| REVISIONS | | APPROVAL | | | |
|---|---|---|---|---|---|
| REV | Description | Chk | Date | Eng | Date |
| A | Production Release | | | | |
| B | Incorporate ECN 22,369 | | | | |
| | | | | | |
| | | | | | |

Level II

Automatic Test Equipment Procedure

For The

**Transceiver Circuit Card Assembly**

**P/N 4101255-501**

**Using Test Fixture P/N 4800160**

Used In The

Racal 25 Radio



| Approval | Signature | Date |
|---|---|---|
| Engineering | R. DiDonato | 12/14/98 |
| Test Ops. | P. Ross | 12/14/98 |
| Q.A. | K. Burns | 12/14/98 |
| | | |

RACAL COMMUNICATIONS, INCORPORATED
Rockville, Maryland

| CAGE CODE | DWG SIZE | DRAWING NUMBER | REV |
|---|---|---|---|
| 23386 | A | 1800123 | B |

## 1. SCOPE AND PURPOSE

### 1.1 Scope of Procedure.

This procedure applies to the Transceiver Board Circuit Card Assembly (CCA), P/N 4101128-501, used in the Racal 25 Radio using the Automatic Test Equipment (ATE) and Test Fixture P/N 4800160.

### 1.2 Purpose of Procedure.

This procedure provides Level II tests necessary to verify satisfactory performance of the Transceiver CCA, Part Number 4101255-501, using the Automatic Test Equipment (ATE) ) and Test Fixture P/N 4800160.

## 2. APPLICABLE DOCUMENTS

### 2.1 Racal Documents.

Unless the revision level is specified, the latest revision in effect will be used.

| | |
|---|---|
| PP 10-124 | Electrostatic Discharge Control Policy |
| TOP 1702 | Test Event Log (TEL) & Test Failure Report(TFR) Procedure |
| 4101255-501 | CCA Transceiver Module |
| 4101255-Assy | Assembly Drawing Transceiver Board |
| 4200675 | Transceiver Board CCA Schematic Diagram |

## 3. TEST REQUIREMENTS

### 3.1 Security.

This procedure does not involve any "proprietary" or "company confidential" material.

## 3.2 Precautions and Safety.

3.2.1 The equipment under test is capable of generating RF powers sufficient to cause RF burns. During transmit tests, care should be taken to eliminate the possibility of touching exposed RF output points such as the center conductors of coaxial cables or antenna connector.

3.2.2 The equipment under test contains components that are susceptible to damage by static electrical charges. Appropriate precautions must be observed in accordance with PP10-124.

## 3.3 Test Event Logging and Failure Reporting.

3.3.1 Test event and failure reporting shall be in accordance with TOP 1702.

3.3.2 Any UUT that fails any paragraph of this procedure shall be classified as a failed unit.

## 3.4 Test Conditions.

3.4.1 This procedure will be conducted under room ambient conditions.

## 3.5 Test Equipment

3.5.1 The test equipment listed in Table 1 will be required to perform this procedure. All Measuring and Test Equipment (M&TE) shall be calibrated in accordance with ANSI/NCSL Z540-1-1994 and OP-24-101.

3.5.2 Any equivalent device capable of performing the required functions with equal or greater accuracy may replace items listed in Table 1 that are defective, out of calibration, or are not available.

3.5.3 Items listed in Table 1 whose descriptions include an asterisk (*) do not require calibration.

3.5.4 No equipment will be used which has an expired calibration status or has broken calibration "seals".

3.5.5 Items listed Table 1 whose descriptions include a pound sign (#) are Factory Test Equipment (FTE) or Special Test Equipment (STE) and require certification in accordance with their applicable Certification Procedures. No equipment will be used which has an expired certification status or has broken integrity "seals".

## Table 1 : ATE Required Test Equipment

| ITEM | DESCRIPTION | MANUFACTURER | MODEL/PART NO. | QTY. |
|---|---|---|---|---|
| 1 | Signal Generator | Hewlett-Packard | 8657A | 1 |
| 2 | Audio Analyzer | Hewlett-Packard | 8903B | 1 |
| 3 | Modulation Analyzer | Hewlett-Packard | 8901B | 1 |
| 4 | Power Sensor | Hewlett-Packard | 8482A | 1 |
| 5 | Power Sensor Cable | Hewlett-Packard | 11730B | 1 |
| 6 | Spectrum Analyzer | Hewlett-Packard | 8560A | 1 |
| 7 | System Power Supply | Hewlett-Packard | 6033A | 1 |
| 8 | Digital Multimeter | Hewlett-Packard | 3478A | 1 |
| 9 | Oscilloscope (optional) | Tektronix | 2465B | 1 |
| 10 | * Personal Computer | Dell | 425s/P | 1 |
| 11 | * Monitor | Dell | Vi1428U | 1 |
| 12 | * Keyboard | Dell | SK-1000RS | 1 |
| 13 | * Controller | Hewlett-Packard | 362 | 1 |
| 14 | * Monitor | Hewlett-Packard | D1182A | 1 |
| 15 | * Keyboard | Hewlett-Packard | 46021A | 1 |
| 16 | # Test Fixture | Racal | 480015 | 1 |
| 17 | # RF Switching Unit | Racal | TJ2341 | 1 |
| 18 | * 10dB 10W Attenuator | Lucas-Weinschel | 1 | 2 |
| 19 | * 25D(m)-25D(f) RFSU Control Cable | Racal | 732513/10 | 1 |
| 20 | * 25D(f-f) Parallel Port Cable | N/A | N/A | 1 |
| 21 | * 25D(f)-9D(f) Serial Port Cable | N/A | N/A | 1 |
| 22 | * IEEE-488 Cable | Hewlett-Packard | 10833A | 7 |
| 23 | * SMA(m)-SMA(m) 50 Ohm RF Cable | N/A | N/A | 3 |
| 24 | * SMA(m)-BNC(m) 50 Ohm RF Cable | N/A | N/A | 1 |
| 30 | * SMA(m)-N(m) 50 Ohm RF Cable | N/A | N/A | 3 |
| 31 | * N(m)-BNC(m) 50 Ohm RF Cable | N/A | N/A | 1 |
| 32 | * SMA(m)-N(f) 50 Ohm RF Cable | N/A | N/A | 1 |
| 33 | * SMA(m)-MSHR(f) RF Cable | N/A | N/A | 3 |
| 33 | * BNC(m-m) RF Cable (1 optional) | N/A | N/A | 5 |
| 34 | * SMA(f-f) Adapter | N/A | | 3 |
| 35 | * BNC-T(f-f-m) Adapter (1 optional) | N/A | WS1020 | 2 |
| 36 | * Standard Stacking Banana Cord (Red) | N/A | WS1022 | 1 |
| 37 | * Standard Stacking Banana Cord (Black) | N/A | WS1021 | 1 |
| 38 | * Power Supply Cable with Sense Lines | Racal | 732420/50 | 1 |
| 39 | * AC Power Cord | N/A | N/A | 8 |
| 40 | # Racal 25 Transceiver Test Program (resident on PC C:) | Racal | APCO25 | 1 |
| 41 | # Racal 25 Transceiver Test Program (on Controller) | Racal | PROG_3466 | 1 |

## 3.6 Automatic Test Equipment (ATE) Acceptance Test Procedure.

Detailed descriptions of the specification requirements and the steps performed during each of the tests are provided in Appendix A.

3.6.1 Perform the following preliminary checks.

a) Verify that all previous production, test, and inspection steps have been completed as evidenced by the Unit Under Test (UUT) Work Order Traveler.

b) Verify there is not any evidence of damage to the UUT.

c) Verify that the serial number and part number on the UUT Work Order match those on the UUT.

d) Verify test equipment requiring calibration is within the calibration decal due date and that all calibration "seals" are intact.

e) Visually inspect the UUT and verify there is no evidence of workmanship errors (for example, solder shorts, missing parts, or improperly installed parts).

f) Verify that all the RF fences and lids are on the UUT. If the fence are not installed or are not secure then return the UUT for rework.

3.6.2 Test Set Up

3.6.2.1 Set up the test equipment, except for UUT, as shown in Figure 1.

3.6.2.2 Using the PC mouse, double-click on the **"APCO25"** icon. *The Transceiver Driver screen appears.*

3.6.2.3 Press **F8 (Ready)** on the Test Controller Keyboard. *The ATE Options Page appears.*

3.6.2.4 Carefully place the UUT on the Test Fixture (TF) and connect as described below:

a) Set the power switches on the TF and test equipment to ON.

b) Unscrew the three thumbscrews holding the TF Upper Clamshell to the lower part, lift it up off the guide pins, turn it upside down (to prevent bending pins) and place it on top of the TF.

c) Place the UUT in the TF Lower Clamshell.

d) Install the Top, Side, and LINOUT RF cables.

e) Place the top of the Clamshell gently and evenly (do not rock) over the UUT while taking care that the probe pins do not pierce the RF cables.

f) Ensure the probe pins are making contact with the test points then tighten the three thumbscrews.

g) Connect the TF 32-way ribbon cable to the UUT 32-pin connector. Be careful not to break the UUT connector.

3.6.2.5 On the Controller Keyboard, select Ready (F8). The Controller Monitor will display prompts for information; complete as needed. The Controller Monitor will also prompt, "Do you wish to load data from the EPROM on the UUT into memory?"

a) If this is the first time the UUT is tested, select **NO (F8)**.
b) If UUT has been tested previously, select **YES (F1)**.

3.6.2.6 Throughout the ATE test, follow the instructions on the Test Controller Monitor. Manual intervention will be necessary as described in subsequent steps.

a) Test 01.01 - Confirmation that visual inspection was satisfactory.
b) Test 07.01 - Adjust C19 for the lowest distortion reading on the Audio Analyzer.

3.6.2.7 The system will prompt "You may save the UUT data to TEST on the PC's disk or enter a new filename." Select F1 (Save). The system will prompt when the save is successfully completed.

3.6.2.8 The system will prompt "Do you wish to write test and curve fit data to EEPROM on UUT." If the ATE was completed, select YES (F1); otherwise, select NO (F8).

3.6.2.9 At the completion of the "ATE" test program, the computer will list the test result record options. If an ATE Data Sheet is required, select the FULL RESULTS (F2) option and the computer will generate the ATE Data Sheets. The data sheet includes the specification limits and the measured values for the ATE tests.

3.6.3 Post Test Steps

3.6.3.1 Verify that the voltage is off on the Power Supply.

3.6.3.2 Carefully remove the board in the reverse sequence in which it was installed on the fixture

3.6.3.3 Route the completed test data sheet, UUT, and other documentation for further processing in accordance with the Work Order Traveler.

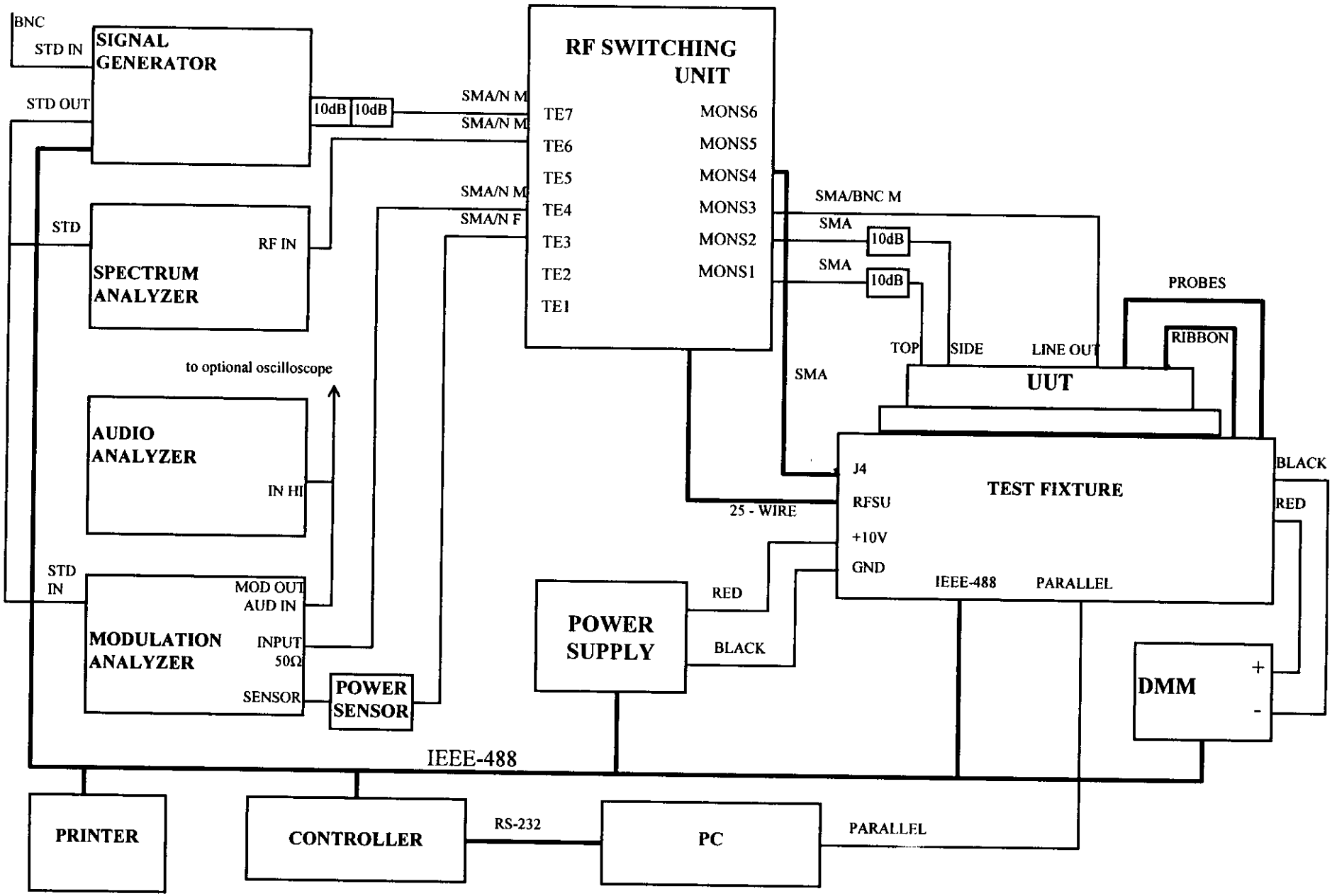


**Figure 1: Test Setup**

# APPENDIX A - LEVEL 2 AUTOMATIC TEST EQUIPMENT ACCEPTANCE TESTS

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 01.01 | Visual inspection | 3.3V supply ON<br>Path = RX | UUT Power ON<br>TX Power OFF | | | | Data stored in the EEPROM on the UUT may be loaded into the PC as part of the first test. Settings shown apply to all tests unless otherwise specified. |
| 01.03 | +5V Digital check | | | TP7<br>Measure DC Voltage | 5.25 VDC | 4.75 VDC | |
| 01.04 | +20V SW check | | | TP14<br>Measure DC Voltage | | 20 VDC | |
| 01.05 | 3.3VRXS check | | | TP12<br>Measure DC Voltage | 3.54 VDC | 3.20 VDC | |
| 01.08 | 3.3VTXS check | Path = TX | | TP13<br>Measure DC Voltage | 3.54 VDC | 3.20 VDC | |
| 01.11 | +3.3V Analog check | | | TP8<br>Measure DC Voltage | 3.47 VDC | 3.13 VDC | |
| 01.12 | +3.3V Digital check | | | TP6<br>Measure DC Voltage | 3.35 VDC | 3.25 VDC | |
| 02.01 | RX Coarse Tune Maximum | RX Coarse = 0 | | TP18<br>Measure DC Voltage | 2.2 VDC | 1.8 VDC | |
| 02.02 | RX Coarse Tune Minimum | RX Coarse = 255 | | TP18<br>Measure DC Voltage | 18.5 VDC | 17.5 VDC | |
| 02.03 | RX Coarse Adjust 136.0 MHz | Freq = 136.0 MHz | | TP10<br>Measure DC Voltage while adjusting RX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |
| 02.04 | RX Coarse Adjust 145.0 MHz | Freq = 145.0 MHz | | TP10<br>Measure DC Voltage while adjusting RX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 02.05 | RX Coarse Adjust 155.0 MHz | Freq = 155.0 MHz | | TP10<br>Measure DC Voltage while adjusting RX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |
| 02.06 | RX Coarse Adjust 165.0 MHz | Freq = 165.0 MHz | | TP10<br>Measure DC Voltage while adjusting RX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |
| 02.07 | RX Coarse Adjust 174.0 MHz | Freq = 174.0 MHz | | TP10<br>Measure DC Voltage while adjusting RX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |
| 02.08 | RX Coarse Adjustment Curve Fit | N/A | | | | | Curve fitting routine determines RX Coarse data for all frequencies. The resulting array is sent to the UUT via the PC. The test will pass if the PC processes the same number of fields sent. |
| 03.01 | TX Coarse Adjust 136.0 MHz | Freq = 136.0 MHz<br>Path = TX | | TP10<br>Measure DC Voltage while adjusting TX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |
| 03.02 | TX Coarse Adjust 145.0 MHz | Freq = 145.0 MHz<br>Path = TX | | TP10<br>Measure DC Voltage while adjusting TX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |
| 03.03 | TX Coarse Adjust 155.0 MHz | Freq = 155.0 MHz<br>Path = TX | | TP10<br>Measure DC Voltage while adjusting TX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 03.04 | TX Coarse Adjust 165.0 MHz | Freq = 165.0 MHz<br>Path = TX | | TP10<br>Measure DC Voltage while adjusting TX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |
| 03.05 | TX Coarse Adjust 174.0 MHz | Freq = 174.0 MHz<br>Path = TX | | TP10<br>Measure DC Voltage while adjusting TX Coarse for 1.65 VDC +/- 0.1<br>Test DAC value | 255 | 0 | Returns 999 if adjustment not possible. Store the DAC value for later curve fitting. |
| 03.06 | TX Coarse Adjustment Curve Fit | N/A | | | | | Curve fitting routine determines TX Coarse data for all frequencies. The resulting array is sent to the UUT via the PC. The test will pass if the PC processes the same number of fields sent. |
| 04.01 | Reference Oscillator Adjust | Freq = 174.0 MHz<br>Pwr level = 0.5 W<br>RF Pwr = 50<br>PA Bias 1 = 80<br>PA Bias 2 = 80<br>RF = Top | | Top RF output<br>Measure frequency with Modulation Analyzer while adjusting REF for 174 MHz +/- 100 Hz | 2 ppm | | Value is retained throughout test but is can not be stored in UUT EEPROM. |
| 04.02 | Reference Oscillator DAC value | N/A | | DAC value determined in step 03.02 | 1500 | 1000 | |
| 05.02 | RX 2nd LO Adjustment | Path = RX | | Y1 with RF sniffer using Spectrum Analyzer while adjusting 2nd LO value for 44.55 MHz +/- 50 Hz | 44.5451 MHz | 44.5449 MHz | Value is stored for later writing to EEPROM |
| 05.03 | RX 2nd LO DAC Value | N/A | | DAC value determined in step 05.02 | 255 | 20 | |
| 05.04 | RX Ctune Stability vary 2nd LO | Vary 2nd LO DAC setting from 0 to 250 | | TP18 with DMM | | Sat | Verify that TP18 value is constant ±20 mV |
| 05.05 | RX Ctune Stability vary RXVTF | Vary RXVTF DAC setting from 0 to 250 | | TP18 with DMM | | Sat | Verify that TP18 value is constant ±20 mV |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 06.05 | Volt Tune Curve Fit | N/A | | | | | Default values are used for the Volt Tune data. Curve fitting routine determines Volt Tune data for all frequencies. The resulting array is sent to the UUT via the PC. The test will pass if the PC processes the same number of fields sent. |
| 07.01 | Harmonic Distortion Adjust 136.025 MHz | Freq = 136.025 MHz<br>Path = RX<br>RF = Top | 136.025 MHz at -47 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | Demodulate LINOUT with Modulation Analyzer; monitor demodulated output with Audio Analyzer. Measure distortion while operator adjusts C19 for the best value. | 3.5 % | | Special settings:<br>Modulation Analyzer:<br>300 Hz HI Pass filter<br>3 kHz LO pass filter<br>Tune for 455 kHz<br>Frequency Measurement<br>Audio Analyzer:<br>400 Hz HI Pass filter<br>30 kHz LO Pass filter<br>0.0754V Range<br>1 second measurement delay |
| 07.02 | Harmonic Distortion 155.050 MHz | Freq = 155.050 MHz<br>Path = RX<br>RF = Top | 155.050 MHz at -47 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | Demodulate LINOUT with Modulation Analyzer; monitor demodulated output with Audio Analyzer. Measure distortion | 3.5 % | | same special settings as 07.01 |
| 07.03 | Harmonic Distortion 173.975 MHz | Freq = 173.975 MHz<br>Path = RX<br>RF = Top | 173.975 MHz at -47 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | Demodulate LINOUT with Modulation Analyzer; monitor demodulated output with Audio Analyzer. Measure distortion | 3.5 % | | same special settings as 07.01 |
| 07.04 | IF Level | Freq = 136.025 MHz<br>Path = RX<br>RF = Top | 136.025 MHz at -119 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | LINOUT RF power with spectrum analyzer.<br>RES BW = 100Hz<br>VID BW = 100 Hz | -13 dBm | -19 dBm | same special settings as 07.01 |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 07.05 | Hum and Noise 136.025 MHz | Freq = 136.025 MHz<br>Path = RX<br>RF = Top | 136.025 MHz at -47 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | Demodulate LINOUT with Modulation Analyzer; monitor demodulated output with Audio Analyzer. Measure AC Voltage. Remove the modulation and measure again; determine the RATIO | -40 dB | | same special settings as 07.01 |
| 07.06 | Hum and Noise 155.050 MHz | Freq = 155.050 MHz<br>Path = RX<br>RF = Top | 155.050 MHz at -47 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | Demodulate LINOUT with Modulation Analyzer; monitor demodulated output with Audio Analyzer. Measure AC Voltage. Remove the modulation and measure again; determine the RATIO | -40 dB | | same special settings as 07.01 |
| 07.07 | Hum and Noise 173.975 MHz | Freq = 173.975 MHz<br>Path = RX<br>RF = Top | 173.975 MHz at -47 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | Demodulate LINOUT with Modulation Analyzer; monitor demodulated output with Audio Analyzer. Measure AC Voltage. Remove the modulation and measure again; determine the RATIO | -40 dB | | same special settings as 07.01 |
| 07.08 | RX Sensitivity 136.050 MHz | Freq = 136.025 MHz<br>Path = RX<br>RF = Top | 136.025 MHz at -117 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | Demodulate LINOUT with Modulation Analyzer; monitor demodulated output with audio analyzer. Measure SINAD | | 12 dB | same special settings as 07.01 |
| 07.09 | RX Sensitivity 155.050 MHz | Freq = 155.050 MHz<br>Path = RX<br>RF = Top | 155.050 MHz at -117 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | Demodulate LINOUT with Modulation Analyzer; monitor demodulated output with audio analyzer. Measure SINAD | | 12 dB | |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 07.10 | RX Sensitivity 173.975 MHz | Freq = 173.975 MHz<br>Path = RX<br>RF = Top | 173.975 MHz at -117 dBm<br>1 kHz modulation at 3 kHz deviation to top connector | Demodulate LINOUT with Modulation Analyzer; monitor demodulated output with audio analyzer. Measure SINAD | | 12 dB | |
| 08.01 | 5VTX Voltage | Pwr level = 0.1W<br>RF Power = 0<br>Path = TX<br>PAA = 60<br>PAB = 60<br>previous values retained | | TP5<br>Measure DC Voltage | 5.25 VDC | 4.75 VDC | Voltage connected to TX Power input for all transmit tests.<br>Set path to RX after completion of all TX tests. |
| 08.09 | PA1 Bias Adjust | Pwr level = 0.1W<br>RF Power = 0<br>Path = TX<br>PAA = 0<br>PAB = 0 | | Measure TX supply current then monitor it while increasing PAA until the current exceeds the original value by 100 mA<br>Record PAA DAC value and leave set. | 110 | 80 | Returns NO ADJ if adjustment not possible. |
| 08.10 | PA2 Bias Adjust | Pwr level = 0.1W<br>RF Power = 0<br>Path = TX<br>PAA = 0<br>PAB = 0 | | Measure TX supply current then monitor it while increasing PAB until the current exceeds the original value by 100 mA<br>Record PAB DAC value and leave set. | 110 | 80 | Returns NO ADJ if adjustment not possible. |
| 09.01 | TX Power Adjust 5 Watts 136.000 MHz | Freq = 136.000 MHz<br>Pwr level = 5 W<br>RF Power = 110<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 5.25 W.<br>Record DAC Value.<br>Record final power reading.<br>Measure and record TX supply current | 150 | 100 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 09.02 | TX Current 5 Watts 136.000 MHz | N/A | | Supply current reading from previous test | 1.5 A | | |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 09.03 | TX Power Adjust 5 Watts 145.000 MHz | Freq = 145.000 MHz<br>Pwr level = 5 W<br>RF Power = 110<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 5.25 W.<br>Record DAC Value.<br>Measure and record TX supply current | 150 | 100 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 09.04 | TX Current 5 Watts 145.000 MHz | N/A | | Supply current reading from previous test | 1.5 A | | |
| 09.05 | TX Power Adjust 5 Watts 155.000 MHz | Freq = 155.000 MHz<br>Pwr level = 5 W<br>RF Power = 110<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 5.25 W.<br>Record DAC Value.<br>Measure and record TX supply current | 150 | 100 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 09.06 | TX Current 5 Watts 155.000 MHz | N/A | | Supply current reading from previous test | 1.5 A | | |
| 09.07 | TX Power Adjust 5 Watts 165.000 MHz | Freq = 165.000 MHz<br>Pwr level = 5 W<br>RF Power = 110<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 5.25 W.<br>Record DAC Value.<br>Measure and record TX supply current | 150 | 100 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 09.08 | TX Current 5 Watts 165.000 MHz | N/A | | Supply current reading from previous test | 1.5 A | | |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 09.09 | TX Power Adjust 5 Watts 174.000 MHz | Freq = 174.000 MHz<br>Pwr level = 5 W<br>RF Power = 110<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 5.25 W.<br>Record DAC Value.<br>Measure and record TX supply current | 150 | 100 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 09.10 | TX Current 5 Watts 174.000 MHz | N/A | | Supply current reading from previous test | 1.5 A | | |
| 09.11 | Power Adjustment Curve Fit 5 Watts | N/A | | | | | Curve fitting routine determines 5 Watt RF Power data for all frequencies. The resulting array is sent to the UUT via the PC. The test will pass if the PC processes the same number of fields sent. |
| 09.12 | TX Power 5 Watts 136.000 MHz | N/A | | Power reading from 09.01 | 5.5 W | 5.0 W | |
| 10.01 | TX Power Adjust 2 Watts 136.000 MHz | Freq = 136.000 MHz<br>Pwr level = 2 W<br>RF Power = 50<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 2.2 W.<br>Record DAC Value.<br>Record final power reading. | 95 | 60 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 10.02 | TX Power Adjust 2 Watts 145.000 MHz | Freq = 145.000 MHz<br>Pwr level = 2 W<br>RF Power = 50<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 2.2 W.<br>Record DAC Value. | 95 | 60 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 10.03 | TX Power Adjust 2 Watts 155.000 MHz | Freq = 155.000 MHz<br>Pwr level = 2 W<br>RF Power = 50<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 2.2 W.<br>Record DAC Value. | 95 | 60 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 10.04 | TX Power Adjust 2 Watts 165.000 MHz | Freq = 165.000 MHz<br>Pwr level = 2 W<br>RF Power = 50<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 2.2 W.<br>Record DAC Value. | 95 | 60 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 10.05 | TX Power Adjust 2 Watts 174.000 MHz | Freq = 174.000 MHz<br>Pwr level = 2 W<br>RF Power = 50<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 2.2 W.<br>Record DAC Value. | 95 | 60 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 10.06 | Power Adjustment Curve Fit 2 Watts | N/A | | | | | Curve fitting routine determines 2 Watt RF Power data for all frequencies. The resulting array is sent to the UUT via the PC. The test will pass if the PC processes the same number of fields sent. |
| 10.07 | TX Power 2 Watts 136.000 MHz | N/A | | Power reading from 10.01 | 2.4W | 2.0 W | |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 11.01 | TX Power Adjust 1 Watt 136.000 MHz | Freq = 136.000 MHz<br>Pwr level = 1 W<br>RF Power = 30<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 1.1 W.<br>Record DAC Value.<br>Record final power reading. | 75 | 30 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 11.02 | TX Power Adjust 1 Watt 145.000 MHz | Freq = 145.000 MHz<br>Pwr level = 1 W<br>RF Power = 30<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 1.1 W.<br>Record DAC Value. | 75 | 30 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 11.03 | TX Power Adjust 1 Watt 155.000 MHz | Freq = 155.000 MHz<br>Pwr level = 1 W<br>RF Power = 30<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 1.1 W.<br>Record DAC Value. | 75 | 30 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 11.04 | TX Power Adjust 1 Watt 165.000 MHz | Freq = 165.000 MHz<br>Pwr level = 1 W<br>RF Power = 30<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 1.1 W.<br>Record DAC Value. | 75 | 30 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 11.05 | TX Power Adjust 1 Watt 174.000 MHz | Freq = 174.000 MHz<br>Pwr level = 1 W<br>RF Power = 30<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 1.1 W.<br>Record DAC Value. | 75 | 30 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 11.06 | Power Adjustment Curve Fit 1 Watt | N/A | | | | | Curve fitting routine determines 1 Watt RF Power data for all frequencies. The resulting array is sent to the UUT via the PC. The test will pass if the PC processes the same number of fields sent. |
| 11.07 | TX Power 1 Watt 136.000 MHz | N/A | | Power reading from 11.01 | 1.2 W | 1.0 W | |
| 12.01 | TX Power Adjust 0.5 Watts 136.000 MHz | Freq = 136.000 MHz<br>Pwr level = 0.5 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.55 W.<br>Record DAC Value.<br>Record final power reading. | 50 | 10 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 12.02 | TX Power Adjust 0.5 Watts 145.000 MHz | Freq = 145.000 MHz<br>Pwr level = 0.5 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.55 W.<br>Record DAC Value. | 50 | 10 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 12.03 | TX Power Adjust 0.5 Watts 155.000 MHz | Freq = 155.000 MHz<br>Pwr level = 0.5 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.55 W.<br>Record DAC Value. | 50 | 10 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 12.04 | TX Power Adjust 0.5 Watts 165.000 MHz | Freq = 165.000 MHz<br>Pwr level = 0.5 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.55 W.<br>Record DAC Value. | 50 | 10 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 12.05 | TX Power Adjust 0.5 Watts 174.000 MHz | Freq = 174.000 MHz<br>Pwr level = 0.5 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.55 W.<br>Record DAC Value. | 50 | 10 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 12.06 | Power Adjustment Curve Fit 0.5 Watts | N/A | | | | | Curve fitting routine determines 0.5 Watt RF Power data for all frequencies. The resulting array is sent to the UUT via the PC. The test will pass if the PC processes the same number of fields sent. |
| 12.07 | TX Power 0.5 Watts 136.000 MHz | N/A | | Power reading from 12.01 | 0.6 W | 0.5 W | |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 13.01 | TX Power Adjust 0.1 Watts 136.000 MHz | Freq = 136.000 MHz<br>Pwr level = 0.1 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.11 W.<br>Record DAC Value.<br>Record final power reading. | 35 | 5 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 13.02 | TX Power Adjust 0.1 Watts 145.000 MHz | Freq = 145.000 MHz<br>Pwr level = 0.1 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.11 W.<br>Record DAC Value. | 35 | 5 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 13.03 | TX Power Adjust 0.1 Watts 155.000 MHz | Freq = 155.000 MHz<br>Pwr level = 0.1 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.11 W.<br>Record DAC Value. | 35 | 5 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 13.04 | TX Power Adjust 0.1 Watts 165.000 MHz | Freq = 165.000 MHz<br>Pwr level = 0.1 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.11 W.<br>Record DAC Value. | 35 | 5 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 13.05 | TX Power Adjust 0.1 Watts 174.000 MHz | Freq = 174.000 MHz<br>Pwr level = 0.1 W<br>RF Power = 10<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Monitor RF output power with power sensor and modulation analyzer; adjust RF Power until reading is closest to target of 0.11 W.<br>Record DAC Value. | 35 | 5 | Returns NO ADJ if adjustment not possible. Store the DAC value for later curve fitting. |
| 13.06 | Power Adjustment Curve Fit 0.1 Watts | N/A | | | | | Curve fitting routine determines 0.1 Watt RF Power data for all frequencies. The resulting array is sent to the UUT via the PC. The test will pass if the PC processes the same number of fields sent. |
| 13.07 | TX Power 0.1 Watts 136.000 MHz | N/A | | Power reading from 13.01 | 0.13 W | 0.10 W | |
| 14.01 | Side Connector Power 1 W 136.000 MHz | Freq = 136.000 MHz<br>Pwr level = 1 W<br>RF Power = previous<br>RF = Side<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Side connector output using power sensor and modulation analyzer; measure RF Power | 1.2 W | 1.0 W | |
| 14.02 | Side Connector Power 1 W 155.000 MHz | Freq = 155.000 MHz<br>Pwr level = 1 W<br>RF Power = previous<br>RF = Side<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Side connector output using power sensor and modulation analyzer; measure RF Power | 1.2 W | 1.0 W | |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 14.03 | Side Connector Power 1 W 174.000 MHz | Freq = 174.000 MHz<br>Pwr level = 1 W<br>RF Power = previous<br>RF = Side<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Side connector output using power sensor and modulation analyzer; measure RF Power | 1.2 W | 1.0 W | |
| 15.01 | TX Frequency Tests | Freq = 136.000 MHz<br>Pwr level = 1 W<br>RF Power = previous<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Top Connector output using modulation analyzer | 20 ppm | | |
| 15.02 | TX Frequency Tests | Freq = 155.000 MHz<br>Pwr level = 1 W<br>RF Power = previous<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Top Connector output using modulation analyzer | 20 ppm | | |
| 15.03 | TX Frequency Tests | Freq = 174.000 MHz<br>Pwr level = 1 W<br>RF Power = previous<br>RF = Top<br>Path = TX<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | | Top Connector output using modulation analyzer | 20 ppm | | |

| Test No. | Parameter | Input Stimulus | | Monitor | Limits | | Notes |
|---|---|---|---|---|---|---|---|
| | | Settings | Analog | | Maximum | Minimum | |
| 16.01 | TX Deviation 136.000 MHz | Freq = 136.000 MHz<br>Pwr level = 0.1 W<br>RF = Top<br>Path = TX<br>previous settings retained<br>PAA = as set in 08.09<br>PAB = as set in 08.10 | Continuous DAC updates representing digitized sine wave programmed into TXVCO DAC at maximum speed | Top connector output with modulation analyzer; measure deviation. | 6 kHz | 4 kHz | The sine wave is generated by the PC upon receipt of a command from the controller. |
| 17.01 | Check tests | N/A | | | | | Reports any failed or incomplete tests allowing operator to run them.<br>Always passes.<br>Data may be written to EEPROM and to a PC file at conclusion of testing. |

| REVISIONS | | APPROVAL | | | |
|---|---|---|---|---|---|
| REV | Description | Chk | Date | Eng | Date |
| A | Production Release | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

# ACCEPTANCE TEST PROCEDURE

# FOR THE

# RACAL 25 HAND-HELD RADIO

# RACAL PART NO. 4101256-501



| Approval | Signature | Date |
|---|---|---|
| Engineering | R. Didonato | |
| Test Ops. | M. Bader | |
| Q.A. | R. Rayme | |
| | | |

RACAL COMMUNICATIONS, INCORPORATED
Rockville, Maryland

| CAGE CODE | DWG SIZE | DRAWING NUMBER | REV |
|---|---|---|---|
| 23386 | A | 1800138 | A |

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## 1.0 SCOPE AND PURPOSE

### 1.1 Scope of Procedure.

This procedure applies to Racal 25 Hand-Held Radio (HHR), Part Number 4101256-501.

### 1.2 Purpose of Procedure.

This procedure provides tests necessary to verify satisfactory performance of the Racal 25 HHR.

## 2.0 APPLICABLE DOCUMENTS

### 2.1 Racal Documents.

Unless the revision level is specified, the latest revision in effect will be used.

| | |
|---|---|
| TOP 1702 | Test Event Log (TEL) & Test Failure Report (TFR) Procedure |
| 1700249-501 | PC Programmer Software, Racal 25 |
| 1700298-1 | HHR Loading Software, Racal 25 |
| 1700300-3 | R25 software, P25 DES/CVSD DES |
| 1800139 | Personal Computer Controller Software |
| 4101254-501 | Parts List, Control/Crypto/Display Module Assembly |
| 4101255-501 | Parts List, CCA Transceiver |
| 4101256-501 | Parts List, Racal 25 Hand-Held Radio (HHR) |
| 4200641 | Schematic Diagram, Transceiver |
| PP 10-124 | Electrostatic Discharge Control Policy |

### 2.2 Government Documents.

Unless the revision level is specified, the latest revision in effect will be used.

| | |
|---|---|
| ISO-9001 | Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation, and Servicing |

## 3.0 TEST REQUIREMENTS

### 3.1 Precautions and Safety.

#### 3.1.1 Electrostatic Discharge Notice.

The equipment under test contains components that are susceptible to damage by static electrical charges. Appropriate precautions must be observed in accordance with PP 10-124.

## 3.2 General.

### 3.2.1 References.

During this procedure the Racal 25 HHR will be referred to as the Unit Under Test or UUT.

### 3.2.2 Prerequisites.

The UUT will have successfully completed all previous steps on the Travel Tag/Route Sheet prior to the performance of this procedure.

### 3.2.3 Specification Cross-Reference.

The applicable paragraphs of the Product Development Specification (1908004) and the corresponding test steps of this procedure are cross-referenced in Table 3-1.

**Table 3-1. Specification Cross-Reference to Tests**

| SPECIFICATION PARAGRAPH | SPECIFICATION DESCRIPTION | TEST PARAGRAPH |
|---|---|---|
| 3.5.1.1 | Frequency Range | All |
| 3.5.1.2 | Channel Spacing | All |
| 3.51.3 | Frequency Accuracy | 4.1 |
| 3.5.1.5.1 | Clear Analog Voice FM, 25 kHz | 5.7.2.5 |
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| 3.5.1.5.3 | DES Encrypted CVSD FSK Voice, 25 kHz, 12 kbps | 5.7.2.6 |
| 3.5.1.5.6 | Project 25 Clear Digital Voice, 12.5 kHz | 5.7.2.3 |
| 3.5.1.5.7 | Project 25 Clear Digital Data, 12.5 kHz | |
| 3.5.1.5.8 | Project 25 DES Encrypted Digital Voice, 12.5 kHz | 5.7.2.4 |
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| 3.5.3.1 | Reference Sensitivity | 4.8 |
| 3.5.3.5 | Clear Voice Override | 5.7.2.7 |
| 3.5.3.6 | Adjacent Channel Rejection | 4.14 |

| SPECIFICATION PARAGRAPH | SPECIFICATION DESCRIPTION | TEST PARAGRAPH |
|---|---|---|
| 3.5.3.7 | Receiver Hum and Noise | 4.11 |
| 3.5.3.8 | IF Rejection | 4.12 |
| 3.5.3.10 | Image Rejection | 4.13 |
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| 3.5.5.1.1 | Keypad | 5.3.2 |
| 3.5.5.1.2 | Push-To-Talk (PTT) Switch | 5.5.2 |
| 3.5.5.1.3 | Programmable Function Side Keys | 5.5.2 |
| 3.5.5.1.4 | On/Off/Volume Switch | 5.7.2.8 |
| 3.5.5.1.5 | Channel Switch | 5.4.2 |
| 3.5.5.1.6 | Three-Position Toggle Switch | 5.4.2 |
| 3.5.5.2.1 | Visual Display | 5.2.2 |
| 3.5.5.2.2 | Audio Indicators | |
| 3.5.5.2.3 | Three-Color Light-Emitting Diode (LED) | 5.7.2.9 |
| 3.5.7.3 | Cloning Cable | 5.6.2 |

### 3.2.4 Quality Assurance Provisions.

Racal has implemented a Quality Assurance program in compliance with ISO-9001 which satisfies the requirements of MIL-Q-9858 to provide the necessary assurance and verify satisfactory performance of the Racal 25 HHR.

## 3.3 Security.

### 3.3.1 Racal Classification.

This procedure will not involve any "proprietary" or "company confidential" material.

## 3.4 Test Event Logging and Failure Reporting.

### 3.4.1 Test Reporting.

Test event and failure reporting will be in accordance with TOP 1702.

### 3.4.2 UUT Failures.

Any UUT that fails any step of this procedure will be classified as a failed unit.

### 3.4.3 Retest.

Failed UUTs will be repaired and retested in their entirety, unless otherwise approved by Engineering, Quality Assurance, and the customer.

## 3.5 Test Requirements.

### 3.5.1 Facilities.

The tests specified herein will be carried out in an environment where no electromagnetic interference or extraneous fields will affect the test results.

### 3.5.2 Test Software.

The following Software is required to perform the full test.

Windows 95, Windows 98, or Windows NT loaded into the Personal Computer Controller software, written in HPVEE 4.01, RCI part number 1800139.

### 3.5.3 Required Test Equipment.

The test equipment required to perform this procedure is as shown in Table 3-1.

### 3.5.4 Equivalent Test Equipment.

Test equipment that is defective, out of calibration, or is not available may be replaced by any equivalent device capable of performing the required functions with equal or greater accuracy.

### 3.5.5 Non-Calibrated Test Equipment.

Test equipment whose description includes an asterisk (*) does not require calibration.

### 3.5.6 Calibrated Test Equipment.

No equipment will be used which is in an expired calibration status or has broken calibration seals.

### 3.5.7 Test Environment.

All testing within this procedure will be conducted under room ambient conditions.

### 3.5.8 ATE Test Configuration.

The UUT test configuration is shown in Figure 3-1.

**Table 3-1. Required Test Equipment**

| Item | Description | Manufacturer | Model |
|---|---|---|---|
| 1 | PC (with Pentium CPU) | Various | Various |
| 2 | RF Communications Test Set | Hewlett-Packard | HP8920B |
| 3 | Signal Generator | Hewlett-Packard | HP8656 |
| 4 * | Power Supply | Hewlett-Packard | HP6033 |
| 5 * | Breakout Box | Mini Circuits | ZSC-2-4 |
| 6 * | Cabling, as required | Various | Various |

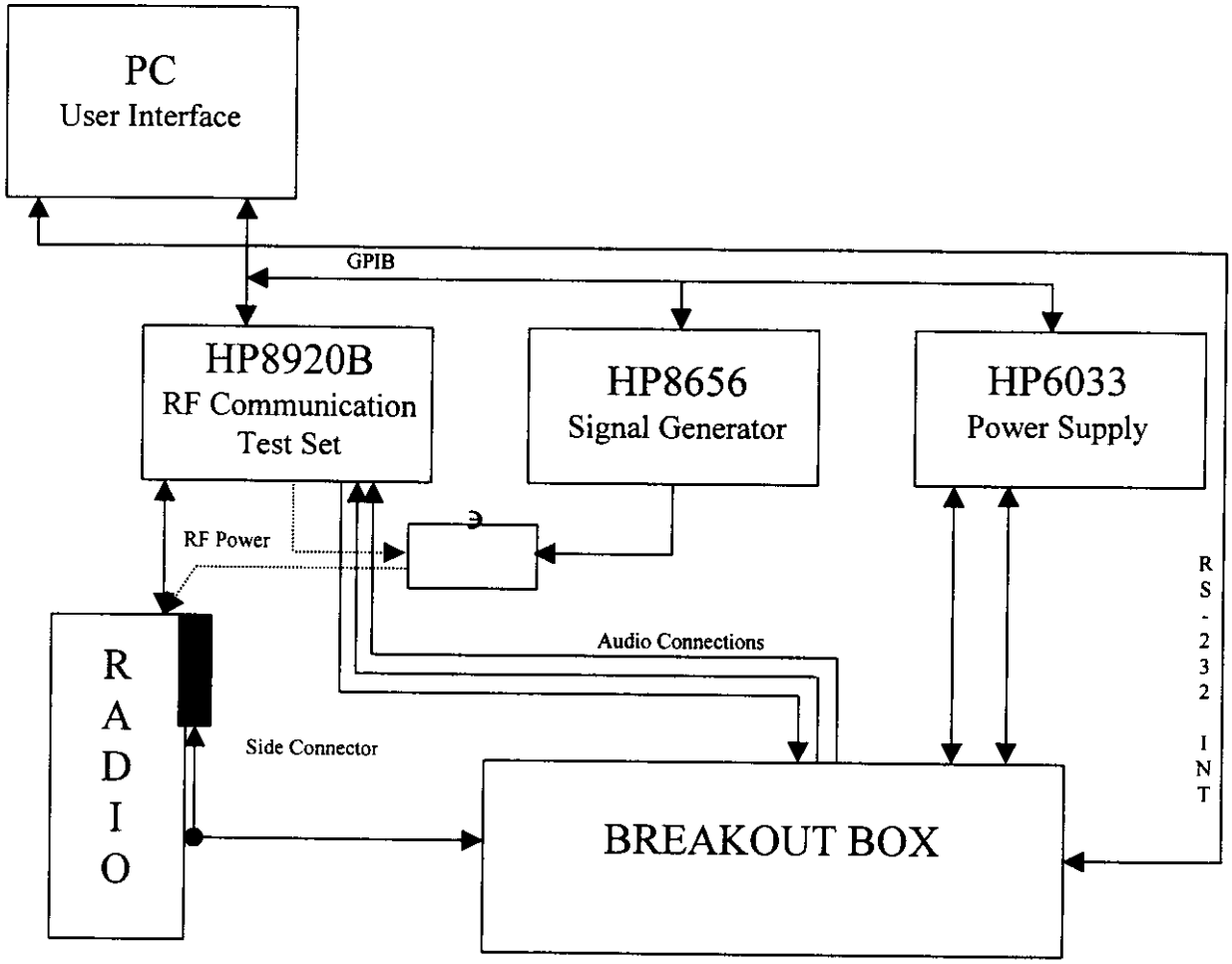



**Figure 3-1. Test Configuration**

### 3.5.9 Equipment Setup.

The following connections are valid for all Transmit and Receive tests with the exception of the three Rejection tests:

a) Connect the UUT side connector to the Breakout Box (JP1 Side Connector).

b) Set the UUT to Zone A Channel 1.

c) Connect the Power Supply to the Breakout Box.

d) Connect the UUT antenna port to the RF IN/OUT of the HP8920. ***

e) Connect the Breakout Box audio ports to the HP8920 audio ports as follows:

| HP 8920 | Breakout Box |
|---|---|
| Audio out | J1 (MIC) |
| Audio in HI | J2 (HI) |
| Audio in LO | J3 (LO) |

f) Connect the Breakout Box P2 (DATA) to the HP8920 MIC/ACC port.

g) Connect the Breakout Box P1 (PC Programmer) to the computer serial port (COM1).

h) Verify the position of the Breakout Box top four switches as follows

| | |
|---|---|
| S1 (/RADOFF) | OFF |
| S2 (PTT) | OFF |
| S3 (SELECT) | ON |
| S4 (AUDIO) | ON |

*** - For the IF Rejection, Image Rejection, Adjacent Channel Rejection receive tests change this line as follows:

- Connect Radio antenna port to T1000 Combiner output.
- Connect HP8920 RF IN/OUT port to T1000 Combiner input A.
- Connect HP8656 RF OUTPUT to the T1000 Combiner input B.

## 4.0 ATE TEST PROCEDURE.

### 4.1 Carrier Offset.

#### 4.1.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO to Analog Narrow Mode (MODEAN).

b) Set RADIO Output Power to 0.5 Watt (PWR 0.5 W).

c) Reset HP8920.

d) Select HP8920 Transmit (TX) Screen.

e) Set HP8920 Audio Frequency Analyzer DE-Emphasis OFF.

f) Activate the HP8920 Aux. Switch (set the RADIO to TX mode).

g) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

#### 4.1.2 Test Procedure.

##### 4.1.2.1 Carrier Offset, 136 MHz.

Perform the following steps.

a) Set RADIO Transmit Frequency to 136 MHz.

b) Measure RADIO Carrier Frequency on HP8920.

c) Calculate the Difference between the Measured Value (MEASV) and the Transmit Frequency in parts per million (ppm). [((MEASV/TXFREQ) - 1) * 1,000,000].

d) Verify difference is less than or equal to ∀ 1 ppm.

e) If true, then display Result and Failure Status and Append Parametric Data File.

f) Else prompt Operator to Adjust RADIO XT value (maximum number of attempts is five (5)).

- If RADIO Carrier Frequency is too high (Difference greater than 1 ppm), prompt the operator to enter a value between 0 and -32,000.
- If RADIO Carrier Frequency is too low (Difference less than -1 ppm), prompt the operator to enter a number between 0 and 32,000.

##### 4.1.2.2 Carrier Offset, 155 MHz.

Set RADIO Transmit Frequency to 155 MHz and repeat steps b) through f) of paragraph 4.1.2.1

#### 4.1.2.3 Carrier Offset, 174 MHz.

Set RADIO Transmit Frequency to 174 MHz and repeat steps b) through f) of paragraph 4.1.2.1

### 4.2 CTCSS Level and Frequency.

#### 4.2.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO Transmit Frequency to 155 MHz.

b) Reset HP8920.

c) Select HP8920 Transmit (TX) Screen.

d) Set the HP8920 Audio Frequency Analyzer to 300 Hz LPF.

e) Set HP8920 Modulation OFF.

f) Activate the HP8920 Aux Switch (set the RADIO to TX mode).

g) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING ; Full).

#### 4.2.2 Test Procedure.

##### 4.2.2.1 Set Narrow Mode.

Set RADIO to Analog Narrow Mode (MODEAN).

###### 4.2.2.1.1 CTCSS Tone Level, 155 MHz, Narrow Band.

Perform the following steps:

a) Measure RADIO CTCSS Tone Level on HP8920.

b) Display Result and Failure Status.

c) Append Parametric Data File.

###### 4.2.2.1.2 CTCSS Frequency, 155 MHz, Narrow Band.

Perform the following steps:

a) Measure RADIO CTCSS Frequency Level on HP8920.

b) Display Result and Failure Status.

c) Append Parametric Data File.

##### 4.2.2.2 Set Wide Mode.

Set RADIO to Analog Wide Mode (MODEAW).

#### 4.2.2.2.1 CTCSS Tone Level, 155 MHz, Wide Band.

Repeat steps a) through c) of paragraph 4.2.2.1.1.

#### 4.2.2.2.2 CTCSS Frequency, 155 MHz, Wide Band.

Repeat steps a) through c) of paragraph 4.2.2.1.2.

## 4.3 Carrier Output Power.

### 4.3.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO to Analog Narrow Mode (MODEAN).

b) Reset HP8920.

c) Select HP8920 Transmit (TX) Screen.

d) Set HP8920 Audio Frequency Analyzer De-Emphasis OFF.

e) Set HP8920 Power Unit to DBM.

f) Activate the HP8920 Aux. Switch (set the RADIO to TX mode).

g) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

### 4.3.2 Test Procedure.

#### 4.3.2.1 136 MHz Frequency.

Set RADIO Transmit Frequency to 136 MHz.

#### 4.3.2.1.1 Carrier Output Power, 0.1W, 136 MHz.

Perform the following steps:

a) Set RADIO Output Power Level to 0.1 W.

b) Measure RADIO Output Power on HP8920.

c) Add Power Offset to the measurement.

d) Display Result and Failure Status.

e) Append Parametric Data File.

#### 4.3.2.1.2 Carrier Output Power, 0.5 W, 136MHz.

Set RADIO Output Power Level to 0.5 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

#### 4.3.2.1.3 Carrier Output Power, 1.0 W, 136MHz.

Set RADIO Output Power Level to 1.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.1.4 Carrier Output Power, 2.0 W, 136MHz.**

Set RADIO Output Power Level to 2.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.1.5 Carrier Output Power, 5.0 W, 136MHz.**

Set RADIO Output Power Level to 5.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1. Go to paragraph 4.3.2.1.6.

**4.3.2.1.6 Transmit Current Drain, 5.0 W, 136MHz.**

With the RADIO still in transmit mode, read Current Draw from the HP6033. Display Result and Failure Status and append Parametric Data File.

**4.3.2.2 145 MHz Frequency.**

Set RADIO Transmit Frequency to 145 MHz.

**4.3.2.2.1 Carrier Output Power, 5.0 W, 145MHz.**

Verify RADIO Output Power Level at 5.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1. Go to paragraph 4.3.2.2.2.

**4.3.2.2.2 Transmit Current Drain, 5.0 W, 145MHz.**

With the RADIO still in transmit mode, read Current Draw from the HP6033. Display Result and Failure Status and append Parametric Data File.

**4.3.2.3 145 MHz Frequency.**

Set RADIO Transmit Frequency to 155 MHz.

**4.3.2.3.1 Carrier Output Power, 0.1 W, 155MHz.**

Set RADIO Output Power Level to 0.1 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.3.2 Carrier Output Power, 0.5 W, 155MHz.**

Set RADIO Output Power Level to 0.5 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.3.3 Carrier Output Power, 1.0 W, 155MHz.**

Set RADIO Output Power Level to 1.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.3.4 Carrier Output Power, 2.0 W, 155MHz.**

Set RADIO Output Power Level to 2.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.3.5 Carrier Output Power, 5.0 W, 155MHz.**

Set RADIO Output Power Level to 5.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1. Go to paragraph 4.3.2.3.6.

**4.3.2.3.6 Transmit Current Drain, 5.0 W, 155MHz.**

With the RADIO still in transmit mode, read Current Draw from the HP6033. Display Result and Failure Status and append Parametric Data File.

**4.3.2.4 165 MHz Frequency.**

Set RADIO Transmit Frequency to 165 MHz.

**4.3.2.4.1 Carrier Output Power, 5.0 W, 165MHz.**

Verify RADIO Output Power Level at 5.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1. Go to paragraph 4.3.2.4.2.

**4.3.2.4.2 Transmit Current Drain, 5.0 W, 165MHz.**

With the RADIO still in transmit mode, read Current Draw from the HP6033. Display Result and Failure Status and append Parametric Data File.

**4.3.2.5 174 MHz Frequency.**

Set RADIO Transmit Frequency to 174 MHz.

**4.3.2.5.1 Carrier Output Power, 0.1 W, 174MHz.**

Set RADIO Output Power Level to 0.1 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.5.2 Carrier Output Power, 0.5 W, 174MHz.**

Set RADIO Output Power Level to 0.5 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.5.3 Carrier Output Power, 1.0 W, 174MHz.**

Set RADIO Output Power Level to 1.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.5.4 Carrier Output Power, 2.0 W, 174MHz.**

Set RADIO Output Power Level to 2.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1.

**4.3.2.5.5 Carrier Output Power, 5.0 W, 174MHz.**

Set RADIO Output Power Level to 5.0 W and repeat steps b) through e) of paragraph 4.3.2.1.1. Go to paragraph 4.3.2.5.6.

#### 4.3.2.5.6 Transmit Current Drain, 5.0 W, 174MHz.

With the RADIO still in transmit mode, read Current Draw from the HP6033. Display Result and Failure Status and append Parametric Data File.

## 4.4 Analog Voice Deviation.

### 4.4.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO Output Power Level to 0.5W (PWR 0.5W).

b) Reset HP8920.

c) Select HP8920 Transmit (TX) Screen.

d) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

e) Set HP8920 Audio Frequency Analyzer De-Emphasis OFF.

f) Activate the HP8920 Aux. Switch (Set the RADIO to TX mode).

g) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

### 4.4.2 Test Procedure.

#### 4.4.2.1 Set Narrow Mode.

Set RADIO to Analog Narrow Mode (MODEAN).

#### 4.4.2.1.1 Analog Voice Deviation, 136 MHz, Narrow Band.

Perform the following steps:

a) Set RADIO Transmit Frequency to 136 MHz.

b) Measure RADIO Analog Deviation on HP8920.

c) Display Result and Failure Status.

d) Append Parametric Data File.

#### 4.4.2.1.2 Analog Voice Deviation, 155 MHz, Narrow Band.

Set RADIO Transmit Frequency to 155 MHz and repeat steps b) through d) of paragraph 4.4.2.1.1.

#### 4.4.2.1.3 Analog Voice Deviation, 174 MHz, Narrow Band.

Set RADIO Transmit Frequency to 174 MHz and repeat steps b) through d) of paragraph 4.5.2.1.

#### 4.4.2.2 Set Wide Band.

Set HP8920 Audio Frequency Generator Deviation to 3.0 kHz and set RADIO to Analog Wide Mode (MODEAW).

##### 4.4.2.2.1 Analog Voice Deviation, 136 MHz, Wide Band.

Repeat steps a) through d) of paragraph 4.4.2.1.1.

##### 4.4.2.2.2 Analog Voice Deviation, 155 MHz, Wide Band.

Set RADIO Transmit Frequency to 155 MHz and repeat steps b) through d) of paragraph 4.4.2.1.1.

##### 4.4.2.2.3 Analog Voice Deviation, 174 MHz, Wide Band.

Set RADIO Transmit Frequency to 174 MHz and repeat steps b) through d) of paragraph 4.4.2.1.1.

## 4.5 Digital Modulation Fidelity.

### 4.5.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO to Digital Mode (MODEBER).

b) Set RADIO Output Power level to 0.5W (PWR 0.5W).

c) Reset HP8920.

d) Select HP8920 Transmit (TX) Screen.

e) Set the HP8920 Audio Frequency Analyzer De-Emphasis OFF.

f) Activate the HP8920 Aux Switch (set the RADIO to TX mode).

g) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

### 4.5.2 Test Procedure.

#### 4.5.2.1 Set Low Deviation.

Set RADIO Deviation Test Pattern to LOW Deviation (VOL 2).

##### 4.5.2.1.1 Digital Modulation Low Deviation at 136MHz.

Perform the following steps:

a) Set RADIO Transmit Frequency to 136 MHz.

b) Measure RADIO Frequency Deviation on HP8920.

c) Display Result and Failure Status.

d) Append Parametric Data File.

**4.5.2.1.2 Digital Modulation Low Deviation at 155 MHz.**

Set RADIO Transmit Frequency to 155 MHz and repeat steps b) through d) of paragraph 4.5.2.1.1.

**4.5.2.1.3 Digital Modulation Low Deviation at 174 MHz.**

Set RADIO Transmit Frequency to 174 MHz and repeat steps b) through d) of paragraph 4.5.2.1.1.

**4.5.2.2 Set High Deviation.**

Set RADIO Deviation Test Pattern to HIGH Deviation (VOL 1).

**4.5.2.2.1 Digital Modulation High Deviation at 136 MHz.**

Repeat steps a) through d) of paragraph 4.5.2.1.1.

**4.5.2.2.2 Digital Modulation High Deviation at 155 MHz.**

Set RADIO Transmit Frequency to 155 MHz and repeat steps b) through d) of paragraph 4.5.2.1.1.

**4.5.2.2.3 Digital Modulation High Deviation at 174 MHz.**

Set RADIO Transmit Frequency to 174 MHz and repeat steps b) through d) of paragraph 4.5.2.1.1.

## 4.6 Receive Standby Current Drain.

### 4.6.1 Test Setup.

Configure the test equipment as follows:

a) Reset HP8920.

b) Select HP8920 TX Screen.

### 4.6.2 Test Procedure.

**4.6.2.1 Receive Standby Current Drain at 136 MHz.**

Perform the following steps:

a) Set RADIO Transmit Frequency to 136 MHz.

b) Read Current Draw from the HP6033

c) Display Result and Failure Status.

d) Append Parametric Data File.

#### 4.6.2.2 Receive Standby Current Drain at 155 MHz.

Set RADIO Transmit Frequency to 155 MHz. Repeat steps b) through d) of paragraph 4.6.2.1.

#### 4.6.2.3 Receive Standby Current Drain at 174 MHz.

Set RADIO Transmit Frequency to 174 MHz. Repeat steps b) through d) of paragraph 4.6.2.1.

## 4.7 Transmit Audio Distortion

### 4.7.1 Test Setup.

Configure the Test Equipment as follows:

a) Set RADIO Output Power Level to 0.5W (PWR 0.5W).

b) Set RADIO Transmit Frequency to 155 MHz.

c) Reset HP8920.

d) Select HP8920 Transmit (TX) Screen.

e) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

f) Set HP8920 Audio Frequency Generator Output to 3 mV.

g) Set HP8920 Audio Frequency Analyzer De-Emphasis OFF.

h) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

i) Activate the HP8920 Aux Switch (set the RADIO to TX mode).

j) Measure RADIO Analog Deviation on HP8920.

k) Modify HP8920 Audio Frequency Generator Output by ∀ 0.2mV until the measured deviation is equal to 40% of the rated deviation ∀ 50 Hz.

### 4.7.2 Test Procedure.

#### 4.7.2.1 Set Narrow Mode.

Set RADIO to Analog Narrow Mode (MODEAN).

#### 4.7.2.1.1 Transmit Audio Distortion, 155 MHz, Narrow Band.

Perform the following steps:

a) Set HP8920 Audio Frequency Analyzer De-Emphasis to 750 μs.

b) Set HP8920 Audio Frequency Analyzer Detector to RMS.

c) Set HP8920 Audio Frequency Analyzer Filter to 1 to 300 Hz HPF.

d) Set HP8920 Audio Frequency Analyzer Filter to 2 to 3 kHz LPF.

e) Measure RADIO Audio Distortion on HP8920.

f) Display Result and Failure Status.

g) Append Parametric Data File.

#### 4.7.2.2 Set Wide Mode

Repeat steps a) through d) of paragraph 4.7.1. Set HP8920 Audio Frequency Generator Deviation to 3.0 kHz. Repeat steps f) through k) of paragraph 4.7.1 .Set RADIO to Analog Wide Mode (MODEAW).

#### 4.7.2.2.1 Transmit Audio Distortion, 155 MHz, Wide Band.

Repeat steps a) through g) of paragraph 4.7.2.1.1.

## 4.8 Transmit Hum and Noise.

### 4.8.1 Test Setup.

Configure the Test Equipment as follows:

a) Set RADIO Output Power Level to 0.5W (PWR 0.5W).

b) Set RADIO Transmit Frequency to 155 MHz.

c) Reset HP8920.

d) Select HP8920 Transmit (TX) Screen.

e) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

f) Set HP8920 Audio Frequency Generator Output to 3 mV.

g) Set HP8920 Audio Frequency Analyzer De-Emphasis OFF.

h) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

i) Activate the HP8920 Aux Switch (set the RADIO to TX mode).

j) Measure RADIO Analog Deviation on HP8920.

k) Modify HP8920 Audio Frequency Generator Output by ∀ 0.2mV until the measured deviation is equal to 60% of the rated deviation ∀ 50 Hz.

### 4.8.2 Test Procedure.

#### 4.8.2.1 Set Narrow Mode.

Set RADIO to Analog Narrow Mode (MODEAN).

#### 4.8.2.1.1 Transmit Hum and Noise, 155.05 MHz, Narrow Band.

Perform the following steps:

a) Set HP8920 Audio Frequency Analyzer De-Emphasis to 750 μs.

b) Set HP8920 Audio Frequency Analyzer Detector to RMS.

c) Set HP8920 Audio Frequency Analyzer Filter to 1 to 300 Hz HPF.

d) Set HP8920 Audio Frequency Analyzer Filter to 2 to 3 kHz LPF.

e) Measure RADIO Analog Deviation (HUM) on HP8920.

f) Turn HP8920 Audio Frequency Generator Output OFF.

g) Measure Radio Analog Deviation (NOISE) on HP8920.

h) Calculate TX HUM and NOISE ratio in dB [ratio = 20*Log(HUM/NOISE)].

i) Display Result and Failure Status.

j) Append Parametric Data File.

**4.8.2.2 Set Wide Mode.**

Repeat steps a) through d) of paragraph 4.8.1. Set HP8920 Audio Frequency Generator Deviation to 3.0 kHz. Repeat steps f) through k) of paragraph 4.8.1. Set RADIO to Analog Wide Mode (MODEAW).

**4.8.2.2.1 Transmit Hum and Noise, 155 MHz, Wide Band.**

Repeat steps a) through j) of paragraph 4.8.2.1.1.

## 4.9 Modulation Limiting.

### 4.9.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO Output Power level to 0.5W

b) Set RADIO Transmit Frequency to 155 MHz.

c) Reset HP8920.

d) Select HP8920 TX Screen.

e) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

f) Set HP8920 Audio Frequency Generator Output to 3 mV.

g) Set HP8920 Audio Frequency Analyzer De-Emphasis OFF.

h) Activate the HP8920 Aux Switch (set the RADIO to TX mode).

i) Set the HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

j) Measure the RADIO Analog Deviation on HP8920.

k) Modify HP8920 Audio Frequency Generator Output by ∀ 0.2 mV until the measured deviation is equal to 60% of the rated deviation ∀ 50 Hz.

### 4.9.2 Test Procedure.

#### 4.9.2.1 Set Narrow Mode.

Set RADIO to Analog Narrow Mode (MODEAN).

##### 4.9.2.1.1 Modulation Limiting, 155 MHz, +20dB, Narrow Band.

Perform the following steps:

a) Increase the Audio Frequency Generator Output (from 4.9.1) by 20 dB.

b) Measure RADIO Analog Deviation on HP8920.

c) Display Result and Failure Status.

d) Append Parametric Data File.

##### 4.9.2.1.2 Modulation Limiting, 300 Hz, Narrow Band.

Set HP8920 Audio Frequency Generator Frequency to 300 Hz. Repeat steps b) through d) of paragraph 4.9.2.1.1.

##### 4.9.2.1.3 Modulation Limiting, 1,610 Hz, Narrow Band.

Set HP8920 Audio Frequency Generator Frequency to 1,610 Hz. Repeat steps b) through d) of paragraph 4.9.2.1.1.

##### 4.9.2.1.4 Modulation Limiting, 2,400 Hz, Narrow Band.

Set HP8920 Audio Frequency Generator Frequency to 2,400 Hz. Repeat steps b) through d) of paragraph 4.9.2.1.1.

##### 4.9.2.1.5 Modulation Limiting, 3,000 Hz, Narrow Band.

Set HP8920 Audio Frequency Generator Frequency to 3,000 Hz. Repeat steps b) through d) of paragraph 4.9.2.1.1.

#### 4.9.2.2 Set Wide Mode.

Repeat steps a) through d) of Paragraph 4.9.1. Set HP8920 Audio Frequency Generator Deviation to 3.0 kHz. Repeat steps f) through k) of paragraph 4.9.1. Set RADIO to Analog Wide Mode (MODEAW).

##### 4.9.2.2.1 Modulation Limiting, 155 MHz, +20dB, Wide Band.

Then repeat steps a) through d) of paragraph 4.9.2.1.1.

##### 4.9.2.2.2 Modulation Limiting, 300 Hz, Wide Band.

Set HP8920 Audio Frequency Generator Frequency to 300 Hz. Repeat steps b) through d) of paragraph 4.9.2.1.1.

#### 4.9.2.2.3 Modulation Limiting, 1,610 Hz, Wide Band.

Set HP8920 Audio Frequency Generator Frequency to 1,610 Hz. Repeat steps b) through d) of paragraph 4.9.2.1.1.

#### 4.9.2.2.4 Modulation Limiting, 2,400 Hz, Wide Band.

Set HP8920 Audio Frequency Generator Frequency to 2,400 Hz. Repeat steps b) through d) of paragraph 4.9.2.1.1.

#### 4.9.2.2.5 Modulation Limiting, 3,000 Hz, Wide Band.

Set HP8920 Audio Frequency Generator Frequency to 3,000 Hz. Repeat steps b) through d) of paragraph 4.9.2.1.1.

## 4.10 Analog Sensitivity.

### 4.10.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO to minimum VOL setting that produces at least 500 mW audio output.

b) Set Radio RX Squelch OFF.

c) Set RADIO Receive Frequency to 136.05 MHz.

d) Reset HP8920.

e) Select HP8920 Receive (RX) Screen.

f) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

g) Set HP8920 Audio Frequency Analyzer De-Emphasis OFF.

h) Set HP8920 Audio Frequency Analyzer Detector to RMS.

i) Set HP8920 Audio Frequency Analyzer Filter 1 to 300 Hz HPF.

j) Set HP8920 Audio Frequency Analyzer Filter 2 to 3 kHz LPF.

k) Select SINAD for Audio Frequency Measurement on HP8920.

l) Set HP8920 RF Generator Amplitude to -119 dBm.

m) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

### 4.10.2 Test Procedure.

#### 4.10.2.1 Set Narrow Mode

Set RADIO to Analog Narrow Mode (MODEAN).

#### 4.10.2.1.1 SINAD, 136MHz, Narrow Band.

Perform the following steps:

a) Set HP8920 RF Generator Frequency to 136.05 MHz.

b) Measure RADIO Analog Sensitivity on HP8920. Adjust HP8920 RF Generator Amplitude until the measured sensitivity is equal to 12 ∀ 0.5 dB.

c) Display Results and Failure Status.

d) Append Parametric Data File

**4.10.2.1.2 SINAD, 155.05 MHz, Narrow Band.**

Set RADIO Receive Frequency and the HP8920 RF Generator Frequency to 155.05 MHz. Repeat steps b) through d) of paragraph 4.10.2.1.1.

**4.10.2.1.3 SINAD, 173.975 MHz, Narrow Band.**

Set RADIO Receive Frequency and the HP8920 RF Generator Frequency to 173.975 MHz. Repeat steps b) through d) of paragraph 4.10.2.1.1.

**4.10.2.2 Set Wide Mode**

Set RADIO to Analog Wide Mode (MODEAW) and set HP8920 Audio Frequency Generator Deviation to 3 kHz.

**4.10.2.2.1 SINAD, 136.05 MHz, Wide Band.**

Set RADIO Receive Frequency and the HP8920 RF Generator Frequency to 136.05 MHz. Repeat steps b) through d) of paragraph 4.10.2.1.1.

**4.10.2.2.2 SINAD, 155.05 MHz, Wide Band.**

Set RADIO Receive Frequency and the HP8920 RF Generator Frequency to 155.05 MHz. Repeat steps b) through d) of paragraph 4.10.2.1.1.

**4.10.2.2.3 SINAD, 173.975 MHz, Wide Band.**

Set RADIO Receive Frequency and the HP8920 RF Generator Frequency to 173.975 MHz. Repeat steps b) through d) of paragraph 4.10.2.1.1.

## 4.11 Receive Audio Output.

### 4.11.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO to minimum VOL setting that produces at least 500mW audio output.

b) Set RADIO Receive Frequency to 155.05 MHz.

c) Reset HP8920.

d) Select HP8920 Receive (RX) Screen.

e) Set HP8920 RF Generator Amplitude to -60 dBm.

f) Set HP8920 RF Generator Frequency to 155.05 MHz.

g) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

h) Set HP8920 Audio Frequency Analyzer External Load Resistance to 8 Ohms.

i) Set HP 8920 Audio Frequency Analyzer Audio-In to Float.

j) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

**4.11.2 Test Procedure.**

**4.11.2.1 Set Narrow Mode.**

Set RADIO to Analog Narrow Mode (MODEAN).

**4.11.2.1.1 Audio Power, 155.05 MHz, Narrow Band.**

Perform the following steps:

a) Measure RADIO Audio Output Level on HP8920.

b) Convert level to Watt by [((Average$^2$)/8) * 1,000].

c) Display Result and Failure Status.

d) Append Parametric Data File

e) Go directly to paragraph 4.11.2.1.2.

**4.11.2.1.2 Audio Distortion, 0.5W, Narrow Band.**

Immediately after step d) of paragraph 4.11.2.1.1, perform the following steps:

a) Measure RADIO Audio Output Distortion on HP8920.

b) Display Result and Failure Status.

c) Append Parametric Data File.

**4.11.2.1.3 Audio Current Draw, Narrow Band.**

Read the Current Draw from the HP6033. Display Result and Failure Status and append Parametric Data File

**4.11.2.2 Set Wide Mode**

Set HP8920 Audio Frequency Generator Deviation to 3.0 kHz and set RADIO to Analog Wide Mode (MODEAW)

**4.11.2.2.1 Audio Power, 155.05 MHz, Wide Band.**

Repeat steps a) through d) of paragraph 4.11.2.1.1. After the completion of step d), go directly to paragraph 4.11.2.2.2.

**4.11.2.2.2 Audio Distortion, 0.5W, Wide Band.**

Repeat steps a) through c) of paragraph 4.11.2.1.2.

#### 4.11.2.2.3 Audio Current Draw, Wide Band.

Read the Current Draw from the HP6033. Display Result and Failure Status and append Parametric Data File

### 4.12 Audio Frequency Response.

#### 4.12.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO to minimum VOL setting that produces at least 500mW audio output.

b) Set RADIO Receive Frequency to 155.05 MHz.

c) Reset HP8920.

d) Select HP8920 Receive (RX) Screen.

e) Set HP8920 RF Generator Amplitude to -60 dBm.

f) Set HP8920 RF Generator Frequency to 155.05 MHz.

g) Set HP8920 Audio Frequency Generator Deviation to 0.5 kHz.

h) Set HP8920 Audio Frequency Analyzer Filter 1 to < 20 Hz.

i) Measure Radio Audio Output Level on the HP8920.

#### 4.12.2 Test Procedure.

##### 4.12.2.1 Set Narrow Mode

Set RADIO to Analog Narrow Mode (MODEAN).

##### 4.12.2.1.1 Audio Frequency Response, 300 Hz, Narrow Band.

Perform the following steps:

a) Set HP8920 Audio Frequency Generator Frequency to 300 Hz.

b) Measure RADIO Audio Output on HP8920.

c) Display Result and Failure Data.

d) Append Parametric Data File.

##### 4.12.2.1.2 Audio Frequency Response, 700 Hz, Narrow Band.

Set HP8920 Audio Frequency Generator Frequency to 700 Hz. Repeat steps b) through d) of paragraph 4.12.2.1.1.

##### 4.12.2.1.3 Audio Frequency Response, 1,000 Hz, Narrow Band.

Set HP8920 Audio Frequency Generator Frequency to 1,000 Hz. Repeat steps b) through d) of paragraph 4.12.2.1.1.

#### 4.12.2.1.4 Audio Frequency Response, 2,400 Hz, Narrow Band.

Set HP8920 Audio Frequency Generator Frequency to 2,400 Hz. Repeat steps b) through d) of paragraph 4.12.2.1.1.

#### 4.12.2.1.5 Audio Frequency Response, 3,000 Hz, Narrow Band.

Set HP8920 Audio Frequency Generator Frequency to 3,000 Hz. Repeat steps b) through d) of paragraph 4.12.2.1.1.

### 4.12.2.2 Set Wide Mode

Repeat steps a) through f) of paragraph 4.12.1. Set the HP8920 Audio Frequency Generator Deviation to 1.0 kHz. Repeat steps h) and i) of paragraph 4.12.1. Set RADIO to Analog Wide Mode (MODEAW).

#### 4.12.2.2.1 Audio Frequency Response, 300 Hz, Wide Band.

Set HP8920 Audio Frequency Generator Frequency to 300 Hz. Repeat steps b) through d) of paragraph 4.12.2.1.1.

#### 4.12.2.2.2 Audio Frequency Response, 700 Hz, Wide Band.

Set HP8920 Audio Frequency Generator Frequency to 700 Hz. Repeat steps b) through d) of paragraph 4.12.2.1.1.

#### 4.12.2.2.3 Audio Frequency Response, 1,000 Hz, Wide Band.

Set HP8920 Audio Frequency Generator Frequency to 1,000 Hz. Repeat steps b) through d) of paragraph 4.12.2.1.1.

#### 4.12.2.2.4 Audio Frequency Response, 2,400 Hz, Wide Band.

Set HP8920 Audio Frequency Generator Frequency to 2,400 Hz. Repeat steps b) through d) of paragraph 4.12.2.1.1.

#### 4.12.2.2.5 Audio Frequency Response, 3,000 Hz, Wide Band.

Set HP8920 Audio Frequency Generator Frequency to 3,000 Hz. Repeat steps b) through d) of paragraph 4.12.2.1.1.

## 4.13 Receive Hum and Noise.

### 4.13.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO to minimum VOL setting that produces at least 500 mW audio output.

b) Set RADIO Receive Frequency to 155.05 MHz.

c) Reset HP8920.

d) Select HP8920 Receive (RX) Screen.

e) Set HP8920 RF Generator Amplitude to -60dBm.

f) Set HP8920 RF Generator Frequency to 155.05 MHz.

g) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

h) Set HP8920 Audio Frequency Analyzer Audio-In to Float.

i) Set HP8920 Audio Frequency Analyzer Filter 1 to 300 Hz HPF.

j) Set HP8920 Audio Frequency Analyzer Filter 2 to 3 kHz LPF.

k) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

**4.13.2 Test Procedure.**

**4.13.2.1 Set Narrow Mode**

Set RADIO to Analog Narrow Mode (MODEAN).

**4.13.2.1.1 Receive Hum and Noise, 155.05 MHz, Narrow Band.**

Perform the following steps:

a) Measure RADIO Audio Output Level (HUM) on HP8920.

b) Turn HP8920 Audio Frequency Generator Modulation OFF.

c) Measure RADIO Audio Output Level (NOISE) on HP8920.

d) Calculate RX HUM and NOISE ratio in dB. [ratio = 20*Log (HUM/NOISE)]

e) Display Result and Failure Status.

f) Append Parametric Data File.

**4.13.2.2 Set Wide Mode**

Set HP8920 Audio Frequency Generator Deviation to 3.0 kHz and set RADIO to Analog Wide Mode (MODEAW).

**4.13.2.2.1 Receive Hum and Noise, 155.05 MHz, Wide Band.**

Repeat steps a) through f) of paragraph 4.13.2.1.1.

**4.14 IF Rejection.**

**4.14.1 Test Setup.**

Configure the test equipment as follows:

a) Set RADIO to minimum VOL setting that produces at least 500 mW audio output.

b) Set RADIO Receive Frequency to 155.05 MHz.

c) Reset HP8920.

d) Select HP8920 Receive (RX) Screen.

e) Set HP8920 RF Generator Amplitude to -119dBm.

f) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

g) Set HP8920 Audio Frequency Analyzer Input to Float.

h) Set HP8920 Audio Frequency Analyzer External Load Resistance to 8 Ohms.

i) Select SINAD for Audio Frequency Measurement on HP8920.

j) Set HP8920 Trigger (RETRIGGERING: Single; SETTLING: Full).

k) Reset HP8656.

l) Set HP8656 RF Frequency to 100 MHz.

m) Set HP8656 RF Amplitude to -119 dBm.

n) Set HP8656 Modulation to FM and Frequency to 1.5 kHz.

o) Set HP8656 Internal Modulation to 400 Hz.

p) Set HP8656 RF Generator OFF.

### 4.14.2 Test Procedure.

#### 4.14.2.1 Set Narrow Mode

Set RADIO to Analog Narrow Mode (MODEAN).

##### 4.14.2.1.1 IF Rejection, 155.05 MHz, Narrow Band.

Perform the following steps:

a) Set HP8920 RF Generator Frequency to 155.05 MHz.

b) Measure RADIO Analog Sensitivity on HP8920. Adjust HP8920 RF Generator Amplitude, until Analog Sensitivity is equal to 12 ∀ 0.5 dB for up to 15 attempts.

c) Set HP8656 RF Generator to ON.

d) Set HP8656 RF Generator to IF Frequency 45 MHz.

e) Measure RADIO Analog Sensitivity on HP8920. Adjust HP8656 RF Generator Amplitude until Analog Sensitivity is equal to 12 ∀ 0.5 dB for up to 15 attempts.

f) Display Result and Failure Status.

g) Append Parametric Data File.

#### 4.14.2.2 Set Wide Mode

Set HP8920 Audio Frequency Generator Deviation to 3.0 kHz. Set RADIO to Analog Wide Mode (MODEAW)

#### 4.14.2.2.1 IF Rejection, 155.05 MHz, Wide Band.

Repeat steps a) through g) of paragraph 4.14.2.1.1.

### 4.15 Image Rejection.

#### 4.15.1 Test Setup.

Configure the test equipment as follows:

a) Set RADIO to minimum VOL setting that produces at least 500 mW audio output.

b) Set RADIO Receive Frequency to 155.05.

c) Reset HP8920.

d) Select HP8920 Receive (RX) Screen.

e) Set HP8920 Generator Amplitude to -119dBm.

f) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

g) Set HP8920 Audio Frequency Analyzer Input to Float.

h) Set HP8920 Audio Frequency Analyzer External Load Resistance to 8 Ohms.

i) Select SINAD for Audio Frequency Measurement on HP8920.

j) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

k) Reset HP8656.

l) Set HP8656 RF Frequency to 100 MHz.

m) Set HP8656 RF Amplitude to -119 dBm.

n) Set HP8656 Modulation to FM and Frequency to 1.5 kHz.

o) Set HP8656 Internal Modulation to 400 Hz.

p) Set HP8656 RF Generator OFF.

#### 4.15.2 Test Procedure.

#### 4.15.2.1 Set Narrow Mode

Set RADIO to Analog Narrow Mode (MODEAN).

#### 4.15.2.1.1 Image Rejection, 155.05 MHz, Narrow Band.

Perform the following steps:

a) Set HP8920 RF Generator Frequency to 155.05 MHz.

b) Measure RADIO Analog Sensitivity on HP8920. Adjust HP8920 RF Generator Amplitude, until Analog Sensitivity is equal to 12 ∀ 0.5 dB for up to 15 attempts.

c) Set HP8656 RF Generator to ON.

d) Set HP8656 RF Generator to IF Frequency 45 MHz.

e) Measure RADIO Analog Sensitivity on HP8920. Adjust HP8656 RF Generator Amplitude until Analog Sensitivity is equal to 12 ∀ 0.5 dB for up to 15 attempts.

f) Display Result and Failure Status.

g) Append Parametric Data File.

**4.15.2.2 Set Wide Mode.**

Set HP8920 Audio Frequency Generator Deviation to 3.0 kHz. Set RADIO to Analog Wide Mode (MODEAW).

**4.15.2.2.1 Image Rejection, 155.05 MHz, Wide Band.**

Repeat steps a) through g) of paragraph 4.15.2.1.1.

**4.16 Adjacent Channel Rejection.**

**4.16.1 Test Setup.**

a) Set Radio to minimum VOL setting that produces at least 500mW audio output.

b) Set RADIO Receive Frequency to 155.05 MHz.

c) Reset HP8920.

d) Select HP8920 Receive (RX) Screen.

e) Set HP8920 RF Generator Amplitude to -119dBm.

f) Set HP8920 Audio Frequency Generator Deviation to 1.5 kHz.

g) Set HP8920 Audio Frequency Analyzer Input to Float.

h) Set HP8920 Audio Frequency Analyzer External Load Resistance to 8 Ohms.

i) Select SINAD for Audio Frequency measurement on HP8920.

j) Set HP8920 Trigger Mode (RETRIGGERING: Single; SETTLING: Full).

k) Reset HP8656.

l) Set HP8656 RF Frequency to 100 MHz.

m) Set HP8656 RF Amplitude to -119 dBm.

n) Set HP8656 Modulation to FM and Frequency to 1.5 kHz.

o) Set HP Internal Modulation to 400 Hz.

p) Set HP8656 Generator OFF.

### 4.16.2 Test Procedure.

#### 4.16.2.1 Set Narrow Mode

Set RADIO to Analog Narrow Mode (MODEAN).

#### 4.16.2.1.1 High Adjacent Channel (HAC) Rejection, 155.05 MHz, Narrow Band.

Perform the following steps:

a) Set HP8920 RF Generator Frequency to 155.05 MHz.

b) Measure RADIO Analog Sensitivity on HP 8920.. Adjust HP8920 RF Generator Amplitude until Analog Sensitivity is equal to 12 ∀ 0.5 dB for up to 15 attempts.

c) Set HP8656 RF Generator ON.

d) Set HP8656 RF Generator to the next highest Adjacent Channel (155.0625 MHz).

e) Measure RADIO Analog Sensitivity on HP8920. Adjust HP8656 RF Generator Amplitude until Analog Sensitivity is equal to 12 ∀ 0.5 dB for up to 15 attempts.

f) Display Result and Failure Status.

g) Append Parametric Data File.

#### 4.16.2.1.2 Low Adjacent Channel (LAC) Rejection, 155.05 MHz, Narrow Band.

Repeat steps a) through c) of paragraph 4.16.2.1.1. At step d), set HP8656 RF Generator to the next lowest Adjacent Channel (155.0375 MHz) and repeat steps e) through g).

#### 4.16.2.2 Set Wide Mode

Set HP8920 Audio Frequency Generator Deviation to 3.0 kHz. Set RADIO to Analog Wide Mode (MODEAW).

#### 4.16.2.2.1 High Adjacent Channel (HAC) Rejection, 155.05 MHz, Wide Band.

Repeat steps a) through g) in paragraph 4.16.2.1.1.

#### 4.16.2.2.2 Low Adjacent Channel (LAC) Rejection, 155.05 MHz, Wide Band.

Repeat steps a) through c) of paragraph 4.16.2.1.1. At step d), set HP8656 RF Generator to the next lowest Adjacent Channel (155.0375 MHz) and repeat steps e) through g).

## 5.0 MANUAL TEST PROCEDURE.

### 5.1 Test Data Sheets.

All test data shall be recorded by the test technician on the Test Data Sheet as required by current internal directives and the test paragraph. For tests requiring indication of completion, the test technician shall enter the test result as YES in the "Meas" column to indicate the action was completed. For qualitative test results (i.e. PASS/FAIL), the test technician shall enter the test result as PASS (or P for PASS) or FAIL (or F for FAIL) in the "Meas" column of the Test Data Sheet. Copies of the test data sheets shall be used during normal production testing.

### 5.2 Preliminary Checks.

#### 5.2.1 Visual.

Perform the following preliminary checks. *Record results on the Test Data Sheet.*

a) Verify that all previous production, test, and inspection steps have been completed as evidenced by the UUT Travel Tag/Route Sheet.

b) Examine the UUT for any evidence of damage and verify that no damage is apparent.

c) Verify that the serial number and part number on the UUT Travel Tag/Route Sheet match those on the UUT.

d) Verify test equipment requiring calibration is within the calibration decal due date and that all calibration "seals" are intact.

e) *Print the UUT Serial Number and Job Number in the "Serial No." and "Job No." blocks at the top of the Test Data Sheet.* Do not stamp or date the "Tested By" and "Date" blocks at this time.

### 5.3 Numerical Keypad Check.

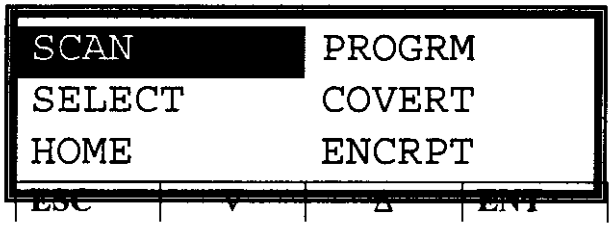
#### 5.3.1 Test Setup.

Ensure the radio is turned ON and the default display screen displayed on the LCD.

#### 5.3.2 Test Procedure.

Perform the following steps. *Record results on the Test Data Sheet.*

a) Press the ENTER button on the front panel and verify that the programming screen, as shown below appears and that a shaded box is over SCAN text.




b) Press the "circle" button (the button directly under the down arrow on the bottom of screen) on the front panel and verify that the shaded box moves down over SELECT.

c) Press the "diamond" button (the button directly under the up arrow on the bottom of the screen) and verify that the shaded box moves back up to SCAN.

d) Press the "square" button (the button directly under the ESC on the bottom of the display) and verify that the default display screen appears.

e) At the default display screen, press each numeric key (and the "*" and "#" keys) and verify that a beep is heard as each key is pressed.

## 5.4 Switches and Buttons Check.

### 5.4.1 Test Setup.

Ensure the radio is turned ON and the default display screen displayed on the LCD. Use the PC Programmer to program the Toggle switch for "Zone Select", to two top side buttons to Hi/Lo Power Select., and the bottom side button for Encryption on/off. Also have a test radio with a channel having the same receive and transmit frequencies as a channel on the UUT

### 5.4.2 Test Procedure.

#### 5.4.2.1 Top Switch Test.

Perform the following steps to verify operation of the Channel Select Switch, 3-position Toggle Switch, and On/Off/Volume Switch. *Record results on the Test Data Sheet.*

a) Set the 3-Position Toggle Switch to A (rear position).

b) Turn the Channel Switch counter-clockwise until it stops and verify that a channel screen, similar to the default screen, appears.

c) Turn the Channel Switch clockwise through all 15 positions. Verify that a different channel is displayed at each position.

d) Set the Toggle Switch to B (mid position) and verify the zone changed.

e) Set the Toggle Switch to C (front position) and verify the zone changed.

f) Set the UUT and test radio to the same channel and verify clear communications between both radios. Turn the UUT Off and then On using the On/Off/Volume Switch. Ensure that the radio beeps approximately 5 seconds after being turned on and the default screen appears on the display. Press the test radio PTT and start talking in a steady voice. On the UUT, turn the On/Off/Volume switch clock-wise one turn and verify that no voice communications is heard. Turn the UUT On/Off/Volume switch clock-wise one more turn and verify that very low voice communications is heard. Start turning the UUT On/Off/Volume switch clock-wise one turn at a time and verify that the voice communications becomes louder after each turn.

#### 5.4.2.2 Side Button/Switch Test.

Perform the following steps to verify operation of the three programmable side buttons and the Push To Talk (PTT) switch. *Record results on the Test Data Sheet.*

a) Press the "circle" button (top button) on the side of the radio a few times. Verify that the power indicator in the bottom right hand corner of the display screen toggles from LO to HI and vice versa.

b) Press the "ellipse" button (second from top) on the side of the radio a few times. Verify that the power indicator in the bottom right hand corner of the display screen toggles from LO to HI and vice versa.

c) Press and hold the large rectangular side switch (Push-To-Talk (PTT) switch)). Verify that the LED at the top of the radio (between the On/Off/Volume Knob and the antenna Connector) turns Red.

d) Press the "triangle" button (bottom button) on the side of the radio a few times. Verify that the encryption indicator (key icon next to the left of the HI/LO power indicator) toggles on and off.

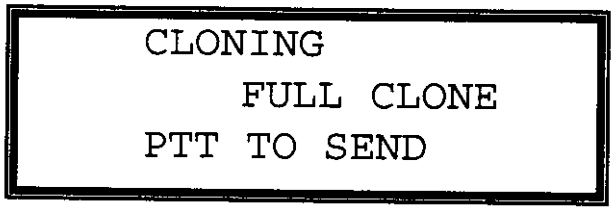
## 5.5 Cloning Cable.

### 5.5.1 Test Setup.

Attach the Source side of the cloning cable to the UUT

### 5.5.2 Test Procedure.

Turn the UUT On using the On/Off/Volume switch. Verify that the following screen appears. Remove the cable and turn the UUT Off. *Record results on the Test Data Sheet.*



## 5.6 Operating Modes Check.

### 5.6.1 Test Setup.

Ensure that the required Air Test software is loaded into the UUT and a "known good" Test Radio. Set the volume switch to the full volume setting. Setup the radios according to Table 5-1

**Table 5-1. Air Test Setup.**

| TEST | UUT | TEST RADIO |
|---|---|---|
| 1 | Channel 1, Zone A<br>Channel Tag: AN-CLR | Channel 1, Zone A<br>Channel Tag: AN-CLR |
| 2 | Channel 2, Zone A<br>Channel Tag: AN-CTCSS | Channel 2, Zone A<br>Channel Tag: AN-CTCSS |
| 3 | Channel 1, Zone B<br>Channel Tag DIG-CLR | Channel 1, Zone B<br>Channel Tag: DIG-CLR |
| 4 | Channel 2, Zone B<br>Channel Tag: DIG-DES | Channel 2, Zone B<br>Channel Tag: DIG-DES |
| 5 | Channel 1, Zone C<br>Channel Tag: AW-CLEAR | Channel 1, Zone C<br>Channel Tag: AW-CLEAR |
| 6 | Channel 2, Zone C<br>Channel Tag: AW-DES | Channel 2, Zone C<br>Channel Tag: AW-DES |
| 7 | Channel 2, Zone C<br>Channel Tag: AW-DES | Channel 1, Zone C<br>Channel Tag: AW-CLEAR |

### 5.6.2 Test Procedure.

Perform the following tests. *Record results on the Test Data Sheet.*

#### 5.6.2.1 Clear Analog Voice, 12.5 kHz.

Set both radios as shown at test 1 and verify clear communications between both radios.

#### 5.6.2.2 Dual-Tone Multiple-Frequency (DTMF) Overdial.

Set both radios as shown at test 2 and verify clear communications between both radios. On the UUT, press the PTT and then press the numeric buttons one-by-one, verify that a telephone-like tones are heard on both radios as each key is pressed.

#### 5.6.2.3 Project 25 Clear Digital Voice.

Set both radios as shown at test 3 and verify clear communications between both radios.

#### 5.6.2.4 Project 25 DES Encrypted Digital Voice.

Set both radios as shown in test 4 and verify clear communications between both radios.

**5.6.2.5 Clear Analog Voice, 25 kHz.**

Set both radios as shown in test 5 and verify clear communications between both radios.

**5.6.2.6 DES Encrypted CVSD FSK Voice.**

Set both radios as shown in test 6 and verify clear communications between both radios.

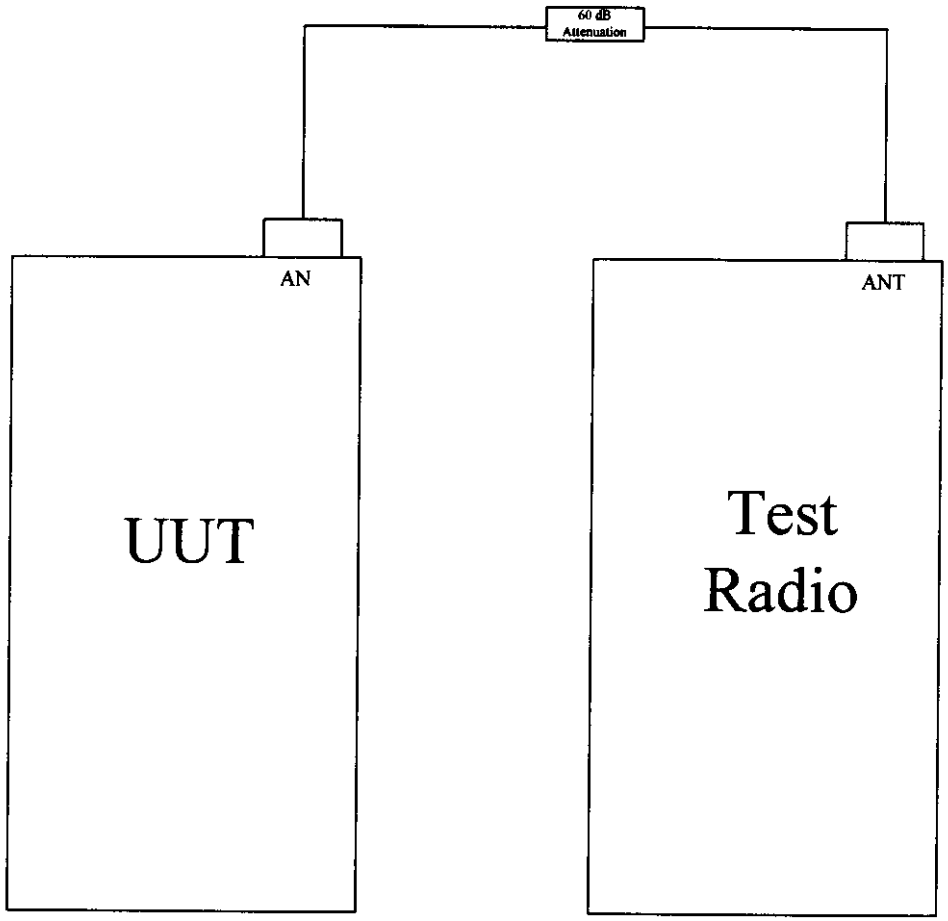
**5.6.2.7 Clear Voice Override.**

Set both radios as shown at test 7 and verify the UUT can receive communications from the test radio, however, the test radio can NOT receive communications from the UUT.

**5.6.2.8 On/Off/Volume Switch.**

**5.6.2.9 Three-Color Light-Emitting Diode (LED).**

Set both radios as shown in test 1and verifying that when transmitting from the UUT to the Test Radio that the UUT LED is Red . Verify that when transmitting from the Test Radio top the UUT that the UUT LED is green. Set both radios as shown in test 4. Verify that when transmitting form the Test Radio to the UUT the UUT LED is flashing green.




**END OF TEST PROCEDURE**

ATTACHMENT A
Test Data Sheet for the
Racal 25 Hand-Held Radio

| Tested by: | Serial Number: | Rev.: |
|---|---|---|
| Part No.: 4101045-501 | Job Number: | Date: |

| Test Paragraph | Description | Meas | Limits Min | Limits Max | Unit |
|---|---|---|---|---|---|
| 5.2.1 | Visual | _____ | PASS | N/A | N/A |
| 5.3.2 | Numerical Keypad Check | _____ | PASS | N/A | N/A |
| 5.4 | Switches and Buttons Check | _____ | PASS | N/A | N/A |
| 5.4.2.1 | 3-Position Toggle Switch | | | | |
| 5.4.2.1 | Channel Switch | | | | |
| 5.4.2.1 | On/Off/Volume Switch | | | | |
| 5.4.2.2 | Programmable Side Buttons | | | | |
| 5.4.2.2 | Push-To-Talk (PTT) Switch | | | | |
| 5.5.2 | Cloning Cable Check | _____ | PASS | N/A | N/A |
| 5.6 | Operating Modes Check | _____ | PASS | N/A | N/A |
| 5.7.2.1 | Clear Analog Voice, 12.5 kHz | | | | |
| 5.7.2.2 | DTMF Overdial | | | | |
| 5.7.2.3 | Project 25 Clear Digital Voice | | | | |
| 5.7.2.4 | Project 25 DES Encrypted Digital Voice | | | | |
| 5.7.2.5 | Clear Analog Voice, 25 kHz | | | | |
| 5.7.2.6 | DES Encrypted CVSD FSK Voice | | | | |
| 5.7.2.7 | Clear Voice Override | | | | |
| 5.7.2.8 | On/Off/Volume Switch | | | | |
| 5.7.2.9 | Three-Color LED | | | | |

COMPANY PROPRIETARY INFORMATION

Final; Production Test Result Record

FOR

Racal 25 Hand Held Radio

P/N : 4101256-501

Source Code Revision Status

Boot Code :

Control Code :

DSP Code :

Keypad Code :

Radio Serial Number :

Tester :

Work Order :

Stage Code :

Test Code :

Project :

Date and Time :

Stack Number :

Individual Test Results

| Test | Description | Min | Result | Max | Units | Status |
|---|---|---|---|---|---|---|
| Para4121 | Carrier Offset @ 136 MHz | -1 | | 1 | ppm | |
| para4122 | Carrier Offset @ 155 MHz | | | | ppm | |
| para4123 | Carrier Offset @ 174 MHz | -1 | | | ppm | |
| para42211 | CTCSS Level @ 155 MHz (narrow) | | | .6 | kHz | |
| para42212 | CTCSS Frequency @ 155 MHz (narrow) | 99.5 | | | Hz | |
| para42221 | CTCSS Level @ 155 MHz (wide) | 0.5 | | 1 | kHz | |
| para42222 | CTCSS Frequency @ 155 MHz (wide) | | | 00.5 | Hz | |
| para43211 | 0.1 W @ 136 MHz | 0.1 | | 0.12 | W | |
| para43212 | 0.5 W @ 136 MHz | 0.5 | | 0.6 | W | |
| para43213 | 1 W @ 136 MHz | 1 | | 1.2 | W | |
| para43214 | 2 W @ 136 MHz | 2 | | 2.4 | W | |
| para43215 | 5 W @ 136 MHz | 5 | | 6 | W | |
| para43216 | Tx Current Drain @ 5 W / 136MHz | 1 | | 1.7 | A | |
| para43221 | 5 W @ 145 MHz | 5 | | 6 | W | |
| para43222 | Tx Current Drain @ 5 W / 145MHz | 1 | | 1.7 | A | |
| para43231 | 0.1 W @ 155 MHz | 0.1 | | 0.12 | W | |
| para43232 | 0.5 W @ 155 MHz | 0.5 | | 0.6 | W | |
| para43233 | 1 W @ 155 MHz | 1 | | 1.2 | W | |
| para43234 | 2 W @ 155 MHz | 2 | | 2.4 | W | |
| para43235 | 5 W @ 155 MHz | 5 | | 6 | W | |
| para43236 | Tx Current Drain @ 5 W / 155MHz | 1 | | 1.7 | A | |
| para43241 | 5 W @ 165 MHz | 5 | | 6 | W | |
| para43242 | Tx Current Drain @ 5 W / 165MHz | 1 | | 1.7 | A | |
| para43251 | 0.1 W @ 174 MHz | 0.1 | | 0.12 | W | |
| para43252 | 0.5 W @ 174 MHz | 0.5 | | 0.6 | W | |
| para43253 | 1 W @ 174 MHz | 1 | | 1.2 | W | |
| para43254 | 2 W @ 174 MHz | 2 | | 2.4 | W | |
| para43255 | 5 W @ 174 MHz | 5 | | 6 | W | |
| para43256 | Tx Current Drain @ 5 W / 174MHz | 1 | | 1.7 | A | |
| para44211 | Ana Voice Dev @ 136 MHz (narrow) | 1.5 | | 2.5 | kHz | |
| para44212 | Ana Voice Dev @ 155 MHz (narrow) | 1.5 | | 2.5 | kHz | |
| para44213 | Ana Voice Dev @ 174 MHz (narrow) | 1.5 | | 2.5 | kHz | |
| para44221 | Ana Voice Dev @ 136 MHz (wide) | 3 | | 5 | kHz | |
| para44222 | Ana Voice Dev @ 155 MHz (wide) | 3 | | 5 | kHz | |
| para44223 | Ana Voice Dev @ 174 MHz (wide) | 3 | | 5 | kHz | |



| | | | | |
|---|---|---|---|---|
| para45211 | Digital Mod low dev @ 136 MHz | 841 | 1037 | Hz |
| para45212 | Digital Mod low dev @ 155 MHz | 841 | 1037 | Hz |
| para45213 | Digital Mod low dev @ 174 MHz | 841 | 1037 | Hz |
| para45221 | Digital Mod high dev @ 136 MHz | 2543 | 3110 | Hz |
| para45222 | Digital Mod high dev @ 155 MHz | 2543 | 3110 | Hz |
| para45223 | Digital Mod high dev @ 174 MHz | 2543 | 3110 | Hz |

| | | | | |
|---|---|---|---|---|
| para4621 | Rx Standby Current @ 136 MHz | 50 | 90 | mA |
| para4622 | Rx Standby Current @ 155 MHz | 50 | 90 | MA |
| para4623 | Rx Standby Current @ 174 MHz | 50 | 90 | mA |
| para47211 | Tx Audio Distortion @ 155 MHz (Narrow) | | 5 | % |
| para47221 | Tx Audio Distortion @ 155 MHz (Wide) | | 5 | % |
| para48211 | Tx Hum & Noise @ 155 MHz (Narrow) | 34 | | dB |
| para48221 | Tx Hum & Noise @ 155 MHz (Wide) | 40 | | dB |
| Para49211 | Mod Limiting @ 155 MHz / +20dB (narrow) | | 2.5 | kHz |
| Para49212 | Modulation Limiting @ 300 HZ (narrow) | | 2.5 | kHz |
| Para49213 | Modulation Limiting @ 1610 HZ (narrow) | | 2.5 | kHz |
| Para49214 | Modulation Limiting @ 2400 HZ (narrow) | | 2.5 | kHz |
| Para49215 | Modulation Limiting @ 3000 HZ (narrow) | | 2.5 | kHz |
| Para49221 | Mod Limiting @ 155 MHz / +20dB (wide) | | 5 | kHz |
| Para49222 | Modulation Limiting @ 300 HZ (wide) | | 5 | kHz |
| Para49223 | Modulation Limiting @ 1610 HZ (wide) | | 5 | kHz |
| Para49224 | Modulation Limiting @ 2400 HZ (wide) | | 5 | kHz |
| Par | Mo lation L iting @ 3000 HZ (wide) | | 5 | kHz |
| par | 10211 SI AD @ 136. MH (narrow) | | -116 | dBm |
| par | 10212 SI AD @ 155. (narrow) | | -116 | dBm |
| par | 10213 SI AD @ 173. 5 M z (narrow) | | -116 | dBm |
| par | 10221 SI AD @ 1 6. MHz ( ide) | | -116 | dBm |
| pa | 0222 S 55 ide) | | -116 | dBm |
| para410223 | SINAD @ 173.975 MHz (wide) | | -116 | dBm |
| para411211 | Audio Power @ 155.05 MHz (narrow) | 500 | | mW |
| para411212 | Audio Distortion @ 0.5 W (narrow) | 0 | 5 | % |
| para411213 | Audio Current Drain (narrow) | 180 | 500 | mA |
| para411221 | Audio Power @ 155.05 MHz (wide) | 500 | | mW |
| para411222 | Audio Distortion @ 0.5 W (wide) | 0 | 5 | % |
| para411223 | Audio Current Drain (wide) | 180 | 500 | mA |
| Para412211 | Audio Freq Response @ 300 Hz (narrow) | 3 | 11.42 | dB |
| Para412212 | Audio Freq Response @ 700 Hz (narrow) | 0.9 | 3.09 | dB |
| Para412213 | Audio Freq Response @ 1000 Hz (narrow) | -3 | 1 | dB |
| Para412214 | Audio Freq Response @ 2400 Hz (narrow) | 10.58 | -6.58 | dB |
| Para412215 | Audio Freq Response @ 3000 Hz (narrow) | 15.67 | -8.51 | dB |
| Para412221 | Audio Freq Response @ 300 Hz (wide) | 3 | 11.42 | dB |
| Para412222 | Audio Freq Response @ 700 Hz (wide) | 0.9 | 3.09 | dB |
| Para412223 | Audio Freq Response @ 1000 Hz (wide) | -3 | 1 | dB |
| Para412224 | Audio Freq Response @ 2400 Hz (wide) | 10.58 | -6.58 | dB |
| Para412225 | Audio Freq Response @ 3000 Hz (wide) | 15.67 | -8.51 | dB |
| para413211 | Rx Hum & Noise @ 155.05 MHz (Narrow) | 34 | | dB |
| para413221 | Rx Hum & Noise @ 155.05 MHz (Wide) | 40 | | dB |
| para414211 | IF Rejection @ 155.05 MHz (narrow) | 70 | | dB |
| para414221 | IF Rejection @ 155.05 MHz (wide) | 70 | | dB |
| para415211 | IMAGE Reject @ 155.05 MHz (narrow) | 70 | | dB |
| para415221 | IMAGE Reject @ 155.05 MHz (wide) | 70 | | dB |
| para416211 | HAC Rejection @ 155.05 MHz (narrow) | 55 | | dB |
| para416212 | LAC Rejection @ 155.05 MHz (narrow) | 55 | | dB |
| para416221 | HAC Rejection @ 155.05 MHz (wide) | 65 | | dB |
| Para416222 | LAC Rejection @ 155.05 MHz (wide) | 65 | | dB |

Total Number of Tests:
Total Number of Tests Passed:
Total Number of Test Failed:
Percent Failures:

U.U.T. TEST TIME:

# SAMPLE

Eric R Hooker
Racal Communications, Inc.
May 3, 1999





# List of Active Circuit Devices and their Function

## (For the Racal-25 VHF Transceiver)

[redacted]

FCC ID: OKC4101256

**Control Section:** ACTIVE DEVICES: Item 4

1. U32 (MAX873B): 2.5 vdc reference for the digital to analog converters (DAC).
2. U31 (MAX525B): 12-bit DAC used to FM modulate the reference oscillator and TX VCO. Additionally, used to temperature compensate the reference oscillator.
3. U18D (LM2902): Amplifier (3.74x) for REFOSCMOD signal.
4. U33 & U34 (MAX534B): Quad 8-bit DAC's used to control VCO coarse tuning, second LO frequency, receive voltage tuned amplifier, transmit output power and transmit PA bias adjustments.
5. U18B (LM2902): Amplifier for VCO coarse tune dc voltage.
6. CR25 (BAR43S): Diodes used to "speed up" VCO coarse tuning.
7. U35 (74HCT125): Logic level converter (3.3 to 5 vdc).

### Receiver Section

1. CR1 & CR2 (MMBD701): Protection diodes for the receiver chain.
2. CR3, CR4, CR27 & CR28 (SMV1204-136): Varactor diodes for the preselector bandpass filter. Used to electronically tune the bandpass filter over frequency.
3. CR29 & CR30 (NU): PIN diodes for the first receiver attenuator. (Not used on the present circuit version).
4. Q1 (MMBR941): Bipolar transistor for low noise receive pre-amp circuit.
5. U1 (EMRS-1A): Passive double-balanced diode ring mixer.
6. Q2 (MMBR901): Bipolar transistor for low noise receive IF amp circuit.
7. CR26 (SMV1236-011): Varactor diode for adjusting the second local oscillator.
8. Q35 (MMBR901): Active device for the second local oscillator.
9. CR31, CR32, CR33 & CR34 (NU): PIN diodes for the second receiver attenuator. (Not used on the present circuit version).
10. Q36 (MMBR901): Bipolar transistor for second IF amp circuit.
11. U28 (AD607ARS): Intermediate Frequency (IF) IC. Contains the second mixer, AGC amps, and receive signal strength (RSSI) circuitry.
12. U29 (LM7131): Buffer amplifier for the IFOUT signal.
13. U27 (LM7111): Buffer amplifier for the RSSI signal.
14. U4 (LP2980A-3.3): Voltage regulator (3.3 vdc) for the receive circuitry.

### Frequency Synthesizer Section

1. U16 (LP2980A-5.0): Voltage regulator (5.0 vdc) for the digital synthesizer circuitry.
2. U17 (LP2980A-5.0): Voltage regulator (3.5 vdc) for the analog synthesizer circuitry.
3. Q20 (NU): Active LPF for U17 voltage regulator. (Not used on this version).

4. U18C (LM2902): Active LPF for VCO modulating signal.
5. U19 (SA7025DK): Frequency synthesizer integrated circuit. Contains serial input and program latches, prescaler, reference and main dividers, phase detectors and charge pump circuitry.
6. CR15 (BBY31): Varactor diode used to FM modulate the TX VCO circuit.
7. CR17 (SMV1213-001): Fine control varactor diode for the TX VCO. Reverse bias voltage comes from the synthesizer (U19) and loop filter.
8. CR16 & CR18 (BBY40): Coarse tune varactor diodes for the TX VCO circuit.
9. Q21 (MMBR901): Active device for TX VCO circuit.
10. Q22 (MMBR901): Buffer amplifier for TX VCO.
11. CR19 (SMV1494-011): Fine control varactor diode for the RX VCO. Reverse bias voltage comes from the synthesizer (U19) and loop filter.
12. CR20 & CR21 (SMV1207-001): Coarse tune varactor diodes for the RX VCO circuit.
13. Q24 (MMBR901): Active device for RX VCO circuit.
14. Q26 (MMBR901): Buffer amplifier for RX VCO.
15. Q25 (MMBR901): Common buffer amplifier for RX and TX VCO's.
16. Q27 (MMBR901): Final buffer amplifier for TX VCO.
17. Q23 (MMBR901): Final buffer amplifier for RX VCO.
18. U22 (LM50B): Temperature sensor for reference oscillator circuit. Used to maintain the desired +/- 2.5 ppm temperature stability.
19. CR22 (BBY40): Varactor diode used to temperature compensate and FM modulate the reference oscillator (Y2).
20. Q28 (MMBR901): Active device for reference oscillator circuit.
21. U24: (74HC595): 8-bit shift register used for transceiver control.
22. Q34 (BSS123) & Q32 (Si2301DS): Forms transistor switch for +3.3VA to +3.3VRXS (receive dc supply).
23. Q33 (BSS123) & Q31 (Si2301DS): Forms transistor switch for +3.3VA to +3.3VTXS (transmit dc supply).
24. U20 (MIC5205): Adjustable voltage regulator set to +5.75 vdc for voltage multiplier.
25. U21 (MIC4416BM4): MOSFET driver used to buffer the 192 kHz clock signal for use in the voltage multiplier circuit.
26. CR23, CR24 & CR25 (BAR43S): Diodes used in the voltage multiplier circuit.
27. Q46 (MMBT3904): Active LPF for output voltage from multiplier circuit.
28. U18A (LM2902): Unused op-amp configured as unity gain buffer.

**Transmitter Section**

1. U14 (LP2980A-5.0): Voltage regulator (5.0 vdc) for the transmit circuitry.
2. U2 (LMC7111): Amplifier (gain=2x) for Q6 FET gate bias dc voltage.
3. U6 (LMC7111): Amplifier (gain=2x) for Q9 FET gate bias dc voltage.
4. Q7 (MMBR941): Transmit pre-driver amplifier.
5. CR5 & CR6 (SMP1314-13): PIN diodes used in the RF attenuator circuit. This circuit is part of the power control loop.
6. Q5 (MMBT3906): Active bias circuit for Q8 amplifier.
7. Q8 (MRF5812): Transmit driver amplifier.
8. Q6 & Q9 (PTF10027): Final power amplifier transistors.

9. U10 (MAX471): Used to sense current drain for the final power amplifier.
10. U11 (LM50B): Used to sense temperature for the final power amplifier.
11. CR11 & CR12 (HSMS-2800): RF detector diodes used in the power control circuit.
12. U13 (LMC7101A): Op-amp configured as an integrator. Used to control RF output power by controlling the PIN diode attenuator.
13. CR7-CR10, CR13 & CR14 (MA4P7001F): PIN diodes used to switch TX and RX signals. In addition, switches between internal and external antennas.
14. Q12-Q19 (BSS123 & Si2301DS): DC switches used to control PIN diode switch operation.
15. U15 (24C64): EEPROM used to store calibration data unique to each transceiver assembly.
16. U3 (LP2980A-3.3): Voltage regulator (3.3 vdc) for digital circuitry.