FCC Test Report

Product Name: CDMA Radio Frequency Unit

Model Number: CRFU-1900AG

Report No: SYBH(R)010032011EB-1
FCC ID: QISCRFU-1900AG

Reliability Laboratory of Huawei Technologies Co., Ltd.

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REPORT ON	FCC Test of radio frequency unit Model Name: CRFU-1900AG Report No: SYBH(R) 010032011EB-1
REGULATION	**47 CFR FCC Part 2, Subpart J** **47 CFR FCC Part 24, Subpart E**
CONCLUSION	**PASSED**

General Manager	**2011-04-15**	**Zhang Xinghai**	Zhang Xing Hai
	Date (y-m-d)	Name	Signature
Technical Responsibility For Area of Testing	**2011-04-15**	**Hu Jun**	Hu Jun
	Date (y-m-d)	Name	Signature
Test Lab Engineer	**2011-04-15**	**Liang Changguan**	Liang Changguan
	Date (y-m-d)	Name	Signature

Contents

1 Summary

The table below summarizes the measurements and results for the equipment of CDMA Radio Frequency Unit –CRFU. Detailed results and descriptions are shown in the following pages.

table 1. Summary of results for FCC requirements for US PCS Band

47 CFR FCC Part(s) Requirements		Description	Result
Specification	Limits		
2.1046	24.232	Maximum Channel 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

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

2 Product Description

2.1 Production Information of the Equipment under Test (EUT)

2.1.1 General Description

CRFU is used for up-conversion and down-conversion of signals and for power amplification.
The CRFU performs the following functions:

On the forward link, implementing up-conversion and power amplification for modulated transmitted signals and filtering the transmitted signals to make them meet the requirements of the air interface protocol.

On the reverse link, filtering the signals received by the antenna to suppress out-band interference and then performing low noise amplification, down-conversion, and channel-selective filtering.

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(Note)
CDMA2000 1x	Modulation: BPSK,QPSK RC1&RC3	TM1	
1x EV-DO	Modulation: 16QAM	TM2	

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: 25. Mar.2011
Date of End: 14. Apr.2011

3.2 Applied Standards

table 4. Applied Standard

Standards Name	Standards Description
47 CFR Part 2(10-1-09 Edition)	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
47 CFR Part 24 (10-1-09 Edition)	Personal Communications Services

table 5. Test Method

Standards Name	Standards Description
EIA/TIA-102-CAAA:1999	Digital C4FM/CQPSK Transceiver Measurement Methods (ANSI/TIA/EIA-102.CAAA-1999)
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
3GPP2 C.S0010-B	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Base Stations. Release B
3GPP2 C.S0032-0	Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access Network
3GPP2 C.S0057-B	Band Class Specification for cdma2000 Spread Spectrum Systems

4 Product Description

4.1 Technical Characteristics

4.1.1 Frequency Range

table 6. Frequency Range for US PCS Band

☒ FDD ☐ TDD	Center Frequency Range	Frequency Block Range
Uplink band:	Uplink band (RX):	1850 to 1915 MHz
Downlink band:	Downlink band (TX):	1930 to 1995 MHz

4.1.2 Channel Separation/Bandwidth

table 7. Frequency Interval and Channel Separation for US PCS Band

Frequency interval:	50 kHz
Channel separation/bandwidth:	1.25MHz

4.1.3 Type of Emission

Refer to FCC part 2.201 and 2.202..

table 8. Type of Emission

Emission Designation:	1M25F9W

4.1.4 Environmental Requirements

table 9. Environmental Requirements

Minimum temperature:	-40 °C
Maximum temperature:	+52 °C
Relative Humidity:	5% to 100% RH

table 10. Power Source DC Power Source

DC voltage nominal:	⎓ -48 V
DC voltage range:	⎓ -36 V to ⎓ -57 V
DC current maximal:	8 A

4.1.5 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 11. Component Parts Information

Model Name	Qty.	H/W Ver.	S/W Ver.	Description	Serial Number
CRFU	1	VER.C	V400R007	CDMA Radio Frequency Unit	2102231817110B2000011
CMPT	1	VER.C	V400R007	Control Main Processing transmitter	020GKV107C000246
HCPM	1	VER.B	V400R007	1X Channel Processing Module	020NFM1095000084
HECM	1	VER.R	V400R007	EVDO Channel Processing Module	020GBA1082000187

4.2.2 Adapter Technical Data

Not Applicable

4.2.3 Battery Technical Data

Not Applicable

4.2.4 FCC Identification

Grantee Code: **QIS**
Product Code: **CRFU-1900AG**
FCC Identification: **QIS CRFU-1900AG**

5 Main Test Instruments

table 12. Main Test Equipments

Description	Manufacturer	Model	S/N	Cal. Due
Signal Analyzer	R&S	FSQ40	100025	2011-10-12
Signal Analyzer	Agilent	E4440A	MY49420179	2011-04-25
Signal Generator	R&S	SMR 40	100325	2011-05-12
Receiver	R&S	ESU40	100144	2011-05-04
BiLog Antenna	Schaffner	CBL6112B	2747	2011-12-10
Horn Antenna	R&S	FH906	100683	2011-05-14
Climate Chamber	Weiss	WK1-1000	59226002300010	2011-10-11

6 Transmitter Measurements

For tests in this section, 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. Unless otherwise stated, all tested frequency points were employed to perform tests.

table 13. Frequency points (channels) selected to perform tests

Operating Band	Multi-Carriers	Channels No.		
		Channel B	Channel M	Channel T
US PCS band:	1	No.25 1931.25MHz	No.650 1962.5MHz	No 1275 1993.75MHz
US PCS band:	2	No.25/50 1931.25/1932.5MHz	No.625/650 1961.25/1962.5MHz	No .1275/1250 1993.75/1992.5MHz
US PCS band:	3	No.25/50/75 1931.25/1932.5/ 1933.75MHz	No.625/650/675 1961.25/1962.5/ 1963.75MHz	No 1275/1250/1225 1993.75/1992.5/ 1991.25MHz
US PCS band:	4	No.25/50/75/100 1931.25/1932.5/ 1933.75/1935MHz	No.600/625/650/675 1960/1961.25/ 1962.5/1963.75MHz	No.1275/1250/ 1225/1200 1993.75/1992.5/ 1991.25/1990MHz

6.1 Maximum Channel Power

6.1.1 Test Conditions

table 14. Test Conditions

Preconditioning:	2 hour
Measured at:	Antenna connector
Ambient temperature (+15 °C to +35 °C):	20~25°C
Relative humidity (45 % to 85 %):	48~72%
Air Pressure (86 kPa to 106 kPa):	101 kPa
Test Configuration/Mode:	US PCS Band: B, M, T Multi Carriers: 1, 2, 3, 4, TM1, TM2

6.1.2 Test Specifications and Limits

Compliance with FCC part 2.1046 and part 24.232, Base stations are limited to 1640 watts peak equivalent isotropically radiated power (EIRP);

table 15. FCC Limits for US PCS Band

Maximum EIRP:	< 1640 Watts (= 62 dBm)

However, According to 3GPP2 C.S0010-B and C.S0032-0, Base station total power is the mean power delivered to a load with resistance equal to the nominal load impedance of the transmitter. In fact, the RMS detector' value is the manufacturer's rated power for the CDMA2000 equipment.

6.1.3 Test Method and Setup

The EUT (CDMA Radio Frequency Unit，CRFU) was connected to the Wireless Signal Analyzer or equivalent Agilent E4440A 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 Agilent E4440A.

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.

Before the test, (1) For CDMA2000 1X system, set the EUT/BTS to transmit a signal modulated with a combination of Pilot, Sync, Paging, and 6 traffic channels; (2) For CDMA2000 1X EV-DO system, configure the MAC channel with 14 MAC indices, i.e. the RA channel and 13 RPC channels.

Test setup

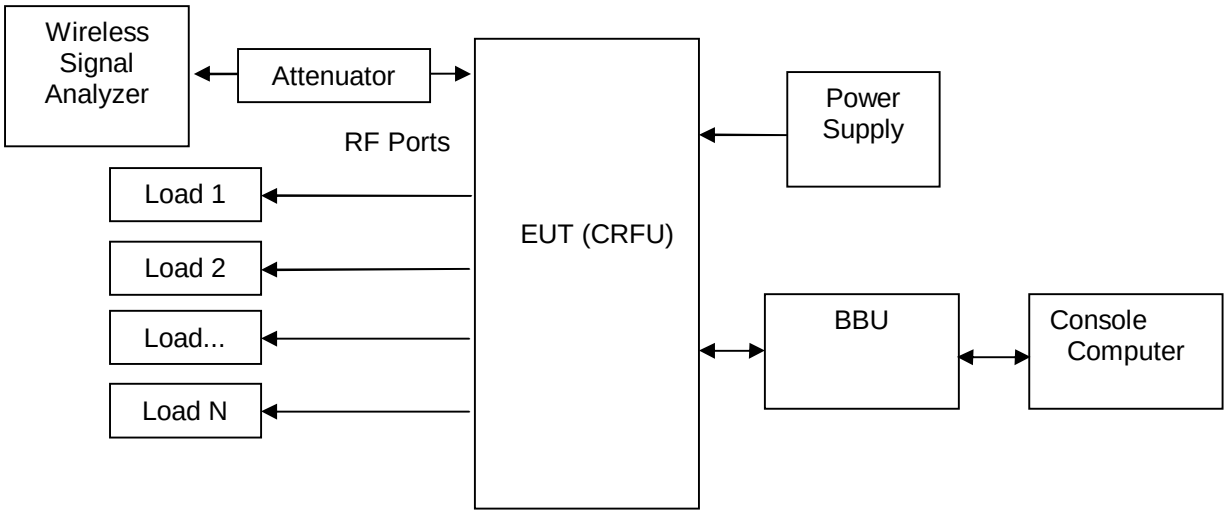

Figure 1. TEST SETUP

6.1.4 Measurement Results

6.1.4.1 Output Power

(1) TM1: CDMA2000 1X

(a) Single Carrier

table 16. Measurement Output Power for single carrier

Maximum Output Power (dBm)					
Channel B		**Channel M**		**Channel T**	
Measured	**Limit**	**Measured**	**Limit**	**Measured**	**Limit**
42.88	<62	42.75	<62	42.82	<62

(b)Two Carriers

table 17. Measurement Output Power for two carriers

Maximum Output Power (dBm)					
Channel B		**Channel M**		**Channel T**	
Measured	**Limit**	**Measured**	**Limit**	**Measured**	**Limit**
45.63	<62	45.74	<62	45.40	<62

(c) Three Carriers

table 18. Measurement Output Power for three carriers

Maximum Output Power (dBm)					
Channel B		**Channel M**		**Channel T**	
Measured	**Limit**	**Measured**	**Limit**	**Measured**	**Limit**
47.41	<62	47.38	<62	47.17	<62

(d) Four Carriers

table 19. Measurement Output Power for four carriers

Maximum Output Power (dBm)					
Channel B		Channel M		Channel T	
Measured	Limit	Measured	Limit	Measured	Limit
48.64	<62	48.47	<62	48.61	<62

(2) TM2: CDMA2000 1X EV-DO

(a) Single Carrier

table 20. Measurement Output Power for single carrier

Maximum Output Power (dBm)					
Channel B		Channel M		Channel T	
Measured	Limit	Measured	Limit	Measured	Limit
42.68	<62	42.83	<62	42.91	<62

(b) Two Carriers

table 21. Measurement Output Power for two carriers

Maximum Output Power (dBm)					
Channel B		Channel M		Channel T	
Measured	Limit	Measured	Limit	Measured	Limit
45.64	<62	45.68	<62	45.63	<62

(c) Three Carriers

table 22. Measurement Output Power for three carriers

Maximum Output Power (dBm)					
Channel B		Channel M		Channel T	
Measured	Limit	Measured	Limit	Measured	Limit
47.38	<62	47.31	<62	47.28	<62

(d) Four Carriers

table 23. Measurement Output Power for four carriers

Maximum Output Power (dBm)					
Channel B		Channel M		Channel T	
Measured	Limit	Measured	Limit	Measured	Limit
48.71	<62	48.79	<62	48.64	<62

6.1.4.2 Peak-to-Average Ratio

table 24. Measurement Results for Peak-to-Average Ratio

Test Mode	Peak-to-Average Ratio (PAR), dB			Limit (dB)
	Ch. B	Ch. M	Ch. T	
1X	7.13	7.22	7.36	< 13
EVDO	6.47	7.97	7.96	< 13

6.1.4.3 Peak EIRP

Peak EIRP= Output Power + Peak-to-Average Ratio

6.1.5 Conclusion

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

6.2 Modulation Characteristics

6.2.1 Test Conditions

table 25. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature (+15 °C to +35 °C):	20~25°C
Relative humidity (45 % to 85 %):	48~72%
Air Pressure (86 kPa to 106 kPa):	101 kPa
Test Configuration/Mode:	US PCS Band: B, M, T Multi Carriers: 1 TM1, TM2

6.2.2 Test Specifications and Limits

No specific modulation characteristics requirement limits in FCC part 2.1047 and 47 CFR FCC Part 24, Subpart E for US PCS Band. In addition, limits according to the technical requirements of the EUT can be adopted as showed in the following table.

table 26. Limits According to 3GPP2 C.S0010-B and C.S0032-0

Limits	Rho > 0.912 (for CDMA2000 1X) Rho > 0.97 (for CDMA2000 1X EV-DO)

6.2.3 Test Method and Setup

The EUT (CDMA Radio Frequency Unit，CRFU) was connected to the Wireless Signal Analyzer or equivalent R&S FSQ40 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 R&S FSQ40.

For the CDMA2000 1X, the measurement was made based on two Radio Configurations: RC1 and RC3. The modulation mode of RC1 is BPSK, and the modulation mode of RC3 is QPSK. For the CDMA2000 1X EV-DO, the modulation mode is 16-QAM.

Test setup

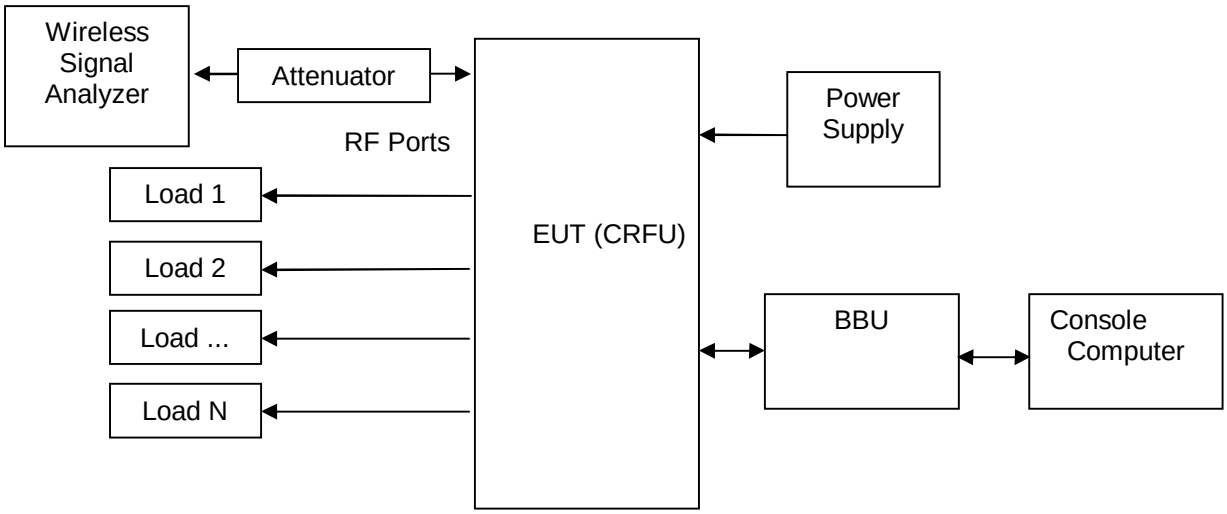

Figure 2. TEST SETUP

6.2.4 Measurement Results

(1) TM1: CDMA2000 1X

(a) RC1

table 27. Measurement Results for RC1

Modulation Characteristics				
Parameters Observed (Type/Mode)	**channel**	**Measured**	**Limit**	**Remark**
Rho(BPSK)	25	0.982	>0.912	See Appendix B
	650	0.982	>0.912	See Appendix B
	1275	0.976	>0.912	See Appendix B

(b) RC3

table 28. Measurement Results for RC3

Parameters Observed (Type/Mode)	**channel**	**Measured**	**Limit**	**Remark**
Rho(QPSK)	25	0.990	>0.912	See Appendix B
	650	0.990	>0.912	See Appendix B
	1275	0.993	>0.912	See Appendix B

(2) TM2: CDMA2000 1X EVDO

table 29. Measurement Results for 1X EVDO

Modulation Characteristics				
Parameters Observed (Type/Mode)	**channel**	**Measured**	**Limit**	**Remark**
Rho(16-QAM)	25	0.991	>0.97	See Appendix B

	650	0.990	>0.97	See Appendix B
	1275	0.990	>0.97	See Appendix B

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 30. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature (+15 °C to +35 °C):	20~25°C
Relative humidity (45 % to 75 %):	48~72%
Air Pressure (86 kPa to 106 kPa):	101 kPa
Test Configuration/Mode:	US PCS Band: B, M, T Multi Carriers: 1 TM1, TM2,

6.3.2 Test Specifications and Limits

No specific occupied bandwidth requirement in FCC part 2.1049 and part 24 subpart E for US PCS Band. Limits according to the technical requirements of the EUT can be adopted as showed in the following table.

table 31. Limits According to EUT technical requirements

Limits	< 1.48MHz

6.3.3 Test Method and Setup

The EUT (CDMA Radio Frequency Unit，CRFU) was connected to the Spectrum Analyzer or equivalent R&S FSQ40 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 R&S FSQ40.

Refer to 47CFR part2.1049 section (g) & (h).
(g) Transmitter in which the modulating base band comprises not more than three independent channels - when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer's maximum rated condition.
(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudorandom generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at discretion of the user.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured (as 99% bandwidth).

Measurement bandwidth (RBW) of Spectrum Analyzer or equivalent:
for CDMA equipments 30 kHz (close to 1% of 1.25 MHz)

Test setup

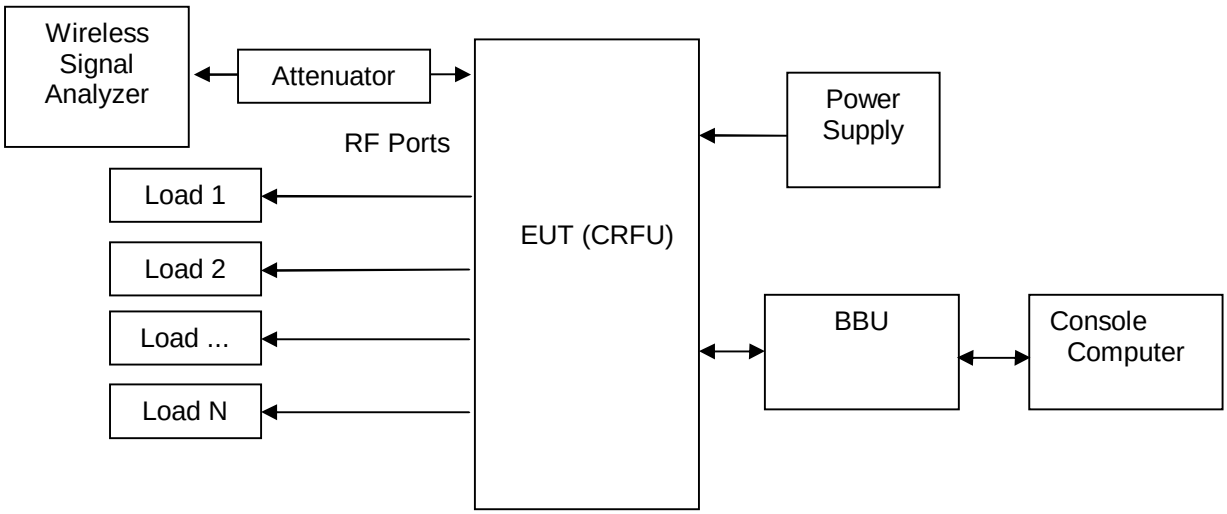

Figure 3. TEST SETUP

6.3.4 Measurement Results

(1) TM1: CDMA2000 1X

table 32. Measurement Results for CDMA2000 1X

Occupied Bandwidth (99% Bandwidth)					
Channel B		Channel M		Channel T	
Measured	Limit	Measured	Limit	Measured	Limit
1.238	< 1.48	1.238	<1.48	1.233	< 1.48

(2) TM2: CDMA2000 1X EVDO

table 33. Measurement Results for CDMA2000 1X EVDO

Occupied Bandwidth (99% Bandwidth)					
Channel B		Channel M		Channel T	
Measured	Limit	Measured	Limit	Measured	Limit
1.232	< 1.48	1.238	<1.48	1.239	< 1.48

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 34. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature (+15 °C to +35 °C):	20~25°C
Relative humidity (45 % to 85 %):	48~72%
Air Pressure (86 kPa to 106 kPa):	101 kPa
Test Configuration/Mode:	US PCS Band: B, T Multi Carriers: 1, 4 TM1, TM2

6.4.2 Test Specifications and 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 35. FCC Limits for US PCS Band

Limit:	< P[Watt]+(43+10log$_{10}$P)=10log$_{10}$(1000P)-(43+10log$_{10}$P)=30-43=-13dBm

6.4.3 Test Method and Setup

The EUT (CDMA Radio Frequency Unit，CRFU) was connected to the Spectrum Analyzer or equivalent Agilent E4440A 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 Agilent E4440A

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 ±250% of the emission bandwidth or 2 MHz, which is larger.

Measurement bandwidth (RBW) of Spectrum Analyzer or equivalent:
for CDMA equipments 20 kHz (close to 1% of 1.25 MHz)

Test setup

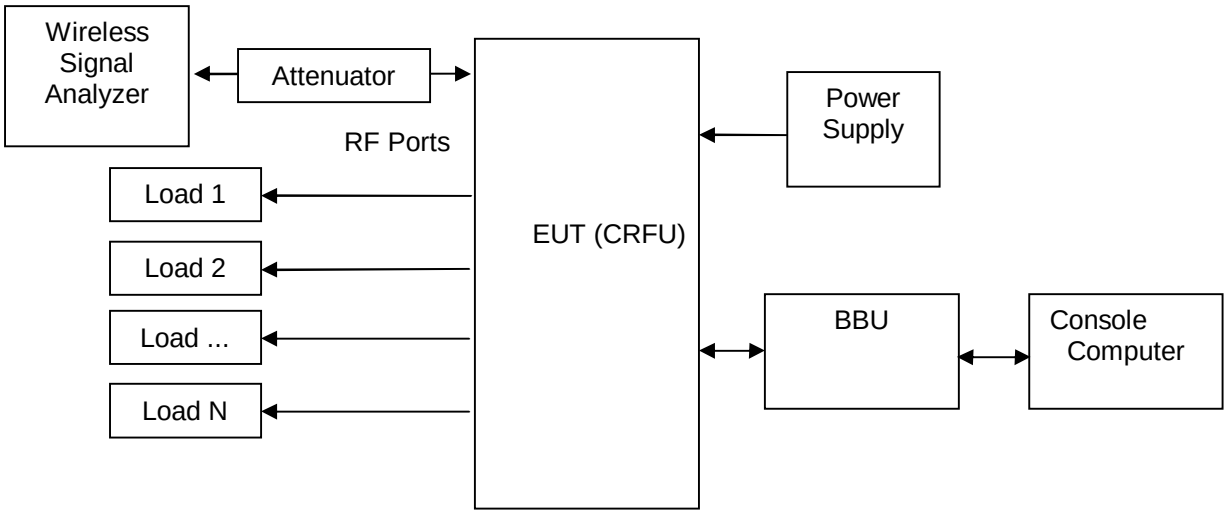

Figure 4. TEST SETUP

6.4.4 Measurement Results

(1) TM1: CDMA2000 1X

(a) Single Carrier

table 36. Measurement Results for 1X

Channel No./Operating Frequency		Multi-Carriers	Measured Frequency Range (MHz)	Max. Spurious Level Measured (dBm)	Limit (dBm)	Remark
B	No.25 1931.25MHz	1	1929 to 1930	-30.95	< -13	See Appendix C
T	No 1275 1993.75MHz	1	1995 to 1996	-30.08	< -13	See Appendix C

(b) Multi Carriers

table 37. Measurement Results for 1X

Channel No./Operating Frequency		Multi-Carriers	Measured Frequency Range (MHz)	Max. Spurious Level Measured (dBm)	Limit (dBm)	Remark
B	No.25/50/75/100 1931.25/1932.5/ 1933.75/1935MHz	4	1929 to 1930	-23.08	< -13	See Appendix C
T	No.1275/1250/1225/1200 1993.75/1992.5/ 1991.25/1990MHz	4	1995 to 1996	-29.93	< -13	See Appendix C

(2) CDMA2000 1X EV-DO
a) Single Carrier

table 38. Measurement Results for 1X EVDO

Channel No./Operating Frequency		Multi-Carriers	Measured Frequency Range (MHz)	Max. Spurious Level Measured (dBm)	Limit (dBm)	Remark
B	No.25 1931.25MHz	1	1929 to 1930	-19.15	< -13	See Appendix C
T	No 1275 1993.75MHz	1	1995 to 1996	-23.49	< -13	See Appendix C

(b) Multi Carriers

table 39. Measurement Results for 1X EVDO

Channel No./Operating Frequency		Multi-Carriers	Measured Frequency Range (MHz)	Max. Spurious Level Measured (dBm)	Limit (dBm)	Remark
B	No.25/50/75/100 1931.25/1932.5/ 1933.75/1935MHz	4	1929 to 1930	-25.55	< -13	See Appendix C
T	No.1275/1250/1225/1200 1993.75/1992.5/ 1991.25/1990MHz	4	1995 to 1996	-29.46	< -13	See Appendix C

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 40. Test Conditions

Preconditioning:	1 hour
Measured at:	Antenna connector
Ambient temperature (+15 °C to +35 °C):	20~25°C
Relative humidity (45 % to 85 %):	48~72%
Air Pressure (86 kPa to 106 kPa):	101 kPa
Test Configuration/Mode:	US PCS Band: B, M, T Multi Carriers: 1, 4 TM1, TM2

6.5.2 Test Specifications and 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 41. FCC Limits for US PCS Band

Limit:	< P[Watt]-(43+10log$_{10}$P)=10log$_{10}$(1000P)-(43+10log$_{10}$P)=30-43=-13dBm (per MHz)

6.5.3 Test Method and Setup

The EUT (CDMA Radio Frequency Unit，CRFU) was connected to the Spectrum Analyzer or equivalent Agilent E4440A 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 Agilent E4440A.

For the Out-of-block Emissions:

Frequency Search Range:

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) for 9 kHz to 10th harmonic included: 1MHz;

Alternatively, according to ITU SM.329-10,
Measurement bandwidth (RBW) for 9 kHz up to 150 KHz: 1 kHz;
Measurement bandwidth (RBW) for 150 kHz up to 30 MHz: 10 kHz;
Measurement bandwidth (RBW) for 30 MHz up to 20 GHz: 1MHz;

Test setup

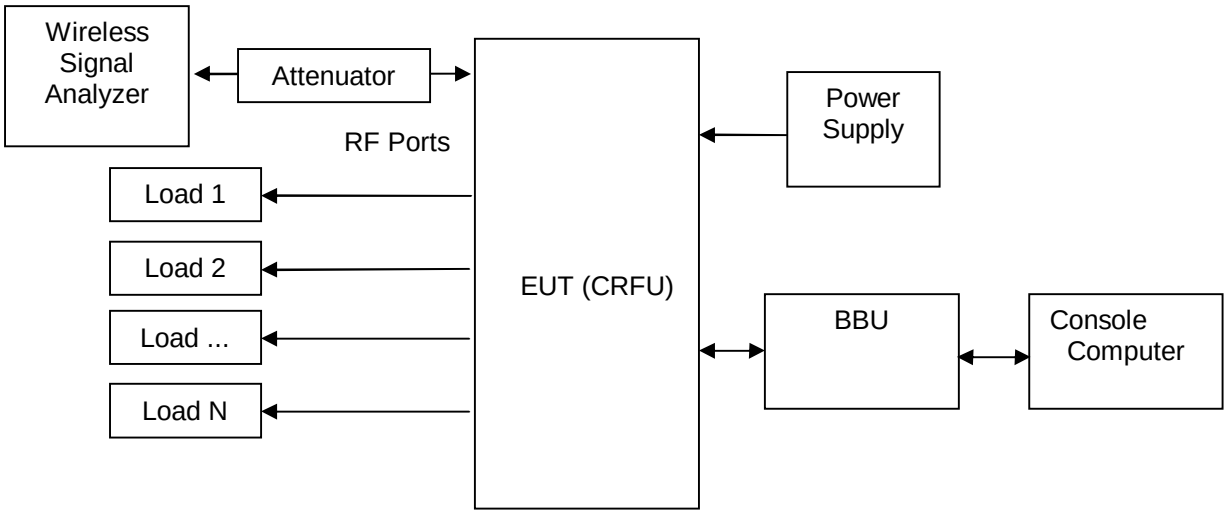

Figure 5. TEST SETUP

6.5.4 Measurement Results

6.5.4.1 Out-of-block Emissions Measurement

(1) CDMA2000 1X

Single Carrier

table 42. Measurement Results for CDMA2000 1X

Channel No./Operating Frequency		Multi-Carriers	Measured Frequency Range	Max. Spurious Level Measured (dBm)	Limit (dBm)	Remark
B	No.25 1931.25MHz	1	9 kHz to 20 GHz	-24.5	< -13	See Appendix D
M	No.650 1962.5MHz	1	9 kHz to 20 GHz	-20.53	< -13	See Appendix D
T	No 1275 1993.75MHz	1	9 kHz to 20 GHz	-24.87	< -13	See Appendix D

(b) Multi Carriers

table 43. Measurement Results for CDMA2000 1X

Channel No./Operating Frequency		Multi-Carriers	Measured Frequency Range (MHz)	Max. Spurious Level Measured (dBm)	Limit (dBm)	Remark
B	No.25/50/75/100 1931.25/1932.5/ 1933.75/1935MHz	4	9 kHz to 20 GHz	-23.44	< -13	See Appendix D

M	No.600/625/650/675 1960/1961.25/ 1962.5/1963.75MHz	4	9 kHz to 20 GHz	-23.67	< -13	See Appendix D
T	No.1275/1250/1225/1200 1993.75/1992.5/ 1991.25/1990MHz	4	9 kHz to 20 GHz	-24.39	< -13	See Appendix D

(2) CDMA2000 1X EV-DO

(a) Single Carrier

table 44. Measurement Results for CDMA2000 1X EVDO

Channel No./Operating Frequency		Multi-Carriers	Measured Frequency Range	Max. Spurious Level Measured (dBm)	Limit (dBm)	Remark
B	No.25 1931.25MHz	1	9 kHz to 20 GHz	-27.82	< -13	See Appendix D
M	No.650 1962.5MHz	1	9 kHz to 20 GHz	-27.81	< -13	See Appendix D
T	No 1275 1993.75MHz	1	9 kHz to 20 GHz	-23.40	< -13	See Appendix D

(b) Multi Carriers

table 45. Measurement Results for CDMA2000 1X EVDO

Channel No./Operating Frequency		Multi-Carriers	Measured Frequency Range (MHz)	Max. Spurious Level Measured (dBm)	Limit (dBm)	Remark
B	No.25/50/75/100 1931.25/1932.5/ 1933.75/1935MHz	4	9 kHz to 20 GHz	-23.83	< -13	See Appendix D
M	No.600/625/650/675 1960/1961.25/ 1962.5/1963.75MHz	4	9 kHz to 20 GHz	-24.52	< -13	See Appendix D
T	No.1275/1250/1225/1200 1993.75/1992.5/ 1991.25/1990MHz	4	9 kHz to 20 GHz	-24.63	< -13	See Appendix D

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 46. Test Conditions

Preconditioning:	2 hour
Measured at:	Enclosure
Ambient temperature (+15 °C to +35 °C):	20~25°C
Relative humidity (45 % to 85 %):	48~72%
Air Pressure (86 kPa to 106 kPa):	101 kPa
Test Configuration/Mode:	US PCS Band: M Multi Carriers: 1 TM1

6.6.2 Test Specifications and 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 47. FCC Limits for US PCS Band

Limit:	< P[Watt]-(43+10log$_{10}$P)=10log$_{10}$(1000P)-(43+10log$_{10}$P)=30-43=-13dBm (per MHz)

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 (CDMA Radio Frequency Unit，CRFU) was equipped with non-integral antenna. And it should

test according to part (b) of above section. 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 specified in FCC part 2.1033(c)(8). The EUT/CRFU 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 R&S ESMI 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 R&S ESMI, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.

Frequency Search Range:

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) for 9 kHz to 10^{th} harmonic included: 1MHz;

Alternatively, according to ITU SM.329-10,
Measurement bandwidth (RBW) for 9 kHz up to 150 KHz: 1 kHz;
Measurement bandwidth (RBW) for 150 kHz up to 30 MHz: 10 kHz;
Measurement bandwidth (RBW) for 30 MHz up to 18 GHz: 1MHz;

Test setup

Step 1: Pre-test

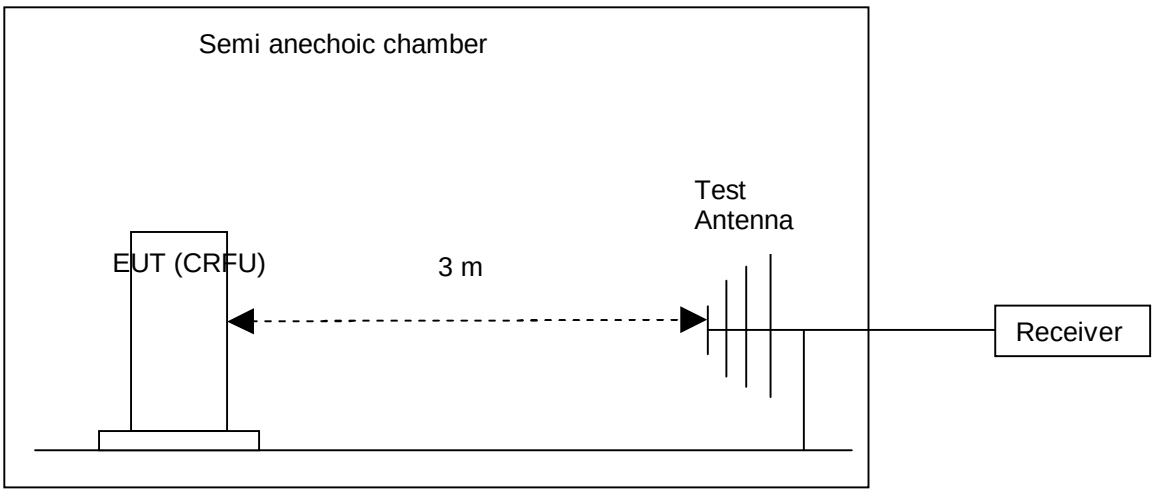

Figure 6. Test Set-up for Pre-test

Step 2: Substitution method to verify the maximum ERP

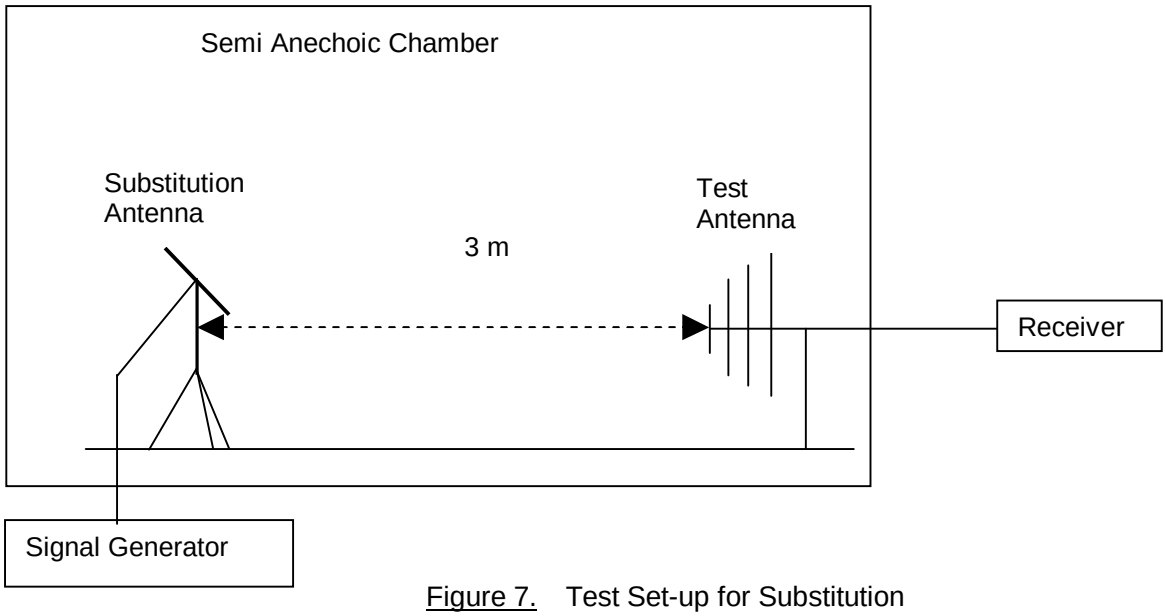

Figure 7. Test Set-up for Substitution

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 48. Measurement Result

Channel Number	Test Range (Frequency)	Power [dBm]	Spurious Level measured [dBm]	FCC limit	Result
Channel650 1962.5MHz	30MHz ~18GHz	43	<- 13 dBm (See appendix E)	- 13 dBm	Pass

6.6.4.2 Substitution Results

table 49. 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,

ERP [dBm] = SGP [dBm] – Cable Loss [dB] + Gain [dBd]

NOTE: SGP- Signal Generator Level

6.6.5 Conclusion

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

6.7 Frequency Stability

6.7.1 Test Conditions

table 50. Test Conditions

Preconditioning:	3 hour
Measured at:	Antenna connector
Ambient temperature:	See below
Relative humidity (45 % to 85 %):	48~69%
Air Pressure (86 kPa to 106 kPa):	101 kPa
Test Configuration/Mode:	US PCS band at Channel M Multi Carriers: 1 under TM1, TM2,

6.7.2 Test Specifications and Limit

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 51. FCC Limits for US PCS Band

Limit:	(not defended)

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

table 52. Limits According to EUT technical requirements

Limits for CDMA2000 equipments: (acc. to 3GPP2 C.S0010, C.S0032)	< ±0.05 ppm

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

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 operating end points are: -48 VDC (normal point), -36 VDC (lowest point) and -57 VDC (highest point).

Test Set up

The EUT (CDMA Radio Frequency Unit，CRFU) was connected to the Spectrum Analyzer or equivalent R&S FSQ40 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 R&S FSQ40.

The EUT was placed inside an environmental temperature chamber.

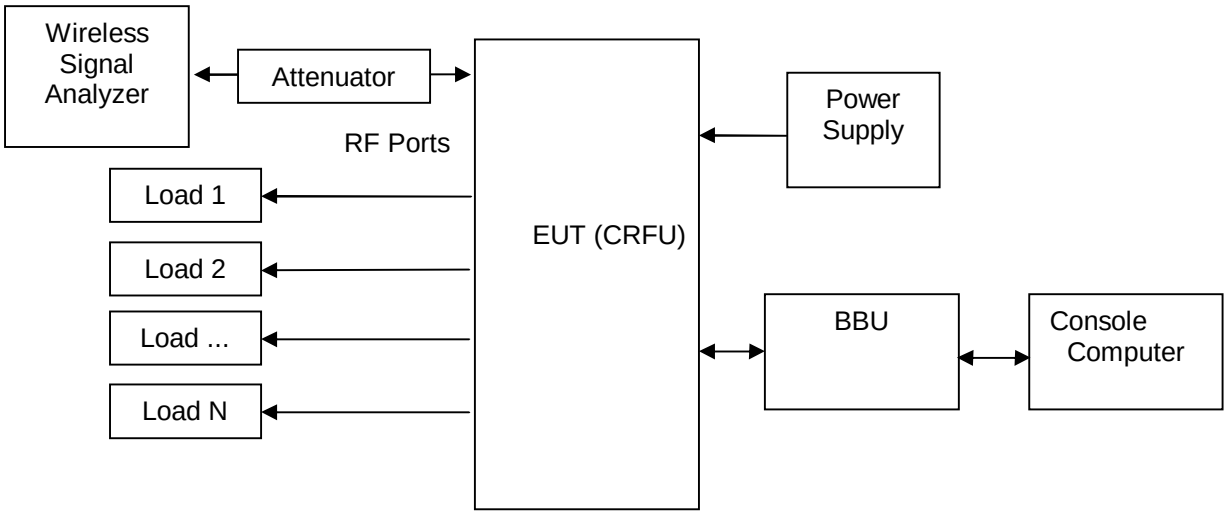

Figure 8. Test Set up

6.7.4 Measurement Results

6.7.4.1 Frequency Error vs. Temperature

TM1, ~48V DC Channel M

table 53. Measurement Results for TM1

TEST CONDITIONS		Frequency Stability Middle Channel		
		Measured Max. Frequency Error		Limit (ppm)
		Hz	ppm	
V_{nom} (-48 VDC)	-30 °C	-3.1	-0.001	< ±0.05
	-20 °C	-3.1	-0.001	< ±0.05
	-10 °C	-1.1	-0.001	< ±0.05

	0 °C	-0.3	-0.000	< ±0.05
	+10 °C	4.9	0.002	< ±0.05
	+20 °C	-2.1	-0.001	< ±0.05
	+30 °C	0.1	0.000	< ±0.05
	+40 °C	-0.4	-0.000	< ±0.05
	+50 °C	-0.3	-0.000	< ±0.05

TM2, ~48V DC Channel Channel M

table 54. Measurement Results for TM2

TEST CONDITIONS		Frequency Stability Middle Channel		
		Measured Max. Frequency Error		Limit (ppm)
		Hz	ppm	
V_{nom} (-48 VDC)	-30 °C	3.03	0.001	< ±0.05
	-20 °C	1.62	0.001	< ±0.05
	-10 °C	1.97	0.001	< ±0.05
	0 °C	-2.09	-0.001	< ±0.05
	+10 °C	-0.02	0.000	< ±0.05
	+20 °C	-2.1	-0.001	< ±0.05
	+30 °C	2.13	0.001	< ±0.05
	+40 °C	1.95	0.001	< ±0.05
	+50 °C	2.67	0.001	< ±0.05

6.7.4.2 Frequency Error vs. Voltage

TM1, 25 °C , Channel M

table 55. Measurement Results for CDMA2000 TM1

TEST CONDITIONS		Frequency Stability Middle Channel		
		Measured Max. Frequency Error		Limit (ppm)
		Hz	ppm	
T_{nom} (22°C)	85%V_{nom} (-36 VDC)	1.99	0.001	< ±0.05
	100%V_{nom} (-48 VDC)	2.84	0.001	< ±0.05
	115%V_{nom} (-57 VDC)	-2.78	-0.001	< ±0.05

TM2, 25 °C ,Channel M

table 56. Measurement Results for CDMA2000 TM2

TEST CONDITIONS		Frequency Stability Middle Channel		
		Measured Max. Frequency Error		Limit (ppm)
		Hz	ppm	
T_{nom} (22°C)	85%V_{nom} (-36 VDC)	1.56	0.001	< ±0.05
	100%V_{nom} (-48 VDC)	1.82	0.001	< ±0.05
	115%V_{nom} (-57 VDC)	1.88	0.001	< ±0.05

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 57. 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	1~10	Pages
Appendix B	Measurement Results Occupied Bandwidth	11~17	Pages
Appendix C	Measurement Results Band Edges	18~26	Pages
Appendix D	Measurement Results Spurious Emission at Antenna Terminal	27~63	Pages
Appendix E	Measurement Results Radiated Spurious Emission	64~66	Pages
Appendix F	Photos of Test Setup	67~69	Pages

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