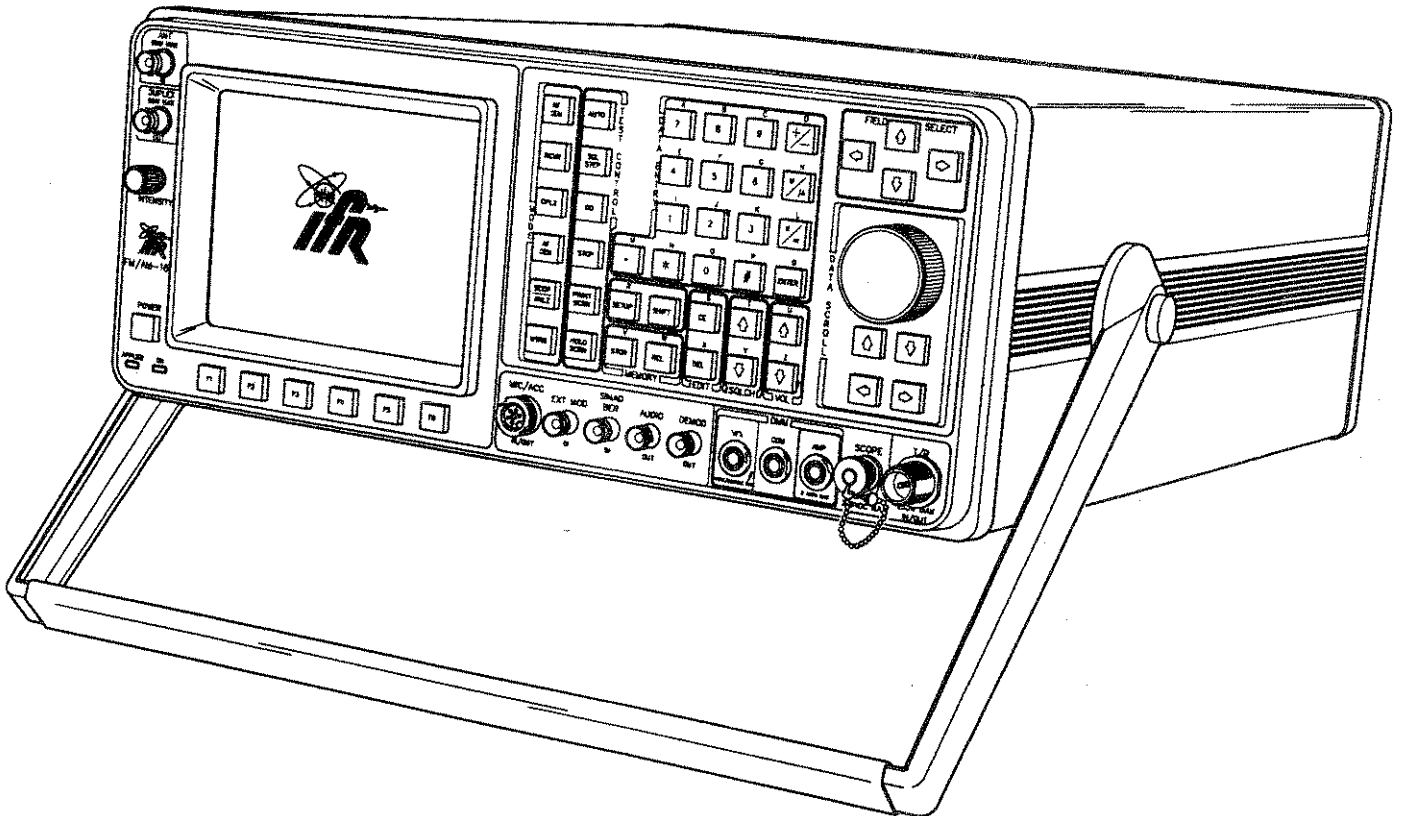


# OPERATION MANUAL

## FM/AM-1600S COMMUNICATIONS SERVICE MONITOR



10200 West York Street/Wichita, Kansas 67215

1002-8600-000  
Ver - 1.10

MAY '92

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FOR SALE

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**WARNING!**  
**HIGH VOLTAGE EQUIPMENT:**  
**FOR QUALIFIED SERVICING TECHNICIANS ONLY**

**THIS EQUIPMENT CONTAINS CERTAIN CIRCUITS AND COMPONENTS OF EXTREMELY HIGH VOLTAGES, CAPABLE OF CAUSING SERIOUS BODILY INJURY OR DEATH. WHEN PERFORMING MAINTENANCE PROCEDURES ON THIS EQUIPMENT, HEED ALL WARNINGS THAT FOLLOW AND REFER TO THE "SAFETY FIRST" PAGES IN THE OPERATION MANUAL FOR PRECAUTIONARY MEASURES.**

- 1. BE SURE TO SERVICE ONLY WHEN ANOTHER PERSON IS PRESENT WHO IS CERTIFIED TO PERFORM FIRST AID FOR ELECTRICAL SHOCK AND CARDIO-PULMONARY RESUSCITATION (CPR). STEPS IN THE PROCEDURES BELOW MARKED WITH AN ASTERISK (\*), ASSUME SUCH CERTIFICATION.**
- 2. EXERCISE CAUTION WHILE SERVICING EQUIPMENT WHEN POWER IS TURNED ON. TURN OFF POWER FROM THE UNIT BEFORE REMOVING COVERS, PANELS, PC BOARDS, CANNISTERS OR BEFORE ENGAGING IN ANY OTHER ACTIVITY THAT COULD RESULT IN DIRECT CONTACT WITH AN ELECTRICAL CURRENT, SUCH AS REMOVING AND SOLDERING COMPONENTS.**
- 3. TO PREVENT ELECTRICAL SHOCK OR EQUIPMENT DAMAGE, ALWAYS CHECK THAT YOUR EQUIPMENT IS PROPERLY GROUNDED PRIOR TO CONNECTING IT WITH ITS POWER SOURCE. THIS EQUIPMENT IS CAPABLE OF PRODUCING A MAXIMUM OF 120 Vac (U.S./CANADA) OR 240 Vac (EUROPE).**

**RESCUE AND FIRST AID FOR SHOCK VICTIMS**

- 1. STOP MOMENTARILY TO ASSESS THE SITUATION. CALL FOR HELP FROM YOUR FIRST AID REPRESENTATIVE. DO NOT ATTEMPT TO PULL OR GRAB THE VICTIM.**
- 2. IF POSSIBLE, TURN OFF ELECTRICAL POWER SOURCE AND REMOVE POINT OF CONTACT FROM VICTIM.**
- 3. IF YOU CANNOT TURN OFF ELECTRICAL POWER: USE A WOODEN POLE, ROPE OR SOME OTHER DRY INSULATING MATERIAL TO PUSH, PULL OR LIFT THE VICTIM TO SAFETY.**
- 4. SEND FOR A DOCTOR AND/OR AMBULANCE.**
- \*5. IF VICTIM'S BREATHING HAS STOPPED: YOUR FIRST AID REPRESENTATIVE SHOULD IMMEDIATELY BEGIN TO TAKE STEPS IN ADMINISTERING CPR.**
- \*6. IF VICTIM IS BREATHING: ATTEMPT TO CONTROL ALL SERIOUS BLEEDING, IF NEEDED.**
- 7. IF THERE IS NO BLEEDING OR BLEEDING IS STOPPED: KEEP VICTIM WARM AND FLAT ON HIS/HER BACK.**

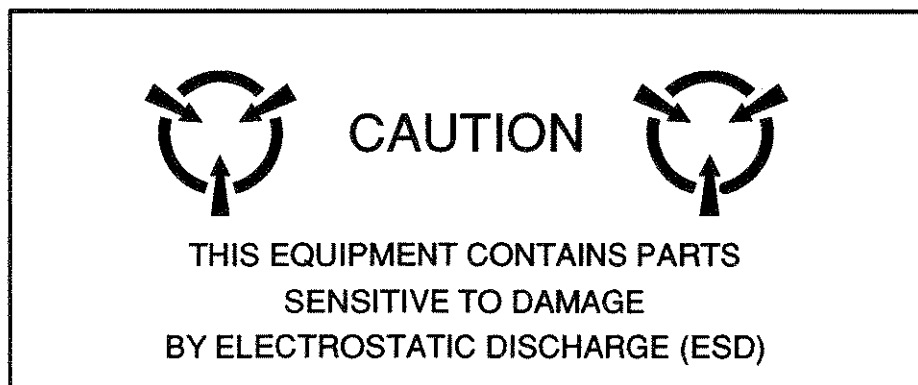
**WARNING: DEVICES MUST NOT BE INSERTED NOR REMOVED FROM CIRCUITS WITH POWER ON.**

**CAUTION: INTEGRATED CIRCUITS AND SOLID STATE DEVICES SUCH AS MOS FETS, ESPECIALLY CMOS TYPES, ARE SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGES RECEIVED FROM IMPROPER HANDLING, THE USE OF UNGROUNDED TOOLS, AND IMPROPER STORAGE AND PACKAGING. ANY MAINTENANCE TO THIS UNIT MUST BE PERFORMED WITH THE FOLLOWING PRECAUTIONS:**

- BEFORE USING A CIRCUIT, KEEP ALL LEADS SHORTED TOGETHER WITH VENDOR-SUPPLIED SHORTING SPRINGS OR BY INSERTING LEADS INTO A CONDUCTIVE MATERIAL.
- GROUND THE HAND BEING USED TO REMOVE DEVICES FROM THEIR CONTAINERS WITH A CONDUCTIVE WRISTBAND. REMOVE ALL METAL JEWELRY BEFORE WORKING WITH DEVICES.
- TIPS OF SOLDERING IRONS, AND ALL OTHER TOOLS, MUST BE GROUNDED WHEN USED.
- PC BOARDS, WHEN REMOVED FROM EQUIPMENT, MUST BE SET ON A GROUNDED CONDUCTIVE MAT OR STORED IN A CONDUCTIVE STORAGE BAG. REMOVE ANY BUILT-IN POWER SOURCE, SUCH AS A BATTERY, BEFORE LAYING PC BOARDS ON A CONDUCTIVE MAT OR STORING IN A CONDUCTIVE BAG.
- PC BOARDS, IF BEING SHIPPED TO THE FACTORY FOR REPAIR, MUST BE PACKAGED IN A CONDUCTIVE BAG AND PLACED IN A WELL-CUSHIONED SHIPPING CONTAINER.

THE USE OF SIGNAL GENERATORS FOR MAINTENANCE AND OTHER ACTIVITIES CAN BE A SOURCE OF ELECTRO-MAGNETIC INTERFERENCE (EMI) TO COMMUNICATION RECEIVERS, WHICH CAN CAUSE DISRUPTION AND INTERFERENCE TO COMMUNICATION SERVICE OUT TO A DISTANCE OF SEVERAL MILES.

USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION WHICH RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND SHOULD TAKE NECESSARY PRECAUTIONS TO AVOID POTENTIAL COMMUNICATION INTERFERENCE PROBLEMS.





**SAFETY FIRST:  
TO ALL OPERATIONS & SERVICE PERSONNEL**

READ AND LEARN THESE PAGES IN THEIR ENTIRETY. THE EXPLANATIONS GIVEN APPLY TO BOTH OPERATORS AND SERVICE PERSONNEL AS A MATTER OF SAFETY WHEN USING THIS PRODUCT AND WHEN REFERENCING THIS MANUAL.

**REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL.**

**SAFETY IDENTIFICATION IN TECHNICAL MANUAL**

The following terms are used throughout this manual to draw attention to possible safety hazards, which may exist when operating or servicing this equipment.

**CAUTION:** THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES WHICH, IF IGNORED, CAN RESULT IN EQUIPMENT OR PROPERTY DAMAGE (E.G., FIRE).

**WARNING:** THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES WHICH, IF IGNORED, CAN RESULT IN PERSONAL INJURY OR DEATH.

**SAFETY IDENTIFICATION USED IN EQUIPMENT**

Markings identified with the terms CAUTION and DANGER are to be addressed before accessing that part of the device.

**CAUTION:** A HAZARD EXISTS WHICH, IF IGNORED, COULD RESULT IN DAMAGE TO THE DEVICE OR PROPERTY. SUCH A MARKING IS NOT LIKELY TO CAUSE PERSONAL INJURY IN THE VICINITY OF THE MARKING.

**DANGER:** A PERSONAL INJURY HAZARD EXISTS AT THE IMMEDIATE PLACEMENT OF THE MARKING ON THE DEVICE. SPECIAL PRECAUTIONS MUST BE OBSERVED WHEN REQUIRED TO PERFORM ANY TASK IN THE VICINITY OF THESE MARKINGS.

**SAFETY SYMBOLS IN MANUALS & ON UNITS**



**INFORMATION PRECAUTION:** Corresponds with an applicable item on the device and in the manual. This symbol defines specific voltage, current and power requirements or other related information for safe operation or service of equipment.



**AC OR DC TERMINAL:** Terminal which may supply or be supplied with ac or dc.



**DC TERMINAL:** Terminal which may supply or be supplied with dc or direct voltage.



**AC TERMINAL:** Terminal which may supply or be supplied with ac or alternating voltage.



**SWITCH OFF:** Ac line power to the device is OFF.



**SWITCH ON:** Ac line power to the device is ON.

## **POWER SUPPLY**

This device is intended for operation from a power source no more than 120 VAC (North American)/240 VAC (European) at a frequency of 50 to 400 Hz. Power supply specifications are provided within the manual.

## **EQUIPMENT GROUNDING PRECAUTION**

When equipment is connected to ac power, it must be connected to LOAD, NEUTRAL and GROUND inputs at their respective points of contact. Improper grounding of equipment can result in electrical shock anywhere on the device, even if it appears to be insulated.

## **USE OF PROBES**

Check the maximum voltage, current and power ratings of any connector on the equipment in the product specifications prior to connecting it with a probe from a terminal device. Be sure the terminal device performs within these specifications prior to using it for measurement, to prevent electrical shock or damage to the equipment.

## **POWER CORDS**

Power cords are supplied specifically for use with this product for 12 Vdc and 120 VAC operation (U.S.). The power cord must not be frayed, broken nor expose bare wiring when operating this equipment, to prevent electrical shock, fires and to protect your equipment.

## **USE RECOMMENDED FUSES ONLY**

Fuses are provided to prevent electrical fire and for protection of equipment. Use only fuses specifically recommended for the equipment at the specified current and voltage ratings.

## **OPERATION OF EQUIPMENT IN HAZARDOUS ENVIRONMENT**

Do not operate equipment in an explosive environment, out of doors in an electrical storm nor under any other such dangerous circumstances, unless the equipment has been specifically designated for use in such an adverse environment. Environmental requirements are listed with the specifications of this product.

## **CASE, COVER OR PANEL REMOVAL**

Removing protective covers, casings or panels from equipment before operation of this product exposes the operator to electrical hazards which can result in electrical shock or equipment damage. Do not operate this equipment with the case, cover or panels removed.

# LIST OF EFFECTIVE PAGES

The manual pages listed below which are affected by a current change or revision, are so identified by a revision number and an asterisk.

**Date of Issue for original and changed pages are:**

Original . . . . .0 . . . . . August 1, 1991

**TOTAL NUMBER OF PAGES IN THIS MANUAL IS 436 CONSISTING OF THE FOLLOWING:**

Pg. No.	Change No.	Pg. No.	Change No.
Title . . . . .	.0	3-180 Blank . . . . .	.0
Copyright . . . . .	.0	4-1 through 4-111 . . . . .	.0
Warning . . . . .	.0	4-112 Blank . . . . .	.0
Caution . . . . .	.0	5-1 through 5-3 . . . . .	.0
Safety . . . . .	.0	5-4 Blank . . . . .	.0
A . . . . .	.0	6-1 through 6-44 . . . . .	.0
B Blank . . . . .	.0	7-1 through 7-20 . . . . .	.0
i through viii . . . . .	.0	A-1 through A-6 . . . . .	.0
1-1 through 1-16 . . . . .	.0	B-1 through B-10 . . . . .	.0
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2-4 Blank . . . . .	.0	C-20 Blank . . . . .	.0
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# PREFACE

## SCOPE

This manual contains instructions for operating the FM/AM-1600S Communications Service Monitor. The instruction level is relatively basic and presupposes no previous experience on the part of the operator with a communication service monitor of this type. A basic understanding of communication electronics and practical troubleshooting methods is helpful. It is strongly recommended that the operator be thoroughly familiar this manual before attempting to operate the unit.

## ORGANIZATION

The FM/AM-1600S Operation Manual is composed of the following sections:

### SECTION 1 - INTRODUCTION

Provides an introduction to the unit and a brief overview of unit functions. Specifications are also included in this section.

### SECTION 2 - INSTALLATION

Provides a step-by-step procedure for placing the FM/AM-1600S into operation.

### SECTION 3 - DESCRIPTION OF CONTROLS, CONNECTORS AND INDICATORS

Identifies and functionally describes all FM/AM-1600S controls, connectors and indicators. Additionally, all CRT Operation Screens and Menus are identified and available parameters listed and explained.

**NOTE:** As an operating aid, Figures 3-1 and 3-2, which locate and identify all FM/AM-1600S controls, connectors and indicators, are located on a fold-out page. By extending the fold-out page, the operator can reference any front or rear panel control while simultaneously performing any operating procedure contained elsewhere in the manual.

### SECTION 4 - OPERATION

Contains instructions for operating the FM/AM-1600S Mode Operating Screens and Menus. In addition, this section contains a selection of basic operating procedures pertaining to all major functions of the set.

### SECTION 5 - PERFORMANCE EVALUATION

Identifies and explains procedures the operator can use to insure the FM/AM-1600S is performing properly.

### SECTION 6 - REMOTE OPERATION

Contains step-by-step procedures for configuring and operating the FM/AM-1600S remotely. Lists unit specific commands for remote operations as well as commands mandated by IEEE 488.2 1987.

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# SECTION 1 - INTRODUCTION

## 1-1 GENERAL

The FM/AM-1600S is a microprocessor controlled, digitally synthesized communication service monitor which combines the operations of many different test instruments into a single, compact unit. Functions the FM/AM-1600S is capable of performing include:

RF Generator	Receiver
Duplex	AF Generator
Spectrum Analyzer	Oscilloscope
DMM	Deviation (Peak) Meter
Distortion Meter	SINAD Meter
Audio Frequency Meter	Frequency Error Meter
RF Power Meter	Modulation Meter
Signal Strength Meter	Bit Error Rate Meter
Phase Meter	Deviation (RMS) Meter
Tracking Generator	Cable Fault Detector
Digital Radio Paging	Analog Radio Paging
Encode and Decode	Encode and Decode

The FM/AM-1600S utilizes an alphanumeric keypad, dedicated function keys, multitask "Soft" Function Keys and a high-resolution color CRT to display, enter and edit functions and data. Testing with this instrument can be done remotely or manually. The FM/AM-1600S can perform tests from preprogrammed setups or formats determined at the time of the test. Microprocessor controlled memory allows storage and recall of parameters for each of the testing modes as well as storage and recall of Oscilloscope and Spectrum Analyzer traces for signal comparison.

## 1-2 RF GENERATOR

The FM/AM-1600S is capable of generating modulated or unmodulated carrier signals from 250 kHz to 999.9999 MHz (in 100 Hz steps). The output level is variable from -137 dBm to 0 dBm. Modulation types include AM, FM and PM. Modulation can also be applied from an external source. The RF Generator also functions as a tracking generator for swept measurements or as an offset generator in Duplex Mode. Metering functions available for this operation mode include SINAD, DMM, Distortion and Audio Frequency Level meters. The Oscilloscope and Spectrum Analyzer are also available for use on the RF Generator Operation Screen.

## 1-3 RECEIVER

The FM/AM-1600S is capable of receiving modulated and unmodulated signals from 250 kHz to 999.9999 MHz (in 100 Hz steps). The FM/AM-1600S receives AM, FM, PM, and SSB modulated signals. Metering functions in the FM/AM-1600S available with the Receiver include RF Power, Modulation, Deviation, Distortion, Frequency Error, AF Frequency, Signal Strength and SINAD meters and counters. The Oscilloscope and Spectrum Analyzer are also available for use on the Receiver Operation Screen. The FM/AM-1600S Receiver is capable of executing user defined frequency scan operations as well as single frequency operations. The Receiver is accessible to "off the air" signals through the ANTENNA IN Connector or the T/R Connector for higher powered signals.

## **1-4 DUPLEX**

The FM/AM-1600S features Duplex Operation from 250 kHz to 999.9999 MHz. The operator has the option of monitoring the transmitter, receiver or both with the CRT. All features available with the RF Generator and Receiver are available in Duplex as well as the ability to use an offset frequency from -999.7499 to +999.7499 MHz to test communication equipment capable of generating and receiving simultaneously on different frequencies.

## **1-5 AUDIO FUNCTION GENERATORS**

Two Audio Function Generators are included in the FM/AM-1600S with a range of 10 Hz through 40 kHz. Signals generated are transmitted as generated or modulated before transmission. Available waveforms include sine, square, triangle, ramp and pulse. The FM/AM-1600S is also capable of creating digital data bit patterns of 100 to 100,000 bits. Data rates include 75, 150, 300, 600, 1200, 2400, 4800 and 16000 bps. Pattern types include random, fixed and user defined.

## **1-6 OSCILLOSCOPE**

The FM/AM-1600S includes a 1 MHz single trace Oscilloscope as one of its major test functions. The Oscilloscope allows input from 1 mV to 50 V/div with a maximum input voltage of 200 Vdc. Sweep rates range from 1  $\mu$ s to 100 ms/div. The FM/AM-1600S Oscilloscope has a store and recall ability of up to nine signals. The recalled trace are shown simultaneously with a live trace, giving the operator the opportunity to compare the two traces. Signals available for use include AC, DC, GND, Receiver IF, Demodulated Audio, Function Generators, External Audio, SINAD/BER and RF Power. The Oscilloscope is available for view alone or in all major Operation Modes except where Duplex Transmitter and Receiver are shown simultaneously. Size options for view in other modes are full-size and 1/4-size.

## **1-7 SPECTRUM ANALYZER**

The Spectrum Analyzer monitors internal and external signals from 250 kHz to 999.9999 MHz. Scan widths range from 1 kHz to 100 MHz. Available log scales are 2 and 10 dB/div with amplitude scale units of dBm, dB $\mu$ V, dBmV, dBV and dB $\mu$ W. Memory functions for the Spectrum Analyzer include store and recall of a trace, compare a stored trace to a live trace and peak hold. External signals can be "off the air" through the ANTENNA IN Connector or applied through the T/R Connector. The Spectrum Analyzer has variable attenuation through both connectors. The Spectrum Analyzer also has a tracking generator function with a variable level from -137 to 0 dB. The Spectrum Analyzer is available for display alone or with all RF Generate and Receive functions except where the Duplex Transmit and Receive functions are shown simultaneously. Size options for view in other Modes are full-size and 1/4-size.

## **1-8 METERS**

The FM/AM-1600S provides the meters listed in 1-1 for use as independent test functions as well as synthesizing them into the major mode functions. As independent functions, the meters provide a bar graph display and digital data. On the Major Operations Screens, these meters display as bar graph display and digital data or just as digital data, depending on the Oscilloscope/Spectrum Analyzer display size. The meters are used to monitor both internal and external input.

## 1-9 DATA ENTRY AND DISPLAY

Unless the FM/AM-1600S is configured for remote testing, all data received by the operator is in the form of screens and menus. Each major test operation has a dedicated operation screen with subordinate setup menus. The microprocessor edits operation screens to reflect changes in parameters imposed by the operator or reflects changes in data delivered by the Unit Under Test (UUT). Individual meters also have dedicated operation screens and subordinate setup menus. The Meter Operation Screens can be accessed through the Mode Operation Screen that is being supported by that specific Meter Operation or through the Meter Menu. Refer to 3-3-9 for a description of the different Meters.

On selecting a specific Mode of Operation, the Operation Screen will appear on the CRT. The parameters shown reflect the parameters last entered in that operation. This specific operation screen is accessed with one of six dedicated MODE Keys. Setup menus on all mode operation screens are accessed from the specific Operation Screen by pressing the SETUP Key. Operator entry and edit of data is performed on the operation screen or on the setup menu. The operation screen and menu have active cursors which the operator can use to access a specific parameter. Once the parameter is accessed, data can be selected with DATA SCROLL Spinner or DATA SCROLL Keys or by using the alphanumeric DATA ENTRY Keypad. Multitask "Soft" Function Keys are also available to perform setup, edit and entry. Each operation screen defines "Soft" Function Keys to fit the specific needs for that operation. These definitions are displayed on the screen above the defined key. Each Operation Screen may have several definitions for each "Soft" Function Key or make a definition unavailable depending on the parameters of the operation. Various functions performed by these multitask keys include toggling between two values, selecting connectors for access, entering data or selecting a field to be edited.

## 1-10 SPECIFICATIONS

**NOTE:** A warm-up time of five minutes is required for the following performance requirements.

RF measurements are referenced to 50  $\Omega$ .

Accuracy and Resolution stated in percent are referenced to measured or selected value unless otherwise stated.

Where specified resolution exceeds specified accuracy, specified resolution takes precedence.

### RF SIGNAL GENERATOR AND MODULATION

#### RF SIGNAL GENERATOR (T/R CONNECTOR)

##### Frequency:

Range: 400.0 kHz through 999.9999 MHz

Resolution: 100 Hz

Accuracy: Same as Master Oscillator

##### Level:

Range: -137.0 to 0.0 dBm, -40 dBm Max  
with Reverse Power Present

Resolution:	0.1 dB
Accuracy:	±1.5 dB, 0.0 to ≥-90.0 dBm ±2.5 dB, <-90.0 dBm to -127.0 dBm
Output Impedance:	50 Ω (See Power Meter for return loss).
Spectral Purity:	
Residual FM:	(Post Detection BW: 300 Hz to 3 kHz) <10 Hz rms from 1.0 to 500.0 MHz <20 Hz rms for <1.0 and >500.0 MHz
S.S.B. Phase Noise:	<-90 dBc/Hz at 20 kHz from carrier <-80 dBc/Hz for <1.0 MHz <-85 dBc/Hz for ≥930 MHz
Harmonics:	<-26 dBc
Non-Harmonics:	<-50 dBc
Residual AM:	(Post Detection BW: 300 Hz to 3 kHz) <0.10% rms, 1 MHz to 999.9999 MHz
Input Protection:	See Power Meter.

#### DUPLEX GENERATOR (DUPLEX CONNECTOR)

##### Frequency (Independent of Receiver Frequency Setting):

Range:	400.0 kHz to 999.9999 MHz
Resolution:	100 Hz
Accuracy:	Same as Master Oscillator

##### Level:

Range:	-120.0 to +10 dBm, CW or FM -120.0 to + 7 dBm, AM
Resolution:	0.1 dB
Accuracy:	±1.5 dB, 0.0 to ≥-90.0 dBm ±2.5 dB, <-90.0 to -120.0 dBm
Output Impedance:	50 Ω Nominal (<1.38 VSWR)

##### Spectral Purity:

Residual FM:	(Post Detection BW: 300 Hz to 3 kHz) <10 Hz rms from 1.0 to 500.0 MHz <20 Hz rms for <1.0 and >500.0 MHz
--------------	--



S.S.B.Phase Noise: <-90 dBc/Hz at 20 kHz from carrier  
 Harmonics: <-26 dBc  
 Non-Harmonics: <-50 dBc  
 Residual AM: (Post Detection BW: 300 Hz to 3 kHz)  
 <0.10% rms, 1 MHz to 999.9999 MHz  
 Input Protection: Up to 65 W for 15 sec with Alarm

**RF SIGNAL MODULATION (T/R AND DUPLEX CONNECTORS)**

**Internal FM:**

**Deviation:**

Range: Off,  $\pm 100$  Hz to  $\pm 100.0$  kHz  
 Accuracy: <5% from  $\pm 1.0$  to  $\pm 25.0$  kHz  
 <7% for  $<\pm 1.0$  and  $>\pm 25.0$  kHz  
 Resolution: 100 Hz ( $\leq 25.0$  kHz)  
 500 Hz ( $> 25.0$  kHz)

**Modulation:**

Rate: Off, 30.0 Hz to 40.0 kHz up to 20 kbs Digital  
 Waveforms: Sine, Square, Triangle, Ramp or Pulse

**NOTE:** Reference AF Generator for modulation rate accuracy and resolution.

Distortion (Sine wave only): <1.0%, at 1 kHz, 0.3 to 3 kHz BW)

**Internal AM:**

RF Generator Range: 500 kHz to 999.9999 MHz

**Amplitude Modulation:**

Range: Off, 1% to 90%  
 Accuracy: 5% of setting for 30% to 90% modulation, at 1kHz  
 10% of setting for  $f < 1$  MHz  
 Resolution: 1%

**Modulation:**

Rate: 100.0 Hz to 10.0 kHz  
 Waveforms: Sine, Square, Triangle, Ramp or Pulse

**NOTE:** Reference AF Generator for modulation rate accuracy and resolution.

**Distortion (Sine Wave Only):**

For 30% to 70% Modulation:	<0.7%, (700 Hz to 1.1 kHz) <1.0% (100 Hz to 6.0 kHz) <1.5% (>6.0 to 10.0 kHz) <3.0% (0.5 to 1 MHz [RF]; 0.1 to 10 kHz [AF])
----------------------------	---

**Internal Phase:**

**Phase Modulation**

Range:	Off, 0.1 to 10.0 radians
Accuracy:	<5% at 1 kHz
Resolution:	0.1 radians

**Modulation:**

Rate:	Off, 30.0 Hz to 6.0 kHz
Wave Forms:	Sine, Square, Triangle, Ramp or Pulse

**NOTE:** Reference AF Generator for modulation rate accuracy and resolution.

Distortion:	<2.0%
-------------	-------

**External:**

**NOTE:** External signals input with the same characteristics as the referenced internal modulation sources are supported.

FM Deviation Sensitivity:	5.0 kHz/Vpeak for <25 kHz 20.0 kHz/Vpeak for ≥25 kHz
AM Modulation Sensitivity:	20%/Vpeak
Phase Modulation Sensitivity:	2.0 Rad/Vpeak

**FREQUENCY AGILITY (FOR BOTH RF GENERATOR AND RECEIVER)**

Settling Time:	1.5 ms to within 1.0 kHz of desired frequency from 1.0 to 100 MHz (25.0 kHz steps) 2.5 ms to within 1.0 kHz of desired frequency from 250.0 kHz to 999.9999 MHz (100 Hz steps)
----------------	---

## **SIGNAL GENERATORS**

### **AF GENERATORS #1 AND #2**

#### **Frequency:**

<b>Range:</b>	10.0 Hz to 40.0 kHz
<b>Resolution:</b>	0.1 Hz $\leq$ 2.0 kHz 1.0 Hz $>$ 2.0 kHz
<b>Accuracy:</b>	0.1%

#### **Level:**

<b>Range:</b>	0.7 mVrms to 2.5 Vrms (150 $\Omega$ ), up to 3.0 Vrms (600 $\Omega$ )
<b>Resolution:</b>	0.1 mV for 10.0 to 200.0 mV 3% for $>$ 200.0 mV or $>$ 10.0 kHz
<b>Accuracy (150 <math>\Omega</math> load):</b>	$\pm$ 0.1 mV or 3% for 10 kHz <5% for $>$ 10 to $<$ 25 kHz

#### **Spectral Purity:**

<b>Total Harmonic Distortion (Sine wave only):</b>	<0.25%, from 700 Hz to 1.1 kHz <1.0%, for $<$ 700 Hz and $>$ 1.1 kHz
--	---

#### **Waveshape:**

Sine, Square, Triangle, Ramp or Pulse

### **DIGITAL DATA GENERATOR AND PATTERN GENERATOR FOR BER**

<b>Data Rates:</b>	75, 150, 300, 600, 1200, 2400 and 4800 bps; and 16 kbps
<b>Data Pattern Size:</b>	100 to 100,000 bits
<b>Data Pattern Type:</b>	Random, Fixed and User Defined
<b>Accuracy:</b>	$1 \times 10^{-8}$

#### **Level:**

<b>Range:</b>	Digital 0.1 to 5.0 V
<b>Resolution:</b>	0.1 V
<b>Accuracy:</b>	3%

## **AUDIO FREQUENCY COUNTER**

### **Frequency:**

Range: 10.0 Hz to 40.00 kHz (In four decade ranges)

Accuracy: Same as Master Oscillator

Resolution: 0.1 Hz from 10.0 Hz to  $\leq 2.0$  kHz  
1.0 Hz from  $> 2.0$  to  $\leq 20.0$  kHz  
10.0 Hz from  $> 20.0$  to 40.0 kHz

Input Waveform: Sine or Square Wave

### **External:**

Level: 0.1 to 10.0 VRMS

Impedance: 1.0 M $\Omega$

Internal Signal Selections: Demod Audio  
AF Generators  
External Audio

## **RF ERROR METER/RF COUNTER**

### **RADIO FREQUENCY COUNTER**

#### **Frequency:**

Range: 250000 to 999,999,990 Hz

Accuracy: Same as Master Oscillator

Resolution: 1 Hz,  $< 20$  MHz  
10 Hz,  $\geq 20$  MHz

Level: -10 to +50 dBm at T/R Connector  
-80 to +10 dBm at ANTENNA IN Connector

### **RADIO FREQUENCY ERROR COUNTER/FREQUENCY METER**

#### **Frequency:**

Counter Range: 0 Hz to  $\pm 150.000$  kHz

Meter Range: 0 to  $\pm 100.0$  kHz, in four decade ranges and  
Autorange:  $\pm 100$  Hz,  $\pm 1$  kHz,  $\pm 10$  kHz and  $\pm 100$  kHz

Counter/Meter Accuracy: Same as Master Oscillator

Counter/Meter Resolution: 1 Hz from  $\pm 1$  Hz to  $\leq \pm 10.0$  kHz  
10 Hz from  $> \pm 10$  to  $\pm 150.0$  kHz

**NOTE:** Receiver Bandwidth determines the upper limits.

Counter/Meter Level: -10 to +50 dBm at T/R Connector  
-80 to +10 dBm at ANTENNA IN Connector

## RF POWER METER

Frequency:

Range: 1.5 to 999.9999 MHz

Level:

Input Level: 0.2 mW to 200.0 W

Ranges: 20.0 mW, 200.0 mW, 2.0 W, 20.0 W  
200.0 W (Full Scale)

Resolution: 1% or 0.1 mW

Accuracy: 10%,  $\pm 1$  count

Return Loss: 0.25 to 100.0 MHz, <1.15 VSWR  
>100.0 to 400.0 MHz, <1.23 VSWR  
>400.0 to 999.9999 MHz, <1.38 VSWR

Operating Conditions: Continuous On at 50 W and 25.0°C Ambient  
30.0 Sec ON, 2.0 Min OFF  
(at 100 W and 50.0°C Ambient)  
15.0 Sec ON, 2.0 Min OFF  
(at 200 W and 50.0°C Ambient)

**NOTE:** Over Temperature Alarm provided for all input levels.

## RECEIVER

Frequency Range: 400.0 kHz to 999.9999 MHz

Sensitivity: Typically 2  $\mu$ V for 10.0 dB SINAD in 30 kHz  
IF Bandwidth (1.0 kHz Tone, 3 kHz Deviation,  
10 kHz Audio Bandwidth)

Selectivity:	<u>Mode</u>	<u>Rec. IF BW</u>	<u>Audio BW</u>
	FM 4	300 kHz	75 kHz
	FM 3	300 kHz	20 kHz
	FM 2	30 kHz	10 kHz
	FM 1	30 kHz	10 kHz
	AM 1	2.9 kHz	3.0 kHz
	AM 2	30 kHz	10 kHz
	USB	2.9 kHz	3.0 kHz
	LSB	2.9 kHz	3.0 kHz

**NOTE:** 30 kHz BW is standard, 12.5 or 20 kHz BW Hardware Option is available.

**NOTE:** 2.9 kHz BW is standard, 6 kHz BW Hardware Option is available. No USB or LSB comes with this option.

Adjacent Channel Rejection:

Receiver Nominal 3.0 dB Bandwidth	> 30.0 dB Down
300 kHz	±485 kHz Max
30 kHz	±52 kHz Max
2.9 kHz	±2.5 kHz Max

**NOTE:** For USB or AM1 Operation Center Frequency is shifted -1825 kHz according to mode of operation.

Demodulation Output:

Impedance:	600 Ω
Output Level:	AM; 80% = 1.02 ±0.06 VRMS FM1; ±10 kHz = ±2.5 Vpp, 10% FM2; ±20 kHz = ±2.5 Vpp, 10% FM3; ± 50 kHz = ±2.5 Vpp, 10% FM4; ±100 kHz = ± 2.5 Vpp, 10% SSB; Beat Tone = 1.15 ±0.10 VRMS PM1; 18.25 Volt/Rad, ± 10% PM2; 36.5 Volt/Rad, ±10% PM3; 91.2 Volt/Rad, ±10% PM4; 182.5 Volt/Rad, ±10%

Receiver, Antenna Connector:

Input Protection:	≤65 W for 15 Seconds With Alarm
-------------------	---------------------------------

## FM DEVIATION METER

Deviation:

Range:	+100 kHz and -100 kHz (+Peak and -Peak), in six ranges and Autorange: ±2 kHz, ±5 kHz, ±10 kHz, ±20 kHz, ±50 kHz and ±100 kHz
Resolution:	50 Hz, ≤20 kHz Ranges 1 kHz, >20 kHz to 100 kHz Ranges
Accuracy:	±3.0% full scale, ±1 count, applies for the following conditions:

Deviation Rate	Receiver IF	Post Audio	Carrier Level
≤1 kHz	30 kHz	3 kHz	-80 dBm
≤3 kHz	30 kHz	15 kHz	-70 dBm
≤10 kHz	300 kHz	20 kHz	-70 dBm

Modulation Rate:	100.0 Hz to 40.0 kHz
------------------	----------------------

Carrier Range: 400.0 kHz to 999.9999 MHz  
Carrier Level: -10 to +50 dBm on T/R Connector  
-70 to +10 dBm on ANTENNA IN Connector

### **PM DEVIATION METER**

Deviation Range: 0 to 10.0 Rad (Peak)  
Resolution: 0.02 Rad;  $\leq 8.0$  Rad  
0.1 Rad;  $> 8.0$  Rad  
Accuracy:  $\pm 3.0\%$  full scale,  $\pm 1$  count  
Modulation Rate: 300.0 Hz to 4.0 kHz  
Carrier Range: 400.0 kHz to 999.9999 MHz  
Carrier Level: -10 to +50 dBm on T/R Connector  
-80 to +10 dBm on ANTENNA IN Connector

### **AM MODULATION METER**

Modulation Range: 1% to 100%  
Resolution: 1%  
Accuracy: 5% full scale,  $\pm 1$  count from 30% to 90%  
Modulation Rate: 100.0 Hz to 10.0 kHz  
Carrier Range: 400.0 kHz to 999.9999 MHz  
Carrier Level: -10 to +50 dBm on T/R Connector  
-80 to +10 dBm on ANTENNA IN Connector

### **DISTORTION METER**

Distortion Range: 0.1% to 20.0%  
Resolution: 0.1%  
Accuracy:  $\pm 0.5\%$  Distortion,  $\pm 1$  count from 1.0% through 10.0%,  
 $\pm 2.0\%$  Distortion,  $\pm 1$  count from 10.0% through 20.0%  
Signal Frequency: 600 Hz to 1.4 kHz (770 Hz and 1.0 kHz Std.)  
Signal Level: 0.1 to 30.0 VRMS, SINAD/BER IN Connector

### **SINAD METER**

Range: 3.0 to 30.0 dB  
Resolution: 0.1 dB

Accuracy:  $\pm 1.0$  dB,  $\pm 1$  count (@ 12 dB SINAD)  
Signal Frequency: 600 Hz to 1.4 kHz (770 Hz and 1.0 kHz Std.)  
Signal Level: 0.1 to 30.0 VRMS, SINAD/BER IN Connector

## DIGITAL MULTIMETER

### VOLTMETER (DC/AC)

Ranges: 200.0 mV, 2.000 V, 20.00 V, 200.0 V,  
2000 V (full scale) and Autorange (1 M $\Omega$ )

**NOTE:** Maximum voltage is 1000 Vdc or 500.0 VAC (true RMS)

Resolution: 3.5 digit display,  
Max. resolution 0.1 on 200.0 mV Scale.

Accuracy:  $\pm 5\%$ , full scale (ac),  $\pm 1$  count  
 $\pm 1\%$ , full scale (dc),  $\pm 1$  count

**NOTE:** AC accuracy applies for AC Volts times kHz product  $< 140$ .

Frequency: dc, ac mode 50 Hz to 20 kHz

Input Impedance: Selectable  $\pm 5\%$   
150  $\Omega$   
600  $\Omega$  (line load)  
1 M $\Omega$   
User. 1 to 999  $\Omega$  (requires external load)

### OHMMETER

Ranges: 200.0  $\Omega$ , 2.000 k $\Omega$ , 20.00 k $\Omega$ , 200.0 k $\Omega$ ,  
2.000 M $\Omega$  or 20.00 M $\Omega$  (full scale)

Resolution: 3.5 digit display,  
Max. resolution 0.1  $\Omega$  on 200.0  $\Omega$  Scale.

Accuracy:  $\pm 5\%$  or 0.1 W,  $\pm 1$  count

### CURRENT METER (DC/AC)

Ranges: 20.00 mA, 200.0 mA, 2.000 A (full scale)  
(20.0 A possible using an External Shunt  
and setting the voltmeter to 0.2 V scale)

**NOTE:** 10 A dc or 5 A ac (true RMS) is maximum allowable current.

Resolution: 3.5 digit display, Max. resolution  
0.01 mA on 20.0 mA Scale.

Accuracy:  $\pm 5\%$  or 0.10 mA,  $\pm 1$  count



HIGHEST FREQUENCY TO RESOLVE:

## OSCILLOSCOPE

Display Size: 3.4 inches x 3.8 inches (8.6 cm x 9.7 cm)  
Approx. Full Size

Vertical Bandwidth(-3dB): 1.0 MHz

Input Ranges: Units per div (8 div on the screen)

2 mV	5 mV	10 mV
20 mV	50 mV	100 mV
200 mV	500 mV	1 V
2 V	5 V	10 V
20 V	50 V	

Max Input Voltage: 200 V

Accuracy:  $\pm 5\%$  of full scale ( $\pm 10\%$  with x 10 probe)

Resolution: 1% of full scale, (digital scope data range 0 to 255, in 8 div)

Coupling: dc, ac, GND

Horizontal Sweep: Units per div (10 div on the screen)

1 $\mu$ s	2 $\mu$ s	5 $\mu$ s
10 $\mu$ s	20 $\mu$ s	50 $\mu$ s
100 $\mu$ s	200 $\mu$ s	500 $\mu$ s
1 ms	2 ms	5 ms
10 ms	20 ms	50 ms
100 ms		

Accuracy:  $\pm 1\%$  of full scale

Resolution: 1%, (digital scope data sweep, 400 points displayed per sweep)

External Input:

Impedance: - 1.0 M $\Omega$ , shunted by 27 pF

Internal Signals (DC Coupled): 425.0 kHz IF  
Demod Audio  
Function Generator  
SINAD/BER  
RF Power  
External Audio

SPECIAL  
O SEM

## SPECTRUM ANALYZER

Display Size: 3.4 inches x 3.8 inches (8.6 cm x 9.7 cm),  
Approx. Full Size

Range: 250.0 kHz to 999.9999 MHz

Frequency Span:

    Range: 0, 1, 2, 5, 10, 20, 50, 100, 200 and 500 kHz  
          1, 2, 5, 10, 20, 50 and 100 MHz/div

    Accuracy:  $\pm 5\%$  of Span Width

    Reference Accuracy: See Master Oscillator

Level:

    Vertical Range: 2 or 10 dB/div

    Vertical Resolution: 1 dB (1/2 of a minor div)

    Range (Dynamic): 70 dB (1 kHz, 0 dB atten.) at ANTENNA IN Connector

    Bandwidth Switching Error: <2 dB (5 kHz to 100 MHz mode)  
                                  <4 dB (1 kHz to 2 kHz mode)

    Overall Accuracy:  $\pm 2$  dB (normalized)  
                           $\pm 4$  dB (250 kHz to 400.0 MHz),  
                           $\pm 5$  dB (400.0 to 999.9999 MHz)  
                           $\pm 2.5$  dB (>400 MHz normalized)

    Attenuator: 0, 20, 40 dB at ANTENNA IN Connector  
                  40, 60, 80, 100 dB at T/R Connector

### Modes:

<u>Scan Width</u>	<u>Resolution Bandwidth</u>
100 MHz/DIV	3 MHz
50 MHz/DIV	3 MHz
20 MHz/DIV	300 kHz
5 MHz/DIV	300 kHz
2 MHz/DIV	300 kHz
1 MHz/DIV	300 kHz
500 kHz/DIV	30 kHz
200 kHz/DIV	30 kHz
100 kHz/DIV	30 kHz
50 kHz/DIV	30 kHz
20 kHz/DIV	3 kHz
10 kHz/DIV	3 kHz
5 kHz/DIV	3 kHz
2 kHz/DIV	300 Hz
1 kHz/DIV	300 Hz
0 kHz/DIV	3 kHz

**NOTE:** The receiver is fixed on the Center Frequency for monitoring while the analyzer scans as specified.

Receiver Operation Screen Analyzer Display is not available with 1 MHz Scan Width.

### **BIT ERROR RATE METER (BER)**

Data generated by Digital Data Generator. Inputs to BER meter from received RF or from front panel connector.

Range:	$1 \times 10^{-1}$ to $1 \times 10^{-5}$
Data Rates:	75, 150, 300, 600, 1200, 2400 and 4800 bps; and 16 kbps
Data Pattern Size:	100 to 100,000 bits
Data Pattern Type:	Random, Fixed, User Definable
Accuracy:	$1 \times 10^{-6}$
External Input Level:	
Signal Level:	0.1 through 30.0 VRMS, SINAD/BER IN Connector

### **INPUT/OUTPUT (I/O) CONNECTORS**

IEEE-488.1-1987 CONNECTOR	(24 pin Champ Connector)
Interface Capabilities:	SH1, AH1, TEO, L2, LEO, SR1, RL2, PP0, DC1, DT1,C0
RS-232 CONNECTOR (Asynchronous)	(9 pin sub-miniature D, male connector)
Operations Mode:	Off, PC (Input/Output), Printer (Output)
Baud Rates:	300, 600, 1200, 2400, 4800 and 9600 bps
Stop Bits:	1, 2
Parity:	Odd, Even, Mark, Space, None
AUXILIARY BOX INTERFACE (SCSI-1).	(50 pin Champ connector)
Auxiliary Box Interface Connector:	Per ANSI X3.131-1986 standard
EXTERNAL VIDEO	(9 pin sub-miniature D, female connector)
External Computer Monitor Interface:	EGA (Enhanced Graphic Adapter)

## MASTER OSCILLATOR

### TCXO

Temperature Stability:	±0.2 ppm (0 to 50°C)
Aging:	±0.5 ppm per year
Accuracy:	±0.5 ppm
Adjustment Resolution:	0.005 ppm over 4.0 ppm adjustment range

### OPTIONAL OVEN

Temperature Stability:	±0.05 ppm (0 to 50°C)
Aging:	±0.25 ppm per year
Accuracy:	±0.30 ppm

## GENERAL CHARACTERISTICS

### Dimensions:

(Without Bail Handle): 7.4" (18.8 cm) High, 17" (43.2 cm) Wide  
22" (55.9 cm) Deep (With front panel cover on)

(With Bail Handle): 7.4" (18.8 cm) High, 18.8" (47.8 cm) Wide  
25" (63.5 cm) Deep (With front panel cover on)

Weight: 48 lbs (21.8 kg)

Operating Temperature Range: 0 to 50°C

## POWER REQUIREMENTS

Line: 85 to 135 VAC or 180 to 260 VAC  
50 to 400 Hz at 180 W typical

## DISPLAY

Type: Color, 70° deflection, inline

Size: 6.8" (17.3 cm) Diag., 5.6" (14.2 cm) H,  
5.2" (13.2 cm) V

Resolution: 640 pixels X 350 Lines

# SECTION 2 - INSTALLATION

## 2-1 GENERAL

This section contains information on preparing the FM/AM-1600S for use. Also listed are installation and operating precautions for safe use of the unit.

## 2-2 PRECAUTIONS

Before operating this instrument, the operator should be thoroughly familiar with all aspects of this manual.

For operator safety and to prevent damage to this instrument, the following operating precautions should be observed at all times:

**WARNING:** THE FM/AM-1600S MUST BE CONNECTED TO ELECTRICAL GROUND. CONNECT THE FURNISHED AC POWER CORD TO A PROPERLY GROUNDED 3-PIN RECEPTACLE. DUE TO POTENTIAL SAFETY HAZARDS, USE OF THREE-PRONG TO TWO-PRONG ADAPTOR PLUGS IS NOT RECOMMENDED.

**CAUTION:** THE DMM AMP CONNECTOR REQUIRES A CURRENT SHUNT WHEN MEASURING CURRENT ABOVE 2 A.

THE T/R CONNECTOR ACCEPTS NO MORE THAN 200 W. MAXIMUM OPERATION TIME FOR MEASUREMENT USING THE T/R CONNECTOR IS:

- CONTINUOUS ON AT 50 W AND 25°C AMBIENT.
- 30 SECONDS ON AND 2 MINUTES OFF AT 100 W AND 50°C AMBIENT.
- 15 SECONDS ON AND 2 MINUTES OFF AT 200 W AND 50°C AMBIENT.

NO MORE THAN 1000 VDC OR 500 VAC SHOULD BE APPLIED TO THE DMM V $\Omega$  CONNECTOR.

DO NOT APPLY MORE THAN 65 WATTS TO THE FM/AM-1600S THROUGH THE DUPLEX OUT CONNECTOR.

DO NOT APPLY MORE THAN 65 WATTS TO THE FM/AM-1600S THROUGH THE ANTENNA IN CONNECTOR.

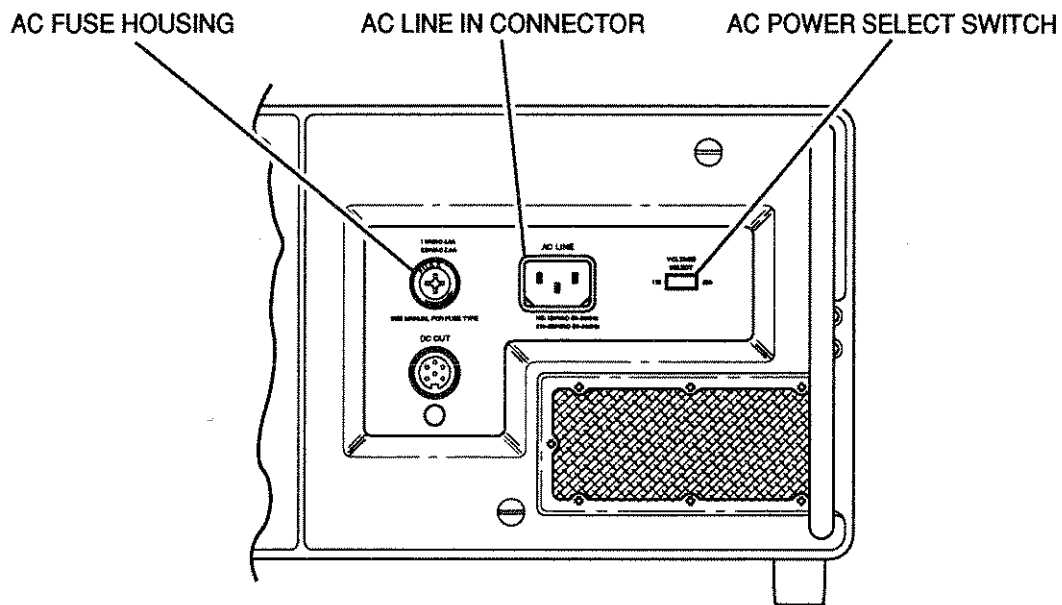
THIS EQUIPMENT CONTAINS PARTS SENSITIVE TO DAMAGE BY ELECTRO-STATIC DISCHARGE (ESD).

## 2-3 POWER UP PROCEDURE

The following procedure should be followed when applying power to the FM/AM-1600S. Refer to Figures 2-1 and 2-2 for specific controls, connectors or indicators.

STEP	PROCEDURE
------	-----------

1. Place FM/AM-1600S in the horizontal operating position.
2. If connected, remove ac power cord from receptacle.
3. Determine operating voltage to be used with the unit.
4. Set AC POWER SELECT Switch to required setting (115 or 230 V).



8607005

Figure 2-1 Rear Panel Power Up Controls, Connectors and Indicators

5. Rotate AC FUSE Housing on Rear Panel ccw and remove to expose ac fuse.
6. Insure proper fuse is installed in AC FUSE Housing. A 4.0 A fuse is provided for use with 115 VAC and a 2.0 A fuse is provided for use with 230 VAC.

**CAUTION:** FOR SAFE OPERATION, REPLACE ONLY WITH FUSE OF SPECIFIED VOLTAGE AND CURRENT RATINGS.

7. Reinstall AC FUSE Housing.

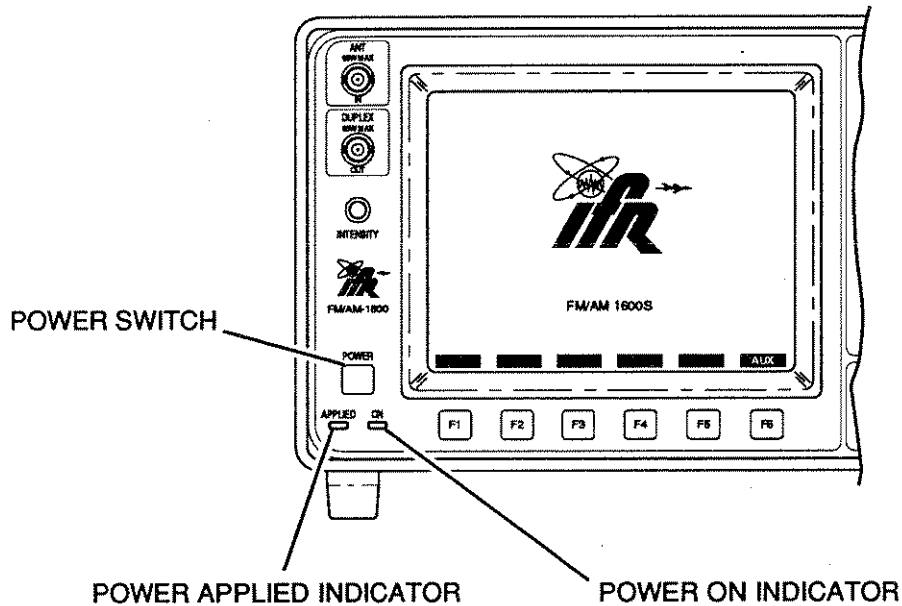
STEP

PROCEDURE

8. Connect power cord provided to the AC LINE IN Connector (Figure 2-1). One ac power cord (U.S. only) is provided with unit. Be sure to inspect cord before using it with the equipment.

**WARNING: A FRAYED OR BROKEN POWER CORD CAN RESULT IN FIRE OR ELECTRICAL SHOCK. DISCARD ALL DAMAGED POWER CORDS AND REPLACE WITH A POWER CORD FREE OF DISFORMATIONS.**

9. Plug cord into user provided power source. Insure compatibility with voltage selected for the FM/AM-1600S and proper grounding.
10. When power is connected to the FM/AM-1600S, the POWER APPLIED Indicator is lit.
11. Press FM/AM-1600S POWER Switch to ON Position.
12. POWER ON Indicator lights.





8607006

Figure 2-2 Front Panel Power Up Controls, Connectors and Indicators





### 3-1 FM/AM-1600S FRONT PANEL

ITEM	DESCRIPTION
1. <u>FIELD SELECT Keys</u>	Up, down, left and right arrow keys are used to place the cursor in the desired data field on a menu or operation screen. FIELD SELECT Keys (←, ↑, →, ↓) move cursor to next data field in the indicated direction.
2. <u>DATA SCROLL Spinner</u>	Rapidly increases or decreases data within a selected field or chooses entries from lists.
3. <u>DATA SCROLL ↑ and ↓ Keys</u>	Steps data within a selected field. Data increases or decreases by a preset amount or next higher or lower data setting appears.
4. <u>DATA SCROLL ← and → Keys</u>	Moves data entry cursor to digit position. When a digit is selected, it becomes the significant digit and the number to its left increments or decrements as the selected digit passes "0".
5. <u>VOL Control Keys</u>	Increases (↑) or decreases (↓) speaker volume.
6. <u>T/R Connector</u> 	Connector for RF Generator Output and high power input.  <b>CAUTION:</b> THE T/R CONNECTOR ACCEPTS NO MORE THAN 200 WATTS. MAXIMUM OPERATION TIME FOR MEASUREMENT USING THE T/R CONNECTOR IS: <ul style="list-style-type: none"><li>● CONTINUOUS ON AT 50 W AND 25°C AMBIENT.</li><li>● 30 SECONDS ON AND 2 MINUTES OFF AT 100 W AND 50°C AMBIENT.</li><li>● 15 SECONDS ON AND 2 MINUTES OFF AT 200 W AND 50°C AMBIENT.</li></ul>
7. <u>SCOPE IN Connector</u> 	Connector for signal input to digital Oscilloscope.  <b>CAUTION:</b> APPLY NO MORE THAN 200 VDC THROUGH THE SCOPE IN CONNECTOR.

ITEM	DESCRIPTION
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8. DMM AMP Connector 

Digital Multimeter (DMM) External Input Connector. Provides input to ac and dc Current Meter.

**CAUTION:** CURRENT INPUT ABOVE 2 A REQUIRES CURRENT SHUNT.

9. DMM COM Connector 


Digital Multimeter External Input Common Connector. Provides common connection for DMM functions. Connect DMM Probe leads to connectors as follows:

DMM V $\Omega$  Connector (11) and DMM COM Connector for ac or dc voltage measurements.  
DMM AMP Connector (8) and DMM COM Connector for ac or dc current measurements.  
DMM V $\Omega$  Connector (11) and DMM COM Connector for resistance (ohms) measurements.

**NOTE:** A set of DMM Probes are included with FM/AM-1600S.


10. SQLCH Control Keys

Increases ( $\uparrow$ ) or decreases ( $\downarrow$ ) Squelch level.

11. DMM V $\Omega$  Connector 

Digital Multimeter External Input Connector. Provides input for the DMM ac or dc Voltmeter and Ohmmeter.

**CAUTION:** NO MORE THAN 1000 VDC OR 500 VAC SHOULD BE APPLIED TO THE DMM V $\Omega$  CONNECTOR.

12. DEMODO OUT Connector 

Provides demodulated audio or data from the Receiver.

13. EDIT Keys

a. CE (Clear Entry) Key

Clears selected data entry field.

b. DEL (Delete) Key

Deletes preceding keystroke or character.

14. AUDIO OUT Connector

Provides demodulated audio from Receiver Module, Function Generator output from Monitor Module, EXT MOD signal or SINAD/BER signals for use by the UUT.

## ITEM

## DESCRIPTION

15. SINAD/BER IN Connector 

Provides access for signals to SINAD measurement or Bit Error Rate Meter Functions.

16. MEMORY and SPECIAL FUNCTION Keysa. SHIFT Key

Allows direct entry of hexadecimal digits and alpha characters. See Table 3-1 for a complete listing of "SHIFT" characters.

Front Panel Key	2nd Function Character	Front Panel Key	2nd Function Character
7	A	*	N
8	B	0	O
9	C	#	P
+/-	D	ENTER	Q
4	E	SETUP	R
5	F	CE	S
6	G	SQLCH ↑	T
M/μ	H	VOL ↑	U
1	I	STOR	V
2	J	RCL	W
3	K	DEL	X
K/m	L	SQLCH ↓	Y
• (Decimal Point)	M	VOL ↓	Z

Table 3-1 "SHIFT" Characters

b. RCL (Parameter Recall) Key

Recalls previously stored operation screen or test parameters from memory.

c. STORE (Parameter Storage) Key

Stores operation screen or test parameters in memory.

d. SETUP Key




Displays of setup menu for the operating screen on the CRT (26).

17. EXT MOD IN Connector 

Connector for external modulation input from AM, FM or PM modulation sources.

ITEM DESCRIPTION

---

- 18. MIC/ACC IN/OUT Connector   
Used as microphone or accessory audio input/output connector.
- 19. Soft Function Keys  
Functions of Soft Function Keys are dependent on the operating mode.
- 20. POWER ON Indicator  
Green LED illuminates when POWER Switch (22) is pressed to turn power on. LED goes off when POWER Switch (22) is pressed to turn power off.
- 21. POWER APPLIED Indicator  
Yellow LED illuminates when ac power is applied to FM/AM-1600S.
- 22. POWER Switch  
Red power switch used to turn unit power on and off. Under extreme operating conditions (i.e., high temperature indication), power may be switched off under processor control.
- 23. CRT INTENSITY Control  
Adjusts intensity and contrast of the CRT Display (26).
- 24. DUPLEX OUT Connector   
RF Generator output when unit is in Duplex Mode.  
**CAUTION:** DO NOT APPLY MORE THAN 0.25 W CONTINUOUSLY THROUGH DUPLEX OUT CONNECTOR OR MORE THAN 65 W, AS THIS CAUSES PERMANENT DAMAGE TO SET.
- 25. ANTENNA IN Connector   
Antenna Input Connector used to monitor low level "off the air" signals.  
**CAUTION:** DO NOT APPLY MORE THAN 65 W TO THE FM/AM-1600S THROUGH THE ANTENNA IN CONNECTOR.  
**NOTE:** An Antenna is provided with the FM/AM-1600S.
- 26. CRT Display  
Provides visual information to operator via a 6.8" (5.6" X 4.3") 16-color CRT screen.

**ITEM****DESCRIPTION**

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**27. MODE Keys**

Each mode and respective screens and menus are covered in detail in 3-3.

**a. RF GEN Key**

Accesses RF Generator Operation Screen.

**b. RCVR Key**

Accesses Receiver Operation Screen.

**c. DPLX Key**

Accesses Duplex Operation Screen.

**d. AF GEN Key**

Accesses AF Generator Operation Screen.

**e. SCOP/ANLZ Key**

Accesses Oscilloscope or Spectrum Analyzer Operation Screen.

**f. MTRS Key**

Accesses Meter Menu to select Meter Operation.

**28. TEST CONTROL Keys**

Used to enter test execution mode or function.

**a. AUTO Key**

Controls special functions.

**b. SGL STEP (Single Step) Key**

Controls special functions.

**c. GO Key**

Starts operator controlled functions. Functions affected include Frequency Scan, DTMF and Decode Functions.

**d. STOP Key**

Stops operator controlled functions. Functions affected include Frequency Scan and Decode.

**e. PRINT SCRN Key**

Prints current CRT display when connected to an external printer.

f. HOLD SCR N Key

Freezes the current CRT display on the screen.

29. DATA ENTRY Keypad

Provides direct entry of test set parameters into selected data field. Pressing ENTER, K/m or M/ $\mu$  Key ends data entry and returns field selection cursor. Parameters are not changed until ENTER Key or a Scale and Unit Key is pressed.

a. "0-9" (Numeric) and "." (Decimal point) Keys

Allows numeric data entry. Numeric keys automatically repeat if held in for more than one second and repeat at an approximate rate of two per second.

b. +/- Key

Toggles the sign of a selected data entry.

c. M/ $\mu$  and K/m Keys

Scale and Unit Keys, "M/ $\mu$ " ( $\times 10^6/\times 10^{-6}$ ) and "K/m" ( $10^3/\times 10^{-3}$ ), are used as multipliers for selected data entry. Toggles to multiply entry by selected factor.

d. ENTER Key

Accesses a selected field and enters selected data in its present configuration.






e. # and \* Keys

Used for DTMF Functions

f. Alpha Keys

Alpha Keys are accessed by using the SHIFT Key along with the DATA ENTRY, MEMORY, EDIT, SQLCH and VOL Keys. Table 3-1 shows each key and associated alpha character.

### 3-2 FM/AM-1600S REAR PANEL

ITEM	DESCRIPTION
30. <u>AC POWER SELECT Switch</u>	Allows selection of 115 or 230 VAC power input.
31. <u>AC LINE IN Connector</u> 	Provides input from ac power source. An ac power cord is included with the unit.
32. <u>DC OUT Connector</u> 	Provides operational dc power from the FM/AM-1600S. Specific voltage outputs and current levels are listed in A-3.
33. <u>SCSI (Small Computer System Interface) Bus</u>	Provides a standard, high speed, digital bus for communication.
34. <u>GPIB (IEEE-488) Connector</u>	Allows FM/AM-1600S to control other test modules, transfer test results, drive a plotter or be controlled by an external test controller.
35. <u>RS-232 Connector</u>	Allows FM/AM-1600S to communicate with any serial device, to control other test modules, upload and download parameter sets, transfer test results, drive a printer or be controlled by an external test controller. All commands or data available to the operator at Front Panel are available at RS-232 Connector.
36. <u>RECEIVER IF Connector</u> 	Provides user access to Receiver IF Signal.
37. <u>EXTERNAL VIDEO Connector</u> 	Allows an external CRT (EGA compatible) to be attached to FM/AM-1600S. Attached CRT echoes current display.
38. <u>EXTERNAL REFERENCE Connector</u> 	Allows attachment of an external 10 MHz reference to FM/AM-1600S.
39. <u>AC FUSE Housing</u>	115 VAC operation requires 4.0 A fuse. 230 VAC operation requires 2.0 A fuse.

### **3-3 OPERATION SCREENS AND MENU CONFIGURATIONS**

The operation screens of the FM/AM-1600S and their accompanying setup menus contain a great deal of information. This information displays differently according to the type of operation screen displayed, the configuration of the screen and signal type and input source used.

Operation screens are accessed by pressing any MODE Key except the MTRS Key. Setup Menus for each operation screen are accessed by pressing the SETUP Key while that Operating Screen is displayed on the CRT.

Pressing the MTRS MODE Key accesses the Meter Menu. The Meter Menu is used to access each Meter Operating Screen. Menus for individual Meters are accessed by pressing the SETUP Key while a Meter Operation Screen is displayed on the CRT.

When editing, use the FIELD SELECT Keys to move the cursor to the parameter to be edited and press ENTER Key to access the data field. Use the DATA ENTRY Keypad to enter numerical data. Use the DATA SCROLL Spinner or DATA SCROLL ↑ and ↓ Keys to select parameters from a list. Parameters with only two possible settings automatically switch to the opposite setting when selected.



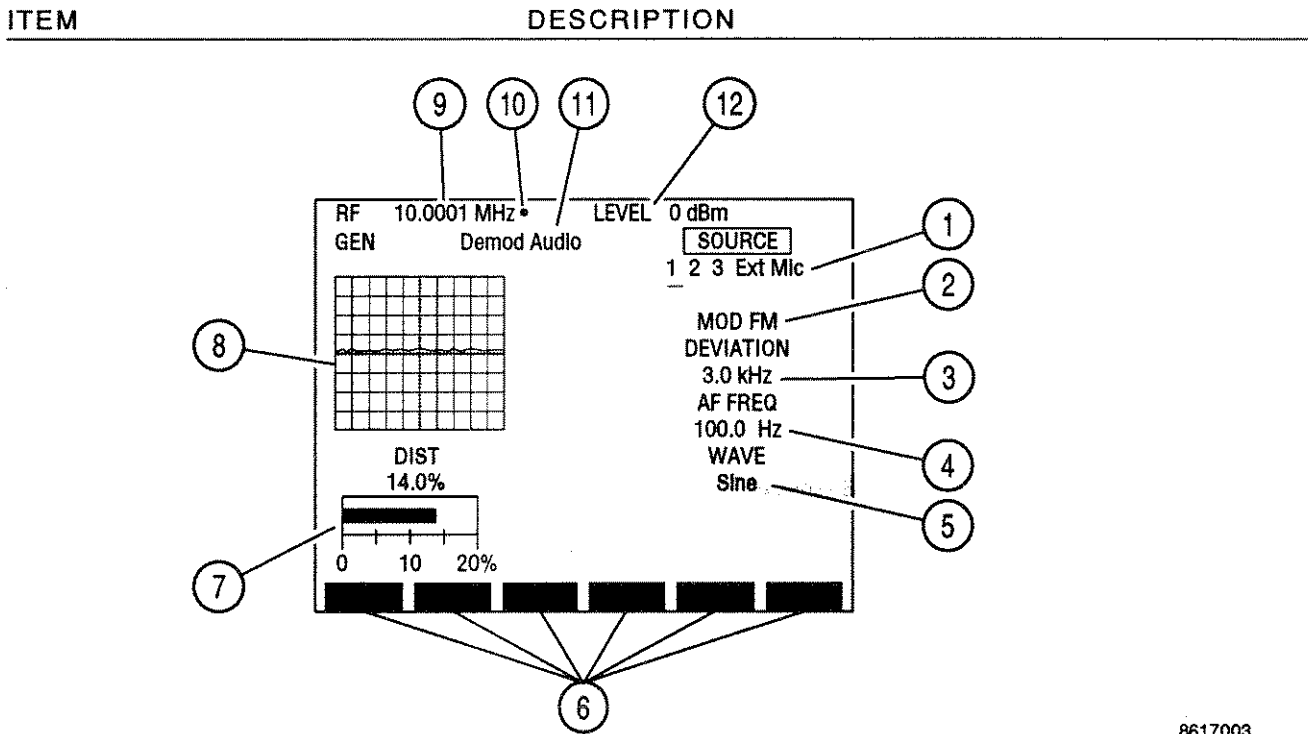
### 3-3-1 RF GENERATOR OPERATION SCREEN

Press the RF GEN MODE Key to access the RF Generator Operation Screen. Use the index of screen features to identify the operation screen parameters that may be edited, the value range available to each feature and/or its usage.

When editing, use the FIELD SELECT Keys to move the cursor to the parameter to be edited and press ENTER Key to access the data field. Use the DATA ENTRY Keypad to enter numerical data. Use the DATA SCROLL Spinner or DATA SCROLL ↑ and ↓ Keys to select parameters from a list. Parameters with only two possible settings automatically switch to the opposite setting when selected. To access a displayed Meters Operation Screen, move cursor to the Meters Callout and press ENTER.

#### A. SCREEN PARAMETERS

The following index includes screen parameters and screen parameter attributes. Possible parameter settings are listed where parameters can be changed from the operation screen.



8617003

#### 1. Modulation Sources

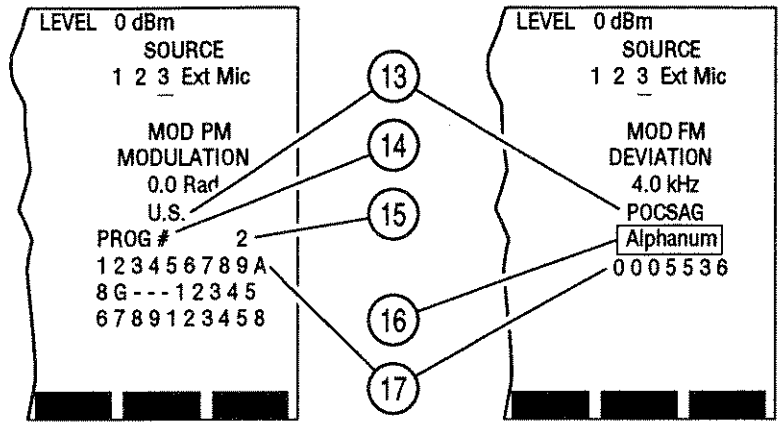
Selects Source and Source Modulation. "1" is AF Generator 1, "2" is AF Generator 2, "3" is Signaling Formats, "Ext" is external signals received at the EXT MOD Connector and "Mic" is external sources received at the MIC/ACC Connector. Underline indicates active Source. Select for Modulation: AM, FM, PM or OFF.

**NOTE:** Different Sources cannot be FM and PM simultaneously. Selecting FM changes PM sources to FM. Selecting PM changes FM sources to PM. Sources that are AM or OFF are not affected.

ITEM	DESCRIPTION
2. <u>Modulation Type</u>	Not an editable parameter. Readout indicates Active Source Modulation Type. Indicates FM, AM, PM or OFF.
3. <u>Modulation Level</u>	Selects Modulation Level. Range is 0.0 to 100.0 kHz for FM Modulation, 0% to 90% for AM Modulation or 0.0 to 10.0 radians for PM Modulation.
4. <u>Active Source Audio Frequency</u>	Appears if Source 1 or 2 is active. Select from 0.0 to 40000.0 Hz.
5. <u>Active Source Wave Form</u>	Appears if Source 1 or 2 is active. Select Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl or -1 Lvl.
6. <u>Soft Function Keys</u>	Soft Function Keys for RF Generator Operating Screen are covered in 3-3-1B.
7. <u>Distortion/SINAD/AF Level/DMM Meter</u>	Displays selected meter. Meter is selected using "Meters" Soft Function Key F4. Accessing Meter Callout displays Meters Operation Screen. Meter displayed as a digital readout if Scope/Analyzer is full size.
8. <u>Oscilloscope or Spectrum Analyzer</u>	Displays Oscilloscope or Spectrum Analyzer Operation. Use "Disp" Soft Function Key F1 to display full size or 1/4 size Oscilloscope, full size or 1/4 size Spectrum Analyzer or set to "None" for no display.
9. <u>RF Generator Frequency</u>	Selects frequency from 0.2500 to 999.9999 MHz.
10. <u>10 MHz External Reference Light</u>	Blue asterisk appears when 10 MHz External Reference signal is applied to the EXTERNAL REFERENCE Connector (38) (Figure 3-2).
11. <u>Oscilloscope Input</u>	Appears with Oscilloscope on. Select Rcvr IF, Demod Audio, RF Pwr Lvl, SINAD/BER, Func Gen, Ext Mod, AC, DC or GND.
12. <u>RF Generator Level</u>	If RF Generator Level Units are set to dBm, select from -137.0 to 0.0 dBm. If RF Generator Level Units are set to Volts, select from 0.031 $\mu$ V to 0.224 V.

If Source 3 is selected as the Active Source, the Operation Screen appears as follows:

ITEM	DESCRIPTION
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8617057

13. Signaling Code Display

- Displays DTMF if DTMF is the selected Signaling Format.
- Accesses Audio Code if Audio Signaling Format is active. Select from:

CCIR	EEA	U.S.(EIA)
ZVEI	DDZVEI(ZVEI 2)	DZVEI (ZVEI 3)
NATEL	EURO	5/6 Tone Seq
CCIRH	CCIRH4	User Defined

- Accesses Digital Code if Digital Signaling Format is active. Select from:

DCS	DCS INV	POCSAG
-----	---------	--------

- Accesses RCC Code if RCC Signaling Format is active. Select from:

IMTS	MTS	2805
Tone Rem		

14. DIRECT ENTRY/PROG #

Accessing callout toggles it to the function not shown. Select PROG # to generate a sequence programmed from the Setup Menu. Select DIRECT ENTRY to allow sequence entry from the Operation Screen. Press GO TEST CONTROL Key to transmit sequence.

15. Program Number Callout

Does not appear if DIRECT ENTRY is active. Select from 16 possible sequences programmed from the Setup Menu.

**ITEM****DESCRIPTION**

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**16. POCSAG or Tone Remote Callout**

Accesses POCSAG or Tone Remote Function. For POCSAG, select one of the following:

Tone - 1 beep	Numeric	Alphanumeric
Tone - 2 beep	Numeric seq	Alpha special
Tone - 3 beep	Alpha lower	
Tone - 4 beep	Alpha upper	

For Tone Remote, select one of the following:

2050 (Monitor)	1650 (R2 Unmute)	1250 (Wild Card 1 Off)
1950 (F1)	1550 (Repeater Off)	1150 (Wild Card 2 On)
1850 (F2)	1450 (Repeater On)	1050 (Wild Card 2 Off)
1750 (R2 Mute)	1350 (Wild Card 1 On)	

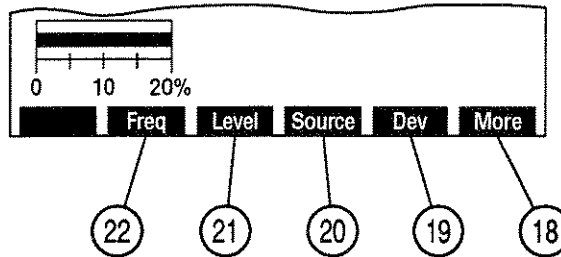
**17. Tone Sequence Listing**

Displays coded sequence. If DIRECT ENTRY is selected, accessing allows entry of sequence unless POCSAG or Tone Remote is in use.

## B. SOFT FUNCTION KEYS

The following index lists, by screen, the different Soft Function Key sets available for the RF Generator Operation Screen. Whichever set is accessed last is the set that comes up first when the RF Generator Operation Screen is next accessed. Press "More" Soft Function Key F6 to access the next set of Soft Function Keys.

ITEM	DESCRIPTION
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8617050

18. "More" Soft Function Key F6

Displays additional sets of Soft Function Keys.

19. "Dev"/"Mod" Soft Function Key F5

Appears if Modulation is not "OFF". Selects Modulation Level, with a range of 0 to  $\pm 100$  kHz for FM, 0% to 90% for AM or 0.0 to 10.0 radians for PM.

20. "Source" Soft Function Key F4

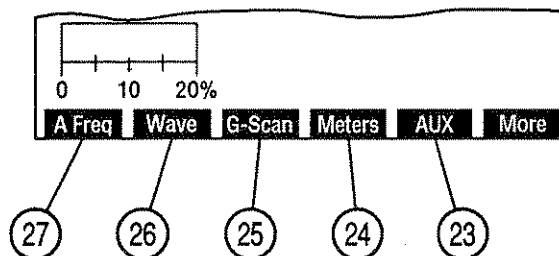
Selects Modulation Source. Select OFF, AM, FM or PM for each Source.

21. "Level" Soft Function Key F3

Selects RF Generator Signal Level. Select from -137.0 to 0.0 for dBm Level Units. Select from 0.031 mV to 0.224 V for voltage Level Units.

22. "Freq" Soft Function Key F2

Selects RF Generator Frequency. Select from 0.2500 to 999.9999 MHz.



8617049

23. "AUX" Soft Function Key F5

Displays Auxiliary Functions Menu.

ITEM	DESCRIPTION
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24. "Meters" Soft Function Key F4

Displays submenu of available Meters. Select SINAD, DIST (Distortion), AF LVL or DMM.

**NOTE:** SINAD and Distortion Meters measure only SINAD/BER Connector Input. DMM measures only DMM Connector Input.

25. "G-Scan" Soft Function Key F3

Activates RF Frequency Scan. RF Generator Scan Parameters are set from the Gen Menu.

26. "Wave" Soft Function Key F2

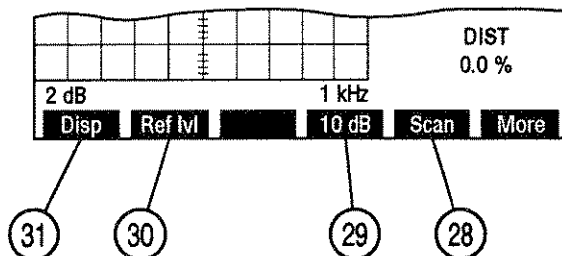
Appears if 1 or 2 are the active Modulation Source. Selects active source Wave Form. Select Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl or -1 Lvl.

27. "A Freq" Soft Function Key F1

Appears if 1 or 2 are the active Modulation Source. Selects active source Audio Frequency. Select from 0.0 to 40000.0 Hz.

The following set of Soft Function Keys are accessed when a full size Spectrum Analyzer is in use:

ITEM	DESCRIPTION
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8617028

28. "Scan" Soft Function Key F5

Selects Spectrum Analyzer Scan Width. Select from the following:

- |                   |         |         |
|-------------------|---------|---------|
| (0 kHz) Zero Scan | 1 kHz   | 2 kHz   |
| 5 kHz             | 10 kHz  | 20 kHz  |
| 50 kHz            | 100 kHz | 200 kHz |
| 500 kHz           | 1 MHz   |         |

29. "10 dB/2 dB" Soft Function Key F4

Selects Analyzer Vertical Scale. Toggles between 10 and 2 dB/div.

ITEM	DESCRIPTION
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30. "Ref lvl" Soft Function Key F2

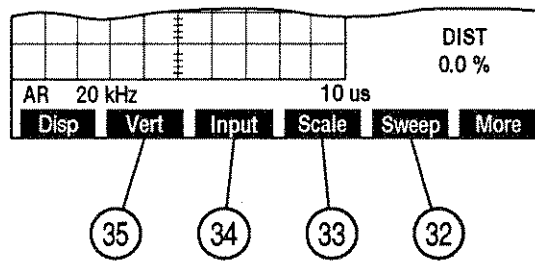
Appears with 2 dB/div scale. Adjusts vertical trace position on Spectrum Analyzer.

31. "Disp" Soft Function Key F1

Accesses menu listing Oscilloscope and Spectrum Analyzer displays. Select full or 1/4 size displays for Oscilloscope or Spectrum Analyzer or select none.

The following set of Soft Function Keys are accessed when an Oscilloscope is in use:

ITEM	DESCRIPTION
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8617034

32. "Sweep" Soft Function Key F5

Appears with full size Oscilloscope and does not appear if "Rcvr IF" is the Oscilloscope Input. Selects Oscilloscope Sweep Rate. Select one of the following:

- |             |             |             |
|-------------|-------------|-------------|
| 1 $\mu$ s   | 2 $\mu$ s   | 5 $\mu$ s   |
| 10 $\mu$ s  | 20 $\mu$ s  | 50 $\mu$ s  |
| 100 $\mu$ s | 200 $\mu$ s | 500 $\mu$ s |
| 1 ms        | 2 ms        | 5 ms        |
| 10 ms       | 20 ms       | 50 ms       |
| 100 ms      |             |             |

33. "Scale" Soft Function Key F4

Appears with full size Oscilloscope. For AC, DC or GND Oscilloscope Input, select one of the following:

- |            |            |            |
|------------|------------|------------|
| 1 mV/div   | 2 mV/div   | 5 mV/div   |
| 10 mV/div  | 20 mV/div  | 50 mV/div  |
| 100 mV/div | 200 mV/div | 500 mV/div |
| 1 V/div    | 2 V/div    | 5 V/div    |
| 10 V/div   | 20 V/div   | 50 V/div   |

For Demod Audio Oscilloscope Input with FM Source Modulation, select one of the following:

- |            |           |            |
|------------|-----------|------------|
| 2 kHz/div  | 4 kHz/div | 10 kHz/div |
| 20 kHz/div | Autorange |            |

**ITEM****DESCRIPTION**

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For Demod Audio Oscilloscope Input with AM or PM Source Modulation, Oscilloscope Scale is not editable and "Scale" Soft Function Key F4 does not appear.

For Func Gen or Ext Mod Oscilloscope Input, select one of the following:

500 mV/div

1 V/div

2.5 V/div

For RF Pwr Lvl Oscilloscope Input, Oscilloscope Scale reads 2 W/div or 200 W/div. Power Meter Ranges of 20, 50 or 100 mW set Oscilloscope Scale to 2 W/div. All other Power Meter Ranges sets Oscilloscope Scale to 200 W/div.

Oscilloscope Scale is not editable for SINAD/BER or Rcvr IF Oscilloscope Input and "Scale" Soft Function Key F4 does not appear.

34. "Input" Soft Function Key F3

Selects Oscilloscope Input. Select one of the following:

Rcvr IF  
SINAD/BER  
AC

Demod Audio  
Func Gen  
DC

RF Pwr Lvl  
Ext Mod  
GND

35. "Vert" Soft Function Key F2

Appears with full size Oscilloscope. Adjusts vertical trace position on Oscilloscope.

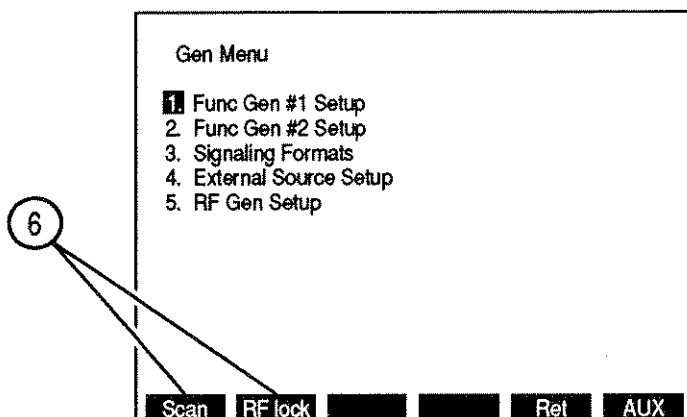


### C. RF GENERATOR MENU OPERATION

When the RF Generator Operation Screen is displayed on the CRT, press SETUP to access the RF Generator Menu. Many RF Generator Operating Screen Parameters are edited from the Generator Menu or one of its submenus.

ITEM	DESCRIPTION
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#### RF GENERATOR MENU



8610077

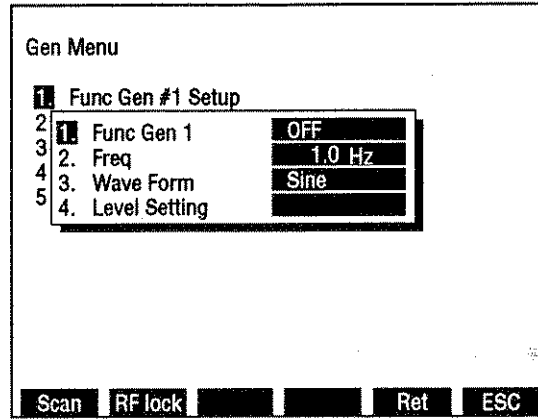
1. Func Generator #1 Setup  
Displays Function Generator #1 Menu.
2. Func Generator #2 Setup  
Displays Function Generator #2 Menu.
3. Signaling Formats  
Displays Signaling Format Menu featuring DTMF, Audio, Digital and RCC.
4. External Source Setup  
Displays External Source Setup Menu.
5. RF Gen Setup  
Displays RF Generator Setup Menu.
6. Gen Menu Soft Function Keys
  - "Scan" Soft Function Key F1 displays the RF Generator Frequency Scan Menu.
  - "RF lock" Soft Function Key F2 activates the RF Lock Function, locking the RF Generator Frequency to the Receiver RF Frequency and the Analyzer Center Frequency. The last frequency entered from among the three frequencies locked is the frequency locked on. The letters "RF lock" appear in red when the RF Lock Function is active.

Selecting "1. Func Gen #1 Setup" displays the Function Generator #1 Menu.

ITEM

DESCRIPTION

FUNCTION GENERATOR #1 MENU



8610051

1. Func Gen 1

Selects Function Generator Modulation Type. Choose AM, FM, PM or OFF.

**NOTE:** Different sources cannot be FM and PM simultaneously. Selecting FM changes PM sources to FM. Selecting PM changes FM sources to PM. Sources that are AM or OFF are not affected.

2. Freq

Selects Function Generator Frequency. Range is from 0.0 to 40000.0 Hz.

3. Wave Form

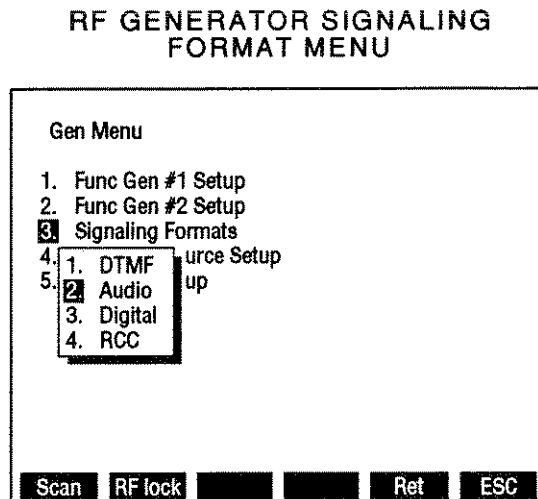
Selects Function Generator Wave Form. Choose Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl or -1 Lvl.

4. Level Setting

Not operational when active source off. Selects Function Generator Modulation Level. Range is from 0.000 to 100.000 kHz for FM Deviation, 0% to 90% for AM Modulation and 0.0 to 10.0 radians for PM Modulation.

Accessing "2. Func Gen #2 Setup" displays the Function Generator #2 Menu. Function Generator #2 Parameters are identical to those of Function Generator #1.

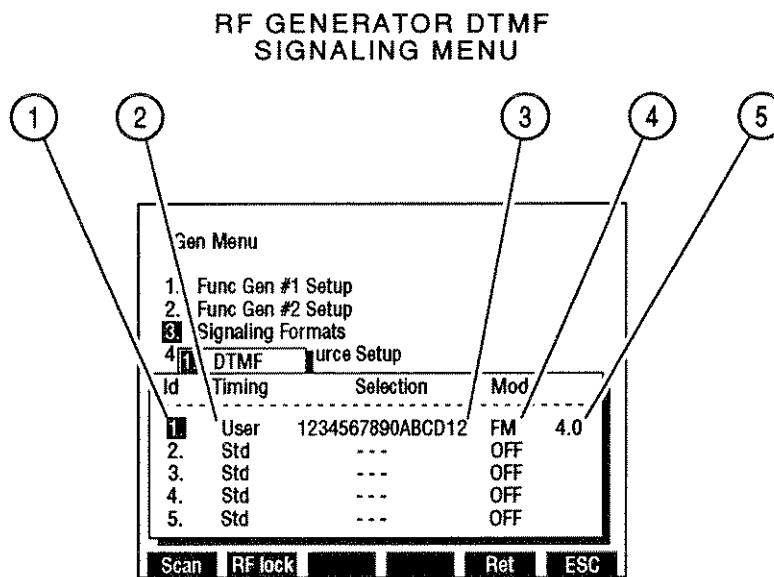
When "3. Signaling Formats" is selected on the Gen Menu, the following menu appears on the CRT:



8610080

If DTMF is selected, the DTMF Format Menu appears on the screen:

ITEM DESCRIPTION



8607054

1. Id

Program Identification number. Used to select a specific sequence from the Operation Screen while using the Program feature.

2. Timing

Choose from Std (standard) or User (user defined). If User is selected, two data fields appear allowing entry of desired Mark Timing and Space Timing. Range of both is 25 to 9999 ms.

ITEM

DESCRIPTION

3. Sequence

Select the desired sequence of up to 15 tones using digits 0 through 9 and letters A through D.

4. Mod Type

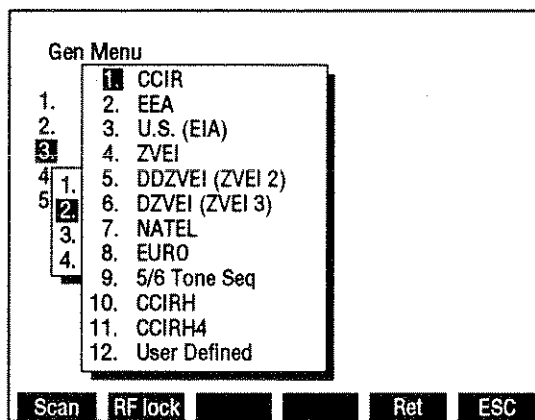
Select AM, FM, PM or OFF for the DTMF modulation.

5. Mod Level

Modulation Level range is 0.0 to 20.0 kHz for FM, 0.0% to 24.5% for AM, 0.0 to 3.0 radians for PM.

If Audio is selected as the Signaling Format, the RF Generator Audio Signaling Format Menu appears on the screen listing 12 Audio Signaling Codes:

RF GENERATOR AUDIO  
SIGNALING FORMAT MENU



8610081

Selecting an Audio Code displays the Audio Code Sequence Menu:

### RF GENERATOR AUDIO CODE SEQUENCE MENU

Gen Menu

1. CCIR
2. EEA
3. U.S. (EIA)
4. Id Selection
5. Id Selection
6. Id Selection
7. Id Selection
8. Id Selection
9. Id Selection
10. Id Selection
11. Id Selection
12. Id Selection

Id	Selection
1	1234567890
2.	---
3.	---
4.	---

Scan RF lock Ret ESC

8610082

Select an Id number from 1 to 15. Enter a sequence up to 30 tones in length using the characters 0 through 9, -, A, G and R.

Selecting "12. User Defined" for the Audio Code displays the Audio Code User Defined Menu:

### RF GENERATOR AUDIO CODE USER DEFINED MENU

Gen Menu

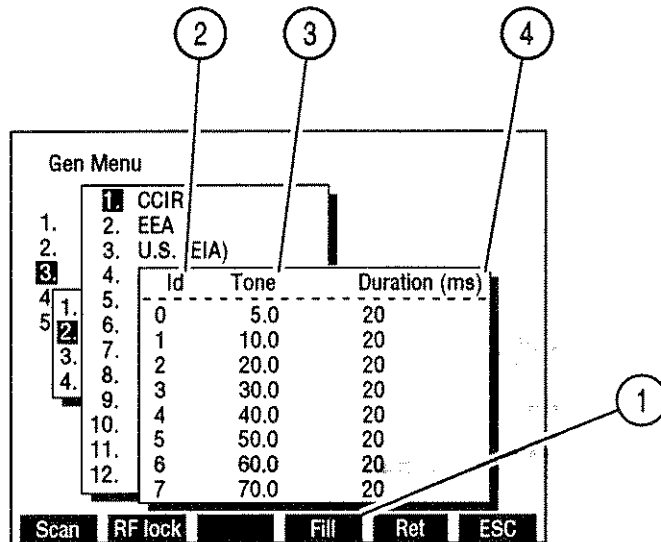
1. CCIR
2. EEA
3. U.S. (EIA)
4. Define Sequence
5. Define Tones
6. Define Tones
7. NATEL
8. EURO

Scan RF lock Ret ESC

8610159

Selecting "2. Define Tones" displays a menu used to define the desired tones.

ITEM DESCRIPTION



8610155

1. "Fill" Soft Function Key F4

When a Tone or Duration is highlighted, pressing "Fill" Soft Function Key F4 changes all entries below and in the same column to the value highlighted.

2. Id

Select an Id to represent the tone to be defined. Range of characters for the Id is 0 to 9 and A to T. Defining the tone consists of setting the frequency and duration of the tone.

3. Tone(Hz)

Set "Tone(Hz)" to frequency of desired tone. Range is 0.0 to 9999.9 Hz.

4. Duration(ms)

Set "Duration(ms)" to duration of desired tone. Range is 20 to 9999 ms.

Selecting "Define Sequence" displays the RF Generator Audio Code Sequence Menu shown above. User Defined sequences are selected as other Audio Codes using this menu.

If Digital is selected as the Signaling Format, the Digital Code Menu appears:

**RF GENERATOR  
DIGITAL CODE MENU**

Gen Menu

- 1. Func Gen #1 Setup
- 2. Func Gen #2 Setup
- 3. Signaling Formats
- 4. 1. DTMF | Source Setup
- 5. 2. Audio | Setup
- 3. Digital
- 4. 1. DCS
- 2. DCS INV
- 3. POCSAG

Scan   RF lock   Ret   ESC

8610142

Selecting DCS or DCS INV displays the DCS Code Menu:

**RF GENERATOR  
DCS CODE MENU**

Gen Menu

	Func Gen	Id	Code
1.	Func Gen		
2.	Func Gen	1.	456
3.	Signaling	2.	000
4.	1. DTMF	3.	000
5.	2. Audio	4.	000
	3. Digital	5.	000
	4. 1. DCS	6.	000
	2. DCS	7.	000
	3. POC	8.	000

Scan   RF lock   Ret   ESC

8610083

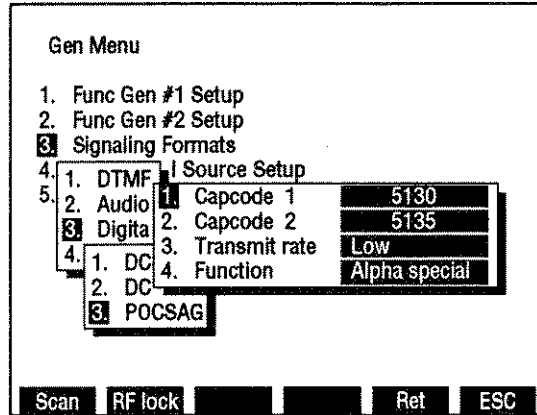
After selecting the Id number, enter a 3 digit DCS Code.

Selecting POCSAG from the Digital Code Menu displays the POCSAG Menu:

ITEM

DESCRIPTION

RF GENERATOR  
POCSAG MENU



8610143

1. Capcode 1

Selects beginning Capcode of sequence. Sequence generated consist of Capcodes from Capcode 1 through Capcode 2.

2. Capcode 2

Selects ending Capcode of Capcode sequence. Sequence generated consist of Capcodes from Capcode 1 through Capcode 2.

3. Transmit rate

Toggles Transmit Rate to Low or High.

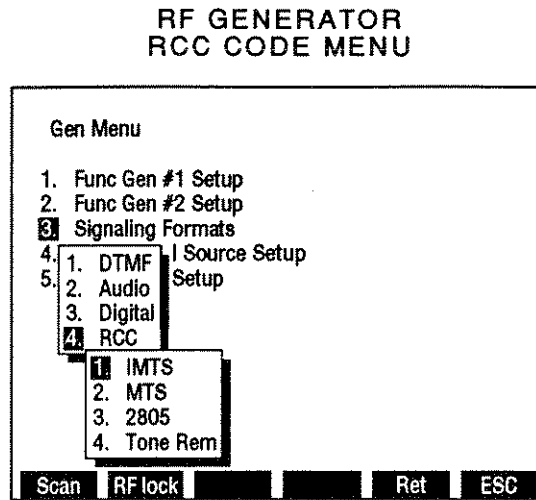
4. Function

Displays POCSAG Function Submenu. Choose one of the following:

Tone - 1 beep	Numeric	Alphanumeric
Tone - 2 beep	Numeric seq	Alpha special
Tone - 3 beep	Alpha lower	
Tone - 4 beep	Alpha upper	

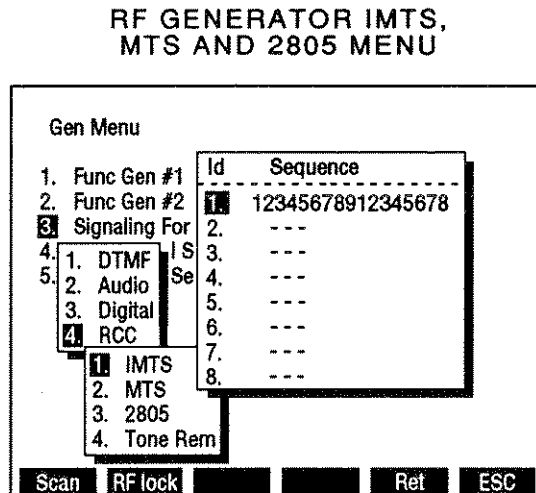


If RCC is selected for the Signaling Format, the RCC Code Menu appears:



8610144

Selecting IMTS, MTS or 2805 displays the following menu:



8610145

After selecting an Id, select the sequence to be generated using characters 1 through 9.

If 2805 is selected, "Tone" Soft Function Key F3 appears. Accessing F3 displays the 2805 Tone Freq data field allowing this frequency to be changed. Range of Tone Freq is 0.0 to 40000.0 Hz.

Selecting Tone Rem displays the Tone Remote Function Menu. Select one of the following:

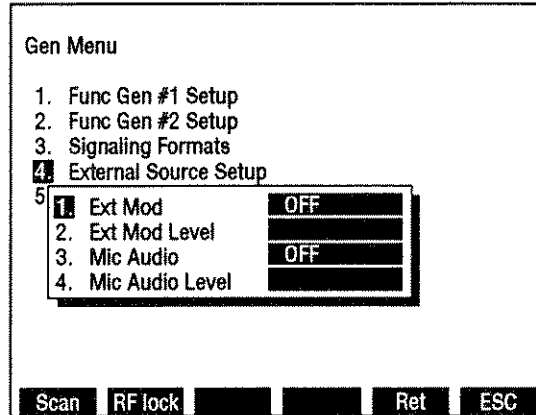
2050 (Monitor)	1650 (R2 Unmute)	1250 (Wild Card 1 Off)
1950 (F1)	1550 (Repeater Off)	1150 (Wild Card 2 On)
1850 (F2)	1450 (Repeater On)	1050 (Wild Card 2 Off)
1750 (R2 Mute)	1350 (Wild Card 1 On)	

When "4. External Source Setup" is selected on the Gen Menu, the following menu appears on the CRT:

ITEM

DESCRIPTION

RF GENERATOR EXTERNAL  
SOURCE SETUP MENU



8610053

1. Ext Mod

Select FM, AM, PM or OFF for the External Modulation Type.

2. Ext Mod Level

Selects External Modulation Level. Select from 0.0 to 100.0 kHz for FM, 0% to 90% for AM or 0.0 to 10.0 radians for PM. Field is blank if set to OFF.

3. Mic Audio

Select FM, AM, PM or OFF for Microphone Input Modulation Type.

4. Mic Audio Level

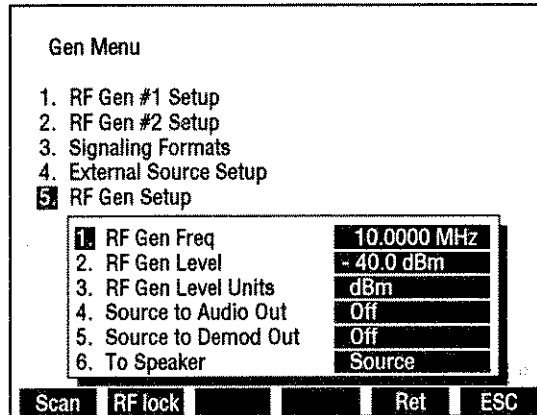
Selects Microphone Input Modulation Level. Select from 0.0 to 100.0 kHz for FM, 0% to 90% for AM or 0.0 to 10.0 radians for PM. Field is blank if set to OFF.

When "5. RF Generator Setup" is selected on the Gen Menu, the RF Generator Setup Menu appears on the CRT:

ITEM

DESCRIPTION

RF GENERATOR SETUP MENU



8610074

1. RF Gen Freq

Selects RF Generator frequency. Range is from 0.2500 to 999.9999 MHz.

2. RF Gen Level

Selects RF Generator Output Level. If RF Generator Level Units are set to dBm, range is from -137.0 to 0.0 dBm. If RF Generator Level Units are set to Volts, range is from 0.031  $\mu$ V to 0.224 V.

3. RF Gen Level Units

Selects RF Generator Output Level Units. Accessing toggles units to dBm or Volts.

4. Source to Audio Out

Sets routing of RF Generator Output to AUDIO OUT Connector. Accessing toggles routing on or off.

5. Source to Demod Out

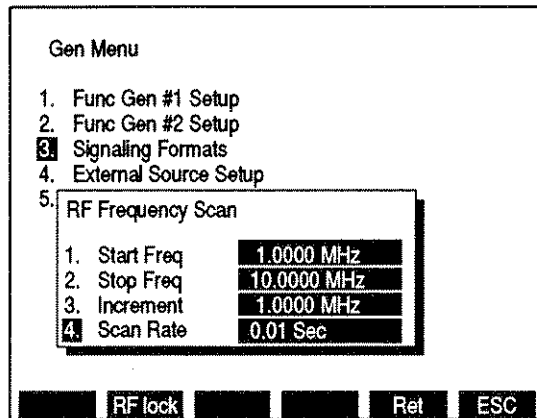
Sets routing of RF Generator Output to DEMOD OUT Connector. Accessing toggles routing on or off.

6. To Speaker

Displays menu listing signals to be routed to Speaker. Select None, Source, SINAD/BER or Ext Mod/DTMF.

If "Scan" Soft Function Key F1 is pressed, the RF Frequency Scan Menu appears on the screen. RF Generator Frequency Scan is activated by pressing "G Scan" Soft Function Key F3 (25).

### RF FREQUENCY SCAN MENU



8610084

ITEM	DESCRIPTION
1. <u>Start Freq</u>	Selects starting frequency for RF Frequency Scan. Range is from 0.2500 to 999.9999 MHz.
2. <u>Stop Freq</u>	Selects upper limit frequency for RF Frequency Scan. Range is from 0.2500 to 999.9999 MHz.
3. <u>Increment</u>	Selects increment between frequencies to be scanned. Range is from 0.0000 to 999.9999 MHz.
4. <u>Scan Rate</u>	Selects time period for each frequency to be generated. Range is from 0.00 to 99.99 sec.

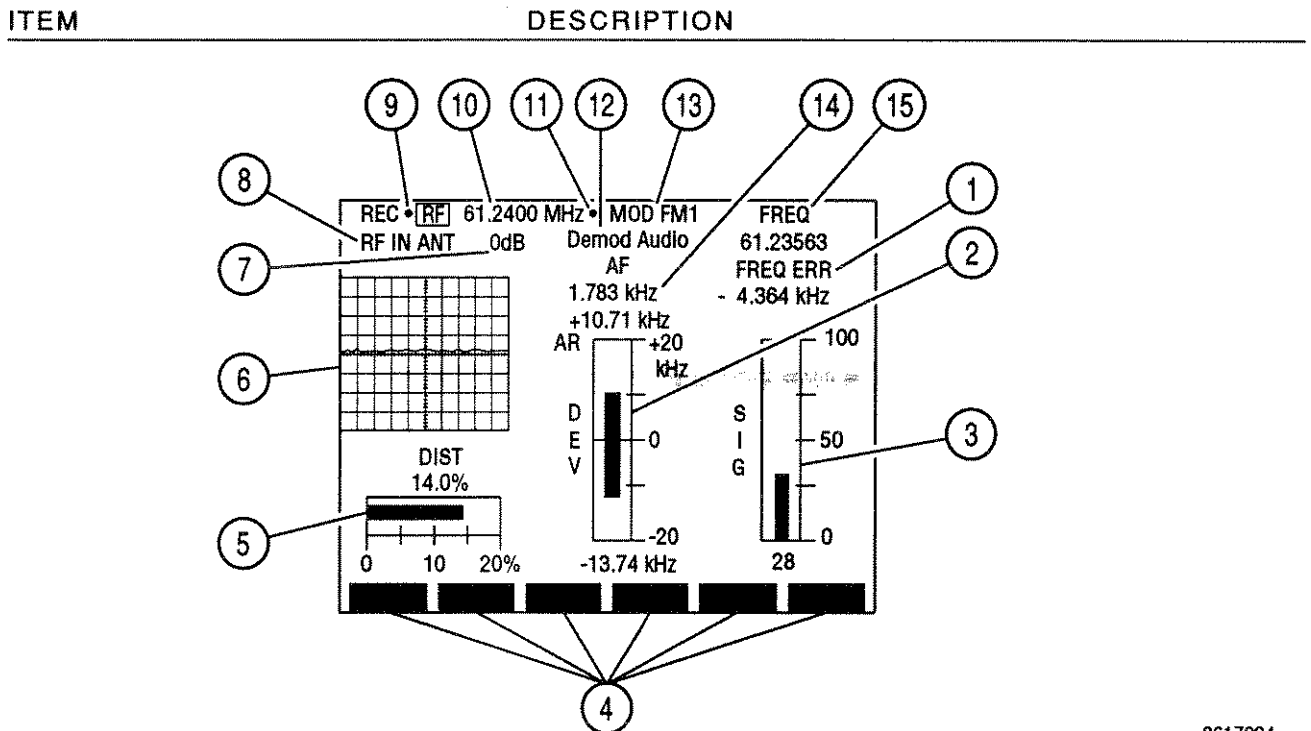
### 3-3-2 RECEIVE OPERATION SCREEN

Press RCVR MODE Key to access Receive Operating Screen. Use the index of screen features to identify the operation screen parameters that may be edited, the value range available to each feature and/or its usage.

When editing, use the FIELD SELECT Keys to move the cursor to the parameter to be edited and press ENTER Key to access the data field. Use the DATA ENTRY Keypad to enter numerical data. Use the DATA SCROLL Spinner or DATA SCROLL UP and DOWN ARROW Keys to select parameters from a list. Parameters with only two possible settings automatically toggle to the opposite setting when selected. To access a displayed Meters Operation Screen, move cursor to the Meters Callout and press ENTER.

#### A. SCREEN PARAMETERS

The following index includes screen parameters and screen parameter attributes. Possible parameter settings are listed where parameters can be changed from the Operation Screen.



8617004

#### 1. Frequency Error Counter

Display for Frequency Error Counter. Frequency Error Counter indicates difference between received frequency and Receive Frequency (10) setting.

#### 2. Deviation Meter/Modulation Meter/Phase Meter

Does not appear for USB, LSB or BFO Modulation. Selects Deviation Meter for FM Modulation, Modulation Meter for AM Modulation, or Phase Modulation Meter for PM Modulation.

ITEM	DESCRIPTION
3. <u>Signal Strength Meter/Power Meter</u>	Displays Signal Strength Meter (if ANTENNA Connector is selected as "RF IN" Source) or Power Meter Operation (if T/R Connector is selected as "RF IN" Source).
4. <u>Soft Function Keys</u>	Soft Function Keys for the Receive Operation Screen are covered in 3-3-2B.
5. <u>Distortion/SINAD/Deviation-RMS Meter</u>	Does not appear for USB, LSB or BFO Modulation. Meter is selected using "Meters" Soft Function Key (23)
6. <u>Oscilloscope/Spectrum Analyzer/Decode Display</u>	Use "Disp" Soft Function Key to display full size or 1/4 size Oscilloscope, full size or 1/4 size Spectrum Analyzer or set to Decode for the Decode Display. Meters are reduced to digital readouts when a full size display is selected.
7. <u>Receive RF Input Attenuation Level</u>	Selects RF Input Attenuation Level. Select 0, 20 or 40 dB.
8. <u>Receive RF Input Source</u>	Select from "ANT" (ANTENNA) Connector or "T/R" Connector. If "ANT" is selected, the Signal Meter is displayed. If "T/R" is selected, the Power Meter is displayed.
9. <u>Squelch Indicator Light</u>	Green dot appears when squelch is broken.
10. <u>Receiver Frequency</u>	Selects Receiver Frequency. Range is from 0.2500 to 999.999 MHz. Frequency callout turns yellow when Phase Lock is lost. Regaining Phase Lock does not restore the Frequency callout. To restore the callout after regaining Phase Lock, select another Operation Mode, then reselect the Receiver Operation Mode.
11. <u>10 MHz External Reference Light</u>	Blue asterisk appears when 10 MHz External Reference Signal is applied to the EXTERNAL REFERENCE Connector (38) (Figure 3-2).
12. <u>Oscilloscope Input/Analyzer Reference Level</u>	If an Oscilloscope is displayed, select Oscilloscope Input from Rcvr IF, Demod Audio, RF Pwr Lvl, SINAD/BER, Func Gen, Ext Mod, AC, DC or GND. If a full size Analyzer is displayed, callout shows the Analyzer Reference Level. Field is blank otherwise.

ITEM	DESCRIPTION
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13. Receiver Modulation Type

Select Receiver Modulation Type. Choose one of the following:

FM1	FM2	FM3
FM4	AM1	AM2
USB	LSB	BFO
PM	User Defined	

14. Receive Audio Frequency Counter

Displays Audio Frequency Received. Not an editable parameter.

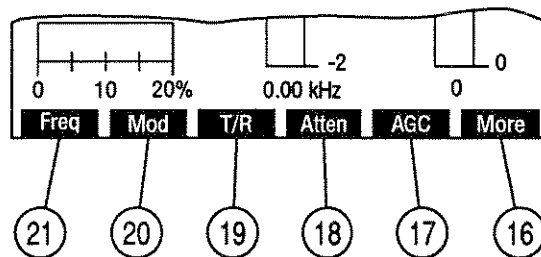
15. RF Frequency Meter

Displays RF Frequency Received. Not an editable parameter.

B. SOFT FUNCTION KEYS

The following index lists the Soft Function Keys available for the Receiver Operation Screen:

ITEM	DESCRIPTION
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8617065

16. "More" Soft Function Key F6

Displays additional sets of Soft Function Keys.

17. "AGC" Soft Function Key F5

Appears when Automatic Gain Control is set to Manual. Adjusts the AGC using the DATA SCROLL Spinner. An AGC Reading does not appear on the Operation Screen and is adjusted precisely from the Receiver Setup Menu.

18. "Atten" Soft Function Key F4

Selects Receive RF Input Attenuation Level (7). Choose 0, 20 or 40 dB.

19. "T/R" or "Ant" Soft Function Key F3

Selects Receive RF Input Source (8). Access toggles Source to T/R Connector or Ant (ANTENNA) Connector.

## ITEM

## DESCRIPTION

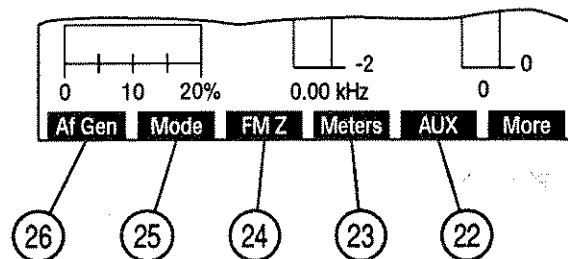
20. "Mod" Soft Function Key F2

Selects Receiver Modulation Type (13). Choose one of the following:

AM1	FM3	USB
AM2	FM4	LSB
FM1	PM	BFO
FM2	User Defined	

21. "Freq" Soft Function Key F1

Selects Receiver Frequency (10). Range is from 0.2500 to 999.9999 MHz.



8617011

22. "AUX" Soft Function Key F5

Accesses Auxiliary Functions Menu.

23. "Meters"/"Dist"/"Modul"/"Tune" Soft Function Key F4

- For FM or PM Modulation, "Meters" appears. Pressing F4 displays menu listing available meters. Select Distortion, SINAD or Deviation-RMS.
- For AM Modulation, "Modul" or "Dist" appears. Pressing F4 toggles between Modulation and Distortion Meter.

**NOTE:** If Receiver Modulation Type is AM, both Modulation and Distortion Meters are displayed on the Operation Screen, yet only one is active.

- For USB, LSB or BFO Modulation, "Tune" appears. Pressing F4 accesses TUNE callout and tunes the receiver higher or lower in 125 Hz steps.

24. "FM Z" Soft Function Key F3

Appears if Receiver Modulation Type is FM. Access to zero the Deviation Meter.

25. "Mode" Soft Function Key F2

Displays menu listing the Receiver Operation Modes. Choose Direct (normal operation), Channel or Freq Scan (for Receiver Scanning). Channel Mode displays the RF Receive Frequency as a channel number.

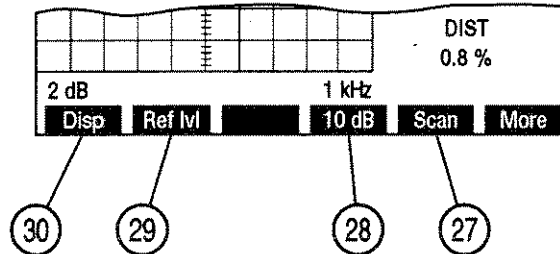


26. "AF Gen" Soft Function Key F1

Displays menu allowing access to Function Generator parameters. Select F1 Freq, F2 Freq or Level.

- Selecting F1 Freq displays callout allowing the entry of Function Generator #1 Frequency. Range is from 0.0 to 40000.0 Hz.
- Selecting F2 Freq displays callout allowing the entry of Function Generator #2 Frequency. Range is from 0.0 to 40000.0 Hz.
- Selecting Level displays callout allowing the entry of Function Generator Output Level. Range is from 0.0000 to 3.1000 V.

The following set of Soft Function Keys are accessed when a full size Spectrum Analyzer is displayed.



8617030

27. "Scan" Soft Function Key F5

Selects Spectrum Analyzer Scan Width. Choose Zero Scan (0 kHz) or one of the following:

1 kHz	2 kHz	5 kHz
10 kHz	20 kHz	50 kHz
100 kHz	200 kHz	500 kHz
1 MHz		

28. "10 dB/2 dB" Soft Function Key F4

Toggles the vertical scale to 2 or 10 dB/div.

29. "Ref lvl" Soft Function Key F3

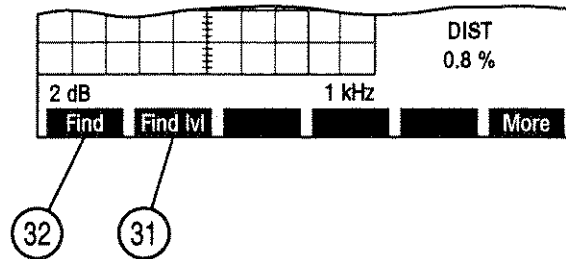
Appears when using 2 dB/div scale. Selects the Spectrum Analyzer Reference Level. Range is from +10 to -94 dB.

30. "Disp" Soft Function Key F1

Displays menu listing Oscilloscope and Spectrum Analyzer displays. Select full or 1/4 size displays for Oscilloscope or Spectrum Analyzer or select Decode to display code being decoded.

The following set of Soft Function Keys are accessed when a full size Spectrum Analyzer is displayed:

ITEM DESCRIPTION



8607055

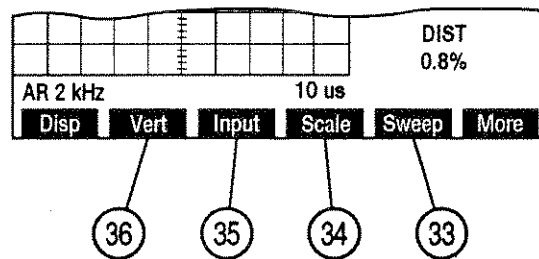
31. "Find lvl" Soft Function Key F2

Sets Find Reference Level used in the Find Function.

32. "Find" Soft Function Key F1

When activated, finds the first frequency containing a signal with an amplitude greater than the Find Reference Level.

The following set of Soft Function Keys may be accessed when an Oscilloscope is displayed:



8617045

33. "Sweep" Soft Function Key F5

Appears only with full size Oscilloscope and does not appear if "Rcvr IF" is the Oscilloscope Input (12). Selects Oscilloscope Sweep Rate. Choose from the following:

- |             |             |             |
|-------------|-------------|-------------|
| 1 $\mu$ s   | -2 $\mu$ s  | 5 $\mu$ s   |
| 10 $\mu$ s  | 20 $\mu$ s  | 50 $\mu$ s  |
| 100 $\mu$ s | 200 $\mu$ s | 500 $\mu$ s |
| 1 ms        | 2 ms        | 5 ms        |
| 10 ms       | 20 ms       | 50 ms       |
| 100 ms      |             |             |

## ITEM

## DESCRIPTION

34. "Scale" Soft Function Key F4

Appears with full size Oscilloscope. For AC, DC or GND Oscilloscope Input, select one of the following:

1 mV/div	2 mV/div	5 mV/div
10 mV/div	20 mV/div	50 mV/div
100 mV/div	200 mV/div	500 mV/div
1 V/div	2 V/div	5 V/div
10 V/div	20 V/div	50 V/div

For Demod Audio Oscilloscope Input with FM Receiver Modulation, select one of the following:

2 kHz/div	4 kHz/div	10 kHz/div
20 kHz/div	Autorange	

For Demod Audio Oscilloscope Input with Receiver Modulation other than FM, Oscilloscope Scale is not editable and "Scale" Soft Function Key does not appear.

For Func Gen or Ext Mod Oscilloscope Input, select one of the following:

500 mV/div	1 V/div	2.5 V/div
------------	---------	-----------

For RF Pwr Lvl Oscilloscope Input, Oscilloscope Scale reads 2 W/div or 200 W/div. Power Meter Ranges of 20, 50 or 100 mW set Oscilloscope Scale to 2 W/div. All other Power Meter Ranges set Oscilloscope Scale to 200 W/div.

Oscilloscope Scale is not editable for SINAD/BER or Rcvr IF Oscilloscope Input and "Scale" Soft Function Key F4 does not appear.

35. "Input" Soft Function Key F3

Selects Oscilloscope Input. Choose one of the following:

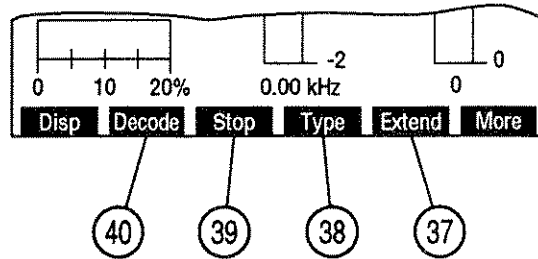
Rcvr IF	Demod Audio	RF Pwr Lvl
SINAD/BER	Func Gen	Ext Mod
AC	DC	GND

36. "Vert" Soft Function Key F2

Appears with full size Oscilloscope. Adjusts vertical trace position of Oscilloscope.

The following set of Soft Function Keys are accessed when Decode Option is selected:

ITEM	DESCRIPTION
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8607056

37. "Extend"/"Input" Soft Function Key F5

Does not appear if DTMF is the selected code.

- If DCS or DCS INV is the selected code, "Input" appears. Pressing F5 displays menu listing available Decode Input Sources. Select Demod Audio, SINAD/BER (with Input inverted) or Ext Mod.
- If Audio or POCSAG is the selected code, "Extend" appears. Pressing F5 displays the Extend Screen.

38. "Type" Soft Function Key F4

Does not appear if DTMF is the selected code. Selects code to be decoded.

- If Audio is the selected Signaling Format, choose one of the following:

CCIR	EEA	U.S.(EIA)
ZVEI	DDZVEI (ZVEI 2)	DZVEI (ZVEI 3)
NATEL	EURO	5/6 Tone Seq
CCIRH	CCIRH4	User Defined

- If Digital is the selected Signaling Format. Choose one of the following:

DCS	DCS INV	POCSAG
-----	---------	--------

39. "Stop" Soft Function Key F3

Appears when Decode Function is active. Stops the Decode Function.

40. "Decode" Soft Function Key F2

Activates Decode Function. Decode Soft Function Key turns red while decoding.

For Audio Signaling Format, the Extend Screen appears as follows:

ITEM	DESCRIPTION								
	46	47	48		49	50			
	#	Audio Frq	Tones Decod/ Err %	Dur	CCIR #	Frq	Err %	Dur	
	1	1158	3.2	98					
	2	1167	2.5	99					
	3	1298	1.8	101					
	4	1406	3.5	98					
	5	1475	2.0	98					
		Input	Decode	Stop	Type	Ret			
	45	44	43	42	41				

8610146

41. "Ret" Soft Function Key F5

Returns display to the Receiver Operation Screen.

42. "Type"/"Rate" Soft Function Key F4

If the Signaling Format is Audio, "Type" is displayed. Select one of the following Audio codes to be decoded:

CCIR	EEA	U.S.(EIA)
ZVEI	DDZVEI (ZVEI 2)	DZVEI (ZVEI 3)
NATEL	EURO	5/6 Tone Seq
CCIRH	CCIRH4	User Defined

If POCSAG is the selected Signaling Format, "Rate" is displayed. Select the POCSAG rate received. Toggles to Low or High.

43. "Stop" Soft Function Key F3

Appears when Decode Function is active. Stops the Decode Function.

44. "Decode" Soft Function Key F2

Activates Decode Function. Decode Callout turns red when active.

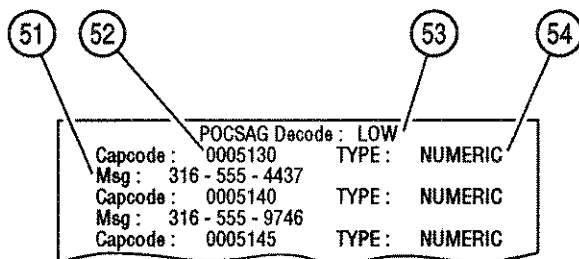
45. "Input" Soft Function Key F1

Displays menu listing available Decode Input Sources. Select Demod Audio, SINAD/BER (with Input inverted) or Ext Mod.

ITEM	DESCRIPTION
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- 46. # Callout  
Displays Audio Code Digits received.
- 47. Frq Callout  
Displays received frequency for each Audio Code Digit in Hz.
- 48. Err % Callout  
Displays Frequency Error of received frequency in percentage of ideal Audio Code Digit frequency.
- 49. Dur Callout  
Displays Duration of each Audio Code Digit in ms.
- 50. Audio Code or POCSAG Receive Rate Callout  
If Audio is the Signaling Format, the Audio Code is displayed. If POCSAG is the Signaling Format, the POCSAG Receive Rate is displayed.

If POCSAG is the Signaling Format, the Extend Screen appears as follows:



8610147

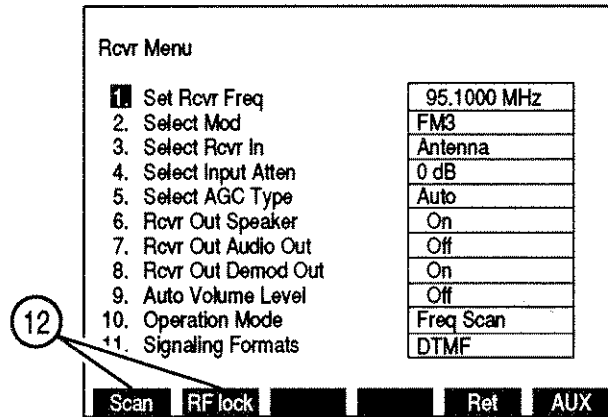
- 51. Message  
Displays message received with Capcode.
- 52. Capcode  
Displays Capcode number received.
- 53. POCSAG Rate  
Displays POCSAG Rate that is decoded. Toggles between High and Low using "Rate" Soft Function Key F4.
- 54. POCSAG Function Type  
Displays POCSAG Function received.

### C. RECEIVE MENU OPERATION

When the Receive Operation Screen is displayed on the CRT, press SETUP Key to access the Receive Menu. Many Receive Operating Screen Parameters may also be edited from the Receive Menu or one of its submenus.

ITEM	DESCRIPTION
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#### RECEIVER MENU



8610049

#### 1. Set Rcvr Freq

Select Receiver Frequency. Range is 0.2500 to 999.9999 MHz.

#### 2. Select Mod

Selects Receiver Modulation Type. Select one of the following:

FM1	FM2	FM3
FM4	AM1	AM2
USB	LSB	BFO
PM	User Defined	

#### 3. Select Rcvr In

Selects Receiver Input Source. Toggles between Antenna (ANTENNA Connector) or T/R Connector.

#### 4. Select Input Atten

Selects Receiver Input Attenuation. Choose 0, 20 or 40 dB.

#### 5. Select AGC Type

Displays AGC Type Menu.

#### 6. Rcvr Out Speaker

Sets Receiver Output routing to Speaker. Toggles between on and off.

ITEM	DESCRIPTION
7. <u>Rcvr Out Audio Out</u>	Sets Receiver Output routing to AUDIO OUT Connector. Toggles between on and off.
8. <u>Rcvr Out Demod Out</u>	Sets Receiver Output routing to DEMOD OUT Connector. Toggles between on and off.
9. <u>Auto Volume Level</u>	Toggles Automatic Volume Level between on or off.
10. <u>Operation Mode</u>	Displays menu listing the Receiver Operation Modes. Choose Direct (normal operation), Channel or Freq Scan (for Receiver Scanning). Channel Mode displays the Receive Frequency as a channel number.
11. <u>Signaling Formats</u>	Displays menu featuring DTMF, Audio and Digital Functions. Select Format to decode. Selecting Audio displays the Audio Code Menu. Selecting Digital displays the Digital Code Menu.
12. <u>Receiver Menu Soft Function Keys</u>	<ul style="list-style-type: none"> <li>● "Scan" Soft Function Key F1 displays the Receiver Frequency Scan Menu.</li> <li>● "RF lock" Soft Function Key F2 activates the RF Lock Function, locking the Receiver RF Frequency to the RF Generator Frequency and the Analyzer Center Frequency. The last frequency entered from among the three frequencies locked is the frequency locked on. The letters "RF lock" appear in red when the RF Lock Function is active.</li> </ul>



If "2. Select Mod" is selected and "User Defined" is selected as the Modulation Type, the User Defined Modulation Menu appears:

ITEM

DESCRIPTION

RECEIVER'S USER DEFINED  
MODULATION MENU

Rcvr Menu	
1. Set Rcvr Freq	200.0000MHz
2. Select Mod	User Defined
3. 1. Modulation	FM DATA
4. 2. IF Filters	3 KHz
5. 3. Post Detection	All Pass
6.	
7. Rcvr Out Audio Out	Off
8. Rcvr Out Demod Out	On
9. Auto Volume Level	Off
10. Operation Mode	Freq Scan
11. Signaling Formats	DTMF

Scan RF lock Ret ESC

8610059

1. Modulation

Selects User Defined Modulation Type. Choose one of the following:

FM	AM	SSB (Upper)
SSB (Lower)	BFO	FM DATA
PM		

2. IF Filters

Selects User Defined IF Filter. Choose 3, 30 or 300 kHz.

3. Post Detection

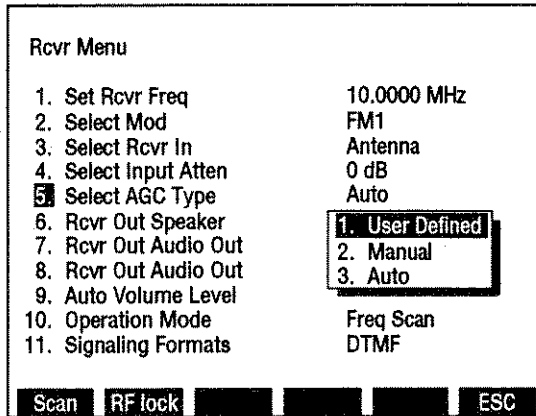
Selects Post Detection Filter. Choose All Pass, Low-Pass, High-Pass, Bandpass or C Wt Pass. If Low-Pass, High-Pass and Bandpass are selected, a data field appears to allow the cutoff frequencies to be entered. The ranges of the allowable cutoff frequencies are:

Low-Pass	100 Hz to 30 kHz
High-Pass	500 Hz to 30 kHz
Bandpass low cutoff	500 Hz to 20 kHz
Bandpass high cutoff	100 Hz to 30 kHz

When "5. Select AGC Type" is selected on the Receiver Menu, the following menu appears:

ITEM	DESCRIPTION
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RECEIVER AGC TYPE MENU



8610062

1. User Defined

Displays User Defined AGC Menu. Select Measurement, Speech, Data, High Speed, Type 1, Type 2 or Type 3.

2. Manual

Selects Receiver AGC Level. Range is 1 to 255.

3. Auto

AGC is automatically adjusted.

ITEM

DESCRIPTION

If "10. Operation Mode" is selected, the Receiver Operation Mode Menu appears:

RECEIVER OPERATION MODE MENU

Rcvr Menu						
1. Set Rcvr Freq	103.7000 MHz					
2. Select Mod	AM2					
3. Select Rcvr In	Antenna					
4. Select Input Atten	0 dB					
5. Select AGC Type	User Defined					
6. Rcvr Out Speaker	On					
7. Rcvr Out Audio Out	On					
8. Rcvr Out Demod Out	On					
9. Auto Volume Level	Off					
<b>10. Operation Mode</b>	<table border="1"> <tr><td>1. Direct</td></tr> <tr><td>2. Channel</td></tr> <tr><td><b>3. Freq Scan</b></td></tr> </table>	1. Direct	2. Channel	<b>3. Freq Scan</b>		
1. Direct						
2. Channel						
<b>3. Freq Scan</b>						
11. Signaling Formats						
<table border="1"> <tr> <td>Scan</td> <td>RF lock</td> <td></td> <td>Ret</td> <td>ESC</td> </tr> </table>		Scan	RF lock		Ret	ESC
Scan	RF lock		Ret	ESC		

8610086

Select Direct for normal operation. Select Channel to Receive AMPS and ETACS Cellular channels. Select Freq Scan to perform Receiver Frequency Scan. If Channel is selected, "Chan" Soft Function Key F2 appears. Pressing F2 displays the Receiver Cellular Format Menu. Select the desired Format.

RECEIVER CELLULAR FORMAT MENU

Rcvr Menu						
1. Set Rcvr Freq	1 Chan #					
2. Select Mod	AM2					
3. Select Rcvr In	Antenna					
4. Select Input Atten	0 dB					
5.	User Defined					
6.						
7.						
8.						
9.						
<b>10. Operation Mode</b>	Channel					
11. Signaling Formats	Audio					
<table border="1"> <tr> <td>Scan</td> <td>Chan</td> <td></td> <td>Ret</td> <td>ESC</td> </tr> </table>		Scan	Chan		Ret	ESC
Scan	Chan		Ret	ESC		

8610085

If "11. Signaling Formats" is selected, the Receiver Signaling Format Menu is displayed. If Audio is selected as the Signaling Format, the Audio Code Menu appears allowing the selection of a Audio Code.

### RECEIVER AUDIO CODE MENU

Rcvr Menu	
1. S	1. CCIR
2. S	2. EEA
3. S	3. U.S. (EIA)
4. S	4. ZVEI
5. S	5. DDZVEI (ZVEI 2)
6. R	6. DZVEI (ZVEI 3)
7. R	7. NATEL
8. R	8. EURO
9. A	9. 5/6 Tone Seq
10. O	10. CCIRH
11. S	11. CCIRH4
	12. User Defined

000 MHz
nna
Defined
. DTMF
1. Audio
. Digital

Scan	RF lock		Ret	ESC
------	---------	--	-----	-----

8610106

If Digital is selected as the Signaling Format, the Digital Code Menu is displayed allowing the selection of a Digital Code.

### RECEIVER DIGITAL CODE MENU

Rcvr Menu		
1.	Set Rcvr Freq	10.0000 MHz
2.	Select Mod	User Defined
3.	Select Rcvr In	Antenna
4.	Select Input Atten	0 dB
5.	Select AGC Type	Auto
6.	Rcvr Out Speaker	On
7.	Rcvr Out Audio Out	Off
8.	Rcvr Out Demod Out	Off
9.	Auto Volume L	1. DCS
10.	Operation Mod	2. DCS INV
11.	Signaling Form	3. POCSAG

1. DTMF
2. Audio
3. Digital

Scan	RF lock		Ret	AUX
------	---------	--	-----	-----

8610165

Pressing "Scan" Soft Function Key F1 on the Receiver Setup Menu displays the RF Frequency Scan Menu. "3. Freq Scan" must be the selected Receiver Operation Mode for the Receiver Scan to operate.

ITEM	DESCRIPTION
------	-------------

RECEIVER RF FREQUENCY SCAN MENU

Rcvr Menu		
1. Set Rcvr Freq	103.7000 MHz	
2. Select Mod	AM2	
3. Select Rcvr In	Antenna	
4. Select Input Atten	0 dB	
5. Select AGC Type	User Defined	
6. RF Frequency Scan		
7.		
8. 1. Start Freq	1.0000 MHz	
9. 2. Stop Freq	10.0000 MHz	
10. 3. Increment	1.0000 MHz	
11. 4. Scan Rate	0.01 Sec	
	5. Pause Time	1.0 Sec
Scan RF lock Ret ESC		

8610092

1. Start Freq

Selects lower limit frequency for scan. Range is from 0.2500 to 999.9999 MHz.

2. Stop Freq

Selects upper limit frequency for scan. Range is from 0.2500 to 999.9999 MHz.

3. Increment

Selects increment between frequencies to be scanned. Range is from 0.0000 to 999.9999 MHz.

4. Scan Rate

Selects time period for receiver to sit on a frequency unless squelch is broken. Range is from 0.00 to 99.99 sec.

5. Pause Time

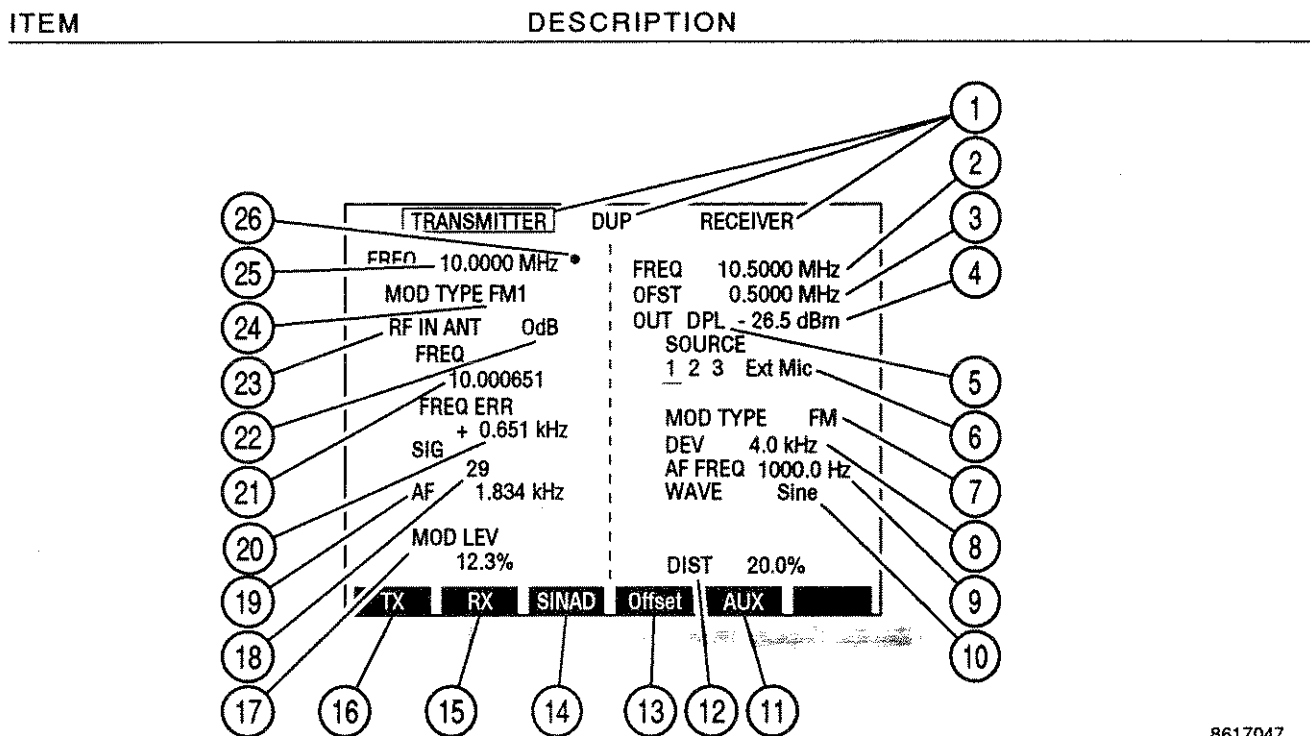
Selects time period for receiver to sit on a frequency if squelch is broken. Range is from 0.00 to 99.99 sec.

### 3-3-3 DUPLEX OPERATION SCREEN

Press DPLX MODE Key to access Duplex Operation Screen. Use the index of screen features to identify the operation screen parameters that may be edited, the value range available to each feature and/or its usage.

When editing, use the FIELD SELECT Keys to move the cursor to the parameter to be edited and press the ENTER Key to access the data field. Use the DATA ENTRY Keypad to enter numerical data. Use the DATA SCROLL Spinner or DATA SCROLL UP and DOWN ARROW Keys to select parameters from a list. Parameters with two settings automatically switch to the opposite setting when selected. To access a displayed Meters Operation Screen, move cursor to the Meters callout and press ENTER.

All available Soft Function Keys are displayed on one screen.



8617047

#### 1. Duplex Screen Labels

With cursor at any left side screen location, press SETUP Key to access Duplex Transmitter Menu. With cursor at any right side screen location, press SETUP Key to access Duplex Receiver Menu.

#### 2. Duplex Receiver Frequency

Select frequency from 0.2500 to 999.9999 MHz. Either the Receiver Frequency or the Offset Frequency is the editable frequency at any one time. The parameter not editable automatically changes so the Offset Frequency added to the Transmitter Frequency is always equal to the Receiver Frequency.

## ITEM

## DESCRIPTION

- 
3. Duplex Offset Frequency

Selects frequency from -999.7499 to 999.7499 MHz. Either the Receiver Frequency or the Offset Frequency is the editable frequency at any one time. The parameter not editable automatically changes so the Offset Frequency added to the Transmitter Frequency is always equal to the Receiver Frequency.
  4. Duplex Receiver Output Level

Selects Duplex Receiver Output Level. Range is -120.0 to 7.0 dBm if DUPLEX Connector is selected for RF Output. Range is -137.0 to 0.0 dBm if T/R Connector is selected for RF Output.
  5. RF Generator Output Connector

Selects "DPL" (Duplex) or "T/R" for RF Generator Output Level.
  6. Duplex Receiver Source

Underline indicates active Signal Source. Selects AM, FM, PM or OFF.

**NOTE:** Different sources cannot be FM and PM simultaneously. Selecting FM changes PM sources to FM. Selecting PM changes FM sources to PM. Sources that are AM or OFF are not affected.
  7. Duplex Receiver Modulation Type

Not an editable parameter. Readout indicates the active modulation type. Readout shows FM, PM, AM or OFF.
  8. Duplex Receiver Modulation Level

Does not appear if Modulation is set to OFF. Range is from 0.0 to 100.0 kHz for FM, 0.0 to 10.0 radians for PM or 0% to 90% for AM.
  9. Duplex Receiver Active Source Audio Frequency

Appears when 1 or 2 is the Active Source. Range is from 0.0 to 40000.0 Hz.
  10. Duplex Receiver Active Source Wave Form

Appears when 1 or 2 is the Active Source. Select Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl or -1 Lvl.
  11. "AUX" Soft Function Key F5

Accesses Auxiliary Functions Menu.

ITEM	DESCRIPTION
12. <u>Distortion/SINAD Meter Readout</u>	<p>Displays Distortion Meter, SINAD Meter or OFF Operation. Definition shown for Soft Function Key F3 is the next choice activated when F3 is pressed. When OFF, Distortion Meter callout is displayed with no reading.</p> <p><b>NOTE:</b> SINAD and Distortion Meter measure SINAD/BER IN Connector Input only.</p>
13. <u>"Offset"/"R Freq" Soft Function Key F4</u>	<p>Selects Offset or Receive Frequency. Range for Offset Frequency is from -999.7499 to 999.7499 MHz. Range for Receive Frequency is from 0.2500 to 999.9999 MHz.</p>
14. <u>"Dist"/"SINAD"/"Modul" Soft Function Key F3</u>	<p>Rotates Meter in use. Selects Modulation (17), Distortion (12) or SINAD (12) Meter. Although two Meter callouts are displayed, only one is active.</p>
15. <u>"RX" (Duplex Receiver) Soft Function Key F2</u>	<p>Displays RX (Duplex Receiver) Operation Screen.</p>
16. <u>"TX" (Duplex Transmitter) Soft Function Key F1</u>	<p>Displays TX (Duplex Transmitter) Operation Screen.</p>
17. <u>Modulation Meter Readout</u>	<p>Displays Modulation Meter for AM, Phase Meter for PM or Deviation (Peak) Meter for FM when. For AM Modulation, meter is selected using "Modul" Soft Function Key F3. Meter Operation Screens are accessed through the Meter Callouts or the Meter Menu.</p>
18. <u>Signal Strength Meter or Power Meter</u>	<p>Displays Signal Strength Meter (if ANT is selected for Input Connector) or Power Meter (if T/R is selected for Input connector). Meters are accessed through the Meter callout or the Meter Menu.</p>
19. <u>Duplex Transmitter AF Meter Readout</u>	<p>Displays Audio Frequency received. AF Meter Operation Screen is accessed through the Meter callout or the Meter Menu.</p>
20. <u>Frequency Error Meter</u>	<p>Displays difference between frequency setting and frequency received. Frequency Error Meter Operation Screen is accessed through the Meter callout or the Meter Menu.</p>



**ITEM**

**DESCRIPTION**

**21. Frequency Meter Display**

Displays frequency actually received. Frequency Meter Operation Screen is accessed through the Meter Callout or the Meter Menu.

**22. Duplex Transmitter Input Attenuation Level**

Select 0, 20 or 40 dB.

**23. Duplex Transmitter Input Connector**

Selects "ANT" (Antenna) or "T/R" Connector. "ANT" selects the Signal Strength Meter for (18). "T/R" selects the Power Meter for (18).

**24. Duplex Transmitter Modulation Type**

Select one of the following:

FM1	FM2	FM3
FM4	AM1	AM2
USB	LSB	BFO
PM	User Defined	

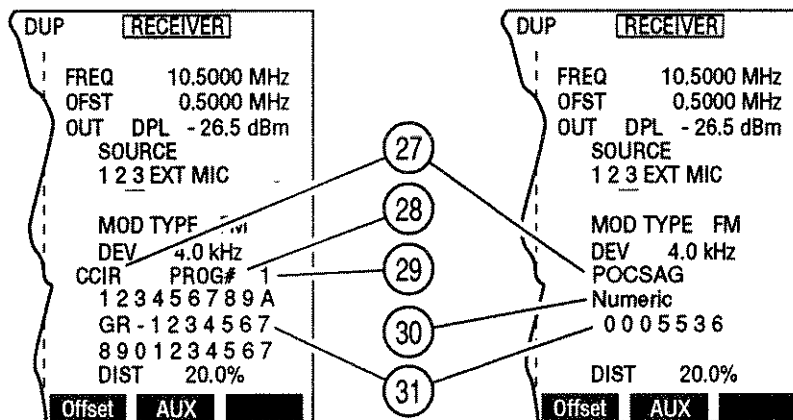
**25. Duplex Transmitter Frequency Setting**

Select from 0.2500 to 999.999 MHz.

**26. 10 MHz External Reference Light**

Blue asterisk appears when 10 MHz External Reference Signal is applied to the EXTERNAL REFERENCE Connector (38) (Figure 3-2).

If "3" is selected as Duplex Receiver Modulation Source (6), the Operation Screen appears as follows:



8617058

## ITEM

## DESCRIPTION

27. Signaling Code Display

- Displays DTMF if DTMF is the selected Signaling Format.
- Accesses Audio Code if Audio Signaling Format is active. Select from:

CCIR	EEA	U.S.(EIA)
ZVEI	DDZVEI(ZVEI 2)	DZVEI (ZVEI 3)
NATEL	EURO	5/6 Tone Seq
CCIRH	CCIRH4	User Defined

- Accesses Digital Code if Digital Signaling Format is active. Select from:

DCS	DCS INV	POCSAG
-----	---------	--------

- Accesses RCC Code if RCC Signaling Format is active. Select from:

IMTS	MTS	2805
Tone Rem		

28. DIRECT ENTRY/PROG #

Accessing callout toggles to the function not shown. Select PROG # to generate a sequence programmed from the Setup Menu. Select DIRECT ENTRY to allow sequence entry from the Operation Screen. Press GO TEST CONTROL Key to transmit sequence.

29. Program Number Callout

Does not appear if DIRECT ENTRY is active. Select from 16 possible sequences programmed from the Setup Menu.

30. POCSAG or Tone Remote Callout

Accesses POCSAG or Tone Remote Function. For POCSAG, select one of the following:

Tone - 1 beep	Numeric	Alphanumeric
Tone - 2 beep	Numeric seq	Alpha special
Tone - 3 beep	Alpha lower	
Tone - 4 beep	Alpha upper	

For Tone Remote, select one of the following:

2050 (Monitor)	1650 (R2 Unmute)	1250 (Wild Card 1 Off)
1950 (F1)	1550 (Repeater Off)	1150 (Wild Card 2 On)
1850 (F2)	1450 (Repeater On)	1050 (Wild Card 2 Off)
1750 (R2 Mute)	1350 (Wild Card 1 On)	

31. Tone Sequence Listing

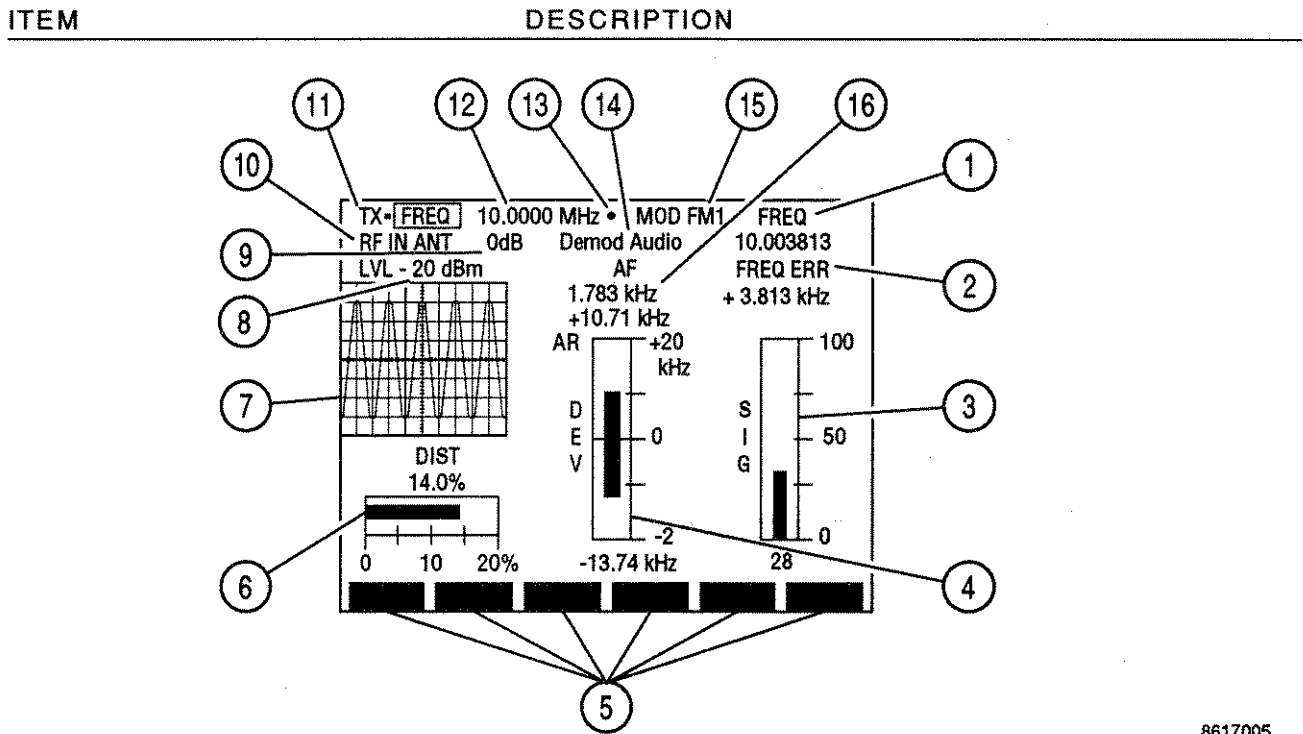
Displays coded sequence. If DIRECT ENTRY is selected, accessing allows entry of sequence unless POCSAG or Tone Remote are in use.

### 3-3-4 DUPLEX TRANSMITTER OPERATION SCREEN

With the Duplex Operation Screen displayed on the CRT, press "TX" Soft Function Key F1 to access the Duplex Transmitter Operation Screen. Use the index of screen features to identify the operation screen parameters that may be edited, the value range available to each feature and/or its usage.

When editing, use FIELD SELECT Keys to move the cursor to the parameter to be edited and press ENTER Key to access the data field. Use the DATA ENTRY Keypad to enter numerical data, Use the DATA SCROLL Spinner or DATA SCROLL UP and DOWN ARROW Keys to select the parameters from a list. Parameters with only two settings automatically toggle to the opposite setting when selected. To access a displayed Meters Operation Screen, move cursor to the Meters callout and press ENTER.

#### A. SCREEN PARAMETERS



8617005

#### 1. Frequency Meter Display

Displays received Duplex Transmitter Frequency. Frequency Meter Operation Screen is accessed through the Meter callout or the Meter Menu.

#### 2. Frequency Error Meter Display

Displays difference between received Duplex Transmitter Frequency and Duplex Transmitter Frequency Setting. Frequency Error Meter Operation Screen is accessed through the Meter callout or the Meter Menu.

ITEM	DESCRIPTION
3. <u>Signal Strength Meter or Power Meter</u>	Displays Signal Strength Meter (if "ANT" is selected as Duplex Transmitter Input Source) or Power Meter (if "T/R" is selected as Duplex Transmitter Input Source). Meters are accessed through Meter callouts or through the Meter Menu.
4. <u>Deviation Meter/Modulation Meter/Phase Meter</u>	Does not appear for USB, LSB, or BFO Modulation. Displays Deviation Meter (for FM Modulation), Phase Meter (for PM Modulation) or Modulation Meter (for AM Modulation).
5. <u>Soft Function Keys</u>	Duplex Transmitter Soft Function Keys are covered in 3-3-4B.
6. <u>Selected Meter/TUNE Adjustment</u>	<ul style="list-style-type: none"> <li>● For AM Modulation, a Distortion Meter is displayed, but active only when selected using "Dist" Soft Function Key F4.</li> <li>● For FM or PM Modulation, select DIST (Distortion), SINAD or DEV RMS (Deviation-RMS) Meter using "Meters" Soft Function Key F4.</li> <li>● For USB, LSB or BFO Modulation, the TUNE Adjustment callout is displayed allowing adjustment in 125 Hz steps using the DATA SCROLL UP and DOWN Keys.</li> </ul>
7. <u>Signaling Format, Oscilloscope or Spectrum Analyzer</u>	Displays Signaling Format, Oscilloscope or Spectrum Analyzer operation. When full size display, Distortion/SINAD, Deviation/Modulation and Signal Strength/Power Meters display as digital readouts. Selected using "Disp" Soft Function Key F1 (31).
8. <u>Duplex Receiver RF Output Level</u>	Displayed in top right corner of screen when Oscilloscope or Analyzer are shown full size. Range is -120.0 to +7.0 dBm if DPL is selected for Duplex Receiver RF Output or -137.0 to 0.0 dBm if T/R is selected for Duplex Receiver RF Output.
9. <u>Duplex Transmitter Input Attenuation</u>	Select 0, 20 or 40 dB.
10. <u>Duplex Transmitter Input Source</u>	Selects "ANT" (ANTENNA) or "T/R" Connector for Duplex Transmitter Input Source.
11. <u>Duplex Transmitter Operation Screen Callout</u>	Label used for screen identification. Not an editable parameter.

ITEM	DESCRIPTION
------	-------------

12. Duplex Transmitter Frequency

Select from 0.2500 to 999.999 MHz.

13. 10 MHz External Reference Light

Blue asterisk appears when 10 MHz External Reference Signal is applied to the EXTERNAL REFERENCE Connector (38) (Figure 3-2).

14. Oscilloscope Input

Appears with Oscilloscope. Select Receive IF, Demod Audio, RF Power Input, SINAD/BER, Function Generator, External Audio, AC, DC or GND.

15. Duplex Transmitter Modulation Type

Select one of the following:

- |     |              |     |
|-----|--------------|-----|
| FM1 | FM2          | FM3 |
| FM4 | AM1          | AM2 |
| USB | LSB          | BFO |
| PM  | User Defined |     |

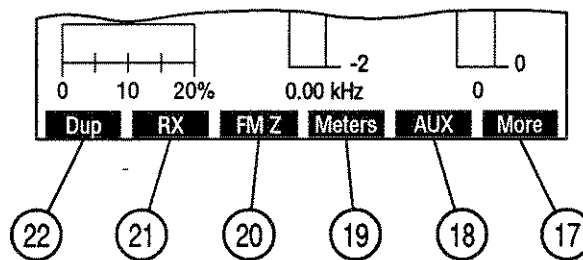
16. Audio Frequency Meter

Displays Audio Frequency received. AF Meter Operation Screen is accessed through the Meter callout or through the Meter Menu.

B. SOFT FUNCTION KEYS

The following index lists the Soft Function Keys available for the Duplex Transmitter Operation Screen:

ITEM	DESCRIPTION
------	-------------



8617056

17. "More" Soft Function Key F6

Displays additional sets of Soft Function Keys.

18. "AUX" Soft Function Key F5

Displays the Auxiliary Functions Menu.

ITEM	DESCRIPTION
------	-------------

19. "Meters"/"Dist"/"Modul"/"Tune" Soft Function Key F4

- For AM Modulation, both Distortion and Modulation Meter are displayed. Pressing F4 toggles which meter is active.
- For FM or PM Modulation, displays submenu allowing the selection of the DIST (Distortion), SINAD or DEV RMS (Deviation-RMS) Meter.
- For USB, LSB or BFO Modulation, selects the TUNE Adjustment Callout allowing adjustment in 125 Hz steps using the DATA SCROLL UP and DOWN Keys.

20. "FM Z" Soft Function Key F3

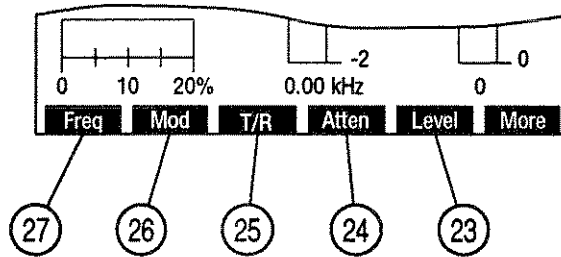
Appears with FM Modulation. Zero's Deviation Meter.

21. "RX" Soft Function Key F2

Displays Duplex Receiver Operation Screen.

22. "Dup" Soft Function Key F1

Displays Duplex Operation Screen.



8617008

23. "Level" Soft Function Key F5

Selects Duplex Transmitter Input Level. Range is -120.0 to +7.0 dBm if "DPL" Connector used for Duplex Receiver RF Output or -137.0 to 0.0 dBm if T/R Connector used for Duplex Receiver RF Output.

24. "Atten" Soft Function Key F4

Selects Duplex Transmitter Input Attenuation. Select 0, 20 or 40 dB.

25. "T/R" or "Ant" Soft Function Key F3

Toggles Duplex Transmitter Input Source between "T/R" and "ANT" (ANTENNA) Connector.

ITEM	DESCRIPTION
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26. "Mod" Soft Function Key F2

Selects Duplex Transmitter Modulation Type. Select one of the following:

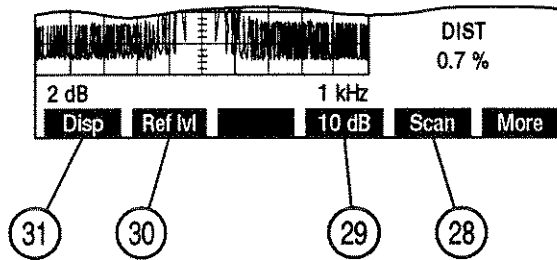
FM1	FM2	FM3
FM4	AM1	AM2
USB	LSB	BFO
PM	User Defined	

27. "Freq" Soft Function Key F1

Selects Duplex Transmitter Frequency. Range is 0.2500 to 999.9999 MHz.

The following set of Soft Function Keys appear when the full size Spectrum Analyzer is displayed:

ITEM	DESCRIPTION
------	-------------



8617031

28. "Scan" Soft Function Key F5

Appears with full size Spectrum Analyzer. Selects Spectrum Analyzer Scan Width. Select from Zero Scan (0 kHz) or:

1 kHz	2 kHz	5 kHz
10 kHz	20 kHz	50 kHz
100 kHz	200 kHz	500 kHz
1 MHz		

29. "10 dB/2 dB" Soft Function Key F4

Appears with full size Spectrum Analyzer. Toggles vertical scale between 10 and 2 dB/div.

30. "Ref lvl" Soft Function Key F2

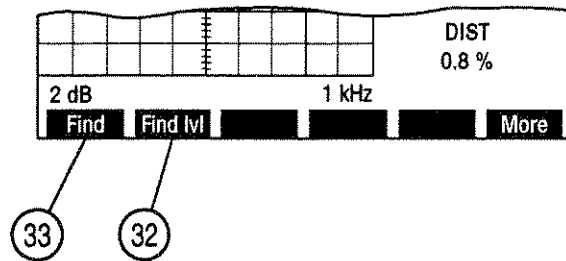
Appears with full size Spectrum Analyzer. Adjusts vertical grid position of the Spectrum Analyzer Trace.

31. "Disp" Soft Function Key F1

Submenu appears listing Oscilloscope, Spectrum Analyzer and Decode displays. Select desired display using DATA ENTRY Keypad.

The following set of Soft Function Keys appear when the full size Spectrum Analyzer is displayed.

ITEM	DESCRIPTION
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8607107

32. "Find lvl" Soft Function Key F2

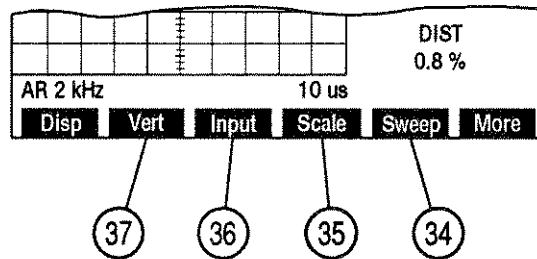
Sets Find Reference Level used in the Find Function.

33. "Find" Soft Function Key F1

Finds the first frequency containing a signal with an amplitude greater than the Find Reference Level and resets the Duplex Transmitter Frequency to the frequency found.

The following set of Soft Function Keys appear when the Oscilloscope is displayed:

ITEM	DESCRIPTION
------	-------------



8617043

34. "Sweep" Soft Function Key F5

Does not appear with 1/4 size Oscilloscope or if "Rcvr IF" is used as Oscilloscope Input. Select one of the following:

- |             |             |             |
|-------------|-------------|-------------|
| 1 $\mu$ s   | 2 $\mu$ s   | 5 $\mu$ s   |
| 10 $\mu$ s  | 20 $\mu$ s  | 50 $\mu$ s  |
| 100 $\mu$ s | 200 $\mu$ s | 500 $\mu$ s |
| 1 ms        | 2 ms        | 5 ms        |
| 10 ms       | 20 ms       | 50 ms       |
| 100 ms      |             |             |



## ITEM

## DESCRIPTION

35. "Scale" Soft Function Key F4

Appears with full size Oscilloscope. Selects Oscilloscope Scale. For AC, DC or GND Oscilloscope Input, select one of the following:

1 mV/div	2 mV/div	5 mV/div
10 mV/div	20 mV/div	50 mV/div
100 mV/div	200 mV/div	500 mV/div
1 V/div	2 V/div	5 V/div
10 V/div	20 V/div	50 V/div

For Demod Audio Oscilloscope Input with FM Modulation, select one of the following:

2 kHz/div	4 kHz/div	10 kHz/div
20 kHz/div	Autorange	

For Demod Audio Oscilloscope Input with Modulation other than FM, Oscilloscope Scale is not editable and "Scale" Soft Function Key does not appear.

For RF Pwr Lvl Oscilloscope Input, Oscilloscope Scale reads 2 W/div or 200 W/div. Power Meter Ranges of 20, 50 or 100 mW set Oscilloscope Scale to 2 W/div. All other Power Meter Ranges set Oscilloscope Scale to 200 W/div.

Oscilloscope Scale is not editable for SINAD/BER or Rcvr IF Oscilloscope Input and "Scale" Soft Function Key F4 does not appear.

36. "Input" Soft Function Key F3

Selects Oscilloscope Input. Select one of the following:

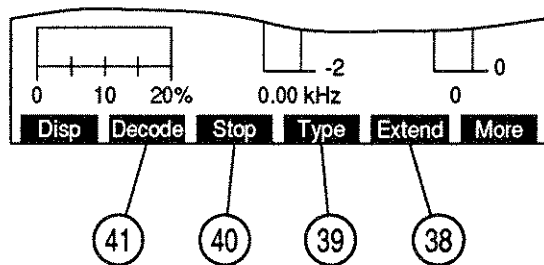
Rcvr IF	Demod Audio	RF Pwr Lvl
SINAD/BER	Func Gen	Ext Mod
AC	DC	GND

37. "Vert" Soft Function Key F2

Appears with full size Oscilloscope. Adjusts vertical Trace position of Oscilloscope.

The following set of Soft Function Keys are accessed when the Decode is selected using "Disp" Soft Function Key F1 (31).

ITEM	DESCRIPTION
------	-------------



8617044

38. "Extend"/"Input" Soft Function Key F5

Does not appear if DTMF is the selected code.

- If DCS or DCS INV is the selected code, "Input" appears. Pressing F5 displays menu listing available Decode Input Sources. Select Demod Audio, SINAD/BER (with Input inverted) or Ext Mod.
- If Audio or POCSAG is the selected code, "Extend" appears. Pressing F5 displays the Extend Screen.

39. "Type" Soft Function Key F4

Does not appear if DTMF is the selected code. Selects code to be decoded.

- If Audio is the selected Signaling Format, choose one of the following:

CCIR	EEA	U.S.(EIA)
ZVEI	DDZVEI (ZVEI 2)	DZVEI (ZVEI 3)
NATEL	EURO	5/6 Tone Seq
CCIRH	CCIRH4	User Defined

- If Digital is the selected Signaling Format, choose one of the following:

DCS                      DCS INV                      POCSAG

40. "Stop" Soft Function Key F3

Appears when Decode Function is active. Stops the Decode Function.

41. "Decode" Soft Function Key F2

Activates Decode Function. Decode Soft Function Key turns red while decoding.

For Audio Signaling Format, the Extend Screen appears as follows:

ITEM	DESCRIPTION
47	#
48	Audio Frq
49	Tones Decod/ Err % Dur
50	CCIR #
51	Frq Err % Dur
	1 1158 3.2 98
	2 1167 2.5 99
	3 1298 1.8 101
	4 1406 3.5 98
	5 1475 2.0 98
46	Input
45	Decode
44	Stop
43	Type
42	Ret

8610163

42. "Ret" Soft Function Key F5

Returns display to the Duplex Transmitter Operation Screen.

43. "Type"/"Rate" Soft Function Key F4

If the Signaling Format is Audio, "Type" is displayed. Select the Audio code to be decoded. Choose one of the following:

CCIR	EEA	U.S.(EIA)
ZVEI	DDZVEI (ZVEI 2)	DZVEI (ZVEI 3)
NATEL	EURO	5/6 Tone Seq
CCIRH	CCIRH4	User Defined

If POCSAG is the selected Signaling Format, "Rate" is displayed. Select the POCSAG rate received. Toggles between Low or High.

44. "Stop" Soft Function Key F3

Appears when Decode Function is active. Stops the Decode Function.

45. "Decode" Soft Function Key F2

Activates Decode Function. Decode callout turns red when active.

46. "Input" Soft Function Key F1

Displays menu listing available Decode Input Sources. Select Demod Audio, SINAD/BER (with Input inverted) or Ext Mod.

ITEM	DESCRIPTION
47. <u># Callout</u>	Displays Audio Code Digits received.
48. <u>Frq Callout</u>	Displays received frequency for each Audio Code Digit in Hz.
49. <u>Err % Callout</u>	Displays Frequency Error of received frequency in percentage of ideal Audio Code Digit frequency.
50. <u>Dur Callout</u>	Displays Duration of each Audio Code Digit in ms.
51. <u>Audio Code or POCSAG Receive Rate Callout</u>	If Audio is the Signaling Format, the Audio Code is displayed. If POCSAG is the Signaling Format, the POCSAG Receive Rate is displayed.

For POCSAG as the Signaling Format, the Extend Screen appears as follows:

ITEM	DESCRIPTION
<p>The diagram shows a rectangular screen with the following text:            POCSAG Decode : LOW            Capcode : 0005130      TYPE : NUMERIC            Msg : 316 - 555 - 4437            Capcode : 0005140      TYPE : NUMERIC            Msg : 316 - 555 - 9746            Capcode : 0005145      TYPE : NUMERIC            Callout 52 points to the first 'Capcode' field.            Callout 53 points to the first 'Msg' field.            Callout 54 points to the 'POCSAG Decode' field.            Callout 55 points to the first 'TYPE' field.</p>	
52. <u>Message</u>	Displays message received with Capcode.
53. <u>Capcode</u>	Displays Capcode number received.
54. <u>POCSAG Rate</u>	Displays POCSAG Rate that is decoded. Toggles between High and Low using "Rate" Soft Function Key F4.
55. <u>POCSAG Function Type</u>	Displays POCSAG Function received.

8610164

### C. DUPLEX TRANSMITTER MENU OPERATION

When the Duplex Transmitter Operation Screen is displayed on the CRT, press the SETUP Key to access the Duplex Transmitter Menu:

ITEM	DESCRIPTION
<b>DUPLEX TRANSMITTER MENU</b>	
Duplex Transmitter Menu	
1. Set Rcvr Freq	95.1000 MHz
2. Select Mod	FM3
3. Select Rcvr In	Antenna
4. Select Input Atten	0 dB
5. Select AGC Type	Auto
6. Rcvr Out Speaker	On
7. Rcvr Out Audio Out	Off
8. Rcvr Out Demod Out	On
9. Auto Volume Level	Off
10. Operation Mode	Freq Scan
11. Signaling Formats	DTMF
	Ret    AUX

8610075

1. Set Rcvr Freq

Selects Duplex Transmitter Frequency. Range is from 0.2500 to 999.9999 MHz.

2. Select Mod

Selects Duplex Transmitter Modulation Type. Select one of the following:

FM1	FM2	FM3	FM4
AM1	AM2	USB	LSB
BFO	PM	User Defined	

3. Select Rcvr In

Selects Duplex Transmitter Input. Select "Antenna" or "T/R" Connector.

4. Select Input Atten

Selects Duplex Transmitter Input Attenuation. Select 0, 20 or 40 dB.

5. Select AGC Type

Displays "Select AGC Type" Menu.

6. Rcvr Out Speaker

Sets Duplex Transmitter Output routing to Speaker. Toggles between on or off.

7. Rcvr Out Audio Out

Sets Duplex Transmitter Output routing to AUDIO OUT Connector. Toggles between on or off.

ITEM	DESCRIPTION
8. <u>Rcvr Out Demod Out</u>	Sets Duplex Transmitter Output routing to DEMOD OUT Connector. Toggles between on or off.
9. <u>Auto Volume Level</u>	Toggles Automatic Volume Level between on or off.
10. <u>Operation Mode</u>	Selects the Duplex Transmitter Operation Mode. Select Direct (normal operation) or Channel. Channel Mode displays the Duplex Transmitter RF as a channel number.
11. <u>Signaling Formats</u>	Displays menu featuring DTMF, Audio and Digital Functions. Selects Format to decode. Selecting Audio displays the Audio Signaling Menu. Selecting Digital displays the Digital Code Menu.

If "2. Select Mod" is selected and "11. User Defined" is selected as the Modulation Type, the User Defined Modulation Menu appears:

ITEM	DESCRIPTION
<b>DUPLEX TRANSMITTER USER DEFINED MODULATION MENU</b>	
Duplex Transmitter Menu	
1. Set Rcvr Freq	200.0000MHz
2. Select Mod	User Defined
3. Modulation	FM DATA
4. IF Filters	3 KHz
5. Post Detection	All Pass
6. Rcvr Out Audio Out	Off
7. Rcvr Out Demod Out	On
8. Auto Volume Level	Off
9. Operation Mode	Freq Scan
10. Signaling Formats	DTMF
Ret ESC	

8610060

1. Modulation

Selects User Defined Modulation Type. Select one of the following:

- |             |     |             |
|-------------|-----|-------------|
| FM          | AM  | SSB (Upper) |
| SSB (Lower) | BFO | PM          |
| FM DATA.    |     |             |

ITEM	DESCRIPTION
------	-------------

2. IF Filters

Selects User Defined IF Filter. Select 3, 30 or 300 kHz.

3. Post Detection

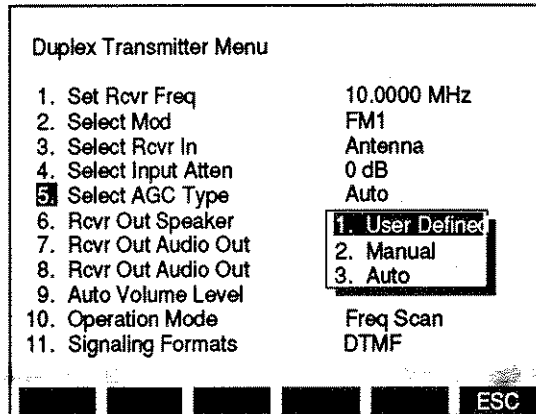
Selects Post Detection Filter. Select All Pass, Low-Pass, High-Pass, Bandpass or C Wt Pass. When Low-Pass, High-Pass and Bandpass are selected, a data field appears to allow the cutoff frequencies to be entered. The ranges of the allowable cutoff frequencies are:

Low-Pass	100 Hz to 30 kHz
High-Pass	500 Hz to 30 kHz
Bandpass low cutoff	500 Hz to 20 kHz
Bandpass high cutoff	100 Hz to 30 kHz

When "5. Select AGC Type" is selected on the Duplex Transmitter Menu, the following Menu appears:

ITEM	DESCRIPTION
------	-------------

**DUPLEX TRANSMITTER  
AGC MENU**



8610061

1. User Defined

Displays User Defined AGC Menu. Select Measurement, Speech, Data, High Speed, Type 1, Type 2 or Type 3.

2. Manual

Selects Duplex Transmitter AGC Level. Range is from 1 to 255.

3. Auto

AGC is automatically adjusted.

ITEM

DESCRIPTION

If "10. Operation Mode" is selected, the Duplex Transmitter Operation Mode Menu appears:

DUPLEX TRANSMITTER  
OPERATION MODE MENU

Duplex Transmitter Menu	
1. Set Rcvr Freq	103.7000 MHz
2. Select Mod	AM2
3. Select Rcvr In	Antenna
4. Select Input Atten	0 dB
5. Select AGC Type	User Defined
6. Rcvr Out Speaker	On
7. Rcvr Out Audio Out	On
8. Rcvr Out Demod Out	On
9. Auto Volume Level	Off
<b>10. Operation Mode</b>	1. Direct 2. Channel
11. Signaling Formats	

Ret ESC

8610122

Select Direct for normal operation. Select Channel to receive AMPS and ETACS Cellular channels. If Channel is selected, "Chan" Soft Function Key F2 appears. Pressing F2 displays the Duplex Transmitter Cellular Format Menu. Select the desired Format.

DUPLEX TRANSMITTER  
CELLULAR FORMAT MENU

Duplex Transmitter Menu	
1. Set Rcvr Freq	1 Chan #
2. Select Mod	AM2
3. Select Rcvr In	Antenna
4. Select Input Atten	0 dB
5.	User Defined
6.	
7.	
8.	
9.	
<b>10. Operation Mode</b>	Channel
11. Signaling Formats	Audio

Chan Ret ESC

8610123



If "11. Signaling Formats" is selected, the Receiver Signaling Format Menu is displayed. If Audio is selected as the Signaling Format, the Audio Code Menu appears allowing selection of an Audio Code:

### DUPLEX TRANSMITTER AUDIO CODE MENU

Duplex Transmitter Menu	
1. S	1. CCIR
2. S	2. EEA
3. S	3. U.S. (EIA)
4. S	4. ZVEI
5. S	5. DDZVEI (ZVEI 2)
6. R	6. DZVEI (ZVEI 3)
7. R	7. NATEL
8. R	8. EURO
9. A	9. 5/6 Tone Seq
10. O	10. CCIRH
11. S	11. CCIRH4
	12. User Defined

000 MHz
Defined
na

DTMF
Audio
Digital

Ret	ESC
-----	-----

8610162

If Digital is selected as the Signaling Format, the Digital Code Menu appears allowing the selection of a Digital Code:

### DUPLEX TRANSMITTER DIGITAL CODE MENU

Duplex Transmitter Menu	
1. Set Rcvr Freq	10.0000 MHz
2. Select Mod	User Defined
3. Select Rcvr In	Antenna
4. Select Input Atten	0 dB
5. Select AGC Type	Auto
6. Rcvr Out Speaker	On
7. Rcvr Out Audio Out	Off
8. Rcvr Out Demod Out	Off
9. Auto Volume L	1. DCS
10. Operation Mod	2. DCS INV
11. Signaling Form	3. POCSAG

1. DTMF
2. Audio
3. Digital

Ret	AUX
-----	-----

8610161

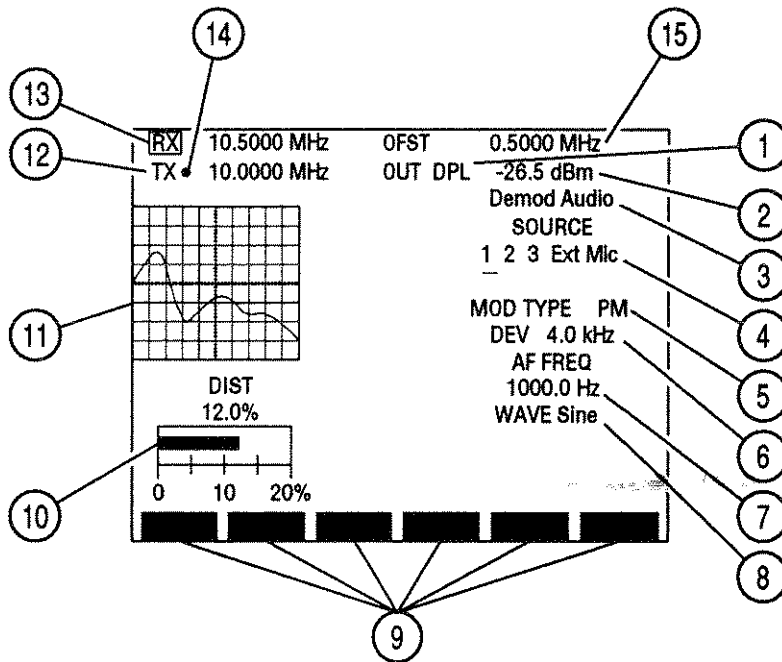
### 3-3-5 DUPLEX RECEIVER OPERATION SCREEN

With the Duplex Operation Screen displayed on the CRT, press "RX" Soft Function Key F2 to access the Duplex Transmitter Operation Screen. Use the index of screen features to identify the operation screen parameters that may be edited, the value range available to each feature and/or its usage.

When editing, use FIELD SELECT Keys to move the cursor to the parameter to be edited and press ENTER Key to access the data field. Use the DATA ENTRY Keypad to enter numerical data, Use the DATA SCROLL Spinner or DATA SCROLL UP and DOWN ARROW Keys to select the parameters from a list. Parameters with only two settings automatically toggle to the opposite setting when selected. To access a displayed Meters Operation Screen, move cursor to the Meters callout and press ENTER.

#### A. SCREEN PARAMETERS

ITEM	DESCRIPTION
------	-------------



8617006

#### 1. Duplex Receiver Output Connector

Select "DPL" (DUPLEX) or "T/R" Connector for Duplex Receiver Output.

#### 2. Duplex Receiver RF Out Level

If DPL (DUPLEX) is the Output Connector, range is -120.0 to +7.0 dBm or .224  $\mu$ V to .501 V. If T/R is the Output Connector, range is -137.0 to 0.0 dBm or .031  $\mu$ V to .224 V.

#### 3. Oscilloscope Input

Appears with Oscilloscope. Select Rcvr IF, Demod Audio, RF Pwr Lvl, SINAD/BER, Func Gen, Ext Mod, AC, DC or GND.

## ITEM

## DESCRIPTION

- 
4. Duplex Receiver Modulation Source
- Underline indicates active Modulation Source. Select AM, FM, PM or OFF.
- NOTE:** Different sources cannot be FM and PM simultaneously. Selecting FM changes PM sources to FM. Selecting PM changes FM sources to PM. Sources that are AM or OFF are not affected.
5. Duplex Receiver Modulation Type
- Not an editable parameter. Readout indicates Active Source Modulation Type.
6. Duplex Receiver Modulation Level
- Appears if a source is active. Range is 0.0 to 100.0 kHz for FM Modulation, 0% to 90% for AM Modulation or 0.0 to 10.0 radians for PM Modulation.
7. Duplex Receiver Active Source Audio Frequency
- Appears if 1 or 2 is the Active Source. Range is 0.0 to 40000.0 Hz.
8. Duplex Receiver Wave Form
- Appears if 1 or 2 is the Active Source. Select Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl or -1 Lvl.
9. Soft Function Keys
- Soft Function Keys for the Duplex Receiver Operation Screen are covered in 3-3-5B.
10. Distortion/SINAD/AF LVL/DMM Meter
- Displays selected meter. Meter is selected using "Meters" Soft Function Key F4. Meters can be accessed through display or through the Meter Menu. Meter displayed as a digital readout if Oscilloscope or Spectrum Analyzer is full size.
- NOTE:** SINAD and Distortion Meters measure only SINAD/BER Connector Input. DMM measures only DMM Connectors Input.
11. Oscilloscope or Spectrum Analyzer
- Displays Oscilloscope or Spectrum Analyzer Operation. Use "Disp" Soft Function Key to display full size or 1/4 size Oscilloscope, full size or 1/4 size Spectrum Analyzer or set to None for no display.
12. Duplex Transmitter Frequency
- Selects Duplex Transmitter Frequency. Range is 0.2500 to 999.9999 MHz.

ITEM

DESCRIPTION

13. Duplex Receiver Frequency

Selects Duplex Receiver Frequency. Range is 0.2500 to 999.9999 MHz. Either the Receiver Frequency or the Offset Frequency is the editable frequency at any one time. The parameter not editable automatically changes so the Offset Frequency added to the Transmitter Frequency is equal to the Receiver Frequency.

14. Squelch Indicator Light

Green dot appears when squelch is broken.

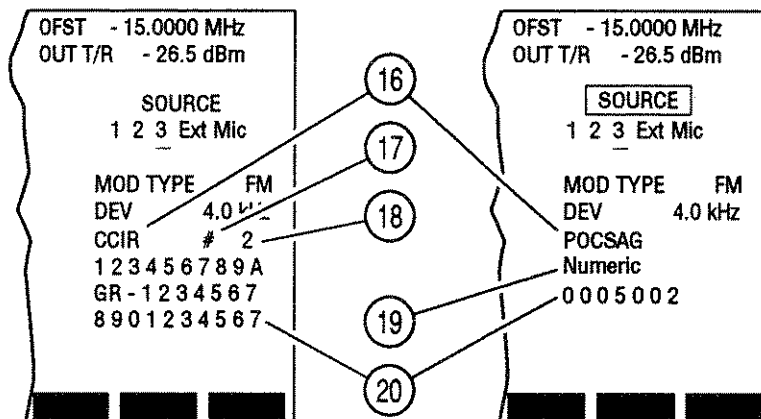
15. Duplex Offset Frequency

Selects Duplex Offset Frequency. Range is -999.7499 to 999.7499 MHz. Either the Receiver Frequency or the Offset Frequency is the editable frequency at any one time. The parameter not editable automatically changes so the Offset Frequency added to the Transmitter Frequency is equal to the Receiver Frequency.

If "3" (Signaling Format) is selected as the Active Source, the Operation Screen appears as follows:

ITEM

DESCRIPTION



8617075

16. Signaling Code Display

- Displays DTMF if DTMF is the selected Signaling Format.
- Accesses Audio Code if Audio Signaling Format is active. Select from:

CCIR  
ZVEI  
NATEL  
CCIRH

EAA  
DDZVEI(ZVEI 2)  
EURO  
CCIRH4

U.S.(EIA)  
DZVEI (ZVEI 3)  
5/6 Tone Seq  
User Defined

## ITEM

## DESCRIPTION

- Accesses Digital Code if Digital Signaling Format is active. Select from:

DCS

DCS INV

POCSAG

- Accesses RCC Code if RCC Signaling Format is active. Select from:

IMTS

MTS

2805

Tone Rem

17. #/DIR

Accessing callout toggles it to the function not shown. Select # (Program #) to generate a sequence programmed from the Setup Menu. Select DIR (Direct Entry) to allow sequence entry from the Operation Screen. Press GO TEST CONTROL Key to transmit sequence.

18. Program Number

Does not appear if DIRECT ENTRY is active. Select from 16 possible sequences programmed from the Setup Menu.

19. POCSAG or Tone Remote Callout

Accesses POCSAG or Tone Remote Function. For POCSAG, select one of the following:

Tone - 1 beep

Numeric

Alphanumeric

Tone - 2 beep

Numeric seq

Alpha special

Tone - 3 beep

Alpha lower

Tone - 4 beep

Alpha upper

For Tone Remote, select one of the following:

2050 (Monitor)

1650 (R2 Unmute)

1250 (Wild Card 1 Off)

1950 (F1)

1550 (Repeater Off)

1150 (Wild Card 2 On)

1850 (F2)

1450 (Repeater On)

1050 (Wild Card 2 Off)

1750 (R2 Mute)

1350 (Wild Card 1 On)

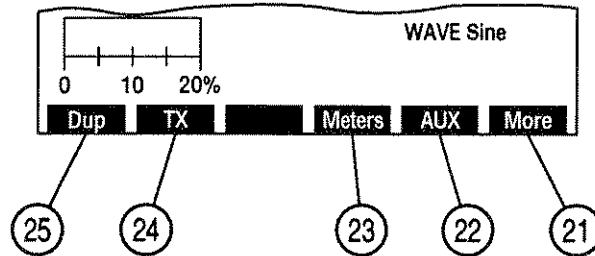
20. Tone Sequence Listing

Displays coded sequence.. Displays coded sequence. If DIRECT ENTRY is selected for 28, accessing allows entry of sequence unless POCSAG or Tone Remote are in use.

## B. SOFT FUNCTION KEYS

The following index lists the sets of Soft Function Keys available for the Duplex Transmitter Operation Screen. Whichever list is accessed last is the list that comes up first when the Duplex Transmitter Operation Screen is next accessed.

ITEM	DESCRIPTION
------	-------------



8617042

21. "More" Soft Function Key F6

Displays additional sets of Soft Function Keys.

22. "AUX" Soft Function Key F5

Displays Auxiliary Functions Menu.

23. "Meters" Soft Function Key F4

Displays menu listing available Meters. Select SINAD, DIST (Distortion), AF LVL or DMM.

**NOTE:** SINAD and Distortion Meters measure only SINAD/BER Connector Input. DMM measures only DMM Connector Input.

24. "TX" Soft Function Key F2

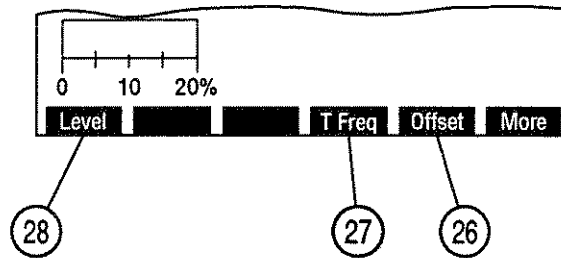
Displays Duplex Transmitter Operation Screen.

25. "Dup" Soft Function Key F1

Displays Duplex Operation Screen.

## ITEM

## DESCRIPTION



8617013

26. "Offset"/"R Freq" Soft Function Key F5

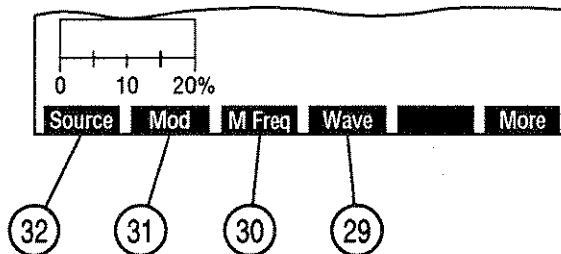
Toggles which frequency is editable (Duplex Receiver or Offset) and selects frequency. Range for Duplex Receiver Frequency is 0.2500 to 999.9999 MHz. Range for Duplex Offset Frequency is -999.7499 to 999.9999 MHz.

27. "T Freq" Soft Function Key F4

Selects Duplex Transmitter Frequency. Range is 0.2500 to 999.9999 MHz.

28. "Level" Soft Function Key F1

Selects Duplex Receiver RF Out Level. If DPL is the Output Connector, range is -120.0 to +7.0 dBm or .224  $\mu$ V to .501 V. If T/R is the Output Connector, range is -137.0 to 0.0 dBm or .031  $\mu$ V to .224 V.



8617014

29. "Wave" Soft Function Key F4

Appears if Source 1 or 2 is the Active Source. Selects Modulation Wave Form. Select Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl or -1 Lvl.

30. "M Freq" Soft Function Key F3

Appears if Source 1 or 2 is the Active Source. Selects Modulation Audio Frequency. Range is 0.0 to 40000.0 Hz.

ITEM	DESCRIPTION
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31. "Mod"/"Dev" Soft Function Key F2

Appears if Source 1 or 2 is the active Source. Selects Modulation Level. Range is 0% to 90% for AM Modulation, 0.0 to 100.0 kHz for FM Modulation, 0.0 to 10.0 radians for PM Modulation.

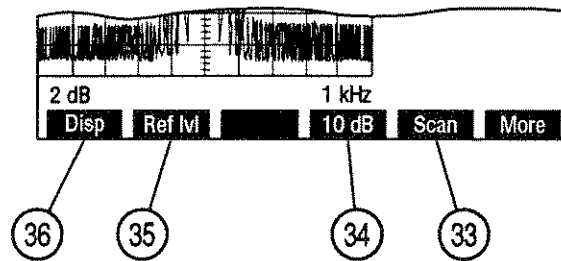
32. "Source" Soft Function Key F1

Underline indicates active Modulation Source. Select AM, FM, PM or OFF.

**NOTE:** Different sources cannot be FM and PM simultaneously. Selecting FM changes PM sources to FM. Selecting PM changes FM sources to PM. Sources that are AM or OFF are not affected. Press F1 to access and edit Duplex Receiver Source.

The following set of Soft Function Keys are accessed with a full size Spectrum Analyzer Display:

ITEM	DESCRIPTION
------	-------------



8617032

33. "Scan" Soft Function Key F5

Selects Analyzer Scan Width. Select Zero Scan (0 kHz) or:

- |         |         |         |
|---------|---------|---------|
| 1 kHz   | 2 kHz   | 5 kHz   |
| 10 kHz  | 20 kHz  | 50 kHz  |
| 100 kHz | 200 kHz | 500 kHz |
| 1 MHz   |         |         |

34. "10 dB/2 dB" Soft Function Key F4

Toggles Analyzer Vertical Scale between 10 and 2 dB/div.

35. "Ref lvl" Soft Function Key F2

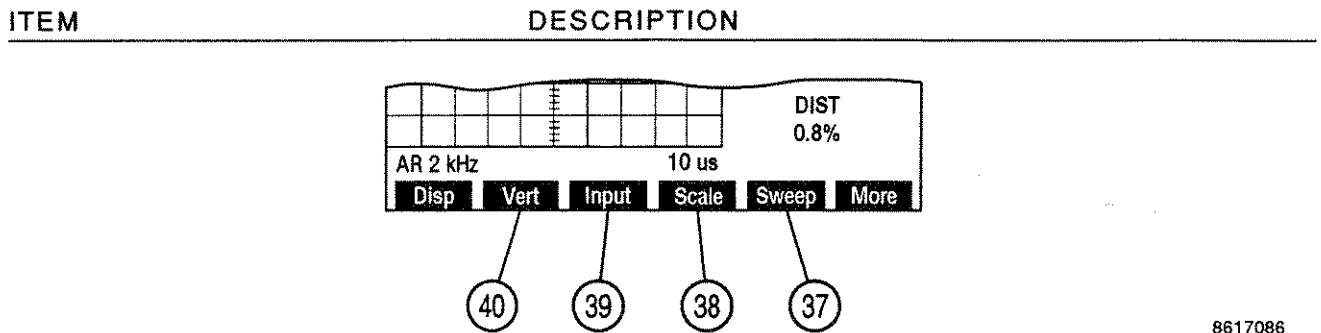
Adjusts vertical grid position of the Spectrum Analyzer Trace.

36. "Disp" Soft Function Key F1

Menu appears listing Oscilloscope, Spectrum Analyzer and Decode displays. Select desired display using DATA ENTRY Keypad.



The following set of Soft Function Keys are accessed when the Oscilloscope is displayed:



8617086

37. "Sweep" Soft Function Key F5

Appears with full size Oscilloscope except with "Rcvr IF" as Oscilloscope Input. Select one of the following:

- |             |             |             |
|-------------|-------------|-------------|
| 1 $\mu$ s   | 2 $\mu$ s   | 5 $\mu$ s   |
| 10 $\mu$ s  | 20 $\mu$ s  | 50 $\mu$ s  |
| 100 $\mu$ s | 200 $\mu$ s | 500 $\mu$ s |
| 1 ms        | 2 ms        | 5 ms        |
| 10 ms       | 20 ms       | 50 ms       |
| 100 ms      |             |             |

38. "Scale" Soft Function Key F4

Appears with full size Oscilloscope. For AC, DC or GND Oscilloscope Input, select one of the following:

- |            |            |            |
|------------|------------|------------|
| 1 mV/div   | 2 mV/div   | 5 mV/div   |
| 10 mV/div  | 20 mV/div  | 50 mV/div  |
| 100 mV/div | 200 mV/div | 500 mV/div |
| 1 V/div    | 2 V/div    | 5 V/div    |
| 10 V/div   | 20 V/div   | 50 V/div   |

For Demod Audio Oscilloscope Input with FM Modulation, select one of the following:

- |            |           |            |
|------------|-----------|------------|
| 2 kHz/div  | 4 kHz/div | 10 kHz/div |
| 20 kHz/div | Autorange |            |

For Demod Audio Oscilloscope Input with Modulation other than FM, Oscilloscope Scale is not editable and "Scale" Soft Function Key F4 does not appear.

For Func Gen or Ext Mod Oscilloscope Input, select one of the following:

- |            |         |           |
|------------|---------|-----------|
| 500 mV/div | 1 V/div | 2.5 V/div |
|------------|---------|-----------|

For RF Pwr Lvl Oscilloscope Input, Oscilloscope Scale reads 2 W/div or 200 W/div. Power Meter Ranges of 20, 50 or 100 mW set Oscilloscope Scale to 2 W/div. All other Power Meter Ranges set Oscilloscope Scale to 200 W/div.

Oscilloscope Scale is not editable for SINAD/BER or Rcvr IF Oscilloscope Input and "Scale" Soft Function Key F4 does not appear.

**ITEM**

**DESCRIPTION**

---

**39. "Input" Soft Function Key F3**

Selects Oscilloscope Input. Choose one of the following:

Rcvr IF  
SINAD/BER  
AC

Demod Audio  
Func Gen  
DC

RF Pwr Lvl  
Ext Mod  
GND

**40. "Vert" Soft Function Key F2**

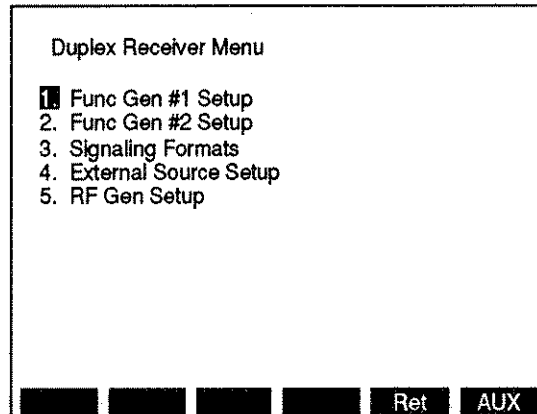
Appears with full size Oscilloscope. Adjusts vertical trace position on Oscilloscope.

### C. DUPLEX RECEIVER MENU OPERATION

When the Duplex Receiver Operation Screen is displayed on the CRT or when the cursor is on any parameter on the left side of the Duplex Operation Screen, press SETUP to access the Duplex Receiver Menu. Many Duplex Receiver Operating Screen parameters may also be edited from Duplex Receiver Menu or one of its submenus.

ITEM	DESCRIPTION
------	-------------

#### DUPLEX RECEIVER MENU



8610072

1. Func Gen #1 Setup

Displays Func Gen #1 Setup Menu.

2. Func Gen #2 Setup

Displays Func Gen #2 Setup Menu.

3. Signaling Formats

Displays Signaling Format Menu featuring DTMF, Audio, Digital and RCC.

4. External Source Setup

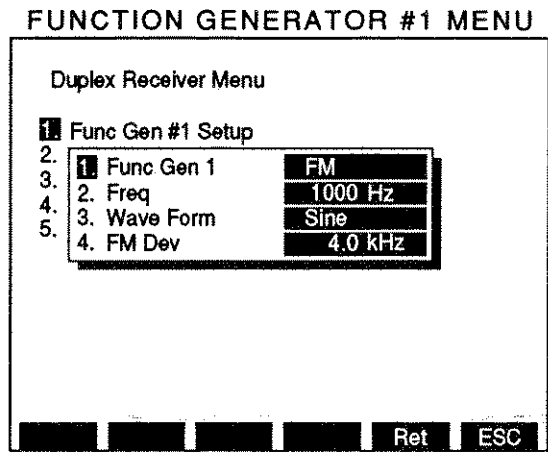
Displays External Source Setup Menu.

5. RF Gen Setup

Displays RF Generator Setup Menu.

Selecting "1. Func Gen #1 Setup" displays the Function Generator #1 Menu:

ITEM DESCRIPTION



8610057

1. Func Gen 1

Selects Function Generator Modulation Type. Select AM, FM, PM or OFF.

**NOTE:** Different sources cannot be FM and PM simultaneously. Selecting FM changes PM sources to FM. Selecting PM changes FM sources to PM. Sources that are AM or OFF are not affected.

2. Freq

Selects Function Generator Frequency. Range is 0.0 to 40000 Hz.

3. Wave Form

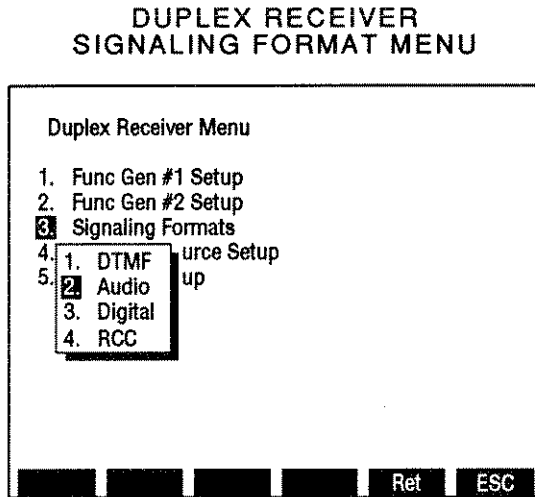
Selects Function Generator Wave Form. Select Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl, -1 Lvl.

4. Level Setting

Not operational when active source off. Selects Function Generator Modulation Level. Range is 0.000 to 100.000 kHz for FM Modulation, 0% to 90% for AM Modulation or 0.0 to 10.0 radians for PM Modulation.

Accessing "2. Func Gen #2 Setup" displays the Function Generator #2 Menu. Function Generator #2 parameters are identical to those of Function Generator #1.

When "3. Signaling Formats" is selected on the Duplex Receiver Menu, the following menu appears on the CRT:

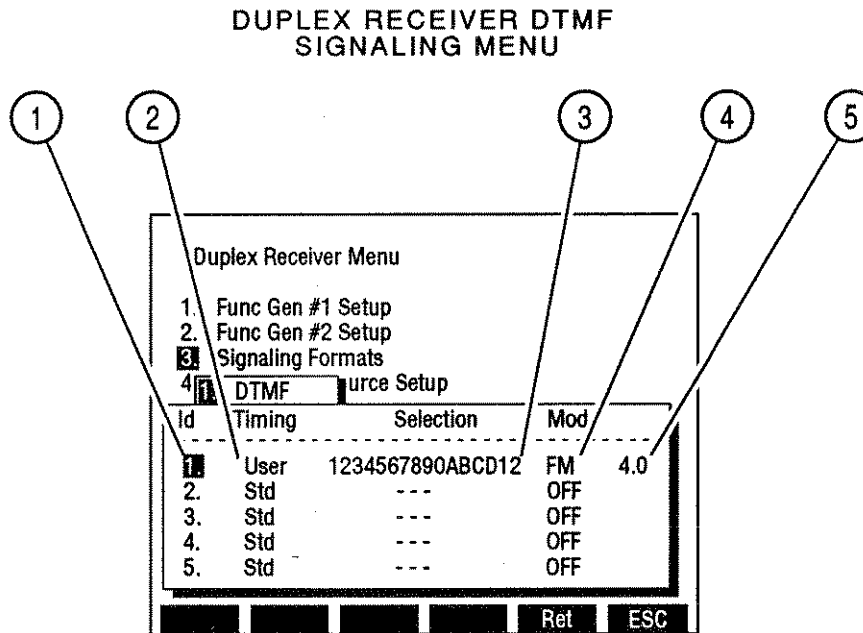


8610090

If "1. DTMF" is selected, the DTMF Format Menu appears on the screen:

ITEM DESCRIPTION

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8607057

1. Id

Program Identification number. Used to select a specific sequence from the Operation Screen while using the Program feature.

ITEM

DESCRIPTION

2. Timing

Choose from Std (standard) or User (user defined). If User is selected, two data fields appear allowing entry of desired Mark Timing and Space Timing. Range of both is 25 to 9999 ms.

3. Sequence

Select the desired sequence of up to 15 tones using digits 0 through 9 and letters A through D.

4. Mod Type

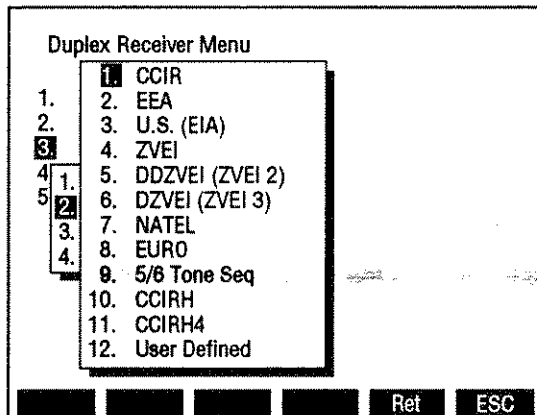
Select AM, FM, PM or OFF for the DTMF Modulation.

5. Mod Level

Modulation Level range for FM is 0.0 to 20.0 kHz, for AM, 0.0% to 24.5%, for PM, 0.0 to 3.0 radians.

If Audio is selected as the Signaling Format, the Audio Signaling Format Menu appears:

DUPLEX RECEIVER AUDIO  
SIGNALING FORMAT MENU



8610089

Selecting an Audio Code displays the Audio Code Sequence Menu:

### DUPLEX RECEIVER AUDIO CODE SEQUENCE MENU

Duplex Receiver Menu

1.	1. CCIR
2.	2. EEA
3.	3. U.S. (EIA)
4.	4. Id Selection
5.	5. 1. 1234567890
6.	6. 2. ---
7.	7. 3. ---
8.	8. 4. ---
9.	9. ---
10.	10. ---
11.	11. ---
12.	12. ---

Scan RF lock Ret ESC

8610088

Select the Id number from 1 to 15. Enter a sequence up to 30 tones in length using the characters 0 through 9, A, G, R and - signifying a blank space.

Selecting "12. User Defined" for the Audio Code displays the Audio Code User Defined Menu:

### DUPLEX RECEIVER AUDIO CODE USER DEFINED MENU

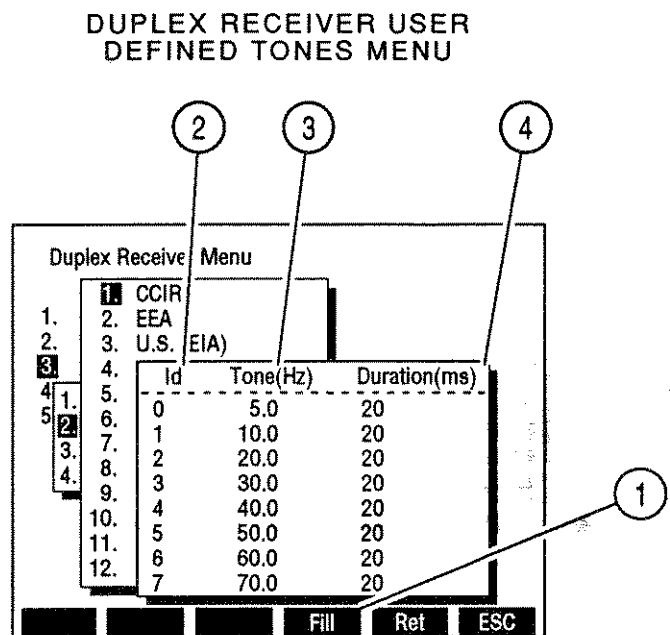
Duplex Receiver Menu

1.	1. CCIR
2.	2. EEA
3.	3. U.S. (EIA)
4.	4. 1. Define Sequence
5.	5. 2. Define Tones
6.	6. ---
7.	7. NATEL
8.	8. EURO

8610170

Selecting "2. Define Tones" displays a menu used to define the desired tones:

ITEM DESCRIPTION



8610154

1. "Fill" Soft Function Key F4

When a Tone or Duration is highlighted, pressing F4 changes all entries below and in the same column to the value highlighted.

2. Id

Select an Id to represent the tone to be defined. Range of characters for the Id is 0 to 9 and A to T. Defining the tone consists of setting the frequency and duration of the tone.

3. Tone(Hz)

Set "Tone(Hz)" to frequency of desired tone. Range is 0.0 to 9999.9 Hz.

4. Duration(ms)

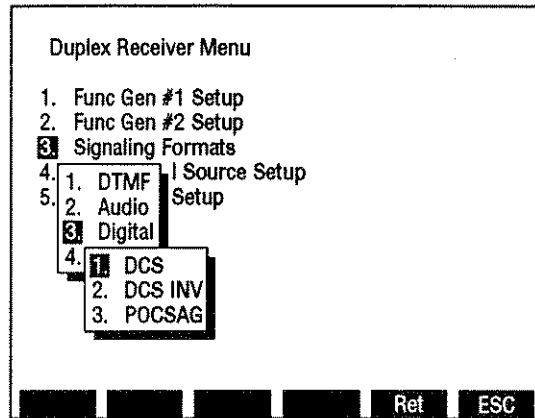
Set "Duration(ms)" to duration of desired tone. Range is 20 to 9999 ms.

Selecting "Define Sequence" displays the Duplex Receiver Audio Code Sequence Menu shown above. User Defined sequences are selected as other Audio Codes using this menu.



If "3. Digital" is selected as the Signaling Format, the Digital Code Menu appears:

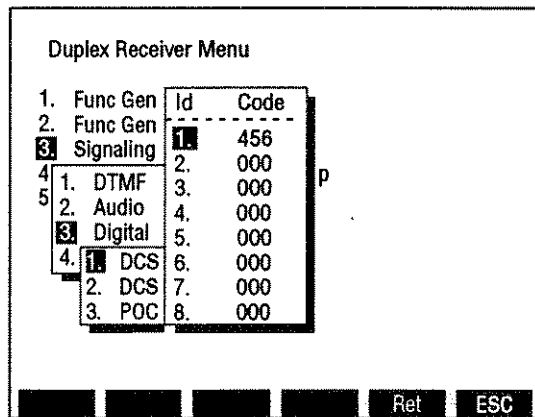
DUPLEX RECEIVER  
DIGITAL CODE MENU



8610150

Selecting DCS or DCS INV displays the DCS Code Menu:

DUPLEX RECEIVER  
DCS CODE MENU



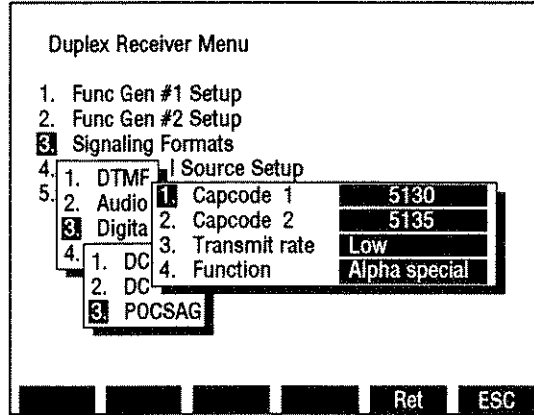
8610087

After selecting the Id number, enter a 3 digit DCS Code.

Selecting POCSAG from the Digital Code Menu displays the POCSAG Menu:

ITEM DESCRIPTION

DUPLEX RECEIVER  
POCSAG MENU



8610151

1. Capcode 1

Selects beginning Capcode of sequence. Sequence generated consist of Capcodes from Capcode 1 through Capcode 2.

2. Capcode 2

Selects ending Capcode of Capcode sequence. Sequence generated consist of Capcodes from Capcode 1 through Capcode 2.

3. Transmit Rate

Toggles Transmit Rate to Low or High.

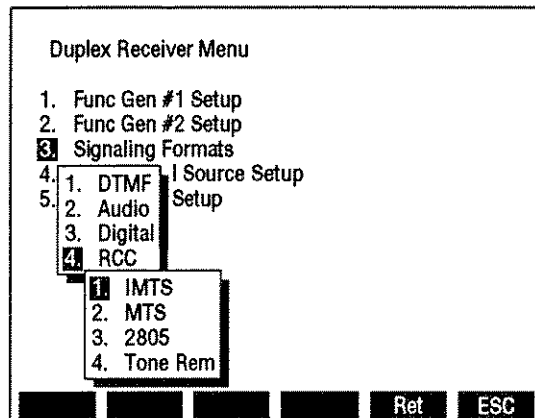
4. Function

Selects POCSAG Function Submenu. Choose one of the following:

Tone - 1 beep	Numeric	Alphanumeric
Tone - 2 beep	Numeric seq	Alpha special
Tone - 3 beep	Alpha lower	
Tone - 4 beep	Alpha upper	

If RCC is selected for the Signaling Format, the RCC Code Menu appears:

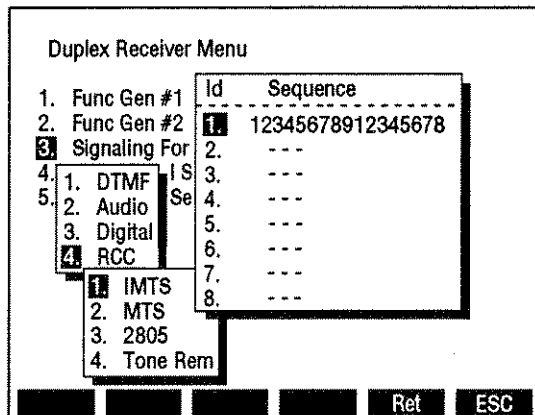
**DUPLEX RECEIVER  
RCC CODE MENU**



8610152

Selecting IMTS, MTS or 2805 displays the following menu:

**DUPLEX RECEIVER IMTS,  
MTS AND 2805 MENU**



8610153

After selecting an Id, select the sequence to be generated using characters 1 through 9.

If 2805 is selected, "Tone" Soft Function Key F3 appears. Accessing F3 displays the 2805 Tone Freq callout allowing this frequency to be changed. Range of Tone Freq is 0.0 to 40000.0 Hz.

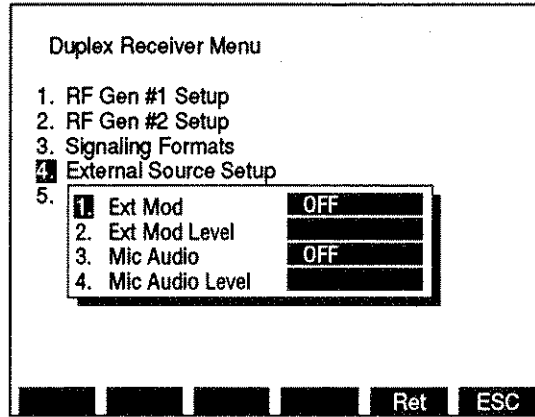
Selecting Tone Rem displays the Tone Remote Function Menu. Select one of the following:

- |                |                       |                        |
|----------------|-----------------------|------------------------|
| 2050 (Monitor) | 1650 (R2 Unmute)      | 1250 (Wild Card 1 Off) |
| 1950 (F1)      | 1550 (Repeater Off)   | 1150 (Wild Card 2 On)  |
| 1850 (F2)      | 1450 (Repeater On)    | 1050 (Wild Card 2 Off) |
| 1750 (R2 Mute) | 1350 (Wild Card 1 On) |                        |

When "4. External Source Setup" is selected on the Duplex Receiver Menu, the following menu appears on the CRT:

ITEM DESCRIPTION

DUPLEX RECEIVER EXTERNAL SOURCE SETUP MENU



8610056

1. Ext Mod

Selects External Modulation Type. Select FM, AM, PM or OFF.

2. Ext Mod Level

Selects External Modulation Level. Select from 0.0 to 100.0 kHz for FM, 0% to 90% for AM or 0.0 to 10.0 radians for PM. Field is blank if set to OFF.

3. Mic Audio

Select FM, AM, PM or OFF for Microphone Input Modulation Type.

4. Mic Audio Level

Selects Microphone Input Modulation Level. Select from 0.0 to 100.0 kHz for FM, 0% to 90% for AM or 0.0 to 10.0 radians for PM. Field is blank if set to OFF.

When "5. RF Gen Setup" is selected on the Duplex Receiver Menu, the RF Generator Setup Menu appears on the CRT:

ITEM

DESCRIPTION

DUPLEX RECEIVER  
SETUP MENU

Duplex Receiver Menu													
1. RF Gen #1 Setup													
2. RF Gen #2 Setup													
3. Signaling Formats													
4. External Source Setup													
<b>5. RF Gen Setup</b>													
<table border="1"> <tbody> <tr> <td><b>1. RF Gen Freq</b></td> <td>10.0000 MHz</td> </tr> <tr> <td>2. RF Gen Lvl</td> <td>-20 dBm</td> </tr> <tr> <td>3. RF Gen Level Units</td> <td>dBm</td> </tr> <tr> <td>4. Source to Audio Out</td> <td>Off</td> </tr> <tr> <td>5. Source to Demod Out</td> <td>Off</td> </tr> <tr> <td>6. To Speaker</td> <td>None</td> </tr> </tbody> </table>		<b>1. RF Gen Freq</b>	10.0000 MHz	2. RF Gen Lvl	-20 dBm	3. RF Gen Level Units	dBm	4. Source to Audio Out	Off	5. Source to Demod Out	Off	6. To Speaker	None
<b>1. RF Gen Freq</b>	10.0000 MHz												
2. RF Gen Lvl	-20 dBm												
3. RF Gen Level Units	dBm												
4. Source to Audio Out	Off												
5. Source to Demod Out	Off												
6. To Speaker	None												
Ret    ESC													

8610073

1. RF Gen Freq

Selects Duplex Receiver Frequency. Range is from 0.2500 to 999.9999 MHz.

2. RF Gen Lvl

Selects Duplex Receiver Output Level. If Duplex Receiver Level Units are set to dBm, range is from -137.0 to 0.0 dBm. If Duplex Receiver Level Units are set to Volts, range is from 0.031  $\mu$ V to 0.224 V.

3. RF Gen Level Units

Selects Duplex Receiver Output Level Units. Accessing toggles units to "dBm" or "Volts".

4. Source to Audio Out

Sets routing of Duplex Receiver Output to AUDIO OUT Connector. Accessing toggles routing to on or off.

5. Source to Demod Out

Sets routing of Duplex Receiver to DEMOD OUT Connector. Accessing toggles routing to on or off.

6. To Speaker

Displays menu listing signals to be routed to Speaker. Select None, Source, SINAD/BER or Ext Mod/DTMF.

### 3-3-6 AF GENERATOR (FUNCTION GENERATOR) OPERATION SCREEN

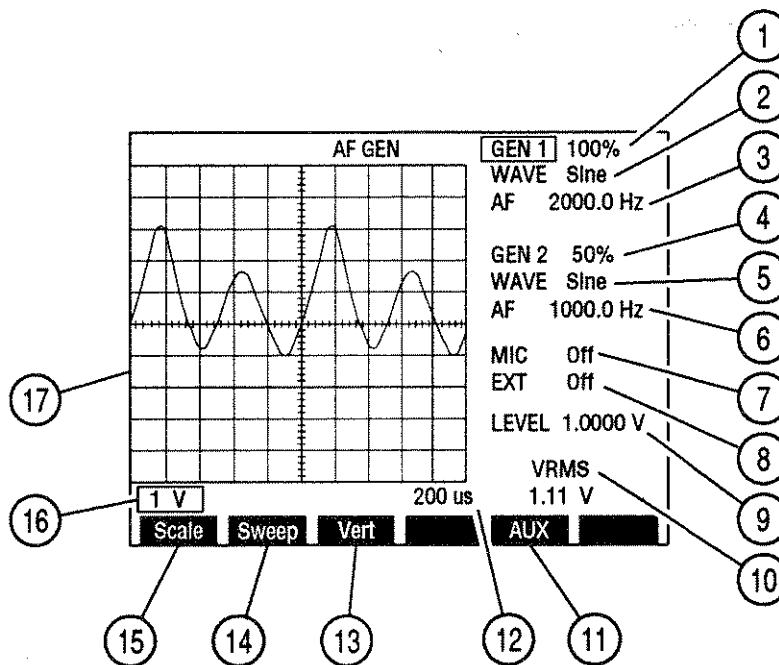
Press AF GEN MODE Key to access Function Generator Operating Screen. Use the index of screen features to identify the operation screen parameters that may be edited, the value range available to each feature and/or its usage.

When editing, use the FIELD SELECT Keys to move the cursor to the parameter to be edited and press ENTER Key to access the data field. Use the DATA ENTRY Keypad to enter numerical data. Use the DATA SCROLL Spinner or DATA SCROLL UP and DOWN ARROW Keys (3) to select parameters from a list. Parameters with only two possible settings automatically switch to the opposite setting when selected. To access a displayed Meters Operation Screen, move cursor to the Meters callout and press ENTER.

All available Soft Function Keys are on one screen.

#### A. SCREEN PARAMETERS

ITEM	DESCRIPTION
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8617051

1. GEN 1

Selects Function Generator #1 Status. For Proportional Mode select 0% to 100%; otherwise select on and off. Proportional Mode is selected from AF Gen Menu.

2. WAVE (GEN 1)

Selects Function Generator #1 Output Wave Form. Select Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl, or -1 Lvl.

3. AF (GEN 1)

Selects Function Generator #1 Audio Frequency. Range is 0.0 to 40000.0 Hz.

## ITEM

## DESCRIPTION

- 
4. GEN 2  
Selects Function Generator #2 Status. For Proportional Mode select 0% to 100%; otherwise select on or off. Proportional Mode is selected from AF Gen Menu.
5. WAVE (GEN 2)  
Selects Function Generator #2 Output Wave Form. Select Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl, or -1 Lvl.
6. AF (GEN 2)  
Selects Function Generator #2 Audio Frequency. Range is 0.0 to 40000.0 Hz.
7. MIC  
Selects Function Generator Status at MIC/ACC IN/OUT Connector. For Proportional Mode select 0% to 100%; otherwise select on or off. Proportional Mode is selected from AF Gen Menu.
8. EXT  
Selects Function Generator Status at EXT MOD IN Connector. For Proportional Mode select 0% to 100%; otherwise select on or off. Proportional Mode is selected from AF Gen Menu.
9. LEVEL  
Selects Function Generator Output Attenuation Level. Range is 0.0000 to 3.1000 V.
10. VRMS  
Displays VRMS level of Function Generator Output.
11. "AUX" Soft Function Key F5  
Displays Auxiliary Functions Menu.
12. Oscilloscope Sweep Rate  
Select one of the following:
- |             |             |             |
|-------------|-------------|-------------|
| 1 $\mu$ s   | 2 $\mu$ s   | 5 $\mu$ s   |
| 10 $\mu$ s  | 20 $\mu$ s  | 50 $\mu$ s  |
| 100 $\mu$ s | 200 $\mu$ s | 500 $\mu$ s |
| 1 ms        | 2 ms        | 5 ms        |
| 10 ms       | 20 ms       | 50 ms       |
| 100 ms      |             |             |

**ITEM****DESCRIPTION**

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**13. "Vert" Soft Function Key F3**

Adjusts vertical position of Oscilloscope Trace by using DATA SCROLL Spinner.

**14. "Sweep" Soft Function Key F2**

Selects Oscilloscope Sweep Rate. Select one of the following:

1 $\mu$ s	2 $\mu$ s	5 $\mu$ s
10 $\mu$ s	20 $\mu$ s	50 $\mu$ s
100 $\mu$ s	200 $\mu$ s	500 $\mu$ s
1 ms	2 ms	5 ms
10 ms	20 ms	50 ms
100 ms		

**15. "Scale" Soft Function Key F1**

Selects Oscilloscope Scale. Select 500 mV, 1 or 2.5 V.

**16. Oscilloscope Scale**

Selects Oscilloscope Scale. Select 500 mV, 1 or 2.5 V.

**17. Oscilloscope**

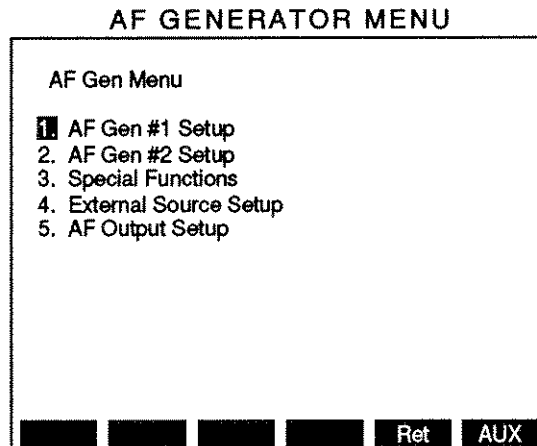
Oscilloscope displays Function Generator Output.



## B. AF GENERATOR MENU OPERATION

When the Function Generator Operation Screen is displayed on CRT, press SETUP Key to access the Function Generator Menu. Many Function Generator Operating Screen parameters may be edited from Function Generator Menu or one of its submenus.

ITEM	DESCRIPTION
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8610013

### 1. AF Gen #1 Setup

Displays Function Generator #1 Menu.

### 2. AF Gen #2 Setup

Displays Function Generator #2 Menu.

### 3. Special Functions

Displays menu listing AF Scan and Tone Remote. Selecting a function displays the Functions Menu.

### 4. External Source Setup

Displays External Source Setup Menu.

### 5. AF Output Setup

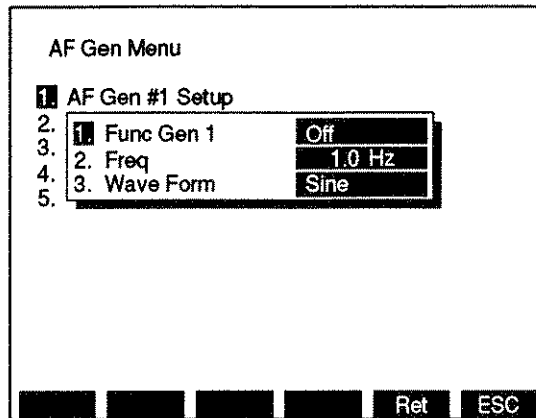
Displays AF Generator Setup Menu.

Selecting "1. AF Gen #1 Setup" displays the Function Generator #1 Menu:

ITEM

DESCRIPTION

FUNCTION GENERATOR #1 MENU



8610014

1. Func Gen 1

Selects Function Generator Status. For Proportional Mode select from 0% to 100%; otherwise select on or off.

2. Freq

Selects Function Generator Frequency. Range is 0.0 to 40000.0 Hz.

3. Wave Form

Selects Function Generator Wave Form. Select Sine, Square, Ramp, Triangle, Pulse, +1 Lvl, 0 Lvl or -1 Lvl.

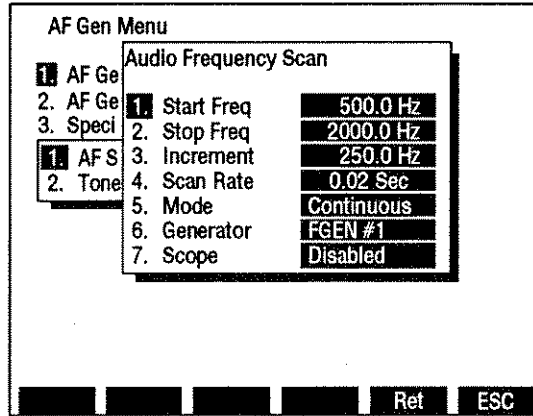
Selecting "2. Func Gen #2 Setup" displays the Function Generator #2 Menu. Function Generator #2 Parameters are identical to those of Function Generator #1.

Selecting "3. Special Functions" displays the Special Functions Menu. Selecting "1. AF Scan" displays the Audio Frequency Scan Menu:

ITEM

DESCRIPTION

AUDIO FREQUENCY SCAN MENU



8610102

1. Start Freq

Selects starting frequency for AF Scan. Range is 0.0 to 40000.0 Hz.

2. Stop Freq

Selects ending frequency for AF Scan. Range is 0.0 to 40000.0 Hz.

3. Increment

Selects increment between generated frequencies. Range is 0.0 to 40000.0 Hz.

4. Scan Rate

Blank if "7. Scope" is enabled. Selects length of time each frequency is generated. Range is 0.00 to 99.99 sec.

5. Mode

Selects AF Scan Mode. Choose Continuous or One Shot. Continuous allows AF Scan to repeat until STOP TEST CONTROL Key is pressed. One Shot Mode generates the AF Scan once. Pressing GO TEST CONTROL Key starts the AF Scan regardless of Mode.

6. Generator

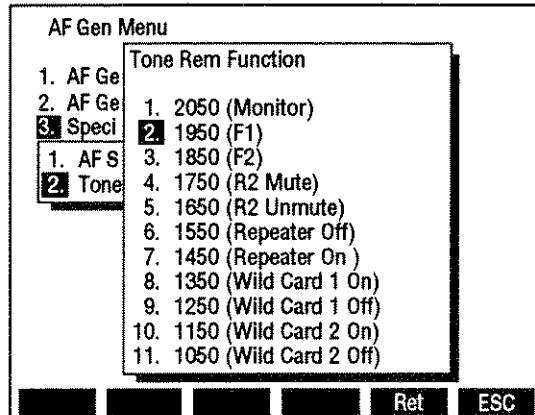
Selects Function Generator used for AF Scan. Toggles between Function Generator #1 or Function Generator #2.

7. Scope

Enables or disables Oscilloscope. Oscilloscope enabled slows Scan Rate.

If "3. Special Functions" is selected and "2. Tone Remote" is selected, the Tone Remote Function Menu appears. Select The Tone Remote Function desired.

### AUDIO FREQUENCY TONE REMOTE FUNCTION MENU

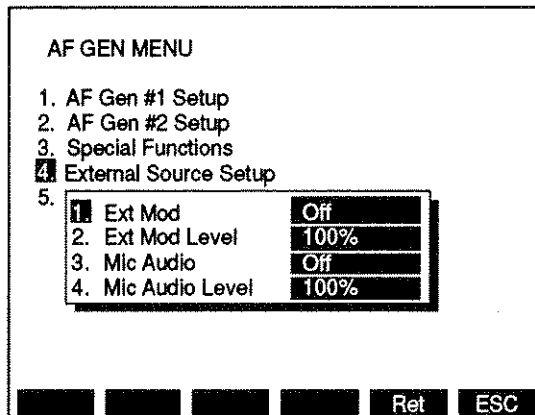


8610158

Selecting "4. External Source Setup" displays the External Source Setup Menu:

ITEM	DESCRIPTION
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### EXTERNAL SOURCE SETUP MENU



8610016

1. Ext Mod

Selects EXT MOD IN Connector as Function Generator Input. Select on or off.

2. Ext Mod Level

Sets EXT MOD IN Connectors Proportional Level. Range is 0% to 100%. Although displayed, Proportional Level is not activated if Proportional Output is off.

ITEM	DESCRIPTION
3. <u>Mic Audio</u>	Selects MIC/ACC IN/OUT Connector as Function Generator Input. Select on or off.
4. <u>Mic Audio Level</u>	Sets MIC/ACC IN/OUT Connectors Proportional Level. Range is 0% to 100%. Although displayed, Proportional Level is not activated if Proportional Output is off.

Selecting "5. AF Output Setup" displays the AF Output Setup Menu:

ITEM	DESCRIPTION
<b>AF OUTPUT SETUP MENU</b>	

8610017

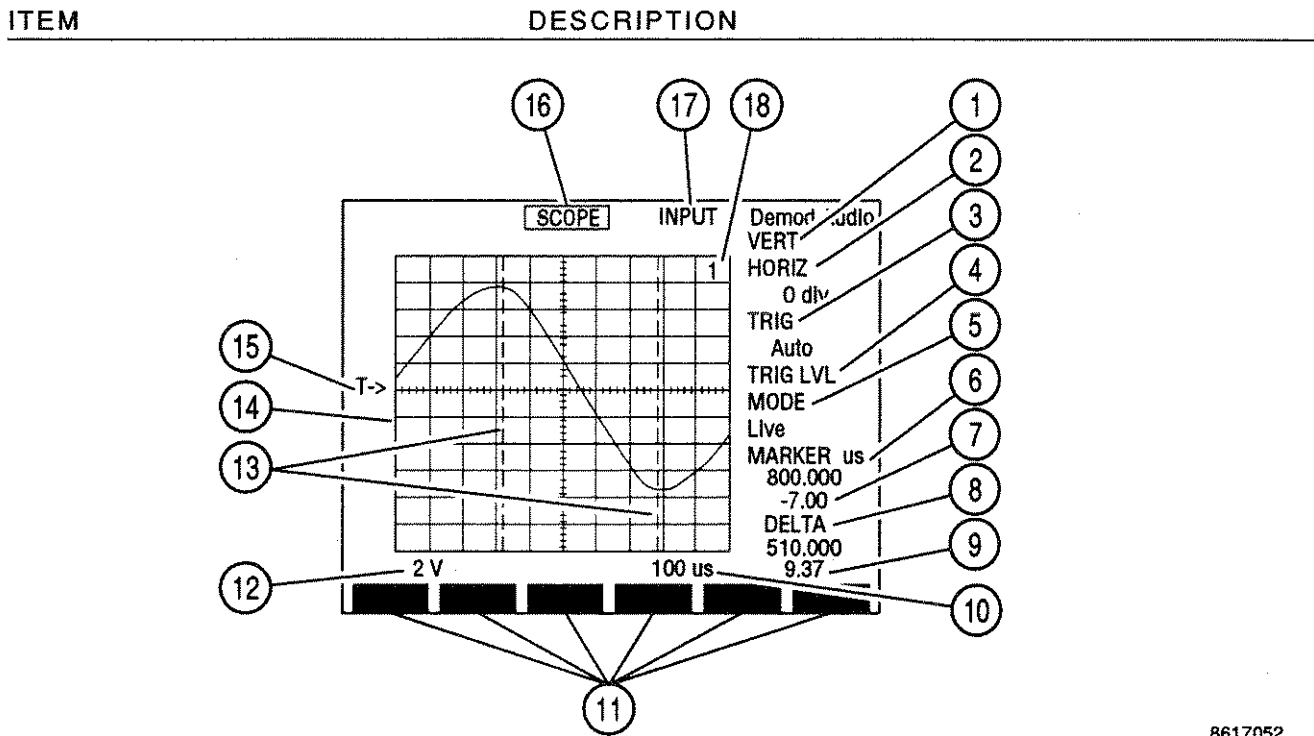
1. To Audio Out Conn  
Sets routing of Function Generator Output to AUDIO OUT Connector. Select on or off.
2. To Speaker  
Sets routing of Function Generator Output to the Speaker. Select on or off.
3. To Demod Out  
Sets routing of Function Generator Output to DEMOD OUT Connector. Select on or off.
4. Func Gen Out Level  
Stores an Output Attenuation Setting for Proportional Output On and another Setting for Proportional Output Off. Range is 0.0000 to 3.1000 V.
5. Proportional Output  
Sets Function Generator Proportional Output to on or off.

### 3-3-7 OSCILLOSCOPE OPERATION SCREEN

Press SCOPE/ANLZ MODE key to access the Oscilloscope Operating Screen. Since both Spectrum Analyzer and Oscilloscope are accessed with the SCOPE/ANLZ MODE Key, it may be necessary to press SCOPE/ANLZ Key twice to access the Oscilloscope Operation Screen. Use the index of screen features to identify the operation screen parameters that may be edited, the value range available to each feature and/or its usage.

When editing, use the FIELD SELECT Keys to move the cursor to the parameter to be edited and press ENTER Key to access the data field. Use the DATA ENTRY Keypad to enter numerical data. Use the DATA SCROLL Spinner or DATA SCROLL UP and DOWN ARROW Keys to select parameters from a list. Parameters with only two possible settings automatically switch to the opposite setting when selected. To access a displayed Meters Operation Screen, move cursor to the Meters Callout and press ENTER.

#### A. SCREEN PARAMETERS



8617052

#### 1. Vertical Trace Adjustment

Adjusts vertical position of Oscilloscope Trace.

#### 2. Horizontal Marker Offset

Adjusts horizontal position of Oscilloscope Trace -12 to +12 divisions. Marker readings (6) adjust to reflect new Trace position.

#### 3. Trigger Setting

Selects Trigger Mode. Select Normal, Auto or One Shot.

**ITEM****DESCRIPTION**

---

**4. Trigger Level Adjust**

Adjusts Trigger Level indicator vertically on Oscilloscope.

**5. MODE Setting**

Displays menu of Oscilloscope Operation Modes. Select Live, Recall, Compare or Average. Live is the normal operation. Recall allows a stored Trace and set of parameters to be recalled. Compare allows the comparing of a recalled Trace and the live Trace. Average produces a steadier Trace.

**6. Marker Reading**

Reads active Marker position relative to Trigger position in Oscilloscope Sweep units. Marker 1 is default marker if neither marker is selected. If "Track" Function is activated, reading corresponds to Marker 1 location.

**7. Marker Voltage Reading**

Appears when AC, DC or GND is the Oscilloscope Input. Reads voltage of Oscilloscope Trace at point of Marker.

**8. DELTA Reading**

Provides time difference between Marker Positions in Oscilloscope Sweep units.

**9. DELTA Voltage Reading**

Appears when AC, DC or GND is the Oscilloscope Input. Reads Trace voltage difference between Marker Positions.

**10. Oscilloscope Sweep Rate**

Select one of the following:

1 $\mu$ s	2 $\mu$ s	5 $\mu$ s
10 $\mu$ s	20 $\mu$ s	50 $\mu$ s
100 $\mu$ s	200 $\mu$ s	500 $\mu$ s
1 ms	2 ms	5 ms
10 ms	20 ms	50 ms
100 ms		

**11. Soft Function Keys**

Soft Function Keys for the Oscilloscope Operation Screen are covered in 3-3-7B.

**ITEM**

**DESCRIPTION**

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**12 Oscilloscope Scale**

Does not appear for Rcvr IF Oscilloscope Input. For AC, DC or GND Oscilloscope Input, select one of the following:

1 mV/div	2 mV/div	5 mV/div
10 mV/div	20 mV/div	50 mV/div
100 mV/div	200 mV/div	500 mV/div
1 V/div	2 V/div	5 V/div
10 V/div	20 V/div	50 V/div

For Demod Audio Oscilloscope Input, select one of the following:

2 kHz/div	4 kHz/div	10 kHz/div
20 kHz/div		

For Func Gen or Ext Mod Oscilloscope Input, select one of the following:

500 mV/div	1 V/div	2.5 V/div
------------	---------	-----------

For RF Pr Lvl Oscilloscope Input, Oscilloscope Scale reads 2 W/div or 200 W/div. Power Meter Ranges of 20, 50 or 100 mW set Oscilloscope Scale to 2 W/div. All other Power Meter Ranges set Oscilloscope Scale to 200 W/div.

Oscilloscope Scale is 4 V/div for SINAD/BER and is not editable.

**13. Markers**

Two Markers are available for use with the Oscilloscope. Markers are selected using Soft Function Keys.

**14. Oscilloscope Grid**

Used to view waveform of INPUT Source.

**15. Trigger Level Indicator**

Level Indicator adjusts vertically on the Oscilloscope Screen using Trigger Level Adjust (4).

**16. Oscilloscope Operation Screen Callout**

Access to display Spectrum Analyzer Operation Screen.

**17. INPUT Source**

Displays INPUT Menu. Select Rcvr IF, Demod Audio, RF Pr Lvl, SINAD/BER, Func Gen, Ext Mod, AC, DC and GND.

**18. Recall Trace Number Callout**

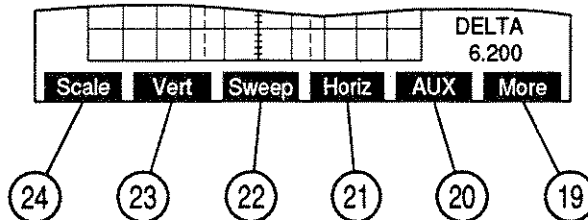
Displays number corresponding to recalled trace. Trace numbers possible are 1 through 9 and are displayed only in Compare and Recall Modes.



## B. SOFT FUNCTION KEYS

The following index lists the Soft Function Keys available for the Oscilloscope Operation Screen.

ITEM	DESCRIPTION
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8617053

19. "More" Soft Function Key F6

Displays additional sets of Soft Function Keys.

20. "AUX" Soft Function Key F5

Displays Auxiliary Functions Menu.

21. "Horiz" Soft Function Key F4

Adjusts horizontal position of Oscilloscope Trace -12 to +12 divisions. Marker readings (6) adjust to reflect new Trace position. In this screen configuration, press F4 to edit Horizontal Oscilloscope Trace.

22. "Sweep" Soft Function Key F3

Selects Oscilloscope Sweep Rate. Select one of the following:

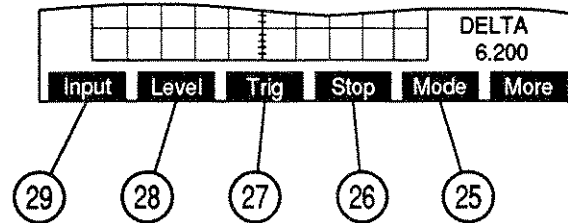
1 $\mu$ s	2 $\mu$ s	5 $\mu$ s
10 $\mu$ s	20 $\mu$ s	50 $\mu$ s
100 $\mu$ s	200 $\mu$ s	500 $\mu$ s
1 ms	2 ms	5 ms
10 ms	20 ms	50 ms
100 ms		

23. "Vert" Soft Function Key F2

Adjusts vertical position of Oscilloscope Trace.

24. "Scale" Soft Function Key

Selects Oscilloscope Scale.



8617054

25. "Mode" Soft Function Key F5

Displays menu of Oscilloscope Operation Modes. Select Live, Recall, Compare or Average.

26. "Stop/Arm" Soft Function Key F4

- "Stop" appears for Normal or Auto Trigger Mode (3). Freezes Oscilloscope Trace. While Trace is stopped, Soft Function Key shows "Start" and is used to resume normal Oscilloscope Operation.
- "Arm" appears for One Shot Trigger Mode. Holds Trace for one screen until pressed again, then current screen is released and the next screen is held.

27. "Trig" Soft Function Key F3

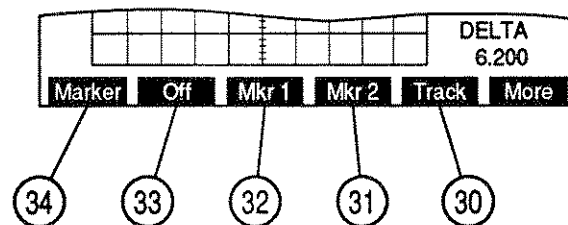
Selects Trigger Mode. Select Auto, Normal or One Shot.

28. "Level" Soft Function Key F2

Adjusts Trigger Level indicator vertically on Oscilloscope.

29. "Input" Soft Function Key F1

Selects Oscilloscope Input. Select Rcvr IF, Demod Audio, RF Pwr Lvl, SINAD/BER, Func Gen, Ext Mod, AC, DC and GND.



8617055

30. "Track" Soft Function Key F5

Activates Marker Tracking locking Markers a constant distance apart. To edit marker locations, press "Marker" Soft Function Key F1 (34). Marker Positions are changed using the DATA SCROLL Spinner. Both Markers move, but maintain the same DELTA Reading (8). Marker Reading (6) displays Marker 1 location.

**ITEM****DESCRIPTION**

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**31. "Mkr 2" Soft Function Key F4**

Selects Marker 2 as the active marker. When active, label highlights in red. Access Marker 2 location using "Marker" Soft Function Key F1 (34). Deactivate by pressing "Mkr 1" Soft Function Key F3 (32) or "Off" Soft Function Key F2 (33).

**32. "Mkr 1" Soft Function Key F3**

Selects Marker 1 as the active marker. When active, label highlights in red. Access Marker 1 location using "Marker" Soft Function Key F1 (34). Deactivate by pressing "Mkr 2" Soft Function Key F4 (32) or "Off" Soft Function Key F2 (33).

**33. "Off" Soft Function Key F2**

Deactivates and removes Markers from screen. "Off" is highlighted in red when activated.

**34. "Marker" Soft Function Key F1**

Activates Markers. Edits selected Marker positions. If a Marker is not selected, Marker 1 is edited.

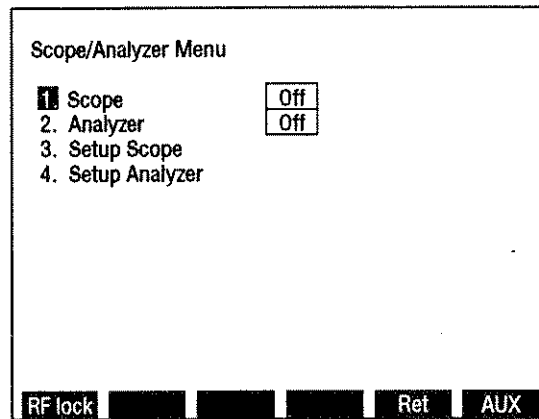
### C. SCOPE/ANALYZER (OSCILLOSCOPE) MENU OPERATION

When the Oscilloscope Operation Screen is displayed on the CRT, press the SETUP Key to access the Scope/Analyzer Menu. Both the Oscilloscope and Spectrum Analyzer Operating Screens may be edited from the Scope/Analyzer Menu or one of its submenus.

**NOTE:** Only one of the "1. Scope" or "2. Analyzer" Menu items may be on at a time, yet both may be turned off.

ITEM	DESCRIPTION
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#### SCOPE/ANALYZER SETUP MENU



8610018

#### 1. Scope

Selects Oscilloscope display for RF Generator, Receiver, Duplex Transmitter and Duplex Receiver Operation Screens. Select on or off.

#### 2. Analyzer

Selects Spectrum Analyzer display for RF Generator, Receiver, Duplex Transmitter and Duplex Receiver Operation Screens. Select on or off.

#### 3. Setup Scope

Displays "Setup Scope" Menu.

#### 4. Setup Analyzer

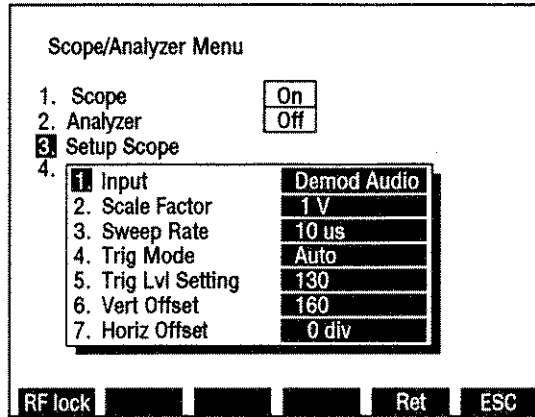
Not applicable for Oscilloscope Operation.

Selecting "3. Setup Scope" displays the Oscilloscope Menu:

ITEM

DESCRIPTION

OSCILLOSCOPE MENU



8610019

1. Input

Selects Oscilloscope Input. Select Rcvr IF, Demod Audio, RF Pwr Lvl, SINAD/BER, Func Gen, Ext Mod, AC, DC or GND.

2 Scale Factor

Blank if Rcvr IF is selected for Oscilloscope Input. For AC, DC or GND Oscilloscope Input, select one of the following:

1 mV/div	2 mV/div	5 mV/div
10 mV/div	20 mV/div	50 mV/div
100 mV/div	200 mV/div	500 mV/div
1 V/div	2 V/div	5 V/div
10 V/div	20 V/div	50 V/div

For Demod Audio Oscilloscope Input, select one of the following:

2 kHz/div	4 kHz/div	10 kHz/div
20 kHz/div	Autorange	

For Func Gen or Ext Mod Oscilloscope Input, select one of the following:

500 mV/div	1 V/div	2.5 V/div
------------	---------	-----------

For RF Pwr Lvl Oscilloscope Input, Oscilloscope Scale reads 2 W/div or 200 W/div. Power Meter Ranges of 20, 50 or 100 mW set Oscilloscope Scale to 2 W/div. All other Power Meter Ranges set Oscilloscope Scale to 200 W/div.

Oscilloscope Scale is 4 V/div for SINAD/BER and is not editable.

**ITEM****DESCRIPTION**

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**3. Sweep Rate**

Selects Oscilloscope Sweep Rate. Select one of the following:

1 $\mu$ s	2 $\mu$ s	5 $\mu$ s
10 $\mu$ s	20 $\mu$ s	50 $\mu$ s
100 $\mu$ s	200 $\mu$ s	500 $\mu$ s
1 ms	2 ms	5 ms
10 ms	20 ms	50 ms
100 ms		

**4. Trig Mode**

Selects Trigger Mode. Select One Shot, Normal or Auto.

**5. Trig Lvl Setting**

Selects Trigger Level. Range is 0 to 255, 0 signifying the bottom of the Oscilloscope grid and 255 signifying the top.

**6. Vert Offset**

Selects vertical Trace Level. Range is 0 to 255, 0 signifying the bottom of the Oscilloscope grid and 255 signifying the top.

**7. Horiz Offset**

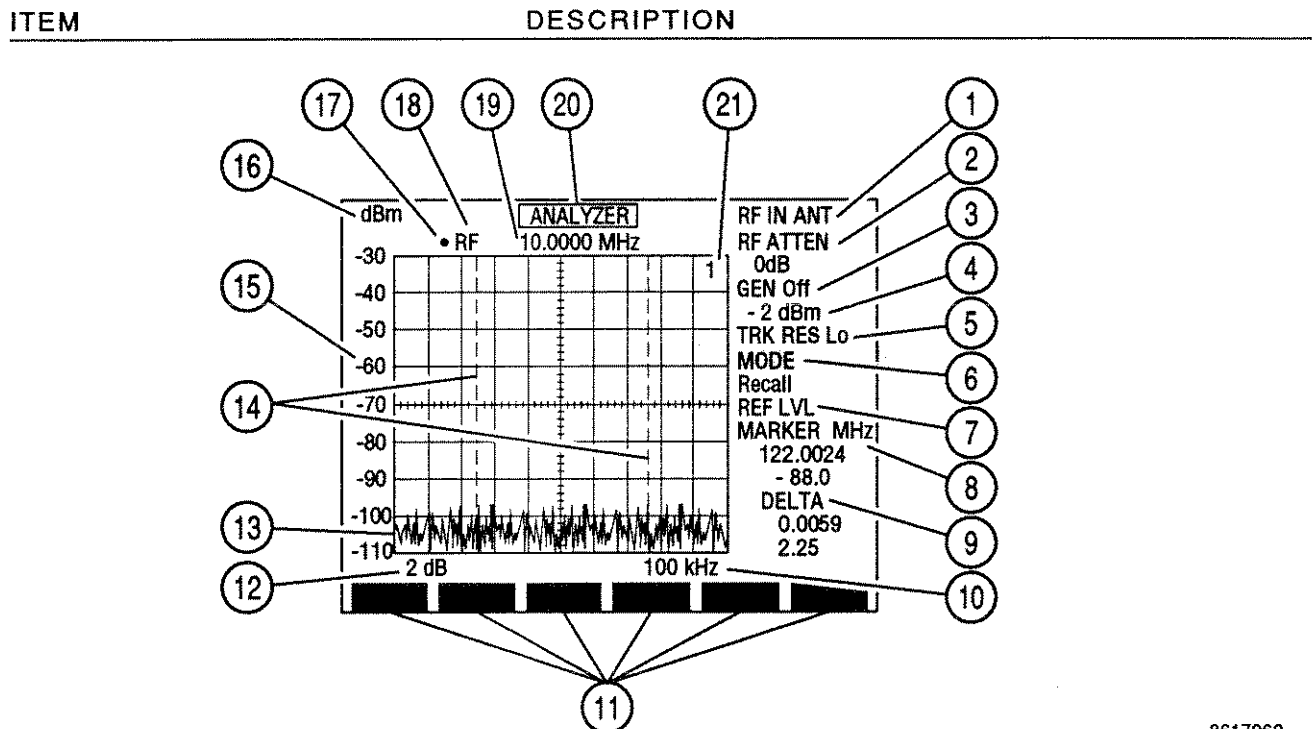
Adjusts horizontal position of Oscilloscope Trace. Select -12 to +12 divisions.

### 3-3-8 SPECTRUM ANALYZER OPERATION SCREEN

Press SCOPE/ANLZ MODE Key to access the Spectrum Analyzer Operating Screen. Since both Spectrum Analyzer and Oscilloscope are accessed with the SCOPE/ANLZ MODE Key, it may be necessary to press SCOPE/ANLZ Key twice to access the Spectrum Analyzer Operation Screen. Use the index of screen features to identify the operation screen parameters that may be edited, the value range available to each feature and/or its usage.

When editing, use the FIELD SELECT Keys to move the cursor to the parameter to be edited and press ENTER Key to access the data field. Use the DATA ENTRY Keypad to enter numerical data. Use the DATA SCROLL Spinner or DATA SCROLL UP and DOWN ARROW Keys to select parameters from a list. Parameters with only two possible settings automatically switch to the opposite setting when selected. To access a displayed Meters Operation Screen, move cursor to the Meters callout and press ENTER.

#### A. SCREEN PARAMETERS



8617060

#### 1. RF Input Source

Select "ANT" (ANTENNA) or "T/R" Connector.

#### 2. RF Input Attenuation

Select 0, 20 or 40 dB.

#### 3. Tracking Generator Setting

Displays current Tracking Generator Output ("T/R", "DPL" or "Off"). Accessed from Analyzer Setup Menu.

ITEM	DESCRIPTION
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4. Tracking Generator Level

Selects Tracking Generator Level. Range is 0.0 to -127.0 dBm.

5. Tracking Resolution Setting

Selects Tracking Generator Resolution. Toggles between "Lo" and "Hi" resolution. "Lo" allows trace to sweep faster with less resolution. "Hi" resolution gives a slower sweep with greater trace accuracy.

6. MODE Setting

Selects Analyzer Operation Mode. Select Live, Recall (recalls a stored set of parameters with Trace), Compare (compares Live Trace with Recalled Trace), Peak Hold or Average.

7. REF LVL

Appears with 2 dB/div Scale. Adjusts vertical reference of Analyzer Trace using DATA SCROLL Spinner. Analyzer Grid Vertical Scale changes to reflect different reference.

8. MARKER Frequency

Access turns active Marker on. Displays Analyzer Center Frequency plus Marker adjustment. With Marker on, Trace vertical position appears below Marker reading in Analyzer Grid Units.

9. DELTA Reading

Upper Reading provides readout of frequency difference between Markers. Lower Reading provides difference in signal amplitude between Markers.

10. Scan Width

Select 0 kHz or one of the following:

- |         |         |         |
|---------|---------|---------|
| 1 kHz   | 2 kHz   | 5 kHz   |
| 10 kHz  | 20 kHz  | 50 kHz  |
| 100 kHz | 200 kHz | 500 kHz |
| 1 MHz   | 2 MHz   | 5 MHz   |
| 10 MHz  | 20 MHz  | 50 MHz  |
| 100 MHz |         |         |

11. Soft Function Keys

Soft Function Keys for the Spectrum Analyzer Operation Screen are covered in 3-3-8B.

12. Units/Division Factor

Toggles Units/Division Factor between 2 and 10 dB/div.

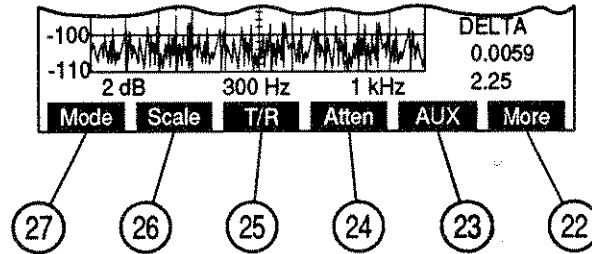


ITEM	DESCRIPTION
13. <u>Analyzer Trace</u>	Spectrum Analyzer Trace displays visual readout of amplitude versus frequency of measured input.
14. <u>Markers</u>	When Markers are on, two vertical graduated markers appear on the screen.
15. <u>Analyzer Grid Vertical Scale</u>	Vertical Scale displays in units of Analyzer Grid Scale (16). Numeric vertical scale is dependent on per Units/Division Factor (12).
16. <u>Analyzer Grid Scale</u>	For "ANT" selected as RF Input Source (1), select dB $\mu$ W, dBm, dBV, dBmV or dB $\mu$ V. For "T/R" selected as RF IN (1), select dBW or dBm.
17. <u>Squelch Indicator Light</u>	Green dot appears when squelch is broken.
18. <u>RF Frequency Setting</u>	Selects Analyzer Center Frequency. Range is 0.2500 to 999.9999 MHz. Center Frequency is forced to 500 MHz if Scan width is 100 MHz.
19. <u>RF Frequency Display</u>	Displays RF Frequency setting.
20. <u>ANALYZER Operation Screen Callout</u>	Access ANALYZER callout to display Oscilloscope Operation Screen.
21. <u>Recall Trace Number Callout</u>	Displays number of Recalled Trace. Displayed in Compare and Recall Modes only.

## B. SOFT FUNCTION KEYS

The following index lists the sets of Soft Function Keys available for the Spectrum Analyzer Operation Screen.

ITEM	DESCRIPTION
------	-------------



8617061

22. "More" Soft Function Key F6

Displays additional sets of Soft Function Keys.

23. "AUX" Soft Function Key F5

Displays Auxiliary Functions Menu.

24. "Atten" Soft Function Key F4

Selects RF Input Attenuation. Select 0, 20 or 40 dB.

25. "T/R" or "Ant" Soft Function Key F3

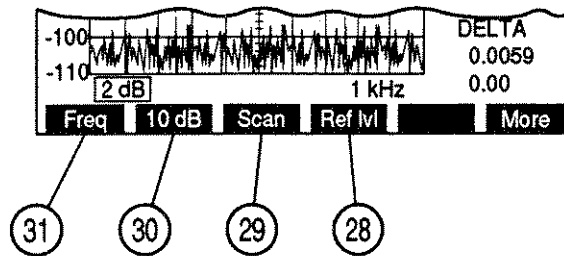
Toggles RF Input Source between "T/R" and "ANT" (ANTENNA).

26. "Scale" Soft Function Key F2

Selects Analyzer Grid Scale. For "ANT" selected as RF IN (1), select dB $\mu$ W, dBm, dBV, dBmV or dB $\mu$ V. For "T/R" selected as RF IN (1), select dBW or dBm.

27. "Mode" Soft Function Key F1

Selects Analyzer Operation Mode. Select Live, Recall, Compare, Peak Hold and Average.



8617062

28. "Ref lvl" Soft Function Key F4

Appears with 2 dB/div Scale. Adjusts vertical reference of Analyzer Trace using DATA SCROLL Spinner. Analyzer Grid Vertical Scale (15) changes to reflect different reference.

29. "Scan" Soft Function Key F3

Selects Analyzer Scan Width. Select 0 kHz or one of the following:

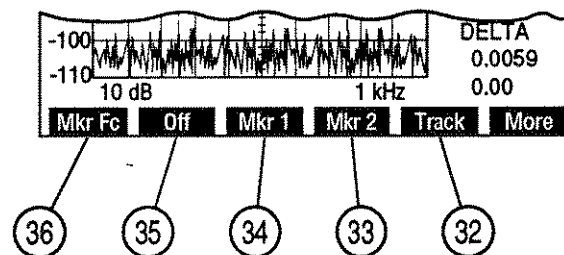
1 kHz	2 kHz	5 kHz
10 kHz	20 kHz	50 kHz
100 kHz	200 kHz	500 kHz
1 MHz	2 MHz	5 MHz
10 MHz	20 MHz	50 MHz
100 MHz		

30. "2 dB"/"10 dB" Soft Function Key F2

Toggles Units/Division Factor (12) between 2 and 10 dB/div.

31. "Freq" Soft Function Key F1

Selects Analyzer Center Frequency. Range is 0.2500 to 999.9999 MHz. Center Frequency is forced to 500 MHz if Scan Width is 100 MHz.



8617059

32. "Track" Soft Function Key F5

Activates Marker Tracking and edits the Markers position. Tracking locks Markers a constant distance apart. Marker positions are changed using the DATA SCROLL Spinner. With Tracking on, Marker Frequency reading (8) displays Marker 1 position and Delta Frequency reading remains constant.

## ITEM

## DESCRIPTION

33. "Mkr 2" Soft Function Key F4

Selects Marker 2 as the active marker. Accessing Marker Callout (8) edits Marker 2 position when Marker 2 is active. "Mkr 2" appears in red while Marker 2 is active. Deactivate by pressing "Mkr 1", "Track" or "Off" Soft Function Key. Marker 2 remains visible while not active unless "Off" is chosen.

34. "Mkr 1" Soft Function Key F3

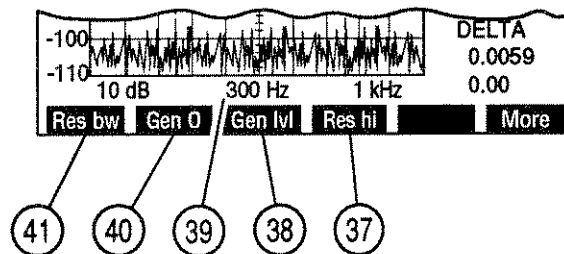
Selects Marker 1 as the active marker. Accessing Marker Frequency (8) edits Marker 1 position unless Marker 2 is active. "Mkr 1" appears in red while Marker 1 is active. Deactivate by pressing "Mkr 2", or "Off" Soft Function Key. Marker 1 remains visible while not active unless "Off" is chosen.

35. "Off" Soft Function Key F2

Turns Markers off. When off, Markers do not appear on the Analyzer display.

36. "Mkr Fc" Soft Function Key F1

Appears when a Marker is active. Resets RF Frequency Setting (18) to the active Marker Frequency Setting (8).



8617063

37. "Res hi"/"Res lo" Soft Function Key F4

Toggles Analyzer Trace resolution between high and low. High resolution produces a more accurate display, low resolution causes the Trace to sweep faster.

38. "Gen lvl" Soft Function Key F3

Selects Tracking Generator Output Level. For T/R RF Input, range is 7.0 to -120.0 dBm or 0.224 mV to 0.501 V. For ANT RF Input, range is 0 to -137 dBm or 0.031 mV to 0.224 V

39. Resolution Bandwidth Setting

Appears if Tracking Generator is on. Selects Resolution Bandwidth. Select 300 Hz, 3 kHz, 30 kHz, 300 kHz or 3 MHz.

ITEM	DESCRIPTION
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40. "Gen 0"/"Gen 1" Soft Function Key F2

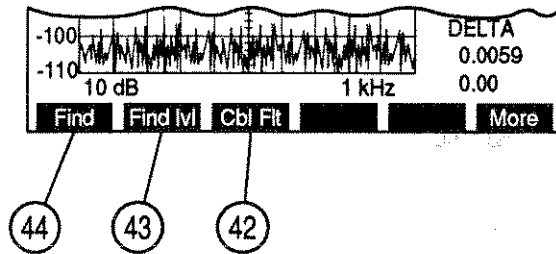
Toggles Tracking Generator on or off. "Gen 0" displays if Tracking Generator is on. "Gen 1" displays if Tracking Generator is off.

41. "Res bw"/"Norm" Soft Function Key F1

- If Tracking Generator is on, "Res bw" is shown. Selects Resolution Bandwidth. Select 300 Hz, 3 kHz, 30 kHz, 300 kHz or 3 MHz.
- When Tracking Generator is off, "Norm" is shown. Access normalizes the Analyzer Trace on the Analyzer Grid to match the RF Generator Output.

The following set of Soft Function Keys appear if Tracking Generator is off.

ITEM	DESCRIPTION
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8607062

42. "Cbl Fit" Soft Function Key F3

Starts Cable Fault Operation. Cable Fault determines the distance to point of fault in a cable and displays this length. "Cbl Fit" is displayed in red when active.

43. "Find lvl" Soft Function Key F2

Adjusts the Find Reference Level of the Find Function.

44. "Find" Soft Function Key F1

Does not appear when Cable Fault is active. Starts the Find Function. Find Function sets the RF Frequency to the first frequency with a signal greater in amplitude than the Find Reference Level.

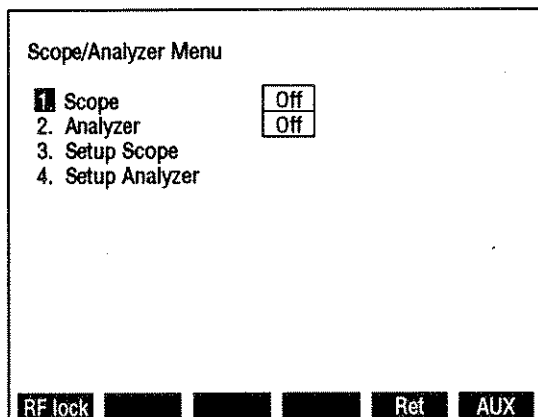
### C. SCOPE/ANALYZER (SPECTRUM ANALYZER) MENU

When Spectrum Analyzer Operation Screen is displayed on the CRT, press SETUP to access Scope/Analyzer Menu. Both Oscilloscope and Spectrum Analyzer Operating Screens may be edited from Scope/Analyzer Menu or one of its submenus.

**NOTE:** Only one of the "1. Scope" or "2. Analyzer" menu items may be on at a time, yet both may be turned off.

ITEM	DESCRIPTION
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#### SCOPE/ANALYZER SETUP MENU



8610018

#### 1. Scope

Selects Oscilloscope display for RF Generator, Receiver, Duplex Transmitter and Duplex Receiver Operation Screens. Select on or off.

#### 2. Analyzer

Selects Spectrum Analyzer display for RF Generator, Receiver, Duplex Transmitter and Duplex Receiver Operation Screens. Select on or off.

#### 3. Setup Scope

Not applicable for Spectrum Analyzer Operation.

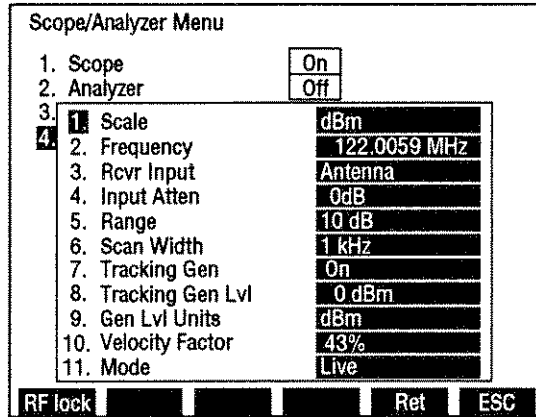
#### 4. Setup Analyzer

Displays Setup Analyzer Menu.

When "4. Setup Analyzer" is selected the Analyzer Parameter Menu appears:

ITEM DESCRIPTION

SETUP ANALYZER MENU



8610069

1. Scale

Selects Vertical Scale Grid. Select dB $\mu$ W, dBm, dBV, dBmV or dB $\mu$ V for ANT RF Input. Select dBm or dBW for T/R RF Input.

2. Frequency

Selects Analyzer Center Frequency. Range is 0.2500 to 999.9999 MHz.

3. Rcvr Input

Selects Analyzer Input Connector. Select ANT or T/R Connector.

4. Input Aatten

Selects Input Attenuation. Select 0, 20 and 40 dB.

5. Range

Selects Units/Division Factor. Select either 2 or 10 dB.

6. Scan Width

Selects Analyzer Scan Width. Select 0 kHz (Zero Scan) or one of the following:

- |         |         |         |
|---------|---------|---------|
| 1 kHz   | 2 kHz   | 5 kHz   |
| 10 kHz  | 20 kHz  | 50 kHz  |
| 100 kHz | 200 kHz | 500 kHz |
| 1 MHz   | 2 MHz   | 5 MHz   |
| 10 MHz  | 20 MHz  | 50 MHz  |
| 100 MHz |         |         |

**ITEM****DESCRIPTION**

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**7. Tracking Gen**

Toggles Tracking Generator between on or off.

**8. Tracking Gen Lvl**

Selects Tracking Generator Output Level. For T/R RF Input, range is 0 to -137 dBm or 0.224  $\mu$ V to 0.501 V. For ANT RF Input, range is +7.0 to 120.0 dBm or 0.031  $\mu$ V to 0.224 V.

**9. Gen Lvl Units**

Toggles Generator Level Units to dBm or volts.

**10. Velocity Factor**

Selects Velocity Factor for Cable Fault Operation. Range is 0.0% to 100%.

**11. Mode**

Selects Analyzer Operation Mode. Select Live, Recall (recalls a stored set of parameters with Trace), Compare (compares Live Trace with Recalled Trace), Peak Hold or Average.



### 3-3-9 METER OPERATION SCREENS AND MENUS

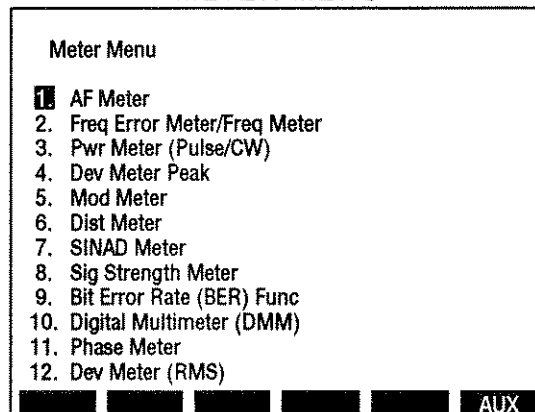
Each meter has an operation screen and a setup menu. Meter Operation Screens are accessed from other Operation Screens by moving the cursor to the Meter callout and pressing the ENTER Key. When a Meter Operation Screen is accessed from another operation screen, the operator returns to that screen by pressing "Ret" Soft Function Key F6.

Direct access to meters is made through the Meter Menu. Press the MTRS MODE Key to display the Meter Menu. Access the desired Meter Operation Screen by pressing the indicated number key or by moving the menu highlight to the desired menu number and pressing the ENTER Key. Setup Menus for each meter are accessed by pressing the SETUP Key.

Many meter parameters are accessed or enabled from the Meter Operation Screen but some are only accessed from the setup menu for that meter. Use FIELD SELECT Keys to move the Meter Operation Screen cursor to the parameter to be edited and press the ENTER Key to access its data field or to enable or disable the feature. Use the DATA ENTRY Keypad to enter numeric data. Use the DATA SCROLL Spinner or DATA SCROLL UP And DOWN Keys to select from lists. Parameters with only two possible settings (such as on/off) automatically toggle to the opposite setting when selected.

Use the index of meter parameters on the following pages to identify the meter parameters which are edited from the Meter Operation Screens and which must be edited from the individual meter's setup menu:

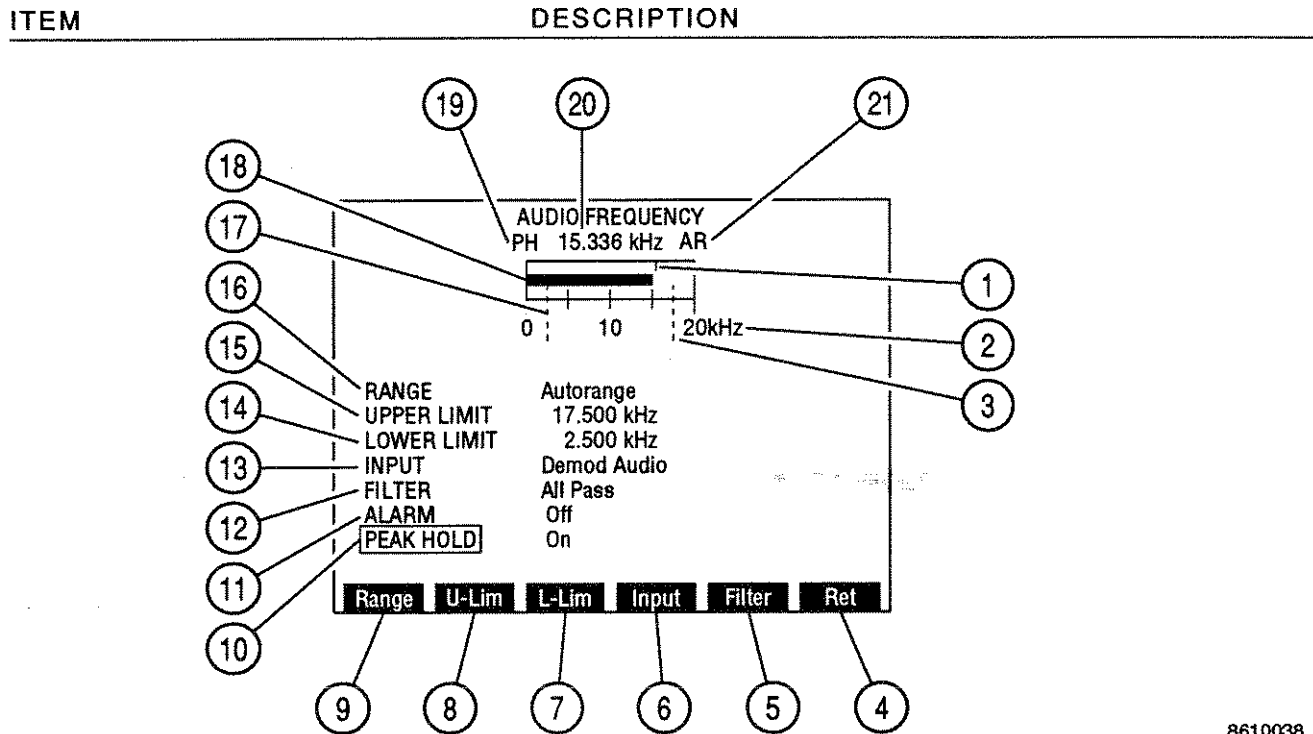
#### METER MENU



8610001

## A. AF METER OPERATION SCREEN

With the Meter Menu displayed on the CRT, press "1" on the DATA ENTRY Keypad to access the AF Meter Operation Screen:



8610038

### 1. "Peak Hold" Indicator

Appears when Peak Hold is on. Yellow indicator line shows highest point of meter deflection.

### 2. Meter Range Scale

Meter scale of four divisions is marked from 0 to the limits of the active scale with center division labeled with the midpoint of the range.

### 3. Upper Limit Indicator

When Upper Limit feature is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set. The indicator appears at the right edge of the meter window if the limit is set higher than the meter range.

### 4. "Ret"/"ESC" Soft Function Key F6

- When editing a parameter, "ESC" is shown. Stops editing process and voids any changes to parameter.
- "Ret" displays the last accessed Operation Screen.

ITEM	DESCRIPTION
5. <u>"Filter" Soft Function Key F5</u>	Selects AF Filter. Select All Pass, Low-Pass or High-Pass. Cutoff frequencies are set from AF Meter Setup Menu.
6. <u>"Input" Soft Function Key F4</u>	Selects AF Meter Input. Select Ext Mod, Demod Audio, Func Gen Out, SINAD/BER or RF Power.
7. <u>"L-Lim" Soft Function Key F3</u>	Activates and selects Lower Limit. Range is 0.000 to 200.0 kHz. Lower Limit is deactivated from AF Meter Setup Menu.
8. <u>"U-Lim" Soft Function Key F2</u>	Activates and selects Upper Limit. Range is 0.000 to 200.0 kHz. Upper Limit is deactivated from AF Meter Setup Menu.
9. <u>"Range" Soft Function Key F1</u>	Selects AF Meter Range. Select Autorange, 200 Hz, 2 kHz, 20 kHz or 200 kHz.
10. <u>PEAK HOLD</u>	Toggles Peak Hold feature between on and off.
11. <u>ALARM</u>	Toggles Alarm between off and on. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
12. <u>FILTER</u>	Selects AF Filter. Select All Pass, Low-Pass or High-Pass. Cutoff frequencies are set from AF Meter Setup Menu.
13. <u>INPUT</u>	Selects AF Meter Input. Select Ext Mod, Demod Audio, Func Gen Out, SINAD/BER or RF Power.
14. <u>LOWER LIMIT</u>	Activates and selects Lower Limit. Range is 0.000 to 200.0 kHz. Lower Limit is deactivated from AF Meter Setup Menu.
15. <u>UPPER LIMIT</u>	Activates and selects Upper Limit. Range is 0.000 to 200.0 kHz. Upper Limit is deactivated from AF Meter Setup Menu.

## ITEM

## DESCRIPTION

16. RANGE

Selects AF Meter Range. Select Autorange, 200 Hz, 2 kHz, 20 kHz or 200 kHz.

17. Lower Limit Indicator

When the Lower Limit feature is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.

18. Meter Indicator Bar

Displays Frequency Error reading. Bar turns red if Upper or Lower Limit is exceeded. Bar turns yellow if the maximum of the current range is reached.

19. PH

Appears above left corner of the meter window if Peak Hold (10) is on.

20. Digital Meter Readout

Provides digital readout of the meter indication. Readout shows highest meter indication reached when Peak Hold (10) is on.

21. AR Callout

Appears above upper right corner of the meter window when Autorange is selected for Range (16). The Range Scale (2) changes to the next higher scale when meter indicator reaches the edge of the meter window. Range changes to the next lower scale if the meter indicator falls to a level of about 1/2 of the lowest scale division.

With the AF Meter Operation Screen displayed on the CRT, press the SETUP Key to access the AF Meter Menu:

**AF METER MENU**

AF Meter Menu	
1. <input checked="" type="checkbox"/> Select AF Meter In	Demod Audio
2. Select Filter	All Pass
3. Meter Range	Autorange
4. Gate Time	1 Second
5. Select Peak Hold	On
6. Upper Lmt	On
7. Set Upper Lmt	17.500 kHz
8. Lower Lmt	On
9. Set Lower Lmt	2.500 kHz
10. Set Alarm	Off

Ret    AUX

8610002

ITEM	DESCRIPTION
1. <u>Select AF Meter In</u>	Selects AF Meter Input. Select Ext Mod, Demod Audio, Func Gen Out, SINAD/BER or RF Power.
2. <u>Select Filter</u>	Selects AF Meter Filter. Select All Pass, Low-Pass or High-Pass. If Low-Pass or High-Pass is selected, a data field appears allowing entry of the cutoff frequency. Range for the Low-Pass cutoff frequency is 0.1 to 30 kHz, for the High-Pass, 0.5 to 20 kHz.
3. <u>Meter Range</u>	Selects AF Meter Range. Select Autorange, 200 Hz, 2, 20 or 200 kHz.
4. <u>Gate Time</u>	Toggles Gate Time to 1 or 10 sec. Longer Gate Times produce more accurate slower readings.
5. <u>Select Peak Hold</u>	Toggles Peak Hold feature on or off.
6. <u>Upper Lmt</u>	Toggles Upper Limit on or off.
7. <u>Set Upper Lmt</u>	Selects Upper Limit Level. Range is 0.000 to 200.0 kHz.

ITEM

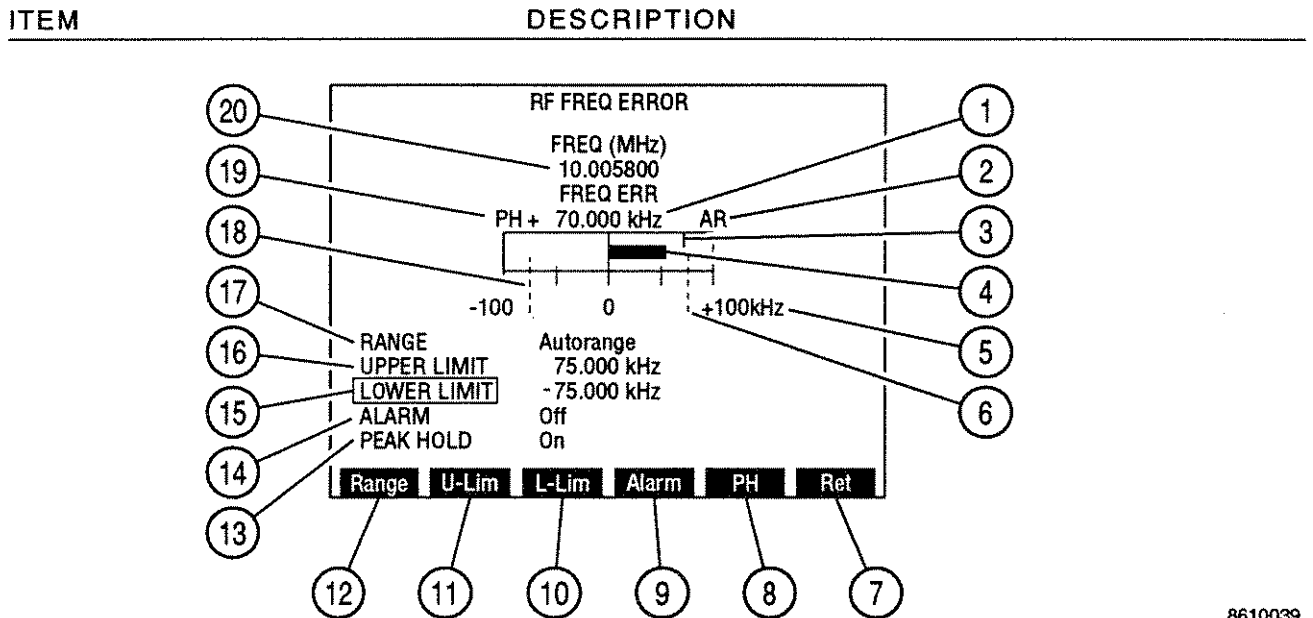
DESCRIPTION

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- 8. Lower Lmt  
Toggles Lower Limit on or off.
- 9. Set Lower Lmt  
Selects Lower Limit Level. Range is 0.000 to 200.0 kHz.
- 10. Set Alarm  
Toggles Alarm on or off. Enables Alarm sounds when an Upper or Lower Limit is exceeded.

## B. FREQUENCY ERROR METER

With the Meter Menu displayed on the CRT, press "2" DATA ENTRY Key to access the Frequency Error Meter Operation Screen:



8610039

### 1. Frequency Error Digital Readout

Provides a digital readout of the difference between the Received Frequency and the Receiver Frequency Setting. Readout shows the highest meter indication reached when Peak Hold (13) is on.

### 2. AR Callout

Appears above upper right corner of the meter window when Autorange is selected for Range (17). The Range Scale (5) changes to the next higher scale when the Meter Indicator Bar (3) reaches the edge of the meter window. The range changes to the next lower scale if the meter indicator bar falls to a level of about 1/2 of the lowest scale division.

### 3. "Peak Hold" Indicator

Appears when Peak Hold is on. Yellow indicator line shows highest point of positive meter deflection when the Frequency Error is positive. When Frequency Error is negative, a yellow indicator line appears in the negative half of the meter window and indicates the lowest point of negative meter deflection.

### 4. Meter Indicator Bar

Displays Frequency Error reading. Bar turns red if Upper or Lower Limit is exceeded. Bar turns yellow if the current range is surpassed.

## ITEM

## DESCRIPTION

5. Meter Range Scale

The meter scale of four divisions is marked from "-" the scale limit on the left to "+" the scale limit on the right. The center division of the scale is always marked "0".

6. Upper Limit Indicator

When Upper Limit feature is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set. The line appears at the right edge of the meter window if the limit is set higher than the meter range. The Upper Limit is positive and appears on the right half of the meter window.

7. "Ret"/"ESC" Soft Function Key F6

- When editing a parameter, "ESC" is shown. Stops editing process and voids any changes to parameter.
- "Ret" displays the last accessed Operation Screen.

8. "PH" Soft Function Key F5

Toggles Peak Hold feature on or off.

9. "Alarm" Soft Function Key F4

Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.

10. "L-Lim" Soft Function Key F3

Activates and selects Lower Limit. Range is 0.000 to 100.000 kHz. Lower Limit is deactivated from Frequency Error Meter Setup Menu.

11. "U-Lim" Soft Function Key F2

Activates and selects Upper Limit. Range is 0.000 to 100.000 kHz. Upper Limit is deactivated from Frequency Error Meter Setup Menu.

12. "Range" Soft Function Key F1

Selects Frequency Error Meter Range. Select Autorange,  $\pm 100$  Hz,  $\pm 1$  kHz,  $\pm 10$  kHz or  $\pm 100$  kHz.

13. PEAK HOLD

Toggles Peak Hold feature on or off.

14. ALARM

Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.



**ITEM****DESCRIPTION**

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**15. LOWER LIMIT**

Activates and selects Lower Limit. Range is 0.000 to 100.000 kHz. Lower Limit is deactivated from Frequency Error Meter Setup Menu.

**16. UPPER LIMIT**

Activates and selects Upper Limit. Range is 0.000 to 100.000 kHz. Upper Limit is deactivated from Frequency Error Meter Setup Menu.

**17. RANGE**

Selects Frequency Error Meter Range. Select Autorange,  $\pm 100$  Hz,  $\pm 1$  kHz,  $\pm 10$  kHz or  $\pm 100$  kHz.

**18. Lower Limit Indicator**

When Lower Limit feature is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set. The line appears at the left edge of the meter window if Limit is set lower than the meter range. The Lower Limit is negative and appears on the left half of the meter window.

**19. PH**

Indicator appears above the left corner of the meter window if Peak Hold (13) is on.

**20. Received Frequency Digital Readout**

Provides a digital readout of the received frequency in MHz.

With the Frequency Error Meter Operation Screen displayed on the CRT, press the SETUP Key to access the Frequency Error Meter Menu:

ITEM DESCRIPTION

FREQUENCY ERROR METER MENU

RF Frequency Error Meter Menu	
1. Meter Range	Autorange
2. Gate Time	1 Second
3. Select Peak Hold	On
4. Upper Lmt	On
5. Set Upper Lmt	75.000 kHz
6. Lower Lmt	On
7. Set Lower Lmt	-75.000 kHz
8. Set Alarm	Off

Ret AUX

8610003

1. Meter Range

Selects Frequency Error Meter Range. Select Autorange,  $\pm 100$  Hz,  $\pm 1$  kHz,  $\pm 10$  kHz or  $\pm 100$  kHz.

2. Gate Time

Toggles Gate Time to 0.1 or 1 Sec. Longer Gate Times produce more accurate slower readings.

3. Select Peak Hold

Toggles Peak Hold feature on or off.

4. Upper Lmt

Toggles Upper Limit on or off.

5. Set Upper Lmt

Selects Upper Limit Level. Range is 0.000 to 100.0 kHz.

6. Lower Lmt

Toggles Lower Limit on or off.

7. Set Lower Lmt

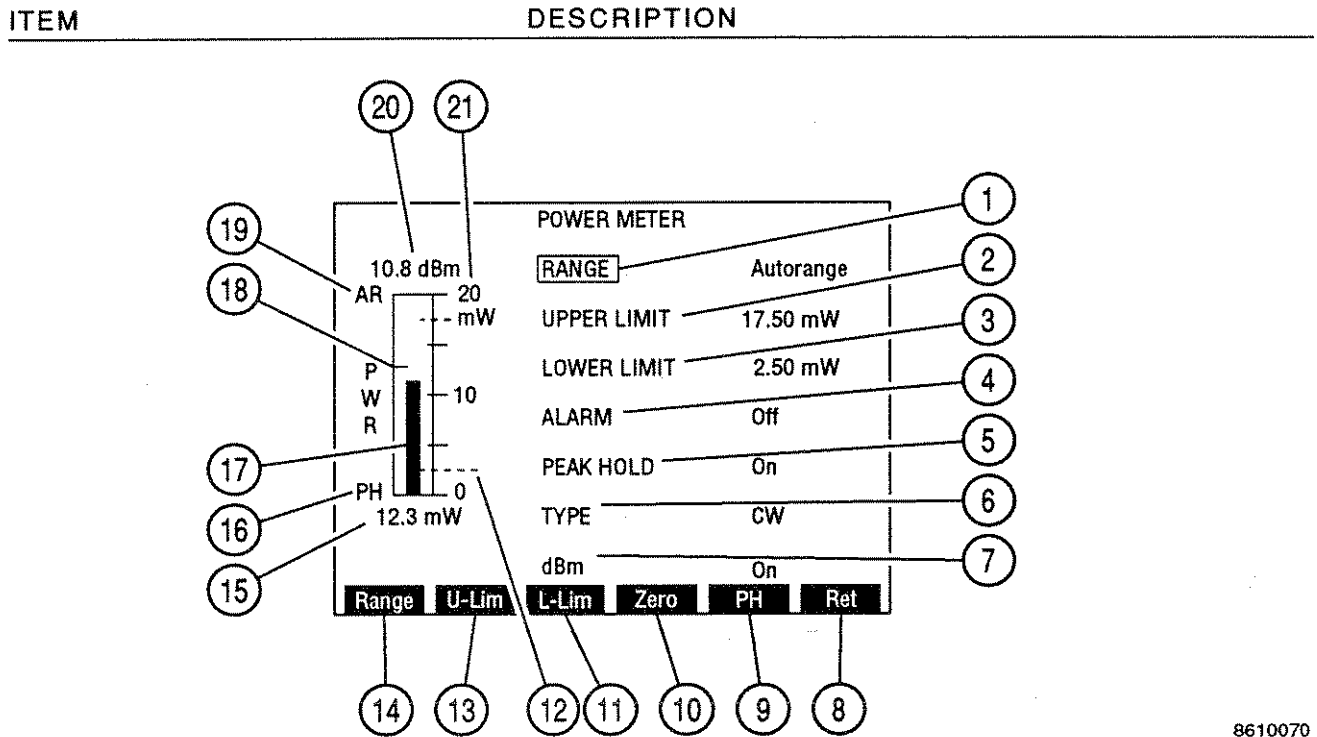
Selects Lower Limit Level. Range is 0.000 to 100.0 kHz. Value is negative.

8. Set Alarm

Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.

### C. POWER METER

With the Meter Menu displayed on the CRT, press "3" DATA ENTRY Key to access the Power Meter Operation Screen:



8610070

#### 1. RANGE

Selects Power Meter Range. Select one of the following:

20 mW	50 mW	100 mW
200 mW	500 mW	1 W
2 W	5 W	10 W
20 W	50 W	100 W
200 W	Autorange	

#### 2. UPPER LIMIT

Activates and selects Upper Limit. Range is 0.0 to 200.0 W. Upper Limit is turned off from Power Meter Setup Menu.

#### 3. LOWER LIMIT

Activates and selects Lower Limit. Range is 0.0 to 200.0 W. Lower Limit is turned off from Power Meter Setup Menu.

#### 4. ALARM Callout

Toggles alarm on or off. Enabled alarm sounds when Upper or Lower Limit is exceeded.

ITEM	DESCRIPTION
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5. PEAK HOLD

Toggles Peak Hold feature on or off.

6. TYPE

Displays the type of Power Meter in use. CW is the type available at this time.

7. dBm

Toggles dBm readout on or off. Readout appears above Meter Scale when on.

8. "Ret"/"ESC" Soft Function Key F6

- When editing a parameter, "ESC" is shown. Stops editing process and voids any changes to parameters.
- "Ret" displays the last accessed Operation Screen.

9. "PH" Soft Function Key F5

Toggles Peak Hold feature on or off.

10. "Zero" Soft Function Key F4

Zeros Power Meter reading if Range is 20 mW or 20 W.

11. "L-Lim" Soft Function Key F3

Activates and selects Lower Limit. Range is 0.0 to 200.0 W. Lower Limit is turned off from Power Meter Setup Menu.

12. Lower Limit Indicator

When Lower Limit is on, a dotted blue line appears across the meter window at the point on the scale where the Limit is set.

13. "U-Lim" Soft Function Key F2

Activates and selects Upper Limit. Range is 0.0 to 200.0 W. Upper Limit is turned off from Power Meter Setup Menu.

14. "Range" Soft Function Key F1

Selects Power Meter Range. Select one of the following:

20 mW	50 mW	100 mW
200 mW	500 mW	1 W
2 W	5 W	10 W
20 W	50 W	100 W
200 W	Autorange	

ITEM	DESCRIPTION
15. <u>Digital Readout</u>	Displays digital readout of the Power Meter in W or mW.
16. <u>PH</u>	Appears at the lower left corner of the meter window when Peak Hold (5) is on.
17. <u>Meter Indicator Bar</u>	Displays Power Meter reading. Bar turns red when an Upper or Lower Limit is exceeded. Bar turns yellow if the current range is surpassed.
18. <u>Peak Hold Indicator</u>	Appears when Peak Hold is on. Yellow indicator line shows the highest point of meter deflection.
19. <u>AR</u>	Appears at the upper right side of the meter window when Autorange is selected for Range. The Range Scale changes to the next higher scale when the meter bar reaches the edge of the meter window. The range changes to the next lower scale if the meter bar falls to a level of about 1/2 of the lowest scale division.
20. <u>dBm Readout</u>	Appears when dBm (7) is on. Provides a digital readout in dBm of the meter reading.
21. <u>Meter Range Scale</u>	The meter scale of four divisions is marked from 0 to the limits of the active scale with the center division labeled with the midpoint of the range.

With the Power Meter Operation Screen displayed on the CRT, press the SETUP Key to access the Power Meter Menu:

ITEM DESCRIPTION

**POWER METER MENU**

Power Meter Menu	
1. Meter Range	Autorange
2. Measurement Type	CW
3. dBm Enable	On
4. Select Peak Hold	On
5. Upper Lmt	On
6. Set Upper Lmt	17.5 mW
7. Lower Lmt	On
8. Set Lower Lmt	2.5 mW
9. Set Alarm	Off

Ret AUX

8610004

1. Meter Range

Selects Power Meter Range. Select one of the following:

20 mW	50 mW	100 mW
200 mW	500 mW	1 W
2 W	5 W	10 W
20 W	50 W	100 W
200 W	Autorange	

2. Measurement Type

Displays type of Power Measurement. CW is the type available at this time.

3. dBm Enable

Toggles dBm digital readout on or off.

4. Select Peak Hold

Toggles Peak Hold feature on or off.

5. Upper Lmt

Toggles Upper Limit on or off.

6. Set Upper Lmt

Select Upper Limit Level. Range is 0.0 mW to 200.0 W.

7. Lower Lmt

Toggles Lower Limit on or off.

**ITEM****DESCRIPTION**

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**8. Set Lower Lmt**

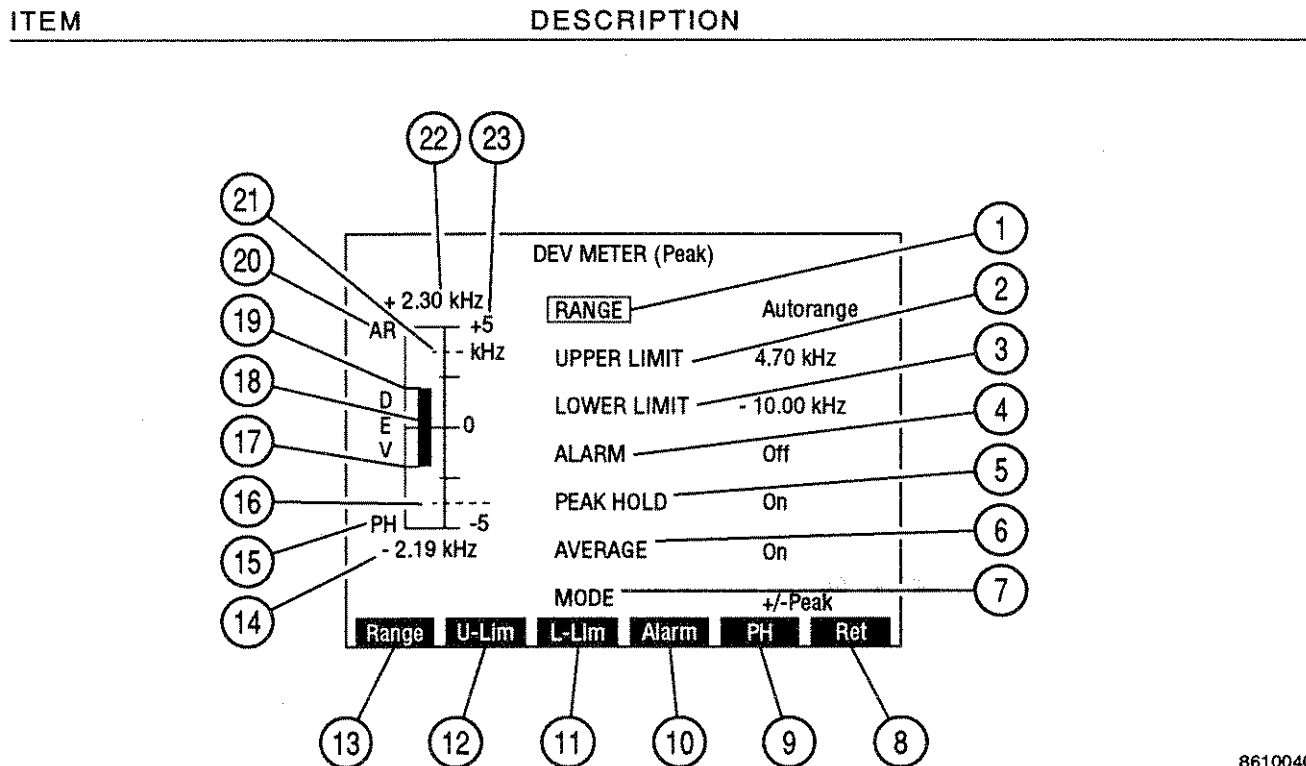
Select Lower Limit Level. Range is 0.0 mW to 200.0 W.

**9. Set Alarm**

Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.

## D. DEVIATION (PEAK) METER

With the Meter Menu displayed on the CRT, press "4" DATA ENTRY Key to access the Deviation Meter Operation Screen:



8610040

### 1. RANGE

Selects Deviation Meter Range. Select Autorange, 2, 5, 10, 20, 50 or 100 kHz.

### 2. UPPER LIMIT

Activates and selects Upper Limit. Range is 0.0 to 100.0 kHz. Upper Limit is turned off from Deviation Meter Setup Menu.

### 3. LOWER LIMIT

Activates and selects Lower Limit. Range is 0.0 to 100.0 kHz. Lower Limit is turned off from Deviation Meter Setup Menu.

### 4. ALARM

Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.

### 5. PEAK HOLD

Toggles Peak Hold feature on or off.



ITEM	DESCRIPTION
6. <u>AVERAGE</u>	Toggles Average feature on or off. When on, Meter reads a running average of last 10 readings.
7. <u>MODE</u>	Selects Deviation Meter Mode. Select +Peak, -Peak, +/-Peak or +/-Peak/2. +Peak displays as positive scale. -Peak displays as negative scale. +/-Peak displays as positive and negative scale. +/-Peak/2 displays absolute value of the average of positive and negative deviation readings.
8. <u>"Ret"/"ESC" Soft Function Key F6</u>	<ul style="list-style-type: none"> <li>● When editing a parameter, "ESC" is shown. Stops editing process and voids any changes to parameter.</li> <li>● "Ret" displays the last accessed Operation Screen.</li> </ul>
9. <u>"PH" Soft Function Key F5</u>	Toggles Peak Hold feature on or off.
10. <u>"Alarm" Soft Function Key F4</u>	Toggles Alarm on or off.
11. <u>"L-Lim" Soft Function Key F3</u>	Activates and selects Lower Limit. Range is 0.0 to 100.0 kHz. Lower Limit is deactivated from Deviation Meter Setup Menu.
12. <u>"U-Lim" Soft Function Key F2</u>	Activates and selects Upper Limit. Range is 0.0 to 100.0 kHz. Lower Limit is deactivated from Deviation Meter Setup Menu.
13. <u>"Range" Soft Function Key F1</u>	Selects Deviation Meter Range. Select Autorange, 2, 5, 10, 20, 50 or 100 kHz.
14. <u>Negative Digital Deviation Readout</u>	Provides a digital readout of the negative deviation in kHz.
15. <u>PH</u>	Appears at the lower left side of the meter window if Peak Hold (5) is on.

## ITEM

## DESCRIPTION

16. Lower Limit Indicator

When the Lower Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.

17. Lower Peak Hold Indicator

Appears when Peak Hold (5) is on and in -Peak or +/-Peak Mode. Indicates point of lowest negative Deviation Meter deflection.

18. Meter Indicator Bar

Displays Deviation Meter reading. Bar turns red when a Upper or Lower Limit is exceeded. Bar turns yellow if the current range is surpassed.

19. Upper Peak Hold Indicator

Appears when Peak Hold is on. Yellow indicator line shows the highest point of positive Deviation Meter deflection.

20. AR Callout

Appears at the upper right side of the meter window if the Range is set for Autorange. The Range Scale changes to the next higher scale when the meter indicator reaches the edge of the meter window. The meter changes to the next lower scale if the meter indicator falls to a level of about 1/2 of the lowest scale division.

21. Upper Limit Indicator

When Upper Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.

22. Positive Digital Deviation Readout

Does not appear if in -Peak Mode. Provides a digital readout of the positive deviation in kHz.

23. Meter Range Scale

Displays Meter Scale in four divisions.

With the Deviation Meter Operation Screen displayed on the CRT, press the SETUP Key to access the Deviation Meter Menu:

ITEM

DESCRIPTION

DEVIATION METER MENU	
Deviation Meter Peak	
1. Meter Range	Autorange
2. Select Peak Hold	On
3. Upper Lmt	On
4. Set Upper Lmt	1.5 kHz
5. Lower Lmt	On
6. Set Lower Lmt	-1.5 kHz
7. Set Alarm	Off
8. Average	Off
9. Mode	+/-Peak

Ret AUX

8610005

1. Meter Range

Displays submenu allowing the selection of the Deviation Meter Range. Select Autorange, 2, 5, 10, 20, 50 or 100 kHz.

2. Select Peak Hold

Toggles Peak Hold feature on or off.

3. Upper Lmt

Toggles Upper Limit on or off.

4. Set Upper Lmt

Selects Upper Limit Level. Range is 0.0 to 20.0 kHz.

5. Lower Lmt

Toggles Lower Limit on or off.

6. Set Lower Lmt

Selects Lower Limit Level. Range is 0.0 to 20.0 kHz.

7. Set Alarm

Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.

**ITEM****DESCRIPTION**

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**8. Average**

Toggles Average feature on or off. When on, Meter reads a running average of last 10 readings.

**9. Mode**

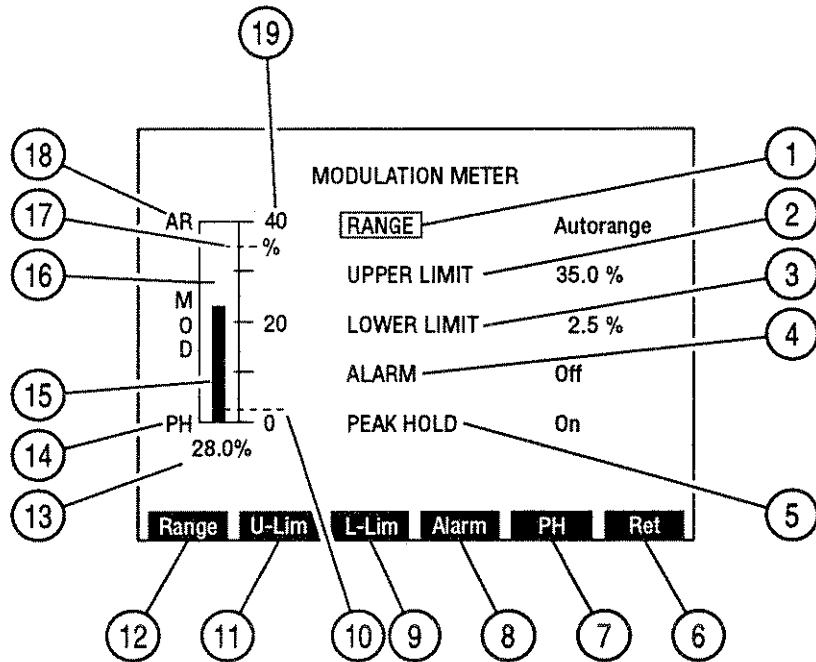
Selects deviation Meter Mode. Select +Peak, -Peak, +/-Peak or +/-Peak/2.

2017-10-10 10:10:10

## E. MODULATION METER

With the Meter Menu displayed on the CRT, press "5" on the DATA ENTRY Keypad to access the Modulation Meter Operation Screen:

ITEM	DESCRIPTION
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8610042

### 1. RANGE

Selects Modulation Meter Range. Select Autorange, 40% or 100%.

### 2. UPPER LIMIT

Activates and selects Upper Limit. Range is 0.0% to 100.0%. Upper Limit is turned off from the Modulation Meter Setup Menu.

### 3. LOWER LIMIT

Activates and selects Lower Limit. Range is 0.0% to 100.0%. Lower Limit is turned off from Modulation Meter Setup Menu.

### 4. ALARM

Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.

### 5. PEAK HOLD

Toggles Peak Hold feature on or off.

ITEM	DESCRIPTION
6. <u>"Ret"/"ESC" Soft Function Key F6</u>	<ul style="list-style-type: none"> <li>● When editing a parameter, "ESC" is shown. Stops editing process and voids any changes to parameter.</li> <li>● "Ret" displays the last accessed Operation Screen.</li> </ul>
7. <u>"PH" Soft Function Key F5</u>	Toggles Peak Hold feature on or off.
8. <u>"Alarm" Soft Function Key F4</u>	Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
9. <u>"L-Lim" Soft Function Key F3</u>	Activates and selects Lower Limit. Range is 0.0% to 100.0%. Lower Limit is turned off from Modulation Meter Setup Menu.
10. <u>Lower Limit Indicator</u>	When the Lower Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.
11. <u>"U-Lim" Soft Function Key F2</u>	Activates and selects Upper Limit. Range is 0.0% to 100.0%. Upper Limit is turned off from the Modulation Meter Setup Menu.
12. <u>"Range" Soft Function Key F1</u>	Selects Modulation Meter Range. Select Autorange, 40% or 100%.
13. <u>Digital Readout of Modulation Meter</u>	Provides a digital readout of the Modulation Percentage.
14. <u>PH</u>	Appears at the lower left side of the Meter window if Peak Hold is on.
15. <u>Meter Indicator Bar</u>	Displays Modulation Meter reading. Bar turns red when an Upper or Lower Limit is exceeded. Bar turns yellow if the current range is surpassed.
16. <u>Peak Hold Indicator</u>	Appears when Peak Hold is on. Yellow indicator line shows the highest point of meter deflection.

**ITEM****DESCRIPTION**

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**17. Upper Limit Indicator**

When Upper Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.

**18. AR**

Appears at the upper right side of the meter window if the Range is set for Autorange. The Range Scale changes to the next higher scale when the meter indicator reaches the edge of the meter window. The meter changes to the next lower scale if the meter indicator falls to a level of about 1/2 of the lowest scale division.

**19. Meter Range Scale**

The meter scale of four divisions is marked from 0 to the limits of the active scale with the center division labeled with the midpoint of the range.

With the Modulation Meter Operation Screen displayed on the CRT, press the SETUP Key to access the Modulation Meter Menu.

ITEM DESCRIPTION

MODULATION METER MENU	
Modulation Meter Menu	
1. Meter Range	Autorange
2. Select Peak Hold	On
3. Upper Lmt	On
4. Set Upper Lmt	35.0 %
5. Lower Lmt	On
6. Set Lower Lmt	2.5 %
7. Set Alarm	Off

Ret AUX

8610006

1. Meter Range

Selects Range. Select Autorange, 40% or 100%.

2. Select Peak Hold

Toggles Peak Hold feature on or off.

3. Upper Lmt

Toggles Upper Limit on or off.

4. Set Upper Limit

Selects Upper Limit Level. Range is from 0.0% to 100.0%.

5. Lower Lmt

Toggles Lower Limit on or off.

6. Set Lower Limit

Selects Lower Limit Level. Range is from 0.0% to 100.0%.

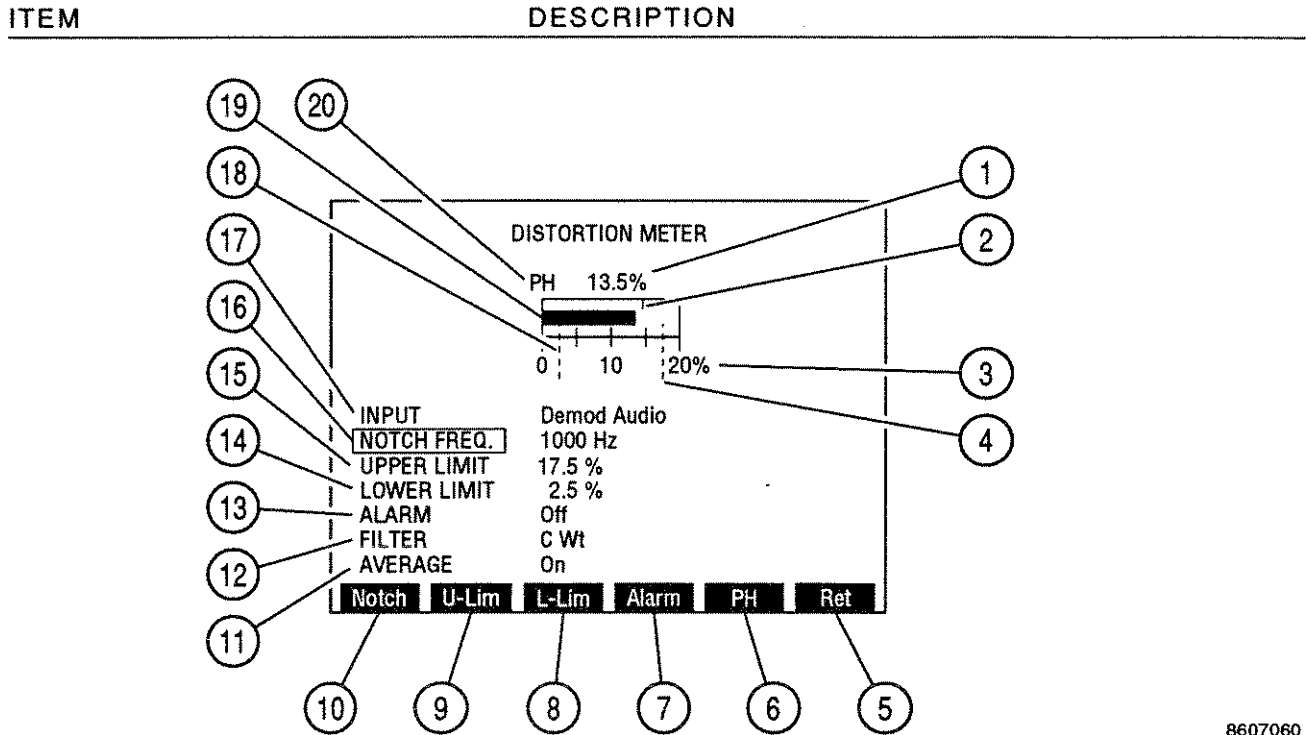
7. Set Alarm

Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.



## F. DISTORTION METER

With the Meter Menu displayed on the CRT, press "6" DATA ENTRY Key to access the Distortion Meter Operation Screen:



8607060

### 1. Digital Readout

Provides a digital readout of meter indication.

### 2. Peak Hold Indicator

Appears when Peak Hold is on. Yellow indicator line shows the highest point of meter deflection.

### 3. Meter Range Scale

The meter scale of four divisions is marked from 0 to the limits of the active scale with the center division labeled with the midpoint of the range.

### 4. Upper Limit Indicator

When the Upper Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set. The indicator appears at the right edge of the meter window if the limit is set higher than the meter range.

ITEM	DESCRIPTION
5. <u>"Ret"/"ESC" Soft Function Key F6</u>	<ul style="list-style-type: none"> <li>● When editing a parameter, "ESC" is shown. Stops editing process and voids any changes to parameter.</li> <li>● "Ret" displays the last accessed Operation Screen.</li> </ul>
6. <u>"PH" Soft Function Key F5</u>	Toggles Peak Hold feature on or off.
7. <u>"Alarm" Soft Function Key F4</u>	Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
8. <u>"L-Lim" Soft Function Key F3</u>	Activates and selects Lower Limit. Range is 0.0% to 20.0%. Lower Limit is turned off from Distortion Meter Setup Menu.
9. <u>"U-Lim" Soft Function Key F2</u>	Activates and selects Upper Limit. Range is 0.0% to 20.0%. Upper Limit is turned off from the Distortion Meter Setup Menu.
10. <u>"Notch" Soft Function Key F1</u>	Selects Notch Filter Frequency. Range is 600 to 1400 Hz.
11. <u>AVERAGE</u>	Toggles Average feature on or off. When on, Meter reads a running average of last 10 readings.
12. <u>FILTER</u>	Selects Distortion Meter Filter. Select C Wt or Low-Pass. If Low-Pass is selected, a data field appears allowing entry of cutoff frequency.
13. <u>ALARM</u>	Toggles Alarm on or off. Enable Alarm sounds when Upper or Lower Limit is exceeded.
14. <u>LOWER LIMIT</u>	Activates and selects Lower Limit. Range is 0.0% to 20.0%. Lower Limit is turned off from Distortion Meter Setup Menu.

**ITEM****DESCRIPTION**

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**15. UPPER LIMIT**

Activates and selects Upper Limit. Range is 0.0% to 20.0%. Upper Limit is turned off from the Distortion Meter Setup Menu.

**16. NOTCH FREQ**

Selects Notch Filter Frequency. Range is 600 to 1400 Hz.

**17. INPUT**

Selects Distortion Meter Input. Select Ext Mod, Demod Audio, Func Gen or SINAD/BER.

**18. Lower Limit Indicator**

When the Lower Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.

**19. Meter Indicator Bar**

Displays Distortion Meter reading. Bar turns red when an Upper or Lower Limit is exceeded. Bar turns yellow if the current range is surpassed.

**20. PH**

Appears above the left corner of the meter window if Peak Hold is on.

With the Distortion Meter Operation Screen displayed on the CRT, press the SETUP Key to access the Distortion Meter Menu:

ITEM DESCRIPTION

DISTORTION METER MENU	
Distortion Meter Menu	
1. Select Dist In	Demod Audio
2. Set Filter Freq	770 Hz
3. Select Peak Hold	On
4. Upper Lmt	On
5. Set Upper Lmt	17.5 %
6. Lower Lmt	On
7. Set Lower Lmt	2.5 %
8. Set Alarm	Off
9. Average	On
10. Filter Select	C wt

Ret AUX

8610007

1. Select Dist In

Selects Distortion Meter Input. Select Ext Mod, Demod Audio, Func Gen or SINAD/BER.

2. Set Filter Freq

Selects Notch Filter Frequency. Range is 600 to 1400 Hz.

3. Select Peak Hold

Toggles Peak Hold feature on or off.

4. Upper Lmt

Toggles Upper Limit on or off.

5. Set Upper Lmt

Selects Upper Limit Level. Range is 0.0% to 20.0%.

6. Lower Lmt

Toggles Lower Limit on or off.

7. Set Lower Lmt

Selects Lower Limit Level. Range is 0.0% to 20.0%.

8. Set Alarm

Toggles Alarm on or off. Enabled Alarm sounds when Upper or Lower Limit is exceeded.

**ITEM****DESCRIPTION**

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**9. Average**

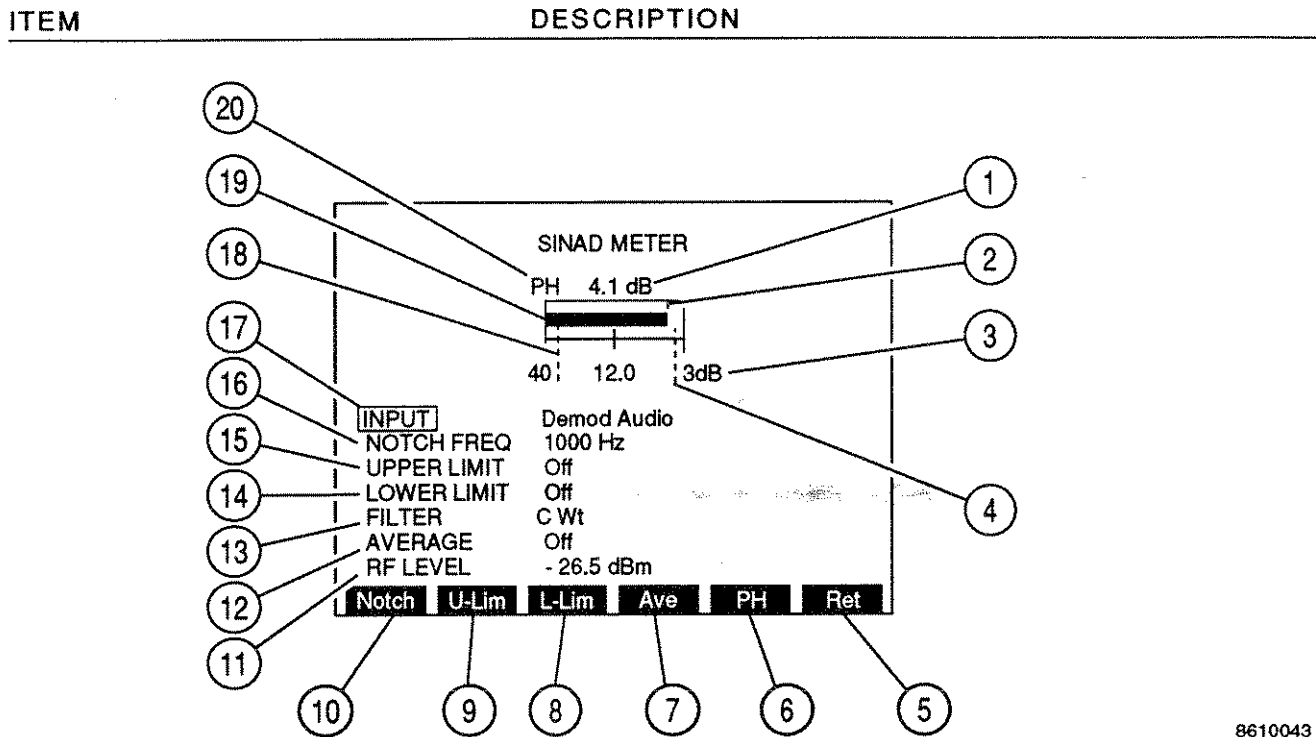
Toggles Average feature on or off. When on, Meter reads a running average of last 10 readings. Select on or off.

**10. Filter Select**

Selects Distortion Meter Filter. Select C Wt or Low-Pass. If Low-Pass is selected, a data field appears allowing entry of cutoff frequency.

## G. SINAD METER

With the Meter Menu displayed on the CRT, press "7" DATA ENTRY Key to access the SINAD Meter Operation Screen:



8610043

### 1. Digital Readout

Provides a digital readout of meter indication.

### 2. "Peak Hold" Indicator

Appears when Peak Hold is on. Yellow indicator line shows the highest point of meter deflection.

### 3. Meter Range Scale

The meter scale of two divisions is marked from 3 to 40 dB with the center division labeled 12.0 dB.

### 4. Upper Limit Indicator

When the Upper Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set. The indicator appears at the right edge of the meter window if the limit is set higher than the meter range.

ITEM	DESCRIPTION
5. <u>"Ret"/"ESC" Soft Function Key F6</u>	<ul style="list-style-type: none"> <li>● When editing a parameter, "ESC" is shown. Stops editing process and voids any changes to parameter.</li> <li>● "Ret" displays the last accessed Operation Screen.</li> </ul>
6. <u>"PH" Soft Function Key F5</u>	Toggles Peak Hold feature on or off.
7. <u>"Ave" Soft Function Key F4</u>	Toggles Average feature on or off. When on, Meter reads a running average of last 10 readings.
8. <u>"L-Lim" Soft Function Key F3</u>	Activates and selects Lower Limit. Range is 3.0 to 40.0 dB. Lower Limit is turned off from SINAD Meter Setup Menu.
9. <u>"U-Lim" Soft Function Key F2</u>	Activates and selects Upper Limit. Range is 3.0 to 40.0 dB. Upper Limit is turned off from the SINAD Meter Setup Menu.
10. <u>"Notch" Soft Function Key F1</u>	Selects Notch Filter Frequency. Range is 600 to 1400 Hz.
11. <u>RF LEVEL</u>	Appears if RF GEN, Duplex or Duplex Receiver is the last accessed Operation Screen. Displays RF Generator or Duplex Receiver Output Level.
12. <u>AVERAGE</u>	Toggles Average feature on or off. When on, Meter reads a running average of last 10 readings.
13. <u>FILTER</u>	Selects SINAD Filter. Select C Wt or Low-Pass. If Low-Pass is selected, a data field appears allowing entry of cutoff frequency.
14. <u>LOWER LIMIT</u>	Activates and selects Lower Limit. Range is 3.0 to 40.0 dB. Lower Limit is turned off from SINAD Meter Setup Menu.

**ITEM****DESCRIPTION**

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**15. UPPER LIMIT**

Activates and selects Upper Limit. Range is 3.0 to 40.0 dB. Upper Limit is turned off from the SINAD Meter Setup Menu.

**16. NOTCH FREQ**

Selects Notch Filter Frequency. Range is 600 to 1400 Hz.

**17. INPUT**

Selects SINAD Meter Input. Select Demod Audio, SINAD/BER or Ext Mod.

**18. Lower Limit Indicator**

When the Lower Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.

**19. Meter Indicator Bar**

Displays SINAD Meter reading. Bar turns red when an Upper or Lower Limit is exceeded. Bar turns yellow if the current range is surpassed.

**20. PH**

Appears above the left corner of the meter window if Peak Hold is on.



With the SINAD Meter Operation Screen displayed on the CRT, press the SETUP Key to access the SINAD Meter Menu:

ITEM DESCRIPTION

SINAD METER MENU	
SINAD Meter Menu	
1. Select SINAD In	Demod Audio
2. Notch Filter Freq	1000 Hz
3. Select Peak Hold	Off
4. Upper Lmt	Off
5. Set Upper Lmt	3.0 dB
6. Lower Lmt	Off
7. Set Lower Lmt	30.0 dB
8. Average	Off
9. Filter Select	C Wt
Ret AUX	

8610008

1. Select SINAD In

Selects SINAD Meter Input. Select Demod Mod, SINAD/BER or Ext Audio.

2. Notch Filter Freq

Selects Notch Filter Frequency. Range is 600 to 1400 Hz.

3. Select Peak Hold

Toggles Peak Hold feature on or off.

4. Upper Lmt

Toggles Upper Limit on or off.

5. Set Upper Lmt

Selects Upper Limit Level. Range is 3.0 to 40.0 dB.

6. Lower Lmt

Toggles Lower Limit on or off.

7. Set Lower Lmt

Selects Lower Limit Level. Range is 3.0 to 40.0 dB.

8. Average

Toggles Average feature on or off. When on, Meter reads a running average of last 10 readings.

ITEM

DESCRIPTION

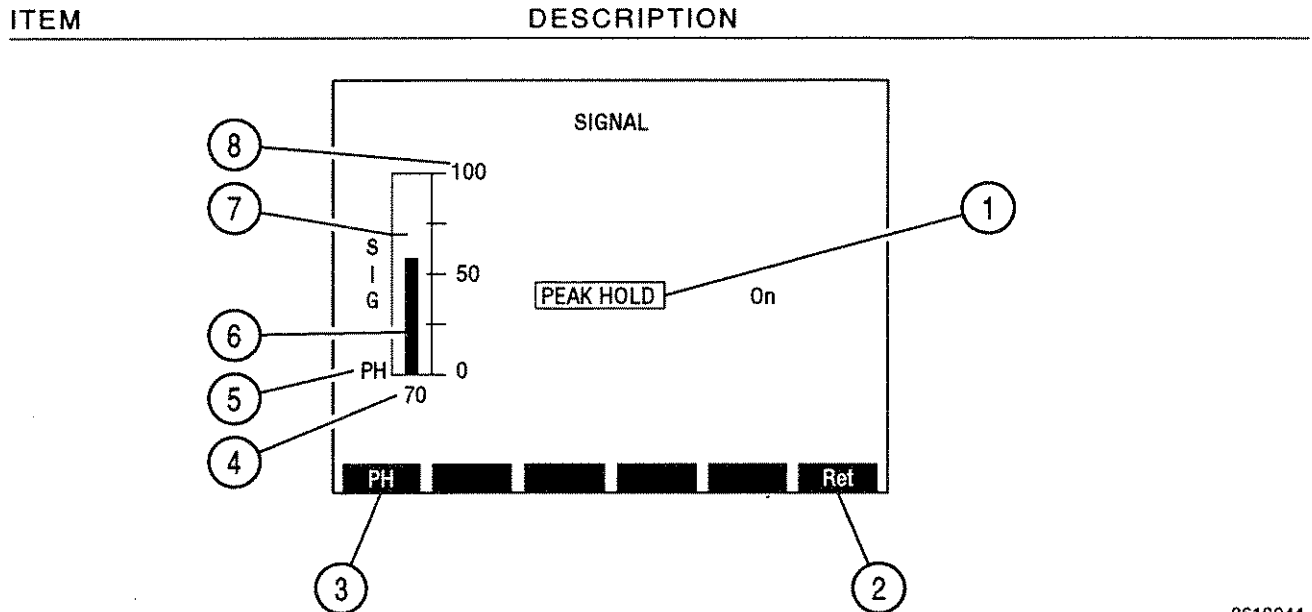
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9. Filter Select

Selects SINAD Filter. Select C Wt or Low-Pass. If Low-Pass is selected, a data field appears allowing entry of cutoff frequency.

## H. SIGNAL STRENGTH METER

With the Meter Menu displayed on the CRT, press "8" DATA ENTRY Key to access the Signal Strength Meter Operation Screen:



8610044

1. PEAK HOLD

Toggles Peak Hold feature on or off.

2. "Ret"/"ESC" Soft Function Key F6

- When editing a parameter, "ESC" is shown. Stops editing process and voids any changes to parameter.
- "Ret" displays the last accessed Operation Screen.

3. "PH" Soft Function Key F1

Toggles Peak Hold feature on or off.

4. Signal Strength Digital Readout

Provides digital Signal Strength Meter readings.

5. PH

When Peak Hold is on, this indicator appears beside the lower left corner of the meter window.

6. Meter Indicator Bar

Displays Signal Strength Meter readings.

**ITEM**

**DESCRIPTION**

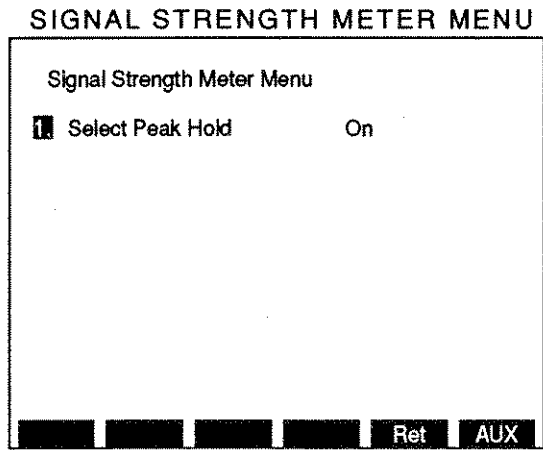
7. Peak Hold Indicator

Appears when Peak Hold is on. Yellow indicator line shows the highest point of meter deflection.

8. Meter Range Scale

The meter scale of four divisions is marked from 0 to 100 with the center division marked 50.

With the Signal Strength Meter Operation Screen displayed on the CRT, press the SETUP Key to access the Signal Strength Meter Menu:



8610009

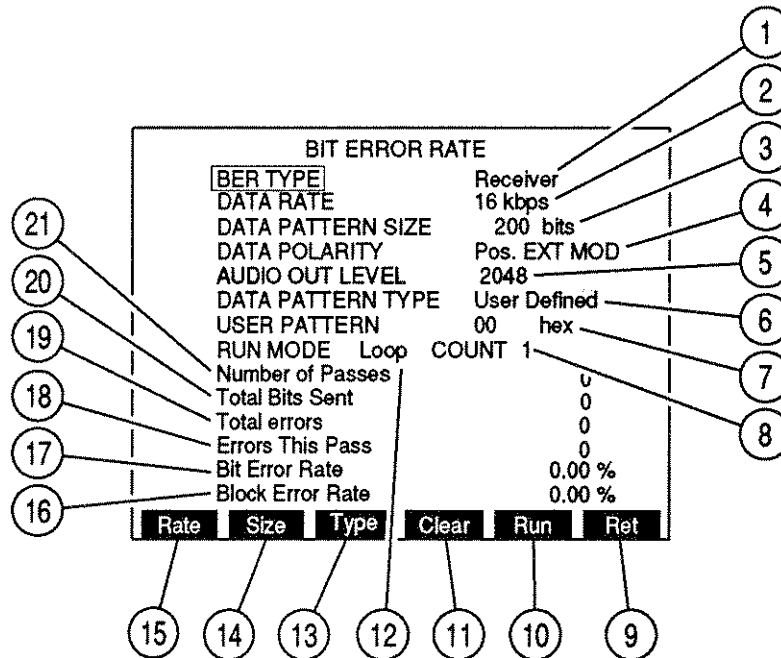
1. Select Peak Hold

Toggles Peak Hold feature on or off.

## I. BIT ERROR RATE (BER) METER

With the Meter Menu displayed on the CRT, press "9" DATA ENTRY Key to access the BER Meter Operation Screen. Use the FIELD SELECT Keys to move the cursor to the parameter to be edited and press ENTER to access the parameter data field. For parameters with two settings, access toggles the parameter setting to the other value.

ITEM	DESCRIPTION
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8610030

### 1. BER TYPE

Selects BER Type. Select Receiver, Generator, Baseband or Duplex.

- With Receiver BER Type, the specified test data is sent through the AUDIO Connector to be modulated by the UUT. The UUT Output returns to the specified Connector of the Test Set and is demodulated and compared to the original test data.
- With Generator BER Type, the modulated test data is sent to the UUT to be demodulated. The demodulated data is received by the Test Set and compared with the original test data.
- With Baseband BER Type, the test data is sent through the Audio Out Connector to be modulation and then demodulated by the UUT. Demodulated UUT output is received by the Test Set and compared to the original test data.
- With Duplex BER Type, the modulated test data is sent to the UUT to be demodulated and then modulated. This signal is received and demodulated by the Test Set and compared to the original test data.

## ITEM

## DESCRIPTION

2. DATA RATE

Selects baud rate of data. Select one of the following:

75 bps	150 bps	300 bps
600 bps	1200 bps	2400 bps
4800 bps	16 kbps	

3. DATA PATTERN SIZE

Selects number of bits for each pass. Range is from 100 to 100000 bits.

4. DATA POLARITY

Select Positive received at EXT MOD Connector or Negative (inverted) received at the SINAD/BER Connector.

5. AUDIO OUT LEVEL/RF GEN LEVEL

- AUDIO OUT LEVEL is displayed for Receiver and Baseband BER Types. Select from 0 to 4095 bits. 0 corresponds to 0 V and 4095 corresponds to 5 V.
- RF GEN LEVEL is displayed for Generator and Duplex BER Types. Range is from 0.0 to -137.0 dBm.

6. DATA PATTERN TYPE

Select Random, Fixed or User Defined.

7. USER PATTERN

Appears when "User Defined" is selected as DATA PATTERN TYPE (6). Enter User Pattern in hexadecimal digits using DATA ENTRY Keypad.

8. Loop COUNT

Appears when Loop is selected as RUN MODE. Select loop count from 1 to 100000.

9. "Ret" Soft Function Key F6

Displays the last active Operation Screen.

10. "Run"/"Stop" Soft Function Key F5

Pressing "Run" Starts BER test and changes Soft Function Key to "Stop". Pressing "Stop" stops BER test.

11. "Clear" Soft Function Key F4

Clears BER test readout data.

ITEM	DESCRIPTION
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12. RUN MODE

Selects BER Meter Run Mode. Select from Continuous, One Shot or Loop.

- With Continuous Run Mode, the BER tests are run until "Stop" Soft Function Key F5 is pressed.
- With One Shot Run Mode, one pass is completed. The size of the pass is set by DATA PATTERN SIZE (3).
- With Loop Run Mode, the specified number of passes is completed. The number of passes completed is set by the Loop COUNT (8).

13. "Type" Soft Function Key F3

Selects DATA PATTERN TYPE. Select Random, Fixed or User Defined.

14. "Size" Soft Function Key F2

Selects DATA PATTERN SIZE (number of bits for each pass). Range is from 100 to 100000 bits.

15. "Rate" Soft Function Key F1

Selects baud rate of data. Select one of the following:

- |          |          |          |
|----------|----------|----------|
| 75 bps   | 150 bps  | 300 bps  |
| 600 bps  | 1200 bps | 2400 bps |
| 4800 bps | 16 kbps  |          |

16. Block Error Rate

Percentage readout of the ratio of blocks with at least one error versus the number of blocks sent during BER test.

17. Bit Error Rate

Percentage readout of the ratio of bit errors versus the number or bits sent during BER test.

18. Errors This Pass

Readout of the number of errors detected during current pass. The number of bits specified by the DATA PATTERN SIZE is processed during each pass.

19. Total Errors

Readout of the total number of errors occurring during BER test.

20. Total Bits Sent

Readout of the total number of bits sent during BER test.

ITEM	DESCRIPTION
------	-------------

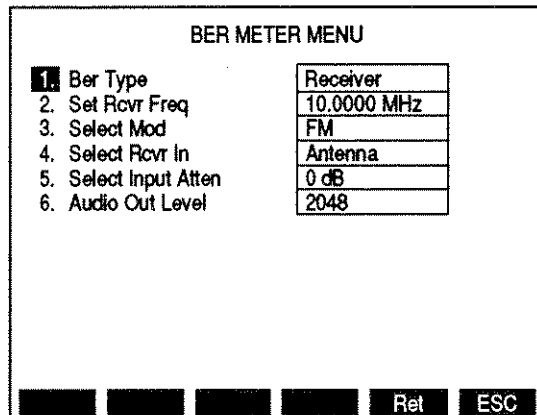
21. Number of Passes

Readout of the number of passes made during BER test.

With the BER Meter Operation Screen displayed on the CRT, press the SETUP Key to access the BER Meter Menu. There are 4 different BER METER MENU Screens, one for each BER Type. If "Receiver" is the BER Type, the following screen is displayed:

ITEM	DESCRIPTION
------	-------------

RECEIVER BER METER MENU



8610094

1. BER Type

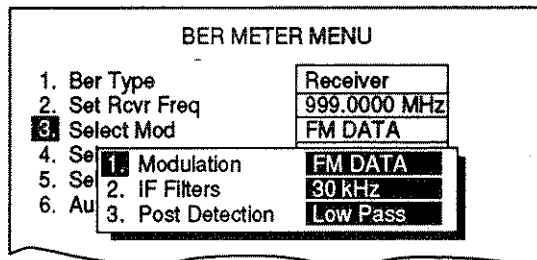
Selects BER Type. Select Receiver, Generator, Baseband or Duplex. Changing BER Type changes BER METER MENU.

2. Set Rcvr Freq

Selects Receiver Frequency. Range is from 0.2500 to 999.9999 MHz.

3. Select Mod

Displays Modulation Submenu:



8610095

- Selects Received Modulation. Select FM, AM, SSB (upper), SSB (lower), BFO, PM or FM DATA.
- Selects Receiver IF Filter. Select from 3, 30 or 300 kHz.



**ITEM****DESCRIPTION**

---

- **Select Receiver Post Detection Filter.** Select All Pass, Low Pass, High Pass or Band Pass. If Low Pass, High Pass or Bandpass is selected, a data field is displayed to allow entry of cutoff frequencies. Range of the cutoff frequencies are:

Low-Pass	0.100 to 30.000 kHz.
High-Pass	0.500 to 20.000 kHz.
Bandpass low	0.500 to 20.000 kHz.
Bandpass high	0.100 to 30.000 kHz.

4. Select Rcvr In

Toggles Receiver Input Connector between Antenna and T/R.

5. Select Input Atten

Selects Input Attenuation. Select 0, 20 or 40 dB.

6. Audio Out Level

Selects Test Data Output Level at AUDIO OUT Connector. Select from 0 to 4095. 0 corresponds to 0 V and 4095 corresponds to 5 V.

If "Generator" is the BER Type, the Generator BER Meter Menu is displayed:

ITEM DESCRIPTION

GENERATOR BER METER MENU

BER METER MENU	
1 Ber Type	Generator
2. RF Gen Freq	10.0000 MHz
3. RF Gen Level	- 20.0 dBm
4. RF Gen Level Units	dBm
5. RF Gen Mod	FM
6. RF Gen Mod Level	255

Ret ESC

8610097

1. BER Type

Selects BER Type. Select Receiver, Generator, Baseband or Duplex. Changing BER Type changes BER Meter Menu. With Generator BER Type, the modulated test data is sent to the UUT to be demodulated. The demodulated data is received by the Test Set and compared with the original test data.

2. RF Gen Freq

Selects RF Generator Frequency. Range is from 0.2500 to 999.9999 MHz.

3. RF Gen Level

Selects RF Generator Output Level. Range is from 0.0 to -137.0 dBm or 0.031  $\mu$ V to 0.224 V.

4. RF Gen Level Units

Selects RF Generator Output Level Units. Toggles between dBm and volts.

5. RF Gen Mod

Selects RF Generator Modulation. Select AM, FM, PM or OFF.

6. RF Gen Mod Level

Selects RF Generator Modulation Level. Range is from 0 to 180.

If "Baseband" is the BER Type, the Baseband BER Meter Menu is displayed:

ITEM	DESCRIPTION
------	-------------

**BASEBAND BER METER MENU**

BER METER MENU

1. Ber Type	Baseband
2. Audio Out Level	2048

Ret ESC

8610096

1. BER Type

Selects BER Type. Select Receiver, Generator, Baseband or Duplex. Changing BER Type changes BER Meter Menu.

2. Audio Out Level

Selects Test Data Output Level at AUDIO OUT Connector. Select from 0 to 4095. 0 corresponds to 0 V and 4095 corresponds to 5 V.

If "Duplex" is the BER Type, the Duplex BER Meter Menu is displayed:

ITEM

DESCRIPTION

DUPLEX BER METER MENU

BER METER MENU	
1. Ber Type	Duplex
2. Set Rcvr Freq	10.0000 MHz
3. Select Mod	FM
4. Select Rcvr In	Antenna
5. Select Input Atten	0 dB
6. RF Gen Freq	10.0000 MHz
7. RF Gen Level	- 20.1 dBm
8. RF Gen Level Units	dBm
9. RF Gen Mod	Off
10. RF Gen Mod Level	128
11. RF Gen Output	T/R

Ret ESC

8610098

1. BER Type

Selects BER Type. Select Receiver, Generator, Baseband or Duplex. Changing BER Type changes BER Meter Menu. With Duplex BER Type, the modulated test data is sent to the UUT to be demodulated and then modulated. This signal is received and demodulated by the Test Set and compared to the original test data.

2. Set Rcvr Freq

Selects Receiver Frequency. Range is from 0.2500 to 999.9999 MHz.

3. Select Mod

Displays Modulation Submenu:

BER METER MENU		
1. Ber Type	Duplex	
2. Set Rcvr Freq	999.0000 MHz	
3. Select Mod	FM DATA	
4. Sel	1. Modulation	FM DATA
5. Sel	2. IF Filters	30 kHz
6. Au	3. Post Detection	Low Pass

8610172

- Selects Received Modulation. Select FM, AM, SSB (upper), SSB (lower), BFO, PM or FM DATA.
- Selects Receiver IF Filter. Select from 3, 30 or 300 kHz.

## ITEM

## DESCRIPTION

- Select Receiver Post Detection Filter. Select All Pass, Low-Pass, High-Pass or Bandpass. If Low-Pass, High-Pass or Bandpass is selected, a data field is displayed to allow entry of cutoff frequencies. Range of cutoff frequencies are:

Low-Pass	0.100 to 30.000 kHz.
High-Pass	0.500 to 20.000 kHz.
Bandpass low	0.500 to 20.000 kHz.
Bandpass high	0.100 to 30.000 kHz.

4. Select Rcvr In  
Selects Receiver Input Connector. Toggles between Antenna or T/R.
5. Select Input Atten  
Selects Input Attenuation. Select 0, 20 or 40 dB.
6. RF Gen Freq  
Selects RF Generator Frequency. Range is from 0.2500 to 999.9999 MHz.
7. RF Gen Level  
Selects RF Generator Output Level. Range is from 0.0 to -137.0 dBm or 0.031  $\mu$ V to 0.224 V.
8. RF Gen Level Units  
Selects RF Generator Output Level Units. Toggles between dBm and Volts.
9. RF Gen Mod  
Selects RF Generator Modulation Type. Select AM, FM, PM or OFF.
10. RF Gen Mod Level  
Selects RF Generator Modulation Level. Range is from 0 to 255. Table 3-2 specifies the modulation level corresponding to the range.
11. RF Gen Output  
Selects RF Generator Output Connector. Toggles between T/R and Antenna.

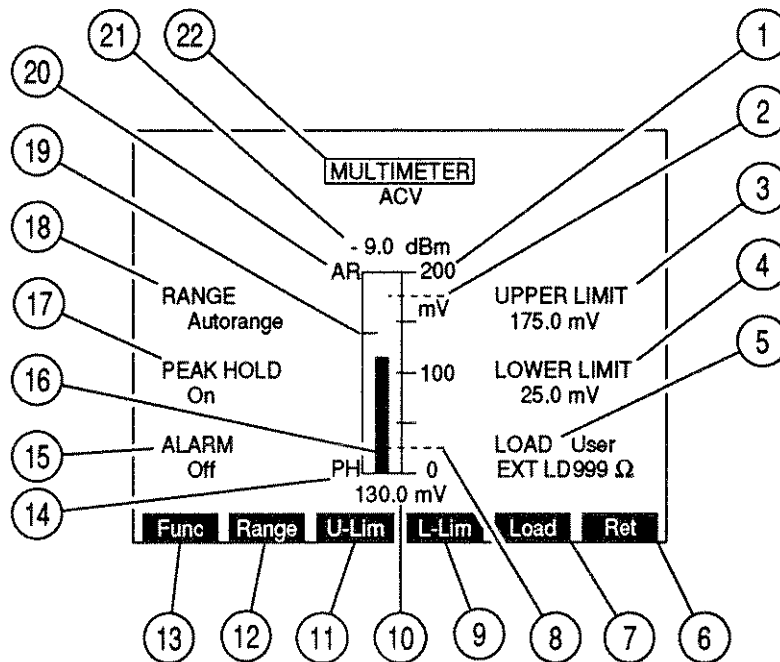
## J. DIGITAL MULTIMETER

With the Meter Menu displayed on the CRT, use the FIELD SELECT Keys to highlight "10. Digital Multimeter (DMM)" and press ENTER to access the Digital Multimeter Operation Screen.

**NOTE:** The Digital Multimeter appears in the Function last used.

The "Install Shunt Between V $\Omega$  and COM" message appears when 20 A range is accessed.

ITEM	DESCRIPTION
------	-------------



8610045

### 1. Meter Range Scale

The meter scale of four divisions is marked from 0 to the limits of the active range scale with the center division labeled with the midpoint of the range.

### 2. Upper Limit Indicator

When Upper Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set. The indicator appears at the window's upper edge if the limit is set higher than the meter range.

### 3. UPPER LIMIT

Activates and selects Upper Limit. If ACV or DCV is selected as the Function, Range is from 0.0 mV to 1000.00 V. If ACC or DCC is selected as the Function, range is from 0.00 mA to 19.990 A. If Ohm is selected as the Function, range is from 0.000  $\Omega$  to 19.990 M $\Omega$ . Upper Limit is turned off from the Multimeter Setup Menu.

## ITEM

## DESCRIPTION

4. LOWER LIMIT

Activates and selects Lower Limit. If ACV or DCV is selected as the Function, Range is from 0.0 mV to 1000.00 V. If ACC or DCC is selected as the Function, range is from 0.00 mA to 19.990 A. If Ohm is selected as the Function, range is from 0.000  $\Omega$  to 19.990 M $\Omega$ . Lower Limit is turned off from the Multimeter Setup Menu.

5. LOAD

Appears when "ACV" is selected as MULTIMETER Function (22). Select 1 MEG, 600  $\Omega$ , 150  $\Omega$  or User. User allows the use of an external load from 1 to 999  $\Omega$ . If User is selected, a callout is displayed for external load entry used to ensure dBm Callout accuracy. The external load is installed by the operator.

6. "Ret/Esc" Soft Function Key F6

- When editing a parameter, "ESC" is shown. Stops editing process and voids any changes to parameters.
- "Ret" displays the last accessed Operation Screen.

7. "Load" Soft Function Key F5

Appears when "ACV" is selected as MULTIMETER Function (22). Select 1 MEG, 600  $\Omega$ , 150  $\Omega$  or User. User allows the use of an external load from 1 to 999  $\Omega$ . If User is selected, a callout is displayed for external load entry used to ensure dBm callout accuracy. The external load is installed by the operator.

8. Lower Limit Indicator

When the Lower Limit is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.

9. "L-Lim" Soft Function Key F4

Activates and selects Lower Limit. If ACV or DCV is selected as the Function, range is from 0.0 mV to 1000.00 V. If ACC or DCC is selected as the Function, range is from 0.00 mA to 19.990 A. If Ohm is selected as the Function, range is from 0.000  $\Omega$  to 19.990 M $\Omega$ . Lower Limit is turned off from the Multimeter Setup Menu.

10. Digital Meter Readout

Digital readout of meter in the units set by the meter scale. If Peak Hold is on, the readout reads the highest meter deflection.

## ITEM

## DESCRIPTION

11. "U-Lim" Soft Function Key F3

Activates and selects Upper Limit. If ACV or DCV is selected as the Function, Range is from 0.0 mV to 1000.00 V. If ACC or DCC is selected as the Function, range is from 0.00 mA to 19.990 A. If Ohm is selected as the Function, range is from 0.000  $\Omega$  to 19.990 M $\Omega$ . Upper Limit is turned off from the Multimeter Setup Menu.

12. "Range" Soft Function Key F2

Selects Meter Range.

- For Functions ACV or DCV, select Autorange, 200 mV, 2.0 V, 20 V, 200 V or 2000 V.
- For Functions ACC or DCC, select Autorange, 20 mA, 200 mA, 2 A or 20 A.
- For Ohm Function, select Autorange, 200  $\Omega$ , 2 k $\Omega$ , 20 k $\Omega$ , 200 k $\Omega$ , 2 M $\Omega$  or 20 M $\Omega$ .

13. "Func" Soft Function Key F1

Selects Multimeter Function. Select ACV, DCV, ACC, DCC or Ohm.

14. PH

Toggles Peak Hold feature on or off.

15. ALARM

Toggles Alarm on or off. Enables Alarm sounds when Upper or Lower Limit is exceeded.

16. Meter Indicator Bar

Displays Meter reading. Bar turns red when an Upper or Lower Limit is exceeded. Bar turns yellow if the current range is surpassed.

17. PEAK HOLD

Toggles Peak Hold feature between on or off.

18. RANGE

Selects Meter Range.

- For Functions ACV or DCV, select Autorange, 200 mV, 2.0 V, 20 V, 200 V or 2000 V.
- For Functions ACC or DCC, select Autorange, 20 mA, 200 mA, 2 A or 20 A.
- For Ohm Function, select Autorange, 200  $\Omega$ , 2 k $\Omega$ , 20 k $\Omega$ , 200 k $\Omega$ , 2 M $\Omega$  or 20 M $\Omega$ .



**ITEM****DESCRIPTION**

---

**19. PEAK HOLD Indicator**

Appears when Peak Hold is on. Yellow indicator line shows the highest point of meter deflection.

**20. AR**

Appears above the upper left corner of the meter window if the Range (18) is set for Autorange. The Range Scale changes to the next higher scale when the meter indicator reaches the edge of the meter window. The meter changes to the next lower scale if the meter indicator falls to a level of about 1/2 of the lowest scale division.

**21. dBm Digital Reading**

Appears if DCV is selected for Multimeter Function unless 1 MEG is selected for LOAD. Displays Meter reading in dBm.

**22. MULTIMETER**

Selects Multimeter Function. Select ACV, DCV, ACC, DCC or Ohm.

With Digital Multimeter Operation Screen displayed on the CRT, press SETUP Key to access the Digital Multimeter Menu:

ITEM

DESCRIPTION

DIGITAL MULTIMETER MENU	
Multimeter Menu	
1. Multimeter Func	ACV
2. Set Range	Autorange
3. Select Peak Hold	On
4. Upper Lmt	On
5. Set Upper Lmt	175.0 mV
6. Lower Lmt	On
7. Set Lower Lmt	25.0 mV
8. Set Alarm	Off

Ret    AUX

8610010

1. Multimeter Func

Selects Multimeter Function. Select ACV, DCV, ACC, DCC or Ohm.

2. Set Range

Selects Meter Range.

- For Functions ACV or DCV, select Autorange, 200 mV, 2.0 V, 20 V, 200 V or 2000 V.
- For Functions ACC or DCC, select Autorange, 20 mA, 200 mA, 2 A or 20 A.
- For Ohm Function, select Autorange, 200 Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ or 20 MΩ.

3. Select Peak Hold

Toggles Peak Hold feature between on and off.

4. Upper Lmt

Toggles Upper Limit between on and off.

5. Set Upper Lmt

Selects Upper Limit Level. If ACV or DCV is selected as the Function, range is from 0.0 mV to 1000.00 V. If ACC or DCC is selected as the Function, range is from 0.00 mA to 19.990 A. If Ohm is selected as the Function, range is from 0.000 Ω to 19.990 MΩ.

6. Lower Lmt

Toggles Lower Limit between on and off.

**ITEM****DESCRIPTION**

---

**7. Set Lower Lmt**

Selects Lower Limit. If ACV or DCV is selected as the Function, range is from 0.0 mV to 1000.00 V. If ACC or DCC is selected as the Function, range is from 0.00 mA to 19.990 A. If Ohm is selected as the Function, range is from 0.000  $\Omega$  to 19.990 M $\Omega$ .

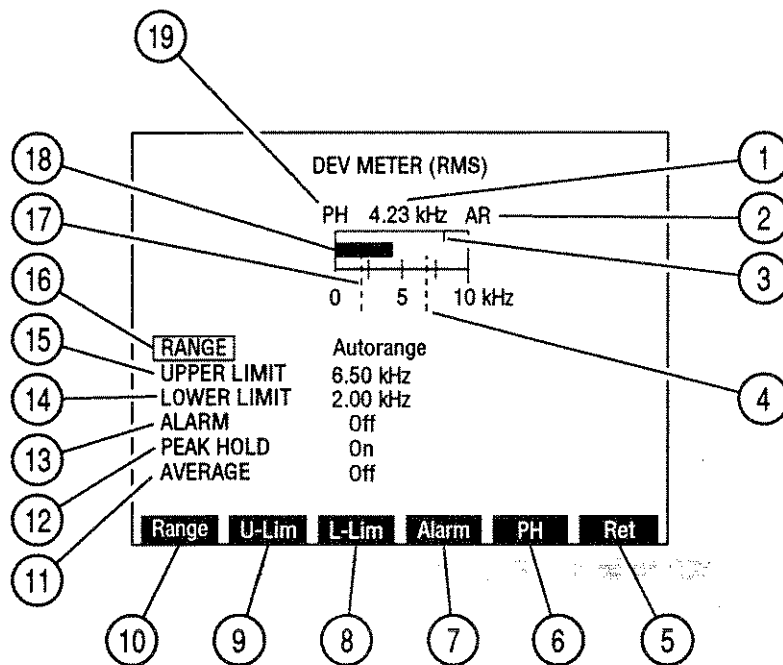
**8. Set Alarm**

Toggles Alarm on or off. Enables Alarm sounds when Upper or Lower Limit is exceeded.

## K. PHASE METER

With the Meter Menu displayed on the CRT, use the FIELD SELECT Keys to highlight "11. Phase Meter" and press ENTER to access the Phase Meter Operation Screen:

ITEM	DESCRIPTION
------	-------------



8607116

### 1. RANGE

Selects Meter Range. Select Autorange, 1, 5, or 10 radians.

### 2. UPPER LIMIT

Activates and selects Upper Limit. Range is from 0.00 to 10.00 radians. Upper Limit is turned off from Phase Meter Setup Menu.

### 3. LOWER LIMIT

Activates and selects Lower Limit. Range is from 0.00 to 10.00 radians. Lower Limit is turned off from Phase Meter Setup Menu.

### 4. ALARM

Toggles Alarm between on and off. Enabled Alarm sounds when an Upper or Lower Limit is exceeded.

### 5. PEAK HOLD

Toggles Peak Hold feature between on and off.

6. "Ret" Soft Function Key F6

Displays the last accessed Operation Screen.

ITEM	DESCRIPTION
7. <u>"PH" Soft Function Key F5</u>	Toggles Peak Hold between on and off.
8. <u>"Alarm" Soft Function Key F4</u>	Toggles Alarm between on and off. Enabled Alarm sounds when an Upper or Lower Limit is exceeded.
9. <u>"L-Lim" Soft Function Key F3</u>	Activates and selects Lower Limit. Range is from 0.00 to 10.00 radians. Lower Limit is turned off from Phase Meter Setup Menu.
10. <u>Lower Limit Indicator</u>	When Lower Limit feature is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.
11. <u>"U-Lim" Soft Function Key F2</u>	Activates and selects Upper Limit. Range is from 0.00 to 10.00 radians. Upper Limit is turned off from Phase Meter Setup Menu.
12. <u>"Range" Soft Function Key F1</u>	Selects Meter Range. Select Autorange, 1, 5, or 10 radians.
13. <u>Digital Meter Readout</u>	Digital readout of meter in radians. If Peak Hold is on, the readout reads the highest meter deflection.
14. <u>PH</u>	This indicator appears beside the meter window lower left corner if Peak Hold is on.
15. <u>Meter Indicator Bar</u>	Displays Meter reading. Bar turns red when an Upper or Lower Limit is exceeded. Bar turns yellow if the current-range is surpassed.
16. <u>Peak Hold Indicator</u>	Appears when Peak Hold is on. Yellow indicator line shows the highest point of meter deflection.

**ITEM****DESCRIPTION**

---

**17. Upper Limit Indicator**

When Upper Limit feature is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set. The indicator appears at the window's upper edge if the limit is set higher than the meter range.

**18. AR**

Indicator appears above the upper left corner of the meter window if the Range is set for Autorange. The Range Scale changes to the next higher scale when the meter indicator bar reaches the edge of the meter window. The meter changes to the next lower scale if the meter indicator bar falls to a level of about 1/2 of the lowest scale division.

**19. Meter Range Scale**

The meter scale of four divisions is marked from 0 to the limits of the active range scale with the center division labeled with the midpoint of the range.

With the Phase Meter Operation Screen displayed on the CRT, press the SETUP Key to access the Phase Meter Menu.

ITEM

DESCRIPTION

PHASE METER MENU

Phase Meter Menu	
1. Meter Range	Autorange
2. Select Peak Hold	On
3. Upper Lmt	On
4. Set Upper Lmt	5.00
5. Lower Lmt	On
6. Set Lower Lmt	3.00
7. Set Alarm	Off

Ret ESC

8610093

1. Meter Range

Selects Meter Range. Select Autorange, 1, 5, or 10 radians.

2. Select Peak Hold

Toggles Peak Hold feature between on and off.

3. Upper Lmt

Toggles Upper Limit between on or off.

4. Set Upper Lmt

Selects Upper Limit. Range is from 0.00 to 10.00 radians.

5. Lower Lmt

Toggles Lower Limit between on or off.

6. Set Lower Lmt

Selects Lower Limit. Range is from 0.00 to 10.00 radians.

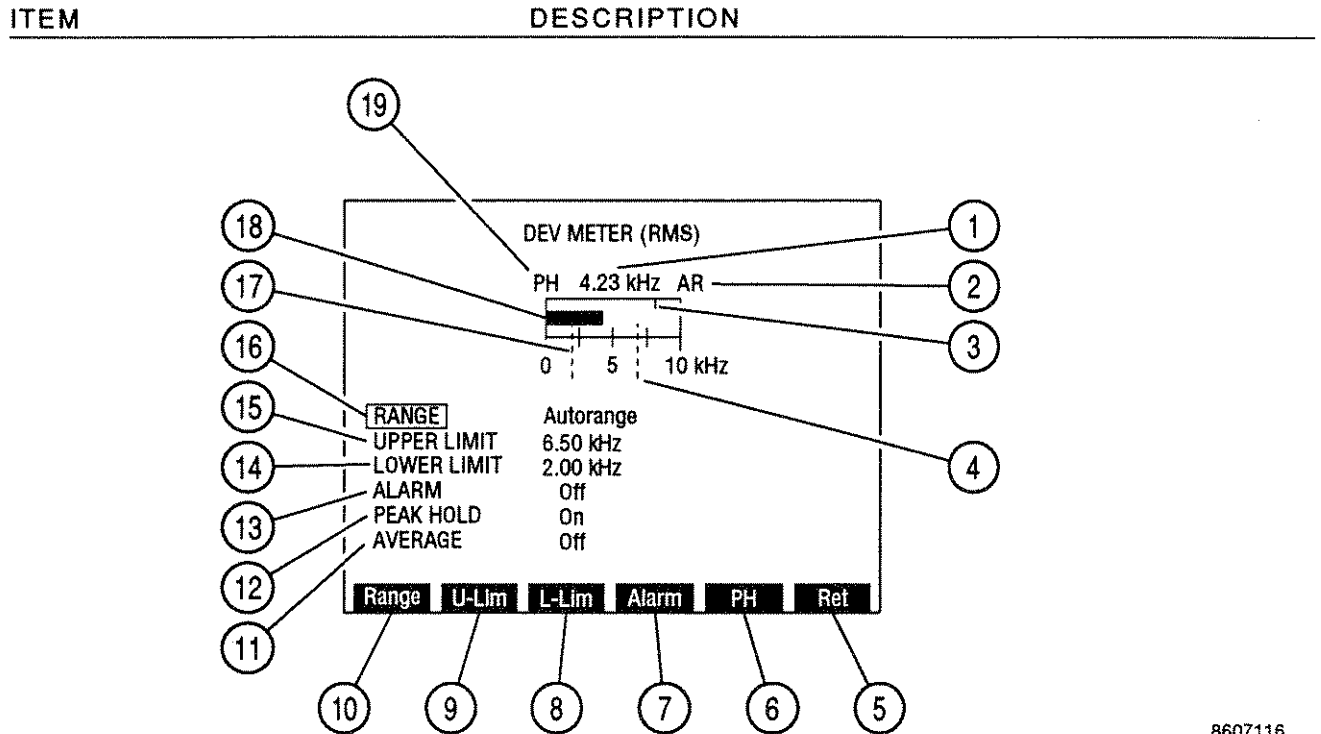
7. Set Alarm

Toggles Alarm between on and off. Enabled Alarm sounds when an Upper or Lower Limit is exceeded.



## L. DEVIATION METER (RMS)

With the Meter Menu displayed on the CRT, use the FIELD SELECT Keys to highlight "12. Dev Meter (RMS)" and press ENTER to access the Deviation (RMS) Meter Operation Screen:



8607116

### 1. Digital Meter Readout

Digital readout of meter in radians. If Peak Hold is on, the readout reads the highest meter deflection.

### 2. AR

Indicator appears above the upper left corner of the meter window if the Range is set for Autorange. The Range Scale changes to the next higher scale when the meter indicator bar reaches the edge of the meter window. The meter changes to the next lower scale if the meter indicator falls to a level of about 1/2 of the lowest scale division.

### 3. Peak Hold Indicator

Appears when Peak Hold is on. Yellow indicator line shows the highest point of meter deflection.

### 4. Upper Limit Indicator

When Upper Limit feature is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set. The indicator appears at the window's upper edge if the limit is set higher than the meter range.

ITEM	DESCRIPTION
5. <u>"Ret" Soft Function Key F6</u>	Displays the last accessed Operation Screen.
6. <u>"PH" Soft Function Key F5</u>	Toggles Peak Hold between on and off.
7. <u>"Alarm" Soft Function Key F4</u>	Toggles Alarm between on and off. Enabled Alarm sounds when an Upper or Lower Limit is exceeded.
8. <u>"L-Lim" Soft Function Key F3</u>	Activates and selects Lower Limit. Range is from 0.0 to 10.0 kHz. Lower Limit is turned off from Deviation-RMS Meter Setup Menu.
9. <u>"U-Lim" Soft Function Key F2</u>	Activates and selects Upper Limit. Range is from 0.0 to 10.0 kHz. Upper Limit is turned off from Deviation (RMS) Meter Setup Menu.
10. <u>"Range" Soft Function Key F1</u>	Selects Meter Range. Select Autorange, 2, 5, or 10 kHz.
11. <u>AVERAGE</u>	Toggles Average feature on or off. When on, Meter reads a running average of last 10 readings.
12. <u>PEAK HOLD</u>	Toggles Peak Hold feature between on and off.
13. <u>ALARM</u>	Toggles Alarm between on and off. Enabled Alarm sounds when an Upper or Lower Limit is exceeded.
14. <u>LOWER LIMIT</u>	Activates and selects Lower Limit. Range is from 0.00 to 10.00 kHz. Lower Limit is turned off from Deviation-RMS Meter Setup Menu.
15. <u>UPPER LIMIT</u>	Activates and selects Upper Limit. Range is from 0.00 to 10.00 kHz. Upper Limit is turned off from Deviation-RMS Meter Setup Menu.

ITEM	DESCRIPTION
16. <u>RANGE</u>	Selects Meter Range. Select Autorange, 2, 5, or 10 kHz.
17. <u>Lower Limit Indicator</u>	When Lower Limit feature is on, a dotted blue line appears across the meter window at the point on the scale where the limit is set.
18. <u>Meter Indicator Bar</u>	Displays Meter reading. Bar turns red when an Upper or Lower Limit is exceeded. Bar turns yellow if the current range is surpassed.
19. <u>PH</u>	This indicator appears beside the meter window lower left corner if Peak Hold is on.

With the Deviation (RMS) Meter Operation Screen displayed on the CRT, press the SETUP Key to access the Deviation (RMS) Meter Menu.

ITEM DESCRIPTION

DEVIATION (RMS) METER MENU

Deviation Meter (RMS) MENU	
1. Meter Range	10 kHz
2. Select Peak Hold	Off
3. Upper Lmt	On
4. Set Upper Lmt	7.00 kHz
5. Lower Lmt	On
6. Set Lower Lmt	3.00 kHz
7. Set Alarm	On
8. Average	Off

Ret ESC

8610171

1. Meter Range

Selects Meter Range. Select Autorange, 2, 5, or 10 kHz.

2. Select Peak Hold

Toggles Peak Hold feature between on and off.

3. Upper Lmt

Toggles Upper Limit between on or off.

4. Set Upper Lmt

Selects Upper Limit. Range is from 0.00 to 10.00 kHz.

5. Lower Lmt

Toggles Lower Limit between on or off.

6. Set Lower Lmt

Selects Lower Limit. Range is from 0.00 to 10.00 kHz.

7. Set Alarm

Toggles Alarm between on and off. Enabled Alarm sounds when an Upper or Lower Limit is exceeded.

8. Average

Toggles Average feature on or off. When on, Meters reads a running average of last 10 readings.

# SECTION 4 - OPERATION

## 4-1 GENERAL

The FM/AM-1600S has six Operation Modes accessed through the MODE Keys. Editing operation screens is done in one of the following ways:

- Moving screen cursor to a parameter and pressing ENTER Key to access its data field.
- Accessing the parameter data field using Soft Function Keys.
- Accessing and editing parameters on the Operation Screen's Setup Menus and Submenus.

Due to the number of Soft Function Key Definitions, only cursor/ENTER Key access on Operation Screens is discussed in the following paragraphs unless a parameter is only accessed through Soft Function Keys or Setup Menus.

While editing parameter data fields on Operation Screens or Menus, Soft Function Key F6 Definition shows "ESC". Pressing "ESC" Soft Function Key F6 at this time allows escape from the data field without changing its data.

When editing the Setup Menu of an Operation Screen or a meter accessed from an Operation Screen, one Soft Function Key Definition (F5 on menus, F6 on meters) shows "Ret". Pressing "Ret" Soft Function Key returns operation to the last accessed Operation Screen.

### 4-1-1 PARAMETER MEMORY OPERATION

The FM/AM-1600S allows storage and recall of 9 sets of parameters within each Operation Mode in the following manner:

STEP	PROCEDURE
------	-----------

1. To store a set of parameters:

- Press STORE MEMORY Key to access Store Parameters Menu. Use DATA ENTRY Keypad (29) to select a memory location (1 to 9). A data field appears asking for a title to be entered:

#### STORE PARAMETERS MENU

```
Store Parameters Menu (Duplex)
1 STORED PARAMETERS 1
2.
3.
4.
5.
6.
7.
8.
9.
Ret
```

8610103

- Use DATA ENTRY Keypad (29) to enter a title up to 20 characters in length and press ENTER Key. Press "Ret" Soft Function Key F5 to return to Operation Screen.

**NOTE:** Press SHIFT to toggle DATA ENTRY Keypad (29) to either numeric or alphabetic values. Numeric values are printed on the keys and alphabetic values are printed above keys in blue.

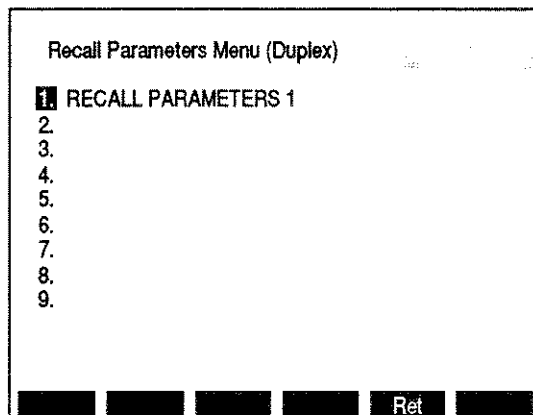
The DEL (Delete) KEY causes a character to be deleted. CE (Clear Entry) Key causes a blank space to be entered.

- If a set of parameters are already stored under the number chosen, a data field appears with the message "Entry Exists. Delete it?". Press STORE MEMORY Key to toggle this entry between yes and no and press ENTER Key. If yes is chosen, use DATA ENTRY Keypad to enter a new title. Press ENTER Key and "Ret" Soft Function Key F5 to return to Operation Screen.

2. To recall a set of parameters:

- Press RCL (Recall) MEMORY Key to access Recall Parameters Menu. Use DATA ENTRY Keypad (29) to select memory location. A "Recall?" message and data field appears:

RECALL PARAMETERS MENU



8610105

- Press RCL (Recall) MEMORY Key to toggle between yes and no, and press ENTER Key to activate. Press "Ret" Soft Function Key F5 to return to Operation Screen.

**NOTE:** If nothing is stored under entry chosen, a "Does Not Exist" message briefly appears. Use DATA ENTRY Keypad (29) to select another entry or press "Ret" Soft Function Key to return to Operation Screen.

## 4-1-2 PRINTING CRT SCREENS

A screen print is performed using the following instructions:

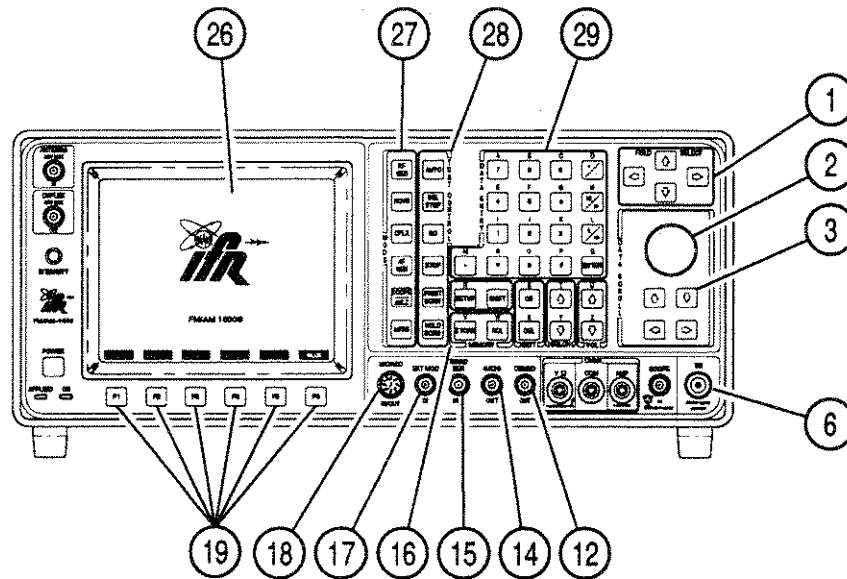
STEP	PROCEDURE
1.	Confirm RS-232 parameters are set for printing (see 6-2).
2.	Connect Printer to RS-232 Connector (38) (figure 3-2).
3.	Press PRINT SCRN Key. If Oscilloscope or Analyzer Operation Screen is displayed, a submenu appears listing print and plot options. Press "1" DATA ENTRY Key (29) to print the CRT screen. To plot Oscilloscope Trace, see 4-6. To plot Analyzer Trace, see 4-7.

## 4-2 RF GENERATOR OPERATION

### 4-2-1 GENERAL OPERATION

Operate RF Generator using the following procedure:

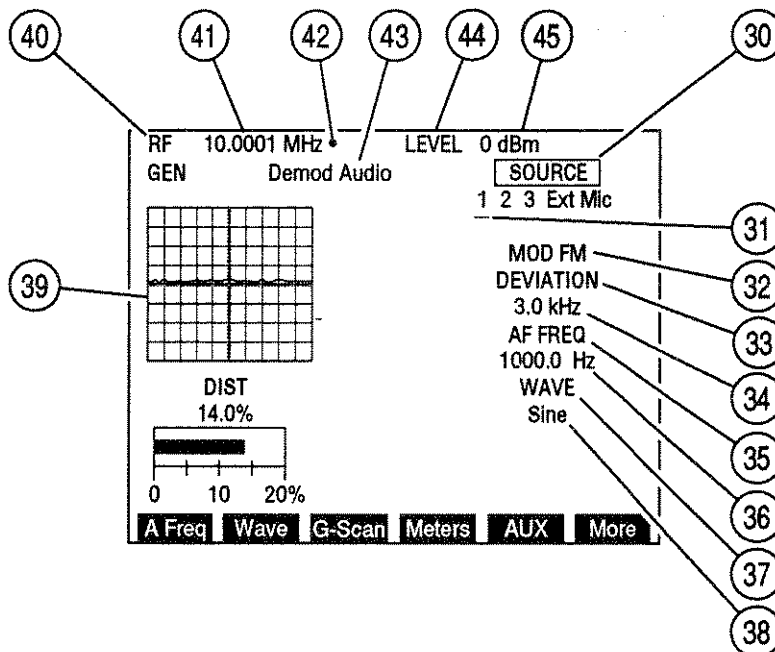
STEP PROCEDURE



8607058

1. Press RF GEN MODE Key (27) to access RF Generator Operation Screen.

**NOTE:** While RF Generator Operation Screen is displayed, a signal >100 mW applied to T/R Connector (6) causes Receiver Operation Screen to be displayed.



8607101



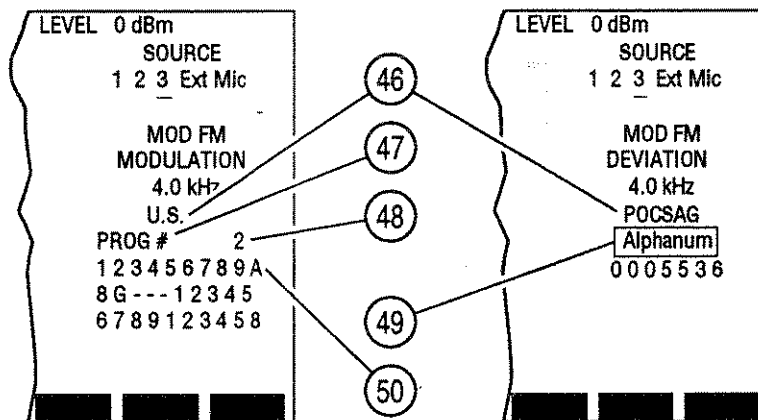
**STEP**

**PROCEDURE**

2. Move cursor to RF (40) and press ENTER Key to access its data field (41). Use DATA ENTRY Keypad (29) to enter a frequency (in MHz) and press ENTER Key to activate entered frequency.
3. Move cursor to LEVEL (44) and press ENTER Key to access Output Level data field (45). Use DATA ENTRY Keypad (29) to enter level and press ENTER Key to activate Output Level. If necessary, press "+/-" Key to place a "-" in the data field.
4. Move cursor to SOURCE (30) and press ENTER Key to access active Modulation Source. If no source is active, data field cursor (31) appears under Source 1 Callout. If more than one source is on, active source is indicated by an underline. Source 1 refers to AF Generator 1, Source 2 refers to AF Generator 2, Source 3 refers to Signaling Formats, Ext refers to signals received at Ext Mod Connector (17) and Mic refers to signals received at MIC/ACC Connector (18). Last accessed source becomes the active source.

Use FIELD SELECT ← and → Keys (1) to place cursor over desired source and use DATA SCROLL ↑ or ↓ Keys (3) to select desired Modulation Type. White indicates OFF, red indicates AM, yellow indicates FM and green indicates PM. Selected Modulation Type is displayed on Modulation Type Callout (32).

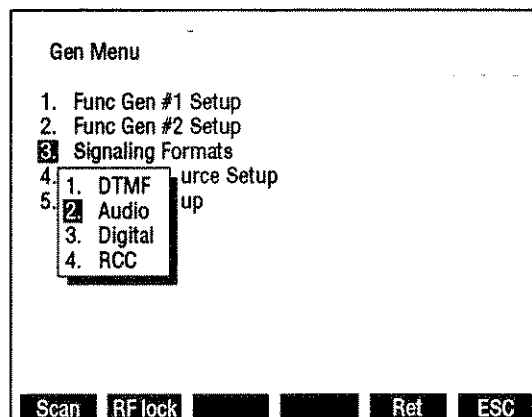
5. Move cursor to DEVIATION or MODULATION (33) and press ENTER Key to access its data field (34). Use DATA ENTRY Keypad (29) to enter digits of desired deviation frequency or modulation percentage. Press ENTER Key to activate deviation or modulation.
6. If Source 1 or 2 is selected as active source:
  - Move cursor to AF FREQ (35) and press ENTER Key to access its data field (36). Use DATA ENTRY Keypad (29) to enter desired frequency and press ENTER Key to activate Audio Frequency.
  - Move cursor to WAVE (37) and press ENTER Key to access its data field (38). Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field, and press ENTER Key to activate Wave Shape.
7. If Source 3 is not selected as the Active Source, proceed to step 18. If Source 3 is selected as the Active Source, the Operation Screen appears as follows:



8617080

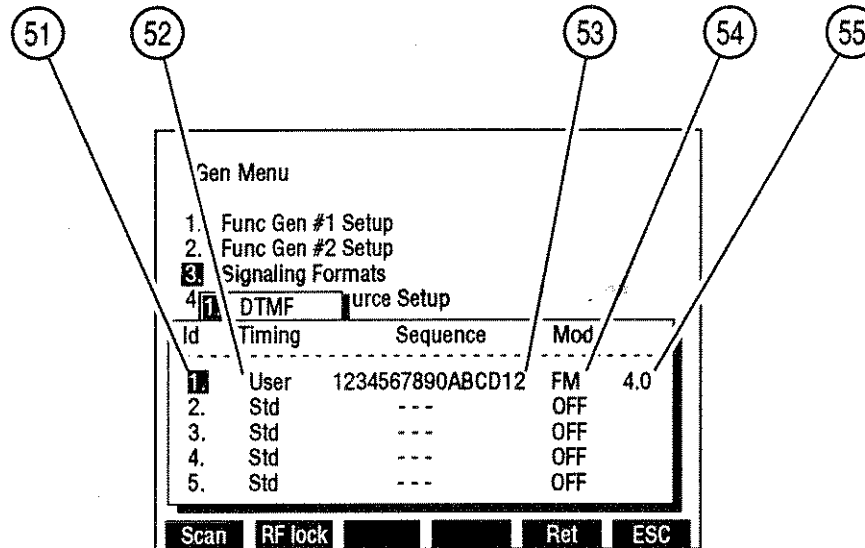
8. If DTMF is the Signaling Format:
  - Move cursor to DIRECT ENTRY/PROG # Callout (47). Press ENTER Key to toggle between Direct Entry and Program features.
  - If PROG is selected, move cursor to Program Number (48) and use DATA ENTRY Keypad (29) to select a programmed sequence. Press ENTER Key.
  - If DIRECT ENTRY is selected, move cursor to sequence (50) and use DATA ENTRY Keypad (29) to enter desired sequence. Press ENTER Key.
9. If DTMF is not the Signaling Format, move cursor to Signaling Code (46) and use DATA SCROLL Keys ↑ and ↓ (3) to select one of the Signaling Codes of the current Signaling Format. Press ENTER Key.
  - If POCSAG or Tone Remote is selected as Signaling Code, move cursor to POCSAG or Tone Remote Function Callout (49). Use DATA SCROLL ↑ and ↓ Keys (3) to select a function and press ENTER Key.
  - If a Signaling Code other than DTMF, POCSAG or Tone Remote is selected:
    - Move cursor to DIRECT ENTRY/PROG # Callout (47). Press ENTER Key to toggle between Direct Entry and Program features.
    - If PROG is selected, move cursor to Program Number (48) and use DATA ENTRY Keypad (29) to select a programmed sequence. Press ENTER Key.
    - If DIRECT ENTRY is selected, move cursor to sequence (50) and use DATA ENTRY Keypad (29) to enter desired sequence. Press ENTER Key.
10. To generate Code, press GO TEST CONTROL Key (28). To stop generating Code, press STOP TEST CONTROL Key (28). To generate Code one tone at a time, press SGL STEP TEST CONTROL Key (28).
11. To select a different Signaling Format, press SETUP Key to display Gen Menu. Press "3" DATA ENTRY Key (29) to display Signaling Formats Menu.

### RF GENERATOR SIGNALING FORMAT MENU



8610080

12. Use DATA ENTRY Keys (29) to select a Signaling Format and press "Ret" Soft Function Key F5.
13. To program a Signaling Code sequence, press SETUP Key to display Gen Menu. Press "3" DATA ENTRY Key (29) to display the Signaling Formats Menu. Use DATA ENTRY Keys (29) to select a Signaling Format.
14. If DTMF is selected, DTMF Signaling Menu appears:



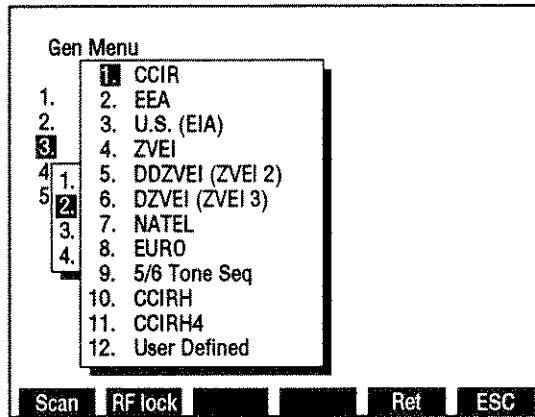
8607123

- Select Id (51) of Sequence to be edited using the FIELD SELECT ↑ and ↓ Keys.
  - Move cursor to Timing column (52) and use DATA SCROLL ↑ and ↓ Keys (3) to select Std (Standard) or User. Press ENTER Key.
  - If User is chosen, data fields appear for Mark Timing and Space Timing:
    - Press "1" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Mark Timing. Press ENTER Key.
    - Press "2" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Space Timing. Press ENTER Key.
    - Press "ESC" Soft Function Key F6.
  - Move cursor to Selection column (53) and enter a sequence using DATA ENTRY Keypad (29) and press ENTER Key.
- NOTE:** Pressing SHIFT Key toggles DATA ENTRY Keypad (29) between numeric and alphabetic characters.
- Move cursor to Mod column (54) and use DATA SCROLL ↑ and ↓ Keys (3) to select Modulation Type and press ENTER Key.

- Move cursor to Modulation Level (55) and use DATA ENTRY Keypad (29) to select Modulation Level and press ENTER Key.
- When all desired sequences are entered, press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.

15. If Audio is selected as Signaling Format, the Audio Code Menu appears:

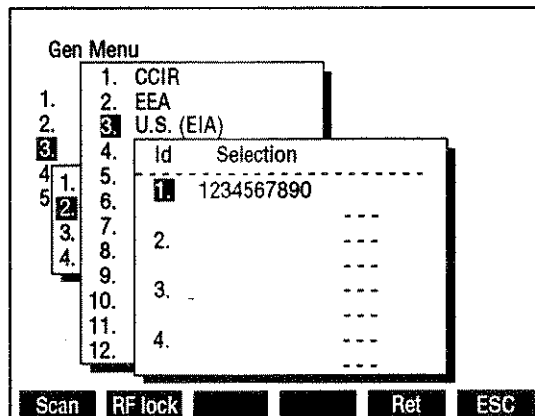
RF GENERATOR AUDIO  
CODE MENU



8610081

- Use FIELD SELECT Keys (1) to select an Audio Code and press ENTER Key. Audio Code Sequence Menu appears:

RF GENERATOR AUDIO  
CODE SEQUENCE MENU

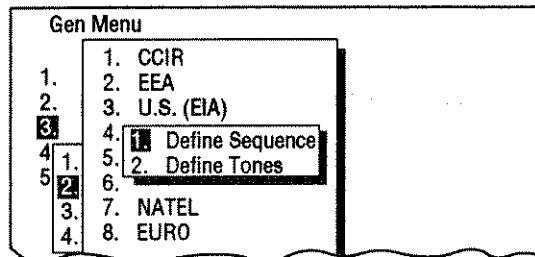


8610082

- Use FIELD SELECT Keys (1) to select an Id and press ENTER Key.
- Use DATA ENTRY Keys (29) to enter a sequence and press ENTER Key.

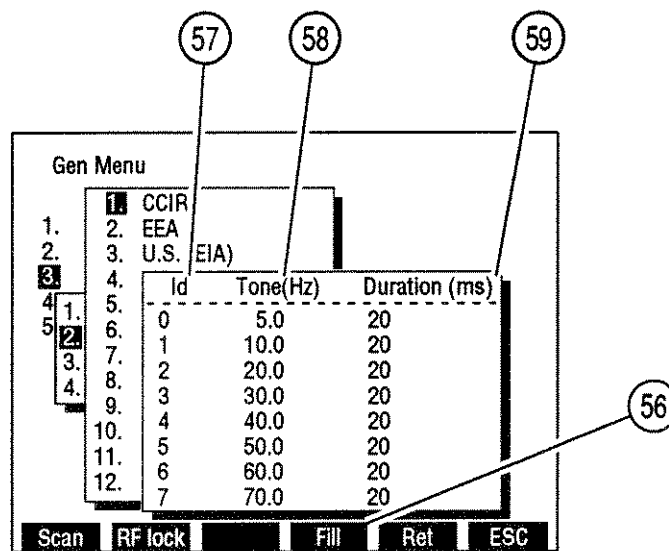
**NOTE:** Pressing SHIFT Key toggles DATA ENTRY Keypad (29) between numeric and alphabetic characters.

- If "12. User Defined" is selected as Audio Code, the Audio Code User Defined Menu appears:



8610159

- Press "2" DATA ENTRY Key (29) to display the following menu:



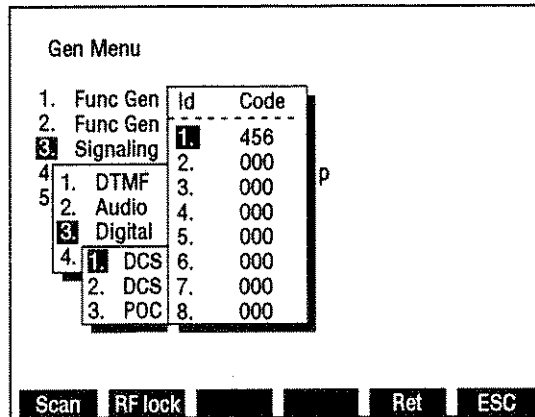
8607119

- Move cursor to Tone(Hz) column (58) of desired Id (57) and use DATA ENTRY Keypad (29) to select a frequency. Press ENTER Key.
- Move cursor to Duration(ms) column (59) and use DATA ENTRY Keypad (29) to select duration. Press ENTER Key.
- With cursor in Tone(Hz) (58) or Duration(ms) (59) columns, press "Fill" Soft Function Key F4 to fill column below cursor with value highlighted by cursor.
- When all desired tones are defined, press "ESC" Soft Function Key F6 to return to Audio Code User Defined Menu.
- Press "1" DATA ENTRY Key (29) to access Audio Code Sequence Menu. User Defined Sequences are selected as other Audio Code Sequences. When all desired sequences have been entered, press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.

16. If Digital is selected as the Signaling Format, the Digital Code Menu appears. Use DATA ENTRY Keypad (29) to select a Digital Code.

- If DCS or DCS INV is selected as the Digital Code, the DCS Code Menu appears:

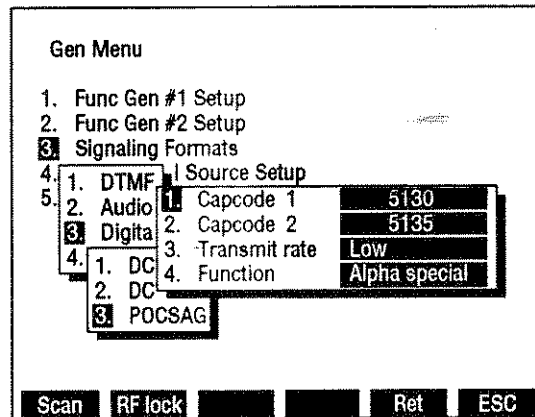
RF GENERATOR  
DCS CODE MENU



8610083

- Use FIELD SELECT Keys (1) to select an Id and press ENTER Key.
- Use DATA ENTRY Keypad (29) to enter a sequence and press ENTER Key. When all desired sequences are entered, press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
- If POCSAG is selected as the Digital Code, POCSAG Menu appears:

RF GENERATOR POCSAG MENU

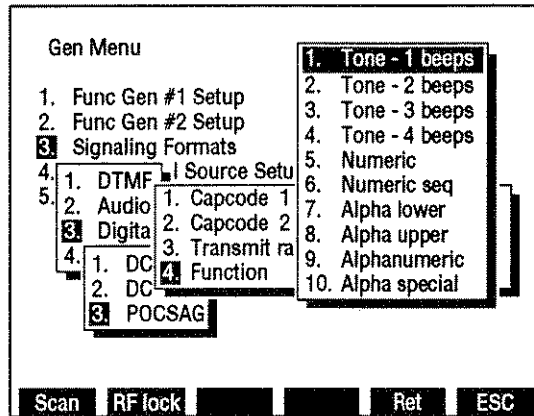


8610143

- Press "1" DATA ENTRY Key (29) to access Capcode 1. Use DATA ENTRY Keypad (29) to enter Starting Capcode and press ENTER Key.
- Press "2" DATA ENTRY Key (29) to access Capcode 2. Use DATA ENTRY Keypad (29) to enter Ending Capcode and press ENTER Key.

- Press "3" DATA ENTRY Key (29) to toggle Transmit rate until set as desired.
- Press "4" DATA ENTRY Key (29) to display POCSAG Function Menu:

RF GENERATOR POCSAG FUNCTION MENU

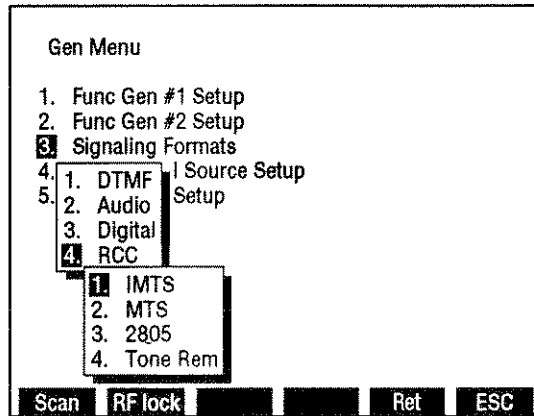


8610173

- Use FIELD SELECT Keys (1) to select a Function Type and press ENTER Key. Press "Ret" Soft Function Key F5 to return to the RF Generator Operation Screen.

17. If RCC is selected as the Signaling Format, RCC Menu appears. Use DATA ENTRY Keypad (29) to select a RCC Code.

RF GENERATOR RCC MENU



8610144

- If IMTS, MTS or 2805 is selected, RCC sequence Menu appears.

### RF GENERATOR RCC SEQUENCE MENU

Gen Menu		Id	Sequence
1.	Func Gen #1		
2.	Func Gen #2	1.	12345678912345678
3.	Signaling For	2.	---
4.	1. DTMF	3.	---
5.	2. Audio	4.	---
	3. Digital	5.	---
	4. RCC	6.	---
		7.	---
		8.	---

1.	IMTS
2.	MTS
3.	2805
4.	Tone Rem

Scan RF lock Ret ESC

8610145

- Use FIELD SELECT Keys (1) to select an Id and press ENTER Key.
- Use DATA ENTRY Keypad (29) to enter a sequence and press ENTER Key.
- When 2805 is chosen, "Tone" Soft Function Key F3 appears. To edit 2805 frequency, press "Tone" Soft Function Key F3 and use DATA ENTRY Keypad (29) to enter frequency. Press ENTER Key.
- When all desired sequences have been entered, press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
- If Tone Rem (Remote) is selected, Tone Rem Function Menu appears:

### TONE REM FUNCTION MENU

Gen Menu		Tone Rem Function	
1.	Func Gen	1.	2050 (Monitor)
2.	Func Gen	2.	1950 (F1)
3.	Signaling F	3.	1850 (F2)
4.	1. DTMF	4.	1750 (R2 Mute)
5.	2. Audio	5.	1650 (R2 Unmute)
	3. Digital	6.	1550 (Repeater Off)
	4. RCC	7.	1450 (Repeater On)
		8.	1350 (Wild Card 1 On)
		9.	1250 (Wild Card 1 Off)
		10.	1150 (Wild Card 2 On)
		11.	1050 (Wild Card 2 Off)

1.	IMTS
2.	MTS
3.	2805
4.	Tone Rem

Scan RF lock Ret ESC

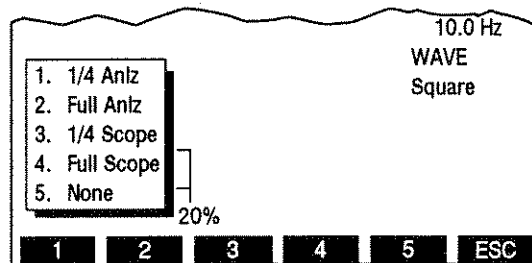
8610174

- Use FIELD SELECT Keys (1) to select a Tone Remote Function and press the ENTER Key.
- Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.



18. If an Oscilloscope or Spectrum Analyzer display is desired for the RF Generator Screen or if this feature is desired in a different size:

- Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 appears. Press "DISP" Soft Function Key F1.
- A menu appears in lower left corner of CRT screen displaying the following options:

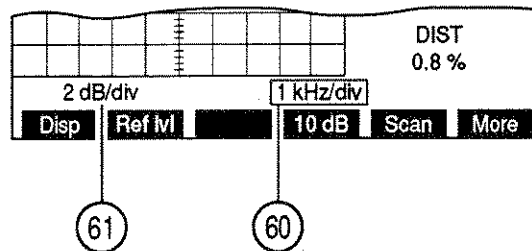


8617084

Select desired screen option using DATA ENTRY Keypad (29).

**NOTE:** 1/4 size Analyzer Screen parameters are edited by selecting full size Analyzer Screen, editing parameters and reselecting 1/4 size Analyzer Screen.

19. If "2. Full Anlz" is selected:



8607108

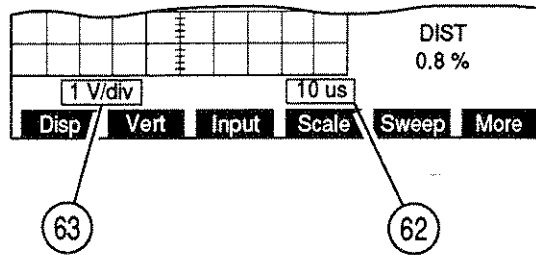
- Move cursor to Analyzer Scan Width (60) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate Scan Width desired.
- Move cursor to Analyzer Scale (61) and press ENTER Key to change this parameter. Pressing ENTER Key toggles its value between 2 and 10 dB.

20. If "3. 1/4 Scope" is selected:

- Move cursor to Oscilloscope Input (43) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field, and press ENTER Key to activate Oscilloscope Input desired.

**NOTE:** The remaining Oscilloscope parameters are edited by selecting full size Scope Screen, changing parameters and reselecting 1/4 size Scope Screen.

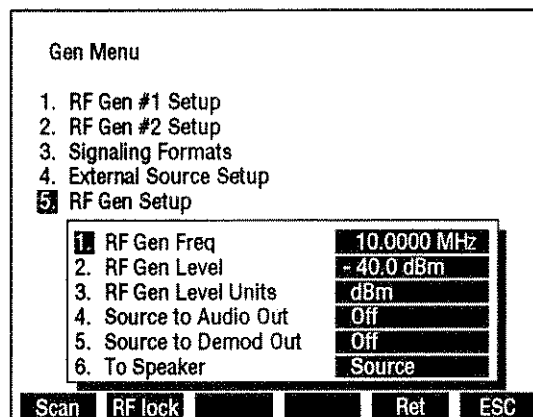
21. If "4. Full Scope" is selected:



8607106

- Move cursor to Oscilloscope Input (43) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate selected Oscilloscope Input.
  - Move cursor to Oscilloscope Sweep Rate (62) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate selected Oscilloscope Sweep Rate.
  - Move cursor to Oscilloscope Scale (63) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate selected Oscilloscope Scale.
  - If needed, press "More" Soft Function Key F6 until "Vert" Soft Function Key F2 appears. Press "Vert" Soft Function Key F2. Use DATA SCROLL Spinner (2) or DATA SCROLL ↑ or ↓ Keys (3) to adjust vertical position of Oscilloscope Trace.
22. If RF Generator Output to AUDIO OUT Connector (14) or DEMOD OUT Connector (12) is desired, press SETUP Key to display the Gen Menu. Press "5" DATA ENTRY Key (29) to access RF Gen Setup Menu:

#### RF GEN SETUP MENU



8610074

- Press "4" DATA ENTRY Key (29) as needed to enable or disable RF Generator Output to AUDIO OUT Connector (14).

- Press "5" DATA ENTRY Key (29) as needed to enable or disable RF Generator Output to DEMOD OUT Connector (12).
  - Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
23. To display SINAD, Distortion, AF Level Meter or Digital Multimeter, press "More" Soft Function Key F6 until "Meters" Soft Function Key F4 appears. Press "Meters" Soft Function Key F4 to display a submenu listing available meters. Use DATA ENTRY Keypad (29) to select a meter. To access a meters Operation Screen, move cursor to Meters Callout and press ENTER Key.
- For SINAD Meter Operation Procedures, see 4-8-7.
  - For Distortion Meter Operation Procedures, see 4-8-6.
  - For Digital Multimeter Operating Procedures, see 4-8-10.
- NOTE:** SINAD, Distortion and AF Level Meters measure only SINAD/BER Connector (15) Input. DMM measures only DMM Connector Input.
24. To use RF Generator Frequency Scan, press SETUP Key to access Gen Menu. Press "Scan" Soft Function Key F1 to access RF Generator Frequency Scan Menu:

#### RF GENERATOR FREQUENCY SCAN MENU

Gen Menu													
1.	Func Gen #1 Setup												
2.	Func Gen #2 Setup												
3.	Signaling Formats												
4.	External Source Setup												
5.	RF Frequency Scan												
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">1.</td> <td>Start Freq</td> <td style="text-align: center;">1.0000 MHz</td> </tr> <tr> <td>2.</td> <td>Stop Freq</td> <td style="text-align: center;">10.0000 MHz</td> </tr> <tr> <td>3.</td> <td>Increment</td> <td style="text-align: center;">1.0000 MHz</td> </tr> <tr> <td style="background-color: #cccccc;">4.</td> <td style="background-color: #cccccc;">Scan Rate</td> <td style="background-color: #cccccc;">0.01 Sec</td> </tr> </table>		1.	Start Freq	1.0000 MHz	2.	Stop Freq	10.0000 MHz	3.	Increment	1.0000 MHz	4.	Scan Rate	0.01 Sec
1.	Start Freq	1.0000 MHz											
2.	Stop Freq	10.0000 MHz											
3.	Increment	1.0000 MHz											
4.	Scan Rate	0.01 Sec											
<table style="width: 100%; border: none;"> <tr> <td style="width: 33%; border: 1px solid black; text-align: center;">RF lock</td> <td style="width: 33%; border: 1px solid black; text-align: center;">Ret</td> <td style="width: 33%; border: 1px solid black; text-align: center;">ESC</td> </tr> </table>		RF lock	Ret	ESC									
RF lock	Ret	ESC											

8610084

- Press "1" DATA ENTRY Key (29) to access Starting Frequency. Use DATA ENTRY Keypad (29) to enter Starting Frequency and press ENTER Key.
- Press "2" DATA ENTRY Key (29) to access Stopping Frequency. Use DATA ENTRY Keypad (29) to enter Stopping Frequency and press ENTER Key.
- Press "3" DATA ENTRY Key (29) to access Increment. Use DATA ENTRY Keypad (29) to enter Increment and press ENTER Key.
- Press "4" DATA ENTRY Key (29) to access Scan Rate. Use DATA ENTRY Keypad (29) to enter Scan Rate. Press ENTER Key and "Ret" Soft Function Key F5 to return to Operation Screen.

**STEP****PROCEDURE**

---

- Press "More" Soft Function Key F6 until "G Scan" Soft Function Key F3 appears. Press "G Scan" Soft Function Key F3 to start the RF Frequency Scan. Scanning continues repeatedly until "G Scan" Soft Function Key F4 is pressed again.
25. To activate RF Lock Function, press SETUP Key to access Gen Menu. Press "RF lock" Soft Function Key F2. "RF lock" appears in red when active. Press "RF lock" Soft Function Key F2 to deactivate RF Lock Function.
  26. To store or recall a set of screen parameters, see 4-1-1.

**4-2-2 GENERATING FM MODULATED RF SIGNAL**

**EXAMPLE:** The following example generates a 90 MHz signal FM modulated with a 1 kHz sine wave. The modulation level is 4 kHz and the RF Output Level is -60 dBm.

**STEP****PROCEDURE**

---

1. Move cursor to RF (40) and press "9" and "0" DATA ENTRY Keys (29). Press ENTER Key.
2. Press SETUP Key and "5" DATA ENTRY Key (29) to display RF Gen Setup Menu. Press "3" DATA ENTRY Key (29) until "dBm" is selected for RF Gen Level Units. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
3. Move cursor to LEVEL (43) and press "+/-, 6, 0" DATA ENTRY Keys (29). Press ENTER Key.
4. Move cursor to SOURCE (30) and press ENTER Key. Use DATA SCROLL ← and → Keys (3) to select AF Generator 1. Use DATA SCROLL ↑ and ↓ Keys (3) to select FM and press ENTER Key.
5. Move cursor to DEVIATION (33) and press "4" DATA ENTRY Key (29). Press ENTER Key.
6. Move cursor to AF FREQ (35) and press "1, 0, 0, 0" DATA ENTRY Keys (29). Press ENTER Key.
7. Move cursor to WAVE (37) and press DATA SCROLL ↑ and ↓ Keys (3) until Sine appears and press ENTER Key.

### 4-2-3 GENERATING AM MODULATED RF SIGNAL

**EXAMPLE:** The following example generates a 850 kHz signal AM modulated with a 2 kHz sine wave. The modulation level is 25% and RF Output Level is .224 mV.

STEP	PROCEDURE
1.	Move cursor to RF (40) and press "•, 8, 5" DATA ENTRY Keys (29). Press ENTER Key.
2.	Press SETUP Key and "5" DATA ENTRY Key (29) to display RF Gen Setup Menu. Press "3" DATA ENTRY Key (29) until "Volts" is selected for RF Gen Level Units. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
3.	Move cursor to LEVEL (44) and press ENTER Key. Press "•, 2, 2, 4, k/m" DATA ENTRY Keys (29).
4.	Move cursor to SOURCE (30) and press ENTER Key. Use DATA SCROLL ← and → Keys (3) to select AF Generator 1. Use DATA SCROLL ↑ and ↓ Keys (3) to select AM and press ENTER Key.
5.	Move cursor to MODULATION (33) and press "2" and "5" DATA ENTRY Keys (29). Press ENTER Key.
6.	Move cursor to AF FREQ (35) and press "2, 0, 0, 0" DATA ENTRY Keys (29). Press ENTER Key.
7.	Move cursor to WAVE (37) and press DATA SCROLL ↑ and ↓ Keys (3) until Sine appears and press ENTER Key.

### 4-2-4 EXTERNALLY MODULATING RF SIGNAL GENERATOR

**EXAMPLE:** The following example generates a 450 MHz signal FM modulated with an external signal applied to EXT MOD Connector. The modulation level is 4 kHz and RF Output Level is -65 dBm.

STEP	PROCEDURE
1.	Move cursor to RF (40) and press "4, 5, 0" DATA ENTRY Keys (29). Press ENTER Key.
2.	Press SETUP Key and "5" DATA ENTRY Key (29) to display RF Gen Setup Menu. Press "3" DATA ENTRY Key (29) until "dBm" is selected for RF Gen Level Units. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
3.	Move cursor to LEVEL (44) and press "+/-, 6, 5" DATA ENTRY Keys (29). Press ENTER Key.
4.	Move cursor to SOURCE Callout (30) and press ENTER Key. Use DATA SCROLL ← and → Keys (3) to select EXT. Use DATA SCROLL ↑ and ↓ Keys (3) to select FM and press ENTER Key.
5.	Move cursor to DEVIATION (33) and press "4" DATA ENTRY Key (29). Press ENTER Key.
6.	Apply external modulated signal to EXT MOD Connector (17).

## 4-2-5 GENERATING DTMF CODED RF SIGNAL

**EXAMPLE:** The following example generates a 450 MHz signal FM modulated with a DTMF Code. The modulation level is 4 kHz and RF Output Level is -60 dBm.

STEP	PROCEDURE
1.	Move cursor to RF (40) and press "4, 5, 0" DATA ENTRY Keys (29). Press ENTER Key.
2.	If LEVEL units are Volts, press SETUP Key and "5" DATA ENTRY Key to display RF Gen Setup Menu. Press "3" DATA ENTRY Key until "dBm" is selected for RF Gen Level Units. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
2.	Move cursor to LEVEL (44) and press "+/-, 6, 0" DATA ENTRY Keys (29). Press ENTER Key.
3.	Move cursor to SOURCE (30) and press ENTER Key. Use DATA SCROLL ← and → Keys (3) to select Source 3. Use DATA SCROLL ↑ and ↓ Keys (3) to select FM and press ENTER Key.
4.	Move cursor to DEVIATION (33) and press "4" DATA ENTRY Key (29). Press ENTER Key.
5.	Press SETUP Key to access RF GEN MENU and press "3" DATA ENTRY Key (29). Press "1" DATA ENTRY Key (29) and DTMF Menu appears.
6.	Select Id of Sequence to be edited using FIELD SELECT Keys (1) and press ENTER Key.
7.	Move cursor to Timing column and use DATA SCROLL Keys (3) to select Std (standard) or User. If User is chosen, data fields appear for Mark Timing and Space Timing. Use DATA ENTRY Keypad (29) to enter timing desired and press ENTER Key.
8.	Move cursor to Selection column and enter a sequence using DATA ENTRY Keypad (29) and press ENTER Key.
	<b>NOTE:</b> Pressing SHIFT toggles DATA ENTRY Keypad (29) between numeric to alphabetic characters.
9.	Move cursor to Mod column and use DATA SCROLL Keys (3) to select modulation. Move cursor to percent modulation and select using DATA ENTRY Keypad (29).
10.	Press ENTER Key and "Ret" Soft Function Key to return to RF Generator Operation Screen.
11.	Move cursor to PROG #/DIRECT ENTRY (47) and press ENTER Key until PROG # appears.
12.	Move cursor to Program Number (48) and use DATA ENTRY Keypad (29) to select an Id.
13.	Press GO TEST CONTROL Key (28) to generate DTMF sequence continuously. Press STOP TEST CONTROL Key (28) to stop DTMF sequence. Press STOP TEST CONTROL Key (28) to stop sequence. Press SGL STEP TEST CONTROL Key (28) to generate sequence once.

## 4-2-6 GENERATING AUDIO 2 TONE CODING

**EXAMPLE:** The following example generates a 150 MHz signal FM modulated with an AUDIO 2 Tone Code. The modulation level is 4 kHz and RF Output Level is 0 dBm.

STEP	PROCEDURE
1.	Move cursor to RF (40) and press "1, 5, 0" DATA ENTRY Keys (29). Press ENTER Key.
2.	If LEVEL units are Volts, press SETUP Key and "5" DATA ENTRY Key to display RF Gen Setup Menu. Press "3" DATA ENTRY Key until "dBm" is selected for RF Gen Level Units. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
3.	Move cursor to LEVEL (44) and press "0" DATA ENTRY Key (29). Press ENTER Key.
4.	Move cursor to SOURCE (30) and press ENTER Key. Use DATA SCROLL ← and → Keys (3) to select Source 3. Use DATA SCROLL ↑ and ↓ Keys (3) to select FM and press ENTER Key.
5.	Move cursor to DEVIATION (33) and press "4" DATA ENTRY Key (29). Press ENTER Key.
6.	Press SETUP Key to access RF GEN MENU and press "3" DATA ENTRY Key (29). Press "2" DATA ENTRY Key (29) and AUDIO Menu appears.
7.	Move cursor to "12. User Defined" and press ENTER Key. Press "2" DATA ENTRY Key to access Define Tones Menu.
8.	Move cursor to Tone(Hz) location in 0 row. Press "0" DATA ENTRY (29) Keys and press ENTER Key. Press FIELD SELECT → Key (1) to move cursor to Duration(ms) column. Press "1, 0, 0" DATA ENTRY Keys (29) and press ENTER Key.
9.	Move cursor to Tone(Hz) location in 1 row. Press "8, 8, 0" DATA ENTRY Keys and press ENTER Key. Press FIELD SELECT → Key (1) to move cursor to Duration(ms) column. Press "5, 0, 0" DATA ENTRY Keys (29) and press ENTER Key.
10.	Move cursor to Tone(Hz) location in the 2 row. Press "2, 2, 0, 0" DATA ENTRY (29) Keys and press ENTER Key. Press FIELD SELECT → Key (1) to move cursor to Duration(ms) column. Press "5, 0, 0" DATA ENTRY Keys (29) and press ENTER Key.
11.	Press "ESC" Soft Function Key F6 and press "1" DATA ENTRY Key (29) to display Define Sequence Menu. Move cursor to 1 in Id column and press ENTER Key. Press "1, 0, 2" DATA ENTRY Keys (29) and press ENTER Key. Press "Ret" Soft Function Key F5 to return to RF Generator Operating Screen.
12.	Move cursor to PROG #/DIRECT ENTRY (47) and press ENTER Key until PROG # appears.
13.	Move cursor to Program Number (48) and press "1" DATA ENTRY Key (29) and press ENTER Key.
14.	Press GO TEST CONTROL Key (28) to generate sequence continuously. Press STOP TEST CONTROL Key (28) to stop sequence. Press STOP TEST CONTROL Key (28) to stop sequence. Press SGL STEP TEST CONTROL Key (28) to generate sequence once.

## 4-2-7 GENERATING 5/6 AUDIO TONE

**EXAMPLE:** The following example generates a 162 MHz signal FM modulated with an AUDIO 5/6 Tone Code. The modulation level is 4 kHz and RF Output Level is 0 dBm.

STEP	PROCEDURE
1.	Move cursor to RF (40) and press "1, 6, 2" DATA ENTRY Keys (29). Press ENTER Key.
2.	If LEVEL units are Volts, press SETUP Key and "5" DATA ENTRY Key to display RF Gen Setup Menu. Press "3" DATA ENTRY Key until "dBm" is selected for RF Gen Level Units. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
3.	Move cursor to LEVEL (44) and press "0" DATA ENTRY Keys (29). Press ENTER Key.
4.	Move cursor to SOURCE (30) and press ENTER Key. Use DATA SCROLL ← and → Keys (3) to select Source 3. Use DATA SCROLL ↑ and ↓ Keys (3) to select FM and press ENTER Key.
5.	Move cursor to DEVIATION (33) and press "4" DATA ENTRY Key (29). Press ENTER Key.
6.	Press SETUP Key to access RF GEN MENU and press "3" DATA ENTRY Key (29). Press "2" DATA ENTRY Key (29) and AUDIO Menu appears.
7.	Move cursor to "12. User Defined" and press ENTER Key. Press "2" DATA ENTRY Key to access Define Tones Menu.
8.	Move cursor to Tone(Hz) location in 0 row. Press "9, 0, 0" DATA ENTRY (29) Keys and press ENTER Key. Press FIELD SELECT → Key (1) to move cursor to Duration(ms) column. Press "1, 5, 0" DATA ENTRY Keys (29) and press ENTER Key.
9.	Move cursor to Tone(Hz) location in 1 row. Press "1, 1, 0, 0" DATA ENTRY Keys and press ENTER Key. Press FIELD SELECT → Key (1) to move cursor to Duration(ms) column. Press "8, 0" DATA ENTRY Keys (29) and press ENTER Key.
10.	Move cursor to Tone(Hz) location in 2 row. Press "1, 2, 0, 0" DATA ENTRY (29) Keys and press ENTER Key. Press FIELD SELECT → Key (1) to move cursor to Duration(ms) column. Press "8, 0" DATA ENTRY Keys (29) and press ENTER Key.
11.	Move cursor to Tone(Hz) location in 3 row. Press "1, 3, 0, 0" DATA ENTRY Keys (29) and press ENTER Key. Press FIELD SELECT → Key (1) to move cursor to Duration(ms) column. Press "8, 0" DATA ENTRY Keys (29) and press ENTER Key.
12.	Move cursor to Tone(Hz) location in 4 row. Press "1, 4, 0, 0" DATA ENTRY Keys (29) and press ENTER Key. Press FIELD SELECT → Key (1) to move cursor to Duration(ms) column. Press "8, 0" DATA ENTRY Keys (29) and press ENTER Key.
13.	Move cursor to Tone(Hz) location in A row. Press "0" DATA ENTRY Key (29) and press ENTER Key. Press FIELD SELECT → Key (1) to move cursor to Duration(ms) column. Press "4, 0" DATA ENTRY Keys (29) and press ENTER Key.



**STEP****PROCEDURE**

---

14. Press "ESC" Soft Function Key F6 and press "1" DATA ENTRY Key (29) to display Define Sequence Menu. Move cursor to 2 in Id column and press ENTER Key. Press "0" DATA ENTRY Key, press SHIFT Key, press "A" DATA ENTRY Key and press "1, 2, 3, 4" DATA ENTRY Keys (29). Press ENTER Key. Press "Ret" Soft Function Key F5 to return to RF Generator Operating Screen.
15. Move cursor to PROG #/DIRECT ENTRY (47) and press ENTER Key until PROG # appears.
16. Move cursor to Program Number (48) and press "1" DATA ENTRY Key (29) and press ENTER Key.
17. Press GO TEST CONTROL Key (28) to generate sequence continuously. Press STOP TEST CONTROL Key (28) to stop sequence. Press STOP TEST CONTROL Key (28) to stop sequence. Press SGL STEP TEST CONTROL Key (28) to generate sequence once.

**4-2-8 GENERATING DCS CODE**

**EXAMPLE:** The following example generates a 162.4571 MHz signal FM modulated with a DCS Code. The modulation level is 4 kHz and RF Output Level is 0 dBm.

**STEP****PROCEDURE**

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1. Move cursor to RF (40) and press "1, 6, 2, \*, 4, 5, 7, 1" DATA ENTRY Keys (29). Press ENTER Key.
3. If LEVEL units are Volts, press SETUP Key and "5" DATA ENTRY Key to display RF Gen Setup Menu. Press "3" DATA ENTRY Key until "dBm" is selected for RF Gen Level Units. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
4. Move cursor to LEVEL (44) and press "0" DATA ENTRY Keys (29). Press ENTER Key.
5. Move cursor to SOURCE (30) and press ENTER Key. Use DATA SCROLL ← and → Keys (3) to select Source 3. Use DATA SCROLL ↑ and ↓ Keys (3) to select FM and press ENTER Key.
6. Move cursor to DEVIATION (33) and press "4" DATA ENTRY Key (29). Press ENTER Key.
7. Press SETUP Key to access RF GEN MENU and press "3" DATA ENTRY Key (29). Press "3" DATA ENTRY Key (29) and Digital Menu appears. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
8. Move cursor to Signaling Code (46) and press DATA SCROLL ↑ and ↓ Keys (3) until DCS appears. Press ENTER Key.
9. Move cursor to PROG #/DIRECT ENTRY (47) and press ENTER Key until DIRECT ENTRY appears.

STEP	PROCEDURE
10.	Move cursor to Sequence (50) and press "4, 5, 6" DATA ENTRY Keys (29). Press ENTER Key.
11.	Press GO TEST CONTROL Key (28) to generate sequence continuously. Press STOP TEST CONTROL Key (28) to stop sequence. Press STOP TEST CONTROL Key (28) to stop sequence. Press SGL STEP TEST CONTROL Key (28) to generate sequence once.

#### 4-2-9 GENERATING POCSAG CODE

**EXAMPLE:** The following example generates a 930 MHz signal FM modulated with a POCSAG Code. The modulation level is 4 kHz and RF Output Level is 0 dBm.

STEP	PROCEDURE
1.	Move cursor to RF (40) and press "9, 3, 0" DATA ENTRY Keys (29). Press ENTER Key.
2.	If LEVEL units are Volts, press SETUP Key and "5" DATA ENTRY Key to display RF Gen Setup Menu. Press "3" DATA ENTRY Key until "dBm" is selected for RF Gen Level Units. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
3.	Move cursor to LEVEL (44) and press "0" DATA ENTRY Key (29). Press ENTER Key.
4.	Move cursor to SOURCE (30) and press ENTER Key. Use DATA SCROLL ← and → Keys (3) to select Source 3. Use DATA SCROLL ↑ and ↓ Keys (3) to select FM and press ENTER Key.
5.	Move cursor to DEVIATION (33) and press "4" DATA ENTRY Key (29). Press ENTER Key.
6.	Press SETUP Key to access RF GEN MENU and press "3" DATA ENTRY Key (29). Press "3" DATA ENTRY Key (29) and Digital Menu appears. Press "3" DATA ENTRY Key (29) to display POCSAG Menu.
7.	Press "1" and "5, 1, 3, 0" DATA ENTRY Keys (29). Press ENTER Key. Press "2" and "5, 1, 3, 5" DATA ENTRY Keys (29). Press ENTER Key.
8.	Press "3" DATA ENTRY Key (29) until "Low" appears as the Transmit rate. Press "4" and "9" DATA ENTRY Keys to select Alphanumeric as message type.
9.	Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
10.	Press GO TEST CONTROL Key (28) to generate POCSAG Code. Capcode being generated appears below message type (49). When all capcodes specified are generated, Complete appears. Press SGL STEP TEST CONTROL Key (28) to generate one capcode and pause. Press STOP TEST CONTROL Key (28) to stop generating Code.

## 4-2-10 GENERATING 2805 CODE

**EXAMPLE:** The following example generates a 155 MHz signal FM modulated with a 2805 Tone (with frequency reset to 1500 Hz). The modulation level is 4 kHz and RF Output Level is -60 dBm.

STEP	PROCEDURE
1.	Move cursor to RF (40) and press "1, 5, 5" DATA ENTRY Keys (29). Press ENTER Key.
2.	If LEVEL units are Volts, press SETUP Key and "5" DATA ENTRY Key to display RF Gen Setup Menu. Press "3" DATA ENTRY Key until "dBm" is selected for RF Gen Level Units. Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
3.	Move cursor to LEVEL (44) and press "+/-, 6, 0" DATA ENTRY Keys (29). Press ENTER Key.
4.	Move cursor to SOURCE (30) and press ENTER Key. Use DATA SCROLL ← and → Keys (3) to select Source 3. Use DATA SCROLL ↑ and ↓ Keys (3) to select FM and press ENTER Key.
5.	Move cursor to DEVIATION (33) and press "4" DATA ENTRY Key (29). Press ENTER Key.
6.	Press SETUP Key to access RF GEN MENU and press "3" DATA ENTRY Key (29). Press "4" DATA ENTRY Key (29) and RCC Menu appears. Press "3" DATA ENTRY Key (29) to display 2805 Menu.
7.	Press "Tone" Soft Function Key F3 to display 2805 Frequency data field. Press "1, 5, 0, 0" DATA ENTRY Key (29) and press ENTER Key.
8.	Move cursor to 1 Id (Identification Number) and press ENTER Key. Press "5, 5, 5, 1. 2. 3. 4" DATA ENTRY Keys (29) and press ENTER Key.
9.	Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
10.	Move cursor to PROG #/DIRECT ENTRY (47) and press ENTER Key until PROG # appears.
11.	Move cursor to Program Number (48) and press "1" DATA ENTRY Key (29) and press ENTER Key.
12.	Press GO TEST CONTROL Key (28) to generate sequence continuously. Press STOP TEST CONTROL Key (28) to stop sequence. Press STOP TEST CONTROL Key (28) to stop sequence. Press SGL STEP TEST CONTROL Key (28) to generate sequence once.

## 4-2-11 MEASURING SINAD SENSITIVITY, CENTER FREQUENCY AND MODULATION ACCEPTANCE BANDWIDTH

STEP	PROCEDURE
1.	Connect T/R Connector (6) to UUT Antenna. Connect SINAD/BER Connector (15) to Speaker Audio Out of UUT.
2.	Press RF GEN MODE Key (27) .
3.	Press "More" Soft Function Key until "Meters" is shown for Soft Function Key F4. Press Soft Function Key F4 and press "1" DATA ENTRY Key (29) to select SINAD Meter.
4.	Move cursor to Source (30) and press ENTER Key. Use FIELD SELECT Keys (1) to select Source 1 and press DATA SCROLL ↑ and ↓ Keys (3) to select FM Modulation. Press ENTER Key.
5.	Move cursor to DEVIATION (33) and press "3" DATA ENTRY Key (29). Press ENTER Key.
6.	Move cursor to AF FREQ (35) and press "1, 0, 0, 0" DATA ENTRY Keys (29). Press ENTER Key.
7.	Move cursor to WAVE (37) and press DATA SCROLL Keys until Sine appears in data field. Press ENTER Key.
8.	Use FIELD SELECT Keys (1) to move cursor to SINAD Callout and press ENTER Key. <ul style="list-style-type: none"><li>● Use FIELD SELECT Keys (1) to move cursor to INPUT and press ENTER Key. Use DATA SCROLL Keys (3) to select "SINAD/BER" and press ENTER Key.</li><li>● Use FIELD SELECT Keys (1) to move cursor to NOTCH FREQ and press ENTER Key. Use DATA ENTRY Keypad (29) to set Notch Freq to 1000 Hz and press ENTER Key.</li><li>● Use FIELD SELECT Keys (1) to move cursor to FILTER and press ENTER Key until "C Wt" is selected.</li><li>● Use FIELD SELECT Keys (1) to move cursor to AVERAGE and press ENTER Key until "On" is selected.</li><li>● If red PH is showing at left end of Meter Bar (Peak Hold on), press Soft Function Key F5 to toggle Peak Hold off.</li><li>● Press Soft Function Key F6 to return to RF Generator Operation Screen.</li></ul>
9.	Use FIELD SELECT Keys (1) to move cursor to RF (40) and press ENTER Key. Use DATA ENTRY Keypad (29) to set RF Frequency to approximately UUT Receiving Frequency and press ENTER Key.

**STEP****PROCEDURE**

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10. Use FIELD SELECT Keys (1) to move cursor to LEVEL (44) and press ENTER Key. Use DATA SCROLL Keys (3) to adjust RF Out Level until SINAD Meter reads 10 dB. Use FIELD SELECT Keys (1) to move cursor to RF (40) and press ENTER Key. Adjust RF Frequency using DATA SCROLL Keys (3) until a maximum reading is attained on SINAD Meter. RF Frequency shows UUT Receiver's Center Frequency.
11. Leaving RF Frequency at UUT Receiver's Center Frequency, use FIELD SELECT Keys (1) to move cursor to LEVEL Callout and press ENTER Key. Use DATA SCROLL Keys (3) to increase RF Out Level until SINAD Meter reads 10 dB. RF Out Level reads UUT Receiver Sensitivity.
12. Use DATA SCROLL Keys (3) to increase RF Out Level 6 dBm and press ENTER Key.
13. Use FIELD SELECT Keys (1) to move cursor to DEVIATION Callout and press ENTER Key. Use DATA SCROLL Keys (3) to increase Deviation until SINAD Meter again reads 10 dB. Modulation Acceptance Bandwidth is twice the Deviation reading.

Example: If Deviation reads 5 kHz, then Modulation Acceptance Bandwidth is 10 kHz.

## 4-2-12 MEASURING RECEIVER IF BANDWIDTH

STEP	PROCEDURE
1.	Connect Antenna of receiver under test to T/R Connector of 1600S. Connect Audio Out Connector of receiver under test to SINAD/BER Connector of 1600S.
2.	Open squelch fully on receiver under test.
3.	Press RF GEN MODE Key (27) and move cursor to RF (40). Use DATA ENTRY Keys (29) to set frequency to frequency of receiver under test.
4.	Move cursor to SOURCE (30) and press ENTER Key. Use FIELD SELECT ← and → Keys (1) to select AF Generator 1 and use DATA SCROLL ↑ and ↓ Keys (3) to select FM Modulation. Press ENTER Key.
5.	Move cursor to DEVIATION (33) and press "1" DATA ENTRY Key (29). Press ENTER Key.
6.	Move cursor to AF FREQ (35) and use DATA ENTRY Keys (29) to set AF Frequency to 1000 Hz. Press ENTER Key.
7.	Move cursor to WAVE (37) and use DATA SCROLL ↑ and ↓ Keys (3) to select Sine. Press ENTER Key.
8.	Press "More" Soft Function Key F6 until "Meters" Soft Function Key F4 appears. Press "Meters" Soft Function Key F4 and press "1" DATA ENTRY Key (29) to select SINAD Meter.
9.	If LEVEL (45) units are V or mV, press SETUP and press "5" DATA ENTRY Key (29) to display RF Gen Setup Menu. Press "3" DATA ENTRY Key (29) to toggle RF Gen Level Units to dBm and press "Ret" Soft Function Key F5 to return to RF Gen Operation Screen.
10.	Move cursor to LEVEL (45) and use DATA SCROLL ↑ and ↓ Keys (3) to adjust Output Level until SINAD Meter reads 12 dB. Resulting Output Level is Reference Sensitivity.
11.	Use DATA SCROLL ↑ and ↓ Keys (3) to adjust Output Level 60 dBm above Reference Sensitivity measured in step 10.
12.	Move cursor to RF (40) and press ENTER Key. Press DATA SCROLL → Key until least significant digit is highlighted. Press DATA SCROLL ↑ Key until SINAD Meter reads 12 dB. RF reads Upper Frequency.
13.	Press DATA SCROLL ↓ Key until SINAD Meter reads 12 dB. RF reads Lower Frequency. The difference between Upper Frequency and Lower Frequency is the 60 dB skirt width.

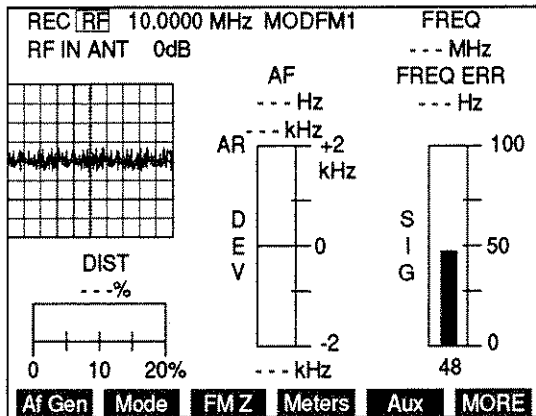
## 4-3 RECEIVER OPERATION

### 4-3-1 GENERAL OPERATION

Low power (1/2 W max) RF signals are monitored "off the air" from ANTENNA Connector (25) or high power RF signals (1/2 to 65 W) are monitored through T/R Connector (6) using the following procedures:

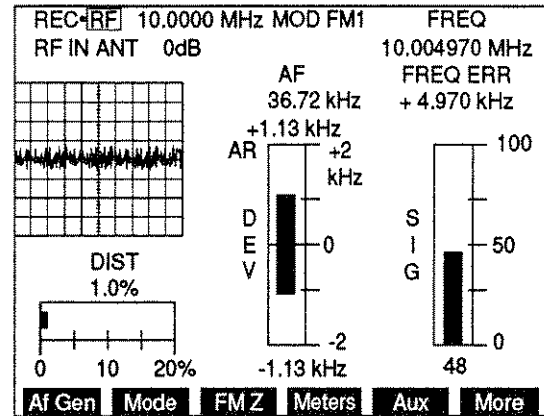
**NOTE:** Valid Receive. Operation Screen meter readings are not displayed until Squelch is broken

RECEIVE SCREEN WITH  
SQUELCH UNBROKEN



8617069

RECEIVE SCREEN WITH  
SQUELCH BROKEN



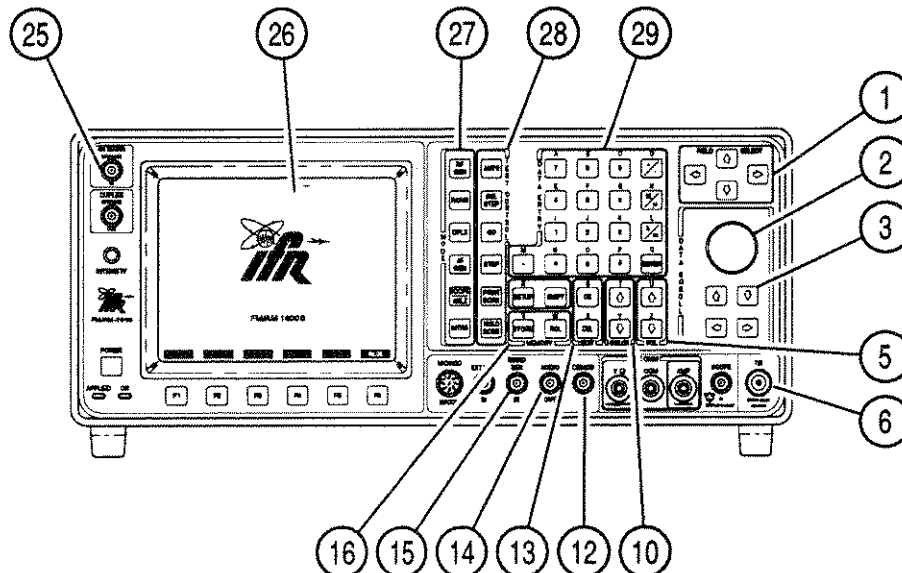
8617070

### STEP

### PROCEDURE

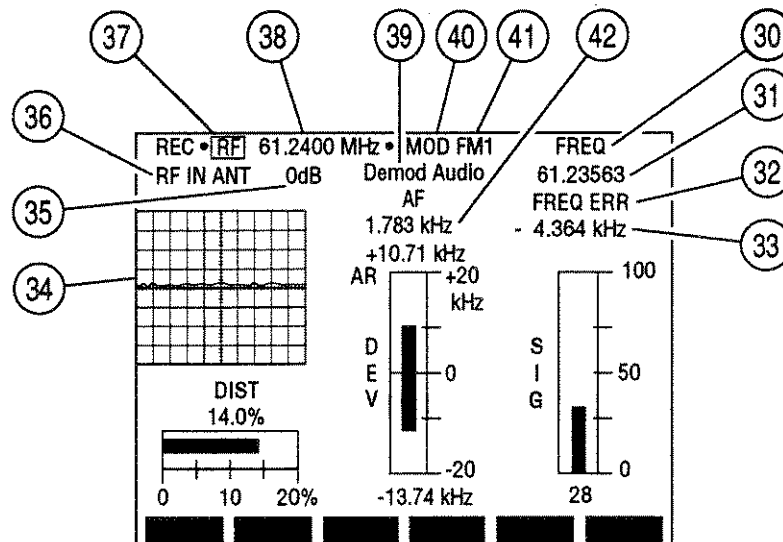
1. If needed, assemble antenna and right angle BNC adapter for antenna input to ANTENNA Connector (25) or connect RF signal input to T/R Connector (6).

**CAUTION** MAXIMUM CONTINUOUS INPUT TO ANTENNA CONNECTOR (25) IS LIMITED TO 1/2 W WITH PROTECTION PROVIDED TO A MAXIMUM INPUT OF 65 W. MAXIMUM CONTINUOUS INPUT TO T/R CONNECTOR (6) IS LIMITED TO 50 W WITH PROTECTION PROVIDED TO A MAXIMUM INPUT OF 200 W.



8607085

2. Press RCVR MODE Key (27). Receiver Operation Screen appears on CRT.



8607059

3. If needed, use FIELD SELECT Keys (1) to move cursor to RF IN data field (36) and press ENTER Key to toggle RF Input location between "ANT" and "T/R" to match input location of received signal.
4. Move cursor to RF (37) and press ENTER Key to access frequency data field (38). Use DATA ENTRY Keypad (29) to enter a frequency (in MHz) and press ENTER Key.
5. To adjust squelch level, press a SQLCH Control Key (10). Squelch Callout appears on CRT. Press SQLCH Control Keys (10) to adjust Squelch and press ENTER Key.
6. To adjust volume, press a VOL Control Key (5). Volume Callout appears on CRT. Press VOL Control Keys (5) to adjust Volume and press ENTER Key.
7. Move cursor to Input Attenuation (35) and press ENTER Key to access data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate input attenuation.
8. Move cursor to MOD (40) and press ENTER Key to access Modulation Type data field (41). Use DATA SCROLL ↑ or ↓ Keys (3) until desired setting appears in data field and press ENTER Key to activate.
9. If User is the selected Modulation Type, press SETUP Key to access Receive Menu. Press "2" DATA ENTRY Key (29) to display Receiver Modulation Menu and press ENTER Key. User Defined Modulation Menu appears:



Rcvr Menu		
1.	Set Rcvr Freq	200.0000MHz
2.	Select Mod	User Defined
3.	1. Modulation	FM DATA
4.	2. IF Filters	3 KHz
5.	3. Post Detection	All Pass
6.		
7.	Rcvr Out Audio Out	Off
8.	Rcvr Out Demod Out	On
9.	Auto Volume Level	Off
10.	Operation Mode	Freq Scan
11.	Signaling Formats	DTMF

Scan RF lock Ret ESC

8610059

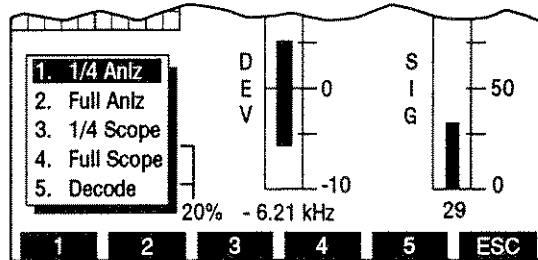
- Press "1" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select User Modulation Type.
  - Press "2" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select an IF Filter.
  - Press "3" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select a Post Detection Filter. If Low Pass, High Pass or Band Pass is selected, a cutoff frequency data field appears. Use DATA ENTRY Keypad to enter cutoff frequencies and press ENTER Key.
  - Press "Ret" Soft Function Key F5 to return to Receiver Operation Screen.
10. If decoding Signaling Formats is not desired, proceed with step 17.
11. Press SETUP Key to display Receive Menu and move cursor to "11. Signaling Formats" and press ENTER Key. Use DATA ENTRY Keypad (29) to select a Signaling Format.
- If DTMF is selected, press "Ret" Soft Function Key F5 to return to Receiver Operation Screen.
  - If Audio is selected, Audio Code Menu appears. Use FIELD SELECT Keys (1) to select an Audio Code and press ENTER Key. Press "Ret" Soft Function Key F5 to return to Receiver Operation Screen.

Rcvr Menu		
1. S	1. CCIR	000 MHz
2. S	2. EEA	nna
3. S	3. U.S. (EIA)	Defined
4. S	4. ZVEI	. DTMF
5. S	5. DDZVEI (ZVEI 2)	. Audio
6. R	6. DZVEI (ZVEI 3)	. Digital
7. R	7. NATEL	t
8. R	8. EURO	
9. A	9. 5/6 Tone Seq	
10. O	10. CCIRH	
11. S	11. CCIRH4	
	12. User Defined	

Scan RF lock Ret ESC

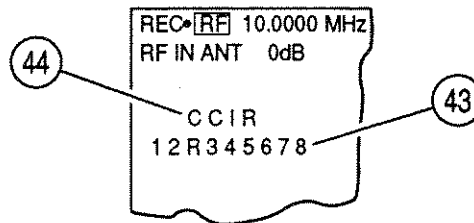
8610106

- If Digital is selected, Digital Code Menu appears. Use DATA ENTRY Keypad (29) to select a Digital Code. Press "Ret" Soft Function Key F5 to return to Receiver Operation Screen.
12. Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 is displayed. Press "Disp" Soft Function Key F1 to display following submenu:



8617081

13. Press "5" DATA ENTRY Key (29) to display Decode Callout (44).



8617066

14. For DTMF Decode, press "Decode" Soft Function Key F2. Decoded digits (43) are displayed under DTMF Callout. To stop decoding, press "Stop" Soft Function Key F3.
15. For DCS or DCS INV Decode:

- To change Input Source, press "Input" Soft Function Key F5. A submenu appears listing Input Sources. Use DATA ENTRY Keypad (29) to select an Input Source.

**NOTE:** Source "2. SIN/BER (INV)" inverts Input before decoding.

- Press "Decode" Soft Function Key F2. Decoded digits (43) are displayed under Digital Code Callout (44). To stop decoding, press "Stop" Soft Function Key F3.

16. For Audio or Digital POCSAG Decode, press "Extend" Soft Function Key F5 to display the following Extend Screen:

Audio Tones Decode: CCIR							
#	Frq	Err %	Dur	#	Frq	Err %	Dur
1	1158	3.2	98				
2	1167	2.5	99				
3	1298	1.8	101				
4	1406	3.5	98				
5	1475	2.0	98				

Input Decode Stop Type Ret

8610175

- To change Input Source, press "Input" Soft Function Key F1. A submenu appears listing Input Sources. Use DATA ENTRY Keypad (29) to select an Input Source.
  - For POCSAG, press "Rate" Soft Function Key F4 to toggle the POCSAG Rate to Low or High.
  - For Audio, press "Type" Soft Function Key F4 to access the Audio Code Callout. Use DATA SCROLL ↑ and ↓ Keys (3) to select an Audio Code and press ENTER Key.
  - Press "Decode" Soft Function Key F2 to decode. Decoded digits, frequencies, frequency error percentages and time durations are displayed.
  - Press "Stop" Soft Function Key F3 to stop decoding. Press "Ret" Soft Function Key F5 to return to Receive Operation Screen.
17. To set Receiver Output parameters, press SETUP Key to display Receive Menu.
- Press "5" DATA ENTRY Key (29) to display AGC Type Menu. Use DATA ENTRY Keypad (29) to select an AGC Type.
    - If User Defined is selected as AGC Type, User Defined AGC Type Menu appears. Use DATA ENTRY Keypad (29) to select an User Defined AGC Type.
    - If Manual is selected, a data field appears. Use DATA ENTRY Keypad to enter an AGC Level and press ENTER Key.
  - To route demodulated Received Signal to Speaker, press "6" DATA ENTRY Key (29) to toggle "Rcvr Out Speaker" on.
  - To route demodulated Received Signal to AUDIO Connector, press "7" DATA ENTRY Key (29) to toggle "Rcvr Out Audio Out" on.
  - To route demodulated Received Signal to Demod Connector, press "8" DATA ENTRY Key (29) to toggle "Rcvr Out Demod Out" on.

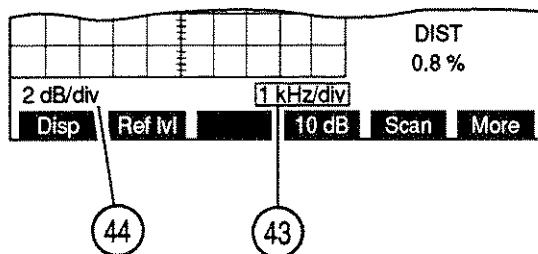
- Press "9" DATA ENTRY Key (29) to toggle Automatic Volume Level on or off.
  - Press "Ret" Soft Function Key F5 to return to Receive Operation Screen.
18. If an Oscilloscope or Analyzer Display is not desired, proceed with step 23.
19. Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 appears. Press "Disp" Soft Function Key F1 to display a menu listing Oscilloscope and Analyzer options. Use DATA ENTRY Keypad (29) to select an option.

**NOTE:** When LSB is selected for Modulation or 3 kHz is selected as User Modulation IF Filter, the Center Frequency of Receivers Analyzer Display is shifted 1.8 kHz less than the center line.

When USB is selected for Modulation, Center Frequency of Receivers Analyzer Display is shifted 3.6 kHz less than the center line.

1/4 size Analyzer Screen parameters are edited by first selecting full size Analyzer Screen, changing parameters and then reselecting 1/4 size Analyzer Screen.

20. If "2. Full Anlz" is selected, following Soft Function Keys are displayed:



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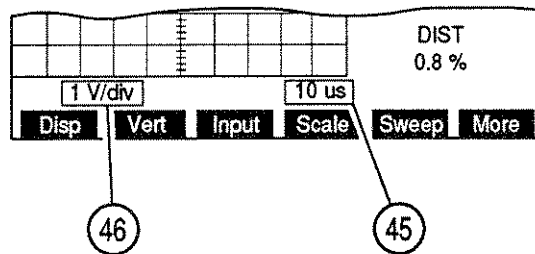
- Move cursor to Analyzer Scan Width (43) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate Scan Width desired.
- Move cursor to Analyzer Scale (44) and press ENTER Key to toggle Analyzer Scale between 2 and 10 dB.
- If 2 dB is selected for Analyzer Scale, press "Ref lvl" Soft Function Key F2 and use DATA SCROLL Spinner (2) or DATA SCROLL ↑ and ↓ Keys (3) to adjust Reference Level. Press ENTER Key.

21. If "3. 1/4 Scope" is selected:

- Move cursor to Oscilloscope Input (39) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate.

**NOTE:** The remaining Oscilloscope parameters are edited by selecting full size Scope Screen, editing desired parameters and reselecting 1/4 size Scope Screen.

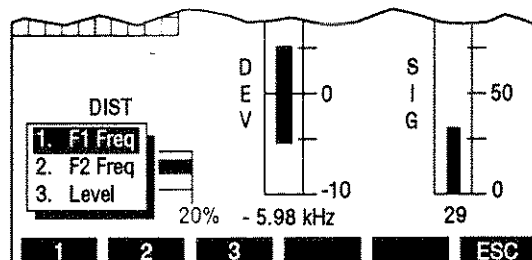
22. If "4. Full Scope" is selected:



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- Move cursor to Oscilloscope Input (39) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate.
- If needed, move cursor to Oscilloscope Sweep Rate (45) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate.
- Move cursor to Oscilloscope Scale (46) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate.
- If needed, press "Vert" Soft Function Key F2 to edit vertical adjustment of Oscilloscope Trace. Use DATA SCROLL Spinner (2) or DATA SCROLL ↑ or ↓ Keys (3) to adjust vertical position of Oscilloscope Trace.

23. Press "More" Soft Function Key F6 until "Af Gen" Soft Function Key F1 appears. Press "Af Gen" Soft Function Key F1 to display the following submenu:



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- To edit AF Generator #1 Frequency, press "1" DATA ENTRY Key. A data field appears displaying the current frequency. Use DATA ENTRY Keypad (29) to enter desired frequency and press ENTER Key.

- To edit AF Generator #2 Frequency, press "2" DATA ENTRY Key (29). A data field appears displaying current frequency. Use DATA ENTRY Keypad (29) to enter desired frequency and press ENTER Key.
  - To edit AF Generator Level, press "3" DATA ENTRY Key (29). A data field appears displaying current level. Use DATA ENTRY Keypad (29) to enter desired level and press ENTER Key.
24. To select a meter, press "More" Soft Function Key F6 until "Af Gen" Soft Function Key F1 appears:
- For FM or PM Modulation (41), press "Meters" Soft Function Key F4 to select SINAD, Distortion or Deviation (RMS) Meter.
  - For AM Modulation (41), press "Modul"/"Dist" Soft Function Key F4 to select Modulation or Distortion Meter. Both Meters are displayed, but only selected meter is functional.
  - For USB, LSB or BFO Modulation (41), press "Tune" Soft Function Key F4 and use DATA SCROLL ↑ and ↓ Keys (3) to tune Receiver in 125 Hz steps. Press ENTER Key.
25. To edit a Meters settings, move cursor to Callout of Meter to be edited and press ENTER Key. Meters Operation Screen appears.
- For Frequency Error Meter/Frequency Meter Operation Procedures, see 4-8-2.
  - For AF Meter Operation Procedures, see 4-8-1.
  - For Deviation Meter Operation Procedures, see 4-8-4.
  - For Phase Meter Operation Procedures, see 4-8-11.
  - For Modulation Meter Operation Procedures, see 4-8-5.
  - For Distortion Meter Operation Procedures, see 4-8-6.
  - For Power Meter Operation Procedures, see 4-8-3.
  - For Signal Strength Meter Operation Procedures, see 4-8-8.
  - For SINAD Meter Operation Procedures, see 4-8-7.
  - For Deviation (RMS) Meter Operation Procedures, see 4-8-12.
26. To operate Receiver in Channel Mode, press SETUP Key to display Receive Menu.
- Move cursor to "10. Operation Mode" and press ENTER Key. Press "2" DATA ENTRY Key (29) to select Receiver Channel Mode.
  - Press "Chan" Soft Function Key F2 to display a submenu listing cellular formats. Use DATA ENTRY Keypad (29) to select a cellular format.

- Press "Ret" Soft Function Key F5 to return to Receiver Operation Screen. Receiver Frequency is displayed by channel number. For a list of AMPS cellular channels and corresponding frequencies, see Appendix B. For a list of ETACS cellular channels and corresponding frequencies, see Appendix C.
- To select Direct Receiver Mode, press SETUP Key to display Receiver Menu. Move cursor to "10. Operation Mode" and press ENTER Key. Press "1" DATA ENTRY Key (29) to select Receiver Direct Mode. Press "Ret" Soft Function Key F6 to return to Receiver Operation Screen.

27. To operate Find Function:

- Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 appears. Press "Disp" Soft Function Key F1 to display a menu listing Oscilloscope and Analyzer options.
- Press "2" DATA ENTRY Key (29) to select full size Analyzer.
- Press "More" Soft Function Key F6 and press "Find lvl" Soft Function Key F2. Find Level is indicated by a red horizontal line. Use DATA SCROLL Spinner (2) or DATA SCROLL ↑ and ↓ Keys (3) to adjust Find Level and press ENTER Key.
- Press "Find" Soft Function Key F1 to activate Find Function. Receiver Frequency is changed to frequency found.

28. To operate Receiver Scan Function, press SETUP Key to display Receiver Menu. Press "Scan" Soft Function Key F1 to display RF Frequency Scan Menu.

Rcvr Menu		
1. Set Rcvr Freq	103.7000 MHz	
2. Select Mod	AM2	
3. Select Rcvr In	Antenna	
4. Select Input Atten	0 dB	
5. Select AGC Type	User Defined	
6. RF Frequency Scan		
7.		
8. 1. Start Freq	1.0000 MHz	
9. 2. Stop Freq	10.0000 MHz	
10. 3. Increment	1.0000 MHz	
11. 4. Scan Rate	0.01 Sec	
	5. Pause Time	1.0 Sec

Scan   RF lock   Ret   ESC

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- Press "1" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Starting Frequency. Press ENTER Key.
- Press "2" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Ending Frequency. Press ENTER Key.
- Press "3" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Increment. Press ENTER Key.
- Press "4" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Scan Rate. Press ENTER Key.

- Press "5" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Pause Time. Press ENTER Key.
  - Press "Ret" Soft Function Key F5 to return to Receiver Operation Screen.
  - Press "More" Soft Function Key F6 until "Mode" Soft Function Key F2 appears. Press "Mode" Soft Function Key and press "3" DATA ENTRY Key (29) to select Receiver Scan Operation Mode.
  - Press GO TEST CONTROL Key (28) to start Receiver Scan. Press STOP TEST CONTROL Key (28) to stop Scanning. Pressing GO TEST CONTROL Key (28) again resumes scanning operation. Press SGL STEP TEST CONTROL Key (28) to single step through scanning operation one increment at a time. Press AUTO TEST CONTROL Key (28) to single step through scanning operation backward one step at a time.
  - To return Receiver Operation Mode to Direct Operation, press "More" Soft Function Key F6 until "Mode" Soft Function Key F2 appears. Press "Mode" Soft Function Key F2 and press "1" DATA ENTRY Key (29) to select Receiver Direct Operation Mode.
29. To activate RF Lock feature, press SETUP Key to display Receiver Menu. Press "RF lock" Soft Function Key F2. "RF lock" appears in red when active.



## 4-3-2 RECEIVING FM SIGNALS

**EXAMPLE:** The following example receives a 90 kHz FM modulated signal "off the air" and routes demodulated signal to AUDIO OUT Connector and Test Set Speaker.

STEP	PROCEDURE
1.	Connect external antenna to ANTENNA Connector (25).
2.	Move cursor to RF (37) and press "9, 0" DATA ENTRY Keys (29). Press ENTER Key.
3.	Move cursor to MOD (40) and use DATA SCROLL Keys (3) to select a FM Modulation and press ENTER Key.
4.	Move cursor to RF IN (36) and press ENTER Key to toggle RF Input Location to ANTENNA (25).
5.	If Signal Strength Meter reading is greater than 90, move cursor to RF Input Attenuation (35) and press DATA SCROLL Keys (3) to select greater attenuation and press ENTER Key.
6.	Press a SQLCH Key (10) to display Squelch data field. Press SQLCH Keys until squelch is broken and press ENTER Key.
7.	Press SETUP Key to access Rcvr Menu. <ul style="list-style-type: none"><li>● Press "6" DATA ENTRY Key (29) to toggle Rcvr Out Speaker setting to on.</li><li>● Press "7" DATA ENTRY Key (29) to toggle Rcvr Out Audio Out setting to on.</li><li>● Press "Ret" Soft Function Key F5 to return to Operation Screen.</li></ul>
8.	Press a VOL Key (5) to display Volume data field. Press VOL Keys (5) to adjust volume to desired level and press ENTER Key.

### 4-3-3 RECEIVING AM SIGNALS

**EXAMPLE:** The following example receives a 850 kHz FM modulated signal and routes demodulated signal to AUDIO OUT Connector and Test Set Speaker.

STEP	PROCEDURE
1.	Connect external antenna to ANTENNA Connector (25).
2.	Move cursor to RF (37) and press "•, 8, 5" DATA ENTRY Keys (29). Press ENTER Key.
3.	Move cursor to MOD (40) and use DATA SCROLL Keys (3) to select an AM Modulation and press ENTER Key.
4.	Move cursor to RF IN (36) and press ENTER Key to toggle RF Input Location to ANTENNA (25).
5.	If Signal Strength Meter reading is greater than 90, move cursor to RF Input Attenuation (35) and press DATA SCROLL Keys (3) to select greater attenuation and press ENTER Key.
6.	Press a SQLCH Key (10) to display Squelch data field. Press SQLCH Keys until squelch is broken and press ENTER Key.
7.	Press SETUP Key to access Rcvr Menu. <ul style="list-style-type: none"><li>● Press "6" DATA ENTRY Key (29) to toggle Rcvr Out Speaker setting to on.</li><li>● Press "7" DATA ENTRY Key (29) to toggle Rcvr Out Audio Out setting to on.</li><li>● Press "Ret" Soft Function Key F5 to return to Operation Screen.</li></ul>
8.	Press a VOL Key (5) to display Volume data field. Press VOL Keys (5) to adjust volume to desired level and press ENTER Key.

#### 4-3-4 RECEIVING SSB SIGNALS

**EXAMPLE:** The following example receives a 14 MHz LSB signal and routes demodulated signal to AUDIO OUT Connector and Test Set Speaker.

STEP	PROCEDURE
1.	Connect coax cable from UUT to T/R Connector (6).
2.	Move cursor to RF (37) and press "1, 4" DATA ENTRY Keys (29). Press ENTER Key.
3.	Move cursor to MOD (40) and use DATA SCROLL Keys (3) to select LSB Modulation and press ENTER Key.
4.	Move cursor to RF IN (36) and press ENTER Key to toggle RF Input Location to T/R (6).
5.	Press a SQLCH Key (10) to display Squelch data field. Press SQLCH Keys until squelch is broken and press ENTER Key.
6.	Press SETUP Key to access Rcvr Menu. <ul style="list-style-type: none"><li>● Press "6" DATA ENTRY Key (29) to toggle Rcvr Out Speaker setting to on.</li><li>● Press "7" DATA ENTRY Key (29) to toggle Rcvr Out Audio Out setting to on.</li><li>● Press "Ret" Soft Function Key F5 to return to Operation Screen.</li></ul>
7.	Press a VOL Key (5) to display Volume data field. Press VOL Keys (5) to adjust volume to desired level and press ENTER Key.
8.	If received voice transmissions sound high-pitched or low-pitched, move cursor to TUNE and press ENTER Key. Use DATA SCROLL ↑ and ↓ Keys (3) to adjust Signal Frequency in 125 Hz steps and press ENTER Key.

#### 4-3-5 DECODING DTMF CODED SIGNALS

**EXAMPLE:** The following example receives a 450 kHz FM modulated DTMF signal and routes demodulated signal to AUDIO OUT Connector and Test Set Speaker.

STEP	PROCEDURE
1.	Connect coax cable from UUT to T/R Connector (6).
2.	Move cursor to RF (37) and press "4, 5, 0" DATA ENTRY Keys (29). Press ENTER Key.
3.	Move cursor to MOD (40) and use DATA SCROLL Keys (3) to select a FM Modulation and press ENTER Key.
4.	Move cursor to RF IN (36) and press ENTER Key to toggle RF Input Location to T/R (6).
5.	Press a SQLCH Key (10) to display Squelch data field. Press SQLCH Keys until squelch is broken and press ENTER Key.
6.	Press SETUP Key to access Rcvr Menu. <ul style="list-style-type: none"><li>● Move cursor to "11. Signaling Formats" and press ENTER Key. Press "1" DATA ENTRY Key (29) to select DTMF.</li><li>● Press "6" DATA ENTRY Key (29) to toggle Rcvr Out Speaker setting to on.</li><li>● Press "7" DATA ENTRY Key (29) to toggle Rcvr Out Audio Out setting to on.</li><li>● Press "Ret" Soft Function Key F5 to return to Operation Screen.</li></ul>
7.	Press a VOL Key (5) to display Volume data field. Press VOL Keys (5) to adjust volume to desired level and press ENTER Key.
8.	Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 appears. Press "Disp" Soft Function Key F1 and press "5" DATA ENTRY Key (29).
9.	"Decode" Soft Function Key F2 appears. Press "Decode" Soft Function Key F2. Decoded digits appear below DTMF Callout. To stop decoding, press "Stop" Soft Function Key F3.

## 4-3-6 DECODING AUDIO CCIR CODED SIGNALS

**EXAMPLE:** The following example receives a 450 kHz FM modulated Audio signal and routes demodulated signal to AUDIO OUT Connector and Test Set Speaker.

STEP	PROCEDURE
1.	Connect external antenna to ANTENNA Connector (25).
2.	Move cursor to RF (37) and press "4, 5, 0" DATA ENTRY Keys (29). Press ENTER Key.
3.	Move cursor to MOD (40) and use DATA SCROLL Keys (3) to select a FM Modulation and press ENTER Key.
4.	Move cursor to RF IN (36) and press ENTER Key to toggle RF Input Location to ANTENNA (25).
5.	If Signal Strength Meter reading is greater than 90, move cursor to RF Input Attenuation (35) and press DATA SCROLL Keys (3) to select greater attenuation and press ENTER Key.
6.	Press a SQLCH Key (10) to display Squelch data field. Press SQLCH Keys until squelch is broken and press ENTER Key.
7.	Press SETUP Key to access Rcvr Menu. <ul style="list-style-type: none"><li>● Move cursor to "11. Signaling Formats" and press ENTER Key. Press "2" DATA ENTRY Key (29) to select AUDIO. Press "1" DATA ENTRY Key to select CCIR.</li><li>● Press "6" DATA ENTRY Key (29) to toggle Rcvr Out Speaker setting to on.</li><li>● Press "7" DATA ENTRY Key (29) to toggle Rcvr Out Audio Out setting to on.</li><li>● Press "Ret" Soft Function Key F5 to return to Operation Screen.</li></ul>
8.	Press a VOL Key (5) to display Volume data field. Press VOL Keys (5) to adjust volume to desired level and press ENTER Key.
9.	Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 appears. Press "Disp" Soft Function Key F1 and press "5" DATA ENTRY Key (29).
10.	"Extend" Soft Function Key F5 appears. Press "Extend" Soft Function Key F5 to display Extend Screen.
11.	Press "Input" Soft Function Key F1 and press "1" DATA ENTRY Key to select Demod Audio input.
12.	Press "Decode" Soft Function Key F2. Decoded digits, frequencies, frequency errors and time durations are displayed. To stop decoding, press "Stop" Soft Function Key F3.

## 4-3-7 DECODING DCS CODED SIGNALS

**EXAMPLE:** The following example receives a 450 kHz FM modulated DCS signal and routes demodulated signal to AUDIO OUT Connector and Test Set Speaker.

STEP	PROCEDURE
1.	Connect external antenna to ANTENNA Connector (25).
2.	Move cursor to RF (37) and press "4, 5, 0" DATA ENTRY Keys (29). Press ENTER Key.
3.	Move cursor to MOD (40) and use DATA SCROLL Keys (3) to select an FM Modulation and press ENTER Key.
4.	Move cursor to RF IN (36) and press ENTER Key to toggle RF Input Location to ANTENNA (25).
5.	If Signal Strength Meter reading is greater than 90, move cursor to RF Input Attenuation (35) and press DATA SCROLL Keys (3) to select greater attenuation and press ENTER Key.
6.	Press a SQLCH Key (10) to display Squelch data field. Press SQLCH Keys until squelch is broken and press ENTER Key.
7.	Press SETUP Key to access Rcvr Menu. <ul style="list-style-type: none"><li>● Move cursor to "11. Signaling Formats" and press ENTER Key. Press "3" DATA ENTRY Key (29) to select Digital. Press "1" DATA ENTRY Key (29) to select DCS.</li><li>● Press "6" DATA ENTRY Key (29) to toggle Rcvr Out Speaker setting to on.</li><li>● Press "7" DATA ENTRY Key (29) to toggle Rcvr Out Audio Out setting to on.</li><li>● Press "Ret" Soft Function Key F5 to return to Operation Screen.</li></ul>
8.	Press a VOL Key (5) to display Volume data field. Press VOL Keys (5) to adjust volume to desired level and press ENTER Key.
9.	Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 appears. Press "Disp" Soft Function Key F1 and press "5" DATA ENTRY Key (29).
10.	"Decode" Soft Function Key F2 appears. Press "Decode" Soft Function Key F2. Decoded digits appear below DCS Code Callout. To stop decoding, press "Stop" Soft Function Key F3.

## 4-3-8 DECODING POCSAG CODED SIGNALS

**EXAMPLE:** The following example receives a 450 kHz FM modulated POCSAG signal and routes demodulated signal to AUDIO OUT Connector and Test Set Speaker.

STEP	PROCEDURE
1.	Connect external antenna to ANTENNA Connector (25).
2.	Move cursor to RF (37) and press "4, 5, 0" DATA ENTRY Keys (29). Press ENTER Key.
3.	Move cursor to MOD (40) and use DATA SCROLL Keys (3) to select a FM Modulation and press ENTER Key.
4.	Move cursor to RF IN (36) and press ENTER Key to toggle RF Input Location to ANTENNA (25).
5.	If Signal Strength Meter reading is greater than 90, move cursor to RF Input Attenuation (35) and press DATA SCROLL Keys (3) to select greater attenuation and press ENTER Key.
6.	Press a SQLCH Key (10) to display Squelch data field. Press SQLCH Keys until squelch is broken and press ENTER Key.
7.	Press SETUP Key to access Rcvr Menu. <ul style="list-style-type: none"><li>● Move cursor to "11. Signaling Formats" and press ENTER Key. Press "3" DATA ENTRY Key (29) to select Digital. Press "3" DATA ENTRY Key (29) to select POCSAG.</li><li>● Press "6" DATA ENTRY Key (29) to toggle Rcvr Out Speaker setting to on.</li><li>● Press "7" DATA ENTRY Key (29) to toggle Rcvr Out Audio Out setting to on.</li><li>● Press "Ret" Soft Function Key F5 to return to Operation Screen.</li></ul>
8.	Press a VOL Key (5) to display Volume data field. Press VOL Keys (5) to adjust volume to desired level and press ENTER Key.
9.	Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 appears. Press "Disp" Soft Function Key F1 and press "5" DATA ENTRY Key (29).
10.	"Extend" Soft Function Key F5 appears. Press "Extend" Soft Function Key F5 to display Extend Screen.
11.	Press "Input" Soft Function Key F1 and press "1" DATA ENTRY Key to select Demod Audio input.
12.	Press "Decode" Soft Function Key F4. Decoded digits, frequencies, frequency errors and time durations are displayed.

## 4-3-9 MEASURING AM OR FM TRANSMITTER DISTORTION

STEP	PROCEDURE
1.	Connect UUT Audio Input to AUDIO OUT Connector (14). Connect Transmitter Output to T/R Connector (6) using 50 $\Omega$ coax.
2.	Press AF GEN MODE Key (27) and press SETUP Key to access AF Gen Menu.
3.	Press "5" DATA ENTRY Key (29) to access AF Output Setup Menu. If needed, press "1" DATA ENTRY Key (29) to toggle Audio Out Connector on.
4.	Press "4" DATA ENTRY Key (29) to access Function Generator Out Attenuation. Use DATA ENTRY Keypad (29) to select Attenuation to a level low enough so as not to over-modulate the Transmitter. Press ENTER Key.
5.	If needed, press "5" DATA ENTRY Key (29) to toggle Proportional Output to off.
6.	Press "ESC" Soft Function Key F6 and "1" DATA ENTRY Key (29) to access Function Generator 1 Menu.
7.	If needed, press "1" DATA ENTRY Key (29) to toggle Generator on.
8.	Press "2" DATA ENTRY Key (29) to access Freq data field. Press "1, 0, 0, 0" DATA ENTRY Keys (29) and press ENTER Key to set Frequency to 1000 Hz.
9.	Press "3" DATA ENTRY Key (29) to access Wave Form. Press "1" DATA ENTRY Key (29) to select Sine Wave Form.
10.	Press MTRS MODE Key (27) to exit AF Gen Menu. Press "6" DATA ENTRY Key (29) to access Distortion Meter Operation Screen.
11.	Use FIELD SELECT Keys (1) to move cursor to INPUT and press ENTER Key. Use DATA SCROLL Keys (3) to select "Demod Audio" and press ENTER Key.
12.	Use FIELD SELECT Keys (1) to move cursor to NOTCH FREQ and press ENTER Key. Use DATA ENTRY Keypad (29) to set Notch Frequency to 1 kHz and press ENTER Key.
13.	Use FIELD SELECT Keys (1) to move cursor to FILTER FREQ and press ENTER Key. Use DATA ENTRY Keypad (29) to select Filter Frequency to required frequency of Transmitter and press ENTER Key.
14.	If desired, use FIELD SELECT Keys (1) to move cursor to PEAK HOLD and press ENTER Key to toggle Peak Hold on.
15.	If desired, use FIELD SELECT Keys (1) to move cursor to AVERAGE and press ENTER Key to toggle Average on.
16.	Press RCVR MODE Key (27) to access Receiver Operation Screen.
17.	Use FIELD SELECT Keys (1) to move cursor to RF (37) and press ENTER Key. Use DATA ENTRY Keypad (29) to select Receiver Frequency (38) to UUT Transmitting Frequency and press ENTER Key.



**STEP****PROCEDURE**

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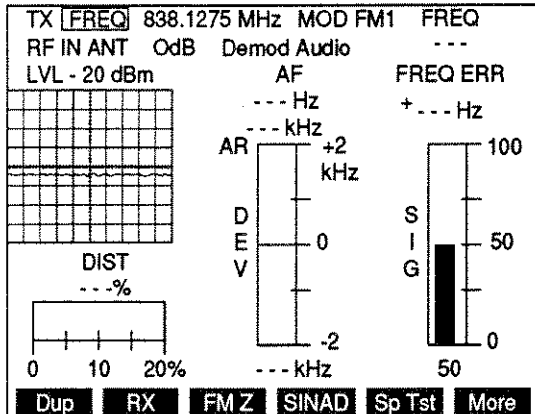
18. Use FIELD SELECT Keys (1) to move cursor to MOD (40) and press ENTER Key.
19. If AM Modulation, use DATA SCROLL Keys (3) to set Receiver Modulation (41) to either AM1 or AM2, whichever results in lower Distortion reading. After Modulation selection is complete, Distortion Meter displays AM Transmitter Distortion.
20. If FM Modulation, use DATA SCROLL Keys (3) to set Receiver Modulation (41) to either FM1, FM2, FM3 or FM4, whichever results in lowest Distortion reading. After modulation selection is complete, Distortion Meter displays FM Transmitter Distortion.

## 4-4 DUPLEX OPERATION

Duplex Receiver signals are routed to T/R Connector or DUPLEX Connector. Duplex Transmitter signals are monitored at ANTENNA Connector or T/R Connector. Use following procedures to access and set up Duplex Transmitter and Duplex Receiver Operation screens:

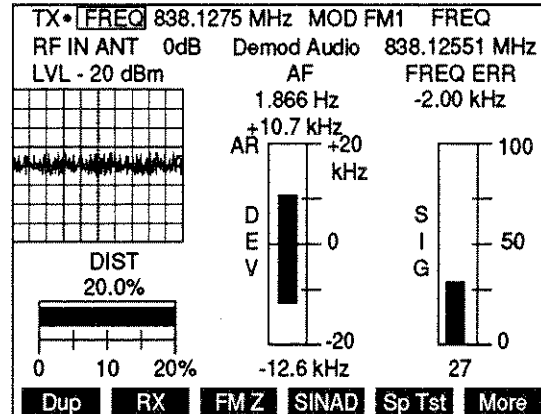
**NOTE:** Valid Duplex Operation Screen meter readings are not displayed until Squelch is broken.

DUPLEX TRANSMITTER SCREEN  
WITH SQUELCH UNBROKEN



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DUPLEX TRANSMITTER SCREEN  
WITH SQUELCH BROKEN



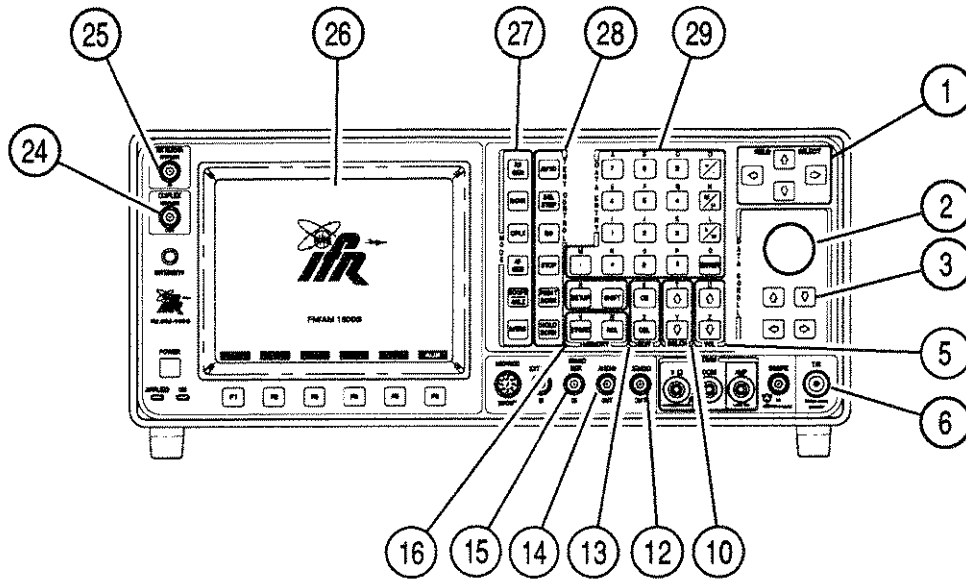
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### 4-4-1 DUPLEX TRANSMITTER GENERAL OPERATION

Duplex Transmitter Low-power (1/2 W maximum) RF signals are monitored "off the air" from ANTENNA Connector or High-power RF signals (1/2 to 50 W) are monitored through T/R Connector.

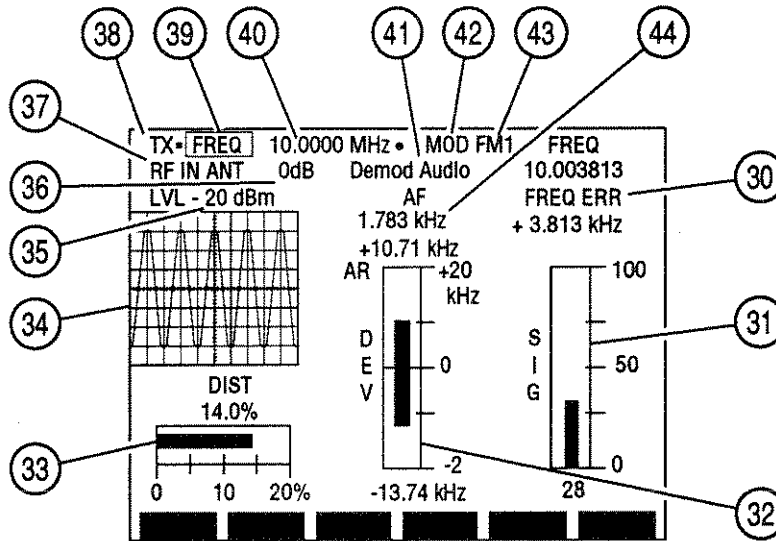
**CAUTION:** MAXIMUM CONTINUOUS INPUT TO ANTENNA CONNECTOR (25) IS LIMITED TO 1/2 W WITH PROTECTION PROVIDED TO A MAXIMUM INPUT OF 65 W.

MAXIMUM CONTINUOUS INPUT TO T/R CONNECTOR (6) IS LIMITED TO 50 W WITH PROTECTION PROVIDED TO A MAXIMUM INPUT OF 200 W.



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1. Press DPLX MODE Key (27). Duplex Operation Screen appears on the CRT. Press "TX" Soft Function Key F1. Duplex Transmitter Operation Screen appears on CRT.



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2. If needed, use FIELD SELECT Keys (1) to move cursor to RF IN data field (37) and press ENTER Key to toggle RF Input location between "ANT" and "T/R" to match input location of received signal.
3. Move cursor to FREQ (39) and press ENTER Key to access frequency data field (40). Use DATA ENTRY Keypad (29) to enter desired setting in MHz and press ENTER Key.

4. To adjust squelch level, press a SQLCH Control Key (10). Squelch Callout appears on CRT. Press SQLCH Control Keys (10) to adjust Squelch and press ENTER Key.
5. To adjust volume, press a VOL Control Key (5). Volume Callout appears on CRT. Press VOL Control Keys (5) to adjust Volume and press ENTER Key.
6. Move cursor to LVL (35) and press ENTER Key to access its data field. LVL Callout appears in top right corner of the Operation Screen when Oscilloscope/ Analyzer is full size. Use DATA ENTRY Keypad (29) to enter desired level and press ENTER Key.
7. Move cursor to MOD (42) and press ENTER Key to access Modulation Type data field (43). Use DATA SCROLL ↑ or ↓ Keys (3) until desired setting appears in data field and press ENTER Key.
8. If User is selected for Modulation Type, press SETUP Key to access Duplex Transmitter Menu. Press "2" DATA ENTRY Key (29) to display Duplex Transmitter Modulation Menu and press ENTER Key. User Defined Modulation Menu appears:

Duplex Transmitter Menu	
1. Set Rcvr Freq	200.0000MHz
2. Select Mod	User Defined
3. 1. Modulation	FM DATA
4. 2. IF Filters	3 KHz
5. 3. Post Detection	All Pass
6.	
7. Rcvr Out Audio Out	Off
8. Rcvr Out Demod Out	On
9. Auto Volume Level	Off
10. Operation Mode	Freq Scan
11. Signaling Formats	DTMF

Ret ESC

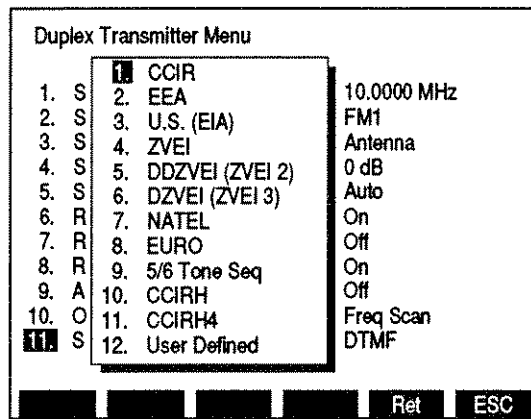
8610060

- Press "1" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select User Modulation Type.
  - Press "2" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select an IF Filter.
  - Press "3" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select a Post Detection Filter. If Low Pass, High Pass or Band Pass is selected, a cutoff frequency data field appears. Use DATA ENTRY Keypad (29) to enter cutoff frequencies and press ENTER Key.
  - Press "Ret" Soft Function Key F5 to return to Duplex Transmitter Operation Screen.
9. If decoding Signaling Formats is not desired proceed with step 17.

STEP

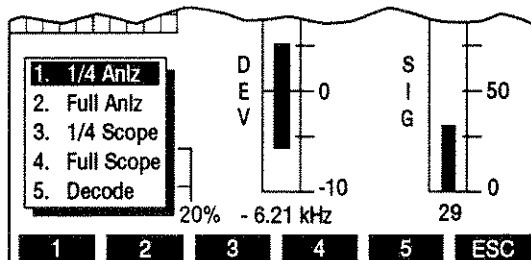
PROCEDURE

10. Press SETUP Key to display Duplex Transmitter Menu and move cursor to "11. Signaling Formats" and press ENTER Key. Use DATA ENTRY Keypad (29) to select a Signaling Format.
  - If DTMF is selected, press "Ret" Soft Function Key F5 to return to Duplex Transmitter Operation Screen.
  - If Audio is selected, Audio Code Menu appears. Use FIELD SELECT Keys (1) to select an Audio Code and press ENTER Key. Press "Ret" Soft Function Key F5 to return to Duplex Transmitter Operation Screen.



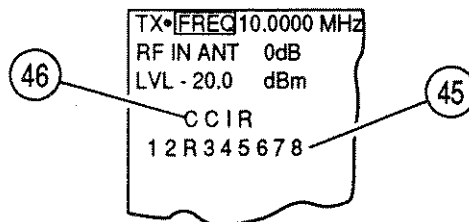
8610116

- If Digital is selected, Digital Code Menu appears. Use DATA ENTRY Keys (29) to select a Digital Code. Press "Ret" Soft Function Key F5 to return to Duplex Transmitter Operation Screen.
11. Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 is displayed. Press "Disp" Soft Function Key F1 to display following submenu:



8617081

12. Press "5" DATA ENTRY Key (29) to display Decode Callout (46).



8617083

13. For DTMF Decode, press "Decode" Soft Function Key F2. Decoded digits (45) are displayed under DTMF Callout. To stop decoding, press "Stop" Soft Function Key F3.

14. For DCS or DCS INV Decode:

- To change Input Source, press "Input" Soft Function Key F5. A submenu appears listing Input Sources. Use DATA ENTRY Keypad (29) to select an Input Source.

**NOTE:** Source "2. SIN/BER (INV)" inverts Input before decoding.

- Press "Decode" Soft Function Key F2. Decoded digits (45) are displayed under Digital Code Callout (46). To stop decoding, press "Stop" Soft Function Key F3.

15. For Audio or Digital POCSAG Decode, press "Extend" Soft Function Key F5 to display following Extend Screen:

Audio Tones Decode: CCIR							
#	Frq	Err %	Dur	#	Frq	Err %	Dur
1	1158	3.2	98				
2	1167	2.5	99				
3	1298	1.8	101				
4	1406	3.5	98				
5	1475	2.0	98				

Input Decode Stop Type Ret

8610175

- To change Input Source, press "Input" Soft Function Key F1. A submenu appears listing Input Sources. Use DATA ENTRY Keypad (29) to select an Input Source.
- For POCSAG, press "Rate" Soft Function Key F4 to toggle POCSAG Rate to Low or High.
- For Audio, press "Type" Soft Function Key F4 to access the Audio Code Callout. Use DATA SCROLL ↑ and ↓ Keys (3) to select an Audio Code and press ENTER Key.
- Press "Decode" Soft Function Key F2 to decode. Decoded digits, frequencies, frequency error percentages and time durations are displayed.
- Press "Stop" Soft Function Key F3 to stop decoding. Press "Ret" Soft Function Key F5 to return to Duplex Transmitter Operation Screen.

16. To set Duplex Transmitter Output parameters, press SETUP Key to display Duplex Transmitter Menu.

- Press "5" DATA ENTRY Key (29) to display AGC Type Menu. Use DATA ENTRY Keypad (29) to select an AGC Type.

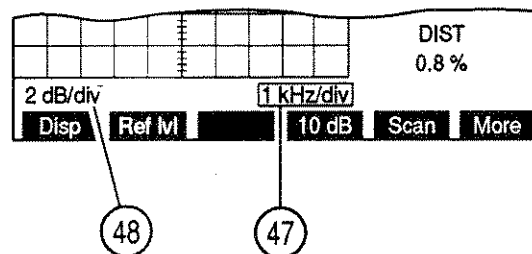
- If User Defined is selected as AGC Type, User Defined AGC Type Menu appears. Use DATA ENTRY Keypad (29) to select an User Defined AGC Type.
  - If Manual is selected, a data field appears. Use DATA ENTRY Keypad (29) to enter an AGC Level and press ENTER Key.
  - To route demodulated received signal to Speaker, press "6" DATA ENTRY Key (29) to toggle "Rcvr Out Speaker" on.
  - To route demodulated received signal to AUDIO Connector, press "7" DATA ENTRY Key (29) to toggle "Rcvr Out Audio Out" on.
  - To route demodulated Received Signal to Demod Connector, press "8" DATA ENTRY Key (29) to toggle "Rcvr Out Demod Out" on.
  - Press "9" DATA ENTRY Key (29) to toggle Automatic Volume Level on or off.
  - Press "Ret" Soft Function Key F5 to return to Duplex Transmitter Operation Screen.
17. If an Oscilloscope or Analyzer Display is not desired, proceed with step 23.
18. Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 appears. Press "Disp" Soft Function Key F1 to display a menu listing Oscilloscope and Analyzer options. Use DATA ENTRY Keypad (29) to select an option.

**NOTE:** When LSB is selected as Modulation or a 3 kHz is selected as User Modulation IF Filter, Center Frequency of Duplex Transmitter Analyzer Display is shifted 1.8 kHz less than center line.

When USB is selected as Modulation, Center Frequency of Duplex Transmitter Analyzer Display is shifted 3.6 kHz less than center line.

1/4 size Analyzer Screen parameters are edited by first selecting full size Analyzer Screen, changing parameters, and then reselecting 1/4 size Analyzer Screen.

19. If "2. Full Anlz" is selected, following Soft Function Keys are displayed:



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- Move cursor to Analyzer Scan Width (47) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate Scan Width desired.

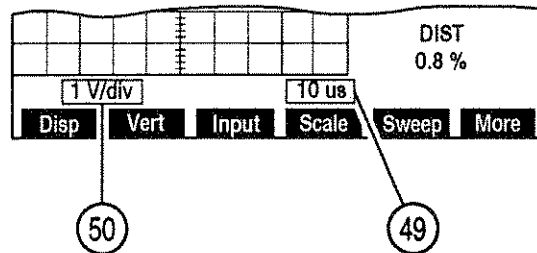
- Move cursor to Analyzer Scale (48) and press ENTER Key to toggle Analyzer Scale between 2 and 10 dB.
- If 2 dB is selected for Analyzer Scale, press "Ref lvl" Soft Function Key F2 and use DATA SCROLL Spinner (2) or DATA SCROLL ↑ and ↓ Keys (3) to adjust Reference Level. Press ENTER Key.

20. If "3. 1/4 Scope" is selected:

- Move cursor to Oscilloscope Input (41) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate.

**NOTE:** The remaining Oscilloscope parameters are edited by selecting full size Scope Screen, editing desired parameters and reselecting 1/4 size Scope Screen.

21. If "4. Full Scope" is selected:



8607110

- Move cursor to Oscilloscope Input (41) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate.
  - If needed, move cursor to Oscilloscope Sweep Rate (49) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate.
  - Move cursor to Oscilloscope Scale (50) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate.
  - If needed, press "Vert" Soft Function Key F2 to edit vertical adjustment of Oscilloscope Trace. Use DATA SCROLL Spinner (2) or DATA SCROLL ↑ or ↓ Keys (3) to adjust vertical position of Oscilloscope Trace.
22. To select a meter, press "More" Soft Function Key F6 until "AUX" Soft Function Key F5 appears:
- For FM or PM Modulation, press "Meters" Soft Function Key F4 to select SINAD, Distortion or Deviation (RMS) Meter.
  - For AM Modulation, press "Modul"/"Dist" Soft Function Key F4 to select Modulation or Distortion Meter. Both Meters are displayed, but only selected meter is functional.



**STEP****PROCEDURE**

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- For USB, LSB or BFO Modulation, press "Tune" Soft Function Key F4 and use DATA SCROLL ↑ and ↓ Keys (3) to tune Receiver in 125 Hz steps. Press ENTER Key.
23. To edit a Meters settings, move cursor to Callout of Meter to be edited and press ENTER Key. Meters Operation Screen appears.
- For Frequency Error Meter/Frequency Meter Operation Procedures, see 4-8-2.
  - For AF Meter Operation Procedures, see 4-8-1.
  - For Deviation Meter Operation Procedures, see 4-8-4.
  - For Phase Meter Operation Procedures, see 4-8-11.
  - For Modulation Meter Operation Procedures, see 4-8-5.
  - For Distortion Meter Operation Procedures, see 4-8-6.
  - For Power Meter Operation Procedures, see 4-8-3.
  - For Signal Strength Meter Operation Procedures, see 4-8-8.
  - For SINAD Meter Operation Procedures, see 4-8-7.
24. To operate Duplex Transmitter in Channel Mode, press SETUP Key to display Duplex Transmitter Menu.
- Move cursor to "10. Operation Mode" and press ENTER Key. Press "2" DATA ENTRY Key (29) to select Duplex Transmitter Channel Mode.
  - Press "Chan" Soft Function Key F2 to display a submenu listing cellular formats. Use DATA ENTRY Keypad (29) to select a cellular format.
  - Press "Ret" Soft Function Key F5 to return to Duplex Transmitter Operation Screen. Duplex Transmitter Frequency is displayed by channel number. For a list of AMPS cellular channels and corresponding frequencies, see Appendix B. For a list of ETACS cellular channels and corresponding frequencies, see Appendix C.
  - To select Direct Duplex Transmitter Mode, press SETUP Key to display Duplex Transmitter Menu. Move cursor to "10. Operation Mode" and press ENTER Key. Press "1" DATA ENTRY Key (29) to select Duplex Transmitter Direct Mode. Press "Ret" Soft Function Key F6 to return to Duplex Transmitter Operation Screen.
25. To operate Find Function:
- Press "More" Soft Function Key F6 until "Disp" Soft Function Key F1 appears. Press "Disp" Soft Function Key F1 to display a menu listing Oscilloscope and Analyzer options.
  - Press "2" DATA ENTRY Key (29) to select full size Analyzer.

**STEP****PROCEDURE**

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- Press "More" Soft Function Key F6 and press "Find lvl" Soft Function Key F2. Find Level is indicated by a red horizontal line. Use DATA SCROLL Spinner (2) or DATA SCROLL ↑ and ↓ Keys (3) to adjust Find Level and press ENTER Key.
- Press "Find" Soft Function Key F1 to activate Find Function. Duplex Transmitter Frequency (39) changes to frequency found.

**4-4-2 DUPLEX TRANSMITTER (TX) EXAMPLE****STEP****PROCEDURE**

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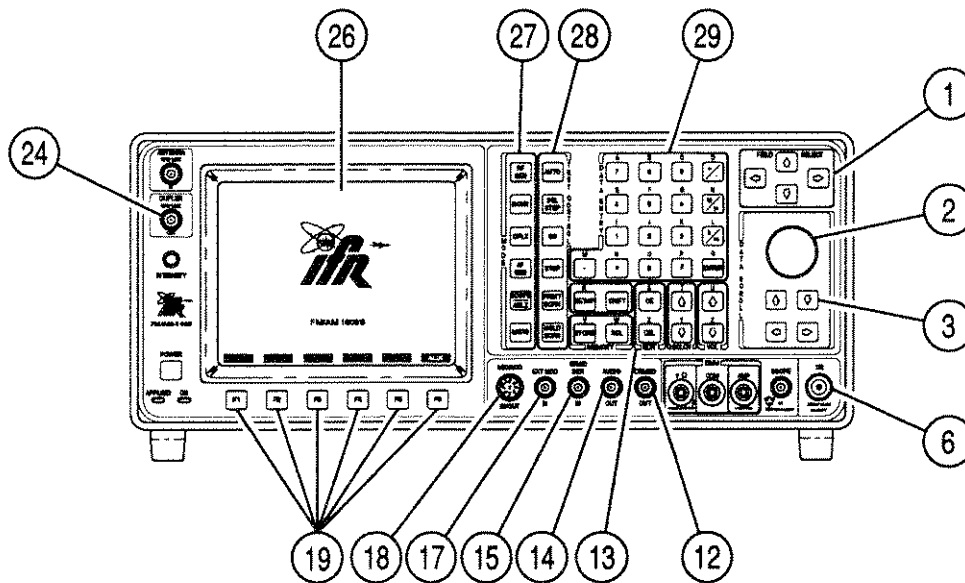
1. Press DPLX MODE Key (27). Duplex Operation Screen appears on CRT. Press "Tx" Soft Function Key F1 to access the Duplex Transmitter Operation Screen.
2. Use FIELD SELECT Keys (1) to move cursor to FREQ Callout (38) and press ENTER Key. Use DATA ENTRY Keypad (29) to enter "10.7" and press ENTER Key.
3. Move cursor to RF IN (37) and press ENTER Key to toggle RF Input to ANTENNA.
4. Move cursor to RF Input Level Callout (36) and press ENTER Key. Press DATA SCROLL Keys (3) until "0 dB" is displayed and press ENTER Key.
5. Move cursor to LEVEL Callout (35) and press ENTER Key. Press "+/-, 5, 0" DATA ENTRY Keys (29) and press ENTER Key.
6. Move cursor to MOD Callout (42) and press ENTER Key. Press DATA SCROLL Keys (3) until "FM1" appears in Modulation Callout (43) and press ENTER Key.
7. Connect UUT Output to ANTENNA Connector (25).

**NOTE:** The Duplex Transmitter is now set up to receive 10.7 MHz FM modulated signal through ANTENNA Connector (25).

## 4-4-3 DUPLEX RECEIVER GENERAL OPERATION

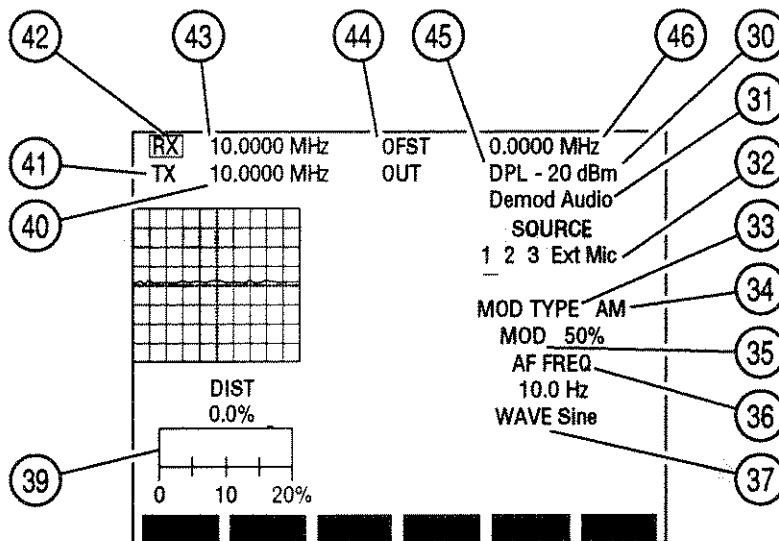
STEP

PROCEDURE



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1. If Duplex Operation Screen is displayed on the CRT, press "RX" Soft Function Key F2. If Duplex Transmitter Operation Screen is displayed on CRT, press "More" Soft Function Key F6 until "RX" Soft Function Key F2 appears. Press "RX" Soft Function Key F2. Duplex Receiver Operation Screen appears on CRT.



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2. Press "More" Soft Function Key F6 until "Offset" or "R Freq" Soft Function Key F5 appears. Press Soft Function Key F5 to toggle which frequency is editable. Use DATA ENTRY Keypad (29) to enter desired frequency and press ENTER Key.

**NOTE:** When Duplex Offset Frequency (OFST) or Duplex Receiver Frequency (RX) is edited, other frequency changes for their sum to equal to Duplex Transmitter Frequency (TX). Duplex Transmitter Frequency (TX) is not edited from this screen.

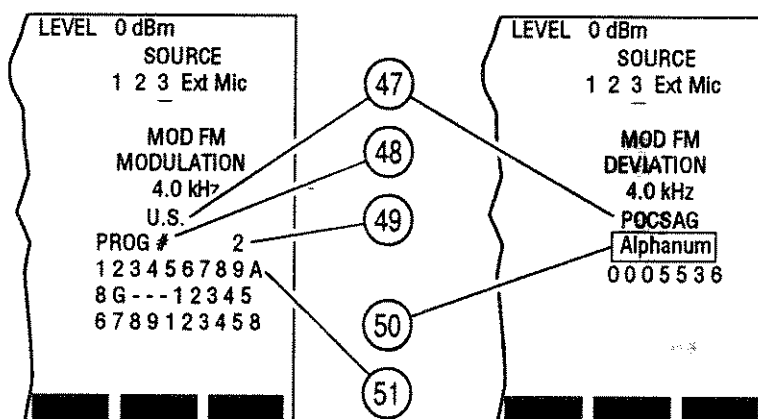
## PROCEDURE

Move cursor to RF OUT (45) and press ENTER Key to toggle Duplex Receiver Output location between "DPL" (DUPLEX Connector) (24) and "T/R" (T/R Connector) (6).

4. Move cursor to Output Level (30) and press ENTER Key. Use DATA ENTRY Keypad (29) to enter desired level and press ENTER Key. If necessary, press "+/-" Key to place "-" in data field.
5. Move cursor to SOURCE (32) and press ENTER Key to access active Modulation Source. If no source is active, data field cursor appears under SOURCE 1 Callout. If more than one source is on, active source is indicated by an underline. Source 1 refers to AF Generator 1, Source 2 refers to AF Generator 2, Source 3 refers to Signaling Formats, Ext refers to signals received at EXT MOD Connector (17) and Mic refers to signals received at MIC/ACC Connector (18). last selected source becomes active source.

Use FIELD SELECT ← and → Keys (1) to place cursor over desired source and use DATA SCROLL ↑ or ↓ Keys (3) to select desired Modulation Type. White indicates OFF, red indicates AM, yellow indicates FM and green indicates PM. selected Modulation Type is displayed on Modulation Type Callout (34).

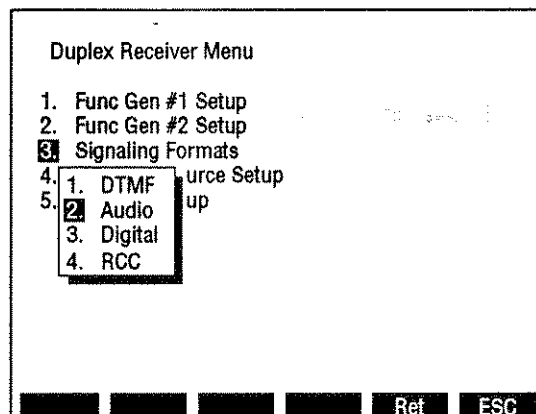
6. Move cursor to DEV or MOD (35) and press ENTER Key to access its data field. Use DATA ENTRY Keypad (29) to enter digits of desired deviation frequency or modulation percentage and press ENTER Key.
7. If Source 1 or 2 is selected as Active Source:
  - Move cursor to AF FREQ (36) and press ENTER Key to access its data field. Use DATA ENTRY Keypad (29) to enter desired frequency and press ENTER Key.
  - Move cursor to WAVE (37) and press ENTER Key to access its data field (38). Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field, and press ENTER Key to activate Wave Shape.
8. If Source 3 is not selected as Active Source, proceed with step 19. If Source 3 is selected as Active Source, the Operation Screen appears as follows:



8617085

9. If DTMF is Signaling Format:
  - Move cursor to DIRECT ENTRY/PROG # (48). Press ENTER Key to toggle between Direct Entry and Program features.
  - If PROG is selected, move cursor to Program Number (49) and use DATA ENTRY Keypad (29) to select a programmed sequence. Press ENTER Key.
  - If DIRECT ENTRY is selected, move cursor to sequence (51) and use DATA ENTRY Keypad (29) to enter desired sequence. Press ENTER Key.
10. If DTMF is not Signaling Format, move cursor to Signaling Code (47) and use DATA SCROLL ↑ and ↓ Keys (3) to select one of Signaling Codes of current Signaling Format. Press ENTER Key.
  - If POCSAG or Tone Remote is selected as Signaling Code, move cursor to POCSAG or Tone Remote Function Callout (50). Use DATA SCROLL ↑ and ↓ Keys (3) to select a function and press ENTER Key.
  - If DTMF, POCSAG or Tone Remote is not selected as the Signaling Code:
    - Move cursor to DIRECT ENTRY/PROG # (48). Press ENTER Key to toggle between Direct Entry and Program features.
    - If PROG is selected, move cursor to Program Number (49) and use DATA ENTRY Keypad (29) to select a programmed sequence. Press ENTER Key.
    - If DIRECT ENTRY is selected, move cursor to sequence (51) and use DATA ENTRY Keypad (29) to enter desired sequence. Press ENTER Key.
11. To generate Code, press GO TEST CONTROL Key (28). To stop generating Code, press STOP TEST CONTROL Key (28). To generate Code one tone at a time, press SGL STEP TEST CONTROL Key (28).
12. To select a different Signaling Format, press SETUP Key to display Gen Menu. Press "3" DATA ENTRY Key (29) to display Signaling Formats Menu.

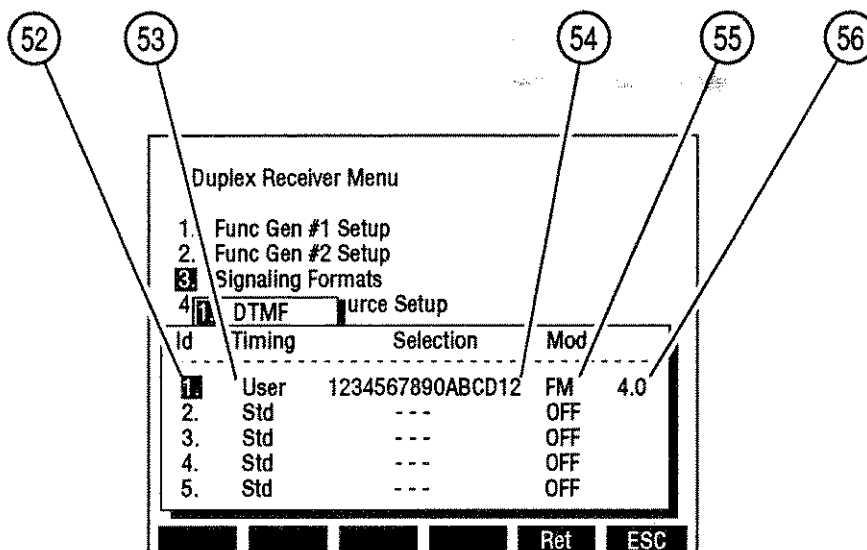
#### DUPLIX RECEIVER SIGNALING FORMAT MENU



8610090

13. Use DATA ENTRY Keys (29) to select a Signaling Format and press "Ret" Soft Function Key F5.
14. To program a Signaling Code sequence, press SETUP Key to display Gen Menu. Press "3" DATA ENTRY Key (29) to display the Signaling Formats Menu. Use DATA ENTRY Keys (29) to select a Signaling Format.
15. If DTMF is selected, DTMF Signaling Menu appears:

**DUPLEX RECEIVER DTMF  
SIGNALING MENU**



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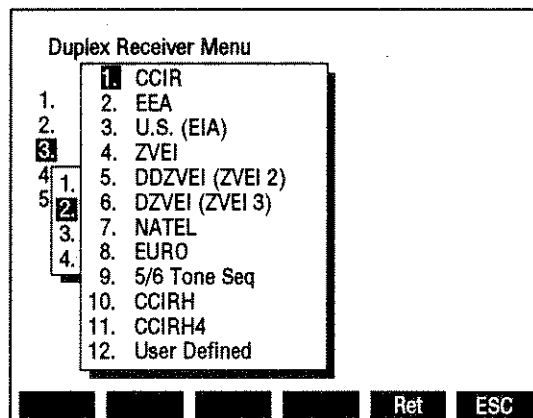
- Select Id (52) of Sequence to be edited using FIELD SELECT ↑ and ↓ Keys (1).
- Move cursor to Timing column (53) and use DATA SCROLL ↑ and ↓ Keys (3) to select Std (Standard) or User. Press ENTER Key.
- If User is chosen, data fields appear for Mark Timing and Space Timing.
  - Press "1" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Mark Timing. Press ENTER Key.
  - Press "2" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Space Timing. Press ENTER Key.
  - Press "ESC" Soft Function Key F6.
- Move cursor to Selection column (54) and enter a sequence using DATA ENTRY Keypad (29) and press ENTER Key.

**NOTE:** Pressing SHIFT Key toggles DATA ENTRY Keypad (29) between numeric and alphabetic characters.

- Move cursor to Mod column (55) and use DATA SCROLL ↑ and ↓ Keys (3) to select Modulation Type and press ENTER Key.
- Move cursor to Modulation Level (56) and use DATA ENTRY Keypad (29) to select Modulation Level and press ENTER Key.
- When desired sequences are entered, press ENTER Key and "Ret" Soft Function Key. F5 to return to Duplex Receiver Operation Screen.

16. If Audio is selected as Signaling Format, the Audio Code Menu appears:

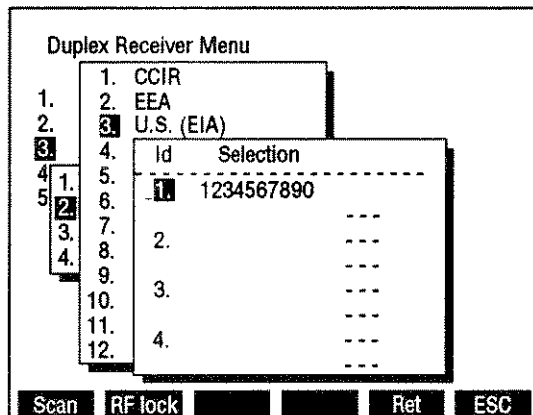
DUPLEX RECEIVER AUDIO CODE MENU



8610089

- Use FIELD SELECT Keys (1) to select an Audio Code and press ENTER Key. Audio Code Sequence Menu appears:

DUPLEX RECEIVER AUDIO CODE SEQUENCE MENU

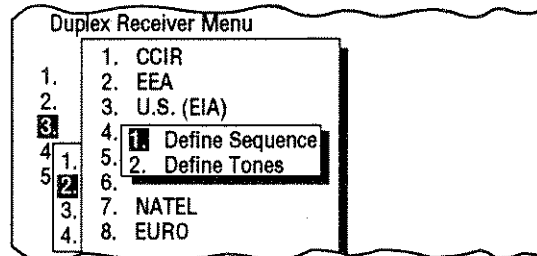


8610088

- Use FIELD SELECT Keys (1) to select an Id and press ENTER Key.
- Use DATA ENTRY Keys (29) to enter a sequence and press ENTER Key.

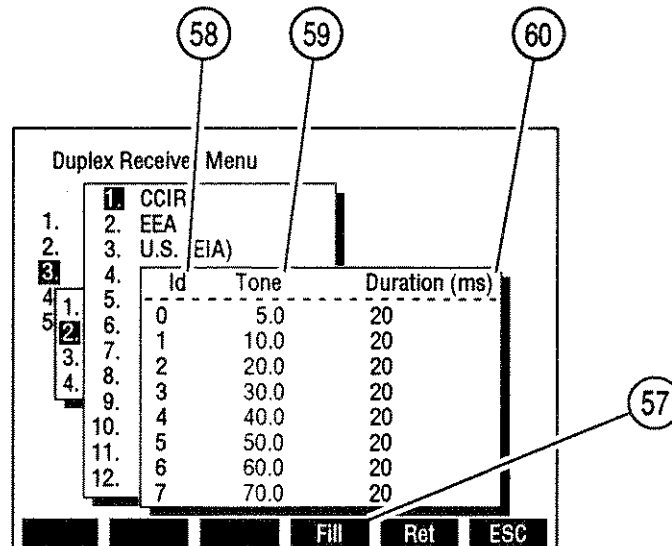
**NOTE:** Pressing SHIFT Key toggles DATA ENTRY Keypad (29) between numeric and alphabetic characters.

- If "12. User Defined" is selected as Audio Code, the Audio Code User Defined Menu appears:



8610170

- Press "2" DATA ENTRY Key (29) to display following menu:



8607118

- Move cursor to Tone(Hz) column (58) of desired Id (57) and use DATA ENTRY Keypad (29) to select frequency. Press ENTER Key.
- Move cursor to Duration(ms) column (59) and use DATA ENTRY Keypad (29) to select duration. Press ENTER Key.
- While cursor is in Tone(Hz) (58) or Duration(ms) columns (59), press "Fill" Soft Function Key F4 to fill column below cursor with value highlighted by cursor.
- When all desired tones are defined, press "ESC" Soft Function Key F6 to return to Audio Code User Defined Menu.
- Press "1" DATA ENTRY Key (29) to access Audio Code Sequence Menu. User Defined Sequences are selected as other Audio Code Sequences. When all desired sequences have been entered, press "Ret" Soft Function Key F5 to return to Duplex Receiver Operation Screen.



17. If Digital is selected as Signaling Format, the Digital Code Menu appears. Use DATA ENTRY Keypad (29) to select a Digital Code.

- If DCS or DCS INV is selected as Digital Code, the DCS Code Menu appears:

**DUPLEX RECEIVER  
DCS CODE SUBMENU**

Duplex Receiver Menu		
1.	Func Gen	Id Code
2.	Func Gen	1. 456
3.	Signaling	2. 000
4.	1. DTMF	3. 000
5.	2. Audio	4. 000
	3. Digital	5. 000
	4. 1. DCS	6. 000
	2. DCS	7. 000
	3. POC	8. 000

Ret ESC

8610087

- Use FIELD SELECT Keys (1) to select an Id and press ENTER Key.
- Use DATA ENTRY Keypad (29) to enter a sequence and press ENTER Key. When all desired sequences have been entered, press "Ret" Soft Function Key F5 to return to Duplex Receiver Operation Screen.
- If POCSAG is selected as the Digital Code, POCSAG Menu appears:

**DUPLEX RECEIVER POCSAG MENU**

Duplex Receiver Menu		
1.	Func Gen #1 Setup	
2.	Func Gen #2 Setup	
3.	Signaling Formats	
4.	1. DTMF	Source Setup
5.	2. Audio	1. Capcode 1 5130
	3. Digital	2. Capcode 2 5135
	4. 1. DC	3. Transmit rate Low
	2. DC	4. Function Alpha special
	3. POCSAG	

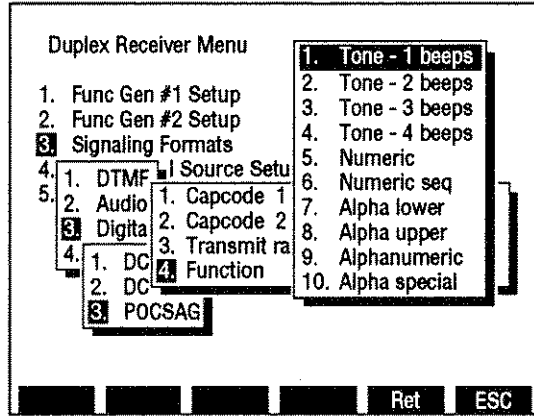
Ret ESC

8610151

- Press "1" DATA ENTRY Key (29) to access Capcode 1. Use DATA ENTRY Keypad (29) to enter Starting Capcode and press ENTER.
- Press "2" DATA ENTRY Key (29) to access Capcode 2. Use DATA ENTRY Keypad (29) to enter Ending Capcode and press ENTER.

- Press "3" DATA ENTRY Key (29) to toggle Transmit rate until set as desired.
- Press "4" DATA ENTRY Key (29) to display POCSAG Function Menu.

DUPLEX RECEIVER POCSAG  
FUNCTION MENU

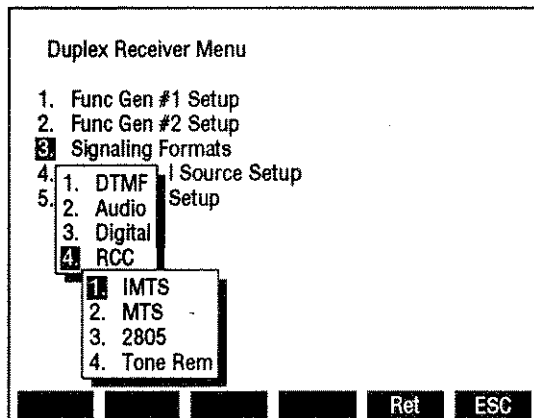


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- Use FIELD SELECT Keys (1) to select a Function Type and press ENTER Key. Press "Ret" Soft Function Key F5 to return to the Duplex Receiver Operation Screen.

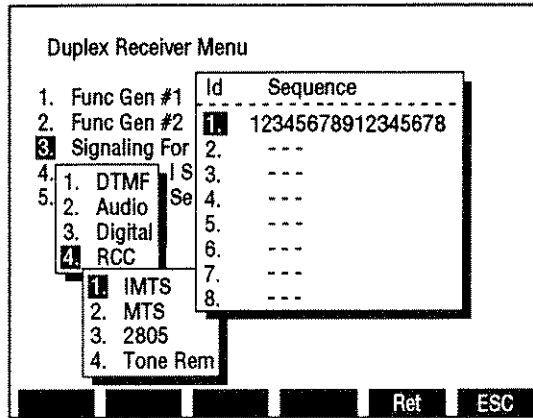
18. If RCC is selected as the Signaling Format, RCC Menu appears. Use DATA ENTRY Keypad (29) to select a RCC Code.

DUPLEX RECEIVER RCC MENU



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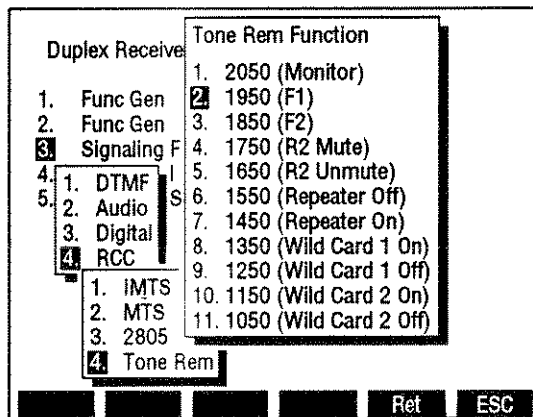
- If IMTS, MTS or 2805 is selected, RCC Sequence Menu appears:



8610153

- Use FIELD SELECT Keys (1) to select an Id and press ENTER Key.
- Use DATA ENTRY Keypad (29) to enter a sequence and press ENTER Key.
- When 2805 is chosen, "Tone" Soft Function Key F3 appears. To edit 2805s frequency, press "Tone" Soft Function Key F3 and use DATA ENTRY Keypad (29) to enter frequency. Press ENTER Key.
- When all desired sequences have been entered, press "Ret" Soft Function Key F5 to return to Duplex Receiver Operation Screen.
- If Tone Rem is selected, Tone Rem Function Menu appears:

TONE REM FUNCTION MENU

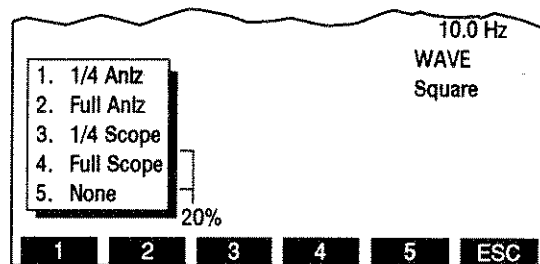


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- Use FIELD SELECT Keys (1) to select a Tone Remote Function and press ENTER Key.
- Press "Ret" Soft Function Key F5 to return to Duplex Receiver Operation Screen.

19. If an Oscilloscope or Spectrum Analyzer display is desired for Duplex Receiver Operation Screen or if this feature is desired in a different size:

- Press "More" Soft Function Key F6 until "DISP" Soft Function Key F1 appears. Press "DISP" Soft Function Key F1.
- A menu appears in lower left corner of CRT screen displaying following options:

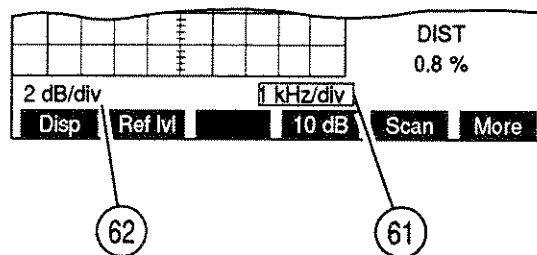


8617084

Select desired screen option using DATA ENTRY Keypad (29).

**NOTE:** 1/4 size Analyzer Screen parameters are edited by selecting full size Analyzer Screen, editing parameters and reselecting 1/4 size Analyzer Screen.

20. If "2. Full Anlz" is selected:



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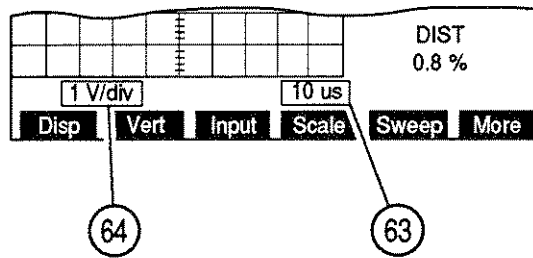
- Move cursor to Analyzer Scan Width (61) and press ENTER Key to access its data field. Press DATA SCROLL  $\uparrow$  or  $\downarrow$  Keys (3) until desired selection appears in data field and press ENTER Key to activate Scan Width desired.
- Move cursor to Analyzer Scale (62) and press ENTER Key to change this parameter. Pressing ENTER Key toggles its value between 2 and 10 dB.

21. If "3. 1/4 Scope" is selected:

- Move cursor to Oscilloscope Input (32) and press ENTER Key to access its data field. Press DATA SCROLL  $\uparrow$  or  $\downarrow$  Keys (3) until desired selection appears in data field and press ENTER Key to activate Oscilloscope Input desired.

**NOTE:** Remaining Oscilloscope parameters are edited by selecting full size Scope Screen, changing parameters and reselecting 1/4 size Scope Screen.

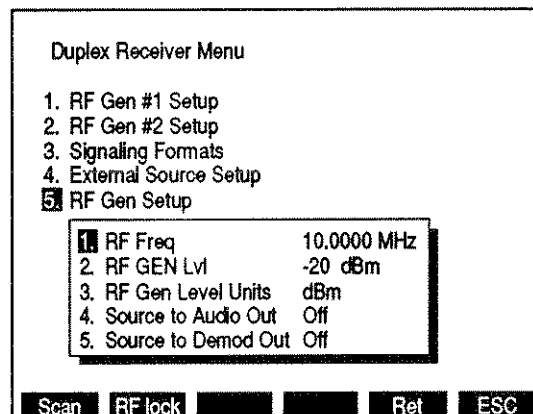
22. If "4. Full Scope" is selected:



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- Move cursor to Oscilloscope Input (32) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate selected Oscilloscope Input.
  - Move cursor to Oscilloscope Sweep Rate (63) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate selected Oscilloscope Sweep Rate.
  - Move cursor to Oscilloscope Scale (64) and press ENTER Key to access its data field. Press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate selected Oscilloscope Scale.
  - If needed, press "More" Soft Function Key F6 until "Vert" Soft Function Key F2 appears. Press "Vert" Soft Function Key F2 and use DATA SCROLL Spinner (2) or DATA SCROLL ↑ or ↓ Keys (3) to adjust vertical position of Oscilloscope Trace. Press ENTER Key.
23. If Duplex Receiver Output to AUDIO OUT Connector (14) or DEMOD OUT Connector (12) is desired, press SETUP Key to display the Gen Menu. Press "5" DATA ENTRY Key (29) to access RF Gen Setup Menu.

#### DUPLEX RECEIVER SETUP MENU



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- Press "4" DATA ENTRY Key (29) as needed to enable or disable RF Generator Output to AUDIO OUT Connector (14).

- Press "5" DATA ENTRY Key (29) as needed to enable or disable RF Generator Output to DEMOD OUT Connector (12).
  - Press "Ret" Soft Function Key F5 to return to RF Generator Operation Screen.
24. To display SINAD, Distortion or AF Level Meter or Digital Multimeter, press "More" Soft Function Key F6 until "Meters" Soft Function Key F4 appears. Press "Meters" Soft Function Key F4 to display a submenu listing available meters. Use DATA ENTRY Keypad (29) to select a meter. To access a meters Operation Screen, move cursor to Meters Callout and press ENTER Key.
- For SINAD Meter Operation Procedures, see 4-8-7.
  - For Distortion Meter Operation Procedures, see 4-8-6.
  - For DMM Operation Procedures, see 4-8-10.
- NOTE:** SINAD, Distortion and AF Level Meters measure SINAD/BER Connector (15) Input. DMM measures only DMM Connector Input.
25. After parameters of Duplex Receiver Operation Screen are set, connect UUT to FM/AM-1600S:
- For testing using separate transmit and receive lines, apply UUT transmitter output to T/R Connector (6). Connect DUPLEX Connector (24) to RF input of UUT receiver.
  - For "off the air" Duplex testing, connect antenna to ANTENNA Connector (25). Connect DUPLEX Connector (24) or T/R Connector (6) to RF input of UUT receiver.

#### 4-4-4 DUPLEX RECEIVER (RX) EXAMPLE

##### STEP

##### PROCEDURE

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1. Press DPLX MODE Key (27), Duplex Operation Screen appears on CRT. Press "Rx" Soft Function Key F2 to access the Duplex Receiver Operation Screen.
2. If RX Callout (42) is shown in red, press "More" Soft Function Key F6 until "R Freq" Soft Function Key F5 appears. Press F5 to make Receiver Frequency the active parameter.
3. Use FIELD SELECT Keys (1) to move cursor to RX Callout (42) and press ENTER Key. Press "1, 0, 0" DATA ENTRY Keys (29) and ENTER Key.
4. Move cursor to RF OUT (45) and press ENTER Key to toggle RF Output to DPL.
5. Move cursor to RF Output Level (30) and press ENTER Key. Press "5, 0" DATA ENTRY Keys (29) and press ENTER Key.
6. Move cursor to SOURCE (32) and press ENTER Key. Press DATA SCROLL ← and → Keys (4) to move cursor box over 1 Callout. Press DATA SCROLL ↑ and ↓ Keys (3) until "FM" appears in Modulation Callout (34) and press ENTER Key.
7. Move cursor to MOD (33) and press ENTER Key. Press "5" DATA ENTRY Key (29) and press ENTER Key.
8. Move cursor to AF FREQ (36) and press ENTER Key. Press "1, 0, 0, 0" DATA ENTRY Keys (29) and ENTER Key.
9. Move cursor to WAVE (37) and press ENTER Key. Press DATA SCROLL Keys (3) until "Sine" appears and press ENTER Key.
10. Connect DUPLEX Connector (24) to UUT Input.

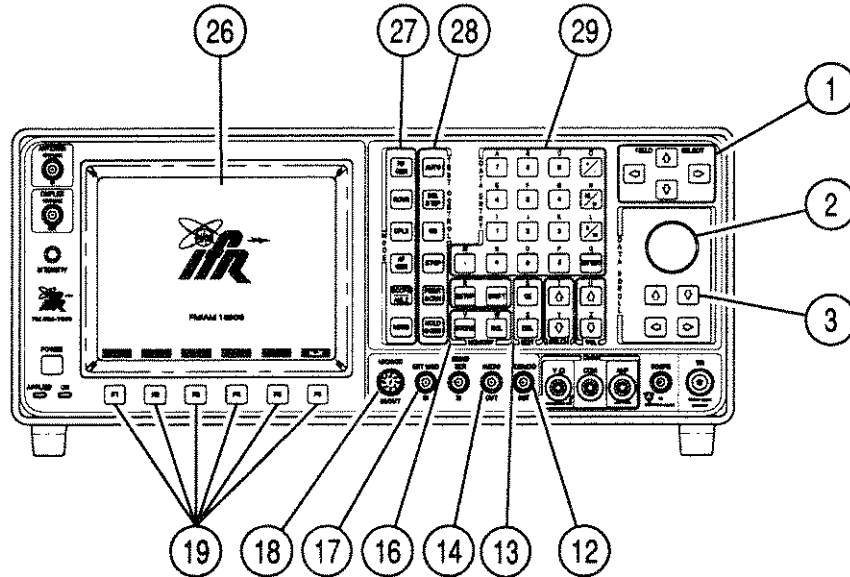
**NOTE:** The Duplex Receiver is now set up to transmit a 100 MHz FM modulated signal with a 1000 Hz sine wave audio signal.

## 4-5 AF SIGNAL GENERATOR OPERATION

### 4-5-1 GENERAL OPERATION

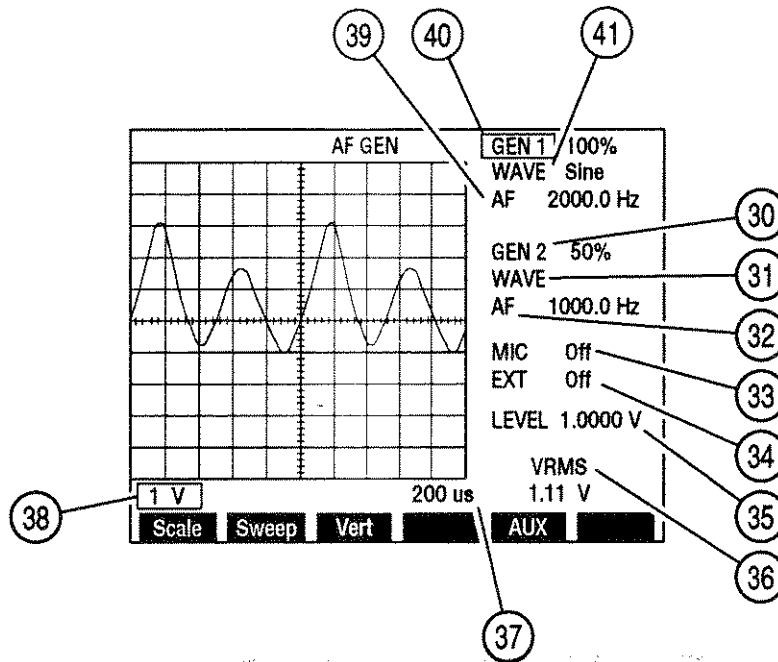
Operate AF Signal Generator using following procedure:

STEP	PROCEDURE
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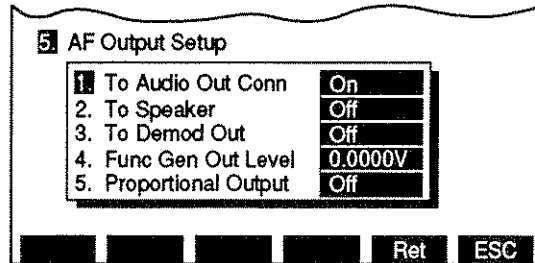
1. Press AF GEN MODE Key (27). AF Generator Operation Screen appears on CRT:



8607066



2. Press SETUP Key and press "5" DATA ENTRY Key (29) to display AF Output Setup Menu.



8610178

- Press "5" DATA ENTRY Key (29) to toggle Proportional Output on or off. With proportional Output on, set proportions of the AF Generators and external sources are summed instead of 100% of each. Press "Ret" Soft Function Key F5.
3. Move cursor to GEN 1 (40):
- If Proportional Output is off, press ENTER Key to toggle AF Generator #1 on or off.
  - If Proportional Output is on, press Enter Key and use DATA ENTRY Keypad (29) to enter a proportional percentage. Press ENTER Key.
4. Move cursor to WAVE (41) under GEN 1 and press ENTER Key to access its data field. Use DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key.
5. Move cursor to AF (39) under GEN 1 and press ENTER Key to access its data field. Use DATA ENTRY Keypad (29) to enter desired frequency and press ENTER Key.
6. Move cursor to GEN 2 (30):
- If Proportional Output is off, press ENTER Key to toggle AF Generator #2 on or off.
  - If Proportional Output is on, press Enter Key and use DATA ENTRY Keypad (29) to enter a proportional percentage. Press ENTER Key.
7. Move cursor to WAVE (31) under GEN 2 and press ENTER Key to access its data field. Use DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key.
8. Move cursor to AF (32) under GEN 2 and press ENTER Key to access its data field. Use DATA ENTRY Keypad (29) to enter desired frequency and press ENTER Key.
9. Move cursor to MIC (33):
- If Proportional Output is off, press ENTER Key to toggle External MIC/ACC Connector (18) Input on or off.

- If Proportional Output is on, press Enter Key and use DATA ENTRY Keypad (29) to enter a proportional percentage. Press ENTER Key.
10. Move cursor to EXT (34):
    - If Proportional Output is off, press ENTER Key to toggle External EXT MOD Connector (17) Input on or off.
    - If Proportional Output is on, press Enter Key and use DATA ENTRY Keypad (29) to enter a proportional percentage. Press ENTER Key.
  11. Move cursor to LEVEL (35) and press ENTER Key to access its data field. Use DATA ENTRY Keypad (29) to enter desired output and press ENTER Key to activate AF Generator Output Level.
  12. Measure VRMS Output Level by reading VRMS digital readout (36).
  13. Move cursor to Oscilloscope Sweep Rate (33) and press ENTER Key to access its data field. Use DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate Sweep Rate.
  14. Move cursor to Oscilloscope Scale (38) and press ENTER Key to access its data field. Use DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate Scale.
  15. If needed, press "Vert" Soft Function Key F3 to enable Vertical Adjustment Feature of Oscilloscope. Use DATA SCROLL Spinner (2) or press DATA SCROLL ↑ or ↓ Keys (3) to adjust position of Trace on Oscilloscope grid. When Trace is in desired position, press ENTER Key.
  16. To select AF Generator Outputs, press SETUP Key and "5" DATA ENTRY Key (29) to display AF Output Setup Menu:

## AF OUTPUT SETUP MENU

AF Gen Menu																
1.	AF Gen #1 Setup															
2.	AF Gen #2 Setup															
3.	Special Functions															
4.	External Source Setup															
5.	AF Output Setup															
<table border="1"> <tbody> <tr> <td>1.</td> <td>To Audio Out Conn</td> <td>On</td> </tr> <tr> <td>2.</td> <td>To Speaker</td> <td>Off</td> </tr> <tr> <td>3.</td> <td>To Demod Out</td> <td>Off</td> </tr> <tr> <td>4.</td> <td>Func Gen Out Level</td> <td>0.0000V</td> </tr> <tr> <td>5.</td> <td>Proportional Output</td> <td>Off</td> </tr> </tbody> </table>		1.	To Audio Out Conn	On	2.	To Speaker	Off	3.	To Demod Out	Off	4.	Func Gen Out Level	0.0000V	5.	Proportional Output	Off
1.	To Audio Out Conn	On														
2.	To Speaker	Off														
3.	To Demod Out	Off														
4.	Func Gen Out Level	0.0000V														
5.	Proportional Output	Off														
Ret    ESC																

8610017

- For AF Generator Output routed to AUDIO Connector (14), press "1" DATA ENTRY Key (29) to toggle "1. To Audio Out Conn" on or off.

- For AF Generator Output routed to Test Set Speaker, press "2" DATA ENTRY Key (29) to toggle "2. To Speaker" on or off.
  - For AF Generator Output routed to DEMOD Connector (12), press "3" DATA ENTRY Key (29) to toggle "3. To Demod Out" on or off.
  - Press "Ret" Soft Function Key F5 to return to AF Generator Operation Screen.
17. For Audio Frequency Scan, press SETUP Key and "3" DATA ENTRY Key (29) to display Special Functions Menu. Press "1" DATA ENTRY Key (29) to display Audio Frequency Scan Menu:

## AUDIO FREQUENCY SCAN MENU

AF Gen Menu	
1. AF Ge	Audio Frequency Scan
2. AF Ge	1. Start Freq 500.0 Hz
3. Speci	2. Stop Freq 2000.0 Hz
1. AF S	3. Increment 250.0 Hz
2. Tone	4. Scan Rate 0.02 Sec
	5. Mode Continuous
	6. Generator FGEN #1
	7. Scope Disabled

Ret ESC

8610102

- Press "1" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Starting Frequency.
- Press "2" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Stopping Frequency.
- Press "3" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Increment.
- Press "4" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter Scan Rate. Scan Rate data field is blank if "7. Scope" is enabled.
- Press "5" DATA ENTRY Key (29) to toggle Mode between Continuous and One Shot.
- Press "6" DATA ENTRY Key (29) to toggle Source between AF Generator #1 and AF Generator #2.
- Press "7" DATA ENTRY Key (29) to toggle between Scope Enabled and Disabled. Scope Enabled slows Scan Rate.

- When AF Frequency Scan parameters are set, press GO TEST CONTROL Key (28) to start Scan and press STOP TEST CONTROL Key (28) to stop Scan. Pressing SGL STEP TEST CONTROL Key (28) causes the Scan to increment once for each time Key is pressed.

**NOTE:** TEST CONTROL Keys (28) operate last accessed Special Function, AF Frequency Scan or Tone Remote Function.

- Press "Ret" Soft Function Key F5 to return to AF Generator Operation Screen.

18. To generate a Tone Remote signal, press SETUP Key and press "3" DATA ENTRY Key (29) to display Special Functions Menu. Press "2" DATA ENTRY Key (29) to display Tone Remote Menu:

### AF GENERATOR TONE REMOTE MENU

AF Gen Menu	
1. AF Ge	Tone Rem Function
2. AF Ge	1. 2050 (Monitor)
3. Speci	2. 1950 (F1)
1. AF S	3. 1850 (F2)
2. Tone	4. 1750 (R2 Mute)
	5. 1650 (R2 Unmute)
	6. 1550 (Repeater Off)
	7. 1450 (Repeater On)
	8. 1350 (Wild Card 1 On)
	9. 1250 (Wild Card 1 Off)
	10. 1150 (Wild Card 2 On)
	11. 1050 (Wild Card 2 Off)
	Ret ESC

8610158

- Use FIELD SELECT Keys (1) to select a Tone Remote Function and press ENTER Key.
- Press "Ret" Soft Function Key F5 to return to AF Generator Operation Screen.
- Press GO TEST CONTROL (28) to generate Tone Remote Function. Press STOP TEST CONTROL Key (28) to stop generating Tone Remote Function.

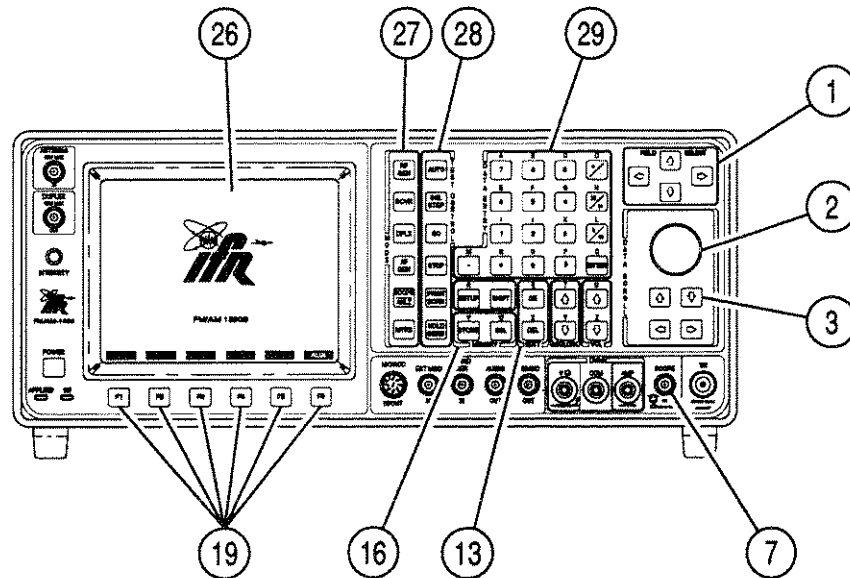
**NOTE:** TEST CONTROL Keys (28) operate last accessed Special Function, AF Frequency Scan or Tone Remote Functions.

## 4-6 OSCILLOSCOPE OPERATION

### 4-6-1 GENERAL OPERATION

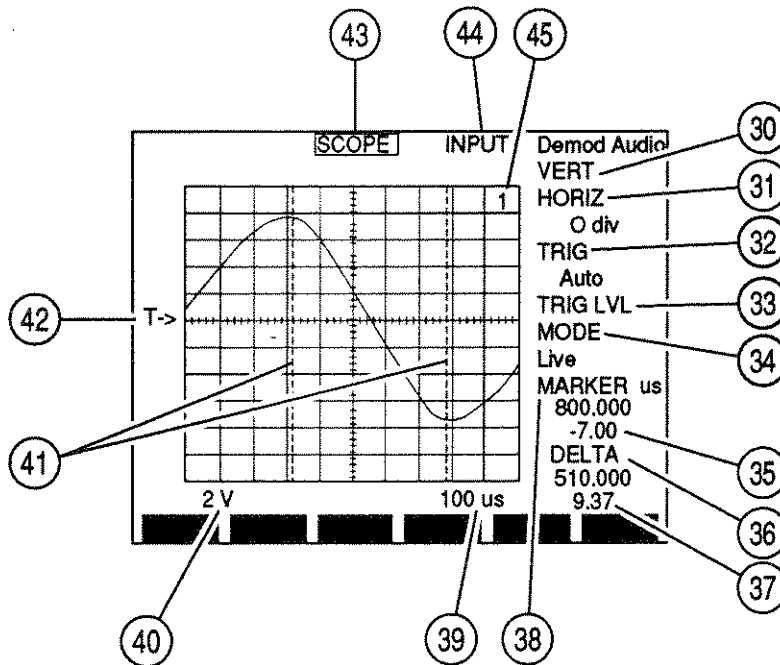
The Oscilloscope is operated using the following procedures:

STEP	PROCEDURE
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1. Press SCOPE/ANLZ MODE Key (27). Oscilloscope or Spectrum Analyzer Operation Screen appears on the CRT. If Spectrum Analyzer Operation Screen appears, press SCOPE/ANLZ MODE Key (27) again to access the Oscilloscope Operation Screen.



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2. Move cursor to INPUT (44) and press ENTER Key. INPUT Submenu appears overlaying Scope Operation Screen. Use DATA ENTRY Keypad (29) to select an Input and press ENTER Key.

**NOTE:** When Rcvr IF is selected for Oscilloscope Input (44), only Oscilloscope Input (44) and Vertical adjustment (30) is editable.

3. If Func Gen, Ext Mod, AC, DC, GND or Demod Audio with FM Receiver Modulation is selected for INPUT (44), move cursor to Oscilloscope Scale (40) and press ENTER Key. Use DATA SCROLL ↑ or ↓ Keys (3) to select a scale and press ENTER Key.
4. If Rcvr IF is not selected for Input (44), move cursor to Sweep Rate (39) and press ENTER Key. Use DATA SCROLL ↑ or ↓ Keys (3) to select a Sweep Rate and press ENTER Key.
5. Move cursor to VERT (30) and press ENTER Key. Use DATA SCROLL Spinner (2) or DATA SCROLL ↑ and ↓ Keys (3) to adjust vertical level of Trace and press ENTER Key.
6. Move cursor to HORIZ (31) and press ENTER Key. Use DATA ENTRY Keypad (29) to select Trace Horizontal Offset value in whole divisions and press ENTER Key.
7. Move cursor to TRIG (32) and press ENTER Key. Use DATA SCROLL ↑ and ↓ Keys (3) to select a Trigger Type and press ENTER Key. Press "More" Soft Function Key F6 until "Trig" Soft Function Key F3 appears.
  - If Auto or Norm is selected, press "Start" Soft Function Key F4 to start Trace. With Trace active, Soft Function Key F4 becomes "Stop". Press "Stop" Soft Function Key F4 to freeze Trace.
  - If One Shot is selected, press "Arm" Soft Function Key F4 to freeze a new screen of Trace.
8. To adjust Trigger Level, move cursor to TRIG LVL (33) and press ENTER Key. Use DATA SCROLL Spinner (2) or DATA SCROLL ↑ or ↓ Keys (3) to adjust Trigger Level Indicator higher or lower on Oscilloscope Scale and press ENTER Key.

**NOTE:** Setting Trigger Level in this manner is an approximate setting. To set Trigger Level at an exact point on vertical scale, press SETUP Key and "3" DATA ENTRY Key (29) to access Setup Scope Menu. Press "5" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to enter a Trigger Level (0 to 255, 128 corresponding to middle line).

9. Move cursor to MODE (34) and press ENTER Key. Use DATA ENTRY Keypad (29) to select a Mode. To recall a Trace for Recall or Compare Modes, press RCL MEMORY Key (16) and use DATA ENTRY Keypad (29) to select a stored Trace and press ENTER Key.

**NOTE:** When in Recall Mode, only Markers and Oscilloscope Mode are editable.

When in Compare Mode, recalled Trace does not change when Oscilloscope parameters are changed.

## STEP

## PROCEDURE

10. To store a set of Oscilloscope parameters and Trace, see 4-1-1.
11. To use Markers, move cursor to MARKER (38). Press "More" Soft Function Key F6 until "Marker" Soft Function Key F1 appears.
- For Marker 1 use, press "Mkr 1" Soft Function Key F3 and use DATA SCROLL Spinner (2) or DATA SCROLL Keys (3) to adjust its position and press ENTER Key. "Mkr 1" appears in red while Marker 1 is the active Marker.
  - For Marker 2 use, press "Mkr 2" Soft Function Key F4 and use DATA SCROLL Spinner (2) or DATA SCROLL Keys (3) to adjust its position and press ENTER Key. "Mkr 2" appears in red while Marker 2 is the active Marker.

Marker reading shows active Markers position using Sweep Rate units and referencing display's left side as 0. For AC, DC or GND Input, Marker voltage reading (voltage at Marker Trace crossing) (35) is displayed in V.

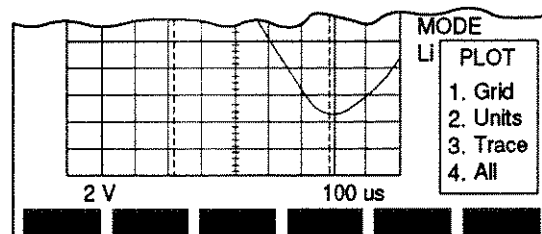
- To lock Markers a constant distance apart, press "Track" Soft Function Key F5. Use DATA SCROLL Spinner (2) or DATA SCROLL Keys (3) to adjust both Markers at once. Marker and Marker voltage readings reflect Marker 1 position.

Delta reading shows position difference of the two Markers. Delta voltage reading (37) shows voltage difference of the two Marker Trace crossings.

- To deactivate Markers, press "Off" Soft Function Key F2.

**NOTE:** If Marker is "Off", Marker Indicator appears on Oscilloscope grid if Marker Callout is accessed. Marker disappears from grid when Marker value is activated.

12. If needed, install Oscilloscope Probe (optional) to SCOPE Connector (7) and attach Oscilloscope Probe to desired test points of UUT.
13. To plot Trace via GPIB Connector:
- Configure GPIB parameters (see 6-2).
  - Connect Plotter to GPIB Connector.
  - Press PRINT SCREEN TEST CONTROL Key (28). If submenu appears listing Print and Plot options, press "2" DATA ENTRY Key (29). The following submenu appears:



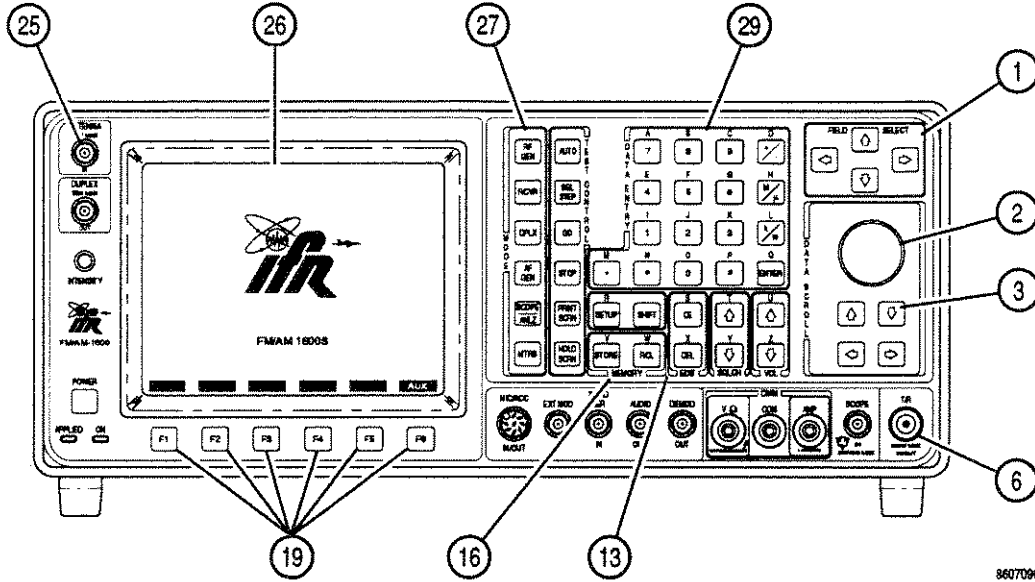
8607120

- Use DATA ENTRY Keys (29) to select items to plot until desired items are plotted.

## 4-7 SPECTRUM ANALYZER OPERATION

Spectrum Analyzer is operated using the following procedures:

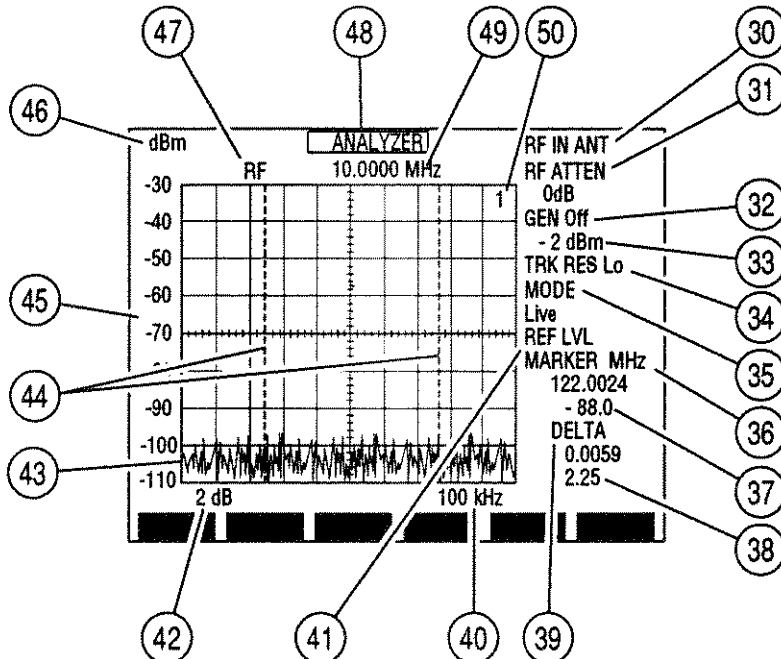
STEP	PROCEDURE
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1. Press SCOPE/ANLZ MODE Key (27). Oscilloscope or Spectrum Analyzer Operation Screen appears on CRT. If Oscilloscope Operation Screen appears, press SCOPE/ANLZ MODE Key (27) again. Spectrum Analyzer Operation Screen appears.

**NOTE:** Spectrum Analyzer is not operable when Receiver Modulation is AM1 or USB. Spectrum Analyzer is not operable when Receiver Modulation is User with 3 kHz selected as the IF Filter unless BFO or LSB is selected as User Modulation.



8607068



## STEP

## PROCEDURE

2. Connect RF Source of Spectrum Analyzer Input Signal to ANTENNA Connector (25) or T/R Connector (6).
3. Move cursor to RF (47) and press ENTER Key to access RF data field (49). Use DATA ENTRY Keypad (29) to enter frequency and press ENTER Key.
4. Move cursor to RF IN (30) and press ENTER Key to toggle RF Input location between ANTENNA Connector (25) and T/R Connector (6).
5. Move cursor to RF ATTEN (31) and press ENTER Key to access RF Attenuation data field. Use DATA SCROLL ↑ or ↓ Keys (3) to select desired attenuation and press ENTER Key.
6. Move cursor to Analyzer Scale (46) and press ENTER Key to activate its data field. Use DATA SCROLL ↑ or ↓ Keys (3) to select desired scale and press ENTER Key.
7. Move cursor to Scan Width (40) and press ENTER Key to access its data field. Use DATA SCROLL ↑ and ↓ Keys (3) to select desired Scan Width and press ENTER Key.
8. To activate Tracking Generator, press "More" Soft Function Key F2 until "Gen lvl" Soft Function Key F3 appears. If "Gen 0" is displayed for Soft Function Key F2, Tracking Generator is activated. If "Gen 1" is displayed for Soft Function Key F2, press "Gen 1" Soft Function Key F2 to activate Tracking Generator.

**NOTE:** Tracking Generator is routed to T/R Connector (6) if ANT is selected for RF IN (30). Tracking Generator is routed to DPL Connector if T/R is selected for RF IN (30).

9. Move cursor to GEN (32) and press ENTER Key. Use DATA ENTRY Keys (29) to set Tracking Generator Level and press ENTER Key.
10. Move cursor to TRK RES (34) and press ENTER Key to toggle Tracking Generator Resolution between Lo and Hi.
11. To normalize Spectrum Analyzer if Tracking Generator is off, press "More" Soft Function Key F2 until "Norm" Soft Function Key F1 appears. Press "Norm" Soft Function Key F1.
12. Move cursor to MODE (35) and press ENTER Key to display Spectrum Analyzer Mode Submenu. Use DATA ENTRY Keys (29) to select an Operation Mode and press ENTER Key. To recall a Trace for Recall or Compare Modes, press RCL MEMORY Key and use DATA ENTRY Keypad (29) to select a stored Trace and press ENTER Key.

**NOTE:** When in Recall Mode, only Markers and Analyzer Mode are editable.

When in Compare Mode, recalled Trace does not change when Analyzer parameters are changed.

13. Move cursor to REF LVL (41) and press ENTER Key. Use DATA SCROLL Spinner (2) or DATA SCROLL Keys (3) to adjust Reference Level as desired and press ENTER Key. Analyzer Grid Vertical Scale (45) changes to reflect different reference. REF LVL (41) appears only when Scale is set to 2 dB/div.

14. To use Markers, press "More" Soft Function Key F6 until "Mkr 1" Soft Function Key F3 appears.

- For Marker 1 use, press "Mkr 1" Soft Function Key F3 and use DATA SCROLL Spinner (2) or DATA SCROLL Keys (3) to adjust its position and press ENTER Key. "Mkr 1" appears in red while Marker 1 is the active Marker.
- For Marker 2 use, press "Mkr 2" Soft Function Key F4 and use DATA SCROLL Spinner (2) or DATA SCROLL Keys (3) to adjust its position and press ENTER Key. "Mkr 2" appears in red while Marker 2 is the active Marker.

Marker reading shows active Markers position in MHz. Marker amplitude reading (amplitude at Marker Trace crossing) (37) is displayed in current Analyzer Grid units.

- To lock Markers a constant distance apart, press "Track" Soft Function Key F5. Use DATA SCROLL Spinner (2) or DATA SCROLL Keys (3) to adjust both Markers at once. Marker readings reflect Marker 1 position.

Delta reading shows position difference of Markers in MHz. Delta amplitude reading (38) shows amplitude difference of each Marker Trace crossing in current Analyzer Grid units.

- To change RF Frequency (49) to active Markers frequency, press "Mkr Fc" Soft Function Key F1.
- To deactivate Markers, press "Off" Soft Function Key F2.

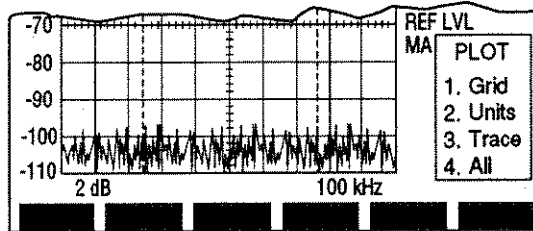
**NOTE:** If Marker is "Off", Marker Indicator appears on Oscilloscope grid when Marker Callout is accessed. Marker disappears from grid when Marker value is activated.

15. To operate Find Function (relocate RF Frequency [49] to first signal with amplitude greater than Find level):

- If Tracking Generator is on, press "More" Soft Function Key F2 until "Gen 0" Soft Function Key F3 appears. Press "Gen 0" Soft Function Key F2 to deactivate Tracking Generator.
- Press "More" Soft Function Key F6 until "Find" appears above Soft Function Key F1. Press "Find lvl" Soft Function Key F2.
- Use DATA SCROLL Spinner (2) or DATA SCROLL Keys (3) to adjust red horizontal Marker to amplitude level that is to be searched for and press ENTER Key.
- Press "Find" Soft Function Key F1. Find Function searches for lowest frequency signal with greater amplitude than amplitude set using "Find lvl". RF Frequency is also changed to frequency found.

## 16. To plot Trace via GPIB Connector:

- Configure GPIB parameters (see 6-2).
- Connect Plotter to GPIB Connector.
- Press PRINT SCREEN TEST CONTROL Key. If submenu appears listing Print and plot options, press "2" DATA ENTRY Key (29). The following submenu appears:



8607121

- Use DATA ENTRY Keys (29) to select items to plot until desired items are plotted.
- To print CRT screen, see 4-1-2.

## 4-7-2 MEASURING VERY LOW POWER TRANSMITTER OUTPUT

- | STEP | PROCEDURE  |
|------|--|
| 1.   | Press SCOPE/ANLZ MODE Key (27). If Oscilloscope Operation Screen appears, press SCOPE/ANLZ MODE Key (27) again.  |
| 2.   | Use FIELD SELECT Keys (1) to move cursor to RF (49) and press ENTER Key. Use DATA ENTRY Keys (29) to enter transmitting frequency of UUT and press ENTER Key.  |
| 3.   | If needed, use FIELD SELECT Keys (1) to move cursor to GEN (33) and press ENTER Key to toggle Tracking Generator off.  |
| 4.   | If needed, use FIELD SELECT Keys (1) to move cursor to MODE (36) and press ENTER Key. Press "1" DATA ENTRY Key (29) to select Live Mode.   |
| 5.   | Apply test signal to T/R Connector (6) and read power level using Analyzer Scale (47).   |
| 6.   | If reading is <-30 dB, disconnect incoming signal from T/R Connector (6) and apply signal to ANTENNA Connector (25).   |
| 7.   | Use FIELD SELECT Keys (1) to move cursor to RF IN (30) and press ENTER Key to toggle RF Input to ANTENNA.  |
| 8.   | Use FIELD SELECT Keys (1) to move cursor to RF ATTEN (31) and press ENTER Key. Press DATA SCROLL Keys (3) until "0 dB" appears and press ENTER Key.  |
| 9.   | Press "More" Soft Function Key F6 until "Mkr 1" appears above Soft function Key F3. Press F3 to highlight Marker Position data field.  |
| 10.  | Rotate DATA SCROLL SPINNER (2) until Marker 1 lies directly on peak of specified signal. Marker dB readout (just below Marker Position readout [40]) displays power at point of signal crossing of Marker. For dBm conversion to W, see Table 4-3. |

CONVERSION TABLE (dBm to watts)	
+50 dBm = 100 W	-10 dBm = 100 $\mu$ W
+40 dBm = 10 W	-20 dBm = 10 $\mu$ W
+30 dBm = 1 W	-30 dBm = 1 $\mu$ W
+20 dBm = 100 mW	-40 dBm = 100 nW
+10 dBm = 10 mW	-50 dBm = 10 nW
0 dBm = 1 mW	-60 dBm = 1 nW

Table 4-3 dBm to Watts Conversion Table

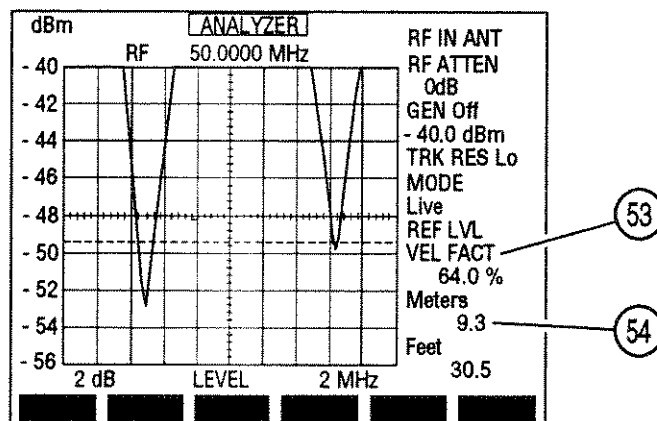
### 4-7-3 MEASURING TRANSMITTER HARMONICS

STEP	PROCEDURE
1.	Press SCOPE/ANLZ MODE Key (27). If Oscilloscope Operation Screen appears, press SCOPE/ANLZ MODE Key (27) again.
2.	Use FIELD SELECT Keys (1) to move cursor to RF (49) and press ENTER Key. Use DATA ENTRY Keys (29) to enter transmitting frequency under test and press ENTER Key.
3.	If needed, use FIELD SELECT Keys (1) to move cursor to GEN (33) and press ENTER Key to toggle Tracking Generator off.
4.	If needed, use FIELD SELECT Keys (1) to move cursor to MODE (35) and press ENTER Key. Press "1" DATA ENTRY Key (29) to select Live Mode.
5.	Use FIELD SELECT Keys (1) to move cursor to RF IN (30) and press ENTER Key to toggle RF Input to T/R.
6.	Apply signal under test to T/R Connector (6) and read power level using Analyzer Scale (47).
7.	If reading is less than -30 dB, disconnect incoming signal from T/R Connector (6) and apply signal to ANTENNA Connector (25).
8.	Use FIELD SELECT Keys (1) to move cursor to RF IN (30) and press ENTER Key to toggle RF Input to ANT.
9.	Use FIELD SELECT Keys (1) to move cursor to RF ATTEN (31) and press ENTER Key. Press DATA SCROLL Keys (3) until "0 dB" appears and press ENTER Key.
10.	Use FIELD SELECT Keys (1) to move cursor to Scan Width (40) and press ENTER Key. Use DATA SCROLL Keys (3) to adjust Scan Width until first and second harmonics appear alone on CRT.
9.	Press "More" Soft Function Key F6 until "Mkr 1" appears above Soft function Key F3. Press F3 to highlight Marker Position data field.
10.	Rotate DATA SCROLL SPINNER (2) until Marker 1 lies directly on peak of first harmonic frequency. Press F4 to activate Marker 2. Rotate DATA SCROLL SPINNER (2) until Marker 2 lies directly on peak of second harmonic frequency. Delta dB Callout (below Delta Position reading [39]) displays difference, in dB, of first and second harmonics.

## 4-7-4 CABLE FAULT TESTING

STEP	PROCEDURE
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1. Connect 50  $\Omega$  coaxial cable between ANTENNA Connector (25) and a coaxial tee connected to T/R Connector (6). Connect coaxial cable under test to other side of coaxial tee connector.
2. Move cursor to GEN (32) and press ENTER Key. Use DATA ENTRY Keys (29) to set Tracking Generator Level to -30 dBm and press ENTER Key.
3. Move cursor to Scan Width (40) and press ENTER Key. Use DATA SCROLL Keys (3) to set Scan Width to 100 MHz and press ENTER Key.
4. Move cursor to Division Factor Units (42) and press ENTER Key. Use DATA SCROLL Keys (3) to set Division Factor Units to 10 dB/div and press ENTER Key.
5. Press "More" Soft Function Key F6 until "Cbl Flt" Soft Function Key F3 appears. Press "Cbl Flt" Soft Function Key F3.
6. Move cursor to VEL FACT (53) and press ENTER Key. Use DATA ENTRY Keypad (29) to enter velocity factor of cable under test and press ENTER Key.
7. Note location of lowest group of troughs displayed on CRT.
8. Move cursor to Scan Width (40) and use DATA SCROLL  $\uparrow$  and  $\downarrow$  Keys (3) to set Scan Width (40) to 50 MHz. Press ENTER Key.
9. Move cursor to RF (47) and use DATA ENTRY Keys (29) to set Analyzer Center Frequency to center of troughs. Press ENTER Key.
10. Move cursor to Scan Width (40) and use DATA SCROLL  $\uparrow$  and  $\downarrow$  Keys (3) to set Scan Width (40) until only two or three troughs appear on CRT. Press ENTER Key.
11. Move cursor to Division Factor Units (42) and press ENTER Key until 2 dB/div appears.



8617067

Fig 4-1 Cable Fault Horizontal Marker Setting

**STEP****PROCEDURE**

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12. Press "Find lvl" Soft Function Key F2 and use DATA SCROLL KEYS (3) to adjust red horizontal line to lowest point while touching two troughs as shown in Figure 4-1 and press ENTER Key.
13. Press GO TEST CONTROL Key (28). Cable Fault Length readout (54) displays in meters and feet.

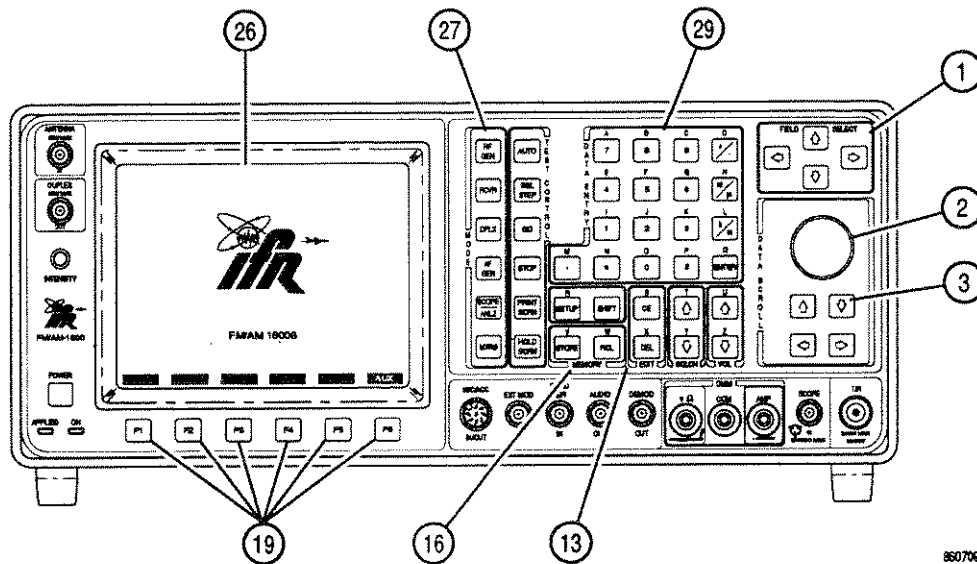
## 4-8 METER OPERATION

### 4-8-1 AUDIO FREQUENCY METER OPERATION

Received or generated Audio Frequency signals are measured using following procedures:

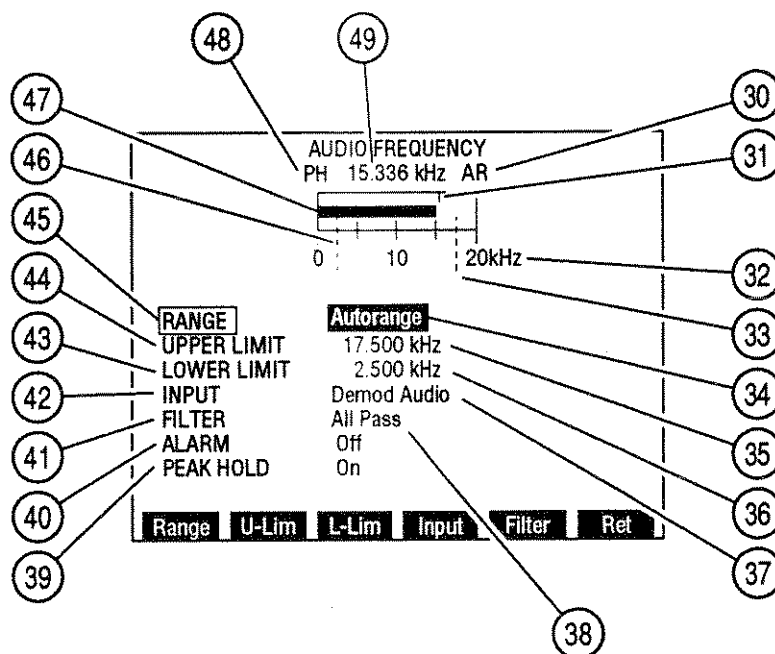
**NOTE:** The Audio Frequency Meter is accessed from Receive Operation Screen, Duplex Operation Screen, Duplex Transmitter Operation Screen or Meters Menu. meter reflects readings of last Operation Mode of Test Set.

STEP	PROCEDURE
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8607062

1. Press MTRS MODE Key (27). Press "1" DATA ENTRY Key (29) to access Audio Frequency Meter Operation Screen.



8607069



**STEP****PROCEDURE**

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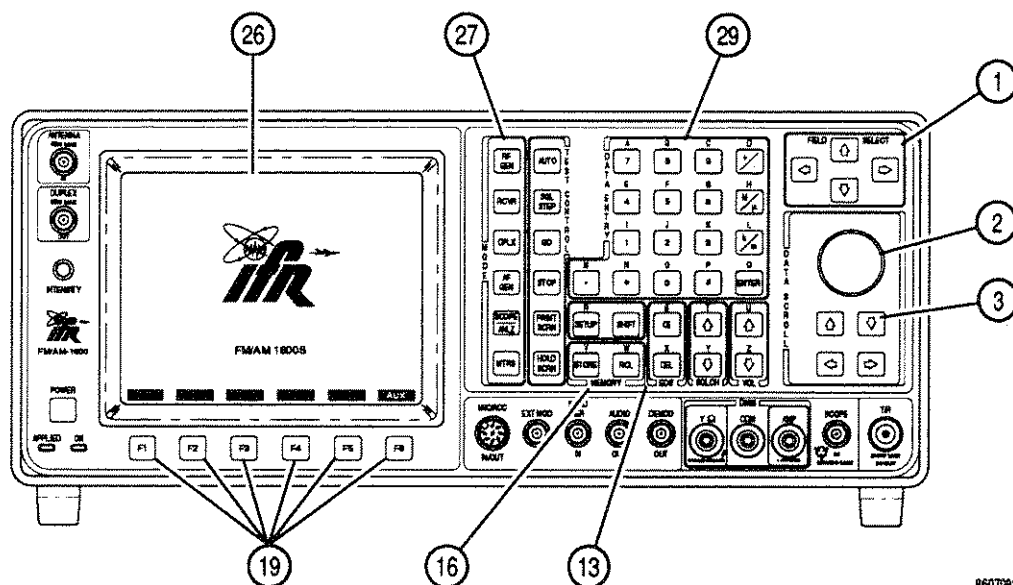
2. Move cursor to RANGE (45) and press ENTER Key to access its data field (34). Rotate DATA SCROLL Spinner (2) or press DATA SCROLL ↑ or ↓ Keys (3) to select desired Range and press ENTER Key.
3. Move cursor to UPPER LIMIT (44) and press ENTER Key to activate Upper Limit and access its data field (35). Use DATA ENTRY Keypad (29) to enter desired Upper Limit and press ENTER Key. A blue line (33) appears across meter window marking position of Upper Limit.
4. Move cursor to LOWER LIMIT (43) and press ENTER Key to activate Lower Limit and access its data field (36). Use DATA ENTRY Keypad (29) to enter desired Lower Limit and press ENTER Key. A blue line (46) appears across meter window marking position of Lower Limit.
5. To deactivate Upper or Lower Limit, press SETUP Key to display AF Meter Menu. Press "6" (Upper Limit) or "8" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to AF Meter Operation Screen.
6. Move cursor to INPUT (42) and press ENTER Key to access its data field (37). Use DATA SCROLL ↑ and ↓ Keys (3) to select an Input and press ENTER.
7. Press SETUP Key to display AF Meter Menu.
  - Press "2" DATA ENTRY Key (29) to display a Filter submenu. Use DATA ENTRY Keypad (29) to select a Filter. If Low Pass or High Pass is selected, a data field appears. Use DATA ENTRY Keypad (29) to enter cutoff frequency and press ENTER Key.
  - Press "4" DATA ENTRY Key (29) to toggle Gate Time to desired setting. Press "Ret" Soft Function Key F5 to return to Audio Frequency Meter Operation Screen.
8. Move cursor to ALARM (40) and press ENTER Key to enable or disable Alarm. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
9. Move cursor to PEAK HOLD (39) and press ENTER Key to enable or disable Peak Hold feature of Power Meter. A PH Callout (48) appears at lower left of meter window and a yellow peak indicator (31) appears on meter indicating highest point reached by Meter Indicator Bar (47).
10. Measure AF Frequency using Meter Indicator Bar (47) or digital readout (49) in Hz or kHz.
11. To store or recall a set of AF Meter parameters, see 4-1-1.
12. To Return to last Operation Screen, press "Ret" Soft Function Key F6.

## 4-8-2 RF FREQUENCY ERROR METER OPERATION

Received Radio Frequencies and Frequency Error (the difference between Received Radio Frequency and frequency setting of Receive Operation Screen or Duplex Transmitter Operation Screen) is measured using following procedures:

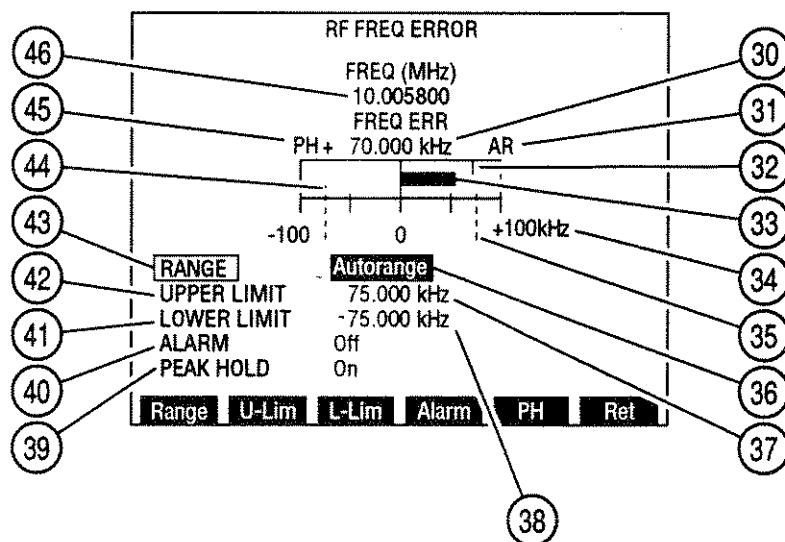
Frequency Error Meter is accessed from Receive Operation Screen, Duplex Operation Screen or Meter Menu. meter reflects readings of last Operation Mode of Test Set.

STEP	PROCEDURE
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8607092

1. Press MTRS MODE Key (27). Press "2" DATA ENTRY Key (29) to access RF Frequency Error Meter Operation Screen.



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**STEP****PROCEDURE**

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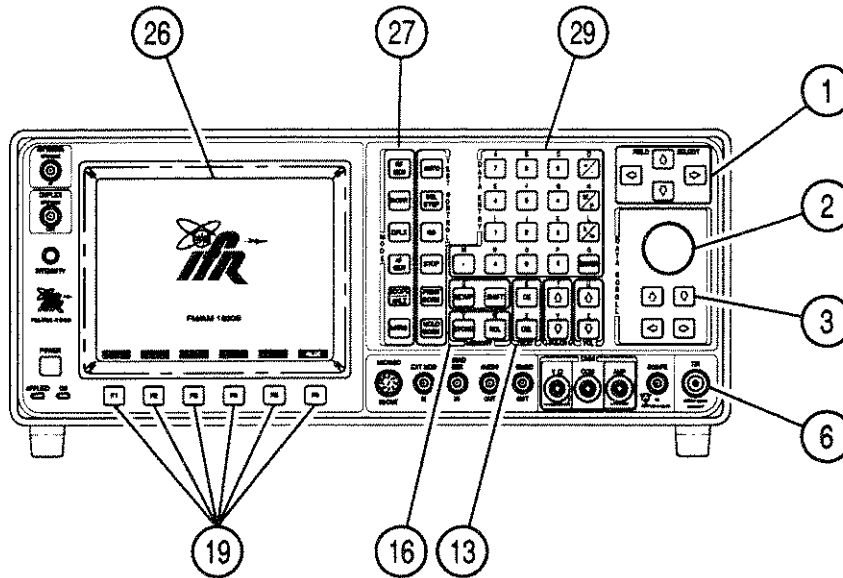
2. Move cursor to RANGE (43) and press ENTER Key to access its data field (36). Rotate DATA SCROLL Spinner (2) or press DATA SCROLL ↑ or ↓ Keys (3) to select desired Range and press ENTER Key.
3. Move cursor to UPPER LIMIT (42) and press ENTER Key to activate Upper Limit and access its data field (37). Use DATA ENTRY Keypad (29) to enter desired Upper Limit and press ENTER Key. A blue line (35) appears across meter window marking position of Upper Limit.  
  
**NOTE:** The Upper Limit for Frequency Error Meter is positive and affects only meter bar deflections in right half of meter window (frequency error above Receive RF setting or Duplex Transmitter FREQ setting).
4. Move cursor to LOWER LIMIT (41) and press ENTER Key to activate Lower Limit and access its data field (38). Use DATA ENTRY Keypad (29) to enter desired Lower Limit and press ENTER Key. A blue line (44) appears across meter window marking position of Lower Limit.  
  
**NOTE:** The Lower Limit for Frequency Error Meter is negative and affects only meter bar deflections in left half of meter window (frequency error below Receive RF setting or Duplex Transmitter FREQ setting).
5. To deactivate Upper or Lower Limit, press SETUP Key to display RF Meter Menu. Press "4" (Upper Limit) or "6" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to RF Meter Operation Screen.
6. Move cursor to ALARM (40) and press ENTER Key to enable or disable Alarm. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
7. Move cursor to PEAK HOLD (39) and press ENTER Key to enable or disable Peak Hold feature of RF Meter. A PH Callout (45) appears at lower left of meter window and a yellow peak indicator (32) appears on meter indicating highest point reached by Meter Indicator Bar (33).
8. Measure Received Frequency using Frequency Meter Digital Reading (46). Measure Frequency Error using Meter Indicator Bar (33) or Frequency Error Meter Digital Reading (30).
9. To store or recall a set of Frequency Error Meter parameters, see 4-1-1.
10. To return to last Operation Screen, press "Ret" Soft Function Key F6.

### 4-8-3 POWER METER OPERATION

Power Meter measurements of RF signals received at T/R Connector (6) are measured using following procedures:

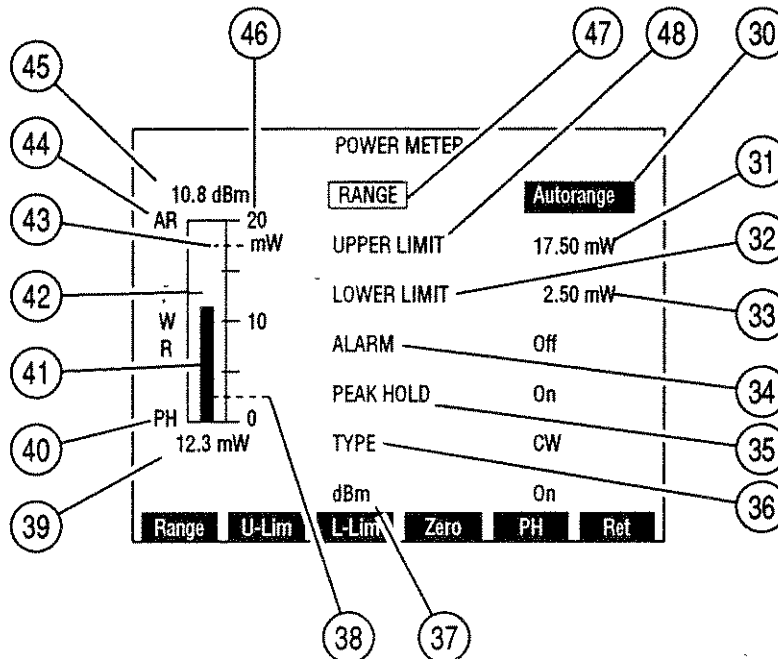
**NOTE:** The RF Power Meter is accessed from Receive Operation Screen, Duplex Transmitter Operation Screen or Meter Menu. meter reflects readings of last Operation Mode of Test Set.

STEP PROCEDURE



8607093

1. Press MTRS MODE Key (27). Press "3" DATA ENTRY Key (29) to access Power Meter Operation Screen.



8607071

**STEP****PROCEDURE**

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2. Move cursor to RANGE (47) and press ENTER Key to access its data field (30). Rotate DATA SCROLL Spinner (2) or press DATA SCROLL ↑ or ↓ Keys (3) to select desired Range and press ENTER Key.
3. Move cursor to UPPER LIMIT (48) and press ENTER Key to activate Upper Limit and access its data field (31). Use DATA ENTRY Keypad (29) to enter desired Upper Limit and press ENTER Key. A blue line (43) appears across meter window marking position of Upper Limit.
4. Move cursor to LOWER LIMIT (32) and press ENTER Key to activate Lower Limit and access its data field (33). Use DATA ENTRY Keypad (29) to enter desired Lower Limit and press ENTER Key. A blue line (38) appears across meter window marking position of Lower Limit.
5. To deactivate Upper or Lower Limit, press SETUP Key to display Power Meter Menu. Press "5" (Upper Limit) or "7" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to Power Meter Operation Screen.
6. Move cursor to ALARM (34) and press ENTER Key to enable or disable Alarm. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
7. Move cursor to PEAK HOLD (35) and press ENTER Key to enable or disable Peak Hold feature of Power Meter. A PH Callout (40) appears at lower left of meter window and a yellow peak indicator (42) appears on meter indicating highest point reached by Meter Indicator Bar (41).
8. Move cursor to dBm (37) and press ENTER Key to enable or disable digital dBm readout (45) of Power Meter.
9. To zero Power Meter:
  - Use FIELD SELECT Keys (1) to move cursor to RANGE Callout (47) and press ENTER Key. Use DATA SCROLL Keys ↑ and ↓ (3) to set Range to 20 mW and press ENTER Key.
  - Press "Zero" Soft Function Key F4. Use FIELD SELECT Keys (1) to move cursor to RANGE Callout (47) and press ENTER Key. Use DATA SCROLL Keys (3) to set Range to desired value and press ENTER Key.
10. Measure RF Power using Meter Indicator Bar (41) or digital readout (39) in W or dBm (45).
11. To store or recall a set of Power Meter parameters, see 4-1-1.
12. To Return to last Operation Screen, press "Ret" Soft Function Key F6.

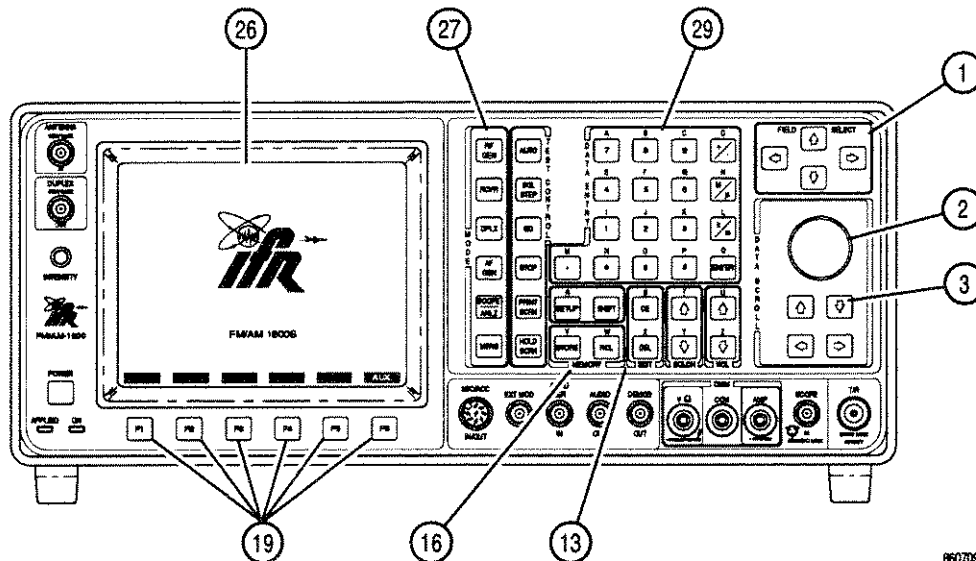
## 4-8-4 DEVIATION METER (PEAK) OPERATION

Deviation of received or generated FM signals is measured using following procedures:

**NOTE:** The FM Deviation Meter is accessed from Receive Operation Screen, Duplex Operation Screen, Duplex Transmitter Operation Screen or Meter Menu. meter reflects readings of last Operation Mode of Test Set.

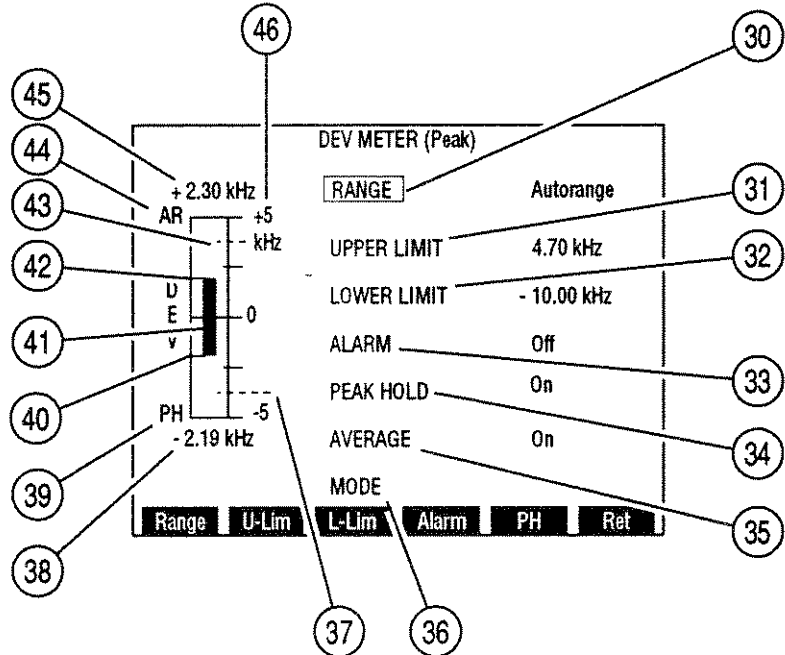
Receiver or RF Gen Modulation must be FM for Deviation Meter measurements.

STEP	PROCEDURE
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8607062

1. Press MTRS MODE Key (27). Press "4" DATA ENTRY Key (29) to access FM Deviation Meter Operation Screen.



8607072

**STEP****PROCEDURE**

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2. Move cursor to RANGE (30) and press ENTER Key to access its data field. Rotate DATA SCROLL Spinner (2) or press DATA SCROLL ↑ or ↓ Keys (3) to select desired Range and press ENTER Key.
3. Move cursor to UPPER LIMIT (31) and press ENTER Key to activate Upper Limit and access its data field. Use DATA ENTRY Keypad (29) to enter desired Upper Limit and press ENTER Key. A blue line (43) appears across meter window marking position of Upper Limit.

**NOTE:** The Upper Limit is positive and affects only meter bar deflections in upper half of meter window.

4. Move cursor to LOWER LIMIT (32) and press ENTER Key to activate Lower Limit and access its data field. Use DATA ENTRY Keypad (29) to enter desired Lower Limit and press ENTER Key. A blue line (37) appears across meter window marking position of Lower Limit.

**NOTE:** The Lower Limit is negative and affects only meter bar deflections in lower half of meter window.

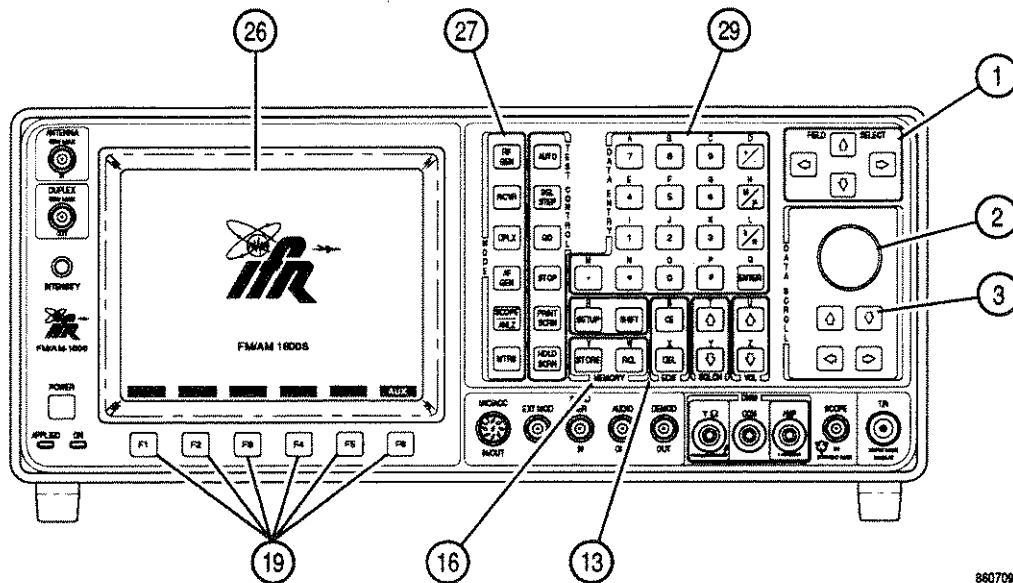
5. To deactivate Upper or Lower Limit, press SETUP Key to display Deviation (peak) Meter Menu. Press "3" (Upper Limit) or "5" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to Deviation (Peak) Meter Operation Screen.
6. Move cursor to ALARM (33) and press ENTER Key to enable or disable Alarm. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
7. Move cursor to PEAK HOLD (34) and press ENTER Key to enable or disable Peak Hold feature of Deviation (peak) Meter. A PH Callout (39) appears at lower left of meter window and a yellow peak indicator (42) and (40) appears on meter indicating highest and lowest point reached by Meter Indicator Bar (41).
8. Move cursor to AVERAGE Callout (35) and press ENTER Key to enable or disable Deviation Meter Averaging. With Averaging enabled, a running average of last 10 readings are reported.
9. Move cursor to MODE Callout (36) and press ENTER Key. Use DATA SCROLL ↑ and ↓ Keys (3) to select a Mode and press ENTER Key.
10. Measure FM Deviation (peak) using Meter Indicator Bar (41) or + Meter Digital Readings (45) and - Meter Digital Readings (38).
11. To store or recall a set of Deviation Meter parameters, see 4-1-1.
12. To return to last Operation Screen, press "Ret" Soft Function Key F6.

## 4-8-5 AM MODULATION METER OPERATION

Received or generated AM Modulation signals are measured using following procedures:

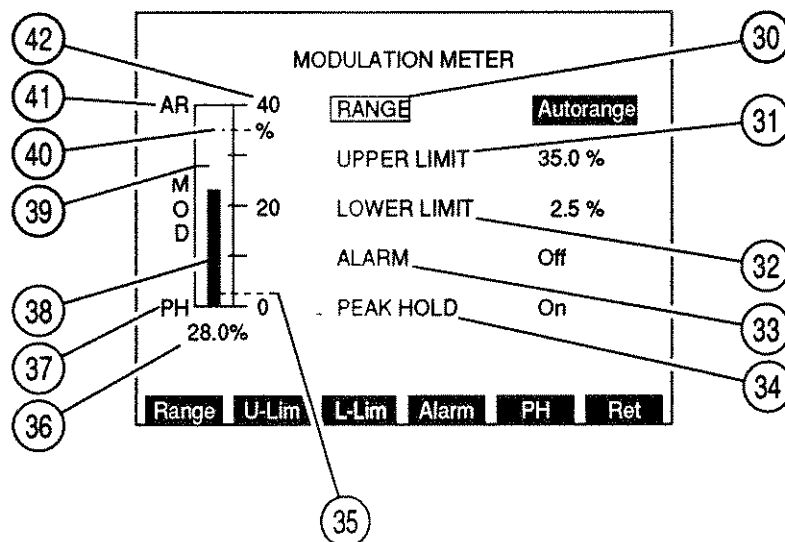
**NOTE:** The AM Modulation Meter is accessed from Receive Operation Screen, Duplex Operation Screen or Duplex Transmitter Operation Screen. meter reflects readings of last Operation Mode of Test Set.

STEP	PROCEDURE
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8607092

1. Press MTR MODE Key (27). Press "5" DATA ENTRY Key (29) to access AM Modulation Meter Operation Screen.



8607073



**STEP****PROCEDURE**

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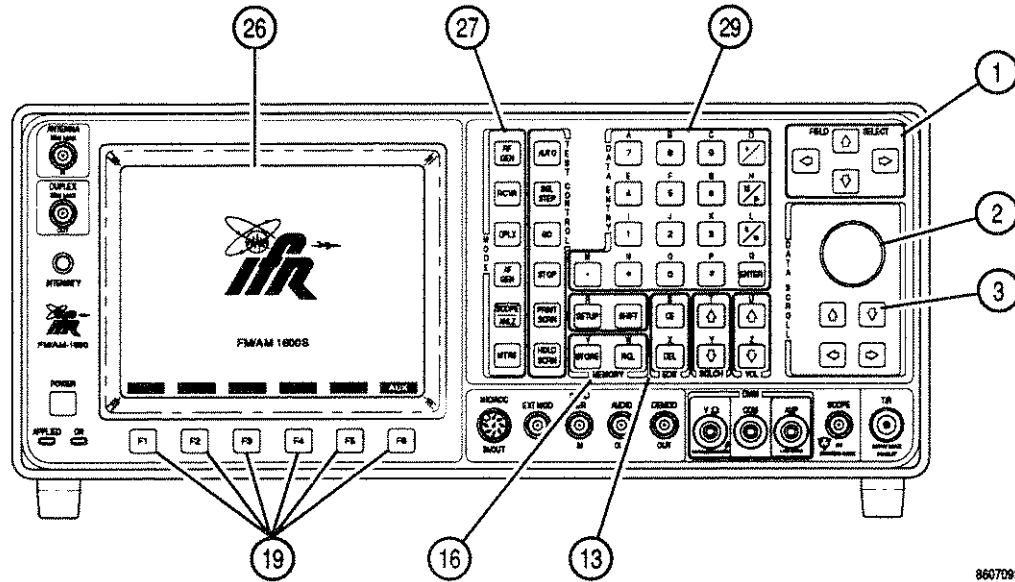
2. Move cursor to RANGE (30) and press ENTER Key to access its data field. Rotate DATA SCROLL Spinner (2) or press DATA SCROLL ↑ or ↓ Keys (3) to select desired Range and press ENTER Key.
3. Move cursor to UPPER LIMIT (31) and press ENTER Key to activate Upper Limit and access its data field. Use DATA ENTRY Keypad (29) to enter desired Upper Limit and press ENTER Key. A blue line (40) appears across meter window marking position of Upper Limit.
4. Move cursor to LOWER LIMIT (32) and press ENTER Key to activate Lower Limit and access its data field. Use DATA ENTRY Keypad (29) to enter desired Lower Limit and press ENTER Key. A blue line (35) appears across meter window marking position of Lower Limit.
5. To deactivate Upper or Lower Limit, press SETUP Key to display Modulation Meter Menu. Press "3" (Upper Limit) or "5" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to Modulation Meter Operation Screen.
6. Move cursor to ALARM (33) and press ENTER Key to enable or disable Alarm. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
7. Move cursor to PEAK HOLD (34) and press ENTER Key to enable or disable Peak Hold feature of Modulation Meter. A PH Callout (37) appears at lower left of meter window and a yellow peak indicator (39) appears on meter indicating highest point reached by Meter Indicator Bar (38).
8. Measure AM Modulation using Meter Indicator Bar (38) or digital readout (36).
9. To store or recall a set of Modulation Meter parameters, see 4-1-1.
10. To return to last Operation Screen, press "Ret" Soft Function Key F6.

## 4-8-6 DISTORTION METER OPERATION

The distortion of received or generated RF signals is measured using following procedures:

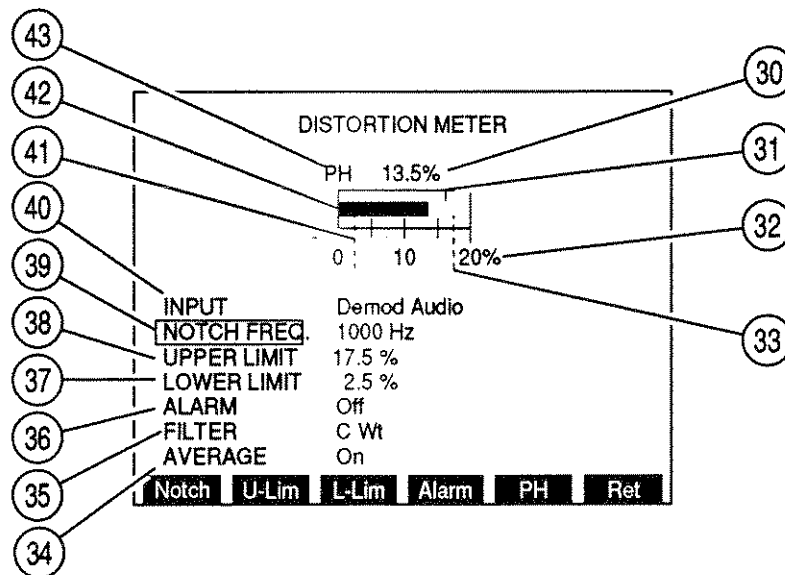
**NOTE:** The Distortion Meter is accessed from RF Generator Operation Screen, Receive Operation Screen, Duplex Operation Screen, Duplex Transmitter Operation Screen or Duplex Receiver Operation Screen. meter reflects readings of last Operation Mode of Test Set.

STEP PROCEDURE



8607092

1. Press MTRS MODE Key (27). Press "6" DATA ENTRY Key (29) to access Distortion Meter Operation Screen.



8607074

## STEP

## PROCEDURE

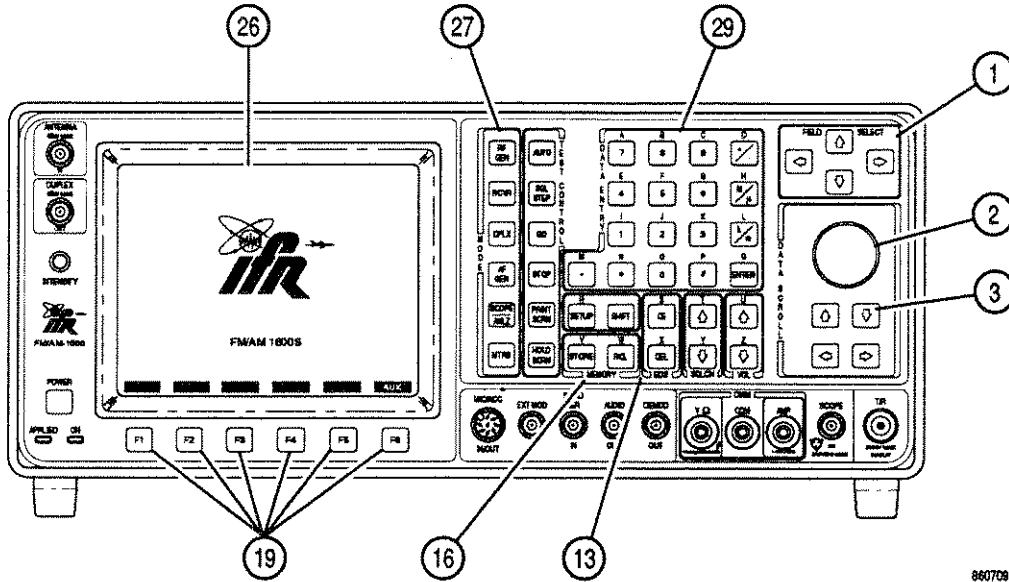
2. Move cursor to INPUT (40) and press ENTER Key to access its data field. Rotate DATA SCROLL Spinner (2) or press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate Distortion Meter Input.
3. Move cursor to NOTCH FREQ (39) and press ENTER Key to access its data field. Use DATA ENTRY Keypad (29) to set Notch frequency and press ENTER Key.
4. Move cursor to UPPER LIMIT (38) and press ENTER Key to activate Upper Limit and access its data field. Use DATA ENTRY Keypad (29) to enter Upper Limit and press ENTER Key. A blue line (33) appears across meter window marking position of Upper Limit.
5. Move cursor to LOWER LIMIT (37) and press ENTER Key to activate Lower Limit and access its data field. Use DATA ENTRY Keypad (29) to enter Lower Limit and press ENTER Key. A blue line (41) appears across meter window marking position of Lower Limit.
6. To deactivate Upper or Lower Limit, press SETUP Key to display Power Meter Menu. Press "4" (Upper Limit) or "6" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to Distortion Meter Operation Screen.
7. Move cursor to ALARM (36) and press ENTER Key to enable or disable Alarm. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
8. Move cursor to FILTER (35) and press ENTER Key to toggle Filter between C Wt and Low Pass. If Low Pass is selected, Low Pass cutoff frequency appears. Use FIELD SELECT Keys (1) to move cursor to Low Pass frequency data field and press ENTER Key. Use DATA ENTRY Keys (29) to enter a cutoff frequency and press ENTER Key.
9. Move cursor to AVERAGE (34) and press ENTER Key to enable or disable Distortion Meter Averaging. With Averaging enabled, a running average of last 10 readings are reported.
10. Press "PH" Soft Function Key F5 to enable or disable Peak Hold feature of Distortion Meter. When enabled, a PH Callout (43) appears at upper left of meter window and a yellow peak indicator (31) appears on meter indicating highest point reached by Meter Indicator Bar (42).
11. Measure Percent Distortion using Meter Indicator Bar (42) or digital readout (30).
12. To store or recall a set of Distortion Meter parameters, see 4-1-1.
13. To return to last Operation Screen, press "Ret" Soft Function Key F6.

## 4-8-7 SINAD METER OPERATION

SINAD of received or generated RF signals are measured using following procedures:

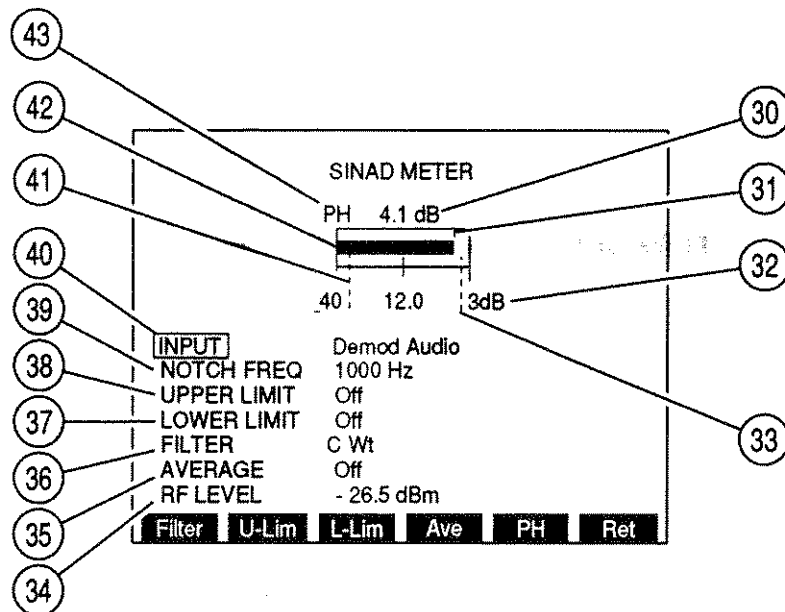
**NOTE:** The SINAD Meter is accessed from RF Generator Operation Screen, Receive Operation Screen, Duplex Operation Screen, Duplex Transmitter Operation Screen or Duplex Receiver Operation Screen. meter reflects readings of last Operation Mode of Test Set.

STEP	PROCEDURE
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8607092

1. Press MTRS MODE Key (27). Press "7" DATA ENTRY Key (29) to access SINAD Meter Operation Screen.



8607075

**STEP****PROCEDURE**

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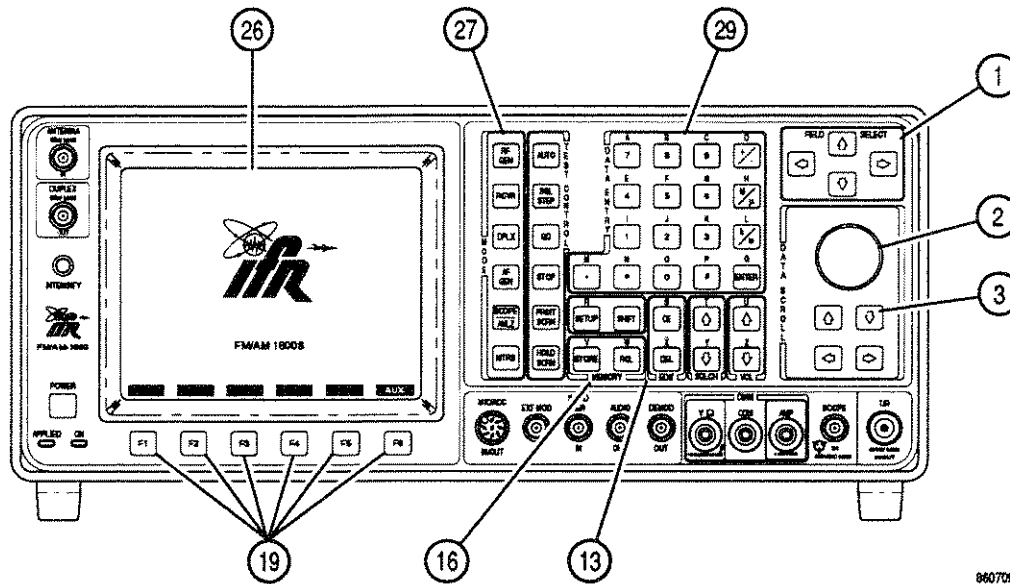
2. Move cursor to INPUT (40) and press ENTER Key to access its data field. Rotate DATA SCROLL Spinner (2) or press DATA SCROLL ↑ or ↓ Keys (3) until desired selection appears in data field and press ENTER Key to activate Distortion Meter Input.
3. Move cursor to NOTCH FREQ (39) and press ENTER Key to access its data field. Use DATA ENTRY Keypad (29) to set Notch frequency and press ENTER Key.
4. Move cursor to UPPER LIMIT (38) and press ENTER Key to activate Upper Limit and access its data field. Use DATA ENTRY Keypad (29) to enter Upper Limit and press ENTER Key. A blue line (33) appears across meter window marking position of Upper Limit.
5. Move cursor to LOWER LIMIT (37) and press ENTER Key to activate Lower Limit and access its data field. Use DATA ENTRY Keypad (29) to enter Lower Limit and press ENTER Key. A blue line (41) appears across meter window marking position of Lower Limit.
6. To deactivate Upper or Lower Limit, press SETUP Key to display Power Meter Menu. Press "4" (Upper Limit) or "6" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to SINAD Meter Operation Screen.
7. Move cursor to FILTER (36) and press ENTER Key to toggle Filter between C Wt and Low Pass. If Low Pass is selected, Low Pass cutoff frequency appears. Use FIELD SELECT Keys (1) to move cursor to Low Pass frequency data field and press ENTER Key. Use DATA ENTRY Keypad (29) to enter a cutoff frequency and press ENTER Key.
8. Move cursor to AVERAGE (35) and press ENTER Key to enable or disable SINAD Meter Averaging. With Averaging enabled, a running average of last 10 readings are reported.
9. If RF Generator or Duplex Receiver Operation Screen is last Operation Screen accessed, RF LEVEL (34) appears. Move cursor to RF LEVEL (34) and press ENTER Key. Use DATA ENTRY Keypad (29) to select RF Generator Level or Duplex Receiver Output Level and press ENTER Key.
10. Press "PH" Soft Function Key F5 to enable or disable Peak Hold feature of SINAD Meter. When enabled, a PH Callout (43) appears at upper left of meter window and a yellow peak indicator (31) appears on meter indicating highest point reached by Meter Indicator Bar (42).
11. Measure SINAD using Meter Indicator Bar (42) or digital readout (30).
12. To store or recall a set of SINAD Meter parameters, see 4-1-1.
13. To return to last Operation Screen, press "Ret" Soft Function Key F6.

## 4-8-8 SIGNAL STRENGTH METER OPERATION

Signal Strength measurements of generated signals are measured using following procedures

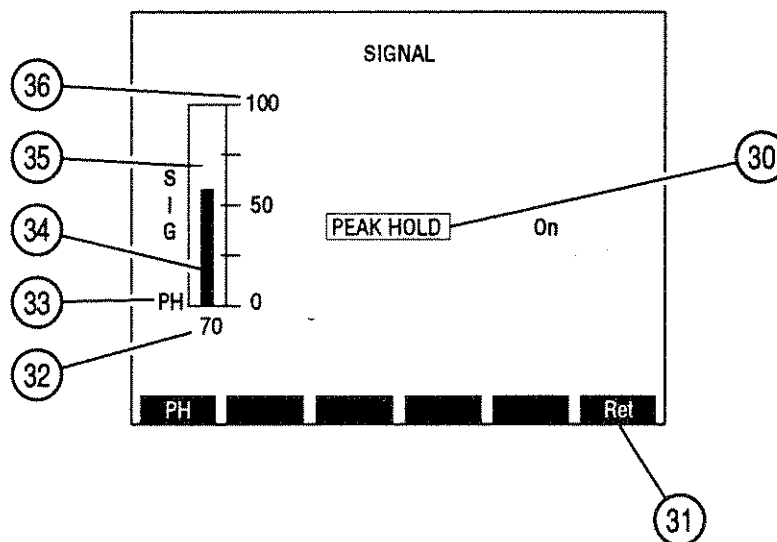
**NOTE:** The Signal Strength Meter is accessed from Receiver Operation Screen, Duplex Operation Screen, Duplex Transmitter Operation Screen or Meter Menu. meter reflects readings of last Operation Mode of Test Set.

STEP	PROCEDURE
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8607092

1. Press MTRS MODE Key (27). Press "8" DATA ENTRY Key (29) to access Signal Strength Meter Operation Screen.



8607105

**STEP****PROCEDURE**

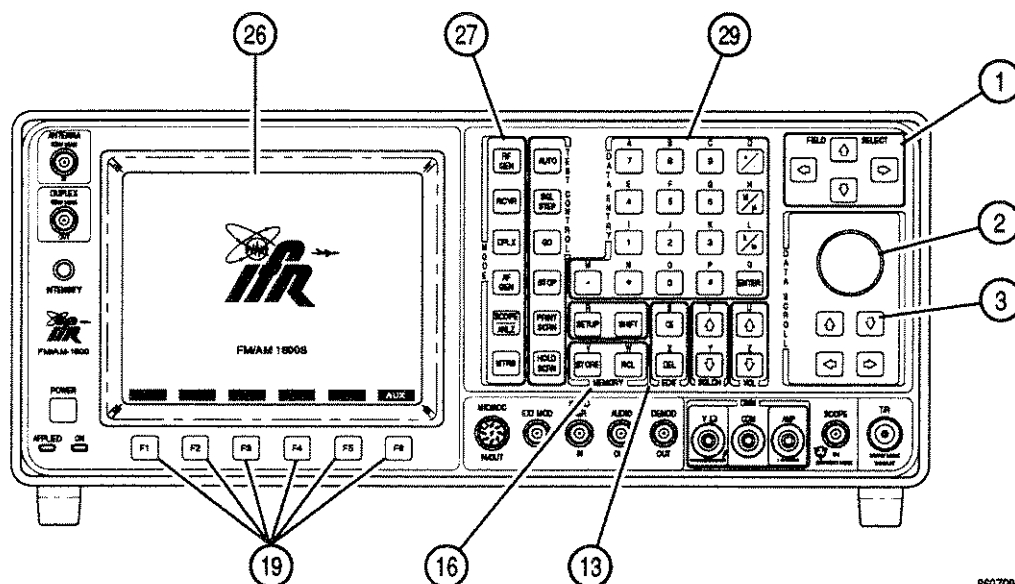
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2. Move cursor to PEAK HOLD (30) and press ENTER Key to enable or disable Peak Hold feature of Signal Strength Meter. A PH Callout (33) appears at lower left of meter window and a yellow peak indicator (35) appears on meter indicating highest point reached by Meter Indicator Bar (34).
3. Measure Signal Strength readings using Meter Indicator Bar (34) or digital readout (32).
4. To store or recall a set of SINAD Meter parameters, see 4-1-1.
5. To return to last Operation Screen, press "Ret" Soft Function Key F6.

## 4-8-9 BIT ERROR RATE (BER) METER OPERATION

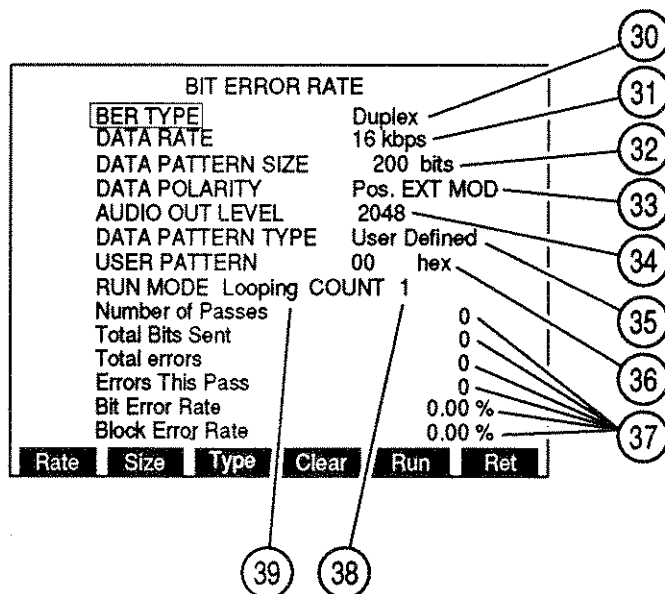
The Bit Error Rate Meter is operated using following procedures:

STEP	PROCEDURE
------	-----------



8607096

1. Press MTRS MODE Key (16). Meter Menu appears on CRT. Press "9" on DATA ENTRY Keypad (29) to access BIT ERROR RATE Meter Operation Screen.



8607076

2. Move cursor to BER TYPE (30) and press ENTER Key. BER TYPE Submenu appears. Use DATA ENTRY Keypad (29) to select a BER Type.

**NOTE:** The BER Type determines Operation Mode of BER Meter. Each BER Type has its own Setup Menu.



**NOTE:** With Receiver BER Type, specified test data is sent through AUDIO (14) Connector to be modulated by UUT. UUT Output returns to ANTENNA Connector (25) or T/R Connector (6) of Test Set and is demodulated and compared to original test data.

With Generator BER Type, modulated test data is sent through T/R Connector (6) to UUT to be demodulated. demodulated data is received by Test Set at SINAD/BER (inverted) Connector (15) or EXT MOD Connector (17) and compared with original test data.

With Baseband BER Type, test data is sent through AUDIO Connector (14) to be modulation and then demodulated by UUT. Demodulated UUT output is received by Test Set at SINAD/BER (inverted) or EXT MOD Connector and compared to original test data.

With Duplex BER Type, modulated test data is sent through T/R Connector (6) or DUPLEX Connector (24) to UUT to be demodulated and then modulated. This signal is received at ANTENNA Connector (25) or T/R Connector (6) and demodulated by Test Set and compared to original test data.

3. If Receiver is selected as BER Type, proceed with step 4. If Generator is selected as BER Type, proceed with step 10. If Baseband is selected as BER Type, proceed with step 27. If Duplex is selected as BER Type, proceed with step 17.
4. For Receiver BER Type, press SETUP Key to display BER Receiver Setup Menu.

BER METER MENU	
1. Ber Type	Receiver
2. Set Rcvr Freq	10.0000 MHz
3. Select Mod	FM
4. Select Rcvr In	Antenna
5. Select Input Atten	0 dB
6. Audio Out Level	2048
Ret ESC	

8610094

5. Press "2" DATA ENTRY Key (29)-and use DATA ENTRY Keypad (29) to enter Receiver Frequency. Press ENTER Key.

6. Press "3" DATA ENTRY Key (29) to access Modulation Menu.

### BER RECEIVER MODULATION MENU

BER METER MENU	
1. Ber Type	Receiver
2. Set Rcvr Freq	999.0000 MHz
3. Select Mod	FM DATA
4. Sel	1. Modulation
5. Sel	2. IF Filters
6. Au	3. Post Detection
	FM DATA
	30 kHz
	Low Pass

8610095

- Press "1" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select a Modulation Type.
  - Press "2" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select an IF Filter.
  - Press "3" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select a Post Detection Filter. If a data field appears, use DATA ENTRY Keypad (29) to select cutoff frequencies and press ENTER Key.
7. Press "4" DATA ENTRY Key (29) to toggle Receiver Input to either ANTENNA Connector (25) or T/R Connector (6).
8. Press "5" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select an Input Attenuation.
9. Press "Ret" Soft Function Key F5 to return to BER Operation Screen. Proceed with step 29.
10. For Generator BER Type, press SETUP Key to access Generator BER Setup Menu:

### GENERATOR BER SETUP MENU

BER METER MENU	
1. Ber Type	Generator
2. RF Gen Freq	10.0000 MHz
3. RF Gen Level	- 20.0 dBm
4. RF Gen Level Units	dBm
5. RF Gen Mod	FM
6. RF Gen Mod Level	255

Ret ESC

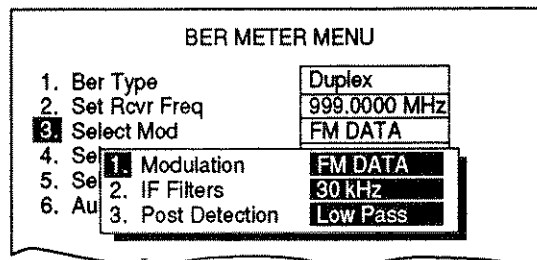
8610097

11. Press "2" DATA ENTRY Key (29). Use DATA ENTRY Keypad (29) to set RF Generator Frequency and press ENTER Key.
12. Press "3" DATA ENTRY Key (29). Use DATA ENTRY Keypad (29) to set RF Generator Level and press ENTER Key.
13. Press "4" DATA ENTRY Key (29) to toggle RF Generator Units between dBm and volts.
14. Press "5" DATA ENTRY Key (29). Use DATA ENTRY Keypad (29) to select RF Generator Modulation and press ENTER Key.
15. Press "6" DATA ENTRY Key (29). Use DATA ENTRY Keypad (29) to select RF Generator Modulation Level and press ENTER Key. Table 4-2 specifies how modulation levels correspond to this setting.

Range Limits	Modulation Type		
	AM	FM	PM
0	0%	0.0 kHz	0.0 radians
255	90%	25.0 kHz	10.0 radians

Table 4-2 Generator BER Type Modulation Levels

16. Press "Ret" Soft Function Key F5 to return to BER Meter Operation Screen. Proceed with step 29.
17. For Duplex BER Type, press Setup Key to display Duplex BER Meter Menu.
18. Press "2" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to set Receiver Frequency and press ENTER Key.
19. Press "3" DATA ENTRY Key (29) to access Modulation Submenu:



8610172

- Press "1" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select a Modulation Type.
- Press "2" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select an IF Filter Type.
- Press "3" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select a Post Detection Filter. If a data field appears, use DATA ENTRY Keypad (29) to select cutoff frequencies and press ENTER Key.

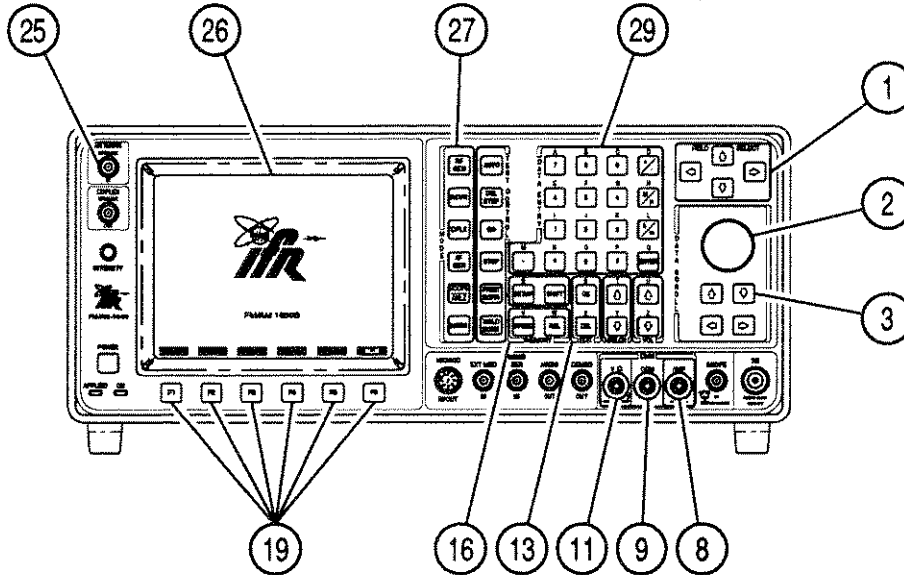
STEP	PROCEDURE
20.	Press "4" DATA ENTRY Key (29) to toggle Receiver Input to either Antenna or T/R.
21.	Press "5" DATA ENTRY Key (29) and use DATA ENTRY Keypad (29) to select an Input Attenuation.
22.	Press "6" DATA ENTRY Key (29). Use DATA ENTRY Keypad (29) to set RF Generator Frequency and press ENTER Key.
23.	Press "7" DATA ENTRY Key (29). Use DATA ENTRY Keypad (29) to set RF Generator Level and press ENTER Key.
24.	Press "8" DATA ENTRY Key (29) to toggle RF Generator Units to either dBm or volts.
25.	Press "9" DATA ENTRY Key (29). Use DATA ENTRY Keypad (29) to select RF Generator Modulation and press ENTER Key.
26.	Move cursor to "10. RF Gen Mod Level" and press ENTER Key. Use DATA ENTRY Keypad (29) to set RF Generator Modulation Level and press ENTER Key.
27.	Move cursor to "11. RF Gen Output" and press ENTER Key to toggle RF Generator Output to either Antenna or T/R.
28.	Press "Ret" Soft Function Key F5 to return to BER Meter Operation Screen.
29.	Move cursor to DATA RATE (31) and press ENTER Key. DATA RATE Submenu appears. Use DATA ENTRY Keys (29) to select a Data Rate.
<p><b>NOTE:</b> If 16 kbps is selected, it is recommended to set IF Filter to 300 kHz and Post Detection Filter to Low-Pass (15 kHz cutoff) for Receiver or Duplex Transmitter Operation.</p>	
30.	Move cursor to DATA PATTERN SIZE (32) and press ENTER Key. DATA PATTERN SIZE data field highlights. Use DATA ENTRY Keypad (29) to enter Data Pattern Size (1 through 100000) and press ENTER Key to activate Data Pattern Size.
31.	Move cursor to DATA POLARITY (30) and press ENTER Key. Use DATA SCROLL ↑ or ↓ Keys (3) to toggle polarity between "Pos. EXT MOD" and "Neg. SINAD/BER". Press ENTER Key to activate selection.
32.	If Receiver or Baseband is selected as BER Type (30), move cursor to AUDIO OUT LEVEL (34) and press ENTER Key. Use DATA ENTRY Keys (29) to set Audio Out Level and press ENTER Key.
33.	If Duplex or Generator is selected as BER Type (30), move cursor to RF GEN LEVEL and press ENTER Key. Use DATA ENTRY Keys (29) to set RF Generator Level and press ENTER Key.
34.	Move cursor to DATA PATTERN TYPE and press ENTER Key. DATA PATTERN TYPE Submenu appears. Use DATA ENTRY Keypad (29) to select a Data Pattern Type.

- 
35. If "3. User Defined" is selected as DATAPATTERN TYPE, "USER PATTERN" (28) appears:
- Move cursor to "USER PATTERN" (36) and press ENTER Key. User Pattern data field highlights.
  - Use DATA ENTRY Keypad (29) and SHIFT Key, to enter desired pattern in hex digits and press ENTER Key.
- NOTE:** If "1. Random" or "2. Fixed" is selected as User Pattern, USER PATTERN (36) and User Pattern data field does not appear.
36. Move cursor to RUN MODE (38) and press ENTER Key. RUN MODE Submenu appears. Use DATA ENTRY Keypad (29) to select a Run Mode.
- For Continuous RUN MODE, press "Run" Soft Function Key F5. Soft Function Key F5 becomes "Stop". BER Test runs continually until "Stop" Soft Function Key F5 is pressed.
  - For One Shot RUN MODE, press "Run" Soft Function Key F5 to run BER Test once. Press "Stop" Soft Function Key F5 to stop BER Test before completion.
  - For Loop RUN MODE, COUNT appears. Move cursor to COUNT and use DATA ENTRY Keypad (29) to select number of passes for BER Test. Press ENTER Key. Press "Run" Soft Function Key F5 to start BER Test. Press "Stop" Soft Function Key F5 to stop BER Test before specified passes are completed.
37. Press "Clear" Soft Function Key F4 to reset BER Meter readouts to 0.
38. The BER Meter readouts are interpreted in following manner:
- Number of Passes  
Read number of BER Test passes. One pass consists of a block containing DATAPATTERN SIZE number of bits.
  - Total Bits Sent  
Read total number of bits sent including all passes of all BER Tests.
  - Errors This Pass  
Read number of errors for last pass. One pass consists of a block containing DATAPATTERN SIZE number of bits.
  - Bit Error Rate  
Read percentage of total number of bits that are in error.
  - Block Error Rate  
Read percentage of blocks containing at least one error. A block contains DATAPATTERN SIZE number of bits.

## 4-8-10 DIGITAL MULTIMETER OPERATION

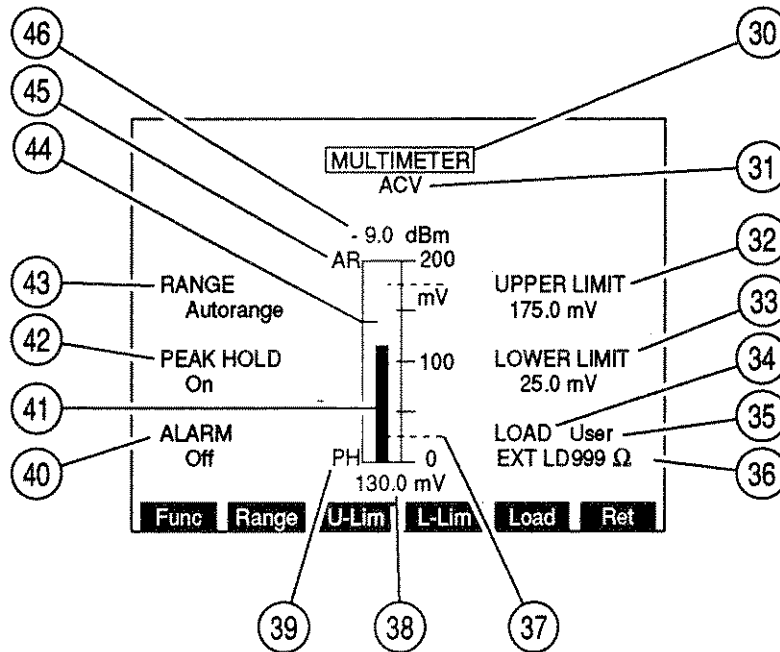
The Digital Multimeter is operated using following procedures:

STEP	PROCEDURE
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1. Press MTRS MODE Key (27). Meter Menu appears on CRT. Use FIELD SELECT  $\uparrow$  or  $\downarrow$  Keys (3) to move cursor to "10. Digital Multimeter" and press ENTER Key. Digital Multimeter Operation Screen appears on CRT.



8607077

2. Move cursor to MULTIMETER (30) and press ENTER Key to access MULTIMETER data field (31). Use DATA SCROLL  $\uparrow$  or  $\downarrow$  Keys (3) until desired Multimeter Function appears in data field and press ENTER Key.

## STEP

## PROCEDURE

3. Install DMM Probes on Front Panel using following DMM Connectors for indicated DMM Function.
  - Voltage Measurements: V $\Omega$  and COM
  - Current Measurement: AMP and COM
  - Ohmmeter: V $\Omega$  and COM

**NOTE:** For high amperage current (20 A range) measurements, install Current Shunt between DMM Probes and Test Set AMP and COM Connectors.
4. Move cursor to RANGE (43) and press ENTER Key to access its data field. Use DATA SCROLL  $\uparrow$  or  $\downarrow$  Keys (3) to select a Range and press ENTER Key.
5. Move cursor to PEAK HOLD (42) and press ENTER Key to toggle Peak Hold Feature between on or off. A PH Callout (39) appears at lower left of Meter window and a yellow peak indicator (44) appears on meter indicating highest point reached by Meter Indicator Bar (41).
6. Move cursor to ALARM (40) and press ENTER Key to enable or disable Alarm. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
7. Move cursor to UPPER LIMIT (32) and press ENTER Key to activate Upper Limit and access its data field. Use DATA ENTRY Keypad (29) to enter Upper Limit and press ENTER Key. A blue line appears across meter window marking position of Upper Limit.
8. Move cursor to LOWER LIMIT (33) and press ENTER Key to activate Lower Limit and access its data field. Use DATA ENTRY Keypad (29) to enter Lower Limit and press ENTER Key. A blue line (37) appears across meter window marking position of Lower Limit.
9. To deactivate Upper or Lower Limits, press SETUP Key to display DMM Menu. Press "4" (Upper Limit) or "6" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to DMM Operation Screen.
10. If "ACV" is selected as Multimeter Function:
  - Move cursor to LOAD (34) and press ENTER Key to access LOAD data field (35). Press DATA SCROLL  $\uparrow$  and  $\downarrow$  Keys (3) until desired load appears in data field and press ENTER Key.
  - If User is selected as Load, move cursor to EXT LD (36) and press ENTER Key. Use DATA ENTRY Keys (29) to set External Load and press ENTER Key.

**NOTE:** External Load must be installed externally by operator.
11. Connect DMM Probes to UUT test points and observe Meter Indicator Bar (41) and DMM Digital Readout (38).
12. To store or recall a set of Multimeter parameters, see 4-1-1.

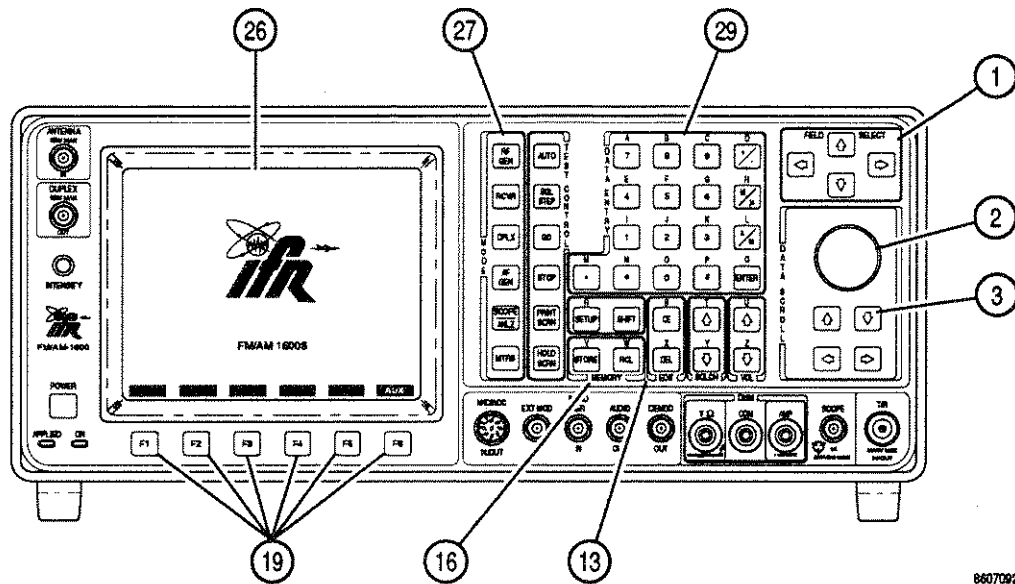
## 4-8-11 PHASE METER OPERATION

Received or generated Phase Modulation signals are measured using following procedures:

**NOTE:** The Phase Meter is accessed from Receive Operation Screen, Duplex Operation Screen, Duplex Transmitter Operation Screen or Meter Menu. meter reflects readings of last Operation Mode of Test Set.

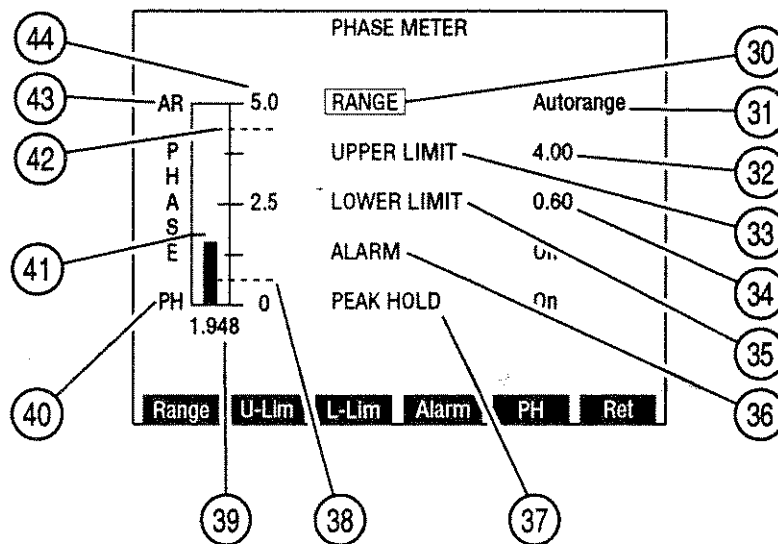
The Receiver or Generator Modulation must be set to PM for measurements by the Phase Meter.

STEP	PROCEDURE
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8607092

1. Press MTRRS (27) MODE Key. Meter Menu appears on CRT. Use FIELD SELECT ↑ or ↓ Keys (3) to move cursor to "11. Phase Meter" and press ENTER Key. Phase Meter Operation Screen appears on CRT.



8607083



**STEP****PROCEDURE**

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2. Move cursor to RANGE (30) and press ENTER Key to access its data field (31). Press DATA SCROLL ↑ or ↓ Keys (3) to select desired Range and press ENTER Key.
3. Move cursor to UPPER LIMIT (33) and press ENTER Key to activate Upper Limit and access its data field. Use DATA ENTRY Keypad (29) to enter desired Upper Limit and press ENTER Key. A blue line (42) appears across meter window marking position of Upper Limit.
4. Move cursor to LOWER LIMIT (35) and press ENTER Key to activate Lower Limit and access its data field. Use DATA ENTRY Keypad (29) to enter desired Lower Limit and press ENTER Key. A blue line (38) appears across meter window marking position of Lower Limit.
5. To deactivate Upper or Lower Limit, press SETUP Key to display Phase Meter Menu. Press "3" (Upper Limit) or "5" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to Phase Meter Operation Screen.
6. Move cursor to ALARM (36) and press ENTER Key to enable or disable Alarm. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
7. Move cursor to PEAK HOLD (37) and press ENTER Key to enable or disable Peak Hold feature of Phase Meter. A PH Callout (40) appears at lower left of meter window and a yellow peak indicator (41) appears on meter indicating highest point reached by Meter Indicator Bar.
8. Measure Phase Modulation using Meter Indicator Bar or digital readout (39).
9. To store or recall a set of Phase Meter parameters, see 4-1-1.
10. To return to last Operation Screen, press "Ret" Soft Function Key F6.

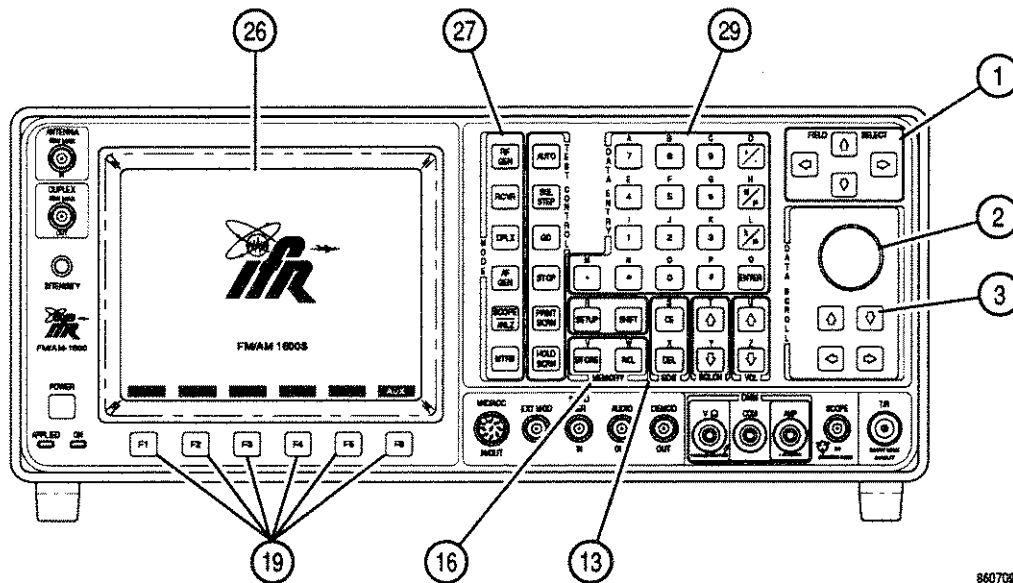
## 4-8-12 DEVIATION METER (RMS) OPERATION

RMS Deviation of received or generated FM signals is measured using following procedures:

**NOTE:** The FM Deviation (RMS) Meter is accessed from Receive Operation Screen, Duplex Operation Screen, Duplex Transmitter Operation Screen or Meter Menu. meter reflects readings of last Operation Mode of Test Set.

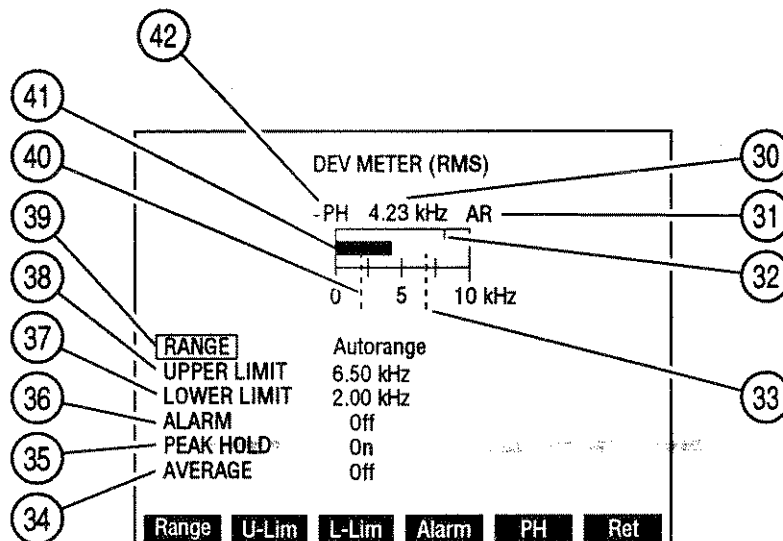
Receiver or RF Gen Modulation must be FM for Deviation (RMS) Meter measurements.

STEP	PROCEDURE
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8607092

1. Press MTRRS (27) MODE Key. Meter Menu appears on CRT. Use FIELD SELECT  $\uparrow$  or  $\downarrow$  Keys (3) to move cursor to "11. Phase Meter" and press ENTER Key. Phase Meter Operation Screen appears on CRT.



8607122

**STEP****PROCEDURE**

---

2. Move cursor to RANGE (39) and press ENTER Key to access its data field. Rotate DATA SCROLL Spinner (2) or press DATA SCROLL ↑ or ↓ Keys (3) to select desired Range and press ENTER Key.
3. Move cursor to UPPER LIMIT (38) and press ENTER Key to activate Upper Limit and access its data field. Use DATA ENTRY Keypad (29) to enter desired Upper Limit and press ENTER Key. A blue line (33) appears across meter window marking position of Upper Limit.
4. Move cursor to LOWER LIMIT (37) and press ENTER Key to activate Lower Limit and access its data field. Use DATA ENTRY Keypad (29) to enter desired Lower Limit and press ENTER Key. A blue line (40) appears across meter window marking position of Lower Limit.
5. To deactivate Upper or Lower Limits, press SETUP Key to display Deviation (RMS) Meter Menu. Press "3" (Upper Limit) or "5" (Lower Limit) DATA ENTRY Key (29) to toggle Limit off. Press "Ret" Soft Function Key F5 to return to Deviation (RMS) Meter Operation Screen.
6. Move cursor to ALARM (36) and press ENTER Key to enable or disable Alarm. Enabled Alarm sounds when Upper or Lower Limit is exceeded.
7. Move cursor to PEAK HOLD (35) and press ENTER Key to enable or disable Peak Hold feature of Deviation (RMS) Meter. A PH Callout (42) appears at lower left of meter window and a yellow peak indicator (32) appears on meter indicating highest point reached by Meter Indicator Bar (41).
8. Move cursor to AVERAGE (34) and press ENTER Key to enable or disable Deviation (RMS) Meter Averaging. With Averaging enabled, a running average of last 10 readings are reported.
9. Measure FM Deviation using Meter Indicator Bar (41) or digital readings (30).
10. To store or recall a set of Deviation (RMS) Meter parameters, see 4-1-1.
11. To return to last Operation Screen, press "Ret" Soft Function Key F6.



# SECTION 5 - PERFORMANCE EVALUATION

## 5-1 GENERAL

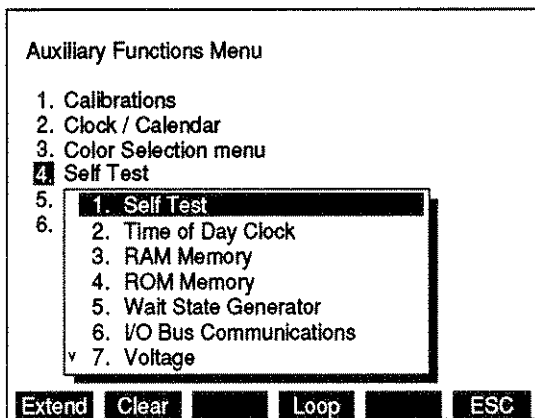
This section contains information on test procedures for assessing the performance of the FM/AM-1600S. All tests conducted are self-tests performed by the unit. No additional equipment is needed to conduct these tests. For maximum benefit, the operator should be thoroughly familiar with all aspects of this manual before performing these procedures.

## 5-2 POWER-UP SELF-TEST

When power is switched on to the FM/AM-1600S, the unit performs a Power-up Self-test. A 1-2-4 beep series sounds if unit is functioning normally and the IFR Logo Screen is displayed. An abnormality causes a break in this sequence or an error message to be displayed on the screen. If an error message occurs, switch power off, wait thirty seconds and power unit on again. If error reoccurs, refer unit to maintenance for corrective action.

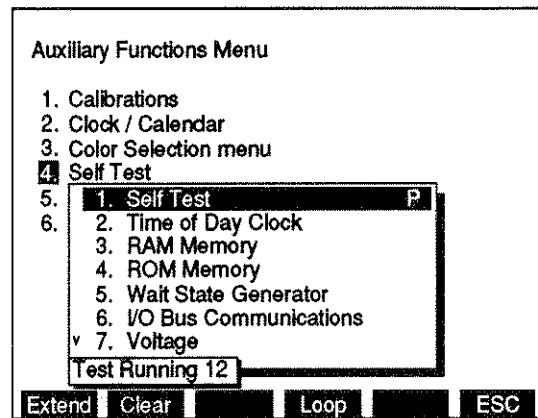
## 5-3 SELF TEST

A more thorough check of the FM/AM-1600S is provided by a user-requested Self Test. This Self Test is accessible from the Auxiliary Functions Menu. Refer to 3-3-10 for more information on the Auxiliary Functions Menu. From the Auxiliary Functions Menu, select "4. Self Test." This selection displays the Self Test Menu in Figure 5-1.



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Figure 5-1 Self Test Menu



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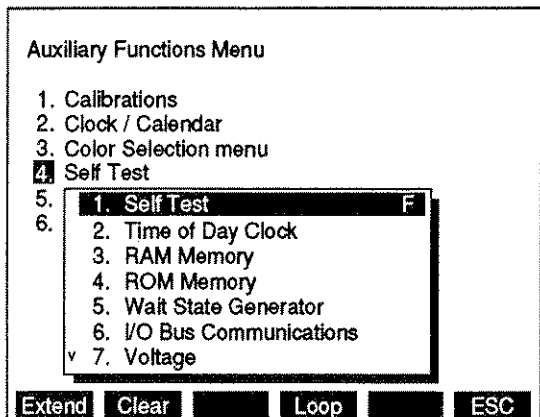
Figure 5-2 Test Running Counter

The Self Test Menu is composed of 22 individual tests and the Self Test. Seven of these items are visible at one time. Access to other parts of the Self Test Menu is available by using the DATA SCROLL Keys (1)(Fig 3-1). The DATA SCROLL UP and DOWN Keys (3)(Fig 3-1) scroll the menu up and down one item at a time. The DATA SCROLL LEFT ARROW Key functions as a page-up key and the DATA SCROLL RIGHT ARROW Key functions as a page-down key.

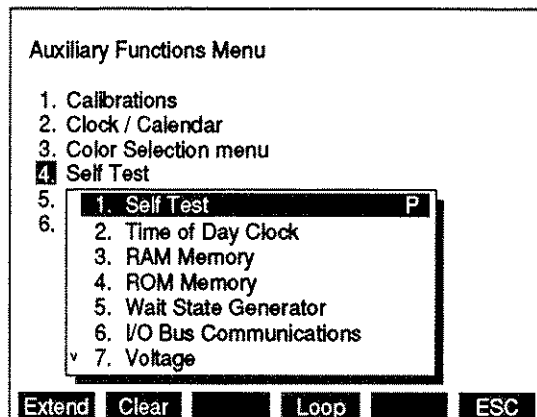
To initiate Self Test, insure cursor is on "1. Self Test" and press ENTER Key. A "Test Running" prompt appears with current test number displayed as shown in Figure 5-2.

The Self Test performs all tests and returns a result of "P" for pass or "F" for fail as shown in Figures 5-3 and 5-4. A Self Test failure occurs with even one individual test failure. If Self Test fails, examine the entire menu to determine specific test failures. An "F" prompt is visible to the right of a test which has failed as shown in Figure 5-5. Specific tests that pass do not have a "P" prompt.

**NOTE:** Failure of a specific test may lead to failure in other specific tests although those modules being tested may be operating properly.



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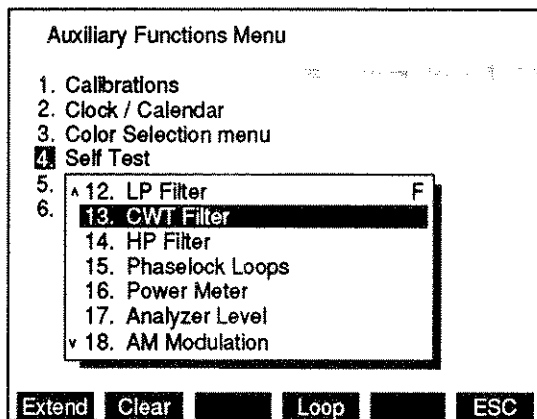


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Figure 5-3 Self Test Failure

Figure 5-4 Self Test Pass

An individual test can be activated by moving cursor to desired test and pressing the ENTER Key. The result of an individual test is returned as "P" for pass or "F" for fail.

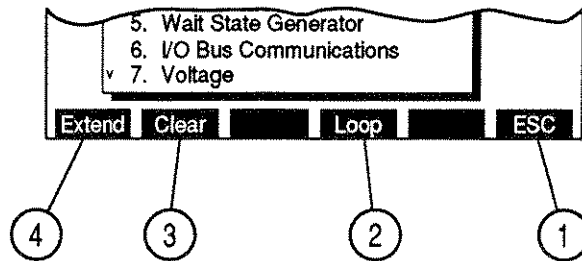


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Figure 5-5 Individual Test Failure

Various Soft Function Keys are defined for use with the Self Test. These Soft Function Keys are displayed and defined as follows:

ITEM	DESCRIPTION
------	-------------



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1. "ESC" Soft Function Key

Exits user from current submenu level to next higher menu.

2. "Loop" Soft Function Key

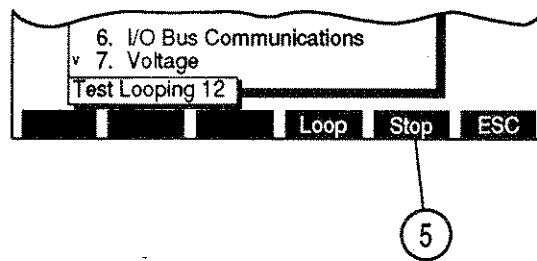
Selection activates currently designated test. Test repeats until failure or until "Stop" Soft Function Key (5) is selected. Can be used with Self Test or any individual test.

3. "Clear" Soft Function Key

Erases all test results displayed.

4. "Extend" Soft Function Key

Used on individual tests. If test is composed of multiple tests, Extend allows each subtest to be performed and result obtained separately. On some tests, use of "Extend" displays numeric measurement associated with test. On tests where neither of the above apply, selection activates the test and returns "Pass" or "Fail" as a result.



8610067

5. "STOP" Soft Function Key

Selection discontinues "Loop" function. Posts "P" or "F" appropriately.





# SECTION 6 - REMOTE OPERATION

## 6-1 GENERAL

The FM/AM-1600S is designed to operate remotely through an external controller. All data available through Front Panel Operation is available through the External Controller. The External Controller can generate any command available except CRT Intensity Control and Power On.

Remote Operation can be performed using the RS-232 Connector or the GPIB Connector. Refer to Appendix A for pin-out information. Location of both connectors is shown in Figure 3-2.

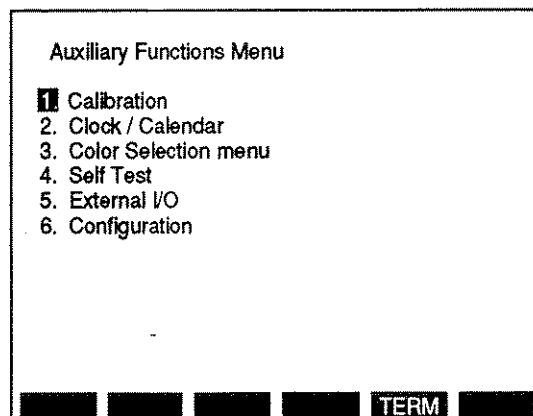
It is important that the operator be familiar with this manual and the Front Panel Operation of the FM/AM-1600S before initiating Remote Operations. Refer to Section 3, as needed, for information regarding Controls, Connectors, Indicators, Operation Screens and Menus. The operator must take care in programming the FM/AM-1600S remotely. An illegal command, normally ignored by the Front Panel, might be executed remotely.

## 6-2 OPERATING PROCEDURES

Perform the following steps for Remote Operation of the FM/AM-1600S:

STEP	PROCEDURE
1.	Connect the external control device to the FM/AM-1600S. Connection is between like connector types; either RS-232 or GPIB.
2.	Perform Power Up procedure as described in Section 2-3.
3.	Press MTRS MODE Key and press "AUX" Soft Function Key F6. The Auxiliary Functions Menu appears on the CRT:

### AUXILIARY FUNCTIONS MENU



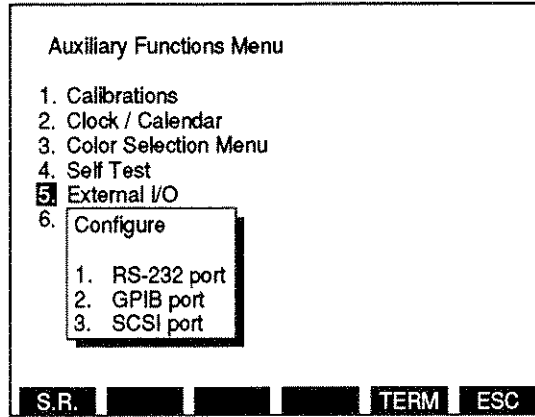
8610021

STEP

PROCEDURE

4. Press "5" DATA ENTRY Key to display the External I/O Menu on the CRT:

AUXILIARY FUNCTIONS  
EXTERNAL I/O MENU



8610078

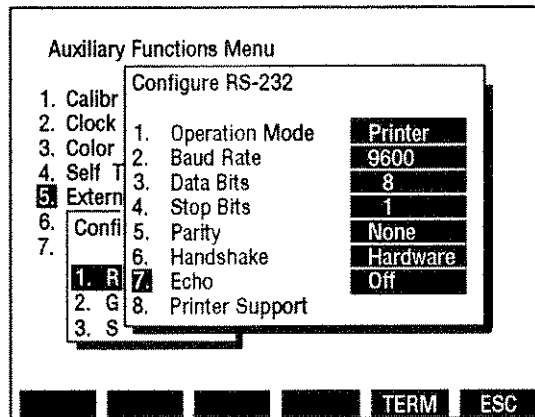
5. To configure the RS-232 Connector:

STEP

PROCEDURE

1. Press "1" DATA ENTRY Key to display the Configure RS-232 Menu:

AUXILIARY FUNCTIONS RS-232 SUBMENU



8610026

2. Press "1" DATA ENTRY Key. Use DATA ENTRY Keypad to select "2. Host" for talker/listener operation or "3. Printer" to print using the RS-232 Connector.
3. Press "2" DATA ENTRY Key. Use DATA ENTRY Keypad to select a Baud Rate in bps.

300  
2400  
19200

600  
4800

1200  
9600

4. Press "3" DATA ENTRY Key to toggle the number of Data Bits between 7 and 8.

5. Press "4" DATA ENTRY Key to toggle the number of Stop Bits between 1 and 2.
6. Press "5" DATA ENTRY Key. Use DATA ENTRY Keypad to select Parity. Select None, Odd, Even, Mark or Space.
7. Press "6" DATA ENTRY Key. Use DATA ENTRY Keypad to select type of Handshaking. Select None, Hardware or Xon/Xoff.
8. Press "7" DATA ENTRY Key to toggle Echo on or off.
9. Press "8" DATA ENTRY Key to display the Printer Support Menu:

### PRINTER SUPPORT MENU

Auxiliary Functions Menu	
1. Calibr	Configure RS-232
2. Clock	1. Operation Mode <b>Printer</b>
3. Color	2. Baud Rate <b>9600</b>
1. Printer	<b>IBM Graphics</b>
2. Mode	<b>Landscape</b>
3. Pattern	<b>Shading</b>
4. Title	<b>TEST PRINTER</b>
7. Echo	<b>Off</b>
2. GP	8. Printer Support
3. SCSI port	

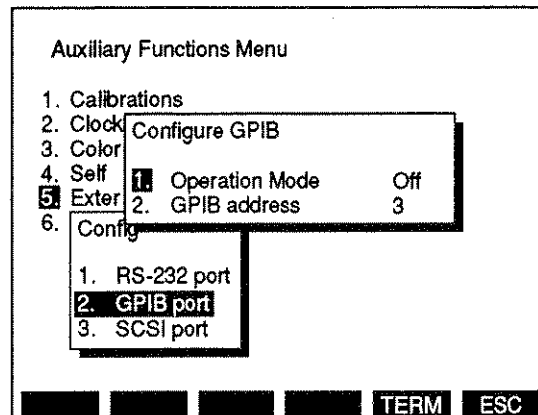
TERM ESC

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- Press "1" DATA ENTRY Key. Use FIELD SELECT Keys to select a printer. Select Epson EX/FX/RX, HP LaserJet II or IBM Graphics and press ENTER.
- Press "2" DATA ENTRY Key to toggle printer mode between Landscape and Portrait.
- Press "3" DATA ENTRY Key to toggle printer pattern between Black and White and Shading.
- Press "4" DATA ENTRY Key to enter a title. Use DATA ENTRY Keypad to enter a title up to 14 characters and press ENTER.

6. To configure the GPIB Connector:

1. Press "2" DATA ENTRY Key to display the Configure GPIB Menu.



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2. Press "1" DATA ENTRY Key. Use DATA ENTRY Keypad to select "2. Host" for talker/listener operation or "3. Talk Only" for talk only operation such as printing.
3. Press "2" DATA ENTRY Key and use the DATA ENTRY Keypad to enter an address used for the Test Set. Range is from 0 to 31.

### 6-3 TMAC (TEST MACRO LANGUAGE)

TMAC is used to remotely operate the FM/AM-1600S and provide a format to store and perform user defined test sequences. TMAC is based on the IEEE-488.2 format and also conforms to the SCPI Standard.

One of TMAC's main strengths is the capability to define macros. This allows step by step test procedures to be developed, stored and remotely implemented. Flow control commands allow decision making and looping within the macro. TMAC also provides a variety of data structures to assist in developing test procedures. Developing macros is made easier by allowing a macro to execute by entering the macro name and its parameters. Macros can be executed from other macros with parameters being passed from one macro to the other, allowing complicated procedures to be divided into smaller tasks. Multitasking commands allow several macros to alternate command execution, giving the appearance of being executed simultaneously.

A full explanation of the TMAC Language is beyond the scope of this manual. Table 6-3 lists the specific instrument commands. For a complete explanation of the TMAC Language including the use of macros, variables, data structures, flow control commands, and multitasking commands, see the FM/AM-1600S TMAC User Manual.

### 6-4 COMMAND SYNTAX

TMAC structures commands hierarchically through the use of the colon (:) delimiter. This concept allows the command paths to be formulated using common key sequences (e.g., To set either of the generator frequencies, :GEN:FREQ 1000 or :RX:FREQ 1000 are employed). Both the generator family of commands and receiver family of commands have common key words.

To allow access to the command paths, the FM/AM-1600S interpreter keeps track of the current path or command level where it expects to find the next command. The current path is determined by using a set of rules. On power-up or after a \*RST command, the unit sets the current path to the root command node. This is the highest level of the command tree structure. Also, the end of a message or command line resets the current path to the root node.

When a colon is used as the delimiter between commands, the current path is moved down one level in the command structure (e.g., The colon in GEN:FREQ specifies that FREQ is one level down from GEN). When a colon is used as the first character of a command, it specifies that the command is to be found at the root node. A semicolon is used to separate multiple commands in the same message line. A semicolon does not change the current path.

For example:

```
:FGEN:DATA:STAT ON;BILVL;DEV 5600;ATT 0;RATE 1600;FLT:OUT
```

is equivalent to:

```
:FGEN:DATA:STAT ON
:FGEN:DATA:BILVL
:FGEN:DATA:DEV 5600
:FGEN:DATA:ATT 0
:FGEN:DATA:RATE 1600
:FGEN:DATA:FLT:OUT
```

Commands with multiple parameter fields separate the parameters with a comma (,). An example of a multiple parameter command would be: :SCOP:TRACE:GET? 9,200. At least one space is needed between commands and parameters, other spaces or lack of them do not affect the command. This command is also an example of a query command, where the operator is requesting data from the FM/AM-1600S. Query commands contain a question mark (?) at the end of the command and before any parameters.

Commands are entered using a short or a long form. The short form is shown in upper case, the remainder of the long form is shown in lower case.

Various Command Syntax punctuation marks are shown in Table 6-1.

Punctuation Mark	Name	Description
;	Message Separator	Used to separate commands on same line.
:	Compound Command Separator	Allows hierarchy of command structure.
,	Parameter Separator	Separates parameters in multiple parameter command line.
?	Query Command Ending	Requests return of data.
\	End of Line Continuation	Allows command to continue on next line. Command words cannot be broken.

Table 6-1 Command Syntax Punctuation Marks

## 6-6 MANDATORY GPIB COMMANDS

In compliance with IEEE 488.2 1987, Table 6-2 lists reserved commands for remote operations. When these commands are used, they must include the leading asterisk (\*).

Mnemonic	Command
*CLS	Clear Status Command
*ESE	Standard Event Status Enable
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*IDN?	Identification Query
*OPC	Operation Complete Command
*OPC?	Operation Complete Query
*RST	Restart Command
*SRE	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query
*TST?	Self Test Query
*WAI	Wait-to-continue
*DMC	Define Macro Command
*EMC	Enable Macro Command
*EMC?	Enable Macro Query
*LMC?	Learn Macro Query
*RCL	Recall Command
*SAV	Save Command

Table 6-2 Mandatory GPIB Commands

## 6-7 FM/AM-1600S SPECIFIC COMMANDS

Table 6-3 lists specific instrument commands for the FM/AM-1600S. These commands are broken out by operation type such as Deviation Meter or Oscilloscope commands. These commands are complete commands except where the user must determine a parameter. This field is shown in the command line as x. All possible values or value ranges are listed for commands requiring parameters. For simplicity, boolean values are limited to 0 and 1 in this manual.

COMMAND	RANGE/VALUE	DESCRIPTION
<b>AUDIO FREQUENCY METER COMMANDS</b>		
:M_AF:RANGe:UPPer x	.2, 2, 20, 200	Sets Frequency Range of Audio Frequency Meter in kHz.
:M_AF:RANGe:AUTO		Enables Autorange of Audio Frequency Meter.
:M_AF:UL:STATe x	0 = off, 1 = on	Toggles Upper Limit of Audio Frequency Meter on or off.
:M_AF:UL:LEVel x	0.0000 to 200.0000	Sets Upper Limit Level of Audio Frequency Meter in kHz.
:M_AF:LL:STATe x	0 = off, 1 = on	Toggles Lower Limit of Audio Frequency Meter on or off.
:M_AF:LL:LEVel x	0.0000 to 200.0000	Sets Lower Limit Level of Audio Frequency Meter in kHz.
:M_AF:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of Audio Frequency Meter.
:M_AF:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Audio Frequency Meter.
:M_AF:RESolution x	1/0.1 Hz	Sets Audio Frequency Meter resolution.
:M_AF:STORe x	1 to 9	Stores parameters of Audio Frequency Meter at indicated Store Parameters Menu location.
:M_AF:RCL x	1 to 9	Recalls parameters of Audio Frequency Meter from indicated Recall Parameters Menu location.
:M_AF:INPut:XAUDio		Selects External Audio Input for Audio Frequency Meter.
:M_AF:INPut:DEMOD		Selects Demod Audio Input for Audio Frequency Meter.

Table 6-3 FM/AM-1600S Specific Commands

COMMAND	RANGE/VALUE	DESCRIPTION
:M_AF:INPut:FGEN		Selects Function Generator Input for Audio Frequency Meter.
:M_AF:INPut:SINAD		Selects SINAD Input for Audio Frequency Meter.
:M_AF:INPut:BER		Selects BER Input for Audio Frequency Meter.
:M_AF:INPut:POWer		Selects RF Power Input for Audio Frequency Meter.
:M_AF:FILTer:LPASs:STATe x		Enables/Disables low-pass filter.
:M_AF:FILTer:LPASs:STATe?		Query low-pass filter state.
:M_AF:FILTer:LPASs:FREQuency x	0.1 to 30.0 kHz.	Set low-pass filter freq.
:M_AF:FILTer:LPASs:FREQuency?		Query low-pass filter freq.
:M_AF:FILTer:HPASs:STATe x		Enable/Disable high-pass filter.
:M_AF:FILTer:HPASs:STATe?		Query high-pass filter state.
:M_AF:FILTer:HPASs:FREQuency x	0.5 to 20.0 kHz.	Set high-pass filter freq.
:M_AF:FILTer:HPASs:FREQuency?		Query high-pass filter freq.
:M_AF?		Returns Audio Frequency Meter reading in Hz.
:M_AF:PEAK?		Returns Audio Frequency Meter Peak reading in Hz.
<b>RADIO FREQUENCY ERROR METER COMMANDS</b>		
:M_RF:RANGe:UPPer x	0.1, 1, 10, 100	Sets Frequency Range of Radio Frequency Error Meter in kHz.
:M_RF:RANGe:AUTO		Enables Autorange of Radio Frequency Error Meter.
:M_RF:UL:STATe x	0 = off, 1 = on	Toggles Upper Limit of Radio Frequency Error Meter on or off.

Table 6-3 FM/AM-1600S Specific Commands (cont)



COMMAND	RANGE/VALUE	DESCRIPTION
:M_RF:UL:LEVel x	0.0000 to 100.0000	Sets Upper Limit Level of Radio Frequency Error Meter in kHz.
:M_RF:LL:STATe x	0 = off, 1 = on	Toggles Lower Limit of Radio Frequency Error Meter on or off.
:M_RF:LL:LEVel x	0.0000 to 100.0000	Sets Lower Limit Level of Radio Frequency Error Meter in kHz.
:M_RF:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of Radio Frequency Error Meter.
:M_RF:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Radio Frequency Error Meter.
:M_RF:RESolution x	1, 10	Sets Radio Frequency Error Meter resolution in Hz.
:M_RF:STORe x	1 to 9	Stores parameters of Radio Frequency Error Meter at indicated Store Parameters Menu location.
:M_RF:RCL x	1 to 9	Recalls parameters of Radio Frequency Error Meter from indicated Recall Parameters Menu location.
:M_RF?		Requests return of Radio Frequency Error Meter reading in Hz.
:M_RF:PEAK?		Requests return of Radio Frequency Error Meter Peak reading in Hz.
<b>POWER METER COMMANDS</b>		
:M_PWR:RANGe:UPPer x	.02, .05, .10, .2, .5, 1, 2, 5, 10, 20, 50, 100, 200	Sets Range Value of Power Meter in Watts.
:M_PWR:RANGe:AUTO		Enables Autorange of Power Meter.
:M_PWR:UL:STATe x	0 = off, 1 = on	Toggles Upper Limit of Power Meter on or off.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:M_PWR:UL:LEVel x	0.0000 to 200.0000	Sets Upper Limit Level of Power Meter in Watts.
:M_PWR:LL:STATe x	0 = off, 1 = on	Toggles Lower Limit of Power Meter on or off.
:M_PWR:LL:LEVel x	0.0000 to 200.0000	Sets Lower Limit Level of Power Meter in Watts.
:M_PWR:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of Power Error Meter.
:M_PWR:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Power Meter.
:M_PWR:STORE x	1 to 9	Stores parameters of Power Meter at indicated Store Parameters Menu location.
:M_PWR:RCL x	1 to 9	Recalls parameters of Power Meter from indicated Recall Parameters Menu location.
:M_PWR:TYPE:CWeight		Measure average power.
:M_PWR?		Requests return of Power Meter reading in mW.
x=M_PWR?		Query power meter for value.
:M_PWR:PEAK?		Requests return of Power Meter Peak reading in mW.
<b>DEVIATION METER COMMANDS</b>		
:M_DEV:RANGe:UPPer x	2, 5, 10, 20, 50, 100	Sets Range Value of Deviation Meter in kHz.
:M_DEV:RANGe:AUTO		Enables Autorange of Deviation Meter.
:M_DEV:UL:STATe x	0 = off, 1 = on	Toggles Upper Limit of Deviation Meter on or off.
:M_DEV:UL:LEVel x	0.00 to 100.00	Sets Upper Limit Level of Deviation Meter in kHz with .05 kHz resolution.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:M_DEV:LL:STATe x	0 = off, 1 = on	Toggles Lower Limit of Deviation Meter on or off.
:M_DEV:LL:LEVel x	0.00 to 100.00	Sets Lower Limit Level of Deviation Meter in kHz in .05 kHz resolution.
:M_DEV:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of Deviation Meter.
:M_DEV:AVERage x	0 = off, 1 = on	Enables/Disables Averaging of Deviation-RMS Meter.
:M_DEV:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Deviation Meter.
:M_DEV:STORe x	1 to 9	Stores parameters of Deviation Meter at indicated Store Parameters Menu location.
:M_DEV:RCL x	1 to 9	Recalls parameters of Deviation Meter from indicated Recall Parameters Menu location.
:M_DEV:POS?		Returns positive Deviation Meter reading in kHz.
:M_DEV:NEG?		Returns negative Deviation Meter reading in kHz.
:M_DEV:PEAK:POS?		Returns Positive Deviation Peak reading in kHz.
:M_DEV:PEAK:NEG?		Returns Negative Deviation Peak reading in kHz.
:M_DEV:MODE:BOTH		Read positive and negative deviation.
:M_DEV:MODE:POSitive		Read positive deviation only.
:M_DEV:MODE:NEGative		Read negative deviation only.
:M_DEV:MODE:NORMAlize		Read (pos+neg)/2 deviation.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
<b>MODULATION METER COMMANDS</b>		
:M_MOD:RANGe:UPPer x	40, 100	Sets Range Value of Modulation Meter in %.
:M_MOD:RANGe:AUTO		Enables Autorange of Modulation Meter.
:M_MOD:UL:STATe x	0 = off, 1 = on	Toggles Upper Limit of Modulation Meter on or off.
:M_MOD:UL:LEVel x	0.0 to 100.0	Sets Upper Limit Level of Modulation Meter in %.
:M_MOD:LL:STATe x	0 = off, 1 = on	Toggles Lower Limit of Modulation Meter on or off.
:M_MOD:LL:LEVel x	0.0 to 100.0	Sets Lower Limit Level of Modulation Meter in %.
:M_MOD:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of Modulation Meter.
:M_MOD:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Modulation Meter.
:M_MOD:STORe x	1 to 9	Stores parameters of Modulation Meter at indicated Store Parameters Menu location.
:M_MOD:RCL x	1 to 9	Recalls parameters of Modulation Meter from indicated Recall Parameters Menu location.
:M_MOD?		Requests return of Modulation Meter reading in %.
:M_MOD:PEAK?		Requests return of Modulation Meter Peak reading in %.
<b>DISTORTION METER COMMANDS</b>		
:M_DISTortion:SELEct:LPASs x	100 to 30000	Selects low-pass filter with cutoff frequency of x Hz.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:M_DISTortion:SElect:CWeight		Selects C-weight filter.
:M_DISTortion:FILTer x	600 to 1400	Sets Notch Filter Frequency of Distortion Meter in Hz.
:M_DISTortion:UL:STATe x	0 = off, 1 = on	Toggles Upper Limit of Distortion Meter on or off.
:M_DISTortion:UL:LEVel x	0.0 to 20.0	Sets Upper Limit Level of Distortion Meter in %.
:M_DISTortion:LL:STATe x	0 = off, 1 = on	Toggles Lower Limit of Distortion Meter on or off.
:M_DISTortion:LL:LEVel x	0.0 to 20.0	Sets Lower Limit Level of Distortion Meter in %.
:M_DISTortion:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of Distortion Meter.
:M_DISTortion:AVErage		Enables Distortion averaging.
:M_DISTortion:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Distortion Meter.
:M_DISTortion:STORe x	1 to 9	Stores parameters of Distortion Meter at indicated Store Parameters Menu location.
:M_DISTortion:RCL x	1 to 9	Recalls parameters of Distortion Meter from indicated Recall Parameters Menu location.
:M_DISTortion:INPut:DEMOD		Selects Demod Audio Input for Distortion Meter.
:M_DISTortion:INPut:SINAD		Selects SINAD Input for Distortion Meter.
:M_DISTortion:INPut:BER		Selects BER Input for Distortion Meter.
:M_DISTortion:INPut:XAUDio		Selects External Audio Input for Distortion Meter.
:M_DISTortion?		Returns Distortion Meter reading in %.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
x=M_DISTortion?		Query for value.
:M_DISTortion:PEAK?		Returns Distortion Meter Peak reading in %.
<b>SINAD METER COMMANDS</b>		
:M_SINAD:SElect:LPASs x	100 to 30000	Selects low-pass filter with cutoff frequency of x Hz.
:M_SINAD:SElect:CWeight		Selects C-Weight filter.
:M_SINAD:FILTer x	770, 1000	Sets Notch Filter Frequency of SINAD Meter in Hz.
:M_SINAD:UL:STATe x	0 = off, 1 = on	Toggles Upper Limit of SINAD Meter on or off.
:M_SINAD:UL:LEVel x	3.0 to 30.0	Sets Upper Limit Level of SINAD Meter in dB.
:M_SINAD:LL:STATe x	0 = off, 1 = on	Toggles Lower Limit of SINAD Meter on or off.
:M_SINAD:LL:LEVel x	3.0 to 30.0	Sets Lower Limit Level of SINAD Meter in dB.
:M_SINAD:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of SINAD Meter.
:M_SINAD:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of SINAD Meter.
:M_SINAD:STORe x	1 to 9	Stores parameters of SINAD Meter at indicated Store Parameters Menu location.
:M_SINAD:RCL x	1 to 9	Recalls parameters of SINAD Meter from indicated Recall Parameters Menu location.
:M_SINAD:INPut:DEMOD		Selects Demod Audio Input for SINAD Meter.
:M_SINAD:INPut:SINAD		Selects SINAD Input for SINAD Meter.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:M_SINAD:INPut:BER		Selects BER Input for SINAD Meter.
:M_SINAD:INPut:XAUDiO		Selects External Audio Input for SINAD Meter.
:M_SINAD?		Returns SINAD Meter reading in dB.
x=M_SINAD?		Query for value.
:M_SINAD:PEAK?		Returns SINAD Meter Peak reading in dB.
<b>SIGNAL STRENGTH METER COMMANDS</b>		
:M_SIG:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Signal Strength Meter.
:M_SIG:STORe x	1 to 9	Stores parameters of Signal Strength Meter at indicated Store Parameters Menu location.
:M_SIG:RCL x	1 to 9	Recalls parameters of Signal Strength Meter from indicated Recall Parameters Menu location.
:M_SIG?		Returns Signal Strength Meter reading.
:M_SIG:PEAK?		Returns Signal Strength Meter Peak reading.
x=M_SIG?		Query for value.
<b>VOLTAGE RMS METER</b>		
:M_VRMS?		Returns voltage RMS reading.
<b>BIT ERROR RATE (BER) METER COMMANDS</b>		
:M_BER:TYPE:GENerator		Sets Bit Error Rate Meter Type to Generator.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:M_BER:TYPE:RECEive		Sets Bit Error Rate Meter Type to Receiver.
:M_BER:TYPE:DUPlEx		Sets Bit Error Rate Meter Type to Duplex.
:M_BER:TYPE:BASEband		Sets Bit Error Rate Meter Type to Baseband.
:M_BER:SIZE x	100 to 100000	Sets Bit Error Rate Meter Block Size in bits.
:M_BER:SIZE?	100 to 100000	Returns Bit Error Rate Meter Block Size setting in bits.
:M_BER:PATtern:RANDom		Sets Bit Error Rate Meter Data Pattern to "Random."
:M_BER:PATtern:FIXED		Sets Bit Error Rate Meter Data Pattern to "Fixed."
:M_BER:PATtern:USER x	8 Bit Pattern	Sets Bit Error Rate Meter Data Pattern to "User Defined" (8-bit pattern).
:M_BER:RATE x	75, 150, 300, 600, 1200, 2400, 4800, 16000	Sets Bit Error Rate Meter bit rate in bps.
:M_BER:RATE?	75, 150, 300, 600, 1200, 2400, 4800, 16000	Returns Bit Error Rate Meter rate setting in bps.
:M_BER:POLarity:POSitive		Sets Bit Error Rate Meter data polarity to "Pos. EXT AUDIO" setting.
:M_BER:POLarity:NEGative		Sets Bit Error Rate Meter data polarity to "Neg. SINAD/BER" setting.
:M_BER:STORE x	1 to 9	Stores parameters of Bit Error Rate Meter at indicated Store Parameters Menu location.
:M_BER:RCL x	1 to 9	Recalls parameters of Bit Error Rate Meter from indicated Recall Parameters Menu location.
:M_BER?		Returns Bit Error Rate Meter reading in %.

Table 6-3 FM/AM-1600S Specific Commands (cont)



COMMAND	RANGE/VALUE	DESCRIPTION
x=M_BER?		Query for value.
<b>DIGITAL MULTIMETER COMMANDS</b>		
:M_DMM:FUNCTION:VOLTage:DC		Sets Digital Multimeter Function for DC Voltage measurement.
:M_DMM:FUNCTION:VOLTage:AC		Sets Digital Multimeter Function for AC Voltage measurement.
:M_DMM:FUNCTION:CURRENT:DC		Sets Digital Multimeter Function for DC Current measurement.
:M_DMM:FUNCTION:CURRENT:AC		Sets Digital Multimeter Function for AC Current measurement.
:M_DMM:FUNCTION:RESistance		Sets Digital Multimeter Function for Resistance (ohm) measurement.
:M_DMM:FUNCTION?		Returns Digital Multimeter Function setting.
:M_DMM:RANGE:UPPER x	If ACV or DCV function: .2, 2, 20, 200, 2000 If ACC or DCC function: .02, .2, 2, 20 If RESistance Function: .2, 2, 20, 200, 2000, 20000	Sets Range Value of Digital Multimeter for selected function.
:M_DMM:RANGE:AUTO		Sets Digital Multimeter for selected function to Autorange.
:M_DMM:UL:STATE x	0 = off, 1 = on	Toggles Upper Limit of Digital Multimeter on or off.
:M_DMM:UL:LEVEL x	If ACV or DCV function: 0.0000 to 1000.0 (V) If ACC or DCC function: 0.0000 to 19.99 (A) If RESistance Function: 0.000 to 19999 (Ohm)	Sets Upper Limit Level of Digital Multimeter.
:M_DMM:LL:STATE x	0 = off, 1 = on	Toggles Lower Limit of Digital Multimeter on or off.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:M_DMM:LL:LEVel x	If ACV or DCV function: 0.0000 to 1000.0 (V) If ACC or DCC function: 0.0000 to 19.99 (A) If RESistance Function: 0.000 to 1999999 (Ohm)	Sets Lower Limit Level of Digital Multimeter.
:M_DMM:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of Digital Multimeter.
:M_DMM:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Digital Multimeter.
:M_DMM:INPut:IMPedance x	150, 600, 1e6	Sets input impedance in ohms for Digital Multimeter ACV or DCV measurement functions.
:M_DMM:STORe x	1 to 9	Stores parameters of Digital Multimeter at indicated Store Parameters Menu location.
:M_DMM:RCL x	1 to 9	Recalls parameters of Digital Multimeter from indicated Recall Parameters Menu location.
:M_DMM?		Returns DMM reading depending on current range and function settings.
x=M_DMM?		Query for DMM reading depending on current DMM range and function.
<b>PHASE METER COMMANDS</b>		
:M_PM:RANGe:UPPer x	2, 5, 10	Sets Range Value of Phase Meter in radians.
:M_PM:RANGe:AUTO		Enables Autorange of Phase Meter.
:M_PM:UL:STATe x	0 = off, 1 = on	Toggles Upper Limit of Phase Meter on or off.
:M_PM:UL:LEVel x	0.00 to 10.00	Sets Upper Limit Level of Phase Meter in radians.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:M_PM:LL:STATe x	0 = off, 1 = on	Toggles Lower Limit of Phase Meter on or off.
:M_PM:LL:LEVel x	0.00 to 10.00	Sets Lower Limit Level of Phase Meter in radians.
:M_PM:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of Phase Meter.
:M_PM:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Phase Meter.
:M_PM:STORe x	1 to 9	Stores parameters of Phase Meter at indicated Store Parameters Menu location.
:M_PM:RCL x	1 to 9	Recalls parameters of Phase Meter from indicated Recall Parameters Menu location.
:M_PM?		Requests return of Phase Meter reading in .01 radians.
<b>DEVIATION-RMS METER COMMANDS</b>		
:M_DRMS:RANGe:UPPer x	2, 5, 10	Sets Range Value of Deviation (RMS) Meter in kHz.
:M_DRMS:RANGe:AUTO		Enables Autorange of Deviation-RMS Meter.
:M_DRMS:UL:STATe x	0 = off, 1 = on	Toggles Upper Limit of Deviation-RMS Meter on or off.
:M_DRMS:UL:LEVel x	0.00 to 10.00	Sets Upper Limit Level of Deviation-RMS Meter in kHz.
:M_DRMS:LL:STATe x	0 = off, 1 = on	Toggles Lower Limit of Deviation-RMS Meter on or off.
:M_DRMS:LL:LEVel x	0.00 to 10.00	Sets Lower Limit Level of Deviation-RMS Meter in kHz.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:M_DRMS:ALARM x	0 = off, 1 = on	Enables/Disables Over/Under Limit Alarm of Deviation-RMS Meter.
:M_DRMS:AVERage x	0 = off, 1 = on	Enables/Disables Averaging of Deviation-RMS Meter.
:M_DRMS:PH x	0 = off, 1 = on	Enables/Disables Peak Hold of Deviation-RMS Meter.
:M_DRMS:STORe x	1 to 9	Stores parameters of Deviation-RMS Meter at indicated Store Parameters Menu location.
:M_DRMS:RCL x	1 to 9	Recalls parameters of Deviation-RMS Meter from indicated Recall Parameters Menu location.
:M_DRMS?		Requests return of Deviation-RMS Meter reading in kHz.
<b>OSCILLOSCOPE OPERATION SCREEN COMMANDS</b>		
:SCOPE:STATe x	0 = off, 1 = on	Enable/Disable Oscilloscope Operation Screen.
:SCOPE:SCALE x	For Demod Audio Input and FM Modulation: 1, 2, 4, 10, 20 (kHz) For AC, DC or GND input: 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000 (mV) For Func Gen or Ext Mod Input: 500, 1000, 2500	Sets Oscilloscope vertical scale.
:SCOPE:SCALE?	For Demod Audio Input and FM Modulation: 1, 2, 4, 10, 20 (kHz) For AC, DC or GND input: 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000 (mV) For Func Gen or Ext Mod Input: 500, 1000, 2500	Returns Oscilloscope scale setting.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:SCOPE:SWEEP x	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000	Sets Oscilloscope horizontal sweep rate in $\mu$ s.
:SCOPE:SWEEP?	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000	Requests return of Oscilloscope sweep rate setting in $\mu$ s.
:SCOPE:SOURce x	EXT, INTernal	Selects External Scope Input or Internal routing Scope Input.
:SCOPE:INTernal x	IF, DEMOD, POWer, SINAD, FUNCtion, XAUDio	Sets Oscilloscope Input to: Receiver IF Demodulated Audio RF Power Level SINAD/BER Function Generators External Audio
:SCOPE:INPut:FILTer:LPASs:STATe x	0 = off, 1 = on	Enables Oscilloscope Input from Low Pass Filter.
:SCOPE:INPut:FILT:LPAS:FREQuency x	0.2 to 50	Sets Low-Pass Filter Frequency in kHz.
:SCOPE:INPut:FILTer:HPASs:STATe x	0 = off, 1 = on	Enables Oscilloscope Input from High-Pass Filter.
:SCOPE:INPut:FILT:HPAS:FREQuency x	0.2 to 100	Sets High-Pass Filter Frequency in kHz.
:SCOPE:INPut:FILT:CWEIGHT:STATe x	0 = off, 1 = on	Enables Oscilloscope Input from C-Weight Filter.
:SCOPE:INPut:FILTer:NOTch:STATe x	0 = off, 1 = on	Enables Oscilloscope Input from internal Notch Filter.
:SCOPE:INPut:FILT:NOT:FREQuency x	0.5 to 1.5	Sets Notch Filter width in kHz.
:SCOPE:COUPling x	AC, DC, GRO	Sets Oscilloscope internal coupling.
:SCOPE:TRIGger:x	ONE, NORM, AUTO	Sets Oscilloscope Trigger Mode.
:SCOPE:ARM		Arms Oscilloscope (Ignored if not in "One-Shot" mode).

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:SCOPE:LEVEL x	0 to 255	Sets Trigger Level.
:SCOPE:VERTICAL x	1 to 10	Sets Vertical Offset of Oscilloscope Trace in the number of grid divisions.
:SCOPE:HORIZONTAL x	1 to 10	Sets Horizontal Offset of Oscilloscope center line in the number of grid divisions.
:SCOPE:FULL		Sets Oscilloscope for "full size" display on RF Generator, Receive, Duplex Transmitter and Duplex Receiver Operation Screens.
:SCOPE:QTR		Sets Oscilloscope for "1/4 size" display on RF Generator, Receive, Duplex Transmitter and Duplex Receiver Operation Screens.
:SCOPE:STORE x	1 to 9	Stores parameters of Oscilloscope Operation Screen at indicated Store Parameters Menu location.
:SCOPE:RCL x	1 to 9	Recalls parameters of Oscilloscope Operation Screen from indicated Recall Parameters Menu location.
:SCOPE:LIVE		Put Scope into Live Mode.
:SCOPE:AVERAGE x	1 to 100	Put Scope into Average Mode with number of average samples specified.
:SCOPE:COMPARE x	1 to 9	Put Scope into Compare Mode. Compares against given stored trace number.
:SCOPE:MARKER1:STATE x	1=ON, 0=OFF	Enables/disables Oscilloscope Marker 1.
:SCOPE:MARKER1:STATE?	1=ON, 0=OFF	Returns state of Oscilloscope Marker 1.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:SCOPE:MARKer1:POINT? x	0 to 100	Sets Oscilloscope Marker 1 graticule position in .25 graticule resolution (100 graticules in grid or 10 per grid division).
:SCOPE:MARKer1:POINT?	0 to 100	Returns Oscilloscope Marker 1 horizontal position in graticules.
:SCOPE:MARKer1:TIME?		Returns Oscilloscope Marker 1 horizontal position in ms.
:SCOPE:MARKer1:AMPLitude?		Returns vertical value of trace at Marker 1 in V.
:SCOPE:MARKer2:STATe x	1=ON, 0=OFF	Enables/disables Oscilloscope Marker 2.
:SCOPE:MARKer2:STATe?	1=ON, 0=OFF	Returns state of Oscilloscope Marker 2.
:SCOPE:MARKer2:POINT? x	0 to 100	Sets Oscilloscope Marker 2 graticule position in .25 graticule resolution (100 graticules in grid or 10 per grid division).
:SCOPE:MARKer2:POINT?	0 to 100	Returns Oscilloscope Marker 2 horizontal position in graticules.
:SCOPE:MARKer2:TIME?		Returns Oscilloscope Marker 2 horizontal position in ms.
:SCOPE:MARKer2:AMPLitude?		Returns vertical value of trace at Marker 2 in V.
:SCOPE:MARKer:STATe x	0=OFF, 1=ON	Enables/disables Oscilloscope Marker 1.
:SCOPE:MARKer:STATe?	0=OFF, 1=ON	Returns state of Oscilloscope Marker 1.
:SCOPE:MARKer:POINT? x	0 to 100	Sets Oscilloscope Marker 1 graticule position in .25 graticule resolution (100 graticules in grid or 10 per grid division).

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:SCOPE:MARKer:POINT?	0 to 100	Returns Oscilloscope Marker 1 horizontal position in graticules.
:SCOPE:MARKer:TIME?		Returns Oscilloscope Marker 1 horizontal position in ms.
:SCOPE:MARKer:AMPLitude?		Returns vertical value of trace at Marker 1 in V.
:SCOPE:MARKer:AOff		Turns off all markers.
:SCOPE:TRACK x	1=ON, 0=OFF.	Enables/Disables Oscilloscope tracking.
:SCOPE:DELTA:AMPLitude?		Returns amplitude difference between Marker 1 and Marker 2.
:SCOPE:DELTA:POINT?		Returns horizontal difference between markers in graticules.
:SCOPE:DELTA:TIME?		Returns horizontal difference between markers in ms.
:SCOPE:TRACE:DATA x,y,z	x is storage location number 1 to 9 y is horizontal offset 0 to 399 z is data location where point is placed 0 to 255	Creates abstract trace, pixel by pixel, at the specified memory location.
:SCOPE:TRACE:DATA? x,y,z	x = storage location number 0 to 9 y = horizontal offset 0 to 399 (Optional; default = 0) z = number of points to be returned (Optional; default = 400)	Returns trace data points from desired stored trace or live trace (0). All data points are returned unless otherwise specified by optional parameters.
:SCOPE:TRACE:MAX? x,y,z	x = storage location number 0 to 9 y = horizontal offset 0 to 399 (Optional; default = 0) z = number of points to be returned (Optional; default = 400)	Returns x,y position of maximum vertical point in trace. Entire trace is considered unless otherwise specified by optional parameters.

Table 6-3 FM/AM-1600S Specific Commands (cont)



COMMAND	RANGE/VALUE	DESCRIPTION
:SCOPE:TRACE:MIN? x,y,z	x is storage location number 1 to 9 y = horizontal offset 0 to 399 (Optional; default = 0) z = number of points to be returned (Optional; default = 400)	Returns x,y position of minimum vertical point in trace. Entire trace is considered unless otherwise specified by optional parameters.
:SCOPE:TRACE:GET? x,y	x is storage location number 1 to 9 y is horizontal offset 0 to 399	Returns point at location specified. Point returned is vertical pixel value 0 to 255.
<b>SPECTRUM ANALYZER COMMANDS</b>		
:ANLZ:SCAN x	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000	Sets Spectrum Analyzer Scan Width in kHz.
:ANLZ:SCAN?	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000	Returns Spectrum Analyzer Scan Width.
:ANLZ:FREQuency x	250 to 999999.9	Sets Spectrum Analyzer Frequency in kHz.
:ANLZ:FREQuency?	250 to 999999.9	Returns Spectrum Analyzer Frequency in kHz.
:ANLZ:STATe x	0 = OFF, 1 = ON	Enables/Disables Spectrum Analyzer.
:ANLZ:FULL		Sets Spectrum Analyzer for "full size" display on RF Generator, Receive, Duplex Transmitter and Duplex Receiver Operation Screens.
:ANLZ:QTR		Sets Spectrum Analyzer for "1/4 size" display on RF Generator, Receive, Duplex Transmitter and Duplex Receiver Operation Screens.
:ANLZ:STORe x	1 to 9	Stores parameters of Spectrum Analyzer Operation Screen at indicated Store Parameters Menu location.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:ANLZ:RCL x	1 to 9	Recalls parameters of Spectrum Analyzer Operation Screen from indicated Recall Parameters Menu location.
:ANLZ:LIVe		Put Analyzer into Trace Mode.
:ANLZ:AVERage x	1 to 100	Put Analyzer into Average Mode. The sample number may be specified. Default is 100.
:ANLZ:PEAK		Put Analyzer into Peak Hold Mode.
:ANLZ:COMPare x	1 to 9	Put Analyzer into Compare Mode. Compares against given stored trace number.
:ANLZ:SCALE x	2, 10	Sets Analyzer Scale to 2 or 10 dB.
:ANLZ:SCALE?	2, 10	Returns scale setting.
:ANLZ:SCALE:UNIT:DBM		Set reference scale to dBm.
:ANLZ:SCALE:UNIT:DBMV		Set reference scale to dBmV.
:ANLZ:SCALE:UNIT:DBUV		Set reference scale to dB $\mu$ V.
:ANLZ:SCALE:UNIT:DBV		Set reference scale to dBV.
:ANLZ:SCALE:UNIT:DBUW		Set reference scale to dB $\mu$ W.
:ANLZ:SCALE:UNIT:DBW		Set reference scale to W (T/R Connector only).
:ANLZ:SCALE:UNIT:UNIT?		Query reference setting. T/R Connector returns dBm and dBW only. ANT does not return dBW.
:ANLZ:MARKer1:STATe x	0 = off, 1 = on	Enables/Disables Spectrum Analyzer Marker 1.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:ANLZ:MARKer1:POINT? x	0.5 to 100.0	Sets Spectrum Analyzer Marker 1 graticule position in .25 graticule resolution (100 graticules in grid or 10 per grid division).
:ANLZ:MARKer1:POINT?		Returns Spectrum Analyzer Marker 1 position in graticules.
:ANLZ:MARKer1:FREQuency?		Returns Spectrum Analyzer Marker 1 position in kHz.
:ANLZ:MARKer1:AMPLitude?		Returns Spectrum Analyzer Trace value at the point where it crosses Marker 1. This value will be in units of the Spectrum Analyzer reference setting.
:ANLZ:MARKer2:STATe x	0 = off, 1 = on	Enables/Disables Spectrum Analyzer Marker 2.
:ANLZ:MARKer2:POINT? x	0.5 to 100.0	Sets Spectrum Analyzer Marker 2 graticule position in .25 graticule resolution (100 graticules in grid or 10 per grid division).
:ANLZ:MARKer2:POINT?		Returns Spectrum Analyzer Marker 2 position in graticules.
:ANLZ:MARKer2:FREQuency?		Request return of Spectrum Analyzer Marker 2 position in kHz.
:ANLZ:MARKer2:AMPLitude?		Returns Spectrum Analyzer Trace value at the point where it crosses the Marker 2. This value will be in units of the Spectrum Analyzer reference setting.
:ANLZ:MARKer:STATe x	0 = off, 1 = on	Enables/Disables Spectrum Analyzer Marker 1.
:ANLZ:MARKer:POINT? x	0.5 to 100.0	Sets Spectrum Analyzer Marker 1 graticule position in .25 graticule resolution (100 graticules in grid or 10 per grid division).

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:ANLZ:MARKer:POINT?		Returns Spectrum Analyzer Marker 1 position in graticules.
:ANLZ:MARKer:FREQuency?		Returns Spectrum Analyzer Marker 1 position in kHz.
:ANLZ:MARKer:AMPLitude?		Returns Spectrum Analyzer Trace value at the point where it crosses the Marker 1. This value will be in units of the Spectrum Analyzer reference setting.
:ANLZ:MARKer:AOFF		Deactivates all markers.
:ANLZ:TRACK x	0 = off, 1 = on	Enables/disables Marker tracking function.
:ANLZ:DELTA:AMPLitude?		Returns vertical difference between two markers in current vertical scale units.
:ANLZ:DELTA:POINT?		Returns horizontal difference in frequency between two markers in graticules.
:ANLZ:DELTA:FREQuency?		Returns horizontal difference in frequency between two markers in MHz.
:ANLZ:TRACE:DATA x,y,z	x is storage location number 1 to 9 y is horizontal offset 0 to 399 z is data location where point is placed 0 to 255	Creates abstract trace, pixel by pixel, at the specified memory location.
:ANLZ:TRACE:DATA? x,y,z	x = storage location number 0 to 9 y = horizontal offset 0 to 399 (Optional; default = 0) z = number of points to be returned (Optional; default = 400)	Returns trace data points from desired stored trace or live trace (0). All data points are returned unless otherwise specified by optional parameters.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:ANLZ:TRACE:MAX? x,y,z	x = storage location number 0 to 9 y = horizontal offset 0 to 399 (Optional; default = 0) z = number of points to be returned (Optional; default = 400)	Returns x,y position of maximum vertical point in trace. Entire trace is considered unless otherwise specified by optional parameters.
:ANLZ:TRACE:MIN? x,y,z	x = storage location number 1 to 9 y = horizontal offset 0 to 399 (Optional; default = 0) z = number of points to be returned (Optional; default = 400)	Returns x,y position of minimum vertical point in trace. Entire trace is considered unless otherwise specified by optional parameters.
:ANLZ:TRACE:GET? x,y	x is storage location number 1 to 9 y is horizontal offset 0 to 399	Returns point at location specified. Point returned is vertical pixel value 0 to 255.
:ANLZ:TRACK:STATe x	0 = off, 1 = on	Enables/Disables Spectrum Analyzer Tracking Generator.
:ANLZ:TRACK:STATe?		Returns status of Tracking Generator.
:ANLZ:TRACK:RESolution:HIGH		Sets Tracking Generator to high resolution trace.
:ANLZ:TRACK:RESolution:LOW		Sets Tracking Generator to low resolution trace.
:ANLZ:TRACK:RESolution?		Returns Tracking Generator resolution setting.
:ANLZ:TRACK:LEVel x	-127 to 0	Sets Tracking Generator output level in dBm.
:ANLZ:TRACK:LEVel?		Returns Tracking Generator output level.
:ANLZ:TRACK:BWIDth x	.3, 3, 30, 300, 3000	Sets Tracking Generator Bandwidth in kHz.
:ANLZ:INPut:ANTenna		Set Analyzer input to ANT. Analyzer screen should already be displayed.
:ANLZ:INPut:TR		Set Analyzer input to T/R. Analyzer screen should already be displayed.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:ANLZ:INPut:Attenuation?		Set analyzer attenuation value.
:ANLZ:INPut:Attenuation x	0, 20, 40	Query analyzer attenuation value.
:ANLZ:INPut?		Query analyzer input setting.
:ANLZ:TOP?		Query top of screen scale value.
:ANLZ:RLEVel?	0 to 64	Query scalar offset used in 2 dB/div scale.
:ANLZ:FIND:FREQuency?		Search for the freq with the largest amplitude in the Receiver spectrum.
:ANLZ:FIND:REFeRence x		Set the Find freq amplitude search level in dB.
:ANLZ:FIND:REFeRence?		Query the reference setting.
:ANLZ:TRACK:BWIDth?		Returns value of current Tracking Generator bandwidth.
<b>RECEIVE COMMANDS</b>		
:RECeive:SQUelch x	0.0 to 1.0	Turn squelch up or down.
:RECeive:SQUelch? x	0.0 to 1.0	Returns squelch setting.
:RECeive:VOLume x	0.0 to 1.0	Turns volume up or down.
:RECeive:VOLume? x	0.0 to 1.0	Returns volume setting.
:RECeive:FREQuency x	250.0 to 999999.9	Sets Receiver RF Frequency from 250 kHz to 999.9999 MHz in 1 kHz steps.
:RECeive:FREQuency?	250.0 to 999999.9	Returns RF Frequency.
:RECeive:MODulation:x	FM1, FM2, FM3, FM4, AM1, AM2, USB, LSB, BFO, PM	Sets Receiver Modulation Type.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:RECeive:MOD:USER:MODulation:x	FM, AM, USB, LSB, BFO, PM, DATA	Sets Receiver Modulation Type - User Selected Modulation.
:RECeive:MOD:USER:FILTer x	3, 30, 300	Sets User selected IF Filter in kHz.
:RECeive:MOD:USER:POST:APASs		Sets User selected Post Detection - All Pass.
:RECeive:MOD:USER:POST:HPASs x	0.5 to 20.0	Sets User selected Post Detection High-Pass Filter cutoff in kHz.
:RECeive:MOD:USER:POST:LPASs x	0.1 to 30.0	Sets User selected Post Detection Low-Pass Filter cutoff in kHz.
:RECeive:MOD:USER:POST:BPASs x,y	Range for lower cutoff is 0.5 to 20, for upper cutoff 0.1 to 30	Sets User selected Post Detection Bandpass Filter cutoff in kHz.
:RECeive:MODulation:USER:POST:CWT		Sets User selected Post Detection C-Weighted Filter.
:RECeive:MODulation?		Returns Modulation Type.
:RECeive:INPut:ANTenna		Selects Antenna Receiver input.
:RECeive:INPut:TR		Selects T/R Connector Receiver input.
:RECeive:INPut:ATTenuation x	0, 20, 40	Sets IF Block Attenuator in dB.
:RECeive:OUTput:SPEAKer x	0 = off, 1 = on	Turns Speaker output to on or off.
:RECeive:OUTput:DEMOD x	0 = off, 1 = on	Turns Demod output to on or off.
:RECeive:OUTput:AUDio x	0 = off, 1 = on	Turns Audio output to on or off.
:RECeive:AGC:MANual x	0 to 255	Sets AGC Manual mode level, 0 to 255.
:RECeive:AGC:AUTO		Selects AGC Auto mode.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:RECeive:AGC:USER x	MEASure, SPeech, DATA, HIGH, TYPE1, TYPE2, TYPE3	Selects AGC User Type.
:RECeive:OFF:USB x	0.200 to 30000	Sets Receiver Offset Frequency - USB in kHz.
:RECeive:OFF:LSB x	0.200 to 30000	Sets Receiver Offset Frequency - LSB in kHz.
:RECeive:DISToRTion		When followed by screen:receiver command, insures Distortion Meter will be shown.
:RECeive:SINAD		When followed by screen:receiver command, insures SINAD Meter will be shown.
:RECeive:MODMeter		When followed by screen:receiver command, insures Modulation Meter will be shown.
:RECeive:DTMF:STATe x	0 = off, 1 = on	Enable/Disable DTMF decoding.
:RECeive:DTMF?		Returns decoded digits or -1 if nothing decoded.
:RECeive:POCSAG:STATe x	0 = off, 1 = on	Enable/Disable POCSAG decoding.
:RECeive:POCSAG:RATe x	0 = LOW, 1 = HIGH	Sets POCSAG rate to decode.
:RECeive:POCSAG:RATe?		Returns POCSAG Rate. 1 for high, 0 for low.
:RECeive:POCSAG:CAPcode?		Returns received capcode or -1 if not available.
:RECeive:POCSAG:TYPE?		Returns POCSAG Function Type or -1 if not available.
:RECeive:POCSAG:MESSAge?		Returns POCSAG message string or -1 if not available.
:RECeive:DCS:STATe x	0 = off, 1 = on	Enables/Disables DCS decoding.

Table 6-3 FM/AM-1600S Specific Commands (cont)



COMMAND	RANGE/VALUE	DESCRIPTION
:RECeive:DCS:NORMAl?		Returns received DCS digits or -1 if normal DCS not received.
:RECeive:DCS:INVert?		Returns received DCS digits or -1 if inverted DCS not received.
:RECeive:TONE:STATe	0 = off, 1 = on	Enables/Disables Audio Tone decoding.
:RECeive:TONE:TYPE x	CCIR, EEA, EIA, ZVEI, DDZVEI, DZVEI, NATEL, EURO, TONE56, CCIRH, CCIRH4, USER	Sets Audio Tone Type decoded.
:RECeive:TONE?		Returns received Audio Tone sequence or -1 if not available.
:RECeive:FIND:FREQUency?		Returns first frequency with amplitude greater than Find Reference.
:RECeive:FIND:REFerence x		Sets Find Reference Level in dB.
:RECeive:FIND:REFerence?		Returns Find Reference Level in dB.
:RECeive:SCAN:START x	250.0 to 999999.9	Receivers Scan starting frequency in kHz.
:RECeive:SCAN:STOP	250.0 to 999999.9	Receivers Scan stopping frequency in kHz.
:RECeive:SCAN:INCRe ment x	250.0 to 999999.9	Sets Receiver Scan increment in kHz.
:RECeive:SCAN:RATE x	0.00 to 99.99	Sets time, in sec, frequency is received if squelch not broken.
:RECeive:SCAN:PAUSE x	0.00 to 99.99	Sets time, in sec, frequency is received if squelch is broken.
:RECeive:SCAN:CONTInue		Starts or continues Receiver Scan.
:RECeive:SCAN:PAUSE?		Returns 1 if paused, 0 if not.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:RECeive:SCAN:ABORT		Aborts Receiver Scan.
:RECeive:SCAN:FREQuency?		Returns frequency currently being scanned.
:RECeive:STORE	1 to 9	Stores parameters.
:RECeive:RCL	1 to 9	Recalls parameters.
<b>RF GENERATOR COMMANDS</b>		
:GENerator:FREQuency x	250.0 to 999999.9	Sets Generator RF Frequency 250 kHz to 999.9999 MHz in 1 kHz steps.
:GENerator:FREQuency?	250.0 to 999999.9	Requests RF Frequency.
:GENerator:LEVel:DBm x	-137.0 to 0.0	Sets Output level in dBm, 1 dB steps.
:GENerator:LEVel:DBm?	-137.0 to 0.0	Returns output level.
:GENerator:STORE x	1 to 9	Stores parameters.
:GENerator:RCL x	1 to 9	Recalls parameters.
:GENerator:DISToRTion		When followed by screen:generator command, insures Distortion Meter will be shown.
:GENerator:SINAD		When followed by screen:generator command, insures SINAD Meter will be shown.
:GENerator:AF		When followed by screen:generator command, insures AF Meter will be shown.
:GENerator:DMM		When followed by screen:generator command, insures DMM Meter will be shown.
:GENerator:DTMF x,y,z	Range of y and z - 25 to 9999	x is string to be encoded. y is mark time in ms. z is space time in ms.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:GENerator:POCSAG:BEEP x,y	Range of x, 1 to 4 Range of y is 0 to 9999999	Generates Beep Tone specified by x for capcode y.
:GENerator:POCSAG:RATE x	0 = low, 1 = high	Sets generated POCSAG rate.
:GENerator:POCSAG:RATE?		Returns current POCSAG rate. 1 for high, 0 for low.
:GENerator:POCSAG:NUMeric x	0 to 9999999	Generates a numeric message for capcode x.
:GENerator:POCSAG:ALPHA:LOWer x	0 to 9999999	Generates a lower case message for capcode x.
:GENerator:POCSAG:ALPHA:UPPer x	0 to 9999999	Generates an upper case message for capcode x.
:GENerator:POCSAG:ALPHA:NUMeric x	0 to 9999999	Generates an alphanumeric message for capcode x.
:GENerator:POCSAG:ALPHA:SPECIAL x	0 to 9999999	Generates a special character message for capcode x.
:GENerator:DCS:NORMAL x	000 to 777	Generates DCS octal code in normal mode.
:GENerator:DCS:INVERT x	000 to 777	Generates DCS octal code in inverted mode.
:GENerator:DCS:STOP		Stops DCS transmit.
:GENerator:IMTS x	0 to 9	Generates IMTS sequence up to 16 characters.
:GENerator:MTS	0 to 9	Generates MTS sequence up to 16 characters.
:GENerator:DIAL x	0 to 9	Generates 2805 pulse sequence up to 16 characters.
:GENerator:FREQUENCY x	0.0 to 40000.0	Sets pulse tone frequency to x Hz.
:GENerator:FREQUENCY?		Returns current 2805 pulse frequency.
:GENerator:TREMOte x	2050, 1950, 1850, 1750, 1650, 1550, 1450, 1350, 1250, 1150, 1050	Generates sequence for given frequency in Hz.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:GENerator:TREmote		Stops Tone Remote guard tone.
:GENerator:TONE:TYPE x		Sets Audio Type to generate.
:GENerator:TONE:USER:DEFine x, y, z	Range of y is 0.0 to 9999.9. Range of z is 20 to 9999	Defines the first character of string x with frequency y in Hz and duration z in ms.
:GENerator:TONE x	0 to 9, A, G, R or -	Generates sequence x using Audio tone previously defined.
:GENerator:OUTput:DEMODO x	0 = off, 1 = on	Turns Demod output to on or off.
:GENerator:OUTput:AUDIO x	0 = off, 1 = on	Turns Audio output to on or off.
<b>DUPLEX COMMANDS</b>		
:DUPlEx:INPut:FREQuency x		Sets Duplex Transmitter Frequency.
:DUPlEx:INPut:FREQuency?		Sets Duplex Transmitter Frequency.
:DUPlEx:INPut:MODulation:x	FM1, FM2, FM3, FM4, AM1, AM2, USB, LSB, BFO, PM	Sets Duplex Transmitter Modulation Type.
:DUPlEx:INPut:MOD:USER:MODulation:x	FM, AM, USB, LSB, BFO, PM, DATA	Sets Duplex Transmitter Modulation Type - User Selected Modulation.
:DUPlEx:INPut:MOD:USER:FILTEr x	3, 30, 300	Sets User selected IF Filter in kHz.
:DUPlEx:INPut:MOD:USER:POST:APASs		Sets User selected Post Detection - All Pass.
:DUPlEx:INPut:MOD:USER:POST:HPASs x	0.5 to 20.0	Sets User selected Post Detection High-Pass Filter cutoff in kHz.
:DUPlEx:INPut:MOD:USER:POST:LPASs x	0.1 to 30.0	Sets User selected Post Detection Low-Pass Filter cutoff in kHz.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:DUP:INP:MOD:USER:POST:BPAS x,y	Range for lower cutoff is 0.5 to 20.0, for upper is 0.1 to 30.0	Sets User selected Post Detection Bandpass Filter with cutoffs in kHz.
:DUPlEx:INPut:MOD:USER:POST:CWT		Sets User selected Post Detection - C Weighted Filter.
:DUPlEx:INPut:MODulation?		Returns Modulation type.
:DUPlEx:INPut:ANTenna		Selects Antenna Receiver input.
:DUPlEx:INPut:TR		Selects T/R Connector Receiver input.
:DUPlEx:INPut:ATTenuation x	0, 20, 40	Sets IF Block Attenuators in dB.
:DUPlEx:INPut:FIND:FREQuency?		Search for the freq. with the largest amplitude in the Receiver spectrum.
:DUPlEx:INPut:REFerence x		Set the Find freq. amplitude search level in dB.
:DUPlEx:INPut:REFerence?		Query the reference setting.
:DUPlEx:INPut:MODMeter		When followed by SCREEN:DUPlEx command, insures Modulation Meter will be shown.
:DUPlEx:INPut:DISToRtion		When followed by SCREEN:DUPlEx command, insures Distortion Meter will be shown.
:DUPlEx:INPut:SINAD		When followed by SCREEN:DUPlEx command, insures SINAD Meter will be shown.
:DUPlEx:OUTput:FREQuency x		Sets RF Generator Frequency.
:DUPlEx:OUTput:FREQuency?		Returns Duplex Generator Frequency.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:DUPlEx:OUTput:OFFSet		Sets RF Generator relative to Duplex Receiver Frequency.
:DUPlEx:OUTput:OFFSet?		Returns Offset.
:DUPlEx:OUTput:LEVel:DBm x	-127.0 to 0.0	Sets Duplex output level.
:DUPlEx:OUTput:LEVel:DBm?	-127.0 to 0.0	Returns Duplex output level.
:DUPlEx:OUTput:DUPlEx		Changes output to Duplex Connector.
:DUPlEx:OUTput:TR		Changes output to T/R Connector.
:DUPlEx:OUTput:DEMOD x	0 = off, 1 = on	Turns Demod output to on or off.
:DUPlEx:OUTput:AUDio x	0 = off, 1 = on	Turns Audio output to on or off.
:DUPlEx:OUTput:DISToRtion		When followed by SCREEN:DUPlEx command, insures Distortion Meter will be shown.
:DUPlEx:OUTput:SINAD		When followed by SCREEN:DUPlEx command, insures SINAD Meter will be shown.
:DUPlEx:OUTput:AF		When followed by SCREEN:DUPlEx command, insures AF Meter will be shown.
:DUPlEx:OUTput:DMM		When followed by SCREEN:DUPlEx command, insures DMM Meter will be shown.
:DUPlEx:STORe	1 to 9	Stores parameters.
:DUPlEx:RCL	1 to 9	Recalls parameters.
<b>AF MODULATION COMMANDS</b>		
:FGEN:GEN1:STATe x	0 = off, 1 = on	Turns AF GENerator 1 to on or off.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:FGEN:GEN1:FREQuency x	0.0 to 40000.0	Sets AF GENerator 1 Frequency in Hz.
:FGEN:GEN1:FREQuency?	0.0 to 40000.0	Returns AF GENerator 1 Frequency in Hz.
:FGEN:GEN1:MODulation x	AM, FM, PM or OFF	Sets Modulation type.
:FGEN:GEN1:MODulation?	AM, FM, PM or OFF	Returns Modulation type.
:FGEN:GEN1:MODL x	0 to 100 for AM 0.0 to 100.0 for FM 0.0 to 10.0 for PM	Sets Modulation level. AM in %, FM in kHz, PM in radians.
:FGEN:GEN1:MODL?	0 to 100 for AM 0.0 to 100.0 for FM 0.0 to 10.0 for PM	Returns Modulation level. AM in %, FM in kHz, PM in radians.
:FGEN:GEN1:SHAPE: x	SIN, SQU, RAMP or TRI	Selects Wave Shape.
:FGEN:GEN1:SHAPE:PULse:DCYCLe 50		Selects Pulse Shape with 50% Duty Cycle.
:FGEN:GEN1:SHAPE:DC x	1, 0, -1	Sets DC Level to -1, 0 or 1.
:FGEN:GEN1:LEVel x	0 to 255	Sets Generator Attenuator setting in DAC steps.
:FGEN:GEN1:LEVel?	0 to 255	Returns Attenuator level.
:FGEN:GEN2:STATe x	0 = off, 1 = on	Turns AF GENerator 2 to on or off.
:FGEN:GEN2:FREQuency x	0.0 to 40000.0	Sets AF GENerator 2 Frequency in Hz.
:FGEN:GEN2:FREQuency?	0.0 to 40000.0	Returns AF GENerator 1 Frequency in Hz.
:FGEN:GEN2:MODulation x	AM, FM, PM or OFF	Sets Modulation type.
:FGEN:GEN2:MODulation?	AM, FM, PM or OFF	Returns Modulation type.
:FGEN:GEN2:MODL x	0 to 100 for AM 0.0 to 100.0 for FM 0.0 to 10.0 for PM	Sets Modulation level. AM in %, FM in kHz, PM in radians.
:FGEN:GEN2:MODL?	0 to 100 for AM 0.0 to 100.0 for FM 0.0 to 10.0 for PM	Returns Modulation level. AM in %, FM in kHz, PM in radians.
:FGEN:GEN2:SHAPE:SIN	SIN, SQU, RAMP or TRI	Selects Wave Shape.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:FGEN:GEN2:SHAPE:PULSe:DCYCLe 50		Selects Pulse Shape with 50% Duty Cycle.
:FGEN:GEN2:SHAPE:DC x	1, 0, -1	Sets DC Level to -1, 0 or 1.
:FGEN:GEN2:LEVel x	0 to 255	Sets Generator Attenuator setting in DAC steps.
:FGEN:GEN2:LEVel?	0 to 255	Returns Attenuator level.
:FGEN:GEN3:MODulation x	AM, FM, PM or OFF	Sets Modulation type.
:FGEN:GEN3:MODulation?	AM, FM, PM or OFF	Returns Modulation type.
:FGEN:GEN3:MODL x	0 to 100 for AM 0.0 to 100.0 for FM 0.0 to 10.0 for PM	Sets Modulation level. AM in %, FM in kHz, PM in radians.
:FGEN:GEN3:MODL?	0 to 100 for AM 0 to 100.0 for FM 0.0 to 10.0 for PM	Returns Modulation level. AM in %, FM in kHz, PM in radians.
:FGEN:DATA:STATe x	0 = off, 1 = on	Sets Digital Data Generator to on or off.
:FGEN:DATA:MODulation x	AM, FM, PM or OFF	Selects Modulation type.
:FGEN:DATA:MODulation?	AM, FM, PM or OFF	Returns Modulation type.
:FGEN:DATA:MODL x	0 to 100 for AM 0.0 to 100.0 for FM 0.0 to 10.0 for PM	Sets Modulation level. AM in %, FM in kHz, PM in radians.
:FGEN:DATA:MODL?	0 to 100 for AM 0.0 to 100.0 for FM 0.0 to 10.0 for PM	Returns Modulation level. AM in %, FM in kHz, PM in radians.
:FGEN:DATA:PATtern:FIX		Selects Data Type - Fixed Pattern.
:FGEN:DATA:PATtern:RND x		Selects Data Type - Pseudo-Random Pattern.
:FGEN:DATA:PATtern:USR x		Selects Data Type - User Enter Pattern.
:FGEN:DATA:SIZE x	100 to 100,000	Selects Data block size in bits .
:FGEN:DATA:SIZE?	100 to 100,000	Returns Block size setting.
:FGEN:DATA:RATE x	75, 150, 300, 600, 1200, 1600, 2400, 4800,16000	Sets Rate in bps.

Table 6-3 FM/AM-1600S Specific Commands (cont)



COMMAND	RANGE/VALUE	DESCRIPTION
:FGEN:DATA:TTL		Sets Data Level - 0 to 5 V.
:FGEN:DATA:BILVL		Sets Data Level - +/- 5 V.
:FGEN:DATA:FILTER x	IN/OUTput	Sets Data Filter IN/OUTput.
:FGEN:EXT:STATEx	0 = off, 1 = on	Turns External Mod to on or off.
:FGEN:EXT:MODulation x	AM, FM, PM, OFF	Sets Modulation type.
:FGEN:EXT:MODulation?	AM, FM, PM, OFF	Returns Modulation type.
:FGEN:EXT:MODL x		Sets External Attenuation.
:FGEN:EXT:MODL?		Returns External Attenuation.
:FGEN:EXT:LEVel x	0 to 255	Sets Generate Attenuator setting in DAC steps.
:FGEN:EXT:LEVel?	0 to 255	Returns Attenuator setting.
:FGEN:MIC:STATEx	0 = off, 1 = on	Turns MIC/ACC to on or off.
:FGEN:MIC:MODulation x	AM, FM, PM, OFF	Sets Modulation type.
:FGEN:MIC:MODulation?	AM, FM, PM, OFF	Returns Modulation type.
:FGEN:MIC:MODL x		Sets MIC Attenuator.
:FGEN:MIC:MODL?		Returns MIC Attenuator.
:FGEN:MIC:LEVel x	0 to 255	Sets Generate Attenuator setting in DAC steps.
:FGEN:MIC:LEVel?	0 to 255	Returns Attenuator setting.
:FGEN:OUTput:LEVel x	0 to 3.276	Sets Audio output level in Volts.
:FGEN:OUTput:LEVel?	0 to 3.276	Returns Audio output level.
:FGEN:OUTput:SPEAKer x	0 = off, 1 = on	Sets Speaker output to on or off.
:FGEN:OUTput:SPEAKer?	0 = off, 1 = on	Returns whether Speaker is enabled.
:FGEN:OUTput:DEMod x	0 = off, 1 = on	Sets Demod output to on or off.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:FGEN:OUTput:DEMod?	0 = off, 1 = on	Returns value of Demod output enable.
:FGEN:OUTput:AUDio x	0 = off, 1 = on	Sets Audio output to on or off.
:FGEN:OUTput:AUDio?	0 = off, 1 = on	Returns value of Audio output enable.
:FGEN:PROPPortional x	0 = off, 1 = on	Sets Proportional output enable.
:FGEN:PROPPortional?	0 = off, 1 = on	Returns value of proportional state.
:FGEN:STORe x	1 to 9	Stores screen parameters.
:FGEN:RCL x	1 to 9	Recalls screen parameters.
:FGEN:FSK x	0 = off, 1 = on	Selects GEN1 and GEN2 as the two tones for a FSK implementation. GEN1 is the designated true tone and GEN2 is the designated false tone. Frequency and level of each must be independently set.
<b>MISCELLANEOUS COMMANDS</b>		
:DELAY x		Delays strobe in seconds.
:PAD x	0, 20, 40	Sets Attenuator pads.
:PWR_PAD:STATe x	0 = off, 1 = on	Sets Power Pad on or off.
:PTT:STATe x	0 = off, 1 = on	Sets the Push to talk pin on front panel MIC Connector.
:SCREEN:RECeive		Renews Receiver Screen.
:SCREEN:GENerator		Renews Gen Screen.
:SCREEN:DUPlax		Renews Duplex Screen.
:SCREEN:SCOPE		Renews Scope Screen.
:SCREEN:ANLZ		Renews Analyzer Screen.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:SCREEN:AF		Renews AF Counter Screen.
:SCREEN:FREQuency		Renews Freq Meter Screen.
:SCREEN:POWer		Renews Power Meter Screen.
:SCREEN:DEV		Renews Deviation Screen.
:SCREEN:MODulation		Renews Mod Meter Screen.
:SCREEN:DISToRTion		Renews Distortion Screen.
:SCREEN:SINAD		Renews SINAD Meter Screen.
:SCREEN:SIG		Renews Signal Strength Screen.
:SCREEN:DMM		Renews DMM Screen.
:SCREEN:FUNC		Renews Function Generator Screen.
:SCREEN:BER		Renews BER Meter Screen.
:SCREEN:USER		Renews Blank Screen for user.
:SETUP:RECeive		Configures hardware for Receiver routing.
:SETUP:GENerator		Configures hardware for Generator routing.
:SETUP:DUPlax		Configures hardware for Duplex routing.
:SETUP:SCOPE		Configures hardware for Scope routing.
:SETUP:ANLZ		Configures hardware for Analyzer screen routing.
:SETUP:FUNC		Configures hardware for AF GENERator screen routing.
:SETUP:DUPTX		Configures hardware for Duplex - TX routing.
:SETUP:DUPRX		Configures hardware for Duplex - RX routing.

Table 6-3 FM/AM-1600S Specific Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:SETUP:MON		Configures hardware for Generator routing.
:FLUSH		Flush query data to remote.

Table 6-3 FM/AM-1600S Specific Commands (cont)

# SECTION 7 - OPTIONS

## 7-1 CELLULAR OPTION

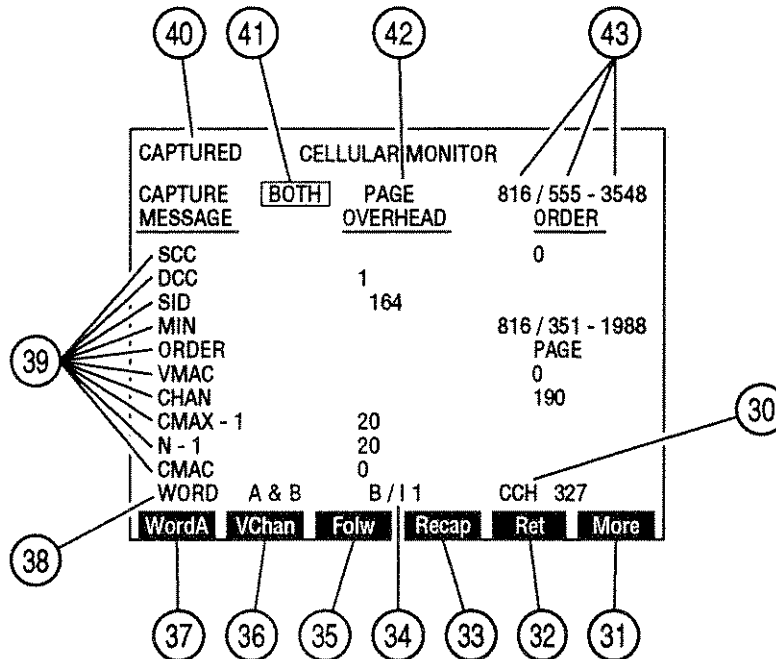
### 7-1-1 CELLULAR OPERATION SCREENS AND MENU CONFIGURATIONS

The Cellular Monitor Screen is accessed from the Receiver Setup Menu or the Duplex Transmitter Setup Menu. Pressing "Cellr" Soft Function Key F3 from one of these screens displays the Cellular Monitor Screen on the CRT. The Voice Channel Screen, Mobile Voice Channel Screen and Cellular Setup Menu are accessed from the Cellular Monitor Screen.

#### A. CELLULAR MONITOR SCREEN

Press "Cellr" Soft Function Key F3 to access the Cellular Monitor Screen. Use the index of screen features to identify the parameters that may be edited, the value range available with each feature and/or usage.

ITEM	DESCRIPTION
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8610126

#### 30. CCH (Control Channel)

Selects Control Channel. Range is from 1 to 1023. Channels 313 to 354 are usually Control Channels. Channels 313 to 333 are System A channels and channels 334 to 354 are System B channels.

#### 31. "More" Soft Function Key F6

Displays other set of Soft Function Keys.

#### 32. "Ret" Soft Function Key F5

Returns operation to the previous Operation Screen (either Receiver or Duplex Transmitter).

ITEM	DESCRIPTION
33. <u>"Recap" Soft Function Key F4</u>	Restarts Capture Function. The CAPTURED Indicator (40) disappears until a Capture reoccurs.
34. <u>B/I (Busy/Idle Bit)</u>	Not an editable parameter. Displays the Busy/Idle Bit status: 0 for Busy, 1 for Idle.
35. <u>"Folw" Soft Function Key F3</u>	Activates the Follow Function. When a Voice Channel is assigned, the Follow Function displays the Voice Channel Screen on the CRT and monitors the assigned channel. If a Handoff occurs, the Voice Channel Screen monitors the new Voice Channel. If the call is dropped, Follow returns the Cellular Monitor Screen to the CRT and monitors the selected Control Channel (30) for the next Voice Channel assignment.
36. <u>"VChan" Soft Function Key F2</u>	Displays Voice Channel Screen.
37. <u>Word Soft Function Key F1</u>	Selects Word A, Word B or Word A & B (38). Soft Function Key F1 definition displays the next choice.
38. <u>WORD Callout</u>	Displays current Word choice.
39. <u>MESSAGE Listing</u>	Ten messages can be monitored at one time and are selected from the Cellular Setup Menu.
40. <u>CAPTURED Indicator</u>	Red CAPTURED Indicator is displayed when a Capture occurs and continues to show until "Recap" Soft Function Key F4 is pressed or until another screen is chosen.
41. <u>CAPTURE Data Field</u>	Select OFF, ORDER, MIN or BOTH. Capture freezes the data displayed on the Cellular Monitor and Voice Channel Screen when a specified ORDER or MIN Number is received. Selecting BOTH requires the Order and MIN Number to be received before a Capture takes place.
<b>NOTE:</b> When BOTH is chosen as the Capture Field, and VC DES is the ORDER, a Capture displays the Voice Channel Screen on the CRT.	

ITEM	DESCRIPTION
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42. ORDER Callout

Selects Order to Capture on:

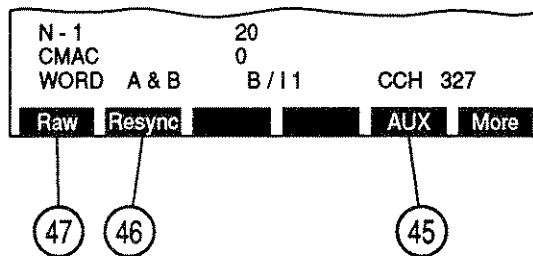
- |                                |                                    |
|--------------------------------|------------------------------------|
| PAGE                           | MAINTNC (Maintenance)              |
| ALERT                          | PWR LVL (Change Power Level)       |
| RELEASE                        | DIR RTRY (Directed Retry)          |
| REORDER                        | AUT REG (Abbreviated Registration) |
| S ALERT (Stop Alert)           | A INTCP (Abbreviated Intercept)    |
| AUDIT                          | A REORD (Abbreviated Reorder)      |
| SND ADDR (Send Called-Address) | A ALERT (Abbreviated Alert)        |
| INTRCPT (Intercept)            | VC DES (Voice Channel Designation) |

43. MIN Number Callout

Selects MIN Number to Capture. Editable in three separate data fields.

Press "More" Soft Function Key F6 for the next set of Soft Function Keys.

ITEM	DESCRIPTION
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8607114

45. "AUX" Soft Function Key F5

Displays the Auxillary Functions Menu.

46. "Resync" Soft Function Key F2

Accesses a new set of Control Channel Data when the Raw Data Monitor is displayed,

47. "Raw" Soft Function Key F1

Press "Raw" Soft Function Key F1 to display the Raw Data Monitor over the Cellular Monitor Screen. Press "Raw" Soft Function Key F1 again to remove the Raw Data Monitor.

**NOTE:** Raw Data Monitor is not fully functional at this time.

## B. CELLULAR SETUP MENU

When the Cellular Monitor Screen is displayed on the CRT, press the SETUP Key to access the Cellular Setup Menu. The Cellular Setup Menu displays 32 Messages, any 10 of which can be chosen to be displayed on the Cellular Monitor Screen at one time. Following is the list of Messages and descriptions.

ITEM DESCRIPTION

CELLULAR SETUP					
USE 0-9 TO MAKE YOUR SELECTIONS					
SCC	<b>0</b>	END	X	OLC	X
DCC	1	WFOM	X	BIS	X
SID	2	ACT	X	REGINCR	X
MIN	3	NAWC	X	CHANPOS1	X
ORDER	4	S	X	CHANPOS2	X
VMAC	5	E	X	NEWACC	X
CHAN	6	REGH	X	MBUSY - PGR	X
CMAx - 1	7	REGR	X	MSZTR - PGR	X
N - 1	8	DTX	X	MBUSY - OTH	X
CMAC	9	RCF	X	MSZTR - OTH	X
REGID	X	CPA	X		
			Ret	AUX	

8610124

1. SCC (Supervisory Audio Tone Color Code)

Supervisory Audio Tone Color Code is displayed in the ORDER Column.

2. DCC (Digital Color Code)

Digital Color Code is displayed in the OVERHEAD Column.

3. SID (System Identification Number)

System Identification Number is displayed in the OVERHEAD Column.

4. MIN (Mobile Identification Number)

Mobile Identification Number is displayed in the ORDER Column.

5. ORDER

Order is displayed in the ORDER Column.

6. VMAC (Voice Mobile Attenuation Code)

Displays the Voice Mobile Attenuation Code in the ORDER Column.

7. CHAN (Voice Channel)

Displays the designated Voice Channel in the ORDER Column.

8. CMAx-1

CMAx is the number of Access Channels to be scanned when accessing the system. CMAx-1 is displayed in the OVERHEAD Column.

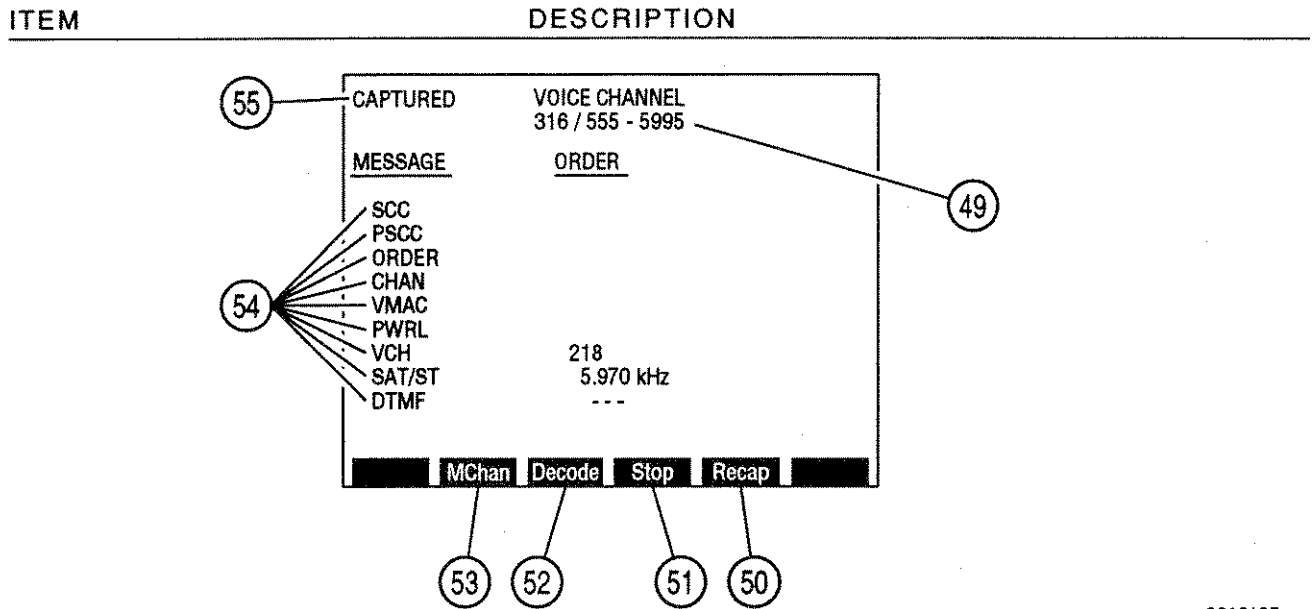


ITEM	DESCRIPTION
9. <u>N-1</u>	N is the number of Paging Channels to be scanned by the Mobile Equipment and is displayed in the OVERHEAD Column.
10. <u>CMAC (Control Mobile Attenuation Code)</u>	Control Mobile Attenuation Code is displayed in the OVERHEAD Column.
11. <u>REGID (Registration Identification)</u>	Registration Identification is displayed in the OVERHEAD Column.
12. <u>END</u>	End Indication bit is displayed in the OVERHEAD Column.
13. <u>WFOM (Wait For Overhead Message)</u>	Wait For Overhead Message bit is displayed in the OVERHEAD Column.
14. <u>ACT (Global Action)</u>	Global Action value is displayed in the OVERHEAD Column.
15. <u>NAWC (Number of Additional Words Coming)</u>	Number of Additional Words Coming is displayed in the OVERHEAD Column.
16. <u>S (Serial Number Field)</u>	Serial Number bit is displayed in the OVERHEAD Column.
17. <u>E (Extended Address Field)</u>	Extended Address bit is displayed in the OVERHEAD Column.
18. <u>REGH (Registration for Home Mobile Stations)</u>	Registration for Home Mobile Stations is displayed in the OVERHEAD Column.
19. <u>REGR (Registration for Roaming Mobile Stations)</u>	Registration for Roaming Mobile Stations is displayed in the OVERHEAD Column.
20. <u>DTX (Discontinuous Transmission)</u>	Discontinuous Transmission Bit is displayed in the OVERHEAD Column.
21. <u>RCF (Read Control-Filler)</u>	Read Control-Filler bit is displayed in the OVERHEAD Column.

ITEM	DESCRIPTION
22. <u>CPA (Combined Paging/Access)</u>	Combined Paging/Access bit is displayed in the OVERHEAD Column.
23. <u>OLC (Overload Control Class)</u>	Overload Control Class is displayed in the OVERHEAD Column.
24. <u>BIS (Busy-Idle Status Field)</u>	Busy-Idle bit is displayed in the OVERHEAD Column.
25. <u>REGINCR</u>	Registration Increment bit is displayed in the OVERHEAD Column.
26. <u>CHANPOS1 (Channel Position 1)</u>	Channel Position of Access Channel relative to the First Access Channel (from Word 3 of the Directed Retry Message) is displayed in the OVERHEAD Column.
27. <u>CHANPOS2 (Channel Position 2)</u>	Channel Position of Access Channel relative to the First Access Channel (from Word 4 of the Directed Retry Message) is displayed in the OVERHEAD Column.
28. <u>NEWACC</u>	New Access Channel Starting point is displayed in the OVERHEAD Column.
29. <u>MBUSY-PGR (Maximum Busy Occurrences for Page Responses)</u>	Maximum Busy Occurrences for Page Responses is displayed in the OVERHEAD Column.
30. <u>MSZTR-PGR (Maximum Seizure Tries for Page Responses)</u>	Maximum Seizure Tries for Page Responses is displayed in the OVERHEAD Column.
31. <u>MBUSY-OTH (Maximum Busy Occurrences for Other Accesses)</u>	Maximum Busy Occurrences for Other Accesses is displayed in the OVERHEAD Column.
32. <u>MSZTR-OTH (Maximum Seizure Tries for Other Accesses)</u>	Maximum Seizure Tries for Other Accesses is displayed in the OVERHEAD Column.

### C. VOICE CHANNEL SCREEN

Pressing "VChan" Soft Function Key F2 when in the Cellular Monitor Screen displays the (Forward) Voice Channel Screen on the CRT. By pressing "MChan" Soft Function Key F2, the Voice Channel Screen becomes the Mobile (Reverse) Voice Channel Screen and Soft Function Key F2 Definition becomes "CChan".



8610125

49. Mobile Identification Number (MIN)

Displays Mobile Identification Number of Mobile Unit as decoded from the Voice Designation Order.

50. "Recap" Soft Function Key F5

Restarts Capture Function and unfreezes Voice Channel Screen.

51. "Stop" Soft Function Key F4

Appears when Decode is active. Stops Decode Function.

52. "Decode" Soft Function Key F3

Starts DTMF Decoding Function. Appears in red when active and will continue until "Stop" Soft Function Key is pressed.

53. "MChan"/"CChan" Soft Function Key F2

When (Forward) Voice Channel Screen is displayed, "MChan" accesses the Mobile (Reverse) Voice Channel Screen. When Mobile (Reverse) Voice Channel Screen is displayed, "CChan" accesses the Cellular Monitor Screen.

**ITEM****DESCRIPTION**

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**54. Voice Channel Messages**

- **SCC (SAT Color Code)**  
Displays Supervisory Audio Tone Color Code.
- **PSCC (Present SAT Color Code)**  
Displays Color Code for the present Voice Channel.
- **ORDER**  
Displays specified ORDER.
- **CHAN (Channel Number)**  
Displays new Voice Channel designated for Handcuff.
- **VMAC (Voice Mobile Attenuation Code)**  
Displays Voice Mobile Attenuation Code.
- **PWRL (Power Level of Change Power Order)**  
Displays Power Level of the Change Power Order.
- **VCH (Voice Channel)**  
Displays current Voice Channel.
- **SAT/ST**  
Displays SAT Frequency.
- **DTMF**  
The decoded DTMF is displayed 16 digits at a time.

**55. CAPTURED Callout**

Red CAPTURED Indicator is displayed when a Capture occurs.

## 7-1-2 CELLULAR OPERATION

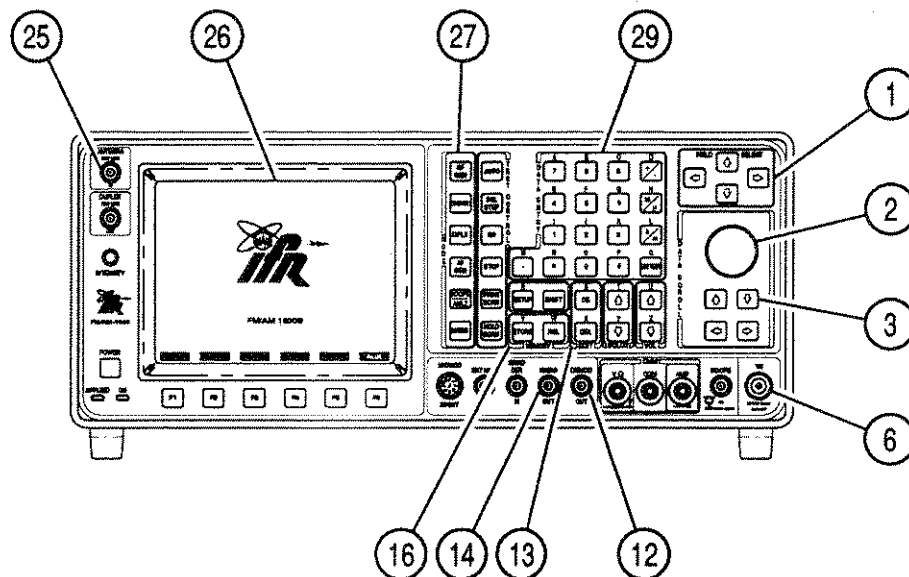
The Receiver or Duplex Transmitter must be configured for Cellular Operation. Only Receiver setup for Cellular Operation is shown. Duplex Transmitter setup for Cellular Operation follows the same procedure.

**NOTE:** If Receiver is set up for Cellular Operation, the Cellular Option is accessed through the Receiver Menu. If Duplex Transmitter is setup for Cellular Operation, the Cellular Option is accessed through the Duplex Transmitter Menu.

When editing, use the FIELD SELECT Keys (1) to move the cursor to the parameter to be edited and press ENTER Key to access the data field. Use the DATA ENTRY Keypad (29) to enter data. Use the DATA SCROLL Spinner (2) or DATA SCROLL Keys (3) to select parameters from a list.

### A. RECEIVER SETUP FOR CELLULAR OPERATION

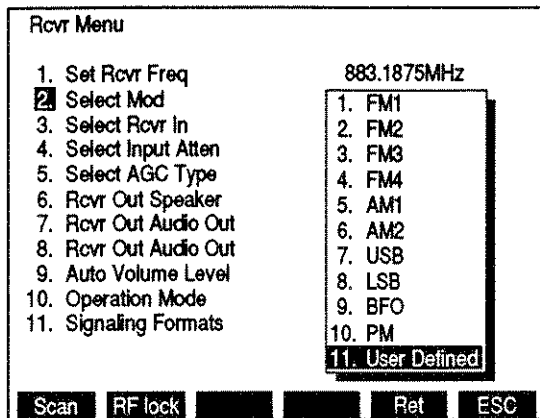
STEP	PROCEDURE
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8607100

1. Install Antenna to ANTENNA Connector (25) for "off the air" reception. For signals greater than -30 dB (Signal Strength Meter reading greater than 100), route Cellular input through T/R Connector (6).
2. Press RCVR MODE Key (27) and SETUP Key to access the Receiver Menu. Press "2" DATA ENTRY Key (29) to access the Receiver Select Modulation Menu:

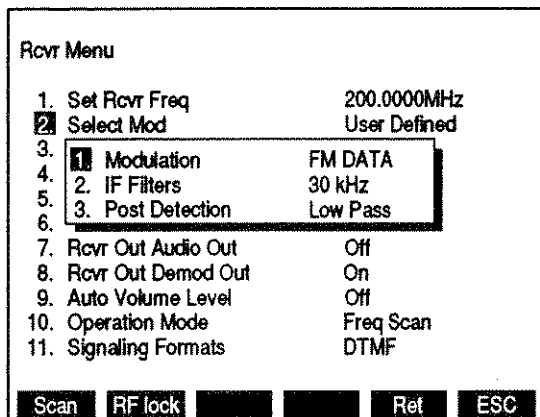
RECEIVER SELECT MODULATION MENU



8610115

3. Use FIELD SELECT Keys (1) to move cursor to "11. User Defined" and press ENTER. The User Defined Menu appears on the CRT:

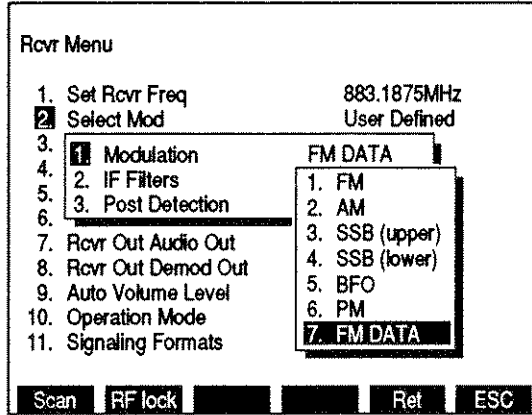
RECEIVER USER DEFINED MENU



8610132

- 4. Press "1" DATA ENTRY Key (29) to access User Defined Modulation Menu. Press "7" DATA ENTRY Key (29) to select "FM DATA":

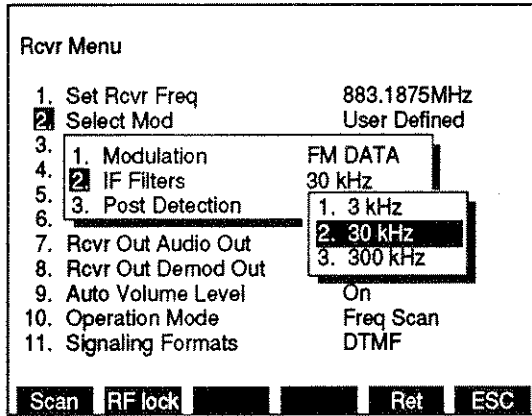
RECEIVER USER DEFINED MODULATION MENU



8610130

- 5. Press "2" DATA ENTRY Key (29) to access User Defined IF Filter Menu. Press "2" DATA ENTRY Key (29) to select "30 kHz":

RECEIVER USER DEFINED IF FILTER MENU



8610111

6. Press "3" DATA ENTRY Key (29) to access User User Defined Post Detection Menu. Press "2" DATA ENTRY Key (29) to select "Low Pass":

RECEIVER USER DEFINED  
POST DETECTION MENU

Rcvr Menu	
1. Set Rcvr Freq	883.1875MHz
2. Select Mod	User Defined
3. 1. Modulation	FM DATA
4. 2. IF Filters	30 kHz
5. 3. Post Detection	Low Pass
6. 1. All Pass	
7. Rcvr Out Audio Out	2. Low Pass
8. Rcvr Out Demod Out	3. High Pass
9. Auto Volume Level	4. Band Pass
10. Operation Mode	5. C Wt Pass
11. Signaling Formats	
Scan RF lock Ret ESC	

8610129

7. The Low Pass data field appears. Use DATA ENTRY Keypad (29) to select 15.000 kHz and press ENTER. Press "ESC" Soft Function Key F6 to remove the User Defined Menu.
8. Press "3" DATA ENTRY Key (29) and ENTER Key to select either "Antenna" (for receiving Cellular input through the ANTENNA Connector [25]) or "T/R" (for receiving Cellular input through the T/R Connector [6]).
9. Press "5" DATA ENTRY Key (29) to access the Receiver AGC Menu. Press "1" DATA ENTRY Key (29) to access the AGC User Defined Menu. Press "4" DATA ENTRY Key (29) to select "High Speed":

RECEIVER AGC USER  
DEFINED MENU

Rcvr Menu	
1. Set Rcvr Freq	870.0300 MHz
2. Select Mod	FM4
3. Select Rcvr In	Antenna
4. Select Input Atten	0 dB
5. Select AGC Type	U 1. Measurement
6. Rcvr Out Speaker	2. Speech
7. Rcvr Out Audio Out	3. Data
8. Rcvr Out Demod Out	4. High Speed
9. Auto Volume Level	5. Type 1
10. Operation Mode	6. Type 2
11. Signaling Formats	7. Type 3
Scan RF lock Cellr Ret ESC	

8610128

10. To route the demodulated signal to the Test Set Speaker, press "6" DATA ENTRY Key (29) until "On" is selected for "6. Rcvr Out Speaker".



**STEP****PROCEDURE**

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11. To route the demodulated signal to the AUDIO OUT Connector (14), press "7" DATA ENTRY Key (29) until "On" is selected for "7. Rcvr Out Audio Out".

**NOTE:** The Bandwidth for the AUDIO OUT Connector (14) is limited by the Low Pass Filter setting set in 7-1-2-A, step 6.

12. To route the demodulated signal to the DEMOD OUT Connector (12), press "7" DATA ENTRY Key (29) until "On" is selected for "8. Rcvr Out Demod Out".

**NOTE:** The SAT and Overhead Data is filtered out by the C Weighted Filter installed with the DEMOD OUT Connector (12).

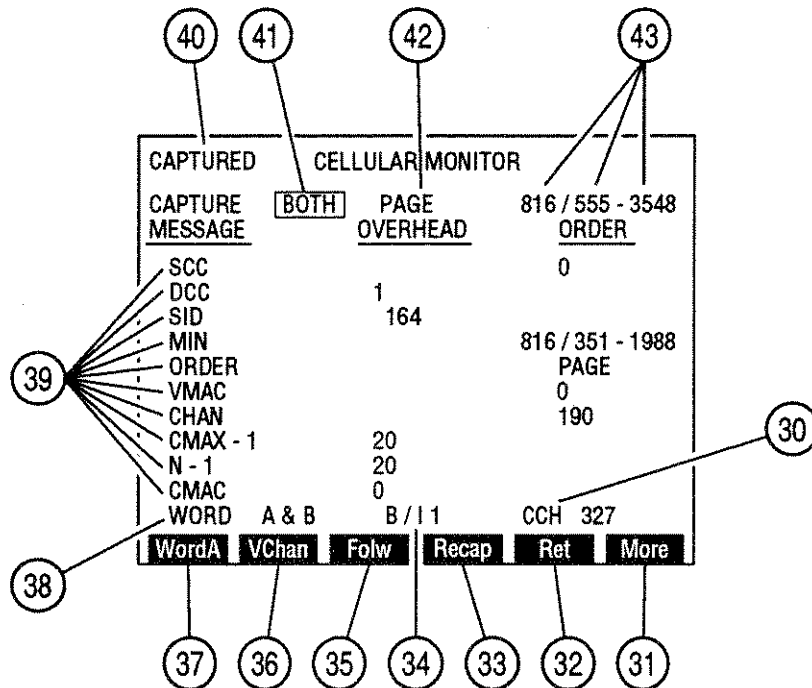
13. The previous Receiver parameter settings can be stored using the Store Parameters Menu, see 4-1-1.

14. Press MTRS MODE Key (27) to access METER Menu. Press "4" DATA ENTRY Key (29) to access the Deviation Meter Operation Screen. Press "Range" Soft Function Key F1, use DATA SCROLL Keys (3) to select 10 kHz and press ENTER Key. Press "Ret" Soft Function Key F6 to return to the Receiver Operation Screen.

15. Press SETUP Key for the Receiver Menu to appear on the CRT. Press "Cellr" Soft Function Key F3 to access the Cellular Monitor Screen.

## B. CELLULAR MONITOR SCREEN OPERATION

STEP	PROCEDURE
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8610126

1. Use FIELD SELECT Keys (1) to move cursor to CCH (Control Channel) (30) and press ENTER Key. Use DATA ENTRY Keypad (29) to select a Control Channel and press ENTER Key. Range is from 1 to 1023.

**NOTE:** Channels 313 to 354 are usually Control Channels. Channels 313 to 333 are System A channels and channels 334 to 354 are System B channels.

2. If desired, use FIELD SELECT Keys (1) to move cursor to Capture Condition (41) and press ENTER Key. Use DATA SCROLL Keys (3) to select a Capture Condition and press ENTER Key.
  - If ORDER or BOTH is selected for the Capture Condition (41), use FIELD SELECT Keys (1) to move cursor to the Order Callout (42) and press ENTER Key. Use DATA SCROLL Keys (3) to select an ORDER and press ENTER Key.
  - If MIN or BOTH is selected for the Capture Condition (41), use FIELD SELECT Keys (1) to move cursor to each part of the MIN Number (43) and press ENTER Key. Use DATA ENTRY Keypad (29) to enter a MIN Number one part at a time.
3. To reset a captured screen, press "Recap" Soft Function Key F4 (33).
4. If "Raw" is displayed for Soft Function Key F1, press "More" Soft Function Key F6 (31). Press Soft Function Key F1 (37) until WORD (38) displays the desired setting.
5. Press "Folw" Soft Function Key F3 (35) to activate the Follow Function. Press "Folw" Soft Function Key F3 (35) again to turn Follow off.

6. Press SETUP Key to access the Cellular Setup Menu:

CELLULAR SETUP					
USE 0-9 TO MAKE YOUR SELECTIONS					
SCC	0	END	X	OLC	X
DCC	1	WFOM	X	BIS	X
SID	2	ACT	X	REGINCR	X
MIN	3	NAWC	X	CHANPOS1	X
ORDER	4	S	X	CHANPOS2	X
VMAC	5	E	X	NEWACC	X
CHAN	6	REGH	X	MBUSY - PGR	X
CMAx - 1	7	REGR	X	MSZTR - PGR	X
N - 1	8	DTX	X	MBUSY - OTH	X
CMAC	9	RCF	X	MSZTR - OTH	X
REGID	X	CPA	X		

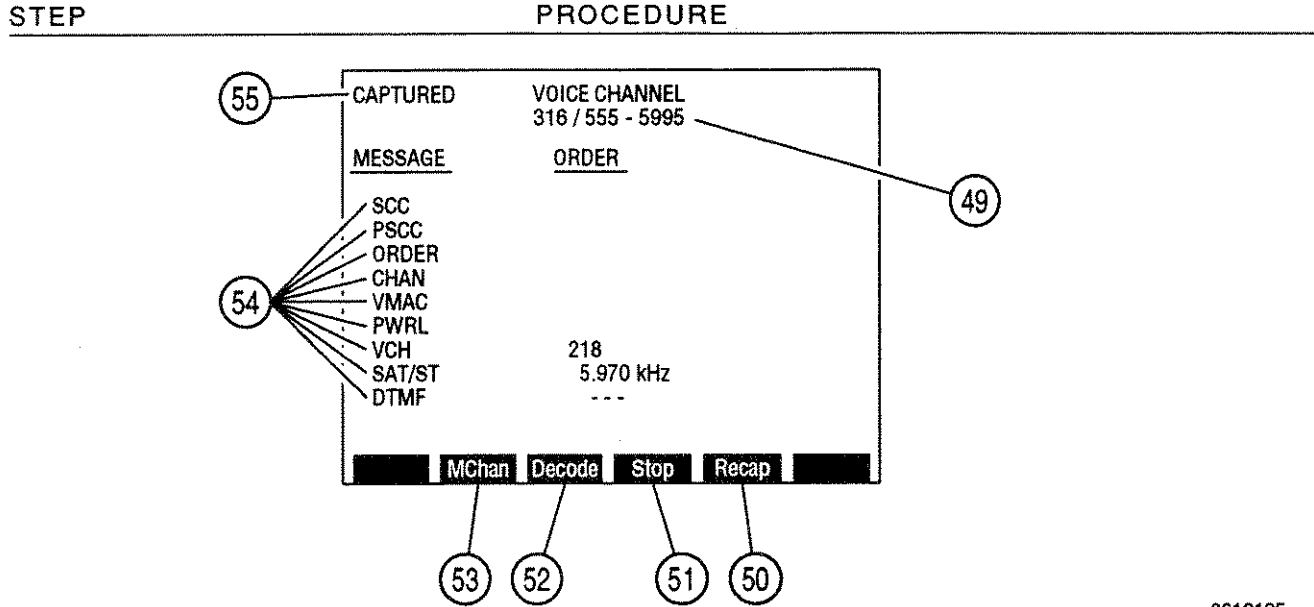
Ret    AUX

8610124

7. Use FIELD SELECT Keys (1) to move cursor to the right of the Messages to be monitored on the Cellular Monitor Screen. Select a Message by pressing a numeric DATA ENTRY Key (29). The number chosen determines the order displayed (0 first, 9 last).
8. To remove a Message from being selected, move the cursor to the right of the Message and press any nonnumeric DATA ENTRY Key (29). Selecting two Messages with the same digit voids selection of the first Message. After the desired Messages have been selected, press the "Ret" Soft Function Key F5 to return to the Cellular Monitor Screen.
9. To access the RAW DATA Monitor, press "More" Soft Function Key F6 until "Raw" is displayed for Soft Function Key F1 (47). Press "Raw" Soft Function Key F1 and the RAW DATA Monitor appears over the Cellular Monitor Screen.
- NOTE:** Raw Data Monitor is not fully functional at this time.
10. To view another set of raw data, press "Resync" Soft Function Key F2 (46). To remove the RAW DATA Monitor, press "Raw" Soft Function Key F1 (47).

### C. VOICE CHANNEL AND MOBILE VOICE CHANNEL SCREEN OPERATION

Press the "VChan" Soft Function Key F2 to access the (Forward) Voice Channel Screen. Press "MChan" Soft Function Key F2 (53) to access the Mobile (Reverse) Voice Channel Screen. Operation is the same for both Screens.



8610125

1. To restart a Capture, press "Recap" Soft Function Key F5 (50). The Capture Function can only be initiated from the Cellular Monitor Screen.
2. To decode DTMF, press "Decode" Soft Function Key F3 (52). Press "Stop" Soft Function Key F4 (51) to stop decoding.
3. To access the Mobile (Reverse) Voice Channel Screen while in the (Forward) Voice Channel Screen, press "MChan" Soft Function Key F2 (53).
4. When in the Mobile (Reverse) Voice Channel Screen, Soft Function Key F2 definition becomes "CChan". Pressing F2 returns operation to the Cellular Monitor Screen.

### 7-1-3 CELLULAR REMOTE OPERATION

The Cellular Option can be remotely operated similar to other Operation Modes of the FM/AM-1600S. To perform the setup for Remote Operation, see Section 6. The Cellular TMAC Commands are listed in Table 7-1.

The Cellular Monitor Screen must be displayed when executing most of the Cellular commands. A command for displaying the Cellular Monitor Screen, :SCREEN:CELL, is included in the table of commands. Most of the Cellular Commands are time dependent and holds the last decoded information. Once the command has been read, the information may not be available until decoded from another stream sequence. Recording the readings prevents the loss of information.

Following is a list of Cellular Remote Operation Commands. These commands are complete except where the user must determine a parameter shown by x. The parameter value or value range is listed where applicable.

COMMAND	RANGE/VALUE	DESCRIPTION
:SCREEN:CELL		Displays Cellular Screen.
:CELL:WORDA		Selects decoding of stream A words.
:CELL:WORDB		Selects decoding of stream B words.
:CELL:BOTH		Selects decoding of both stream A and B words.
:CELL:WORD?		Requests word selection.
:CELL:CHAN x	1 to 1023	Selects a cellular frequency by channel number.
:CELL:CHAN?		Requests currently selected cellular number.
:CELL:DCC?		Returns latest DCC value or -1 if not available.
:CELL:SCC?		Returns latest SCC value or -1 if not available.
:CELL:SID?		Returns latest SID value or -1 if not available.

Table 7-1 FM/AM-1600S Specific Cellular Commands

COMMAND	RANGE/VALUE	DESCRIPTION
:CELL:MIN?		Returns latest MIN value or -1 if not available. Returning format is: AAA/DDD-DDDD
:CELL:VMAC?		Returns latest VMAC value or -1 if not available.
:CELL:VCHAN?		Returns latest VCHAN value or -1 if not available.
:CELL:CMAX_1?		Returns latest CMAX value or -1 if not available.
:CELL:N_1?		Returns latest N-1 value or -1 if not available.
:CELL:CMAC?		Returns latest CMAC value or -1 if not available.
:CELL:END?		Returns latest END value or -1 if not available.
:CELL:WFOM?		Returns latest WFOM value or -1 if not available.
:CELL:ACT?		Returns latest ACT value or -1 if not available.
:CELL:NAWC?		Returns latest NAWC value or -1 if not available.
:CELL:S?		Returns latest S value or -1 if not available.
:CELL:E?		Returns latest E value or -1 if not available.
:CELL:REGH?		Returns latest REGH value or -1 if not available.
:CELL:REGR?		Returns latest REGR value or -1 if not available.
:CELL:REGID?		Returns latest REGID value or -1 if not available.

Table 7-1 FM/AM-1600S Specific Cellular Commands (cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:CELL:DTX?		Returns latest DTX value or -1 if not available.
:CELL:RCF?		Returns latest RCF value or -1 if not available.
:CELL:CPA?		Returns latest CPA value or -1 if not available.
:CELL:OLC?		Returns latest OLC value or -1 if not available.
:CELL:BIS?		Returns latest BIS value or -1 if not available.
:CELL:REGINCR?		Returns latest REGINCR value or -1 if not available.
:CELL:CHANPOS1?		Returns first channel position field from directed retry message or -1 if not applicable.
:CELL:CHANPOS2?		Returns second channel position field from directed retry message or -1 if not applicable.
:CELL:CHANPOS3?		Returns third channel position field from directed retry message or -1 if not applicable.
:CELL:CHANPOS4?		Returns fourth channel position field from directed retry message or -1 if not applicable.
:CELL:CHANPOS5?		Returns fifth channel position field from directed retry message or -1 if not applicable.

Table 7-1 FM/AM-1600S Specific Cellular Commands (Cont)

COMMAND	RANGE/VALUE	DESCRIPTION
:CELL:CHANPOS6?		Returns sixth channel position field from the directed retry message or -1 if not applicable.
:CELL:NEWACC?		Returns New Access Channel or -1 if not available.
:CELL:MAX:PGR?		Returns Maximum Busy field for page response or -1 if not available.
:CELL:MAX:OTH?		Returns Maximum Busy field for other accesses or -1 if not available.
:CELL:MAXS:PGR?		Returns Maximum Seizure tries for page response or -1 if not available.
:CELL:MAXS:OTH?		Returns Maximum Seizure tries for other accesses or -1 if not available.

Table 7-1 FM/AM-1600S Specific Cellular Commands (cont)



# APPENDICES

## APPENDIX A - USER I/O CONNECTORS AND PIN-OUT TABLES

### A-1 TABLE OF I/O CONNECTORS

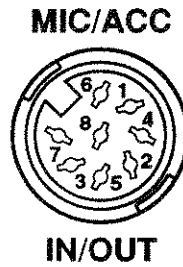
CONNECTOR NAME	CONNECTOR TYPE	SIGNAL IN/OUT	SIGNAL TYPE
T/R	"N" TYPE	IN/OUT	RF, 200 W MAX
SCOPE IN	BNC	IN	Analog, 200 Vdc MAX
DMM AMP	Banana Jack	IN	ac/dc, 2 A MAX
DMM COM	Banana Jack	IN	GND
DMM V $\Omega$	Banana Jack	IN	ac/dc, 1 kVdc or 500 VAC MAX
DEMOD OUT	BNC	OUT	Audio
AUDIO OUT	BNC	OUT	Audio
SINAD/BER IN	BNC	IN	Analog - SINAD Digital - BER
EXT MOD IN	BNC	IN	Audio
MIC/ACC IN/OUT	8 Pin DIN	IN/OUT	See Pin-Out (A-2)
DUPLEX OUT	BNC	OUT	RF, 65 W MAX
ANTENNA IN	BNC	IN	RF, 65 W MAX
AC LINE IN	AC Power In	IN	90 - 260 VAC Switchable 115/230 V
DC OUT	6 Pin Lumberg	OUT	See Pin-Out (A-3)
SCSI	50 Pin Champ	IN/OUT	See Pin-Out (A-4)
GPIO (IEEE-488)	24 Pin Champ	IN/OUT	See Pin-Out (A-5)
RS-232	9 Pin, D	IN/OUT	See Pin-Out (A-6)
RECEIVER IF	BNC	OUT	>-30 dBm leveled
EXTERNAL VIDEO	9 Pin, D	OUT	Video, EGA Format, IBM Compatible
EXTERNAL REFERENCE	BNC	IN	10 MHz ( $\approx$ 2 mVpp)

Table A-1 Table of I/O Connectors

## A-2 PIN-OUT TABLE FOR MIC/ACC IN/OUT CONNECTOR

Pin Number	Signal Name	Signal Type	I/O
1	PTT-Out	TTL	Programmable Out
2	Mic Audio	Audio	In
3	Demod Audio	Audio	Out
4	ACC-2	TTL	Programmable In
5	+15 Vdc	10-15 Vdc, 1 mA	Out
6	ACC-1	TTL	Programmable In
7	Mic Switch	TTL	Programmable In
8	GND		

Table A-2 Pin-Out for MIC/ACC IN/OUT Connector



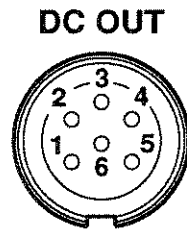
8618013

Figure A-1 MIC/ACC IN/OUT Connector Pin Identification

### A-3 PIN-OUT TABLE FOR DC OUT CONNECTOR

Pin Number	Signal Type
1	+5 Vdc, 3 A MAX
2,4,6	GND
3	+15 Vdc, 1.5 A MAX
5	-15 Vdc, 100 mA MAX

Table A-3 Pin-Out for DC OUT Connector



8618014

Figure A-2 DC OUT Connector Pin Identification

## A-4 PIN-OUT TABLE FOR SCSI CONNECTOR

Pin Number	Assignment	Pin Number	Assignment
1-25,35-37,39, 40,42	Digital GND	38	TERM PWR
26	SD0	41	ATN
27	SD1	43	BSY
28	SD2	44	ACK
29	SD3	45	RST
30	SD4	46	MSG
31	SD5	47	SEL
32	SD6	48	C/D
33	SD7	49	REQ
34	SD8	50	I/O

Table A-4 Pin-Out for SCSI Connector

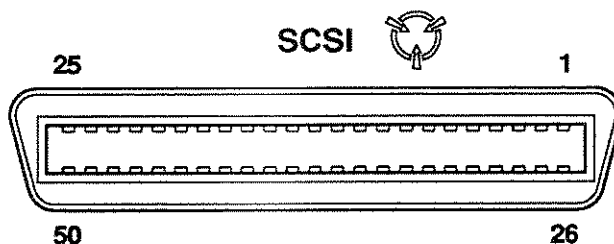


Figure A-3 SCSI Connector Pin Identification

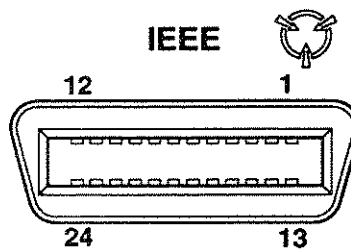
Use of the SCSI Connector conforms with the Common Command Set (CCS) of the Small Computer System Interface (SCSI) published by the ANSI X3T9.2 Committee as X3T9.2/85-52 Rev 4.B.

8618015

## A-5 PIN-OUT TABLE FOR IEEE-448 CONNECTOR

Pin Number	Assignment	Pin Number	Assignment
1	DIO 1	10	SRO
2	DIO 2	11	ATN
3	DIO 3	12	Digital GND
4	DIO 4	13	DIO 5
5	EOI	14	DIO 6
6	DAV	15	DIO 7
7	NFRD	16	DIO 8
8	NDAC	17	REN
9	IFC	18-24	Digital GND

Table A-5 Pin-Out for IEEE-488 Connector



8618016

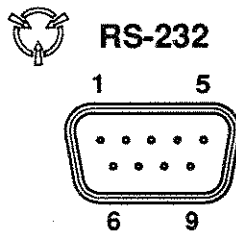
Figure A-4 IEEE-488 Pin Identification

Use of the IEEE-488 Connector is in compliance with ANSI/IEEE Standard 488.2-1987.

## A-6 PIN-OUT FOR RS-232 CONNECTOR

Pin Number	Assignment
1	CD
2	TX DATA
3	RX DATA
4	DSR
5	Digital GND
6	DTR
7	CTS
8	RTS
9	RI

Table A-6 Pin-Out for RS-232 Connector



8618017

Figure A-5 RS-232 Connector Pin Identification

## APPENDIX B - AMPS CELLULAR TELEPHONE CHANNEL NUMBERS AND ASSIGNED CENTER FREQUENCIES

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
1	825.030	870.030	49	826.470	871.470
2	825.060	870.060	50	826.500	871.500
3	825.090	870.090	51	826.530	871.530
4	825.120	870.120	52	826.560	871.560
5	825.150	870.150	53	826.590	871.590
6	825.180	870.180	54	826.620	871.620
7	825.210	870.210	55	826.650	871.650
8	825.240	870.240	56	826.680	871.680
9	825.270	870.270	57	826.710	871.710
10	825.300	870.300	58	826.740	871.740
11	825.330	870.330	59	826.770	871.770
12	825.360	870.360	60	826.800	871.800
13	825.390	870.390	61	826.830	871.830
14	825.420	870.420	62	826.860	871.860
15	825.450	870.450	63	826.890	871.890
16	825.480	870.480	64	826.920	871.920
17	825.510	870.510	65	826.950	871.950
18	825.540	870.540	66	826.980	871.980
19	825.570	870.570	67	827.010	872.010
20	825.600	870.600	68	827.040	872.040
21	825.630	870.630	69	827.070	872.070
22	825.660	870.660	70	827.100	872.100
23	825.690	870.690	71	827.130	872.130
24	825.720	870.720	72	827.160	872.160
25	825.750	870.750	73	827.190	872.190
26	825.780	870.780	74	827.220	872.220
27	825.810	870.810	75	827.250	872.250
28	825.840	870.840	76	827.280	872.280
29	825.870	870.870	77	827.310	872.310
30	825.900	870.900	78	827.340	872.340
31	825.930	870.930	79	827.370	872.370
32	825.960	870.960	80	827.400	872.400
33	825.990	870.990	81	827.430	872.430
34	826.020	871.020	82	827.460	872.460
35	826.050	871.050	83	827.490	872.490
36	826.080	871.080	84	827.520	872.520
37	826.110	871.110	85	827.550	872.550
38	826.140	871.140	86	827.580	872.580
39	826.170	871.170	87	827.610	872.610
40	826.200	871.200	88	827.640	872.640
41	826.230	871.230	89	827.670	872.670
42	826.260	871.260	90	827.700	872.700
43	826.290	871.290	91	827.730	872.730
44	826.320	871.320	92	827.760	872.760
45	826.350	871.350	93	827.790	872.790
46	826.380	871.380	94	827.820	872.820
47	826.410	871.410	95	827.850	872.850
48	826.440	871.440	96	827.880	872.880

Table B-1 Cellular Channel Numbers and Frequencies

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
97	827.910	872.910	145	829.350	874.350
98	827.940	872.940	146	829.380	874.380
99	827.970	872.970	147	829.410	874.410
100	828.000	873.000	148	829.440	874.440
101	828.030	873.030	149	829.470	874.470
102	828.060	873.060	150	829.500	874.500
103	828.090	873.090	151	829.530	874.530
104	828.120	873.120	152	829.560	874.560
105	828.150	873.150	153	829.590	874.590
106	828.180	873.180	154	829.620	874.620
107	828.210	873.210	155	829.650	874.650
108	828.240	873.240	156	829.680	874.680
109	828.270	873.270	157	829.710	874.710
110	828.300	873.300	158	829.740	874.740
111	828.330	873.330	159	829.770	874.770
112	828.360	873.360	160	829.800	874.800
113	828.390	873.390	161	829.830	874.830
114	828.420	873.420	162	829.860	874.860
115	828.450	873.450	163	829.890	874.890
116	828.480	873.480	164	829.920	874.920
117	828.510	873.510	165	829.950	874.950
118	828.540	873.540	166	829.980	874.980
119	828.570	873.570	167	830.010	875.010
120	828.600	873.600	168	830.040	875.040
121	828.630	873.630	169	830.070	875.070
122	828.660	873.660	170	830.100	875.100
123	828.690	873.690	171	830.130	875.130
124	828.720	873.720	172	830.160	875.160
125	828.750	873.750	173	830.190	875.190
126	828.780	873.780	174	830.220	875.220
127	828.810	873.810	175	830.250	875.250
128	828.840	873.840	176	830.280	875.280
129	828.870	873.870	177	830.310	875.310
130	828.900	873.900	178	830.340	875.340
131	828.930	873.930	179	830.370	875.370
132	828.960	873.960	180	830.400	875.400
133	828.990	873.990	181	830.430	875.430
134	829.020	874.020	182	830.460	875.460
135	829.050	874.050	183	830.490	875.490
136	829.080	874.080	184	830.520	875.520
137	829.110	874.110	185	830.550	875.550
138	829.140	874.140	186	830.580	875.580
139	829.170	874.170	187	830.610	875.610
140	829.200	874.200	188	830.640	875.640
141	829.230	874.230	189	830.670	875.670
142	829.260	874.260	190	830.700	875.700
143	829.290	874.290	191	830.730	875.730
144	829.320	874.320	192	830.760	875.760

Table B-1 Cellular Channel Numbers and Frequencies (Cont)



Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
193	830.790	875.790	241	832.230	877.230
194	830.820	875.820	242	832.260	877.260
195	830.850	875.850	243	832.290	877.290
196	830.880	875.880	244	832.320	877.320
197	830.910	875.910	245	832.350	877.350
198	830.940	875.940	246	832.380	877.380
199	830.970	875.970	247	832.410	877.410
200	831.000	876.000	248	832.440	877.440
201	831.030	876.030	249	832.470	877.470
202	831.060	876.060	250	832.500	877.500
203	831.090	876.090	251	832.530	877.530
204	831.120	876.120	252	832.560	877.560
205	831.150	876.150	253	832.590	877.590
206	831.180	876.180	254	832.620	877.620
207	831.210	876.210	255	832.650	877.650
208	831.240	876.240	256	832.680	877.680
209	831.270	876.270	257	832.710	877.710
210	831.300	876.300	258	832.740	877.740
211	831.330	876.330	259	832.770	877.770
212	831.360	876.360	260	832.800	877.800
213	831.390	876.390	261	832.830	877.830
214	831.420	876.420	262	832.860	877.860
215	831.450	876.450	263	832.890	877.890
216	831.480	876.480	264	832.920	877.920
217	831.510	876.510	265	832.950	877.950
218	831.540	876.540	266	832.980	877.980
219	831.570	876.570	267	833.010	878.010
220	831.600	876.600	268	833.040	878.040
221	831.630	876.630	269	833.070	878.070
222	831.660	876.660	270	833.100	878.100
223	831.690	876.690	271	833.130	878.130
224	831.720	876.720	272	833.160	878.160
225	831.750	876.750	273	833.190	878.190
226	831.780	876.780	274	833.220	878.220
227	831.810	876.810	275	833.250	878.250
228	831.840	876.840	276	833.280	878.280
229	831.870	876.870	277	833.310	878.310
230	831.900	876.900	278	833.340	878.340
231	831.930	876.930	279	833.370	878.370
232	831.960	876.960	280	833.400	878.400
233	831.990	876.990	281	833.430	878.430
234	832.020	877.020	282	833.460	878.460
235	832.050	877.050	283	833.490	878.490
236	832.080	877.080	284	833.520	878.520
237	832.110	877.110	285	833.550	878.550
238	832.140	877.140	286	833.580	878.580
239	832.170	877.170	287	833.610	878.610
240	832.200	877.200	288	833.640	878.640

Table B-1 Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
289	833.670	878.670	337	835.110	880.110
290	833.700	878.700	338	835.140	880.140
291	833.730	878.730	339	835.170	880.170
292	833.760	878.760	340	835.200	880.200
293	833.790	878.790	341	835.230	880.230
294	833.820	878.820	342	835.260	880.260
295	833.850	878.850	343	835.290	880.290
296	833.880	878.880	344	835.320	880.320
297	833.910	878.910	345	835.350	880.350
298	833.940	878.940	346	835.380	880.380
299	833.970	878.970	347	835.410	880.410
300	834.000	879.000	348	835.440	880.440
301	834.030	879.030	349	835.470	880.470
302	834.060	879.060	350	835.500	880.500
303	834.090	879.090	351	835.530	880.530
304	834.120	879.120	352	835.560	880.560
305	834.150	879.150	353	835.590	880.590
306	834.180	879.180	354	835.620	880.620
307	834.210	879.210	355	835.650	880.650
308	834.240	879.240	356	835.680	880.680
309	834.270	879.270	357	835.710	880.710
310	834.300	879.300	358	835.740	880.740
311	834.330	879.330	359	835.770	880.770
312	834.360	879.360	360	835.800	880.800
313	834.390	879.390	361	835.830	880.830
314	834.420	879.420	362	835.860	880.860
315	834.450	879.450	363	835.890	880.890
316	834.480	879.480	364	835.920	880.920
317	834.510	879.510	365	835.950	880.950
318	834.540	879.540	366	835.980	880.980
319	834.570	879.570	367	836.010	881.010
320	834.600	879.600	368	836.040	881.040
321	834.630	879.630	369	836.070	881.070
322	834.660	879.660	370	836.100	881.100
323	834.690	879.690	371	836.130	881.130
324	834.720	879.720	372	836.160	881.160
325	834.750	879.750	373	836.190	881.190
326	834.780	879.780	374	836.220	881.220
327	834.810	879.810	375	836.250	881.250
328	834.840	879.840	376	836.280	881.280
329	834.870	879.870	377	836.310	881.310
330	834.900	879.900	378	836.340	881.340
331	834.930	879.930	379	836.370	881.370
332	834.960	879.960	380	836.400	881.400
333	834.990	879.990	381	836.430	881.430
334	835.020	880.020	382	836.460	881.460
335	835.050	880.050	383	836.490	881.490
336	835.080	880.080	384	836.520	881.520

Table B-1 Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
385	836.550	881.550	433	837.990	882.990
386	836.580	881.580	434	838.020	883.020
387	836.610	881.610	435	838.050	883.050
388	836.640	881.640	436	838.080	883.080
389	836.670	881.670	437	838.110	883.110
390	836.700	881.700	438	838.140	883.140
391	836.730	881.730	439	838.170	883.170
392	836.760	881.760	440	838.200	883.200
393	836.790	881.790	441	838.230	883.230
394	836.820	881.820	442	838.260	883.260
395	836.850	881.850	443	838.290	883.290
396	836.880	881.880	444	838.320	883.320
397	836.910	881.910	445	838.350	883.350
398	836.940	881.940	446	838.380	883.380
399	836.970	881.970	447	838.410	883.410
400	837.000	882.000	448	838.440	883.440
401	837.030	882.030	449	838.470	883.470
402	837.060	882.060	450	838.500	883.500
403	837.090	882.090	451	838.530	883.530
404	837.120	882.120	452	838.560	883.560
405	837.150	882.150	453	838.590	883.590
406	837.180	882.180	454	838.620	883.620
407	837.210	882.210	455	838.650	883.650
408	837.240	882.240	456	838.680	883.680
409	837.270	882.270	457	838.710	883.710
410	837.300	882.300	458	838.740	883.740
411	837.330	882.330	459	838.770	883.770
412	837.360	882.360	460	838.800	883.800
413	837.390	882.390	461	838.830	883.830
414	837.420	882.420	462	838.860	883.860
415	837.450	882.450	463	838.890	883.890
416	837.480	882.480	464	838.920	883.920
417	837.510	882.510	465	838.950	883.950
418	837.540	882.540	466	838.980	883.980
419	837.570	882.570	467	839.010	884.010
420	837.600	882.600	468	839.040	884.040
421	837.630	882.630	469	839.070	884.070
422	837.660	882.660	470	839.100	884.100
423	837.690	882.690	471	839.130	884.130
424	837.720	882.720	472	839.160	884.160
425	837.750	882.750	473	839.190	884.190
426	837.780	882.780	474	839.220	884.220
427	837.810	882.810	475	839.250	884.250
428	837.840	882.840	476	839.280	884.280
429	837.870	882.870	477	839.310	884.310
430	837.900	882.900	478	839.340	884.340
431	837.930	882.930	479	839.370	884.370
432	837.960	882.960	480	839.400	884.400

Table B-1 Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
481	839.430	884.430	529	840.870	885.870
482	839.460	884.460	530	840.900	885.900
483	839.490	884.490	531	840.930	885.930
484	839.520	884.520	532	840.960	885.960
485	839.550	884.550	533	840.990	885.990
486	839.580	884.580	534	841.020	886.020
487	839.610	884.610	535	841.050	886.050
488	839.640	884.640	536	841.080	886.080
489	839.670	884.670	537	841.110	886.110
490	839.700	884.700	538	841.140	886.140
491	839.730	884.730	539	841.170	886.170
492	839.760	884.760	540	841.200	886.200
493	839.790	884.790	541	841.230	886.230
494	839.820	884.820	542	841.260	886.260
495	839.850	884.850	543	841.290	886.290
496	839.880	884.880	544	841.320	886.320
497	839.910	884.910	545	841.350	886.350
498	839.940	884.940	546	841.380	886.380
499	839.970	884.970	547	841.410	886.410
500	840.000	885.000	548	841.440	886.440
501	840.030	885.030	549	841.470	886.470
502	840.060	885.060	550	841.500	886.500
503	840.090	885.090	551	841.530	886.530
504	840.120	885.120	552	841.560	886.560
505	840.150	885.150	553	841.590	886.590
506	840.180	885.180	554	841.620	886.620
507	840.210	885.210	555	841.650	886.650
508	840.240	885.240	556	841.680	886.680
509	840.270	885.270	557	841.710	886.710
510	840.300	885.300	558	841.740	886.740
511	840.330	885.330	559	841.770	886.770
512	840.360	885.360	560	841.800	886.800
513	840.390	885.390	561	841.830	886.830
514	840.420	885.420	562	841.860	886.860
515	840.450	885.450	563	841.890	886.890
516	840.480	885.480	564	841.920	886.920
517	840.510	885.510	565	841.950	886.950
518	840.540	885.540	566	841.980	886.980
519	840.570	885.570	567	842.010	887.010
520	840.600	885.600	568	842.040	887.040
521	840.630	885.630	569	842.070	887.070
522	840.660	885.660	570	842.100	887.100
523	840.690	885.690	571	842.130	887.130
524	840.720	885.720	572	842.160	887.160
525	840.750	885.750	573	842.190	887.190
526	840.780	885.780	574	842.220	887.220
527	840.810	885.810	575	842.250	887.250
528	840.840	885.840	576	842.280	887.280

Table B-1 Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
577	842.310	887.310	625	843.750	888.750
578	842.340	887.340	626	843.780	888.780
579	842.370	887.370	627	843.810	888.810
580	842.400	887.400	628	843.840	888.840
581	842.430	887.430	629	843.870	888.870
582	842.460	887.460	630	843.900	888.900
583	842.490	887.490	631	843.930	888.930
584	842.520	887.520	632	843.960	888.960
585	842.550	887.550	633	843.990	888.990
586	842.580	887.580	634	844.020	889.020
587	842.610	887.610	635	844.050	889.050
588	842.640	887.640	636	844.080	889.080
589	842.670	887.670	637	844.110	889.110
590	842.700	887.700	638	844.140	889.140
591	842.730	887.730	639	844.170	889.170
592	842.760	887.760	640	844.200	889.200
593	842.790	887.790	641	844.230	889.230
594	842.820	887.820	642	844.260	889.260
595	842.850	887.850	643	844.290	889.290
596	842.880	887.880	644	844.320	889.320
597	842.910	887.910	645	844.350	889.350
598	842.940	887.940	646	844.380	889.380
599	842.970	887.970	647	844.410	889.410
600	843.000	888.000	648	844.440	889.440
601	843.030	888.030	649	844.470	889.470
602	843.060	888.060	650	844.500	889.500
603	843.090	888.090	651	844.530	889.530
604	843.120	888.120	652	844.560	889.560
605	843.150	888.150	653	844.590	889.590
606	843.180	888.180	654	844.620	889.620
607	843.210	888.210	655	844.650	889.650
608	843.240	888.240	656	844.680	889.680
609	843.270	888.270	657	844.710	889.710
610	843.300	888.300	658	844.740	889.740
611	843.330	888.330	659	844.770	889.770
612	843.360	888.360	660	844.800	889.800
613	843.390	888.390	661	844.830	889.830
614	843.420	888.420	662	844.860	889.860
615	843.450	888.450	663	844.890	889.890
616	843.480	888.480	664	844.920	889.920
617	843.510	888.510	665	844.950	889.950
618	843.540	888.540	666	844.980	889.980
619	843.570	888.570	667	845.010	890.010
620	843.600	888.600	668	845.040	890.040
621	843.630	888.630	669	845.070	890.070
622	843.660	888.660	670	845.100	890.100
623	843.690	888.690	671	845.130	890.130
624	843.720	888.720	672	845.160	890.160

Table B-1 Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
673	845.190	890.190	721	846.630	891.630
674	845.220	890.220	722	846.660	891.660
675	845.250	890.250	723	846.690	891.690
676	845.280	890.280	724	846.720	891.720
677	845.310	890.310	725	846.750	891.750
678	845.340	890.340	726	846.780	891.780
679	845.370	890.370	727	846.810	891.810
680	845.400	890.400	728	846.840	891.840
681	845.430	890.430	729	846.870	891.870
682	845.460	890.460	730	846.900	891.900
683	845.490	890.490	731	846.930	891.930
684	845.520	890.520	732	846.960	891.960
685	845.550	890.550	733	846.990	891.990
686	845.580	890.580	734	847.020	892.020
687	845.610	890.610	735	847.050	892.050
688	845.640	890.640	736	847.080	892.080
689	845.670	890.670	737	847.110	892.110
690	845.700	890.700	738	847.140	892.140
691	845.730	890.730	739	847.170	892.170
692	845.760	890.760	740	847.200	892.200
693	845.790	890.790	741	847.230	892.230
694	845.820	890.820	742	847.260	892.260
695	845.850	890.850	743	847.290	892.290
696	845.880	890.880	744	847.320	892.320
697	845.910	890.910	745	847.350	892.350
698	845.940	890.940	746	847.380	892.380
699	845.970	890.970	747	847.410	892.410
700	846.000	891.000	748	847.440	892.440
701	846.030	891.030	749	847.470	892.470
702	846.060	891.060	750	847.500	892.500
703	846.090	891.090	751	847.530	892.530
704	846.120	891.120	752	847.560	892.560
705	846.150	891.150	753	847.590	892.590
706	846.180	891.180	754	847.620	892.620
707	846.210	891.210	755	847.650	892.650
708	846.240	891.240	756	847.680	892.680
709	846.270	891.270	757	847.710	892.710
710	846.300	891.300	758	847.740	892.740
711	846.330	891.330	759	847.770	892.770
712	846.360	891.360	760	847.800	892.800
713	846.390	891.390	761	847.830	892.830
714	846.420	891.420	762	847.860	892.860
715	846.450	891.450	763	847.890	892.890
716	846.480	891.480	764	847.920	892.920
717	846.510	891.510	765	847.950	892.950
718	846.540	891.540	766	847.980	892.980
719	846.570	891.570	767	848.010	893.010
720	846.600	891.600	768	848.040	893.040

Table B-1 Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
769	848.070	893.070	817	849.510	894.510
770	848.100	893.100	818	849.540	894.540
771	848.130	893.130	819	849.570	894.570
772	848.160	893.160	820	849.600	894.600
773	848.190	893.190	821	849.630	894.630
774	848.220	893.220	822	849.660	894.660
775	848.250	893.250	823	849.690	894.690
776	848.280	893.280	824	849.720	894.720
777	848.310	893.310	825	849.750	894.750
778	848.340	893.340	826	849.780	894.780
779	848.370	893.370	827	849.810	894.810
780	848.400	893.400	828	849.840	894.840
781	848.430	893.430	829	849.870	894.870
782	848.460	893.460	830	849.900	894.900
783	848.490	893.490	831	849.930	894.930
784	848.520	893.520	832	849.960	894.960
785	848.550	893.550	833	849.990	894.990
786	848.580	893.580	834	850.020	895.020
787	848.610	893.610	835	850.050	895.050
788	848.640	893.640	836	850.080	895.080
789	848.670	893.670	837	850.110	895.110
790	848.700	893.700	838	850.140	895.140
791	848.730	893.730	839	850.170	895.170
792	848.760	893.760	840	850.200	895.200
793	848.790	893.790	841	850.230	895.230
794	848.820	893.820	842	850.260	895.260
795	848.850	893.850	843	850.290	895.290
796	848.880	893.880	844	850.320	895.320
797	848.910	893.910	845	850.350	895.350
798	848.940	893.940	846	850.380	895.380
799	848.970	893.970	847	850.410	895.410
800	849.000	894.000	848	850.440	895.440
801	849.030	894.030	849	850.470	895.470
802	849.060	894.060	850	850.500	895.500
803	849.090	894.090	851	850.530	895.530
804	849.120	894.120	852	850.560	895.560
805	849.150	894.150	853	850.590	895.590
806	849.180	894.180	854	850.620	895.620
807	849.210	894.210	855	850.650	895.650
808	849.240	894.240	856	850.680	895.680
809	849.270	894.270	857	850.710	895.710
810	849.300	894.300	858	850.740	895.740
811	849.330	894.330	859	850.770	895.770
812	849.360	894.360	860	850.800	895.800
813	849.390	894.390	861	850.830	895.830
814	849.420	894.420	862	850.860	895.860
815	849.450	894.450	863	850.890	895.890
816	849.480	894.480	864	850.920	895.920

Table B-1 Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
865	850.950	895.950	1007	824.520	869.520
866	850.980	895.980	1008	824.550	869.550
991	824.040	869.040	1009	824.580	869.580
992	824.070	869.070	1010	824.610	869.610
993	824.100	869.100	1011	824.640	869.640
994	824.130	869.130	1012	824.670	869.670
995	824.160	869.160	1013	824.700	869.700
996	824.190	869.190	1014	824.730	869.730
997	824.220	869.220	1015	824.760	869.760
998	824.250	869.250	1016	824.790	869.790
999	824.280	869.280	1017	824.820	869.820
1000	824.310	869.310	1018	824.850	869.850
1001	824.340	869.340	1019	824.880	869.880
1002	824.370	869.370	1020	824.910	869.910
1003	824.400	869.400	1021	824.940	869.940
1004	824.430	869.430	1022	824.970	869.970
1005	824.460	869.460	1023	825.000	870.000
1006	824.490	869.490			

**NOTE:** Channel Numbers 800 through 866 are not presently assigned to any to any Cellular Telephone System.

Channel Numbers 800 through 866 are not presently assigned to any to any Cellular Telephone System.

Frequencies for Channel Numbers 867 through 989 are not assigned and are not used by Cellular Telephone Systems. Channel Number 990 is not assigned to any system.

Table B-1 Cellular Channel Numbers and Frequencies (Cont)



## APPENDIX C - E-TACS CELLULAR TELEPHONE CHANNEL NUMBERS AND ASSIGNED CENTER FREQUENCIES

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
0	889.9875	934.9875	48	891.1875	936.1875
1	890.0125	935.0125	49	891.2125	936.2125
2	890.0375	935.0375	50	891.2375	936.2375
3	890.0625	935.0625	51	891.2625	936.2625
4	890.0875	935.0875	52	891.2875	936.2875
5	890.1125	935.1125	53	891.3125	936.3125
6	890.1375	935.1375	54	891.3375	936.3375
7	890.1625	935.1625	55	891.3625	936.3625
8	890.1875	935.1875	56	891.3875	936.3875
9	890.2125	935.2125	57	891.4125	936.4125
10	890.2375	935.2375	58	891.4375	936.4375
11	890.2625	935.2625	59	891.4625	936.4625
12	890.2875	935.2875	60	891.4875	936.4875
13	890.3125	935.3125	61	891.5125	936.5125
14	890.3375	935.3375	62	891.5375	936.5375
15	890.3625	935.3625	63	891.5625	936.5625
16	890.3875	935.3875	64	891.5875	936.5875
17	890.4125	935.4125	65	891.6125	936.6125
18	890.4375	935.4375	66	891.6375	936.6375
19	890.4625	935.4625	67	891.6625	936.6625
20	890.4875	935.4875	68	891.6875	936.6875
21	890.5125	935.5125	69	891.7125	936.7125
22	890.5375	935.5375	70	891.7375	936.7375
23	890.5625	935.5625	71	891.7625	936.7625
24	890.5875	935.5875	72	891.7875	936.7875
25	890.6125	935.6125	73	891.8125	936.8125
26	890.6375	935.6375	74	891.8375	936.8375
27	890.6625	935.6625	75	891.8625	936.8625
28	890.6875	935.6875	76	891.8875	936.8875
29	890.7125	935.7125	77	891.9125	936.9125
30	890.7375	935.7375	78	891.9375	936.9375
31	890.7625	935.7625	79	891.9625	936.9625
32	890.7875	935.7875	80	891.9875	936.9875
33	890.8125	935.8125	81	892.0125	937.0125
34	890.8375	935.8375	82	892.0375	937.0375
35	890.8625	935.8625	83	892.0625	937.0625
36	890.8875	935.8875	84	892.0875	937.0875
37	890.9125	935.9125	85	892.1125	937.1125
38	890.9375	935.9375	86	892.1375	937.1375
39	890.9625	935.9625	87	892.1625	937.1625
40	890.9875	935.9875	88	892.1875	937.1875
41	891.0125	936.0125	89	892.2125	937.2125
42	891.0375	936.0375	90	892.2375	937.2375
43	891.0625	936.0625	91	892.2625	937.2625
44	891.0875	936.0875	92	892.2875	937.2875
45	891.1125	936.1125	93	892.3125	937.3125
46	891.1375	936.1375	94	892.3375	937.3375
47	891.1625	936.1625	95	892.3625	937.3625

Table C-1 E-TACS Cellular Channel Numbers and Frequencies

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
96	892.3875	937.3875	143	893.5625	938.5625
97	892.4125	937.4125	144	893.5875	938.5875
98	892.4375	937.4375	145	893.6125	938.6125
99	892.4625	937.4625	146	893.6375	938.6375
100	892.4875	937.4875	147	893.6625	938.6625
101	892.5125	937.5125	148	893.6875	938.6875
102	892.5375	937.5375	149	893.7125	938.7125
103	892.5625	937.5625	150	893.7375	938.7375
104	892.5875	937.5875	151	893.7625	938.7625
105	892.6125	937.6125	152	893.7875	938.7875
106	892.6375	937.6375	153	893.8125	938.8125
107	892.6625	937.6625	154	893.8375	938.8375
108	892.6875	937.6875	155	893.8625	938.8625
109	892.7125	937.7125	156	893.8875	938.8875
110	892.7375	937.7375	157	893.9125	938.9125
111	892.7625	937.7625	158	893.9375	938.9375
112	892.7875	937.7875	159	893.9625	938.9625
113	892.8125	937.8125	160	893.9875	938.9875
114	892.8375	937.8375	161	894.0125	939.0125
115	892.8625	937.8625	162	894.0375	939.0375
116	892.8875	937.8875	163	894.0625	939.0625
117	892.9125	937.9125	164	894.0875	939.0875
118	892.9375	937.9375	165	894.1125	939.1125
119	892.9625	937.9625	166	894.1375	939.1375
120	892.9875	937.9875	167	894.1625	939.1625
121	893.0125	938.0125	168	894.1875	939.1875
122	893.0375	938.0375	169	894.2125	939.2125
123	893.0625	938.0625	170	894.2375	939.2375
124	893.0875	938.0875	171	894.2625	939.2625
125	893.1125	938.1125	172	894.2875	939.2875
126	893.1375	938.1375	173	894.3125	939.3125
127	893.1625	938.1625	174	894.3375	939.3375
128	893.1875	938.1875	175	894.3625	939.3625
129	893.2125	938.2125	176	894.3875	939.3875
130	893.2375	938.2375	177	894.4125	939.4125
131	893.2625	938.2625	178	894.4375	939.4375
132	893.2875	938.2875	179	894.4625	939.4625
133	893.3125	938.3125	180	894.4875	939.4875
134	893.3375	938.3375	181	894.5125	939.5125
135	893.3625	938.3625	182	894.5375	939.5375
136	893.3875	938.3875	183	894.5625	939.5625
137	893.4125	938.4125	184	894.5875	939.5875
138	893.4375	938.4375	185	894.6125	939.6125
139	893.4625	938.4625	186	894.6375	939.6375
140	893.4875	938.4875	187	894.6625	939.6625
141	893.5125	938.5125	188	894.6875	939.6875
142	893.5375	938.5375	189	894.7125	939.7125

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
190	894.7375	939.7375	237	895.9125	940.9125
191	894.7625	939.7625	238	895.9375	940.9375
192	894.7875	939.7875	239	895.9625	940.9625
193	894.8125	939.8125	240	895.9875	940.9875
194	894.8375	939.8375	241	896.0125	941.0125
195	894.8625	939.8625	242	896.0375	941.0375
196	894.8875	939.8875	243	896.0625	941.0625
197	894.9125	939.9125	244	896.0875	941.0875
198	894.9375	939.9375	245	896.1125	941.1125
199	894.9625	939.9625	246	896.1375	941.1375
200	894.9875	939.9875	247	896.1625	941.1625
201	895.0125	940.0125	248	896.1875	941.1875
202	895.0375	940.0375	249	896.2125	941.2125
203	895.0625	940.0625	250	896.2375	941.2375
204	895.0875	940.0875	251	896.2625	941.2625
205	895.1125	940.1125	252	896.2875	941.2875
206	895.1375	940.1375	253	896.3125	941.3125
207	895.1625	940.1625	254	896.3375	941.3375
208	895.1875	940.1875	255	896.3625	941.3625
209	895.2125	940.2125	256	896.3875	941.3875
210	895.2375	940.2375	257	896.4125	941.4125
211	895.2625	940.2625	258	896.4375	941.4375
212	895.2875	940.2875	259	896.4625	941.4625
213	895.3125	940.3125	260	896.4875	941.4875
214	895.3375	940.3375	261	896.5125	941.5125
215	895.3625	940.3625	262	896.5375	941.5375
216	895.3875	940.3875	263	896.5625	941.5625
217	895.4125	940.4125	264	896.5875	941.5875
218	895.4375	940.4375	265	896.6125	941.6125
219	895.4625	940.4625	266	896.6375	941.6375
220	895.4875	940.4875	267	896.6625	941.6625
221	895.5125	940.5125	268	896.6875	941.6875
222	895.5375	940.5375	269	896.7125	941.7125
223	895.5625	940.5625	270	896.7375	941.7375
224	895.5875	940.5875	271	896.7625	941.7625
225	895.6125	940.6125	272	896.7875	941.7875
226	895.6375	940.6375	273	896.8125	941.8125
227	895.6625	940.6625	274	896.8375	941.8375
228	895.6875	940.6875	275	896.8625	941.8625
229	895.7125	940.7125	276	896.8875	941.8875
230	895.7375	940.7375	277	896.9125	941.9125
231	895.7625	940.7625	278	896.9375	941.9375
232	895.7875	940.7875	279	896.9625	941.9625
233	895.8125	940.8125	280	896.9875	941.9875
234	895.8375	940.8375	281	897.0125	942.0125
235	895.8625	940.8625	282	897.0375	942.0375
236	895.8875	940.8875	283	897.0625	942.0625

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
284	897.0875	942.0875	331	898.2625	943.2625
285	897.1125	942.1125	332	898.2875	943.2875
286	897.1375	942.1375	333	898.3125	943.3125
287	897.1625	942.1625	334	898.3375	943.3375
288	897.1875	942.1875	335	898.3625	943.3625
289	897.2125	942.2125	336	898.3875	943.3875
290	897.2375	942.2375	337	898.4125	943.4125
291	897.2625	942.2625	338	898.4375	943.4375
292	897.2875	942.2875	339	898.4625	943.4625
293	897.3125	942.3125	340	898.4875	943.4875
294	897.3375	942.3375	341	898.5125	943.5125
295	897.3625	942.3625	342	898.5375	943.5375
296	897.3875	942.3875	343	898.5625	943.5625
297	897.4125	942.4125	344	898.5875	943.5875
298	897.4375	942.4375	345	898.6125	943.6125
299	897.4625	942.4625	346	898.6375	943.6375
300	897.4875	942.4875	347	898.6625	943.6625
301	897.5125	942.5125	348	898.6875	943.6875
302	897.5375	942.5375	349	898.7125	943.7125
303	897.5625	942.5625	350	898.7375	943.7375
304	897.5875	942.5875	351	898.7625	943.7625
305	897.6125	942.6125	352	898.7875	943.7875
306	897.6375	942.6375	353	898.8125	943.8125
307	897.6625	942.6625	354	898.8375	943.8375
308	897.6875	942.6875	355	898.8625	943.8625
309	897.7125	942.7125	356	898.8875	943.8875
310	897.7375	942.7375	357	898.9125	943.9125
311	897.7625	942.7625	358	898.9375	943.9375
312	897.7875	942.7875	359	898.9625	943.9625
313	897.8125	942.8125	360	898.9875	943.9875
314	897.8375	942.8375	361	899.0125	944.0125
315	897.8625	942.8625	362	899.0375	944.0375
316	897.8875	942.8875	363	899.0625	944.0625
317	897.9125	942.9125	364	899.0875	944.0875
318	897.9375	942.9375	365	899.1125	944.1125
319	897.9625	942.9625	366	899.1375	944.1375
320	897.9875	942.9875	367	899.1625	944.1625
321	898.0125	943.0125	368	899.1875	944.1875
322	898.0375	943.0375	369	899.2125	944.2125
323	898.0625	943.0625	370	899.2375	944.2375
324	898.0875	943.0875	371	899.2625	944.2625
325	898.1125	943.1125	372	899.2875	944.2875
326	898.1375	943.1375	373	899.3125	944.3125
327	898.1625	943.1625	374	899.3375	944.3375
328	898.1875	943.1875	375	899.3625	944.3625
329	898.2125	943.2125	376	899.3875	944.3875
330	898.2375	943.2375	377	899.4125	944.4125

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
378	899.4375	944.4375	425	900.6125	945.6125
379	899.4625	944.4625	426	900.6375	945.6375
380	899.4875	944.4875	427	900.6625	945.6625
381	899.5125	944.5125	428	900.6875	945.6875
382	899.5375	944.5375	429	900.7125	945.7125
383	899.5625	944.5625	430	900.7375	945.7375
384	899.5875	944.5875	431	900.7625	945.7625
385	899.6125	944.6125	432	900.7875	945.7875
386	899.6375	944.6375	433	900.8125	945.8125
387	899.6625	944.6625	434	900.8375	945.8375
388	899.6875	944.6875	435	900.8625	945.8625
389	899.7125	944.7125	436	900.8875	945.8875
390	899.7375	944.7375	437	900.9125	945.9125
391	899.7625	944.7625	438	900.9375	945.9375
392	899.7875	944.7875	439	900.9625	945.9625
393	899.8125	944.8125	440	900.9875	945.9875
394	899.8375	944.8375	441	901.0125	946.0125
395	899.8625	944.8625	442	901.0375	946.0375
396	899.8875	944.8875	443	901.0625	946.0625
397	899.9125	944.9125	444	901.0875	946.0875
398	899.9375	944.9375	445	901.1125	946.1125
399	899.9625	944.9625	446	901.1375	946.1375
400	899.9875	944.9875	447	901.1625	946.1625
401	900.0125	945.0125	448	901.1875	946.1875
402	900.0375	945.0375	449	901.2125	946.2125
403	900.0625	945.0625	450	901.2375	946.2375
404	900.0875	945.0875	451	901.2625	946.2625
405	900.1125	945.1125	452	901.2875	946.2875
406	900.1375	945.1375	453	901.3125	946.3125
407	900.1625	945.1625	454	901.3375	946.3375
408	900.1875	945.1875	455	901.3625	946.3625
409	900.2125	945.2125	456	901.3875	946.3875
410	900.2375	945.2375	457	901.4125	946.4125
411	900.2625	945.2625	458	901.4375	946.4375
412	900.2875	945.2875	459	901.4625	946.4625
413	900.3125	945.3125	460	901.4875	946.4875
414	900.3375	945.3375	461	901.5125	946.5125
415	900.3625	945.3625	462	901.5375	946.5375
416	900.3875	945.3875	463	901.5625	946.5625
417	900.4125	945.4125	464	901.5875	946.5875
418	900.4375	945.4375	465	901.6125	946.6125
419	900.4625	945.4625	466	901.6375	946.6375
420	900.4875	945.4875	467	901.6625	946.6625
421	900.5125	945.5125	468	901.6875	946.6875
422	900.5375	945.5375	469	901.7125	946.7125
423	900.5625	945.5625	470	901.7375	946.7375
424	900.5875	945.5875	471	901.7625	946.7625

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
472	901.7875	946.7875	519	902.9625	947.9625
473	901.8125	946.8125	520	902.9875	947.9875
474	901.8375	946.8375	521	903.0125	948.0125
475	901.8625	946.8625	522	903.0375	948.0375
476	901.8875	946.8875	523	903.0625	948.0625
477	901.9125	946.9125	524	903.0875	948.0875
478	901.9375	946.9375	525	903.1125	948.1125
479	901.9625	946.9625	526	903.1375	948.1375
480	901.9875	946.9875	527	903.1625	948.1625
481	902.0125	947.0125	528	903.1875	948.1875
482	902.0375	947.0375	529	903.2125	948.2125
483	902.0625	947.0625	530	903.2375	948.2375
484	902.0875	947.0875	531	903.2625	948.2625
485	902.1125	947.1125	532	903.2875	948.2875
486	902.1375	947.1375	533	903.3125	948.3125
487	902.1625	947.1625	534	903.3375	948.3375
488	902.1875	947.1875	535	903.3625	948.3625
489	902.2125	947.2125	536	903.3875	948.3875
490	902.2375	947.2375	537	903.4125	948.4125
491	902.2625	947.2625	538	903.4375	948.4375
492	902.2875	947.2875	539	903.4625	948.4625
493	902.3125	947.3125	540	903.4875	948.4875
494	902.3375	947.3375	541	903.5125	948.5125
495	902.3625	947.3625	542	903.5375	948.5375
496	902.3875	947.3875	543	903.5625	948.5625
497	902.4125	947.4125	544	903.5875	948.5875
498	902.4375	947.4375	545	903.6125	948.6125
499	902.4625	947.4625	546	903.6375	948.6375
500	902.4875	947.4875	547	903.6625	948.6625
501	902.5125	947.5125	548	903.6875	948.6875
502	902.5375	947.5375	549	903.7125	948.7125
503	902.5625	947.5625	550	903.7375	948.7375
504	902.5875	947.5875	551	903.7625	948.7625
505	902.6125	947.6125	552	903.7875	948.7875
506	902.6375	947.6375	553	903.8125	948.8125
507	902.6625	947.6625	554	903.8375	948.8375
508	902.6875	947.6875	555	903.8625	948.8625
509	902.7125	947.7125	556	903.8875	948.8875
510	902.7375	947.7375	557	903.9125	948.9125
511	902.7625	947.7625	558	903.9375	948.9375
512	902.7875	947.7875	559	903.9625	948.9625
513	902.8125	947.8125	560	903.9875	948.9875
514	902.8375	947.8375	561	904.0125	949.0125
515	902.8625	947.8625	562	904.0375	949.0375
516	902.8875	947.8875	563	904.0625	949.0625
517	902.9125	947.9125	564	904.0875	949.0875
518	902.9375	947.9375	565	904.1125	949.1125

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
566	904.1375	949.1375	613	905.3125	950.3125
567	904.1625	949.1625	614	905.3375	950.3375
568	904.1875	949.1875	615	905.3625	950.3625
569	904.2125	949.2125	616	905.3875	950.3875
570	904.2375	949.2375	617	905.4125	950.4125
571	904.2625	949.2625	618	905.4375	950.4375
572	904.2875	949.2875	619	905.4625	950.4625
573	904.3125	949.3125	620	905.4875	950.4875
574	904.3375	949.3375	621	905.5125	950.5125
575	904.3625	949.3625	622	905.5375	950.5375
576	904.3875	949.3875	623	905.5625	950.5625
577	904.4125	949.4125	624	905.5875	950.5875
578	904.4375	949.4375	625	905.6125	950.6125
579	904.4625	949.4625	626	905.6375	950.6375
580	904.4875	949.4875	627	905.6625	950.6625
581	904.5125	949.5125	628	905.6875	950.6875
582	904.5375	949.5375	629	905.7125	950.7125
583	904.5625	949.5625	630	905.7375	950.7375
584	904.5875	949.5875	631	905.7625	950.7625
585	904.6125	949.6125	632	905.7875	950.7875
586	904.6375	949.6375	633	905.8125	950.8125
587	904.6625	949.6625	634	905.8375	950.8375
588	904.6875	949.6875	635	905.8625	950.8625
589	904.7125	949.7125	636	905.8875	950.8875
590	904.7375	949.7375	637	905.9125	950.9125
591	904.7625	949.7625	638	905.9375	950.9375
592	904.7875	949.7875	639	905.9625	950.9625
593	904.8125	949.8125	640	905.9875	950.9875
594	904.8375	949.8375	641	906.0125	951.0125
595	904.8625	949.8625	642	906.0375	951.0375
596	904.8875	949.8875	643	906.0625	951.0625
597	904.9125	949.9125	644	906.0875	951.0875
598	904.9375	949.9375	645	906.1125	951.1125
599	904.9625	949.9625	646	906.1375	951.1375
600	904.9875	949.9875	647	906.1625	951.1625
601	905.0125	950.0125	648	906.1875	951.1875
602	905.0375	950.0375	649	906.2125	951.2125
603	905.0625	950.0625	650	906.2375	951.2375
604	905.0875	950.0875	651	906.2625	951.2625
605	905.1125	950.1125	652	906.2875	951.2875
606	905.1375	950.1375	653	906.3125	951.3125
607	905.1625	950.1625	654	906.3375	951.3375
608	905.1875	950.1875	655	906.3625	951.3625
609	905.2125	950.2125	656	906.3875	951.3875
610	905.2375	950.2375	657	906.4125	951.4125
611	905.2625	950.2625	658	906.4375	951.4375
612	905.2875	950.2875	659	906.4625	951.4625

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
660	906.4875	951.4875	707	907.6625	952.6625
661	906.5125	951.5125	708	907.6875	952.6875
662	906.5375	951.5375	709	907.7125	952.7125
663	906.5625	951.5625	710	907.7375	952.7375
664	906.5875	951.5875	711	907.7625	952.7625
665	906.6125	951.6125	712	907.7875	952.7875
666	906.6375	951.6375	713	907.8125	952.8125
667	906.6625	951.6625	714	907.8375	952.8375
668	906.6875	951.6875	715	907.8625	952.8625
669	906.7125	951.7125	716	907.8875	952.8875
670	906.7375	951.7375	717	907.9125	952.9125
671	906.7625	951.7625	718	907.9375	952.9375
672	906.7875	951.7875	719	907.9625	952.9625
673	906.8125	951.8125	720	907.9875	952.9875
674	906.8375	951.8375	721	908.0125	953.0125
675	906.8625	951.8625	722	908.0375	953.0375
676	906.8875	951.8875	723	908.0625	953.0625
677	906.9125	951.9125	724	908.0875	953.0875
678	906.9375	951.9375	725	908.1125	953.1125
679	906.9625	951.9625	726	908.1375	953.1375
680	906.9875	951.9875	727	908.1625	953.1625
681	907.0125	952.0125	728	908.1875	953.1875
682	907.0375	952.0375	729	908.2125	953.2125
683	907.0625	952.0625	730	908.2375	953.2375
684	907.0875	952.0875	731	908.2625	953.2625
685	907.1125	952.1125	732	908.2875	953.2875
686	907.1375	952.1375	733	908.3125	953.3125
687	907.1625	952.1625	734	908.3375	953.3375
688	907.1875	952.1875	735	908.3625	953.3625
689	907.2125	952.2125	736	908.3875	953.3875
690	907.2375	952.2375	737	908.4125	953.4125
691	907.2625	952.2625	738	908.4375	953.4375
692	907.2875	952.2875	739	908.4625	953.4625
693	907.3125	952.3125	740	908.4875	953.4875
694	907.3375	952.3375	741	908.5125	953.5125
695	907.3625	952.3625	742	908.5375	953.5375
696	907.3875	952.3875	743	908.5625	953.5625
697	907.4125	952.4125	744	908.5875	953.5875
698	907.4375	952.4375	745	908.6125	953.6125
699	907.4625	952.4625	746	908.6375	953.6375
700	907.4875	952.4875	747	908.6625	953.6625
701	907.5125	952.5125	748	908.6875	953.6875
702	907.5375	952.5375	749	908.7125	953.7125
703	907.5625	952.5625	750	908.7375	953.7375
704	907.5875	952.5875	751	908.7625	953.7625
705	907.6125	952.6125	752	908.7875	953.7875
706	907.6375	952.6375	753	908.8125	953.8125

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)



Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
754	908.8375	953.8375	801	910.0125	955.0125
755	908.8625	953.8625	802	910.0375	955.0375
756	908.8875	953.8875	803	910.0625	955.0625
757	908.9125	953.9125	804	910.0875	955.0875
758	908.9375	953.9375	805	910.1125	955.1125
759	908.9625	953.9625	806	910.1375	955.1375
760	908.9875	953.9875	807	910.1625	955.1625
761	909.0125	954.0125	808	910.1875	955.1875
762	909.0375	954.0375	809	910.2125	955.2125
763	909.0625	954.0625	810	910.2375	955.2375
764	909.0875	954.0875	811	910.2625	955.2625
765	909.1125	954.1125	812	910.2875	955.2875
766	909.1375	954.1375	813	910.3125	955.3125
767	909.1625	954.1625	814	910.3375	955.3375
768	909.1875	954.1875	815	910.3625	955.3625
769	909.2125	954.2125	816	910.3875	955.3875
770	909.2375	954.2375	817	910.4125	955.4125
771	909.2625	954.2625	818	910.4375	955.4375
772	909.2875	954.2875	819	910.4625	955.4625
773	909.3125	954.3125	820	910.4875	955.4875
774	909.3375	954.3375	821	910.5125	955.5125
775	909.3625	954.3625	822	910.5375	955.5375
776	909.3875	954.3875	823	910.5625	955.5625
777	909.4125	954.4125	824	910.5875	955.5875
778	909.4375	954.4375	825	910.6125	955.6125
779	909.4625	954.4625	826	910.6375	955.6375
780	909.4875	954.4875	827	910.6625	955.6625
781	909.5125	954.5125	828	910.6875	955.6875
782	909.5375	954.5375	829	910.7125	955.7125
783	909.5625	954.5625	830	910.7375	955.7375
784	909.5875	954.5875	831	910.7625	955.7625
785	909.6125	954.6125	832	910.7875	955.7875
786	909.6375	954.6375	833	910.8125	955.8125
787	909.6625	954.6625	834	910.8375	955.8375
788	909.6875	954.6875	835	910.8625	955.8625
789	909.7125	954.7125	836	910.8875	955.8875
790	909.7375	954.7375	837	910.9125	955.9125
791	909.7625	954.7625	838	910.9375	955.9375
792	909.7875	954.7875	839	910.9625	955.9625
793	909.8125	954.8125	840	910.9875	955.9875
794	909.8375	954.8375	841	911.0125	956.0125
795	909.8625	954.8625	842	911.0375	956.0375
796	909.8875	954.8875	843	911.0625	956.0625
797	909.9125	954.9125	844	911.0875	956.0875
798	909.9375	954.9375	845	911.1125	956.1125
799	909.9625	954.9625	846	911.1375	956.1375
800	909.9875	954.9875	847	911.1625	956.1625

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
848	911.1875	956.1875	895	912.3625	957.3625
849	911.2125	956.2125	896	912.3875	957.3875
850	911.2375	956.2375	897	912.4125	957.4125
851	911.2625	956.2625	898	912.4375	957.4375
852	911.2875	956.2875	899	912.4625	957.4625
853	911.3125	956.3125	900	912.4875	957.4875
854	911.3375	956.3375	901	912.5125	957.5125
855	911.3625	956.3625	902	912.5375	957.5375
856	911.3875	956.3875	903	912.5625	957.5625
857	911.4125	956.4125	904	912.5875	957.5875
858	911.4375	956.4375	905	912.6125	957.6125
859	911.4625	956.4625	906	912.6375	957.6375
860	911.4875	956.4875	907	912.6625	957.6625
861	911.5125	956.5125	908	912.6875	957.6875
862	911.5375	956.5375	909	912.7125	957.7125
863	911.5625	956.5625	910	912.7375	957.7375
864	911.5875	956.5875	911	912.7625	957.7625
865	911.6125	956.6125	912	912.7875	957.7875
866	911.6375	956.6375	913	912.8125	957.8125
867	911.6625	956.6625	914	912.8375	957.8375
868	911.6875	956.6875	915	912.8625	957.8625
869	911.7125	956.7125	916	912.8875	957.8875
870	911.7375	956.7375	917	912.9125	957.9125
871	911.7625	956.7625	918	912.9375	957.9375
872	911.7875	956.7875	919	912.9625	957.9625
873	911.8125	956.8125	920	912.9875	957.9875
874	911.8375	956.8375	921	913.0125	958.0125
875	911.8625	956.8625	922	913.0375	958.0375
876	911.8875	956.8875	923	913.0625	958.0625
877	911.9125	956.9125	924	913.0875	958.0875
878	911.9375	956.9375	925	913.1125	958.1125
879	911.9625	956.9625	926	913.1375	958.1375
880	911.9875	956.9875	927	913.1625	958.1625
881	912.0125	957.0125	928	913.1875	958.1875
882	912.0375	957.0375	929	913.2125	958.2125
883	912.0625	957.0625	930	913.2375	958.2375
884	912.0875	957.0875	931	913.2625	958.2625
885	912.1125	957.1125	932	913.2875	958.2875
886	912.1375	957.1375	933	913.3125	958.3125
887	912.1625	957.1625	934	913.3375	958.3375
888	912.1875	957.1875	935	913.3625	958.3625
889	912.2125	957.2125	936	913.3875	958.3875
890	912.2375	957.2375	937	913.4125	958.4125
891	912.2625	957.2625	938	913.4375	958.4375
892	912.2875	957.2875	939	913.4625	958.4625
893	912.3125	957.3125	940	913.4875	958.4875
894	912.3375	957.3375	941	913.5125	958.5125

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
942	913.5375	958.5375	989	914.7125	959.7125
943	913.5625	958.5625	990	914.7375	959.7375
944	913.5875	958.5875	991	914.7625	959.7625
945	913.6125	958.6125	992	914.7875	959.7875
946	913.6375	958.6375	993	914.8125	959.8125
947	913.6625	958.6625	994	914.8375	959.8375
948	913.6875	958.6875	995	914.8625	959.8625
949	913.7125	958.7125	996	914.8875	959.8875
950	913.7375	958.7375	997	914.9125	959.9125
951	913.7625	958.7625	998	914.9375	959.9375
952	913.7875	958.7875	999	914.9625	959.9625
953	913.8125	958.8125	1000	914.9875	959.9875
954	913.8375	958.8375	1329	872.0125	917.0125
955	913.8625	958.8625	1330	872.0375	917.0375
956	913.8875	958.8875	1331	872.0625	917.0625
957	913.9125	958.9125	1332	872.0875	917.0875
958	913.9375	958.9375	1333	872.1125	917.1125
959	913.9625	958.9625	1334	872.1375	917.1375
960	913.9875	958.9875	1335	872.1625	917.1625
961	914.0125	959.0125	1336	872.1875	917.1875
962	914.0375	959.0375	1337	872.2125	917.2125
963	914.0625	959.0625	1338	872.2375	917.2375
964	914.0875	959.0875	1339	872.2625	917.2625
965	914.1125	959.1125	1340	872.2875	917.2875
966	914.1375	959.1375	1341	872.3125	917.3125
967	914.1625	959.1625	1342	872.3375	917.3375
968	914.1875	959.1875	1343	872.3625	917.3625
969	914.2125	959.2125	1344	872.3875	917.3875
970	914.2375	959.2375	1345	872.4125	917.4125
971	914.2625	959.2625	1346	872.4375	917.4375
972	914.2875	959.2875	1347	872.4625	917.4625
973	914.3125	959.3125	1348	872.4875	917.4875
974	914.3375	959.3375	1349	872.5125	917.5125
975	914.3625	959.3625	1350	872.5375	917.5375
976	914.3875	959.3875	1351	872.5625	917.5625
977	914.4125	959.4125	1352	872.5875	917.5875
978	914.4375	959.4375	1353	872.6125	917.6125
979	914.4625	959.4625	1354	872.6375	917.6375
980	914.4875	959.4875	1355	872.6625	917.6625
981	914.5125	959.5125	1356	872.6875	917.6875
982	914.5375	959.5375	1357	872.7125	917.7125
983	914.5625	959.5625	1358	872.7375	917.7375
984	914.5875	959.5875	1359	872.7625	917.7625
985	914.6125	959.6125	1360	872.7875	917.7875
986	914.6375	959.6375	1361	872.8125	917.8125
987	914.6625	959.6625	1362	872.8375	917.8375
988	914.6875	959.6875	1363	872.8625	917.8625

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
1364	872.8875	917.8875	1411	874.0625	919.0625
1365	872.9125	917.9125	1412	874.0875	919.0875
1366	872.9375	917.9375	1413	874.1125	919.1125
1367	872.9625	917.9625	1414	874.1375	919.1375
1368	872.9875	917.9875	1415	874.1625	919.1625
1369	873.0125	918.0125	1416	874.1875	919.1875
1370	873.0375	918.0375	1417	874.2125	919.2125
1371	873.0625	918.0625	1418	874.2375	919.2375
1372	873.0875	918.0875	1419	874.2625	919.2625
1373	873.1125	918.1125	1420	874.2875	919.2875
1374	873.1375	918.1375	1421	874.3125	919.3125
1375	873.1625	918.1625	1422	874.3375	919.3375
1376	873.1875	918.1875	1423	874.3625	919.3625
1377	873.2125	918.2125	1424	874.3875	919.3875
1378	873.2375	918.2375	1425	874.4125	919.4125
1379	873.2625	918.2625	1426	874.4375	919.4375
1380	873.2875	918.2875	1427	874.4625	919.4625
1381	873.3125	918.3125	1428	874.4875	919.4875
1382	873.3375	918.3375	1429	874.5125	919.5125
1383	873.3625	918.3625	1430	874.5375	919.5375
1384	873.3875	918.3875	1431	874.5625	919.5625
1385	873.4125	918.4125	1432	874.5875	919.5875
1386	873.4375	918.4375	1433	874.6125	919.6125
1387	873.4625	918.4625	1434	874.6375	919.6375
1388	873.4875	918.4875	1435	874.6625	919.6625
1389	873.5125	918.5125	1436	874.6875	919.6875
1390	873.5375	918.5375	1437	874.7125	919.7125
1391	873.5625	918.5625	1438	874.7375	919.7375
1392	873.5875	918.5875	1439	874.7625	919.7625
1393	873.6125	918.6125	1440	874.7875	919.7875
1394	873.6375	918.6375	1441	874.8125	919.8125
1395	873.6625	918.6625	1442	874.8375	919.8375
1396	873.6875	918.6875	1443	874.8625	919.8625
1397	873.7125	918.7125	1444	874.8875	919.8875
1398	873.7375	918.7375	1445	874.9125	919.9125
1399	873.7625	918.7625	1446	874.9375	919.9375
1400	873.7875	918.7875	1447	874.9625	919.9625
1401	873.8125	918.8125	1448	874.9875	919.9875
1402	873.8375	918.8375	1449	875.0125	920.0125
1403	873.8625	918.8625	1450	875.0375	920.0375
1404	873.8875	918.8875	1451	875.0625	920.0625
1405	873.9125	918.9125	1452	875.0875	920.0875
1406	873.9375	918.9375	1453	875.1125	920.1125
1407	873.9625	918.9625	1454	875.1375	920.1375
1408	873.9875	918.9875	1455	875.1625	920.1625
1409	874.0125	919.0125	1456	875.1875	920.1875
1410	874.0375	919.0375	1457	875.2125	920.2125

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
1458	875.2375	920.2375	1505	876.4125	921.4125
1459	875.2625	920.2625	1506	876.4375	921.4375
1460	875.2875	920.2875	1507	876.4625	921.4625
1461	875.3125	920.3125	1508	876.4875	921.4875
1462	875.3375	920.3375	1509	876.5125	921.5125
1463	875.3625	920.3625	1510	876.5375	921.5375
1464	875.3875	920.3875	1511	876.5625	921.5625
1465	875.4125	920.4125	1512	876.5875	921.5875
1466	875.4375	920.4375	1513	876.6125	921.6125
1467	875.4625	920.4625	1514	876.6375	921.6375
1468	875.4875	920.4875	1515	876.6625	921.6625
1469	875.5125	920.5125	1516	876.6875	921.6875
1470	875.5375	920.5375	1517	876.7125	921.7125
1471	875.5625	920.5625	1518	876.7375	921.7375
1472	875.5875	920.5875	1519	876.7625	921.7625
1473	875.6125	920.6125	1520	876.7875	921.7875
1474	875.6375	920.6375	1521	876.8125	921.8125
1475	875.6625	920.6625	1522	876.8375	921.8375
1476	875.6875	920.6875	1523	876.8625	921.8625
1477	875.7125	920.7125	1524	876.8875	921.8875
1478	875.7375	920.7375	1525	876.9125	921.9125
1479	875.7625	920.7625	1526	876.9375	921.9375
1480	875.7875	920.7875	1527	876.9625	921.9625
1481	875.8125	920.8125	1528	876.9875	921.9875
1482	875.8375	920.8375	1529	877.0125	922.0125
1483	875.8625	920.8625	1530	877.0375	922.0375
1484	875.8875	920.8875	1531	877.0625	922.0625
1485	875.9125	920.9125	1532	877.0875	922.0875
1486	875.9375	920.9375	1533	877.1125	922.1125
1487	875.9625	920.9625	1534	877.1375	922.1375
1488	875.9875	920.9875	1535	877.1625	922.1625
1489	876.0125	921.0125	1536	877.1875	922.1875
1490	876.0375	921.0375	1537	877.2125	922.2125
1491	876.0625	921.0625	1538	877.2375	922.2375
1492	876.0875	921.0875	1539	877.2625	922.2625
1493	876.1125	921.1125	1540	877.2875	922.2875
1494	876.1375	921.1375	1541	877.3125	922.3125
1495	876.1625	921.1625	1542	877.3375	922.3375
1496	876.1875	921.1875	1543	877.3625	922.3625
1497	876.2125	921.2125	1544	877.3875	922.3875
1498	876.2375	921.2375	1545	877.4125	922.4125
1499	876.2625	921.2625	1546	877.4375	922.4375
1500	876.2875	921.2875	1547	877.4625	922.4625
1501	876.3125	921.3125	1548	877.4875	922.4875
1502	876.3375	921.3375	1549	877.5125	922.5125
1503	876.3625	921.3625	1550	877.5375	922.5375
1504	876.3875	921.3875	1551	877.5625	922.5625

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
1552	877.5875	922.5875	1599	878.7625	923.7625
1553	877.6125	922.6125	1600	878.7875	923.7875
1554	877.6375	922.6375	1601	878.8125	923.8125
1555	877.6625	922.6625	1602	878.8375	923.8375
1556	877.6875	922.6875	1603	878.8625	923.8625
1557	877.7125	922.7125	1604	878.8875	923.8875
1558	877.7375	922.7375	1605	878.9125	923.9125
1559	877.7625	922.7625	1606	878.9375	923.9375
1560	877.7875	922.7875	1607	878.9625	923.9625
1561	877.8125	922.8125	1608	878.9875	923.9875
1562	877.8375	922.8375	1609	879.0125	924.0125
1563	877.8625	922.8625	1610	879.0375	924.0375
1564	877.8875	922.8875	1611	879.0625	924.0625
1565	877.9125	922.9125	1612	879.0875	924.0875
1566	877.9375	922.9375	1613	879.1125	924.1125
1567	877.9625	922.9625	1614	879.1375	924.1375
1568	877.9875	922.9875	1615	879.1625	924.1625
1569	878.0125	923.0125	1616	879.1875	924.1875
1570	878.0375	923.0375	1617	879.2125	924.2125
1571	878.0625	923.0625	1618	879.2375	924.2375
1572	878.0875	923.0875	1619	879.2625	924.2625
1573	878.1125	923.1125	1620	879.2875	924.2875
1574	878.1375	923.1375	1621	879.3125	924.3125
1575	878.1625	923.1625	1622	879.3375	924.3375
1576	878.1875	923.1875	1623	879.3625	924.3625
1577	878.2125	923.2125	1624	879.3875	924.3875
1578	878.2375	923.2375	1625	879.4125	924.4125
1579	878.2625	923.2625	1626	879.4375	924.4375
1580	878.2875	923.2875	1627	879.4625	924.4625
1581	878.3125	923.3125	1628	879.4875	924.4875
1582	878.3375	923.3375	1629	879.5125	924.5125
1583	878.3625	923.3625	1630	879.5375	924.5375
1584	878.3875	923.3875	1631	879.5625	924.5625
1585	878.4125	923.4125	1632	879.5875	924.5875
1586	878.4375	923.4375	1633	879.6125	924.6125
1587	878.4625	923.4625	1634	879.6375	924.6375
1588	878.4875	923.4875	1635	879.6625	924.6625
1589	878.5125	923.5125	1636	879.6875	924.6875
1590	878.5375	923.5375	1637	879.7125	924.7125
1591	878.5625	923.5625	1638	879.7375	924.7375
1592	878.5875	923.5875	1639	879.7625	924.7625
1593	878.6125	923.6125	1640	879.7875	924.7875
1594	878.6375	923.6375	1641	879.8125	924.8125
1595	878.6625	923.6625	1642	879.8375	924.8375
1596	878.6875	923.6875	1643	879.8625	924.8625
1597	878.7125	923.7125	1644	879.8875	924.8875
1598	878.7375	923.7375	1645	879.9125	924.9125

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
1646	879.9375	924.9375	1693	881.1125	926.1125
1647	879.9625	924.9625	1694	881.1375	926.1375
1648	879.9875	924.9875	1695	881.1625	926.1625
1649	880.0125	925.0125	1696	881.1875	926.1875
1650	880.0375	925.0375	1697	881.2125	926.2125
1651	880.0625	925.0625	1698	881.2375	926.2375
1652	880.0875	925.0875	1699	881.2625	926.2625
1653	880.1125	925.1125	1700	881.2875	926.2875
1654	880.1375	925.1375	1701	881.3125	926.3125
1655	880.1625	925.1625	1702	881.3375	926.3375
1656	880.1875	925.1875	1703	881.3625	926.3625
1657	880.2125	925.2125	1704	881.3875	926.3875
1658	880.2375	925.2375	1705	881.4125	926.4125
1659	880.2625	925.2625	1706	881.4375	926.4375
1660	880.2875	925.2875	1707	881.4625	926.4625
1661	880.3125	925.3125	1708	881.4875	926.4875
1662	880.3375	925.3375	1709	881.5125	926.5125
1663	880.3625	925.3625	1710	881.5375	926.5375
1664	880.3875	925.3875	1711	881.5625	926.5625
1665	880.4125	925.4125	1712	881.5875	926.5875
1666	880.4375	925.4375	1713	881.6125	926.6125
1667	880.4625	925.4625	1714	881.6375	926.6375
1668	880.4875	925.4875	1715	881.6625	926.6625
1669	880.5125	925.5125	1716	881.6875	926.6875
1670	880.5375	925.5375	1717	881.7125	926.7125
1671	880.5625	925.5625	1718	881.7375	926.7375
1672	880.5875	925.5875	1719	881.7625	926.7625
1673	880.6125	925.6125	1720	881.7875	926.7875
1674	880.6375	925.6375	1721	881.8125	926.8125
1675	880.6625	925.6625	1722	881.8375	926.8375
1676	880.6875	925.6875	1723	881.8625	926.8625
1677	880.7125	925.7125	1724	881.8875	926.8875
1678	880.7375	925.7375	1725	881.9125	926.9125
1679	880.7625	925.7625	1726	881.9375	926.9375
1680	880.7875	925.7875	1727	881.9625	926.9625
1681	880.8125	925.8125	1728	881.9875	926.9875
1682	880.8375	925.8375	1729	882.0125	927.0125
1683	880.8625	925.8625	1730	882.0375	927.0375
1684	880.8875	925.8875	1731	882.0625	927.0625
1685	880.9125	925.9125	1732	882.0875	927.0875
1686	880.9375	925.9375	1733	882.1125	927.1125
1687	880.9625	925.9625	1734	882.1375	927.1375
1688	880.9875	925.9875	1735	882.1625	927.1625
1689	881.0125	926.0125	1736	882.1875	927.1875
1690	881.0375	926.0375	1737	882.2125	927.2125
1691	881.0625	926.0625	1738	882.2375	927.2375
1692	881.0875	926.0875	1739	882.2625	927.2625

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
1740	882.2875	927.2875	1787	883.4625	928.4625
1741	882.3125	927.3125	1788	883.4875	928.4875
1742	882.3375	927.3375	1789	883.5125	928.5125
1743	882.3625	927.3625	1790	883.5375	928.5375
1744	882.3875	927.3875	1791	883.5625	928.5625
1745	882.4125	927.4125	1792	883.5875	928.5875
1746	882.4375	927.4375	1793	883.6125	928.6125
1747	882.4625	927.4625	1794	883.6375	928.6375
1748	882.4875	927.4875	1795	883.6625	928.6625
1749	882.5125	927.5125	1796	883.6875	928.6875
1750	882.5375	927.5375	1797	883.7125	928.7125
1751	882.5625	927.5625	1798	883.7375	928.7375
1752	882.5875	927.5875	1799	883.7625	928.7625
1753	882.6125	927.6125	1800	883.7875	928.7875
1754	882.6375	927.6375	1801	883.8125	928.8125
1755	882.6625	927.6625	1802	883.8375	928.8375
1756	882.6875	927.6875	1803	883.8625	928.8625
1757	882.7125	927.7125	1804	883.8875	928.8875
1758	882.7375	927.7375	1805	883.9125	928.9125
1759	882.7625	927.7625	1806	883.9375	928.9375
1760	882.7875	927.7875	1807	883.9625	928.9625
1761	882.8125	927.8125	1808	883.9875	928.9875
1762	882.8375	927.8375	1809	884.0125	929.0125
1763	882.8625	927.8625	1810	884.0375	929.0375
1764	882.8875	927.8875	1811	884.0625	929.0625
1765	882.9125	927.9125	1812	884.0875	929.0875
1766	882.9375	927.9375	1813	884.1125	929.1125
1767	882.9625	927.9625	1814	884.1375	929.1375
1768	882.9875	927.9875	1815	884.1625	929.1625
1769	883.0125	928.0125	1816	884.1875	929.1875
1770	883.0375	928.0375	1817	884.2125	929.2125
1771	883.0625	928.0625	1818	884.2375	929.2375
1772	883.0875	928.0875	1819	884.2625	929.2625
1773	883.1125	928.1125	1820	884.2875	929.2875
1774	883.1375	928.1375	1821	884.3125	929.3125
1775	883.1625	928.1625	1822	884.3375	929.3375
1776	883.1875	928.1875	1823	884.3625	929.3625
1777	883.2125	928.2125	1824	884.3875	929.3875
1778	883.2375	928.2375	1825	884.4125	929.4125
1779	883.2625	928.2625	1826	884.4375	929.4375
1780	883.2875	928.2875	1827	884.4625	929.4625
1781	883.3125	928.3125	1828	884.4875	929.4875
1782	883.3375	928.3375	1829	884.5125	929.5125
1783	883.3625	928.3625	1830	884.5375	929.5375
1784	883.3875	928.3875	1831	884.5625	929.5625
1785	883.4125	928.4125	1832	884.5875	929.5875
1786	883.4375	928.4375	1833	884.6125	929.6125

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)



Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
1834	884.6375	929.6375	1881	885.8125	930.8125
1835	884.6625	929.6625	1882	885.8375	930.8375
1836	884.6875	929.6875	1883	885.8625	930.8625
1837	884.7125	929.7125	1884	885.8875	930.8875
1838	884.7375	929.7375	1885	885.9125	930.9125
1839	884.7625	929.7625	1886	885.9375	930.9375
1840	884.7875	929.7875	1887	885.9625	930.9625
1841	884.8125	929.8125	1888	885.9875	930.9875
1842	884.8375	929.8375	1889	886.0125	931.0125
1843	884.8625	929.8625	1890	886.0375	931.0375
1844	884.8875	929.8875	1891	886.0625	931.0625
1845	884.9125	929.9125	1892	886.0875	931.0875
1846	884.9375	929.9375	1893	886.1125	931.1125
1847	884.9625	929.9625	1894	886.1875	931.1875
1848	884.9875	929.9875	1895	886.1625	931.1625
1849	885.0125	930.0125	1896	886.1875	931.1875
1850	885.0375	930.0375	1897	886.2125	931.2125
1851	885.0625	930.0625	1898	886.2375	931.2375
1852	885.0875	930.0875	1899	886.2625	931.2625
1853	885.1125	930.1125	1900	886.2875	931.2875
1854	885.1875	930.1875	1901	886.3125	931.3125
1855	885.1625	930.1625	1902	886.3375	931.3375
1856	885.1875	930.1875	1903	886.3625	931.3625
1857	885.2125	930.2125	1904	886.3875	931.3875
1858	885.2375	930.2375	1905	886.4125	931.4125
1859	885.2625	930.2625	1906	886.4375	931.4375
1860	885.2875	930.2875	1907	886.4625	931.4625
1861	885.3125	930.3125	1908	886.4875	931.4875
1862	885.3375	930.3375	1909	886.5125	931.5125
1863	885.3625	930.3625	1910	886.5375	931.5375
1864	885.3875	930.3875	1911	886.5625	931.5625
1865	885.4125	930.4125	1912	886.5875	931.5875
1866	885.4375	930.4375	1913	886.6125	931.6125
1867	885.4625	930.4625	1914	886.6375	931.6375
1868	885.4875	930.4875	1915	886.6625	931.6625
1869	885.5125	930.5125	1916	886.6875	931.6875
1870	885.5375	930.5375	1917	886.7125	931.7125
1871	885.5625	930.5625	1918	886.7375	931.7375
1872	885.5875	930.5875	1919	886.7625	931.7625
1873	885.6125	930.6125	1920	886.7875	931.7875
1874	885.6375	930.6375	1921	886.8125	931.8125
1875	885.6625	930.6625	1922	886.8375	931.8375
1876	885.6875	930.6875	1923	886.8625	931.8625
1877	885.7125	930.7125	1924	886.8875	931.8875
1878	885.7375	930.7375	1925	886.9125	931.9125
1879	885.7625	930.7625	1926	886.9375	931.9375
1880	885.7875	930.7875	1927	886.9625	931.9625

Table C-1 E-TACS Cellular Channel Numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
1928	886.9875	931.9875	1976	888.1975	933.1975
1929	887.0125	932.0125	1977	888.2125	933.2125
1930	887.0375	932.0375	1978	888.2375	933.2375
1931	887.0625	932.0625	1979	888.2625	933.2625
1932	887.0875	932.0875	1980	888.2875	933.2875
1933	887.1125	932.1125	1981	888.3125	933.3125
1934	887.1975	932.1975	1982	888.3375	933.3375
1935	887.1625	932.1625	1983	888.3625	933.3625
1936	887.1975	932.1975	1984	888.3875	933.3875
1937	887.2125	932.2125	1985	888.4125	933.4125
1938	887.2375	932.2375	1986	888.4375	933.4375
1939	887.2625	932.2625	1987	888.4625	933.4625
1940	887.2875	932.2875	1988	888.4875	933.4875
1941	887.3125	932.3125	1989	888.5125	933.5125
1942	887.3375	932.3375	1990	888.5375	933.5375
1943	887.3625	932.3625	1991	888.5625	933.5625
1944	887.3875	932.3875	1992	888.5875	933.5875
1945	887.4125	932.4125	1993	888.6125	933.6125
1946	887.4375	932.4375	1994	888.6375	933.6375
1947	887.4625	932.4625	1995	888.6625	933.6625
1948	887.4875	932.4875	1996	888.6875	933.6875
1949	887.5125	932.5125	1997	888.7125	933.7125
1950	887.5375	932.5375	1998	888.7375	933.7375
1951	887.5625	932.5625	1999	888.7625	933.7625
1952	887.5875	932.5875	2000	888.7875	933.7875
1953	887.6125	932.6125	2001	888.8125	933.8125
1954	887.6375	932.6375	2002	888.8375	933.8375
1955	887.6625	932.6625	2003	888.8625	933.8625
1956	887.6875	932.6875	2004	888.8875	933.8875
1957	887.7125	932.7125	2005	888.9125	933.9125
1958	887.7375	932.7375	2006	888.9375	933.9375
1959	887.7625	932.7625	2007	888.9625	933.9625
1960	887.7875	932.7875	2008	888.9875	933.9875
1961	887.8125	932.8125	2009	889.0125	934.0125
1962	887.8375	932.8375	2010	889.0375	934.0375
1963	887.8625	932.8625	2011	889.0625	934.0625
1964	887.8875	932.8875	2012	889.0875	934.0875
1965	887.9125	932.9125	2013	889.1125	934.1125
1966	887.9375	932.9375	2014	889.2075	934.2075
1967	887.9625	932.9625	2015	889.1625	934.1625
1968	887.9875	932.9875	2016	889.2075	934.2075
1969	888.0125	933.0125	2017	889.2125	934.2125
1970	888.0375	933.0375	2018	889.2375	934.2375
1971	888.0625	933.0625	2019	889.2625	934.2625
1972	888.0875	933.0875	2020	889.2875	934.2875
1973	888.1125	933.1125	2021	889.3125	934.3125
1974	888.1975	933.1975	2022	889.3375	934.3375
1975	888.1625	933.1625	2023	889.3625	934.3625

Table C-1 E-TACS Cellular Channel numbers and Frequencies (Cont)

Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)	Channel Number	Mobile Transmit (MHz)	Mobile Receive (MHz)
2024	889.3875	934.3875	2036	889.6875	934.6875
2025	889.4125	934.4125	2037	889.7125	934.7125
2026	889.4375	934.4375	2038	889.7375	934.7375
2027	889.4625	934.4625	2039	889.7625	934.7625
2028	889.4875	934.4875	2040	889.7875	934.7875
2029	889.5125	934.5125	2041	889.8125	934.8125
2030	889.5375	934.5375	2042	889.8375	934.8375
2031	889.5625	934.5625	2043	889.8625	934.8625
2032	889.5875	934.5875	2044	889.8875	934.8875
2033	889.6125	934.6125	2045	889.9125	934.9125
2034	889.6375	934.6375	2046	889.9375	934.9375
2035	889.6625	934.6625	2047	889.9625	934.9625

Table C-1 E-Tacs Cellular Channel Numbers and Frequencies (Cont)



## APPENDIX D - ABBREVIATIONS

### A

A	Ampere
ac	Alternating Current
AF	Audio Frequency
AGC	Automatic Gain Control
AM	Amplitude Modulation
amp	Ampere
ANLZ	Analyzer
ANSI	American National Standards Institute
ANT	Antenna
ASCII	American National Standard Code for Information Interchange
Auto	Automatic
AUX	Auxiliary

### B

BFO	Beat Frequency Oscillation
BER	Bit Error Rate

### C

ccw	Counterclockwise
Cont	Continued
CRT	Cathode Ray Tube
CW	Continuous Wave
C Wt	C Weight

### D

DCS	Digital Coded Squelch
dB	Decibels
dBm	Decibels relative to milliwatts

### D

dc	Direct Current
Demod Audio	Demodulated Audio
Dev	Deviation
Dist	Distortion
div	Division(s)
DMM	Digital Multimeter
DPLX	Duplex
DTMF	Dual Tone Modulated Frequency

### E

ESC	Escape
ESD	Electrostatic discharge
EXT Mod	External Source Modulation

### F

Fig	Figure
FM	Frequency Modulation
freq	Frequency
Func Gen	Function Generator

### G

G-Scan	RF Generator Scan
Gen	Generator
GND	Ground
GPIB	General Purpose Interface Bus

### H

Hz	Hertz
Hex	Hexidecimal
Horiz	Horizonal

<b>I</b>		<b>R</b>	
<b>Id</b>	<b>Identification</b>	<b>Ref</b>	<b>Reference</b>
<b>IF</b>	<b>Intermediate Frequency</b>	<b>RF</b>	<b>Radio Frequency</b>
<b>IEEE</b>	<b>Institute of Electrical and Electronic Engineers</b>	<b>RF Pwr Lvl</b>	<b>RF Power Level</b>
	<b>K</b>	<b>R freq</b>	<b>Receiver Frequency</b>
<b>KHz</b>	<b>Kilohertz (1000 Hertz)</b>	<b>RMS</b>	<b>Root Mean Square</b>
	<b>L</b>	<b>Rx</b>	<b>Duplex Receiver (Transmitting) Frequency</b>
<b>LSB</b>	<b>Single Sideband Lower</b>		<b>S</b>
<b>lvl</b>	<b>Level</b>	<b>sec</b>	<b>Second</b>
	<b>M</b>	<b>SSB</b>	<b>Single Side Band</b>
<b>MHz</b>	<b>Megahertz (1000000 Hertz)</b>		<b>T</b>
<b>MIC</b>	<b>Microphone Source</b>	<b>Tx</b>	<b>Duplex Transmitter (Receiving) Frequency</b>
<b>mod</b>	<b>Modulation</b>		<b>U</b>
<b>modul</b>	<b>Modulation</b>	<b>USB</b>	<b>Single Sideband Upper</b>
<b>ms</b>	<b>Miliseconds</b>	<b>UUT</b>	<b>Unit Under Test</b>
<b>MTRS</b>	<b>Meters</b>		<b>V</b>
<b>mV</b>	<b>Milivolts</b>	<b>V</b>	<b>Volt</b>
<b>mW</b>	<b>Milliwatt</b>	<b>VAC</b>	<b>Alternating current voltage</b>
	<b>P</b>	<b>Vdc</b>	<b>Direct current voltage</b>
<b>PM</b>	<b>Phase Modulation</b>	<b>Vert</b>	<b>Vertical</b>
<b>PROG</b>	<b>Program</b>	<b>VRMS</b>	<b>Voltage Root Mean Square</b>
<b>PWR</b>	<b>Power (switch)</b>		<b>W</b>
	<b>R</b>	<b>W</b>	<b>Watts</b>
<b>Rcvr</b>	<b>Receiver</b>		

# APPENDIX E - REPACKING FOR SHIPPING

## E-1 SHIPPING INFORMATION

IFR Test Sets returned to factory for calibration, service or repair must be repackaged and shipped subject to the following conditions:

### E-1-1 AUTHORIZATION

Do not return any products to factory without first receiving authorization from IFR Customer Service Department.

CONTACT: IFR Systems, Inc.  
Customer Service Dept.  
10200 West York Street  
Wichita, Kansas 67215

Telephone: 800-835-2350  
TWX: 910-741-6952

### E-1-2 TAGGING TEST SETS

All test sets must be tagged with:

- Owner's identification and address.
- Nature of service or repair required.
- Model No. and Serial No.

### E-1-3 SHIPPING CONTAINERS

Test Sets must be repackaged in original shipping containers using IFR packing materials. If original shipping containers and materials are not available, contact IFR Customer Service Department for shipping instructions.

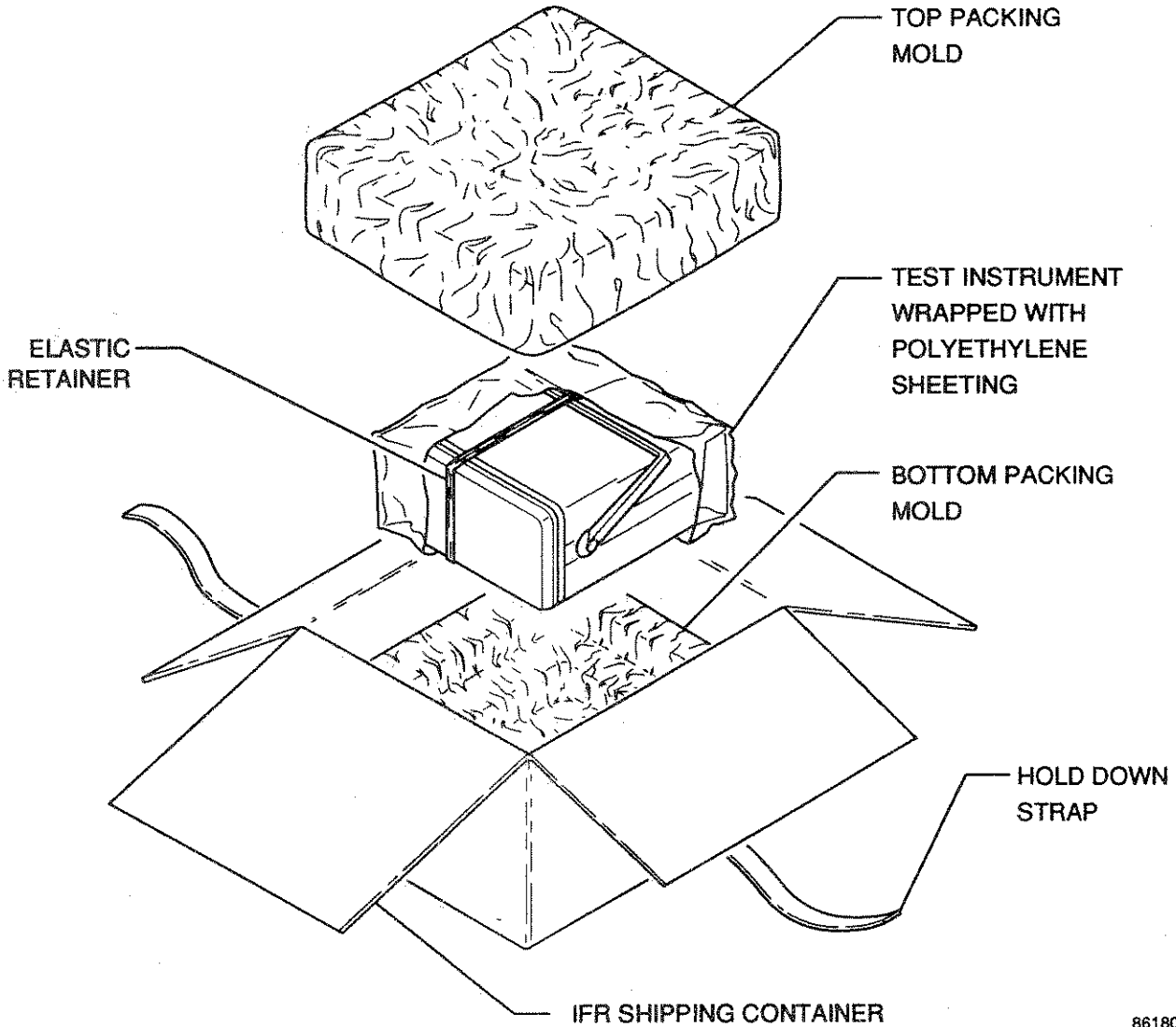
### E-1-4 FREIGHT COSTS

All freight costs on non-warranty shipments are assumed by the customer. (See "Warranty Packet" for freight charge policy on warranty claims.)

## E-2 REPACKING PROCEDURE (Figure E-1)

- Make sure bottom packing mold is seated on floor of shipping container.
- Adjust handle to lay unlocked against Test Set as shown.
- Place Elastic Retainer around Test Set to secure handle.

- Carefully wrap Test Set with polyethylene sheeting.
- Place Test Set into shipping container, making sure Test Set is securely seated in bottom packing mold.
- Place top packing mold over top of Test Set and press down until mold rests solidly on bottom packing mold.
- Close shipping container lids and seal with shipping tape or an industrial stapler. Tie all sides of container with break resistant rope, twine or equivalent.



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Figure E-1 Repacking for Shipment