



# FCC Test Report

**Product Name: Remote Radio Unit**

**Model Number: RRU3702**

**Report No: SYBH (R) 030102008EB-1**  
**FCC ID: QIS RRU3702-2500**

**Reliability Laboratory of Huawei Technologies Co., Ltd.**

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**REPORT ON**                      FCC Test of Remote Radio Unit

Model Name: RRU3702

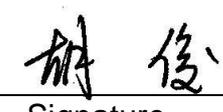
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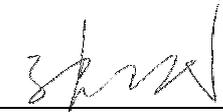
FCC ID: QISRRU3702-2500

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

**CONCLUSION**                      **PASSED**

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# 1 Summary

The table below summarizes the measurements and results for the equipment of Remote Radio Unit - RRU3702. Detailed results and descriptions are shown in the following pages.

Table 1. Summary of results for FCC requirements for BRS&EBS Band

47 CFR FCC Part(s) Requirements		Description	Result
Specification	Limits		
2.1046	27.50(h)(1)	Transmitter Output Power	PASS
2.1047	---	Modulation Characteristics	PASS
2.1049	---	Occupied Bandwidth	PASS
2.1051	27.53(l)(2) 27.53(l)(6)	Band Edges Compliance	PASS
2.1051	27.53(l)(2) 27.53(l)(6)	Spurious Emission at Antenna Terminal	PASS
2.1053	27.53(l)(2) 27.53(l)(6)	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

DBS3900 is a WiMAX base station developed by Huawei based on the IEEE802.16e-2005 protocols. The RRU3702 is the distributed site remote radio unit of the DBS3900. RRU3702 performs the intermediate frequency and radio frequency processing. The RRU3702 and the distributed site indoor baseband unit DBS3900 are connected through fibers.

#### 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
Data	Modulation: QPSK CTC 1/2	TM1	---
Data	Modulation: QPSK CTC 3/4	TM2	---
Data	Modulation: 16QAM CTC 1/2	TM3	---
Data	Modulation: 16QAM CTC 3/4	TM4	---
Data	Modulation: 64QAM CTC 1/2	TM5	---
Data	Modulation: 64QAM CTC 2/3	TM6	---
Data	Modulation: 64QAM CTC 3/4	TM7	---
Data	Modulation: 64QAM CTC 5/6	TM8	---

Note: The test conditions and settings are defined in WiMAX MRCT.

### 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

06 January 2009 to 18 February 2009

## 4 Product Description

### 4.1 Technical Characteristics

#### 4.1.1 Frequency Range

Table 4. Frequency Range for BRS&amp;EBS Band

Uplink band:	2496 to 2690 MHz
Downlink band:	2496 to 2690 MHz

#### 4.1.2 Channel Separation/Bandwidth

Table 5. Frequency Interval and Channel Separation

Channel raster:	50 kHz
Channel spacing:	5MHz, 10 MHz

#### 4.1.3 Type of Emission

Refer to FCC part 2.201 and 2.202.

Table 6. Type of Emission

Emission Designation:	5M00W7D, 10M0W7D
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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 95% 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:	8.0 A

#### 4.1.6 Tune-up Procedure

Refer to FCC 2.1033(c) (9).

Please reference the document Tune-up Procedure in TCF.



## 4.2 EUT Identification List

### 4.2.1 Component Parts Information

Table 9. EUT Component Parts Information

Model Name	Qty.	Hardware Version	Software Version	Description	Serial Number
RRU3702	1	VER.C	V300R002	IF and RF Unit	2199050CRAL0 8B000142

Table 10. Ancillary Component Parts Information

Model Name	Qty.	Hardware Version	Software Version	Description	Serial Number
BBU3900	1	REV.C	V300R002	Baseband Unit	020JAW108380 0028 N1

### 4.2.2 Adapter Technical Data

Not Applicable for BTS.

### 4.2.3 Battery Technical Data

Not Applicable for BTS.

### 4.2.4 FCC Identification

Grantee Code: QIS  
Product Code: RRU3702-2500  
FCC Identification: QISRRU3702-2500

## 5 Main Test Instruments

Table 11. Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number
3m-Semi Anechoic Chamber	S+M	N/A	N/A
EMI Test receiver	R&S	ESIB26	100318
Horn Antenna	R&S	HF906	005
Broadband Antenna	SCHAFFNER	CBL6112B	2536
Signal Analyzer	R&S	FSQ 40	100025
Power Meter	R&S	NRP-Z11	100740
Attenuator	Aeroflex/Weinschel	49-30-33-LIM	NC356
Climate Chamber	ESPEC	EW2465	05175005

## 6 Transmitter Measurements

Tests for the EUT in the report were performed as following:

- (1) The EUT consists of 4 TRX routeways/antenna ports, Ch-A, Ch-B, Ch-C and Ch-D, which are equivalent in designs. In the test report, only the channel Ch-A was used representatively.
- (2) The EUT supports up to 2 multiple-carriers; the total output power of single-carrier and dual-carrier configurations is identical, that is 10W.
- (3) The EUT can emit the 5MHz and 10MHz bandwidth signals.
- (4) The EUT supports various modulation types as mentioned in above clause.

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

Multi-Carriers	Channel Bandwidth Configuration	Channels No.		
		Ch. B	Ch. M	Ch. T
1	5MHz	2498.5 MHz	2593 MHz	2687.5 MHz
1	10MHz	2501 MHz	2593 MHz	2685 MHz
2	10MHz+10MHz	2501 MHz + 2511 MHz	2593 MHz + 2603 MHz	2675 MHz + 2685 MHz

## 6.1 Maximum Channel Power

### 6.1.1 Test Conditions

Table 13. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	21 - 22 °C
Relative humidity:	57 %
Power supply:	-48 VDC
Test Configuration/Mode:	Modulation: TM1, TM2, TM3, TM4, TM5, TM6, TM7, TM8 Channel Bandwidth: 5MHz, 10MHz Channel No.: B, M, T Multi Carrier: 1, 2
Rated maximum transmitter output power ( $P_{max}$ ):	Single carrier: total 40dBm(10W); Two carriers: each 37dBm(5W), total 40dBm(10W)

### 6.1.2 Test Specifications and Limits

#### 6.1.2.1 Specification

FCC part 2.1046 and part 27.50(h)(1)

#### 6.1.2.2 Supporting Standards

Table 14. Supporting Standards

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
WiMAX MRCT (2007-08)	WiMAX Forum™ Mobile Radio Conformance Tests

#### 6.1.2.3 Limits

Compliance with FCC part 2.1046 and part 27.50(h)(1), the maximum EIRP of a base station shall not exceed  $33 \text{ dBW} + 10 \lg (X/Y) \text{ dBW}$ , where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition.

Table 15. FCC Limits for BRS&EBS Band

X, Y	for 5MHz channel bandwidth: X = 5 MHz, Y = 6 MHz for 10MHz channel bandwidth: X = 10 MHz, Y = 6 MHz
Maximum EIRP:	for 5MHz channel bandwidth: $< 33 \text{ dBW} + 10 \log (5 \text{ MHz}/6 \text{ MHz}) \text{ dBW} = 62 \text{ dBm}$

	for 10MHz channel bandwidth: $< 33 \text{ dBW} + 10 \log (10 \text{ MHz}/6 \text{ MHz}) \text{ dBW} = 65 \text{ dBm}$
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### 6.1.3 Test Method and Setup

The EUT was connected to the Wireless Signal Analyzer or equivalent (Power Meter) 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

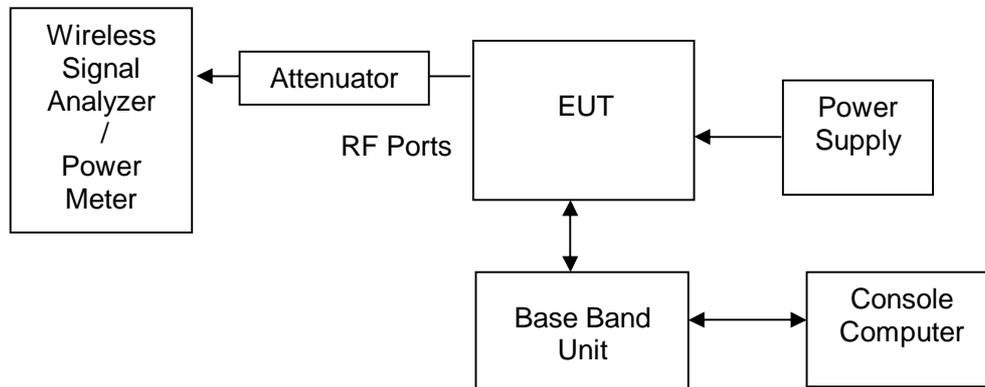


Figure 1. TEST SETUP

### 6.1.4 Measurement Results

#### (1) Single Carrier, 5MHz Channel Bandwidth:

Table 16. Measurement Results for Maximum Output Power

Test Mode	Maximum Output Power (Total)			
	Ch. B	Ch. M	Ch. T	Limit (dBm)
	dBm	dBm	dBm	
TM1	40.15	40.22	40.03	< 62
TM2	40.11	40.20	40.02	< 62
TM3	40.33	40.40	40.21	< 62
TM4	40.10	40.17	40.00	< 62
TM5	40.07	40.14	39.95	< 62
TM6	40.16	40.24	40.05	< 62

Test Mode	Maximum Output Power (Total)			
	Ch. B	Ch. M	Ch. T	Limit (dBm)
	dBm	dBm	dBm	
TM7	40.00	40.07	39.90	< 62
TM8	39.83	39.96	39.95	< 62

**(2) Single Carrier, 10MHz Channel Bandwidth:**

Table 17. Measurement Results for Maximum Output Power

Test Mode	Maximum Output Power (Total)			
	Ch. B	Ch. M	Ch. T	Limit (dBm)
	dBm	dBm	dBm	
TM1	39.65	39.44	39.59	< 65
TM2	39.65	39.44	39.57	< 65
TM3	39.68	39.47	39.58	< 65
TM4	39.54	39.33	39.44	< 65
TM5	39.43	39.21	39.33	< 65
TM6	39.75	39.53	39.64	< 65
TM7	39.37	39.15	39.25	< 65
TM8	39.68	39.46	39.55	< 65

**(3) Dual Carriers, 10MHz+10MHz Channel Bandwidth:**

Table 18. Measurement Results for Maximum Output Power

Test Mode	Maximum Output Power (Total)			
	Ch. B	Ch. M	Ch. T	Limit (dBm)
	dBm	dBm	dBm	
TM1	39.21	39.90	39.77	< 65
TM2	39.22	39.89	39.78	< 65
TM3	39.26	39.92	39.80	< 65
TM4	39.10	39.77	39.66	< 65
TM5	38.96	39.65	39.55	< 65
TM6	39.34	39.96	39.86	< 65
TM7	38.90	39.60	39.49	< 65
TM8	39.27	39.91	39.72	< 65

**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:	21 - 22 °C
Relative humidity:	57 %
Power supply:	-48 VDC
Test Configuration/Mode:	Modulation: TM1, TM2, TM3, TM4, TM5, TM6, TM7, TM8 Channel Bandwidth: 10MHz (representatively) Channel No.: M (representatively) Multi Carrier: 1

### 6.2.2 Test Specifications and Limits

#### 6.2.2.1 Specification

FCC part 2.1047 and part 27 subpart C & M

#### 6.2.2.2 Supporting Standards

Table 20. Supporting Standards

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
WiMAX MRCT (2007-08)	WiMAX Forum™ Mobile Radio Conformance Tests

#### 6.2.2.3 Limits

No specific modulation characteristics requirement limits in FCC part 2.1047 and part 27 subpart C & M for BRS&EBS Band.

### 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

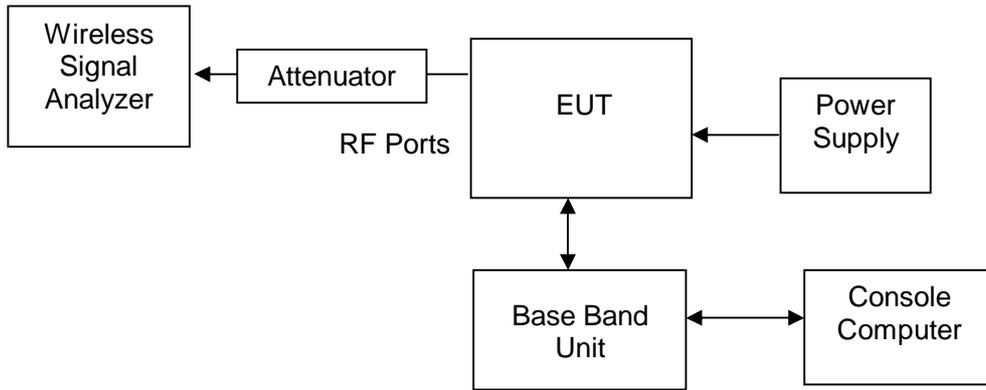


Figure 2. TEST SETUP

### 6.2.4 Measurement Results

#### Single Carrier, 10MHz Channel Bandwidth:

Table 21. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics	
	Ch. M	
	Type/Mode	
TM1	QPSK	
TM2	QPSK	
TM3	16QAM	
TM4	16QAM	
TM5	64QAM	
TM6	64QAM	
TM7	64QAM	
TM8	64QAM	

### 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 22. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	21 - 22 °C
Relative humidity:	57 %
Power supply:	-48 VDC
Test Configuration/Mode:	Modulation: TM1, TM2, TM3, TM4, TM5, TM6, TM7, TM8 Channel Bandwidth: 5MHz, 10MHz Channel No.: B, M, T Multi Carrier: 1

### 6.3.2 Test Specifications and Limits

#### 6.3.2.1 Specification

FCC part 2.1049 and part 27 subpart C & M

#### 6.3.2.2 Supporting Standards

Table 23. Supporting Standards

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
WiMAX MRCT (2007-08)	WiMAX Forum™ Mobile Radio Conformance Tests

#### 6.3.2.3 Limits

No specific occupied bandwidth requirement in FCC part 2.1049 and part 27 subpart C & M for BRS&EBS Band.

### 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 IEEE802.16 equipments:	50 kHz (for 5MHz Channel Bandwidth) 100 kHz (for 10MHz Channel Bandwidth)
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### Test setup

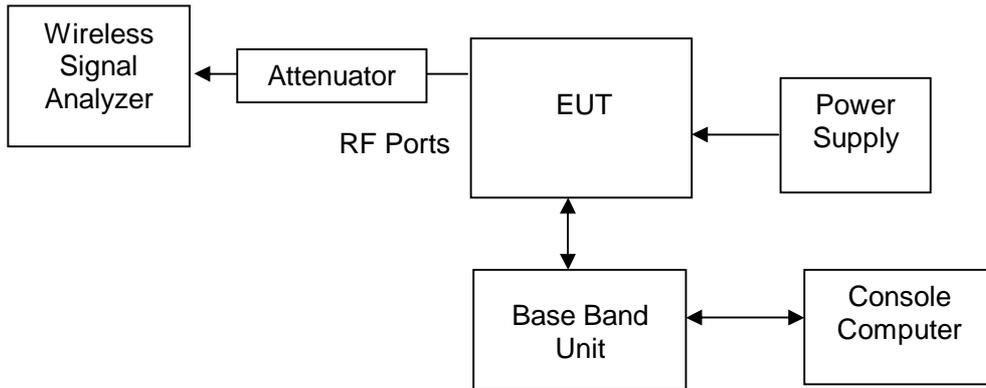


Figure 3. TEST SETUP

### 6.3.4 Measurement Results

#### (1) Single Carrier, 5MHz Channel Bandwidth:

Table 24. Measurement Results for Occupied Bandwidth

Test Mode	Occupied Bandwidth			Limit
	Ch. B	Ch. M	Ch. T	
	MHz	MHz	MHz	
TM1	4.60	4.60	4.60	---
TM2	4.60	4.60	4.60	
TM3	4.60	4.60	4.60	
TM4	4.60	4.60	4.60	
TM5	4.60	4.60	4.60	
TM6	4.60	4.60	4.60	
TM7	4.60	4.60	4.60	
TM8	4.60	4.60	4.60	

#### (2) Single Carrier, 10MHz Channel Bandwidth:

Table 25. Measurement Results for Occupied Bandwidth

Test Mode	Occupied Bandwidth			Limit
	Ch. B	Ch. M	Ch. T	
	MHz	MHz	MHz	



Test Mode	Occupied Bandwidth			Limit
	Ch. B	Ch. M	Ch. T	
	MHz	MHz	MHz	
TM1	9.15	9.15	9.15	---
TM2	9.15	9.15	9.15	
TM3	9.15	9.15	9.15	
TM4	9.15	9.15	9.15	
TM5	9.15	9.15	9.15	
TM6	9.15	9.15	9.15	
TM7	9.15	9.15	9.15	
TM8	9.15	9.15	9.15	

### 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 26. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	21 - 22 °C
Relative humidity:	57 %
Power supply:	-48 VDC
Test Configuration/Mode:	Modulation: TM1, TM2, TM3, TM4, TM5, TM6, TM7, TM8 Channel Bandwidth: 5MHz, 10MHz Channel No.: B, T Multi Carrier: 1, 2
Rated maximum transmitter output power ( $P_{max}$ ):	Single carrier: total 40dBm(10W); Two carriers: each 37dBm(5W), total 40dBm(10W)

### 6.4.2 Test Specifications and Limits

#### 6.4.2.1 Specification

FCC part 2.1051 and part 27.53(l)(2) and part 27.53(l)(6)

#### 6.4.2.2 Supporting Standards

Table 27. Supporting Standards

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
WiMAX MRCT (2007-08)	WiMAX Forum™ Mobile Radio Conformance Tests

#### 6.4.2.3 Limits

Compliance with FCC part 2.1051 and part 27.53(l)(2) and part 27.53(l)(6), for fixed and temporary fixed digital stations, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed, the attenuation below the transmitter power (P) measured in watts shall be not less than  $43 + 10 \log (P)$  dB.

Table 28. FCC Limits for BRS&EBS 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) as close to 1.0% of the emission bandwidth as possible. Set the sweep span to 2 MHz.

Measurement bandwidth (RBW) of Spectrum Analyzer or equivalent:

for IEEE802.16 equipments:	50 kHz (for 5MHz Channel Bandwidth) 100 kHz (for 10MHz Channel Bandwidth)
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### Test setup

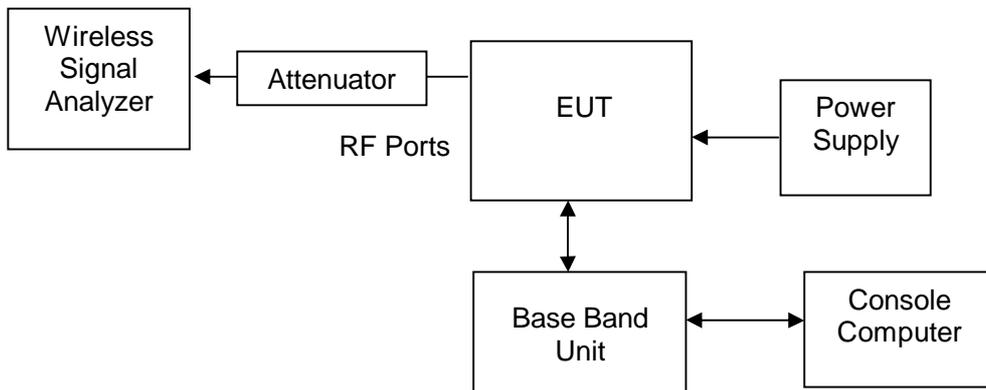


Figure 4. TEST SETUP

### 6.4.4 Measurement Results

**NOTE:** the -3dB point of the measurement filter maybe considered in tests.

(1) Single Carrier, 5MHz Channel Bandwidth:

Table 29. Measurement Results for Band Edge Characteristics

Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
Ch. B	2495 – 2496	TM1	-17.10	-13
		TM2	-17.02	
		TM3	-16.59	
		TM4	-16.91	
		TM5	-15.00	
		TM6	-16.24	
		TM7	-16.37	
		TM8	-17.04	



Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
Ch. T	2690 – 2691	TM1	-16.37	-13
		TM2	-16.41	
		TM3	-17.90	
		TM4	-17.91	
		TM5	-17.87	
		TM6	-18.65	
		TM7	-16.56	
		TM8	-16.74	

**(2) Single Carrier, 10MHz Channel Bandwidth:**

Table 30. Measurement Results for Band Edge Characteristics

Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
Ch. B	2495 – 2496	TM1	-26.55	-13
		TM2	-26.09	
		TM3	-26.38	
		TM4	-26.84	
		TM5	-26.75	
		TM6	-26.32	
		TM7	-26.58	
		TM8	-26.41	
Ch. T	2690 – 2691	TM1	-27.08	-13
		TM2	-27.13	
		TM3	-27.33	
		TM4	-26.20	
		TM5	-26.52	
		TM6	-25.86	
		TM7	-27.41	
		TM8	-26.81	

**(3 Dual Carriers, 10MHz+10MHz Channel Bandwidth:**

Table 31. Measurement Results for Band Edge Characteristics

Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
Ch. B	2495 – 2496	TM1	-28.09	-13
		TM2	-26.46	
		TM3	-28.68	
		TM4	-28.82	



Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
		TM5	-28.84	
		TM6	-28.04	
		TM7	-28.41	
		TM8	-24.86	
Ch. T	2690 – 2691	TM1	-28.31	-13
		TM2	-27.98	
		TM3	-28.34	
		TM4	-28.38	
		TM5	-28.38	
		TM6	-28.24	
		TM7	-28.33	
		TM8	-28.81	

### 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 32. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	21 - 22 °C
Relative humidity:	57 %
Power supply:	-48 VDC
Test Configuration/Mode:	Modulation: TM1, TM2, TM3, TM4, TM5, TM6, TM7, TM8 Channel Bandwidth: 5MHz, 10MHz Channel No.: B, M, T Multi Carrier: 1, 2
Rated maximum transmitter output power ( $P_{max}$ ):	Single carrier: total 40dBm(10W); Two carriers: each 37dBm(5W), total 40dBm(10W)

### 6.5.2 Test Specifications and Limits

#### 6.5.2.1 Specification

FCC part 2.1051 and part 27.53(l)(2) and part 27.53(l)(6)

#### 6.5.2.2 Supporting Standards

Table 33. Supporting Standards

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ITU-R SM.329-10	Unwanted emissions in the spurious domain
WiMAX MRCT (2007-08)	WiMAX Forum™ Mobile Radio Conformance Tests

#### 6.5.2.3 Limits

Compliance with FCC part 2.1051 and part 27.53(l)(2) and part 27.53(l)(6), based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater, the attenuation below the transmitter power (P) measured in watts shall be not less than  $43 + 10 \log (P)$  dB.

Table 34. FCC Limits for BRS&EBS 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:

BRS&EBS Band:	1 MHz
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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

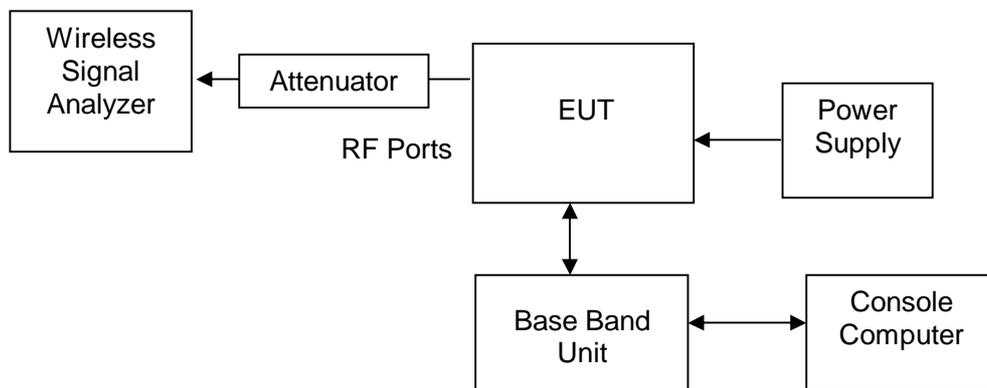


Figure 5. TEST SETUP

### 6.5.4 Measurement Results

#### (1) Single Carrier, 5MHz Channel Bandwidth:

Table 35. Measurement Results for Spurious Emissions

Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
Ch. B	9k – 27G	TM1	< -13 (See Appendix D)	-13
		TM2	< -13 (See Appendix D)	
		TM3	< -13 (See Appendix D)	
		TM4	< -13 (See Appendix D)	
		TM5	< -13 (See Appendix D)	

Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
		TM6	< -13 (See Appendix D)	
		TM7	< -13 (See Appendix D)	
		TM8	< -13 (See Appendix D)	
Ch. M	9k – 27G	TM1	< -13 (See Appendix D)	-13
		TM2	< -13 (See Appendix D)	
		TM3	< -13 (See Appendix D)	
		TM4	< -13 (See Appendix D)	
		TM5	< -13 (See Appendix D)	
		TM6	< -13 (See Appendix D)	
		TM7	< -13 (See Appendix D)	
		TM8	< -13 (See Appendix D)	
Ch. T	9k – 27G	TM1	< -13 (See Appendix D)	-13
		TM2	< -13 (See Appendix D)	
		TM3	< -13 (See Appendix D)	
		TM4	< -13 (See Appendix D)	
		TM5	< -13 (See Appendix D)	
		TM6	< -13 (See Appendix D)	
		TM7	< -13 (See Appendix D)	
		TM8	< -13 (See Appendix D)	

**(2) Single Carrier, 10MHz Channel Bandwidth:**

Table 36. Measurement Results for Spurious Emissions

Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
Ch. B	9k – 27G	TM1	< -13 (See Appendix D)	-13
		TM2	< -13 (See Appendix D)	
		TM3	< -13 (See Appendix D)	
		TM4	< -13 (See Appendix D)	
		TM5	< -13 (See Appendix D)	
		TM6	< -13 (See Appendix D)	
		TM7	< -13 (See Appendix D)	
		TM8	< -13 (See Appendix D)	
Ch. M	9k – 27G	TM1	< -13 (See Appendix D)	-13
		TM2	< -13 (See Appendix D)	
		TM3	< -13 (See Appendix D)	
		TM4	< -13 (See Appendix D)	
		TM5	< -13 (See Appendix D)	
		TM6	< -13 (See Appendix D)	
		TM7	< -13 (See Appendix D)	
		TM8	< -13 (See Appendix D)	

Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
Ch. T	9k – 27G	TM1	< -13 (See Appendix D)	-13
		TM2	< -13 (See Appendix D)	
		TM3	< -13 (See Appendix D)	
		TM4	< -13 (See Appendix D)	
		TM5	< -13 (See Appendix D)	
		TM6	< -13 (See Appendix D)	
		TM7	< -13 (See Appendix D)	
		TM8	< -13 (See Appendix D)	

**(3) Dual Carriers, 10MHz+10MHz Channel Bandwidth:**

Table 37. Measurement Results for Spurious Emissions

Ch. No.	Test Frequency Range (MHz)	Test Mode	Maximum Spurious Level measured (dBm)	Limit (dBm)
Ch. B	9k – 27G	TM1	< -13 (See Appendix D)	-13
		TM2	< -13 (See Appendix D)	
		TM3	< -13 (See Appendix D)	
		TM4	< -13 (See Appendix D)	
		TM5	< -13 (See Appendix D)	
		TM6	< -13 (See Appendix D)	
		TM7	< -13 (See Appendix D)	
		TM8	< -13 (See Appendix D)	
Ch. M	9k – 27G	TM1	< -13 (See Appendix D)	-13
		TM2	< -13 (See Appendix D)	
		TM3	< -13 (See Appendix D)	
		TM4	< -13 (See Appendix D)	
		TM5	< -13 (See Appendix D)	
		TM6	< -13 (See Appendix D)	
		TM7	< -13 (See Appendix D)	
		TM8	< -13 (See Appendix D)	
Ch. T	9k – 27G	TM1	< -13 (See Appendix D)	-13
		TM2	< -13 (See Appendix D)	
		TM3	< -13 (See Appendix D)	
		TM4	< -13 (See Appendix D)	
		TM5	< -13 (See Appendix D)	
		TM6	< -13 (See Appendix D)	
		TM7	< -13 (See Appendix D)	
		TM8	< -13 (See Appendix D)	



## 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 38. Test Conditions

Preconditioning:	1 hour
Measured at:	Enclosure
Ambient temperature:	21 - 22 °C
Relative humidity:	57 %
Power supply:	-48 VDC
Test Configuration/Mode:	Modulation: TM1 (representatively) Channel Bandwidth: 10MHz (representatively) Channel No.: M (representatively) Multi Carrier: 2
Rated maximum transmitter output power ( $P_{max}$ ):	Single carrier: total 40dBm(10W); Two carriers: each 37dBm(5W), total 40dBm(10W)

### 6.6.2 Test Specifications and Limits

#### 6.6.2.1 Specification

FCC part 2.1053 and part 27.53(l)(2) and part 27.53(l)(6)

#### 6.6.2.2 Supporting Standards

Table 39. Supporting Standards

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ITU-R SM.329-10	Unwanted emissions in the spurious domain
WiMAX MRCT (2007-08)	WiMAX Forum™ Mobile Radio Conformance Tests

#### 6.6.2.3 Limits

Compliance with FCC part 2.1053 and part 27.53(l)(2) and part 27.53(l)(6), based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater, the attenuation below the transmitter power (P) measured in watts shall be not less than  $43 + 10 \log (P)$  dB.

Table 40. FCC Limits for BRS&EBS 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.

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

BRS&EBS Band:	1 MHz
---------------	-------

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
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150 kHz – 30 MHz:	10 kHz
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## Test setup

### Step 1: Pre-test

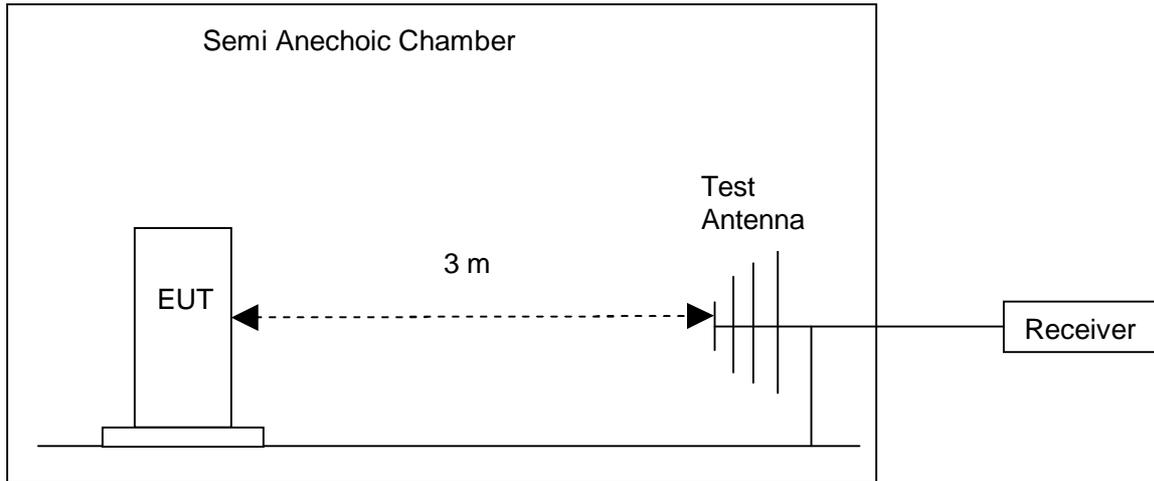


Figure 6. Test Set-up for Pre-test

### Step 2: Substitution method to verify the maximum ERP

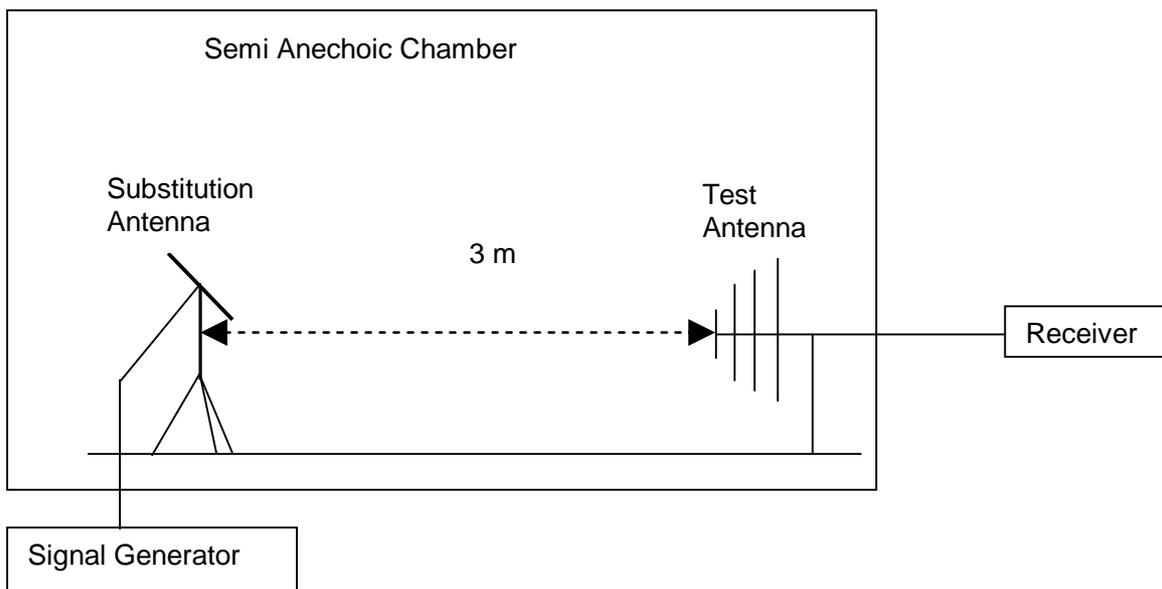


Figure 7. Test Set-up for Substitution

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 41. Measurement Results for Spurious Emissions

Channel Number	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit (dBm)
Ch. M	30M – 27G	< -13 (See Appendix E)	- 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 42. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	(See Measurement Results)
Relative humidity:	57 %
Power supply:	(See Measurement Results)
Test Configuration/Mode: (No modulation required according FCC rules)	Modulation: TM1 (representatively) Channel Bandwidth: 10MHz (representatively) Channel No.: M (representatively) Multi Carrier: 1

### 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 43. Supporting Standards

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
WiMAX MRCT (2007-08)	WiMAX Forum™ Mobile Radio Conformance Tests

#### 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 44. FCC Limits for BRS&EBS Band

Limit:	(not defened)
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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.

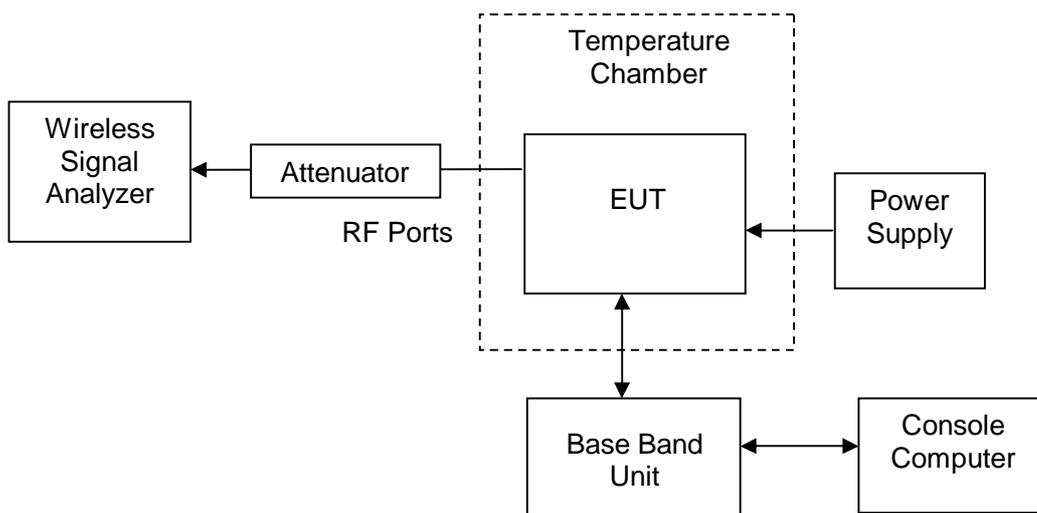
### **The test procedure**

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 primary supply voltages are: -48 VDC (100% rated), -40.8 VDC (85% rated) and -55.2 VDC (115% rated).

### **Test Set up**



**Figure 8.** Test Set up

## 6.7.4 Measurement Results

### 6.7.4.1 Frequency Error vs. Temperature

Single Carrier, 10MHz Channel Bandwidth:

Table 45. Measurement Results for Frequency Error vs. Temperature

Measured Maximum Frequency Error				
Test Environment		Ch. M		
Voltage	Temperature	Hz	ppm	Limit
-48 VDC (100% rated / normal)	-30 °C	44.44	0.02	---
	-20 °C	44.59	0.02	
	-10 °C	45.00	0.02	
	0 °C	44.55	0.02	
	+10 °C	44.57	0.02	
	+20 °C	46.24	0.02	
	+30 °C	45.68	0.02	
	+40 °C	45.10	0.02	
	+50 °C	46.38	0.02	

### 6.7.4.2 Frequency Error vs. Voltage

Single Carrier, 10MHz Channel Bandwidth:

Table 46. Measurement Results for Frequency Error vs. Voltage

Measured Maximum Frequency Error				
Test Environment		Ch. M		
Voltage	Temperature	Hz	ppm	Limit
-40.8 VDC (85% rated / lowest)	+20 °C	45.41	0.02	---
-48 VDC (100% rated / normal)	+20 °C	45.04	0.02	
-55.2 VDC (115% rated / highest)	+20 °C	45.34	0.02	



## 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 47. 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	49	Pages
Appendix C	Measurement Results Band Edges	49	Pages
Appendix D	Measurement Results Spurious Emission at Antenna Terminal	291	Pages
Appendix E	Measurement Results Radiated Spurious Emission	3	Pages
Appendix F	Photos of Test Setup	3	Pages

----- END OF REPORT -----