



FCC RF Test Report

Product Name: LTE 2D USB Rotator

Model Number: E397Bu-502

Report No: SYBH(Z-RF)014042012-2001

FCC ID: QISE397BU-502

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1 General Information

1.1 Applied Standard	
Applied Rules:	47 CFR FCC Part 2, 2010. Subpart J 47 CFR FCC Part 22, 2010.Subpart H ANSI/TIA 603C:2004
1.2 Test Location	
Test Location 1:	Reliability Laboratory of Huawei Technologies Co., Ltd.
Address:	Huawei Base, Bantian, Longgang District, Shenzhen 518129, P.R. China
1.3 Test Environment Condition	
Ambient Temperature:	20 – 25 °C
Ambient Relative Humidity:	45 – 55 %
Atmospheric Pressure:	101 kPa

2 Summary

Table 1 Summary of results

Cellular Band			
Test Case	FCC Part No.	Requirements	Result
Transmitter Output Power	2.1046 & 22.913	ERP not exceed 7 W	Pass
Modulation Characteristics	2.1047	Digital modulation	Pass
Occupied Bandwidth	2.1049	(Not specified)	Pass
Band Edges Compliance	2.1051 & 22.917	Below -13 dBm/1%*EBW, in 1 MHz range	Pass
Spurious Emission at Antenna Terminals	2.1051 & 22.917	Below -13 dBm/1 kHz, 9 kHz to 150 kHz Below -13 dBm/10 kHz, 150 kHz to 30 MHz Below -13 dBm/100 kHz, 30 MHz to 10 th harmonics	Pass
Field Strength of Spurious Radiation	2.1053 & 22.917	Below -13 dBm/100 kHz	Pass
Frequency Stability	2.1055 & 22.355	Maintained within the tolerances of ± 2.5 ppm	Pass



3 Product Description

3.1 Production Information

3.1.1 General Description

E397Bu-502 LTE/EVDO/CDMA dual mode 7 bands 2D USB Rotator is subscriber equipment in the LTE/CDMA system. E397Bu-502 implement such functions as RF signal receiving/transmitting, LTE and EVDO/CDMA protocol processing, data service etc. Externally it provides USB interface (to connect to the notebook etc.), USIM card interface and Micro SD card interface.

3.1.2 Board Information

Table 1 Board Information

LTE 2D USB Rotator	
E397Bu-502	
Main board	
Software Version	Hardware Version
11.515.05.00.000	CD2E397UM

4 Test Description

4.1 Supported Frequency Range

Characteristics	Description
Downlink	869 to 894 MHz
Uplink	824 to 849 MHz

4.2 Transmitter / Receiver Characteristics

Characteristics	Description
System Type	CDMA LTE
TX Output Power (per Antenna Port)	CDMA system: 24 dBm LTE system: 23 dBm
Channel Spacing(s) / Bandwidth(s)	CDMA system: 1.23 MHz (Celluar band) LTE system: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz
Designation of Emissions	CDMA system: 1M28F9W (Celluar band) LTE system: 1M10G7D (1.4 MHz ,QPSK modulation), 1M10W7D (1.4 MHz ,16QAM modulation), 2M70G7D (3.0 MHz QPSK modulation), 2M70W7D (3.0 MHz 16QAM modulation), 4M50G7D (5.0MHz QPSK modulation), 4M50W7D (5.0MHz 16QAM modulation), 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation),

4.3 Antenna Gain

Antenna Gain(dBi):	2.1
Antenna Gain(dBd):	-0.05

4.4 Power Supply

	Description
Power Supply Type	Directly Connected to DC /AC Power Supply
Input to EUT (DC power)	DC Voltage Nominal: \equiv +5.0V DC Voltage Range: \equiv +4.75V to +5.25V
Input to EUT (AC power)	AC Voltage Nominal: ~ 220V (50/60 Hz) AC Voltage Range: ~ 100V-240V

5 General Test Conditions / Configurations

5.1 RF Channels under Test

Test Mode	TX / RX	RF Channel		
		Bottom (B)	Middle (M)	Top (T)
TM1/TM3/ Subtype 0/ Subtype 2	TX	Channel 1013	Channel 384	Channel 777
		824.7MHz	836.52MHz	848.31MHz
	RX	Channel 1013	Channel 384	Channel 777
		869.7MHz	881.52MHz	893.31MHz
LTE Band 5	TX (1.4M)	Channel 20407	Channel 20525	Channel 20643
		824.7 MHz	836.5MHz	848.3 MHz
	TX (3M)	Channel 20415	Channel 20525	Channel 20635
		825.5 MHz	836.5MHz	847.5 MHz
	TX (5M)	Channel 20425	Channel 20525	Channel 20625
		826.5 MHz	836.5MHz	846.5 MHz
	TX (10M)	Channel 20450	Channel 20525	Channel 20600
		829.0 MHz	836.5MHz	844.0 MHz
	RX (1.4M)	Channel 2407	Channel 2525	Channel 2643
		869.7 MHz	881.5MHz	893.3 MHz
	RX (3M)	Channel 2415	Channel 2525	Channel 2635
		870.5 MHz	881.5MHz	892.5MHz
	RX (5M)	Channel 2425	Channel 2525	Channel 2625
		871.5 MHz	881.5MHz	891.5 MHz
	RX (10M)	Channel 2450	Channel 2525	Channel 2600
		874.0 MHz	881.5MHz	889.0 MHz

5.2 Test Modes

Test Mode	Test Modes Description
TM1/TM3	CDMA2000 1x
Subtype 0/ Subtype 2	CDMA2000 1x EV-DO
TM4	LTE QPSK modulation
TM5	LTE 16QAM modulation
Test Mode	Test Modes Description

Test Mode	Test Modes Description
TM1	CDMA2000 1x mode QPSK modulation
TM3	CDMA2000 1x mode HPSK modulation
Subtype 0	CDMA2000 1x EV-DO mode HPSK modulation
Subtype 2	CDMA2000 1x EV-DO mode The R-Data packet size determines the modulation format, R-Data Packet Size:128, 256, 512, 768 or 1024 BPSK Modulation R-Data Packet Size:1536 , 2048,3072,4096,6144 or 8192 QPSK Modulation R-Data Packet Size:12288 8-PSK Modulation
TM4	LTE system, QPSK modulation
TM5	LTE system, 16QAM modulation

5.3 Test Environments

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	4.75V
	VN	5.0V
	VH	5.25V

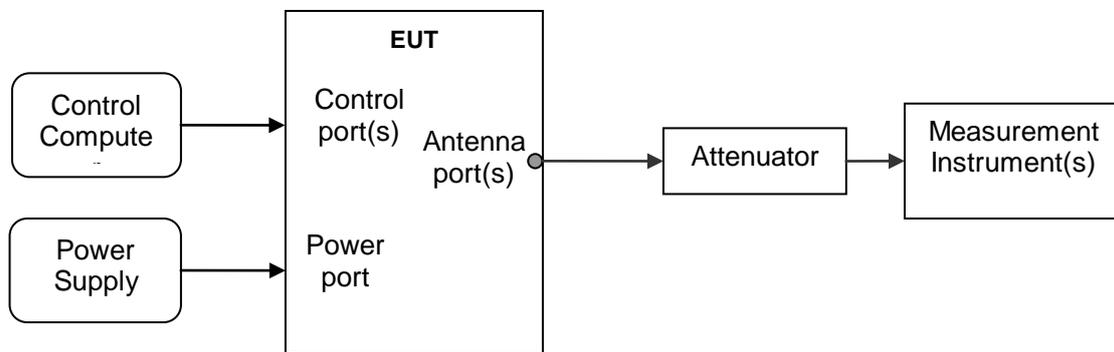
NOTE: VL= lower extreme test voltages
VN= nominal voltage
VH= upper extreme test voltage
TN= normal temperature

5.4 Test Setups

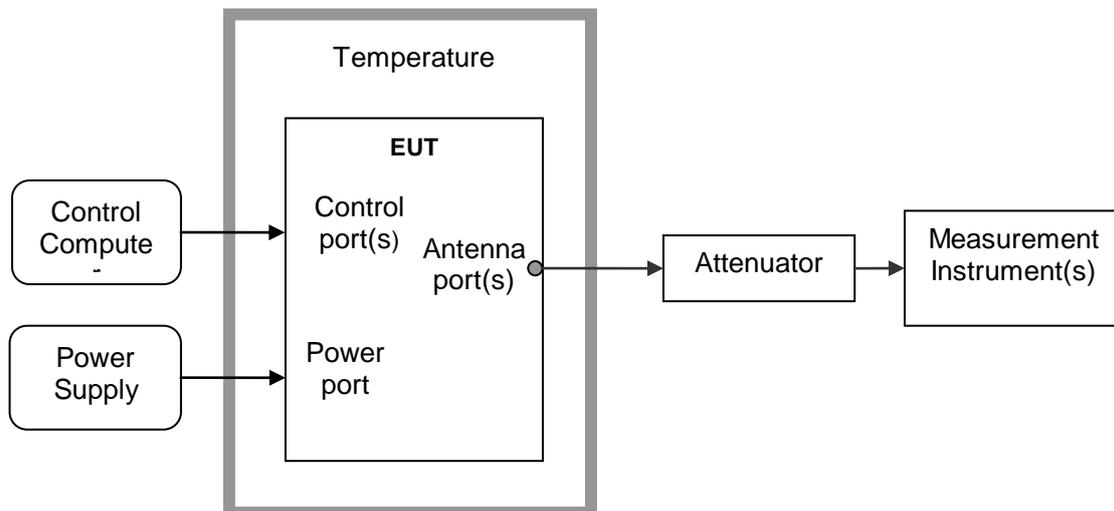
5.4.1 General Test Setup Configurations

Configuration	Description
Test Antenna Ports	Until otherwise declared, all TX tests are ONLY performed at the main Transmitter antenna port (e.g. TRXA, TXA and so on) of the EUT, and all RX tests are ONLY performed at the main Receiver antenna port (e.g. TRXA, RXA and so on) of the EUT.
Multiple RF Sources	Other than the tested RF source of the EUT, other RF source(s) are disabled or shutdown during measurements.

5.4.2 Test Setup 1



5.4.3 Test Setup 2



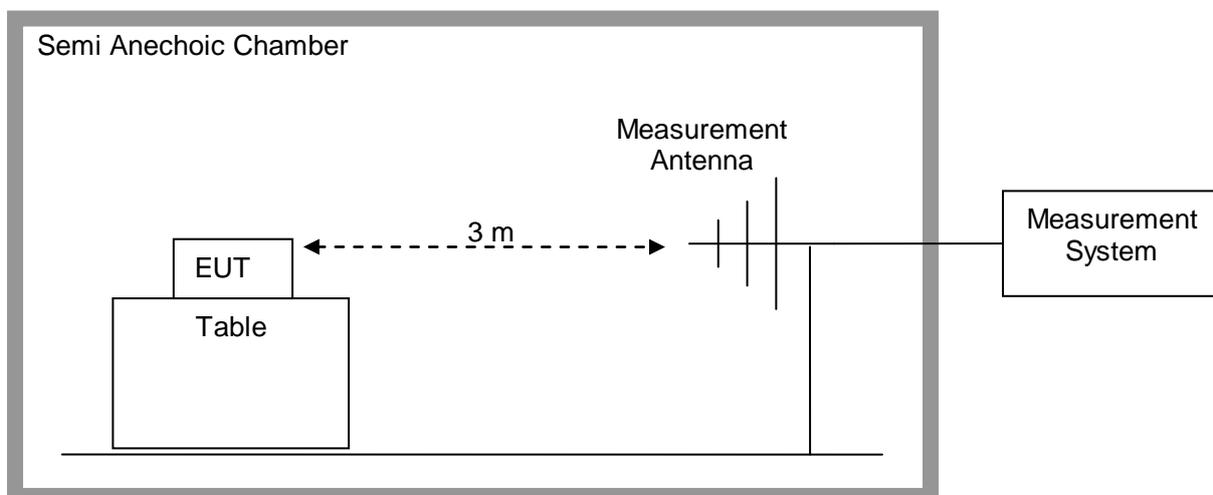
5.4.4 Test Setup 3

NOTE1: Effective radiated power (ERP) refers to the radiation power output of the EUT, assuming all emissions are radiated from half-wave dipole antennas.

NOTE2: The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI-TIA-603C 2004. The measurements were made using a Rohde and Schwarz Test Receiver and control software.

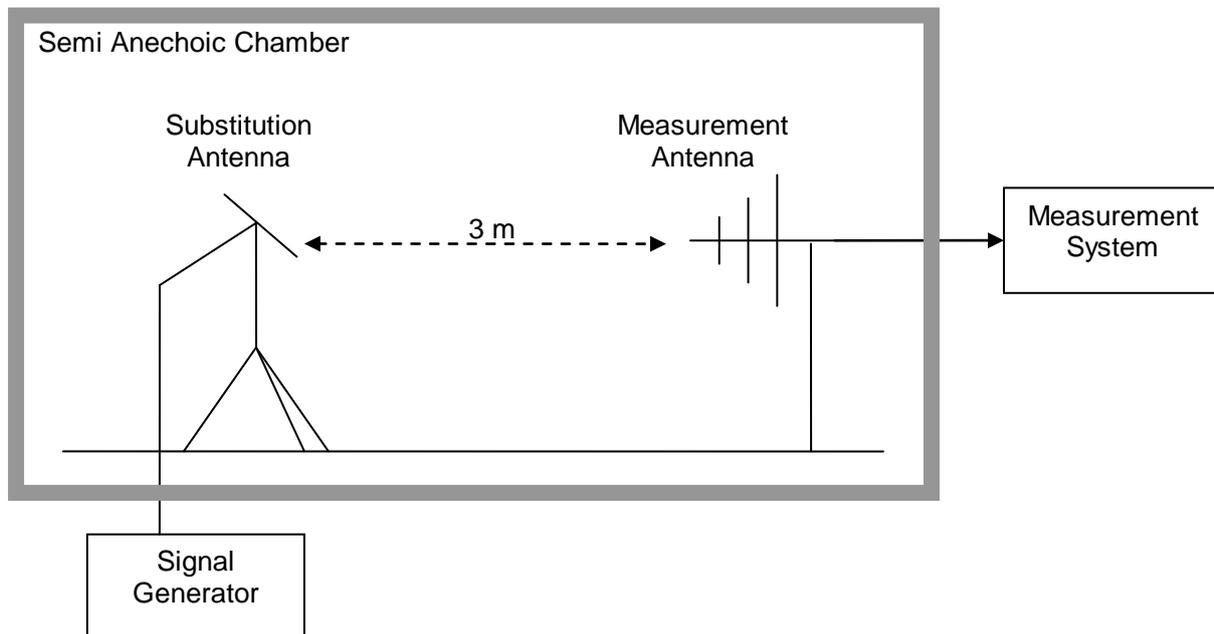
Step 1: Pre-test, find the Maximum ERP

1. Connect the test system according to Figure. EUT is running for 30 minutes before test, and measurement instruments are warming-up for 30 minutes.
2. Set up communication link between Universal radio communication tester and EUT, set EUT working frequency, and control EUT to transmit at maximum power.
3. Set the center frequency of the signal analyzer or receiver to the EUT's operating frequency, the RBW is equal to the emission bandwidth of signal. RMS detector for the test, and the span is equal to 2 times of emission bandwidth, remain other settings to be auto. Normally, the height range of antenna was 1m to 4m, the azimuth range of turntable was 0° to 360°, The receive antenna has two polarizations V and H. A portable or small unlicensed wireless device shall be placed on a non-metallic test fixture or other nonmetallic support during testing. The supporting fixture shall permit orientation of the EUT in each of three orthogonal (x, y, z axes) axis positions such that emissions from the EUT are maximized. Measure the EUT maximum RF power and record the result.
4. Changing EUT working frequency and measuring the RF power at channel T、M、B respectively. Complete the test data.



Step 2: Substitution method to verify the maximum ERP

1. Measurement setup according to figure, EUT was substituted by antenna, and the polarization is identical as the test antenna; the signal generator was connected to the substitution antenna.
2. The radiated output power, measured by signal analyzer set, is as same as recorded in above item 5). Then this power level is matched by a signal from a calibrated signal generator which is substituted for EUT. The power supplied by the generator is then equal to the ERP after corrected by the antenna gain and cable loss.



5.5 Test Conditions

Test Case	Test Conditions	
Transmitter Output Power	Test Configuration	Ambient Temperature & Rated Voltage
	Test Setup	Test Setup 1 & Test Setup 3
	Detector	RMS
	RF Channels (TX)	B, M, T
	Test Mode	TM1/TM3/ Subtype 0/ Subtype 2/TM4/TM5
Modulation Characteristics	Test Configuration	Ambient Temperature & Rated Voltage
	Test Setup	Test Setup 1
	RF Channels (TX)	M
	Test Mode	TM1/TM3/ Subtype 0/ Subtype 2/TM4/TM5
Occupied Bandwidth	Test Configuration	Ambient Temperature & Rated Voltage
	Test Setup	Test Setup 1
	Detector	PK
	RF Channels (TX)	B, M, T (TM4/TM5 only for M)
	Test Mode	TM1/TM3/ Subtype 0/ Subtype 2/TM4/TM5
Band Edges Compliance	Test Configuration	Ambient Temperature & Rated Voltage
	Test Setup	Test Setup 1
	Detector	RMS
	RF Channels (TX)	B, T
	Test Mode	TM1/TM3/ Subtype 0/ Subtype 2/TM4/TM5
Spurious Emission at Antenna Terminals	Test Configuration	Ambient Temperature & Rated Voltage
	Test Setup	Test Setup 1
	Detector	PK
	RF Channels (TX)	B, M, T
	Test Mode	TM1/TM3/ Subtype 0/ Subtype 2/TM4
Field Strength of Spurious Radiation	Test Configuration	Ambient Temperature & Rated Voltage
	Test Setup	Test Setup 3
	Detector	PK
	RF Channels (TX)	M
	Test Mode	TM1/TM3/ Subtype 0/ Subtype 2/TM4
Frequency Stability	Test Configuration	(1) -30 °C to +50 °C with step 10 °C at Rated Voltage; (2) 85%, 100% and 115% of Rated Voltage at Ambient Temperature.



Test Case	Test Conditions	
	Test Setup	Test Setup 2
	RF Channels (TX)	M
	Test Mode	TM1/TM3/ Subtype 0/ Subtype 2/TM4

6 Main Test Instruments

Table 2 Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until
Power supply	KEITHLEY	2303	1288003	Sep.27,2012
Universal Radio Communication Tester	R&S	CMU200	117341	Jan.12.2013
Universal Radio Communication Tester	Agilent	E5515C	MY50260239	Aug.31,2012
Spectrum Analyzer	Agilent	E4440A	MY48250119	Jul.17,2012
Signal Analyzer	R&S	FSQ31	200021	Sep.27,2012
Temperature Chamber	WEISS	WKL64	24600294	Feb.13,2013
Signal generator	Agilent	E8257D	MY49281095	Jul.09.2012
Test receiver	R&S	ESU26	100150	May.29.2012
Tunable Dipole	Schwarzbeck	D69250-UHAP/D69250-VHAP	919/1009	Jan.29.2013
Tunable Dipole	Schwarzbeck	D69250-UHAP/D69250-VHAP	979/917	Jan.29.2013
Horn Antenna	R & S	HF906	100683	May.15, 2012
Horn Antenna	R & S	HF906	100684	Jul.01, 2012
Broadband Antenna	Schwarzbeck	VULB 9163	9163-357	May.15, 2012
Broadband Antenna	Schwarzbeck	VULB 9163	9163-356	May.15, 2012
Universal Radio Communication Tester	R & S	CMW500	20347676	Sep.07,2012
Universal Radio Communication Tester	Anritsu	MT8820C	6200971028	May.04, 2012

7 Test Results

No.	Test Item	Test Result
1	Transmitter Output Power	Appendix A
2	Modulation Characteristics	Appendix B
3	Occupied Bandwidth	Appendix C
4	Band Edges Compliance	Appendix D
5	Spurious Emission at Antenna Terminals	Appendix E
6	Field Strength of Spurious Radiation	Appendix F
7	Frequency Stability	Appendix G
8	Photos of Radiated Spurious Emissions	Appendix H

NOTE: The Appendix H only photos of Radiated Spurious Emissions, no test data



8 Measurement Uncertainty

For a 95% confidence level (k=2), the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

Test Item		Extended Uncertainty
Transmitter Output Power	Power (dBm)	U =0.39 dB
Occupied Bandwidth	Magnitude (%)	U=0.2%
Band Edge Compliance	Disturbance Power (dBm)	U=2.0 dB
Conducted Spurious Emissions	Disturbance Power (dBm)	U=2.0 dB
Field Strength of Spurious Radiation	ERP (dBm)	U=4.6 dB (30 MHz – 1GHz) U=3.0 dB (above 1 GHz)
Frequency Stability	Frequency Accuracy (ppm)	U=0.21 ppm

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