

BOM with References

<u>Assembly</u>	<u>Description</u>	<u>Rev</u>						<u>Stock UOM</u>
2020671-01	PCB ASSY,XCVR,4.3GHZ	8						EA
Item	Component and Description	Rev	Qty Per	UOM	Obs. Date	Eff. Date	ISC	
001	4104999-00 RES,SMD,49.9,1/10W,1%,0603 <u>Reference Designators:</u> R1,R2,R15		3.0000	EA			B	
002	4101002-00 RES,SMD,10.0K,1/10W,1%,0603 <u>Reference Designators:</u> R3,R8,R18		3.0000	EA			B	
003	4105112-00 RES,SMD,51.1K,1/10W,1%,0603 <u>Reference Designators:</u> R4		1.0000	EA			B	
004	4101001-00 RES,SMD,1.00K,1/10W,1%,0603 <u>Reference Designators:</u> R5		1.0000	EA			B	
005	4101500-00 RES,SMD,150,1/10W,1%,0603 <u>Reference Designators:</u> R6		1.0000	EA			B	
006	4040100-00 RES,SMD,1/2W,5%,10 <u>Reference Designators:</u> R7		1.0000	EA			B	
007	4321509-00 RES,SMD,15.0,1/16W,1%,0402 <u>Reference Designators:</u> R9,R10		2.0000	EA			B	
008	4323329-00 RES,SMD,33.2,1/16W,1%,0402 <u>Reference Designators:</u> R11		1.0000	EA			B	
009	4322210-00 RES,SMD,221,1/16W,1%,0402 <u>Reference Designators:</u> R12		1.0000	EA			B	
010	4324751-00 RES,SMD,4.75K,1/16W,1%,0402 <u>Reference Designators:</u> R13,R14		2.0000	EA			B	
011	4102103-00 RES,SMD,210K,1/10W,1%,0603 <u>Reference Designators:</u> R16		1.0000	EA			B	
012	4106342-00 RES,SMD,63.4K,1/10W,1%,0603 <u>Reference Designators:</u> R17		1.0000	EA			B	
013	4040150-00 RES,SMD,1/2W,5%,15 <u>Reference Designators:</u> R19		1.0000	EA			B	
020	2220150-00 CAP,SMD,NPO,15PF,50V,5%,0603 <u>Reference Designators:</u> C1,C2		2.0000	EA			B	
021	2220829-00 CAP,SMD,NPO,8.2PF,50V,5%,0603 <u>Reference Designators:</u> C3		1.0000	EA			B	
022	2220479-00 CAP,SMD,NPO,4.7PF,50V,5%,0603 <u>Reference Designators:</u> C4		1.0000	EA			B	
023	2220102-00 CAP,SMD,NPO,.001,25V,5%,0603 <u>Reference Designators:</u> C5,C6		2.0000	EA			B	
024	2220103-00 CAP,SMD,X7R,0.01UF,50V,10%,0603 <u>Reference Designators:</u> C7,C8,C18,C21		4.0000	EA			B	
025	2220089-00 CAP,SMD,PORC,0.8PF,250V,2%,0603 <u>Reference Designators:</u> C9		1.0000	EA			B	
026	2220339-00 CAP,SMD,NPO,3.3PF,50V,5%,0603 <u>Reference Designators:</u> C10		1.0000	EA			B	

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2020671-01		PCB ASSY,XCVR,4.3GHZ		8	EA		
Item	Component and Description	Rev	Qty Per	UOM	Obs. Date	Eff. Date	ISC
027	2220331-00 CAP,SMD,NPO,330PF,50V,5%,0603 <u>Reference Designators:</u> C11,C12		2.0000	EA			B
028	2220225-00 CAP,SMD,X5R,2.2UF,16V,20%,0603 <u>Reference Designators:</u> C13		1.0000	EA			B
030	2220100-00 CAP,SMD,NPO,10PF,50V,5%,0603 <u>Reference Designators:</u> C15,C22		2.0000	EA			B
031	2220104-00 CAP,SMD,X7R,0.1UF,25V,10%,0603 <u>Reference Designators:</u> C16,C17		2.0000	EA			B
032	2130106-16 CAP,SMD,20%,TANT,16V,10UF,CASEA <u>Reference Designators:</u> C19,C20		2.0000	EA			B
033	2130336-17 CAP,SMD,10%,TANT,16V,33UF,CASEB <u>Reference Designators:</u> C14		1.0000	EA			B
040	4730076-00 XSTR,SMD,NE3210S01,HJ FET,LOW NOISE <u>Reference Designators:</u> Q1		1.0000	EA			B
041	4730032-00 XSTR,SMD,POWER,NPN,MJD112 <u>Reference Designators:</u> Q2		1.0000	EA			B
042	4730042-00 XSTR,SMD,MMBT3906LT,PNP,GP <u>Reference Designators:</u> Q3		1.0000	EA			B
045	2740024-00 DIODE,SMD,MMBZ5232BLT1,ZENER,5.6V <u>Reference Designators:</u> D1		1.0000	EA			B
050	3710002-00 ATTEN,SMD,2DB,0805 <u>Reference Designators:</u> ATN1		1.0000	EA			B
057	3170405-00 IC,SMD,HMC326MS8G,DRIVER AMP,,3-4.5GHZ <u>Reference Designators:</u> U2		1.0000	EA			B
058	3170807-00 IC,SMD,MCA1-85+,2800 TO 8500 MHz,WB,BLUE CELL,ROF <u>Reference Designators:</u> U3		1.0000	EA			B
059	3170552-00 IC,SMD,ADP3334AR,ADJ LO DROPOUT VOLT REG <u>Reference Designators:</u> U4		1.0000	EA			B
059	3530176-00 IND,SMD,4.7NH,5%,0603CS <u>Reference Designators:</u> L1,L2		2.0000	EA			B
060	3530279-00 IND,SMD,MAG SHIELD,47UH,+/-20%,ROHS <u>Reference Designators:</u> L3		1.0000	EA			B
065	2030482-00 PUR ASSY,ISOLATOR,DROP-IN,4.2 TO 4.4 GHZ <u>Reference Designators:</u> ISO1,ISO2		2.0000	EA			B
070	2050012-01 COMP ASSY,VTO-4300-05T1 <u>Reference Designators:</u> U1	1	1.0000	EA			M
995	5950671-01 PCB A/W,XCVR,4.3GHZ	5	0.0001	EA			N
996	5260671-01 PCB FAB,XCVR,4.3GHZ	5	1.0000	EA			B
997	5500671-01 PCB S/D,XCVR,4.3GHZ	5	0.0001	EA			N
999	8000671-01 DWG,PCB ASSY,XCVR,4.3GHZ	5	0.0001	EA			N

Appendix F: Alignment/Tune Up Procedure

Please refer to the following pages.



FINAL TEST PROCEDURE
FOR
FREEFLIGHT SYSTEMS
RA-4000 SERIES RADAR ALTIMETERS

Prepared:	<u> N.ASTON </u>	<u> 12/12/2008 </u>
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REVISION HISTORY

DATE	REV	DESCRIPTION	AUTHOR
08/21/2008	A	Initial Release	Christian Eheim
11/20/2008	B	Modified per PR 3366 and PR 3367	Christian Eheim

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1. Introduction

This document is the Final Test Procedure for FreeFlight Systems RA-4000 Series Radar Altimeters, hereafter referred to as either the "Radar Altimeter" or UUT, or as the model, such as RA-4000 or RA-4500, if the test only applies to one specific model. It is to be used for new production units as well as repair.

2. Required Equipment

The following test equipment is required:

1. UUT FFS P/N 84560-01 or FFS P/N 84560-02
2. Phase Matrix Altitude Simulator RAS-4300-U1 or equivalent
Attenuators:
 - Qty 2, fixed 20 dB
 - Qty 2, fixed 10 dB
 - Qty 1, fixed 6 dB
 - Qty 1, variable 20 dB
3. Qty 2 – 150" of RG-142 antenna cables, P/N 1900-0432-12
4. RS-485/422 to RS-232 adapter
5. RTX Systems SPA Adapter, P/N RTX-429/SPA3-2T2R*
6. DB-9 to DB-25 pin serial cable
7. PC with at least two serial ports, with the following software applications:
 - RAMS.exe Radar Altimeter Monitoring Software version 01.04 or later
 - Flash Magic Radar Altimeter Programming Software 1.65
 - RASCAN Radar Altimeter Burn-In Software version 01.00 or later
 - VORTEX* ARINC 429 Test Software version 1.30 or later
8. Radar Altimeter Test Set, P/N 84648-00
9. Final test harness, P/N 84649-00
10. Programming Cable, P/N 84898-01
11. Spectrum Analyzer (with a frequency range from 3 to 4.5GHz or greater)
12. Power meter (with a frequency range of 0 to 5GHz and power range of 0 to 120mW or higher)
13. Volt meter
14. Oscilloscope
15. 28 VDC power supply
16. Variable Resistor Test Fixture
17. Frequency counter
18. Return loss test fixture, P/N 84893-00 or equivalent
19. RF short SC2133 or equivalent
20. 50 Ohm terminator
21. Temperature chamber: Russell's #RB2-03-03 or equivalent

* Only required if UUT is a model RA-4500 radar altimeter.

4. Setup

Mount all the circuit card assemblies under test on the test fixture as shown in Figure 1.

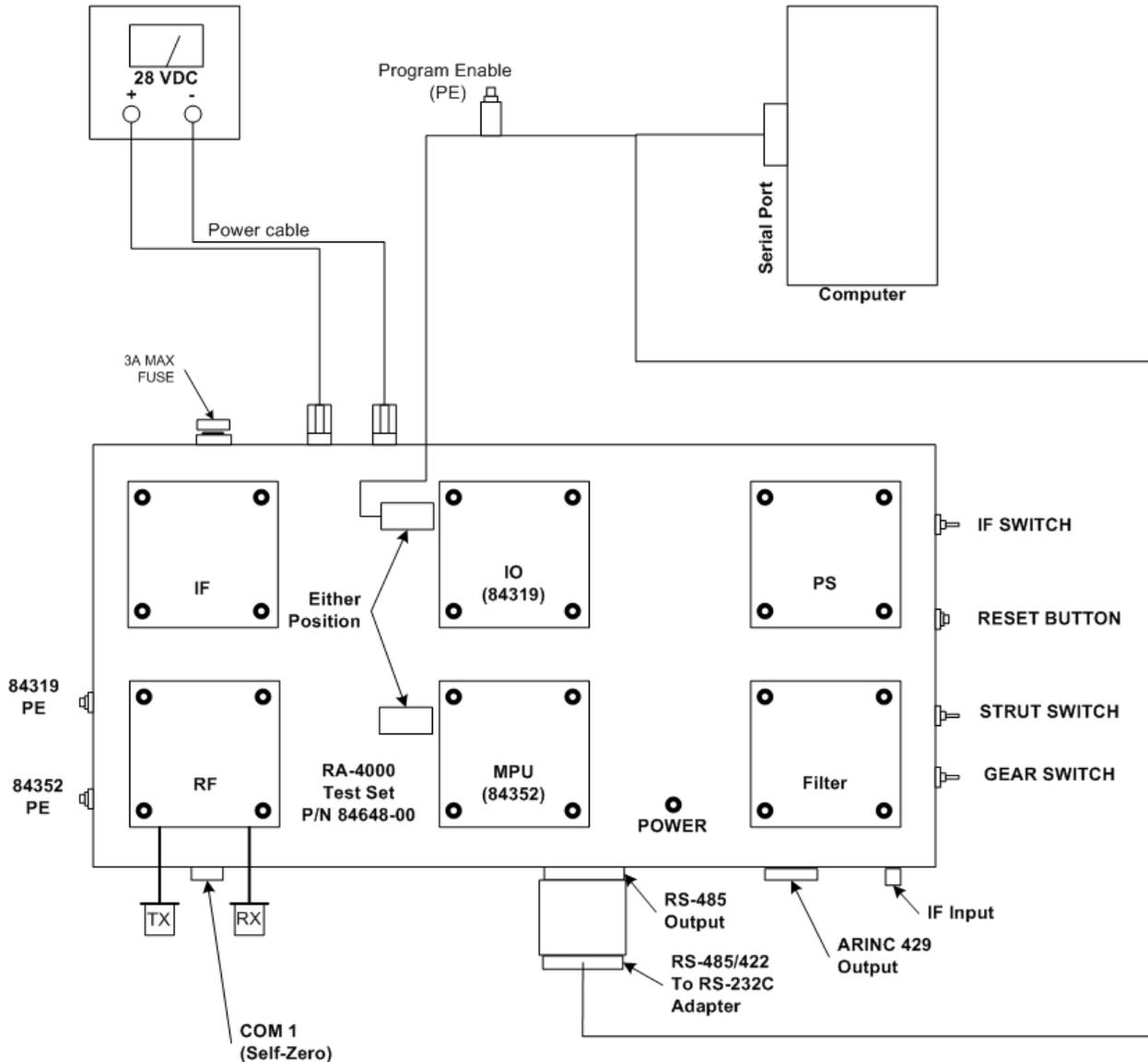


Figure 1: Test Fixture 84648-00

Connect COM1 on the test fixture to a com port (COM1 or any other available port) on the PC using a RS-232 serial cable.

Connect the 28 VDC power supply to Test Fixture P/N 84648-00.

5. Test Procedure

Perform each step as directed then enter data or initial the test data sheet in Appendix A to indicate the step was completed successfully.

NOTE – Unless otherwise noted the following test procedures assume that the altitude simulator is connected using two 12.5 ft RG-142 coaxial cables, that the altitude is set to 100 ft and that the variable attenuator is set to 0 dB.

5.1. Power

Step	Action	Pass Criteria
1.a	Turn power supply ON.	n/a
1.b	Measure the supply current. Record the current on the test data sheet.	Current \leq 500 mA
1.c	Measure the voltage on pin 15 on J202. Record the voltage on the test data sheet.	15 \pm 0.3 VDC
1.d	Measure the voltage on pin 10 on J202. Record the voltage on the test data sheet.	10 \pm 0.1 VDC
1.e	Measure the voltage on pin 14 on J202. Record the voltage on the test data sheet.	5 \pm 0.1 VDC
1.f	Measure the voltage on pin 17 on J402. Record the voltage on the test data sheet.	-3 \pm 0.5 VDC

5.2. Programming Procedure

Step	Action	Pass Criteria
2.a	<p>Launch FlashMagic.exe on PC. Configure FlashMagic as follows:</p> <p><i>Section 1</i></p> <p>Com port: com 1 (or port UUT is connected to) Baud rate: 19200 Device: XA-G49 Osc. Freq.: 25.000000</p> <p><i>Section 2</i></p> <p>Erase all flash + Security "is checked"</p> <p><i>Section 4</i></p> <p>Nothing checked.</p>	n/a
2.b	<p>To program the MPU:</p> <p>Power off UUT. Connect programming harness between UUT and PC. Power on UUT. Press and hold the PE button located in the programming harness. While holding PE button, press and release the reset button. Release the PE button.</p> <p>In FlashMagic <i>Section 3</i>, select the appropriate MPU file (see work order and Table 1). Click start on FlashMagic <i>Section 5</i> to begin programming.</p> <p>If FlashMagic reports "Unable to read security bits...", repeat the reset sequence using the PE button, then click "Retry". If the error message persists, verify 5 VDC is present at 84352-XX J402, pin 14 and that the 25 MHz clock at 84352-XX X401 is working properly. If 5 VDC is not present, troubleshoot problem in power supply. If 5VDC and the 25 MHz clock signal are present, replace the processor located at U402 on 84352-XX.</p> <p>(Programming will take about 1 minute.)</p> <p>When programming is complete, power off the UUT, and remove the programming cable.</p>	n/a
2.c	<p>To program the IO:</p> <p>Connect the programming harness to the IO card. Repeat Step 3.a above with the appropriate IO file (see work order and Table 1).</p>	n/a

Step	Action	Pass Criteria
	<p>If an error message persists, verify 5 VDC is present at 84319-XX J302, pin 5 and that the 25 MHz at 84319-XX X302 clock is working properly. If 5 VDC is not present, troubleshoot problem in power supply. If 5VDC and the 25 MHz clock signal are present, replace the processor located at U313 on 84319-XX.</p>	
2.d	<p>Connect PC serial port cable to COM 1. Connect adapter to Test Fixture (P/N 84648-00, Figure 1) and launch RAMS.exe (Radar Altimeter Monitoring Systems) on PC.</p> <p>Press “F5” to clear the calibration table. If the FLASH read/write failure was posted it should be cleared.</p>	n/a
2.e	<p>Press “i” key for the software info and A/D data.</p>	n/a
2.f	<p>Verify MPU version, build, and CRC</p> <p>Record the CRC on the test data sheet.</p>	see Table 1
2.g	<p>Verify IO version, build, and CRC</p> <p>Record the CRC on the test data sheet.</p>	see Table 1
2.h	<p>On the RAMS display, verify A/D 15V</p> <p>If an out of tolerance condition is seen, use a voltmeter to directly measure 15 volts. Replace the 15V DC/DC converter at M201 on 84249-XX, if necessary.</p> <p>Record the value on the test data sheet.</p>	A/D 15V = [D8 to F0]
2.i	<p>On the RAMS display, verify A/D 10V</p> <p>If an out of tolerance condition is seen, use a voltmeter to directly measure 10 volts. Replace the 10V regulator at U202 on 84249-XX, if necessary.</p> <p>Record the value on the test data sheet.</p>	A/D 10V = [BA to F1]
2.j	<p>On the RAMS display, verify A/D TEMP.</p> <p>Record the value on the test data sheet.</p>	A/D TEMP = [9E to BB]

5.3. Sweep Frequency

Step	Action	Pass Criteria
3.a	Attach the frequency counter or oscilloscope to TP406 on the 84352-XX board.	n/a
3.b	Adjust R446 to 100 Hz (± 1 Hz). Record the frequency on the test data sheet.	Freq. = 100 ± 1 Hz
3.c	In RAMS push 'w'. Adjust R446 until SWP is 0 ± 1 . Record the SWP value on the test data sheet.	SWP = 0 ± 1

5.4. Sweep Linearity

Step	Action	Pass Criteria
4.a	Execute RAMS on the PC. Connect the altitude simulator and set it to 100 feet. Turn attenuator to 0 dB. (If using bulk delay devices connect 25 feet of cable, a 100 ft delay, 46 dB of fixed attenuation, and a 20-dB variable attenuator.)	n/a
4.b	In RAMS, set the UUT in MPU verbose mode by pressing 'v'	n/a
4.c	In RAMS, observe the "sweep linearity meter" $\langle +0.9\% \rangle$ $[\dots * \dots]$ Verify that the asterisk is in the center of the meter and that the percentage is within $\pm 5\%$. If not, refer to Appendix B for the adjustment procedure. Record the linearity percentage on the test data sheet.	Linearity within $\pm 5\%$

5.5. Sweep Bandwidth and PLL

Step	Action	Pass Criteria
5.a	Couple a spectrum analyzer to the unit's "TX" output port found on the RF assembly.	n/a
5.b	Observe the RF output on the spectrum analyzer and verify that the sweep frequency has a 100 ± 2 MHz bandwidth. If not, refer to Appendix C for the adjustment procedure. Record the sweep width on the test data sheet.	100 ± 2 MHz
5.c	On the 84352-XX board, adjust R468 to set the high frequency limit to 4.350 ± 0.001 GHz. Record the high frequency on the test data sheet.	4.350 ± 0.001 GHz
5.d	Verify that the low frequency limit is set to 4.250 ± 0.003 GHz. Record the low frequency on the test data sheet.	4.250 ± 0.003 GHz

5.6. Power Output

Step	Action	Pass Criteria
6.a	Couple a power meter to the unit's "TX" output port found on the RF assembly.	n/a
6.b	Verify the power output is 100 mW (± 10 mW). If not, refer to Appendix D for tuning instructions. Record the output power on the test data sheet.	Power = 100 ± 10 mW

5.7. IF DC Balance

Step	Action	Pass Criteria
7.a	Set the IF output DC balance by first shorting TP501 on 84442 board to ground using a jumper wire (not tweezers!). NOTE: Do not ground TP501 for an extended period of time.	n/a
7.b	On 84442-XX board, adjust R521 to measure a 30 mV (± 1 mV) at TP402 on 84352 board. Record the DC balance voltage on the test data sheet.	TP402 = 30 ± 1 mV
7.c	Disconnect delay lines (or simulator) from both the RX and TX connectors on the RF board. Adjust the IF gain potentiometer, R522 on 84442 board all the way clockwise. Verify a 135 mV maximum reading at TP402 on 84352. Record the output power on the test data sheet.	TP402 < 135 mV

5.8. Lock Threshold

Step	Action	Pass Criteria
8.a	Execute RAMS on the PC. Press "v" on the PC keyboard to put the UUT into MPU verbose mode. Connect the altitude simulator and set it to 2000ft. Turn attenuator to 24 dB.	n/a

Step	Action	Pass Criteria
	(If using bulk delay devices connect 25 feet of cable, a 2000 ft delay, 60 dB of fixed attenuation, and a 20-dB variable attenuator. Set the variable attenuator to 14 dB)	
8.b	<p>Adjust R436 on the MPU board (P/N 84352) until the unit just unlocks (signal invalid) at 24±1 dB.</p> <p>(15±1 dB if using bulk delay)</p> <p>Note: signal invalid = Lock invalid = unlock</p> <p>Verify that the unlock threshold is set to 24 dB by moving the attenuator below 24±1 dB (unit should lock) and then slowly turning the attenuation past 24±1 dB (unit should unlock).</p> <p>The unit should unlock at 24±1 dB of attenuation (or 15±1 dB if using bulk delay). If not readjust R436 until the unit does.</p> <p>Record the unlock attenuation on the test data sheet.</p> <p>Press “s” on the PC keyboard to turn off MPU verbose mode.</p>	Unlock at 24±1 dB

5.9. Self-Test Altitude

Step	Action	Pass Criteria
9.a	<p>Press reset on test fixture.</p> <p>Observe RAMS altitude during the 20 second self-test.</p>	n/a
9.b	<p>Verify that the altitude is 40±1 ft while in self-test.</p> <p>If not 40±1 ft: Remove R452 on the 84352-XX board and connect a variable resistor test fixture. Refer to Table 2 DWG 84352-XX-AD for valid resistor values. Switch resistor values until altitude displays 40±1 ft during the self-test.</p> <p>NOTE: You may press reset again after each value selection.</p> <p>Once the appropriate resistance has been found with the variable resistor test fixture, replace R452 with the selected value and verify that the self-test altitude is 40±1 ft.</p> <p>Record the final self-test altitude on the test data sheet.</p> <p>Record the changed component on the traveler/work order.</p>	Altitude = 40±1 ft

5.10. Calibration

Step	Action	Pass Criteria
10.a	In RAMS, clear the calibration table of the UUT by pressing 'F5'	n/a
10.b	<p>Set the altitude simulator to 0 ft and rotate variable attenuator from 0 to 20 dB.</p> <p>If a range of altitudes is displayed, return the attenuator dial to a point that produces the middle of the range.</p> <p>(If using bulk delay devices connect 25 feet of cable, 36 dB of fixed attenuation, and a 20-dB variable attenuator.)</p> <p>Calibrate 0ft by pressing "F1" on the PC keyboard.</p> <p>Altitude will momentarily turn red and then back to green.</p> <p>Verify that the altitude is now displaying 0 ft (± 1 ft).</p> <p>Record the altitude on the test data sheet.</p>	Altitude = 0 ± 1 ft
10.c	<p>Set the altitude simulator to 50 ft and rotate the variable attenuator from 0 to 20 dB.</p> <p>If a range of altitudes is displayed, return the attenuator dial to a point that produces the middle of the range.</p> <p>(If using bulk delay devices connect 25 feet of cable, a 50 ft delay, 40 dB of fixed attenuation, and a 20-dB variable attenuator.)</p> <p>Calibrate 50 ft by pressing "F2" on the PC keyboard.</p> <p>Altitude will momentarily turn red and then back to green.</p> <p>Verify that the altitude is now displaying 50 ft (± 1 ft).</p> <p>Record the altitude on the test data sheet.</p>	Altitude = 50 ± 1 ft

Step	Action	Pass Criteria
<p>10.d</p>	<p>Set the altitude simulator to 100 ft and rotate variable attenuator from 0 to 20 dB.</p> <p>If a range of altitudes is displayed, return the attenuator dial to a point that produces the middle of the range.</p> <p>(If using bulk delay devices connect 25 feet of cable, a 100 ft delay, 46 dB of fixed attenuation, and a 20-dB variable attenuator.)</p> <p>Calibrate 100ft by pressing “F3” on the PC keyboard.</p> <p>Altitude will momentarily turn red and then back to green.</p> <p>Verify that the altitude is now displaying 100ft (± 1 ft).</p> <p>Record the altitude on the test data sheet.</p>	<p>Altitude = 100 ± 1 ft</p>
<p>10.e</p>	<p>Set Altitude Simulator to 2000ft and rotate variable attenuator from 0 to 20db.</p> <p>If a range of altitudes is displayed, return the attenuator dial to a point that produces the middle of the range.</p> <p>(If using bulk delay devices connect 25 feet of cable, a 2000 ft delay, 46 dB of fixed attenuation, and a 20-dB variable attenuator.)</p> <p>Calibrate 2000ft by pressing “F4” on the PC keyboard.</p> <p>Altitude will momentarily turn red and then back to green.</p> <p>Verify that the altitude is now displaying 2000ft (± 0 ft).</p> <p>Record the altitude on the test data sheet.</p>	<p>Altitude = 2000 ± 0 ft</p>

Step	Action	Pass Criteria
10.f	<p>Move Altitude Simulator dial back to each altitude while observing the PC Screen, or connect separate delay devices at 50, 100 and 2000ft.</p> <p>Verify altitudes display within the ranges: 0', 50', 100' (±1 ft) 2000' (±0 ft)</p> <p>If not, repeat step 10 for each incorrect altitude.</p> <p>Indicate on the test data sheet that all altitudes are within tolerance.</p>	All altitudes indicated within tolerance.

5.11. Strut Switch

Step	Action	Pass Criteria
11.a	On the Test Fixture toggle the 'Strut' switch to the down position.	n/a
11.b	<p>Verify that RAMS displays the change in 'Strut Switch' line to "on ground" and 'Altitude' line to "0 ft".</p> <p>Indicate pass or fail on the test data sheet.</p>	Strut = 'on ground'
11.c	<p>Place switch back to center and verify the 'Strut Switch line is "in air".</p> <p>Indicate pass or fail on the test data sheet.</p>	Strut = 'in air'

5.12. Unlock

Step	Action	Pass Criteria
12.a	<p>Set the variable attenuator on the simulator to 0 dB and set the simulator altitude to 'Termination'.</p> <p>(Disconnect TX or RX antenna cable from UUT if not using an altitude simulator.)</p>	n/a
12.b	<p>Verify that RAMS displays a 'Signal' of invalid.</p> <p>Indicate pass or fail on the test data sheet.</p>	Signal invalid
12.c	Set the simulator altitude to 100 ft.	n/a



Step	Action	Pass Criteria
	(Reconnect the disconnected antenna cable to UUT if not using an altitude simulator.)	
12.d	Verify that RAMS displays a 'Signal' of valid. Indicate pass or fail on the test data sheet.	Signal valid

NOTE: Assemble the UUT at this point but do not put on the top cover. The following test steps assume that the UUT has been assembled, but that the cover has not been put on.

5.13. Return Loss

Step	Action	Pass Criteria				
13.a	<p>Power on spectrum analyzer and set the Frequency to 4.3GHz Span to 100MHz and Ref level to 0dBm.</p> <p>Set up return loss tester as shown in Figure 2 in Appendix E connecting the “short and cable” to the UUT Port. Turn power supply on.</p> <p>Do <u>not</u> power on the UUT.</p> <p>Adjust F1 of the tester until the Frequency peak is 4.3GHz (\pm 50MHz).</p> <p>Verify that the tester output power is 100\pm20 mW.</p>	n/a				
13.b	<p>Verify that Ref Level is 0dBm (\pm3dBm).</p> <p>Record the level on the test data sheet.</p>	Ref Level = 0 \pm 3 dBm				
13.c	<p>Remove short from cable and connect a 50 ohm terminator. Verify that the terminator offset is -14dBm or lower NOTE: If not within these values repair tester as necessary.</p> <p>Record dBm offset value with terminator connected on the test data sheet.</p>	Term Offset \leq -14 dBm				
13.d	<p>Remove terminator and connect cable to UUT TX port.</p> <p>Record dBm offset value with TX port connected on the test data sheet.</p>	Values displayed (dbm)				
13.e	<p>Connect cable to UUT RX port.</p> <p>Record dBm offset value with RX port connected on the test data sheet.</p>	Values displayed (dbm)				
13.f	<p>RX and TX Values must be within +4dBm and – 20dBm of terminator value.</p> <p>Example: if terminator value is -15dBm</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">+4dBm</td> <td style="text-align: center;">-20dBm</td> </tr> <tr> <td style="text-align: center;">-11dBm min</td> <td style="text-align: center;">-35dBm max</td> </tr> </table> <p>Record pass or fail on the test data sheet.</p>	+4dBm	-20dBm	-11dBm min	-35dBm max	Pass/Fail.
+4dBm	-20dBm					
-11dBm min	-35dBm max					

5.14. Verification of the Sweep Setting

Step	Action	Pass Criteria
14.a	Connect test harness 84649-00 to the UUT and connect COM1 on the harness to the PC serial port using RS-232 cable. Execute RAMS on the PC and power on the UUT.	n/a
14.b	In RAMS push 'w'. Verify that SWP is 0 ± 1 . If not, repeat the step in section 5.3. Record the SWP value on the test data sheet.	SWP = 0 ± 1

5.15. Verification of Altitude and Lock Setting

If any of the steps in this section fail, repeat the steps in sections 5.8 and 5.10 as required.

Step	Action	Pass Criteria
15.a	Power off the UUT. Disconnect the RS-232 cable from the UUT. Connect the RS-422 port on the harness to the PC serial port using a RS-422 to RS-232 converter.	n/a
15.b	Set the altitude simulator to 0 ft and the rotate variable attenuator slowly from 0 dB to the point when the signal status goes 'invalid'. (If using bulk delay devices connect 25 feet of cable, 46 dB of fixed attenuation, and a 20-dB variable attenuator.)	n/a
15.c	Verify that the altitude is 0 ± 3 ft and stable while the signal status indicates valid Record the altitude range on the test data sheet.	Altitude = 0 ± 3 ft
15.d	Verify that the system status goes invalid at an attenuation of 23 dB or above (12 dB or above if using bulk delay) Record the attenuation at which the system goes invalid on the test data sheet.	Invalid at 23 dB or above (12 dB or above)

<p>15.e</p>	<p>Set the altitude simulator to 50 ft and rotate variable attenuator slowly from 0 dB to the point when the signal status goes 'invalid'.</p> <p>(If using bulk delay devices connect 25 feet of cable, a 50 ft delay, 50 dB of fixed attenuation, and a 20-dB variable attenuator.)</p>	<p>n/a</p>
<p>15.f</p>	<p>Verify that the altitude is 50 ± 3 ft and stable while the signal status indicates valid</p> <p>Record the altitude range on the test data sheet.</p>	<p>Altitude = 50 ± 3 ft</p>
<p>15.g</p>	<p>Verify that the system status goes invalid at an attenuation of 23 dB or above</p> <p>(13 dB or above if using bulk delay)</p> <p>Record the attenuation at which the system goes invalid on the test data sheet.</p>	<p>Invalid at 23 dB or above</p> <p>(13 dB or above)</p>
<p>15.h</p>	<p>Set the altitude simulator to 100 ft and the rotate variable attenuator slowly from 0 dB to the point when the signal status goes 'invalid'.</p> <p>(If using bulk delay devices connect 25 feet of cable, a 100 ft delay, 56 dB of fixed attenuation, and a 20-dB variable attenuator.)</p>	<p>n/a</p>
<p>15.i</p>	<p>Verify that the altitude is 100 ± 3 ft and stable while the signal status indicates valid</p> <p>Record the altitude range on the test data sheet.</p>	<p>Altitude = 100 ± 3 ft</p>
<p>15.j</p>	<p>Verify that the system status goes invalid at an attenuation of 23 dB or above</p> <p>(13 dB or above if using bulk delay)</p> <p>Record the attenuation at which the system goes invalid on the test data sheet.</p>	<p>Invalid at 23 dB or above</p> <p>(13 dB or above)</p>
<p>15.k</p>	<p>Disconnect the RS-422 cable from the UUT.</p> <p>Connect the RS-232 port on the harness to the PC serial port.</p>	<p>n/a</p>

<p>15.i</p>	<p>Press “v” on the PC keyboard to set the UUT into MPU verbose mode.</p> <p>Set the altitude simulator to 2000 ft and the rotate variable attenuator slowly from 0 dB to the point when the signal status goes ‘invalid’.</p> <p>(If using bulk delay devices connect 25 feet of cable, a 2000 ft delay, 60 dB of fixed attenuation, and a 20-dB variable attenuator.)</p>	<p>n/a</p>
<p>15.m</p>	<p>Verify that the system status goes invalid at an attenuation of 23 dB or above</p> <p>(14 dB or above if using bulk delay)</p> <p>Record the attenuation at which the system goes invalid on the test data sheet.</p>	<p>Invalid at 23 dB or above</p> <p>(14 dB or above)</p>
<p>15.n</p>	<p>Press “s” on the PC keyboard to set the UUT into system altitude mode.</p> <p>NOTE: In system altitude mode, when the altitude is above 2000 ft the system sets the invalid flag. As long as the altitude is within the valid range of altitudes 2000 ± 100 ft an invalid status is not a reason for a failure if the altitude is above 2000 ft.</p> <p>Slowly rotate the attenuator from its current setting to 0 dB.</p> <p>Verify that the altitude is within the valid range of altitudes 2000 ± 100 ft and stable while the signal status indicates valid (if the altitude is ≤ 2000 ft).</p> <p>Record the altitude range on the test data sheet.</p>	<p>Altitude = 2000 ± 100 ft</p>
<p>15.o</p>	<p>Push ‘i’ in RAMS to issue an init query request.</p> <p>Record the calibration table on the test data sheet.</p>	<p>n/a</p>

5.16. Testing the ARINC 429 Output

Perform this step *only if UUT is a model RA-4500* radar altimeter.

Step	Action	Pass Criteria
16.a	<p>Power off the UUT.</p> <p>Connect one side of the RTX SPA converter to the ARINC 429 Output port on the test fixture and connect the other side to the PC using a serial cable.</p>	n/a
16.b	<p>Start the RTX Vortex application.</p> <p>Select “File – New”</p> <p>Select Com Number = 1 (or COM port in use), RS232 Baud Rate = 115200, and press OK</p> <p>The Vortex Main window as shown in Figure 3 in Appendix F should appear.</p>	n/a
16.c	<p>From the Main Window, press the “Receive Setup” button. The receiver setup window as shown in Figure 4 in Appendix F will appear.</p> <p>In the Receivers Setup window, set the “Receiver Speed” to “Low” and press OK.</p> <p>At the Main Window, select “Receiver Channels” 0 to display the “Receive Channel: 0” window.</p> <p>On the “Receive Channel: 0” window (see Figure 5), locate the “Display Mode” field and press the “Update” button.</p> <p>In the “Engineering Units” field, select “Enable”.</p> <p>Set the ARINC switch (formerly known as the Gear switch) on the test fixture to its up (open) position.</p>	n/a
16.d	Power on the UUT.	n/a
16.e	In the “Receive Channel: 0” window, verify that during the self-test (first 20 seconds after power-up), the value of both radio altitude labels (BNR and BCD) is 40 ± 1	Value = 40 ± 1
16.f	Verify that during the self-test (first 20 seconds after power-up), the SSM of both radio altitude labels (BNR and BCD) is 10	SSM = 10

Step	Action	Pass Criteria
16.g	Verify that the Equipment Identification is 007.	Equipment ID = 007
16.h	Set the altitude simulator to 0 ft and set the variable attenuator to 0 dB. (If using bulk delay devices connect 25 feet of cable and 36 dB of fixed attenuation)	n/a
16.i	After the self-test, verify that the value of both radio altitude labels (BNR and BCD) is 0 ± 1 .	Value = 0 ± 1
16.j	Verify that the SSM of the Radio Altitude (BNR) label is 11	SSM = 11
16.k	Set the altitude simulator to 2000 ft and set the variable attenuator to 0 dB. (If using bulk delay devices connect 25 feet of cable, a 2000 ft delay, and 50 dB of fixed attenuation.)	n/a
16.l	Verify that the value of both radio altitude labels (BNR and BCD) is 2000 ± 50 .	Value = 2000 ± 50
16.m	Verify that the Time on all three labels is updated several times a second.	Time updated.
16.n	Power off the UUT and close the "Receive Channel: 0" window.	n/a
16.o	From the Main Window, press the "Receive Setup" button. The receiver setup window as shown in Figure 4 in Appendix F will appear. In the Receivers Setup window, set the "Receiver Speed" to "High" and press OK. At the Main Window, select "Receiver Channels" 0 to display the "Receive Channel: 0" window. On the "Receive Channel: 0" window (see Figure 5), locate the "Display Mode" field and press the "Update" button. In the "Engineering Units" field, select "Enable". Set the ARINC switch (formerly known as the Gear switch) on the test fixture to its down (grounded) position.	n/a
16.p	Power on the UUT.	n/a
16.q	In the "Receive Channel: 0" window, verify that the Equipment Identification is 007.	Equipment ID = 007



Step	Action	Pass Criteria
16.r	Set the altitude simulator to 0 ft and set the variable attenuator to 0 dB. (If using bulk delay devices connect 25 feet of cable and 36 dB of fixed attenuation)	n/a
16.s	After the self-test, verify that the value of both radio altitude labels (BNR and BCD) is 0 ± 1 .	Value = 0 ± 1
16.t	Verify that the SSM of the Radio Altitude (BNR) label is 11	SSM = 11
16.u	Set the altitude simulator to 2000 ft and set the variable attenuator to 0 dB. (If using bulk delay devices connect 25 feet of cable, a 2000 ft delay, and 50 dB of fixed attenuation.)	n/a
16.v	Verify that the value of both radio altitude labels (BNR and BCD) is 2000 ± 50 .	Value = 2000 ± 50
16.w	Verify that the Time on all three labels is updated several times a second.	Time updated.

5.17. Locking the Pots

Step	Action	Pass Criteria
17.a	Place locking compound on variable potentiometers R521 and R522 of 84442-XX board as well as R436, R446 and R468 of 84352-XX board. Initial the step on the test data sheet.	n/a

NOTE: Perform the final assembly of the UUT at this point.

5.18. Burn-In

Step	Action	Pass Criteria
18.a	Place the UUT in the temperature chamber.	n/a
18.b	Connect power/data and antenna cables	n/a
18.c	Turn power ON, initialize RASCAN and fill in the appropriate information as required	n/a
18.d	Observe normal operation of the unit(s). Normal operation is indicated by altitude and lock information being displayed on the PC screen in green. Indicate pass or fail on the test data sheet.	altitude and status green
18.e	With the UUT(s) operating properly, press F2 on the PC to begin test. RASCAN will run the unit(s) through 3 temperature cycles turning the unit(s) on and off at the appropriate temperatures while recording the data to a log file.	n/a
18.f	After testing is complete (testing takes approximately 10 to 15 hours) open the log file for each unit to verify a pass or fail condition. The log file name is the unit serial number plus a txt extension, e.g. 8186009.txt Indicate pass or fail on the test data sheet.	Pass/Fail

5.19. Final Step

Step	Action	Pass Criteria
19.a	Indicate Pass/Fail for the UUT and initial the data sheet.	All steps successful.

END OF TEST PROCEDURE

Appendix A Final Test Data Sheet

Work Order		Serial Number	
Date		Technician	

Step	Pass Criteria	Entry Type	Data Record
1.b	Current \leq 500 mA	mA	
1.c	15 \pm 0.3 VDC	VDC	
1.d	10 \pm 0.1 VDC	VDC	
1.e	5 \pm 0.1 VDC	VDC	
1.f	-3 \pm 0.5 VDC	VDC	
2.f	Correct MPU CRC	CRC	
2.g	Correct IO CRC	CRC	
2.h	A/D 15V = [D8 to F0]	Value	
2.i	A/D 10V = [BA to F1]	Value	
2.j	A/D TEMP = [9E to BB]	Value	
3.b	Freq. = 100 \pm 1 Hz	Hz	
3.c	SWP = 0 \pm 1	Value	
4.c	Linearity \leq \pm 5 %	%	
5.b	Sweep Bandwidth is 100 \pm 2 MHz	MHz	
5.c	High frequency limit is 4.350 \pm 0.001 GHz	GHz	
5.d	Low frequency limit is 4.250 \pm 0.003 GHz	GHz	
6.b	Power = 100 \pm 10 mW	mW	
7.b	TP402 = 30 \pm 1 mV	VDC	
7.c	TP402 maximum = 0.135 VDC	VDC	
8.b	Unlock at 24 \pm 1 dB	dB	
9.b	Self-Test Altitude = 40 \pm 1 ft	Altitude	
10.b	Altitude = 0 \pm 1 ft	Altitude	
10.c	Altitude = 50 \pm 1 ft	Altitude	
10.d	Altitude = 100 \pm 1 ft	Altitude	
10.e	Altitude = 2000 \pm 0 ft	Altitude	
10.f	All altitudes indicated within tolerance	Pass/Fail	
11.b	Strut 'on ground'	Pass/Fail	
11.c	Strut 'in air'	Pass/Fail	
12.b	Signal invalid	Pass/Fail	
12.d	Signal valid	Pass/Fail	
13.b	Ref Level = 0 \pm 3 dBm	dBm	
13.c	Term Offset \leq -14 dBm	dBm	
13.d	Record TX offset level	dBm	
13.e	Record RX offset level	dBm	



Step	Pass Criteria	Entry Type	Data Record
13.f	Return Loss	Pass/Fail	
14.b	SWP reads 0±1.	Clock	
15.c	Altitude = 0±3 ft	Altitude	
15.d	Invalid at 23 dB or above (or 12 dB or above)	dB	
15.f	Altitude = 50±3 ft	Altitude	
15.g	Invalid at 23 dB or above (or 13 dB or above)	dB	
15.i	Altitude = 100±3 ft	Altitude	
15.j	Invalid at 23 dB or above (or 13 dB or above)	dB	
15.m	Invalid at 23 dB or above (or 14 dB or above)	dB	
15.n	Altitude = 2000±100 ft	Altitude	
16.e*	Value is 40±1	Value	
16.f*	SSM is 10	SSM	
16.g*	Value of Equipment ID is 007	Value	
16.i*	Value is 0±1	Value	
16.j*	SSM is 11	SSM	
16.l*	Value is 2000±50	Value	
16.m*	Updated several times a second	Pass/Fail	
16.q*	Value of Equipment ID is 007	Value	
16.s*	Value is 0±1	Value	
16.t*	SSM is 11	SSM	
16.v*	Value is 2000±50	Value	
16.w*	Updated several times a second	Pass/Fail	
17.a	All potentiometers are locked	Initial	
18.d	Altitude and status normal	Pass/Fail	
18.f	Burn-in pass/fail	Pass/Fail	

*Applicable to RA-4500 only. Mark as N/A for other models.

(15.o) System Calibration Table

FLASH:	0	50	100	200
ALT				
OFF				
MULT				
Zero Offset:				

(19.a) Overall Pass/Fail	
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Appendix B Sweep Linearity Adjustment

If the sweep linearity is not within $\pm 5\%$ use the following procedure to correct.

1. Turn unit off. Remove R459 on MPU board 84352-XX and connect a variable resistor test fixture.
2. Set fixture 1 M Ω and turn power on.
3. While watching the “sweep linearity meter” in RAMS, switch resistor values until sweep linearity is within range. Refer to Table 3 DWG 84352-XX-AD for valid resistor values.
4. Replace R459 with selected value. Re-test sweep linearity to verify that it is within tolerance. Record component changed on Traveler/work order.
5. End of sweep linearity adjustment.

Appendix C Sweep Width Adjustment

If the sweep width is not 100 ± 2 MHz use the following procedure to correct.

6. Turn unit off. Remove R469 on MPU board 84352-XX and connect a variable resistor test fixture.
7. Set fixture 3.3k ohms and turn power on.
8. While watching sweep on analyzer, switch resistor values until sweep width is within range. Refer to Table 1 DWG 84352-XX-AD for resistor values.
9. Replace R469 with selected value. Re-test sweep width to verify that it is within tolerance. Record component changed on Traveler/work order.
10. End of sweep width adjustment.

Appendix D Power Output Adjustment

If TX power output is not within specifications then use the following procedure to correct power output.

1. Turn unit power off. Remove R202 on bias board P/N 84768-XX and connect a variable resistor test fixture.
2. Set fixture to 470 ohms and turn unit power on.
3. Connect power meter to TX of unit and observe power output. If power is not within specifications, switch resistance values until power is as close as possible. Refer to Table 1 DWG 84768-XX-AD.
4. Replace R202 with selected value. Re-test power output to verify that it is within 10% of 100mW. Record component changed on Traveler/work order.
5. End of power output adjustment.

Appendix E Return Loss Test Fixture

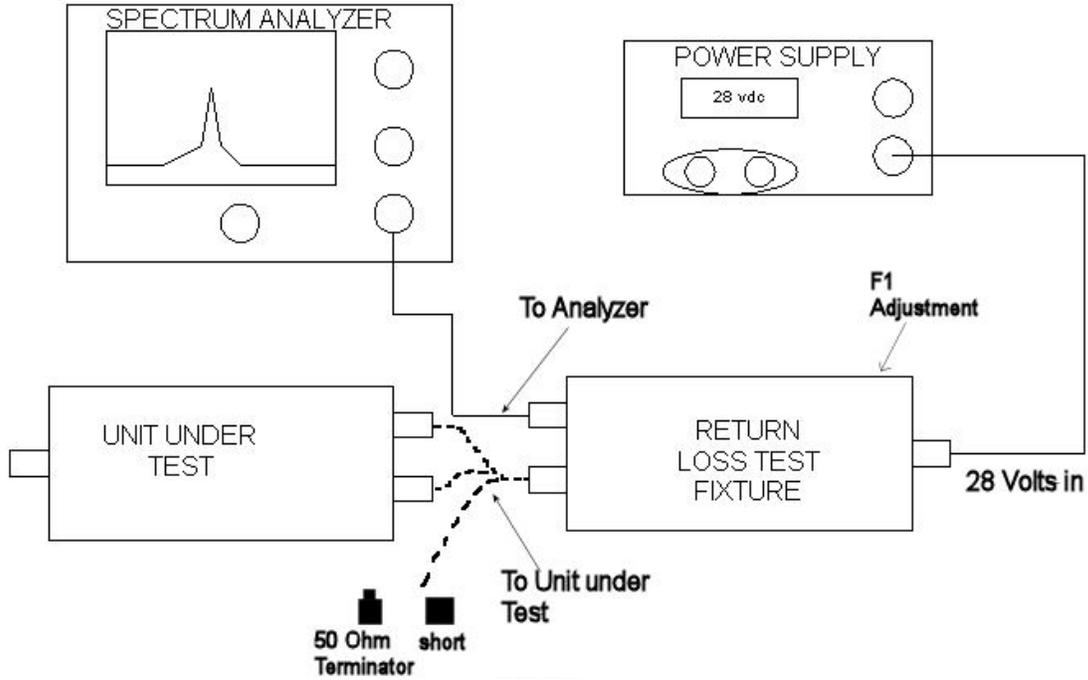


Figure 2: Return Loss Test Fixture 84893-00

Appendix F RTX Vortex Setup



Figure 3: Vortex - Main Window

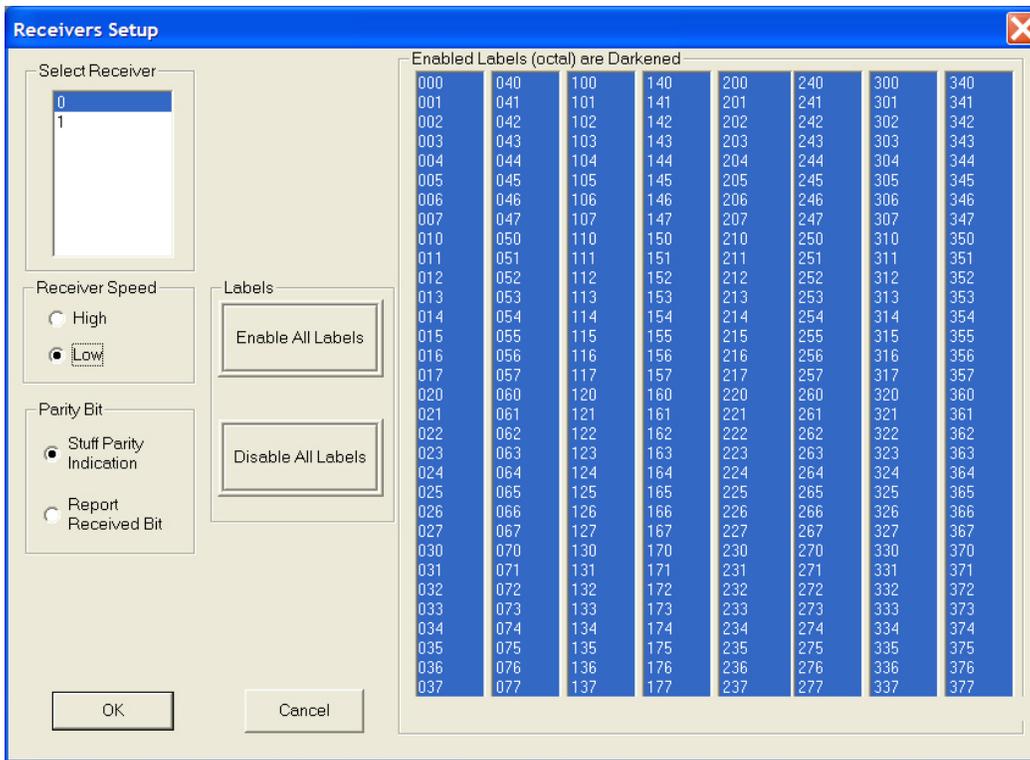


Figure 4: Vortex - Receivers Setup Window

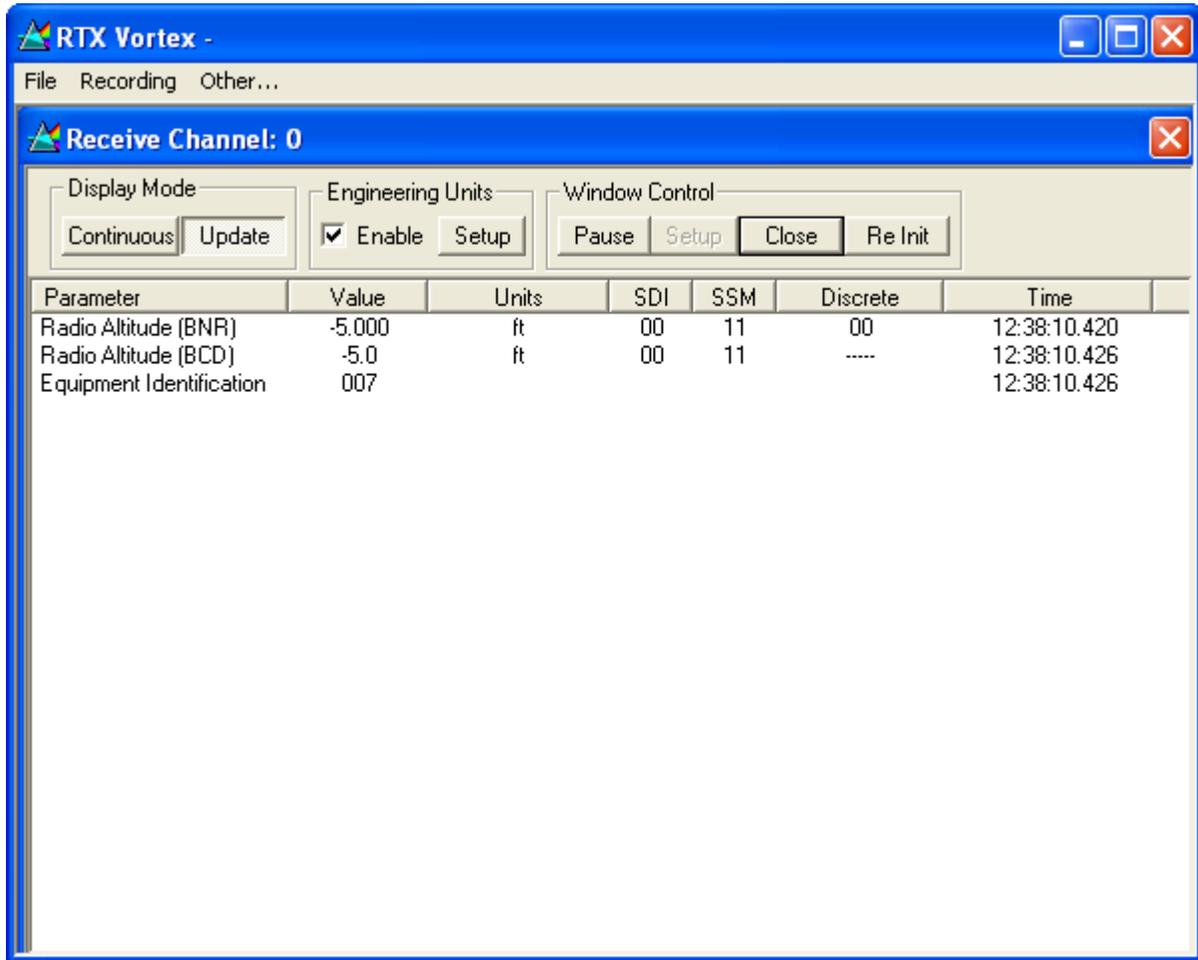


Figure 5: Receive Channel: 0 Window