



Test Report of FCC CFR 47 Part 15 Subpart B

On Behalf of

GL Technologies (Hong Kong) Limited
Unit 210D, 2/F, Enterprise Place Hong Kong Science Park, Shatin, N.T, Hong Kong

Product Name:	Microuter
Model/Type No.:	GL-USB150
FCC ID:	2AFIW-USB150
Prepared By:	Shenzhen Hongcai Testing Technology Co., Ltd. 1st-3rd Floor, Building C, Shuanghuan Xin Yi Dai Hi-Tech Industrial Park, No.8 Baoqing Road, Baolong Industrial Zone, Longgang District, Shenzhen, Guangdong, China Tel: +86-755-86337020 Fax: +86-755-86337028
Report Number:	HCT17CR057E
Tested Date:	March 17~22, 2017
Issued Date:	March 22, 2017
Tested By:	Jerry Zhao/ 

Reviewed By: 
Owen.Yang
EMC Technical Supervisor

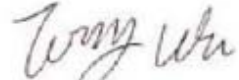
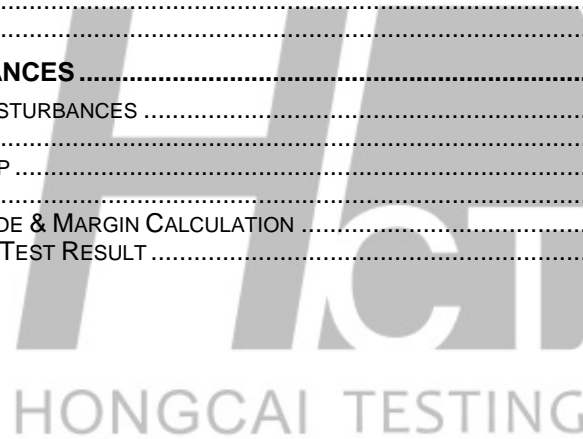
Approved By: 
Tony Wu
EMC Technical Manager

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	3
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	3
1.2 TEST STANDARDS.....	4
1.3 TEST FACILITY.....	4
2. SYSTEM TEST CONFIGURATION.....	5
2.1 EUT CONFIGURATION.....	5
2.2 SUPPORT EQUIPMENTS.....	5
2.3 GENERAL TEST PROCEDURES.....	5
2.4 MEASUREMENT UNCERTAINTY.....	5
2.5 LIST OF MEASURING EQUIPMENTS USED.....	6
3. SUMMARY OF TEST RESULTS.....	6
4. TEST OF AC POWER LINE CONDUCTED EMISSION.....	7
4.1 LIMIT OF AC POWER LINE CONDUCTED EMISSION.....	7
4.2 EUT SETUP.....	7
4.3 INSTRUMENT SETUP.....	8
4.4 TEST PROCEDURE.....	8
4.5 TEST RESULT.....	8
5 - RADIATED DISTURBANCES.....	11
5.1 LIMIT OF RADIATED DISTURBANCES.....	11
5.2 EUT SETUP.....	11
5.3 TEST RECEIVER SETUP.....	12
5.4 TEST PROCEDURE.....	12
5.5 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	12
5.6 RADIATED EMISSIONS TEST RESULT.....	12



1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	GL Technologies (Hong Kong) Limited
Address of Applicant:	Unit 210D, 2/F, Enterprise Place Hong Kong Science Park, Shatin, N.T, Hong Kong
Manufacturer :	GL Technologies (Hong Kong) Limited
Address of manufacturer:	Unit 210D, 2/F, Enterprise Place Hong Kong Science Park, Shatin, N.T, Hong Kong

General Description of E.U.T

Items	Description
EUT Description:	Microuter
Model No.:	GL-USB150
Trade Mark:	GL·iNet
Supplementary Model:	N/A
Frequency Band:	IEEE 802.11b : 2412MHz~2462MHz; IEEE 802.11g : 2412MHz~2462MHz; IEEE 802.11n HT20 : 2412MHz~2462MHz; IEEE 802.11n HT40 : 2422MHz~2452MHz;
Channel Spacing:	IEEE 802.11b : 5MHz IEEE 802.11g : 5MHz IEEE 802.11n HT20 : 5MHz IEEE 802.11n HT40 : 5MHz
Number of Channels:	IEEE 802.11b :11 Channels; IEEE 802.11g :11 Channels; IEEE 802.11n HT20 :11 Channels; IEEE 802.11n HT40 :7 Channels;
Transmit Data Rate:	maximum of 150Mbps
Type of Modulation:	IEEE 802.11b: CCK IEEE 802.11g: OFDM IEEE 802.11n HT20: OFDM IEEE 802.11n HT40: OFDM
Antenna Type:	PCB ANTENNA
Antenna Gain:	3.2dBi
Power Rating:	Input: DC 5V

Remark: * The test data gathered are from the production sample provided by the manufacturer.
*This product have two different color: Black and White. we chose the worst data for the report.

1.2 Test Standards

The report of EUT is prepared in accordance with FCC Rules and Regulations Part 15 Subpart B ,
The objective of the manufacturer is to demonstrate compliance with the described above standards.

1.3 Test Facility

All measurement required was performed at laboratory of Shenzhen CTL Testing Technology Co.,
Ltd. at Floor 1-A,Baisha Technology Park,No.3011,Shahexi Road, Nanshan District, Shenzhen,
China 518055.

The test facility is recognized, certified, or accredited by the following organizations:

FCC – Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described
in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the
FCC is maintained in our files. Registration 970318, December, 2013.



2. SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2 Support Equipments

The calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 or 10 meters from the leading edge of the turntable.

Support equipments or special accessories in test configuration:

AUX Description:	Manufacturer	Model No.	Certificate	CABLE
Laptop	DELL	INSPIRON 3420	CE,FCC	1.5m Unshielded Power Cord with core

2.3 General Test Procedures

Conducted Emissions:The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 7.1 of ANSI C63.4-2014 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak detector mode.

Radiated Emissions: The EUT is a placed on as turntable, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4-2014.

2.4 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Power Line Conducted Emission	+/- 2.3 dB
Radiated Emission	+/- 3.4 dB

Uncertainty figures are valid to a confidence level of 95%.

2.5 List of Measuring Equipments Used

No.	Equipment	Manufacturer	Model No.	S/N	Last Calculator	Due Calculator
1	EMI Test Receiver	R&S	ESCI	100687	2016-7-25	2017-7-24
2	EMI Test Receiver	R&S	ESPI	100097	2016-10-1	2017-10-31
3	Amplifier	HP	8447D	1937A02492	2016-7-25	2017-7-24
4	TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB9163	9163-324	2016-7-25	2017-7-24
5	Triple-Loop Antenna	EVERFINE	LLA-2	711002	2016-10-1	2017-10-31
6	RF POWER AMPLIFIER	FRANKONIA	FLL-75	1020A1109	2016-7-25	2017-7-24
7	6DB Attenuator	FRANKONIA	N/A	1001698	2016-7-25	2017-7-24
8	10dB attenuator	ELECTRO-METRICS	EM-7600	836	2016-7-25	2017-7-24
9	Spectrum Analyzer	R&S	FSP	100397	2016-10-1	2017-10-31
10	Broadband preamplifier	SCHWARZBECK	BBV9718	9718-182	2016-7-25	2017-7-24
11	Horn Antenna	SCHWARZBECK	BBHA 9120D	0437	2016-7-25	2017-7-24
12	Horn Antenna	SCHWARZBECK	BBHA9170	0483	2016-7-25	2017-7-24

3. SUMMARY OF TEST RESULTS

Standard	Test Items	Result
FCC Part 15 Subpart B	Conduction Emission 0.15MHz to 30MHz	Pass
FCC Part 15 Subpart B	Radiation Emission 30MHz to 1000MHz	Pass

4. TEST OF AC POWER LINE CONDUCTED EMISSION

4.1 Limit of AC Power Line Conducted Emission

Frequency Range (MHz)	Limits (dBuV)	
	Quasi-Peak	Average
0.150~0.500	66~56	56~46
0.500~5.000	56	46
5.000~30.00	60	50

4.2 EUT Setup

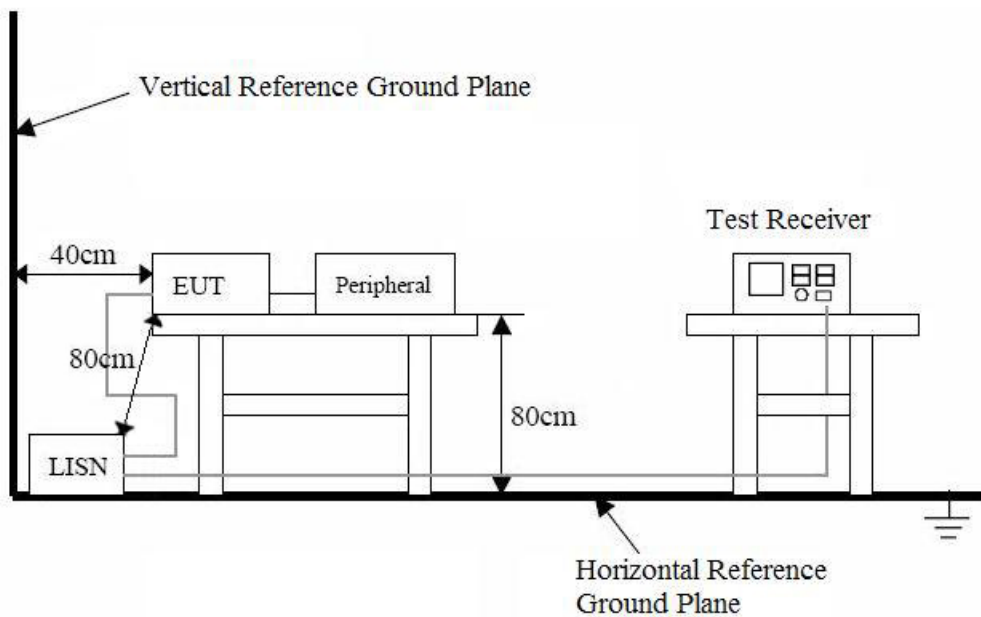
The setup of EUT is according with ANSI C63.4-2014 measurement procedure. The specification used was the FCC Rules and Regulations Part 15 Subpart B limits.

The EUT was placed center and the back edge of the test table.

The AV cables were draped along the test table and bundled to 30-40cm in the middle.

The spacing between the peripherals was 10 cm.

Maximum emission emitted from EUT was determined by manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation and the levels in the final result of the test were recorded with the EUT running in the operating mode that maximum emission was emitted.



Remark: The EUT was connected to a 120VAC/ 60Hz power source.

4.3 Instrument Setup

The test receiver was set with the following configurations:

Test Receiver Setting:

Frequency Range.....150 KHz to 30 MHz
 Detector.....Peak & Quasi-Peak & Average
 Sweep Speed.....Auto
 IF Band Width.....9 KHz

4.4 Test Procedure

During the conducted emission test, the EUT power cord was connected to the auxiliary outlet of the first Artificial Mains.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination.

All data was recorded in the peak detection mode. Quasi-peak and Average readings were only performed when an emission was found to be marginal (within -10 dB μ V of specification limits). Quasi-peak readings are distinguished with a "QP". Average readings are distinguished with a "AV".

4.5 Test Result

Temperature (°C) : 22~23	EUT: Microuter
Humidity (%RH) : 50~54	M/N: GL-USB150
Barometric Pressure (mbar) : 950~1000	Operation Condition: Normal operation

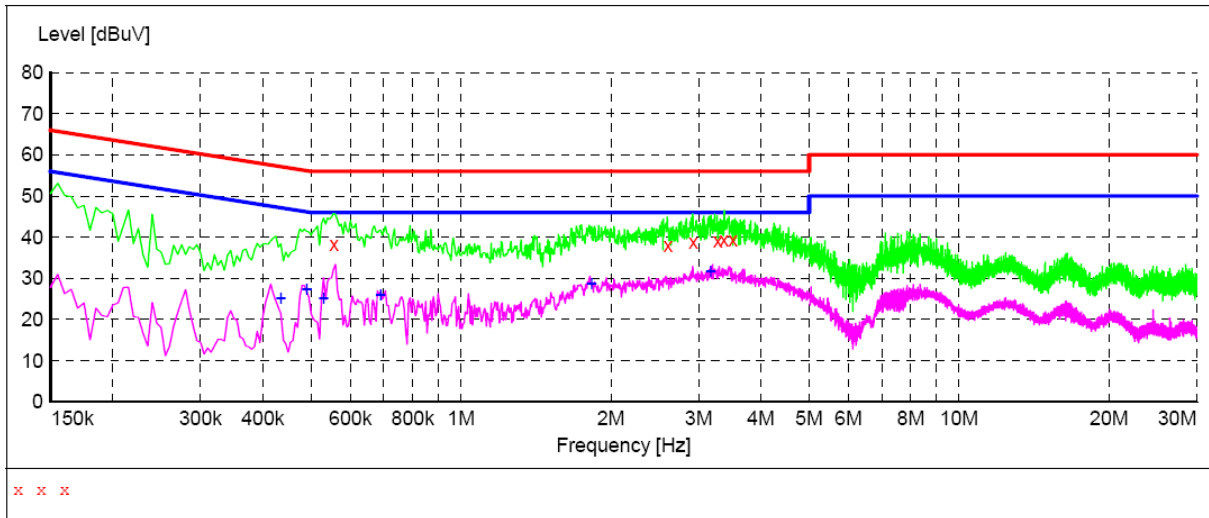
PASS

HONGCAI TESTING

Conducted Emission: GL-USB150

EUT: Microuter
M/N: GL-USB150
Operating Condition: Normal operation
Test Site: Shielded Room
Operator: LV
Test Specification: DC 5V
Comment: L Line

SCAN TABLE: "Voltage (150K-30M) FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.555000	38.20	10.4	56	17.8	QP	L1	GND
2.605000	38.10	12.6	56	17.9	QP	L1	GND
2.925000	38.90	12.4	56	17.1	QP	L1	GND
3.275000	39.10	12.6	56	16.9	QP	L1	GND
3.370000	39.40	12.7	56	16.6	QP	L1	GND
3.515000	39.40	12.8	56	16.6	QP	L1	GND

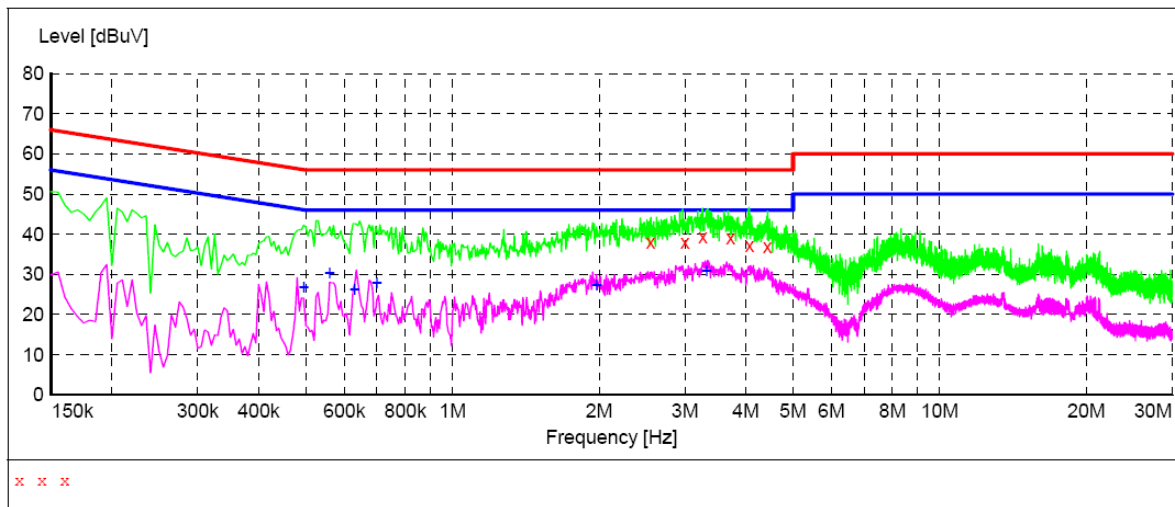
MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.435000	25.30	11.0	47	21.9	AV	L1	GND
0.490000	27.30	10.5	46	18.9	AV	L1	GND
0.530000	25.30	10.4	46	20.7	AV	L1	GND
0.690000	26.10	10.3	46	19.9	AV	L1	GND
1.830000	28.60	12.9	46	17.4	AV	L1	GND
3.170000	31.60	12.5	46	14.4	AV	L1	GND

Conducted Emission: GL-USB150

EUT: Microuter
M/N: GL-USB150
Operating Condition: Normal operation
Test Site: Shielded Room
Operator: LV
Test Specification: DC 5V
Comment: N Line

SCAN TABLE: "Voltage (150K-30M) FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
2.550000	37.90	12.7	56	18.1	QP	N	GND
3.000000	38.10	12.3	56	17.9	QP	N	GND
3.260000	39.30	12.6	56	16.7	QP	N	GND
3.720000	39.00	13.0	56	17.0	QP	N	GND
4.070000	37.20	13.3	56	18.8	QP	N	GND
4.425000	36.90	13.4	56	19.1	QP	N	GND

MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.495000	26.80	10.4	46	19.3	AV	N	GND
0.560000	30.20	10.4	46	15.8	AV	N	GND
0.630000	26.30	10.4	46	19.7	AV	N	GND
0.700000	27.90	10.3	46	18.1	AV	N	GND
1.980000	27.20	13.2	46	18.8	AV	N	GND
3.325000	31.00	12.6	46	15.0	AV	N	GND

5 - RADIATED DISTURBANCES

5.1 Limit of Radiated Disturbances

Frequency (MHz)	Distance (Meters)	Field Strengths Limits (dB μ V/m)
30 ~ 88	3	40
88~216	3	43.5
216 ~ 960	3	46
Above 960	3	54

Note:

- (1) The tighter limit shall apply at the edge between two frequency bands.
- (2) Distance refers to the distance in meters between the test instrument antenna and the closest point of any part of the E.U.T.

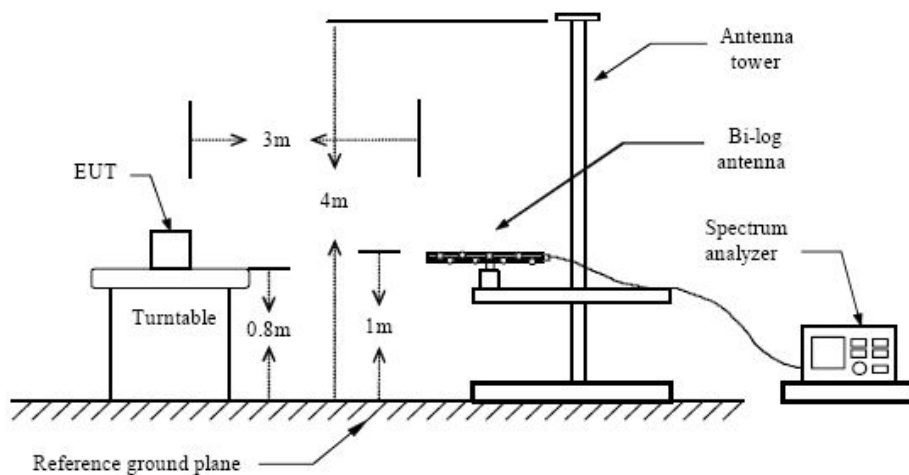
5.2 EUT Setup

The radiated emission tests were performed in the in the 3-meter anechoic chamber, using the setup accordance with the ANSI C63.4-2014. The specification used was the FCC Part 15 Subpart B limits.

The EUT was placed on the center of the test table.

Maximum emission emitted from EUT was determined by manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation and the levels in the final result of the test were recorded with the EUT running in the operating mode that maximum emission was emitted.

Below 1 GHz



5.3 Test Receiver Setup

According to FCC Part 15 rule, the frequency was investigated from 30 to 1000 MHz. During the radiated emission test, the test receiver was set with the following configurations:

Test Receiver Setting:

Detector.....Peak & Quasi-Peak
 IF Band Width.....120KHz
 Frequency Range.....30MHz to 1000MHz
 Turntable Rotated.....0 to 360 degrees

Antenna Position:

Height.....1m to 4m
 Polarity.....Horizontal and Vertical

5.4 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -10 dB μ V of specification limits), and are distinguished with a "QP" in the data table.

5.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB μ V means the emission is 7dB μ V below the maximum limit for Subpart B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corr. Ampl.}$$

5.6 Radiated Emissions Test Result

Temperature (°C) : 22~23	EUT: Microuter
Humidity (%RH) : 50~54	M/N: GL-USB150
Barometric Pressure (mbar) : 950~1000	Operation Condition: Normal operation

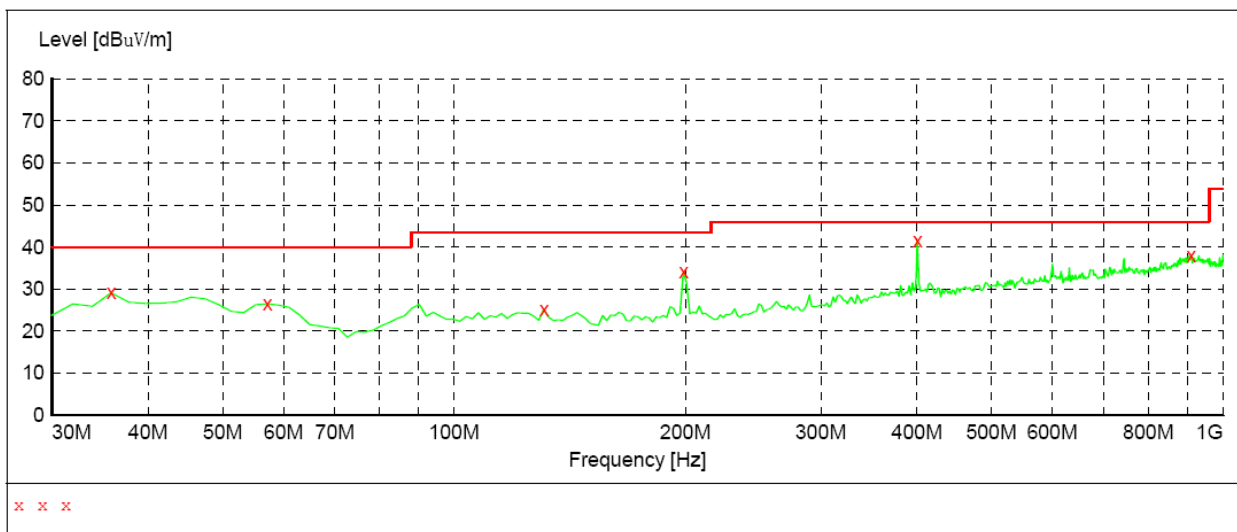
PASS

Radiated Emission Test Data (30~1000M)

EUT: Microuter
M/N: GL-USB150
Operating Condition: Normal operation
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: DC 5V
Comment: Polarization: Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength				Transducer
Start	Stop	Detector	Meas. Time	IF Bandw.		
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015	



MEASUREMENT RESULT:

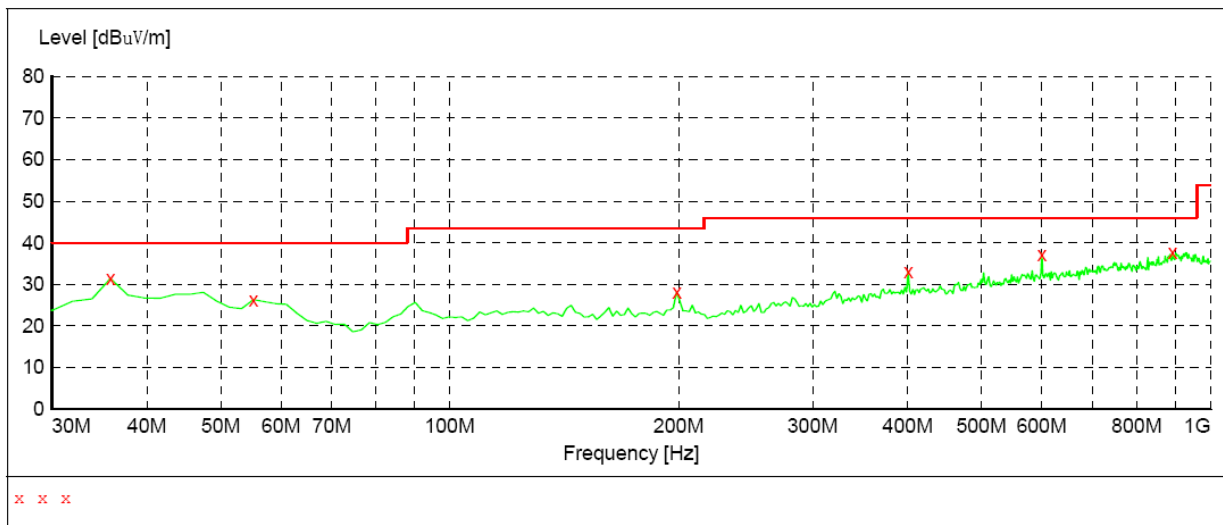
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
35.820000	29.10	14.5	40.0	10.9	QP	300.0	0.00	HORIZONTAL
57.160000	26.50	15.7	40.0	13.5	QP	300.0	0.00	HORIZONTAL
130.880000	25.20	12.7	43.5	18.3	QP	100.0	0.00	HORIZONTAL
198.780000	34.30	13.9	43.5	9.2	QP	100.0	0.00	HORIZONTAL
400.540000	41.50	17.8	46.0	4.5	QP	300.0	0.00	HORIZONTAL
908.820000	38.00	25.8	46.0	8.0	QP	100.0	0.00	HORIZONTAL

Radiated Emission Test Data (30~1000M)

EUT: Microuter
M/N: GL-USB150
Operating Condition: Normal operation
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: DC 5V/1A from micro USB
Comment: Polarization: Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency				
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT:

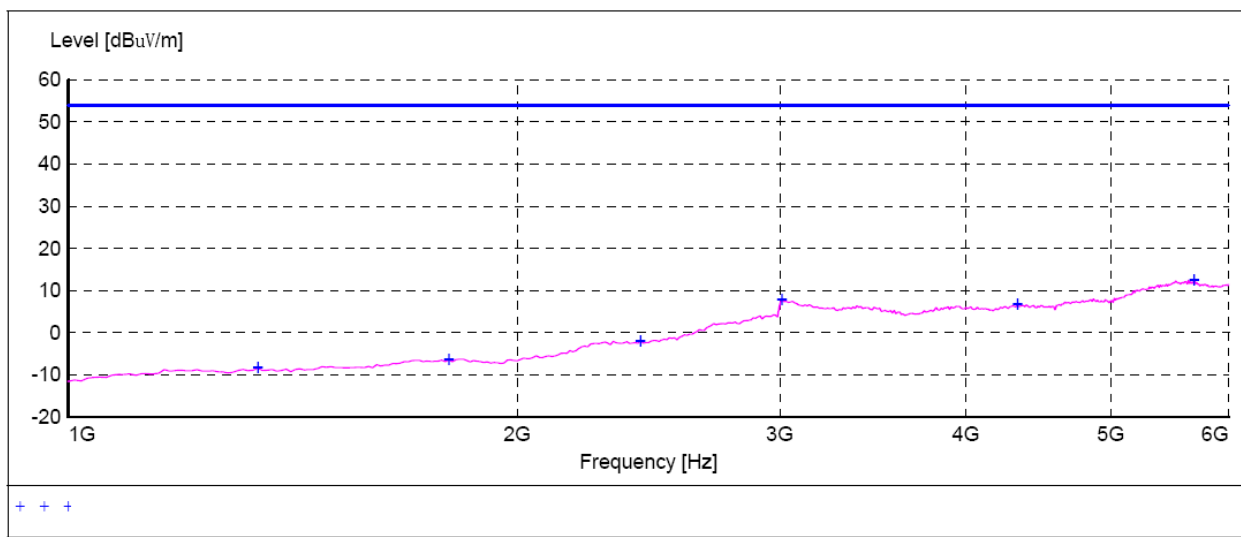
Frequency MHz	Level dBUV/m	Transd dB	Limit dBUV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
35.820000	31.40	14.5	40.0	8.6	QP	100.0	0.00	VERTICAL
55.220000	26.30	15.1	40.0	13.7	QP	100.0	0.00	VERTICAL
198.780000	28.10	13.9	43.5	15.4	QP	100.0	0.00	VERTICAL
400.540000	33.10	17.8	46.0	12.9	QP	100.0	0.00	VERTICAL
600.360000	37.30	21.7	46.0	8.7	QP	100.0	0.00	VERTICAL
891.360000	37.80	25.5	46.0	8.2	QP	100.0	0.00	VERTICAL

Radiated Emission Test Data (Above 1000M)

EUT: Microuter
M/N: GL-USB150
Operating Condition: Normal operation
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: DC 5V/1A from micro USB
Comment: Polarization: Horizontal

SWEEP TABLE: "test (1M-7G) FCC"

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	7.0 GHz	Average	Coupled	100 kHz	BBHA 9120A NEW



MEASUREMENT RESULT:

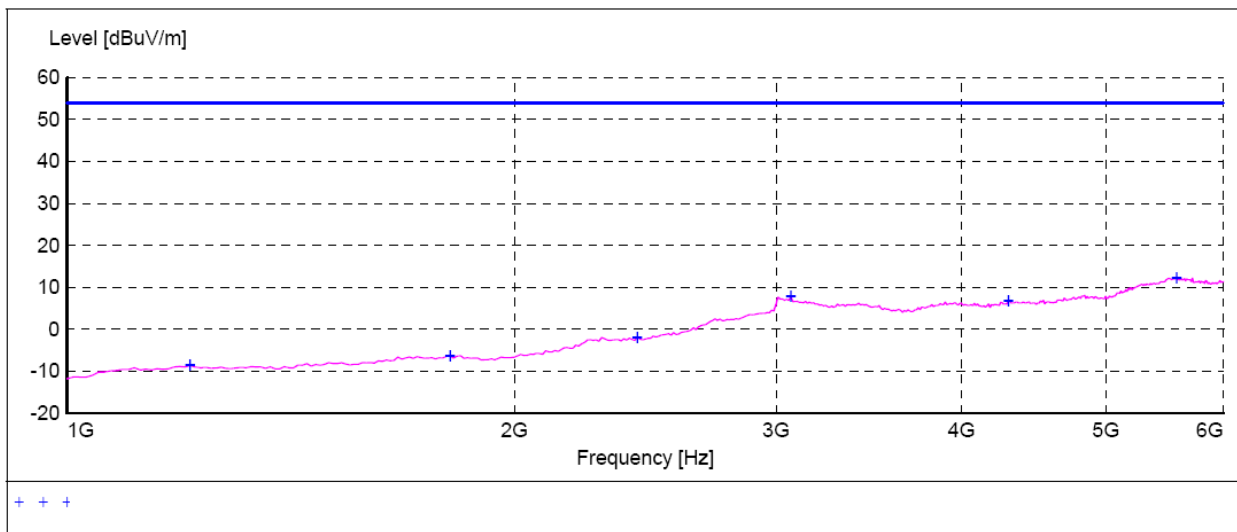
Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1340.000000	-8.30	-10.4	53.9	62.2	AV	100.0	0.00	HORIZONTAL
1800.000000	-6.40	-8.4	53.9	60.3	AV	100.0	0.00	HORIZONTAL
2420.000000	-1.90	-3.9	53.9	55.8	AV	100.0	0.00	HORIZONTAL
3010.000000	7.80	1.0	53.9	46.1	AV	100.0	0.00	HORIZONTAL
4330.000000	6.70	0.4	53.9	47.2	AV	100.0	0.00	HORIZONTAL
5690.000000	12.60	6.7	53.9	41.3	AV	100.0	0.00	HORIZONTAL

Radiated Emission Test Data (Above 1000M)

EUT: Microuter
M/N: GL-USB150
Operating Condition: Normal operation
Test Site: 3m CHAMBER
Operator: Chen
Test Specification: DC 5V/1A from micro USB
Comment: Polarization: Vertical

SWEEP TABLE: "test (1M-7G) FCC"

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
1.0 GHz	7.0 GHz	Average	Coupled	100 kHz	BBHA 9120A NEW



MEASUREMENT RESULT:

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1210.000000	-8.60	-11.0	53.9	62.5	AV	100.0	0.00	VERTICAL
1810.000000	-6.30	-8.4	53.9	60.2	AV	100.0	0.00	VERTICAL
2420.000000	-1.90	-3.9	53.9	55.8	AV	100.0	0.00	VERTICAL
3070.000000	7.80	0.7	53.9	46.1	AV	100.0	0.00	VERTICAL
4300.000000	6.80	0.3	53.9	47.1	AV	100.0	0.00	VERTICAL
5580.000000	12.40	6.8	53.9	41.5	AV	100.0	0.00	VERTICAL