**PRODUCTION TEST REQUIREMENTS – EXHIBIT N**

# Production Test Requirements For the VHF-4000 And VDL-2000

CPN: 827-4660-001

DP-XX-YY

**DEP- 005**

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**CAGEC: 4V792**

# Notices and Signatures

| | Name | Signature / Date |
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# Revision History

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| | 14 Feb 01 | KKH | DEP-002 |
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# Review History

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|---|---|---|

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## 1. Scope

These production test requirements apply to the VHF-4000 Transceiver, CPN 822-1468-xxx and VDL-2000, CPN 822-1603-001.

## 2. Reference Information

### 2.1 SPECIFICATIONS

VHF-4000 Equipment Specification, CPN: 832-6673-001
VHF-4000 Unit Interface Specification, CPN: 832-8567-001
VDL-2000 Equipment Specification, CPN: TBD
VDL-2000 Unit Interface Specification, CPN: TBD

### 2.2 DRAWINGS

#### 2.2.1 VHF-4000

RF Card Assembly (A1), CPN: 828-3186-XXX
DSP/PS Card Assembly (A2), CPN: 828-3187-XXX
Rear Interconnect Card Assembly (A3), CPN: 828-3185-XXX

#### 2.2.2 VDL-2000

RF Card Assembly (A1), CPN: 828-3310- XXX
DSP Card Assembly (A2), CPN: 828-3311-xxx XXX
Interconnect Card Assembly (A3), CPN: 828-3312- XXX
Power Supply Assembly (A4), CPN 828-3313- XXX

### 2.3 OPERATING FREQUENCIES VS ICAO CHANNEL DESIGNATORS

For all test frequencies listed in test setups in this report, the ICAO Channel Identification developed for the 8.33 kHz channels is used. The channel identification will not necessarily reflect the actual operating frequency. Table 4.7-1 shows the relationship between ICAO Channel Identification, actual operating frequency, receiver bandwidth, and ARINC 429 frequency control word. NOTE: Narrow Band (NB) is selectivity for 8.33 kHz channels and Wide Band (WB) is selectivity for 25 kHz channels.

Table 4.7-1

| Frequency (MHz) | ICAO Channel Name | ARINC 429 Control Word Content | ARINC 429 Control Word Label | Receiver IF Bandwidth automatically selected by unit |
|---|---|---|---|---|
| 118.0000 | 118.000 | 118.000 | 030 | WB |
| 118.0000 | 118.005 | 118.000 | 047 | NB |
| 118.0083 | 118.010 | 118.008 | 047 | NB |
| 118.0167 | 118.015 | 118.017 | 047 | NB |
| 118.0250 | 118.025 | 118.025 | 030 | WB |
| 118.0250 | 118.030 | 118.025 | 047 | NB |
| 118.0333 | 118.035 | 118.033 | 047 | NB |

| Frequency (MHz) | ICAO Channel Name | ARINC 429 Control Word Content | ARINC 429 Control Word Label | Receiver IF Bandwidth automatically selected by unit |
|---|---|---|---|---|
| 118.0417 | 118.040 | 118.042 | 047 | NB |
| 118.0500 | 118.050 | 118.050 | 030 | WB |
| 118.0500 | 118.055 | 118.050 | 047 | NB |
| 118.0583 | 118.060 | 118.058 | 047 | NB |
| 118.0667 | 118.065 | 118.067 | 047 | NB |
| 118.0750 | 118.075 | 118.075 | 030 | WB |
| 118.0750 | 118.080 | 118.075 | 047 | NB |
| 118.0833 | 118.085 | 118.083 | 047 | NB |
| 118.0917 | 118.090 | 118.092 | 047 | NB |
| 118.1000 | 118.100 | 118.100 | 030 | WB |
| 118.1000 | 118.105 | 118.100 | 047 | NB |
| 136.9750 | 136.975 | 136.975 | 030 | WB |
| 136.9750 | 136.980 | 136.975 | 047 | NB |
| 136.9833 | 136.985 | 136.983 | 047 | NB |
| 136.9917 | 136.990 | 136.992 | 047 | NB |

## 3. Test Equipment Required

The following test equipment or equivalent is required:

1. CATS-21 Full ATE
2. Lab View 5.1.1 DLS-001
3. Test Stand 1.02 DLT-001
4. I.E Test Exec. 3.1.1 DLR-001

## 4. Test Conditions

Unless otherwise specified, all tests shall be performed under the following conditions:

### 4.1 TEMPERATURE

Normal factory ambient.

### 4.2 HUMIDITY

Normal factory ambient.

### 4.3 WARM-UP AND INITIALIZATION

30 seconds

### 4.4 ATMOSPHERIC PRESSURE

Normal factory ambient.

## 4.5 TRANSMIT DUTY CYCLE

20 %, 30 seconds maximum single transmit duration

**5. Test Definitions and Information**

- In transmit mode, the antenna output shall be terminated in 50 ohm load and the sidetone audio output terminated in 600 ohm load. In receive mode, receiver and data audio outputs are terminated in 600 ohm load.
- All receiver RF levels are in dBm at UUT antenna input.
- Upper limit of operation at ICAO channel 136.990 applies for some units. Disregard operation beyond this frequency in any alignment or tests where frequencies exceeding this limit are specified.
- Connect TX_Mode_Indicator (VHF-4000 Pin 47, VDL-2000 Pin 3) to 27.5 Vdc through a 270 ohm, ½ watt load.

## 5.1 STANDARD DISCRETE CONFIGURATION

The "Standard Discrete Configuration" is defined as the following configuration of the input discretes:

| *DISCRETE* | *VHF-4000 Pin #* | *VDL-2000 Pin #* | *STATUS* |
|---|---|---|---|
| PTT_Sel | 41 | 35 | Open (Receive mode) |
| Simulcom_Cntl_1_Sel | 42 | 16 | Open (Attenuator disabled) |
| Simulcom_Cntl_2_Sel | 46 | 34 | Open |
| RIU_Installed_Sel | 43 | NA | Open (RIU not installed) |
| All_Call_Dsbl_Set | 44 | NA | Open (All-Call enabled) |
| Voice/Data_Sel | 45 | 17 | Open (Voice mode) |
| Burst_Tune_Sell | 49 | NA | Open (Continuous tuning) |
| ARINC/CSDB Select | 50 | NA | Open (ARINC-429 control selected) |
| Port_C_Sel | 51 | NA | Open (ARINC 429 Input Port C not selected) |
| RX_Comp_Dsbl_Sel | 52 | NA | Open (Receive compressor disabled) |
| Port_A/B_Sel | 55 | NA | Open (ARINC 429 Input Port B selected) |
| Unit_ID_A_Sel | 56 | 15 | Open (All-Call enabled *) |
| Unit_ID_B_Sel | 62 | 18 | Open |
| WOW_Sel | 57 | 14 | Open (Weight on Wheels not selected) |
| Data_Load_Enbl_Sel | 61 | 29 | Open (Data Load disabled) |
| SYSTEM_ON_F | NA | 27 | Gnd (Transceiver On) |

## 5.2 STANDARD RF GENERATOR CONFIGURATION

The "Standard RF Generator Configuration" is defined as follows:

Generator set to the frequency defined at time of reference, amplitude modulated by a 1 kHz sine wave at a modulation level of 30%, and a RF level of –47 dBm.

## 5.3 STANDARD ARINC 429 BUS/DATA CONFIGURATIONS

### 5.3.1 Standard Control Data Configurations

#### 5.3.1.1 VHF-4000

All test steps are performed using continuous tuning on the low speed ARINC 429 control bus 429_Input_Port_B (Pins 3 and 4). The control words are labels 030 for 25 kHz channels & 047 for 8.3 kHz channels.

Calibration and TFM parameters are set using the high-speed maintenance input bus MAINT_IN (Pins 9 and 10) and output port MAINT_OUT (Pins 13 and 14). The control word is label 277 (See Appendix for format).

#### 5.3.1.2 VDL-2000

All test steps are performed using continuous tuning on the high-speed ARINC 429 maintenance input bus 429MAINT_IN (pins 1 and 32). The control words are labels 030 for 25 kHz channels & 047 for 8.3 kHz channels.

Calibration and TFM parameters are also set using the high-speed ARINC 429 maintenance input bus 429MAINT_IN (pins 1 and 32). The control word is label 277 (See Appendix for format).

### 5.3.2 Standard Data Configurations

- The "Standard 25 kHz ARINC Configuration" is defined as follows:
  Octal label 047 (8.33 kHz label) set to NCD.
  Transmit the control data on label 030 (Oct) every 200 ms.
  The tuning channel will be defined at the time of reference to this definition.
  The SSM is set to 11 (squelch disabled).
  SDI set to 00 (All call).

- The "Standard 8.33 kHz ARINC Configuration" is defined as follows:
  Octal label 030 (25 kHz label) set to NCD.
  Transmit the control data on label 047 (Oct) every 200 ms.
  The tuning channel will be defined at the time of reference to this definition.
  The SSM is set to 11 (squelch disabled).
  SDI set to 00 (All call).

## 5.4 TEST SEQUENCE

If the UUT has never been aligned then all alignment steps must be performed in sequence. For re-alignment of UUT as a result of a repair action or modification, perform only alignment steps of circuits that have been effected by repair action or modification. Checksum will be automatically updated whenever FLASH memory is updated.

## 6. Alignment

Connect main connector plug from test station to UUT.
Apply 27.5 ± 0.5 Vdc to the power input.

VHF-4000, power pins 58, 64 and ground pins 59, 65.
VDL-2000, power pins 10, 11 and ground pins 8, 9.

Wait 30 seconds for the unit to complete power on testing.

The VHF4000 or VDL2000 may be aligned per Section 6.3 Alignment Procedures or with the automatic alignment system (CATS-21) executing DGS-005.

### 6.1 SOFTWARE LOAD PROCEDURE

Load the desired top-level software using the data loader capability of the VHF-4000 or the boundary scan interface.

### 6.2 CALIBRATION AND TFM PARAMETERS

The VHF-4000 uses electronic alignment for circuits that use values for various parameters stored in FLASH memory. TFM parameters are those that require different values depending upon temperature, frequency or mode. Calibration parameters are those that are the same for all temperature, frequency, and mode.

#### 6.2.1 Initialization of Calibration Parameters

Store into FLASH memory the hex values for calibration parameters listed in the following table or the nominal value (nominal values derived from trend data).

| Calibration Parameter | # | Applicable Mode | Value (hex) | Notes |
|---|---|---|---|---|
| Combined Audio Level Adjust | 43 | Rx | 4268 | level adjust for combined audio Rx output |
| Digital Audio Level Adjust | 44 | Rx | 23E7 | level adjust for digital audio Rx output |
| Rx Compressor Threshold | 45 | Rx | 250F | input level threshold for receiver compressor |
| Carrier Squelch Mute Threshold | 46 | Rx | 7FFF | Carrier Squelch muting upper limit |
| Carrier Squelch Unmute Threshold | 47 | Rx | 7FFF | Carrier Squelch unmuting upper limit |
| 25 kHz Noise Squelch Mute Threshold | 48 | Rx | 7FFF | 25 kHz Noise Squelch muting upper limit |
| 25 kHz Noise Squelch Unmute Threshold | 49 | Rx | 0000 | 25 kHz Noise Squelch unmuting lower limit |
| 8.33 kHz Noise Squelch Mute Threshold | 50 | Rx | 7FFF | 8.33 kHz Noise Squelch muting upper limit |
| 8.33 kHz Noise Squelch Unmute Threshold | 51 | Rx | 0000 | 8.33 kHz Noise Squelch unmuting lower limit |
| 138.6 MHz Noise Squelch Mute Threshold | 52 | Rx | FFFF | 138.6 MHz Noise Squelch muting upper limit |
| 138.6 MHz Noise Squelch Unmute Threshold | 53 | Rx | 0000 | 138.6 MHz Noise Squelch unmuting low limit |
| Digital Audio Sidetone Level Adjust | 54 | Tx | 2C76 | level adjust for digital audio sidetone output |
| Combined Audio Sidetone Level Adjust | 55 | Tx | 1C39 | level adjust for combined audio sidetone out |
| Low Voltage Scaling Threshold | 56 | Tx | 07D0 | low volt limit for signal scaling in transmits |
| VSWR Scaling Threshold | 57 | Tx | 4E20 | VSWR limit for signal scaling in transmits |
| Analog Tx Compressor Threshold | 58 | Tx | 6DE | level to begin analog Tx signal compression |
| Digital Audio Tx Compressor Threshold | 59 | Tx | 07FF | level to begin digital Tx signal compression |
| Tx Power Upper Threshold for all but Mode 2 | 60 | Tx | 07FF | V Fwd high limit for non-Mode 2 Tx faults |
| Tx Power Lower Threshold for all but Mode 2 | 61 | Tx | 0000 | V Fwd low limit for non-Mode 2 Tx faults |
| Tx Power Upper Threshold for Mode 2 | 62 | Tx | 07FF | V Fwd high limit for Mode 2 Tx faults |
| Tx Power Lower Threshold for Mode 2 | 63 | Tx | 0000 | V Fwd low limit for Mode 2 Tx faults |
| VSWR Fault Threshold | 64 | Tx | 7FFF | VSWR limit for reporting of faults |
| PA Over Temperature Threshold | 65 | Tx | 0783 | PA temperature limit at which Tx is aborted |
| +3.3 VDC Upper Threshold | 66 | Rx/Tx | 09C5 | fault upper limit for +3.3 VDC input value |

| Calibration Parameter | # | Applicable Mode | Value (hex) | Notes |
|---|---|---|---|---|
| +3.3 VDC Lower Threshold | 67 | Rx/Tx | 0698 | fault lower limit for +3.3 VDC input value |
| +8.0 VDC Upper Threshold | 68 | Rx/Tx | 0A7A | fault upper limit for +8.0 VDC input value |
| +8.0 VDC Lower Threshold | 69 | Rx/Tx | 0649 | fault lower limit for +8.0 VDC input value |
| -8.0 VDC Upper Threshold | 70 | Rx/Tx | 0965 | fault upper limit for -8.0 VDC input value |
| -8.0 VDC Lower Threshold | 71 | Rx/Tx | 05A3 | fault lower limit for -8.0 VDC input value |
| +5.0 VDC Upper Threshold | 72 | Rx/Tx | 0CF6 | fault upper limit for +5.0 VDC input value |
| +5.0 VDC Lower Threshold | 73 | Rx/Tx | 06FA | fault lower limit for +5.0 VDC input value |
| +15.0 VDC Upper Threshold | 74 | Rx/Tx | 0A79 | fault upper limit for +15.0 VDC input value |
| +15.0 VDC Lower Threshold | 75 | Rx/Tx | 06FB | Fault lower limit for +15.0 VDC input value |
| Tx Timeout Threshold | 76 | Tx | 3FFF | limit at which Tx is aborted |
| TFM Temperature Boundary A | 77 | Rx/Tx | 01C1 | Sets TFM temperature zones 1 & 2 boundary |
| TFM Temperature Boundary B | 78 | Rx/Tx | 0364 | Sets TFM temperature zones 2 & 3 boundary |
| TFM Temperature Boundary C | 79 | Rx/Tx | 0508 | Sets TFM temperature zones 3 & 4 boundary |
| TFM Temperature Hysteresis | 80 | Rx/Tx | 33 | Hysteresis for descending temp zone transits |
| VSWR Scaling Coefficient | 81 | Tx | 571C | Power reduction to apply for VSWR scaling |
| SELCAL Audio Level Adjust | 82 | Rx | 5654 | Level adjust for SELCAL audio DAC output |
| Low V IQ Phase Adj. Upper Threshold | 83 | Tx | 0000 (TBD new value | 28V val. to start Low Voltage IQ Phase Adjust |
| Low V IQ Phase Adj. Lower Threshold | 84 | Tx | 0000 (TBD new value | 28V val. to end Low Voltage IQ Phase Adjust |
| SW AGC Selftest Limit On Threshold | 85 | Rx | 7FFF | SW AGC level max limit with signal present |
| SW AGC Selftest Limit Off Threshold | 86 | Rx | 0000 | SW AGC level min limit with signal absent |
| HW AGC Selftest Limit On Threshold | 87 | Rx | 0000 | HW AGC level max limit with signal present |
| HW AGC Selftest Limit Off Threshold | 88 | Rx | 7FFF | HW AGC level min limit with signal absent |
| Transfer Fault Tone Level Adj. | 89 | Rx/Tx | 12C | Audio level of fault |
| D8PSK Low Voltage Scaling Threshold | 90 | Tx | 0000 (TBD new value) | Low volt limit for signals scaling in transmit in D8PSK modes. |
| I_Q_Ref | 91 | TX | 0000 | Not Used |
| Spare_1 | 92 | N/A | 0000 | Not Used |
| Spare_2 | 93 | N/A | 0000 | Not Used |
| Spare_3 | 94 | N/A | 0000 | Not Used |
| Spare_4 | 95 | N/A | 0000 | Not Used |

### 6.2.2 Initialization of TFM Parameters

Store into FLASH memory the hex values for TFM parameters listed in the following table or the nominal value for 118 MHz (nominal values derived from trend data).

| TFM Parameter | # | Applicable Mode | Value (hex) | Notes |
|---|---|---|---|---|
| I Phase Adjust | 1 | Tx | 0000 | normal setting for I phase adjustment DACs |
| Q Phase Adjust | 2 | Tx | 2048 | normal setting for Q phase adjustment DACs |
| Simulcomm 0 | 3 | Rx | FF | sets SCOM Thresh DAC when Simulcomm discretes = 00 |
| Simulcomm 1 | 4 | Rx | FF | sets SCOM Thresh DAC when Simulcomm discretes = 01 |
| Simulcomm 2 | 5 | Rx | FF | sets SCOM Thresh DAC when Simulcomm discretes = 10 |
| Simulcomm 3 | 6 | Rx | FF | sets SCOM Thresh DAC when Simulcomm discretes = 11 |
| Preselector 1 | 7 | Rx/Tx | 0000 | sets Presel_1 DAC |
| Preselector 2 | 8 | Rx/Tx | 0000 | sets Presel_2 DAC |
| Preselector 3 | 9 | Rx/Tx | 0000 | sets Presel_3 DAC |
| Preselector 4 | 10 | Rx/Tx | 0000 | sets Presel_4 DAC |
| PA Drive Bias for D8PSK | 11 | Rx/Tx | 0000 | sets PA Drive Bias DAC when in ARINC 750 Mode 2 |
| PA Drive Bias for all but D8PSK | 12 | Rx/Tx | 0000 | sets PA Drive Bias DAC when not in ARINC 750 Mode 2 |
| PA Final Bias for D8PSK | 13 | Rx/Tx | 0000 | sets PA Final Bias DAC when in ARINC 750 Mode 2 |
| PA Final Bias for all but D8PSK | 14 | Rx/Tx | 0000 | sets PA Final Bias DAC when not in ARINC 750 Mode 2 |
| D8PSK I Channel Gain | 15 | Tx | 0000 | sets I channel gain for D8PSK transmissions |
| D8PSK Q Channel Gain | 16 | Tx | 0000 | sets Q channel gain for D8PSK transmissions |
| AM I Channel Carrier Power | 17 | Tx | 0000 | sets I channel offset (carrier power) for AM transmissions |
| AM Q Channel Carrier Power | 18 | Tx | 0000 | sets Q channel offset (carrier power) for AM transmissions |
| D8PSK I Channel Carrier Null (offset) | 19 | Tx | 0000 | sets I channel offset (carrier null) for D8PSK transmissions |
| D8PSK Q Channel Carrier Null (offset) | 20 | Tx | 0000 | sets Q channel offset (carrier null) for D8PSK transmissions |
| Mode A I Channel Carrier Power (offset) | 21 | Tx | 0000 | sets I channel offset (carrier power) for Mode A transmissions |
| Mode A Q Channel Carrier Power (offset) | 22 | Tx | 0000 | sets Q channel offset (carrier power) for Mode A transmissions |
| AM I Channel Mod % (gain) | 23 | Tx | 0000 | Sets I channel mod % (gain) for AM Tx |
| AM Q Channel Mod % (gain) | 24 | Tx | 0000 | Sets Q channel mod % (gain) for AM transmissions |
| Mode A I Channel Mod % (gain) | 25 | Tx | 0000 | Sets I channel mod % (gain) for Mode A transmissions |
| Mode A Q Channel Mod % (gain) | 26 | Tx | 0000 | Sets Q channel mod % (gain) for Mode A transmissions |
| AM Voice Rx Audio Phase Shift | 27 | Rx | 0000 | Adjusts phase of Rx audio output relative to input RF modulation |
| D8PSK Quadrature Mismatch | 28 | Tx | 0000 | compensates transmit signal for feedback modulator mismatch |
| Rx Synthesizer Adjust | 29 | Rx | 55 | CN count for receiver synthesizer tuning |
| Tx Synthesizer Adjust | 30 | Tx | 8C | CN count for transmitter synthesizer tuning |
| I Low Voltage Phase Adjust | 31 | Tx | 0000 | normal setting for I phase adjustment DACs |
| Q Low Voltage Phase Adjust | 32 | Tx | 07FF | normal setting for Q phase adjustment DACs |
| Mode 2 –90.5 dBm Level | 33 | Rx | | normal setting for –90.5 dBm Mode 2 Rx level |
| Mode 2 –91.5 dBm Level | 34 | Rx | | normal setting for –91.5 dBm Mode 2 Rx level |
| AM I Channel Carrier Null (offset) | 35 | Tx | 07FF | sets I channel offset null for AM transmissions |
| AM Q Channel Carrier Null (offset) | 36 | Tx | 07FF | sets Q channel offset null for AM transmissions |
| Spur Suppression Noise Level | 37 | Tx | | 8.3 kHz synthesizer spur adj. |
| Spare 6 | 38 | N/A | | |
| Spare 7 | 39 | N/A | | |
| Spare 8 | 40 | N/A | | |
| Spare 9 | 41 | N/A | | |
| Spare 10 | 42 | N/A | | |

## 6.3 ALIGNMENT PROCEDURES

### 6.3.1 Receiver Analog Audio Output Level (VHF4000 Only) [Rx Cal]

1) Set Standard ARINC Configuration at 118.5 MHz.

2) Set Standard RF Generator Setting at 118.5 MHz.
3) Set Standard Discrete Configuration.
4) Set the generator to 85% modulation and -40 dBm RF level.
5) Monitor the receiver audio output and adjust calibration parameter #1 (Combined audio level adjust) for 7.75 Vrms ± 0.1 Vrms.
6) Store the values used for calibration parameters #1, 2, and 40 in Flash memory.

### 6.3.2 Selcal Audio Output Level (VHF4000 Only) [Rx Cal]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard RF Generator setting at current frequency.
3) Set Standard Discrete Configuration.
4) Set the generator to 60% modulation and -40 dBm RF level.
5) Monitor the SELCAL audio output and adjust calibration parameter #40 (SELCAL audio) for 500 mVrms ± 25 mVrms.
6) Store the values used for calibration parameters #1, 2, and 40 in Flash memory.

### 6.3.3 Voice Carrier Null [Tx TFM]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard Discrete Configuration.
3) Set the ARINC data to “Standard 25 kHz ARINC Configuration” on channel 118.500.
4) Connect 50 ohm load to antenna cable.
5) Ground the PTT (Pin 41), Monitor RF Transmitter power.
6) Simultaneously vary TFM parameters # 35 and # 36 (AM I and Q channel offset) to get lowest possible power output. The null power out must be less than 4 dBm.
7) Unground the PTT.

### 6.3.4 Voice/Analog Data Bias Adjustment [Tx TFM]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard Discrete Configuration.
3) Set the ARINC data to “Standard 25 kHz ARINC Configuration” on channel 118.500.
4) Connect 50 ohm load to antenna cable.
5) Set TFM parameters #12 and #14 (PA drive bias and final driver bias) to $0000.
6) Ground the PTT (Pin 41), and monitor the input current to the UUT.
7) Adjust TFM parameter #14 until the current increases by 1500 ma ± 50 ma over the original value.
8) Adjust TFM parameter #12 until the current increases by an additional 500 ma ± 50 ma over the value in step 8.
9) Unground the PTT.
10) Store the values used for TFM parameters #12 and #14 in the Flash memory location for all temperature zones and channels.
11) Find values only at 118 MHz channel, use that value for all other channels.

### 6.3.5 +28 V Transmitter Phasing Adjustment [Tx TFM]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard Discrete Configuration.
3) Verify power supply input voltage is 27.5 +/- 0.2 Vdc.
4) Apply 0.7 Vrms, 1 kHz tone to Microphone Audio input.
5) Set I & Q channel carrier offset to 0
6) Set Q Channel Gain to 0.
7) Set I Channel Gain to get 4 – 6 watts RF output power
8) Monitor the Q_Detector Output of the RF Card

9) Ground the PTT and vary TFM parameter #1 & #2 (Q phase & I adjust) up or down from initial value as necessary to null the Q detector voltmeter reading. Final value must be less than TBD.

   Note: The I& Q Phase Adjust values are calculated as a function of the phase angle using the following formula:

   Q bits = ((1.25 x sine (Angle) + 1.25)) / (2.5/4095)
   I bits = ((1.25 x cos (Angle) + 1.25)) / (2.5/4095)

10) Unground the PTT.
11) Store the values for TFM parameter #1 and #2 in Flash memory.

### 6.3.6 +20 V Transmitter Phasing Adjustment [Tx TFM]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard Discrete Configuration.
3) Verify power supply input voltage is 20.0 +/- 0.2 Vdc.
4) Apply 0.7 Vrms, 1 kHz tone to Microphone Audio input.
5) Set I & Q channel carrier offset to 0
6) Set Q Channel Gain to 0.
7) Set I Channel Gain to get 4 – 6 watts RF output power
8) Monitor the Q_Detector Output of the RF Card
9) Ground the PTT and vary TFM parameter #30 & #31 (LV Q phase & I adjust) up or down from initial value as necessary to null the Q detector voltmeter reading. Final value must be less than TBD.

   Note: The I& Q Phase Adjust values are calculated as a function of the phase angle using the following formula:

   Q bits = ((1.25 x sine (Angle) + 1.25)) / (2.5/4095)
   I bits = ((1.25 x cos (Angle) + 1.25)) / (2.5/4095)

10) Unground the PTT.
11) Store the values for TFM parameter #1 and #2 in Flash memory.

### 6.3.7 Preselector Adjustments [Rx Cal]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard RF Generator setting at current frequency.
3) Set Standard Discrete Configuration.
4) Monitor the combined audio output.
5) Adjust the generator RF level to give approximately 12 dB SINAD ratio.
6) Iteratively adjust TFM parameters #7 –10 from initial values for the best SINAD while reducing the RF level to maintain 12 dB SINAD. The final SINAD after adjustment must be at least 8 dB with –103 dBm input RF level.
7) Store the values used for TFM parameters #7 - #10 in Flash memory.

### 6.3.8 Analog Voice/Data Unmodulated Transmitter RF Power [Tx TFM]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard Discrete Configuration.
3) Set TFM parameters #17 & #18 (AM I and Q channel carrier power) to 2048 (Dec).
4) Ground the PTT and increment TFM parameters # 17 until the RF wattmeter indicates 10 watts +/- 1 watt.

5) Increment TFM parameters # 18 until the RF wattmeter indicates 19.5 watts +/- 1 watt.
6) Unground the PTT.
7) Store the values for TFM parameters #17 and 18 in Flash memory.

### 6.3.9 Simulcomm 0 Adjustment (-20 dBm threshold) [Rx TFM]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard RF Generator setting at current frequency.
3) Set Standard Discrete Configuration.
4) Set rear connector simulcomm discretes to 00 (VHF4000 Pins 42 and 46 open, VDL Pins 16 and 34 open).
5) Set the generator RF level to -20 dBm and 90% modulation.
6) Monitor the AGC_Level output of the RF Card.
7) Decrease TFM parameter # 3 until the AGC_Level decreases at least 2% - 4% from the reading in step 6.
8) Store the value used for TFM variable #3 in the Flash memory.
9) Find value at 118 MHz channel and use value for 119-125 MHz channels.
10) Find value at 126 MHz channel and use value for 127-136 MHz channels.

### 6.3.10 Simulcomm 1 Adjustment (-10 dBm threshold) [Rx TFM]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard RF Generator setting at current frequency.
3) Set Standard Discrete Configuration.
4) Set rear connector simulcomm discretes to 01(VHF4000 Pins 42 open and 46 ground, VDL Pins 16 open and 34 ground).
5) Set the generator RF level to -10 dBm and 90% modulation.
6) Monitor the AGC_Level output of the RF Card.
7) Decrease TFM parameter # 4 until the AGC_Level decreases at least 2% - 4% from the reading in step 6.
8) Store the value used for TFM variable #4 in the Flash memory.
9) Find value at 118 MHz channel and use value for 119-125 MHz channels.
10) Find value at 126 MHz channel and use value for 127-136 MHz channels.

### 6.3.11 Analog Voice/Data Transmitter Modulation [Tx TFM]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard Discrete Configuration.
3) Apply a 0.4 Vrms audio signal at 1.0 kHz to the microphone input.
4) Ground the PTT and simultaneously increment TFM parameters #23 and 24 (AM I and Q Channel Mod) to obtain modulation of the negative peaks at 90 +/- 3 %.
5) Unground the PTT.
6) Store the value used for TFM parameters #23 and #24 in the Flash memory.

### 6.3.12 Simulcomm 2 Adjustment ( 0 dBm threshold) [Rx TFM]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard RF Generator Setting at current frequency.
3) Set Standard Discrete Configuration.
4) Set rear connector simulcomm discretes to 10 (VHF4000 Pins 42 ground and 46 open, VDL Pins 16 open and 34 ground).
5) Set the generator RF level to 0 dBm and 90% modulation.
6) Monitor the AGC_Level output of the RF Card.

7) Decrease TFM parameter # 5 until the AGC_Level decreases at least 2% - 4% from the reading in step 6.
8) Store the value used for TFM variable #5 in the Flash memory.
9) Find value at 118 MHz channel and use value for 119-125 MHz channels.
10) Find value at 126 MHz channel and use value for 127-136 MHz channels.

### 6.3.13 Analog and Digital Sidetone Levels [Tx Cal]

1) Set Standard ARINC Configuration at 126.500 MHz.
2) Set Standard Discrete Configuration.
3) Apply a 0.4 Vrms audio signal to the microphone input.
4) Ground the PTT and monitor the combined receiver audio output.
5) Adjust calibration parameter #13 (combined sidetone level adjust) for 3.87 ± 0.1 Vrms.
6) Unground the PTT.
7) Store the value calibration parameter # 12 and 13 in Flash memory.

### 6.3.14 Squelch Adjustment

#### 6.3.14.1 25 KHZ NOISE QUIETING SQUELCH [RX CAL]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard RF Generator Setting at current frequency.
3) Set Standard Discrete Configuration.
4) Enable squelch on the ARINC tune word.
5) Set Cal Parameter #4 (Carrier Squelch Mute Threshold) to 4000.
6) Set Cal Parameter #5 (Carrier Squelch Unmute Threshold) to 0.
7) Set Cal Parameter #6 (25kHz Noise Squelch Mute Threshold) to 0.
8) Set Cal Parameter #7 (25kHz Noise Squelch Unmute Threshold) to 0.
9) Set Cal Parameter #6 (25kHz Noise Squelch Mute Threshold) to 4000.
10) Set the generator RF level to –103.5 dBm.
11) Monitor the receiver audio output.
12) Increase the value of calibration parameter #7 (25 kHz noise squelch unmute) from $0000 until receiver audio is present (0.05 to 2.6 Vrms).
13) Reduce the RF generator output by 3 dB.
14) Decrease calibration parameter #6 (25 kHz noise squelch mute) from $03FF until the receiver audio is muted (0.0 to 0.0245 Vrms).
15) Store the values for calibration parameters #6 and #7 in flash memory.

#### 6.3.14.2 8.33 KHZ NOISE QUIETING SQUELCH [RX CAL]

1) Set Standard ARINC Configuration at current frequency.
2) Set Standard RF Generator Setting at current frequency.
3) Set Standard Discrete Configuration.
4) Enable squelch on the ARINC tune word.
5) Set Cal Parameter #4 (Carrier Squelch Mute Threshold) to 4000.
6) Set Cal Parameter #5 (Carrier Squelch Unmute Threshold) to 0.
7) Set Cal Parameter #8 (8.33kHz Noise Squelch Mute Threshold) to 0.
8) Set Cal Parameter #9 (8.33kHz Noise Squelch Unmute Threshold) to 0.
9) Set Cal Parameter #8 (8.33kHz Noise Squelch Mute Threshold) to 4000.
10) Set the generator RF level to -104 dBm.
11) Monitor the receiver audio output.
12) Increase value of calibration parameter #9 (8.33 kHz noise squelch unmute) from $0000 until receiver audio is present (0.05 to 2.6 Vrms).

13) Reduce the RF generator output by 4 dB.
14) Decrease calibration parameter #8 (8.33 kHz noise squelch mute threshold) from $03FF until the receiver audio is muted (0.0 to 0.049 Vrms).
15) Store the values for calibration parameters #8 and #9 in flash memory.

#### 6.3.14.3 CARRIER SQUELCH

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the generator to 60% modulation by 6 kHz at –94.5 dBm.
3) Disable noise squelch by setting TFM #8 & #9 to $FFFF (Do not change values in FLASH)
4) Monitor the receiver audio output.
5) Increase value of calibration parameter #5 (carrier squelch unmute) from $0000 until receiver audio is present (0.05 to 2.6 Vrms).
6) Reduce the RF generator output by 5 dB. Decrease calibration parameter #4 (carrier squelch mute) from $FFFF until the receiver audio is muted (0.0 to 0.0245 Vrms).
8) Store the values for calibration parameters #4 and #5 in FLASH memory.

### 6.3.15 Mode A Alignment (Units/w Mode A Option Only)

#### 6.3.15.1 MODE A RECEIVER

None

#### 6.3.15.2 MODE A TRANSMITTER

Reserved

### 6.3.16 Mode 2 Alignment (Units/w Mode 2 Option Only)

#### 6.3.16.1 MODE 2 BIAS ADJUSTMENT

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC data to "Standard 25 kHz ARINC Configuration" on channel 118.500.
3) Connect 50 ohm load to antenna cable
4) Set TFM parameters #18 and 19 (D8PSK I and Q channel offset) and #15 and 16 (D8PSK Channel Gains) to $00 to set transmitter power to 0 watts.
5) Set TFM parameters #12 and #14 (PA drive bias and final driver bias) to $0000.
6) Ground the PTT (VHF-4000 pin 41, VDL-2000 pin 35), and monitor the input current to the UUT.
7) Adjust TFM parameter #12 until the current increases by 500 mA ± 50 mA over the original value.
8) Adjust TFM parameter #14 until the current increases by an additional 1500 mA ± 50 mA over the value in step 5.
9) Unground the PTT.
10) Store the values used for TFM parameters #12 and #14 at 118.500 in 18 FLASH memory location up to 136.500 MHz for the VDL-2000 and 151.5 MHz for the VHF-4000.

#### 6.3.16.2 MODE 2 CARRIER NULL

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Tune the UUT to Channel 118.500.
3) Set TFM parameters # 15 and 16 (D8PSK I_Channel Gain and Q_Channel Gain) to $00.
4) Set TFM parameters # 18 and 19 to mid-scale: $800.
5) Ground the PTT line (Pin 41 VHF-4000, Pin 35 VDL-2000), and adjust TFMs # 18 and 19 (I_Offset and Q_Offset) alternately to null the carrier as detected on a selective measuring receiver or power meter. The null shall be less than -15 dBm at the sampled port.
6) Unground the PTT line.

7) Store the values used for TFM parameters #18 and #19 in FLASH memory.
Repeat for every 1 MHz step through 136.500 MHz using the previous band values as the initial values

#### 6.3.16.3 MODE 2 RF POWER

1) Tune the UUT to Channel 118.500.
2) Set UUT to SSB mode
3) Set TFM parameters # 15 and 16 (D8PSK I_Channel Gain and Q_Channel Gain) to $00.
4) Increase the I_Mod TFM (#15) until 10.0 ± 0.08 Watts is measured at the RF output and record value.
5) Set TFM parameters # 15 (D8PSK I_Channel Gain) to $00.
6) Increase the Q_Mod TFM (#16) until 10.0 ± 0.08 Watts is measured at the RF output and record value.
7) Repeat for every 1 MHz step through 136.500 MHz.
8) Store the values used for TFM parameters #15 and #16 in FLASH memory.

#### 6.3.16.4 D8PSK QUADRATURE MISMATCH

1) Tune the UUT to 118.5 MHz.
2) Set UUT to SSB mode
3) Ground the PTT line (Pin 41 VHF-4000, Pin 35 VDL-2000). Null the lower amplitude sideband of the RF output by adjusting the D8PSK Quadrature Mismatch TFM (#28) while monitoring the output on a spectrum analyzer. The lower amplitude sideband must be at least –40 dBc relative to the higher amplitude sideband. The Q mod TFM (#16) determined in earlier adjustments may be adjusted as required to aid in achieving the required null value of –45 dBc for the lower sideband.
4) Repeat for every 1 MHz step through 136.500 MHz using the previous band values as the initial values for TFM #28.
5) Store the values used for TFM parameter #28 and #16 (if changed from initial value) in FLASH memory.

### 6.3.17 Mode 2 AGC Calibration

8) Set Standard ARINC Configuration at 118.5 MHz.
9) Set Standard RF Generator setting at current frequency with CW signal at –90.5 dBm.
10) Set Standard Discrete Configuration.
11) Read receiver AGC value
12) Store this value in Flash memory for TFM parameter 33 (Mode 2 – 90.5 dBm level)
13) Readjust generator RF level for –91.5 dBm
14) Read receiver AGC value
15) Store this value in Flash memory for TFM parameter 34 (Mode 2- 91.5 dBm level)
16) Repeat for every 1 MHz step through 136.500 MHz

### 6.3.18 Flash Update

1) If not previously performed, write all TFMs that have been adjusted during previous alignment steps to Flash Memory.

## 7. Final Test Requirements

Final Test may be performed manually or with the automatic alignment system (CATS-21) executing DGS-005 or any combination thereof.

Unless otherwise specified, disable the squelch, connect a VHF signal generator to the antenna input, and connect an audio distortion analyzer to the audio output (VHF-4000 combined audio pins 25 and 26, VDL-2000 RX_AUDIO_OUT pins 33 and 19).

*NOTE: If necessary due to interference experienced during testing (and as a result of the testing environment), a frequency on an adjacent channel not more than 100 kHz away from the specified frequency may be used for testing receive mode parameters.*

## 7.1 POWER SUPPLIES

### 7.1.1 Current Drain at 27.5 Vdc

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration" on channel 128.500.
3) Set the input voltage to 27.5 Vdc.
4) Measure the DC input current.

**Production Limit:** 0.43 +/- 0.4 amp
**Abort Test Limit:** > 0.55 amp

### 7.1.2 Current Drain at 18.0 Vdc

1) Decrease the input voltage to 18.0 ± 0.5 Vdc and measure the input current.

**Production Limit:** 0.8 +/- 0.3 amp

### 7.1.3 Internal Power Supplies

1) Reset the input voltage to 27.5 +/- 0.6 Vdc.
2) Measure the outputs of the following internal supplies using the 353 label:
   a) +3.3 Volt Supply **Production Limit:** +3.3 Vdc to 3.55 Vdc
   b) +8.0 Volt Supply **Production Limit:** +7.3 Vdc to 8.90 Vdc
   c) +15.0 Volt Supply **Production Limit:** +14.5 Vdc to 17.5 Vdc

## 7.2 VOICE/ANALOG DATA MODE TESTS

### 7.2.1 Voice/Analog Data Receiver Tests

#### 7.2.1.1 SIMULCOMM

##### 1.2.1.1.1. -20 DBM THRESHOLD

1) Set Standard ARINC Configuration at 112.00 MHz.
2) Set Standard Discrete Configuration.
3) Set rear connector simulcomm discretes to 00 (VHF4000 Pins 42 and 46 open, VDL Pins 16 and 34 open).
4) Set the generator RF level to -50 dBm and 90% modulation, 1 kHz Tone.
5) Monitor the AGC_Level output of the RF Card or the Label 353 AGC Level
6) Increase the RF level in 1 dB steps
7) Verify the RF level required to cause a 2% change in AGC Level.
8) Repeat steps 4 through 6 for channel 132.000 MHz

**Production Limit:** -20 dBm +/- 10 dBm

##### 1.2.1.1.1. -10 DBM THRESHOLD

1) Set Standard ARINC Configuration at 112.00 MHz.

2) Set Standard Discrete Configuration.
3) Set rear connector simulcomm discretes to 01(VHF4000 Pins 42 open and 46 ground, VDL Pins 16 open and 34 ground).
4) Set the generator RF level to -50 dBm and 90% modulation, 1 kHz Tone.
5) Monitor the AGC_Level output of the RF Card or the Label 353 AGC Level
6) Increase the RF level in 1 dB steps
7) Verify the RF level required to cause a 2% change in AGC Level.
8) Repeat steps 4 through 6 for channel 132.000 MHz

**Production Limit:** -10 dBm +/- 10 dBm

#### 1.2.1.1.1. 0 DBM THRESHOLD

1) Set Standard ARINC Configuration at 112.00 MHz.
2) Set Standard Discrete Configuration.
3) Set rear connector simulcomm discretes to 10 (VHF4000 Pins 42 ground and 46 open, VDL Pins 16 open and 34 ground).
4) Set the generator RF level to -50 dBm and 90% modulation, 1 kHz Tone.
5) Monitor the AGC_Level output of the RF Card or the Label 353 AGC Level
6) Increase the RF level in 1 dB steps
7) Verify the RF level required to cause a 2% change in AGC Level.
8) Repeat steps 4 through 6 for channel 132.000 MHz

**Production Limit:** 0 dBm +/- 10 dBm

### 7.2.1.2 SENSITIVITY

#### 1.2.2.1.1. SENSITIVITY 25 KHZ MODE CHANNEL 118.000 (BAND 1 LOW SIDE)

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the RF Generator to “standard RF generator configuration” at 118.000 MHz.
3) Disable squelch
4) Set the ARINC control data to “Standard 25 kHz ARINC Configuration” on channel 118.000 MHz.
5) Set the RF generator output level to –103.5 dBm.
6) Verify the S+N/N ratio at the combined audio output

**Production Limit:** 14.25 +/- 5.75 dB

#### 1.2.2.1.1. SENSITIVITY 25 KHZ MODE CHANNEL 118.975 (BAND 1 HIGH SIDE)

1) Set the ARINC control data to channel 118.975.
2) Set the RF Generator to “standard RF generator configuration” at 118.975.
3) Verify the S+N/N ratio at the combined audio output.

**Production Limit:** 14.25 +/- 5.75 dB

#### 1.2.2.1.1. SENSITIVITY 25 KHZ MODE CHANNEL 119.500 THROUGH 135.500 (BANDS 2 – 17 CENTERS)

1) Set the RF Generator frequency to 119.550, 120.550, 121.550, …, 135.550 MHz.
2) Set the ARINC control data to channel to 119.550, 120.550, 121.550, …, 135.550 MHz.
3) Verify the S+N/N ratio at the combined audio output.

**Production Limit:** 14.25 +/- 5.75 dB

#### 1.2.2.1.1. SENSITIVITY 25 KHZ MODE CHANNEL 136.000 (BAND 18 LOW SIDE)

1) Set the RF Generator frequency to 136.000 MHz.
2) Set the ARINC control data to channel 136.000.
3) Verify the S+N/N ratio at the combined audio output.

**Production Limit:** 14.25 +/- 5.75 dB

#### 1.2.2.1.1. SENSITIVITY 25 KHZ MODE CHANNEL 136.975 (BAND 18 HIGH SIDE)

1) Set the RF Generator frequency to 136.975 MHz.
2) Set the ARINC control data to channel 136.975.
3) Verify the S+N/N ratio at the combined audio output.

**Production Limit:** 14.25 +/- 5.75 dB

#### 1.2.2.1.1. SENSITIVITY 25 KHZ MODE CHANNEL 144.450 (VHF-4000 WITH EXTENDED RANGE OPTION ONLY)

1) Set the RF Generator frequency to 144.450 MHz.
2) Set the ARINC control data to channel 144.450.
3) Verify the S+N/N ratio at the combined audio output.

**Production Limit:** 14.25 +/- 5.75 dB

#### 1.2.2.1.1. SENSITIVITY 25 KHZ MODE CHANNEL 151.000 (VHF-4000 ONLY, BAND 33 LOW SIDE)

1) Set the RF Generator frequency to 151.000 MHz.
2) Set the ARINC control data to channel 151.000.
3) Verify the S+N/N ratio at the combined audio output.

**Production Limit:** 14.25 +/- 5.75 dB

#### 1.2.2.1.1. SENSITIVITY 25 KHZ MODE CHANNEL 151.975 (VHF-4000 ONLY, BAND 33 HIGH SIDE)

1) Set the RF Generator frequency to 151.975 MHz.
2) Set the ARINC control data to channel 151.975.
3) Verify the S+N/N ratio at the combined audio output.

**Production Limit:** 14.25 +/- 5.75 dB

#### 1.2.2.1.1. SENSITIVITY 8.3 KHZ MODE CHANNEL 126.005

1) Set the RF Generator frequency to 126.000 MHz.
2) Set the ARINC control data to "Standard 8.33 kHz ARINC Configuration" on channel 126.005.
3) Verify the S+N/N ratio at the combined audio output.

**Production Limit:** 14.25 +/- 5.75 dB

### 7.2.1.3 SENSITIVITY DURING LOW LINE VOLTAGE [ENTRY]

#### 1.2.3.1.1. SENSITIVITY DURING LOW LINE VOLTAGE CHANNEL 118.000

1) Set the UUT power input for +18 ± 0.2 Vdc.
2) Set the UUT discrete inputs to "standard discrete configuration".
3) Set the RF Generator to "standard RF generator configuration" at 118.000 MHz.
4) Set the ARINC control data to "Standard 25 kHz ARINC Configuration" on channel 118.000 MHz.
5) Set the RF generator output level to –103.5 dBm.
6) Verify the S+N/N ratio at the combined audio output.

**Production Limit:** >= 8.5 dB

#### 1.2.3.1.1. SENSITIVITY DURING LOW LINE VOLTAGE CHANNEL 136.975

1) Set the RF Generator frequency to 136.975 MHz.
2) Set the ARINC control data to channel 136.975.
3) Verify the S+N/N ratio at the combined audio output.
4) Reset the UUT power input to +27.5 ± 0.1 Vdc.

**Production Limit:** >= 8.5 dB

### 7.2.1.4 RECEIVER QUIETING

1) Set the RF generator to "standard RF generator configuration" at 126.000 MHz.
2) Set the ARINC control data to channel 126.000.
3) Set the RF generator output level to -53 dBm.
4) Establish a 0 dB reference for the combined audio output level.
5) Remove the modulation from the RF generator.
6) Verify the change in the level of the combined audio output signal.

**Production Limit:** >= 45 dB

### 7.2.1.5 IMAGE REJECTION

1) Channel the receiver to 135.975 MHz.
2) Set the RF Generator to "standard RF generator configuration" at 135.975 MHz.
3) Record the RSSI level for an input of –103.5 dBm.
4) Set the RF Generator to 193.725 MHz.
5) Increase the level out of the RF Generator until the RSSI level is the same as obtained in step 3.

**Production Limit:** >= 60 dB

### 7.2.1.6 SQUELCH OPERATION

### 1.2.6.1.1. 25 KHZ NOISE SQUELCH OPERATION

7.2.1.6.0.1 25 kHz Noise Squelch Closure

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the RF Generator to "standard RF generator configuration" at 126.600 MHz.
3) Set the ARINC control data to "Standard 25 kHz ARINC Configuration" on channel 126.600.
4) Set the RF Generator output level to –115 dBm.
5) Verify the combined audio output.

**Production Limit:** <= 0.1 Vrms

7.2.1.6.0.2 25 kHz Noise Squelch Opening RF Level

1) Increase the RF generator output level until the audio out is > 3.0 Vrms.
2) Verify the noise squelch opening RF level
3) Record the RF level as $Ref_{sq}$.

**Production Limit:** -103.5 +/- 2 dB

7.2.1.6.0.3 25 kHz Noise Squelch RF Level Change for Closure

1) Decrease the RF generator output level until the audio out is < 1.0 Vrms.
2) Verify the change in RF level from $Ref_{sq}$ to obtain noise squelch closure.

**Production Limit:** -4 +/- 2 dB

7.2.1.6.0.4 8.33 kHz Noise Squelch Closed at –115 dBm

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the RF Generator to "standard RF generator configuration" at 126.600 MHz.
3) Set the ARINC control data to "Standard 8.33 kHz ARINC Configuration" on channel 126.605.
4) Set the RF Generator output level to –115 dBm.
5) Verify the combined audio output.

**Production Limit:** <= 0.1 Vrms

7.2.1.6.0.5 8.33 kHz Noise Squelch Opening RF Level

1) Increase the RF generator output level until the audio out is > 3.0 Vrms.
2) Verify the noise squelch opening RF level
3) Record the RF level as Ref.

**Production Limit:** -103.5 +/- 2 dB

7.2.1.6.0.6 8.33 kHz Noise Squelch RF Level Change for Closure

1) Decrease the RF generator output level until the audio out is < 1.0 Vrms.
2) Verify the change in RF level from Ref. to obtain noise squelch closure.

**Production Limit:** -4 +/- 2 dB

### 1.2.6.1.1. CARRIER SQUELCH OPERATION

7.2.1.6.1.1 Carrier Squelch Open

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the RF Generator to “standard RF generator configuration” at 126.600 MHz.
3) Set the ARINC control data to “Standard 25 kHz ARINC Configuration” on channel 126.600.
4) Set the RF generator for simultaneous modulation with a 6 kHz sine wave at 60% AM and a 1 kHz sine wave at 30% AM at an RF level of -105 dBm.
5) Slowly increase the RF level (approx. 1 dB per 2 sec) until the audio out is > 5.0 Vrms.
6) Verify the carrier squelch opening RF level.
7) Record the RF level as $Ref_{sq2}$.

**Production Limit:** -94.5 +/- 4.5 dBm

7.2.1.6.1.2 Carrier Squelch Closure

1) Slowly decrease the RF level (approx. -1 dB per 2 sec) until the audio out is < 5.0 Vrms.
2) Verify the change in RF level from $Ref_{sq2}$ to obtain carrier squelch closure.

**Production Limit:** -5.0 +/- 2.5 dB

### 7.2.1.7 AGC CHARACTERISTICS

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the RF Generator to “standard RF generator configuration” at 126.600 MHz and -50 dBm.
3) Set the ARINC control data to “Standard 25 kHz ARINC Configuration” on channel 126.600.
4) Establish a 0 dB reference $Ref_{AGC}$.

### 1.2.7.1.1. AGC TRACKING @ 0 DBM

1) Set the RF generator output level to 0 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 3 dB

### 1.2.7.1.1. AGC TRACKING @ -10 DBM

1) Set the RF generator output level to -10 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 3 dB

### 1.2.7.1.1. AGC TRACKING @ -20 DBM

1) Set the RF generator output level to -20 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 3 dB

### 1.2.7.1.1. AGC TRACKING @ -30 DBM

1) Set the RF generator output level to -30 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 3 dB

### 1.2.7.1.1. AGC TRACKING @ -40 DBM

1) Set the RF generator output level to -40 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 3 dB

#### 1.2.7.1.1. AGC TRACKING @ -60 DBM

1) Set the RF generator output level to -60 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 3 dB

#### 1.2.7.1.1. AGC TRACKING @ -70 DBM

1) Set the RF generator output level to -70 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 3 dB

#### 1.2.7.1.1. AGC TRACKING @ -80 DBM

1) Set the RF generator output level to -80 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 3 dB

#### 1.2.7.1.1. AGC TRACKING @ -90 DBM

1) Set the RF generator output level to -90 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 3 dB

#### 1.2.7.1.1. AGC TRACKING @ -104 DBM

1) Set the RF generator output level to -104 dBm.
2) Verify the change in audio output level from $Ref_{AGC}$ in dB.

**Production Limit:** <= 4 dB

### 7.2.1.8 VOICE AUDIO OUTPUT

#### 1.2.8.1.1. COMBINED AUDIO OUTPUT LEVEL

1) For the VHF-4000 only.
2) Set the UUT discrete inputs to “standard discrete configuration”.
3) Set the RF Generator to -54 dBm output level at 126.600 MHz, modulated 80% by a 1 kHz sine wave.
4) Set the ARINC control data to “Standard 25 kHz ARINC Configuration” on channel 126.600.
5) Verify the analog audio output level at the combined audio output (VHF4000 pins 25 and 26).

**Production Limit:** 7.75 +/- 0.2 Vrms

#### 1.2.8.1.1. RECEIVED AUDIO OUTPUT LEVEL

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the RF Generator to -54 dBm output level at 126.600 MHz, modulated 80% by a 1 kHz sine wave.
3) Set the ARINC control data to “Standard 25 kHz ARINC Configuration” on channel 126.600.
4) Verify the analog audio output level at the received audio output (VHF-4000 pins 19 and 26, VDL-2000 pins 33 and 19).

**Production Limit:** 7.75 +/- 0.2 Vrms

#### 1.2.8.1.1. AUDIO OUTPUT PHASING

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) 2) Apply a -54 dBm signal at 126.600 MHz, modulated 30% at 1 kHz.
3) Set the ARINC control data to “Standard 25 kHz ARINC Configuration” on channel 126.600.
4) Verify that the phase of the received combined audio output signal with respect to the envelope of the RF input signal is within ± 20 degrees.

**Production Limit:** Audio output to envelope phase shift: < ± 20 degrees at 1000 Hz.

**CMM Limit:** N/A

#### 1.2.8.1.1. AUDIO FREQUENCY RESPONSE

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the RF Generator to “standard RF generator configuration” at 126.600 MHz.
3) Set the ARINC control data to “Standard 25 kHz ARINC Configuration”.
4) Apply a –54 dBm signal at 126.600 MHz, modulated 30% at 1 kHz.
5) Adjust the distortion analyzer connected to the combined audio output (pins 25 and 26) to establish a 0 dB reference.
6) Change the modulating frequency to 300 Hz and verify the change in level in dB of the audio output

**Production Limit:** <= 6 dB variation 300 to 2500 Hz

**CMM Limit:** <= 6 dB variation 300 to 2500 Hz

7) Change the modulating frequency to 4000 Hz and verify the change in level in dB of the audio output

**Production Limit:** >= 42 dB attenuation at 4 kHz.

**CMM Limit:** >= 18 dB attenuation at 4 kHz

#### 1.2.8.1.1. AUDIO OUTPUT DISTORTION

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Apply a –54 dBm signal at 126.600 MHz, modulated 80% at 1 kHz.
3) Set the ARINC control data to "Standard 25 kHz ARINC Configuration" on channel 126.600.
4) Adjust the distortion analyzer connected to the combined audio output (VHF-4000 pins 25 and 26, VDL-2000 pins 33 and 19 ) and measure audio distortion.

| | | |
|---|---|---|
| **Production Limit:** | Audio distortion: | <= 5% |
| **CMM Limit:** | Audio distortion: | <= 7% |

#### 1.2.8.1.1. RX AUDIO COMPRESSOR

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Apply a –54 dBm signal at 126.600 MHz, modulated 50% at 1 kHz.
3) Set the ARINC control data to "Standard 25 kHz ARINC Configuration" on channel 126.600.
4) Verify the audio output level.
5) Increase the modulation depth to 90% and note that the change in combined audio output level.

| | | |
|---|---|---|
| **Production Limit:** | Audio variation: | <= 1 dB. |
| **CMM Limit:** | Audio variation: | >= 3 dB. |

### 7.2.1.9 SELCAL AUDIO OUTPUT (VHF-4000 ONLY)

#### 1.2.9.1.1. OUTPUT LEVEL

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the RF Generator to "standard RF generator configuration" at 126.600 MHz.
3) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
4) Apply -54 dBm signal at 126.600 MHz, modulated 60% at 1 kHz to the antenna port.
5) Verify the SELCAL audio output level at the combined audio output (pins 38 and 37)

| | |
|---|---|
| **Production Limit:** | SELCAL audio output: 1.0 +/- .2 Vrms |
| **CMM Limit:** | SELCAL output level: 1.0 - .3 Vrms |

#### 1.2.9.1.1. SELCAL AUDIO FREQUENCY RESPONSE (VHF4000 ONLY)

1) Apply a –54 dBm signal at 126.600 MHz, modulated 60% at 1 kHz.
2) Adjust the audio distortion analyzer connected to the combined SELCAL output to establish a 0 dB reference.
3) Set the modulating frequency to 300 Hz and verify the change in level of the audio output from the reference value

**Production Limit:** <= 6 dB variation 300 to 1000 Hz

**CMM Limit:** <= 6 dB variation 300 to 1000 Hz

4) Set the modulating frequency to 6600 Hz and verify the change in level of the audio output from the reference value

**Production Limit:** <= 6 dB variation 1000 to 6600 HZ

**CMM Limit:** <= 6 dB variation 1000 to 6600 Hz

#### 1.2.9.1.1. SELCAL AUDIO OUTPUT DISTORTION (VHF4000 ONLY)

1) Set UUT to ARINC 716 voice mode.
2) Apply a –54 dBm signal at 126.600 MHz, modulated 80% at 1 kHz.
3) Adjust the distortion analyzer connected to the SELCAL audio output and measure audio distortion.

| | | |
|---|---|---|
| **Production Limit:** | Audio distortion: | <= 5% |
| **CMM Limit:** | Audio distortion: | <= 7% |
| | Receiver Compressor OK | |

### 7.2.2 Voice/Analog Data Mode Transmitter Tests

Unless otherwise specified, the tests are to be performed at 126.500 MHz. Always keep the antenna port connected to a 50 ohm load.

#### 7.2.2.1 UNMODULATED RF POWER OUTPUT/CURRENT

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Tune the UUT to Channel 118.500.
4) Ground the PTT line (Pin 41 VHF-4000, Pin 35 VDL-2000 ), measure and verify the output power and input current
5) Unground the PTT line.
6) For the VHF-4000 repeat for every 1 MHz step through 136.500 MHz.
7) For the VDL-2000 repeat for every 1 MHz step through 136.500 MHz.

**Production Limit:** 18-21 watts

**Production Limit:** <= 5.5 amps

**CMM Limit:** >= 16 watts

**CMM Limit:** <= 5.5 amps

#### 7.2.2.2 POWER OUTPUT DURING LOW LINE VOLTAGE

1) Set the UUT power input for +18 +/- 0.2 Vdc.
2) AC couple an audio oscillator to the mic audio input hi and low (Pins 54 and 66 for VHF-4000, Pins 4 and 30 for VDL-2000).
3) Set audio oscillator frequency to 1kHz with amplitude of +1 Vrms.
4) Verify the total RF output power including modulation sidebands at 126.500 MHz.
5) Set input line voltage to 27.5 Vdc.

**Production Limit:** >= 8 watts.

**CMM Limit:** >= 6 watts.

#### 7.2.2.3 TX COMPRESSOR

#### 1.2.3.2.1. ANALOG INPUT COMPRESSOR THRESHOLD

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Tune UUT to 126.500 MHz.
4) Connect the RF output to an AM modulation analyzer through a 40 dB pad.
5) AC coupled the output of the audio analyzer to the mic audio input hi and low (Pins 54 and 66 for VHF-4000, Pins 4 and 30 for VDL-2000).
6) Set the audio analyzer frequency to 1 kHz with amplitude of zero volts.
7) Ground the PTT line and increase the mic audio (1 kHz) from 0 volts until the negative modulation stops increasing.
8) Unground the PTT line.
9) Verify the audio input voltage (Note: The actual input voltage is a factor of 4 less than the output voltage displayed by the audio analyzer due to the impedance mismatch).

**Production Limit:** 0.1 to 0.15 Vrms

**CMM Limit:** 0.08 to 0.175 Vrms

#### 1.2.3.2.1. ANALOG INPUT COMPRESSOR RANGE

1) Tune UUT to 126.500 MHz.
2) Ground the PTT and increase the mic audio voltage to 1.25 Vrms.

3) Verify the percentage of negative modulation. Unkey the PTT line.

**Production Limit:** >= 83% but LT 100%.

**CMM Limit:** >= 70% but LT 100%.

### 7.2.2.4 25 KHZ TRANSMITTER MODULATION DISTORTION (25 KHZ MODE)

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Tune UUT to 126.500 MHz.
4) Apply an audio input of 0.5 Vrms at 1 kHz at mic input.
5) Ground the PTT line and measure the demodulated RF distortion
6) Unground the PTT line.
7) Repeat steps 2-4 using 350 and 2500, and 6600 Hz.

**Production Limit:** <= 7% distortion.

**CMM Limit:** <= 10% distortion.

### 7.2.2.5 25 KHZ VOICE AUDIO FREQUENCY RESPONSE (25 KHZ MODE)

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Tune unit to 126.500 MHz
4) Apply a 0.5 Vrms audio signal to the mic audio input.
5) While the PTT line is grounded, measure the variation in dB of the audio out of the modulation meter as the audio input frequency is set to 300, 1000, and 6600 Hz.
6) Unground the PTT line.

**Production Limit:** <= 4 dB variation.

**CMM Limit:** <= 6 dB variation.

### 7.2.2.6 8.33 KHZ TRANSMITTER MODULATION DISTORTION (8.33 KHZ MODE)

1) Tune UUT to channel 126.430 MHz.
2) Apply an audio input of 0.5 Vrms at 1 kHz to the mic input.
3) Ground the PTT line and measure the demodulated RF distortion
4) Unground the PTT line.
5) Repeat steps 2-4 using 350 and 2500 Hz

**Production Limit:** <= 5% distortion.

**CMM Limit:** <= 7% distortion.

### 7.2.2.7 8.33 KHZ VOICE AUDIO FREQUENCY RESPONSE (8.33 KHZ MODE)

1) Tune unit to channel 126.430 MHz
2) Apply a 0.5 Vrms audio signal to the mic audio input.
3) Connect a distortion analyzer to the modulation output of the modulation meter.
4) While the PTT line is grounded, measure the variation in dB of the audio out of the modulation meter with the audio input frequency set to 300, 1000, 2500, and 3200 Hz.
5) Unground the PTT line.

**Production Limit:** <= 6 dB variation 300 to 2500 Hz, –30 dB or less at 3200 Hz

**CMM Limit:** <= 6 dB variation 300 to 2500 Hz, –30 dB or less at 3200 Hz

### 7.2.2.8 MICROPHONE BIAS

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the ARINC control data to “Standard 25 kHz ARINC Configuration”.
3) With no audio applied, ground the PTT line and measure open circuit voltage at mic audio input hi (Pin 54 VHF-4000, Pin 4 VDL-2000).
4) Unground the PTT line.

**Production Limit:** 16.0 ± 1.5 Vdc.

**CMM Limit:** 16.0 ± 1.5 Vdc.

### 7.2.2.9 SIDETONE

#### 1.2.9.2.1. SIDETONE FREQUENCY RESPONSE

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the ARINC control data to “Standard 25 kHz ARINC Configuration”.
3) Tune UUT to 126.500 MHz.
4) Connect the combined audio out (pins 25 and 26 VHF-4000, pins 31 and 19 VDL-2000) to the distortion analyzer.
5) Apply 0.125 Vrms at 1 kHz signal to the mic audio input
6) Ground the PTT line.
7) Obtain a 0 dB reference on the audio analyzer.
8) Set the modulating frequency to 300, 1000, and 2500 Hz, verify the change in the audio out level measured on the audio analyzer.
9) Unground the PTT line.

**Production Limit:** <= 6 dB.

**CMM Limit:** <= 6 dB.

#### 1.2.9.2.1. SIDETONE DISTORTION

1) Tune UUT to 126.500 MHz.
2) Connect the Sidetone audio out (pins 20 and 26 VHF-4000, pins 31 and 19 VDL-2000) to the distortion analyzer.
3) Apply 0.25 Vrms at 1 kHz to the mic audio input
4) Ground the PTT line.
5) Measure and verify the audio output distortion
6) Repeat using 300, 1000, and 2500 Hz at mic audio input.
7) Unground PTT

**Production Limit:** <= 7%.

**CMM Limit:** <= 10%.

### 1.2.9.2.1. SIDETONE LEVEL AND SIDETONE SWITCHING

1) Tune UUT to 126.500 MHz.
2) Connect the Sidetone audio output (pins 20 and 26 VHF-4000, pins 31 and 19 VDL-2000) to the audio analyzer.
3) Apply 0.25 Vrms at 1 kHz to the mic audio input
4) Ground the PTT line.
5) Measure the audio level at Sidetone audio output.
6) Unground the PTT.
7) Apply a –54 dBm RF signal at 1 kHz, 30 % at 126.500 MHz to RF input
8) Measure the audio level at sidetone output.

**Production Limit:** 3.87 +/- 0.2 Vrms

**CMM Limit:** 3.87 +/- 0.3 Vrms

**Production Limit:** <= 0.1 Vrms

**CMM Limit:** <= 0.1 Vrms

### 7.2.2.10 TRANSMIT CARRIER NOISE LEVEL

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the ARINC control data to “Standard 25 kHz ARINC Configuration”.
3) Apply a 1 kHz audio signal to the mic audio input.
4) Connect the modulation analyzer to the antenna port.
5) Ground the PTT line.
6) Establish a 0 dB reference on the distortion analyzer.
7) Remove the modulation and verify the change in level of the modulation meter’s modulation output. (Use 300 Hz - 3 kHz filtering on the modulation meter and disable any auto ranging function
8) Unground PTT line.

**Production Limit:** >= 43 dB.

**CMM Limit:** > 35 dB.

### 7.2.2.11 8.33 KHZ SPECTRUM TEST (PERFORM ON A SAMPLE BASIS ONLY!)

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the ARINC control data to “Standard 8.33 kHz ARINC Configuration”.
3) Set UUT to Channel 126.430.
4) Apply an 800 Hz, 0.125 Vrms audio signal to the mic audio input.
5) Ground the PTT line and adjust level of audio signal so as to achieve 80 +/- 2% modulation on combined positive and negative peaks.
6) With a spectrum analyzer connected so as to measure the RF output, measure level of modulation sidebands at +/- 3200 Hz relative to the carrier level.
7) Unground the PTT line.

**Production Limit:** >= 50 dB.

**CMM Limit:** N/A.

### 7.2.2.12 3:1 VSWR TEST (PERFORM ON A SAMPLE BASIS ONLY!)

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Tune the UUT to channel 118.500.
4) Apply 1.0 Vrms at 1 kHz to the mic audio input.
5) Connect UUT to 3:1 VSWR simulator
8) Ground the PTT line while monitoring RF envelope with oscilloscope connected to test port on 3:1 VSWR simulator
9) Rotate VSWR simulator through all phase angles and verify that no oscillators are present
10) Unground the PTT line.
11) For the VHF-4000 repeat for every 1 MHz step through 136.5 MHz.
12) For the VDL-2000 repeat for every 1 MHz step through 136.950 MHz.

**Production Limit:** No oscillations evident

**CMM Limit:** N/A

### 7.2.2.13 BROADBAND NOISE TEST (PERFORM ON A SAMPLE BASIS ONLY!)

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Tune the UUT to channel 119.000.
4) Apply 1.0 Vrms at 1 kHz to the mic audio input.
5) Connect UUT to 30 dB In-line pad and then to a bandpass filter tuned to 114.000 MHz. (The bandpass filter must have at least 50 dB attenuation at 114.1 MHz)
6) Connect spectrum analyzer to output of bandpass filter.
7) Ground the PTT line while monitoring channel power with spectrum analyzer.
8) Measure the total power in a 30 kHz bandwidth (IF BW and Video BW on analyzer must be adjusted so noise floor is no more than –80 dBm)

**Production Limit:** <= –65 dBm (-150 dBc/Hz).

**CMM Limit:** N/A

### 7.2.2.14 FREQUENCY ACCURACY

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Tune the UUT to 135.000 MHz.
4) With no modulation applied, ground the PTT line and verify the frequency error between tuned and measured frequencies.
5) Unground the PTT.

**Production Limit:** +/- 3 PPM (+/-405 Hz)

**CMM Limit:** +/- 5 PPM (+/-675 Hz)

### 7.2.2.15 TRANSMITTER FM

### 1.2.15.2.1. TRANSMITTER INCIDENTAL FM

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".

3) Tune UUT 10 118.000 MHz.
4) Set the modulation meter to measure FM deviation and enable the 15 kHz low pass and 300 Hz high pass filters.
5) Connect the audio oscillator to the UUT's mic audio input and set to 1 kHz at 0.3 Vrms.
6) Ground the PTT line and measure the transmitted incidental FM.
7) Unground the PTT line.
8) Repeat at 127.000 and 136.975 MHz.

**Production Limit:** <=1000 Hz

**CMM Limit:** <=1000 Hz

### 1.2.15.2.1. TRANSMITTER FM DURING LOW LINE VOLTAGE

1) Tune UUT to 118.000 MHz.
2) Set the input line voltage to +18 ± 0.2 Vdc
3) Set the modulation meter to measure FM deviation and enable the 15 kHz low pass and 30 Hz high pass filters.
4) Connect the audio oscillator to the UUT's mic audio input and set to 1 kHz at 0.3 Vrms.
5) Ground the PTT line and measure the transmitted incidental FM $((PEAK^{-} + .PEAK^{+})/2)$
6) Unground the PTT line.
7) Repeat at 127.000 and 136.975 MHz.
8) Return the input line voltage to 27.5 ± 0.5 Vdc.

**Production Limit:** <=1000 Hz

**CMM Limit:** <=1000 Hz

### 7.2.2.16 KEYLINE TIMER

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Key the PTT line and measure time for transmission to automatically terminate.
4) Unkey the transmitter.
5) Cycle the power to the UUT to clear out the transmitter time-out fault.

**Production Limit:** 30 ± 3 seconds

**CMM Limit:** 30 ± 5 seconds

### 7.2.2.17 RF RELAY TESTS (VDL-2000 ONLY)

1) Connect signal generator to J3 of UUT, set for +10dBm at 136.975 MHz CW.
2) Connect power meter to J2 of UUT.
3) Place UUT in "IDLE MODE".
4) Verify losses through UUT from J2 to J3 less than 0.2 dB.
5) Place UUT in "VDL MODE".
6) Verify losses through UUT from J2 to J3 greater than 80 dB.

### 7.2.3 Data Bus Operation

#### 7.2.3.1 CMU_IN_A, PORT_A/B_SELECT, 429_LS_OUT_1 (VHF-4000 ONLY), AND 429_HS_OUT_1 (VHF-4000 ONLY)

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Ground Port_RIU_Install_Select (Pin 43)
4) Ground Port_A/B_Select (Pin 55)
5) Cease applying Label 030 ARINC 429 word on all input ports
6) Simultaneously, using Label 030 ARINC 429 word, tune radio to 120.000 MHz via CMU_IN_A bus (pins 1 and 2 VHF-4000, pins 36 and 37 VDL-2000) and 130.00 MHz via CMU_IN_B bus (pins 7 and 8 VHF-4000, pins 2 and 28 VDL-2000).
7) Verify Label 030 ARINC 429 word on 429_LS_Out_1, and 429_HS_Out_1, busses indicate channel 120.000 MHz

#### 7.2.3.2 CMU_IN_B, PORT_A/B_SELECT, 429_LS_OUT_2 (VHF-4000 ONLY), AND 429_HS_OUT_2 (VHF-4000 ONLY)

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
3) Ground Port_RIU_Install_Select (Pin 43)
4) Open Port_A/B_Select (Pin 55)
5) Cease applying Label 030 ARINC 429 word on all input ports
6) Simultaneously, using Label 030 ARINC 429 word, tune radio to 120.000 MHz via CMU_IN_A bus (pins 1 and 2 VHF-4000, pins 36 and 37 VDL-2000) and 130.00 MHz via CMU_IN_B bus (pins 7 and 8 VHF-4000, pins 2 and 28 VDL-2000).
7) Verify Label 030 ARINC 429 word on 429_LS_Out_2, and 429_HS_Out_2, busses indicate channel 130.000 MHz
8) Unground Port_RIU_Install_Select (Pin 43)

#### 7.2.3.3 TUNE_IN_A (VHF-4000 ONLY)

1) Ground Port_A/B_Select (Pin 55)
2) Cease applying Label 030 ARINC 429 word on all input ports
3) Apply Label 030 ARINC 429 frequency word to TUNE_IN_A (Pins 3 and 4) with frequency of 125.000 MHz
4) Verify Label 030 ARINC 429 word on 429_LS_OUT_1 bus (Pins 5 and 6) indicates 125.000 MHz

#### 7.2.3.4 TUNE_IN_B (VHF-4000 ONLY)

1) Unground Port_A/B_Select (Pin 55)
2) Cease applying Label 030 ARINC 429 word on all input ports
3) Apply Label 030 ARINC 429 frequency word to TUNE_IN_B (Pins 21 and 22) with frequency of 135.000 MHz
4) Verify Label 030 ARINC 429 word on 429_LS_OUT_1 bus (Pins 5 and 6) indicates 135.000 MHz

#### 1.1.1 429_Input_Port_C, Port_C_Sel, Unit_SDI_A_Sel, and Unit_SDI_B_Sel(VHF-4000 only)

1) Ground Burst_Tune_Sel (Pin 49).
2) Ground Port_C_Sel (51)
3) Cease applying Label 030 ARINC 429 word on all input ports
4) Apply Label 030 ARINC 429 frequency word to TUNE_IN_C (Pins 15 and 16) with frequency of 121.000 MHz and SDI of 00.
5) Verify Label 030 ARINC 429 word on 429_LS_OUT_1 bus (Pins 5 and 6) indicates 121.000 MHz and SDI of 00.

6) Ground Unit_SDI_A_Sel (Pin 56).
7) Apply Label 030 ARINC 429 frequency word to TUNE_IN_C (Pins 15 and 16) with frequency of 122.000 MHz and SDI of 01.
8) Verify Label 030 ARINC 429 word on 429_LS_OUT_1 bus (Pins 5 and 6) indicates 122.000 MHz and SDI of 01.
9) Unground Unit_SDI_A_Sel (Pin 56).
10) Ground Unit_SDI_B_Sel (Pin 62).
11) Apply Label 030 ARINC 429 frequency word to TUNE_IN_C (Pins 15 and 16) with frequency of 124.000 MHz and SDI of 10.
12) Verify Label 030 ARINC 429 word on 429_LS_OUT_1 bus (Pins 5 and 6) indicates 124.000 MHz and SDI of 10.

### 1.1.2 429_MAINT_HS_IN

Verified by tests during alignment phase.

### 1.1.3 429_MAINT_HS_OUT

Verified by tests during alignment phase.

### 1.1.4 CSDB_IN and CSDB_OUT (VHF-4000 only)

1) Unground ARINC/CSDB_Sel (Pin 50)
2) Apply Label $10 CSDB frequency word to CSDB_IN (Pins 33 and 34) with frequency of 135.000 MHz.
3) Verify Label $11 CSDB word on CSDB_OUT bus (Pins 35 and 36) indicates 135.000 MHz.
4) Ground ARINC/CSDB_Sel (Pin 50)

### 1.1.5 422_DATA_OUT and 422_DATA_IN (VDL-2000 only)

1) Apply GATM message 6T to 422_DATA_IN (pins 20 and 21).
2) Verify GATM message 6R on 422_DATA_OUT (pins 24 and 23).

## 7.3 DISCRETE I/O TESTS

### 7.3.1 TX_MODE_IND

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the ARINC control data to “Standard 25 kHz ARINC Configuration”.
3) Ground the PTT line keying the transmitter.
4) Verify that the voltage at the TX_MODE_IND (Pin 47 VHF-4000, pin 3 VHF-2000) is 0.0 to 3.0 Vdc.
5) Open the PTT line unkeying the transmitter.
6) Verify that the voltage at the TX_MODE_IND is 25.0 to 30.0 Vdc.

| | | |
|---|---|---|
| **Production Limit:** | Keyed: | 0 - 3.0 Vdc |
| | Unkeyed: | 25 - 30 Vdc |
| **CMM Limit:** | Keyed: | 0 - 3.0 Vdc |
| | Unkeyed: | 25 - 30 Vdc |

### 7.3.2 Data_Load_Enbl_Sel

1) Monitor Bit 11 in Label 060 ARINC 429 output word on the 429_CMU_HS_Out_1 (Pins 1 and 2 VHF-4000, Pins 5 and 22 VDL-2000) buss.
2) Ground DATALOAD_ENB_SEL pin (Pin 61 VHF-4000, Pin 29 VDL-2000)
3) Verify Bit 11 in Label 060 ARINC 429 output word changes to logic 1.
4) Remove ground from Data_Load_Enbl _SEL pin.

### 7.3.3 WOW_Sel

1) Monitor Bit 12 in Label 060 ARINC 429 output word on the 429_CMU_HS_Out_1 (Pins 1 and 2 VHF-4000, Pins 5 and 22 VDL-2000) buss.
2) Ground WOW_SEL pin (Pin 57 VHF-4000, pin 14 VDL-2000)
3) Verify Bit 12 in Label 060 ARINC 429 output word changes to logic 1.
4) Remove ground from WOW_SEL pin.

### 1.1.6 Burst_Tune_Sel

1) Monitor Bit 14 in Label 060 ARINC 429 output word on the 429_CMU_HS_Out_1 (Pins 1 and 2 VHF-4000, Pins 5 and 22 VDL-2000) buss.
2) Ground Burst_Tune_Sel pin (Pin 57 VHF-4000, pin 14 VDL-2000)
3) Verify Bit 14 in Label 060 ARINC 429 output word changes to logic 1.
4) Remove ground from Burst_Tune_Sel pin.

### 7.3.4 Voice/Data_Sel

1) Monitor Bit 18 in Label 060 ARINC 429 output word on the 429_CMU_HS_Out_1 (Pins 1 and 2 VHF-4000, Pins 5 and 22 VDL-2000) buss.
2) Ground VOICE/DATA_SEL pin (Pin 45 VHF-4000, Pin 17 VDL-2000)
3) Verify Bit 18 in Label 060 ARINC 429 output word changes to logic 1.
4) Remove ground from VOICE/DATA_SEL pin.

### 7.3.5 RX_Comp_Disbl_Sel (VHF4000 Only)

1) Monitor Bit 19 in Label 060 ARINC 429 output word on the 429_CMU_HS_Out_1 (Pins 1 and 2 VHF-4000, Pins 5 and 22 VDL-2000) buss.
2) Ground RX_Comp_Disbl _SEL pin (Pin 52 VHF-4000)
3) Verify Bit 19 in Label 060 ARINC 429 output word changes to logic 1.
4) Remove ground from RX_Comp_Disbl _SEL pin.

### 7.3.6 RIU_Installed_Sel (VHF-4000 only)

1) Monitor Bit 20 in Label 060 ARINC 429 output word on the 429_CMU_HS_Out_1 (Pins 1 and 2 VHF-4000, Pins 5 and 22 VDL-2000) buss.
2) Ground RIU_Installed_Sel pin (Pin 61 VHF-4000, Pin 29 VDL-2000)
3) Verify Bit 20 in Label 060 ARINC 429 output word changes to logic 1.
4) Remove ground from RIU_Installed_Sel pin.

### 7.3.7 All_Call_Disable_Sel (VHF-4000 only)

1) Monitor Bit 21 in Label 060 ARINC 429 output word on the 429_CMU_HS_Out_1 (Pins 1 and 2 VHF-4000) buss.
2) Ground All_Call_Disable_Select pin (Pin 44)
3) Verify Bit 21 in Label 060 ARINC 429 output word changes to logic 1
4) Remove ground from All_Call_Disable_Sel pin.

### 7.3.8 SIMULCOM_CNTL_1_SEL

1) Monitor Bit 22 in Label 060 ARINC 429 output word on the 429_CMU_HS_Out_1 (Pins 1 and 2 VHF-4000, Pins 5 and 22 VDL-2000) buss.
2) Ground SIMULCOM_CNTL_1_SEL pin (Pin 42 VHF-4000, Pin 16 VDL-2000)
3) Verify Bit 22 in Label 060 ARINC 429 output word changes to logic 1.
4) Remove ground from SIMULCOM_CNTL_1_SEL pin.

### 7.3.9 SIMULCOM_CNTL_2_SEL

1) Monitor Bit 23 in Label 060 ARINC 429 output word on the 429_CMU_HS_Out_1 (Pins 1 and 2 VHF-4000, Pins 5 and 22 VDL-2000) buss.

2) Ground SIMULCOM_CNTL_2_SEL pin (Pin 46 VHF-4000, Pin 34 VDL-2000)
3) Verify Bit 23 in Label 060 ARINC 429 output word changes to logic 1.
4) Remove ground from SIMULCOM_CNTL_2_SEL pin.

### 7.3.10 SYSTEM_ON_F (VDL-2000 only)

1) Open SYSTEM_ON_F (pin 27).
2) Verify input current on +28VDC primary power is less than 500 mA.

## 7.4 ARINC 429 I/O TESTS (VHF4000 ONLY!)

### 7.4.1 VHF ARINC 429 Low Speed Output Port 1

#### 7.4.1.1 VHF ARINC 429 LOW SPEED OUTPUT 1A RISE TIME

1) Verify the rise time (10 - 90%) of a "HI" on the VHF ARINC 429 Low Speed Output 1A (Pin 5 VHF-4000).

**Limit: = 10.0 +/- 5.0 uS**

#### 1.1.6.1 VIR ARINC 429 LOW SPEED OUTPUT 1A FALL TIME

1) Verify the fall time (90 - 10%) of a "HI" on the VIR ARINC 429 Low Speed Output 1A (Pin 5 VHF-4000).

**Limit: = 10.0 +/- 5.0 uS**

#### 1.1.6.2 VHF ARINC 429 LOW SPEED OUTPUT 1A HI LEVEL

1) Verify the dc voltage (ref to gnd) of a "HI" on the VHF ARINC 429 Low Speed Output 1A (Pin 5 VHF-4000).

**Limit: = 5.25 +/- 0.75 VDC**

#### 1.1.6.3 VIR ARINC 429 LOW SPEED OUTPUT 1A LO LEVEL

1) Verify the dc voltage (ref to gnd) of a "LO" on the VIR ARINC 429 Low Speed Output 1A (Pin 5 VHF-4000).

**Limit: = -5.25 +/- 0.75 VDC**

#### 1.1.6.4 VHF ARINC 429 LOW SPEED OUTPUT 1B RISE TIME

1) Verify the rise time (10 - 90%) of a "LO" on the VHF ARINC 429 Low Speed Output 1B (PIN 5 VHF-4000).

**Limit: = 10.0 +/- 5.0 uS**

#### 1.1.6.5 VHF ARINC 429 LOW SPEED OUTPUT 1B FALL TIME

1) Verify the fall time (90 - 10%) of a "LO" on the VHF ARINC 429 Low Speed Output 1B (PIN 5 VHF-4000).

**Limit: = 10.0 +/- 5.0 uS**

#### 1.1.6.6 VHF ARINC 429 LOW SPEED OUTPUT 1B HI LEVEL

1) Verify the dc voltage (ref to gnd) of a "HI" on the VHF ARINC 429 Low Speed Output 1B (PIN 5 VHF-4000).

**Limit: = =-5.25 +/- 0.75 VDC**

#### 1.1.6.7 VHF ARINC 429 LOW SPEED OUTPUT 1B LO LEVEL

1) Verify the dc voltage (ref to gnd) of a "LO" on the VHF ARINC 429 Low Speed Output 1B (PIN 5 VHF-4000).

**Limit: = 5.25 +/- 0.75 VDC**

### 7.4.2 VHF ARINC 429 Low Speed Output Port 2

#### 1.1.6.8 VHF ARINC 429 LOW SPEED OUTPUT 2A RISE TIME

1) Verify the rise time (10 - 90%) of a "HI" on the VHF ARINC 429 Low Speed Output 2A (PIN 11 VHF-4000).

**Limit: = 10.0 +/- 5.0 uS**

#### 1.1.6.9 VHF ARINC 429 LOW SPEED OUTPUT 2A FALL TIME

1) Verify the fall time (90 - 10%) of a "HI" on the VHF ARINC 429 Low Speed Output 2A (PIN 11 VHF-4000).

**Limit: = 10.0 +/- 5.0 uS**

#### 7.4.2.1 VHF ARINC 429 LOW SPEED OUTPUT 2A HI LEVEL

1) Verify the dc voltage (ref to gnd) of a "HI" on the VHF ARINC 429 Low Speed Output 2A (PIN 11 VHF-4000).

**Limit: = 5.25 +/- 0.75 VDC**

#### 7.4.2.2 VHF ARINC 429 LOW SPEED OUTPUT 2A LO LEVEL

1) Verify the dc voltage (ref to gnd) of a "LO" on the VHF ARINC 429 Low Speed Output 2A (PIN 11 VHF-4000).

**Limit: = -5.25 +/- 0.75 VDC**

#### 7.4.2.3 VHF ARINC 429 LOW SPEED OUTPUT 2B RISE TIME

1) Verify the rise time (10 - 90%) of a "LO" on the VHF ARINC 429 Low Speed Output 2B (PIN 12 VHF-4000).

**Limit: = 10.0 +/- 5.0 uS**

#### 7.4.2.4 VHF ARINC 429 LOW SPEED OUTPUT 2B FALL TIME

1) Verify the fall time (90 - 10%) of a "LO" on the VHF ARINC 429 Low Speed Output 2B (PIN 12 VHF-4000).

**Limit: = 10.0 +/- 5.0 uS**

#### 7.4.2.5 VHF ARINC 429 LOW SPEED OUTPUT 2B HI LEVEL

1) Verify the dc voltage (ref to gnd) of a "HI" on the VHF ARINC 429 Low Speed Output 2B (PIN 12 VHF-4000).

**Limit: = -5.25 +/- 0.75 VDC**

#### 7.4.2.6 VHF ARINC 429 LOW SPEED OUTPUT 2B LO LEVEL

1) Verify the dc voltage (ref to gnd) of a "LO" on the VHF ARINC 429 Low Speed Output 2B (PIN 12 VHF-4000).

**Limit: = 5.25 +/- 0.75 VDC**

### 7.4.3 VHF ARINC 429 High Speed Output Port 1

#### 7.4.3.1 VHF ARINC 429 HIGH SPEED OUTPUT 1A RISE TIME

1) Verify the rise time (10 - 90%) of a "HI" on the VHF ARINC 429 High Speed Output 1A (PIN 17 VHF-4000).

**Limit: = 1.5 +/- 0.75 uS**

#### 7.4.3.2 VHF ARINC 429 HIGH SPEED OUTPUT 1A FALL TIME

1) Verify the fall time (90 - 10%) of a "HI" on the VHF ARINC 429 High Speed Output 1A (PIN 17 VHF-4000).

**Limit: = 1.5 +/- 0.75 uS**

#### 7.4.3.3 VHF ARINC 429 HIGH SPEED OUTPUT 1A HI LEVEL

1) Verify the dc voltage (ref to gnd) of a "HI" on the VHF ARINC 429 High Speed Output 1A (PIN 17 VHF-4000).

**Limit: = 5.25 +/- 0.75 VDC**

#### 7.4.3.4 VHF ARINC 429 HIGH SPEED OUTPUT 1A LO LEVEL

1) Verify the dc voltage (ref to gnd) of a "LO" on the VHF ARINC 429 High Speed Output 1A (PIN 17 VHF-4000).

**Limit: = -5.25 +/- 0.75 VDC**

#### 7.4.3.5 VHF ARINC 429 HIGH SPEED OUTPUT 1B RISE TIME

1) Verify the rise time (10 - 90%) of a "LO" on the VHF ARINC 429 High Speed Output 1B (PIN 18 VHF-4000).

**Limit: = 1.5 +/- 0.75 uS**

#### 7.4.3.6 VHF ARINC 429 HIGH SPEED OUTPUT 1B FALL TIME

1) Verify the fall time (90 - 10%) of a "LO" on the VHF ARINC 429 High Speed Output 1B (PIN 18 VHF-4000).

**Limit: = 1.5 +/- 0.75 uS**

#### 7.4.3.7 VHF ARINC 429 HIGH SPEED OUTPUT 1B HI LEVEL

1) Verify the dc voltage (ref to gnd) of a "HI" on the VHF ARINC 429 High Speed Output 1B (PIN 18 VHF-4000).

**Limit: = -5.25 +/- 0.75 VDC**

#### 7.4.3.8 VHF ARINC 429 HIGH SPEED OUTPUT 1B LO LEVEL

1) Verify the dc voltage (ref to gnd) of a "LO" on the VHF ARINC 429 High Speed Output 1B (PIN 18 VHF-4000).

**Limit: = 5.25 +/- 0.75 VDC**

### 7.4.4 VHF ARINC 429 High Speed Output Port 2

#### 7.4.4.1 VHF ARINC 429 HIGH SPEED OUTPUT 2A RISE TIME

1) Verify the rise time (10 - 90%) of a "HI" on the VHF ARINC 429 High Speed Output 2A (PIN 23 VHF-4000).

**Limit: = 1.5 +/- 0.75 uS**

#### 7.4.4.2 VHF ARINC 429 HIGH SPEED OUTPUT 2A FALL TIME

1) Verify the fall time (90 - 10%) of a "HI" on the VHF ARINC 429 High Speed Output 2A (PIN 23 VHF-4000).

**Limit: = 1.5 +/- 0.75 uS**

#### 7.4.4.3 VHF ARINC 429 HIGH SPEED OUTPUT 2A HI LEVEL

1) Verify the dc voltage (ref to gnd) of a "HI" on the VHF ARINC 429 High Speed Output 2A (PIN 23 VHF-4000).

**Limit: = 5.25 +/- 0.75 VDC**

#### 7.4.4.4 VHF ARINC 429 HIGH SPEED OUTPUT 2A LO LEVEL

1) Verify the dc voltage (ref to gnd) of a "LO" on the VHF ARINC 429 High Speed Output 2A (PIN 23 VHF-4000).

**Limit: = -5.25 +/- 0.75 VDC**

#### 7.4.4.5 VHF ARINC 429 HIGH SPEED OUTPUT 2B RISE TIME

1) Verify the rise time (10 - 90%) of a "LO" on the VHF ARINC 429 High Speed Output 2B (PIN 24 VHF-4000).

**Limit: = 1.5 +/- 0.75 uS**

#### 7.4.4.6 VHF ARINC 429 HIGH SPEED OUTPUT 2B FALL TIME

1) Verify the fall time (90 - 10%) of a "LO" on the VHF ARINC 429 High Speed Output 2B (PIN 24 VHF-4000).

**Limit: = 1.5 +/- 0.75 uS**

#### 7.4.4.7 VHF ARINC 429 HIGH SPEED OUTPUT 2B HI LEVEL

1) Verify the dc voltage (ref to gnd) of a "HI" on the VHF ARINC 429 High Speed Output 2B (PIN 24 VHF-4000).

**Limit: = -5.25 +/- 0.75 VDC**

#### 7.4.4.8 VHF ARINC 429 HIGH SPEED OUTPUT 2B LO LEVEL

1) Verify the dc voltage (ref to gnd) of a "LO" on the VHF ARINC 429 High Speed Output 2B (PIN 24 VHF-4000).

**Limit: = 5.25 +/- 0.75 VDC**

### 7.5 SELFTEST (VHF4000 ONLY)

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Set the ARINC data to "Standard 25 kHz ARINC Configuration" on channel 128.500
3) Connect the transceiver's antenna port to a dummy load.
4) Place the WOW_sel discrete in the weight-on-wheels position, grounded.
5) Remove the DC input power for longer than 2 seconds.
6) Reapply the power and verify the transceiver's status by monitoring bits 11, 12, and 15 in the label 350 word on the OMS bus for "O" condition.

### 7.6 VIBRATION (PERFORM ON A SAMPLE BASIS ONLY!)

Mount the UUT on the shake table and perform Voice/Analog Data Receiver Quieting and Voice/Analog Data Transmit Noise Level tests.

| | |
|---|---|
| **Production Limit:** | Receiver quieting: >= 35 dB.<br>Transmitter noise level: >= 35 dB. |
| **CMM Limit:** | N/A. |

### 7.7 TALK OUT/VOICE (PERFORM ON A SAMPLE BASIS ONLY!)

1) Connect a headset & microphone to the UUT.
2) Communicate with another VHF-4000 station using approximately 100 dB of RF attenuation between antennas of the units.
3) Operate at 118.205, 123.250, and 136.975 MHz and verify clear reception from each unit.
4) Set RF attenuation between units to approximately 40 dB. Set one unit to receive on 123.25 MHz. Key the other unit on 121.800, 125.10, and 130.5 MHz and verify that the squelch does not open on the unit tuned to 123.25 MHz.

### 7.8 MODE A TESTS (UNITS/W MODE A OPTION ONLY)

Reserved

### 7.9 MODE 2 TESTS (UNITS/W MODE 2 OPTION ONLY)

#### 7.9.1 Load application Software (CPN: 822-1468-985 Only)

For CPN: 822-1468-985 load unit with software called out by drawing CPN: 653-4078-101

#### 7.9.2 Mode 2 Receiver Tests (Units/w Mode 2 Option Only)

#### 7.9.2.1 VDL MODE 2 SENSITIVITY

1. Tune UUT to Channel 118.425 (118.425 MHz on Label 030).
2. Apply a –100 dBm (at receiver antenna input) VDL Mode 2 BFR (Block Failure Rate) message per Appendix C at 118.425 MHz. Measure the BFR of 1000 messages. Repeat the measurement at 126.425 MHz and 136.975 MHz.

| | |
|---|---|
| **Production Limit:** | -100 dBm: NMT .159 BFR (Equivalent to .001 BER) |
| **CMM Limit:** | -98 dBm: NMT .159 BFR. (Equivalent to .001 BER) |

#### 7.9.2.2 MODE 2 RECEIVER DYNAMIC RANGE

1. Tune UUT to Channel 118.425 (118.425 MHz on Label 030). Place unit in receiver BER test mode.
2. Apply a –87 dBm (at receiver antenna input) VDL Mode 2 BFR (Block Failure Rate) message per Appendix C at 118.425 MHz. Measure the BFR of 1000 messages. Repeat the measurement at –67, -47, -27 and –7 dBm.

| | |
|---|---|
| **Production Limit:** | < .159 BFR (equivalent to .001 BER) |
| **CMM Limit:** | < .159 BFR (equivalent to .001 BER) |

### 7.9.3 Mode 2 Transmitter Tests

Unless otherwise specified, the tests are to be performed at 126.500 MHz. Always keep the antenna port connected to a 50 ohm, high-power load.

#### 7.9.3.1 TRANSMIT POWER

1) Tune the UUT to Channel 118.500.
2) Transmit at a 249 byte application message (may be same content as in Appendix C) and measure and record the output power. A spectrum analyzer in channel power mode, 16 kHz BW, may be used. Alternate messages may be used to achieve desired transmit time for different spectrum analyzer sweep rates.
3) Repeat at 1 MHz increment to 136.5 MHz.

| | |
|---|---|
| **Production Limit:** | 18 - 21 watts and <= 6.5 amps |
| **CMM Limit:** | >= 15 watts and 7 amps at 118.000, 126.000, and 136.975, and 151.975 MHz (151.975 MHz for VHF-4000 only). |

#### 7.9.3.2 IQ MISMATCH

1) Tune the UUT to 118.5 MHz.
2) Configure the test software to send a 1 kHz Single Sideband signal by applying a cosine signal to the I channel and a sine signal to the Q channel.
3) Ground the PTT line (Pin 41 VHF-4000, Pin 35 VDL-2000 )
4) Verify that the lower sideband component of the RF output is at least 40 dB below the upper sideband.
5) Repeat at 1 MHz increment to 136.5 MHz.

#### 7.9.3.3 EVM

1. Tune the UUT to 118.425 MHz.
2. Transmit at a 249 byte application message (may be same content as in Appendix C) and measure and record the output power.
3. Verify that the Error Vector Magnitude is $\leq$ 5%.
4. Repeat at 127.000 and 136.975 MHz.
5. Note: This test may be conducted on a sample test basis as determined by production engineering.

**Production Limit:** 5%

**CMM Limit:** 6%

### 7.9.3.4 ACI

1. Tune the UUT to 118.000 MHz.
2. Transmit at a 249 byte application message (may be same content as in Appendix C) and measure and record the output power.
3. Verify that the adjacent channel interference meets the following mask:
    1. 1st ACI: < -20 dBm (power at the antenna)
    2. 2nd ACI: < -30 dBm
    3. 4th ACI: < -40 dBm
4. Repeat at 127.000 and 137.000 MHz.

Note: This test may be conducted on a sample test basis as determined by production engineering.

**Production Limit:** 1st ACI: < -20 dBm (power at the antenna)
2nd ACI: < -30 dBm
4th ACI: < -40 dBm

**CMM Limit:** 1st ACI: < -18 dBm (power at the antenna)
2nd ACI: < -28 dBm
4th ACI: < -38 dBm

### 7.9.3.5 2:1 VSWR TEST (PERFORM ON A SAMPLE BASIS ONLY!)

1. Set the UUT discrete inputs to “standard discrete configuration”.
2. Set the ARINC control data to “Standard 25 kHz ARINC Configuration”.
3. Tune the UUT to channel 118.500.
4. Transmit at a 249 byte application message (may be same content as in Appendix C) and measure and record the output power.
5. Connect UUT to 2:1 VSWR simulator.
6. Ground the PTT line while monitoring RF envelope with oscilloscope connected to test port on 2:1 VSWR simulator.
7. Rotate VSWR simulator through all phase angles and verify that no oscillations are present.
8. Verify that EVM does not exceed 5% at five phase angles chosen at random.
9. Unground the PTT line.
10. Repeat at 127.000 and 136.500 MHz.

**Production Limit:** EVM $\leq$ 6%.

**CMM Limit:** EVM $\leq$ 8%.

## 8. Temperature Testing

### 8.1 SELFTEST (VHF4000 ONLY, PERFORMED DURING THE RAPID CYCLE PORTION OF ESS)

1) Set the UUT discrete inputs to “standard discrete configuration”.
2) Set the ARINC data to “Standard 25 kHz ARINC Configuration” on channel 128.500
3) Connect the transceiver’s antenna port to a dummy load.
4) Place the WOW_sel discrete in the weight-on-wheels position, grounded.
5) Command Selftest
6) Monitor bits 11, 12, and 15 in the label 350 word on the OMS bus for ”O” condition.

## 8.2 PARAMETRIC TESTS (VHF4000 ONLY, PERFORMED DURING THE EXTENDED DWELL PORTIONS OF ESS)

### 8.2.1 Receiver:

#### 8.2.1.1 SENSITIVITY

1) Set the UUT discrete inputs to "standard discrete configuration".
2) Apply a –95.0 dBm signal at a frequency of 118 MHz, modulated 30% with a 1 kHz tone.
3) Disable squelch
4) Set the ARINC control data to "Standard 25 kHz ARINC Configuration" on channel 118.000 MHz.
5) Set the RF generator output level to –95.0 dBm.
6) Verify the S+N/N ratio at the combined audio output
7) Repeat steps 1- 6 at 126, 131, and 136 MHz

**Production Limit:** S+N/N ratio: >=8.0 dB

#### 1.1.6.10 AUDIO OUTPUT LEVEL

5) Set the UUT discrete inputs to "standard discrete configuration".
6) Set the RF Generator to -54 dBm output level at 118.000 MHz, modulated 30% by a 1 kHz sine wave.
7) Set the ARINC control data to "Standard 25 kHz ARINC Configuration" on channel 126.600.
8) Verify the analog audio output level at the received audio output (VHF-4000 pins 19 and 26, VDL-2000 pins 33 and 19).

**Production Limit:** 7.0 +/- 1.0 Vrms

#### 8.2.1.2 AUDIO OUTPUT DISTORTION

5) Set the UUT discrete inputs to "standard discrete configuration".
6) Apply a –20 dBm signal at a frequency of 118 MHz, modulated 90% with a 1 kHz tone.
7) Set the ARINC control data to "Standard 25 kHz ARINC Configuration" on channel 126.600.
8) Adjust the distortion analyzer connected to the combined audio output (VHF-4000 pins 25 and 26, VDL-2000 pins 33 and 19 ) and measure audio distortion.
9) Repeat steps 1- 4 at 126, 131, and 136 MHz

**Production Limit:** Audio distortion: <= 5%

### 8.2.2 Transmitter:

#### 8.2.2.1 UNMODULATED RF POWER OUTPUT/CURRENT

13) Set the UUT discrete inputs to "standard discrete configuration".
14) Set the ARINC control data to "Standard 25 kHz ARINC Configuration".
15) Tune the UUT to Channel 118.000.
16) Ground the PTT line (Pin 41 VHF-4000, Pin 35 VDL-2000 ), measure and verify the output power and input current
17) Unground the PTT line.
10) Repeat steps 1-5 at 126, 131, and 136 MHz

**Production Limit:** >=16.5 watts

**Production Limit:** <= 5.5 amps

#### 8.2.2.2 MODULATION DISTORTION

8) Set the UUT discrete inputs to “standard discrete configuration”.
9) Set the ARINC control data to “Standard 25 kHz ARINC Configuration”.
10) Tune UUT to 118.000 MHz.
11) Apply an audio input of 1.25 Vrms at 1 kHz at mic input.
12) Ground the PTT line and measure the demodulated RF distortion
13) Unground the PTT line.
14) Repeat steps 1- 6 at 126, 131, and 136 MHz

**Production Limit:** <= 5% distortion

#### 8.2.2.3 ANALOG INPUT COMPRESSOR RANGE

4) Tune UUT to 118.000 MHz.
5) Set the mic audio voltage to 1.25 Vrms.
6) Ground the PTT
7) Verify the percentage of negative modulation. Unkey the PTT line.
8) Repeat steps 1- 4 at 126, 131, and 136 MHz

**Production Limit:** >= 70% but LT 95 %.

#### 8.2.2.4 FREQUENCY ACCURACY

6) Set the UUT discrete inputs to “standard discrete configuration”.
7) Set the ARINC control data to “Standard 25 kHz ARINC Configuration”.
8) Tune the UUT to 135.000 MHz.
9) With no modulation applied, ground the PTT line and verify the frequency error between tuned and measured frequencies.
10) Unground the PTT.

**Production Limit:** +/- 3 PPM (+/-405 Hz)

# Appendix A Alignment Formats

The ARINC 429 Label 277 Diagnostic Request input word is defined as follows:

| Bit(s) | Function | Contents |
|---|---|---|
| 8-1 | Label 277 (octal) | 11111101 (binary) |
| 27-9 | Request Parameters | Request Type specific (see below) |
| 29-28 | Sequence Number | Indicates position in sequence of Request Words |
| 31-30 | Request Type | 31 30 Definition<br>0 0 Software Version Request (Deactivated in VHF-4000)<br>0 1 Memory Access Request (Program, Data, or Serial EEPROM)<br>1 0 Alignment Data Request<br>1 1 Diagnostic Data Request |
| 32 | Parity Bit | Set for odd parity |

The ARINC 429 Label 277 Diagnostic Request input word is used in conjunction with the ARINC 429 Label 351 Diagnostic Response output word. The Label 277 word is intended to be compatible with the VHF-422 legacy radio's Label 277 Bench Test Request word and will be used only on the ARINC 429 Diagnostic Data Bus.

Since read requests require up to two input Label 277 words to complete and write requests require up to four input Label 277 words to complete, the Sequence Number field is used to specify which word in the request is being used. For example, a Memory Access word requesting a write to Program memory requires an input sequence of three Label 277 words. The first word has a Sequence Number of 00b and specifies the Memory Type as "Program", the Access Type as "Write", and provides the required Write Access Code (i.e., a password for enabling Memory Access writes). The second word provides the 16-bit address within Program Space Page 1 (i.e., internal DSP RAM) of the memory location to be written and will have a Sequence Number of 01 (binary). The third word provides the data to be written and will have a Sequence Number of 10b. The Write Access Code in the first word of the three-word Memory Access write request sequence is a key to prevent write access to memory by anyone but the manufacturer.

The number of Label 277 words required in the input sequence for each type of Label 277 diagnostic request is defined as follows:

| Request Type | Operation | Sequence Length (Label 277 Words) |
|---|---|---|
| 00 (Software Version) | N/A | N/A |
| 01 (Memory Access) | Access Type 0 (Read), Memory Type 00 (Program Space) | 2 |
| 01 (Memory Access) | Access Type 0 (Read), Memory Type 01 (Data Space) | 2 |
| 01 (Memory Access) | Access Type 0 (Read), Memory Type 10 (Serial EEPROM) | 2 |
| 01 (Memory Access) | Access Type 0 (Read), Memory Type 11 (Serial Number) | 4 |
| 01 (Memory Access) | Access Type 1 (Write), Memory Type 00 (Program Space) | 3 |
| 01 (Memory Access) | Access Type 1 (Write), Memory Type 01 (Data Space) | 3 |
| 01 (Memory Access) | Access Type 1 (Write), Memory Type 10 (Serial EEPROM) | 3 |
| 01 (Memory Access) | Access Type 1 (Write), Memory Type 11 (Serial Number Locations) | 4 |
| 10 (Alignment Data) | Alignment Operation Codes 0, 2, 3, & 5-A | 1 |
| 10 (Alignment Data) | Alignment Operation Codes 1, 4, B, & C | 2 |
| 11 (Diagnostic Data) | Diagnostic Data Operation Codes 00h-0Bh, 11h, 15h-18h, & 20h-26h | 1 |
| 11 (Diagnostic Data) | Diagnostic Data Operation Codes 27h, 28h, & 2Ah-3Ch | 2 |
| 11 (Diagnostic Data) | All Other Diagnostic Data Operation Codes | N/A |

Every Label 277 input word will be answered with a Label 351 output word that contains a Response Type that corresponds to the input Label 277 word's Request Type and a Sequence Number that reflects the input Label 277 word's Sequence Number.

The form of the Request Parameters field for each Request Type supported via the ARINC 429 Diagnostic Request input word is defined in the following table. In the Alignment Data requests, bits 24-27 of word 00 in the sequence are always used, regardless of the operation being requested. A write request via a Label 277 input sequence (including Memory Access write requests, Alignment Data write requests, and Diagnostic Data write requests) will have no effect if the VHF-4000 unit is not in Alignment Mode. Bit 27 of the Label 351 word(s) output in response to input Label 277 Alignment Data requests indicates whether

or not the unit is currently in Alignment Mode. Writes to sectored FLASH memory via Label 277 Memory Access requests are not allowed. Limited access to sectored FLASH memory is available through the Alignment Data requests. Diagnostic reads are enabled at all times.

| Request Type (Bits 31-30) | Sequence Number (Bits 29-28) | Request Parameters (Bits 27-9) | Contents |
|---|---|---|---|
| 00<br>SW Version | 00 | 27-9 | Unused |
| 01<br>Memory Access | 00 | 24-9 | If bit 25 = 0 (Read) and bits 27-26 = Memory Type 00 (Program Space):<br>Bits 15-9 : Program Space Page for Program Space Read Accesses (bit 9 is LSB)<br>Bits 24-16 : Unused<br>If bit 25 = 0 (Read) and bits 27-26 = Memory Types 01 (Data Space) or 10 (Serial EEPROM) or<br>11 (Serial Number Locations):<br>Bits 24-9 : Unused<br>If bit 25 = 1 (Write) and bits 27-26 = Memory Types 00 (Program Space) or 01 (Data Space) or 10<br>(Serial EEPROM):<br>Bits 16-9 : Unused (All Program Space Write Accesses Go to Page 1, DSP Internal RAM)<br>Bits 24-17 : Write Access Code<br>If bit 25 = 1 (Write) and bits 27-26 = Memory Type 11 (Serial Number Locations): |
| | | 25 | Bits 16-9 : Input LRU Serial Number 1st Alphanumeric Character (bit 9 is LSB)<br>Bits 24-17 : Write Access Code<br>Otherwise : Unused |
| | | 27-26 | Access Type:<br>0 = Read<br>1 = Write<br>Memory Type :<br>00 = Program Space<br>01 = Data Space<br>10 = Serial EEPROM<br>11 = Serial Number Locations (within LRU Configuration Data Block) |
| 01<br>Memory Access | 01 | 24-9 | For Program Space, Data Space, or Serial EEPROM Read or Write Requests:<br>Target Address (bit 9 is LSB)<br>For Serial Number Locations Write Requests:<br>Input LRU Serial Number 3rd & 2nd Alphanumeric Characters (bit 9 is 2nd character LSB)<br>For Serial Number Locations Read Requests: |
| | | 27-25 | Unused<br>Unused |
| 01<br>Memory Access | 10 | 24-9 | For Program Space, Data Space, or Serial EEPROM Write Requests:<br>Value to Write to Target Address (bit 9 is LSB)<br>For Serial Number Locations Read Requests:<br>Unused<br>For Serial Number Locations Write Requests:<br>Input LRU Serial Number 5th & 4th Alphanumeric Characters (bit 9 is 4th character LSB)<br>For All Other Memory Access Requests (Program/Data Space and Serial EEPROM Reads): |
| | | 27-25 | This word is not provided.<br>Unused |
| 01<br>Memory Access | 11 | 24-9 | For Serial Number Locations Read Requests:<br>Unused<br>For Serial Number Locations Write Requests:<br>Input LRU Serial Number 7th & 6th Alphanumeric Characters (bit 9 is 6th character LSB)<br>For All Other Memory Access Requests (Program/Data Space & Serial EEPROM |

| Request Type (Bits 31-30) | Sequence Number (Bits 29-28) | Request Parameters (Bits 27-9) | Contents |
|---|---|---|---|
| | | 27-25 | Reads/Writes):<br>This word is not provided.<br>Unused |
| 10 Alignment Data | 00 | 16-9 | If bits 20-17 = 1, 2, 3, 4 or 5 hex:<br>Alignment Parameter Code (see table of Alignment Parameter Codes below)<br>If bits 20-17 = B or C:<br>1st (i.e., most significant) digit of desired Installed Service Bulletin (ISO 5 character)<br>Otherwise:<br>Unused |
| | | 20-17 | Requested Alignment Operation Code:<br>0 hex : Mode Change (see Bits 24, 25, 26 and 27)<br>1 hex : Accept Value as Alignment Working Value<br>2 hex : Store Alignment Working Value in FLASH<br>3 hex : Read Alignment Working Value<br>4 hex : Store TFM Value for Given Temperature Zone in FLASH<br>5 hex : Read FLASH TFM for Given Temperature Zone<br>6 hex : Start Duty Cycle Pulse<br>7 hex : Stop Duty Cycle Pulse<br>8 hex : Start Single Side Band<br>9 hex : Stop Single Side Band<br>A hex : Clear All Archived Fault Records<br>B hex : Add Installed Service Bulletin<br>C hex : Remove Installed Service Bulletin<br>D hex : Spare (Unused)<br>E hex : Spare (Unused)<br>F hex : Spare (Unused) |
| | | 22-21 | If bits 20-17 = 4 or 5 hex:<br>Temperature Zone for TFM matrix FLASH storage<br>Otherwise:<br>Unused |
| | | 23 | Unused |
| | | 24 | Inhibit Tx Timer : 0 = Enable Tx Timeout Timer, 1 = Inhibit Tx Timeout Timer |
| | | 25 | Inhibit Tx Key : 0 = Enable Transmission on PA, 1 = Inhibit Transmission on PA |
| | | 26 | Inhibit Transmit Mode : 0 = Enable Transmit Mode, 1 = Inhibit Transmit Mode |
| | | 27 | Alignment Mode Select : 0 = Normal Operation, 1 = Alignment Request |
| 10 Alignment Data | 01 | 24-9 | If previous Label 277 word was an Alignment Data Request with a Sequence Number of 00 and a<br>Requested Alignment Operation Code (bits 20-17) of 1 hex or 4 hex:<br>Value to use as "Alignment Working Value" or as "TFM for Temp Zone" (bit 9 is LSB)<br>If previous Label 277 word was an Alignment Data Request with a Sequence Number of 00 and a<br>Requested Alignment Operation Code (bits 20-17) of B hex or C hex:<br>2nd (least significant) digit of desired Installed Service Bulletin (ISO 5 char in bits 16-9, |
| | | 27-25 | zeros in bits 24-17)<br>Otherwise : This word is not provided.<br>Unused |
| 11 Diagnostic Data | 00 | 14-9 | Unused |
| | | 22-15 | Diagnostic Data Operation Code (see the table of Diagnostic Data Operation Codes below) |
| | | 27-23 | Unused |
| 11 Diagnostic Data | 01 | 24-9 | For Diagnostic Data Operation Codes 27h, 28h, & 2Ah - 3Ch : Data to Write (bit 9 is LSB)<br>For All Other Diagnostic Data Operation Codes : This word is not provided. |
| | | 25 | Unused |
| | | 27-26 | Sync Count (2 LSBs of input word sync count for multiword read operations, starting w/ 00) |

# Appendix B Rear Connector Pins by Function

## VHF-4000

| Pin Name | Signal/Variable Name | Variable Setting/Contents | Signal Type | Pin Number |
|---|---|---|---|---|
| 429_CMU_HS_In_A_A | CMU_IN_A | | Differential HS ARINC 429 input | 1 |
| 429_CMU_HS_In_A_B | | | | 2 |
| 429_Input_Port_A_A | TUNE_IN_A | | Differential HS/LS ARINC 429 input | 3 |
| 429_Input_Port_A_B | | | | 4 |
| 429_LS_Out_1_A | 429_LS_OUT_1 | | Differential LS ARINC 429 output | 5 |
| 429_LS_Out_1_B | | | | 6 |
| 429_CMU_HS_In_B_A | CMU_IN_B | | Differential HS ARINC 429 input | 7 |
| 429_CMU_HS_In_B_B | | | | 8 |
| 429_MAint_In_A | MAINT_IN | | Differential HS ARINC 429 input | 9 |
| 429_MAint_In_B | | | | 10 |
| 429_LS_Out_2_A | 429_LS_OUT_2 | | Differential LS ARINC 429 output | 11 |
| 429_LS_Out_2_B | | | | 12 |
| 429_MAint_HS_Out_A | MAINT_OUT | | Differential HS ARINC 429 output | 13 |
| 429_MAint_HS_Out_B | | | | 14 |
| 429_Input_Port_C_A | TUNE_IN_C | | Differential HS/LS ARINC 429 input | 15 |
| 429_Input_Port_C_B | | | | 16 |
| 429_HS_Out_1_A | 429_HS_OUT_1 | | Differential HS ARINC 429 output | 17 |
| 429_HS_Out_1_B | | | | 18 |
| RX_Audio_Out | RX_AUDIO | | Analog output (100 mW) | 19 |
| Sidetone_Audio_Out | SIDETONE_AUDIO | | Analog output (100 mW) | 20 |
| 429_Input_Port_B_A | TUNE_IN_B | | Differential HS/LS ARINC 429 input | 21 |
| 429_Input_Port_B_B | | | | 22 |
| 429_HS_Out_2_A | 429_HS_OUT_2 | | Differential HS ARINC 429 output | 23 |
| 429_HS_Out_2_B | | | | 24 |
| Combined_Audio_Out | COMBINED_AUDIO | | Analog output (100 mW) | 25 |
| Audio_Out_Return | | | Analog output (100 mW) | 26 |
| 429_Spare_In_A | | | Differential ARINC 429 input | 27 |
| 429_Spare_In_B | | | | 28 |
| 429_Spare_Out_A | | | Differential ARINC 429 output | 29 |
| 429_Spare_Out_B | | | | 30 |
| Spare_Discrete_In | | | Discrete input | 31 |
| Audio_Out_Return | | | Analog output (100 mW) | 32 |
| CSDB_Data_In_A | CSDB_IN | | Differential CSDB input | 33 |
| CSDB_Data_In_B | | | | 34 |
| CSDB_Data_Out_A | CSDB_OUT | | Differential CSDB output | 35 |
| CSDB_Data_Out_B | | | | 36 |
| Selcal_Audio_Gnd | | | Return | 37 |
| Selcal_Audio_Out | SELCAL_AUDIO | | Analog output (0.5 V) | 38 |
| GPS_Sync_In_Lo_Sel | | | Differential Digital (TBD) input | 39 |
| GPS_Sync_In_Hi_Sel | | | | 40 |
| PTT_Sel | PTT_DISC | Gnd = Keyed<br>Open = Not Keyed | Discrete input | 41 |
| Simulcomm_Cntl_1_Sel | SIMULCOM_1 | See **Error! Reference source not found.** | Discrete input | 42 |
| RIU_Installed_Sel | RIU_INSTALLED | Gnd = RIU Installed<br>Open = RIU Not | Discrete input | 43 |

| | | | | |
|---|---|---|---|---|
| | | Installed | | |
| All_Call_Disbl_Sel | ALL_CALL | See **Error! Reference source not found.** | Discrete input | 44 |
| Voice/Data_Sel | V/D_DISC | Gnd = Data<br>Open = Voice | Discrete input | 45 |
| Simulcomm_Cntl_2_Sel | SIMULCOM_2 | See **Error! Reference source not found.** | Discrete input | 46 |
| TX_Mode_Indicator | TX_MODE | Gnd = Transmit<br>Open = Receive | Discrete output | 47 |
| NC | | | | 48 |
| Burst_Tune_Sel | CONT/BURST | Gnd = Burst<br>Open = Continuous | Discrete input | 49 |
| ARINC/CSDB_Sel | A429/CSDB | Gnd = A429<br>Open = CSDB | Discrete input | 50 |
| Port_C_Sel | PORT_C | Gnd = Selected<br>Open = Not selected | Discrete input | 51 |
| RX_Comp_Disbl_Sel | RX_COMP | Gnd = Disabled<br>Open = Enabled | Discrete input | 52 |
| NC | | | | 53 |
| Mic_Audio_In | MIC_AUDIO | | Analog input | 54 |
| Port_A/B_Sel | PORT_A/B | Gnd = B<br>Open = A | Discrete input | 55 |
| Unit_ID_A_Sel | UID_A | See **Error! Reference source not found.** | Strap input | 56 |
| WOW_Sel | WOW | Gnd = Ground<br>Open = Air | Discrete input | 57 |
| (+27.5 Vdc) | | | Power | 58 |
| Power_Ground | | | Power | 59 |
| Chassis_Ground | | | Power | 60 |
| Data_Load_Enbl_Sel | DATALOAD | Gnd = Enabled<br>Open = Disabled | Discrete input | 61 |
| Unit_ID_B_Sel | UID_B | See **Error! Reference source not found.** | Strap input | 62 |
| Strap_Ground | | | Strap input | 63 |
| (+27.5 Vdc) | | | Power | 64 |
| Power_Ground | | | Power | 65 |
| Mic_Audio_Gnd | | | Return | 66 |

## VDL-2000

| Pin Name | Signal/Variable Name | Variable Setting/Contents | Signal Type | Pin Number |
|---|---|---|---|---|
| 429CMU_HS_IN_A_A | CMU_IN_A | | Differential HS ARINC 429 input | 36 |
| 429CMU_HS_IN_A_B | | | | 37 |
| 429MAINT_IN_A | MAINT_IN | | Differential HS ARINC 429 input | 1 |
| 429MAINT_IN_B | | | | 32 |
| 429_MAINT_HSOUT_A | MAINT_OUT | | Differential HS ARINC 429 output | 6 |
| 429_MAINT_HSOUT_B | | | | 7 |
| 429CMU_HS_OUT_A | CMU_OUT | | Differential HS ARINC 429 output | 5 |
| 429CMU_HS_OUT_B | | | | 22 |
| 429CMU_HS_IN_B_A | CMU_IN_B | | Differential HS ARINC 429 input | 28 |

| | | | | |
|---|---|---|---|---|
| 429CMU_HS_IN_B_B | | | | 2 |
| 422_DATA_IN_A | 422_DATA_IN | | Differential RS422 Input | 20 |
| 422_DATA_IN_B | | | | 21 |
| 422_DATA_OUT_A | 422_DATA_OUT | | Differential RS422 Output | 24 |
| 422_DATA_OUT_B | | | | 23 |
| RX_AUDIO_OUT | RX_AUDIO | | Analog output (100 mW) | 33 |
| SIDETONE_AUDIO_OUT | SIDETONE_AUDIO | | Analog output (100 mW) | 31 |
| AUDIO_OUT_RETURN | | | Return | 19 |
| SPARE_DISCRETE_IN | | | Discrete input | 13 |
| PTT_SEL | PTT_DISC | Gnd = Keyed<br>Open = Not Keyed | Discrete input | 35 |
| SCOM_CNTL_1_SEL | SIMULCOM_1 | See Simulcomm Strapping | Discrete input | 16 |
| SCOM_CNTL_2_SEL | SIMULCOM_2 | See Simulcomm Strapping | Discrete input | 34 |
| VOICE_DATA_SEL | V/D_DISC | Gnd = Data<br>Open = Voice | Discrete input | 17 |
| TX_MODE_IND | TX_MODE | Gnd = Transmit<br>Open = Receive | Discrete input | 3 |
| MIC_AUDIO_IN | MIC_AUDIO | | Analog input | 4 |
| WOW_SEL | WOW | Gnd = Ground<br>Open = Air | Discrete input | 14 |
| UNIT_SDI_A_SEL | UID_A | See Unit ID setting | Strap input | 15 |
| UNIT_SDI_B_SEL | UID_B | See Unit ID setting | Strap input | 18 |
| SYSTEM_ON_F | SYSTEM_ON_F | OPEN=OFF<br>0-7 VDC ON | Discrete input | 27 |
| DATALOAD_ENB_SEL | DATALOAD | Gnd = Enabled<br>Open = Disabled | Discrete input | 29 |
| (+28VDC_PRI_PWR_H_1) | | | 28VDC Power | 10 |
| (+28VDC_PRI_PWR_H_2) | | | 28VDC Power | 11 |
| (+28VDC_PRI_PWR_L_1) | | | 28VDC Power Return | 8 |
| (+28VDC_PRI_PWR_L_2) | | | 28VDC Power Return | 9 |
| CHASSIS_GROUND | | | Chassis Ground | 12 |
| MIC_AUDIO_GND | | | Return | 30 |
| NC_1 | | | No Connect | 26 |
| NC_2 | | | No Connect | 25 |

### Unit Simulcomm Strapping

| Simulcom_Cntl_1_Sel | Simulcom_Cntl_2_Sel | Threshold Level (dBm) |
|---|---|---|
| 0 (ground) | 0 (ground) | Attenuator Disabled (> 0 dBm) |
| 0 (ground) | 1 (open) | Programmable Value 1 (-10 dBm) |
| 1 (open) | 0 (ground) | Programmable Value 2 (-30 dBm) |
| 1 (open) | 1 (open) | Programmable Value 3 (-20 dBm) (preferred condition) |

Programmable values should be able to implement attenuation thresholds over the range of 0 - -30 dBm.

### SDI setting is defined as follows:

| UID B Discrete | UID A Discrete | Unit's SDI Setting |
|---|---|---|
| 0 | 0 | 11 (VHF 3) |
| 0 | 1 | 10 (VHF 2) |
| 1 | 0 | 01 (VHF 1) |
| 1 | 1 | 00 (VHF 4, if All Calls disabled) |

# Appendix C - VDL Mode 2 Operation

The BFR test message is a VDL Mode 2 message containing 249 application bytes. The message will also contain 6 Reed Solomon check bytes for a total of 255 bytes. The normal VDL preamble containing the following segments must also be contained in the message:

a) 12 bits (4 symbols) for transmitter power ramp up;
b) 48 bits (16 symbols) for synchronization
*c)* 3 bits as the reserved symbol
*d)* 17 bits transmission length
*e)* 5 bits header FEC.

Refer to DO-224A, “Signal-in-Space Minimum Aviation System Performance Standards (MASPS) for Advanced VHF Digital Data Communications Including Compatibility with Digital Voice Techniques”, September 13, 2000, for specific details on the composition of VDL Mode 2 message and waveform.

A suitable test message is shown in hex format as follows :

```
00000000h: 00 04 F0 37 18 FD F1 08 B3 E5 CD 2D 6C A0 5D 4C ;
00000010h: 1F DC E6 1D 92 97 3E 93 41 73 CC 2A 10 C7 1D 88 ;
00000020h: F9 05 92 BB 2F 22 A6 4C 1B FC DD F6 3A 00 97 6E ;
00000030h: CB C9 C6 61 DC 66 1E 3E C1 2F CE 5F 7B C7 A2 52 ;
00000040h: 90 71 0F D3 15 9B 11 58 E8 3A 51 11 D5 44 01 3A ;
00000050h: 6F 4B 93 BD 2D 1B 5C B4 2E EF 4A 17 CC D1 DF 8B ;
00000060h: C3 63 C9 4F 70 07 B8 AD 49 24 2C E0 91 DE E1 AA ;
00000070h: 56 83 F8 B3 B7 3C 86 64 64 53 88 22 F7 31 84 D2 ;
00000080h: F1 99 9E A1 02 98 C8 97 F7 4C 79 25 30 AF 46 8C ;
00000090h: 1E A7 19 1B 23 7B 58 27 F4 91 80 8B 17 62 F9 4C ;
000000a0h: CF CD ED F5 85 FA C2 36 07 17 28 B7 4A AF D7 23 ;
000000b0h: DD 03 E1 CF 11 C8 C5 F9 E5 EA 42 08 07 40 D7 82 ;
000000c0h: 1E E3 18 32 C9 3F D1 9F 51 08 3B 07 4C BC 21 3F ;
000000d0h: 7C F4 72 33 93 5E F5 9F A4 AC BC 5B C3 D9 FD BA ;
000000e0h: 45 10 3C AF 51 34 1F 33 00 A0 CF 37 FD 33 9E 70 ;
000000f0h: 44 43 F7 9D A2 B6 B2 1A 6E 33 9D C0 EF 9F E9 96 ;
00000100h: D2 21 E7 AB 9C DD 6F 65 C8 80 00                 ;
```

The message starts with 000 hex which is 12 bits (4 symbols) of constant signal which is the ramp up for VDL Mode 2.

For any transmit or receive tests in VDL Mode 2, the unit must first be placed in VDL Mode 2:

1) Ground the Voice/Data Discrete

2) Transmit 0008001D#, 8000235E# on CMU Port A input. This message must be sent at a rate of at least once a second to maintain VDL Mode 2 operation.

3) Monitor CMU output bus for a label 270 message. Bits 20 – 24 show the mode status of the radio, the status should be 0010.

4) Transmit 47000315# (ALO) on CMU Port A input.

5) Monitor CMU output bus for a label 270 message. Bits 20 – 24 show the mode status of the radio, the status should be 0110.

6) Transmit D2050015# (Mode_Set.request) on CMU Port A input.

7) Monitor CMU output bus for a label 270 message. Bits 20 – 24 show the mode status of the radio, the status should be 0111.

8) Transmit D201F115# (Pr_Set.request) on CMU Port A input.

9) Monitor CMU output bus for a label 270 message. Bit 11 should be set to 1 and Bit 14 11 should be set to 1 (Protocol Reset State).

10) Transmit one of the operating frequencies below on CMU Port A input.

11) Monitor CMU output bus for a label 270 message. Bit 11 should be set to 0 and Bit 14 11 should be set to 1 (Protocol Set State).

**To set desired operating frequency in transmit and receive send the following message on the CMU Port A input for the desired frequency:**

a) 118.000 MHz command words:

| | | | | | | |
|---|---|---|---|---|---|---|
| AF040715# | 020F115# | 1207015# | 84000015# | 00100115# | 99000015# | B18CC815# |

b) 118.425 MHz command words:

| | | | | | | |
|---|---|---|---|---|---|---|
| AF040715# | 0020F115# | 81207015# | 04002A15# | 00100115# | 99000015# | 3120A615# |

c) 119.425 MHz command words:

| | | | | | | |
|---|---|---|---|---|---|---|
| AF040715# | 0020F115# | 01307015# | 04002A15# | 00100115# | 99000015# | B1BF7315# |

d) 120.425 MHz command words:

| | | | | | | |
|---|---|---|---|---|---|---|
| AF040715# | 0020F115# | 81407015# | 04002A15# | 00100115# | 99000015# | 31786B15# |

e) 121.425 MHz command words:

| | | | | | | |
|---|---|---|---|---|---|---|
| AF040715# | 0020F115# | 01507015# | 04002A15# | 00100115# | 99000015# | B1E7BE15# |

f) 122.425 MHz command words:

| | | | | | | |
|---|---|---|---|---|---|---|
| AF040715# | 0020F115# | 01607015# | 04002A15# | 00100115# | 99000015# | B14FD015# |

g) 123.425 MHz command words:
AF040715# 0020F115# 81707015# 04002A15# 00100115# 99000015# 31D00515#

h) 124.425 MHz command words:
AF040715# 0020F115# 81807015# 04002A15# 00100115# 99000015# 31C9F115#

i) 125.425 MHz command words:
AF040715# 0020F115# 01907015# 04002A15# 00100115# 99000015# B1562415#

j) 126.000 MHz command words:
AF040715# 0020F115# 01A07015# 84002A15# 00100115# 99000015# 31522415#

k) 126.425 MHz command words:
AF040715# 0020F115# 01A07015# 04002A15# 00100115# 99000015# B1FE4A15#

l) 127.425 MHz command words:
AF040715# 0020F115# 81B07015# 04002A15# 00100115# 99000015# 31619F15#

m) 128.425 MHz command words:
AF040715# 0020F115# 01C07015# 04002A15# 00100115# 99000015# B1A68715#

n) 129.425 MHz command words:
AF040715# 0020F115# 81D07015# 04002A15# 00100115# 99000015# 31395215#

o) 130.425 MHz command words:
AF040715# 0020F115# 81E07015# 04002A15# 00100115# 99000015# 31913C15#

p) 131.425 MHz command words:
AF040715# 0020F115# 01F07015# 04002A15# 00100115# 99000015# B10EE915#

q) 132.425 MHz command words:
AF040715# 0020F115# 02007015# 04002A15# 00100115# 99000015# B1C15715#

r) 133.425 MHz command words:
AF040715# 0020F115# 82107015# 04002A15# 00100115# 99000015# 315E8215#

s) 134.425 MHz command words:
AF040715# 0020F115# 82207015# 04002A15# 00100115# 99000015# 31F6EC15#

t) 135.425 MHz command words:
AF040715# 0020F115# 02307015# 04002A15# 00100115# 99000015# B1693615#

u) 136.425 MHz command words:
AF040715# 0020F115# 82407015# 04002A15# 00100115# 99000015# 31AE2115#

v) 136.975 MHz command words:
AF040715# 0020F115# 82407015# 04002A15# 00100115# 99000015# 3181D515#

**To verify receipt of a message transmited to UUT by a VDL Mode 2 signal generator:**

1) Send address request message after sending the frequency request :

2F 04 09 15# 80 22 F1 15# 00 10 D0 15# 05 55 55 15# 8F E5 55 15# 8E FE FE 15# 0F EF 2F 15#
1B FE FE 15# 31 D3 11 15#

2) Transmit VDL Mode 2 test message and monitor CMU output port for Label 304. Bytes 5 & 6 should have data 51# & F1# respectively to indicate a message was just received by UUT.

**To Transmit the VDL Mode 2 test message from the UUT send the following message on the CMU Port A input to transmit a single message:**

AF446615# 8021F115# 000F5015# 05555515# 05555515# 05555515# 03055515#
01303115# 83332315# 86353415# 03837315# 82413915# 04443415# 8D464515#
0300A015# 01303115# 83332315# 86353415# 03837315# 82413915# 04443415#
8D464515# 0300A015# 01303115# 83332315# 86353415# 03837315# 82413915#
04443415# 8D464515# 0300A015# 01303115# 83332315# 86353415# 03837315#
82413915# 04443415# 8D464515# 0300A015# 01303115# 83332315# 86353415#
03837315# 82413915# 04443415# 8D464515# 0300A015# 01303215# 83332315#
86353415# 03837315# 82413915# 04443415# 8D464515# 0300A015# 01303215#
83332315# 86353415# 03837315# 82413915# 04443415# 8D464515# 0300A015#
01303215# 83332315# 86353415# 03837315# 82413915# 04443415# 8D464515#
0300A015# 01303215# 83332315# 86353415# 03837315# 82413915# 04443415#
8D464515# 0300A015# 01303215# 83332315# 86353415# 03837315# 82413915#
04443415# 8D464515# 0300A015# 81303315# 83332315# 86353415# 03837315#
82413915# 04443415# 8D464515# 0300A015# 81303315# 03E32315# 8E3E3E15#
03E3E315# 8D3E3E15# 9A00A015# 3138B415#