



FCC RF Test Report

Product Name: WiMAX CPE

Model Number: BM623m

Report No: SYBH(Z-RF)004112011-2001

FCC ID:QISBM623M

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Notice

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Notice 2

Modification Information:

Modification Information		
Modification Information	1	
	2	
	3	<i>Not Applicable!</i>
	4	
	5	
	6	
	7	



REGULATION	FCC CFR47 Part 2: Subpart J;
	47 CFR FCC Part 27, Subpart C&M
START OF TEST	Nov.3, 2011
END OF TEST	Nov.11, 2011
Final Judgement:	Pass

Approved By

Nov.17, 2011
Date

Dai Linjun
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Contents

1	<u>Summary</u>	6
1.1	RESULTS SUMMARY	6
1.2	SUPPORTING STANDARDS	6
2	<u>Product Description</u>	7
2.1	PRODUCTION INFORMATION OF EUT	7
3	<u>Test Site Description</u>	8
3.1	TESTING PERIOD	8
4	<u>Product Description</u>	9
4.1	TECHNICAL CHARACTERISTICS	9
4.2	EUT IDENTIFICATION LIST	11
5	<u>Main Test Instruments</u>	12
6	<u>Transmitter & Receiver Measurements</u>	13
6.1	MAXIMUM CHANNEL POWER	14
6.2	MODULATION CHARACTERISTICS	17
6.3	OCCUPIED BANDWIDTH	19
6.4	BAND EDGES COMPLIANCE	21
6.5	SPURIOUS EMISSION AT ANTENNA TERMINAL	24
6.6	RADIATED SPURIOUS EMISSIONS	27
6.7	FREQUENCY STABILITY	29
7	<u>System Measurement Uncertainty</u>	33
8	<u>Appendices</u>	34



1 Summary

1.1 Results Summary

The table below summarizes the measurements and results for the equipment of QISBM623M WiMAX CPE-BM623M. 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)(2)	Transmitter Output Power	PASS
2.1047	---	Modulation Characteristics	PASS
2.1049	---	Occupied Bandwidth	PASS
2.1051	27.53(m)(4) 27.53(m)(6)	Band Edges Compliance	PASS
2.1051	27.53(m)(4) 27.53(m)(6)	Spurious Emission at Antenna Terminal	PASS
2.1053	27.53(m)(4) 27.53(m)(6)	Radiated Spurious Emission	PASS
2.1055	27.54	Frequency Stability	PASS

Note1: If no limits were applied, limits for product standards may be employed in this test report.

1.2 Supporting Standards

Table 2. Supporting Standards

Standard Name	Description
ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
WiMAX MRCT	WiMAX Forum™ Mobile Radio Conformance Tests



2 Product Description

2.1 Production Information of EUT

2.1.1 General Description

HUAWEI BM623m, a WiMAX CPE, is a proprietary product developed by HUAWEI based on IEEE 802.16e-2005, and works in range of 2.496-2.69GHz, The product is composed of two PCB boards, a WiMAX and gateway board, an antenna PCB board, providing two ports and WLAN wireless downlink for the user service.

1×RJ45:10/100M LAN port;

1×RJ11:TEL port for VOIP;

The WLAN module is subscriber equipment in the WLAN system, operated in CH1-CH9. It includes two modulations of type. One is DSSS and another is OFDM. Supports IEEE802.11b, g, n.

2.1.2 Support Modulation and Coding Rate

The EUT supports the modulation and coding rate as follows:

Table 3. Modulation and Coding Rate List

Modulation	Coding Rate	Test Mode	Remark
QPSK	1/2	TM1	DL and UL
	3/4	TM2	DL and UL
16QAM	1/2	TM3	DL and UL
	3/4	TM4	DL and UL
64QAM	1/2	TM5	DL Only
	2/3	TM6	DL Only
	3/4	TM7	DL Only
	5/6	TM8	DL Only

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



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 (y-m-d): 2011-11-3
Date of End (y-m-d): 2011-11-11



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 Bandwidth

Table 5. Channel Bandwidth

Channel bandwidth:	5 MHz and 10 MHz
--------------------	------------------

4.1.3 Output Power

Table 6. Output Power

Transmitter Output Power	25dBm $\pm$ 2dB (Per Antenna Group of EUT) 22dBm $\pm$ 2dB (Per Antenna Port of 2TX MIMO)
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4.1.4 Antenna Profiles

Table 7. Antenna Profiles

Antenna Brand:	Huawei
Antenna Type:	Omnidirectional Antenna
Antenna Frequency Range:	2.496GHz~2.690GHz
Antenna Maximum Peak Gain:	7 dBi

4.1.5 Power Source

Table 8. DC Power Source

Charger voltage range:	~100-240 V, 50/60Hz
Charger current maximal:	600mA Max
DC Voltage Nominal:	$\equiv$ 12V
DC Voltage Range	$\equiv$ 9.6V~14.4 V

4.1.6 Environmental Requirements

Table 9. Environmental Requirements

Temperature Range:	0°C ~+40 °C
Relative Humidity:	5% to 95% RH



4.1.7 UL Zone Type

Table 10. UL Zone Type

UL Zone Type:	PUSC
---------------	------

4.1.8 Tune-up Procedure

Refer to FCC 2.1033(c) (9).

Please reference the document Tune-up Procedure in TCF.

Note:

1. The EUT can support different DL/UL ration in the normal operation, the maximum DL/UL (29:18) ration is used for 5MHz and 10MHz in this test, which can be controlled by the software from the host equipment.
2. The EUT have five TRX antenna ports, respectively named 'TRXA', 'TRXB', 'TRXC', 'TRXD', and 'TRXE'. They are partitioned to three groups; 'TRXE' is group No.1, which is for an external antenna, 'TRXA' and 'TRXC' is group No.2, 'TRXB' and 'TRXD' is group No.3, each of group No.2 and group No.3 gets two inner PCB antenna for MIMO, group No.1 can't supports MIMO.
3. The EUT can switch between the three antenna groups; only one group is used at a time. Which group will be switch is decided by the receiver signal, the group gets a strongest RX signal will be used first for TX and RX.
4. The above EUT information was declared by manufacture, for more detailed features description please refers to the manufacture's specifications or User's Manual.



4.2 EUT Identification List

4.2.1 Component Parts Information

The EUT involved in the test report consists of sub-assembly and ancillary Equipments as below.

(1) Sub-assembly identity of EUT

Sub-assembly identity of EUT

Model Identify	Hardware Version	Qty.	Software Version	Serial Number	Description
BM623M	BM623m	1	V400R001	NA	WiMAX and gateway Board
	BM623m-Antenna	1	NA	NA	WiMAX Antenna Board
	BM623m-WiFi Antenna	1	NA	NA	WiFi Antenna

(2) Sub-assembly identity of Ancillary Equipments

Table 11. Sub-assembly identity of Ancillary Equipments

Model Identify	Qty.	Hardware Version	Software Version	Serial Number	Description
/	/	/	/	/	/

4.2.2 FCC Identification

Grantee Code: QIS
Product Code: BM623M
FCC Identification: QISBM623M



5 Main Test Instruments

Table 12. Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until
Power supply	KEITHLEY	2303	1288003	Sep.27,2012
Wireless Communication Test set	Agilent	N4010A	MY49081592	Dec.14.2011
Universal Radio Communication Tester	R&S	CMU200	105822	Oct.24.2012
Universal Radio Communication Tester	Agilent	E5515C	MY50260239	Aug.04,2012
Spectrum Analyzer	Agilent	E4440A	MY49420179	Apr.24,2012
Signal Analyzer	R&S	FSQ40	100025	Oct.09,2012
Signal Analyzer	R&S	FSQ31	200021	Sep.27,2012
Temperature Chamber	WEISS	WKL64	24600294	Jan.03,2012
Signal Generator	R&S	SMR40	100325	May.12,2012
Vector Signal Generator	R&S	SMU200A	104162	Sep.07,2012
Spectrum Analyzer	R&S	FSU26	EG26725	Mar.07,2012
Test receiver	R&S	ESIB26	100318	May.04.2012
Tunable Dipole	Schwarzbeck	D69250-UHAP/D69250-VHAP	919/1009	Dec.13.2011
Tunable Dipole	Schwarzbeck	D69250-UHAP/D69250-VHAP	979/917	Dec.13.2011
Horn Antenna	R & S	HF906	359287/005	May.07, 2012
Horn Antenna	R & S	HF906	359287/006	April.27, 2012
Broadband Antenna	SCHAFFNER	CBL 6112B	2536	Sep.21, 2012
Broadband Antenna	SCHAFFNER	CBL 6112B	2941	Jun.11, 2012
Horn Antenna	ETS-LINDGREN	3160	60008	Sep.20.2012
Horn Antenna	ETS-LINDGREN	3160	60006	Oct.27.2012



6 Transmitter & Receiver Measurements

Test Ports:

The information as below is followed in tests and in the present test report:

- The EUT has five TRX antenna ports, respectively named 'TRXA', 'TRXB', 'TRXC', 'TRXD', and 'TRXE'. They are partitioned to three groups; 'TRXE' is group No.1, which is for an external antenna, 'TRXA' and 'TRXC' is group No.2, 'TRXB' and 'TRXD' is group No.3, group No.2 and No.3 are used for MIMO with the inner PCB antennas. TRXE can't support MIMO.
- The Uplink of EUT is relevant to Transmitter (TX), while Downlink to Receiver (RX).
- Unless otherwise stated, all "RF Channels under Test", "Test Environments", "Test Modes", "Channel Bandwidth" and "their combinations" should be considered in tests (see detailed as following clauses).

Test Frequencies:

Table 13. Frequency points (channels) selected to perform transmitter tests

Transmitter Operating Band	Multiple Carriers	Channels under Test		
		Bottom/lowest (B)	Middle (M)	Top/highest (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 14. Test Conditions

Measured at:	All Antenna connectors
Ambient temperature:	24 °C to 26 °C
Relative humidity:	55% to 63%

6.1.2 Test Specifications and Limits

Compliance with FCC part 2.1046 and part 27.50(h)(2), Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

Table 15. FCC Limits for BRS&EBS Band

Limits for mobile stations	<2W(33dBm),EIRP
Limits for user stations	<2W(33dBm),transmitter output power

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.

Note 1: Compliance with FCC part 2.1046 and part 27.50(h)(2), Mobile stations are limited to 2.0 watts EIRP and other user stations are limited to 2.0W transmitter output power (see table 15);

Note 2:QISBM623M is desktop equipment, which doesn't belong to mobile station, a normal user stations transmitter output power limit 2W (33dBm) is used;

Test setup

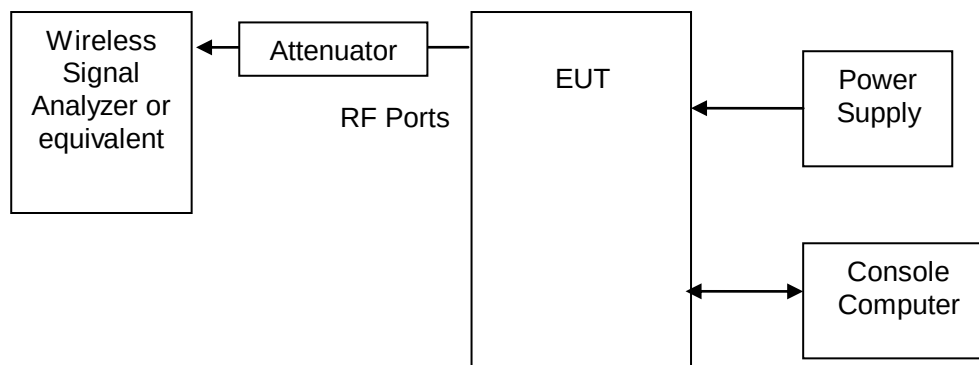


Figure 1. TEST SETUP

6.1.4 Measurement Results

6.1.4.1 Maximum Output Power at Antenna Port

(1) Channel Bandwidth = 5 MHz:

Table 16. Measurement Results for Maximum Output Power

Test Mode		Transmitter output power (dBm)						Limit (dBm)
		Ch. B		Ch. M		Ch. T		
		Single TX	MIMO	Single TX	MIMO	Single TX	MIMO	
TM 1	Antenna TRXA	22.06	25.06	21.52	24.52	23.17	26.17	< 33
	Antenna TRXB	22.17	25.17	21.56	24.56	23.29	26.29	< 33
	Antenna TRXC	22.20	25.20	22.01	25.01	22.36	25.36	< 33
	Antenna TRXD	22.01	25.01	22.08	25.08	22.41	25.41	< 33
	Antenna TRXE	23.84	/	24.53	/	24.68	/	< 33
TM 2	Antenna TRXA	22.16	25.16	21.54	24.54	23.16	26.16	< 33
	Antenna TRXB	22.18	25.18	21.45	24.45	23.30	26.30	< 33
	Antenna TRXC	22.11	25.11	22.03	25.03	22.39	25.39	< 33
	Antenna TRXD	22.02	25.02	22.07	25.07	22.54	25.54	< 33
	Antenna TRXE	23.86	/	24.55	/	24.70	/	< 33
TM 3	Antenna TRXA	22.12	25.12	21.51	24.51	23.12	26.12	< 33
	Antenna TRXB	22.22	25.22	21.55	24.55	23.26	26.26	< 33
	Antenna TRXC	22.16	25.16	21.97	24.97	22.37	25.37	< 33
	Antenna TRXD	21.98	24.98	22.06	25.06	22.51	25.51	< 33
	Antenna TRXE	23.81	/	24.51	/	24.66	/	< 33
TM 4	Antenna TRXA	22.16	25.16	21.53	24.53	23.16	26.16	< 33
	Antenna TRXB	22.23	25.23	21.48	24.48	23.35	26.35	< 33
	Antenna TRXC	22.19	25.19	22.00	25.00	22.39	25.39	< 33
	Antenna TRXD	22.56	25.56	22.09	25.09	22.55	25.55	< 33
	Antenna TRXE	23.94	/	24.51	/	24.70	/	< 33



(2) Channel Bandwidth = 10 MHz:

Table 17. Measurement Results for Maximum Output Power

Test Mode		Transmitter output power (dBm)						Limit (dBm)
		Ch. B		Ch. M		Ch. T		
		Single TX	MIMO	Single TX	MIMO	Single TX	MIMO	
TM 1	Antenna TRXA	22.15	25.15	21.62	24.62	23.48	26.48	< 33
	Antenna TRXB	22.16	25.16	21.67	24.67	23.60	26.60	< 33
	Antenna TRXC	22.48	25.48	22.18	25.18	22.61	25.61	< 33
	Antenna TRXD	22.43	25.43	22.23	25.23	22.69	25.69	< 33
	Antenna TRXE	24.35	/	24.66	/	24.93	/	< 33
TM 2	Antenna TRXA	22.16	25.16	21.61	24.61	23.16	26.16	< 33
	Antenna TRXB	22.16	25.16	21.77	24.77	23.30	26.30	< 33
	Antenna TRXC	22.49	25.49	22.19	25.19	22.39	25.39	< 33
	Antenna TRXD	22.45	25.45	22.25	25.25	22.54	25.54	< 33
	Antenna TRXE	24.33	/	24.77	/	24.70	/	< 33
TM 3	Antenna TRXA	22.13	25.13	21.58	24.58	23.12	26.12	< 33
	Antenna TRXB	22.15	25.15	21.64	24.64	23.26	26.26	< 33
	Antenna TRXC	22.45	25.45	22.17	25.17	22.37	25.37	< 33
	Antenna TRXD	22.43	25.43	22.23	25.23	22.51	25.51	< 33
	Antenna TRXE	22.24	/	24.66	/	24.66	/	< 33
TM 4	Antenna TRXA	22.13	25.13	21.70	24.70	23.16	26.16	< 33
	Antenna TRXB	22.17	25.17	21.66	24.66	23.35	26.35	< 33
	Antenna TRXC	22.48	25.48	22.07	25.07	22.39	25.39	< 33
	Antenna TRXD	22.44	25.44	22.24	25.24	22.55	25.55	< 33
	Antenna TRXE	24.32	/	24.66	/	24.70	/	< 33

Note 1: Double transmitter output power for MIMO is amount to the Single TX output power adding with $10\lg N$, where N is the number of antenna ports used for MIMO at once, $10\lg 2=3$.

Note 2: The maximum output power is **26.60dBm** at Antenna TRXB of MIMO Antenna Group No.2, so the rest tests will be mainly test on Antenna TRXB Port.

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

Measured at:	Antenna TRXA
Ambient temperature:	24 °C to 26 °C
Relative humidity:	55% to 63%

6.2.2 Test Specifications and Limits

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

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

Table 19. Limits According to EUT technical requirements

Limits for IEEE802.16 mobile stations:	QPSK 1/2 modulation: RCE < -15 dB QPSK 3/4 modulation: RCE < -18 dB 16QAM 1/2 modulation: RCE < -20.5 dB 16QAM 3/4 modulation: RCE < -24 dB
--	--

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

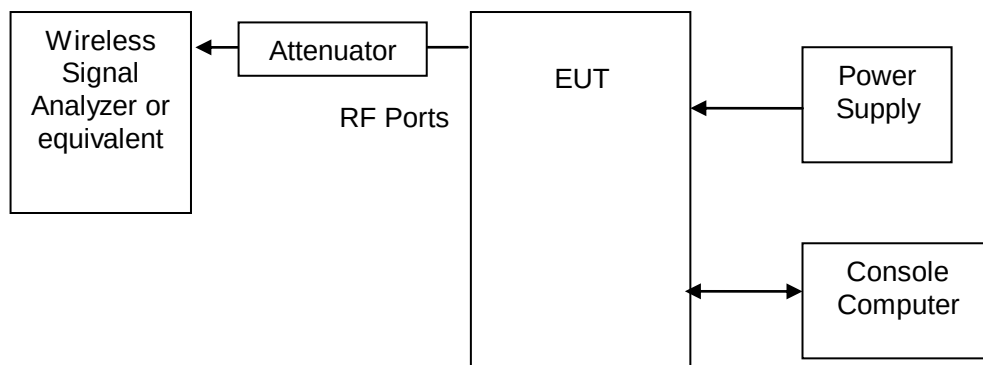


Figure 2. TEST SETUP

6.2.4 Measurement Results

(1) Channel Bandwidth = 5 MHz:

Table 20. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics (dB)			Limit
	B	M	T	
TM 1	-33.67	-32.70	-31.69	< -15 dB
TM 2	-33.88	-32.72	-31.20	< -18 dB
TM 3	-34.12	-32.47	-32.18	< -20.5 dB
TM 4	-33.96	-32.84	-32.34	< -24 dB

(2) Channel Bandwidth = 10 MHz:

Table 21. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics (dB)			Limit
	B	M	T	
TM 1	-32.98	-32.17	-31.86	< -15 dB
TM 2	-33.15	-32.12	-31.88	< -18 dB
TM 3	-33.13	-32.05	-31.98	< -20.5 dB
TM 4	-33.14	-32.24	-31.83	< -24 dB

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

Measured at:	Antenna TRXA
Ambient temperature:	24 °C to 26 °C
Relative humidity:	55% to 63%

6.3.2 Test Specifications and Limits

No specific occupied bandwidth requirement in FCC part 2.1049 and part 27 subpart C 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).

The measurement bandwidth (RBW) of Spectrum Analyzer or equivalent is set to about or less than 1% of the channel bandwidth.

Test setup

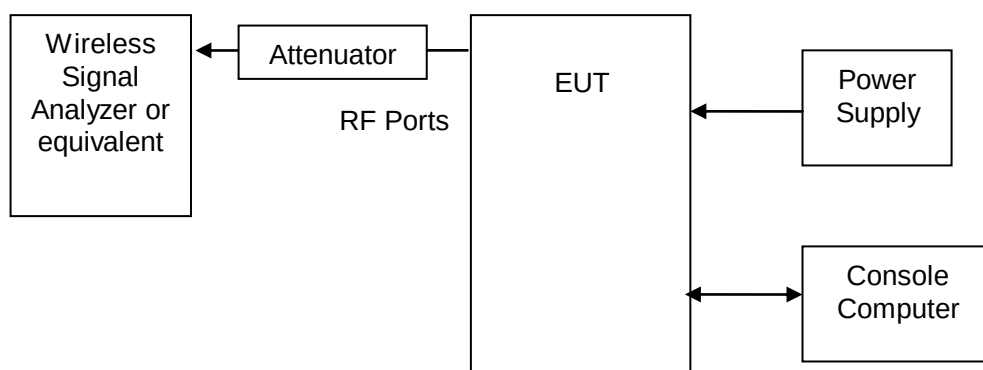


Figure 3. TEST SETUP



6.3.4 Measurement Results

Channel Bandwidth = 5 MHz:

Table 23. Measurement Results for Occupied Bandwidth

Test Mode	Occupied Bandwidth (MHz)						Limit
	B		M		T		
	99%	26dB	99%	26dB	99%	26dB	
TM 1	4.4613	5.011	4.4641	5.027	4.4656	5.008	---
TM 2	4.4486	4.760	4.4511	4.776	4.4509	4.774	
TM 3	4.4479	4.756	4.4480	4.763	4.4496	4.755	
TM 4	4.4505	4.752	4.4511	4.757	4.4515	4.758	

Channel Bandwidth = 10 MHz:

Table 24. Measurement Results for Occupied Bandwidth

Test Mode	99% Occupied Bandwidth (MHz)						Limit
	B		M		T		
	99%	26dB	99%	26dB	99%	26dB	
TM 1	9.1040	9.494	9.1054	9.505	9.1076	9.496	---
TM 2	9.1041	9.510	9.1052	9.516	9.1096	9.488	
TM 3	9.1050	9.478	9.1078	9.486	9.1017	9.485	
TM 4	9.1063	9.487	9.1062	9.492	9.1047	9.483	

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 25. Test Conditions

Measured at:	Antenna TRXA
Ambient temperature:	24 °C to 26 °C
Relative humidity:	55% to 63%

6.4.2 Test Specifications and Limits

FCC part 2.1051 and part 27.53(m)(4) and part 27.53(m)(6)

Table 26. Supporting Standards

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

Compliance with FCC part 2.1051 and part 27.53(m)(4) and part 27.53(m)(6), for mobile digital stations, is based on the use of measurement instrumentation employing a resolution bandwidth of 1MHz or greater. However, 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 factor shall not be less than $43 + 10 \log(P)$ dB at the channel edge and $55 + 10 \log(P)$ dB at 5.5MHz from the channel edges.

Table 27. FCC Limits for BRS&EBS Band

Limit:	At the channel edge: $< P - (43 + 10\log_{10}P) = 10\log_{10}(1000 * P) - (43 + 10\log_{10}P) = 30 - 43 = -13\text{dBm}$ At 5.5MHz from the channel edges: $< P - (55 + 10\log_{10}P) = 10\log_{10}(1000 * P) - (55 + 10\log_{10}P) = 30 - 55 = -25\text{dBm}$, at 5.5MHz from the channel edges
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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.

The measurement bandwidth (RBW) of Spectrum Analyzer or equivalent is set to at least 1% of the channel bandwidth for the 1MHz bands immediately outside and adjacent to the frequency block, But 1MHz or great RBW should be used for other bands offset out of 1MHz to the frequency block.

Test setup

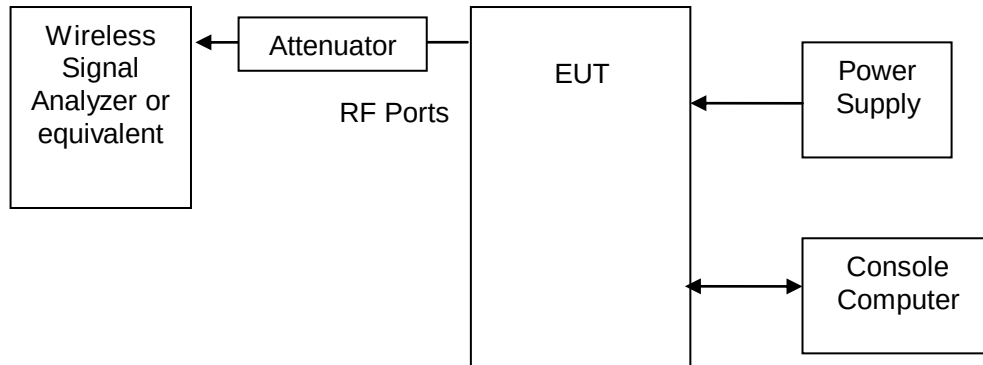


Figure 4. TEST SETUP

6.4.4 Measurement Results

6.4.4.1 Band edge emissions

Channel Bandwidth = 5 MHz:

Table 28. Measurement Results for Band Edge Characteristics

Test Mode	Test Frequency offset (MHz)	Band Edge Emissions (dBm)				
		B		T		Limit (dBm)
		Single TX	MIMO	Single TX	MIMO	
TM 1	Band Edge	-31.45	-28.45	-31.66	-28.66	< -13
	1MHz	-41.11	-38.11	-39.06	-36.06	< -13
	5.5MHz	-37.30	-34.30	-35.89	-32.89	< -25
TM 2	Band Edge	-30.56	-27.56	-31.21	-28.21	< -13
	1MHz	-40.83	-37.83	-38.48	-35.48	< -13
	5.5MHz	-37.32	-34.32	-35.65	-32.65	< -25
TM 3	Band Edge	-31.45	-28.45	-31.95	-28.95	< -13
	1MHz	-41.70	-38.70	-38.65	-35.65	< -13
	5.5MHz	-37.59	-34.59	-36.01	-33.01	< -25
TM 4	Band Edge	-31.44	-28.44	-32.85	-29.85	< -13
	1MHz	-40.64	-37.64	-38.60	-35.60	< -13
	5.5MHz	-37.42	-34.42	-35.94	-32.94	< -25

Channel Bandwidth = 10 MHz:

Table 29. Measurement Results for Band Edge Characteristics

Test Mode	Test Frequency offset (MHz)	Band Edge Emissions (dBm)				
		B		T		Limit (dBm)
		Single TX	MIMO	Single TX	MIMO	
TM 1	Band Edge	-37.21	-34.21	-36.72	-33.72	< -13
	1MHz	-42.04	-39.04	-44.17	-41.17	< -13
	5.5MHz	-33.64	-30.64	-31.21	-28.21	< -25
TM 2	Band Edge	-36.09	-33.09*	-36.75	-33.75	< -13
	1MHz	-42.53	-39.53	-40.69	-37.69	< -13
	5.5MHz	-33.18	-30.18	-31.33	-28.33	< -25
TM 3	Band Edge	-37.66	-34.66	-37.27	-34.27	< -13
	1MHz	-43.29	-40.29	-39.87	-36.87	< -13
	5.5MHz	-34.24	-31.24	-31.02	-28.02	< -25
TM 4	Band Edge	-37.83	-34.83	-36.11	-33.11	< -13
	1MHz	-42.83	-39.83	-40.33	-37.33	< -13
	5.5MHz	-32.91	-29.91	-31.25	-28.25	< -25

Note 1: Double transmitter output power for MIMO is amount to the Single TX output power adding with $10\lg N$, where N is the number of antenna ports used for MIMO at once, $10\lg 2=3$.

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 30. Test Conditions

Measured at:	Antenna TRXA
Ambient temperature:	24 °C to 26 °C
Relative humidity:	55% to 63%

6.5.2 Test Specifications and Limits

FCC part 2.1051 and part 27.53(m) (4) and part 27.53(m)(6)

Table 31. Supporting Standards

WiMAX MRCT	WiMAX Forum™ Mobile Radio Conformance Tests
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Compliance with FCC part 2.1051 and part 27.53(m)(4) and part 27.53(m)(6), for mobile digital stations, is based on the use of measurement instrumentation employing a resolution bandwidth of 1MHz or greater. However, 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 factor shall not be less than $43 + 10 \log(P)$ dB at the channel edge and $55 + 10 \log(P)$ dB at 5.5MHz from the channel edges.

Table 32. FCC Limits for BRS&EBS Band

Limit:	$< P - (55 + 10\log_{10}P) = 10\log_{10}(1000 * P) - (55 + 10\log_{10}P) = 30 - 55 = -25\text{dBm}$
--------	---

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

Detector of Spectrum Analyzer or equivalent

WiMAX equipment	RMS
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Test setup

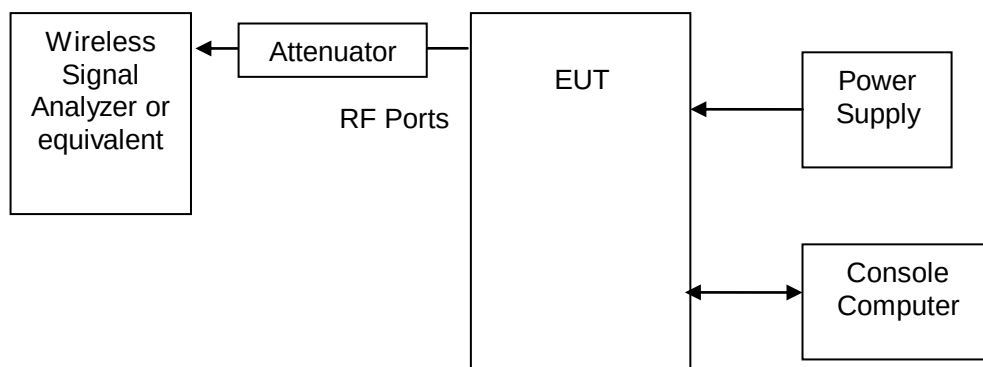


Figure 5. TEST SETUP

6.5.4 Measurement Results

Channel Bandwidth = 5 MHz:

Table 33. Measurement Results for Spurious Emissions

Test Mode	Test Frequency Range	Conducted Spurious Emissions (dBm)						
		B		M		T		Limit (dBm)
		Single TX	MIMO	Single TX	MIMO	Single TX	MIMO	
TM 1	9K – 150K	-57.06	-54.06	-57.63	-54.63	-57.66	-54.66	< -25
	150K – 30M	-60.48	-57.48	-60.78	-57.78	-61.31	-58.31	< -25
	30M – 1G	-53.30	-50.30	-54.67	-51.67	-49.60	-46.60	< -25
	1G – 27G	-43.70	-40.70	-43.67	-40.67	-43.59	-40.59	< -25
TM 2	9K – 150K	-57.79	-54.70	-57.61	-54.61	-56.42	-53.42	< -25
	150K – 30M	-59.62	-56.62	-60.58	-57.58	-60.91	-57.91	< -25
	30M – 1G	-53.30	-50.30	-53.01	-50.01	-49.06	-46.06	< -25
	1G – 27G	-43.67	-40.67	-43.60	-40.60	-43.75	-40.75	< -25
TM 3	9K – 150K	-57.25	-54.25	-57.07	-54.07	-57.40	-54.40	< -25
	150K – 30M	-60.02	-57.02	-60.80	-57.80	-60.82	-57.82	< -25
	30M – 1G	-53.07	-50.07	-53.97	-50.97	-47.88	-44.88	< -25
	1G – 27G	-43.75	-40.75	-43.73	-40.73	-43.67	-40.67	< -25
TM 4	9K – 150K	-57.37	-54.37	-57.21	-54.21	-69.52	-66.52	< -25
	150K – 30M	-60.68	-57.68	-61.11	-58.11	-60.99	-57.99	< -25
	30M – 1G	-53.71	-50.71	-53.72	-50.72	-47.81	-44.81	< -25
	1G – 27G	-43.89	-40.89	-43.65	-40.65	-43.69	-40.69	< -25

Channel Bandwidth = 10 MHz:

Table 34. Measurement Results for Spurious Emissions

Test Mode	Test Frequency Range	Conducted Spurious Emissions (dBm)						Limit (dBm)
		B		M		T		
		Single TX	MIMO	Single TX	MIMO	Single TX	MIMO	
TM 1	9K – 150K	-56.93	-53.93	-57.49	-54.49	-58.07	-55.07	< -25
	150K – 30M	-61.03	-58.03	-61.01	-58.01	-60.68	-57.68	< -25
	30M – 1G	-55.16	-52.16	-53.72	-50.72	-50.74	-47.74	< -25
	1G – 27G	-43.73	-40.73	-43.70	-40.70	-43.58	-40.58	< -25
TM 2	9K – 150K	-57.55	-54.55	-56.72	-53.72	-57.51	-54.51	< -25
	150K – 30M	-60.84	-57.84	-59.64	-56.64	-61.52	-58.52	< -25
	30M – 1G	-54.82	-51.82	-54.56	-51.56	-50.01	-47.01	< -25
	1G – 27G	-43.64	-40.64	-43.60	-40.60	-43.68	-40.68	< -25
TM 3	9K – 150K	-58.28	-55.28	-58.49	-55.49	-58.50	-55.50	< -25
	150K – 30M	-61.34	-58.34	-60.62	-57.62	-60.18	-57.18	< -25
	30M – 1G	-54.54	-51.54	-54.15	-51.15	-49.47	-46.47	< -25
	1G – 27G	-43.64	-40.64	-43.56	-40.56	-43.65	-40.65	< -25
TM 4	9K – 150K	-57.49	-54.49	-57.73	-54.73	-58.63	-55.63	< -25
	150K – 30M	-60.80	-57.80	-60.40	-57.40	-59.65	-56.65	< -25
	30M – 1G	-55.05	-52.05	-53.76	-50.76	-49.16	-46.16	< -25
	1G – 27G	-43.57	-40.57	-43.58	-40.58	-43.63	-40.63	< -25

Note 1: Double transmitter output power for MIMO is amount to the Single TX output power adding with $10\lg N$, where N is the number of antenna ports used for MIMO at once, $10\lg 2=3$.

6.5.5 Conclusion

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

6.6 Radiated Spurious Emissions

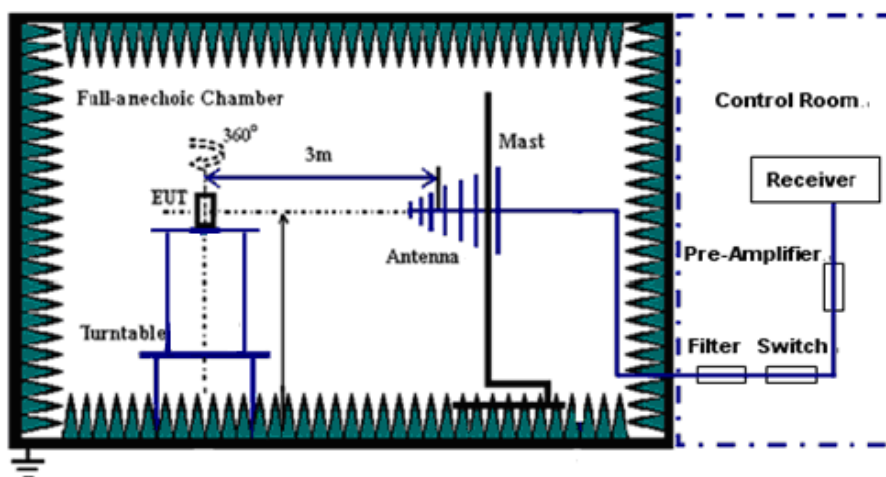
6.6.1 Test Procedure

A test site fulfilling the requirements of ITU-R Recommendation SM329-10 was used. The EUT was placed on a non-conducting support in the anechoic chamber and was operated from a power source via an RF filter to avoid radiation from the power leads.

Step 1:

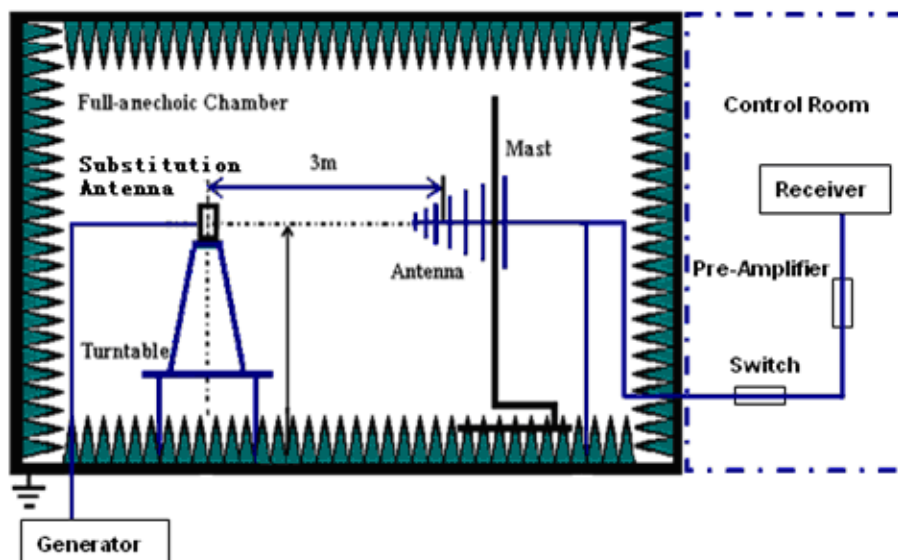
For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, EIRP shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in 2.1033(c)(8). Connect the EUT to the BTS simulator via the air interface.

Test the Radiated maximum output power by the Test Receiver from test antenna.



Step 2:

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 step1 on Test Receiver, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.





Test should be performed in normal voltage condition.

According to part 27.53(m), the defined measurement bandwidth as following:

27.53(m) Measurement procedure: Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1MHz or greater.

Measurement bandwidth (RBW) for 9 kHz up to 150 kHz: 1 kHz;
Measurement bandwidth (RBW) for 150 kHz up to 30 MHz: 10 kHz;
Measurement bandwidth (RBW) for 30MHz up to 26.5GHz: 1MHz;

Table 35. Radiated Spurious Emissions Limits

Frequency band	Minimum requirement (E.R.P) traffic mode
9KHz~26.5GHz	-25dBm

6.6.2 Test Results

The EUT has met the requirements of FCC Part27.
For the measurement results refer to Appendix E.



6.7 Frequency Stability

6.7.1 Test Conditions

Table 36. Test Conditions

Measured at:	Antenna TRXA
Ambient temperature:	See Measurement Results
Relative humidity:	70 %
Power supply:	See Measurement Results

6.7.2 Test Specifications and Limits

FCC part 2.1055 and part 27.54

Table 37. Supporting Standards

WiMAX MRCT	WiMAX Forum™ Mobile Radio Conformance Tests
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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 38. 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 39. 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.

According to IC RSS-Gen clause 4.7, with the transmitter installed in an environment test chamber, the unmodulated carrier frequency shall be measured under the conditions specified below.

The operating end points:	12 VDC (Normal Voltage), 9.6 VDC (Lowest Voltage) and 14.4 VDC (Highest Voltage).
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Test Set up

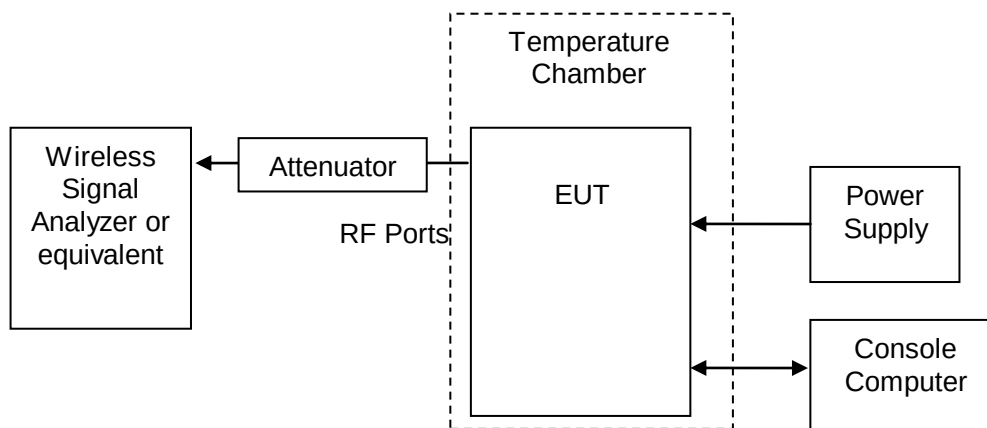


Figure 6. Test Set up



6.7.4 Measurement Results

6.7.4.1 Frequency Error vs. Temperature

Channel Bandwidth = 5 MHz:

Table 40. Measurement Results for Frequency Error vs. Temperature

Measured Maximum Frequency Error									
Test Environment			B		M		T		
Test Mode	Voltage	Temperature	Hz	ppm	Hz	ppm	Hz	ppm	Limit
TM1	12 VDC	-30 °C	940.3	0.376	943.5	0.364	918.0	0.342	< ±2ppm
		-20 °C	953.2	0.382	944.3	0.364	918.3	0.341	
		-10 °C	947.5	0.379	930.5	0.359	911.6	0.340	
		0 °C	959.1	0.384	948.1	0.366	926.2	0.345	
		+10 °C	926.0	0.371	913.3	0.352	988.4	0.368	
		+20 °C	947.5	0.379	930.5	0.359	911.6	0.339	
		+30 °C	853.2	0.341	944.3	0.364	918.3	0.342	
		+40 °C	926.0	0.371	913.3	0.352	988.4	0.367	
		+50 °C	932.2	0.373	909.8	0.351	986.3	0.366	

Channel Bandwidth = 10 MHz:

Table 41. Measurement Results for Frequency Error vs. Temperature

Measured Maximum Frequency Error									
Test Environment			B		M		T		
Test Mode	Voltage	Temperature	Hz	ppm	Hz	ppm	Hz	ppm	Limit
TM1	12 VDC	-30 °C	930.4	0.372	918.2	0.354	954.2	0.355	< ±2ppm
		-20 °C	924.3	0.370	920.1	0.355	947.6	0.353	
		-10 °C	913.1	0.365	904.5	0.349	954.6	0.356	
		0 °C	912.8	0.364	907.6	0.350	956.8	0.356	
		+10 °C	930.4	0.372	910.2	0.351	974.5	0.363	
		+20 °C	932.1	0.373	916.0	0.353	980.2	0.365	
		+30 °C	930.3	0.372	913.4	0.352	980.6	0.365	
		+40 °C	932.1	0.373	920.1	0.355	975.4	0.363	
		+50 °C	923.1	0.369	919.4	0.355	959.3	0.357	



6.7.4.2 Frequency Error vs. Voltage

Channel Bandwidth = 5 MHz:

Table 42. Measurement Results for Frequency Error vs. Temperature

Measured Maximum Frequency Error									
Test Environment			B		M		T		
Test Mode	Voltage	Temperature	Hz	ppm	Hz	ppm	Hz	ppm	Limit
TM1	9.6 VDC	+20 °C	943.5	0.378	927.6	0.358	987.3	0.367	< ±2ppm
	12 VDC	+20 °C	947.5	0.379	930.5	0.359	911.6	0.340	
	14.4 VDC	+20 °C	958.4	0.383	932.4	0.360	998.1	0.371	

Channel Bandwidth = 10 MHz:

Table 43. Measurement Results for Frequency Error vs. Temperature

Measured Maximum Frequency Error									
Test Environment			B		M		T		
Test Mode	Voltage	Temperature	Hz	ppm	Hz	ppm	Hz	ppm	Limit
TM1	9.6 VDC	+20 °C	929.3	0.372	912.5	0.352	976.4	0.364	< ±2ppm
	12 VDC	+20 °C	932.1	0.373	916.0	0.353	980.2	0.365	
	14.4 VDC	+20 °C	934.6	0.374	915.4	0.353	989.2	0.368	

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 44. 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
Appendix B	Measurement Results Occupied Bandwidth
Appendix C	Measurement Results Band Edges
Appendix D	Measurement Results Spurious Emission at Antenna Terminal
Appendix E	Measurement Results Radiated Spurious Emissions
Appendix F	Photos of Radiated Spurious Emissions

END