



FCC Test Report

Product Name: LTE Multi-mode USB Rotator

Model Number: E397u-53

Report No: SYBH(Z-RF)026052011-2001

FCC ID: QISE397U-53

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Notice

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Notice 2

Table 1 Modification Information

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



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1 Summary

The table below summarizes the measurements and results for the EUT. Detailed results and descriptions are shown in the following pages.

Table 2 Summary of results

FCC Measurement Specification	FCC Limits Part(s)	Description	Result
2.1046	24.232	Effective Isotropic radiated power of Transmitter	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



2 Product Description

2.1 Production Information

2.1.1 General Description

E397u-53 LTE/CDMA dual mode USB Rotator is subscriber equipment in the LTE/CDMA system. E397u-53 implement such functions as RF signal receiving/transmitting, LTE, CDMA2000 1x and the CDMA2000 1x EV-DO Rev.A/Rev.0 protocol processing, data service etc. Externally it provides USB interface (to connect to the notebook etc.), USIM card interface and Micro SD card interface. E397u-53 has three internal antennas as default.

2.1.2 Support function and Service

The EUT supports the function and service as follows:

Table 3 CDMA Service and Test mode List

Service Name	Characteristic	Corresponding Test Mode	Note
data and SMS	Modulation: QPSK	TM1*	
data and SMS	Modulation: HPSK	TM3*	
Data(EV-DO)	Default Access Channel MAC	Subtype 0*	Modulation: HPSK
data(EV-DO)	Enhanced Access Channel MAC	Subtype 2*	<p>The R-Data packet size determines the modulation format,</p> <p>R-Data Packet Size: 128, 256, 512, 768 or 1024 Modulation: BPSK</p> <p>R-Data Packet Size: 1536 , 2048,3072,4096,6144 or 8192 Modulation: QPSK</p> <p>R-Data Packet Size: 12288 Modulation: 8-PSK</p>

Note: *The test conditions and settings are defined in ANSI/TIA-98-E section 1.3 , 3GPP2C.S0033



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 have been performed during the period of

Apr17, 2011 to Apr.25, 2011

3.2 General Set up Description

The EUT can Support PCS Band,and Support the CDMA2000 1x standard and the CDMA2000 1xEV-DO Rev. A standard. During this measurement, the EUT works in CDMA / EV-DO mode and PCS Band.

CDMA:

TM1: Forward Traffic Channel Radio Configuration 1, Reverse Traffic Channel Radio Configuration 1

TM3: Forward Traffic Channel Radio Configuration 3, Reverse Traffic Channel Radio Configuration 3

Parameter	Units	Value
\hat{I}_{or}	dBm/1.23 MHz	-104
$\frac{Pilot Ec}{I_{or}}$	dB	-7
$\frac{Traffic Ec}{I_{or}}$	dB	-7.4

EVDO:

Current Physical Layer Subtype:

Subtype 0 * indicates that the protocol subtype assigned to the Access Channel MAC protocol is Default Access Channel MAC and its Subtype ID number is 0x0000.

Subtype 2 * indicates that the protocol subtype assigned to the Access Channel MAC protocol is Enhanced Access Channel MAC and its Subtype ID number is 0x0002

Note: *The test settings are defined in 3GPP2C.S0033.



4 Product Description

4.1 Technical Characteristics

4.1.1 Frequency Range

Table 5 Frequency Range

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

4.1.2 Channel Spacing / Separation

Table 6 Channel Spacing / Separation

Channel spacing:	50 KHz
Channel separation:	1.25 MHz

4.1.3 Type of Emission

Table 7 Type of Emission

Emission Designation:	1M25F9W
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According to CFR 47 (FCC) part 2, subpart C, section 2.201 and 2.202

4.1.4 Environmental Requirements

Table 8 Environmental Requirements

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

4.1.5 Power Source

Table 9 Power Source

Charger voltage range:	~100-240 V, 50/60Hz
Charger current maximal:	0.2 A Max
Battery Rated capacity:	2200mAh
Battery Nominal Voltage:	≡ 3.7V

4.1.6 Tune-up Procedure

According to CFR (FCC) part 2, subpart 2, section 2.1033(c) (9).

Please reference the document Tune-up Procedure in TCF.

4.1.7 Applied DC Voltages and Currents

According to CFR (FCC) part 2, subpart 2, section 2.1033(c) (8).

The voltage and current in the final RF stage is:

Table 10 Applied DC Voltages and Currents

Voltage:	≡ +5V
Current:	500mA According to CFR (FCC) part 2, subpart 2, section 2.1033(c) (8)



4.2 EUT Identification List

4.2.1 Board Information

Table 11 Board Information

LTE Multi-mode USB Rotator		
E397u-53		
Board and Module		
Description	Hardware Version	IMEI
Main board of Mobile Phone	CD1E397uM	357149040014692

4.2.2 FCC Identification

Grantee Code: QIS
Product Code: E397u-53
FCC Identification: QISE397U-53



5 Main Test Instruments

Table 12 Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until
Universal Radio Communication Tester	R&S	CMW 500	103216	Nov.26,2011
Power supply	KEITHLEY	2303	1288003	Sep.27,2011
Universal Radio Communication Tester	R&S	CMU200	105822	Oct.24,2011
Wireless Communication Test set	Agilent	N4010A	MY49081592	Dec.14,2011
Universal Radio Communication Tester	Agilent	E5515C	MY50260239	Aug.04,2011
Signal Analyzer	R&S	FSQ31	200021	Sep.27,2011
Temperature Chamber	WEISS	WKL64	24600294	Jan.03,2012
Signal generator	Agilent	E8257D	MY49281095	Jul.09.2011
Vector Signal Generator	R&S	SMU200A	104162	Sep.07,2011
Test receiver	R&S	ESU26	36090302083	Jun.24.2011
EMI Test receiver	R&S	FSQ43	100048	Jun.23,2011
Tunable Dipole	Schwarzbeck	D69250-UHAP/D69250-VHAP	919/1009	Dec.13,2011
Tunable Dipole	Schwarzbeck	D69250-UHAP/D69250-VHAP	979/917	Dec.13,2011
Horn Antenna	R & S	HF906	359287/005	May.07, 2011
Horn Antenna	R & S	HF906	359287/006	Apr.27, 2012
Horn Antenna	R & S	HF906	100684	Jun.28,2011
Broadband Antenna	SCHAFFNER	CBL 6112B	2536	Sep.21, 2011
Broadband Antenna	SCHAFFNER	CBL 6112B	2941	Jun.11, 2011
Broadband Antenna	SCHAFFNER	VULB 9163	9163-357	Sep.28,2011
Horn Antenna	ETS-LINDGREN	3160	60008	Sep.20,2011
Horn Antenna	ETS-LINDGREN	3160	91989	Sep.28,2011

6 Transmitter Measurements

6.1 Effective Isotropic radiated power (EIRP)

6.1.1 Test Conditions

Table 13 Test Conditions

Preconditioning:	0.5 hour
Measured at:	enclosure
Ambient temperature:	22.5°C
Relative humidity:	55%
Test Configurations:	CDMA TM1 and TM3 at frequency B,M,T EVDO Mode Subtype 0 and Subtype 2 at frequency B,M,T

6.1.2 Test Specifications and Limits

6.1.2.1 Specification

CFR 47 (FCC) part 2.1046 and part 24.232

6.1.2.2 Supporting Standards

Table 14 Supporting Standards:

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA-98-E: 2003	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations

6.1.2.3 Limits

Compliance with part 24.232, mobile/portable stations are limited to 2 watts EIRP peak power.

$W(\text{dBm}) = 10 \cdot \log(W_{\text{watts}})$.

Table 15 Limits

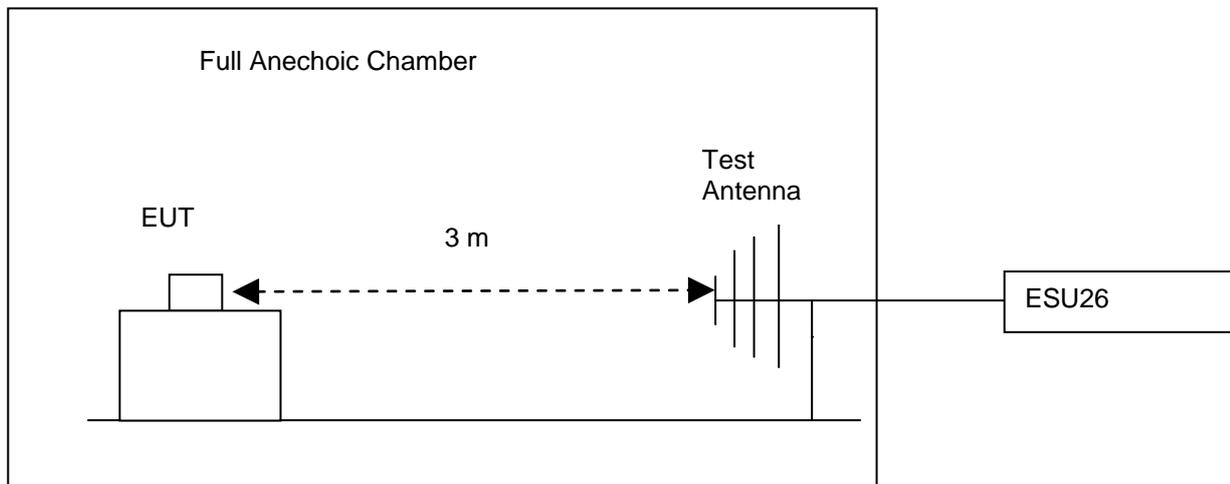
Maximum Output Power (Watts)	< 2 Watts
Maximum Output Power (dBm)	< 33 dBm

6.1.3 Test Method and Setup

- For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, ERP shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in 2.1033(c)(8). Connect the EUT to the wireless communication tester CMU 200 via the air interface. The band class is set as PCS.
- Test the Radiated maximum output power by the CMU 200 received from test antenna.
- Use substitution method to verify the maximum output power. The EUT is substituted by a horn antenna. The horn 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 (b) on CMU 200, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.

Test setup

Step 1: Pre-test



Step 2: Substitution method to verify the maximum EIRP

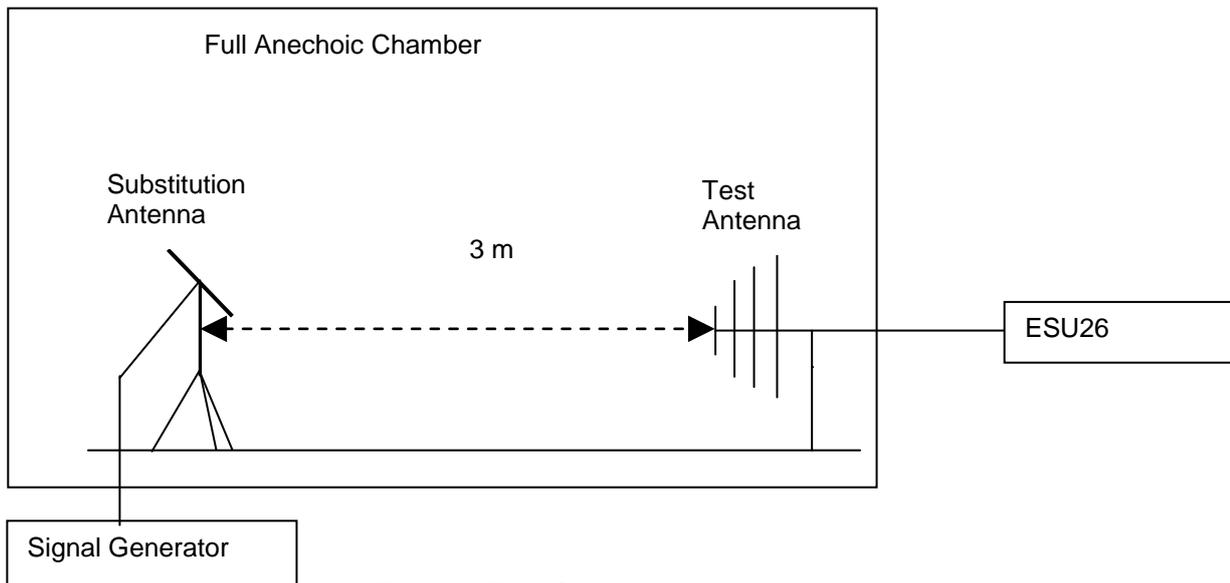


Figure 1. Test Set-up

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

There is a constant difference of 2.15 dB between EIRP and ERP.

$ERP \text{ (dBm)} = EIRP \text{ (dBm)} - 2.15$ (ITU-R Recommendation SM.329-10).

6.1.4 Measurement Results

Table 16 Measurement Results

TEST CONDITIONS		RF Output Power					
		Channel25(B) 1851.25MHz		Channel600(M) 1880.0MHz		Channel1175(T) 1908.75MHz	
		dBm		dBm		dBm	
		Measured	Limit	Measured	Limit	Measured	Limit
TM1	Tnorm (24 °C) Vnorm (5 V)	26.11	33	25.62	33	25.83	33
TM3	Tnorm (24 °C) Vnorm (5 V)	26.05	33	25.89	33	25.81	33
Subtype 0	Tnorm (24 °C) Vnorm (5 V)	26.13	33	26.01	33	26.11	33
Subtype 2	Tnorm (24 °C) Vnorm (5 V)	26.11	33	26.02	33	26.00	33

6.1.4.1 Substitution Results

Table 17 Substitution Results

Test Mode	Freq. [MHz]	Meas. Level [dBm]	Substitution Antenna Type	SGP [dBm]	Substitution Gain [dBi]	Cable Loss [dB]	Substitution Level (ERP) [dBm]	FCC limit [dBm]	Result
TM1	1851.25	26.11	Horn Ant.	22.57	4.5	1	26.07	33	Pass
TM1	1880	25.62	Horn Ant.	22.15	4.5	1	25.65	33	Pass
TM1	1908.75	25.83	Horn Ant.	21.97	4.8	1	25.77	33	Pass
TM3	1851.25	26.05	Horn Ant.	22.51	4.5	1	26.01	33	Pass
TM3	1880	25.89	Horn Ant.	22.32	4.5	1	25.82	33	Pass
TM3	1908.75	25.81	Horn Ant.	22.06	4.8	1	25.86	33	Pass
Subtype 0	1851.25	26.13	Horn Ant.	22.65	4.5	1	26.15	33	Pass
Subtype 0	1880	26.01	Horn Ant.	22.59	4.5	1	26.09	33	Pass
Subtype 0	1908.75	26.11	Horn Ant.	22.37	4.8	1	26.17	33	Pass
Subtype 2	1851.25	26.11	Horn Ant.	22.55	4.5	1	26.05	33	Pass
Subtype 2	1880	26.02	Horn Ant.	22.58	4.5	1	26.08	33	Pass
Subtype 2	1908.75	26.00	Horn Ant.	22.24	4.8	1	26.04	33	Pass



Note: a, For getting the EIRP (Efficient Isotropically Radiated Power) in substitution method, the following formula should take to calculate it,

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

NOTE: SGP- Signal Generator Level

b, A CDMA signal with bandwidth of 1.23MHz is created by the vector generator R&S SMU200A.

c, RBW=10kHz, VBW=300kHz, and integrated by the instrument to 1.23MHz.

6.1.5 Conclusion

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



6.2 Conducted Power of Transmitter

6.2.1 Test Conditions

Table 18 Test Conditions

Preconditioning:	0.5 hour
Measured at:	enclosure
Ambient temperature:	23.5°C
Relative humidity:	55%
Test Configurations:	CDMA TM1 and TM3 at frequency B,M,T EVDO Mode Subtype 0 and Subtype 2 at frequency B,M,T

6.2.2 Test Specifications and Limits

6.2.2.1 Specification

CFR 47 (FCC) part 2.1046 and part 24.232

6.2.2.2 Supporting Standards

Table 19 Supporting Standards:

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA-98-E: 2003	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations

6.2.2.3 Limits

Compliance with part 24.232, in no any case may the peak power of a mobile station transmitter exceed 2 W. The calculated longitude EIRP by following formula:

$$EIRP(dBm) = 10 * \log(EIRP_{in\ watts}).$$

And for conducted power, we can use Antenna Gain to calculate the limit. So the conducted power:

$$P_{cod}(dBm) = EIRP(dBm) - Gain(dBi).$$

and $Gain(dBi) = Gain(dBd) + 2.15dB$

Table 20 Limits

Maximum Output Power (Watts)	< 2 Watts=33 dBm
Antenna Gain(dBi):	1.76
Maximum Conducted Output Power (dBm)	< 31.24 dBm

6.2.3 Test Method and Setup

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, Conducted maximum power shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in 2.1033(c)(8). Connect the EUT to the wireless communication tester CMU 200 via the antenna connector. The band class is set as PCS.

(b) Test the Conducted maximum output power by the CMU 200.

Test setup

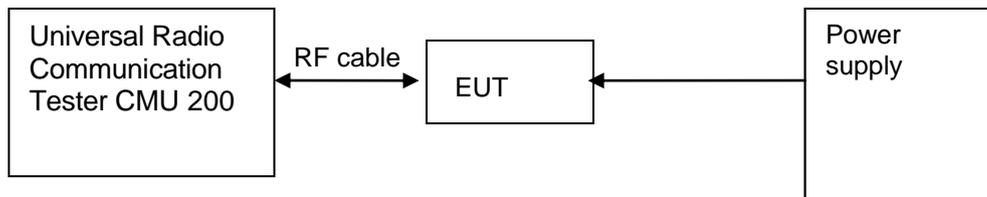


Figure 2. Test Set-up

6.2.4 Measurement Results

Table 21 Measurement Results

TEST CONDITIONS		RF Output Power					
		Channel 25(B) 1851.25MHz		Channel 600(M) 1880.0MHz		Channel 1175(T) 1908.75MHz	
		dBm		dBm		dBm	
		Measured	Limit	Measured	Limit	Measured	Limit
TM1	Tnorm (24 °C) Vnorm (5 V)	24.35	31.24	23.86	31.24	24.07	31.24
TM3	Tnorm (24 °C) Vnorm (5 V)	24.29	31.24	24.13	31.24	24.05	31.24
Subtype 0	Tnorm (24 °C) Vnorm (5 V)	24.37	31.24	24.25	31.24	24.35	31.24
Subtype 2	Tnorm (24 °C) Vnorm (5 V)	24.35	31.24	24.26	31.24	24.24	31.24

6.2.5 Conclusion

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



6.3 Modulation Characteristics

6.3.1 Test Conditions

Table 22 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	22.5 °C
Relative humidity:	54 %
Test Configurations:	CDMA mode TM1 and TM3 at frequency M EVDO mode Subtype 0 and Subtype 2 at frequency M

6.3.2 Test Specifications and Limits

6.3.2.1 Specification

CFR 47 (FCC) part 2.1047 and part 24 subpart E

6.3.2.2 Supporting Standards

Table 23 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA-98-E: 2003	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations.

6.3.2.3 Limits

No specific modulation characteristics requirement limits in part 2.1047 and part 24 subpart E.

Table 24 Limits

Limits	Not applicable
--------	----------------

6.3.3 Test Method and Setup

Connect the EUT to Universal Radio Communication Tester CMU200 via the antenna connector. The band class is set as PCS; the EUT's output is matched with 50 Ω load, test method was according to ANSI/TIA-98-E and. The waveform quality and constellation of the EUT was tested.

Test setup

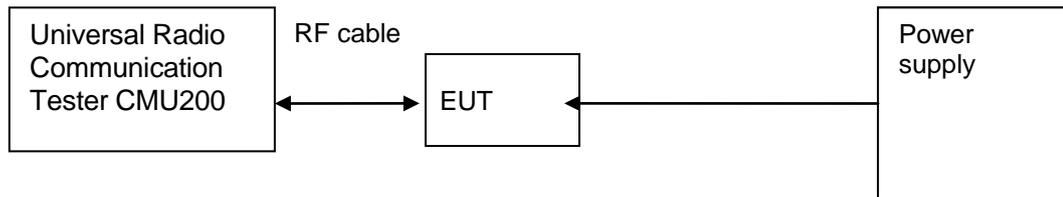


Figure 3. Test Set-up

6.3.4 Measurement Results

Table 25 Measurement Results

TEST CONDITIONS		Modulation Characteristic	
		Channel 600(M) 1880.0MHz	
		Measured	
		CDMA TM1 & TM3	EVDO Mode Subtype 0 & Subtype2
T _{norm} (25 °C)	V _{norm} (5V)	Refer to Appendix_A	Refer to Appendix_A

6.3.5 Conclusion

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

For the measurement results refer to appendix_A.

6.4 Occupied Bandwidth

6.4.1 Test Conditions

Table 26 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	54 %
Test Configurations:	CDMA TM1 and TM3 at frequency B,M,T EVDO Mode Subtype 0 and Subtype 2 at frequency B,M,T

6.4.2 Test Specifications and Limits

6.4.2.1 Specification

CFR 47 (FCC) part 2.1049 and part 24 subpart E

6.4.2.2 Supporting Standards

Table 27 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA-98-E: 2003	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations.

6.4.2.3 Limits

No specific occupied bandwidth requirement in part 24 subpart E, but the occupied bandwidth was defined in part 2.1049: 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.

Table 28 Limits

Upper /lower frequency limits	0.5% of the mean power
-------------------------------	------------------------

6.4.3 Test Method and Setup

The EUT was connected to the wireless signal analyzer R&S FSQ31 via the one RF connector. The band class is set as PCS; EUT was controlled to transmit maximum power. Measure and record the occupied bandwidth of the EUT by the R&S FSQ31.

The OBW, 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 under the following conditions as applicable:

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.

Measurement bandwidth (RBW): 30 kHz (Resolution bandwidth)
Video bandwidth (VBW): 300 kHz

Test Set-up

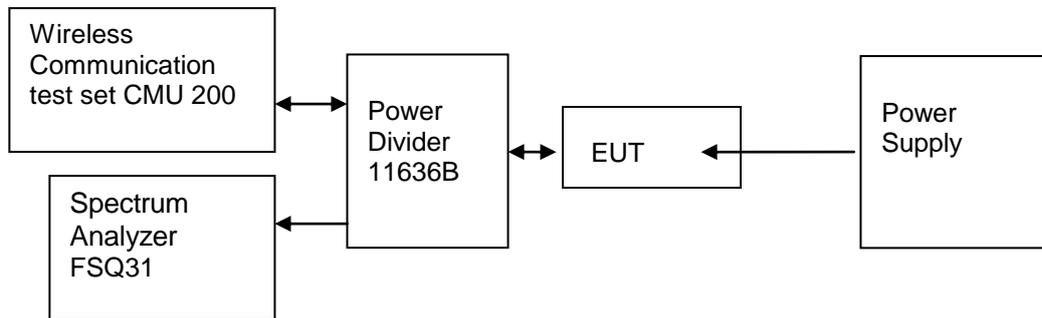


Figure 4.

Test Set-up



6.4.4 Measurement Results

Table 29 Measurement Results

TEST CONDITIONS		Occupied Bandwidth											
		Channel25(B) 1851.25MHz				Channel600(M) 1880.0MHz				Channel1175(T) 1908.75MHz			
		Measured (MHz)				Measured (MHz)				Measured (MHz)			
		CDMA		EVDO		CDMA		EVDO		CDMA		EVDO	
		TM1	TM3	Subtype 0	Subtype 2	TM1	TM3	Subtype 0	Subtype 2	TM1	TM3	Subtype 0	Subtype 2
T _{norm} (24 °C)	V _{norm} (5 V)	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.27	1.27	1.27

6.4.5 Conclusion

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

6.5 Band Edges Compliance

6.5.1 Test Conditions

Table 30 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	23.5°C
Relative humidity:	55 %
Test Configurations:	CDMA TM1 and TM3 at frequency B,T EVDO Mode Subtype 0 and Subtype 2 at frequency B,T

6.5.2 Test Specifications and Limits

6.5.2.1 Specification

CFR 47 (FCC) part 2.1051 and part 24.238

6.5.2.2 Supporting Standards

Table 31 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA-98-E: 2003	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations.

6.5.2.3 Limits

Compliance with part 24.238, all spurious emission must be attenuated below the transmitter power by at least $43 + 10 \log_{10} P$. (Whereas P is the rated power of the EUT).

Table 32 Limits

Rated Power:	24 dBm
Required attenuation:	$43 + 10 \log(0.25) = 37$, 24 dBm – 37 dB
Absolute level	- 13 dBm

6.5.3 Test Method and Setup

The EUT was connected to the wireless signal analyzer R&S FSQ31 via the one RF connector, the band class is set as PCS. EUT was controlled to transmit maximum power. Measure and record band edges compliance of the EUT by the R&S FSQ31.

RBW of 20 kHz (1% of 2MHz) was used up to 5MHz away from the band edge. So the FCC rules specify that RBW of 1MHz for measurements of emissions >1MHz away from the band edges ,the limit was adjusted with -13dBm to -30dBm to compensate for the reduced measurement bandwidth.

Test Set-up

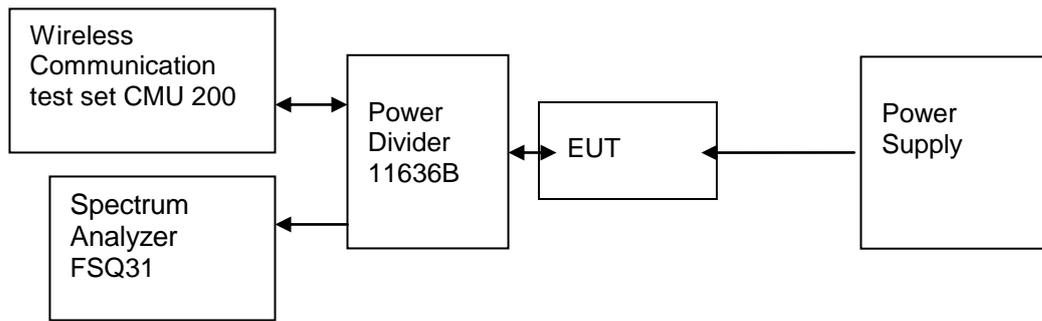


Figure 5. Test Set-up

6.5.4 Measurement Results

Table 33 Measurement Results outside Band Edges-- Single Carrier

Band	Frequency of Band edges [MHz]	Channel Number	Test Mode	Power [dBm]	Spurious Level measured [dBm]	FCC limit	Result
US PCS	$T_{norm} (25\text{ }^{\circ}\text{C}), V_{norm} (5\text{ V})$						
	1850.25	25 (B)	TM1 & TM3	24	<-13(See appendix_C)	- 13 dBm	Pass
	1908.75	1175 (T)	TM1 & TM3	24	<-13(See appendix_C)	- 13 dBm	Pass

Band	Frequency of Band edges [MHz]	Channel Number	Test Mode	Power [dBm]	Spurious Level measured [dBm]	FCC limit	Result
US PCS	$T_{norm} (25\text{ }^{\circ}\text{C}), V_{norm} (5\text{ V})$						
	1850.25	25 (B)	Subtype 0 and Subtype 2	24	<-13(See appendix_C)	- 13 dBm	Pass
	1908.75	1175 (T)	Subtype 0 and Subtype 2	24	<-13(See appendix_C)	- 13 dBm	Pass

6.5.5 Conclusion

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

6.6 Spurious Emission at Antenna Terminal

6.6.1 Test Conditions

Table 34 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	20°C
Relative humidity:	50 %
Test Configurations:	TM1 and TM3 at frequency B,M,T EVDO Mode Subtype 0 and Subtype 2 at frequency B,M,T

6.6.2 Test Specifications and Limits

6.6.2.1 Specification

CFR 47 (FCC) part 2.1051 and part 24.238

6.6.2.2 Supporting Standards

Table 35 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA-98-E: 2003	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations.

6.6.2.3 Limits

Compliance with part 24.238, all spurious emission must be attenuated below the transmitter power by at least $43 + 10 \log_{10} P$. (Whereas P is the rated power of the EUT).

Table 36 Limits

Rated Power:	24 dBm
Required attenuation:	$43 + 10 \log (0.25) = 37$, 24 dBm – 37 dB
Absolute level	- 13 dBm

6.6.3 Test Method and Setup

The EUT was connected to the wireless signal analyzer R&S FSQ31 via the one RF connector, the band class is set as PCS. EUT was controlled to transmit maximum power. Measure and record the Conducted Spurious Emission of the EUT by the R&S FSQ31.

According to part 24.238, the defined measurement bandwidth as following:

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

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

Measurement bandwidth (RBW) for 30MHz up to 20GHz: 1MHz;

Test Set-up

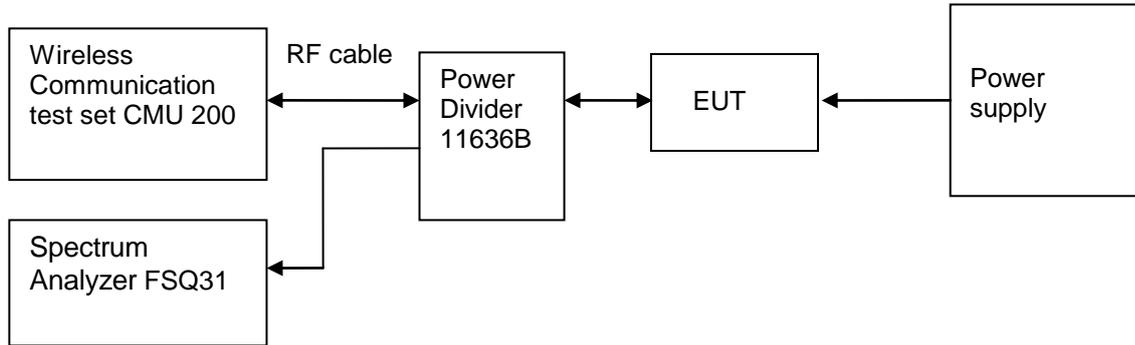


Figure 6.

Test Set-up

6.6.4 Measurement Results

Table 37 Measurement Results

Channel Number	Test Mode	Test Range (Frequency)	Output Power [dBm]	Spurious Level measured [dBm]	FCC limit	Result
Channel 25(B)	TM1	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
	TM3	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
	Subtype 0	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
	Subtype 2	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
Channel 600(M)	TM1	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
	TM3	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
	Subtype 0	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
	Subtype 2	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
Channel 1175(T)	TM1	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
	TM3	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
	Subtype 0	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass
	Subtype 2	9 kHz ~20GHz	24	<- 13 dBm (See appendix_D)	- 13 dBm	Pass

6.6.5 Conclusion

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

6.7 Radiated Spurious Emissions

6.7.1 Test Conditions

Table 38 Test Conditions

Preconditioning:	0.5 hour
Measured at:	enclosure
Ambient temperature:	25°C
Relative humidity:	55%
Test Configurations:	CDMA TM1 at frequency M EVDO Mode Subtype 0 and Subtype 2 at frequency M

6.7.2 Test Specifications and Limits

6.7.2.1 Specification

CFR 47 (FCC) part 2.1053 and part 24.238

6.7.2.2 Supporting Standards

Table 39 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA-98E: 2003	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations.

6.7.2.3 Limits

Compliance with part 24.238, all spurious emission must be attenuated below the transmitter power by at least $43 + 10 \log_{10} P$. (Whereas P is the rated power of the EUT).

Table 40 Limits

Rated Power:	24 dBm
Required attenuation:	$43 + 10 \log(0.25) = 37$, 24 dBm – 37 dB
Absolute level	- 13 dBm

6.7.3 Test Method and Setup

A test site fulfilling the requirements of ITU-R Recommendation SM329-11 was used. The EUT was placed on a non-conducting support in the anechoic chamber and was operated from a power source via an RF filter to avoid radiation from the power leads.

According to part 24.238, the defined measurement bandwidth as following:

24.238(b) Measurement procedure: Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater.

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

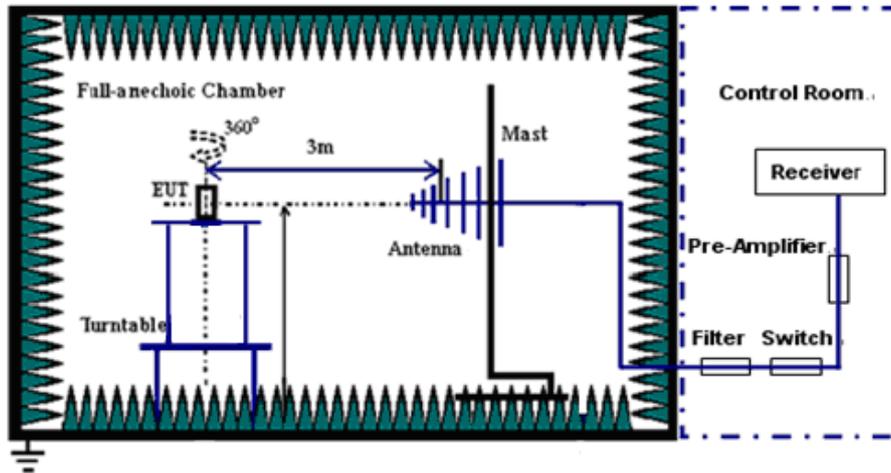
Measurement bandwidth (RBW) for 30MHz up to 26.5GHz: 1MHz;

Test Set-up

Step 1:

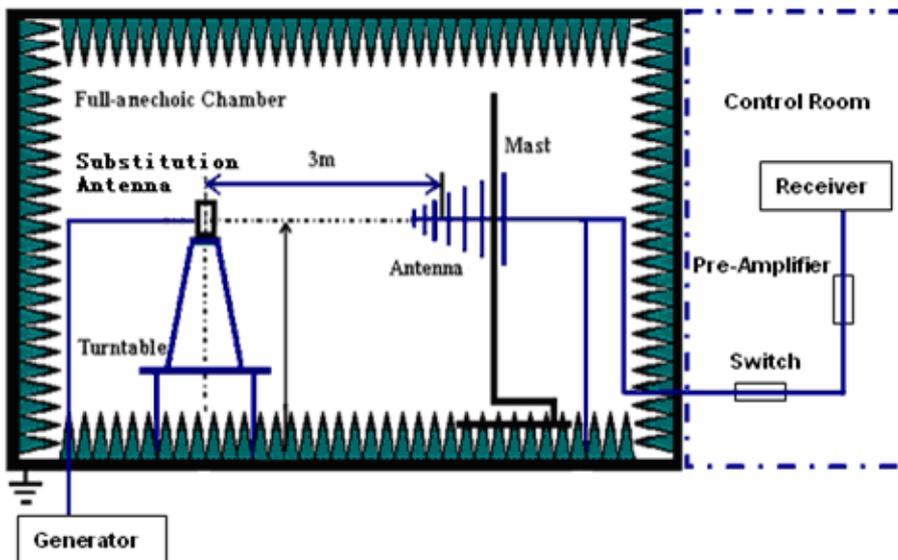
For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, EIRP shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in 2.1033(c)(8). Connect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

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



Step 2:

Use substitution method to verify the maximum output power. The EUT is substituted by a dipole antenna. The dipole is connected to a signal generator. And then adjust the output level of the signal generator to get the same received power recorded in step1 on Test Receiver, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.



Test should be performed in normal voltage condition.

Table 41 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 E.R.P. (Efficient Radiated Power) in substitution method, the following formula should take to calculate it,

$$\text{E.R.P. [dBm]} = \text{SGP [dBm]} - \text{Cable Loss [dB]} + \text{Gain [dBd]}$$

NOTE: SGP- Signal Generator Level

6.7.4 Conclusion

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

6.8 Frequency Stability

6.8.1 Test Conditions

Table 42 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	See below
Relative humidity:	56 % at 25 °C
Test Configurations:	TM1 and TM3 at frequency M EVDO Mode Subtype 0 and Subtype 2 at frequency M

6.8.2 Test Specifications and Limits

6.8.2.1 Specification

CFR 47 (FCC) part 2.1055 and part 24.235

6.8.2.2 Supporting Standards

Table 43 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA-98E: 2003	Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations.

6.8.2.3 Limits

No specific frequency stability requirement in part 2.1055 and part 24.235.

6.8.3 Test Method and Setup

The frequency stability shall be measured with variation of ambient temperature as follows:

- (1) From -30° to $+50^{\circ}$ centigrade for all equipment except that specified in subparagraphs (2) and (3) of paragraph 2.1055

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade 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.

(d) 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.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

Test Setup

Connect the EUT to the Wireless Communication test set CMU 200 via the connector. Then measure the frequency error by the Wireless Communication test set CMU 200. The EUT's output is matched with a 50 Ω load.

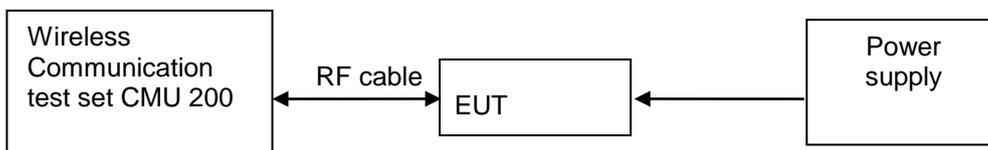


Figure 7.

Test Set up

6.8.4 Measurement Results

6.8.4.1 Measurement Results vs. Variation of Temperature

- TM1, 5 V DC Channel No. **600(1880.0MHz)**

Table 44 Measurement Results vs. Variation of Temperature—
 TM1

Temperature	Normal Frequency (MHz)	Measured Frequency Error(Hz)	Result
-30 °C	1880.0	-15	Pass
-20 °C	1880.0	8	Pass
-10 °C	1880.0	-12	Pass
0 °C	1880.0	-10	Pass
+10 °C	1880.0	-11	Pass
+20 °C	1880.0	-9	Pass
+30 °C	1880.0	7	Pass
+40 °C	1880.0	-11	Pass
+50 °C	1880.0	-4	Pass

● **TM3, 5V DC Channel No.600(1880.0MHz)**

Table 45 Measurement Results vs. Variation of Temperature—
TM3

Temperature	Norminal Frequency (MHz)	Measured Frequency Error(Hz)	Result
-30 °C	1880.0	-13	Pass
-20 °C	1880.0	-6	Pass
-10 °C	1880.0	-11	Pass
0 °C	1880.0	8	Pass
+10 °C	1880.0	12	Pass
+20 °C	1880.0	-4	Pass
+30 °C	1880.0	-11	Pass
+40 °C	1880.0	6	Pass
+50 °C	1880.0	-11	Pass

● **Subtype 0, 5V DC Channel No.600(1880.0MHz)**

Table 46 Measurement Results vs. Variation of Temperature—
Subtype 0

Temperature	Norminal Frequency (MHz)	Measured Frequency Error(Hz)	Result
-30 °C	1880.0	-3	Pass
-20 °C	1880.0	-13	Pass
-10 °C	1880.0	-15	Pass
0 °C	1880.0	-19	Pass
+10 °C	1880.0	-9	Pass
+20 °C	1880.0	-11	Pass
+30 °C	1880.0	7	Pass
+40 °C	1880.0	-14	Pass
+50 °C	1880.0	12	Pass

● **Subtype 2, 5V DC Channel No.600(1880.0MHz)**

Table 47 Measurement Results vs. Variation of Temperature—
Subtype 2

Temperature	Norminal Frequency (MHz)	Measured Frequency Error(Hz)	Result
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-30 °C	1880.0	-8	Pass
-20 °C	1880.0	-6	Pass
-10 °C	1880.0	-13	Pass
0 °C	1880.0	10	Pass
+10 °C	1880.0	-15	Pass
+20 °C	1880.0	-9	Pass
+30 °C	1880.0	-7	Pass
+40 °C	1880.0	-10	Pass
+50 °C	1880.0	3	Pass

6.8.4.2 Measurement Results vs. Variation of Voltage

- TM1, 25 °C ,Channel No. **600(1880.0MHz)**

Table 48 Measurement Results vs. Variation of Voltage – TM1

Voltage	Norminal Frequency (MHz)	Measured Frequency Error(Hz)	Result
4.75 V	1880.0	11	Pass
5 V	1880.0	15	Pass
5.25 V	1880.0	17	Pass

- TM3, 25 °C ,Channel No. **600(1880.0MHz)**

Table 49 Measurement Results vs. Variation of Voltage – TM3

Voltage	Norminal Frequency (MHz)	Measured Frequency Error(Hz)	Result
4.75 V	1880.0	13	Pass
5 V	1880.0	17	Pass
5.25 V	1880.0	20	Pass

- Subtype 0, 25 °C ,Channel No. **600(1880.0MHz)**

Table 50 Measurement Results vs. Variation of Voltage – Subtype 0

Voltage	Norminal Frequency	Measured Frequency Error(Hz)	Result
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	(MHz)		
4.75 V	1880.0	13	Pass
5 V	1880.0	19	Pass
5.25 V	1880.0	7	Pass

- **Subtype 2, 25 °C ,Channel No. 600(1880.0MHz)**

Table 51 Measurement Results vs. Variation of Voltage – Subtype 2

Voltage	Norminal Frequency (MHz)	Measured Frequency Error(Hz)	Result
4.75 V	1880.0	24	Pass
5 V	1880.0	9	Pass
5.25 V	1880.0	12	Pass

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 52 System Measurement Uncertainty

Items		Extended Uncertainty
Effective Radiated Power of Transmitter	EIRP (dBm)	U=3dB; k=2
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
Radiated Spurious Emissions	ERP (dBm)	U=2.8dB; k=2
Frequency Stability	Frequency Accuracy(ppm)	U=0.21ppm; k=2
Field Strength of Spurious Radiation	ERP(dBm)	U=3dB; k=2
Conducted Output Power	Power(dBm)	U=0.39dB; k=2
Conducted Emission at Power Port	Disturbance Voltage (dB μ V)	U=4dB; k=2
Radiated Emission of enclosure at ideal mode	Field strength (dB μ V/m)	U=5dB; k=2



8 Appendixes

Appendix A	Measurement Results Modulation Characteristics	7 pages
Appendix B	Measurement Results Occupied Bandwidth	13 Pages
Appendix C	Measurement Results Band Edges	13 Pages
Appendix D	Measurement Results Spurious Emission at Antenna Terminal	55 Pages
Appendix E	Measurement Results Radiated Spurious Emissions	13Pages
Appendix F	Photos of Radiated Spurious Emissions	7 Pages