



FCC Test Report

Product Name: GSM Radio Frequency Unit

Model Number: GRFU-1900

Report No: SYBH(R)006052010EB-1

FCC ID: QISGRFU-1900

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



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REPORT ON FCC Test of GSM Radio Frequency Unit

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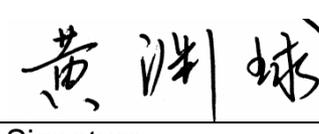
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REGULATION **47 CFR FCC Part 2, Subpart J**

47 CFR FCC Part 24, Subpart E

CONCLUSION **PASSED**

General Manager	2010-07-20 Date (y-m-d)	张兴海 Name	 Signature
Technical Responsibility For Area of Testing	2010-07-20 Date (y-m-d)	胡俊 Name	 Signature
Test Lab Engineer	2010-07-20 Date (y-m-d)	黄渊球 Name	 Signature



Contents

1	SUMMARY	5
1.1	RESULTS SUMMARY	5
1.2	SUPPORTING STANDARDS.....	5
2	Product Description	6
2.1	PRODUCTION INFORMATION OF EUT	6
2.2	MODIFICATION INFORMATION	6
3	Test Site Description	7
3.1	TESTING PERIOD	7
4	Product Description	8
4.1	TECHNICAL CHARACTERISTICS.....	8
4.2	EUT IDENTIFICATION LIST.....	10
5	Main Test Instruments	11
6	Transmitter & Receiver Measurements	12
6.1	MAXIMUM CHANNEL POWER	13
6.2	MODULATION CHARACTERISTICS.....	16
6.3	OCCUPIED BANDWIDTH.....	18
6.4	BAND EDGES COMPLIANCE	20
6.5	SPURIOUS EMISSION AT ANTENNA TERMINAL	23
6.6	RADIATED SPURIOUS EMISSION	25
6.7	FREQUENCY STABILITY	29
7	System Measurement Uncertainty	33
8	Appendices	34



1 SUMMARY

1.1 Results Summary

The table below summarizes the measurements and results for the equipment of GSM Radio Frequency Unit - GRFU-1900. Detailed results and descriptions are shown in the following pages.

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

47 CFR FCC Part(s) Requirements		Description	Result
Specification	Limits		
2.1046	24.232	Transmitter Output Power	PASS
2.1047	---	Modulation Characteristics	PASS
2.1049	---	Occupied Bandwidth	PASS
2.1051	24.238	Band Edges Compliance	PASS
2.1051	24.238	Spurious Emission at Antenna Terminal	PASS
2.1053	24.238	Radiated Spurious Emission	PASS
2.1055	24.235	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
3GPP TS 51.021	3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Base Station System (BSS) equipment specification; Radio aspects



2 Product Description

2.1 Production Information of EUT

2.1.1 General Description

The GRFU-1900 is a new generation outdoor GSM distributed macro RF Unit Cabinet. Designed on the basis of industry-leading design where multiple products use uniform modules, it is small sized and easy to be installed. In addition, it has large capacity while low power consumption.

2.1.2 Support function and Service

The EUT supports the function and service as follows:

Table 3. Service and Test Mode List

Service Name	Characteristic	Corresponding Test Mode	Remark
Data and Voice	Modulation: GMSK	TM1	GSM/GPRS
Data	Modulation: 8PSK	TM2	EDGE

Note: The test conditions and settings are defined in 3GPP TS 51.021.

2.2 Modification Information

For original equipment, following table is not application.

Table 4. 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 (y-m-d): 2010-05-24

Date of End (y-m-d): 2010-07-20

4 Product Description

4.1 Technical Characteristics

4.1.1 Frequency Range

Table 5. Frequency Range for PCS Band

	FCC
Uplink band:	1850 to 1910 MHz
Downlink band:	1930 to 1990 MHz

Note: the EUT is designed to work under the range of FCC.

4.1.2 Channel Separation/Bandwidth

Table 6. Frequency Interval and Channel Separation

Channel raster:	200 kHz
Channel spacing/bandwidth:	200 kHz

4.1.3 Output Power

Table 7. Output Power

Transmitter Output Power (per Antenna Port):	1* 60 W (= 1*47.8 dBm); 2*40 W (= 2*46 dBm) 3*27W (=3*44.3 dBm) 4*20W (=4*43 dBm) 5*12 W (=5*40.8 dBm) 6*10W (=6*40 dBm)
--	---

4.1.4 Type of Emission

Refer to FCC part 2.201 and 2.202.

Table 8. Type of Emission

Emission Designation:	300KGXW (GMSK), 300KG7W (8PSK)
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4.1.5 Environmental Requirements

Table 9. Environmental Requirements

Minimum temperature:	-40 °C
Maximum temperature:	+55 °C
Relative Humidity:	15% to 75% RH

4.1.6 Power Source

Table 10. DC Power Source

DC voltage nominal:	=== -48 V
DC voltage range:	=== -38.4 V to === -57 V
DC current maximal:	70 A

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

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
GRFU	2	VER.E	V100R008C0 0	21023169761094000009 21023169761094000010	GSM Multiple Carriers Transceiver (1900MHz)

(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
GTMU	1	VER.E	V100R008C00	030Hnk4M9B073 224	GBTS Main Processing & Transmission Unit

4.2.2 FCC Identification

Grantee Code: QIS
 Product Code: GRFU-1900
 FCC Identification: QISGRFU-1900



5 Main Test Instruments

Table 13. Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until (y-m-d)
Receiver	R&S	ESU40	100144	2011-04-23
Pre-Amplifier	Agilent	8447D	2944A10146	2011-05-12
Loop Antenna	Schwarzbeck	FMZB1516	1516115	2011-05-12
BiLog Antenna	Schaffner	CBL 6112B	2747	2010-11-30
Horn Antenna	R&S	HF906 4044.4507.02	359287/005	2011-03-27
Dipole	Schwarzbeck	D69250- UHAP/D69250- VHAP	979/917	2010-12-03
Signal Generator	R&S	SMR 40	100325	2010-05-22
Signal Analyzer	R&S	FSQ 40	100025	2010-10-10
Signal Analyzer	Agilent	E4440A	MY49420179	2011-04-25
Climate Chamber	Weiss Umwelttech	WK11-800	592260277700 10	2010-09-27



6 Transmitter & Receiver Measurements

The EUT consists of one TRX port and one RX port, one TRX port can support up to six carriers. 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. The channel 512 and channel 810 aren't used for the RRU.

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)
PCS band	1	No.513 1930.4MHz	No.661 1960MHz	No .809 1989.6MHz
	2	No.513/516 1930.4MHz/1931MHz	No.661/664 1960MHz/1960.6MHz	No .806/809 1989MHz/1989.6MHz
	3	No.513/516 /519 1930.4MHz/1931MHz /1931.6MHz	No.658/661/664 1959.4MHz/1960MHz /1960.6MHz	No .803/806/809 1988.4MHz/1989MHz/ 1989.6MHz
	4	No.513/516 /519/522 1930.4MHz/1931MHz /1931.6MHz/1932.2M Hz	No.658/661/664/667 1959.4MHz/1960MHz /1960.6MHz/1961.2M Hz	No .800/803/806/809 1987.8MHz/1988.4M Hz/1989MHz/1989.6M Hz
	5	No.513/516 /519/522/525 1930.4MHz/1931MHz /1931.6MHz/1932.2M Hz/1932.8MHz	No.655/658/661/664/667/ 1958.8MHz/1959.4M Hz/1960MHz/1960.6 MHz/1961.2MHz	No .797/800/803/806/809 1987.2MHz/1987.8M Hz/1988.4MHz/1989M Hz/1989.6MHz
	6	No.513/516 /519/522/525/528 1930.4MHz/1931MHz /1931.6MHz/1932.2M Hz/1932.8MHz/1933.4 MHz	No.655/658/661/664/667/670 1958.8MHz/1959.4M Hz/1960MHz/1960.6 MHz/1961.2MHz/1961.8MHz	No .794/797/800/803/806/809 1986.8MHz/1987.2M Hz/1987.8MHz/1988.4 MHz/1989MHz/1989.6 MHz

6.1 Maximum Channel Power

6.1.1 Test Conditions

Table 15. Test Conditions

Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	68 %

6.1.2 Test Specifications and Limits

Compliance with FCC part 2.1046 and part 24.232, Base stations with an emission bandwidth of 1 MHz or less are limited to 1640 watts equivalent isotropically radiated power (EIRP); Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP).

In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Table 16. FCC Limits for PCS Band

Maximum EIRP:	< 1640 Watts (= 62 dBm) (for Emission bandwidth \leq 1MHz) < 1640 Watts/MHz (= 62 dBm/MHz) (for Emission bandwidth > 1MHz)
Peak-to-Average Ratio:	< 13 dB

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 and the Peak-to-Average Ratio/Crest Factor (if applicable) 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

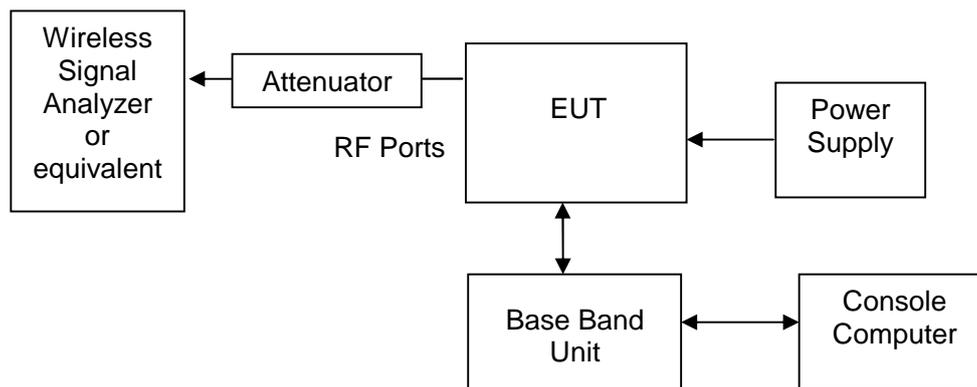


Figure 1. TEST SETUP

6.1.4 Measurement Results

6.1.4.1 Maximum Output Power at Antenna Port

(1) Multiple Carriers = 1

Table 17. Measurement Results for Maximum Output Power (Total)

Test Mode	Maximum Output Power (Total)			Limit (dBm)
	Ch. B (dBm)	Ch. M (dBm)	Ch. T (dBm)	
TM 1	47.4	47.80	47.29	< 62
TM 2	45.71	46.03	45.59	

(2) Multiple Carriers = 2

Table 18. Measurement Results for Maximum Output Power (Total)

Test Mode	Maximum Output Power (Total)			Limit (dBm)
	Ch. B (dBm)	Ch. M (dBm)	Ch. T (dBm)	
TM 1	45.58/45.62	46.00/46.62	45.47/45.56	< 62
TM 2	43.83/43.91	44.28/44.19	43.64/43.75	

(3) Multiple Carriers = 3

Table 19. Measurement Results for Maximum Output Power (Total)

Test Mode	Maximum Output Power (Total)			Limit (dBm)
	Ch. B (dBm)	Ch. M (dBm)	Ch. T (dBm)	
TM 1	43.98/44.02/44.05	43.98/44.05/44.08	43.70/43.75/43.82	< 62
TM 2	42.11/42.16/42.21	42.18/42.20/42.23	42.03/42.09/42.11	

(4) Multiple Carriers = 4

Table 20. Measurement Results for Maximum Output Power (Total)

Test Mode	Maximum Output Power (Total)			Limit (dBm)
	Ch. B (dBm)	Ch. M (dBm)	Ch. T (dBm)	
TM 1	42.53/42.85/42.96/42.79	42.88/42.91/42.81/42.86	42.55/42.61/42.52/42.59	< 62
TM 2	40.82/40.96/40.91/40.	41.22/41.26/41.18/41.	40.84/40.89/40.81/40.	



Test Mode	Maximum Output Power (Total)			Limit (dBm)
	Ch. B (dBm)	Ch. M (dBm)	Ch. T (dBm)	
	87	23	88	

(4) Multiple Carriers = 5

Table 21. Measurement Results for Maximum Output Power (Total)

Test Mode	Maximum Output Power (Total)			Limit (dBm)
	Ch. B (dBm)	Ch. M (dBm)	Ch. T (dBm)	
TM 1	40.25/40.36/40.41/40.39/40.51	40.71/40.76/40.81/40.80/40.75	40.30/40.45/40.61/40.52/40.49	< 62
TM 2	38.56/38.61/38.52/38.59/38.60	38.89/38.91/38.88/38.94/38.87	38.53/38.56/38.61/38.66/38.62	

(4) Multiple Carriers = 6

Table 22. Measurement Results for Maximum Output Power (Total)

Test Mode	Maximum Output Power (Total)			Limit (dBm)
	Ch. B (dBm)	Ch. M (dBm)	Ch. T (dBm)	
TM 1	39.47/39.84/39.86/35.79/35.91/35.84	39.84/39.86/39.91/39.81/39.79/39.92	39.56/39.62/39.51/39.68/35.66/35.61	< 62
TM 2	37.71/37.68/37.74/37.76/37.79/37.68	38.05/38.09/38.12/38.04/38.06/38.11	37.71/37.74/37.72/37.68/37.66/37.74	

6.1.4.2 Peak-to-Average Ratio

Table 23. Measurement Results for Peak-to-Average Ratio

Test Mode	Peak-to-Average Ratio (PAR), dB			Limit (dB)
	Ch. B	Ch. M	Ch. T	
TM1	--	0.3	--	< 13
TM2	--	3.36	--	< 13

6.1.5 Conclusion

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

6.2 Modulation Characteristics

6.2.1 Test Conditions

Table 24. Test Conditions

Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	68 %

6.2.2 Test Specifications and Limits

No specific modulation characteristics requirement limits in FCC part 2.1047 and part 24 subpart E for PCS Band.

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

Table 25. Limits According to EUT technical requirements

Limits for GSM equipments:	GMSK modulation:	RMS phase error	< 5°
		peak phase error	< 20°
	8PSK modulation:	RMS EVM error	< 8%
		peak EVM error	< 22%
		OOS	> 35 dB
		95th Percentile	< 11%

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

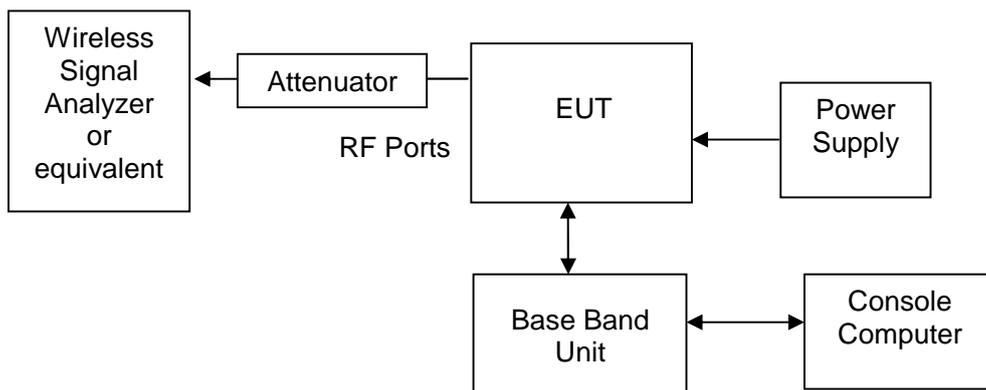


Figure 2. TEST SETUP

6.2.4 Measurement Results

(1) Channel Bandwidth = XXX MHz:

Table 26. Measurement Results for Modulation Characteristics

Test Mode	Modulation Characteristics			Limit
	Ch. M			
	Type/Mode	Parameters	Measured Value	
TM1	GMSK	RMS phase error	1.32°	< 5°
		peak phase error	4.58°	< 20°
TM2	8PSK	RMS EVM error	3.20%	< 8%
		peak EVM error	10.97%	< 22%
		OOS	42.55 dB	> 35 dB
		95th Percentile	5.88%	< 11%

6.2.5 Conclusion

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

6.3 Occupied Bandwidth

6.3.1 Test Conditions

Table 27. Test Conditions

Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	68 %

6.3.2 Test Specifications and Limits

No specific occupied bandwidth requirement in FCC part 2.1049 and part 24 subpart E for PCS 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

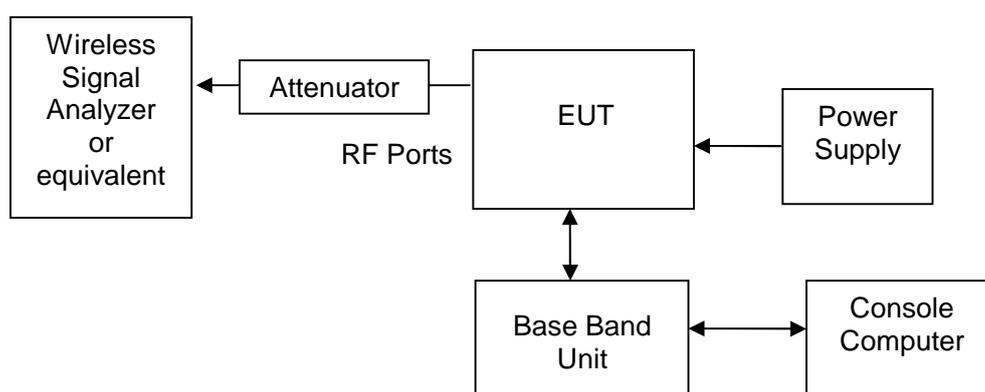


Figure 3. TEST SETUP



6.3.4 Measurement Results

Table 28. Measurement Results for Occupied Bandwidth

Test Mode	99% Occupied Bandwidth			Limit
	B	M	T	
	kHz	kHz	kHz	
TM1	250	246.79	246.79	---
TM2	243.59	243.59	246.79	

6.3.5 Conclusion

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

6.4 Band Edges Compliance

6.4.1 Test Conditions

Table 29. Test Conditions

Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	68 %

6.4.2 Test Specifications and Limits

6.4.2.1 Specification

FCC part 2.1051 and part 24.238

6.4.2.2 Supporting Standards

Table 30. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 51.021	3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Base Station System (BSS) equipment specification; Radio aspects

6.4.2.3 Limits

Compliance with FCC part 2.1051 and part 24.238, 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 31. FCC Limits for PCS Band

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

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

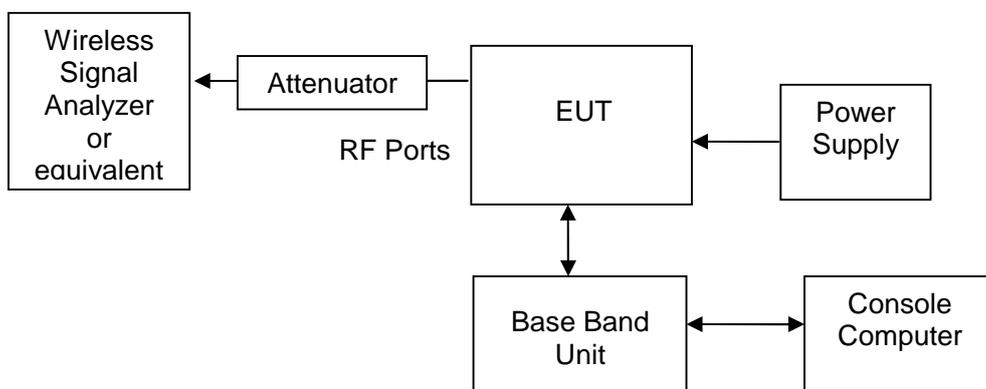


Figure 4. TEST SETUP

6.4.4 Measurement Results

Table 32. Measurement Results for Band Edge Characteristics – Single Carrier

Test Mode	Test Frequency Range (MHz)	Band Edge Emissions – Single Carrier		
		B	T	Limit (dBm)
		dBm	dBm	
TM 1	1929 – 1930	-30.62	/	< -13
	1990 – 1991	/	-30.75	< -13
TM 2	1929 – 1930	-28.22	/	< -13
	1990 – 1991	/	-31.32	< -13

Table 33. Measurement Results for Band Edge Characteristics – 2 Carriers

Test Mode	Test Frequency Range (MHz)	Band Edge Emissions – Single Carrier		
		B	T	Limit (dBm)
		dBm	dBm	
TM 1	1929 – 1930	-28.01	/	< -13
	1990 – 1991	/	-31.44	< -13
TM 2	1929 – 1930	-24.02	/	< -13
	1990 – 1991	/	-30.89	< -13

Table 34. Measurement Results for Band Edge Characteristics – 3 Carriers

Test Mode	Test Frequency Range (MHz)	Band Edge Emissions – Single Carrier		
		B	T	Limit (dBm)
		dBm	dBm	

Test Mode	Test Frequency Range (MHz)	Band Edge Emissions – Single Carrier		
		B	T	Limit (dBm)
		dBm	dBm	
TM 1	1929 – 1930	-25.77	/	< -13
	1990 – 1991	/	-20.70	< -13
TM 2	1929 – 1930	-17.96	/	< -13
	1990 – 1991	/	-24.91	< -13

Table 35. Measurement Results for Band Edge Characteristics – 4 Carriers

Test Mode	Test Frequency Range (MHz)	Band Edge Emissions – Single Carrier		
		B	T	Limit (dBm)
		dBm	dBm	
TM 1	1929 – 1930	-28.72	/	< -13
	1990 – 1991	/	-30.45	< -13
TM 2	1929 – 1930	-27.67	/	< -13
	1990 – 1991	/	-24.67	< -13

Table 36. Measurement Results for Band Edge Characteristics – 5 Carriers

Test Mode	Test Frequency Range (MHz)	Band Edge Emissions – Single Carrier		
		B	T	Limit (dBm)
		dBm	dBm	
TM 1	1929 – 1930	-33.02	/	< -13
	1990 – 1991	/	-34.47	< -13
TM 2	1929 – 1930	-29.42	/	< -13
	1990 – 1991	/	-32.42	< -13

Table 37. Measurement Results for Band Edge Characteristics – 6 Carriers

Test Mode	Test Frequency Range (MHz)	Band Edge Emissions – Single Carrier		
		B	T	Limit (dBm)
		dBm	dBm	
TM 1	1929 – 1930	-31.30	/	< -13
	1990 – 1991	/	-26.42	< -13
TM 2	1929 – 1930	-32.65	/	< -13
	1990 – 1991	/	-26.55	< -13

6.4.5 Conclusion

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

6.5 Spurious Emission at Antenna Terminal

6.5.1 Test Conditions

Table 38. Test Conditions

Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	68 %

6.5.2 Test Specifications and Limits

6.5.2.1 Specification

FCC part 2.1051 and part 24.238

6.5.2.2 Supporting Standards

Table 39. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 51.021	3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Base Station System (BSS) equipment specification; Radio aspects

6.5.2.3 Limits

Compliance with FCC part 2.1051 and part 24.238, 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 40. FCC Limits for PCS Band

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

The EUT was connected to the Spectrum Analyzer or equivalent via one RF connector, and other RF connectors were connected to match loads. The EUT was controlled to transmit maximum power by Console Computer. Measure and record the Out-band Spurious Emissions of the EUT by the Spectrum Analyzer or equivalent.

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

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

PCS 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:

GSM equipment:	Average
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Test setup

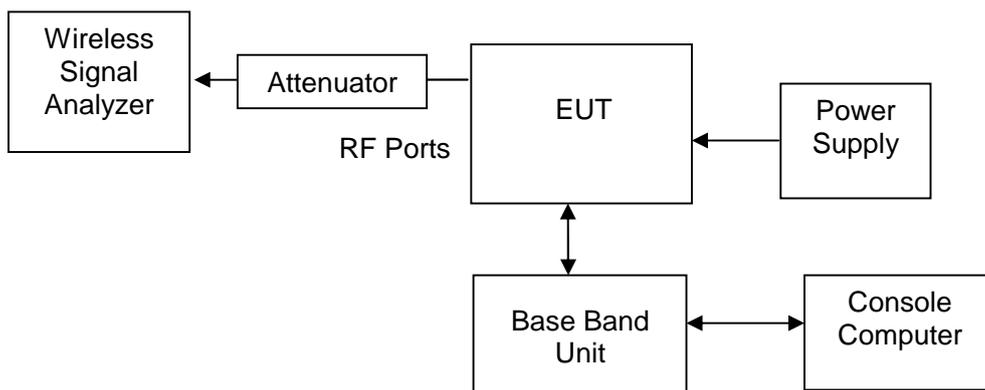


Figure 5. TEST SETUP

6.5.4 Measurement Results

For the test, we only test two worse cases: three carriers and six carriers.
 For the result refer to Appendix E.

6.5.5 Conclusion

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

6.6 Radiated Spurious Emission

6.6.1 Test Conditions

Table 41. Test Conditions

Measured at:	Enclosure
Ambient temperature:	25 °C
Relative humidity:	68 %

6.6.2 Test Specifications and Limits

6.6.2.1 Specification

FCC part 2.1053 and part 24.238

6.6.2.2 Supporting Standards

Table 42. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 51.021	3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Base Station System (BSS) equipment specification; Radio aspects

6.6.2.3 Limits

Compliance with FCC part 2.1053 and part 24.238, 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 43. FCC Limits for PCS 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

(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 30 MHz to 10th harmonic:

PCS Band:	1 MHz
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Test setup

Step 1: Pre-test

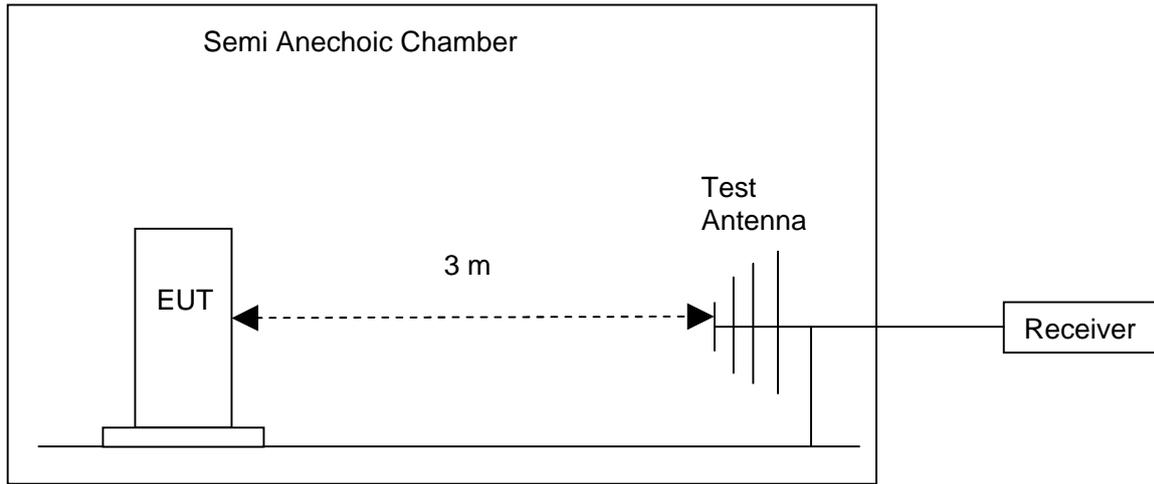


Figure 6. Test Set-up for Pre-test

Step 2: Substitution method to verify the maximum ERP

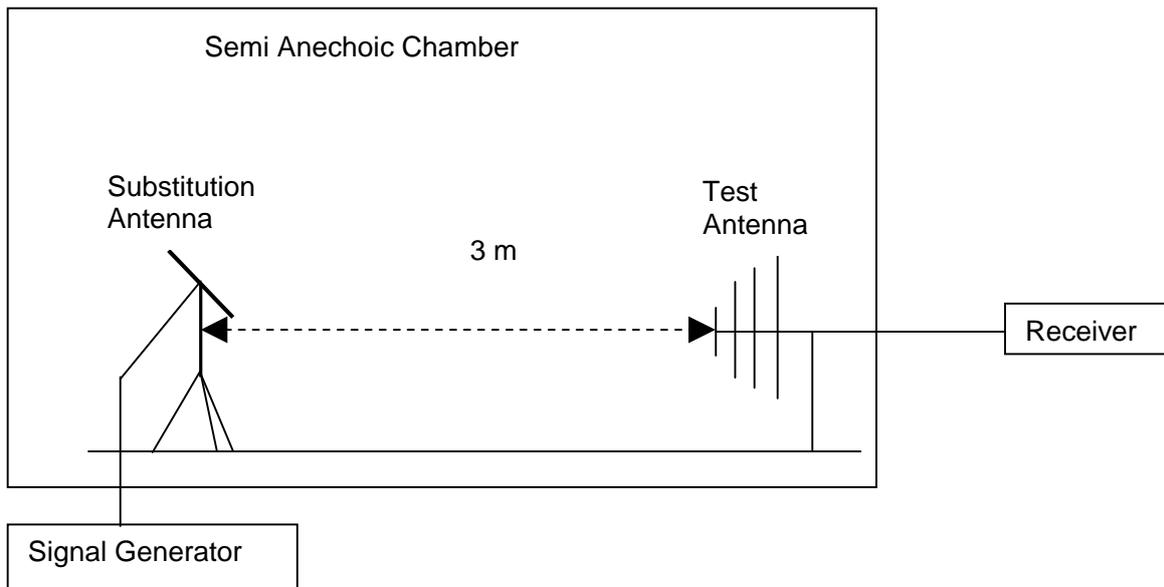


Figure 7. Test Set-up for Substitution

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

6.6.4 Measurement Results

Table 44. Measurement Results for Spurious Emissions

Test Mode	Test Frequency	Radiated Spurious Emissions		
			M	Limit



			No.661 1960MHz		
			dBm		
TM 1	30M – 20G		<13		< -13

6.6.5 Conclusion

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

6.7 Frequency Stability

6.7.1 Test Conditions

Table 45. Test Conditions

Measured at:	Antenna connector
Ambient temperature:	See Measurement Results
Relative humidity:	65 %
Power supply:	See Measurement Results

6.7.2 Test Specifications and Limits

6.7.2.1 Specification

FCC part 2.1055 and part 24.235

6.7.2.2 Supporting Standards

Table 46. Supporting Standards

ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS 51.021	3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Base Station System (BSS) equipment specification; Radio aspects

6.7.2.3 Limits

Compliance with FCC part 2.1055 and part 24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Table 47. FCC Limits for PCS 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 48. Limits According to EUT technical requirements for all operating bands

for GSM equipments:	< ±0.05 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 primary supply voltages:	-48 VDC (100% rated), -40.8 VDC (85% rated) and -55.2 VDC (115% rated).
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Test Set up

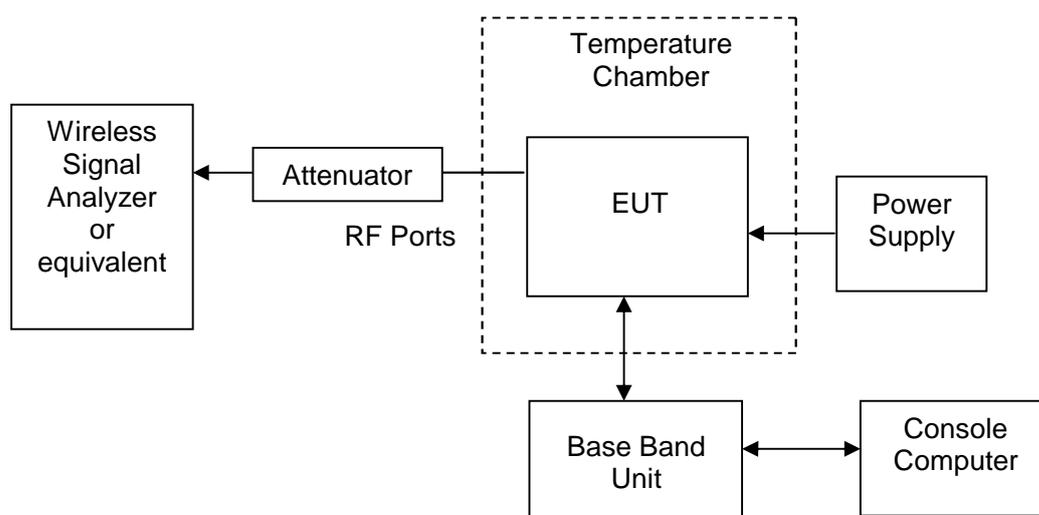


Figure 8. Test Set up

6.7.4 Measurement Results

6.7.4.1 Frequency Error vs. Temperature

Table 49. Measurement Results for Frequency Error vs. Temperature (TM1)

Measured Maximum Frequency Error				
Test Environment		No.661 1960 MHz		
Voltage	Temperature	Hz	ppm	Limit
			Refer to nominal frequency	
-48 VDC (100% rated / normal)	-30 °C	10.99	0.005	< ±0.05ppm
	-20 °C	9.69	0.005	
	-10 °C	25.38	0.013	
	0 °C	26.49	0.014	
	+10 °C	36.58	0.019	
	+20 °C	30.91	0.016	
	+30 °C	11.56	0.006	
	+40 °C	30.17	0.016	
	+50 °C	19.07	0.01	

Table 50. Measurement Results for Frequency Error vs. Temperature (TM2)

Measured Maximum Frequency Error				
Test Environment		No.661 1960 MHz		
Voltage	Temperature	Hz	ppm	Limit
			Refer to nominal frequency	
-48 VDC (100% rated / normal)	-30 °C	13.72	0.007	< ±0.05ppm
	-20 °C	13.51	0.007	
	-10 °C	24.47	0.013	
	0 °C	27.08	0.014	
	+10 °C	25.62	0.013	
	+20 °C	24.34	0.013	
	+30 °C	28.52	0.015	
	+40 °C	18.29	0.009	
	+50 °C	27.21	0.014	

6.7.4.2 Frequency Error vs. Voltage

Table 51. Measurement Results for Frequency Error vs. Voltage (TM1)



Measured Maximum Frequency Error				
Test Environment		M		
		No.661 1960 MHz		
Voltage	Temperature	Hz	ppm	Limit
			Refer to operating frequency	
-40.8 VDC (85% rated / lowest)	+20 °C	17.74	0.009	< ±0.05ppm
-55.2 VDC (115% rated / highest)	+20 °C	15.96	0.008	

Table 52. Measurement Results for Frequency Error vs. Voltage (TM2)

Measured Maximum Frequency Error				
Test Environment		M		
		No.661 1960 MHz		
Voltage	Temperature	Hz	ppm	Limit
			Refer to operating frequency	
-40.8 VDC (85% rated / lowest)	+20 °C	18.76	0.01	< ±0.05ppm
-55.2 VDC (115% rated / highest)	+20 °C	17.24	0.009	

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 53. 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	4 Pages
Appendix B	Measurement Results Modulation Characteristics	4 Pages
Appendix C	Measurement Results Occupied Bandwidth	6 Pages
Appendix D	Measurement Results Band Edges	26 Pages
Appendix E	Measurement Results Spurious Emission at Antenna Terminal	10 Pages
Appendix F	Measurement Results Radiated Spurious Emission	5 Pages
Appendix G	Photos of Test Setup	2 Pages

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