



FCC Test Report

Product Name: Distributed Base Station Radio Remote Unit

Model Number: RRU3203

**Report No: SYBH (R) 009042010EB-1
FCC ID: QIS RRU3203**

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REPORT ON FCC Test of Distributed Base Station Radio Remote Unit

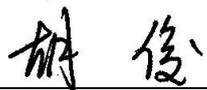
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REGULATION **47 CFR FCC Part 2, Subpart J**
47 CFR FCC Part 27, Subpart C

CONCLUSION **PASSED**

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1 Summary

The table below summarizes the measurements and results for the equipment of Distributed Base Station Radio Remote Unit - RRU3203. Detailed results and descriptions are shown in the following pages.

Table 1. Summary of results for FCC requirements for 698-746MHz Band

47 CFR FCC Part(s) Requirements		Description	Result
Specification	Limits		
2.1046	27.50(d)	Transmitter Output Power	PASS
2.1047	---	Modulation Characteristics	PASS
2.1049	---	Occupied Bandwidth	PASS
2.1051	27.53(g)	Band Edges Compliance	PASS
2.1051	27.53(g)	Spurious Emission at Antenna Terminal	PASS
2.1053	27.53(g)	Radiated Spurious Emission	PASS
2.1055	27.54	Frequency Stability	PASS

Note: If no limits were applied, limits for product standards may be employed in this test report.

2 Product Description

2.1 Production Information of EUT

2.1.1 General Description

HUAWEI Base Station DBS3900 LTE is a distributed eNodeB with the 3GPP LTE FDD protocols. The DBS3900 LTE supports CPRI interfaces and contains BBU and RRU two parts:

- I Baseband unit (BBU): processes baseband signals.
- I Radio remote unit (RRU): processes RF signals.

RRU3203 (Band XII) is the outdoor radio remote unit. It can be mounted close to the antenna on a metal pole or a wall.

For RRU3203 (Band XII), the downlink frequency is 728 MHz~746 MHz and the uplink frequency is 698 MHz~716 MHz.

RRU3203 (Band XII) has a highly integrated structure. The components of RRU3203 are describes as follows:

1. Power supply: leads the external – 48 VDC power to supply power for RRU3203.
2. Duplexer: multiplexes RX signals and TX signals, which enables the RX signals and TX signals to share the same antenna path. The duplexer also filters RX signals and TX signals.
3. Low noise amplifier: amplifies received signals to avoid loss of signals.
4. Power amplifier: amplifies transmission signals to reinforce the power of the signals. It has the power of 40 W per port.
5. TRX: includes two receive channels, two transmission channels and one feedback channel. Each channel supports only one carrier.

2.1.2 Support function and Service

The EUT supports the function and service as follows:

Table 2. Service and Test Mode List

Service Name	Characteristic	Corresponding Test Mode	Remark
LTE voice and data	Modulation: QPSK	TM1.1, TM1.2, TM3.2, TM3.3	/
LTE voice and data	Modulation: 16QAM	TM3.2, TM3.3	/
LTE voice and data	Modulation: 64QAM	TM2.0, TM3.1	/

Note: The test conditions and settings are defined in clause 6.1.1 of 3GPP TS 36.141.

2.2 Modification Information

For original equipment, following table is not application.

Table 3. Modification Information

Model Number	Board/Module	Original Version	New Version	Modify Information
Not applicable				



3 Test Site Description

The test site of:

***Huawei Technologies Co. Ltd.
P.O. Box 518129
Huawei base, Bantian,
Longgang District, Shenzhen, China***

3.1 Testing Period

The test has been performed during the period of

Date of Start: 24 March 2010

Date of End: 28 April 2010

4 Product Description

4.1 Technical Characteristics

4.1.1 Frequency Range

Table 4. Frequency Range for Band12

Uplink band:	698 to 716 MHz
Downlink band:	728 to 746 MHz

4.1.2 Channel Separation/Bandwidth

Table 5. Frequency Interval and Channel Separation

Channel raster:	100 kHz
Channel spacing:	1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz

4.1.3 Type of Emission

Refer to FCC part 2.201 and 2.202.

Table 6. Type of Emission

Emission Designation:	1M10D9W, 2M70D9W, 4M47D9W, 8M92D9W, 13M4D9W
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4.1.4 Environmental Requirements

Table 7. Environmental Requirements

Minimum temperature:	-40 °C
Maximum temperature:	+55 °C
Relative Humidity:	5% to 100% RH

4.1.5 Power Source

Table 8. DC Power Source

DC voltage nominal:	=== -48 V
DC voltage range:	=== -57 V to === -36 V
DC current maximal:	10A

4.1.6 Tune-up Procedure

Refer to FCC 2.1033(c) (9).

Please refer to the document "Tune-up Info" in TCF.



4.2 EUT Identification List

4.2.1 Component Parts Information

Table 9. Component Parts Information

Model Name	Qty.	Hardware Version	Software Version	Description	Serial Number
WD51LRX8C	1	VERB.	V100R002C00	LTE Transceiver Board	020RXY1096800004
WD51LRA8C	1	VERA.	V100R002C00	LTE PA & LNA Board	020AGF10978000043
WD5MHLDU8C	1	VERA.	V100R002C00	Duplex filter	09070104

Table 10. Ancillary Parts Information

Model Name	Qty.	Hardware Version	Software Version	Description	Serial Number
WD2BBBUC	1	VERA.	V100R002C00	Base band unit	21021127226T92018112

4.2.2 Adapter Technical Data

Not Applicable for EUT.

4.2.3 Battery Technical Data

Not Applicable for EUT.

4.2.4 FCC Identification

Grantee Code: QIS
 Product Code: RRU3203
 FCC Identification: QISRRU3203

5 Main Test Instruments

Table 11. Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until (y-m-d)
Receiver	R&S	ESU40	100144	2010-04-21
BiLog Antenna	Schaffner	CBL 6112B	2747	2010-11-29
Horn Antenna	R&S	HF906	359287/005	2010-03-26
Spectrum Analyzer	Agilent	E4445A	MY46181921	2010-09-15
Power Supply	EMERSON	ONU4820	210213035320 89010073	/
Temperature Chamber	ESPEC	EW2465	05175004	2010-08-11
Attenuator	Shanghai Huaxiang	DTS250	08091737	/

6 Transmitter Measurements

Test Ports:

The EUT consists of two TRX channels, Ch-A and Ch-B, which are identical in designs. Each channel can support only one carrier. Each channel can be configured to emit one carrier with 40W, provided that either Ch-A or Ch-B transmits. This configuration is used during the measurement of max. output power in the test report.

Test Frequencies:

For tests in this report, typical operating frequency points (channels) were used, which include bottom/lowest channel (B), middle channel (M) and top/highest channel (T) of each frequency block as the table below.

Table 12. Frequency points (channels) selected to perform tests

Transmitter Operating Band	Single-Carrier	Channels No.		
		Channel B	Channel M	Channel T
Band12(1.4 MHz channel bandwidth)	1	No.5007 728.7MHz	No.5090 737MHz	No.5173 745.3MHz
Band12(3 MHz channel bandwidth)	1	No.5015 729.5MHz	No.5090 737MHz	No.5165 744.5MHz
Band12(5 MHz channel bandwidth)	1	No.5025 730.5MHz	No.5090 737MHz	No.5155 743.5MHz
Band12(10 MHz channel bandwidth)	1	No.5050 733MHz	No.5090 737MHz	No.5130 741MHz
Band12(15 MHz channel bandwidth)	1	No.5075 735.5MHz	No.5090 737MHz	No.5105 738.5MHz

Test Modes:

For tests in this report, not all Test Modes listed in clause 2.1.2 (Support function and Service) will be used. The selection of test modes is based on the description of [clause 6.1.1 of 3GPP TS 36.141](#). The test mode(s) used in each test is described in the table of "Test Conditions" as following clauses.

6.1 Maximum Channel Power

6.1.1 Test Conditions

Table 13. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20-23 °C
Relative humidity:	55-68 %
Power supply:	-48 VDC
Test Configuration/Mode:	TM1.1 at Channel B, M, T for Single Carrier
Rated maximum transmitter output power (P_{max}):	Single carrier: total 46dBm(40W);

6.1.2 Test Specifications and Limits

6.1.2.1 Specification

FCC part 2.1046 and part 27.50(c)

6.1.2.2 Supporting Standards

Table 14. Supporting Standards

3GPP TS 36.141 version 8.1.0 (Release 8)	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing
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6.1.2.3 Limits

Compliance with FCC part 2.1046 and part 27.50(c), the ERP power of base station transmitting in the 728-746 MHz band is limited to a peak ERP power of 1000 watts/MHz.

Table 15. FCC Limits for Band12

Maximum ERP power:	< 1000 Watts /MHz(= 60 dBm/MHz)
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6.1.3 Test Method and Setup

The EUT was connected to the Wireless Signal Analyzer or equivalent via one RF connector, and other RF connectors were connected to match loads. The EUT was controlled to transmit maximum power by Console Computer. Measure and record the Maximum Channel Power of the EUT by the Wireless Signal Analyzer or equivalent.

Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an RMS equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a

true peak measurement for the emission in question over the full bandwidth of the channel.

Test setup

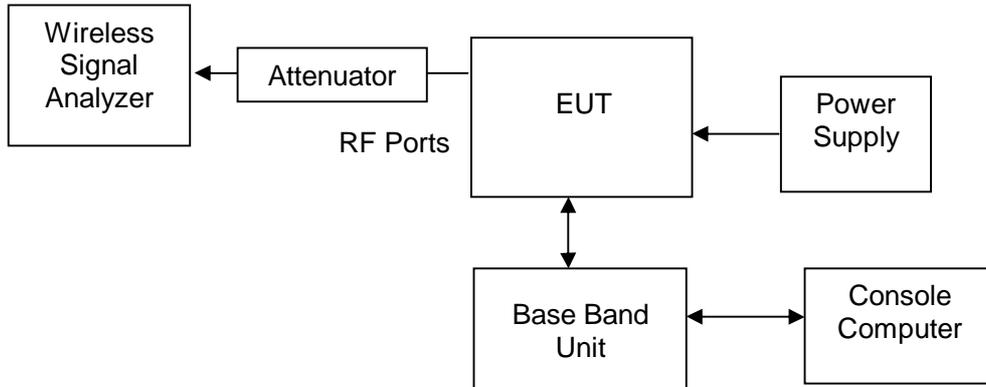


Figure 1. TEST SETUP

6.1.4 Measurement Results

TM1.1:

Table 16. Measurement Results for Maximum Output Power(BW=1.4MHz)

	Maximum Output Power						
	No.5007 728.7MHz		No.5090 737MHz		No.5173 745.3MHz		Limit (dBm/MHz)
	dBm	dBm/M Hz	dBm	dBm/M Hz	dBm	dBm/M Hz	
Single carrier	45.48	44.02	45.52	44.06	45.35	43.89	< 60

Table 17. Measurement Results for Maximum Output Power(BW=3MHz)

	Maximum Output Power						
	No.5015 729.5MHz		No.5090 737MHz		No.5165 744.5MHz		Limit (dBm/MHz)
	dBm	dBm/M Hz	dBm	dBm/M Hz	dBm	dBm/M Hz	
Single carrier	45.58	40.81	45.72	40.95	45.45	40.68	< 60

Table 18. Measurement Results for Maximum Output Power(BW=5MHz)

	Maximum Output Power						
	No.5025 730.5MHz		No.5090 737MHz		No.5155 743.5MHz		Limit (dBm/MHz)
	dBm	dBm/M Hz	dBm	dBm/M Hz	dBm	dBm/M Hz	
Single carrier	45.70	38.70	45.63	38.63	45.53	38.53	< 60

Table 19. Measurement Results for Maximum Output Power(BW=10MHz)

Maximum Output Power							



	No.5050 733MHz		No.5090 737MHz		No.5130 741MHz		Limit (dBm/MHz)
	dBm	dBm/M Hz	dBm	dBm/M Hz	dBm	dBm/M Hz	
Single carrier	45.63	35.63	45.84	35.84	45.47	35.47	< 60

Table 20. Measurement Results for Maximum Output Power(BW=15MHz)

	Maximum Output Power						
	No.5075 735.5MHz		No.5090 737MHz		No.5105 738.5MHz		Limit (dBm/MHz)
	dBm	dBm/M Hz	dBm	dBm/M Hz	dBm	dBm/M Hz	
Single carrier	45.91	34.15	45.97	34.21	45.85	34.09	< 60

6.1.5 Conclusion

The equipment **PASSED** the requirement of this clause.

6.2 Modulation Characteristics

6.2.1 Test Conditions

Table 21. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20-23 °C
Relative humidity:	55-68 %
Power supply:	-48 VDC
Test Configuration/Mode:	TM2.0, TM3.1, TM3.2, TM3.3 at Channel M

6.2.2 Test Specifications and Limits

6.2.2.1 Specification

FCC part 2.1047 and part 27 subpart C & L

6.2.2.2 Supporting Standards

Table 22. Supporting Standards

3GPP TS 36.141 version 8.1.0 (Release 8)	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing
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6.2.2.3 Limits

No specific modulation characteristics requirement limits in FCC part 2.1047 and part 27 subpart C & L for AWS Band.

In addition, limits according to the technical requirements of the EUT can be adopted as showed in the following table.

Table 23. Limits According to EUT technical requirements

Limits for LTE equipments:	QPSK modulation (TM3.3):	EVM	< 18.5%
	16QAM modulation (TM3.2):	EVM	< 13.5%
	64QAM modulation (TM2.0, TM3.1):	EVM	< 9%

6.2.3 Test Method and Setup

The EUT was connected to the Wireless Signal Analyzer or equivalent via one RF connector, and other RF connectors were connected to match loads. The EUT was controlled to transmit maximum power by Console Computer. Measure and record the Modulation Characteristics of the EUT by the Wireless Signal Analyzer or equivalent.

Test setup

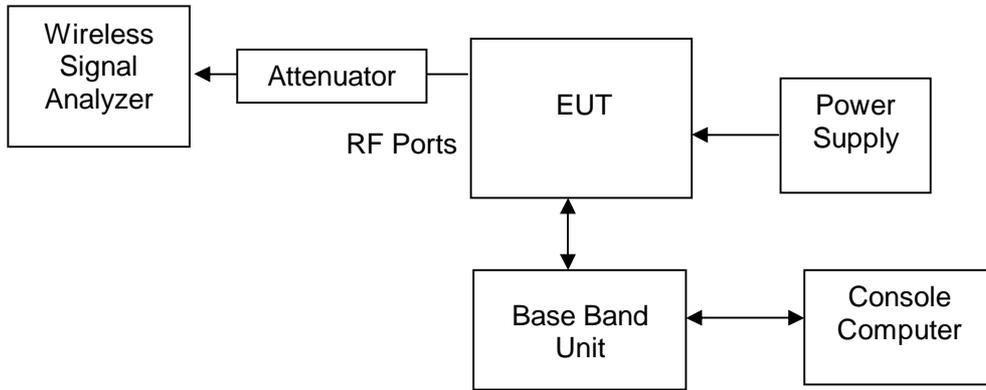


Figure 2. TEST SETUP

6.2.4 Measurement Results

Table 24. Measurement Results for Modulation Characteristics(BW=1.4MHz)

Test Mode	Modulation Characteristics			
	No. 5090 (M) 737MHz			
	Type/Mode	Parameters	Measured	Limit
TM2.0	64QAM	EVM	1.21	< 9%
TM3.1	64QAM	EVM	4.29	< 9%
TM3.2	16QAM	EVM	6.35	< 13.5%
TM3.3	QPSK	EVM	11.48	< 18.5%

Table 25. Measurement Results for Modulation Characteristics(BW=3MHz)

Test Mode	Modulation Characteristics			
	No. 5090 (M) 737MHz			
	Type/Mode	Parameters	Measured	Limit
TM2.0	64QAM	EVM	0.76	< 9%
TM3.1	64QAM	EVM	4.28	< 9%
TM3.2	16QAM	EVM	7.06	< 13.5%
TM3.3	QPSK	EVM	11.59	< 18.5%

Table 26. Measurement Results for Modulation Characteristics(BW=5MHz)

Test Mode	Modulation Characteristics			
	No. 5090 (M) 737MHz			
	Type/Mode	Parameters	Measured	Limit
TM2.0	64QAM	EVM	1.05	< 9%
TM3.1	64QAM	EVM	4.44	< 9%
TM3.2	16QAM	EVM	6.38	< 13.5%
TM3.3	QPSK	EVM	11.06	< 18.5%

Table 27. Measurement Results for Modulation Characteristics(BW=10MHz)

Test Mode	Modulation Characteristics			
	No. 5090 (M) 737MHz			
	Type/Mode	Parameters	Measured	Limit
TM2.0	64QAM	EVM	1.04	< 9%
TM3.1	64QAM	EVM	4.53	< 9%
TM3.2	16QAM	EVM	7.35	< 13.5%
TM3.3	QPSK	EVM	11.35	< 18.5%

Table 28. Measurement Results for Modulation Characteristics(BW=15MHz)

Test Mode	Modulation Characteristics			
	No. 5090 (M) 737MHz			
	Type/Mode	Parameters	Measured	Limit
TM2.0	64QAM	EVM	0.91	< 9%
TM3.1	64QAM	EVM	4.48	< 9%
TM3.2	16QAM	EVM	7.49	< 13.5%
TM3.3	QPSK	EVM	11.70	< 18.5%

6.2.5 Conclusion

The equipment **PASSED** the requirement of this clause.
 For the measurement results refer to Appendix A.

6.3 Occupied Bandwidth

6.3.1 Test Conditions

Table 29. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20-23 °C
Relative humidity:	55-68 %
Power supply:	-48 VDC
Test Configuration/Mode:	TM1.1 at Channel B, M, T

6.3.2 Test Specifications and Limits

6.3.2.1 Specification

FCC part 2.1049 and part 27 subpart C & L

6.3.2.2 Supporting Standards

Table 30. Supporting Standards

3GPP TS 36.141 version 8.1.0 (Release 8)	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing
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6.3.2.3 Limits

No specific occupied bandwidth requirement in FCC part 2.1049 and part 27 subpart C & L for Band12.

6.3.3 Test Method and Setup

The EUT was connected to the Spectrum Analyzer or equivalent via one RF connector, and other RF connectors were connected to match loads. The EUT was controlled to transmit maximum power by Console Computer. Measure and record the Occupied Bandwidth of the EUT by the Spectrum Analyzer or equivalent.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured (as 99% bandwidth).

Measurement bandwidth (RBW) of Spectrum Analyzer or equivalent:

for LTE equipments:	30 kHz
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In addition, limits according to the technical requirements of the EUT can be adopted as showed in the following table.

Table 31. Limits According to EUT technical requirements

Limits for LTE equipments:	< 1.4 MHz (for 1.4MHz channel bandwidth) < 3 MHz (for 3MHz channel bandwidth) < 5 MHz (for 5MHz channel bandwidth) < 10 MHz (for 10MHz channel bandwidth) < 15 MHz (for 15MHz channel bandwidth)
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Test setup

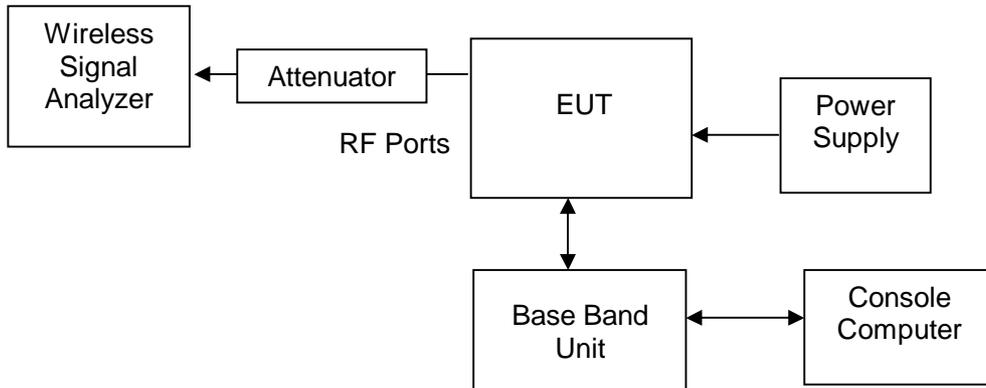


Figure 3. TEST SETUP

6.3.4 Measurement Results

Table 32. Measurement Results for Occupied Bandwidth(BW=1.4MHz)

Test Mode	Occupied Bandwidth			Limit
	No.5007 728.7MHz	No.5090 737MHz	No.5173 745.3MHz	
	MHz	MHz	MHz	
TM1.1	1.0967	1.0987	1.0999	< 1.4MHz

Table 33. Measurement Results for Occupied Bandwidth(BW=3MHz)

Test Mode	Occupied Bandwidth			Limit
	No.5015 729.5MHz	No.5090 737MHz	No.5165 744.5MHz	
	MHz	MHz	MHz	
TM1.1	2.6995	2.6902	2.698	< 3MHz

Table 34. Measurement Results for Occupied Bandwidth(BW=5MHz)

Test Mode	Occupied Bandwidth			Limit
	No.5025 730.5MHz	No.5090 737MHz	No.5155 743.5MHz	
	MHz	MHz	MHz	
TM1.1	4.4657	4.4668	4.4648	< 5MHz

Table 35. Measurement Results for Occupied Bandwidth(BW=10MHz)

Test Mode	Occupied Bandwidth
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	No.5050 733MHz	No.5090 737MHz	No.5130 741MHz	Limit
	MHz	MHz	MHz	
TM1.1	8.9208	8.9191	8.9126	< 10MHz

Table 36. Measurement Results for Occupied Bandwidth(BW=15MHz)

Test Mode	Occupied Bandwidth			Limit
	No.5075 735.5MHz	No.5090 737MHz	No.5105 738.5MHz	
	MHz	MHz	MHz	
TM1.1	13.3612	13.3672	13.3647	< 15MHz

6.3.5 Conclusion

The equipment **PASSED** the requirement of this clause.
 For the measurement results refer to Appendix B.

6.4 Band Edges Compliance

6.4.1 Test Conditions

Table 37. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20-23 °C
Relative humidity:	55-68 %
Power supply:	-48 VDC
Test Configuration/Mode:	TM1.1, TM1.2 at Channel B, T for Single Carrier
Rated maximum transmitter output power (P_{max}):	Single carrier: total 46dBm(40W);

6.4.2 Test Specifications and Limits

6.4.2.1 Specification

FCC part 2.1051 and part 27.53(g)

6.4.2.2 Supporting Standards

Table 38. Supporting Standards

3GPP TS 36.141 version 8.1.0 (Release 8)	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing
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6.4.2.3 Limits

Compliance with FCC part 2.1051 and part 27.53(g), for operations on the 698-746MHz band, in the 100Kilohertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least 30kHz may be employed, the attenuation below the transmitter power (P) measured in watts shall be not less than $43 + 10 \log_{10}(P)$ dB.

Table 39. FCC Limits for Band12

Limit:	$< P - (43 + 10\log_{10}P) = 10\log_{10}(1000*P) - (43 + 10\log_{10}P) = 30 - 43 = -13\text{dBm}$
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6.4.3 Test Method and Setup

The EUT was connected to the Spectrum Analyzer or equivalent via one RF connector, and other RF connectors were connected to match loads. The EUT was controlled to transmit maximum power by Console Computer. Measure and record the Band Edge Spurious Emissions of the EUT by the Spectrum Analyzer or equivalent.

Set the Spectrum Analyzer or equivalent in power averaging mode and resolution bandwidth (RBW)

to 30kHz. Set the sweep span to 200kHz.

Test setup

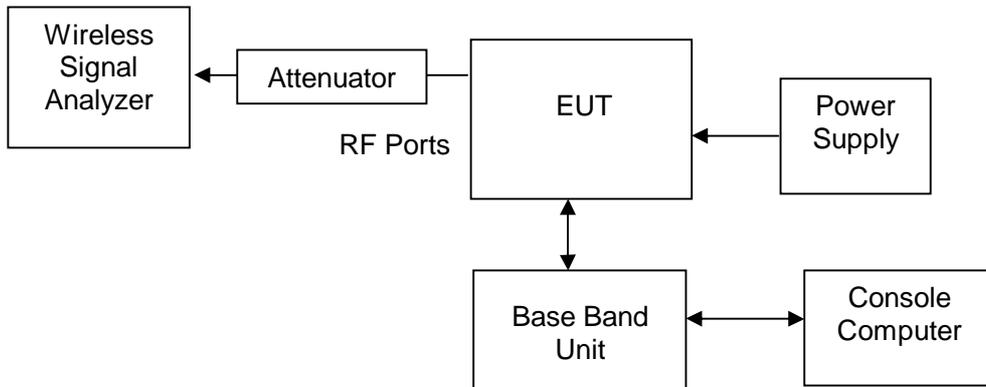


Figure 4. TEST SETUP

6.4.4 Measurement Results

TM1.1:

Table 40. Measurement Results for Band Edge Characteristics(BW=1.4MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5007 728.7MHz	1	727.9 – 728	-14.88	< - 13dBm
No.5173 745.3MHz	1	746– 746.1	-26.89	

Table 41. Measurement Results for Band Edge Characteristics(BW=3MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5015 729.5MHz	1	727.9 – 728	-20.87	< - 13dBm
No.5165 744.5MHz	1	746– 746.1	-23.29	

Table 42. Measurement Results for Band Edge Characteristics(BW=5MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5025 730.5MHz	1	727.9 – 728	-23.23	< - 13dBm
No.5155 743.5MHz	1	746– 746.1	-32.21	

Table 43. Measurement Results for Band Edge Characteristics(BW=10MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
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Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5050 733MHz	1	727.9 – 728	-27.83	< - 13dBm
No.5130 741MHz	1	746– 746.1	-31.19	

Table 44. Measurement Results for Band Edge Characteristics(BW=15MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5075 735.5MHz	1	727.9 – 728	-27.39	< - 13dBm
No.5105 738.5MHz	1	746– 746.1	-26.50	

Note: refer to 3GPP TS 36.141, the offset of measurement filter -3dB point was considered to mark the maximum emission for this test.

TM1.2:

Table 45. Measurement Results for Band Edge Characteristics(BW=1.4MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5007 728.7MHz	1	727.9 – 728	-15.23	< - 13dBm
No.5173 745.3MHz	1	746 – 746.1	-24.39	

Table 46. Measurement Results for Band Edge Characteristics(BW=3MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5015 729.5MHz	1	727.9 – 728	-16.24	< - 13dBm
No.5165 744.5MHz	1	746 – 746.1	-23.09	

Table 47. Measurement Results for Band Edge Characteristics(BW=5MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5025 730.5MHz	1	727.9 – 728	-22.61	< - 13dBm
No.5155 743.5MHz	1	746 – 746.1	-29.66	

Table 48. Measurement Results for Band Edge Characteristics(BW=10MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5050 733MHz	1	727.9 – 728	-29.19	< - 13dBm
No.5130 741MHz	1	746 – 746.1	-30.25	

Table 49. Measurement Results for Band Edge Characteristics(BW=15MHz)



Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5075 735.5MHz	1	727.9 – 728	-28.17	< - 13dBm
No.5105 738.5MHz	1	746 – 746.1	-27.84	

Note: refer to 3GPP TS 36.141, the offset of measurement filter -3dB point was considered to mark the maximum emission for this test.

6.4.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the measurement results refer to Appendix C.

6.5 Spurious Emission at Antenna Terminal

6.5.1 Test Conditions

Table 50. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20-23 °C
Relative humidity:	55-68 %
Power supply:	-48 VDC
Test Configuration/Mode:	TM1.1 at Channel B, M, T for Single Carrier
Rated maximum transmitter output power (P_{max}):	Single carrier: total 46dBm(40W);

6.5.2 Test Specifications and Limits

6.5.2.1 Specification

FCC part 2.1051 and part 27.53(g)

6.5.2.2 Supporting Standards

Table 51. Supporting Standards

3GPP TS 36.141 version 8.1.0 (Release 8)	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing
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6.5.2.3 Limits

Compliance with FCC part 2.1051 and part 27.53(g), based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

Table 52. FCC Limits for Band12

Limit:	$< P - (43 + 10\log_{10}P) = 10\log_{10}(1000 * P) - (43 + 10\log_{10}P) = 30 - 43 = -13\text{dBm}$
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6.5.3 Test Method and Setup

The EUT was connected to the Spectrum Analyzer or equivalent via one RF connector, and other RF connectors were connected to match loads. The EUT was controlled to transmit maximum power by Console Computer. Measure and record the Out-band Spurious Emissions of the EUT by the Spectrum Analyzer or equivalent.

According to FCC part 2.1057, the spectrum shall be investigated from the lowest radio frequency

signal generated in the equipment, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Measurement bandwidth (RBW) of Spectrum Analyzer or equivalent for test frequency range of 9 kHz to 10th harmonic:

728-746MHz Band:	100 kHz
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Alternatively, according to ITU SM.329, measurement bandwidth (RBW) of Spectrum Analyzer or equivalent can be set as following for test frequency range of 9 kHz to 30 MHz:

9 kHz – 150 KHz:	1 kHz
150 kHz – 30 MHz:	10 kHz
Other	100kHz

Test setup

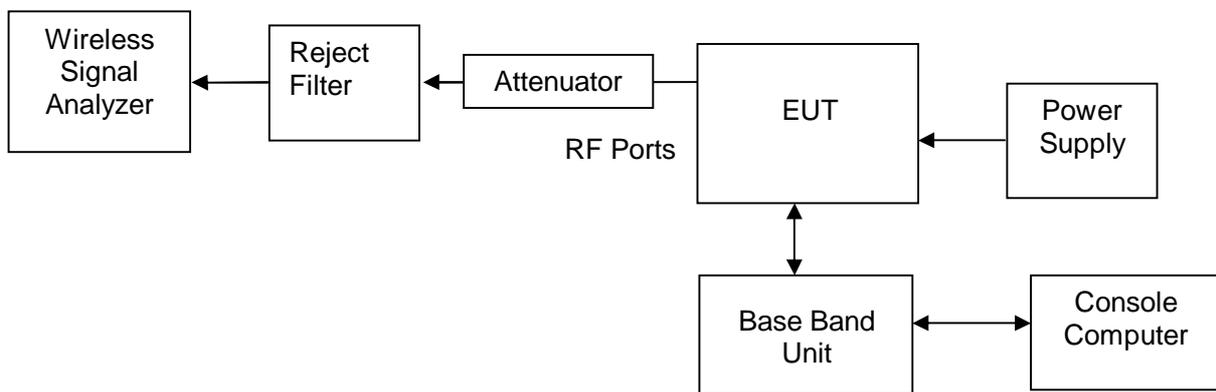


Figure 5. TEST SETUP

6.5.4 Measurement Results

TM1:

Table 53. Measurement Results for Spurious Emissions(BW=1.4MHz)

Channel Number	Multi Carriers	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
No.5007 728.7MHz	1	9k – 8G	-38.64	< - 13dBm
No.5090 737MHz	1	9k – 8G	-38.57	
No.5173 745.3MHz	1	9k – 8G	-39.07	

Table 54. Measurement Results for Spurious Emissions(BW=3MHz)

Channel Number	Multi Carriers	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
No.5015 729.5MHz	1	9k – 8G	-39.55	< - 13dBm
No.5090 737MHz	1	9k – 8G	-39.29	
No.5165	1	9k – 8G	-40.24	



Channel Number	Multi Carriers	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
744.5MHz				

Table 55. Measurement Results for Spurious Emissions(BW=5MHz)

Channel Number	Multi Carriers	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
No.5025 730.5MHz	1	9k – 8G	-40.31	< - 13dBm
No.5090 737MHz	1	9k – 8G	-40.37	
No.5155 743.5MHz	1	9k – 8G	-40.44	

Table 56. Measurement Results for Spurious Emissions(BW=10MHz)

Channel Number	Multi Carriers	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
No.5050 733MHz	1	9k – 8G	-42.20	< - 13dBm
No.5090 737MHz	1	9k – 8G	-42.24	
No.5130 741MHz	1	9k – 8G	-42.21	

Table 57. Measurement Results for Spurious Emissions(BW=15MHz)

Channel Number	Multi Carriers	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
No.5075 735.5MHz	1	9k – 8G	-42.03	< - 13dBm
No.5090 737MHz	1	9k – 8G	-42.51	
No.5105 738.5MHz	1	9k – 8G	-42.55	

6.5.5 Conclusion

The equipment **PASSED** the requirement of this clause.
 For the measurement results refer to Appendix D.

6.6 Radiated Spurious Emission

6.6.1 Test Conditions

Table 58. Test Conditions

Preconditioning:	1 hour
Measured at:	Enclosure
Ambient temperature:	21 °C
Relative humidity:	71 %
Power supply:	-48 VDC
Test Configuration/Mode:	TM1.1 at Channel M for Single Carrier
Rated maximum transmitter output power (P_{max}):	Single carrier: total 46dBm(40W);

6.6.2 Test Specifications and Limits

6.6.2.1 Specification

FCC part 2.1053 and part 27.53(g)

6.6.2.2 Supporting Standards

Table 59. Supporting Standards

3GPP TS 36.141 version 8.1.0 (Release 8)	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing
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6.6.2.3 Limits

Compliance with FCC part 2.1051 and part 27.53(g), for operations in the 698–746 MHz band, the power of any emission outside a licensee’s frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater.

Table 60. FCC Limits for 698-746MHz Band

Limit:	$< P - (43 + 10\log_{10}P) = 10\log_{10}(1000 * P) - (43 + 10\log_{10}P) = 30 - 43 = -13\text{dBm}$
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6.6.3 Test Method and Setup

(a) Measurements were made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.1049(c) as appropriate.



For equipment operating on frequencies below 890 MHz, an Open Field Test is normally required with the measuring instrument antenna located in the far field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections, which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

- (b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:
- (1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
 - (2) All equipment operating on frequencies higher than 25 MHz
 - (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
 - (4) Other types of equipment as required, when deemed necessary by the Commission.

The EUT was equipped with non-integral antenna. And it should test according to part (b). The EUT was connected to match loads. The Console Computer controls the EUT to transmitter the maximum power which defined in specification of product. The EUT operated on a typical channel.

The test procedure

- (1) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, E.R.P. shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements. The EUT was connected to ancillary in order to simulate normal operating conditions with reference to the guidance given in the standard for this type of equipment.
- (2) Test the radiated maximum output power by the test Receiver received from test antenna.
- (3) Use substitution method to verify the Maximum output power. The EUT is substituted by a dipole antenna. The dipole is connected to a Signal Generator. And then adjust the output level of the Signal Generator to get the same received power recorded in step (2) on the test Receiver, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.

According to FCC part 2.1057, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

According to IC RSS-Gen clause 4.9, the search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated or used, without exceeding 40 GHz.

Measurement bandwidth (RBW) of Spectrum Analyzer or equivalent for test frequency range of 9 kHz to 10th harmonic:

698-746MHz Band:	100 kHz or greater
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Test setup

Step 1: Pre-test

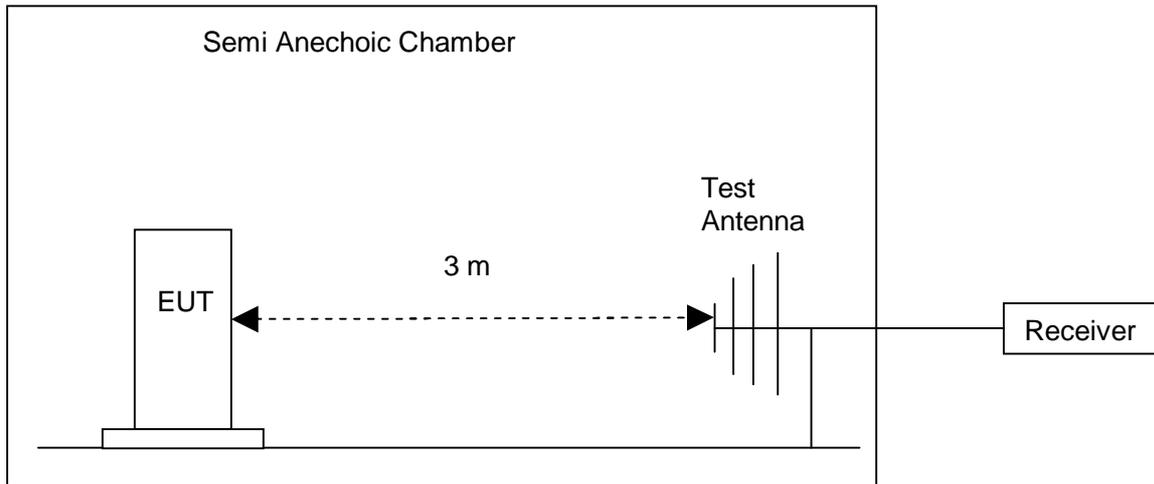


Figure 6. Test Set-up for Pre-test

Step 2: Substitution method to verify the maximum ERP

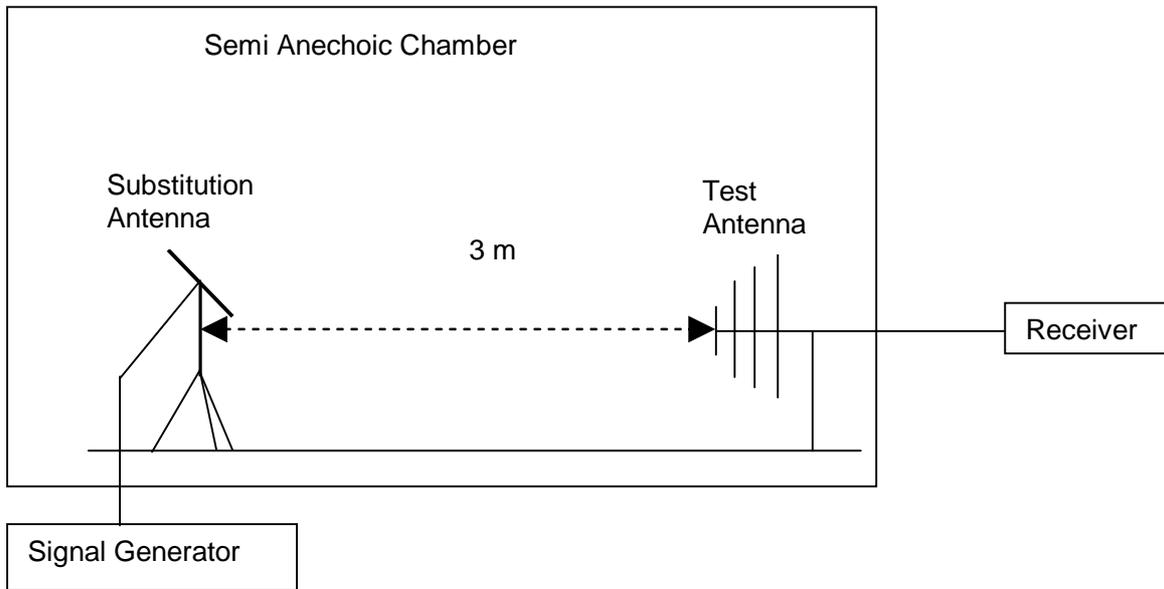


Figure 7. Test Set-up for Substitution

NOTE: Effective radiated power (ERP) refers to the radiation power output of the EUT, assuming all emissions are radiated from half-wave dipole antennas.

6.6.4 Measurement Results

Table 61. Measurement Results for Spurious Emissions

Test Method	Test	Radiated Spurious Emissions
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			No.5090 737MHz		Limit
			dBm		
TM 1.1	30M – 8G		< -13		< -13

6.6.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the measurement results refer to Appendix E.

6.7 Frequency Stability

6.7.1 Test Conditions

Table 62. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	See Measurement Results
Relative humidity:	55-68 %
Power supply:	See Measurement Results
Test Configuration/Mode:	TM2.0 at Channel M, 5MHz bandwidth (according to FCC, the carrier is unmodulated, so a typically test model and channel bandwidth is reported)

6.7.2 Test Specifications and Limits

6.7.2.1 Specification

FCC part 2.1055 and part 27.54

6.7.2.2 Supporting Standards

Table 63. Supporting Standards

3GPP TS 36.141 version 8.1.0 (Release 8)	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing
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6.7.2.3 Limits

Compliance with FCC part 2.1055 and part 27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Table 64. FCC Limits for Band12

Limit:	(not defened)
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Specially, limits according to the technical requirements of the EUT can be adopted as showed in the following table:

Table 65. Limits According to EUT technical requirements for all operating bands

for LTE equipments:	< ± (0.05 ppm+12 Hz)
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6.7.3 Test Method and Setup

The frequency stability shall be measured with variation of ambient temperature from -30 °C to 50 °C.

Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 °C through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

The frequency stability shall be measured with variation of primary supply voltage as follows:

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point, which shall be specified by the manufacturer.
- (3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

The test procedure

The EUT was placed inside an environmental temperature chamber. The EUT was connected to the Signal Analyzer or equivalent via one RF connector, and other RF connectors were connected to match loads. The EUT was controlled to transmit maximum power by Console Computer. Measure and record the Frequency Tolerance of the EUT by the Signal Analyzer or equivalent.

According to ANSI C63.4 clause 13.1.6, no modulation needs to be supplied to the intentional radiator during these tests, unless modulation is required to produce an output, e.g., single-sideband suppressed carrier transmitters.

The operating end points are: -48 VDC (normal point), -36 VDC (lowest point) and -57 VDC (highest point).

Test Set up

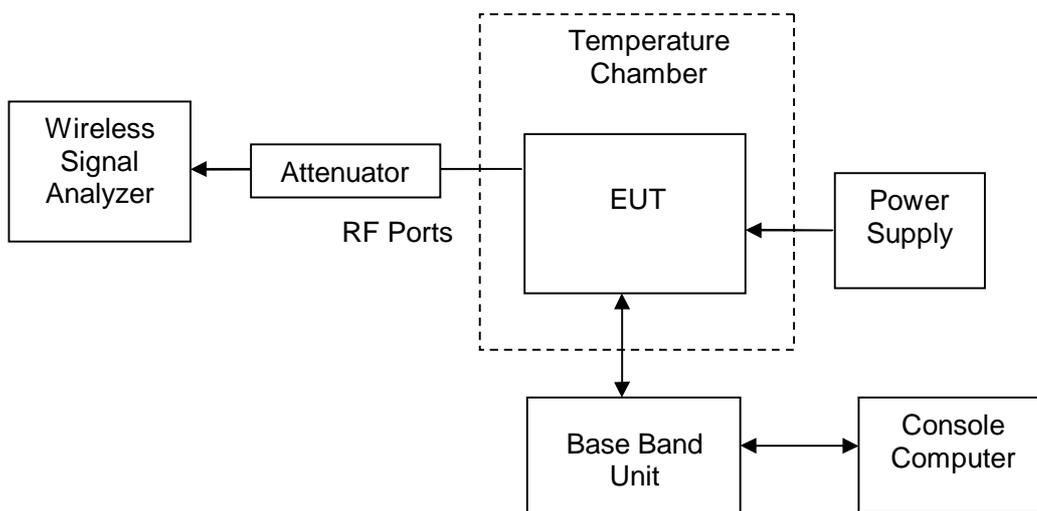


Figure 8. Test Set up

6.7.4 Measurement Results

6.7.4.1 Frequency Error vs. Temperature

Table 66. Measurement Results for Frequency Error vs. Temperature

Measured Maximum Frequency Error				
Test Environment		No.5090 (M) 737MHz		
Voltage	Temperature	Hz	ppm	Limit
-48 VDC (100% rated / normal)	-30 °C	0.54	0.0007	<± (0.05 ppm+12 Hz)
	-20 °C	0.68	0.0009	
	-10 °C	0.93	0.0013	
	0 °C	1.03	0.0014	
	+10 °C	1.33	0.0018	
	+20 °C	1.14	0.0015	
	+30 °C	2.04	0.0028	
	+40 °C	1.43	0.0019	
	+50 °C	2.12	0.0029	

6.7.4.2 Frequency Error vs. Voltage

Table 67. Measurement Results for Frequency Error vs. Voltage

Measured Maximum Frequency Error				
Test Environment		No.5090 (M) 737MHz		
Voltage	Temperature	Hz	ppm	Limit
-36 VDC (85% rated / lowest)	+20 °C	0.46	0.0006	<± (0.05 ppm+12 Hz)
-48 VDC (100% rated / normal)	+20 °C	0.37	0.0005	
-57 VDC (115% rated / highest)	+20 °C	0.17	0.0002	

6.7.5 Conclusion

The equipment **PASSED** the requirement of this clause.

7 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

Table 68. System Measurement Uncertainty

Items		Extended Uncertainty
Band Width	Magnitude (%)	U=0.2%; k=2
Band Edge Compliance	Disturbance Power (dBm)	U=2.0dB; k=2
Conducted Spurious Emission at Antenna Terminal	Disturbance Power (dBm)	U=2.0dB; k=2
Frequency Stability	Frequency Accuracy(ppm)	U=0.21ppm; k=2
Field Strength of Spurious Radiation	ERP (dBm)(30MHz~1G)	U=4.6dB; k=2
	ERP (dBm) (>1G)	U=3dB; k=2
Conducted Output Power	Power (dBm)	U=0.39dB; k=2



8 Appendices

Appendix A	Measurement Results Modulation Characteristics	11	Pages
Appendix B	Measurement Results Occupied Bandwidth	9	Pages
Appendix C	Measurement Results Band Edges	11	Pages
Appendix D	Measurement Results Spurious Emission at Antenna Terminal	31	Pages
Appendix E	Measurement Results Radiated Spurious Emission	2	Pages
Appendix F	Photos of Test Setup	3	Pages

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