



FCC Test Report

Product Name: Distributed NodeB Remote Radio Unit

Model Number: RRU3804

Report No: SYBH(R)092062009EB-1
FCC ID: QISRRU3804B4

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

1. The laboratory has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS), and accreditation number: L0310.
2. The laboratory has obtained the accreditation of THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION (A2LA), and Accreditation Council Certificate Number: 2174.01.
3. The laboratory has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements. The site recognition number is 97456.
4. The laboratory has been listed by industry Canada to perform electromagnetic emission measurement. The site recognition number is 6369A-1.
5. The laboratory also has been listed by the VCCI to perform EMC measurements. The accreditation number is R2364, C2583, and T256.
6. The test report is invalid if not marked with "exclusive stamp for the test report".
7. The test report is invalid if not marked with the stamps or the signatures of the persons responsible for performing, revising and approving the test report.
8. The test report is invalid if there is any evidence of erasure and/or falsification.
9. If there is any dissidence for the test report, please file objection to the test centre within 15 days from the date of receiving the test report.
10. Normally, the test report is only responsible for the samples that have undergone the test.
11. Context of the test report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of the laboratory.



REPORT ON FCC Test of Distributed NodeB Remote Radio Unit

Model Number: RRU3804

Report No: SYBH(R)092062009EB-1

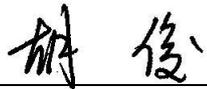
FCC ID: QISRRU3804B4

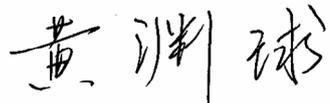
REGULATION **47 CFR FCC Part 2, Subpart J**

47 CFR FCC Part 27, Subpart C & L

CONCLUSION **PASSED**

General Manager	<u>2009-09-04</u>	张兴海	
	Date (yyyy-mm-dd)	Name	

Technical Responsibility For Area of Testing	<u>2009-09-04</u>	胡俊	
	Date (yyyy-mm-dd)	Name	

Test Lab Engineer	<u>2009-09-04</u>	黄渊球	
	Date (yyyy-mm-dd)	Name	



Contents

1	<u>Summary</u>	5
2	<u>Product Description</u>	6
2.1	PRODUCTION INFORMATION OF EUT	6
2.2	MODIFICATION INFORMATION	6
3	<u>Test Site Description</u>	7
3.1	TESTING PERIOD	7
3.2	APPLIED STANDARDS.....	7
4	<u>Product Description</u>	8
4.1	TECHNICAL CHARACTERISTICS.....	8
4.2	EUT IDENTIFICATION LIST.....	10
5	<u>Main Test Instruments</u>	11
6	<u>Transmitter Measurements</u>	12
6.1	MAXIMUM CHANNEL POWER	13
6.2	THE PEAK TO AVERAGE RATIO OF THE POWER	15
6.3	MODULATION CHARACTERISTICS.....	17
6.4	OCCUPIED BANDWIDTH.....	19
6.5	BAND EDGES COMPLIANCE	21
6.6	SPURIOUS EMISSION AT ANTENNA TERMINAL	23
6.7	RADIATED SPURIOUS EMISSION	26
6.8	FREQUENCY STABILITY	30
7	<u>System Measurement Uncertainty</u>	34
8	<u>Appendices</u>	35



1 Summary

The table below summarizes the measurements and results for the equipment of Distributed NodeB Remote Radio Unit - RRU3804. Detailed results and descriptions are shown in the following pages.

Table 1. Summary of results for FCC requirements for AWS Band

47 CFR FCC Part(s) Requirements		Description	Result
Specification	Limits		
2.1046	27.50(d)	Transmitter Output Power	PASS
2.1046	27.50(d)	The peak to average ratio of the power	PASS
2.1047	---	Modulation Characteristics	PASS
2.1049	---	Occupied Bandwidth	PASS
2.1051	27.53(h)	Band Edges Compliance	PASS
2.1051	27.53(h)	Spurious Emission at Antenna Terminal	PASS
2.1053	27.53(h)	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 RRU is a remote radio unit. The RRU has the following functions:

- The RRU receives RF signals from the antenna system, down-converts the signals to IF signals, and then transmits them to the BBU or the macro NodeB after amplification, analog-to-digital conversion, digital down-conversion, matched filtering, and Digital Automatic Gain Control (DAGC).
- The RRU receives downlink baseband signals from the BBU or the macro NodeB, forwards data from its cascaded RRU, performs filtering and digital-to-analog conversion, and upconverts RF signals to the transmitting frequency band.
- The RRU multiplexes RX and TX signals over RF channels and filters the RX signals and TX signals. This enables the RX signals and TX signals to share the same antenna path.

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
WCDMA voice and data	Modulation: QPSK	TM1	
HSDPA	Modulation: 16QAM	TM5	

Note: The test conditions and settings are defined in clause 6.1.1 of 3GPP 25.141.

2.2 Modification Information

For original equipment, following table is not application.

Table 3. Modification Information

Model Number	Board/Module	Original Version	New Version	Modify Information
Not applicable				



3 Test Site Description

The test site of:

Huawei Technologies Co. Ltd.
P.O. Box 518129
Huawei base, Bantian,
Longgang District, Shenzhen, China

3.1 Testing Period

The test has been performed during the period of

Date of Start: 2009-06-25
Date of End: 2009-08-29

3.2 Applied Standards

3.2.1 Rules and Regulations

Table 4. Applied Standards

Standards Name	Standards Description
47 CFR Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
47 CFR Part 27	Miscellaneous Wireless Communications Services

3.2.2 Supporting Standards

Table 5. supporting standards

Standards Name	Standards Description
ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ITU-R Recommendation SM.329-10 (2003)	Unwanted emissions in the spurious domain
3GPP TS 25.141 version 7.9.0 Release 7	Universal Mobile Telecommunications System (UMTS) ; Base Station (BS) conformance testing (FDD)

4 Product Description

4.1 Technical Characteristics

4.1.1 Frequency Range

Table 6. Frequency Range for AWS Band

Uplink band:	1710 MHz~1755 MHz
Downlink band:	2110 MHz~2155 MHz

4.1.2 Channel Separation/Bandwidth

Table 7. Frequency Interval and Channel Separation

Channel Raster	200 kHz
Channel Spacing	5 MHz

4.1.3 Type of Emission

Refer to FCC part 2.201 and 2.202.

Table 8. Type of Emission

Emission Designation:	5M00F9W
-----------------------	---------

4.1.4 Rated maximum transmitter output power

Table 9. Transmit power of EUT

Actives Carrier	TX Total Output Power (per antenna port)
One Carrier	47.8dBm
Two Carriers	2* 44.8dBm
Three Carriers	3* 43dBm
Four Carriers	4* 41.8dBm

4.1.5 Environmental Requirements

Table 10. Environmental Requirements

Minimum temperature:	-40 °C
Maximum temperature:	55 °C
Relative Humidity:	5% to 95% RH

4.1.6 Power Source

Table 11. DC Power Source

DC voltage nominal:	=== -48V
DC voltage range:	=== -37V to === -60V
DC current maximal:	8A

4.1.7 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 12. Component Parts Information

No.	Model Name	Qty	Hardware Version	Software Version	Serial	Description
1	WD34TRX8A	1	VER.C	V200R010	2102315970108B000032	Distributed NodeB Remote Radio Unit

4.2.2 Adapter Technical Data

Not Applicable for BTS.

4.2.3 Battery Technical Data

Not Applicable for BTS.

4.2.4 FCC Identification

Grantee Code: QIS
Product Code: RRU3804B4
FCC Identification: QISRRU3804B4



5 Main Test Instruments

Table 13. Main Test Equipments

Description	Manufacturer	Model	S/N	Cal. Due
Signal Analyzer	R&S	FSQ40	100025	2009-10-05
Vector Signal Generator	R&S	SMU200A	100699	2010-03-14
Power meter	R&S	NRP	100740	2009-10-22
	R&S	NRP-Z11	101007	2009-10-22
Receiver	R&S	ESU40	100144	2010-02-16
Bilog Antenna	Schaffner	CBL6112B	2747	2009-11-10
Horn Antenna	R&S	HF906 4044.4507.02	35928/006	2010-01-24
Climate Chamber	WEISS	WK1-2	59226002300010	2009-10-09

6 Transmitter Measurements

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 14. Frequency points (channels) selected to perform tests

Transmitter Operating Band	Multi-Carriers	Channels No.		
		Channel B	Channel M	Channel T
AWS Band:	1	No:1537 2112.4MHz	No:1640 2133MHz	No:1738 2152.6MHz
	2	No:1537/1562 2112.4MHz/2117.4MHz	No:1640/1665 2133MHz/2138MHz	No:1713/1738 2147.6MHz/2152.6MHz
	3	NO:1537/1562/1587 2112.4MHz/2117.4MHz/ 2122.4MHz	No:1615/1640/1665 2128MHz/2133MHz/ 2138MHz	No:1688/1713/1738 2142.6MHz/MHz/2147.6MHz z/ 2152.6MHz
	4	NO:1537/1562/1587/1612 2112.4MHz/2117.4MHz/ 2122.4MHz/2127.4MHz	No:1615/1640/1665/1690 2128MHz/2133MHz/ 2138MHz/2143MHz	No:1663/1688/1713/1738 2137.6MHz/2142.6MHz/ 2147.6MHz/2152.6MHz

6.1 Maximum Channel Power

6.1.1 Test Conditions

Table 15. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C~26°C
Relative humidity:	65%~70 %
Power supply:	-48V
Test Configuration/Mode:	TM1/TM5 at Channel B, M, T for Multi Carrier 1,2,3,4
Rated maximum transmitter output power (P_{max}):	See 4.1.4

6.1.2 Test Specifications and Limits

6.1.2.1 Specification

FCC part 2.1046 and part 27.50(d);

6.1.2.2 Limits

Compliance with FCC part 2.1046 and part 27.50 (d) , the power of base station transmitting in the 2110-2155 MHz band is limited to a peak EIRP of 1640 watts.

Table 16. FCC Limits for AWS Band

Maximum EIRP:	< 1640 Watts (= 62 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

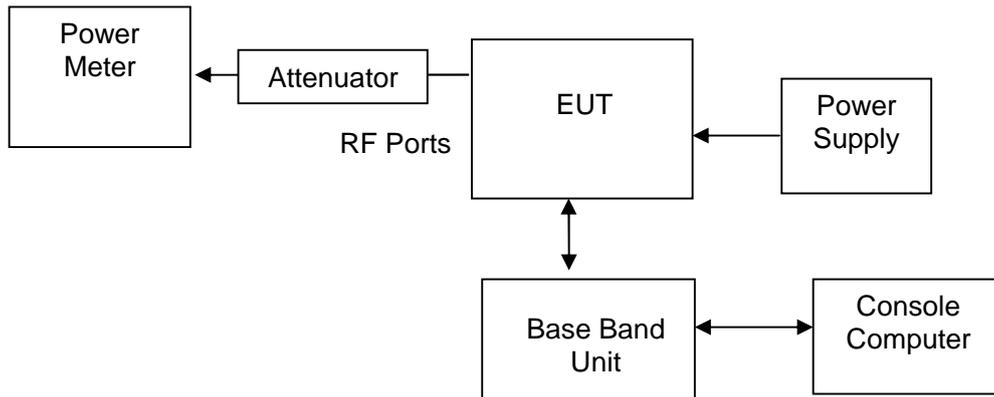


Figure 1. TEST SETUP

6.1.4 Measurement Results

Table 17. Measurement Results for the conducted power

Test Mode	Channel	Multi Carriers	Channel Number	Maximum Output Power(dBm)	Limit (dBm)
TM1	B	1	No:1537	48.09	< 62
		2	No:1537/1562	47.71	
		3	No:1537/1562/1587	48.06	
		4	No:1537/1562/1587/1612	47.75	
	M	1	No:1640	47.9	
		2	No:1640/1665	47.85	
		3	No:1615/1640/1665	47.74	
	T	1	No:1738	47.74	
		2	No:1713/1738	47.72	
		3	No:1688/1713/1738	47.78	
		4	No:1663/1688/1713/1738	47.81	
	TM5	B	1	No:1537	
2			No:1537/1562	47.96	
3			No:1537/1562/1587	47.84	
4			No:1537/1562/1587/1612	47.72	
M		1	No:1640	47.7	
		2	No:1640/1665	47.73	
		3	No:1615/1640/1665	47.69	
T		1	No:1738	47.65	
		2	No:1713/1738	47.67	
		3	No:1688/1713/1738	47.75	
		4	No:1663/1688/1713/1738	47.78	

6.1.5 Conclusion

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

6.2 The peak to average ratio of the power

6.2.1 Test Conditions

Table 18. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C~26°C
Relative humidity:	65%~70 %
Power supply:	-48V
Test Configuration/Mode:	TM1/TM5 at Channel B, M, T for Multi Carrier 1

6.2.2 Test Specifications and Limits

6.2.2.1 Specification

FCC part 2.1046 and FCC part 27.50(d);

6.2.2.2 Limits

When the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

6.2.3 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 peak to average of the power by the Spectrum Analyzer or equivalent.

Test setup

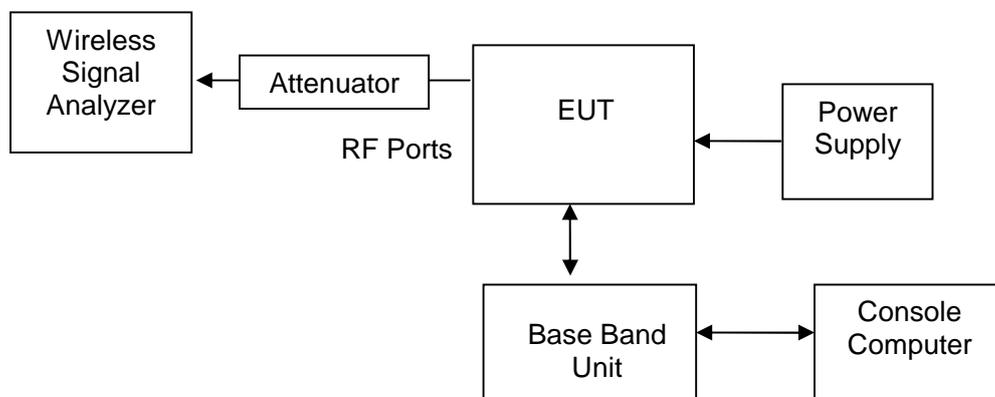


Figure 2. TEST SETUP

6.2.4 Measurement Results

Table 19. Measurement Results for the peak to average ratio of the power

Test Mode	Channel	Channel Number	The peak-to average ratio of the power(dB)	Limits(dB)
TM1	B	No.1537 2112.4MHz	6.17	13
	M	No.1640 2133MHz	6.03	
	T	No.1738 2152.6MHz	6.07	
TM5	B	No.1537 2112.4MHz	6.08	
	M	No.1640 2133MHz	5.93	
	T	No.1738 2152.6MHz	6.03	

6.2.5 Conclusion

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

6.3 Modulation Characteristics

6.3.1 Test Conditions

Table 20. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C~26°C
Relative humidity:	65%~70 %
Power supply:	-48V
Test Configuration/Mode:	TM1/TM5 at Channel M for Multi Carrier 1

6.3.2 Test Specifications and Limits

6.3.2.1 Specification

FCC part 2.1047 and part 27 subpart C & L.

6.3.2.2 Limits

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

6.3.3 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

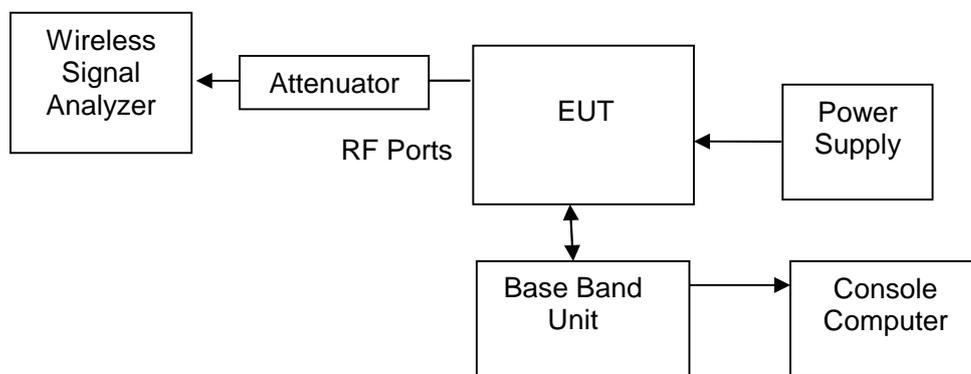


Figure 3. TEST SETUP



6.3.4 Measurement Results

Table 21. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics	
	NO.1640 2133MHz	
	Type/Mode	Remark
TM1	QPSK	See Appendix B
TM5	16QAM	See Appendix B

6.3.5 Conclusion

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

6.4 Occupied Bandwidth

6.4.1 Test Conditions

Table 22. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C~26°C
Relative humidity:	65%~70 %
Power supply:	-48V
Test Configuration/Mode:	TM1/TM5 at Channel B, M, T for Multi Carrier 1

6.4.2 Test Specifications and Limits

6.4.2.1 Specification

FCC part 2.1049 and part 27 subpart C & L.

6.4.2.2 Limits

No specific occupied bandwidth requirement in FCC part 2.1049 and part 27 subpart C & L for AWS Band.

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 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:

AWS band:	50 kHz
-----------	--------

Test setup

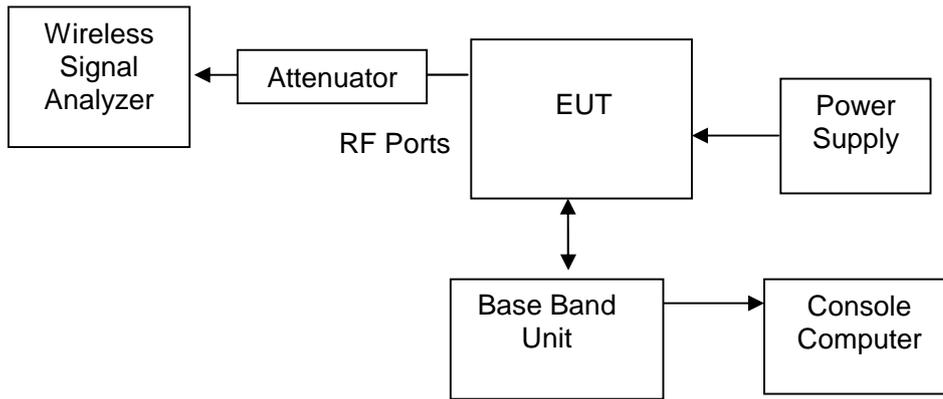


Figure 4. TEST SETUP

6.4.4 Measurement Results

Table 23. Measurement Results for Occupied Bandwidth

Test Mode	Channel	Channel Number	Occupied Bandwidth(MHz)	Limits
TM1	B	No.1537 2112.4MHz	4.167	---
	M	No.1640 2133MHz	4.151	
	T	No.1738 2152.6MHz	4.167	
TM5	B	No.1537 2112.4MHz	4.167	
	M	No.1640 2133MHz	4.151	
	T	No.1738 2152.6MHz	4.167	

6.4.5 Conclusion

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

6.5 Band Edges Compliance

6.5.1 Test Conditions

Table 24. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C~26°C
Relative humidity:	65%~70 %
Power supply:	-48V
Test Configuration/Mode:	TM1/TM5 at Channel B, T for Multi Carrier 1,2,3,4

6.5.2 Test Specifications and Limits

6.5.2.1 Specification

FCC part 2.1051 and part 27.53(h).

6.5.2.2 Limits

Compliance with FCC part 2.1051 and part 27.53(h), 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, and the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

Table 25. FCC Limits for AWS 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 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:

AWS band:	50 kHz
-----------	--------

Test setup

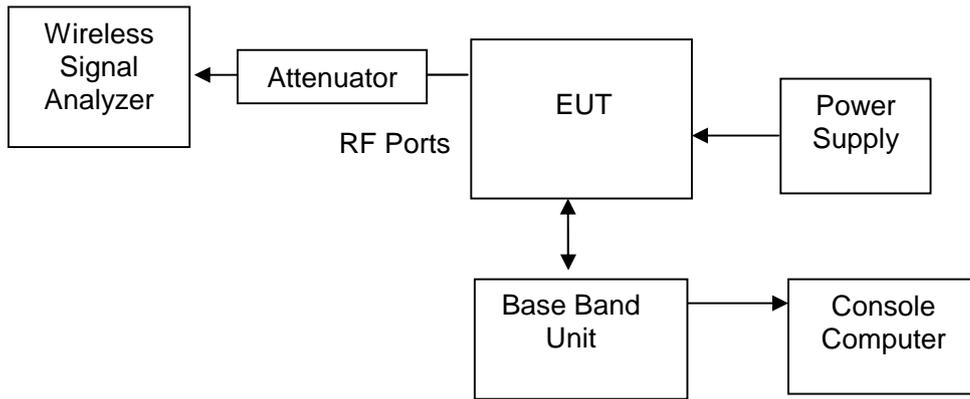


Figure 5. TEST SETUP

6.5.4 Measurement Results

Table 26. Measurement Results for Band Edge Characteristics

Test Mode	Channel	Multi Carriers	Test Frequency Range (MHz)	Maximum Spurious Level measured(dBm)	Limit (dBm)
TM1	B	1	2109 – 2110	-16.52	-13
		2		-19.21	
		3		-14.95	
		4		-19.11	
	T	1	2155 – 2156	-17.46	
		2		-18.17	
		3		-15.18	
		4		-19.48	
TM5	B	1	2109 – 2110	-16.85	-13
		2		-18.99	
		3		-15.43	
		4		-19.22	
	T	1	2155 – 2156	-17.13	
		2		-20.23	
		3		-14.75	
		4		-18.32	

6.5.5 Conclusion

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

6.6 Spurious Emission at Antenna Terminal

6.6.1 Test Conditions

Table 27. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	20 °C~26°C
Relative humidity:	65%~70 %
Power supply:	-48V
Test Configuration/Mode:	TM1/TM5 at Channel B, M, T for Multi Carrier 1,2,3,4

6.6.2 Test Specifications and Limits

6.6.2.1 Specification

FCC part 2.1051 and part 27.53(h).

6.6.2.2 Limits

Compliance with FCC part 2.1051 and part 27.53(h), based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

Table 28. FCC Limits for AWS Band

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

6.6.3 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.

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. And 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
30 MHz – 1 GHz	1 MHz
Above 1 GHz	1 MHz

Test setup

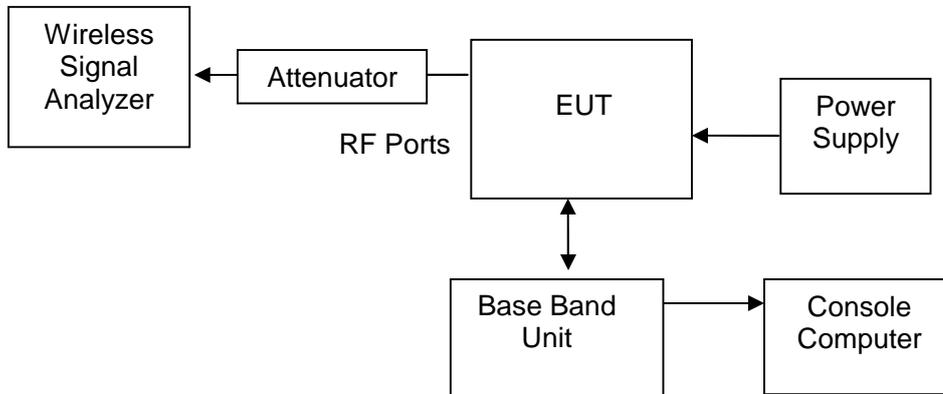


Figure 6. TEST SETUP

6.6.4 Measurement Results

TM1:

Table 29. Measurement Results for Spurious Emissions

Test Configuration:	TM 1			
Channel	Multi carriers	Measured frequency range	Max. Spurious Level Measured (dBm)	Limit (dBm)
Channel B	1	9kHz to 22GHz	-26.31	< -13
	2	9kHz to 22GHz	-26.54	
	3	9kHz to 22GHz	-27.43	
	4	9kHz to 22GHz	-26.00	
Channel M	1	9kHz to 22GHz	-26.66	
	2	9kHz to 22GHz	-26.47	
	3	9kHz to 22GHz	-26.74	
Channel T	1	9kHz to 22GHz	-26.67	
	2	9kHz to 22GHz	-26.65	
	3	9kHz to 22GHz	-27.08	
	4	9kHz to 22GHz	-25.76	

TM5:

Table 30. Measurement Results for Spurious Emissions

Test Configuration:	TM5			
Channel	Multi carriers	Measured frequency range	Max. Spurious Level Measured (dBm)	Limit (dBm)
Channel B	1	9kHz to 22GHz	-26.7	< -13
	2	9kHz to 22GHz	-26.59	
	3	9kHz to 22GHz	-26.33	
	4	9kHz to 22GHz	-28.49	
Channel M	1	9kHz to 22GHz	-25.88	
	2	9kHz to 22GHz	-26.79	



Test Configuration:	TM5			
Channel	Multi carriers	Measured frequency range	Max. Spurious Level Measured (dBm)	Limit (dBm)
	3	9kHz to 22GHz	-28.55	
Channel T	1	9kHz to 22GHz	-26.29	
	2	9kHz to 22GHz	-26.39	
	3	9kHz to 22GHz	-28.44	
	4	9kHz to 22GHz	-28.88	

6.6.5 Conclusion

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

6.7 Radiated Spurious Emission

6.7.1 Test Conditions

Table 31. Test Conditions

Preconditioning:	1 hour
Measured at:	Enclosure
Ambient temperature:	20 °C~26°C
Relative humidity:	65%~70 %
Power supply:	-48V
Test Configuration/Mode:	TM1 at Channel M for Multi Carrier 1

6.7.2 Test Specifications and Limits

6.7.2.1 Specification

FCC part 2.1053 and part 27.53(h).

6.7.2.2 Limits

Compliance with FCC part 2.1053 and part 27.53(h), based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Table 32. FCC Limits for AWS Band

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

6.7.3 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:

AWS Band:	1 MHz
-----------	-------

Alternatively, according to ITU SM.329, measurement bandwidth (RBW) of Spectrum Analyzer or equivalent can be set as following for test frequency range of 9 kHz to 30 MHz:

9 kHz – 150 kHz:	1 kHz
150 kHz – 30 MHz:	10 kHz

Test setup

Step 1: Pre-test

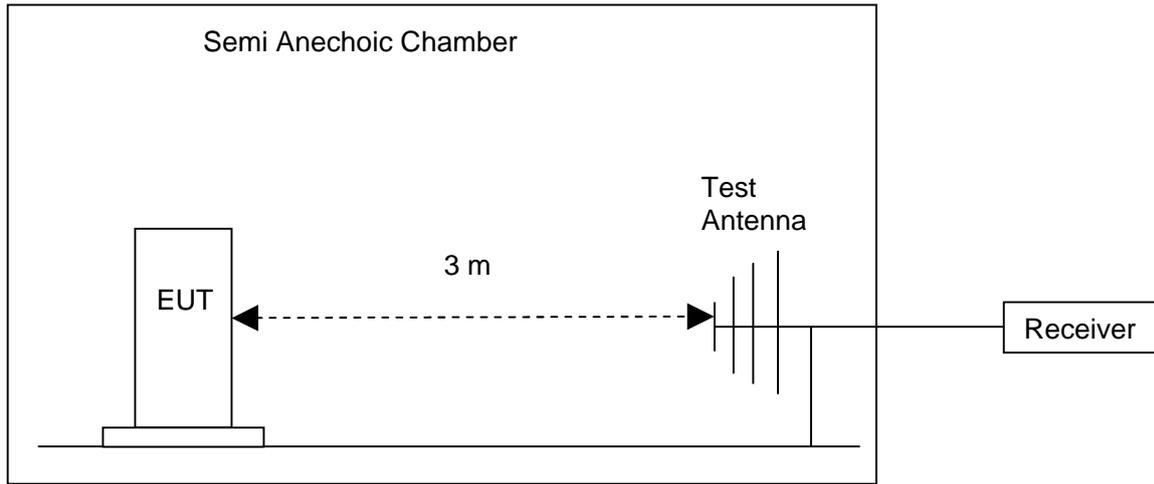


Figure 7. Test Set-up for Pre-test

Step 2: Substitution method to verify the maximum ERP

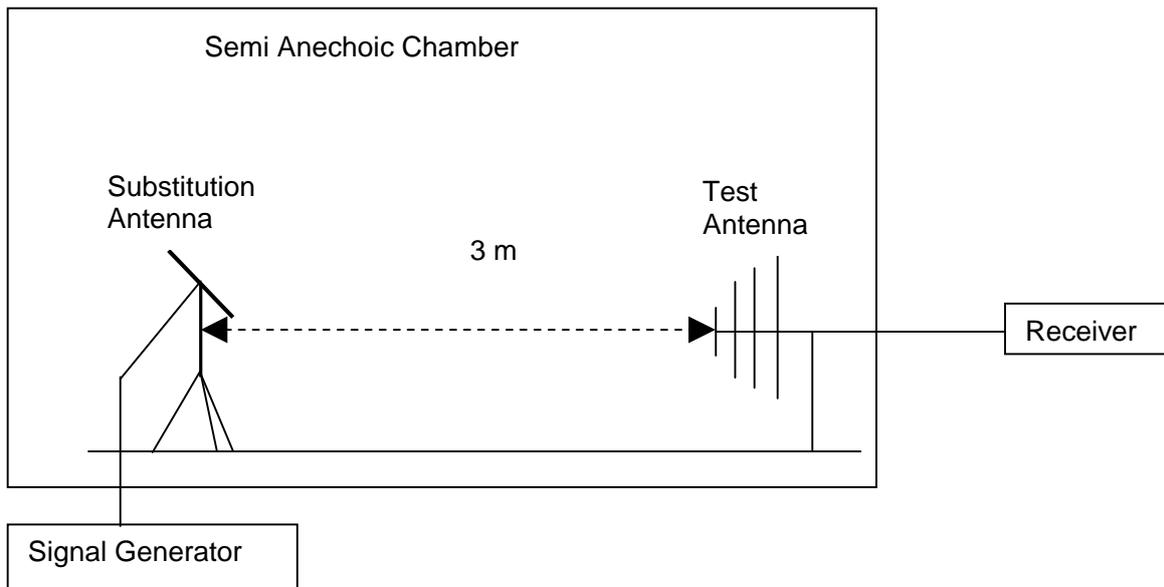


Figure 8. Test Set-up for Substitution

NOTE: Effective radiated power (ERP) refers to the radiation power output of the EUT, assuming all emissions are radiated from half-wave dipole antennas.

6.7.4 Measurement Results

6.7.4.1 Pre-test Measurement Results

Table 33. Measurement Result

Channel Number	Test Range (Frequency)	Spurious Level measured [dBm]	FCC limit	Result
No. 1640 2133MHz	30MHz ~12.8GHz	<- 13 dBm (See appendix F)	- 13 dBm	Pass

6.7.4.2 Substitution Results

Table 34. Substitution Results

Freq. [MHz]	Measurement Value [dBm]	Substitution Antenna Type	Gain [dBd]	Cable Loss [dB]	Signal Generator Level [dBm]	Substitution Level [dBm]	FCC limit [dBm]	Result
/	/	/	/	/	/	/	/	/

Note: For get the ERP. (Efficient Radiated Power) in substitution method, the following formula should take to calculate it,

$$\text{ERP [dBm]} = \text{SGP [dBm]} - \text{Cable Loss [dB]} + \text{Gain [dBd]}$$

NOTE: SGP- Signal Generator Level

6.7.5 Conclusion

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

6.8 Frequency Stability

6.8.1 Test Conditions

Table 35. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature:	See Measurement Results
Relative humidity:	70 %
Power supply:	See Measurement Results
Test Configuration/Mode:	TM1/TM5 at Channel M

6.8.2 Test Specifications and Limits

6.8.2.1 Specification

FCC part 2.1055 and part 27.54.

6.8.2.2 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 36. FCC Limits for AWS Band

Limit:	(not defened)
--------	---------------

Specially, limits according to the technical requirements of the EUT can be adopted as showed in the following table:

Table 37. Limits According to EUT technical requirements for all operating bands

for UMTS equipments:	$< \pm (0.05 \text{ ppm} + 12 \text{ Hz})$
----------------------	--

6.8.3 Test Method and Setup

The frequency stability shall be measured with variation of ambient temperature from -30 °C to 50 °C.

Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 °C through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

The frequency stability shall be measured with variation of primary supply voltage as follows:

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point, which shall be specified by the manufacturer.
- (3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

The test procedure

The EUT was placed inside an environmental temperature chamber. The EUT was connected to the Signal Analyzer or equivalent via one RF connector, and other RF connectors were connected to match loads. The EUT was controlled to transmit maximum power by Console Computer. Measure and record the Frequency Tolerance of the EUT by the Signal Analyzer or equivalent.

According to ANSI C63.4 clause 13.1.6, no modulation needs to be supplied to the intentional radiator during these tests, unless modulation is required to produce an output, e.g., single-sideband suppressed carrier transmitters

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

Test Set up

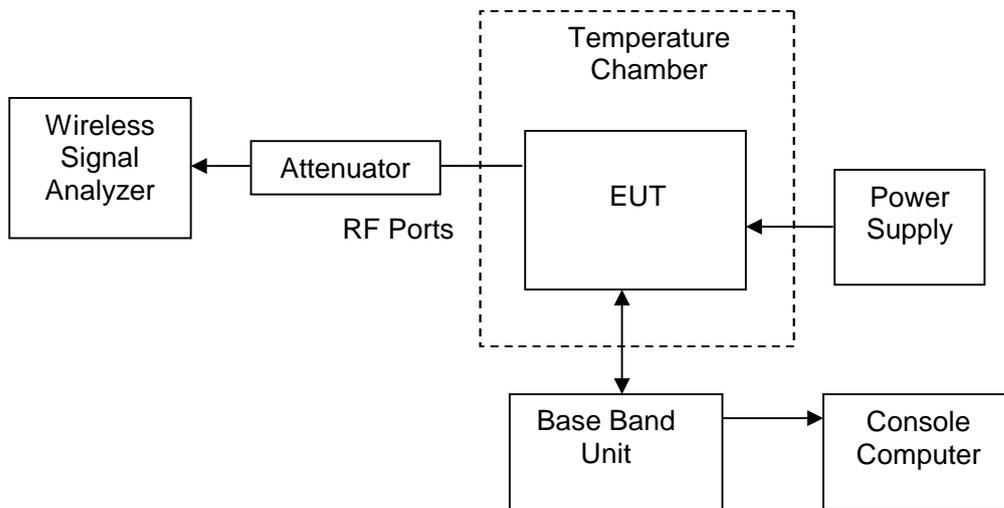


Figure 9. Test Set up

6.8.4 Measurement Results

6.8.4.1 Frequency Error vs. Temperature

Table 38. Measurement Results for Frequency Error vs. Temperature-TM1

Measured Maximum Frequency Error				
Test Environment		TM1		Limit
		No.1640 2133MHz		
Voltage	Temperature	Hz	ppm	

-48V	-30 °C	13.15	0.006	< ± (0.05 ppm+12 Hz)
	-20 °C	2.86	0.001	
	-10 °C	14.57	0.006	
	0 °C	7.85	0.004	
	+10 °C	8.73	0.004	
	+20 °C	1.63	0.001	
	+30 °C	27.47	0.013	
	+40 °C	2.65	0.001	
	+50 °C	11.14	0.005	

Table 39. Measurement Results for Frequency Error vs. Temperature-TM5

Measured Maximum Frequency Error				
Test Environment		TM5		Limit
		No.1640 2133MHz		
Voltage	Temperature	Hz	ppm	
-48V	-30 °C	13.15	0.006	< ± (0.05 ppm+12 Hz)
	-20 °C	2.86	0.001	
	-10 °C	14.57	0.007	
	0 °C	7.85	0.004	
	+10 °C	8.73	0.004	
	+20 °C	1.63	0.001	
	+30 °C	27.47	0.013	
	+40 °C	2.65	0.001	
	+50 °C	11.14	0.005	

6.8.4.2 Frequency Error vs. Voltage

Table 40. Measurement Results for Frequency Error vs. Voltage-TM1

Measured Maximum Frequency Error				
Test Environment		TM1		Limit
		No.1640 2133MHz		
Voltage	Temperature	Hz	ppm	
-40.8V	+20 °C	15.25	0.007	< ± (0.05 ppm+12 Hz)
-55.2V	+20 °C	12.81	0.006	

Table 41. Measurement Results for Frequency Error vs. Voltage-TM5

Measured Maximum Frequency Error				
Test Environment		TM5		Limit
		No.1640 2133MHz		
Voltage	Temperature	Hz	ppm	
-40.8V	+20 °C	15.25	0.007	< ± (0.05 ppm+12 Hz)
-55.2V	+20 °C	12.81	0.006	



6.8.5 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 42. 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 Peak-to-Average Ratio	6 Pages
Appendix B	Measurement Results Modulation Characteristics	2 Pages
Appendix C	Measurement Results Occupied Bandwidth	6 Pages
Appendix D	Measurement Results Band Edges	16 Pages
Appendix E	Measurement Results Spurious Emission at Antenna Terminal	88 Pages
Appendix F	Measurement Results Radiated Spurious Emission	2 Pages
Appendix G	Photos of Test Setup	1 Pages

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