



FCC Test Report

Product Name: 4G Mobile USB Series H

Model Number 1: BM328c
Model Number 2: FWH-USB0328

Report No: SYBHZ(R)E040022010EB-2
FCC ID:QISBM328C

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REPORT ON FCC Test of 4G Mobile USB Series H

Model Name 1: BM328c
Model Name 2: FWH-USB0328

FCC ID:QISBM328C

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

CONCLUSION **PASSED**

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	Date (y-m-d)	Name	

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1 Summary

1.1 Results Summary

The table below summarizes the measurements and results for the equipment of QISBM328C 4G Mobile USB Series H - BM328c. 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

Note: 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

The device (FCC ID:QISBM328C), a proprietary product developed by Huawei based on the IEEE 802.16e-2005 protocols, capable of spread spectrum (OFDMA), is a WiMAX USB Stick for home radio telecommunications service.

The device (FCC ID:QISBM328C) gets two antennas to achieve 1Tx2Rx, and the transmitter antenna should be switched between the two antennas to realize TxD (TX Switching Diversity), the one with a stronger downlink signal will be selected.

Two Tx antennas use the same transmitter RF circuit and switch, so in this report, just a transmitter antenna is be mainly test.

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): 2010-01-20
Date of End (y-m-d): 2010-04-24

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
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4.1.3 Output Power

Table 6. Output Power

Transmitter Output Power (per Antenna Port):	QPSK:+23 dBm 16QAM:+21 dBm
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4.1.4 Antenna Profiles

Table 7. Antenna Profiles

Antenna Brand	Sky Cross
Antenna Type	iMAT
Antenna Frequency Range	2.496GHz~2.690GHz
Antenna Maximum Peak Gain	2 dBi

4.1.5 Power Source

Table 8. DC Power Source

DC voltage nominal:	== 5 V
DC voltage range:	== 5 V (Normal USB Port Supply)
DC current maximal:	0.5 A

4.1.6 Environmental Requirements

Table 9. Environmental Requirements

Minimum temperature:	- 10 °C
Maximum temperature:	+ 55 °C
Relative Humidity:	5% to 95% RH



4.1.7 UL Zone Type

Table 10. UL Zone Type

UL Zone Type:	PUSC
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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 provides one completed transmitter and two receivers (1T2R), but the two antennas can make a TXD (TX diversity), TXD means TX Switching Diversity, TX should be switched between the two antennas, the antenna with a more stronger downlink signal will be selected, because the RF Link for two antennas before the RF Switch is the same, so only one TX conduct is mainly test in this report.
3. The above EUT information was declared by manufacture and 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

Table 11. Sub-assembly identity of EUT

Model Identify	Qty.	Hardware Version	Software Version	Serial Number	Description
BM32WAUG	1	/	V100R001	/	WiMAX and USB Board

(2) Sub-assembly identity of Ancillary Equipments

Table 12. 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: BM328C
FCC Identification: QISBM328C



5 Main Test Instruments

Table 13. Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until (y-m-d)
Signal Analyzer (Note)	R&S	FSQ26.5	200632	2010-5-6
Spectrum Analyzer	Agilent	E4445A	MY46181741	2010-8-31
Spectrum Analyzer	Agilent	N9020A	MY49101025	2011-2-25
ESG Vector Signal Generator	Agilent	E4438C	MY45095755	2010-8-31
Vector Signal Generator	R&S	SMU200A	103420	2010-8-31
Power Meter	R&S	NRP Z55	101665	2010-6-5
Attenuator	Aeroflex/Weinschel	49-30-33-LIM	NC356	---
Combiner/Divider	Werlatone	D7421	10755	---
Temperature Chamber	ChongQing YiHe	SDJ406	200800358	2010-9-2

Note: The special analyzer function for WiMAX was equipped for the Signal Analyzer.

6 Transmitter & Receiver Measurements

Test Ports:

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

- The EUT consists of two TRX channels, respectively named 'TRXA' and 'TRXB'. Each of ports has the equivalent functions.
- "TRXA" and "TRXB" can be TX Diversity, but they use the same RF circuit and Switch, so "TRXA" was mainly used in transmitter tests in this report;
- The Uplink of EUT is relevant to Transmitter (TX), while Downlink to Receiver (RX);
- Unless otherwise stated, all "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 14. 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 15. Test Conditions

Measured at:	Antenna connectors of TRXA and TRXB
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 16. 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 (see table 15);

Note 2: Equivalent EIRP can be delivered by the maximum conducted power and the antenna maximum peak gain, like $EIRP = \text{maximum conducted power} + \text{antenna maximum peak gain}$, the antenna maximum peak gain is 2dBi (see table 2);

Test setup

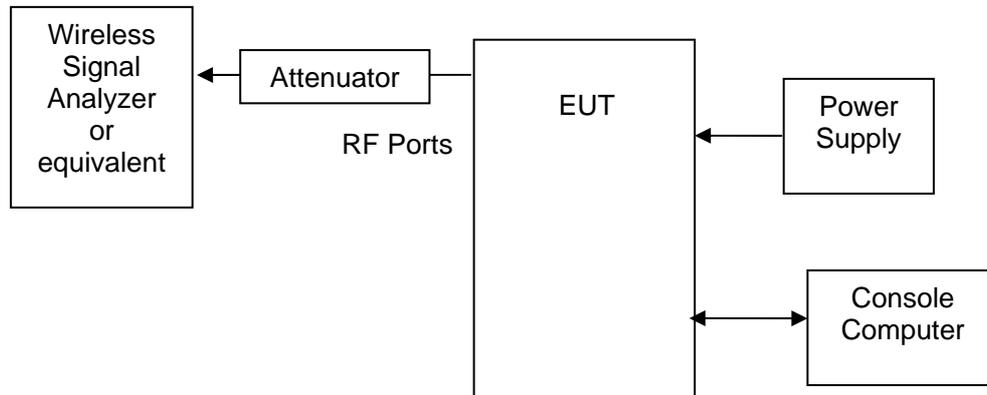


Figure 1. TEST SETUP

6.1.4 Measurement Results

6.1.4.1 Maximum Output Power at Antenna Port

(1) Channel Bandwidth = 5 MHz:

Table 17. Measurement Results for Maximum Output Power

Test Mode	Maximum Output Power (dBm)+ Maximum Peak Gain (dBi)						Limit (dBm)
	Ch. B		Ch. M		Ch. T		
	TRXA	TRXB	TRXA	TRXB	TRXA	TRXB	EIRP
TM 1	23.21+2	23.13+2	23.11+2	23.21+2	23.12+2	23.25+2	< 33
TM 2	23.19+2	23.18+2	23.17+2	23.20+2	23.12+2	23.13+2	< 33
TM 3	21.46+2	21.43+2	21.43+2	21.59+2	21.28+2	21.21+2	< 33
TM 4	21.45+2	21.59+2	21.38+2	21.46+2	21.18+2	21.12+2	< 33

(2) Channel Bandwidth = 10 MHz:

Table 18. Measurement Results for Maximum Output Power

Test Mode	Maximum Output Power (dBm)+ Maximum Peak Gain (dBi)						Limit (dBm)
	Ch. B		Ch. M		Ch. T		
	TRXA	TRXB	TRXA	TRXB	TRXA	TRXB	EIRP
TM 1	22.85+2	23.21+2	23.06+2	23.11+2	23.09+2	23.05+2	< 33
TM 2	23.19+2	23.21+2	23.22+2	23.23+2	23.09+2	22.95+2	< 33
TM 3	21.19+2	21.16+2	21.26+2	21.67+2	20.91+2	20.95+2	< 33
TM 4	21.18+2	20.99+2	21.62+2	21.49+2	20.98+2	21.01+2	< 33

Note 1: For EUT, the antenna maximum peak gain is 2dBi (see table 2), maximum conducted output power is 23.25dBm when it worked on TM1 of 5MHz bandwidth and Top channel (see table 17), so the maximum EIRP=23.25dBm+2dBi=25.25dBm, which is less than the limit of 33dBm.

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

Measured at:	Antenna connectors of 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 20. 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

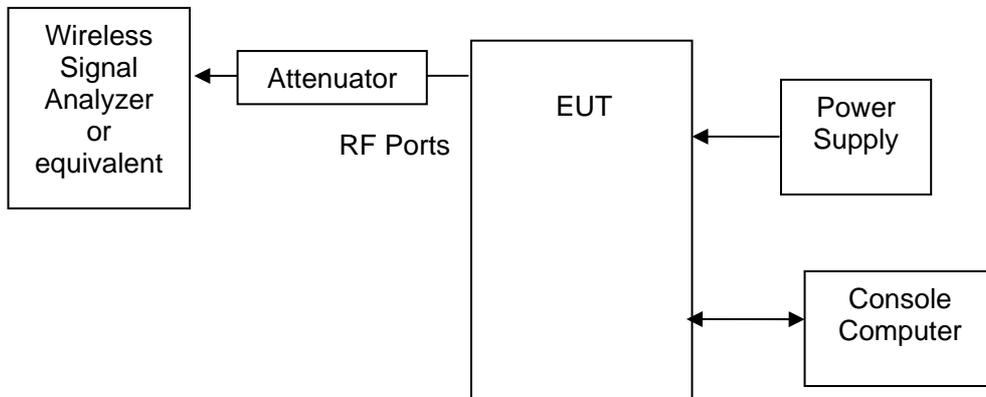


Figure 2. TEST SETUP

6.2.4 Measurement Results

(1) Channel Bandwidth = 5 MHz:

Table 21. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics (dB)			Limit
	B	M	T	
TM 1	-29.01	-28.96	-29.21	< -15 dB
TM 2	-28.58	-28.37	-28.22	< -18 dB
TM 3	-32.67	-33.52	-33.42	< -20.5 dB
TM 4	-33.12	-33.52	-33.01	< -24 dB

(2) Channel Bandwidth = 10 MHz:

Table 22. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics (dB)			Limit
	B	M	T	
TM 1	-28.01	-27.36	-27.55	< -15 dB
TM 2	-28.24	-27.99	-28.11	< -18 dB
TM 3	-32.15	-33.42	-33.32	< -20.5 dB
TM 4	-33.01	-33.17	-32.89	< -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 23. Test Conditions

Measured at:	Antenna connectors of 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

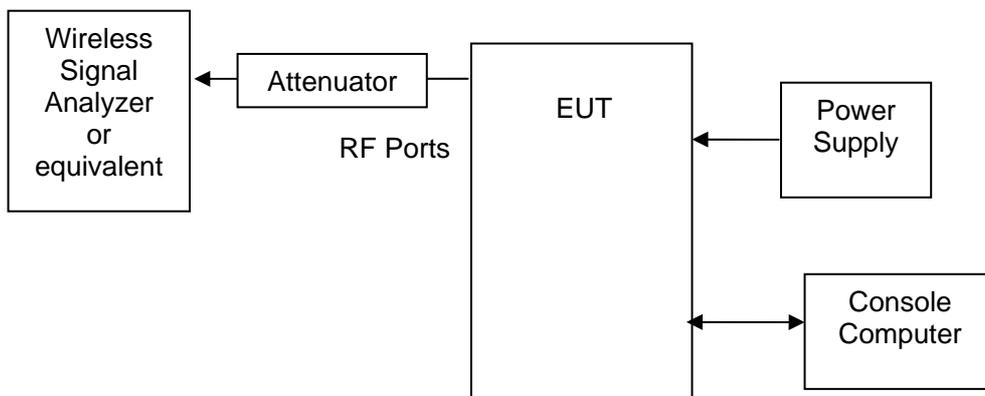


Figure 3. TEST SETUP



6.3.4 Measurement Results

Channel Bandwidth = 5 MHz:

Table 24. Measurement Results for Occupied Bandwidth

Test Mode	Occupied Bandwidth (MHz)						Limit
	B		M		T		
	99%	26dB	99%	26dB	99%	26dB	
TM 1	4.4542	4.870	4.4564	4.891	4.4597	4.904	---
TM 2	4.4544	4.870	4.4563	4.891	4.4594	4.913	
TM 3	4.4534	4.869	4.4549	4.869	4.4540	4.890	
TM 4	4.4532	4.869	4.4548	4.869	4.4542	4.890	

Channel Bandwidth = 10 MHz:

Table 25. Measurement Results for Occupied Bandwidth

Test Mode	99% Occupied Bandwidth (MHz)						Limit
	B		M		T		
	99%	26dB	99%	26dB	99%	26dB	
TM 1	9.0954	9.567	9.0919	9.565	9.0901	9.783	---
TM 2	9.0886	9.780	9.0929	9.824	9.0898	9.784	
TM 3	9.0877	9.780	9.0903	9.822	9.0878	9.782	
TM 4	9.0877	9.822	9.0903	9.822	9.0880	9.782	

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

Measured at:	Antenna connectors of 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 27. 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 28. FCC Limits for BRS&EBS Band

Limit:	<p>At the channel edge: $< P - (43 + 10\log_{10}P) = 10\log_{10}(1000 * P) - (43 + 10\log_{10}P) = 30 - 43 = -13\text{dBm}$</p> <p>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</p>
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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 about or less than 1% of the channel bandwidth.

Test setup

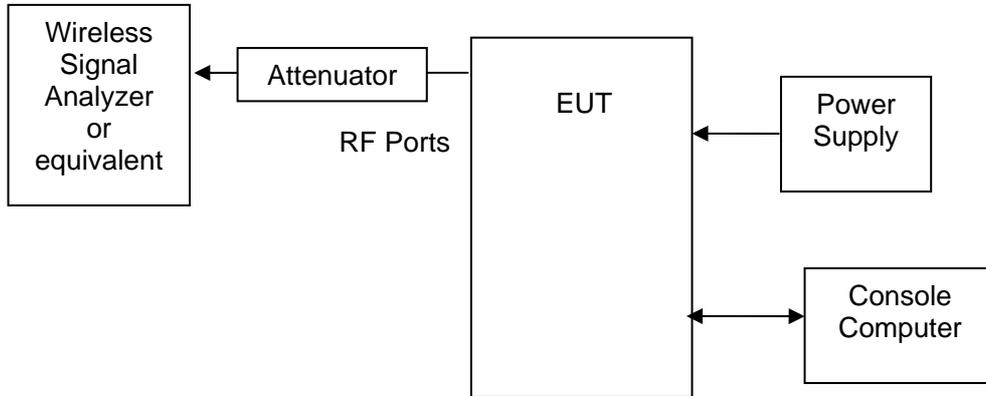


Figure 4. TEST SETUP

6.4.4 Measurement Results

6.4.4.1 Band edge emissions

Channel Bandwidth = 5 MHz:

Table 29. Measurement Results for Band Edge Characteristics

Test Mode	Test Frequency offset (MHz)	Band Edge Emissions (dBm)		
		B	T	Limit (dBm)
TM 1	< 5.5MHz	-20.78	-20.58	< -13
	> 5.5MHz	-44.27	-45.11	< -25
TM 2	< 5.5MHz	-20.78	-20.47	< -13
	> 5.5MHz	-44.27	-45.08	< -25
TM 3	< 5.5MHz	-20.78	-24.92	< -13
	> 5.5MHz	-44.27	-47.18	< -25
TM 4	< 5.5MHz	-20.78	-24.92	< -13
	> 5.5MHz	-44.27	-47.18	< -25

Channel Bandwidth = 10 MHz:

Table 30. Measurement Results for Band Edge Characteristics

Test Mode	Test Frequency offset (MHz)	Band Edge Emissions (dBm)		
		B	T	Limit (dBm)
TM 1	< 5.5MHz	-24.41	-23.55	< -13
	> 5.5MHz	-34.19	-33.70	< -25
TM 2	< 5.5MHz	-24.06	-23.55	< -13



Test Mode	Test Frequency offset (MHz)	Band Edge Emissions (dBm)		
		B	T	Limit (dBm)
	> 5.5MHz	-34.11	-33.45	< -25
TM 3	< 5.5MHz	-24.06	-23.51	< -13
	> 5.5MHz	-34.11	-33.45	< -25
TM 4	< 5.5MHz	-24.06	-23.51	< -13
	> 5.5MHz	-34.11	-33.45	< -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

Measured at:	Antenna connectors of 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 32. 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 33. FCC Limits for BRS&EBS Band

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

Detector of Spectrum Analyzer or equivalent

WiMAX equipment	RMS
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Test setup

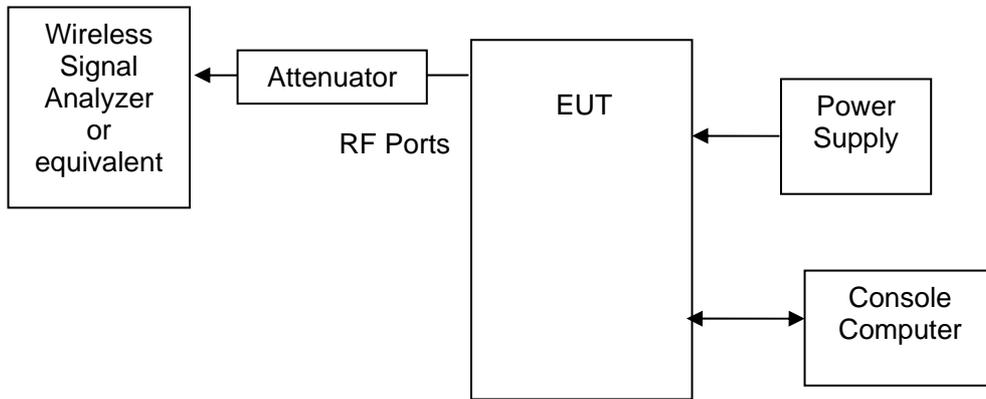


Figure 5. TEST SETUP

6.5.4 Measurement Results

Channel Bandwidth = 5 MHz:

Table 34. Measurement Results for Spurious Emissions

Test Mode	Test Frequency Range	Conducted Spurious Emissions (dBm)			
		B	M	T	Limit (dBm)
TM 1	9K – 150K	-51.52	-52.14	-51.98	< -25
	150K – 30M	-54.47	-52.62	-51.76	< -25
	30M – 1G	-47.79	-46.82	-45.88	< -25
	1G – 27G	-38.07	-38.16	-35.81	< -25
TM 2	9K – 150K	-53.09	-51.52	-53.13	< -25
	150K – 30M	-49.73	-51.92	-51.90	< -25
	30M – 1G	-46.34	-47.37	-46.47	< -25
	1G – 27G	-37.82	-38.00	-35.25	< -25
TM 3	9K – 150K	-51.13	-52.28	-52.65	< -25
	150K – 30M	-51.55	-51.59	-52.78	< -25
	30M – 1G	-48.42	-47.15	-47.30	< -25
	1G – 27G	-37.92	-36.91	-37.93	< -25
TM 4	9K – 150K	-53.58	-53.14	-53.09	< -25
	150K – 30M	-51.90	-52.18	-51.02	< -25
	30M – 1G	-47.02	-47.48	-48.66	< -25
	1G – 27G	-38.07	-35.76	-37.93	< -25



Channel Bandwidth = 10 MHz:

Table 35. Measurement Results for Spurious Emissions

Test Mode	Test Frequency Range	Conducted Spurious Emissions (dBm)			
		B	M	T	Limit (dBm)
TM 1	9K – 150K	-50.78	-51.88	-52.51	< -25
	150K – 30M	-52.95	-52.97	-52.86	< -25
	30M – 1G	-48.75	-48.46	-48.09	< -25
	1G – 27G	-37.55	-38.07	-38.11	< -25
TM 2	9K – 150K	-52.19	-52.23	-51.86	< -25
	150K – 30M	-52.70	-51.20	-51.69	< -25
	30M – 1G	-49.24	-48.94	-48.84	< -25
	1G – 27G	-38.11	-36.68	-37.55	< -25
TM 3	9K – 150K	-51.71	-51.13	-51.50	< -25
	150K – 30M	-52.57	-52.06	-51.51	< -25
	30M – 1G	-48.94	-48.85	-47.03	< -25
	1G – 27G	-37.92	-38.01	-38.11	< -25
TM 4	9K – 150K	-50.79	-52.65	-52.65	< -25
	150K – 30M	-53.66	-53.69	-53.41	< -25
	30M – 1G	-48.32	-48.72	-46.56	< -25
	1G – 27G	-37.45	-36.48	-36.17	< -25

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

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

6.6.2 Test Specifications and Limits

FCC part 2.1053 and part 27.53(m)(4) and part 27.53(m)(6)

Table 37. 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 38. FCC Limits for BRS&EBS Band

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

6.6.3 Test Method and Setup

(a) Measurements were made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.1049(c) as appropriate. For equipment operating on frequencies below 890 MHz, an Open Field Test is normally required with the measuring instrument antenna located in the far field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections, which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz



- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

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

The test procedure

(1) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, E.R.P. shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements. The EUT was connected to ancillary in order to simulate normal operating conditions with reference to the guidance given in the standard for this type of equipment.

(2) Test the radiated maximum output power by the test Receiver received from test antenna.

(3) Use substitution method to verify the Maximum output power. The EUT is substituted by a dipole antenna. The dipole is connected to a Signal Generator. And then adjust the output level of the Signal Generator to get the same received power recorded in step (2) on the test Receiver, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.

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

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

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

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

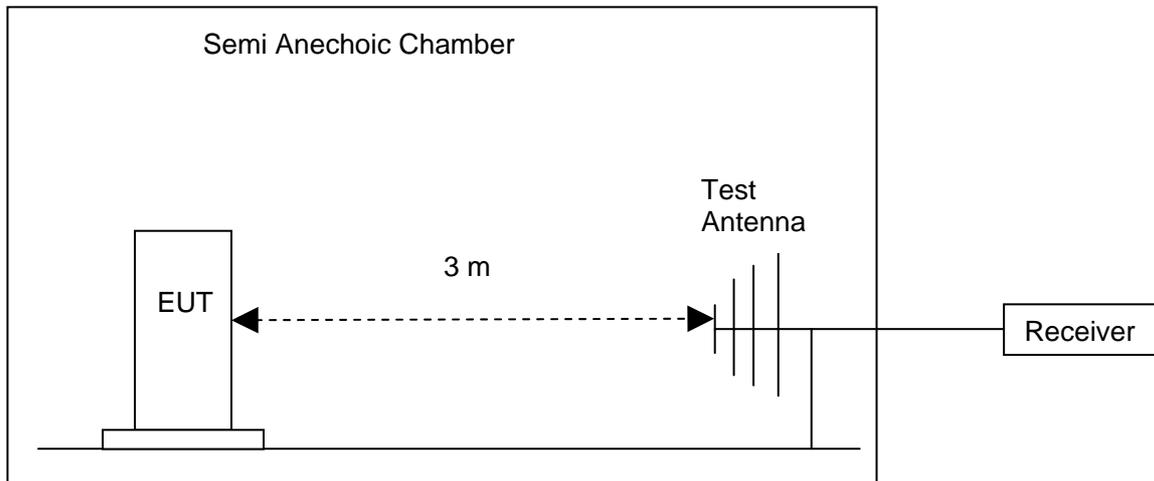


Figure 6. Test Set-up for Pre-test

Step 2: Substitution method to verify the maximum ERP

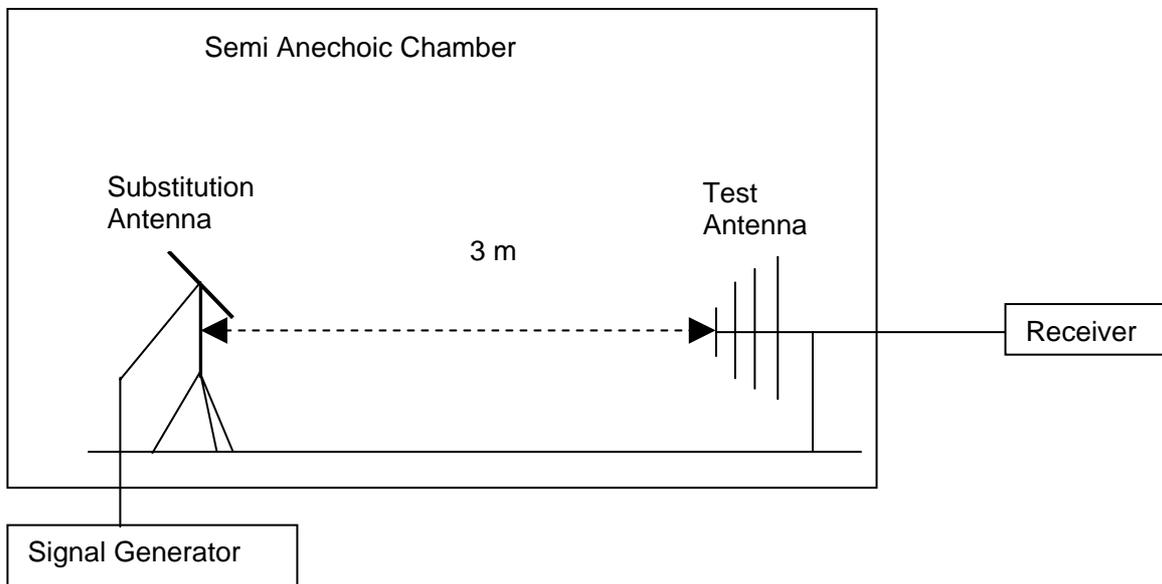


Figure 7. Test Set-up for Substitution

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

6.6.4.1 Pre-test Measurement Results

Table 39. Pre-test Measurement Results

Test Bandwidth (MHz)	Test Mode	Test Range (Frequency)	Rated Power (dBm)	Spurious Level measured (dBm) (See appendix E)			Limit (dBm)	Verdict
				B	M	T		
5MHz	TM1	9 kHz ~26.5 GHz	23	<-25	<-25	<-25	- 25	Pass
10MHz	TM1	9 kHz ~26.5 GHz	23	<-25	<-25	<-25	- 25	Pass

6.6.4.2 Substitution Results

Calculation Sample:

Channel Bandwidth = 5 MHz:

Table 40. Substitution Measurement Results for Spurious Emissions

Freq. (MHz)	SA reading (dBm)	SG reading (dBm)	CL (dB)	Gain (dBi)	Gain (dBd)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Channel B Horizontal								
469.9198	-52.05	-51.97	1.7	7.7	5.6	-48.07	-25.0	-23.07
7495.590	-43.89	-43.56	5.2	11.8	9.7	-39.06	-25.0	-14.06
9994.000	-47.47	-46.69	6.0	12.5	10.4	-42.29	-25.0	-17.29
Channel B Vertical								
469.9198	-52.95	-51.07	1.7	7.7	5.6	-47.97	-25.0	-22.97
7495.590	-45.99	-45.06	5.2	11.8	9.7	-40.56	-25.0	-15.56
9994.000	-49.02	-47.31	6.0	12.5	10.4	-42.91	-25.0	-17.91
Channel M Horizontal								
5186.000	-57.47	-57.07	4.9	10.8	8.7	-53.27	-25.0	-28.27
10372.00	-56.49	-55.84	6.2	13.0	10.9	-51.14	-25.0	-26.14
Channel M Vertical								
5186.000	-56.21	-55.82	4.9	10.8	8.7	-52.02	-25.0	-27.02
10372.00	-56.92	-55.53	6.2	13.0	10.9	-50.83	-25.0	-25.83
Channel T Horizontal								
10750.00	-43.24	-42.99	6.2	13.0	10.9	-38.29	-25.0	-13.29
13437.50	-53.01	-52.77	7.0	12.8	10.7	-49.07	-25.0	-24.07
Channel T Vertical								



10750.00	-47.95	-47.69	6.2	13.0	10.9	-37.99	-25.0	-12.99
13437.50	-54.33	-53.95	7.0	12.8	10.7	-50.25	-25.0	-25.25

Channel Bandwidth = 10 MHz:

Table 41. Substitution Measurement Results for Spurious Emissions

Freq. (MHz)	SA reading (dBm)	SG reading (dBm)	CL (dB)	Gain (dBi)	Gain (dBd)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Channel B Horizontal								
4021.000	-59.48	-59.08	3.9	10.0	7.9	-55.08	-25.0	-30.08
7503.000	-56.83	-56.72	5.3	11.8	9.7	-52.32	-25.0	-27.32
Channel B Vertical								
4021.000	-60.18	-59.54	3.9	10.0	7.9	-55.54	-25.0	-30.54
7503.000	-58.32	-57.42	5.3	11.8	9.7	-53.02	-25.0	-28.02
Channel M Horizontal								
8042.000	-55.62	-54.61	5.4	12.1	10.0	-50.01	-25.0	-25.01
Channel M Vertical								
8042.000	-54.97	-55.12	5.4	12.1	10.0	-50.52	-25.0	-25.52
Channel T Horizontal								
469.9198	-52.52	-51.96	1.7	7.7	5.6	-48.06	-25.0	-23.06
8055.000	-49.64	-48.33	5.4	10.8	8.7	-45.03	-25.0	-20.03
Channel T Vertical								
469.9198	-52.16	-51.85	1.7	7.7	5.6	-47.95	-25.0	-22.95
8055.000	-48.99	-48.73	5.4	10.8	8.7	-45.43	-25.0	-20.43

Note: For getting the E.R.P. (Efficient Radiated Power) in substitution method, the following formula should take to calculate it,

$$\text{E.R.P. (dBm)} = \text{SG (dBm)} - \text{CL (dB)} + \text{Gain (dBd)}$$

6.6.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the pre-test measurement results and markers refer to Appendix E.

6.7 Frequency Stability

6.7.1 Test Conditions

Table 42. Test Conditions

Measured at:	Antenna connector of 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 43. 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 44. 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 45. 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:	5 VDC (100% normal point), 4.25 VDC (85% lowest point) and 5.75 VDC (115% highest point).
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Test Set up

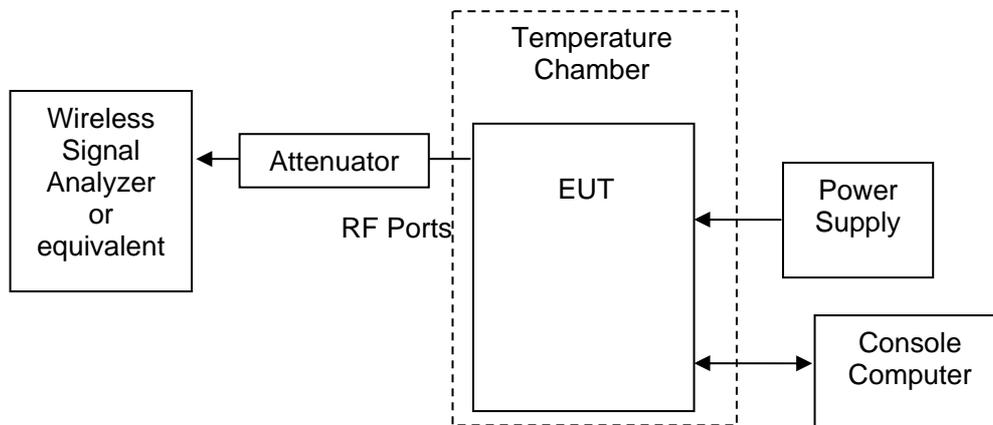


Figure 8. Test Set up

6.7.4 Measurement Results

6.7.4.1 Frequency Error vs. Temperature

Channel Bandwidth = 5 MHz:

Table 46. Measurement Results for Frequency Error vs. Temperature

Measured Maximum Frequency Error									
Test Environment			B		M		T		Limit
Test Mode	Voltage	Temperature	Hz	ppm	Hz	ppm	Hz	ppm	
TM1	5 VDC (100% rated / normal)	-30 °C	-218	-0.08	-227	-0.08	-237	-0.08	< ±2ppm
		-20 °C	-218	-0.08	-227	-0.08	-237	-0.08	
		-10 °C	-218	-0.08	-226	-0.08	-237	-0.08	
		0 °C	-218	-0.08	-225	-0.08	-235	-0.08	
		+10 °C	-218	-0.08	-225	-0.08	-236	-0.08	
		+20 °C	-218	-0.08	-226	-0.08	-236	-0.08	
		+30 °C	-215	-0.08	-226	-0.08	-236	-0.08	
		+40 °C	-218	-0.08	-227	-0.08	-237	-0.08	
		+50 °C	-225	-0.08	-230	-0.08	-241	-0.08	

Channel Bandwidth = 10 MHz:

Table 47. Measurement Results for Frequency Error vs. Temperature

Measured Maximum Frequency Error									
Test Environment			B		M		T		Limit
Test Mode	Voltage	Temperature	Hz	ppm	Hz	ppm	Hz	ppm	
TM1	5 VDC (100% rated / normal)	-30 °C	-221	-0.08	-229	-0.08	-241	-0.08	< ±2ppm
		-20 °C	-220	-0.08	-229	-0.08	-241	-0.08	
		-10 °C	-218	-0.08	-230	-0.08	-241	-0.08	
		0 °C	-218	-0.08	-229	-0.08	-236	-0.08	
		+10 °C	-218	-0.08	-229	-0.08	-236	-0.08	
		+20 °C	-221	-0.08	-230	-0.08	-241	-0.08	
		+30 °C	-221	-0.08	-230	-0.08	-241	-0.08	
		+40 °C	-221	-0.08	-229	-0.08	-241	-0.08	
		+50 °C	-220	-0.08	-230	-0.08	-241	-0.08	

6.7.4.2 Frequency Error vs. Voltage

Channel Bandwidth = 5 MHz:

Table 48. 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	4.25 VDC (85% rated / lowest)	+20 °C	-221	-0.08	-222	-0.08	-236	-0.08	< ±2ppm
	5 VDC (100% rated / normal)	+20 °C	-218	-0.08	-226	-0.08	-236	-0.08	
	5.75 VDC (115% rated / highest)	+20 °C	-216	-0.08	-224	-0.08	-236	-0.08	

Channel Bandwidth = 10 MHz:

Table 49. 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	4.25 VDC (85% rated / lowest)	+20 °C	-219	-0.08	-226	-0.08	-241	-0.08	< ±2ppm
	5 VDC (100% rated / normal)	+20 °C	-221	-0.08	-230	-0.08	-241	-0.08	
	5.75 VDC (115% rated / highest)	+20 °C	-223	-0.08	-230	-0.08	-239	-0.08	

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 50. 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	1-25	Pages
Appendix B	Measurement Results Occupied Bandwidth	26-50	Pages
Appendix C	Measurement Results Band Edges	51-67	Pages
Appendix D	Measurement Results Spurious Emission at Antenna Terminal	68-164	Pages
Appendix E	Measurement Results Radiated Spurious Emission	165-178	Pages

END