

PRODUCTION TEST REQUIREMENTS – EXHIBIT N

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

CPN: 827-4660-001

DP-XX-YY

DEP- 005

1 OCT 2001

NOTICE: The contents of this document are proprietary to Rockwell Collins, Inc. and shall not be disclosed, disseminated, copied, or used except for purposes expressly authorized in writing by Rockwell Collins, Inc.

Rockwell Collins, Inc.
Cedar Rapids, Iowa 52498 USA

CAGEC: 4V792

Notices and Signatures

	Name	Signature / Date
Prepared By:		
Project Engineer	K.H. Hamby	
Approved By:		

Revision History

<u>Version</u>	<u>Document Date</u>	<u>Originator</u>	<u>Reason for Change</u>
	14 Feb 01	KKH	DEP-002
	4 May 01	KKH	DEP-003
	15 Aug 01	KKH	DEP-004
	1 Oct 01	FJS	DEP-005

Review History

<u>Version</u>	<u>Document Date</u>	<u>Reviewer</u>
----------------	----------------------	-----------------

TABLE OF CONTENTS

Notices and Signatures	2
Revision History	3
Review History.....	4
TABLE OF CONTENTS	5
1. Scope.....	8
2. Reference Information.....	8
2.1 Specifications	8
2.2 Drawings	8
2.2.1 VHF-4000	8
2.2.2 VDL-2000.....	8
2.3 Operating Frequencies VS ICAO Channel Designators	8
3. Test Equipment Required.....	9
4. Test Conditions	9
4.1 Temperature.....	9
4.2 Humidity	9
4.3 Warm-up and Initialization	9
4.4 Atmospheric Pressure.....	9
4.5 Transmit Duty Cycle.....	10
5. Test Definitions and Information.....	10
5.1 Standard Discrete Configuration.....	10
5.2 Standard RF Generator Configuration.....	10
5.3 Standard ARINC 429 Bus/Data Configurations.....	11
5.3.1 Standard Control Data Configurations.....	11
5.3.2 Standard Data Configurations.....	11
5.4 Test Sequence	11
6. Alignment.....	12
6.1 Software Load Procedure	12
6.2 Calibration and TFM Parameters.....	12
6.2.1 Initialization of Calibration Parameters	12
6.2.2 Initialization of TFM Parameters	13
6.3 Alignment Procedures.....	14
6.3.1 Receiver Analog Audio Output Level (VHF4000 Only) [Rx Cal]	14
6.3.2 Selcal Audio Output Level (VHF4000 Only) [Rx Cal]	15
6.3.3 Voice Carrier Null [Tx TFM].....	15
6.3.4 Voice/Analog Data Bias Adjustment [Tx TFM]	15
6.3.5 +28 V Transmitter Phasing Adjustment [Tx TFM]	15
6.3.6 +20 V Transmitter Phasing Adjustment [Tx TFM]	16
6.3.7 Preselector Adjustments [Rx Cal]	16
6.3.8 Analog Voice/Data Unmodulated Transmitter RF Power [Tx TFM]	16
6.3.9 Simulcomm 0 Adjustment (-20 dBm threshold) [Rx TFM].....	17
6.3.10 Simulcomm 1 Adjustment (-10 dBm threshold) [Rx TFM].....	17
6.3.11 Analog Voice/Data Transmitter Modulation [Tx TFM]	17
6.3.12 Simulcomm 2 Adjustment (0 dBm threshold) [Rx TFM].....	17
6.3.13 Analog and Digital Sidetone Levels [Tx Cal].....	18

6.3.14	Squelch Adjustment	18
6.3.15	Mode A Alignment (Units/w Mode A Option Only).....	19
6.3.16	Mode 2 Alignment (Units/w Mode 2 Option Only)	19
6.3.17	Mode 2 AGC Calibration	20
6.3.18	Flash Update	20
7.	Final Test Requirements	20
7.1	Power Supplies	21
7.1.1	Current Drain at 27.5 Vdc	21
7.1.2	Current Drain at 18.0 Vdc	21
7.1.3	Internal Power Supplies	21
7.2	Voice/Analog Data Mode Tests	21
7.2.1	Voice/Analog Data Receiver Tests	21
7.2.2	Voice/Analog Data Mode Transmitter Tests	30
7.2.3	Data Bus Operation.....	37
7.2.4	429_Input_Port_C, Port_C_Sel, Unit_SDI_A_Sel, and Unit_SDI_B_Sel(VHF-4000 only)	37
7.2.5	429_MAINT_HS_IN	38
7.2.6	429_MAINT_HS_OUT	38
7.2.7	CSDB_IN and CSDB_OUT (VHF-4000 only)	38
7.2.8	422_DATA_OUT and 422_DATA_IN (VDL-2000 only)	38
7.3	Discrete I/O Tests	38
7.3.1	TX_MODE_IND.....	38
7.3.2	Data_Load_Enbl_Sel	38
7.3.3	WOW_Sel.....	39
7.3.4	Burst_Tune_Sel.....	39
7.3.5	Voice/Data_Sel.....	39
7.3.6	RX_Comp_Disbl_Sel (VHF4000 Only)	39
7.3.7	RIU_Installed_Sel (VHF-4000 only).....	39
7.3.8	All_Call_Disable_Sel (VHF-4000 only)	39
7.3.9	SIMULCOM_CNTL_1_SEL	39
7.3.10	SIMULCOM_CNTL_2_SEL	39
7.3.11	SYSTEM_ON_F (VDL-2000 only)	40
7.4	ARINC 429 I/O Tests (VHF4000 Only!).....	40
7.4.1	VHF ARINC 429 Low Speed Output Port 1	40
7.4.2	VHF ARINC 429 Low Speed Output Port 2	41
7.4.3	VHF ARINC 429 High Speed Output Port 1	42
7.4.4	VHF ARINC 429 High Speed Output Port 2	43
7.5	Selftest (VHF4000 Only).....	44
7.6	Vibration (Perform on a sample basis only!)	44
7.7	Talk Out/Voice (Perform on a sample basis only!).....	44
7.8	Mode A Tests (Units/w Mode A Option Only).....	44
7.9	Mode 2 Tests (Units/w Mode 2 Option Only)	44
7.9.1	Load application Software (CPN: 822-1468-985 Only)	44
7.9.2	Mode 2 Receiver Tests (Units/w Mode 2 Option Only)	44
7.9.3	Mode 2 Transmitter Tests	45
8.	Temperature Testing	46
8.1	Selftest (VHF4000 Only, Performed during the rapid cycle portion of ESS).....	46
8.2	Parametric Tests (VHF4000 Only, performed during the extended dwell portions of ESS)	47
8.2.1	Receiver:.....	47

8.2.2 Transmitter:..... 47

Appendix A Alignment Formats 49

Appendix B Rear Connector Pins by Function 54

Appendix C - VDL Mode 2 Operation 58

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_Sel	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 (squench 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 (squench 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 unmute 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 unmute 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 unmute 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 unmute 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 $7.75 \text{ Vrms} \pm 0.1 \text{ Vrms}$.
- 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 $500 \text{ mVrms} \pm 25 \text{ mVrms}$.
- 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 $1500 \text{ ma} \pm 50 \text{ ma}$ over the original value.
- 8) Adjust TFM parameter #12 until the current increases by an additional $500 \text{ ma} \pm 50 \text{ ma}$ 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 $27.5 \pm 0.2 \text{ Vdc}$.
- 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:

$$\begin{aligned} Q \text{ bits} &= ((1.25 \times \sin(\text{Angle}) + 1.25)) / (2.5/4095) \\ I \text{ bits} &= ((1.25 \times \cos(\text{Angle}) + 1.25)) / (2.5/4095) \end{aligned}$$

- 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:

$$\begin{aligned} Q \text{ bits} &= ((1.25 \times \sin(\text{Angle}) + 1.25)) / (2.5/4095) \\ I \text{ bits} &= ((1.25 \times \cos(\text{Angle}) + 1.25)) / (2.5/4095) \end{aligned}$$

- 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 $\pm$ 50 mA over the original value.
- 8) Adjust TFM parameter #14 until the current increases by an additional 1500 mA $\pm$ 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 $+18 \pm 0.2$ 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 $+27.5 \pm 0.1$ 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) 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: $< \pm 20$ 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: $\leq 5\%$

CMM Limit: Audio distortion: $\leq 7\%$

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: $\geq 83\%$ but LT 100%.

CMM Limit: $\geq 70\%$ 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: $\leq 7\%$ distortion.

CMM Limit: $\leq 10\%$ 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: $\leq 5\%$ distortion.

CMM Limit: $\leq 7\%$ 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: $\leq 7\%$.

CMM Limit: $\leq 10\%$.

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 $+18 \pm 0.2$ 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.
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 (UNITSW 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 ≤ 6%.
CMM Limit: EVM ≤ 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: $\leq 5\%$

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: $\leq 5\%$ 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: $\geq 70\%$ 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	<table><tr><td><u>31</u></td><td><u>30</u></td><td><u>Definition</u></td></tr><tr><td>0</td><td>0</td><td>Software Version Request (Deactivated in VHF-4000)</td></tr><tr><td>0</td><td>1</td><td>Memory Access Request (Program, Data, or Serial EEPROM)</td></tr><tr><td>1</td><td>0</td><td>Alignment Data Request</td></tr><tr><td>1</td><td>1</td><td>Diagnostic Data Request</td></tr></table>	<u>31</u>	<u>30</u>	<u>Definition</u>	0	0	Software Version Request (Deactivated in VHF-4000)	0	1	Memory Access Request (Program, Data, or Serial EEPROM)	1	0	Alignment Data Request	1	1	Diagnostic Data Request
<u>31</u>	<u>30</u>	<u>Definition</u>															
0	0	Software Version Request (Deactivated in VHF-4000)															
0	1	Memory Access Request (Program, Data, or Serial EEPROM)															
1	0	Alignment Data Request															
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.

[illegible]

Request Type (Bits 31-30)	Sequence Number (Bits 29-28)	Request Parameters (Bits 27-9)	Contents
		27-25	Reads/Writes: This word is not provided. Unused
10 Alignment Data	00	16-9	If bits 20-17 = 1, 2, 3, 4 or 5 hex: Alignment Parameter Code (see table of Alignment Parameter Codes below) If bits 20-17 = B or C: 1st (i.e., most significant) digit of desired Installed Service Bulletin (ISO 5 character) Otherwise: Unused
		20-17	Requested Alignment Operation Code: 0 hex : Mode Change (see Bits 24, 25, 26 and 27) 1 hex : Accept Value as Alignment Working Value 2 hex : Store Alignment Working Value in FLASH 3 hex : Read Alignment Working Value 4 hex : Store TFM Value for Given Temperature Zone in FLASH 5 hex : Read FLASH TFM for Given Temperature Zone 6 hex : Start Duty Cycle Pulse 7 hex : Stop Duty Cycle Pulse 8 hex : Start Single Side Band 9 hex : Stop Single Side Band A hex : Clear All Archived Fault Records B hex : Add Installed Service Bulletin C hex : Remove Installed Service Bulletin D hex : Spare (Unused) E hex : Spare (Unused) F hex : Spare (Unused)
		22-21	If bits 20-17 = 4 or 5 hex: Temperature Zone for TFM matrix FLASH storage Otherwise: 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 Requested Alignment Operation Code (bits 20-17) of 1 hex or 4 hex: Value to use as "Alignment Working Value" or as "TFM for Temp Zone" (bit 9 is LSB) If previous Label 277 word was an Alignment Data Request with a Sequence Number of 00 and a Requested Alignment Operation Code (bits 20-17) of B hex or C hex: 2nd (least significant) digit of desired Installed Service Bulletin (ISO 5 char in bits 16-9, zeros in bits 24-17) Otherwise : This word is not provided. 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) 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 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 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 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 Open = Receive	Discrete output	47
NC				48
Burst_Tune_Sel	CONT/BURST	Gnd = Burst Open = Continuous	Discrete input	49
ARINC/CSDB_Sel	A429/CSDB	Gnd = A429 Open = CSDB	Discrete input	50
Port_C_Sel	PORT_C	Gnd = Selected Open = Not selected	Discrete input	51
RX_Comp_Disbl_Sel	RX_COMP	Gnd = Disabled Open = Enabled	Discrete input	52
NC				53
Mic_Audio_In	MIC_AUDIO		Analog input	54
Port_A/B_Sel	PORT_A/B	Gnd = B 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 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 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 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 Open = Voice	Discrete input	17
TX_MODE_IND	TX_MODE	Gnd = Transmit Open = Receive	Discrete input	3
MIC_AUDIO_IN	MIC_AUDIO		Analog input	4
WOW_SEL	WOW	Gnd = Ground 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 0-7 VDC ON	Discrete input	27
DATALOAD_ENB_SEL	DATALOAD	Gnd = Enabled 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 transmitted 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#			