Appendix I: Sample Bill of Materials (BoM)

1/13/2003 1:58:54 PM

BOM EXPLOSION REPORT
KIT, INSTALLATION, BTS, 2.6 Revision B
Part Number: 95-05001-00

Part
13-00034-00 : CONN, COAX, CRIMP, N STRAIGHT PLUG, EZ PIN (LMR600) . Quantity: 36

Part
13-00194-00 A CONN, COAX, CRIMP, N STRAIGHT PLUG, EZ PIN, MALE (LMR400). Quantity: 8

Part
Connectors, NType
13-00218-00 A CONN, LUG, ONE-HOLE #6. Quantity: 10

Connectors
13-00219-00 : CONN, LUG, TWO-HOLE #6. Quantity: 10

Connectors
13-00220-00 : CONN, LUG, TWO-HOLE #2. Quantity: 10

Part
18-00001-00 : CABLE, COAX, OUTDOOR RF, LMR600. Quantity: 1350

Part
18-00035-00 A WIRE, GROUND, GREEN, STRANDED, #2. Quantity: 50

Part
18-00036-00 : CABLE, COAX, OUTDOOR RF, LMR400. Quantity: 200

Cables, Coax
18-00049-00 : WIRE, STRANDED, GREEN, #6 AWG 50. Quantity: 13

Part
24-00045-00 : NUT, REG. HEX, CRES, 1/4-20UNC. Quantity: 8

Part
24-00117-00 : BUSS BAR, GROUND, TOWER, 1/4IN X 2-1/2IN X 12-1/2IN. Quantity: 1

Part
24-00118-00 : BUSS BAR, GROUND, SHELTER, 1/4IN X 4IN, DRILLED TO 5/8IN. Quantity: 1

Part
24-00119-00 : GRIP, HOISTING, PRE-LACED, FOR 1/2IN COAX CABLE. Quantity: 10

Part
24-00120-00 : HANGERS, ASSY, CUSHION, 5H, 1/2IN CORREGATED COAX. Quantity: 4

Mechanical Hardware
24-00121-00 : MOUNT, HANGER, CROSS CUSHION, KIT OF 5. Quantity: 2

Part
24-00122-00 : BLOCK, SUPPORT, MINI COAX. Quantity: 2

Part
24-00134-00 A BREAKER, OUTPUT DISTRIBUTION, 60 AMP, BTS INSTALLATION. Quantity: 1

Mechanical Hardware
24-00156-00 : CLAMP, PIPE TO PIPE, KIT OF 2. Quantity: 1

Mechanical Hardware
24-00170-00 : NUT, REG. HEX, CRES, #10-24. Quantity: 3

Part
24-00171-00 : WASH, STAR, #10. Quantity: 3

Part
24-00172-00 : WASH, STAR, ¼. Quantity: 16

Part
24-00250-10 : BOLT, HEX, 1/4-20 X 1.000 LG, SSPA. Quantity: 8

Mechanical Hardware
24-06156-43 : WASH, FLAT, CRES, #6 T-B-REGULAR, .156 X .438 X .040. Quantity: 16

Part
24-06250-14 : WASH, LOCK, SPLIT, CRES 1/4, Reg, .252X.487X.062. Quantity: 16

Part
32-00031-00 : ARRESTOR, LIGHTNING, RF 1.2 - 2.8GHz, N TYPE FEMALE, DC BLOCK, PSX. Quantity: 9

Part
32-00033-00 : ARRESTOR, LIGHTNING, GPS, PICKOR, DC PASS, MM50MNZ+6. Quantity: 2

Part
32-00052-00 : KIT, GROUNDING, LMR-600, 5FT X 1/2 IN, 2 HOLE LUG. Quantity: 9

Part
32-00053-00 : KIT, GROUNDING, LMR-400, 5FT X 3/8 IN, 2 HOLE LUG. Quantity: 2

Part
32-00077-00 : KIT, WEATHERPROOFING, GEL WRAP. Quantity: 1

Part
32-11004-00 : ARRESTOR, SURGE, EMP, DC BLOCK, RF COAX, In-line 2.4 GHz., PSX-ME. Quantity: 9

Part
92-00006-00 : SUBASSY, MOUNT UNIVERSAL FOR OMNI ANTENNA. Quantity: 1

Antennas
68-00006-00 : DWG, ASSY MOUNT UNIVERSAL FOR OMNI ANTENNA. Quantity: REF

Assembly Drawing, Mechanical
55-00063-00 : BASE, WELDMENT, ANTENNA MOUNT, OMNI. Quantity: 1

Part
55-00079-00 : FLANGE C, ANTENNA MOUNT, OMNI. Quantity: 1

Part
55-00080-00 : GUSSET, ANTENNA MOUNT, OMNI . Quantity: 2

Part
55-00081-00 : PLATE, BASE, ANTENNA MOUNT, OMNI. Quantity: 1

Part
24-10000-00 : NUT, PEM, BLIND .250 1/4-20 BS-0420-2. Quantity: 8

Part Type
55-00088-00 : FLANGE, CLAMP, STANDARD MOUNT, GALVANIZED. Quantity: 2

Part
24-09000-00 : STUD, 7/16 X 14 LG ALL THREAD, GALVANIZED, ANTENNA MOUNT, OMNI. Quantity: 4

Mechanical Hardware
24-09001-00 : WASHER, SQ, ALUMINUM, ANTENNA MOUNT. Quantity: 4

Mechanical Hardware
24-09002-00 : WASHER, SQ, GALVANIZED, ANTENNA MOUNT. Quantity: 4

Mechanical Hardware
24-09003-00 : FLAT WASHER 7/16 REG GALVANIZED. Quantity: 12

Mechanical Hardware
24-09005-00 : LOCK WASHER, 7/16, GALVANIZED. Quantity: 12

Mechanical Hardware
24-09004-00 : HEX NUT 7/16 GALVANIZED. Quantity: 12

Mechanical Hardware
24-00124-00 : BOLT, HEX 1/4-20 X 1.250 LG SSPA. Quantity: 8

Part Type
24-06250-14 : WASH, LOCK, SPLIT, CRES 1/4, Reg, .252X.487X.062. Quantity: 8

Part
24-06250-28 : WASH, FLAT, CRES, 1/4 T-B-REGULAR, .281 X .734 X .063. Quantity: 8

Appendix K: RFS System Test (Cable & RFS Sweep)

Introduction

Before installing the Base Station at a site, the RFS and the associated cables must be tested, and the results of the tests documented. This procedure applies to the full RFS sub-assembly and associated cables: data/power cable, RF cables, and the RFS unit. All results are recorded in the RFS System Test Form P/N 40-00093-00.

Table K1: Pin layout Details

POWER CABLE PIN OUT			
Circular Connector(s)	Wire Color	Wire Color	Signal Name
A	RED	PAIR	+12V A
B	BLACK		+12V A RTN
C	BROWN		Heater
D	DRAIN		GND (Shield Wire)
E	BLACK	PAIR	RX_EN_B-
F	WHITE		RX_EN_B+
G	BLUE	PAIR	RX_EN_A+
H	BLACK		RX_EN_A-
J	BLACK	PAIR	Diagbus-
K	GREEN		Diagbus+
L	BLACK	PAIR	+12V B Return
M	YELLOW		+12V B

Perform the continuity test with both the Volt Ohm Meter (VOM) and the power/data cable tester. If the power/data cable tester is not available, perform the continuity test with the VOM.

Required Equipment

- VOM – Continuity tester
- Jumper for shorting pins
- RFS power/data cable tester

Continuity Test With VOM

Step 1. On one end of the cable, short a pair of conductors using a shorting device.

Step 2. Using a VOM/Digital Volt Meter (DVM) set to ohms, verify a short is present on the pair at the other end.

Step 3. Leaving one probe on one of the paired pins, contact all of the other pins with the other probe, ensuring an open connection.

Step 4. Check all 6 pairs of wires in the same manner.

Step 5. Verify continuity from the connector case to the drain wire (pin D) on each end of the cable and between each connector case.

Step 6. Verify an open circuit from the connector case to each individual wire, except to the drain wire.

Continuity Test With Power/Data Cable Tester

Step 1. Connect one end of the power/data cable to the connector on the power/data cable tester.

Step 2. Using a VOM/DVM set to ohms, check resistance to ground on the other end of the cable. Resistance is checked from the case of the connector to the individual pin. Resistance readings (±10 percent) are shown in Table K2.

Table K2: Resistance to Ground

Pin	Resistance	Pin	Resistance
A	1K ohms	G	6.2K ohms
B	2K ohms	H	8.2K ohms
E	3.3K ohms	L	10K ohms
F	5.1K ohms	M	12K ohms

Step 3. Using a VOM/DVM set to ohms, check resistance between the pairs on the other end of the cable. Resistance should be the sum of the resistance of the two pairs, ±10 percent. Refer to Table K3.

Table K3: Resistance of Two Pairs

Pins	Resistance	Pins	Resistance
A & B	3K ohms	G & H	14.4K ohms
E & F	8.4K ohms	L & M	22K ohms

Step 4. Remove the power/data cable tester from the power/data cable.

Sweep Test of RF Cables & RFS

Sweep testing of the RF cables and the RFS is performed in three separate steps.

- Sweep of the cables
- Sweep of the RFS
- Sweep of the cables and the RFS together

All results will be entered in the fifth (Cable Loss) and seventh (RFS & Cable Loss) worksheets of the I&C Closeout Tool, P/N 40-00217-00. The total of the insertion loss for the cables and the RFS will be equal to the insertion loss of both parts swept together.

Equipment Required

- Signal Generator - Agilent 8648C for 3 GHz / 8648D for 4 GHz, or suitable alternative, tunable to the RFS center frequency
- Spectrum Analyzer - Agilent E4402B, or equivalent
- Signal Generator cable and Spectrum Analyzer cable – Gender can be changed using a barrel connector
- Male and Female barrel connectors for Signal Generator cable and Spectrum Analyzer cable connections
- Power/data test cable
- Navini RFS Test Box

Equipment Settings

Spectrum Analyzer:
- Span – 5 MHz
- RBW – 100 KHz
- VBW – 100 KHz
- Sweep Time – Auto
- Frequency (Provided in Table L4)

Signal Generator:
- Amplitude – 0 dB (except for the Tx side of the RFS Sweep in a TTA system, where the amplitude of the Signal Generator must be set to –20 dBm)
- Frequency (Provided in Table O4)

Test Setup

When performing each type of sweep, the sweep has to be performed at certain frequency intervals (Table K4). Perform the complete test at the first frequency. Go to the next frequency and recalibrate the test setup. Perform the complete test again. Do the same for the third frequency. Refer to Figure K2.

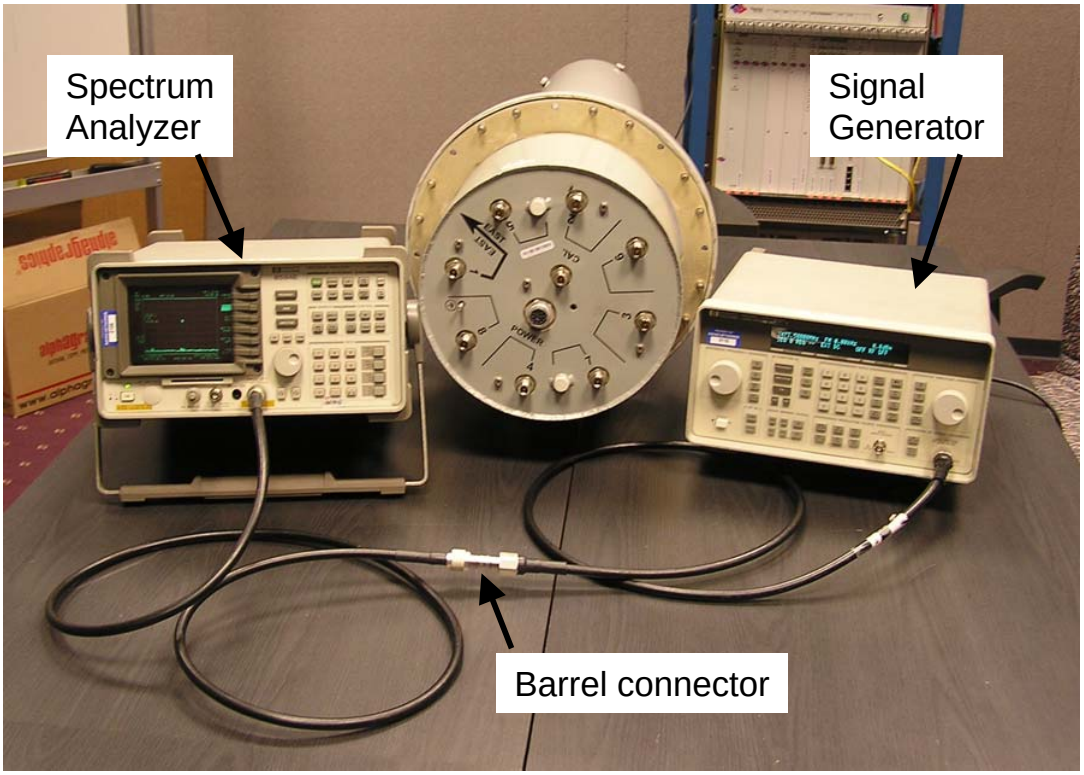
Table K4: Sweep Frequencies

System	Low	Medium	High
2.3 GHz (Low band)	2305.00	2312.50	2316.75

2.3 GHz (High band)	2348.25	2352.50	2360.00
2.4 GHz	2400.00	2440.00	2473.50
2.5 GHz	2500.00	2548.00	2596.00
2.6 GHz	2596.00	2641.00	2686.00
3.4 GHz	3410.00	3462.50	3525.00
3.5 GHz	3500.00	3550.00	3600.00

1. Connect the Signal Generator cable to the Signal Generator.
2. Connect the Spectrum Analyzer cable to the Spectrum Analyzer.
3. Connect the other end of the two cables together. Use a barrel connector if needed.

Figure K2: Test Setup



Test Procedure

The following procedures are for the Agilent E4402B Spectrum Analyzer. If alternative equipment is used, refer to the manufacturer's calibration procedures. The key point is to make accurate microwave frequency power measurements.

Step 1. Turn the Signal Generator and Spectrum Analyzer on. Allow the equipment to warm up for 15 minutes for the output to stabilize.

Step 2. Set the Signal Generator frequency to the desired test frequency (Table K4) of the RFS under test.

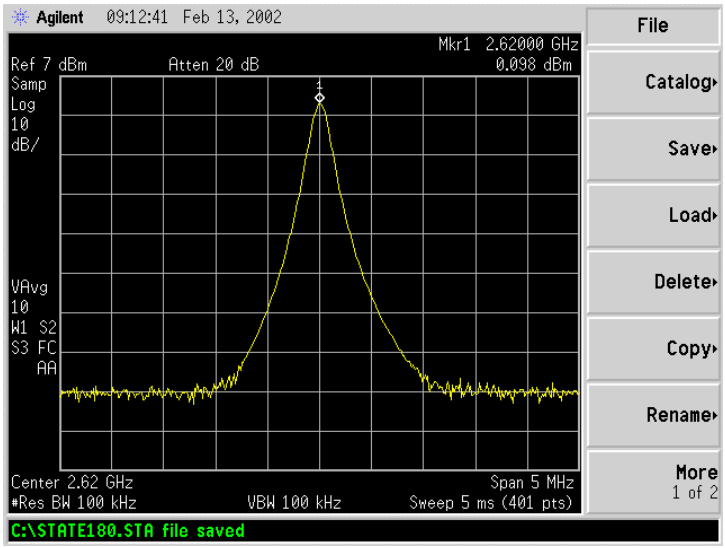
Step 3. Set the Signal Generator output amplitude to 0 dBm.

Step 4. Set the center frequency of the Spectrum Analyzer to the center frequency of the RFS under test.

Step 5. Set the Spectrum Analyzer to Span = 5 MHz, Resolution Bandwidth = 100 kHz, and Video Bandwidth = 100 kHz.

Step 6. Take a marker measurement on the Spectrum Analyzer by using the 'marker to peak' or the 'peak search' function. The screen on the Spectrum Analyzer should look similar to that shown in Figure K3.

Figure K3: Sweep Test Marker Measurement Example



Step 7. If the marker measurement doesn't read 0.0 dBm, adjust the amplitude on the Signal Generator until the Spectrum Analyzer marker reads 0.0 dBm, or as close to 0.0 dBm as possible. This will remove all losses associated with the test cables. All measurement data should be recorded one digit to the right of the decimal point, for example, 31.5dB.

Once the test setup is calibrated, these cables will remain in place and will be used throughout the whole test at this particular frequency. If the test cables are removed or changed during the test, incorrect readings will result.

RF Cable Insertion Loss

This test is performed on all RF cables that are installed in the system. This includes the eight antenna cables, the system calibration cable, and all jumper cables. Follow the procedures for either the cables on the ground or cables run up the tower.

Test Procedure For RF Cables on the Ground

Step 1. Ensure calibration of the test setup has been performed each time the test frequency is changed.

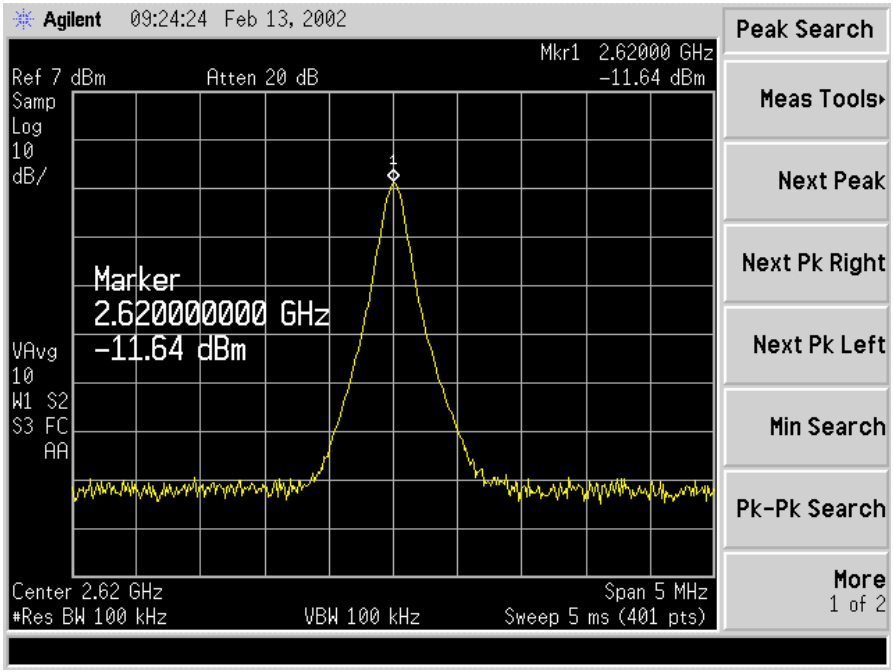
Step 2. If present, remove the barrel connector from between the Signal Generator and Spectrum Analyzer cables.

Step 3. Connect the cable from the Signal Generator to one end of the cable. Use a barrel connector to change the gender, if required.

Step 4. Connect the cable from the Spectrum Analyzer to the other end of the cable. Use a barrel connector to change the gender, if required.

Step 5. Take a marker measurement on the Spectrum Analyzer by using the 'marker to peak' or the 'peak search' function. The screen on the Spectrum Analyzer should look similar to the one shown in Figure K4.

Figure K4: Insertion Loss (Cables on Ground) Marker Measurement Example



Step 6. The result should be within ±0.5 dB of the calculated value. If the insertion loss results do not agree with the manufacturer's data, check the connectors for proper connection to the cable, and check for kinks in the cable. If the Spectrum Analyzer has a distance to fault (DTF) function, it can be used to help troubleshoot kinks in the cable.

CAUTION! Cables with results greater than the specified limits (i.e., 2 or 3 dB high) should not be installed, as a potential hardware fault exists.

Step 7. Add the loss for the jumper cable(s) and main cable for each RF path and for the Cal cable path and record the result in the Cable Loss worksheet.

Step 8. Repeat steps 3 through 7 for all remaining cables and jumpers.

Step 9. Change the frequency to the next test frequency (refer back to the Test Setup section of these procedures). Perform steps 1 through 8 until all cables have been successfully tested at the frequencies shown in Table K4.

Test Procedure For RF Cables Already Run Up the Tower

Step 1. Ensure calibration of the test setup has been performed each time the test frequency is changed.

Step 2. If present, remove the barrel connector from between the Signal Generator and Spectrum Analyzer cables.

Step 3. Have a member of the tower crew positioned on the tower, at the upper end of the cables, connect the calibration cable to antenna cable 1 with a barrel connector.

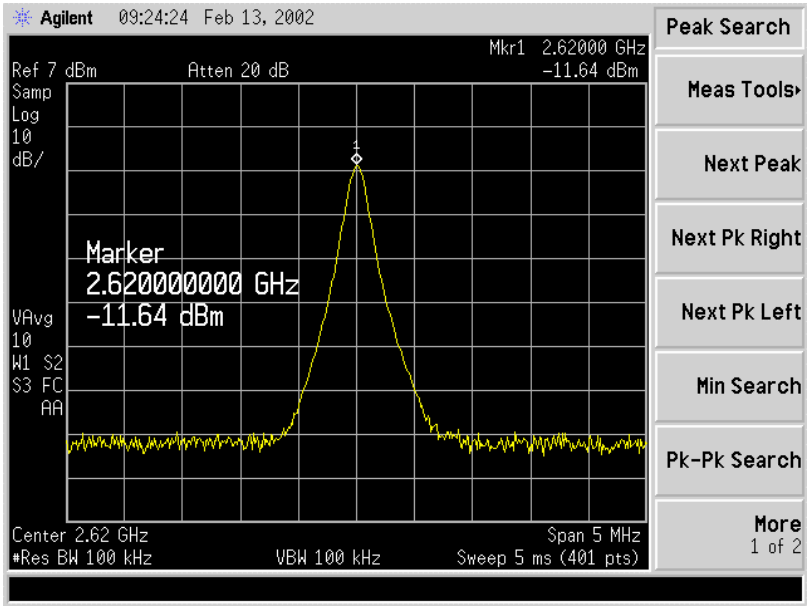
Step 4. At the lower end of the RF cables, connect the cable from the Signal Generator to the calibration cable. Use a barrel connector to change the gender, if required.

Step 5. Connect the cable from the Spectrum Analyzer to antenna cable 1. Use a barrel connector to change the gender, if required.

Step 6. Calculate the marker using the following formula: (the length of **BOTH** the calibration cable and the antenna cable) x (loss per foot at the RFS center frequency for the type of cable used).

Step 7. Take a marker measurement on the Spectrum Analyzer by using the 'marker to peak' or the 'peak search' function. The screen on the Spectrum Analyzer should look similar to the one shown in Figure K5.

Figure K5: Insertion Loss (Cables on Tower) Marker Measurement Example



Step 8. The result should be within ±0.5 dB of the calculated value. If the insertion loss results do not agree with the manufacturer's data, check the cable connectors for proper connection to the cable, and check for kinks in the cable. If the Spectrum Analyzer has a distance to fault (DTF) function, this can be used to help troubleshoot kinks in the cable.

Step 9. Divide this value in half and assign the result to the calibration cable and to the antenna cable.

Caution: Cables with results greater than the specified limits (i.e., 2 or 3 dB high) should not be installed, as a potential hardware fault exists.

Step 10. Record the data in the Cable Loss worksheet.

Step 11. Repeat steps 3 through 10 for antenna cables 2 through 8.

Step 12. When finished, take the average of the eight values obtained for the calibration cable. Use this value for the insertion loss of the calibration cable.

Step 13. Change the frequency to the next test frequency (refer back to Test Setup). Perform steps 1 through 12 until all cables have been successfully tested at the frequencies given in Table K4.

RFS Test Box Setup

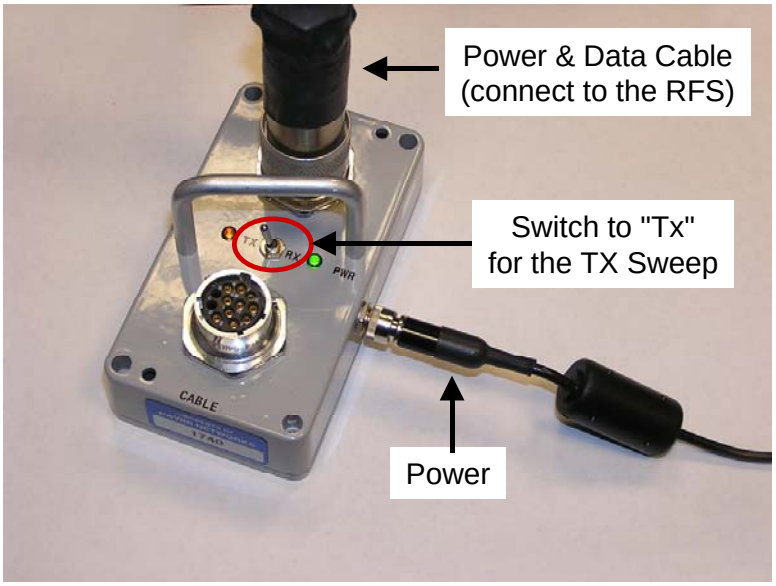
Step 1. For **RFS only** testing, connect the power/data test cable to the data connector on the RFS and to the RFS Test Box.
- OR -
For RFS and cable testing, connect the installation power/data cable to the data connector on the RFS and to the RFS Test Box.

Refer to Figure K6.

Step 2. Connect the RFS Test Box power supply to the RFS Test Box.

Step 3. Plug the RFS Test Box power supply into a 110/220 VAC, 60/50 Hz outlet.

Figure K6: RFS Only Testing Setup



RFS Only Transmit Verification

Ensure that the calibration of the test setup and RFS Test Box setup for RFS Only has been performed each time the test frequency is changed. Refer to Figure K7.

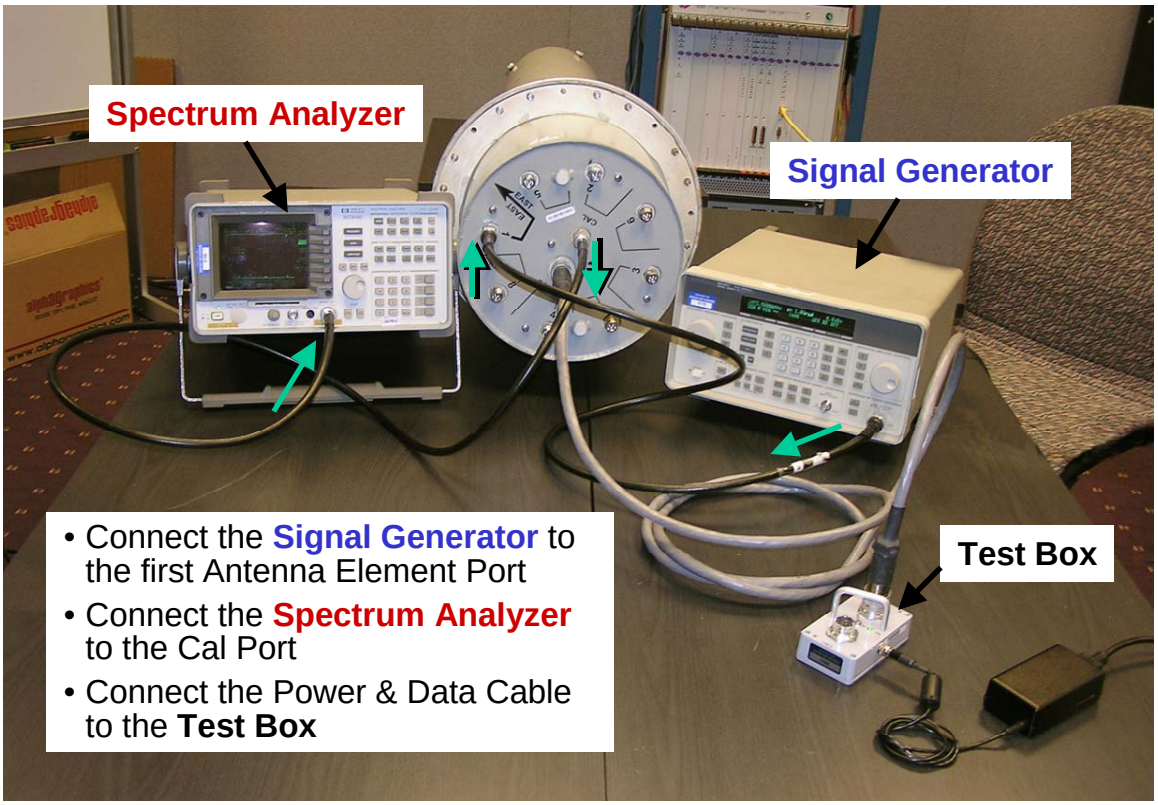
Step 1. Switch the RFS Test Box to the transmit (Tx) mode.

Step 2. Connect the cable from the Spectrum Analyzer to the RFS cal connector. Use a barrel connector to change the gender, if required.

Step 3. Connect the cable from the Signal Generator to the RFS antenna input number 1. Use a barrel connector to change the gender, if required.

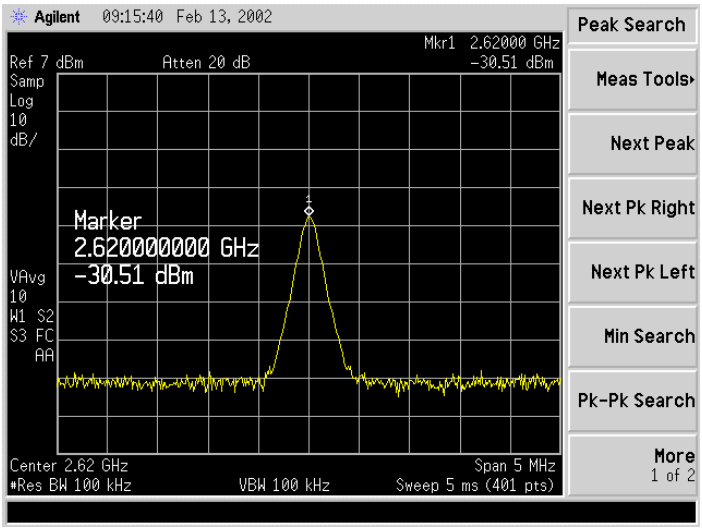
Figure K7: RFS Only Tx Verification

Note: The position of the RFS will vary the sweep results due to reflections from the test surface.



Step 4. Take a marker measurement on the Spectrum Analyzer by using the 'marker to peak' or the 'peak search' function. The screen on the Spectrum Analyzer should look similar to the one shown in Figure K8.

Figure K8: RFS Only Tx Marker Measurement Example



Step 5. The marker value should be equal to the RFS Only Tx insertion loss within ±2.0 dB, per the manufacturer's data. If the insertion loss results do not agree with the manufacturer's data, check the test setup.

Caution: An RFS with results greater than the ±2.0 dB limits should not be installed, as a potential hardware fault exists. Contact Navini Networks Technical Support.

Step 6. Record the data in the RFS System Test Form under "RFS TX PATH LOSS (RFS ONLY)". Ensure that the information is recorded under the channel number of the RFS antenna that is being tested.

Step 7. Repeat steps 5 and 6 for the remaining seven antenna inputs on the RFS.

Step 8. Change to the next test frequency (refer back to Test Setup). Perform steps 1 through 8 until the RFS has been successfully tested at the frequencies shown in Table K4.

RFS Only Receive Verification

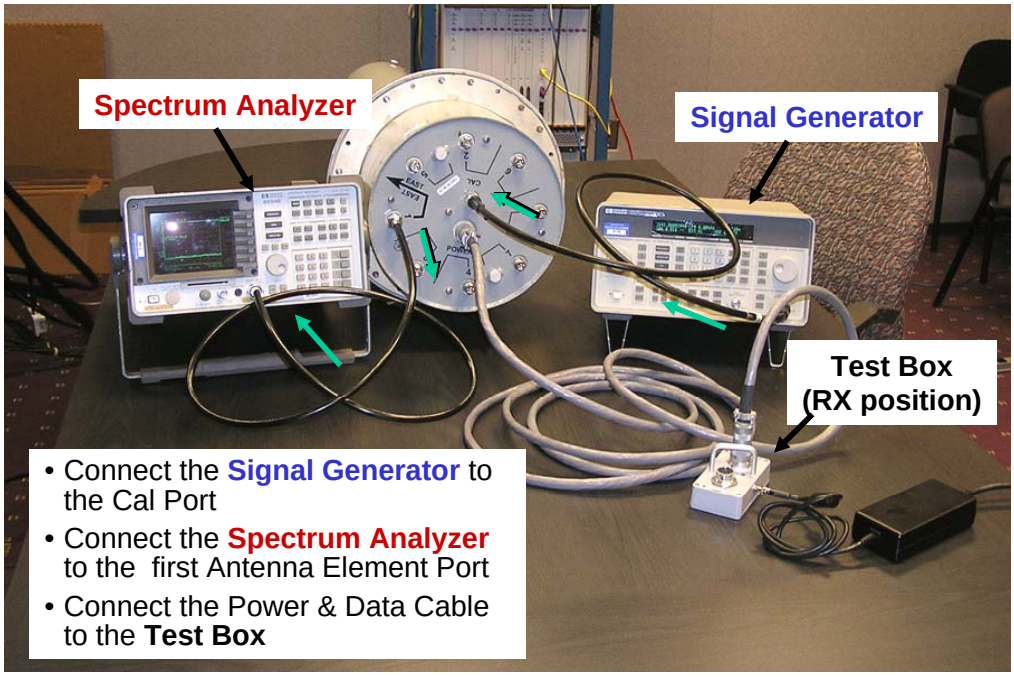
Step 1. Ensure calibration of the test setup and RFS Test Box setup for RFS Only has been performed each time the test frequency is changed.

Step 5. Switch the RFS Test Box to the Receive (Rx) mode.

Step 6. Connect the cable from the Signal Generator to the RFS cal connector. Use a barrel connector to change the gender, if required.

Step 7. Connect the cable from the Spectrum Analyzer to the RFS antenna input number 1. Use a barrel connector to change the gender, if required. See Figure K9.

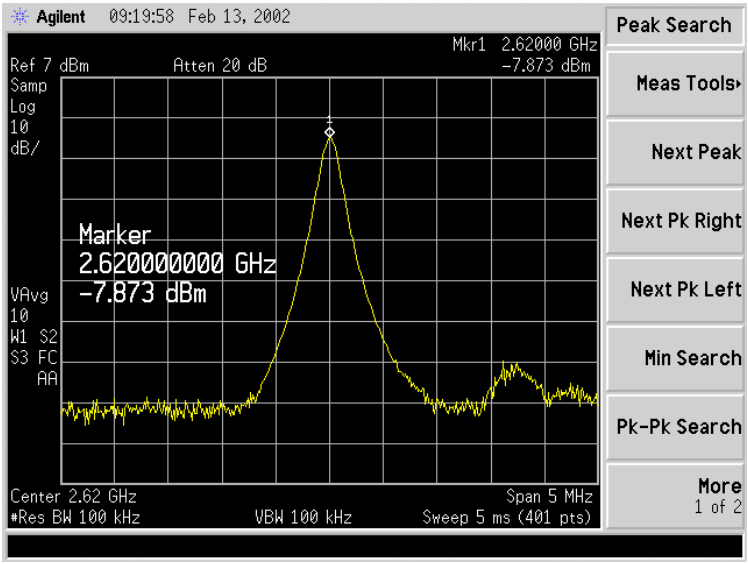
Figure K9: RFS Only Rx Verification



Note: The position of the RFS will vary the sweep results due to reflections from the test surface.

Step 8. Take a marker measurement on the Spectrum Analyzer by using the 'marker to peak' or the 'peak search' function. The screen on the Spectrum Analyzer should look similar to the one shown in Figure K10.

Figure K10: RFS Only Rx Marker Measurement Example



Step 9. The marker value should be equal to the RFS Only Rx insertion loss within ±2.0 dB, per the manufacturer's data. If the insertion loss results do not agree with the manufacturer's data, check the test setup.

Caution: An RFS with results greater than the ±2.0 dB limits should not be installed, as a potential hardware fault exists. Contact Navini Networks Technical Support.

Step 10. Record the data in the RFS System Test Form under "RFS RX PATH LOSS (RFS ONLY)". Ensure that the information is recorded under the channel number that is on the RFS antenna that is being tested.

Step 11. Repeat steps 5 through 7 for the remaining seven antenna inputs on the RFS.

Step 12. Change the frequency to the next test frequency (refer back to Test Setup). Perform steps 1 through 8 until the RFS has been successfully tested at the frequencies shown in Table K4.

RFS & Cables Transmit Verification

This test is performed after the RFS is installed and the antenna cables, calibration cable, and power/data cable are connected to the inputs on the RFS.

Step 8. Ensure calibration of the test setup and RFS Test Box setup for RFS and cables has been performed each time the test frequency is changed.

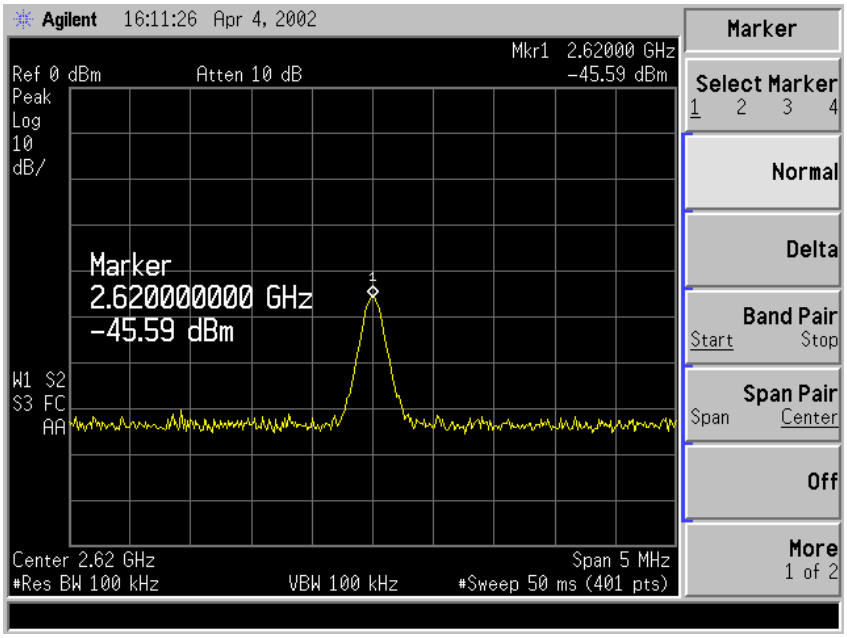
Step 9. Switch the RFS Test Box to the Transmit (Tx) mode.

Step 10. Connect the cable from the Spectrum Analyzer to the RFS calibration cable connector. Use a barrel connector to change the gender, if required.

Step 11. Connect the cable from the Signal Generator to the RFS antenna cable number 1 connector. Use a barrel connector to change the gender, if required.

Step 12. Take a marker measurement on the Spectrum Analyzer by using the ‘marker to peak’ or the ‘peak search’ function. The screen on the Spectrum Analyzer should look similar to the one shown in Figure K11.

Figure K11: RFS & Cables Tx Marker Measurement Example



Step 13. The marker value should be equal to the RFS Only Tx insertion loss + calibration cable loss + antenna cable loss + antenna cable jumper loss. Transmit insertion loss should be within ±2.0 dB of the sum of the parts. If the insertion loss results do not agree with the manufacturer's data, check the test setup and the cable connections.

Caution: If RFS & cables test results are greater than the ±2.0 dB limits, they should not be installed on a tower, as a potential hardware fault exists. Verify the connections and contact Navini Networks Technical Support.

Step 14. Record the data in the RFS System Test Form under "TOTAL TX PATH LOSS (CABLE-RFS)". Ensure that the information is recorded under the channel number that is on the cable label.

Step 15. Repeat steps 5 through 7 for the remaining seven antenna cable inputs on the RFS.

Step 16. Change the frequency to the next test frequency (refer to Test Setup). Perform steps 1 through 8 until the RFS has been successfully tested at the frequencies shown in Table K4.

RFS & Cables Receive Verification

This test is performed after the RFS is installed and the antenna cables, calibration cable, and power/data cable are connected to the inputs on the RFS.

Step 1. Ensure that the calibration of the test setup and RFS Test Box setup for RFS and cables has been performed each time the test frequency is changed.

Step 17. Switch the RFS Test Box to the Receive (Rx) mode.

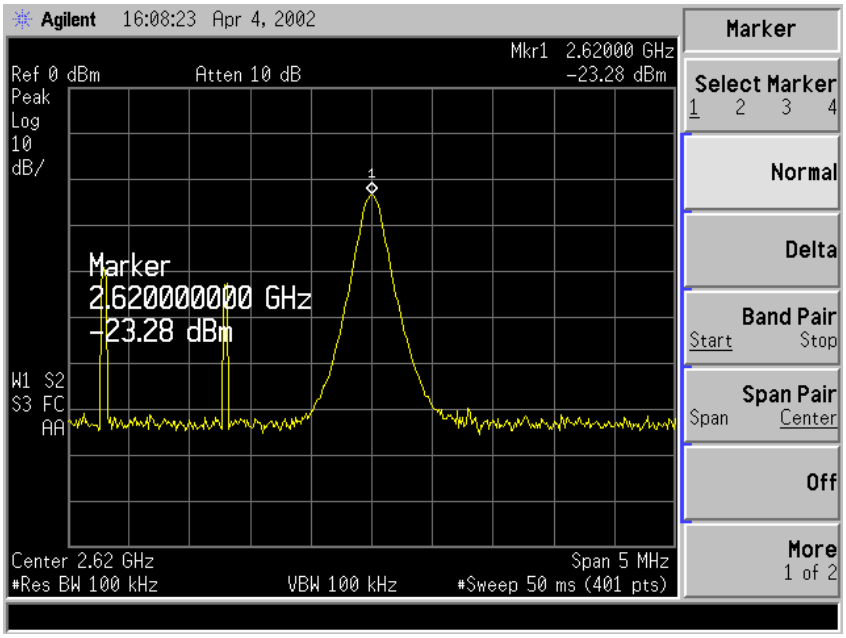
Step 18. If present, remove the barrel connector from between the Signal Generator and Spectrum Analyzer cables.

Step 19. Connect the cable from the Signal Generator to the RFS calibration cable connector. Use a barrel connector to change the gender, if required.

Step 20. Connect the cable from the Spectrum Analyzer to the RFS antenna cable number 1 connector. Use a barrel connector to change the gender, if required.

Step 21. Take a marker measurement on the Spectrum Analyzer by using the 'marker to peak' or the 'peak search' function. The screen on the Spectrum Analyzer should look similar to the one shown in Figure K12.

Figure K12: RFS & Cables Rx Marker Measurement Example



Step 22. The marker value should be equal to the RFS Only RX Insertion Loss + Calibration Cable Loss + Antenna Cable Loss + Antenna Cable Jumper Loss. RX Insertion Loss should be within ±2.0 dB of the sum of the parts. If the Insertion Loss results do not agree with the manufacturers data, check the test setup and the cable connections.

Caution: If RFS & cables test results are greater than the ±2.0 dB limits, they should not be installed on a tower, as a potential hardware fault exists. Verify connections and contact Navini Networks Technical Support.

Step 23. Record the data in the RFS System Test Form under "TOTAL RX PATH LOSS

(CABLE-RFS)". Ensure that the information is recorded under the channel number that is on the cable label.

Step 24. Repeat steps 5 through 8 for the remaining seven antenna cable inputs on the RFS.

Step 25. Change the frequency to the next test frequency (refer to Test Setup). Perform steps 1 through 9 until the RFS has been successfully tested at the frequencies given in Table K4.

Procedures – TTA Base Station

Equipment Required

- Signal Generator - Agilent 8648D, or suitable alternative, tunable to the RFS center frequency
- Spectrum Analyzer - Agilent E4404B, or equivalent
- QMA female to SMA Female adapter
- Three N-type male test cables.
- Two Female/Female N-type barrel connectors.
- RFS test box for RFS tests only (not required for cable tests) – see Figure K13

Figure K13: RFS & RFC Test Box

- **JP1** - Cable port to be connected to the RFC or the RFS.
- **M1/M2** - RFC DC output test points.
- **Load Button** - Tests RFC full Current load. Used in conjunction with Power LED by JP1.
- **RX/TX switch** - Supplies power to the RX or RX circuit in the RFS.
- **RFC/RFS switch** - Moved to the RFS for testing of the RFS and to the RFC for testing of the RFC.
- **10.7MHz** - Test point to measure the 10.7 MHz signal output of the RFC.
- **J1** - External control of switches. **(Engineering use only)**
- **P1** - DC power supply connection. **(Used for RFS testing only)**
- **JP2** - Connection point for test equipment **(DC blocked port)**

Equipment Set-up

- Spectrum Analyzer - connected to the test cable / QMA adapter on BTS end

Center Frequency:	Set to frequency to be tested
Span:	10 MHz
Resolution Bandwidth:	100 KHz
Video Bandwidth:	100 KHz
Sweep Time:	Auto

- Signal Generator - connected to the RFS cable end

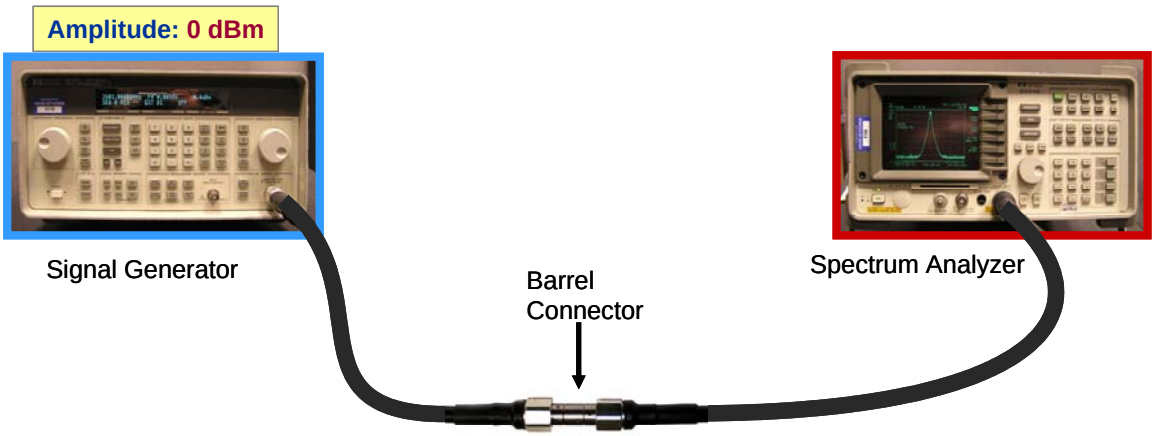
Frequency:	Set to frequency to be tested
Signal Level:	0 dB

Equipment Calibration

Refer to Figure K14 to calibrate the test equipment.

- Perform "Equipment Set-Up".
- Connect the test cable from the "RF Output" of the Signal Generator to the "RF input" of the Spectrum Analyzer.
- Turn on the RF output of the Signal Generator.
- Perform a "peak search" on the Spectrum Analyzer.
- Set a Delta point. The Delta sets a zero point on the Spectrum Analyzer so that when any additional cable or equipment is added to the link the new loss reading can be recorded. (Note: If the Spectrum Analyzer does not have a Delta function, increase the output of the Signal Generator until there is a 0 dB reading on the Spectrum Analyzer.)

Figure K14: Calibrate Test Equipment



RF Cable Sweeps Procedure

This section provides step-by-step procedures for calibrating the test equipment and performing insertion loss measurements of the RF cable. Refer to Figure K15.

Step 1. Calibrate the test equipment.

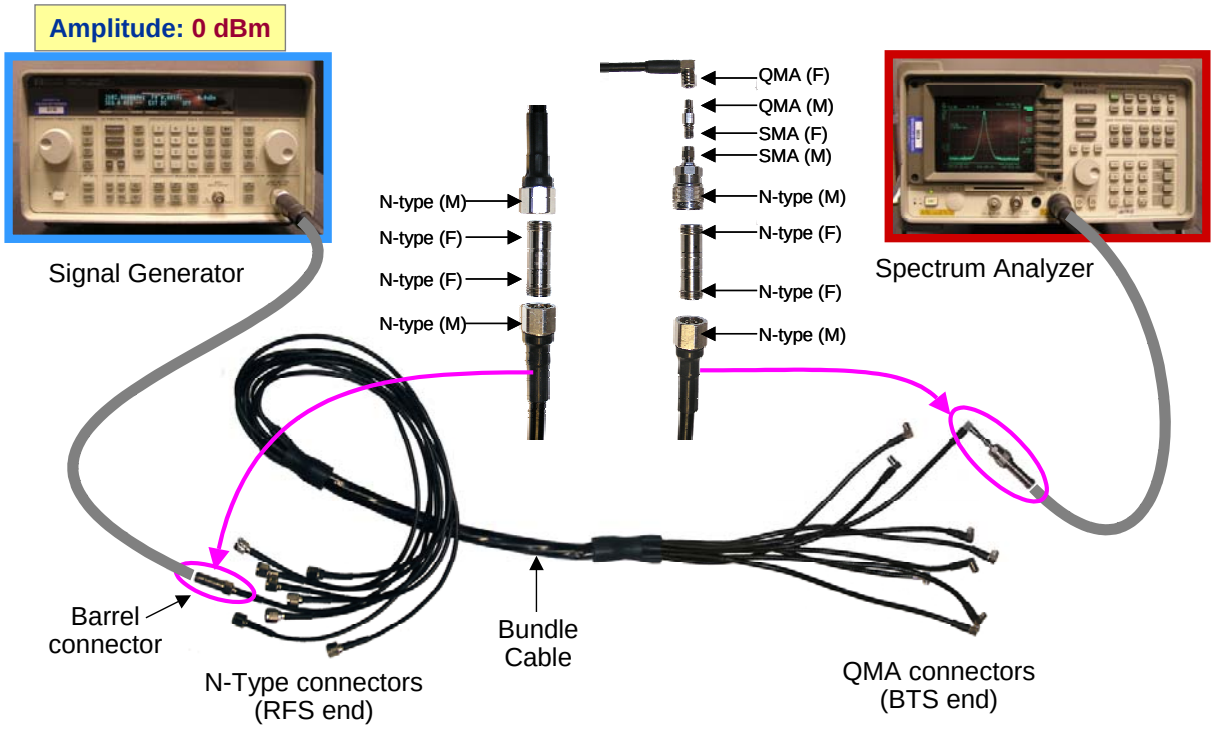
Step 2. Replace the barrel connector with the cable to be measured. Use the appropriate adaptors depending on the type of connectors at the ends of the cable. Figure K15 shows an example).

Step 3. Enable the RF on the signal generator.

Step 4. From the Delta marker found in Step 1 take the loss reading in db. Record the results.

Step 5. Perform steps 2 through 4 for all cables.

Figure K15: RF Cable Test



RFS Test Procedure

This procedure is performed twice for an installation. The first sweep is performed prior to mounting the RFS on the tower. This test verifies that all the equipment is intact from shipment. These sweeps will need to be compared to the factory sweeps that are shipped with the RFS.

The second sweep is performed after the RFS has been mounted on the tower and the RF cables have been connected. This sweep verifies that no damage was done to the RFS when hoisting it, and that the RF cables are properly connected to the RFS.

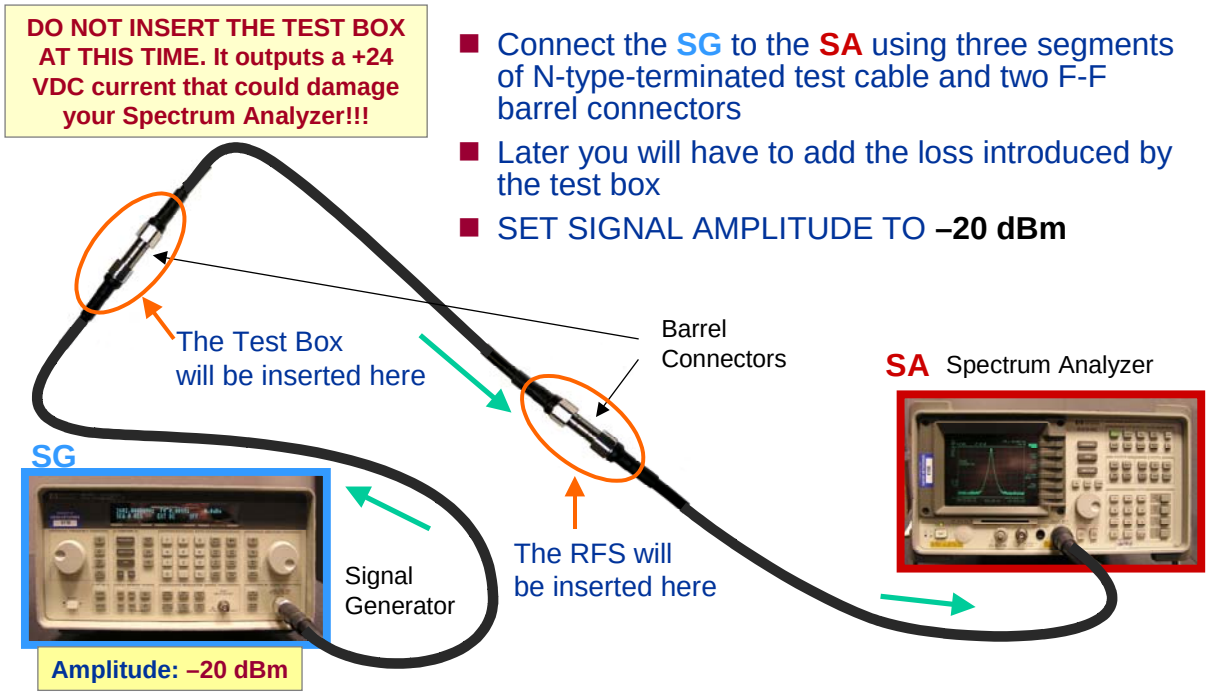
NOTE: For the first sweep of a TTA RFS, you must set the signal level from the Signal Generator to –20 dBm because, due to the high gain of the PAs, if the signal is too strong the PAs will shut down. However, during the second sweep of a TTA RFS (through the main cables) you may need to raise the signal level from the Signal Generator up to, perhaps, 0 dBm because, due to the loss in the main cables, -20 dBm may be too low.

TX SIDE

Step 1. Perform the "Equipment Set-up" as shown in Figures K16 to determine the reference level by pressing on "Marker", "Peak Search", and "Marker Delta" on the Spectrum Analyzer.

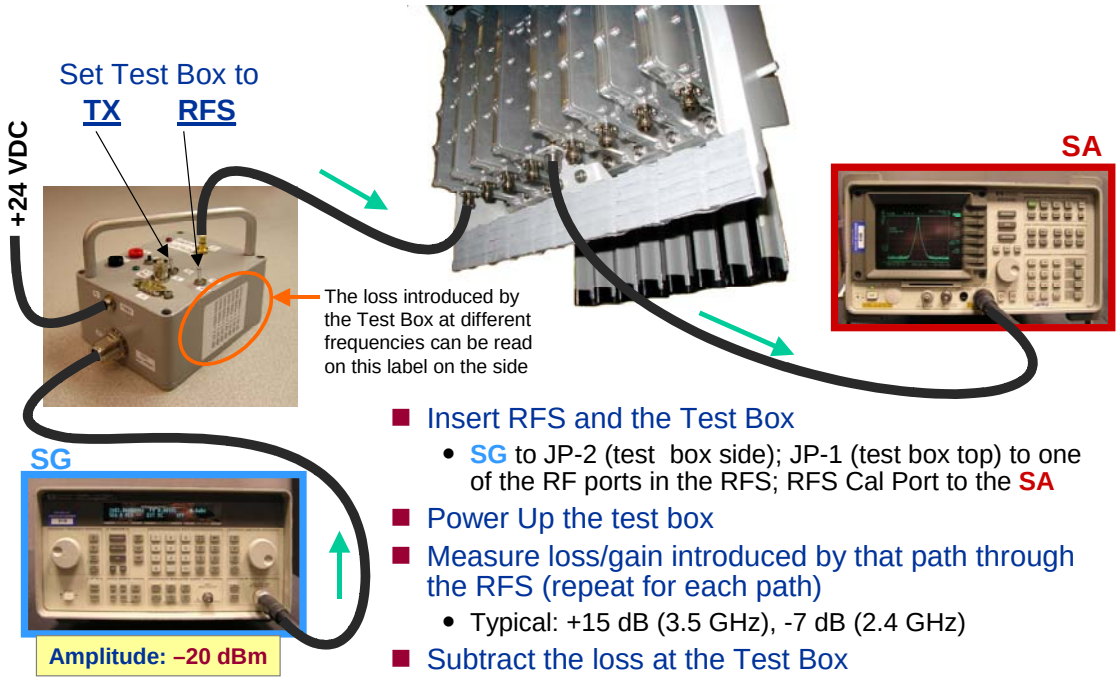
Remember to add later the loss introduced by the Test Box.

Figure K16: Transmit Side (Setting the Reference Level 1)



Step 2. Change the "Equipment Set-up" as shown in Figure K17. Use the first RF port in the RFS

Figure K17: Transmit Side (Measurements)



Step 3. Record the insertion loss dB level. Remember to subtract the loss introduced by the Test Box from your reading.

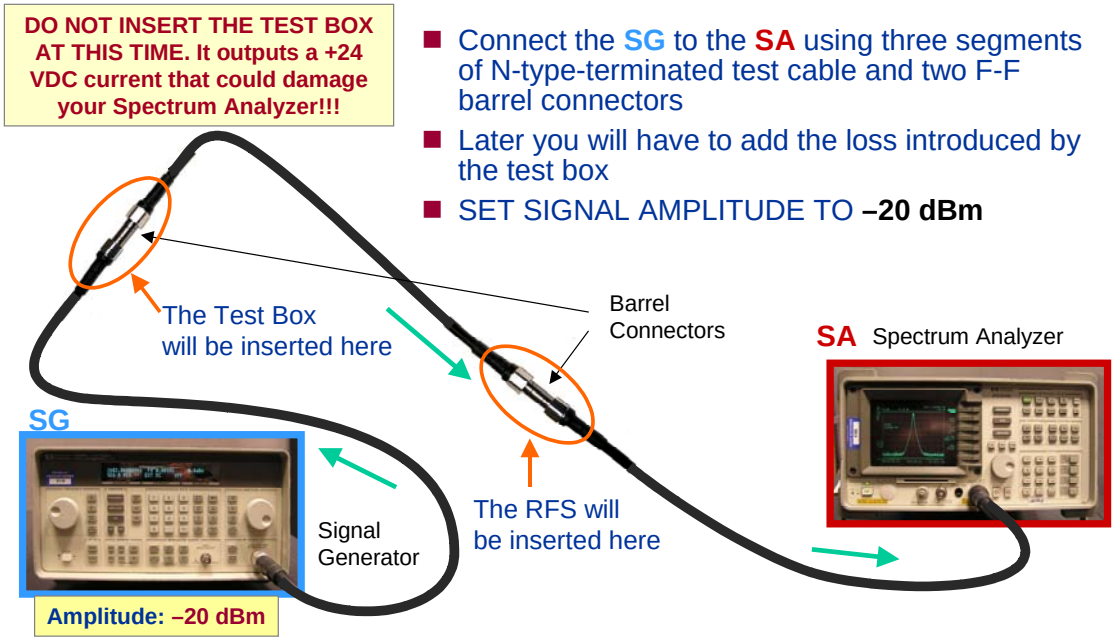
Step 4. Repeat Steps 2 and 3 using the next RF port in the RFS until done for all eight RF ports.

RX SIDE

Step 5. Perform the "Equipment Set-up" as shown in Figures K18 to determine the reference level by pressing on "Marker", "Peak Search", and "Marker Delta" on the Spectrum Analyzer.

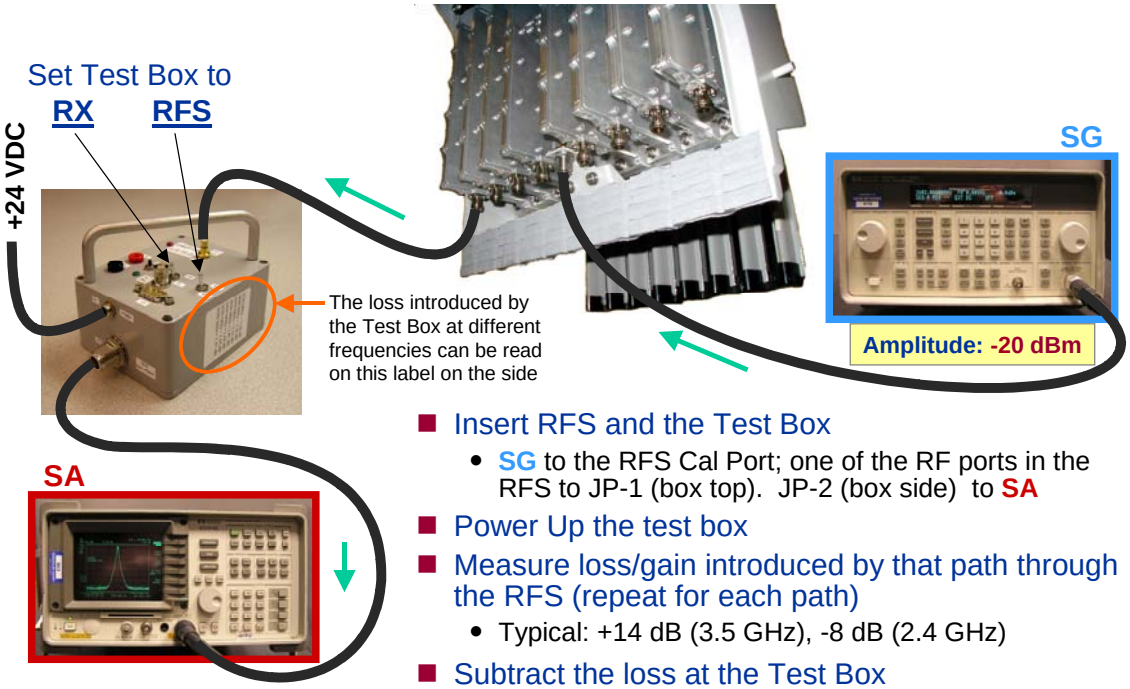
Remember to add later the loss introduced by the Test Box.

Figure K18: Receive Side (Setting the Reference Level)



Step 6. Change the "Equipment Set-up" as shown in Figure K19. Use the first RF port in the RFS

Figure K19: Receive Side (Measuring)



Step 7. Record the insertion loss dB level. Remember to subtract the loss introduced by the Test Box from your reading.

Step 8. Repeat Steps 6 and 7 using the next RF port in the RFS until done for all eight RF ports.

Cable Sweep Form

RF CABLE LOSS INFORMATION

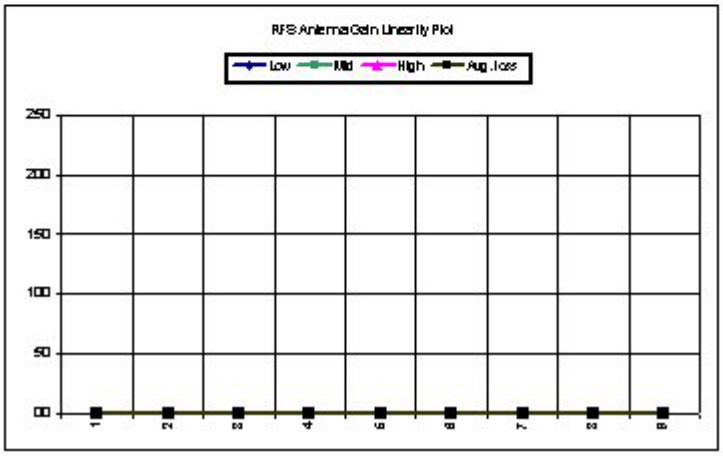
Company Name	0
BTS ID	0
BTS Name	0

Reset Cable Loss Values

CABLE LOSS

Cable	Low	Mid	High	Avg. loss
1				0.0
2				0.0
3				0.0
4				0.0
5				0.0
6				0.0
7				0.0
8				0.0
CAL				0.0

Note Input values as Negative



RFS Sweep and RFS + Cable Sweep Form

RFS AND CABLE SWEEPS INFORMATION

Company Name	0
BTS ID	0
BTS Name	0

Reset RFS & Cable Sweeps Values

INSERTION LOSS THRU RFS

		Low	Mid	High	Average	Cal path loss (calculated)	LNA gain (calculated)		
1	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
2	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
3	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
4	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
6	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
8	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
7	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
8	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0

INSERTION LOSS THRU CAL CABLE AND RFS

		Low	Mid	High	Average	Cal path loss (calculated)	LNA gain (calculated)		
1	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
2	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
3	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
4	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
6	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
8	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
7	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0
8	TX path				0.0	3.0			
	RX path				0.0		0.0	0.0	0.0

INPUT ALL VALUES AS NEGATIVE