ATTACHMENT A

TECHNICAL MODIFICATION

FOR

AGC LEVEL RETURN

TABLE OF CONTENTS

LIST OF APPENDICES

TECHNICAL MODIFICATION
FOR
AGC LEVEL RETURN

1-1. SCOPE

1-2. This document provides technical information on an equipment modification to the HF Receiver, Type RA6790/GM for AGC level return, as well as, addresses the associated circuit changes and receiver deployment, as may be applicable. It should by noted that this modification is a part of the standard configuration for the HF Receiver, Type RA6790/GM.

1-3. INTRODUCTION

1-4. The information presented in the following paragraphs identifies and describes the differences between the HF Receiver, Type RA6790/GM (hereinafter referred to as the standard receiver) and the modified receiver, resulting from an AGC level return software modification to the microcomputer assembly (A6).

1-5. EQUIPMENT MODIFICATIONS

1-6. The standard receiver was modified to provide an AGC level return to all status returns during remote control operation. This level is appended to the status return before a carriage return (CR) in the form Rx. R standing for the AGC return level code and x representing a range from 0 (minimum signal) to 150 (maximum signal). The data character format used for all command and monitor statements during remote control operation, via a remote computer/controller, consists of a start bit, seven data bits, an optional parity bit, and/or two stop bits depending on the optional parity condition. In addition, the AGC return level is sent, via a serial asynchronous RS-232C remote control interface, to the remote computer/controller regardless of AGC mode setting.

1-7. To implement modification to the standard receiver, the existing EPROM set was replaced with a functionally similar circuit, in addition to, being equipped with the necessary software for accommodating AGC level return operation.

1-8. CIRCUIT CHANGES

1-9. The following paragraphs describe those circuits that were replaced and/or changed to implement the equipment modifications.

1-10. MICROCOMPUTER ASSEMBLY (A6) - The microcomputer assembly consists of two separate circuit card assemblies. These include: the serial asynchronous interface (A6A1) and the microprocessor (A6A2) circuit card assemblies. However, for this application only the microprocessor circuit card assembly (A6A2) is to be considered. The microprocessor circuit card assembly used in the modified receiver is physically and functionally the same as the assembly used in the standard receiver with the following exception. The integrated circuits U5, U6, U14 firmware EPROM, ROM set, part number 08449 was replaced with an EPROM, ROM set, Type RAGM01, part number A09666, as a result of the software modification to implement AGC level return operation. In addition, this software modification also provides the modified receiver with a low frequency reception extension to 50 kHz, however, with degradated response below 500 kHz.

1-11. RECEIVER DEPLOYMENT

1-12. The following paragraphs address the installation, operation and maintenance of the modified receiver.

1-13. INSTALLATION - The physical installation of the modified and standard receivers is identical. However, refer to Appendix A for additional technical information concerning the input/output electrical interface for implementing remote control operation, as appropriate.

1-14. OPERATION - Operation of the modified receiver is identical to that of the standard receiver with the following exception.

1-15. AGC Level Return - During remote control operation, the modified receiver will append an AGC level to all status returns in the range of 0-150 (minimum to maximum signal), using a standard ASCII data character of the form Rx. Refer to Appendix B for technical information concerning local and remote operation, as appropriate.

1-16. MAINTENANCE - Maintenance of the modified receiver is the same as for the standard receiver.

APPENDIX A

INPUT/OUTPUT ELECTRICAL INTERFACE

APPENDIX A

INPUT/OUTPUT ELECTRICAL INTERFACE

A-1. INTRODUCTION

A-2. The digital input output connector type is M83723-02R-1626N.

The receiver address, baud rate, and parity option may be selected by grounding pins on the input output connector. See Figure A-1.

Separate lines are provided for command input and monitor output data.

The command receiver meets the specifications of RS423 and MIL-STD-188-114. It is interoperable with MIL-STD-188C or RS232 compatible devices. In addition, the command receiver is interoperable with MIL-STD-188C or RS232 compatible devices.

The monitor transmitter meets the specifications of RS423 and MIL-STD-188-114. It is interoperable with MIL-STD-188C or RS232 compatible devices. In addition, the interface may be strapped for RS422 unipolar operation.

The interface allows up to ten receivers to be placed on a common parallel input/output bus.

The data character is the standard ASCII asynchronous format consisting of one start bit, seven data bits (one ASCII character), one optional parity bit, and one of two stop bits depending on parity condition. See Figure A-4.

PIN	FUNCTION
A	System Ground
B	Data Out A
C	Data Out Ground
D	Data Out B
E	Ground
F	Data in A'
G	Data in Ground
H	Ground in B'
J	Ground
K	Receiver # D1-1
L	Receiver # D1-2
M	Receiver # D1-4
N	Receiver # D1-8
P	Receiver # D2-1
R	Receiver # D2-2
S	Receiver # D2-4
T	Receiver # D2-8
U	/ Parity Select
V	Parity Even / Odd
W	Baud Rate B4
X	Baud Rate B3
Y	Baud Rate B2
Z	Buad Rate B1
a	Ground
b	Ground
c	System Ground

NOTES:

1. Data Input/Output "A" - Mark is negative.
2. Data Input/Output "B" - Mark is positive.
3. For unipolar ballanced (RS-422) operation, a jumper may be changed on the board.
4. The address, Parity option, and Baud rate are configured as follows:
   Logic 1 - Open Circuit
   Logic 0 - Ground
5. The Baud rate selection is shown in Figure 2.
6. The data transmitters and receivers may be wired as shown in Figure 3.

Figure A-1. Digital Interface Connector A6A1 Pin Assignment

CODE (HEX)	BAUD RATE
0	50
1	75
2	110
3	134.5
4	150
5	300
6	600
7	1.2k
8	1.8k
9	2k
A	2.4k
B	3.6k
C	4.8k
D	7.2k
E	9.6k
F	19.2k

Figure A-2. Baud Rate Selection

A. RS423, RS232, MIL-STD-188-114 Unbalanced

A6A1J1	A	System Ground
	B	Data Out (a)
	C	Data Out Ground
	D	
	E	
	F	Data In (a')
	G	Data In Ground
	H	
	J	

B. RS422

A6A1J1	A	System Ground
	B	
	C	Data Out (a)
	D	Data Out (b)
	E	
	F	Data In (a')
	G	
	H	Data In (b')
	J	

Figure A-3. Interface Wiring For Various Control Systems

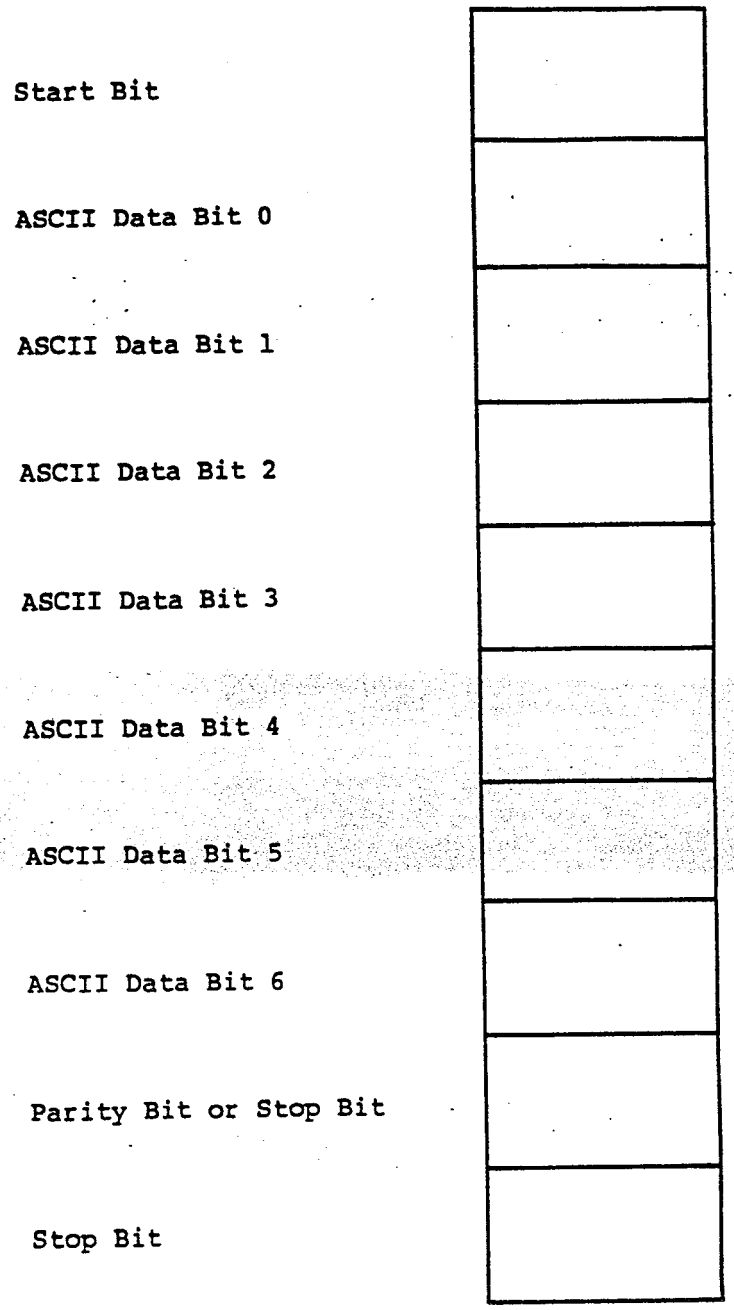

Figure A-4. Data Character Format

APPENDIX B

OPERATION WITH AGC RETURN SOFTWARE INSTALLED

B-1. LOCAL OPERATION

B-2. Operator front panel control is described for selection of frequency, BFO offset, detector mode, AGC time constant, and bandwidth. Also the operator may select audio or RF signal strength indications on the meter, adjust audio and RF gain, and select local or remote control operation. In addition, secondary pushbutton control allows the operator to invoke the build in test function (BITE) and to manually force the filter complement display to any desired set-up.

a. Frequency Selection: The receiver operating frequency may be set in two ways: First, gross changes in frequency may be made rapidly via the push-buttons. Depress the ENTER key, then input the desired frequency using the digit pushbuttons 0-9. The new freqeuncy will be displayed on the LCD panel, starting at the left-most, 10 MHz digit, and progressing to the right. The second method of frequency selection involves the tuning wheel. The tuning wheel is enabled to enter frequency whenever the tune select pushbutton has been depressed, selecting FINE (1 Hz increments), SLOW (30 Hz increments) and FAST (100 Hz increments). (Note that FINE does not display on the auxiliary LCD panel, but SLOW and FAST do.) For protection, LOCK may be selected, disabling the tuning wheel from all functions, so the operating frequency may not be changed inadvertently. Rotating the wheel clockwise will increase the frequency, counterclockwise will decrease the frequency, in the increments chosen.

b. BFO Selection: For CW reception, set the BFO to the required offset frequency by selecting the BFO tuning function and spinning the tuning wheel until the desired BFO offset is displayed. (LOCK will also protect the BFO setup, if depressed.) Depressing the BFO/CENTER button will center the BFO at the IF for use as a zero beat tuning aid. Depressing this button again will restore the original chosen offset frequency. The BFO may not be tuned in the BFO center mode. This BFO center mode is indicated by the display in the BFO frequency of only the first digit and decimal point.

c. IF Bandwidth: Select the desired IF bandwidth by depressing BW1 through BW5. BW1 will select the narrowest IF filter installed. Increasing BW numbered buttons will select increasing filter bandwidths.

d. Detection Mode: AM, FM, CW or separate SSB detection modes may be selected by depressing the appropriate pushbutton. ISB mode for receivers so equipped, may be activated by depressing the ISB pushbutton. Pressing this button will activate both USB and LSB reception channels simultaneously, and will connect the headphone to the last monitored ISB channel, subsequent depressions of the ISB button will connect the headphone to the LSB or USB channels as indicated by the LCD display.

e. AGC Time Constant selection is made via the SHORT, MEDIUM, and LONG pushbuttons. In addition, a variable threshold gain control mode is available which uses manual gain in conjunction with AGC so that a signal below the AGC threshold point, as determined by the IF gain control is cut off while a signal above the MGC threshold is captured by AGC. This is selected using the above switches in conjunction with the MGC button.

f. Manual Gain Control (MGC) or Variable Threshold gain control of the receiver IF strip is enabled by use of the MGC button. The receiver IF strip gain is then controlled by the IF gain control on the front panel, or the minimum set by the IF gain control in variable threshold mode.

g. Audio level to the headphones is set by the AF GAIN control. Audio to the line output is determined by the MAIN LEVEL audio control and indicated by the LCD meter when AF is selected on the meter. Audio to the line output for ISB-LSB is determined by the preset ISB-L control on the front panel, if ISB is installed. If it is installed, the ISB-U line output is set by the main level control, and the main AF output is now switched between upper and lower sideband as determined from the front panel.

h. Meter Selection, AF or RF, is controlled via the METER RF/AF button.

i. Remote/Local control of the receiver is selected by alternate depression of the REMOTE/LOCAL pushbutton.

j. BITE, or the built in test function, can be invoked in local mode at any time by simultaneously depressing LOCK and AM. BITE will then determine, organize, and display the bandwidths of the IF filters installed in the receiver, as well as test receiver parameters for proper operation. Any errors will be displayed on the main LCD display. (See Table B-2 for list and explanation of errors.) If there are no errors, the receiver will return to its pre-BITE frequency, detector mode, etc., when BITE is complete, and will use and display the new filters data. If any errors were encountered, the old filter data will remain unchanged. In addition:

LOCK and CW can be used to force BITE to proceed to the next sequential test after an error has caused it to stop.

LOCK and USB can be used to force BITE to cycle in a tight scope loop for analysis

LOCK and LSB can be used to prematurely terminate BITE.

k. Forced Bandwidth Setup is accomplished, in case BITE results are unsatisfactory, by simultaneously depressing LOCK and ISB (but not during BITE!) The LCD display will indicate AUX. Entry of symmetrical filters is accomplished using the digits 0-9, in 100 Hz steps, delimited with the ENTER key. For example, to enter a .4 kHz (400 Hz) filter, "4" and "ENTER" would be pressed. To enter 20 kHz, "2", "0", "0", "ENTER" would be pressed. (200 x 100 Hz = 20 kHz). USB and LSB filters can be loaded also, using the USB and LSB pushbuttons, each time followed by ENTER. Blank filter slots can be loaded simply by pressing the enter key again. When all seven filter slots have been loaded, the AUX indicator will go off automatically, disabling any further changes, and resetting the receiver to normal operation. If it is desired to terminate this function before all slots have been changed it is only necessary to depress ISB.

B-3. REMOTE OPERATION

B-4. See Table B-1 for a complete list of remote commands and usage. The data is coded as ASCII characters, and transmitted as a string terminated with a carriage return. A typical string would look like the following:

F2.35D3I1.2M4B-2.3A37(CR)

The Carriage Return (CR) is the trigger to the receiver to set up the data from all commands received since the last carriage return. All monitor data streams are terminated with a carriage return.

Table B-1. Command and Monitor Data and Format

A. Receiver Number ($85)

The ASCII followed by two optional numeric characters shall select the receivers to respond to this and all subsequent commands, until changed by another "$" command.

The "$" character followed by no numbers is a system wide unlisten command. Multiple receivers may be addressed with one command sequence by separating the receiver numbers with commas. Multiple addressing may not be used to set control modes or to specify a talker.

B. Frequency (F3.415926)

The main tune Frequency is entered in MHz in up to eight digits with optional decimal point. Leading and trailing zeros may be removed from the command. The frequency given is the true carrier frequency except for the sideband detection modes, when the frequency is that of the virtual carrier.

C. Detector (D3)

The detection mode of receiver is set with this command. The modal commands are:

1 - Amplitude Modulation
2 - Frequency Modulation
3 - Continuous Wave, Variable Offset
4 - Continuous Wave, Center Tuned
5 - Independent Sideband (I-LSB AGC Meter Level Returned)
6 - Lower Sideband
7 - Upper Sideband
8 - Independent Sideband (I-USB AGC Meter Level Returned) See Paragraph L.

Table B-1. Command and Monitor Data and Format (Cont.)

The detection mode contains four non-modal override commands which may be used for maintenance and test purposes. These commands are distinguished from the modal commands by the "=" placed between the letter and the command number. (D=1).

=1 - Envelope Detector
=2 - Continuous Wave Detector
=3 - Frequency Modulation Detector
=4 - ISB

When an override command is given here it must also be used to select the IF filter.

D. IF Bandwidth (I6)

The IF Bandwidth is specified in kiloherz. The receiver selects the bandwidth closest to the one requested. The monitor data shows the actual bandwidth picked.

In override mode the command becomes I=3, where the number is the filter slot number from one to seven. When in ISB override mode, the I= command must be used to select the USB filter.

E. AGC Mode (M2)

The AGC mode and rate are specified as follows:

1 - Short AGC time constant
2 - Medium AGC time constant
3 - Long AGC time constant
4 - Manual IF attenuation
5 - Short time constant Variable Threshold mode
6 - Medium time constant Variable Threshold mode
7 - Long time constant Variable Threshold mode

F. BFO Frequency (B-1.82)

The BFO offset from center frequency, specified in kHz is entered with this command. The data is used in the modal system in CW only.

Table B-1. Command and Monitor Data and Format (Cont.)

G. Attenuation (A30)

The attenuation number defines the amount of attenuation placed in the signal path during the manual attenuation AGC mode, or the minimum attenuation during the variable threshold modes. The attenuation varies from zero (no attenuation) to 150 (maximum attenuation) with no change between numbers greater than 3 dB.

H. Status (S5)

The status command when sent to the receiver controls its operating status. In the monitor mode the status provides summary error indication.

1) Command Status

Command status may only be sent to one receiver, since commands 5 and 6 create monitor data streams. The status commands are:

1 - Set the receiver to local control.
2 - Set the receiver to remote control.
3 - Execute the BITE self test routine.
4 - Terminate the BITE self test routine.
5 - Report currently installed bandwidths.
6 - Report BITE results.
7 - Force bandwidth setup.
8 - Enable remote AGC dump.
9 - Inhibit remote AGC dump.

Command 1 - Sets the receiver to local control mode. This command is invalid in override mode.

Command 2 - Sets the receiver to the remote control.

Command 3 - Starts receiver Bite (Built in Test) routine.
This command, when excepted causes the receiver to output a colon (:) until bite is finished it will output a colon response to any talk command.

Table B-1. Command and Monitor Data and Format (Cont.)

Command 4 - Terminate Bite - causes the receiver to assume its pre Bite status.

Command 5 - Report current bandwidths. This command causes the receiver to list the installed filter bandwidths in slot number order followed by a carriage return.

(FL1), (FL2), (FL3), (FL4), (FL5), (FL6), (FL7), (CR)

A typical output might be L,, 6.2, U, .4, 20, (CR)
Which reports the following:

Slot	Filter Modification
1	Lower Sideband Filter
2	Nothing
3	1.2 kHz Symmetric Filter
4	Upper Sideband Filter
5	400 Hz filter
6	20 kHz filter
7	Nothing

Command 6 - Report results of last bite. Note that this is not cleared after having been read, nor does it cause another Bite cycle. To get a new Bite cycle with report, start with S3, then go to S6.

GOOD response - OK XX (CR)
BAD response - 4, 17, 33 End XX (CR)

Command 7 - Force Receiver Bandwidth setup.

This command is used to force a particular filter complement in the GM receiver. Allowable codes are L for Lower Sideband, U for Upper Sideband, N for None, and bandwidths up to 20 kHz in kHz with a resolution of 100 Hz. Symmetric bandwidths in kHz are terminated with a comma.

The string may contain all seven filters or it may end early with a (CR). Slots not entered will not be altered by the S7 command.

Table B-1. Command and Monitor Data and Format (Cont.)

The command:

Slot	Filter Modification
1	Lower Sideband Filter
2	Upper Sideband
3	1.7 kHz Symmetric
4	400 Hz Symmetric
5	Unused
6	3.2 kHz Symmetric
7	Unchanged from previous setting

Command 8 - Enable AGC Dump

This command causes all subsequent commands containing receiver data to cause an automatic AGC dump.

Command 9 - Inhibit AGC Dump

This command causes the AGC command dump to be disabled. This would be used when free tuning the receiver by remote control.

2) Monitor Status

The following summary status is appended to all other monitor data streams:

1 - Receiver operating in remote control
2 - Synthesizer out of lock
4 - Receiver in Override remote control mode
8 - Last command sequence had character transmission error
16 - Last command sequence had data error
32 - Lost data error in last sequence

The indicators above are added together to from the summary status. For instance 17 indicates remote operation with a data error in the last command stream.

Table B-1. Command and Monitor Data and Format (Cont.)

I. Monitor Command G (G)

This command is the overall monitor command. All data relevant to the current status is returned on receipt of the trigger.

J. Monitor Command T (TFI)

This is the selective monitor command. It allows the controller to specify the data to be returned in the monitor data stream generated following the carriage return trigger.

The monitor commands will be ignored unless sent to only one receiver.

The selective monitor command must immediately precede the carriage return to avoid confusion with the data commands which use the same letter control characters.

K. Override Mode Notes.

The override mode gives the remote controller functional level control of the receiver. That is, the first local oscillator is always tuned to 40.455 MHz above the entered frequency. The IF slot is always enabled regardless of the type of filter installed. It is up to the controller to decide what the filter should be used for, the type of detection mode to employ, and the BFO offset to receive a signal. For instance, in sideband detection with a symmetrical filter, the first local oscillator and BFO must be properly offset to correctly demodulate the signal. The controller also assumes the responsiblity for ensuring that the filter is installed in the selected slot, since an empty slot will cause a dead receiver.

The override mode blanks the display. In addition, override signals cannot be handed off to the operator, since the machine has no way of deciding the difference between a sideband signal with virtual carrier offset or a CW signal with a copy BFO offset. Consequently status command S1 is invalid in override mode.

Table B-1. Command and Monitor Data and Format (Cont.)

The override mode is invoked when both detector and bandwidth are sent in the same command with the = sign. Sending either without the equals stores the = data but leaves the receiver in the modal command mode.

L. AGC Level Return (R30).

This number is appended to all Status returns and is in the range 0 (Minimum Signal) to 150 (Maximum Signal). It is sent to the remote controller regardless of the AGC mode setting, i.e., whether in MAN, SHORT or any combination of the same.

Table B-2. Bite Error Table

ERROR NUMBER	DESCRIPTION
1	First Local oscillator synthesizer not locked after 100 millisecond delay from 500 kHz step change.
2	Second Local Oscillator (reference) synthesizer not locked.
3	First Local Oscillator synthesizer does not break lock to enter fast sampling mode on 500 kHz step change.
4	Third Local Oscillator synthesizer not locked after 100 millisecond delay from 500 kHz step change.
5	First and Third Local Oscillator synthesizers not locked after 100 millisecond delay from 500 kHz and 500 Hz step change, respectively.
6	Filter slot one contains a symmetrical filter, but there are SSB filters also in the system.
7	Filter slot one contains an upper sideband filter. ISB operation, if installed, will be impaired.
8	No USB filter has been found in the system, and filter slot one does not contain a Symmetrical filter.
9	Not used.
10	Not used.
11	No LSB filter has been found in the system and filter slot one does not contain a symmetrical filter.
12	No symmetrical filters have been found in the system.
13	Filter slot one does not contain a lower sideband filter, but ISB is installed.
14	Random access memory test Failure: Data written to memory different from data read back.
15	Either no filters are installed in the system, or the synthesizer signal strength is out of range prescribed for BITE.
16	Filter slot one contains no filter.
17	Two or more LSB filters have been found in the system.

Table B-2. Bite Error Table (Cont.)

ERROR NUMBER	DESCRIPTION
18	Two or more USB filters have been found in the system.
19	Although a lower sideband filter has been found in the system, it is not installed in filter slot one. ISB operation, if installed, will be impaired.
20	Not used.
21	Filter in filter slot one is skewed from the IF center frequency.
22	Filter in filter slot two is skewed from the IF center frequency.
23	Filter in filter slot three is skewed from the IF center frequency.
24	Filter in filter slot four is skewed from the IF center frequency.
25	Filter in filter slot five is skewed from the IF center frequency.
26	Filter in filter slot six is skewed from the IF center frequency.
27	Filter in filter slot seven is skewed from the IF center frequency.
28	Not used.
29	Not used
30	Not used
31	BITE frequency sweep underflowed while attempting to measure bandwidth of filter installed in filter slot one.
32	BITE frequency sweep underflowed while attempting to measure bandwidth of filter installed in filter slot two.
33	BITE frequency sweep underflowed while attempting to measure bandwidth of filter installed in filter slot three.
34	BITE frequency sweep underflowed while attempting to measure bandwidth of filter installed in filter slot four.

Table B-2. Bite Error Table (Cont.)

ERROR NUMBER	DESCRIPTION
35	BITE frequency sweep underflowed while attempting to measure bandwidth of filter installed in filter slot five.
36	BITE frequency sweep underflowed while attempting to measure bandwidth of filter installed in filter slot six.
37	BITE frequency sweep underflowed while attempting to measure bandwidth of filter installed in filter slot seven.