



FCC RF Test Report

Product Name: LTE 2D USB Rotator

Model Number: E397Bu-502

Report No: SYBH(Z-RF)014042012-2003

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 27, 2010.Subpart C&L 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

AWS Band			
Test Case	FCC Part No.	Requirements	Result
Transmitter Output Power	2.1046 & 27.50(d)	Peak EIRP not exceed 1 W	Pass
Modulation Characteristics	2.1047	Digital modulation	Pass
Occupied Bandwidth	2.1049	(Not specified)	Pass
Band Edges Compliance	2.1051 & 27.53(h)	Below -13 dBm/1%*EBW, in 1 MHz range	Pass
Spurious Emission at Antenna Terminals	2.1051 & 27.53(h)	Below -13 dBm/1 kHz, 9 kHz to 150 kHz Below -13 dBm/10 kHz, 150 kHz to 30 MHz Below -13 dBm/1 MHz, 30 MHz to 10 th harmonics	Pass
Field Strength of Spurious Radiation	2.1053 & 27.53(h)	Below -13 dBm/1 MHz	Pass
Frequency Stability	2.1055 & 27.54	Stay within the authorized bands of operation	Pass

698-746MHz Band (LTE Band 12)			
Test Case	FCC Part No.	Requirements	Result
Transmitter Output Power	2.1046 & 27.50(c)	Peak ERP not exceed 3 W	Pass
Modulation Characteristics	2.1047	Digital modulation	Pass
Occupied Bandwidth	2.1049	(Not specified)	Pass
Band Edges Compliance	2.1051 & 27.53(g)	Below -13 dBm/30 kHz, in 100 kHz range	Pass
Spurious Emission at Antenna Terminals	2.1051 & 27.53(g)	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 & 27.53(g)	Below -13 dBm/100 kHz	Pass
Frequency Stability	2.1055 & 27.54	Stay within the authorized bands of operation	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 2 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	Type A:2110 to 2155 MHz; Type B:729 to 746 MHz
Uplink	Type A:1710 to 1755 MHz; Type B:699 to 716 MHz

Note: Type A is for CDMA &EVDO 1700M and LTE band 4; Type B is for LTE band 12.

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: 1.25 MHz LTE system: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz
Designation of Emissions	CDMA system: 1M29F9W LTE system: 1M09G7D (1.4 MHz ,QPSK modulation), 1M10W7D (1.4 MHz ,16QAM modulation), 2M70G7D (3.0 MHz QPSK modulation), 2M69W7D (3.0 MHz 16QAM modulation), 4M49G7D (5.0MHz QPSK modulation), 4M49W7D (5.0MHz 16QAM modulation), 8M99G7D (10 MHz QPSK modulation), 8M97W7D (10 MHz 16QAM modulation),

4.3 Antenna Gain

Antenna Gain(dBi) to CDMA & LTE Band 4	3.40
Antenna Gain(dBi) to LTE Band 12	1.48
Antenna Gain(dBd) to LTE Band 12	-0.67

4.4 Power Supply

Specification	Description
Power Supply Type	Directly Connected to DC /AC Power Supply
Input to EUT (DC power)	DC Voltage Nominal: $\overline{\text{---}}$ +5.0V DC Voltage Range: $\overline{\text{---}}$ +4.75 V to +5.25V
Input to EUT (AC power)	AC Voltage Nominal: ~ 220V (50/60 Hz)



Specification	Description
	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 25	Channel 450	Channel 875
		1711.25MHz	1732.5MHz	1753.75MHz
	RX	Channel 25	Channel 450	Channel 875
		2111.25MHz	2132.5MHz	2153.75MHz
LTE Band 4	TX (5M)	Channel 19975	Channel 20175	Channel 20375
		1712.5 MHz	1732.5MHz	1752.5 MHz
	TX (10M)	Channel 20000	Channel 20175	Channel 20350
		1715.0 MHz	1732.5MHz	1750.0 MHz
	RX (5M)	Channel 1975	Channel 2175	Channel 2375
		2112.5 MHz	2132.5MHz	2152.5 MHz
	RX (10M)	Channel 2000	Channel 2175	Channel 2350
		2115.0 MHz	2132.5MHz	2150.0 MHz
LTE Band 12	TX (1.4M)	Channel 23017	Channel 23095	Channel 23173
		699.7 MHz	707.5MHz	715.3 MHz
	TX (3M)	Channel 23025	Channel 23095	Channel 23165
		700.5 MHz	707.5MHz	714.5
	TX (5M)	Channel 23035	Channel 23095	Channel 23155
		701.5 MHz	707.5MHz	713.5 MHz
	TX (10M)	Channel 23060	Channel 23095	Channel 23130
		704.0 MHz	707.5MHz	711.0 MHz

Test Mode	TX / RX	RF Channel		
		Bottom (B)	Middle (M)	Top (T)
RX (1.4M)		Channel 5017	Channel 5095	Channel 5173
		729.7 MHz	737.5MHz	745.3 MHz
RX (3M)		Channel 5025	Channel 5095	Channel 5165
		730.5 MHz	737.5MHz	744.5MHz
RX (5M)		Channel 5035	Channel 5095	Channel 5155
		731.5 MHz	737.5MHz	743.5 MHz
RX (10M)		Channel 5060	Channel 5095	Channel 5130
		734.0 MHz	737.5MHz	741.0 MHz

5.2 Test Modes

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

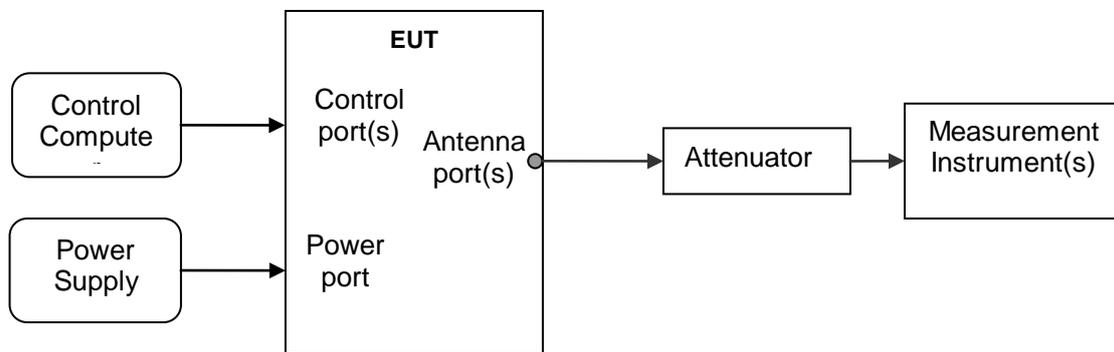
NOTE: VL= lower extreme test voltages
VN= nominal voltage
VH= upper extreme test voltage
TN= normal temperature

5.4 Test Setups

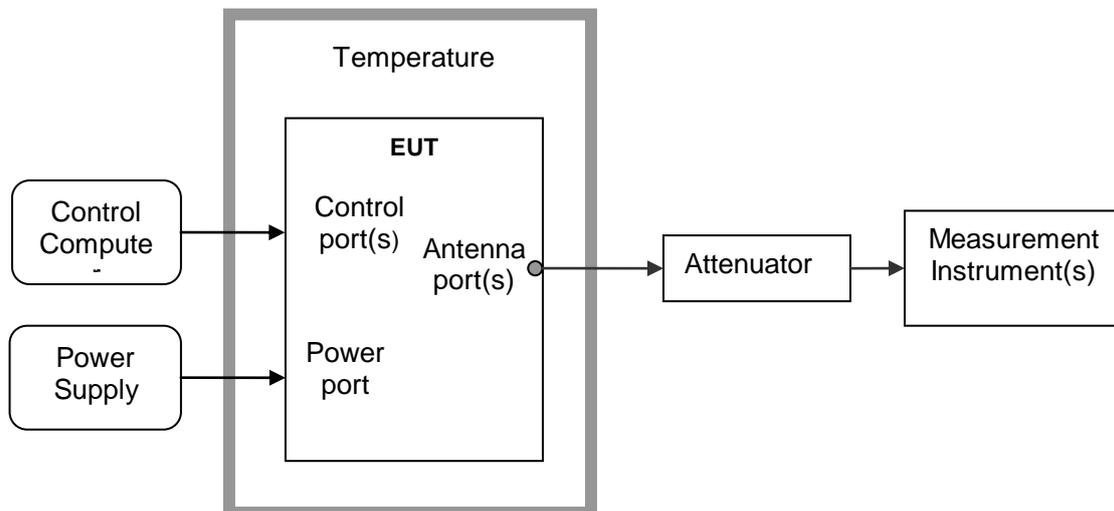
5.4.1 General Test Setup Configurations

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



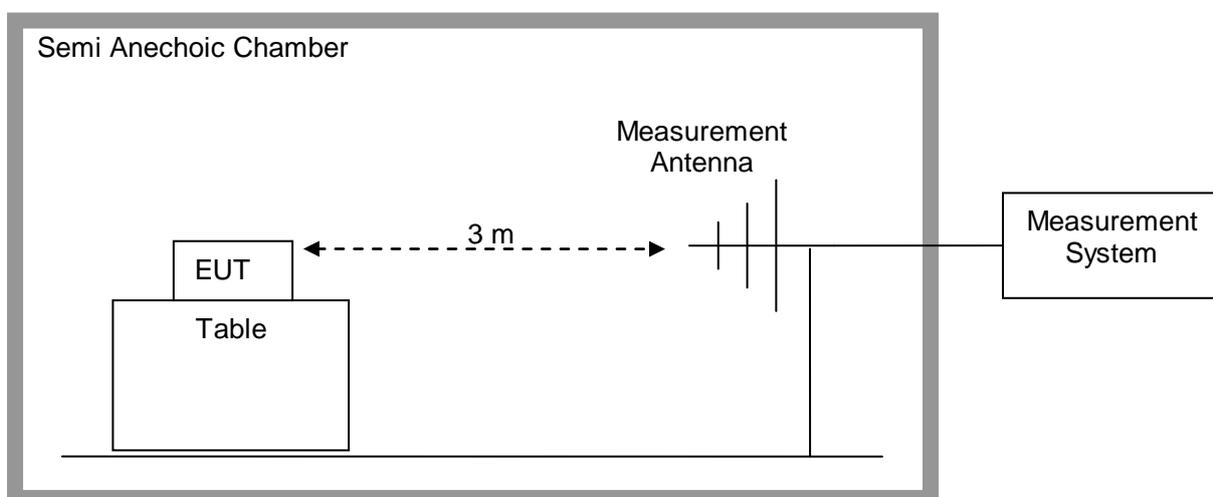
5.4.4 Test Setup 3

NOTE1: Effective Isotropic Radiated Power of Transmitter (EIRP) & Effective radiated power (ERP) refers to the radiation power output of the EUT, assuming all emissions are radiated from Horn antenna.

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.

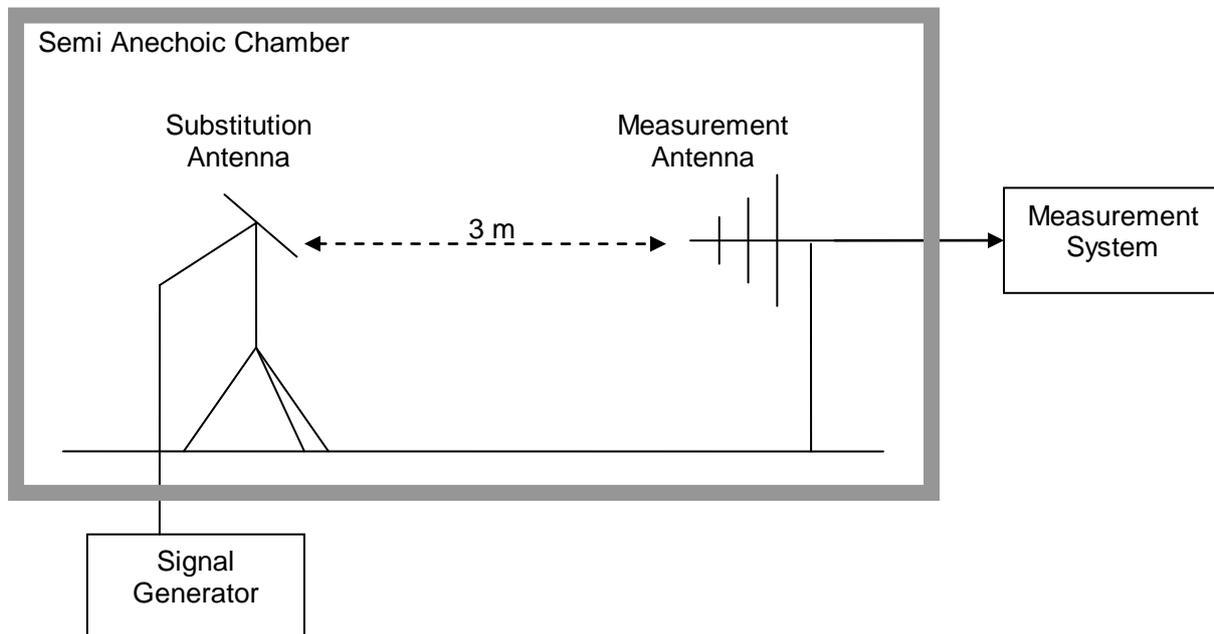
Step 1: Pre-test, find the Maximum EIRP & ERP

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 EIRP & 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 EIRP & 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 Setup	Test Setup 2



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

6 Main Test Instruments

Table 3 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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