August 27, 1990

PROTOTYPE

TECHNICAL MANUAL

FOR

R-110 RECEIVER

DRAFT 2

THIS MANUAL IS INTENDED FOR USE WITH

THE FOLLOWING SERIAL NUMBERS:

_____ thru _____

DYNAMIC SCIENCES, INC
9655 Irondale Ave.
Chatsworth, CA 91311-5009

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FACTORY ACCEPTANCE TEST PROCEDURE FOR R-110 FTTR RECEIVER

TP493000

1. SCOPE

Outlined in this test procedure are steps necessary to ensure the prototype Model R-110 FTTR Receiver meets requirements in accordance with the referenced documents.

2. REFERENCED DOCUMENTS

2.1 Customer Documents

FTTR Specification (part of Statement-Of-Work)

2.2 DSI Documents

SRR Minutes, August 31, 1989
PDR Minutes, October 10, 1989
CDR Minutes, March 3, 1990
R-110 Receiver Specification, March 5, 1990

3. STANDARD TEST CONDITIONS

The tests shall be performed under the following standard conditions:

Temperature	75 ± 10 degrees F
Altitude	0 to 3000 feet
Humidity	10 to 90 %
Line Voltage	115 ± 3 vac

4. TEST PROCEDURES

The tests shall be conducted with the receiver assembled and its cover installed. Refer to Figures 1 and 2 for the location of front and rear panel controls and connectors.

The test equipment shall be energized and allowed to stabilize for at least 2 hours prior to initiating the tests.

Test results are to be recorded on the attached data sheets. All specifications and acceptable limits are defined on the appropriate data sheet.

4.1 EQUIPMENT REQUIRED

4.1.1 Commercial Test Equipment

NAME	MANUFACTURER	MODEL NO.
Dual Directional Coupler	Hewlett Packard	778D
Spectrum Analyzer	Tektronix	7L14
Main Frame	Tektronix	7603
Tracking Generator	Tektronix	501
Frequency Counter	Tektronix	509
Signal Generator	HP	8662
Function Generator	Tektronix	FG501
Digital Multimeter	Fluke	8600A
Volt/Ohmmeter	Triplet	630NS
Broadband Sampling VM	HP	3406A
Oscilloscope	Tektronix	4465A
Storage Oscilloscope	HP	54110D
Signal Generator	HP	3325A
MW Frequency Counter	HP	5342A
Impulse Generator	DSI	I-1700
Power Meter	HP	HP-435A
Power Amplifier	(any)	
Scale, 50 lbs max.	(any)	
Headphone	(any)	
Power Transformer	(any)	
AC Power Supply	(any)	
Termination, BNC, 50 ohm	(any)	
Tee, BNC	(any)	

Figure 1 R-110 FTTR Receiver Front Panel

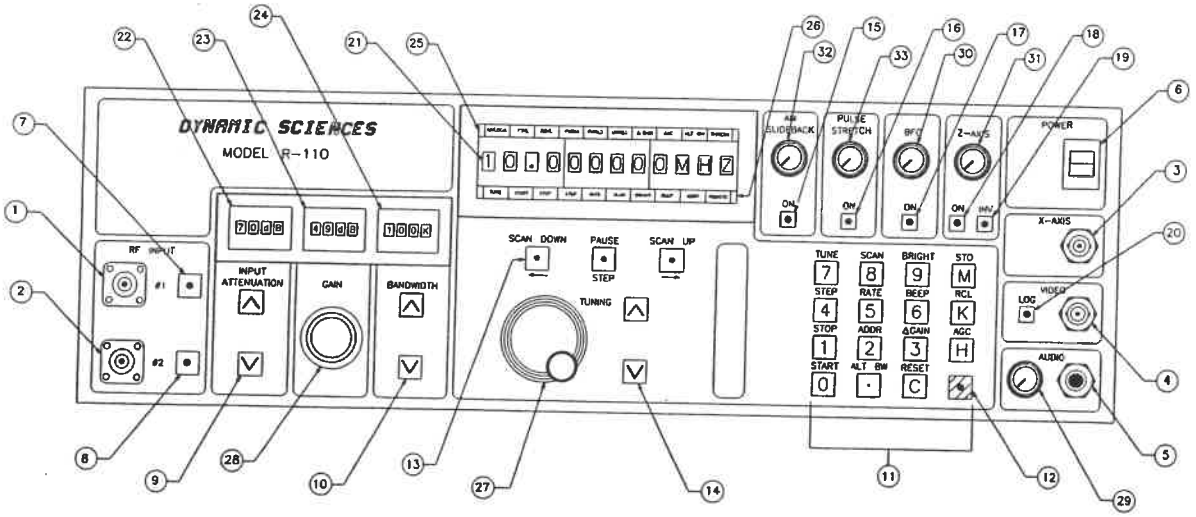
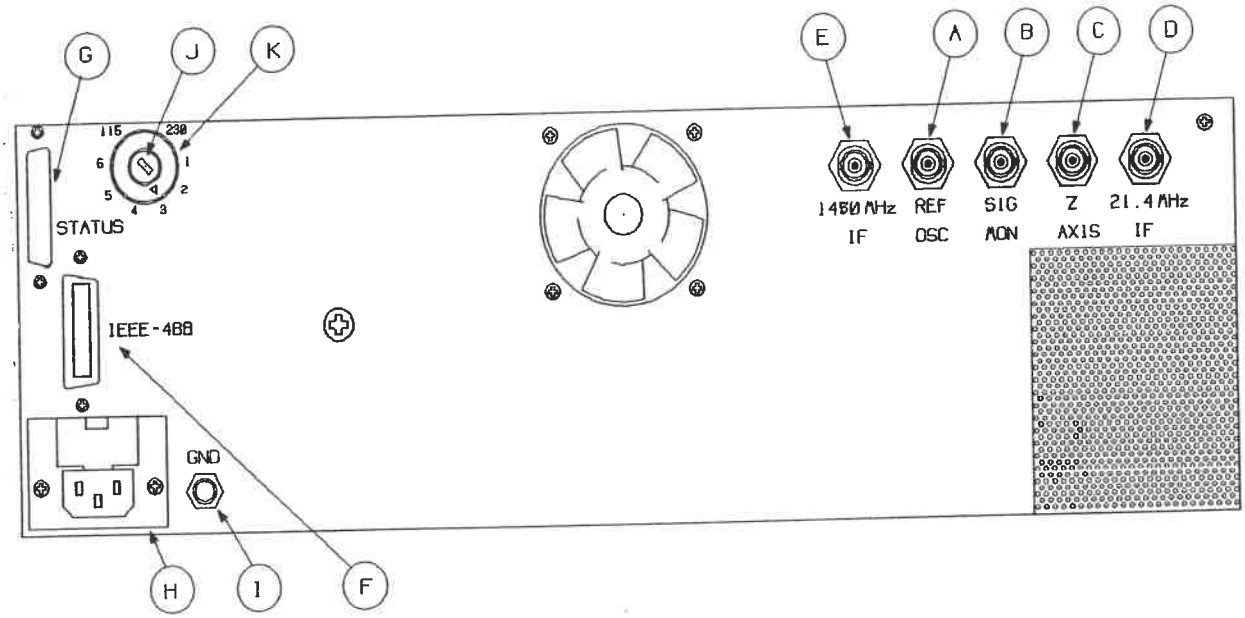


Figure 2 R-110 FTTR Receiver Rear Panel



4.1.2 DSI Test Fixtures

HF Directional Coupler	SK11001
Combiner Network	SK11002
Modulator	SK11003

4.2 TEST SETUP

4.2.1 Basic Test Set-up

The basic set-up used for a major portion of the tests is shown in Figure 3. The HP 8662 Signal Generator is connected to the receiver's RF Input #1. The Tektronix 4465A oscilloscope is connected to the video output, and the Tektronix 7L14 spectrum analyzer to the IF output. Special test set-ups are used for the balance of the tests; these are described in the procedures.

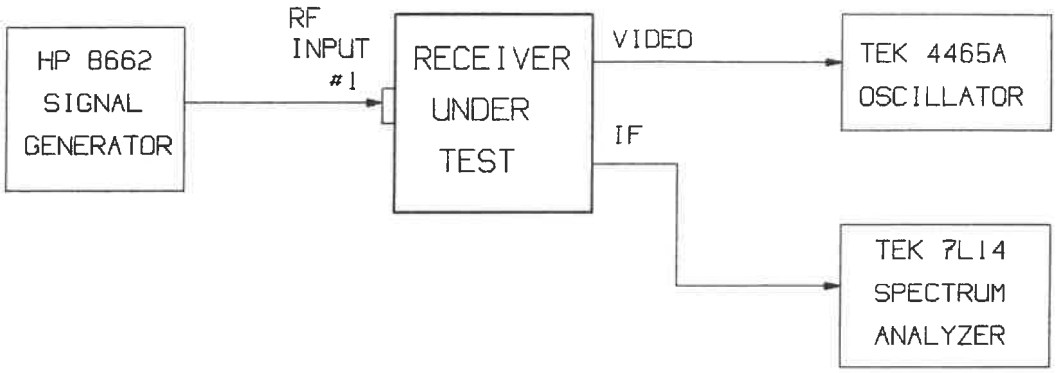


Figure 3 Basic Test Set-up

4.3 TEST PROCEDURES

4.3.1 Physical Audit

The physical audit verifies compliance with the physical and mechanical requirements of the FTTR specification, encompassing paragraphs *4.3.1 Mechanical, 4.3.2 Panel Controls and Connectors, 4.3.2.1 Front Panel, 4.3.2.2 Rear Panel, 4.3.3.8.d Shielded Power Cord, 4.3.3.8.f Line Voltage Select, and 4.5 Size and Weight.*

4.3.1.1 Visual Inspection

Visually examine the receiver and record the status on the Physical Audit Data Sheet.

4.3.1.2 Weight Measurement

Using the scale, weigh the fully assembled receiver and record the weight on the Data Sheet.

4.3.1.3 Size Measurement

Using suitable ruler(s), measure the dimensions of the fully assembled receiver. Record measurements on the Data Sheet.

4.3.2 Operational Tests

The operational test verifies the operational requirements delineated in the following paragraphs of the SOW:

4.3.3.1	*Modes of Operation*
4.3.3.2	*Detection Modes*
4.3.3.3.a	*RF Inputs, Two, Selectable*
4.3.3.3.b	*RF Inputs, tunable range*
4.3.3.3.c	*Input Selection and Termination*
4.3.3.4.a	*Tuning Range*
4.3.3.4.c	*Tuning Schemes*
4.3.3.4.d	*Tuning Resolution*
4.3.3.4.e	*Up/Down Tuning Resolution*
4.3.3.4.f	*Displayed Tuned Frequency*
4.3.3.4.h	*Synthesizer Step Noise in Outputs*
(new)	*Scan Mode*

4.3.2.1 Set-up for Operational Tests

Connect the power cable to receptacle at the rear of the receiver and to the 115 vac power source. Record the test conditions on the data sheet.

4.3.2.2 Knob Alignment

Align the following control knobs so the indicator pointers are at their maximum CCW positions. Record on data sheet.

a. AM Slideback
b. AM Pulse Stretch
c. Z axis
d. BFO Control
e. Audio

NOTE: The circuits for the AM Slideback and AM Pulse stretch functions are not installed in the prototypes, but their controls are included. Setting the controls full CCW does not effect receiver operation but is to be done to insure uniformity in the set-up.

4.3.2.3 Start-up and Initialization

(a) Turn power on; observe that the TUNE light-bar indicator (located adjacent to the frequency display) is illuminated. Record.

(b) Observe if any of the light-bar indicators listed below are illuminated. If so, terminate the test and correct the problem. Record corrective actions taken. Otherwise, proceed with the test.

UNLOCK
RFOVL
IF/DET OL
UNREG

(c) Observe if either the "PWRHI" or "PWRLO" lightbars are illuminated (or both). If so, check the line voltage. Record. If line voltage is satisfactory and either lightbar remains on, terminate the test and correct the problem. Record corrective actions taken. Otherwise, proceed with the test. If the line voltage is high or low, rotate the Power Range Selector switch on the rear panel as required.

(d) Reset Receiver to Standard Test Conditions

NOTE: The receiver's default conditions can be changed by the operator. The following steps are to be performed to return the receiver to its "standard" default settings.

Using keypad, press FNT key (12); press RESET key (key "C"). Record.

Press FNT key (12); press BEEP key (key "6"). Verify that the BEEP light-bar illuminates. Use PAUSE/STEP pushbutton (13) to activate Beeper. Record. Exit the adjustment mode by pressing the TUNE key (key "7").

(e) Observe that the front panel displays are illuminated and indicate the following default values. Record.

Frequency Display:	100 MHz
Input Attenuation Display:	20 dB
Gain Display:	0 dB
Bandwidth Display:	1 MHz

(f) Allow a 10 minute warm up before proceeding. Record.

4.3.2.4 Input Operation

(a) Connect the HP 8662 signal generator to the RF Input #1 connector. Set the generator's frequency to 100 KHz and the output to -50 dBm. Connect a 50 ohm terminator to RF Input #2. Connect the spectrum analyzer to the IF output connector on the receiver's rear panel.

(b) Verify the indicator LED in RF Input #1's pushbutton is illuminated (if not, press the pushbutton to activate). Set the input attenuation display to 0 dB, select the 10 KHz bandwidth, and tune the receiver to 100 KHz.

(c) Set the receiver's gain display to 20 dB with the gain pushbuttons (9). Adjust the analyzer controls for a mid-scale signal level with the analyzer in the 2 dB log position. Record the analyzer measurement. Move the cable from RF Input #1 to RF Input #2, connecting the terminator to RF Input #1. Measure the IF signal with the analyzer. Record. Depress RF Input #2's pushbutton and confirm that its LED illuminates. Record the analyzer's measurement.

4.3.2.5 Display Tests

4.3.2.5.1 Input Attenuation Display

(a) Briefly depress the "up" input attenuation pushbutton (9). Observe the display and record value. Continue to briefly depress, recording the value. When the maximum attenuation (70 dB) is reached, observe that the next depression of the pushbutton causes the display to indicate AUTO. Repeat the process using the "down" pushbutton. Observe that the beeper sounds when the pushbutton is depressed when the attenuation display is at 0 dB. Record.

4.3.2.5.2 Bandwidth Display

(a) Briefly depress the "up" bandwidth pushbutton (10). Observe the display and record value. Continue to briefly depress, recording the value. When the maximum bandwidth (15 MHz) observe that the next depression of the pushbutton causes the beeper to sound. Repeat the process using the "down" pushbutton. Observe that the beeper sounds if pushbutton is depressed when the bandwidth display is at 500 Hz. Record.

4.3.2.5.3 Frequency Display and Tuning

(a) Enter the data sheet's test frequencies (with decimal point) using keypad (11), followed by H, K, or M (Hz, KHz, or MHz). Record if display reads properly.

999.9 MHz
888.88 KHz
7777.7 Hz

4.3.2.6 Tuning Tests

(a) Adjust tuning resolution (indicated by flashing digit) in frequency display (21) by pressing left (13L) arrow pushbutton; select the left-most digit. Turn rotary tuning control (27) CW and ensure that each digit tunes 1 through 9 when the tuning knob is turned. Repeat using tuning pushbuttons (14). Record. Repeat for each digit.

4.3.2.7 Display Brightness

(a) Select display brightness adjust mode by pressing the FNT key (12) and then the BRIGHT key (key "9"). Verify that the BRIGHT light-bar illuminates. Use right/left arrow (13) keys to adjust brightness from maximum to minimum. Record. Exit the adjustment mode by pressing the TUNE key (key "7").

4.3.2.8 Audible Alarm

(a) Connect the headphone to the phone jack, and set the audio level control to its mid-position.

(b) Select the audible alarm adjust mode by pressing the FNT key (12) and then the BEEP key (key "6"). Verify that the BEEP light-bar illuminates. Use right/left arrow (13) keys to adjust loudness from maximum to minimum. Record. Exit the adjustment mode by pressing the TUNE key (key "7").

4.3.2.9 Synthesizer Step Noise in Outputs

(a) Set the receiver bandwidth to 10 Khz and the gain control to the minimum setting (turn CCW). Set the tuning resolution to the 10 KHz digit. Tune the receiver to the first start frequency shown in the data sheet.

(b) Using the headphones, monitor the audio output as the receiver is slowly tuned (using the tuning knob) from the start frequency to the end frequency shown on the data sheet. Observe if audible noises are heard and record the frequencies. Verify that any noise noted is repeatable.

4.3.2.10 Scan Mode

(a) Connect the receiver as shown in the basic test set-up (Figure 3) with the HP 8662 signal generator cabled to the RF Input #1 connector. Set the generator's frequency to 100 KHz and the amplitude to -30 dBm. Connect the storage oscilloscope's vertical axis to the video output, and its horizontal axis to the X-axis output. Adjust the controls to display 0 to 10 vdc on both axes.

(b) Set the receiver's controls as follows:

Tuned Frequency	1 MHz
Input Attenuator	0 dB
Bandwidth	10 KHz
Gain	Maximum (turn CW to max.value)
RF Input #1	On

(c) Select the scan mode by pressing the FNT key (12) and then the SCAN key (key "8"). Verify that the SCAN light-bar illuminates.

(c) Enter the first start frequency shown on the data sheet by pressing the START key (key "0"). Verify that the START light-bar illuminates.

(d) Enter the stop frequency and step size in the same fashion, again verifying that the STOP and STEP light-bars illuminate correctly.

(e) Press the "Scan Up" (13c) to start the scan. Observe the oscilloscope display and note that the sweep shows the presence of a strong signal at the mid-point. When scan is complete record results.

(f) Press "Scan Down" key (13a) to again start the sweep, this time from the stop frequency back to the start frequency. Press the "Pause" key and verify that the scan pauses until the key is pressed again.

4.3.3 Transfer Function Tests

The transfer function test verifies the gain-related characteristics, including those of specification paragraph *4.3.3.5.b RF Gain Adjust* and DSI-provided features. The test evaluates (1) the accuracy and frequency characteristics of the attenuator, (2) the characteristics of the variable gain over the full frequency range at various bandwidths, (3) the AGC response, and (4) the Incremental Gain mode.

4.3.3.1 Input Attenuator

(a) Connect the HP 8662 signal generator to the RF Input #1 connector. Set the generator's frequency to 100 KHz and the amplitude to -30 dBm. Connect the power meter to the IF output connector.

(b) Set the receiver's controls as follows:

Tuned Frequency	100 KHz
Input Attenuator	0 dB
Bandwidth	50 KHz
Gain	Maximum (turn CW to max.value)
RF Input #1	On

(c) Observe the power meter's reading and record on data sheet for reference. Set the input attenuator to the 10 dB position and increase the generator's output by 10 dB using its decade attenuator. Record the change in the meter's reading; it should not change by more than 0.2 dB. Repeat this sequence for the input attenuator's 20 through 70 dB positions.

(d) Reset the R-110 and generator to the next frequency listed in the data sheet. Reset the receiver's input attenuator to 0 dB. Repeat test.

(e) Reset the R-110 and generator to the third frequency listed in the data sheet. Reset the receiver's input attenuator to 0 dB. Repeat test.

4.3.3.2 Variable Gain

(a) The test is performed using the same set-up as above. Set the generator's frequency to 100 KHz and the amplitude to -50 dBm.

(b) Set the receiver's attenuator to 0 dB. Set the bandwidth and gain controls as stated in the data sheet. Turn the RF control to the minimum (0 dB) setting. Record the power meter's indication of IF output amplitude.

(c) Adjust the RF control to the 10, 20, and 50 values, recording the IF output on the data sheet.

(d) Set the generator to the next frequency on the data sheet.

(e) Set the receiver to the next frequency and bandwidth values and repeat the measurements.

4.3.3.3 AGC Mode

(a) The test is performed using the same set-up as above. Set the generator's frequency to 100 KHz and the amplitude to -30 dBm.

(b) Set the receiver's attenuator to 0 dB, the bandwidth to 10 KHz, and the gain display to 20. Record the IF output reading.

(c) Select the AGC mode. Record the IF output reading. Reduce the generator's signal level to -50 dBm. Record the amplitude reading. Determine the differency between the readings (it must be within the range shown). Return the generator's level to -30 dBm.

(d) Connect the storage oscilloscope to the video output. Store the transient when the generator's level is step-changed from -30 to -25 dBm. Estimate and record the time constant. Repeat, changing the level from -25 to -30 dBm. De-select the AGC mode by pressing the TUNE key (key "7").

4.3.3.4 Incremental Gain Mode

(a) The test is performed using the same set-up as above. Set the generator's frequency to 100 KHz and the amplitude to -30 dBm.

(b) Set the receiver's attenuator to 0 dB, the bandwidth to 10 KHz, and the gain display to 20. Record the analyzer's amplitude reading.

(c) Select the Incremental Gain mode by pressing the FNT key (12) and then the △ GAIN key (key "3"). Verify that the △ GAIN light-bar illuminates. Record the Gain display reading (it should be zero). Reduce the generator's signal level to -50 dBm using the decade switch. Increase the gain control to achieve the same amplitude reading on the analyzer. Record the Incremental Gain indication.

(d) De-select the Incremental Gain mode by pressing the TUNE key (key "7"). Set the gain display to 20. Record the analyzer's amplitude reading. Re-select the Incremental Gain mode. Increase the signal generator's level from -50 dBm to -10 dBm by decades. Adjust the receiver's attenuator to return the analyzer to as close as possible its previous indication. Record the Incremental Gain indication. De-select the Incremental Gain mode.

4.3.4 IF Tests

These tests verify the IF-related requirements for specification paragraphs *4.3.3.6.a IF Selectivity, 4.3.3.6.c IF Bandwidths, 4.3.3.6.d IF Bandwidth Selection, 4.3.3.7.d IF Output Level, and 4.3.3.7.f Signal Monitor*. The main purpose of this test is to measure the shape factor of the IF filters which determine the receiver's selectivity. Because the receiver utilizes both fixed and variable (DCIF) filters, two separate procedures are used. The test exercises both the "default" and "alternate" DCIF filter sets.

4.3.4.1 IF Selectivity (Fixed Filters)

(a) Connect the receiver as shown in the basic test set-up (Figure 3) with the HP 8662 signal generator cabled to the RF Input #1 connector. Set the generator's frequency to 100 MHz and the amplitude to -30 dBm.

(b) Set the receiver's controls as follows:

Tuned Frequency	100 MHz
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	Per data sheet

(c) Adjust the spectrum analyzer to produce a mid-screen display. Record the signal generator output level and the analyzer's amplitude reading.

(d) Increase and decrease the signal generator frequency from the preset point in order to find the frequencies at which the analyzer's power reduces by 6 dB. Record the frequency of these two points on the data sheet. Calculate the difference between these points and enter this value on the data sheet under 6 dB BW. The calculated bandwidth must be within the range shown in the MIN MAX column.

(e) Repeat the steps of (C), to find the 60 dB frequencies. Record the frequency of these two points on the data sheet. Calculate the difference between these points and enter this value on the data sheet under 60 dB BW.

(f) Repeat the steps above for all bandwidths listed on the data sheet.

4.3.4.2 IF Selectivity (DCIF Filters)

(a) Set the HP 8662 signal generator's frequency to 100 KHz and the amplitude to -30 dBm. Record. Monitor the video output with the oscilloscope.

(b) Set the receiver's controls as follows:

Tuned Frequency	100 KHz
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)

RF Input #1	On
Bandwidth	Per data sheet

(c) Adjust the signal generator's level to produce a 3 vdc video output; adjust the oscilloscope to obtain as nearly full-scale presentation as can be achieved with calibrated settings. Record the signal generator output level and the oscilloscope's amplitude reading.

(c) Increase and decrease the signal generator frequency from the preset point to find the frequencies at which the oscilloscope's display decreases to 1.5 vdc. Record the frequency of these two points on the data sheet. Calculate the difference between these points and enter this value on the data sheet under 6 dB BW.

(d) Repeat the steps of (C), to find the 60 dB frequencies. This will require increasing the signal generator's level and the oscilloscope's sensitivity as the filter attenuates the signal. Increase the generator's level to -60 dBm using the decade switch as the 60 dB frequency is approached, and increase the oscilloscope's sensitivity by 10. Record the frequency of the two points on the data sheet. Calculate the difference between these points and enter this value on the data sheet under 60 dB BW.

(e) Repeat the steps above for all of the default DCIF bandwidths listed on the data sheet.

(f) Select the Alternate Bandwidth mode by pressing the FNT key (12) and then the ALT BW key (key "."). Verify that the ALT BW light-bar illuminates. Repeat the steps above for the alternative DCIF bandwidths listed on the data sheet. De-select the Alternate Bandwidth mode by pressing the TUNE key (key "7").

4.3.4.3 IF Output Level

(a) Set the HP 8662 signal generator's frequency to 100 MHz and the amplitude to -30 dBm. Monitor the IF output with the power meter.

(b) Set the receiver's controls as follows:

Tuned Frequency	100 MHz
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	1 MHz

(c) Adjust the signal generator's level until the RF or IF/DET overload indicators illuminate. Record the level.

(d) Read and record the power meter's amplitude reading.

4.3.4.4 Signal Monitor

(a) Connect the HP 8662 signal generator to the RF Input #1 connector. Set the signal generator's frequency to 100 MHz and the amplitude to -30 dBm. Connect the spectrum analyzer to the signal monitor connector.

(b) Set the receiver's controls as follows:

Tuned Frequency	100 MHz
Input Attenuator	0 dB
Gain	Maximum (turn CW to max. value)
RF Input #1	On
Bandwidth	15 MHz

(c) Measure and record the frequency of the sinal monitor output with the specrum analyzer.

(d) Adjust the signal generator's level to equal -107 dBm. Set the spectrum analyzer's bandwidth to 3 KHZ and record the amplitude.

(e) Connect the HP 8662 signal generator to the input port of the modulator. Connect the Tektronix FG501 Function Generator to the modulation port of the modulator. Connect the modulator's output port to the RF Input #1 connector. Reset the generator's level to -30 dBm. Set the function generator's frequency to its 1 KHz and its level to -50 dBm.

(f) Record the peak amplitude of either the upper or lower sidebands displayed by the spectrum analyzer. Increase the function generator's frequency until the amplitude of the sideband decreases by 3 dB. Record the function generator's frequency.

4.3.5 Noise Figure Tests

This test verifies the noise figure characteristics in accordance with paragraph *4.3.3.5.a Noise Figure.*

(a) Connect the HP 8662 signal generator to the RF Input #1 connector, and the HP-435A Power Meter to the IF output connector. Set the generator's frequency as indicated on the data sheet and the amplitude to the minimum.

(b) Set the receiver's controls as follows:

Tuned Frequency	Per data sheet
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	Per data sheet

(c) Adjust the power meter to a range that gives an indication of the noise level present at the IF output of the receiver.

(d) Slowly increase the generator's level until the power meter's indication increases by 3 dB. Record the generator's output level on the data sheet under the 3 dB SENSITIVITY column.

Subtract the THEORETICAL NOISE FLOOR value from the 3 dB SENSITIVITY. This difference is the noise figure to be recorded on the data sheet.

(e) Repeat this procedure for each of the bandwidths and associated frequencies indicated on the data sheet.

4.3.6 Image and IF Rejection Test

This test verifies the image and IF rejection characteristics of specification paragraph *4.3.3.6.b IF and Image Rejection.*

(a) Connect the receiver as shown in the basic test set-up (Figure 3) with the HP 8662 signal generator cabled to the RF Input #1 connector. Set the generator's frequency as indicated on the data sheet and the amplitude to the -50 dBm.

(b) Set the receiver's controls as follows:

Tuned Frequency	Per data sheet
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	Per data sheet

(c) Adjust the spectrum analyzer to produce a mid-screen display. Record the signal generator output level and the analyzer's amplitude reading.

(d) Set the signal source to a frequency which equals the tuned frequency plus twice the IF frequency, as shown on the data sheet. Increase the signal source amplitude until the IF output equals the previous level. Record the signal generator's level, and calculate the image rejection (equal to the difference in the signal generator's levels). Determine if the rejection meets the requirement.

(e) Set the signal generator set to the IF frequency for each band as indicated on the second page of the data sheet. Increase the signal source amplitude until the IF output equals the previous level. Record the signal generator's level, and calculate the IF rejection.

(f) Repeat the measurements for the other conditions in the data sheet.

4.3.7 AM Dynamic Range Tests

The basic set-up is used to determine the AM Video and AM Log dynamic ranges using the procedure for paragraph *4.3.3.5.c Spur-free Dynamic Range (RF Input to AM/Video) and 4.3.3.7.b AM Log.*

(a) Connect the signal generator to the RF Input #1 connector. Connect the oscilloscope and the power meter to the video connector, using a "T". Set the generator's frequency to 100 KHz and the level as indicated on the data sheet.

(b) Set the receiver's controls as follows:

Tuned Frequency	100 KHz
Input Attenuator	0 dB
Gain	Minimum (turn CCW to min.value)
RF Input #1	On
Bandwidth	10 KHz

(c) Increase the receiver's gain control until noise is observed on the oscilloscope. Slight decrease the gain to obtain a low-noise display. Record the power meter's reading in the LIN column. Press the Log pushbutton. Readjust the gain control for a low-noise display and record the power meter reading in the LOG column.

(d) Change the signal generator level per the data sheet, and record the linear and log readings as above.

(e) Enter the logarithm of the linear readings in the "LIN (log)" column, and plot the logarithms as a function of the signal generator level on the second page of the data sheet. Determine the 1 dB linear range and calculate the linear dynamic range.

(f) Plot the data in the LOG column vs. the signal generator level on the third page of the data sheet. Again determine the 1 dB points and calculate the log dynamic range.

4.3.8 IDR Tests

This test verifies the instantaneous dynamic range (IDR) meets the requirements of paragraph *4.3.3.5.d Spur-free Dynamic Range (RF Input to IF).*

(a) Connect the HP 8662 signal generator (A) to the #1 port of the combiner network. Connect the Tektronix FG501 Function Generator (B) to the #2 port. Connect the combiner network's output port to the RF Input #1 connector. Connect the spectrum analyzer to the IF output connector. Set the generator's frequencies as indicated in the A and B columns on the data sheet.

(b) Set the receiver's controls as follows:

Tuned Frequency	Per data sheet
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	Per data sheet

(c) Adjust the spectrum analyzer controls to produce a mid-screen display. Observe the analyzer and equally adjust the levels of the signal sources until the third order intermodulation products are 3 dB above the noise floor. Record the levels in the SIG.GEN.LEVEL column on the data sheet.

(d) Calculate the IDR as shown in the data sheet and record the value.

(e) Repeat the process for the data sheet's other test conditions.

4.3.9 Input Tests

These tests verify the input characteristics in accordance with paragraphs *4.3.3.3.d Input Isolation, 4.3.3.3.f Input Impedance and VSWR, 4.3.3.3.g Maximum Tolerated RF Input, and 4.3.3.8.b LO Re-radiation.*

4.3.9.1 Input Isolation

(a) Connect the HP 8662 signal generator to the RF Input #1 connector and the spectrum analyzer to the RF Input #2 connector. Set the generator's frequency and amplitude as indicated on the data sheet.

(b) Set the receiver's controls as follows:

Tuned Frequency	Per data sheet
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	Per data sheet

(c) Increase the generator's output until an adequate reading is obtained with the spectrum analyzer. Record both the signal generator's level and the spectrum analyzer's amplitude reading.

(d) Set the generator frequency to the other values on the data sheet and repeat the test.

(e) Calculate the isolation and record on data sheet

4.3.9.2 LO Re-radiation

(a) Connect the spectrum analyzer to the RF Input #1 connector.

(b) Set the receiver's controls as follows:

Tuned Frequency	Per data sheet
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	Per data sheet

(c) Adjust the spectrum analyzer and record the analyzer's amplitude reading in the LO RE-RADIATION column on the data sheet.

(d) Tune the receiver to the other frequencies on the data sheet and repeat the measurement.

4.3.9.3 Input Impedance and VSWR

(a) Connect the HF directional coupler between the TEK 501 tracking generator and the receiver's RF Input #1. Verify that RF Input #1 is selected. Connect the spectrum analyzer to the test output of the coupler. Set the tracking generator's frequency and the analyzers frequency-span per the data sheet.

(b) Tune the receiver per the data sheet, and set the input attenuator to 0 dB.

(c) Observe and store the analyzer's display of the return loss. Disconnect the cable from the receiver. Again observe the analyzer's display. Recall the stored display and determine the difference between the new and stored displays; record results on the data sheet in the RETURN LOSS column. The return loss must be greater than 9.5 dB at the nominal input impedance of 50 ohms. Set the receiver's attenuator to 30 dB and repeat the test.

(d) Repeat the test at the other frequencies in the data sheet, substituting the dual directional coupler where indicated.

4.3.9.4 Maximum Tolerated RF Input

(a) Connect the power amplifier between the HP 8662 signal generator and the power meter (use the high power head). Set the generator to 100 KHz and adjust the generator's level while monitoring the power meter. Record the generator setting required for a 30 dBm reading on the power meter. Reduce the generator level so the power meter reads -20 dBm. Record the generator setting.

(b) Connect the output of the power amplifier to RF Input #1. Verify that RF Input #1 is selected.

(c) Verify operation of the receiver is normal by selecting different bandwidths and changing the attenuator and gain settings. Record results. Reset the input attenuator to 0 dB and the RF Gain to maximum.

(d) Increase the generator's level to the value required for a 30 dBm input. Maintain this input for 1 minute. Reduce the input to -20 dBm. Verify operation of the receiver is normal. Record results.

(e) Set the input attenuator to 30 dB and the RF Gain to maximum. Increase the generator's level to the value required for a 30 dBm input. Maintain this input for 1 minute. Reduce the input to -20 dBm. Verify operation of the receiver is normal. Record results.

4.3.10 IF Impulse Response Tests

This test verifies impulsive response characteristics of the IF in accordance with paragraph *4.3.3.6.e IF Bandwidth Impulse Response*. Two test sequences are used: the first for the fixed IF filters, and the second for the DCIF's default filter set.

4.3.10.1 Fixed Filter Impulse Response

(a) Connect the impulse generator (IG) to the RF Input #1 connector. Connect the oscilloscope to the IF output connector. Set the IG repetition rate and level per the data sheet.

(b) Set the receiver's controls as follows:

Tuned Frequency	Per data sheet
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	Per data sheet

(c) Adjust the oscilloscope controls to produce a mid-screen display of a single pulse. Measure the peak amplitude of the response and record in the "A" column of the data sheet. Measure the peak-to-peak amplitude of the secondary ringing and record in the "a" column. Calculate the ratio (a/A) and record.

(d) Repeat the test for the remaining bandwidth in the data sheet.

4.3.10.2 DCIF Impulse Response

(a) Connect the impulse generator (IG) to the RF Input #1 connector. Connect the oscilloscope to the video output connector. Set the IG repetition rate and level per the data sheet.

(b) Set the receiver's controls as follows:

Tuned Frequency	Per data sheet
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	Per data sheet

(c) Adjust the oscilloscope controls to produce a mid-screen display of a single pulse. Measure the peak amplitude of the response and record in the "A" column of the data sheet. Measure the peak-to-peak amplitude of the secondary ringing and record in the "a" column. Calculate the ratio (a/A) and record.

(d) Repeat the test for the remaining bandwidths in the data sheet.

4.3.11 Frequency Accuracy and Stability

This test verifies that the receiver's frequency accuracy and stability are in accordance with paragraph *4.3.3.4.b Frequency Accuracy and Stability*. Because this test requires an extended power-off period, it should be performed when most convenient (i.e. first thing in the morning).

(a) Turn off the receiver and allow it to stabilize at room temperature for 8 hours. Do not turn on the receiver until step (c), below.

(b) Turn on the HP 8662 signal generator for at least 3 hours before the test. Connect the generator to the RF Input #1 connector. Set the generator's frequency to exactly 100 MHz using the keypad and the amplitude to -30 dBm. Connect the frequency counter to the IF output connector. Set the counter's controls to permit frequency measurements with a resolution of 0.1 Hz.

(b) Record the time and turn on the receiver; immediately set the receiver's controls as follows:

Tuned Frequency	100 MHz (use keypad)
Input Attenuator	0 dB
Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	1 MHz

(c) Read and record the frequency counter indication and the time of the measurement. Calculate the frequency accuracy by taking the difference between the measurement and the IF center frequency (21.4000000 MHz) and dividing the result by 21.4000000.

(d) Repeat the measurement and calculation every 5 minutes for the first 30 minutes, and at 15 minute intervals until two hours has elapsed.

(e) Determine the frequency stability by calculating the difference between the readings at each interval and the reading at the end of two hours and dividing the result by 21.4000000.

4.3.12 Output Tests

These tests verify the BFO operation and the characteristics of the AM video, AM Log, audio, and Z-axis outputs in accordance with paragraphs *4.3.3.6.g BFO Operation, 4.3.3.7.a Audio, 4.3.3.7.b AM Log, 4.3.3.7.c AM, and 4.3.3.7.e Z-axis.*

4.3.12.1 BFO operation

(a) Connect the HP 8662 signal generator to the RF Input #1 connector. Set the generator's frequency to 1 MHz sheet and the amplitude to the -50 dBm. Connect headphones to the audio phone jack.

(b) Set the receiver's controls as follows:

Tuned Frequency	1 MHz
Input Attenuator	0 dB

Gain	Maximum (turn CW to max.value)
RF Input #1	On
Bandwidth	20 KHz
BFO pushbutton	On

(c) Slowly adjust the signal generator frequency by less than 1 KHz form the 1 MHz setting. Adjust the audio gain control to provide a comfortable sound level. Confirm that the audio frequency changes smoothly as the signal generator is adjusted. Reset the signal generator to the initial frequency.

(d) Connect the frequency counter to the audio phone jack with an adapter. Record the indication (should be zero or a low frequency).

(e) Increase the signal generator frequency by exactly 4 KHz using the keypad. Record the counter's reading (should be 4 KHz).

(f) Adjust the signal generator frequency using a 1 Hz resolution. Confirm that the audio signal changes with the same resolution.

(g) Set the signal generator frequency to equal exactly 4 KHz less than the initial setting using the keypad. Record the counter's reading (should be 4 KHz).

(h) Press the BFO pushbutton to turn off BFO operation

4.3.12.2 AM Video Output

(a) Connect the HP 8662 signal generator to the RF Input #1 connector. Set the signal generator's frequency to 100 MHz and the amplitude to -30 dBm. Connect the oscilloscope (with a 50 ohm load) to the video connector.

(b) Set the receiver's controls as follows:

Tuned Frequency	100 MHz
Input Attenuator	0 dB
Gain	Minimum (turn CCW to min. value)
RF Input #1	On
Bandwidth	Per data sheet
LOG pushbutton	Off

(c) Record the DC video offset voltage present at the video connector at the bandwidth settings indicated on the data sheet.

(d) Return the receiver gain to the maximum setting (turn CW). Set the bandwidth to 15 MHz.

(e) Increase the signal generator output until the video reaches its maximum. Record the maximum DC value.

(f) Introduce the modulator between the signal generator and the receiver. Connect the Tektronix FG501 Function Generator to the modulation port of the modulator. Connect the

modulator's output port to the RF Input #1 connector. Set the HP 8662's frequency to 100 MHz and the amplitude to -30 dBm. Set the function generator's frequency to 100 KHz and its level to -10 dBm.

(g) Increase the function generator's level and observe the video signal with the oscilloscope. Adjust the level to obtain a 2 volt (peak) signal on the oscilloscope.

(h) Change the function generator's frequency per the data sheet and record the peak voltage indication on the oscilloscope at each setting.

(i) Plot the video data. Determine where the signal level decreases to 1 volt. Record as cut-off frequency value.

4.3.12.3 Z-axis

(a) Connect the HP 8662 signal generator to the input port of the modulator. Connect the Tektronix FG501 Function Generator to the modulation port of the modulator. Connect the modulator's output port to the RF Input #1 connector. Set the HP 8662 frequency to 100 MHz and the amplitude to -30 dBm. Set the function generator's frequency to 100 KHz and its level to -10 dBm. Connect the oscilloscope (with a 50 ohm load) to the Z-axis connector.

(b) Set the receiver's controls as follows:

Tuned Frequency	100 MHz
Input Attenuator	0 dB
Gain	Maximum (turn CW to max. value)
RF Input #1	On
Bandwidth	15 MHz
Z-axis ON pushbutton	On
Z-axis INV pushbutton	Off

(c) Increase the signal and function generator's outputs in equal increments until the Z-axis output just starts to distort. Measure or calculate the maximum RMS voltage and record in the NORMAL column on the data sheet.

(d) Press the Z-AXIS INV pushbutton. Readjust the generator's outputs to obtain the inverted Z-axis output at the distortion point. Record the maximum RMS voltage in the INVERTED column on the data sheet. Press the pushbutton to return to normal Z-axis operation.

(e) Return the HP 8662's level to -30 dBm, and decrease the function generator's level to obtain a 2 volt peak-peak signal on the oscilloscope.

(f) Change the function generator's frequency per the data sheet and record the peak voltage indication on the oscilloscope at each setting.

(g) Plot the Z-axis data. Determine where the signal level decreases to 1 volt. Record as cut-off frequency value.

(h) Press the pushbutton to turn off Z-axis operation

4.3.12.4 AM Log Output

(a) Connect the HP 8662 signal generator to the RF Input #1 connector. Connect the oscilloscope (with a 50 ohm load) to the video connector. Set the signal generator's frequency and amplitude per the data sheet.

(b) Set the receiver's controls as follows:

Tuned Frequency	Per data sheet
Input Attenuator	0 dB
Gain	Minimum (turn CCW to min. value)
RF Input #1	On
Bandwidth	10 KHz
Log Pushbutton	On

(c) Record the DC log offset voltage present at the video connector at the bandwidth settings indicated on the data sheet.

(d) Return the receiver gain to the maximum setting (turn CW). Set the bandwidth per the data sheet.

(e) Increase the signal generator output until the maximum level is obtained. Record the maximum DC level seen on the oscilloscope.

(f) Press the pushbutton to turn off Log operation

4.3.12.5 Audio Output

(a) Connect the HP 8662 signal generator to RF Input #1. Select 1 KHz 30% AM modulation. Set the signal generator's frequency to 100 KHz and the amplitude to -30 dBm. Terminate the audio jack with an 8 ohm 15 watt resistor and connect the oscilloscope across this resistor.

(b) Set the receiver's controls as follows:

Tuned Frequency	100 KHz
Input Attenuator	0 dB
Gain	Maximum (turn CW to max. value)
RF Input #1	On
Bandwidth	Per data sheet

(c) Adjust the audio output control until the audio viewed on the oscilloscope just starts to clip. Measure or calculate the RMS voltage and record on the data sheet. Readjust the audio control for 3 vpp.

(d) Set the modulation frequency to the values shown on the data sheet and record the p-p voltages.

(e) Determine and record the end-point frequencies where the voltage is 1.5 vpp.

(f) Turn the audio control full CCW.

4.3.13 Spurious Response Test

The test checks for spurs in accordance with paragraph *4.3.3.8.c Internally Generated Spurs.*

(a) Terminate the receiver's inputs with 50 ohms. Select a bandwidth of 500 Hz. Monitor the IF output with the spectrum analyzer.

(b) Tune the receiver per the data sheet from 1 KHz to 20 KHz. Record the frequency and amplitude of all spurious responses greater than 6 dB above the noise floor.

(c) Set the bandwidth to 10 KHz and tune the receiver through its full range per the data sheet. Record the frequency and amplitude of all spurious responses greater than 6 dB above the noise floor.

(d) Remove the 50 ohm termination and connect the HP 8662 signal generator to RF Input #1. Adjust the signal generator frequency to the first spur frequency recorded in the previous steps. Adjust the generator's level until the IF response is equal to the spur. Record the generator's level in the data sheet's INPUT LEVEL column.

4.3.14 Power Tests

The power tests verify the receiver will not be damaged by connection to a 230 vac source when the line switch is in its 115 vac setting, and determines the power consumption, in accordance with paragraphs *4.3.3.8.e No Damage by High Line Voltage, and 4.4 Power Requirements.* The power consumption is also checked.

4.3.14.1 High Line Voltage

(a) Set the receiver's line switch to 115 vac.

(b) Power the receiver from the tapped transformer. Set the transformer's output voltage to 115 vac.

(c) Connect the HP 8662 signal generator to RF Input #1. Select 1 KHz 30% AM modulation. Set the signal generator's frequency to 100 KHz and the amplitude to -30 dBm. Connect the oscilloscope to the video connector.

(d) Set the receiver's controls as follows:

Tuned Frequency	100 KHz
Input Attenuator	0 dB
Gain	Maximum (turn CW to max. value)

RF Input #1	On
Bandwidth	1 KHz

(e) Adjust the generator's level until the video viewed on the oscilloscope is 1 vpp.

(f) Exercise the receiver's controls to verify that operation is normal.

(g) Switch the transformer to output 230 vac. Observe if the receiver's line fuse(s) blow. If the fuses fail to blow and the receiver continues to operate, shut off the receiver and correct problem.

(h) Shut off power and replace the fuse(s). Set the transformer power to 115 vac and turn on the receiver.

(i) Confirm that the receiver operates properly using the video indication and by exercising the controls.

4.3.14.2 Power Requirements

(a) Set the receiver's line switch to 115 vac.

(b) Connect the receiver to the variable AC power supply. Set the output voltage to 115 vac and the frequency to 60 Hz.

(c) Connect the HP 8662 signal generator to RF Input #1. Select 1 KHz 30% AM modulation. Set the signal generator's frequency to 100 KHz and the amplitude to -30 dBm. Connect the oscilloscope to the video connector.

(d) Set the receiver's controls as follows:

Tuned Frequency	100 KHz
Input Attenuator	0 dB
Gain	Maximum (turn CW to max. value)
RF Input #1	On
Bandwidth	1 KHz

(e) Adjust the generator's level until the video viewed on the oscilloscope is 1 vpp. Exercise the receiver's controls to verify that operation is normal. Record.

(f) Record the AC Power Supply's voltage and current readings. Calculate and record the power consumption.

(g) Set the AC power supply's frequency to 48 Hz.

(h) Check the video signal and exercise the receiver's controls to verify that operation is normal. Record.

(i) Increase the frequency to 62 hz in 1 Hz steps. Check for normal operation at each step. Record. Set the frequency back to 60 Hz.

(j) Adjust the AC power supply's voltage to 127 vac. Observe if the PWRHI light-bar illuminates. Record.

(k) Rotate the receiver's power range switch to the high line setting (position 1). Observe if the PWRHI light-bar extinguishes. Record.

(l) Check the video signal and exercise the receiver's controls to verify that operation is normal. Record.

(m) Set the AC power supply's frequency to 48 Hz. Verify that operation is normal. Record.

(n) Set the AC power supply's frequency to 62 Hz. Verify operation is normal. Record. Reset the frequency to 60 Hz.

(o) Adjust the AC power supply's voltage to 102 vac. Observe if the PWRLO light-bar illuminates. Record.

(p) Rotate the receiver's power range switch to the low line setting (position 6). Observe if the PWRLO light-bar extinguishes. Record.

(q) Check the video signal and exercise the receiver's controls to verify that operation is normal. Record.

(r) Set the AC power supply's frequency to 48 Hz. Verify that operation is normal. Record.

(s) Set the AC power supply's frequency to 62 Hz. Verify operation is normal. Record.

5. TECHNICAL NOTES

TP493000

Prototype R110 FTTR Receiver

ACCEPTANCE TEST PROCEDURE

DATA SHEETS

Test Tech: _____

Inspector: _____

S.N. _____

Final
Test Date: _____

PHYSICAL AUDIT DATA SHEET
TEST PARAGRAPH 4.3.1

PROTOTYPE SERIAL NO. _____
DATE OF AUDIT _____
AUDIT CONDUCTED BY _____ WITNESSED BY _____

REQUIREMENT	YES	NO	SOW Para.
FRONT PANEL			
Dual BNC RF Input Connectors	___	___	4.3.2.1.a, 4.3.3.3.e (modified)
Dual RF Input Select Pushbuttons	___	___	4.3.2.1.b
BNC AM Output Connector	___	___	4.3.2.1.c
BNC Audio Output Connector	___	___	4.3.2.1.d
Attenuator Control Pushbuttons/Display	___	___	4.3.2.1.e (modified)
Gain Control Pushbuttons/Display	___	___	4.3.2.1.e,f (modified)
Freq.Tuning Knob/Pushbuttons	___	___	4.3.2.1.g
Z Axis Gain Control Knob	___	___	4.3.2.1.h
Z Axis On/Off Pushbutton	___	___	4.3.2.1.i
Z Axis Polarity Pushbutton	___	___	4.3.2.1.j
Power On/Off Switch	___	___	4.3.2.1.k
RF Overload Indicator	___	___	4.3.2.1.l
IF/Detector Overload Indicator	___	___	4.3.2.1.m (modified)
Frequency Display	___	___	4.3.2.1.n
Front Panel Controls/Displays OK?			___Yes ___No
REAR PANEL			
Z axis Output Connector	___	___	4.3.2.2.a
IF Output Connector	___	___	4.3.2.2.b
Reference Oscillator Output Connector	___	___	4.3.2.2.c
Signal Monitor Connector	___	___	4.3.2.2.d
IEEE-488 Connector	___	___	4.3.2.2.e
AC Input Connector	___	___	4.3.2.2.f
Line voltage select	___	___	4.3.3.8.f
Rear Panel Switches/Connectors OK?			___Yes ___No
ACCESSORIES			
Shielded Power cord	___	___	4.3.3.8.d
Extender Card	___	___	(n.a.)
Accessories OK?			___Yes ___No

	Measurement	Requirement	
WEIGHT	_____lbs	Not exceed 75 lbs	4.5
Weight OK?			___Yes ___No

PHYSICAL AUDIT DATA SHEET
TEST PARAGRAPH 4.3.1
Continued

SIZE

Height	_____in.	Not exceed 7.0 in. 4.5
Length	_____in.	Not exceed 21.0 in. 4.5
Width	_____in.	Not exceed 17.5 in. 4.5

Size OK? ___Yes ___No

IDENTIFICATION LABELS

Label with Make, Model, and Serial No. is in place on rear panel? ___Yes ___No

OPERATIONAL TESTS DATA SHEET
TEST PARAGRAPH 4.3.2

4.3.2.1 Set-up for Operational Tests

	MEASUREMENT	REQUIREMENT
Temperature	_____ deg.F	75 ± 10 degrees F
Altitude	_____ Ft	0 to 3000 feet
Humidity	_____ %	10 to 90 %
Power line voltage	_____ vac	115 ± 3 vac

Test Conditions OK? Yes___ No___

Power Cable Connection OK? Yes___ No___

4.3.2.2 Knob Alignment

Knob Alignment OK? Yes___ No___

4.3.2.3 Start-up and Initialization

(a) TUNE light-bar indicator illuminated? Yes___ No___

(b) Any of following Light-bar indicators illuminated? Yes___ No___

	Illuminated?
UNLOCK	___
RFOVL	___
IF/DET OL	___
UNREG	___

If yes, terminate the test and correct the problem.
Describe Corrective Actions:

(c) "PwrHi" / "PwrLo" lightbars illuminated? Yes___ No___
If Yes, line voltage is: _____ vac

Corrective action: adjust line voltage

Corrected line voltage: _____ vac

(d) Reset Receiver to Standard Test Conditions

Audible Alarm:
BEEP light-bar illuminates? Yes___ No___

OPERATIONAL TESTS DATA SHEET
TEST PARAGRAPH 4.3.2
Continued

(e) Front panel displays illuminated and indicate the following?

Frequency Display:	100 MHz	
Input Attenuation Display:	20 dB	
Gain Display:	0 dB	
Bandwidth Display:	1 MHz	Yes__ No__

(f) 10 minute warm up completed? Yes__ No__

4.3.2.4 Input Operation Yes__ No__

(b) LED in RF Input #1's pushbutton illuminated? Yes__ No__

(c) IF Signal (cable to RF Input #1) _____ dBm

IF Signal (cable to RF Input #2) _____ dBm

RF Input #2's LED illuminated? Yes__ No__

IF Signal (RF Input #2 selected) _____ dBm

4.3.2.5 Display Tests

4.3.2.5.1 Input Attenuation Display Reading:

Reading:	Should Be:	Reading OK?
____	20 dB	Yes__ No__
____	30 dB	Yes__ No__
____	40 dB	Yes__ No__
____	50 dB	Yes__ No__
____	60 dB	Yes__ No__
____	70 dB	Yes__ No__
____	AUTO	Yes__ No__
____	60 dB	Yes__ No__
____	50 dB	Yes__ No__
____	40 dB	Yes__ No__
____	30 dB	Yes__ No__
____	20 dB	Yes__ No__
____	10 dB	Yes__ No__
____	0 dB	Yes__ No__

Beep tone? Yes__ No__

OPERATIONAL TESTS DATA SHEET
TEST PARAGRAPH 4.3.2
Continued

4.3.2.5.2 Bandwidth Display

Reading:	Should Be:	Reading OK?
____	1 MHz	Yes__ No__
____	4 MHz	Yes__ No__
____	15 MHz	Yes__ No__
Beep tone?		Yes__ No__
____	4 MHz	Yes__ No__
____	1 MHz	Yes__ No__
____	300 KHz	Yes__ No__
____	100 KHz	Yes__ No__
____	50 KHz	Yes__ No__
____	20 KHz	Yes__ No__
____	10 KHz	Yes__ No__
____	5 KHz	Yes__ No__
____	2 KHz	Yes__ No__
____	1 KHz	Yes__ No__
____	500 Hz	Yes__ No__
Beep tone?		Yes__ No__

4.3.2.5.3 Frequency Display and Tuning

Enter:	Reading:	Reading OK?
888.88 KHz	____ KHz	Yes__ No__
7777.7 Hz	____ Hz	Yes__ No__
999.9 MHz	____ MHz	Yes__ No__

4.3.2.6 Tuning Tests

Left-most digit (#1) tunes properly?	Yes__ No__
Digit #2 tunes properly?	Yes__ No__
Digit #3 tunes properly?	Yes__ No__
Digit #4 tunes properly?	Yes__ No__
Digit #5 tunes properly?	Yes__ No__
Digit #6 tunes properly?	Yes__ No__
Digit #7 tunes properly?	Yes__ No__
Digit #8 tunes properly?	Yes__ No__

OPERATIONAL TESTS DATA SHEET
TEST PARAGRAPH 4.3.2
Continued

4.3.2.7 Display Brightness

BRIGHT light-bar illuminates? Yes__ No__

Brightness fully adjustable? Yes__ No__

4.3.2.8 Audible Alarm

BEEP light-bar illuminates? Yes__ No__

Set to comfortable sound level? Yes__ No__

4.3.2.9 Synthesizer Step Noise in Outputs

Step Noise detected? Yes__ No__

List Frequencies:

4.3.2.10 Scan Mode

Start Frequency	50 KHz
Stop Frequency	150 KHz
Step Size	1 KHz

(c) SCAN light-bar illuminates? Yes__ No__

(c) START light-bar illuminates? Yes__ No__

(d) STOP and STEP light-bars illuminate? Yes__ No__

(e) Oscilloscope display shows the presence of a strong signal mid-point of sweep? Yes__ No__

(f) "Pause" key operates correctly? Yes__ No__

TRANSFER FUNCTION TESTS DATA SHEET
TEST PARAGRAPH 4.3.3

4.3.3.1 Input Attenuator

(c) IF Output amplitude:_____dBm (for reference only)

(c) Frequency = 100 KHz

Attenuation Setting (dB)	Pwr.Meter Change (dB) 0.2 dB max.	Attenuator Error Acceptable?	
		YES	NO
10			
20			
30			
40			
50			
60			
70			

(d) Frequency = 100 MHz

Attenuation Setting (dB)	Pwr.Meter Change (dB) 0.2 dB max.	Attenuator Error Acceptable?	
		YES	NO
10			
20			
30			
40			
50			
60			
70			

TRANSFER FUNCTION TESTS DATA SHEET
TEST PARAGRAPH 4.3.3
Continued

4.3.3.1 Input Attenuator, continued

(e) Frequency = 900 MHz

Attenuation Setting (dB)	Pwr.Meter Change (dB) 0.2 dB max.	Attenuator Error Acceptable?	
		YES	NO
10			
20			
30			
40			
50			
60			
70			

TRANSFER FUNCTION TESTS DATA SHEET
TEST PARAGRAPH 4.3.3
Continued

4.3.3.2 Variable Gain

Frequency and BW	Gain Setting (dB)	IF Output (dBm)	Required IF Output (dB) ± 1 dB		Output OK?	
					Yes	No
100 KHz						
10 Khz						
10 MHz						
1 MHz						
500 MHz						
1 MHz						

4.3.3.3 AGC Mode

(b) IF output amplitude (for reference) _____ dBm

(c) IF output amplitude with AGC _____ dBm
(c) IF output with -50 dBm input _____ dBm

Difference (-2 to +2 dB) _____dB AGC OK? Yes___ No___

(d) Time constant for -30 to -25 dBm _____ sec.

T.C. is 0.1 ± .02 sec? Yes___ No___

Time constant for -25 to -30 dBm _____ sec.

T.C. is 0.1 ± .02 sec? Yes___ No___

TRANSFER FUNCTION TESTS DATA SHEET
TEST PARAGRAPH 4.3.3
Continued

4.3.3.4 Incremental Gain Mode

(b) IF output amplitude _____dBm

(c) △ GAIN light-bar illuminates? Yes___ No___

Gain Reading:		Should Be:	Reading OK?
Initial	_____	0	Yes___ No___
@ -50 dBm	_____	+20	Yes___ No___

(d)

Gain Reading:		Should Be:	Reading OK?
Initial	_____	0	Yes___ No___
@ -10 dBm	_____	-40	Yes___ No___

IF TESTS DATA SHEET
TEST PARAGRAPH 4.3.4

4.3.4 IF Selectivity (Fixed Filters)

IF BW	Low 6 dB	High 6 dB	6 dB BW	Min Max	OK ?	Low 60 dB	High 60 dB	60 dB BW	Min Max	OK ?
15 MHz				14.0 17.0					20.0 25.0	
4 MHz										
1 MHz										
300 KHz										
100 KHz										

Fixed filter IF BW OK? Yes__ No__

IF TESTS DATA SHEET
TEST PARAGRAPH 4.3.4
Continued

4.3.4.2 IF Selectivity (DCIF Filters)

(d,e) DEFAULT FILTER SET:

IF BW	Low 6 dB	High 6 dB	6 dB BW	Min Max	OK ?	Low 60 dB	High 60 dB	60 dB BW	Min Max	OK ?
50 KHz										
20 KHz										
10 KHz										
5 KHz										
2 KHz										
1 KHz										
500 Hz										
200 Hz										

Default IF BW OK? Yes___ No___

IF TESTS DATA SHEET
TEST PARAGRAPH 4.3.4
Continued

(f) ADDITIONAL ALTERNATE FILTERS:

ALT BW light-bar illuminates? Yes___ No___

IF BW	Low 6 dB	High 6 dB	6 dB BW	Min Max	OK ?	Low 60 dB	High 60 dB	60 dB BW	Min Max	OK ?
40 KHz										
32 KHz										
25 KHz										
16 KHz										
12.5 KHz										
8 KHz										
6.4 KHz										
4 KHz										
3.2 KHz										

IF TESTS DATA SHEET
TEST PARAGRAPH 4.3.4
Continued

(f) ADDITIONAL ALTERNATE FILTERS (continued):

IF BW	Low 6 dB	High 6 dB	6 dB BW	Min Max	OK ?	Low 60 dB	High 60 dB	60 dB BW	Min Max	OK ?
2.5 KHz										
1.6 KHz										
1.25 KHz										
800 Hz										
640 Hz										
400 Hz										
320 Hz										
250 Hz										

Alternate IF BW OK? Yes__ No__

IF TESTS DATA SHEET
TEST PARAGRAPH 4.3.4
Continued

4.3.4.3 IF Output Level

(c) Sig.Gen. Level ____ dBm

(d) Max. IF output amplitude ____ dBm (Reqmt: at least 0 dBm)

Max.IF Output OK? Yes__ No__

4.3.4.4 Signal Monitor

		Reading	**Spec. Value**
(c)	Freq. counter reading	____ MHz	21.4000000 MHz
(d)	Sig.Monitor amplitude at -107 dBm input	____ dBm	10 uV peak (-90 dBm at 3 MHz BW)
(f)	sideband amplitude at 1 KHz modulation	____ dBm	na
	3 dB Frequency	____ MHz	na
	Bandwidth (2 X 3 dB Frequency)	____ MHz	at least 4.0 MHz

Signal Monitor OK? Yes__ No__

NOISE FIGURE TESTS DATA SHEET
TEST PARAGRAPH 4.3.5

4.3.5 Noise Figure Tests

FREQUENCY	BW	THEORETICAL NOISE FLOOR	3 dB SENSI-TIVITY	NOISE FIGURE 15 dB max	NF OK ?
50 KHz	1 KHz	-144 dBm			
100 KHz	1 KHz	-144 dBm			
200 KHz	1 KHz	-144 dBm			
200 KHz	10 KHz	-134 dBm			
500 KHz	10 KHz	-134 dBm			
5 MHz	10 KHz	-134 dBm			
10 MHz	10 KHz	-134 dBm			
14 MHz	10 KHz	-134 dBm			
16 MHz	10 KHz	-134 dBm			
100 MHz	1 MHz	-114 dBm			
500 MHz	1 MHz	-114 dBm			
900 MHz	1 MHz	-114 dBm			

Noise Figure OK? Yes__ No__

IMAGE AND IF REJECTION TESTS DATA SHEET
TEST PARAGRAPH 4.3.6

4.3.6 Image and IF Rejection Test

RECEIVER		(c) INITIAL READINGS			(d) IMAGE MEASUR-EMENTS		(d) IMAGE RE-JECTION	
Tuned Freq.	Band-width	Sig-Gen. Freq.	Sig.Gen. Level (A)	IF Out put	Sig.Gen. Freq.	Sig.Gen. Level (B)	B-A	At least 80 dB?
10 KHz	1 KHz	10 KHz			16 KHz			
100 KHz	10 KHz	100 KHz			106 KHz			
500 KHz	10 KHz	500 KHz			43.3 MHz			
5 MHz	10 KHz	5 MHz			47.8 MHz			
14 MHz	10 KHz	14 MHz			56.8 MHz			
20 MHz	1 MHz	20 MHz			1470 MHz			
500 MHz	1 MHz	500 MHz			1950 MHz			
900 MHz	1 MHz	900 MHz			2350 MHz			

Image Rejection OK? Yes___ No___

IMAGE AND IF REJECTION TESTS DATA SHEET
TEST PARAGRAPH 4.3.6
Continued

RECEIVER		(c) INITIAL READINGS			(e) IF MEASUR-EMENTS		IF REJECTION	
Tuned Freq.	Band-width	Sig-Gen. Freq.	Sig.Gen. Level (A)	IF Out put	Sig.Gen. Freq.	Sig.Gen. Level (B)	B-A	At least 80 dB?
10 KHz	1 KHz	10 KHz			3 KHz			
100 KHz	10 KHz	100 KHz			3 KHz			
500 KHz	10 KHz	500 KHz			21.4 MHz			
5 MHz	10 KHz	5 MHz			21.4 MHz			
14 MHz	10 KHz	14 MHz			21.4 MHz			
20 MHz	1 MHz	20 MHz			1450 MHz			
500 MHz	1 MHz	500 MHz			1450 MHz			
900 MHz	1 MHz	900 MHz			1450 MHz			

IF Rejection OK? Yes___ No___

AM DYNAMIC RANGE TESTS DATA SHEET
TEST PARAGRAPH 4.3.7

4.3.7 AM Dynamic Range Tests

Sig.Gen Level (dBm)	LIN (dBm)	LIN (log)	LOG (dBm)
-100			
-90			
-80			
-70			
-60			
-50			
-40			
-30			
-20			
-10			

AM DYNAMIC RANGE TESTS DATA SHEET
TEST PARAGRAPH 4.3.7
Continued

Plot LIN (log) Data for Linear Detection:

From plot:

± 1 dB Linear range:

a. Start sig.gen level: _____ dBm

b. End sig.gen level: _____ dBm

Dynamic Range (b-a) _____ dB (must be at least 35 dB)

Linear Dyn. Range OK? Yes__ No__

AM DYNAMIC RANGE TESTS DATA SHEET
TEST PARAGRAPH 4.3.7
Continued

Plot LOG Data for Log Detection:

From plot:

± 1 dB Linear range:

a. Start sig.gen level: _____ dBm

b. End sig.gen level: _____ dBm

Dynamic Range (b-a) _____ dB (must be at least 60 dB)

Log Dyn. Range OK? Yes__ No__

IDR TESTS DATA SHEET
TEST PARAGRAPH 4.3.8

4.3.8 Instantaneous Dynamic Range (IDR) Tests

Receiver Freq.	BW	Noise Figure*	A Freq.	B Freq.	Sig.-Gen Level (dBm)	IDR (dB) **	At least 60 dB?
100 KHz	1 KHz						
10 MHz	10 KHz						
100 MHz	1 MHz						

* from 4.3.5 Noise Figure Tests

** Calculate IDR:

IDR (dB) = 2/3 (IIP - NF + 174 - 10(log BW))

where:
IIP is the third order input intercept point in dBm = Sig.Gen Level
NF is the receiver noise figure = Noise figure from previous test
BW is the receiver bandwidth =

BW	10(log BW)
1 KHz	30
10 KHz	40
1 MHz	60

IDR OK? Yes__ No__

INPUT TESTS DATA SHEET
TEST PARAGRAPH 4.3.9

4.3.9 Input Tests

4.3.9.1 Input Isolation

Receiver Freq.	BW	Sig.Gen. Amplitude (dBm)	Spec.An. Amplitude (dBm)	Isolation (dB)*	At least 60 db?
100 KHz	1 KHz				
10 MHz	10 KHz				
100 MHz	1 MHz				

* Calculate isolation = Sig.Gen Amplitude - Spec.Analyzer Amplitude

Input Isolation OK? Yes__ No__

4.3.9.2 LO Re-radiation

Receiver Freq.	BW	LO Re-Radiation (dBm)	At least -90 dBm?
100 KHz	1 KHz		
10 MHz	10 KHz		
100 MHz	1 MHz		
900 MHz	1 MHz		

LO Re-radiation OK? Yes__ No__

INPUT TESTS DATA SHEET
TEST PARAGRAPH 4.3.9
Continued

4.3.9.3 Input Impedance and VSWR

Coupler	Frequency	Attenuator	Return Loss (dB)	Less than 9 dB?
HF	100 KHz	0 dB		
HF	100 KHz	30 dB		
HF	10 MHz	0 dB		
HF	10 MHz	30 dB		
HP 778D	100 MHz	0 dB		
HP 778D	100 MHz	30 dB		
HP 778D	900 MHz	0 dB		
HP 778D	900 MHz	30 dB		

Input Impedance and VSWR OK? Yes___ No___

4.3.9.4 Maximum Tolerated RF Input

(a) Signal generator level for 30 dBm output from power amplifier _____ dBm

Signal generator level for -20 dBm output from power amplifier _____ dBm

(c) Receiver operation OK? Yes___ No___
Input attenuator to 0 dB and RF Gain to maximum? Yes___ No___

(d) Receiver operation OK after 30 dBm input? Yes___ No___

(e) Input attenuator to 30 dB? Yes___ No___

(d) Receiver operation OK after 30 dBm input? Yes___ No___

Max. Tolerated RF Input OK? Yes___ No___

IF IMPULSIVE TESTS DATA SHEET
TEST PARAGRAPH 4.3.10

4.3.10 IF Impulse Response Tests

4.3.10.1 Fixed Filter Impulse Response

Impulse Gen. (IG)		Tuned Freq	Recvr BW	1st Peak (A)	P-P Ring-ing (a)	Ratio (a/A) (%)	Less than 12% ?
Rep.-Rate	dBm Level						
1 KHz	-30	100 MHz	300 KHz				
1 KHz	-30	100 MHz	1 MHz				
1 Khz	-30	100 MHz	4 MHz				
1 Khz	-30	100 MHz	15 MHz				

Impulse response of fixed filters OK? Yes___ No___

IF IMPULSIVE TESTS DATA SHEET
TEST PARAGRAPH 4.3.10
Continued

4.3.10.2 DCIF Impulse Response

Impulse Gen. (IG)		Receiver Tuned Frequency	Recvr BW	1st Peak (A)	P-P Ring-ing (a)	Ratio (a/A) (%)	Less than 8% ?
Rep.-Rate	dBm Level						
1 KHz	-30	100 KHz	100 KHz				
1 KHz	-30	100 KHz	50 KHz				
1 KHz	-30	100 KHz	20 KHz				
1 KHz	-30	100 KHz	10 KHz				
100 Hz	-30	100 KHz	5 KHz				
100 Hz	-30	100 KHz	2 KHz				
100 Hz	-30	100 KHz	1 KHz				
10 Hz	-30	100 KHz	500 Hz				
10 Hz	-30	100 KHz	100 Hz				

Impulse response of DCIF filters OK? Yes___ No___

FREQUENCY ACCURACY AND STABILITY TESTS DATA SHEET
TEST PARAGRAPH 4.3.11

4.3.11 Frequency Accuracy and Stability

(a) Receiver stabilized at room temperature for 8 hours? Yes__ No__

Time of Measurement	Approx. Elapsed Time	Frequency (MHz)	Frequency Accuracy (%)*	Frequency Stability (%)**
	0			
	5			
	10			
	15			
	20			
	25			
	30			
	45			
	60			
	1 hr 15 min			
	1 hr 30 min			
	1 hr 45 min			
	2 hr			

* Frequency Accuracy = {Frequency (MHz) - 21.4000000}/ 21.4000000.

** Frequency Stability = {Frequency @ 2 hrs - Frequency}/21.4000000.

Frequency Accuracy better than 1 ppm at 1/2 hour? Yes__ No__

Frequency Stability better than 1 ppm at 1/2 hour? Yes__ No__

OUTPUT TESTS DATA SHEET
TEST PARAGRAPH 4.3.12

4.3.12 Output Tests

4.3.12.1 BFO operation

(c) Audio frequency changes smoothly? Yes__ No__

(d) Frequency counter indication: _____

Frequency approx. equal to zero? Yes__ No__

(e) Frequency counter reading for + 4 KHz: _____

Frequency approx. equal to 4 KHz? Yes__ No__

(f) Audio signal changes with same resolution? Yes__ No__

(g) Frequency counter's reading for - 4 KHz: _____

Frequency approx. equal to 4 KHz? Yes__ No__

4.3.12.2 AM Video Output

(c) DC video offset voltage (for reference only)

Bandwidth	1 KHz	10 KHz	50 KHz	1 MHz	15 MHz
DC Offset					

(e) Max. video output level ____ Vdc

Max. video signal greater than 2 Vdc? Yes__ No__

(g) Video signal set to 2 volt (peak)? Yes__ No__

OUTPUT TESTS DATA SHEET
TEST PARAGRAPH 4.3.12
Continued

4.3.12.2 AM Video Output, continued

(h) Peak voltage readings:

Frequency	Peak Volts
100 KHz	
500 KHz	
1 MHz	
2 MHz	
4 MHz	
6 MHz	
7 MHz	
7.5 MHz	
8 MHz	
9 MHz	
10 MHz	
12 MHz	

(i) Cut-off Frequency (from plot) ____ MHz

Cut-off freq. is greater than 7.5 MHz? Yes__ No__

OUTPUT TESTS DATA SHEET
TEST PARAGRAPH 4.3.12
Continued

4.3.12.3 Z-axis

		NORMAL	INVERTED
(c,d)	Max. Z-axis RMS output:	____	____

Max. Z-axis signal greater than 2 Vrms? Yes__ No__

(f) Peak voltage readings:

Frequency	Peak Volts
100 KHz	
500 KHz	
1 MHz	
2 MHz	
4 MHz	
6 MHz	
7 MHz	
7.5 MHz	
8 MHz	
9 MHz	
10 MHz	
12 MHz	

(i) Cut-off Frequency (from plot) ____ MHz

Cut-off freq. is greater than 7.5 MHz? Yes__ No__

OUTPUT TESTS DATA SHEET
TEST PARAGRAPH 4.3.12
Continued

4.3.12.4 AM Log Output

(c) DC Log offset voltage

Bandwidth	1 KHz	10 KHz	50 KHz	1 MHz	15 MHz
DC Log Offset					

(e) Max. Log output level ____ Vdc
Max. Log output greater than +2 vdc? Yes__ No__

4.3.12.5 Audio Output

(c) Max. audio output RMS voltage _____ Vrms
Max. audio output greater 1 vrms? Yes__ No__

Frequency	Peak-Peak Volts
10 Hz	
20 Hz	
30 Hz	
40 Hz	
60 Hz	
100 Hz	
1 KHz	
4 KHz	
6 KHz	
10 KHz	
12 KHz	
13 KHz	
14 KHz	
15 KHz	

(e) Low Cut-off Frequency (from plot) ____ Hz
Low Cut-off freq. less than 30 Hz? Yes__ No__
High Cut-off Frequency (from plot) ____ KHz
High Cut-off freq. greater than 12 KHz? Yes__ No__

SPURIOUS RESPONSE TEST DATA SHEET
TEST PARAGRAPH 4.3.13

4.3.13 Spurious Response Test

(b,d) Frequency range = 1 KHz to 20 KHz

Bandwidth = 500 Hz

(b) Spurious Responses Scan		(d) Spurious Input Level (dBm)	Spurious less than -107 dBm?
Frequency	Amplitude		

Spurious responses up to 20 KHz OK? Yes___ No___

(c,d) Frequency range = 20 KHz to 1 GHz

Bandwidth = 10 KHz

(c) Spurious Responses Scan		(d) Spurious Input Level (dBm)	Spurious less than -107 dBm?
Frequency	Amplitude		

Spurious responses above 20 KHz OK? Yes___ No___

POWER TESTS DATA SHEET
TEST PARAGRAPH 4.3.14

4.3.14.1 High Line Voltage

(d) Receiver operation normal? Yes__ No__

(e) Line fuse(s) blow? Yes__ No__
If no, describe corrective action:

(g) Receiver operates properly after high voltage test? Yes__ No__

4.3.14.2 Power Requirements

(e) Receiver operation normal? Yes__ No__

(f) AC Power Supply: Voltage ____ Vrms

Current ____ Amps

Power = Voltage x Amps = _____ Watts

(h) Receiver operation normal at 48 Hz? Yes__ No__

(i) Receiver operation normal over range of 48 to 62 Hz? Yes__ No__

(j) PWRHI light-bar illuminates with high-line? Yes__ No__

(k) PWRHI light-bar extinguishes when power range switch set to high line position? Yes__ No__

(l) Receiver operation normal at 127 vac and 60 Hz? Yes__ No__

(m) Receiver operation normal at 127 vac and 48 Hz? Yes__ No__

(n) Receiver operation normal at 127 vac and 62 Hz? Yes__ No__

(o) PWRLO light-bar illuminates with low-line? Yes__ No__

(p) PWRLO light-bar extinguishes when power range switch set to low line position? Yes__ No__

(q) Receiver operation normal at 102 vac and 60 Hz? Yes__ No__

(r) Receiver operation normal at 102 vac and 48 Hz? Yes__ No__

(s) Receiver operation normal at 102 vac and 62 Hz? Yes__ No__