



FCC Test Report

Product Name: Distributed Base Station Remote Radio Unit

Model Number: RRU3201

**Report No: SYBH (R) 076082009EB-1
FCC ID: QIS RRU3201-700M**

Reliability Laboratory of Huawei Technologies Co., Ltd.

Huawei Base, Bantian, Longgang District, Shenzhen 518129, P.R. China

Tel: +86 755 28780808 Fax: +86 755 89652518

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REPORT ON FCC Test of Distributed Base Station Remote Radio Unit

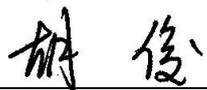
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REGULATION **47 CFR FCC Part 2, Subpart J**
47 CFR FCC Part 27, Subpart C

CONCLUSION **PASSED**

General Manager	2009-09-01	张兴海	
	Date (y-m-d)	Name	
Technical Responsibility For Area of Testing	2009-09-01	胡俊	
	Date (y-m-d)	Name	
Test Lab Engineer	2009-09-01	张卫民	
	Date (y-m-d)	Name	



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1 Summary

The table below summarizes the measurements and results for the equipment of Distributed Base Station Remote Radio Unit - RRU3201. 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(c)	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.

RRU3201 (Band 12) is the outdoor radio remote unit. It can be mounted close to the antenna on a metal pole or a wall.

For RRU3201 (Band 12), the downlink frequency is 728 MHz~746 MHz and the uplink frequency is 698 MHz~716 MHz.

RRU3201 (Band 12) has a highly integrated structure. The components of RRU3201 are describes as follows:

1. Power supply: leads the external -48 VDC power to supply power for RRU3201.
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: 31 July 2009
Date of End: 29 August 2009

4 Product Description

4.1 Technical Characteristics

4.1.1 Frequency Range

Table 4. Frequency Range for 698-746MHz Band

Uplink band (RX):	698 to 716 MHz
Downlink band (TX):	728 to 746 MHz

4.1.2 Channel Separation/Bandwidth

Table 5. Frequency Interval and Channel Separation

Channel raster:	100 kHz
Channel bandwidth/spacing:	5 MHz, 10 MHz

4.1.3 Output Power

Table 6. Output Power

Transmitter Output Power (per Antenna Port):	40 W (= 46 dBm)
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4.1.4 Type of Emission

Refer to FCC part 2.201 and 2.202.

Table 7. Type of Emission

Emission Designation:	4M49D9W (for 5MHz channel bandwidth) 8M94D9W (for 10MHz channel bandwidth)
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4.1.5 Environmental Requirements

Table 8. Environmental Requirements

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

4.1.6 Power Source

Table 9. DC Power Source

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

4.1.7 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 10. Component Parts Information

Model Name	Qty.	Hardware Version	Software Version	Description	Serial Number
WD51LRX8C	1	VERB.	V100R001	LTE Transceiver Board	020RXY1096800004
WD51LRA8C	1	VERA.	V100R001	LTE PA & LNA Board	020AGF10978000043
WD5MHLDU 8H	1	VERA.	V100R001	Duplex filter	09070104

Table 11. Ancillary Parts Information

Model Name	Qty.	Hardware Version	Software Version	Description	Serial Number
WD2BBBUC	1	VERA.	V100R001	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: RRU3201-700M
 FCC Identification: QISRRU3201-700M

5 Main Test Instruments

Table 12. Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until (y-m-d)
Receiver	R&S	ESU40	100144	Jan. 15, 2010
BiLog Antenna	Schaffner	CBL 6112B	2747	Nov. 9, 2009
Horn Antenna	R&S	HF906	359287/005	Jan. 23, 2010
Spectrum Analyzer	R&S	FSQ26	200791	May. 13, 2010
Temperature Chamber	ESPEC	EW2465	05175004	Aug. 12, 2009
Attenuator	Shanghai Huaxiang	DTS250	08091737	/
Power Supply	EMERSON	ONU4820	210213035320 89010073	/

Note: tests taken in the report are within the measurement instruments' calibration valid date.

6 Transmitter Measurements

Test Ports:

The EUT consists of two TRX channels, which are identical in designs. Each channel can support only one carrier. Each channel can be configured to emit one carrier with 40W, provided when either 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 13. Frequency points (channels) selected to perform tests

Transmitter Operating Band	Single-Carrier	Channels No.		
		Channel B	Channel M	Channel T
698-746MHz band (LTE Band12) (10 MHz channel bandwidth)	1	No.5050 733MHz	No.5090 737MHz	No.5130 741MHz
698-746MHz band (LTE Band12) (5MHz channel bandwidth)	1	No.5025 730.5MHz	No.5090 737MHz	No.5155 743.5MHz

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 14. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C
Relative humidity:	70 %
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 15. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 36.141	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing

6.1.2.3 Limits

Compliance with FCC part 2.1046 and part 27.50(c), fixed and base stations transmitting a signal with an emission bandwidth of 1 MHz or less must not exceed an effective radiated power (ERP) of 1000 watts, with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz.

Table 16. FCC Limits for 698-746MHz Band

Maximum ERP:	< 1000 Watts (= 60 dBm) (for Emission bandwidth \leq 1MHz) < 1000 Watts/MHz (= 60 dBm/MHz) (for Emission bandwidth > 1MHz)
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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

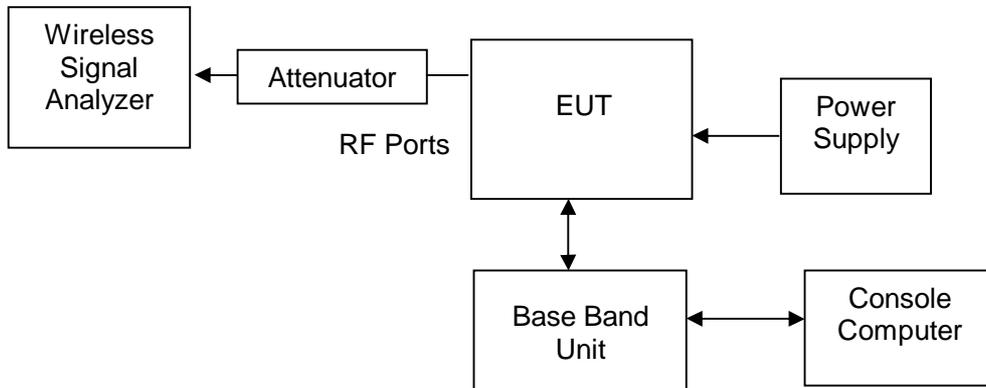


Figure 1. TEST SETUP

6.1.4 Measurement Results

Channel Bandwidth = 10 MHz:

Table 17. Measurement Results for Maximum Output Power

Test Mode	Maximum Output Power – Single Carrier							
	No.5050 (B) 733MHz		No.5090 (M) 737MHz		No.5130 (T) 741MHz		Limit	
	dBm	dBm/MHz	dBm	dBm/MHz	dBm	dBm/MHz	dBm	dBm/MHz
TM 1.1	46.3	36.3	46.1	36.1	46.4	36.4	---	< 60

Channel Bandwidth = 5 MHz:

Table 18. Measurement Results for Maximum Output Power

Test Mode	Maximum Output Power – Single Carrier							
	No.5025 (B) 730.5MHz		No.5090 (M) 737MHz		No.5155 (T) 743.5MHz		Limit	
	dBm	dBm/MHz	dBm	dBm/MHz	dBm	dBm/MHz	dBm	dBm/MHz
TM 1.1	46.2	39.2	46.2	39.2	46.3	39.3	---	< 60



6.1.5 Conclusion

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

6.2 Modulation Characteristics

6.2.1 Test Conditions

Table 19. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C
Relative humidity:	70 %
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

6.2.2.2 Supporting Standards

Table 20. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 36.141	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing

6.2.2.3 Limits

No specific modulation characteristics requirement limits in FCC part 2.1047 and part 27 subpart C for 698-746MHz Band.

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

Table 21. Limits According to EUT technical requirements

Limits for LTE equipments:	QPSK modulation (TM3.3):	EVM	< 17.5%
	16QAM modulation (TM3.2):	EVM	< 12.5%
	64QAM modulation (TM2.0, TM3.1):	EVM	< 8%

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

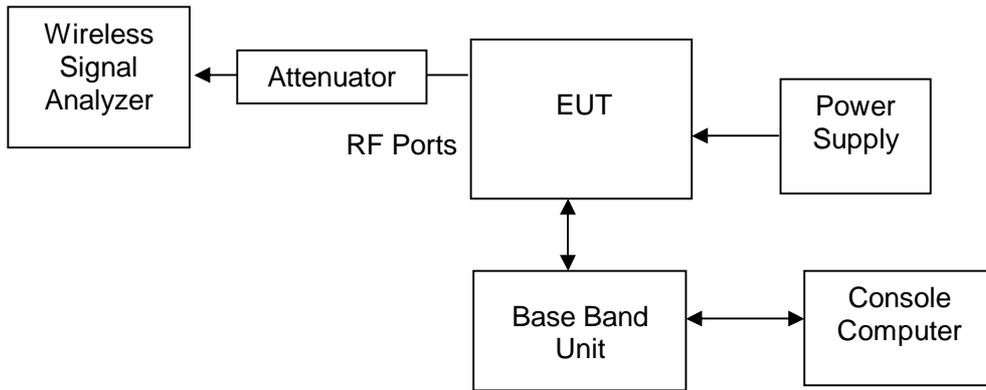


Figure 2. TEST SETUP

6.2.4 Measurement Results

Channel Bandwidth = 10 MHz:

Table 22. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics			
	No. 5090 (M) 737MHz			
	Type/Mode	Parameters	Measured	Limit
TM2.0	64QAM	EVM	0.87%	< 8%
TM3.1	64QAM	EVM	6.24%	< 8%
TM3.2	16QAM	EVM	8.75%	< 12.5%
TM3.3	QPSK	EVM	12.10%	< 17.5%

Channel Bandwidth = 5 MHz:

Table 23. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics			
	No. 5090 (M) 737MHz			
	Type/Mode	Parameters	Measured	Limit
TM2.0	64QAM	EVM	0.68%	< 8%
TM3.1	64QAM	EVM	6.03%	< 8%
TM3.2	16QAM	EVM	8.34%	< 12.5%
TM3.3	QPSK	EVM	11.76%	< 17.5%

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 24. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C
Relative humidity:	70 %
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

6.3.2.2 Supporting Standards

Table 25. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 36.141	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing

6.3.2.3 Limits

No specific occupied bandwidth requirement in FCC part 2.1049 and part 27 subpart C for 698-746MHz Band.

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

Table 26. Limits According to EUT technical requirements

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

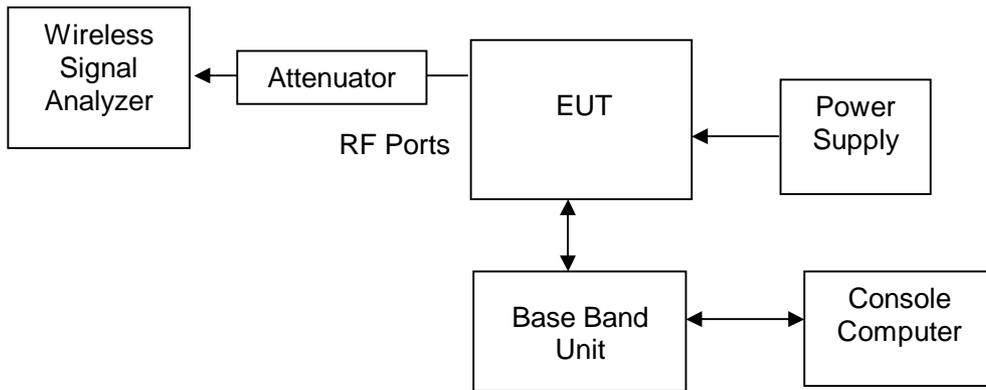


Figure 3. TEST SETUP

6.3.4 Measurement Results

Channel Bandwidth = 10 MHz:

Table 27. Measurement Results for Occupied Bandwidth

Test Mode	99% Occupied Bandwidth			Limit
	No.5050 (B) 733MHz	No.5090 (M) 737MHz	No.5130 (T) 741MHz	
	MHz	MHz	MHz	
TM1.1	8.942	8.918	8.918	< 10MHz

Channel Bandwidth = 5 MHz:

Table 28. Measurement Results for Occupied Bandwidth

Test Mode	99% Occupied Bandwidth			Limit
	No.5050 (B) 730.5MHz	No.5090 (M) 737MHz	No.5130 (T) 743.5MHz	
	MHz	MHz	MHz	
TM1.1	4.487	4.487	4.487	< 5MHz

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 29. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C
Relative humidity:	70 %
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 30. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 36.141	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing

6.4.2.3 Limits

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

Table 31. 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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6.4.3 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 cover at least $\pm 250\%$ of the emission bandwidth or 200kHz, which is less.

Test setup

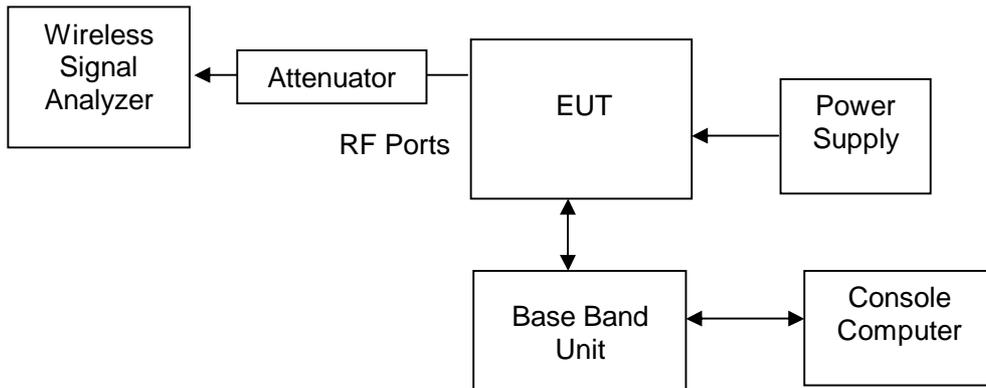


Figure 4. TEST SETUP

6.4.4 Measurement Results

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

TM1.1:

Table 32. Measurement Results for Band Edge Characteristics(Channel Bandwidth=10MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5050 (B) 733MHz	1	727.9 – 728	-25.3	< - 13dBm
No.5130 (T) 741MHz	1	746– 746.1	-21.03	

Table 33. Measurement Results for Band Edge Characteristics(Channel Bandwidth =5MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5025 (B) 730.5MHz	1	727.9 – 728	-24.9	< - 13dBm
No.5155 (T) 743.5MHz	1	746– 746.1	-24.92	



TM1.2:

Table 34. Measurement Results for Band Edge Characteristics(Channel Bandwidth =10MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5050 (B) 733MHz	1	727.9 – 728	-23.19	< - 13dBm
No.5130 (T) 741MHz	1	746 – 746.1	-20.42	

Table 35. Measurement Results for Band Edge Characteristics(Channel Bandwidth =5MHz)

Channel Number	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
No.5025 (B) 730.5MHz	1	727.9 – 728	-22.54	< - 13dBm
No.5155 (T) 743.5MHz	1	746– 746.1	-23.76	

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 36. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C
Relative humidity:	70 %
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 37. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 36.141	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing

6.5.2.3 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 38. 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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6.5.3 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:

698-746MHz Band:	100 kHz or greater
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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

Test setup

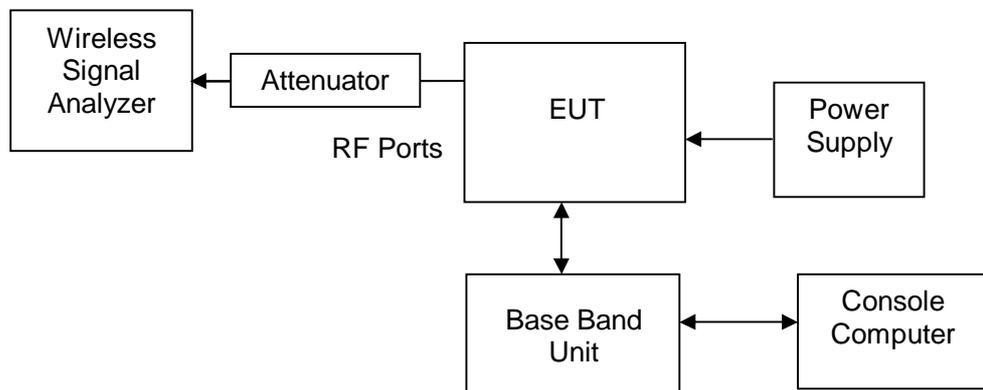


Figure 5. TEST SETUP

6.5.4 Measurement Results

TM1:

Table 39. Measurement Results for Spurious Emissions(Channel Bandwidth=10MHz)

Channel Number	Multi Carriers	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
No.5050 (B) 733MHz	1	9k – 8G	< -25.27	< - 13dBm
No.5090 (M) 737MHz	1	9k – 8G	< -25.11	
No.5130 (T) 741MHz	1	9k – 8G	< -25.22	

Table 40. Measurement Results for Spurious Emissions(Channel Bandwidth =5MHz)

Channel Number	Multi Carriers	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
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Channel Number	Multi Carriers	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
No.5025 (B) 730.5MHz	1	9k – 8G	< -24.99	< - 13dBm
No.5090 (M) 737MHz	1	9k – 8G	< -25.14	
No.5155 (T) 743.5MHz	1	9k – 8G	< -25.10	

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 41. Test Conditions

Preconditioning:	1 hour
Measured at:	Enclosure
Ambient temperature:	20 °C
Relative humidity:	70 %
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 42. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 36.141	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing

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 43. 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

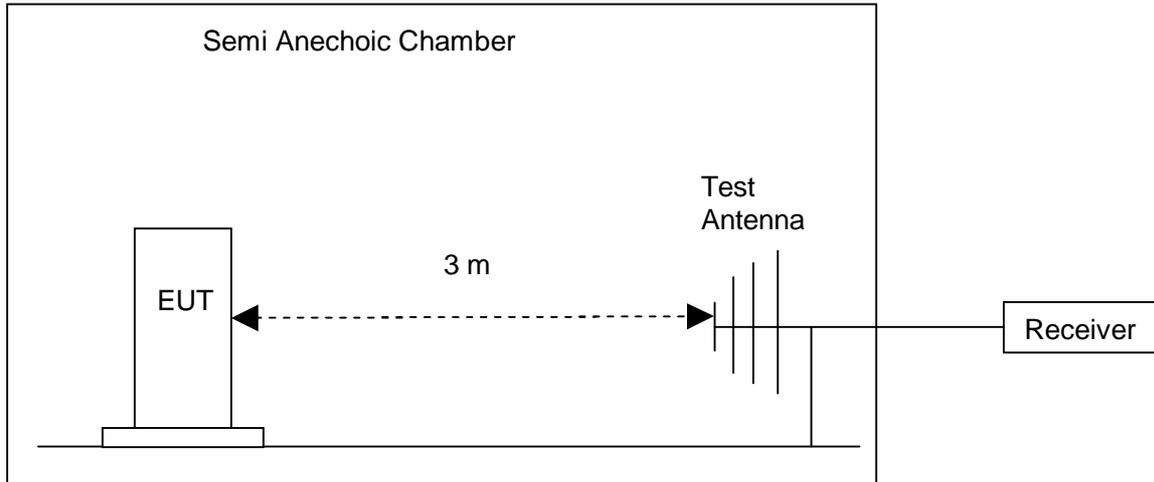


Figure 6. Test Set-up for Pre-test

Step 2: Substitution method to verify the maximum ERP

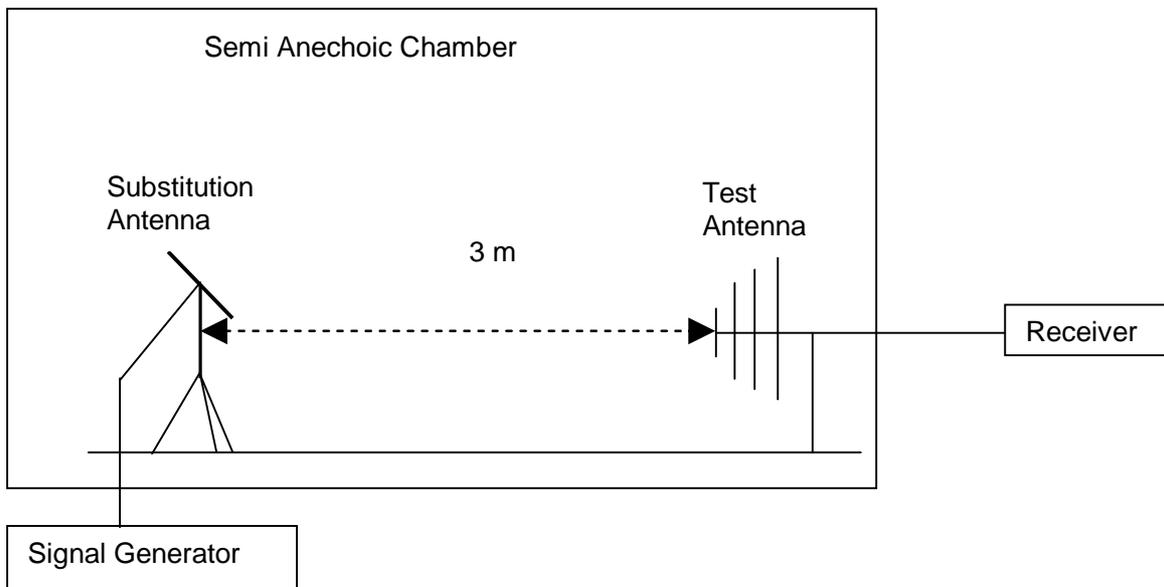


Figure 7. Test Set-up for Substitution

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 44. Measurement Results for Spurious Emissions



Test Mode	Test Frequency Range	Radiated Spurious Emissions			
			No.5090 (M) 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 45. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	See Measurement Results
Relative humidity:	70 %
Power supply:	See Measurement Results
Test Configuration/Mode:	TM2.0, TM3.1, TM3.2, TM3.3 at Channel M

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 46. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 36.141	Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing

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 47. FCC Limits for 698-746MHz Band

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

Table 48. Limits According to EUT technical requirements for all operating bands

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

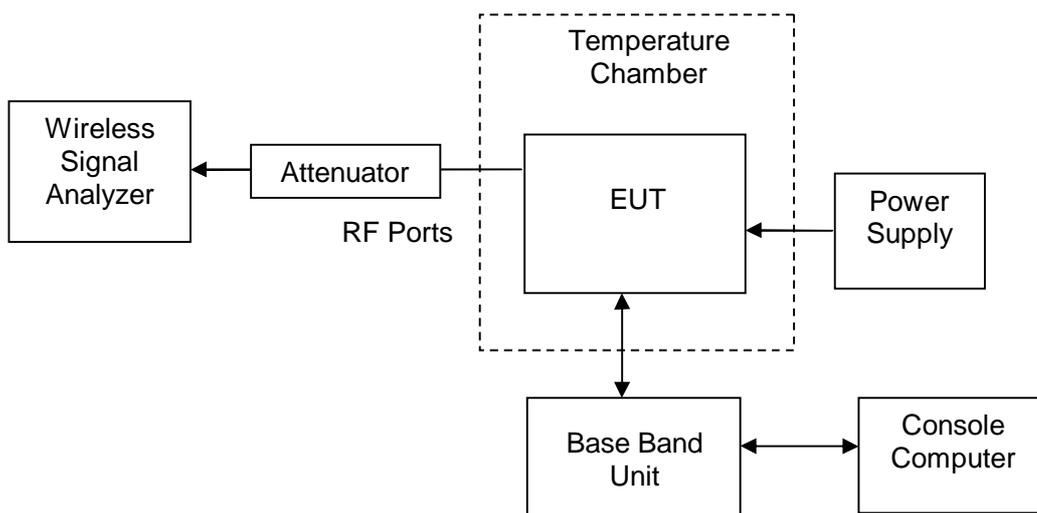


Figure 8. Test Set up

6.7.4 Measurement Results

6.7.4.1 Frequency Error vs. Temperature

Table 49. Measurement Results for Frequency Error vs. Temperature(Bandwidth=10MHz)

Measured Maximum Frequency Error				
Test Environment		No.5090 (M) 737MHz (TM2.0 / TM3.1 / TM3.2 / TM3.3)		
Voltage	Temperature	Hz	ppm	Limit
-48 VDC (100% rated / normal)	-30 °C	0.23/0.21/0.14/0.56	0.0003/0.0003/0.0002/0.0008	<± (0.05 ppm+12 Hz)
	-20 °C	0.24 /0.23/0.09/0.57	0.0003/0.0003/0.0001/0.0008	
	-10 °C	0.3/0.31/0.07/0.65	0.0004/0.0004/0.0001/0.0009	
	0 °C	0.31/0.28/0.12/0.29	0.0004/0.0004/0.0002/0.0004	
	+10 °C	0.54/0.15/0.05/0.74	0.0007/0.0002/0.0001/0.001	
	+20 °C	0.37/0.26/0.04/0.78	0.0005/0.0004/0.0001/0.001	
	+30 °C	0.75/0.42/0.23/0.91	0.001/0.0005/0.0003/0.0012	
	+40 °C	0.89/0.53/0.68/0.66	0.0012/0.0007/0.0009/0.0009	
	+50 °C	0.95/1.03/0.81/0.98	0.0013/0.0014/0.0011/0.0013	

Table 50. Measurement Results for Frequency Error vs. Temperature(Bandwidth=5MHz)

Measured Maximum Frequency Error				
Test Environment		No.5090 (M) 737MHz (TM2.0 / TM3.1 / TM3.2 / TM3.3)		
Voltage	Temperature	Hz	ppm	Limit
-48 VDC (100% rated / normal)	-30 °C	0.54/0.89/0.75/0.46	0.0007/0.0012/0.001/0.0006	<± (0.05 ppm+12 Hz)
	-20 °C	0.68/0.32/0.47/0.85	0.0009/0.0004/0.0006/0.0012	
	-10 °C	0.93/1.34/1.12/0.95	0.0013/0.0018/0.0015/0.0013	
	0 °C	1.03/1.42/0.63/1.06	0.0014/0.0019/0.0009/0.0014	
	+10 °C	1.33/1.89/1.08/1.45	0.0018/0.0026/0.0015/0.002	
	+20 °C	1.14/2.69/0.67/1.13	0.0015/0.0036/0.0009/0.0015	
	+30 °C	2.04/1.69/1.56/1.89	0.0028/0.0023/0.0021/0.0026	
	+40 °C	1.43/2.08/1.17/1.61	0.0019/0.0028/0.0016/0.0022	
	+50 °C	2.12/2.74/1.93/2.03	0.0029/0.0037/0.0026/0.0028	

6.7.4.2 Frequency Error vs. Voltage

Table 51. Measurement Results for Frequency Error vs. Voltage(Bandwidth=10MHz)

Measured Maximum Frequency Error				
Test Environment		No.5090 (M) 737MHz (TM2.0 / TM3.1 / TM3.2 / TM3.3)		
Voltage	Temperature	Hz	ppm	Limit
-36 VDC (85% rated / lowest)	+20 °C	0.46/0.52/0.18/0.82	0.0006/0.0007/0.0002/0.0011	<± (0.05 ppm+12 Hz)
-48 VDC (100% rated / normal)	+20 °C	0.37/0.26/0.04/0.78	0.0005/0.0004/0.0001/0.0011	
-57 VDC (115% rated / highest)	+20 °C	0.17/0.35/0.67/0.42	0.0002/0.0005/0.0009/0.0006	

Table 52. Measurement Results for Frequency Error vs. Voltage(Bandwidth=5MHz)

Measured Maximum Frequency Error				
Test Environment		No.5090 (M) 737MHz (TM2.0 / TM3.1 / TM3.2 / TM3.3)		
Voltage	Temperature	Hz	ppm	Limit
-36 VDC (85% rated / lowest)	+20 °C	1.6/1/3/1.5	0.0022/0.0014/0.0041/0.0020	<± (0.05 ppm+12 Hz)
-48 VDC (100% rated / normal)	+20 °C	1.14/2.69/0.67/1.13	0.0015/0.0036/0.0009/0.0015	
-57 VDC (115% rated / highest)	+20 °C	1.6/1.1/3/1.4	0.0022/0.0015/0.0041/0.0014	

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 53. 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	9 Pages
Appendix B	Measurement Results Occupied Bandwidth	5 Pages
Appendix C	Measurement Results Band Edges	5 Pages
Appendix D	Measurement Results Spurious Emission at Antenna Terminal	13 Pages
Appendix E	Measurement Results Radiated Spurious Emission	3 Pages
Appendix F	Photos of Test Setup	3 Pages

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