
Status	OFF	STATUS	{ON/OFF}
Timeout	20s	TIMEOUT	<expr> [<units>]
DTMF Tone Sequence	123456789*0#	N/A	
Use accessory port	ON	USEACCPORT	{ON/OFF}
Set accessory port logic	2	ACCPORT	{LOGIC0/1/2/3}
Clear from radio		**TEST MOBILECLEAR**	
RF generator level	-80 dBm	RFGENLEVEL	<expr> [<units>]
Timeout	20s	TIMEOUT	<expr> [<units>]
Use accessory port	ON	USEACCPORT	{ON/OFF}
Set accessory port logic	0	ACCPORT	{LOGIC0/1/2/3}
Call radio		**TEST PAGEMOBILE**	
RF generator level	-80 dBm	RFGENLEVEL	<expr> [<units>]
Timeout	30s	TIMEOUT	<expr> [<units>]
Use accessory port	ON	USEACCPORT	{ON/OFF}
Set accessory port logic	3	ACCPORT	{LOGIC0/1/2/3}
Call type	GROUP	CALLTYPE	{INDIVIDUAL/GROUP/EMERGENCY/ROTATE}
Clear from land		**TEST LANDCLEAR**	
RF generator level	-80 dBm	RFGENLEVEL	<expr> [<units>]
Use accessory port	ON	USEACCPORT	{ON/OFF}
Set accessory port logic	3	ACCPORT	{LOGIC0/1/2/3}
Data Performance		**TEST DATAPERFORM**	
Status	ON	STATUS	{ON/OFF}
RF Gen Level	-113 dBm	RFGENLEVEL	<expr> [<units>]
Lower Limit	95%	LOWER	<expr> [<units>]
PTT ON		**TEST PTTON**	
Timeout	20s	TIMEOUT	<expr> [<units>]
Use accessory port	ON	USEACCPORT	{ON/OFF}
Set accessory port logic	0	ACCPORT	{LOGIC0/1/2/3}
PTT OFF		**TEST PTTOFF**	
Timeout	20s	TIMEOUT	<expr> [<units>]
Use accessory port	ON	USEACCPORT	{ON/OFF}
Set accessory port logic	0	ACCPORT	{LOGIC0/1/2/3}
Low speed data deviation		**TEST LSDEVN**	
Status	ON	STATUS	{ON/OFF}
Reference	750 Hz	Ref	<expr> [<units>]
Error tolerance	20%	ERROR	<expr> [<units>]

(continued./...)

Autorun parameter settings (continued)

Transmitter RF power		**TEST TXLEVEL**	
Status	ON	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
Upper limit	60 W	UPPER	<expr> [<units>]
Lower limit	1 W	LOWER	<expr> [<units>]
Tx frequency		**TEST TXFREQ**	
Status	ON	STATUS	{ON/OFF}
Error tolerance	5ppm	ERROR	<expr> [<units>]
Tx SINAD		**TEST TXSINAD**	
Status	OFF	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Tx filter	0.3-3.4 kHz BP	TXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Lower limit	20 dB	LOWER	<expr> [<units>]
Tx distortion		**TEST TXDISTN**	
Status	ON	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Tx filter	0.3-3.4 kHz BP	TXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Upper limit	10%	UPPER	<expr> [<units>]
Tx S/N		**TEST TXSN**	
Status	OFF	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Tx filter	0.3-3.4 kHz BP	TXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Lower limit	30 dB	LOWER	<expr> [<units>]
Tx noise		**TEST TXNOISE**	
Status	ON	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
Tx Filter	300 Hz LP	TXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Upper limit	300 Hz	UPPER	<expr> [<units>]
Tx limiting		**TEST TXLIMIT**	
Status	ON	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Tx filter	15 kHz LP	TXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Overload factor	20 dB	OVERLOAD	<expr> [<units>]
Upper limit	2.5 kHz	UPPER	<expr> [<units>]

Tx compression (not normally used in EDACS)		**TEST COMPRESS**	
Status	OFF	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Tx filter	0.3-3.4 kHz BP	TXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Reference	2	REF	<expr>
Error tolerance	10%	ERROR	<expr> [<units>]
Rx SINAD		**TEST RXSINAD**	
Status	OFF	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
RF level	-80 dBm	RFGENLEVEL	<expr> [<units>]
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Rx filter	0.3-3.4 kHz BP	RXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Lower limit	20 dB	LOWER	<expr> [<units>]
Rx distortion		**TEST RXDISTN**	
Status	ON	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
RF level	-80 dBm	RFGENLEVEL	<expr> [<units>]
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Rx filter	0.3-3.4 kHz BP	RXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Upper limit	7%	UPPER	<expr> [<units>]
Rx S/N		**TEST RXSN**	
Status	OFF	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
RF level	-80 dBm	RFGENLEVEL	<expr> [<units>]
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Rx filter	0.3-3.4 kHz BP	RXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Lower limit	35 dB	LOWER	<expr> [<units>]
Rx sensitivity		**TEST RXSENS**	
Status	ON	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Rx filter	CMESS	RXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
RF upper limit	-113 dBm	UPPER	<expr> [<units>]
Reference SINAD	20 dB	REFSINAD	<expr>
Rx expansion (not normally used in EDACS)		**TEST RXEXPAND**	
Status	OFF	STATUS	{ON/OFF}
Averages	5	AVERAGES	<expr>
Modulation level	1.5 kHz	MODLEVEL	<expr> [<units>]
Rx filter	0.3-3.4 kHz BP	RXFILTER	{NONE/LP15KHZ/LP300HZ/ STDBP/CCITT/CMESS}
Reference	2	REF	<expr>
Error tolerance	10%	ERROR	<expr> [<units>]

MI-BASIC autorun test programs

This section defines what tests are run in each of the built-in test programs.

Note: Braces **{**..**}**

In the following program description, a start brace **{** and a finish brace **}** indicate the start and finish of tests that are run as a group. Each group of tests is repeated in accordance with the condition preceding the group (e.g., while channels to test).

Call Processing Only

```
TEST PLACECALL
TEST MOBILECLEAR
While more channels to test
{
        TEST PAGEMOBILE         Jump to exit if failed
        TEST PTTON              Jump to next channel if failed
        TEST PTTOFF
Next channel:
        TEST LANDCLEAR
}
exit:
```

Call & RF Testing

```
TEST PLACECALL
TEST MOBILECLEAR
While more channels to test
{
        TEST PAGEMOBILE         Jump to exit if failed
        TEST PTTON              Jump to next channel if failed
        if enabled TEST LSDEVN
        if enabled TEST TXLEVEL
        if enabled TEST TXFREQ
        TEST PTTOFF
Next channel:
        TEST LANDCLEAR
}
exit:
```

Brief Testing

```
TEST PLACECALL
If passed TEST MOBILECLEAR
For 3 channels (first working channel, first working channel + channel
increment, first working channel + 2 * channel increments)
{
        TEST PAGEMOBILE         Jump to exit if failed or error
        TEST PTTON              Jump to rxtests if failed
        if enabled TEST LSDEVN
        if enabled TEST TXLEVEL
        if enabled TEST TXFREQ
        if enabled TEST TXDISTN
        if enabled TEST TXLIMIT
        TEST PTTOFF             Jump to next_channel if failed
        rxtests:
        if enabled TEST RXSINAD
        if enabled TEST RXDISTN
        if enabled TEST RXSENS
        next_channel:
        TEST LANDCLEAR
}
exit:
```

Comprehensive Testing

```
TEST PLACECALL
If enabled TEST DTMFDECODE
TEST MOBILECLEAR
if enabled TEST DATAPERFORM
While more channels to test
{
        TEST PAGEMOBILE         Jump to exit if failed
        TEST PTTON              Jump to rxtests if failed
        if enabled TEST LSDEVN
        if enabled TEST TXLEVEL
        if enabled TEST TXFREQ
        if enabled TEST TXSINAD
        if enabled TEST TXDISTN
        if enabled TEST TXSN
        if enabled TEST TXNOISE
        if enabled TEST TXLIMIT
        if enabled TEST TXCOMPRESS
        TEST PTTOFF             Jump to next_channel if failed
        rxtests:
        if enabled TEST RXSINAD
        if enabled TEST RXDISTN
        if enabled TEST RXSN
        if enabled TEST RXSENS
        if enabled TEST RXEXPAND
        next_channel:
        TEST LANDCLEAR
}
exit:
```

User-defined test

The user-defined test program facility allows you to run your own test program. This is written on a PC or other programming equipment using the *MI BASIC language*, then loaded into the Service Monitor.

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OPERATION

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Introduction

This chapter deals with using the Service Monitor for testing radios operating on the EDACS trunking system. It is assumed that you are familiar with the operation of the Service Monitor in its various modes and that it has been prepared for use as described in the main operating manual supplied with it.

If you are unfamiliar with using the Service Monitor for EDACS system testing, it is suggested that a short time is spent exploring the various menus and displays before connecting to a radio.

The operating details that you require when using the Service Monitor for EDACS System Radio testing fall into two areas:

- Customization, where you prepare the Service Monitor before making tests. The *[SYSTEM]* and *[SET-UP]* keys give access to the screens and menus required for this.
- Testing where, with the Service Monitor customized to the requirements of the particular unit or batch of units to be tested, it is connected to the Service Monitor, and automatic or manual tests are carried out. The *[PROGRAM]*, *[AUTO]*, *[MANUAL]* and *[DATA]* keys give access to the screens and menus required for this.

The set-up menus of the SYSTEMS mode give you control of the parameters of the test system. Once set to your requirements, the instrument retains the settings for both immediate and future use.

SYSTEMS mode selection

The EDACS system is one of the system options available with the Service Monitor. The [SYSTEM] key displays the menu of systems currently enabled on the instrument.

Note

The [SYSTEM] key on the Avionics Communication Service Monitor 2946A gives access to the Avionics Systems test facility as well as to the Cellular and Trunked radio communications system test facility. If a Cellular or Trunked system *is not* selected currently, pressing the [SYSTEM] key displays the untitled screen shown in Fig. 2-2. Pressing the *[cell]* key displays the SYSTEM SELECTION MENU**. If a Cellular or Trunked system *is* selected currently, pressing the [SYSTEM] key displays the** SYSTEM SELECTION MENU **directly.**

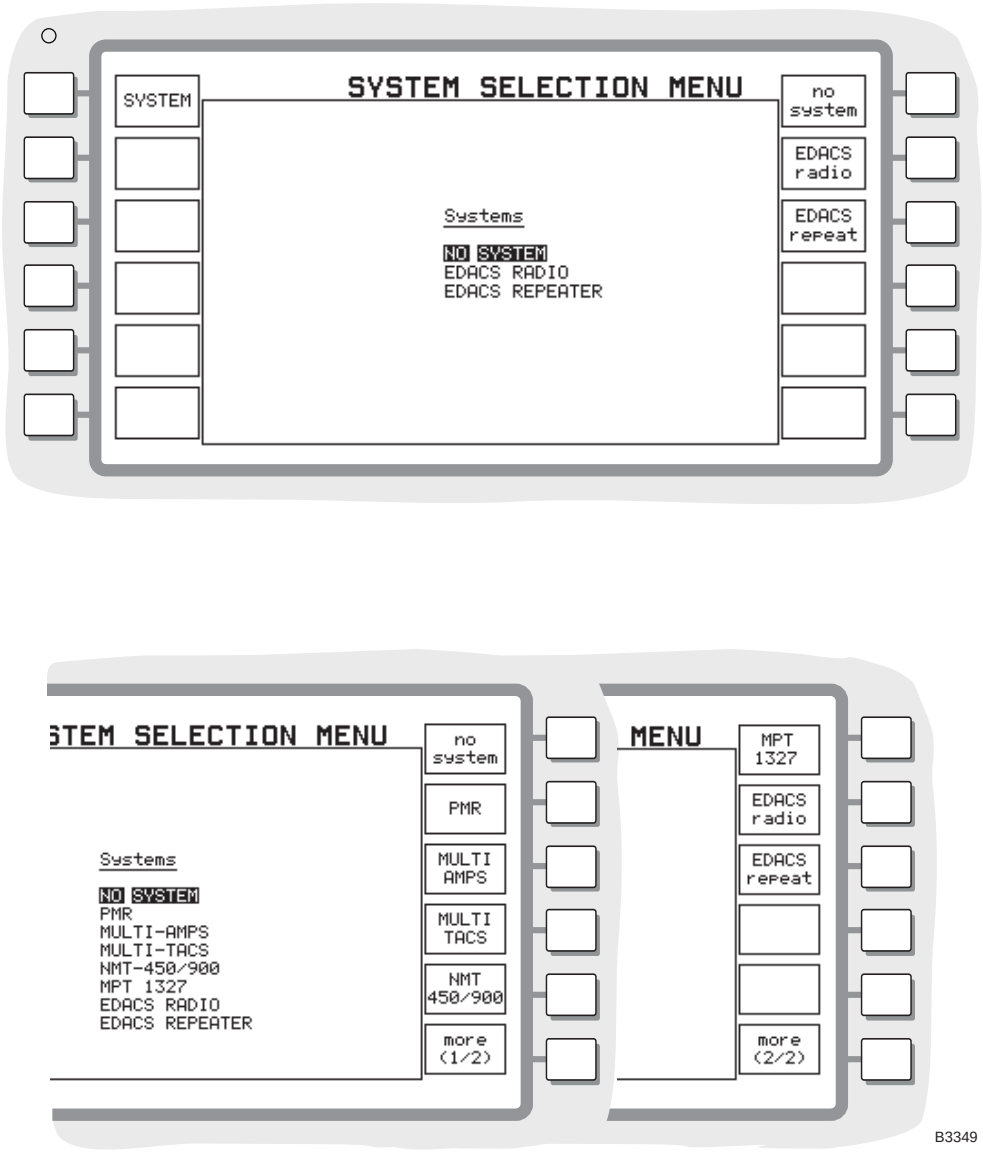

Fig. 2-1 System selection menu

Fig. 2-2 Avionics/Cellular or Trunked system selection screen

Selecting the EDACS radio system

The SYSTEM SELECTION MENU lists all of the test systems that are installed in the instrument and designates one soft key to each. To select the EDACS radio system, press the *[EDACS radio]* key. Variants of the system are selected from the SYSTEM PARAMETERS menu, using the [SYSTEM], *[EDACS radio]*, *[SET-UP]* sequence.

With the EDACS radio system selected, the six soft keys at the left of the screen are given to explicit functions or user operations. The six keys and the function of each is shown below:

[SYSTEM]	**System selection menu**
[SET-UP]	**System set-up menus**
[PROGRAM]	**Test program menu**
[AUTO]	**AUTORUN test mode**
[MANUAL]	**Manual test mode**
[DATA]	**Data display screens**

A description of the use of each menu or screen follows. The headings reflect the menu structure to assist in locating a particular key or function.

Customizing the EDACS Radio system

Before you use the Service Monitor for automatic or manual testing, you may need to customize the system by changing some of the default test parameters. You can do this via the *[SYSTEM]*, *[SET-UP]*, and *[PROGRAM]* keys, as explained in this section.

[SYSTEM]

The *[SYSTEM]* key brings up the SYSTEM SELECTION MENU, allowing access to all of the test systems that are installed in the Service Monitor, and an option *[no system]* to disable the selected system prior to leaving the Systems mode. The *[more]* key toggles between the two displays of system type keys.

[SET-UP]

The *[SET-UP]* key allows access to all of the set-up menus for the EDACS radio system. There are four menus that allow access to the parameters of the system, each dealing with a different aspect of the system. These are:

SYSTEM PARAMETERS
RADIO PARAMETERS
AUTORUN CONTROL
AUTORUN PARAMETERS

Pressing *[SET-UP]* repeatedly toggles through all four menus.

The four menus are:

SYSTEM PARAMETERS	Allows adjustments to control channel number, first and last working channel number etc.
RADIO PARAMETERS	Allows you to change or enter the radio identity number sent to the radio under test and enter the group and individual calling identity numbers associated with the radio. The appropriate power type of the radio is also set.
AUTORUN CONTROL	Allows you to select the format of the test results displayed, the conditions that cause the test program to halt for user attention and to switch the print mode on or off.
AUTORUN PARAMETERS	Allows you to edit the parameters of each of the tests available in the test programs.

A detailed explanation of each menu and the parameters in it follows.

System parameters

When you select the SYSTEM PARAMETERS menu, the EDACS Radio system parameters are displayed and each of the first five soft keys on the right of the screen is dedicated to one parameter: see Fig. 2-3 on page 2- 6.

The sixth soft key is a *[more]* key, which gives access to other parameters. Pressing this key repeatedly cycles you through all the available system parameter screens. The *[more]* key on each menu shows a page count, i.e. 1/2, 2/2. The parameters that do not have soft keys assigned to them on the current display are shown in low contrast text.

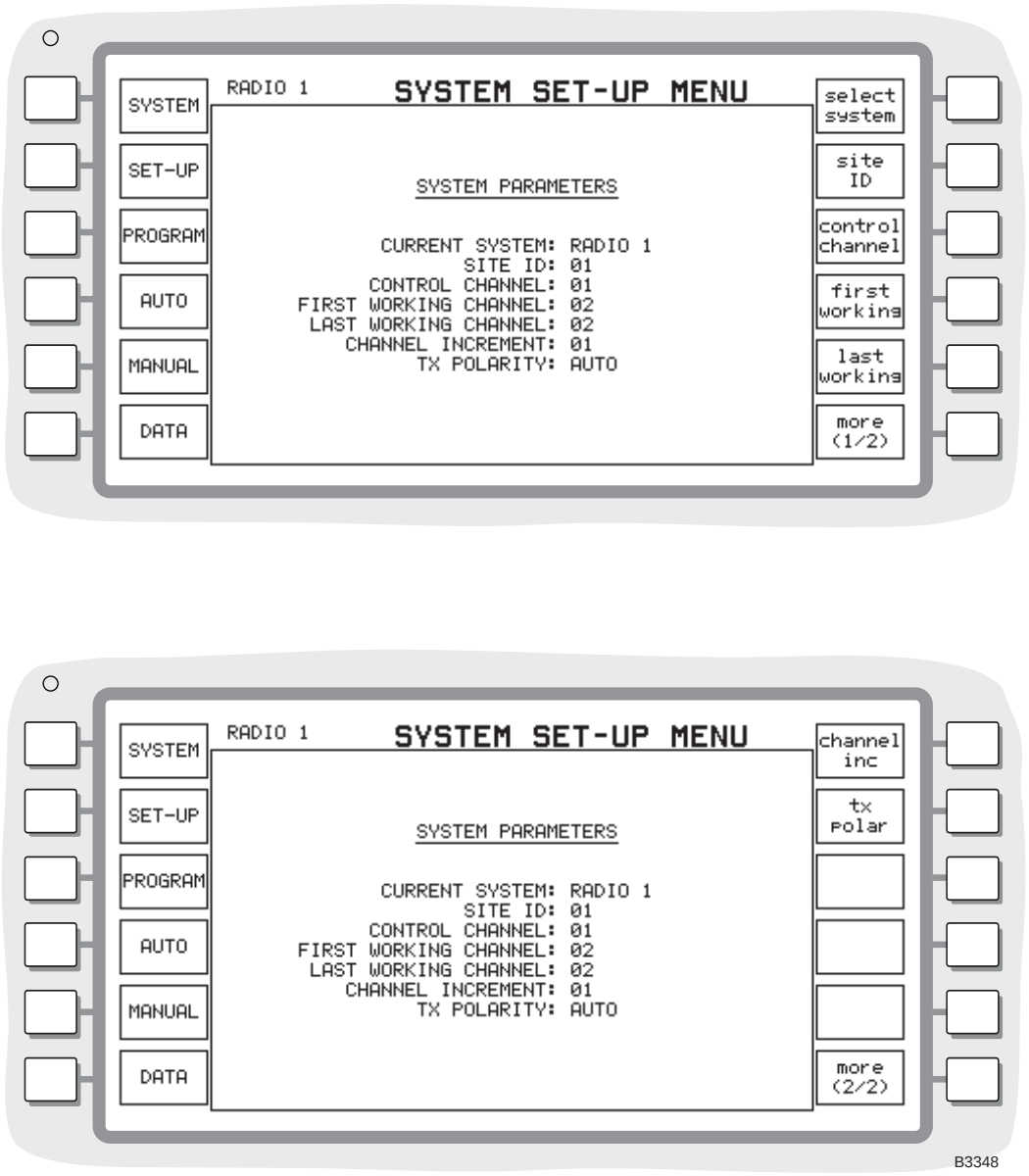

Fig. 2-3 System parameters menu

Changing system parameters

To change a system parameter, first press the soft key appropriate to the parameter to be changed. The selected parameter are highlighted on the listing. For example, pressing *[select system]* displays CURRENT SYSTEM, and pressing *[site ID]* displays SITE ID: There are then two methods for changing the parameter.

- For the SYSTEM TYPE and Tx POLARITY parameter, soft keys are shown for each system type or polarity option. Press the appropriate soft key.
- If the system type is being changed, the selected type name is shown against the CURRENT SYSTEM listing and also at the left of the screen heading. The soft keys revert to system parameter keys.
- If the polarity setting is being changed, the new selection is shown against the Tx POLARITY listing and the soft keys revert to system parameter keys.
- For all other parameters, enter the required value using the data input keys and then press the [ENTER] data key or the selected parameter soft key.

The system parameters that you can modify are described below. Default values are shown in Chapter 1, General Information, under the heading *System parameter settings.*

CURRENT SYSTEM

The SYSTEM selection is not a parameter setting. It shows which of four EDACS System types is currently selected. The selection and setting of the System types is explained in the section starting on page 2-11.

SITE ID

The SITE IDENTITY is an allocated number unique to each repeater on the system. It is transmitted to the radio as part of the control channel.

The SITE ID parameter accepts a 2-digit number within the range 0 to 31.

CONTROL CHANNEL

Before any testing can be carried out on a EDACS radio, the CONTROL CHANNEL in the SYSTEM PARAMETERS menu must be set. When a new SYSTEM TYPE is selected the control channel defaults to the first channel in that system. The required channel number is entered using the data keys.

FIRST WORKING CHANNEL, LAST WORKING CHANNEL and CHANNEL INCREMENT

The channels that can be allocated as working channels by the Service Monitor are shown as FIRST WORKING CHANNEL and LAST WORKING CHANNEL. The values of these parameters are changed in the same way as the CONTROL CHANNEL value.

When running tests within an AUTORUN program, the test uses FIRST WORKING CHANNEL, LAST WORKING CHANNEL and CHANNEL INCREMENT to determine the next working channel to use.

TX POLARITY

The FSK modulation type used for EDACS signaling can have NORMAL or INVERTED polarity. You can select the polarity required to suit the equipment being tested.

The Service Monitor also has an AUTO polarity setting. This sets the polarity according to the set data rate and the direction of data transmission. The following table shows this.

Data rate	Radio Tx	Repeater Tx
9600 Baud	INVERTED	INVERTED
4800 Baud	INVERTED	NORMAL

Radio parameters

The RADIO PARAMETERS menu, shown in Fig. 2-4, enables you to change the numbers within the Service Monitor for RADIO LOGICAL IDENTITY, TESTSET LOGICAL IDENTITY and GROUP IDENTITY. The RADIO POWER TYPE setting is also selected from this menu.

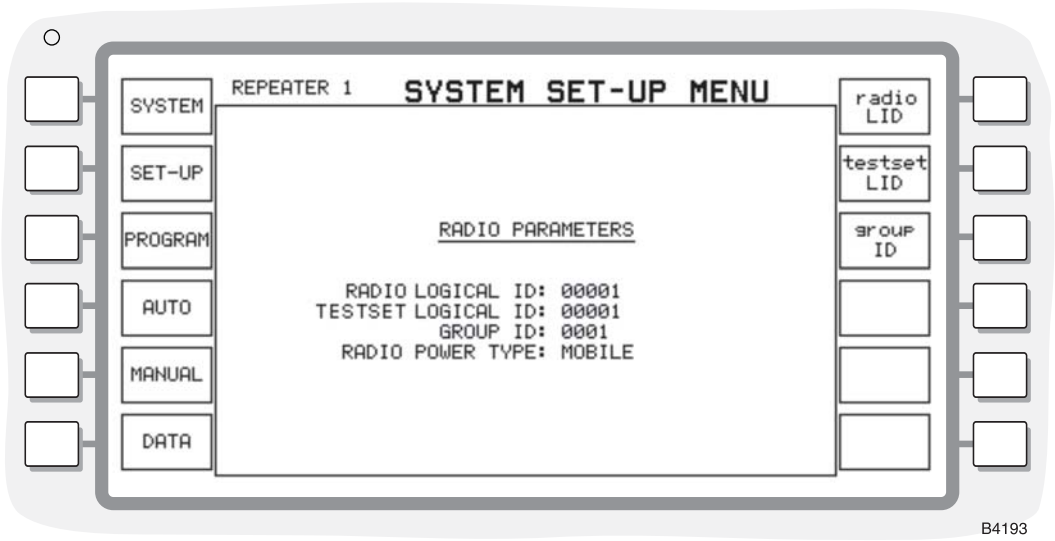

Fig. 2-4 Radio parameters menu

RADIO LOGICAL ID

The RADIO IDENTITY NUMBER is a unique number allocated to the radio and programmed into it. It is transmitted from the radio during signaling. The RADIO IDENTITY parameter allows you to change the number.

When the Service Monitor 'sees' a radio initiate a call, the logical identity of that radio is automatically set into the LOGICAL IDENTITY parameter of the Service Monitor.

The LOGICAL IDENTITY consists of 14 bits, entered as a decimal number between 0 and 16383.

TESTSET LOGICAL ID

The TESTSET LOGICAL parameter allows you to enter any identity from the usable range. This allows the Service Monitor to simulate any radio which might work with the radio under test.

The LOGICAL IDENTITY consists of 14 bits, entered as a decimal number between 0 and 16383.

GROUP ID

The GROUP IDENTITY NUMBER is a unique number allocated to a group of radios. The GROUP NUMBER is programmed into the radio in a similar manner to the RADIO IDENTITY. It is used to page all the radios in the same group. It is transmitted to and from the radio during signaling.

The GROUP IDENTITY consists of 12 bits, entered as a decimal number between 0 and 4095.

RADIO POWER TYPE

EDACS radios can be of type MOBILE or PORTABLE. MOBILES are usually vehicle mounted types and have a much higher RF power output than hand held PORTABLE radios.

Selecting PORTABLE sets the input sensitivity of the Service Monitor to a more sensitive range than when set to MOBILE. This more sensitive range enables lower power radios to be detected.

Autorun control

The AUTORUN CONTROL menu, shown in Fig. 2-5, allows you to select how the Autorun program responds to the results of tests. The soft keys on the right, each give access to a further level of soft keys. This allows you to select options as to the running and results presentation of the autorun test programs.

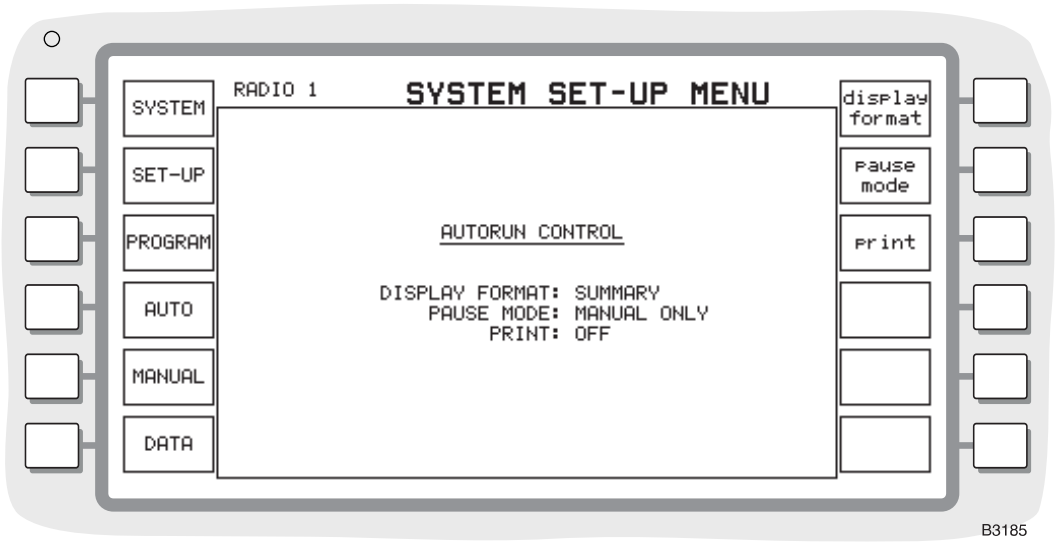

Fig. 2-5 Autorun control menu

DISPLAY FORMAT

This gives you control over the data displayed on completion of each test in the program. With FULL selected, the results of each test are printed in detail, with the results of each measured parameter listed. With SUMMARY selected, one line is displayed or printed for each test, containing the test title, then PASS or *FAIL* with a brief summary of the test.

PAUSE MODE

You can select the criteria that cause the test program to pause and wait for intervention.

Three options are available, displayed on a soft key menu after pressing the *[pause mode]* key. They are:

[manual only]. The AUTORUN program runs through all tests. If the *[pause]* key is pressed during a test the program pauses at the end of the current test.

[on failure]. The AUTORUN program pauses at the end of any test which fails.

[always] The AUTORUN program pauses at the end of every test.

Once the program has paused there are two available options. The program can be continued by pressing the *[cont]* key, or the operation of the radio can be examined by selecting one of the other modes of the Service Monitor. The radio remains active if the [DUPLEX] or [RX] modes are selected and all the settings of the basic instrument modes relate to the ongoing system test. By this means, the current state of the radio can be examined for fault diagnosis or adjustment.

You can return to the test program at any time, by pressing the [SYSTEMS] key. The AUTORUN screen is displayed and pressing the *[cont]* key continues the program from the point where it paused.

PRINT

When print is set ON, all AUTORUN results are printed as they appear in the results screen. The [print] key allows access to the [on] and [off] keys.

Autorun parameters

The AUTORUN PARAMETERS menu, shown in Fig. 2-6 on page 2-10, allows you access to the parameters of each of the tests that are available within the TACS system. The default parameters for each test are listed in Chapter 1, General Information.

Many of the tests can be disabled so that the program does not run them. This gives you flexibility to meet specific requirements. Where this is an option it is shown in the parameter list as the test title, followed by ON or OFF.

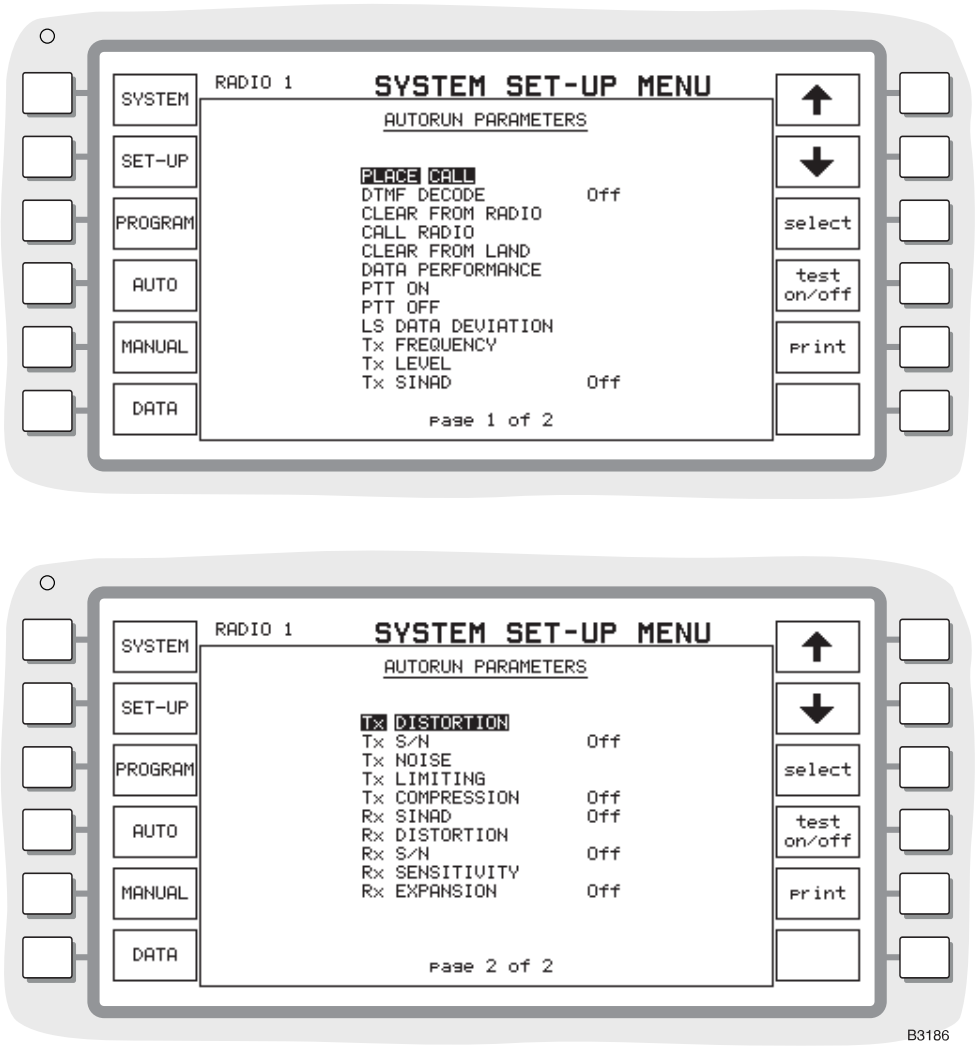

Fig. 2-6 Autorun parameters menu

System type selection, editing and copying

The operating channel frequencies, the channel frequency spacing and the duplex offset between transmit and receive channels of each specific EDACS system are allocated by the appropriate authority. It is most likely that users of the Service Monitor will have a need to test radios operating on different EDACS systems.

The Service Monitor provides four system type choices within the EDACS Radio test system. The parameters in each of these can be set to the requirements of specific systems and each system type can be given a unique title. Once set up, each system type remains available for future use.

To select a particular System type, first press the *[SET-UP}* key a number of times, to display the SYSTEM PARAMETERS menu. Next, press the *[select system]* key. When shipped, all four system types are set to the default settings as described in the performance data section of Chapter 1. They are titled RADIO 1, RADIO 2, RADIO 3 and RADIO 4; and are selected by pressing the *[radio 1], [radio 2], [radio 3] or [radio 4]* key.

The title of current system type is shown against the CURRENT SYSTEM: legend.

Changes to the selected system are made by first pressing the *[select system]* key, then the *[edit current]* key to display the EDIT CURRENT menu.

If the EDACS Repeater Test System software is installed in the Service Monitor, parameter settings can be copied from EDACS System types that have been set up there.

The procedures for changing parameter settings from the EDIT CURRENT menu and for copying them from the EDACS Repeater Test System are described below.

Editing the current system type

General

The system parameters for the selected variant are set up from the EDIT CURRENT menu. The new values or selections are not effective until the *[return]* key is pressed to return to the SYSTEM PARAMETERS menu.

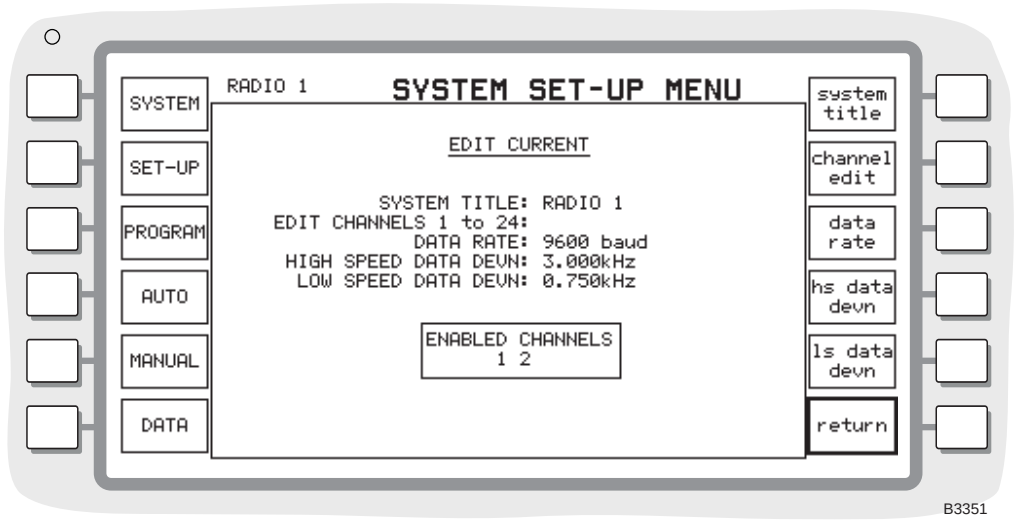

Fig. 2-7 Edit current system type menu

SYSTEM TITLE

This allows you to enter a title of up to ten characters. After a title has been entered as the SYSTEM TITLE and the system type re-elected, it is shown on the SYSTEM PARAMETERS menu and also at the top left of the main title area. The system type keys display the first 7 characters of the new title. For example with a title changed to SUPER the soft key would be labeled *[SUPER]*, if it were changed to SUPEREDACS the soft key would be labeled *[SUPERED]*

When the *[SYSTEM TITLE]* key is pressed, a list of characters that can be used in the title is displayed at the bottom of the screen. A cursor, controlled by the variable rotary control, is used to select characters for the title. The right-hand soft keys are configured to control the entry of the title.

To clear the current SYSTEM TYPE title entry from the display either:

- Press the *[delete char]* key
- Press the [DELETE] key on the front panel
- Enter the first character of the new title

The first character of the title is selected from the character list by placing the cursor over it, then pressing the *[enter char]* key. Pressing the data entry keys, including the decimal point and minus sign, enters their character as the next in the title.

To delete the latest character placed in the title either:

- Press the *[delete char]* key
- Press the [DELETE] key on the front panel

Pressing the *[title complet]* key, enters the title as the SYSTEM TYPE title. When the *[return]* key is next pressed, this becomes the system title, as described above.

Pressing the *[return]* key while the titling character list is displayed (i.e. before the *[title complet]* key has been pressed), aborts the title entry and displays the EDIT CURRENT screen.

EDIT CHANNELS

The allocation of frequencies to service providers for EDACS is not necessarily in continuous frequency bands. To make maximum use of allocated frequencies, some frequency plans for a system may be complex. To allow testing of repeaters programmed with such frequency plans, the Service Monitor has 24 channels, each of which has a Tx frequency and an Rx frequency offset associated with them.

Pressing the *[channel edit]* key gives access to a soft key list of possible channels. Any channel from 1 to 24 can be edited by pressing the *[more]* key until the soft key associated with that channel is displayed, then pressing that soft key, which displays the edit channel screen.

For example:

> From the EDIT CURRENT menu, to edit channel 12, press *[channel edit]*, *[more]*, *[more]*, *[channel 12]*.

DATA RATE

The EDACS system can send high speed data at two different rates: 4800 and 9600 baud. This allows you to select the speed in use in the current system. Pressing the *[data rate]* key toggles between the two data rates

HIGH SPEED DATA DEVN

The EDACS system specification high speed mean deviation level is 3.0 kHz. and is the default value for EDACS. A different value can be entered by you if required.

LOW SPEED DATA DEVN

The EDACS system specification low speed mean deviation level is 750 Hz. and is the default value for EDACS. A different value can be entered by you if required.

Copying system information

(from EDACS Repeater system variant)

With the SYSTEM PARAMETERS menu displayed, pressing *[select system]* then the *[more]* key gives access to further selections, enabling you to copy system information from an EDACS Repeater variant. See Fig 2-8. *Copy system set-up menu.*

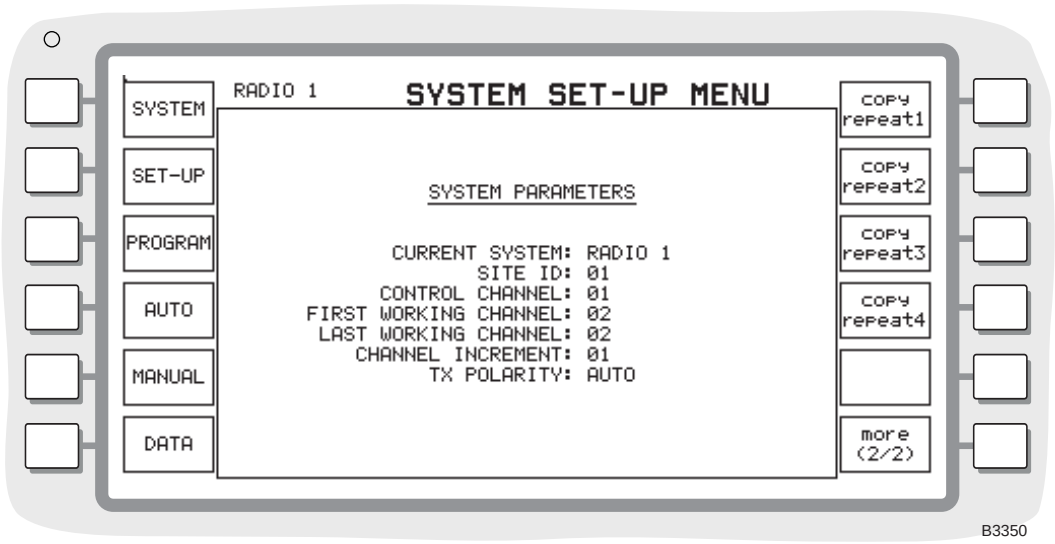

Fig. 2-8 Copy system keys (as shipped)

If the EDACS repeater option is also installed in the Service Monitor, and you have entered system information into it, this can be copied to the EDACS Radio option by pressing the soft key associated with that variant.

For example with the EDACS Radio option active:

Pressing *[copy repeat1]* copies the frequency plan and information from the EDACS Repeater 1 variant, EDIT CURRENT menu into the EDACS Radio 1 variant, EDIT CURRENT menu.

Note:

This causes information from the Repeater variant to overwrite all the current SYSTEM information. **It cannot be retrieved.**

If a SYSTEM TITLE has been changed in the Repeater option (see *SYSTEM TITLE* on page 2-12), the soft key shows the first 7 characters of the changed title. For example with a title of Repeater 1 changed to SUPER the soft key would be labeled *[copy SUPER]*; if it were changed to SUPEREDACS the soft key would be labeled *[copy SUPERED]*.

Test details

A description of each test explains the system function that is being tested and describes the signaling between the Service Monitor and the radio under test. The failure messages associated with each test are explained.

Description of tests

Place Call

Call placement from radio to Service Monitor.

The Place Call test is used to simulate the placement of a call from the radio under test to the Service Monitor. The test accepts group, emergency and individual call types.

Upon initialization, the test title is displayed.

The message ACTIVE **** PRESS PTT **** is displayed.

If the USE ACCESSORY PORT parameter is set to ON, the accessory port is set at this point in the test. Note that the accessory port is not cleared at the end of this test.

The Service Monitor waits to receive a frame from the radio but, if nothing is received within the time specified in the TIMEOUT parameter, then the message *FAIL* NO RESPONSE is displayed and the test exits.

On receiving the call request from the radio, the Service Monitor sends the radio into conversation on a working channel.

If the required working channel signaling is not received from the radio, the message *FAIL* CHANNEL ASSIGNMENT is displayed.

The number which the unit has called is displayed in the form of a logical identity or group identity, together with the call type.

The logical and group identity of the radio under test are displayed. They are also stored in the RADIO PARAMETERS menu.

Other failure messages are:

FAIL NOT ON CONTROL CHANNEL	Radio is not on control channel (i.e. still in conversation).
FAIL ABORTED BY USER	User halted program before test was complete.

Clear From Radio

Clearing down from radio on a working channel.

This tests the termination of a call by the radio.

Upon initialization, the test title is displayed and the Service Monitor checks that the radio is in conversation. Otherwise, the message *FAIL* NOT ON WORKING CHANNEL is displayed.

The flashing message ACTIVE **** RELEASE PTT **** is displayed and the Service Monitor waits to receive a disconnect from the radio. If the USE ACCESSORY PORT parameter is set to ON, the accessory port is cleared at this point in the test.

If nothing is received within the time specified in the TIMEOUT parameter, the message *FAIL* NO RESPONSE is displayed and the test is terminated.

The Service Monitor is re-tuned to the correct control channel and the control channel frames are assembled and transmitted.

The Service Monitor transmits a unit enable message, in order to ensure that the radio has re-acquired the control channel. If the radio does not respond, the message *FAIL* NOT ON CONTROL CHANNEL is displayed.

Other messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL NO RESPONSE	No response was received from the radio
PASSED CLEARED DOWN	

Call Mobile

The Call Mobile test routine is used to simulate the placement of a call from another radio to the radio under test. The number of the radio to be called (called LID) is taken from the RADIO LID in the RADIO PARAMETERS MENU. The caller LID is taken from the TESTSET LID in the RADIO PARAMETERS MENU. The GROUP ID for group calls is also taken from the RADIO PARAMETERS MENU.

Upon initialization, the test title is displayed.

If the USE ACCESSORY PORT parameter is set to ON, the accessory port is set at this point in the test. Note that the accessory port is not cleared at the end of this test unless the test fails.

The type of call used to call the radio depends on the setting of the call type parameter in the AUTORUN PARAMETERS menu. This can be set to the following options:

INDIVIDUAL
GROUP
EMERGENCY
ROTATE

If ROTATE is selected, each time that the test is run during the program the call type is changed to the next call type.

Other messages are:

FAIL NOT ON CONTROL CHANNEL	Radio is not on control channel (i.e. still in conversation.
FAIL ABORTED BY USER	User halted program before test was complete.
PASSED WORKING CHANNEL	

Clear From Land

Clearing down from Service Monitor.

The Clear From Land test simulates the termination of a call placed to the radio under test from another radio, by the other radio.

Upon initialization, the test title is displayed and the Service Monitor checks that the radio is in conversation. Otherwise, the message *FAIL* NOT ON WORKING CHANNEL is displayed.

If the USE ACCESSORY PORT parameter is set ON, the accessory port is cleared at this point in the test.

The Service Monitor generates drop channel dotting on the working channel for 300 ms.

The Service Monitor is then re-tuned to the correct control channel and the control channel frames are assembled and transmitted.

The Service Monitor transmits a unit enable message in order to ensure that the radio has re-acquired the control channel If the radio does not respond, the message *FAIL* NOT ON CONTROL CHANNEL is displayed.

The message 'PASSED CLEARED DOWN' is displayed.

Other failure messages are:

FAIL NO RESPONSE	No response was received from radio on the control channel after cleardown.
FAIL ABORTED BY USER	User halted program before test was complete.

PTT On

Start radio transmission on a working channel.

The PTT On test is used to start the radio transmitting RF. The Service Monitor expects to receive power from the radio in order for the test to pass.

The flashing message **** PRESS PTT **** is displayed.

If the USE ACCESSORY PORT parameter is set to ON, the accessory port is set at this point in the test. Note that the accessory port is not cleared at the end of this test unless the test fails.

If a keyed (KY) message is received, then the PASSED PTT ON message is displayed and the test exits.

Other failure messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL WRONG RESPONSE	The response from the radio was wrong for the message that was sent.

PTT Off

Stop radio transmission on a working channel

The PTT Off test is used to stop the radio transmitting RF.

The flashing message **** RELEASE PTT **** is displayed. If the USE ACCESSORY PORT parameter is set to ON, the accessory port is cleared at this point in the test.

The Service Monitor waits for a time specified in the TIMEOUT test parameter, for an un-keyed (UK) message to be received from the radio. If a UK message is received then the PASSED PTT OFF message is displayed and the test exits. If no UK message is received then the *FAIL* NO PTT OFF message is displayed and the test exits.

Other messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL WRONG RESPONSE	The response from the radio was wrong for the message that was sent.

Data Performance

The Data Performance test checks the accuracy of the radio's data reception under low signal conditions.

The test sequence is as follows. Upon initialization, the test title is displayed. If not on the control channel, the error message *FAIL* NOT ON CONTROL CHANNEL is displayed.

The Service Monitor sets the RF generator level, sends a unit enable message to the radio and waits for an acknowledge message. The Service Monitor checks ten times for any response. If no response is received, the test is aborted and the message *FAIL* NO RESPONSE is displayed. Otherwise the test is repeated another 90 times.

If, after 100 tests, the percentage pass is above the specified limit, the message PASSED is displayed, together with the % bit error rate. The message *FAIL* xx% means that the percentage pass is below the specified limit.

Another possible failure message is:

FAIL ABORTED BY USER	User halted program before test was complete.

Tx Level

Transmitter RF power.

The Tx Level test measures the RF power output from the radio.

Messages are:

FAIL ABORTED BY USER	User halted program before test was complete.

Tx Frequency

Transmitter RF frequency.

The Tx Frequency test is used to determine the accuracy of the RF frequency generated by the radio on the current working channel. The test fails if the RF frequency is found to be outside of the prescribed limits. The message '*FAIL* OUT OF RANGE' is displayed.

Other messages are:

FAIL ABORTED BY USER	User halted program before test was complete.

Tx SINAD

Transmitter SINAD.

The Tx SINAD test is used to measure the SINAD level of the modulated transmission from the radio.

The test fails if the measured SINAD level is below the prescribed level.

The Service Monitor AF generator frequency is set to 1 kHz and its level is adjusted until the radio generates the nominal modulation level. The Service Monitor then measures the Tx SINAD of the modulated signal of the radio.

Failure messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL NO MODULATION	No modulation has been received from the radio.
FAIL UNSTABLE DEMOD	Demodulation was not within 5% after 3 readings or 1% after 10 readings.

Tx Distortion

Transmitter distortion.

The Tx Distortion test is used to measure the distortion level of the modulated signal from the radio.

The test fails if the distortion level is above the prescribed limit.

The Service Monitor AF generator frequency is set to 1 kHz and its level is adjusted until the radio generates the nominal modulation level. The Service Monitor then measures the Tx distortion of the modulated signal of the radio.

Failure messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL NO MODULATION	No modulation has been received from the radio.
FAIL UNSTABLE DEMOD	Demodulation was not within 5% after 3 readings or 1% after 10 readings.

Tx S/N

Transmitter S/N.

The Tx S/N test measures the signal-to-noise level of the modulated signal from the radio. The test fails if the signal-to-noise level is below the prescribed limit.

The Service Monitor AF generator frequency is set to 1 kHz and its level is adjusted until the radio generates the nominal modulation level. The Service Monitor then measures the Tx S/N of the modulated signal of the radio.

Failure messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL NO MODULATION	No modulation has been received from the radio.
FAIL UNSTABLE DEMOD	Demodulation was not within 5% after 3 readings or 1% after 10 readings.
FAIL UNSTABLE DEMOD	Signal-to-noise level is below the prescribed limit.

Tx Noise

Transmitter residual noise.

The Tx Noise test determines the level of 'FM noise' produced by the radio. The test fails if the noise level is above the prescribed limit.

The Service Monitor measures the modulation level of the radio in the absence of a modulating signal from the Service Monitor.

Failure messages are:

FAIL ABORTED BY USER	User halted program before test was complete.

Tx Limiting

Transmitter modulation limiting.

The Tx Limiting test measures the level of carrier deviation from the radio transmitter for differing levels of AF input, thereby establishing the effectiveness of the deviation limiting circuits of the transmitter.

The test fails if the deviation level is above the prescribed limit.

The Service Monitor adjusts the level of the AF generator until the radio generates the nominal modulation level.

The Service Monitor then increases the AF level by the overload factor and checks that the result from the radio is below the limit.

Failure messages are:

FAIL NO MODULATION	No modulation has been received from the radio.
FAIL ABORTED BY USER	User halted program before test was complete.
FAIL UNSTABLE DEMOD	Demodulated signal was not within 5% after 3 readings or 1% after 10 readings
FAIL LOW MIC I/P SENS	AF level required to set the transmitter to reference modulation level was to high to overload by the factor given.

Tx Compression

Transmitter modulation compression.

The Tx Compression test measures the RF carrier deviation from the radio at two levels to test the operation of the compression circuits.

The test fails if the compression ratio is outside the tolerance limit.

The Service Monitor adjusts the AF level until the radio generates the nominal modulation level, then increases the AF level by 10 dB and measures the modulation level. The AF level is then decreased by 20 dB and the modulation level measured.

The compression ratio is the ratio of the two measured modulation levels.

Failure messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL LOW MIC I/P SENS	AF level required to set the transmitter to +10 dB modulation level was to high to overload by the factor given
FAIL NO MODULATION	No modulation has been received from the radio
FAIL UNSTABLE MOD	Demodulated signal was not within 5% after 3 readings or 1% after 10 readings

Rx SINAD

The Rx SINAD test measures the SINAD level of the signal received and demodulated by the radio.

The test fails if the SINAD level is below the prescribed limit.

The Service Monitor RF carrier is modulated at a frequency of 1 kHz at the nominal modulation level. The demodulated audio from the radio is fed to the AF INPUT of the Service Monitor which measures the Rx SINAD.

Failure messages are:

FAIL OUT OF RANGE	SINAD level is below the prescribed limit.
FAIL ABORTED BY USER	User halted program before test was complete.
FAIL LOW DEMOD LEVEL	Receiver audio level <5 mV

Rx Distortion

Receiver distortion.

The Rx Distortion test measures the distortion level of the signal received and demodulated by the radio.

The test fails if the distortion level is above the prescribed limit.

The Service Monitors RF carrier is modulated at a frequency of 1 kHz at the nominal modulation level. The demodulated audio from the radio is fed to the AF INPUT of the Service Monitor which measures the Rx distortion.

Failure messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL LOW DEMOD LEVEL	Receiver audio level <5 mV

Rx S/N

Receiver S/N.

The Rx S/N test measures the signal-to-noise level.

The test fails if the signal-to-noise level is below the prescribed limit.

The Service Monitors RF carrier is modulated at a frequency of 1 kHz at the nominal modulation level. The demodulated audio from the radio is fed to the AF INPUT of the Service Monitor which measures the Rx S/N.

Failure messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL LOW DEMOD LEVEL	Receiver audio level <5 mV

Rx Sensitivity

The Rx Sensitivity test determines the sensitivity of the radio receiver.

The test fails if the sensitivity is below the prescribed limit.

The Service Monitor generates an RF carrier, modulated with 1 kHz frequency at the nominal modulation level. The Service Monitor then reduces the RF level in steps, while measuring the Rx SINAD until the Rx SINAD threshold is passed.

Failure messages are:

FAIL ABORTED BY USER	User halted program before test was complete.
FAIL DROPPED OUT	Radio has dropped the call because the RF generator level was to low.
FAIL LOW DEMOD LEVEL	Receiver audio level <20 mV
FAIL LOW SINAD LEVEL	Unable to reach reference SINAD level at -80 dBm

Rx Expansion

Receiver demodulation expansion.

The Rx Expansion test measures the audio output level from the radio for various levels of carrier deviation to test the operation of the demodulated signal expander circuits. (Refer to Tx Compression test earlier in this section).

The Service Monitor generates an RF carrier modulated at the nominal modulation level. It increases the modulation level by 5 dB and measures the AF level from the radio. It then decreases the modulation level by 10 dB and again measures the AF level. The expansion is the ratio of low to high AF level measurements.

Other failure messages are:

FAIL NO DEMODULATION	+10 dB change in modulation level produced insufficient change in received AF level.
FAIL ABORTED BY USER	User halted program before test was complete.

Selecting the AUTORUN Test Program

[PROGRAM]

The *[PROGRAM]* soft key gives you access to the selection of five test programs. Each test program is made up of selected tests. These tests have been described in detail earlier in this chapter under Description of Tests.

The five programs are:

CALL PROCESSING ONLY

CALL AND RF TESTING

BRIEF TESTING

COMPREHENSIVE TESTING

USER DEFINED TEST

Making tests to radios

Connections

For most radios, the RF connection of the radio is connected to the 'N type' RF connector of the Service Monitor using a suitable RF cable.

For tests which require parametric measurements to be made, connections must be made from the AF GEN OUTPUT connector of the Service Monitor to the audio input of the radio and from the audio output of the radio to the AF INPUT of the Service Monitor.

Automatic testing

With a radio connected to the Service Monitor and with the 'SET-UP' configured to suit the radio, an automatic test can be carried out.

Select the program to be run e.g. CALL PROCESSING ONLY, by using the *[PROGRAM]*, *[call process]*, *[AUTO]*, sequence. The selected program is shown at the top of the display.

The results of the test program are displayed and placed into the results store. To make a permanent record of the results when the program has finished, you may print out a hard copy using the *[print store]* key.

To run the program press the *[start]* key.

When an AUTORUN program is running , soft keys *[stop]* and *[pause]* are displayed.

Pressing the *[stop]* key stops the program immediately and abort the current test. The STATUS message *FAIL* ABORTED BY USER is displayed and a *[cont]* key appears. Pressing this continues the AUTORUN program, commencing at the next test. Pressing the *[stop]* key rather than the *[cont]* key prevents the program continuing and prepares for the AUTORUN program to be started again.

Pressing the *[pause]* key while a program is running makes the program pause at the end of the current test. The program is then in the same condition as when paused due to your setting of the PAUSE MODE in the AUTORUN CONTROL menu.

Manual testing

The manual testing mode is provided to assist in fault location and repair. You are able to set system parameters for the test to be carried out independently from the values in the set-up, system parameters menu. From the mode selection soft key list, each aspect of the system operation can be selected for testing. If one of the other main modes of the Service Monitor is selected while in manual test, the radio remains active and all the settings of the basic instrument modes relate to the ongoing system test. This allows measurements to be made to the receiver or transmitter of the radio.

When the manual test mode is accessed the following system parameters require setting to the relevant values.

CONTROL CHANNEL

This must by set to a channel within the range of the radio.

WORKING CHANNEL

This must by set to a channel within the range of the radio. It cannot be the same as the control channel.

RFGEN LEVEL

This allows the setting of the RF generator output in dBm either by manual entry or by using the rotary control.

HIGH SPEED DATA LEVEL

The high speed data modulation level should be set to the deviation level specified for the system unless the value is required to be different to perform a specific test. This is adjustable either by manual entry or by using the rotary control.

LOW SPEED DATA LEVEL

The low speed data modulation level should be set to the deviation level specified for the system unless the value is required to be different to perform a specific test. This is adjustable either by manual entry or by using the rotary control.

MODE selection

The *[mode]* key displays the test options available to you with the radio in the current state. When first entering manual test mode, the options available are: control channel, individual call, group call, emergency call, unit enable, late entry and BER test.

The *[more]* key is used to access all of the options referred to above.

Selecting each of the options has the action described below.

[control channel] The Service Monitor transmits the continuous forward data on the control channel.

[individ call] The radio is called using the individual identity and goes into conversation mode on the working channel as defined by WORKING CHANNEL.

[group call] The radio is called as above but the call type is an ordinary group call.

[emerg call] The radio is called using the group identity and an emergency call type goes into conversation mode on the working channel as defined by WORKING CHANNEL.

[data perform] The Service Monitor transmits unit enable messages, which demand an acknowledgement from the radio. On receipt of the acknowledgement, or a timeout, another unit enable is sent.

[late entry] The Service Monitor transmits update messages on the control channel, and then goes into conversation mode on the working channel as defined by WORKING CHANNEL.

[BER test] The Service Monitor enters BER Test mode. See *BER testing* below.

When the working channel is active, the MODE legend shows WORKING CHANNEL. The radio remains in conversation mode until action is taken by you:

Releasing the PTT on the radio clears the call and returns the mode to control channel.

Pressing the *[mode]* key on the Service Monitor allows you to select from four possible actions.

Combinations of the following keys are displayed depending on the current state of the Service Monitor settings:

[convers] The Service Monitor restarts the working channel, and the mode changes to ‘CONVERSATION'.

[clear down] The Service Monitor sends the disconnect command to the radio and the mode changes to 'CONTROL CHANNEL'.

[control channel] The Service Monitor restarts the control channel signaling on the channel defined by CONTROL CHANNEL. No disconnect command to the radio is sent, and the mode changes to 'CONTROL CHANNEL'.

[measure ls devn] The Service Monitor measures the transmitted low-speed data deviation and displays the measurements.

BER testing

This facility allows the radio to be put into BER receive mode and then BER transmit mode without having to change the settings on the Service Monitor. For this test mode to function, the radio under test must be equipped with this facility and connected through a programming interface to a suitable control PC. The radio must have been set to BER Test Mode using instructions from the controlling PC.

The Service Monitor transmits the BER data pattern continuously and the radio under test is instructed by the controlling PC to calculate the BER. The results are routed to the controlling PC.

The radio under test is then instructed by the controlling PC to produce a BER data pattern, which is sent to the Service Monitor. The BER calculations are performed by the Service Monitor and displayed on it.

The display shows percentage of bits in error, number of bits received and number of bits in error.

Data displays

Introduction

To enable the data display mode, press the *[DATA]* key at the left-hand side of the screen.

The data display mode allows you to view the data messages which are sent between the Service Monitor and the radio. You can rapidly identify incorrect bits sent by the radio, which may have caused a test to fail. The data displays can also serve as an educational or reference facility for users who are unfamiliar with trunking signaling.

Forward/reverse data

This screen has five active soft keys assigned to it on the right of the display.

The *[⬆]* and *[⬇]* keys *]* select the word to be displayed in the expanded data window at the top of the screen.

The *[forward]* key selects the forward data screen, showing the messages that make up the control channel from the Service Monitor to the radio under test.

The *[clear]* key removes the current information from the display. **IT CANNOT BE RETRIEVED.**

The *[print]* key causes the expanded data window to be printed if the printer is active.

In the lower half, the display lists (in hexadecimal) the codewords that have been sent between the Service Monitor and the radio.

The number of times the codeword has been sent and received, and the identity of the codeword, are shown against each word.

The upper half of the display shows one of the codewords from the list in binary form. The codeword displayed is highlighted in the list and is selected by using either the *[up]* or *[down]* keys, or by using the variable rotary control. Above this window is shown the full title of the codeword.

The binary display of the codeword is presented in two parts:

The small window labeled ‘PARITY’ shows the contents of the parity field of the codeword. This field consists of the 12 least significant bits of the codeword.

The larger window, comprising three character lines, displays the main part of the codeword. This consists of 28 bits when on a control channel and 20 bits on a working channel. A 36-bit codeword is produced on the control channel by a 4800 baud individual call message.

The lower line shows the contents of the codeword (without parity), with the most significant on the left. The upper two lines show the meaning of the bits.

Forward data

This screen has four active soft keys assigned to it on the right of the display. It contains the data that is sent out continuously as the control channel.

The *[⬆]* and *[⬇]* keys select the word to be displayed in the expanded data window at the top of the screen.

The *[forward reverse]* key selects the forward/reverse data screen, showing messages to and from the radio under test.

The *[print]* key causes the expanded data window to be printed if the printer is active.

In the lower half, the display lists (in hexadecimal) the codewords that have been sent from the Service Monitor to the radio.

The number of times the codeword has been sent and received, and the identity of the codeword, are shown against each word.

The upper half of the display shows one of the codewords from the list in binary form. The codeword displayed is highlighted in the list and is selected by using either the *[⬆]* and *[⬇]* keys, or by using the variable rotary control. Above this window is shown the full title of the codeword.

The binary display of the codeword is presented in two parts:

The small window labeled ‘PARITY’ shows the contents of the parity field of the codeword. This field consists of the 12 least significant bits of the codeword.

The larger window, comprising three character lines, displays the main part of the codeword which consists of 28 bits.

The lower line shows the contents of the codeword (without parity), with the most significant on the left. The upper two lines show the meaning of the bits.

Appendix A
ERROR CODES

Autotest error codes

Error codes returned as the first parameter when using the 'NUMRESULTS' MI-BASIC command or the PROG:NUMRESULTS? remote command are listed below, together with their meanings. These error codes are generated when a MI-BASIC 'TEST' command is executed.

Error Code	Error String
0	(test passed)
1	(undefined test failure)
101	"INVALID PARAMETERS"
102	"TIMED OUT",
103	"ABORTED BY USER"
104	"NOT ON CONTROL CHANNEL"
106	"NO RESPONSE"
107	"WRONG RESPONSE"
109	"CHANNEL ASSIGNMENT"
114	"OUT OF RANGE"
115	"LOW MIC I/P SENS"
116	"NO MODULATION"
117	"NO DEMODULATION"
118	"UNSTABLE DEMOD"
119	"LOW DEMOD LEVEL"
120	"LOW SINAD LEVEL"
128	"DROPPED OUT"
154	"NOT ON WORKING CHANNEL"
155	"NO KEYED MESSAGES"
156	"NO UNKEYED MESSAGES"

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