



AirPrime HL78xx

RF Test with Test Commands



SIERRA
WIRELESS®

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Contact Information

Sales information and technical support, including warranty and returns	Web: sierrawireless.com/company/contact-us/ Global toll-free number: 1-877-687-7795 6:00 am to 5:00 pm PST
Corporate and product information	Web: sierrawireless.com

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1. Overview

This document helps Sierra Wireless customers develop a production RF test procedure for HL78xx embedded modules using test commands.

Note: Procedures and values specified in this document are intended for room temperature testing.

Table 1. Supported Bands

LTE Band	Transmit Band (Tx)		Receive Band (Rx)		Cat-M1 (HL7800 and HL7800-M)	Cat-NB1 (HL7800 only)
	Minimum	Maximum	Minimum	Maximum		
B1	1920 MHz	1980 MHz	2110 MHz	2170 MHz	✓	*
B2	1850 MHz	1910 MHz	1930 MHz	1990 MHz	✓	*
B3	1710 MHz	1785 MHz	1805 MHz	1880 MHz	✓	*
B4	1710 MHz	1755 MHz	2110 MHz	2155 MHz	✓	*
B5	824 MHz	849 MHz	869 MHz	894 MHz	✓	*
B8	880 MHz	915 MHz	925 MHz	960 MHz	✓	*
B9	1749.9 MHz	1784.9 MHz	1844.9 MHz	1879.9 MHz	*	*
B10	1710 MHz	1770 MHz	2110 MHz	2170 MHz	*	*
B12	699 MHz	716 MHz	729 MHz	746 MHz	✓	*
B13	777 MHz	787 MHz	746 MHz	756 MHz	✓	*
B14	788 MHz	798 MHz	758 MHz	768 MHz	✓	*
B17	704 MHz	716 MHz	734 MHz	746 MHz	*	*
B18	815 MHz	830 MHz	860 MHz	875 MHz	✓	*
B19	830 MHz	845 MHz	875 MHz	890 MHz	✓	*
B20	832 MHz	862 MHz	791 MHz	821 MHz	✓	*
B25	1850 MHz	1915 MHz	1930 MHz	1995 MHz	✓	*
B26	814 MHz	849 MHz	859 MHz	894 MHz	✓	*
B27	807 MHz	824 MHz	852 MHz	869 MHz	✓	*
B28	703 MHz	748 MHz	758 MHz	803 MHz	✓	*
B66	1710 MHz	1780 MHz	2110 MHz	2200 MHz	✓	*

* Will be supported in a future release.

Note: RF bands supported are configurable through AT command. The software-based radio allows for the ability to support extra bands for worldwide connectivity.

2. Test Procedure

Use an appropriate test station for your testing environment and use AT commands to control the integrated module.

Note: Assuming that your test computer is in a disassembled state, your test location must be protected from ESD to avoid interference with the module and antenna(s). Consider using an RF shielding box; local government regulations may prohibit unauthorized transmissions.

2.1. Suggested Testing Equipment

To perform production tests, you will need the following test equipment:

- 1 PC with Windows 7 OS
- 1 NI GPIB connection
- 1 Power supply, e.g. Agilent 66311
- 1 Call box, e.g. CMU200

Note: You can also use one power meter and one signal generator to replace the call box, e.g. Power Meter Gigatronix 8651A (with Option 12 and Power Sensor 80701), and Signal Generator Agilent 8648C.

2.2. Test Commands

Use AT commands **+WMTXPOWER** and **+WMRXPOWER** to test the module's RF. Refer to document [2] AirPrime HL78xx AT Commands Interface Guide for command details.

2.3. RF Transmission Test

The suggested test procedure that follows uses the parameters in the following table.

Table 2. Transmission Path Test Settings

Mode	Band Number	Band ID	TX Channel*	TX Frequency (MHz)
LTE	B1	1	18300	1950
	B2	2	18900	1880
	B3	3	19575	1747.5
	B4	4	20175	1732.5
	B5	5	20525	836.5
	B8	8	21625	897.5
	B9	9	21975	1767.4
	B10	10	22450	1740
	B12	12	23095	707.5
	B13	13	23230	782
	B14	14	23330	793
B17	17	23790	710	

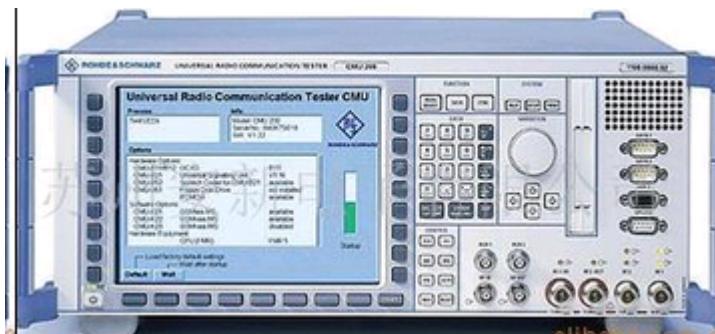
Mode	Band Number	Band ID	TX Channel*	TX Frequency (MHz)
LTE	B18	18	23925	822.5
	B19	19	24075	837.5
	B20	20	24300	847
	B25	25	26365	1882.5
	B26	26	26865	831.5
	B27	27	27125	815.5
	B28	28	27435	725.5
	B66	66	132322	1745

* Channel values shown are at the center of the corresponding bands.

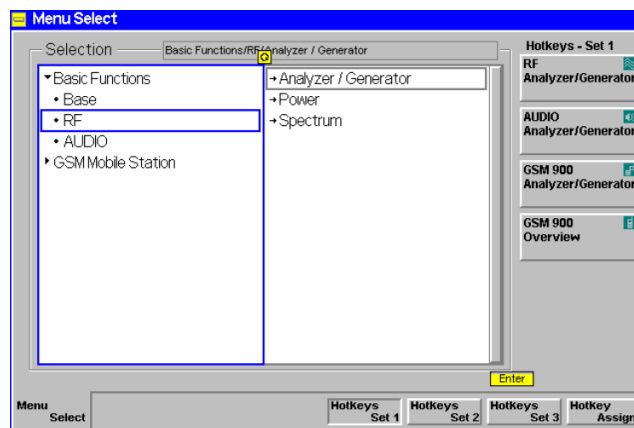
Caution: Do not to transmit at a power too high which will possibly damage the module.

To test the DUT’s transmission path:

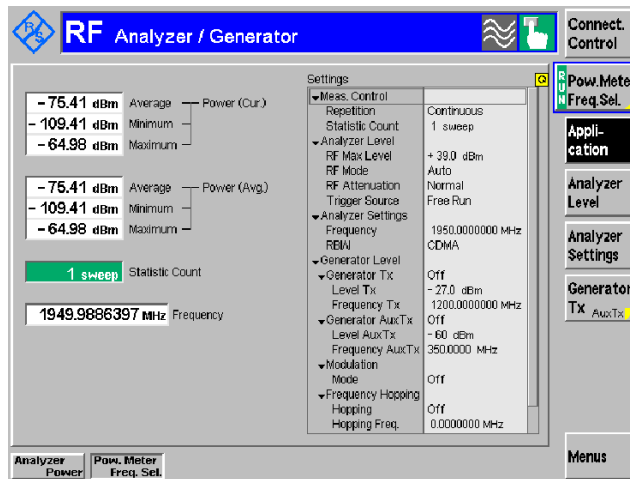
1. Set up the CMU200.



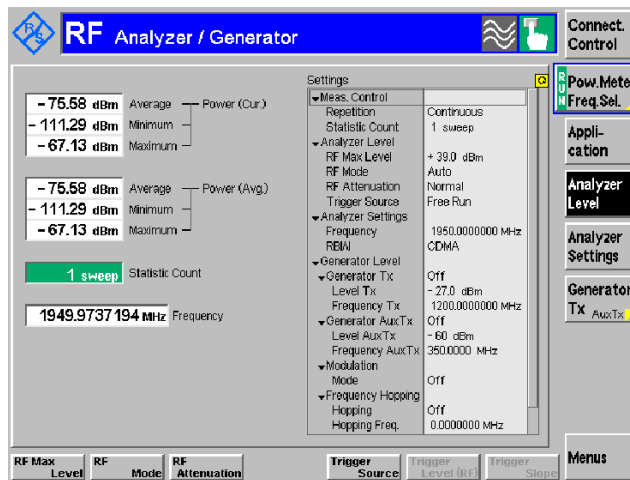
- a. Press “Menu Select” and select “Basic Functions” → “RF” → “Analyzer/Generator”.



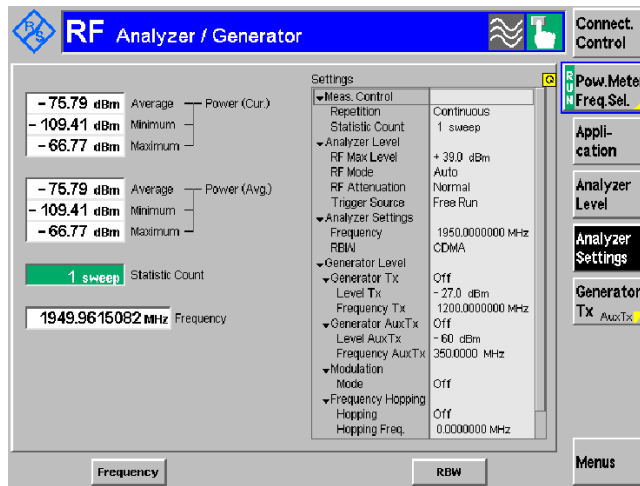
- b. Press “Application” → “Pow.MeterFreq.Seq”.



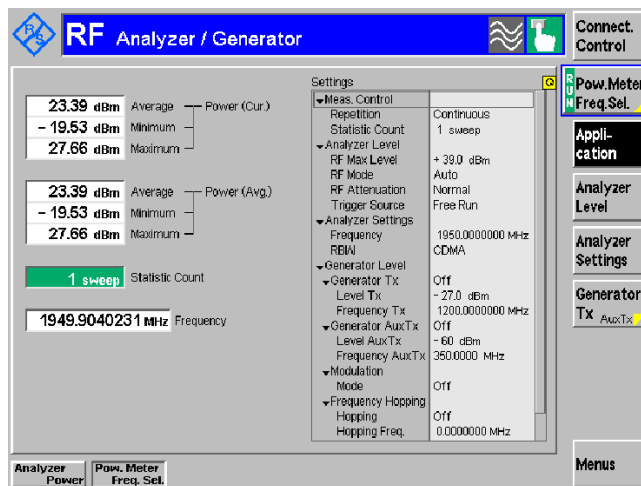
- c. Press “Analyzer Level”.
 - i. Set “RF Max Level” to 39dBm.
 - ii. Set “RF Mode” to Auto.
 - iii. Set “Attenuator” to Normal.
 - iv. Set “Trigger Source” to Free Run.



- d. Press “Analyzer Settings”.
 - i. Set “RBW” to CDMA.
 - ii. Set “Frequency” (see Table 4 for the appropriate value).



2. Prepare the DUT using the following AT commands:
 - a. `AT+WMTXPOWER=1,1,18300,2300,0,0` to start transmission with the specified band, channel, power level, Tx type and bandwidth.
 - b. Take the measurement.
 - c. Use `AT+WMTXPOWER=0` to turn off the transmission.
 - d. Test limits - run ten or more good DUTs through this test procedure to obtain a nominal output power value.
 - e. Apply a tolerance of ± 5 to 6 dB to each measurement (assuming a good setup design).



Note: Ensure that an RF load is connected to the antenna port before turning on the RF transmission. The expected output power will be +21dBm in LTE mode. However, the value measured is significantly influenced by the test setup (host RF cabling loss and choice of shield box).

2.4. RF Reception Test

The suggested test procedure that follows uses the parameters in the following table.

Table 3. Reception Path Test Settings

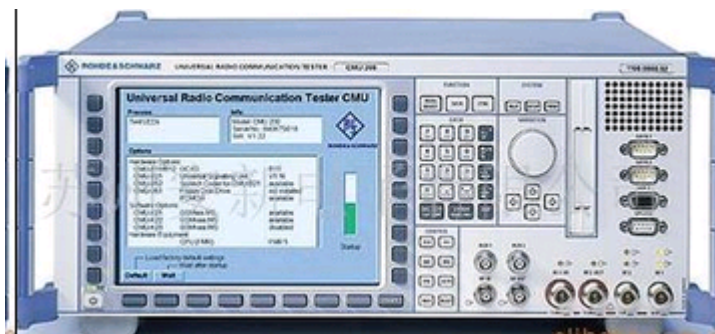
Mode	Band Number	Band ID	RX Channel*	RX Frequency (MHz)**
LTE	B1	1	300	2141
	B2	2	900	1961
	B3	3	1575	1843.5
	B4	4	2175	2133.5
	B5	5	2525	882.5
	B8	8	3625	943.5
	B9	9	3975	1863.4
	B10	10	4450	2141
	B12	12	5095	738.5
	B13	13	5230	752
	B14	14	5330	764
	B17	17	5790	741
	B18	18	5925	868.5
	B19	19	6075	883.5
	B20	20	6300	807
	B25	25	8365	1963.5
	B26	26	8865	877.5
	B27	27	9125	861.5
B28	28	9435	781.5	
B66	66	66886	2156	

* Channel values shown are at the center of the corresponding bands.

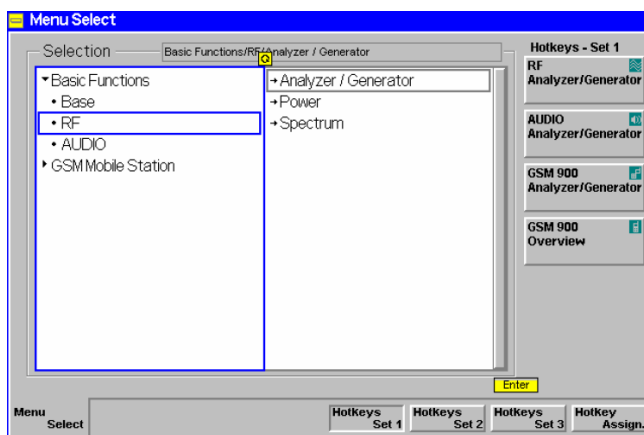
** Receive frequencies shown are 1 MHz offset from center.

To test the DUT's reception path:

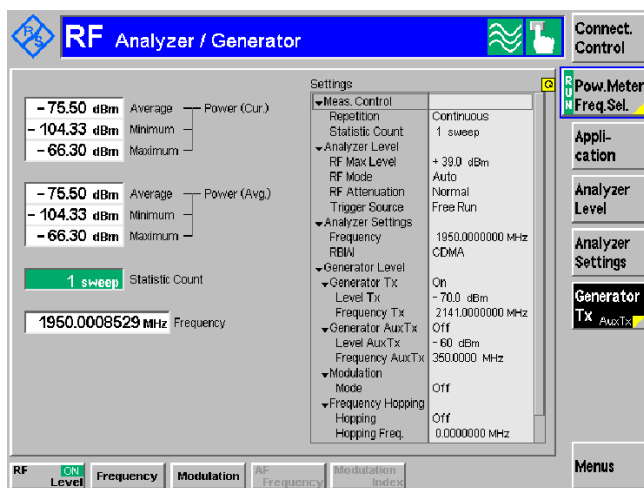
1. Set up the CMU200.



- a. Press “Menu Select” and select “Basic Functions” → “RF” → “Analyzer/Generator”.



- b. Press “GeneratorTx”.
 - i. Set “RF Level” to -70 dBm and press “ON/OFF” to turn it ON.
 - ii. Set “Modulation” to OFF.
 - iii. Set “Frequency” (See Table 5 for the appropriate value).



2. Prepare the DUT using the following AT command:
 - a. **AT+WMRXPOWER=1,1,300** to start reception with the specified band and channel. The module then responds with:


```
+WMRXPOWER: -67.0
```

OK
 - b. Take the measurement.
 - c. Test limits - run ten or more good DUTs through this test procedure to obtain a nominal output power value.
 - d. Apply a tolerance of ± 5 to 6 dB to each measurement (assuming a good setup design).
 - e. Make sure the measurement is made at a level high enough that it is not influenced by DUT-generated and ambient noise.

Note: The value measured from the DUT is significantly influenced by the test setup and DUT design (host RF cabling loss and choice of shield box).

3. References

- [1] AirPrime HL7800 and HL7800-M Product Technical Specification
Reference number: 41111094
- [2] AirPrime HL78xx AT Commands Interface Guide
Reference number: 41111821