

## MAINTENANCE

### 5-1. INTRODUCTION

This section contains periodic maintenance and performance test procedures for the Multicarrier Cellular Amplifier System. It also contains a list of test equipment required to perform the identified tasks.

#### NOTE

Check your sales order and equipment warranty before attempting to service or repair the unit. Do not break the seals on equipment under warranty or the warranty will be null and void. Do not return equipment for warranty or repair service until proper shipping instructions are received from the factory.

### 5-2. PERIODIC MAINTENANCE

Periodic maintenance requirements are listed in Table 5-1. Table 5-1 also lists the intervals at which the tasks should be performed.

#### WARNING

Wear proper eye protection to avoid eye injury when using compressed air.

Table 5-1. Periodic Maintenance

TASK	INTERVAL	ACTION
<b>Cleaning</b> Air Vents	30 Days	Inspect and clean per para. 5-4.
<b>Inspection</b> Cables and Connectors	12 Months	Inspect signal and power cables for frayed insulation. Check RF connectors to be sure that they are tight.
<b>Performance Tests</b>	12 Months	Perform annual test per para. 5-5.

### 5-3. TEST EQUIPMENT REQUIRED FOR TEST

Test equipment required to test the amplifier system is listed in Table 5-2. Equivalent test equipment may be substituted for any item; keep in mind that a thermistor type power meter is required.

#### NOTE

All RF test equipment must be calibrated to 0.05 dB resolution. Any deviation from the nominal attenuation must be accounted for and factored into all output readings.

Table 5-2. Test Equipment Required

NOMENCLATURE	MANUFACTURER	MODEL
Signal Generator	RDL	IMD-801D-03A
30 dB Attenuator, 500 Watt	Weinschel Corp.	53-30-34
10 dB Attenuator, 20 Watt (2 each)	Tenuline	
Spectrum Analyzer	H.P.	8560E
Coax Directional Coupler	H.P.	778D
Power Meter/Sensor	H.P.	437B/8481A
Network Analyzer	H.P.	8753C
Current Probe		

**5-4. CLEANING AIR INLETS/OUTLETS**

The air inlets and outlets should be cleaned every 30 days. If the equipment is operated in a severe dust environment, they should be cleaned more often as necessary. Turn off DC power source before removing fans. If dust and dirt are allowed to accumulate, the cooling efficiency may be diminished. Using either compressed air or a brush with soft bristles, loosen and remove accumulated dust and dirt from the air inlet panels.

**5-5. PERFORMANCE TEST**

Performance testing should be conducted every 12 months to ensure that the amplifier system meets the operational specifications listed in table 5-3. Also verify system performance after any amplifier module is replaced in the field. The test equipment required to perform the testing is listed in table 5-2, and the test setup is shown in figure 5-1.

**NOTE**

The frequencies used in this test are typical for an amplifier with a 25 MHz band from 869 MHz to 894 MHz. Select evenly spaced F1, F2, F3, and F4 frequencies that cover the instantaneous bandwidth of your system.

**5-5.1. AMPLIFIER SYSTEM PERFORMANCE TEST.**

This test is applicable to the MCR20XX Series (NTL107AC) subrack with two plug-in G3X-800 Series (NTL107AA) amplifier modules. To perform the test, proceed as follows:

1. Connect test equipment to the subrack as shown in figure 5-1.

**NOTE**

Do not apply any RF signals at this time.

2. Turn on signal generator and set frequency F1 to 880 MHz, F2 to 883 MHz, F3 to 886 MHz, and F4 to 889 MHz. Adjust each signal generator output so that the sum power output from all four signal generators equals -4 dBm at the output of the 4-way combiner.

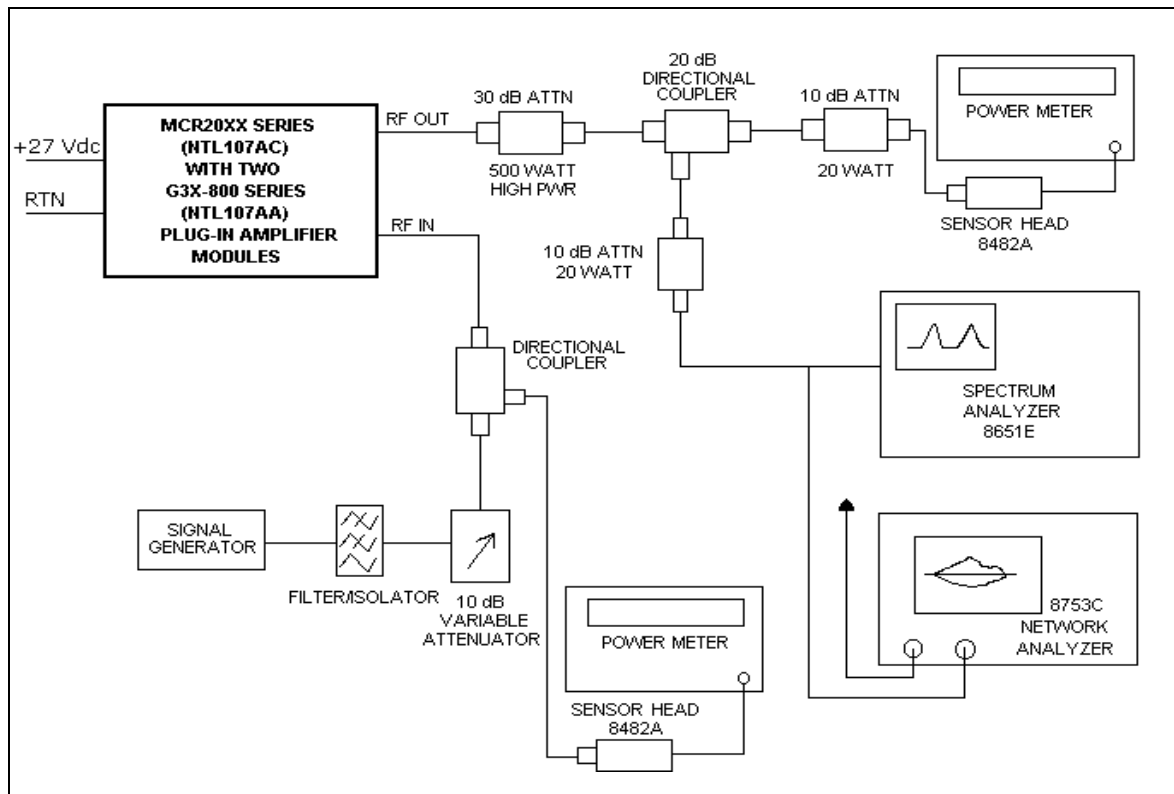


Figure 5-1. Amplifier System Test Setup Diagram

#### SINGLE AMPLIFIER IMD TEST:

3. Adjust attenuator for an input signal at -10 dBm. Turn on both amplifiers, and set RF ON switch of amplifier number two to OFF. Reset first amplifier with the front panel RF ON switch, and set switch to ON. Adjust variable attenuator to set amplifier power output on power meter to 100 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc min. Record test data in table 5-3. Set RF ON switch to OFF.
4. Repeat step 3 for amplifier number two.

#### TWO AMPLIFIER IMD AND CURRENT TEST:

5. Reset and turn on both amplifier modules. Adjust the variable attenuator to set power output on power meter to 200 watts. Measure IMD on spectrum analyzer. IMD should be -65 dBc min. Record test data in table 5-3.
6. With the amplifier modules set at 200 watts power output, use the current probe (magnetic field type) and measure the dc current flow from the +27 Vdc power source. Current should be 110 amps maximum. Record test data in table 5-3.

#### GAIN TEST:

7. Disconnect spectrum analyzer from test setup, and connect the network analyzer.
8. Set network analyzer as follows:
  - Power output to 5 dBm.
  - Frequency start to 869 MHz.
  - Frequency stop to 894 MHz.
  - Normalize the network analyzer for gain and return loss.
9. Reset and turn on the channel 1 amplifier; turn off channel 2 amplifier. Check the gain across the band from 869 MHz to 894 MHz. Gain should be between 30 and 50 dB. Record test data in table 5-3.
10. Turn off the channel 1 amplifier and reset and turn on the channel 2 amplifier. Check the gain across the band from 869 MHz to 894 MHz. Gain should be between 30 and 50 dB. Record test data in table 5-3.
11. Reset and turn on both amplifier modules and check the gain. The gain of both amplifiers should be 3 dB higher than in steps 9 and 10. Record test data in table 5-3.

#### HARMONICS TEST

12. With the power set at 200 watts power output, use the spectrum analyzer and check the frequency band from 869 MHz to 894 MHz for harmonics. Harmonics should be -45 dBc maximum. Record test data in table 5-3.

#### SPURIOUS TEST

13. With the power amplifier set at 200 watts power output, use the spectrum analyzer and check the frequency band from 869 MHz to 894 MHz for spurious signals. Spurious signals should be -60 dBc maximum. Record test data in table 5-3.

#### INPUT RETURN LOSS TEST:

14. Reset and turn on both amplifier modules in the subrack. Read and record the  $S_{11}$  return loss measurement on network analyzer. Input return loss should be -14 dB minimum. Record test data in table 5-3.

Table 5-3. Multicarrier Cellular Amplifier System Test Data Sheet

DATE \_\_\_\_\_

MCR20XX SERIES (NTL107AC) SUBRACK S/N \_\_\_\_\_

MODULE #1 S/N \_\_\_\_\_ MODULE #2 S/N \_\_\_\_\_

**TEST CONDITIONS:**

Load and Source Impedance: 50 Ohms

VSWR: < 1.2:1

Supply Voltage: +27 Vdc ±1.0 Vdc

TEST	SPECIFICATION	MIN	MAX	DATA	
4-TONE IMD One Module	Vcc = 27 Vdc PO = 100 W Freq.: 880, 883, 886, and 889 MHz	-65 dBc		1	2
4-TONE IMD Two Modules	Vcc = 27 Vdc PO = 200 W Freq.: 880, 883, 886, and 889 MHz	-65 dBc		1,2	
RF Gain One Module	Vcc = 27 Vdc PO = 100 W Freq. = 880 MHz	30 dB	50 dB	1	2
RF Gain Two Modules	Vcc = 27 Vdc PO = 200 W Freq. = 880 MHz	30 dB	50 dB	1,2	
Gain Flatness	Vcc = 27 Vdc ±1 Vdc PO = 200 W 869-894 MHz Band	-0.6 dB	+0.6 dB	1,2	
Harmonics	Vcc = 27 Vdc PO = 200 W 869-894 MHz Band		-13 dBm	1,2	
Spurious	Vcc = 27 Vdc PO = 200 W 869-894 MHz Band		-60 dBc	1,2	
Input Return Loss	Vcc = 27 Vdc PO = 200 W 869-894 MHz Band	-16 dB		1,2	
DC Power	Vcc = 27 Vdc PO = 200 W 4 Tones		110 Amps	1,2	

PASS \_\_\_\_\_

FAIL \_\_\_\_\_

Tested by \_\_\_\_\_

## **5-6. FIELD REPLACEABLE PARTS AND MODULES**

The following parts and modules can be replaced in the field on site by a qualified technician with experience maintaining RF power amplifiers and similar equipment:

1. G3X-800 Series (NTL107AA) power amplifier modules
2. Cooling fans

### **5-6.1. G3X-800 SERIES (NTL107AA) MODULE**

To replace a power amplifier module, proceed as follows:

1. Set both the RF ON On/Off/Reset switch and the power ON/OFF switch on the front panel of the amplifier module to OFF.
2. Loosen two screws that secure amplifier module to subrack.
3. Use handle on front of module, and with a steady even pressure, pull module out of subrack.

#### **CAUTION**

When removing the amplifier from the subrack, it is very important to support the amplifier such that the rear of the module does not suddenly drop when it disengages from the track. A drop such as this could damage the module.

### **5-6.2. COOLING FANS**

To replace a cooling fan, proceed as follows:

1. Remove amplifier module from subrack; see paragraph 5-6.1 preceding.
2. Loosen four snap fasteners that secure fan to amplifier module. Disconnect fan power connector from amplifier module.
3. Install replacement in reverse order of steps 1 and 2 above.