



FCC Test Report

Product Name: WiMAX pico base station

Model Number: pBTS3701

Report No: SYBH (R) 065082008EB-1
FCC ID: QIS PBTS3701-2500

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

Notice

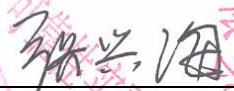
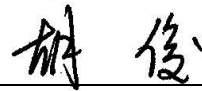
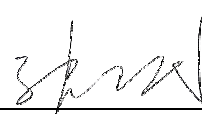
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REPORT ON FCC Test of WiMAX pico base station
Model Name: pBTS3701
Report No: SYBH (R) 065082008EB-1
FCC ID: QISPBT3701-2500

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

CONCLUSION PASSED

General Manager	<u>2008-09-28</u> Date (y-m-d)	<u>张兴海</u> Name	 Signature
Technical Responsibility For Area of Testing	<u>2008-09-28</u> Date (y-m-d)	<u>胡俊</u> Name	 Signature
Test Lab Engineer	<u>2008-09-28</u> Date (y-m-d)	<u>张卫民</u> Name	 Signature



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1 Summary

The table below summarizes the measurements and results for the equipment of WiMAX pico base station - pBTS3701. 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

The pBTS3701 is a compact integrated indoor BTS. It receives and transmits radio signals to enable communication between the WiMAX network and the MS/SS.

The pBTS3701 communicates with the MS/SS through the R1 interface and communicates with the ASN-GW through the R6 interface. With the ASN-GW, the pBTS3701 manages the radio resources and radio parameters.

The pBTS3701 is mainly used to enhance indoor coverage and hot spot coverage.

- I Indoor coverage
The pBTS3701 site is located in small- or medium-sized buildings, enclosed halls, garages, and office buildings. Signals in these areas can be enhanced, and the data transmission speed can be improved.
- I Hot Spot Coverage
The pBTS3701 site is located in shopping malls, gymnasiums, airports, and other places of heavy traffic. In this case, the signal coverage is greatly improved, and the capability and data transmission speed are increased to meet the requirements of high-volume traffic.

The pBTS3701 has the following features:

- I Abundant transmission resources
- I Compact size
- I Easy Installation
- I Convenient OM
- I Flexible Coverage

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 1/2	TM1	/
Data	Modulation: QPSK 3/4	TM2	/
Data	Modulation: 16QAM 1/2	TM3	/
Data	Modulation: 16QAM 3/4	TM4	/
Data	Modulation: 64QAM 1/2	TM5	/
Data	Modulation: 64QAM 3/4	TM6	/

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

Date of Start: 23 September 2008
Date of End: 24 September 2008

4 Product Description

4.1 Technical Characteristics

4.1.1 Frequency Range

Table 4. Frequency Range for BRS&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:	5 MHz and 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:	-5 °C
Maximum temperature:	+40 °C
Relative Humidity:	5% to 95% RH

4.1.5 Power Source

Table 8. DC Power Source (Adapter Output)

DC voltage nominal:	$\pm$ +12 V
DC voltage range:	$\pm$ +11.4 V to $\pm$ +12.6 V
DC current maximal:	4 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. Component Parts Information

Model Name	Qty.	Hardware Version	Software Version	Description	Serial Number
QL51BMSU	1	VER.A	V100R002C0 1B010	Baseband Main Service Unit (with 2 Transmit- Receive Units integrated)	020LNS1088800047 N3

4.2.2 Adapter Technical Data

Table 10. Adapter Information

Model Name	Qty.	Hardware Version	Software Version	Description	Serial Number
FSD060- 1AD101C	1	/	/	INPUT: NOM AC115/230V, MIN AC90V, MAX AC264V; OUTPUT: DC11.4V~DC 12.6V	ZO012978

4.2.3 Battery Technical Data

Not Applicable for BTS.

4.2.4 FCC Identification

Grantee Code: QIS
Product Code: PBTS3701-2500
FCC Identification: QISPBTS3701-2500

5 Main Test Instruments

Table 11. Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until (y-m-d)
Radiated Cases				
Receiver	R&S	ESIB 26	100318	2009-4-21
BiLog Antenna	Schaffner	CBL 6112B	2941	2009-3-17
Horn Antenna	ETS-Lindgren	3117	00062549	2009-8-18
Signal Generator	R&S	SMT06	830264/009	2009-5-11
Signal Generator	R&S	SMR 40	100325	2009-5-11
Signal Generator	R&S	SMU200A	101717	2009-4-10
Conducted Cases				
Signal Analyzer	R&S	FSQ 26	200632	2009-04-15
Attenuator	Aeroflex / Weinschel	49-30-33-LIM	NC356	---
Power Supply	KIKUSUI	PAD110-32LA	EM004681	2009-05-11
Temperature Chamber	ESPEC	MW3030	06114003	2009-5-19

6 Transmitter Measurements

The EUT supports six types of modulation as listed in section 2.1.2, each type of modulation should be considered under 5 MHz and 10 MHz channel bandwidths (refer to section 4.1.2).

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	Multi-Carriers	Channels No.		
		Channel B	Channel M	Channel T
BRS&EBS band (5 MHz channel bandwidth):	1	2498.5 MHz	2593 MHz	2687.5 MHz
BRS&EBS band (10 MHz channel bandwidth):	1	2501 MHz	2593 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:	20 °C
Relative humidity:	74 %
Power supply:	12 VDC
Test Configuration/Mode:	TM1, TM2, TM3, TM4, TM5, TM6 at Channel B, M, T
Rated maximum transmitter output power ($P_{\max}$):	27 dBm (500 mW) per antenna port

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

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

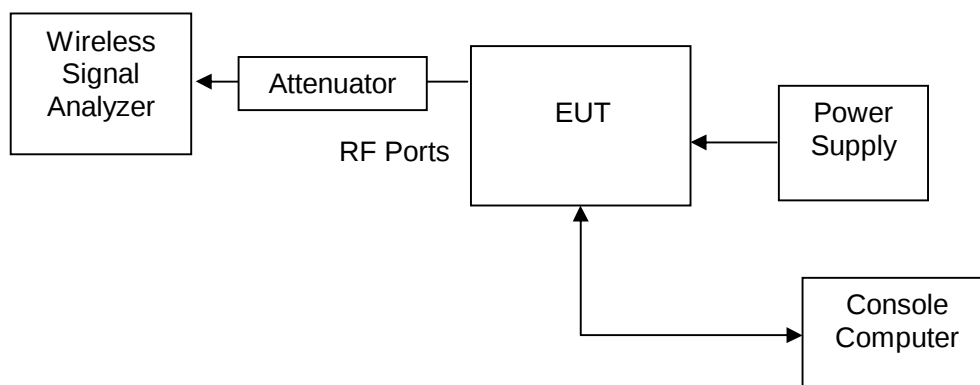


Figure 1. TEST SETUP

6.1.4 Measurement Results

5 MHz channel bandwidth:

Table 16. Measurement Results for Maximum Output Power

Test Mode	Maximum Output Power			
	Ch.B 2498.5 MHz	Ch.M 2593 MHz	Ch.T 2687.5 MHz	Limit (dBm)
	dBm	dBm	dBm	
TM1	27.11	26.64	27.13	< 62
TM2	27.12	26.65	27.13	< 62
TM3	27.24	26.79	27.25	< 62
TM4	27.11	26.66	27.13	< 62
TM5	27.08	26.61	27.09	< 62
TM6	27.04	26.58	27.07	< 62

10 MHz channel bandwidth:

Table 17. Measurement Results for Maximum Output Power

Test Mode	Maximum Output Power			
	Ch.B 2501 MHz	Ch.M 2593 MHz	Ch.T 2685 MHz	Limit (dBm)



	dBm	dBm	dBm	
TM1	26.59	26.08	26.79	< 62
TM2	26.57	26.32	26.77	< 62
TM3	26.64	26.4	26.85	< 62
TM4	26.55	26.3	26.76	< 62
TM5	26.49	26.24	26.7	< 62
TM6	26.46	26.25	26.7	< 62

6.1.5 Conclusion

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

6.2 Modulation Characteristics

6.2.1 Test Conditions

Table 18. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C
Relative humidity:	74 %
Power supply:	12 VDC
Test Configuration/Mode:	TM1, TM2, TM3, TM4, TM5, TM6 at Channel M

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 19. 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

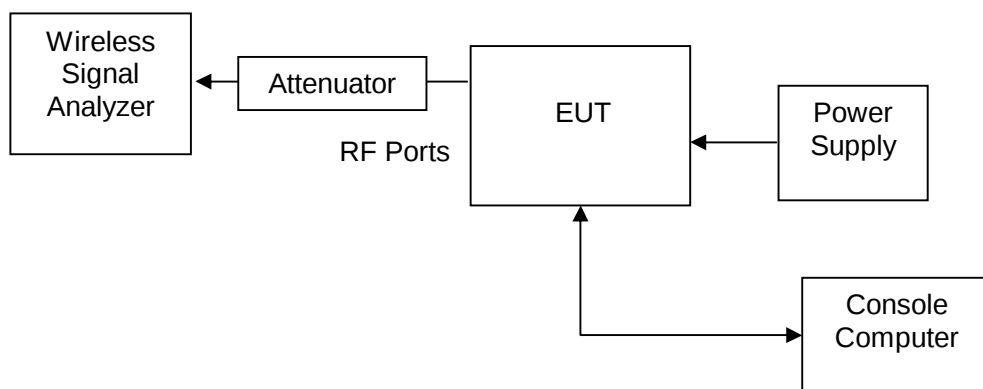


Figure 2. TEST SETUP

6.2.4 Measurement Results

5 MHz channel bandwidth:

Table 20. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics
	Ch.M
	2593 MHz
	Type/Mode
TM1	QPSK
TM2	QPSK
TM3	16QAM
TM4	16QAM
TM5	64QAM
TM6	64QAM

10 MHz channel bandwidth:

Table 21. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics
	Ch.M
	2593 MHz
	Type/Mode
TM1	QPSK
TM2	QPSK
TM3	16QAM
TM4	16QAM
TM5	64QAM
TM6	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:	20 °C
Relative humidity:	74 %
Power supply:	12 VDC
Test Configuration/Mode:	TM1, TM2, TM3, TM4, TM5, TM6 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 & 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

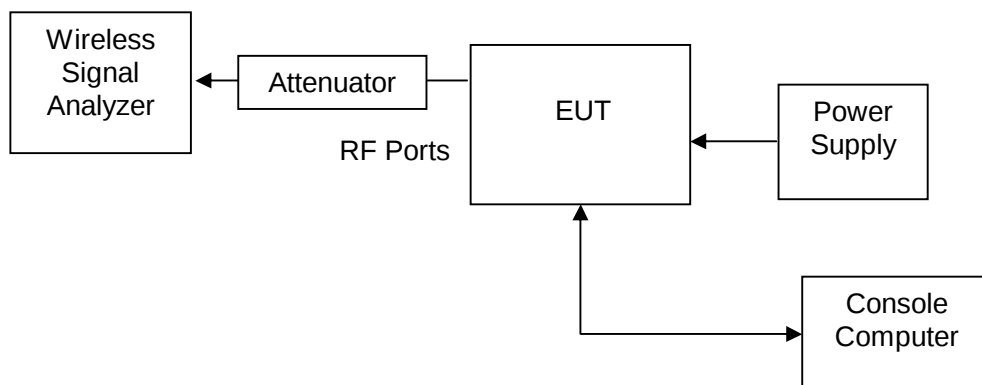


Figure 3. TEST SETUP

6.3.4 Measurement Results

5 MHz channel bandwidth:

Table 24. Measurement Results for Occupied Bandwidth

Test Mode	Occupied Bandwidth			Limit
	Ch.B 2498.5 MHz	Ch.M 2593 MHz	Ch.T 2687.5 MHz	
	MHz	MHz	MHz	
TM1	4.58	4.58	4.58	---
TM2	4.58	4.58	4.58	
TM3	4.58	4.58	4.58	
TM4	4.58	4.57	4.57	
TM5	4.58	4.58	4.58	
TM6	4.58	4.58	4.58	

10 MHz channel bandwidth:

Table 25. Measurement Results for Occupied Bandwidth

Test Mode	Occupied Bandwidth			Limit
	Ch.B 2501 MHz	Ch.M 2593 MHz	Ch.T 2685 MHz	
	MHz	MHz	MHz	
TM1	9.13	9.13	9.13	---
TM2	9.13	9.13	9.13	
TM3	9.13	9.13	9.11	
TM4	9.13	9.13	9.13	
TM5	9.13	9.13	9.13	
TM6	9.13	9.13	9.13	



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:	20 °C
Relative humidity:	74 %
Power supply:	12 VDC
Test Configuration/Mode:	TM1, TM2, TM3, TM4, TM5, TM6 at Channel B, T
Rated maximum transmitter output power (P_{max}):	27 dBm (500 mW) per antenna port

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 cover at least $\pm 250\%$ of the emission bandwidth or 2 MHz, which is larger.

Measurement bandwidth (RBW) of Spectrum Analyzer or equivalent:

for IEEE802.16 equipments:	(close to 1% of channel bandwidth) 50 kHz for 5MHz channel bandwidth 100 kHz for 10MHz channel bandwidth
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Test setup

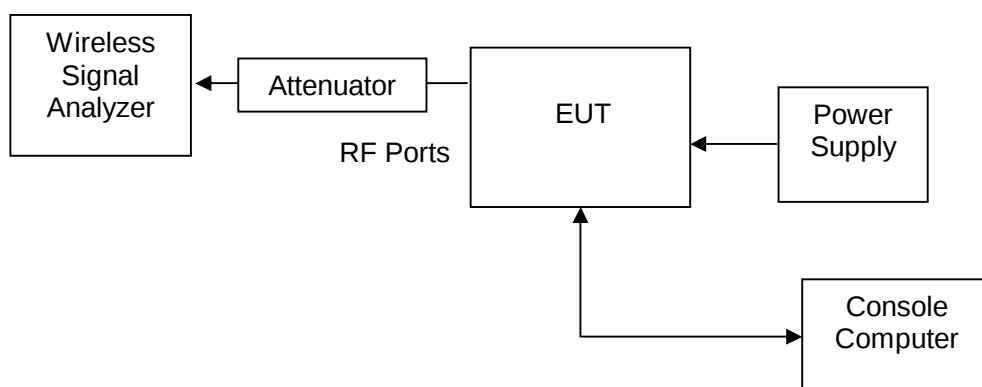


Figure 4. TEST SETUP

6.4.4 Measurement Results

5 MHz channel bandwidth:

Table 29. Measurement Results for Band Edge Characteristics

Channel Number	Test Mode	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
Ch.B 2498.5 MHz	TM1	2495 – 2496	-23.64	< - 13dBm
	TM2	2495 – 2496	-20.77	
	TM3	2495 – 2496	-20.33	
	TM4	2495 – 2496	-21.74	
	TM5	2495 – 2496	-20.89	
	TM6	2495 – 2496	-20.09	
Ch.T 2687.5 MHz	TM1	2690 – 2691	-20.25	
	TM2	2690 – 2691	-19.36	
	TM3	2690 – 2691	-19.04	
	TM4	2690 – 2691	-21.26	



Channel Number	Test Mode	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
	TM5	2690 – 2691	-20.08	
	TM6	2690 – 2691	-19.42	

10 MHz channel bandwidth:

Table 30. Measurement Results for Band Edge Characteristics

Channel Number	Test Mode	Test Frequency Range (MHz)	Maximum Spurious Level measured (dBm)	Limit
Ch.B 2501 MHz	TM1	2495 – 2496	-25.36	< - 13dBm
	TM2	2495 – 2496	-24.88	
	TM3	2495 – 2496	-25.59	
	TM4	2495 – 2496	-25.44	
	TM5	2495 – 2496	-25.49	
	TM6	2495 – 2496	-25.71	
Ch.T 2685 MHz	TM1	2690 – 2691	-25.8	
	TM2	2690 – 2691	-26.3	
	TM3	2690 – 2691	-24.5	
	TM4	2690 – 2691	-25.7	
	TM5	2690 – 2691	-25.28	
	TM6	2690 – 2691	-25.25	

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 31. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C
Relative humidity:	74 %
Power supply:	12 VDC
Test Configuration/Mode:	TM1, TM2, TM3, TM4, TM5, TM6 at Channel B, M, T
Rated maximum transmitter output power (P_{max}):	27 dBm (500 mW) per antenna port

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 32. 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 33. FCC Limits for BRS&EBS Band

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

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

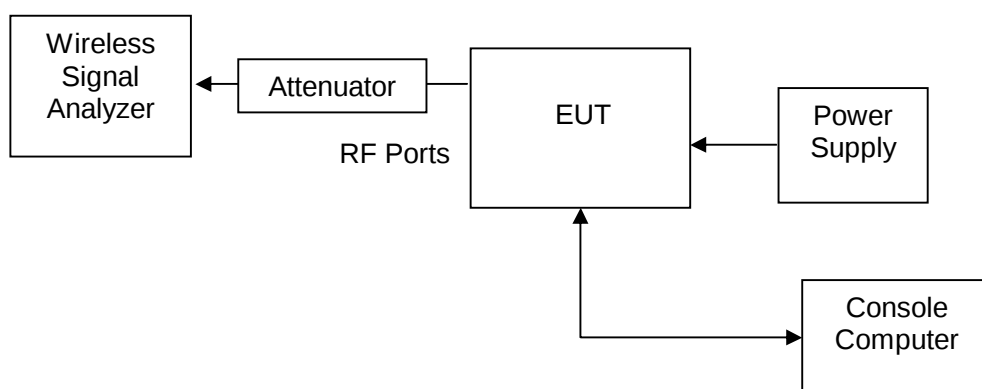


Figure 5. TEST SETUP

6.5.4 Measurement Results

5 MHz channel bandwidth:

Table 34. Measurement Results for Spurious Emissions

Channel Number	Test Mode	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
Ch.B 2498.5 MHz	TM1	9k – 27G	< -13	< - 13dBm
	TM2	9k – 27G	< -13	
	TM3	9k – 27G	< -13	
	TM4	9k – 27G	< -13	
	TM5	9k – 27G	< -13	
	TM6	9k – 27G	< -13	
Ch.M 2593 MHz	TM1	9k – 27G	< -13	
	TM2	9k – 27G	< -13	



Channel Number	Test Mode	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
	TM3	9k – 27G	< -13	
	TM4	9k – 27G	< -13	
	TM5	9k – 27G	< -13	
	TM6	9k – 27G	< -13	
Ch.T 2687.5 MHz	TM1	9k – 27G	< -13	
	TM2	9k – 27G	< -13	
	TM3	9k – 27G	< -13	
	TM4	9k – 27G	< -13	
	TM5	9k – 27G	< -13	
	TM6	9k – 27G	< -13	

10 MHz channel bandwidth:

Table 35. Measurement Results for Spurious Emissions

Channel Number	Test Mode	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
Ch.B 2501 MHz	TM1	9k – 27G	< -13	< -13dBm
	TM2	9k – 27G	< -13	
	TM3	9k – 27G	< -13	
	TM4	9k – 27G	< -13	
	TM5	9k – 27G	< -13	
	TM6	9k – 27G	< -13	
Ch.M 2593 MHz	TM1	9k – 27G	< -13	
	TM2	9k – 27G	< -13	
	TM3	9k – 27G	< -13	
	TM4	9k – 27G	< -13	
	TM5	9k – 27G	< -13	
	TM6	9k – 27G	< -13	
Ch.T 2685 MHz	TM1	9k – 27G	< -13	
	TM2	9k – 27G	< -13	
	TM3	9k – 27G	< -13	
	TM4	9k – 27G	< -13	
	TM5	9k – 27G	< -13	
	TM6	9k – 27G	< -13	



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 36. Test Conditions

Preconditioning:	1 hour
Measured at:	Enclosure
Ambient temperature:	20 °C
Relative humidity:	74 %
Power supply:	12 VDC
Test Configuration/Mode:	TM1 at Channel M (typically)
Rated maximum transmitter output power (P_{max}):	27 dBm (500 mW) per antenna port

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 37. 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 38. 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
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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

Step 1: Pre-test

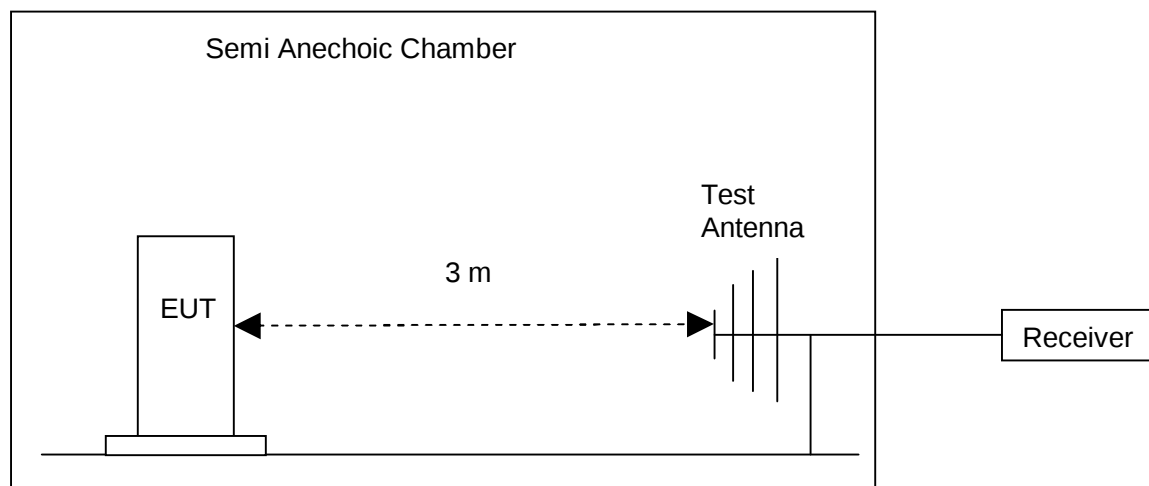


Figure 6. Test Set-up for Pre-test

Step 2: Substitution method to verify the maximum ERP

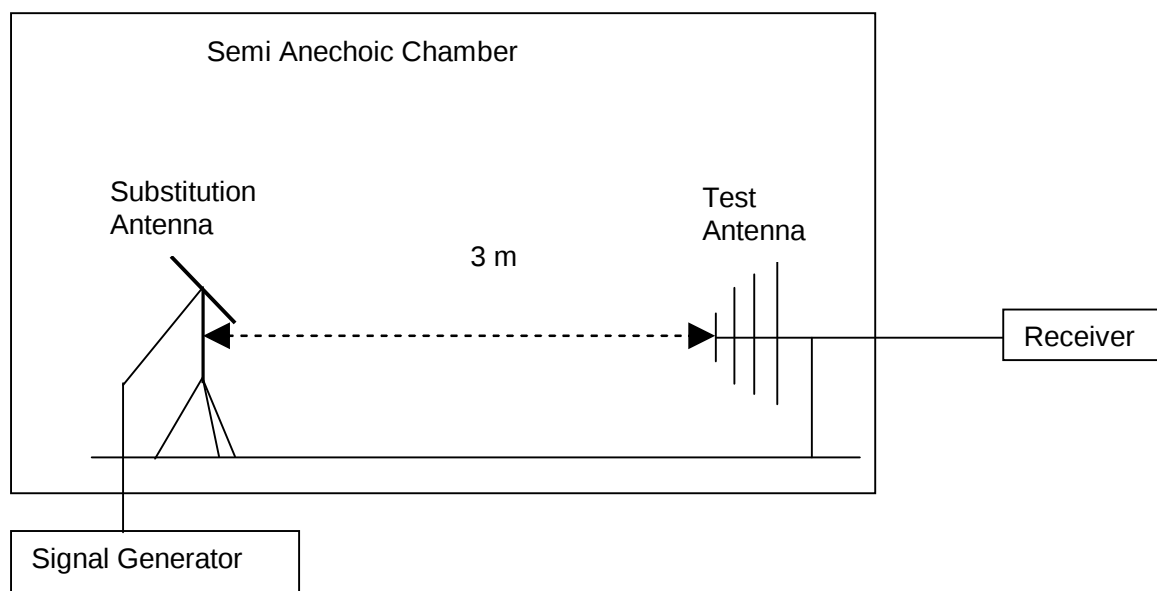


Figure 7. Test Set-up for Substitution

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 39. Measurement Results for Spurious Emissions



Channel Number	Test Frequency Range (Hz)	Maximum Spurious Level measured (dBm)	Limit
Ch.M 2593 MHz	30M – 27G	< -13	< - 13dBm

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 40. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	See Measurement Results
Relative humidity:	74 %
Power supply:	See Measurement Results
Test Configuration/Mode:	Any modulation type (non-modulation required by FCC) 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 41. 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 42. FCC Limits for BRS&EBS 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 43. Limits According to EUT technical requirements for all operating bands

Limits for IEEE802.16 equipments:	< ±2 ppm
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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 extreme voltages are considered for the DC output of the Adapter:

The operating end points are: 12 VDC (normal point), 11.4 VDC (lowest point) and 12.6 VDC (highest point).

Test Set up

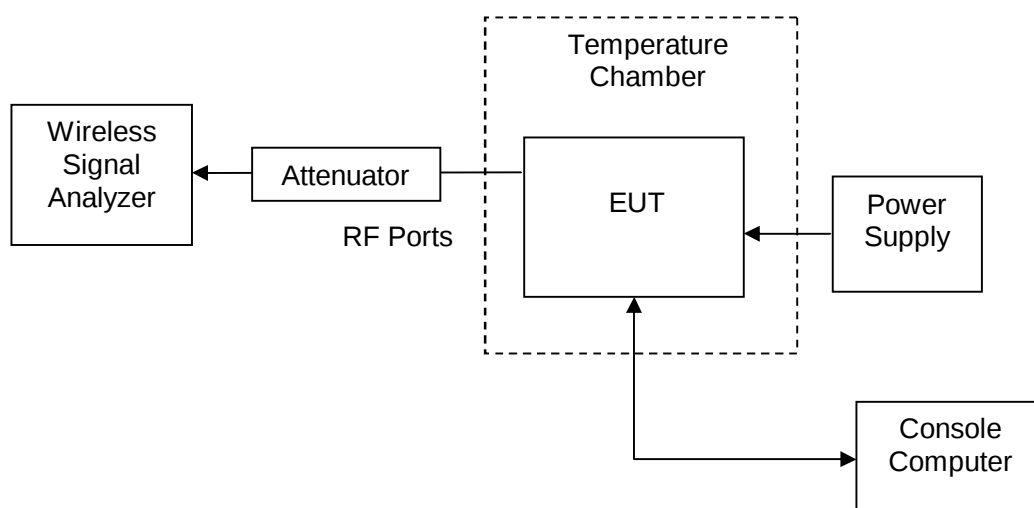


Figure 8. Test Set up

6.7.4 Measurement Results

6.7.4.1 Frequency Error vs. Temperature

Table 44. Measurement Results for Frequency Error vs. Temperature

Measured Maximum Frequency Error				
Test Environment		Ch.M 2593 MHz		
Voltage	Temperature	Hz	ppm	Limit
12 VDC (100% rated / normal)	-30 °C	9.96	0.004	< ±2ppm
	-20 °C	2.67	0.001	
	-10 °C	6.63	0.003	
	0 °C	6.3	0.002	
	+10 °C	12.36	0.005	
	+20 °C	5.9	0.002	
	+30 °C	10.37	0.004	
	+40 °C	4.27	0.002	
	+50 °C	6.99	0.003	

6.7.4.2 Frequency Error vs. Voltage

Table 45. Measurement Results for Frequency Error vs. Voltage

Measured Maximum Frequency Error				
Test Environment		Ch.M 2593 MHz		
Voltage	Temperature	Hz	ppm	Limit
11.4 VDC (85% rated / lowest)	+22 °C	5.75	0.002	< ±2ppm
12 VDC (100% rated / normal)	+22 °C	5.94	0.002	
12.6 VDC (115% rated / highest)	+22 °C	7.4	0.003	



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 46. 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	13	Pages
Appendix B	Measurement Results Occupied Bandwidth	25	Pages
Appendix C	Measurement Results Band Edges	19	Pages
Appendix D	Measurement Results Spurious Emission at Antenna Terminal	61	Pages
Appendix E	Measurement Results Radiated Spurious Emission	3	Pages
Appendix F	Photos of Test Setup	3	Pages

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