

FCC Test Report

Client Name : Shenzhen Feima Robotics Technology Co.,Ltd

Address : 1/f,16, Zhiheng Industrial Park, Nantou Second Road,
Nantou Street, Nanshan District, Shenzhen, China

Product Name : Handheld Laser Scanner

Date : Jul. 18, 2022

Shenzhen Anbotek Compliance Laboratory Limited



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TEST REPORT

Applicant : Shenzhen Feima Robotics Technology Co.,Ltd
Manufacturer : Tianjin Feima Robotics Technology Co., Ltd.
Product Name : Handheld Laser Scanner
Model No. : SLAM100, X120^{GO}
Trade Mark : N.A.
Rating(s) : Input: 20-30V= 3A, or DC 14.4V, 3350mAh with "FM18650A"*4 battery inside

Test Standard(s) : FCC Part15 Subpart C, Section 15.225

Test Method(s) : ANSI C63.10: 2020

The device described above is tested by Shenzhen Anbotech Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotech Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotech Compliance Laboratory Limited.

Date of Receipt

May 30, 2022

Date of Test

May 30~Jun. 21, 2022

Prepared By

Tu Tu Hong

(TuTu Hong)

Approved & Authorized Signer

Kingkong Jin

(Kingkong Jin)

1. General Information

1.1. Client Information

Applicant	:	Shenzhen Feima Robotics Technology Co.,Ltd
Address	:	1/f,16, Zhiheng Industrial Park, Nantou Second Road, Nantou Street, Nanshan District, Shenzhen, China
Manufacturer	:	Tianjin Feima Robotics Technology Co., Ltd.
Address	:	Unit 1, Factory building A09, No1, Huandong Avenue 6, Tianjin Pilot Free Trade Zone (Airport Economic Zone),China
Factory	:	Tianjin Feima Robotics Technology Co., Ltd.
Address	:	Unit 1, Factory building A09, No1, Huandong Avenue 6, Tianjin Pilot Free Trade Zone (Airport Economic Zone),China

1.2. Description of Device (EUT)

Product Name	:	Handheld Laser Scanner
Model No.	:	SLAM100, X120 ^{GO} (Note: All samples are the same except the model number, so we prepare "SLAM100" for test only.)
Trade Mark	:	N.A
Test Power Supply	:	DC 14.4V battery inside
Product Description	:	Operation Frequency: WiFi 2.4G: 2412~2462 MHz for 802.11b/g/n(HT20) 2422~2452 MHz for 802.11n(HT40) WiFi 5.2G: 5180~5240MHz WiFi 5.6G: 5500~5700MHz WiFi 5.8G: 5745~5825MHz NFC: 13.56MHz
	:	Number of Channel: WiFi 2.4G: 11 Channels for 802.11b/g/n(HT20) 7 Channels for 802.11n(HT40) WiFi 5.2G: 4 Channels for 802.11a/n(HT20)/ac(HT20) 2 Channels for 802.11n(HT40)/ac(HT40) 1 Channels for 802.11ac(HT80) WiFi 5.6G: 11 Channels for 802.11a/n(HT20)/ac(HT20) 5 Channels for 802.11n(HT40)/ac(HT40) 2 Channels for 802.11ac(HT80) WiFi 5.8G:

		5 Channels for 802.11a/n(HT20)/ac(HT20) 2 Channels for 802.11n(HT40)/ac(HT40) 1 Channels for 802.11ac(HT80) NFC: 1 Channel
	Modulation Type:	WiFi 2.4G: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM WiFi 5G: OFDM with BPSK/QPSK/16QAM/64QAM/256QAM
	Antenna Type:	WiFi ANT 1: Ceramic antenna WiFi ANT 2: Ceramic antenna NFC: Inductive loop coil Antenna
	Antenna Gain(Peak):	WiFi 2.4G ANT 1: 0dBi (Provided by customer) WiFi 2.4G ANT 2: 0 dBi (Provided by customer) WiFi 5.2G ANT 1: 0dBi (Provided by customer) WiFi 5.2G ANT 2: 0dBi (Provided by customer) WiFi 5.6G ANT 1: 0dBi (Provided by customer) WiFi 5.6G ANT 2: 0dBi (Provided by customer) WiFi 5.8G ANT 1: 0dBi (Provided by customer) WiFi 5.8G ANT 2: 0dBi (Provided by customer) NFC: 0 dBi(Provided by customer)
	Adapter:	N.A.
Remark: 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual. 2) This report is for 13.56MHz module.		

1.3. Auxiliary Equipment Used During Test

N/A

1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	NFC Mode

For Conduction Emission	
Final Test Mode	Description
Mode 1	NFC Mode

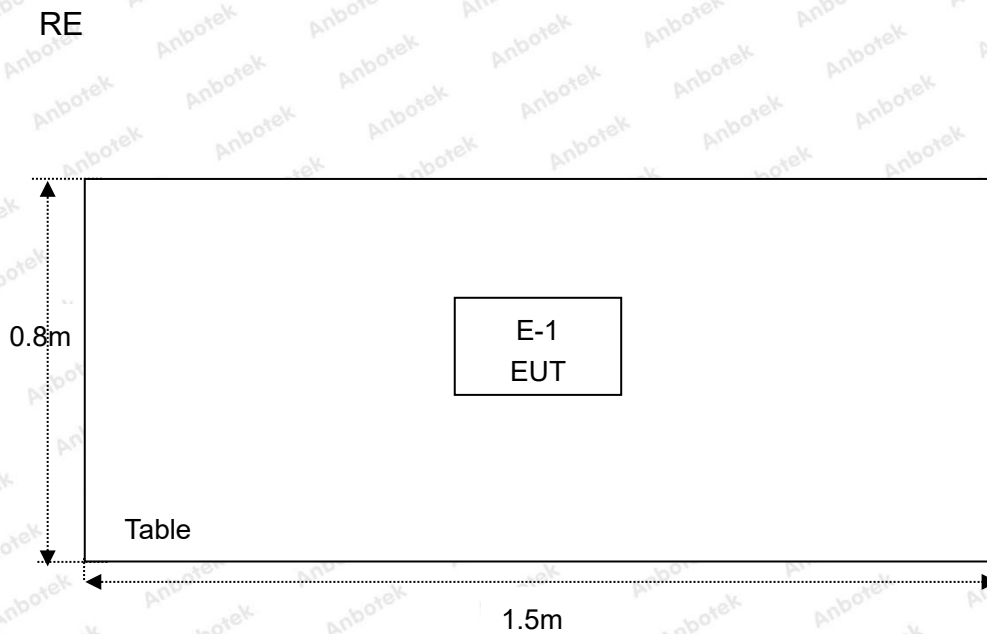
For Radiated Emission	
Final Test Mode	Description
Mode 1	NFC Mode

Note: During the test, the EUT was keeping continuous transmission.

1.5. List of channels

Channel	Freq. (MHz)
01	13.56

1.6. Description Of Test Setup



1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jul 05, 2021	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 22, 2021	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 22, 2021	1 Year
4.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Oct. 22, 2021	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 22, 2021	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Oct. 22, 2021	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Oct. 22, 2021	2 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Oct. 22, 2021	2 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 22, 2021	2 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Oct. 22, 2021	2 Year
11.	Pre-amplifier	SONOMA	310N	186860	Oct. 22, 2021	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	RF Test Control System	YIHENG	YH3000	2017430	Oct. 22, 2021	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Oct. 22, 2021	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Oct. 22, 2021	1 Year
16.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 22, 2021	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 22, 2021	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 22, 2021	1 Year
19.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 22, 2021	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Oct. 22, 2021	1 Year

1.8. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
		Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4 dB

1.9. Description of Test Facility

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

FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, 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 No. 184111.

ISED-Registration No.: 8058A

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotek Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102

2. Summary of Test Results

Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	N/A
15.205/15.209/15.225(b)	Spurious Emission	PASS
15.225(c)	20dB Occupied Bandwidth	PASS
15.225	Frequency Tolerance	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

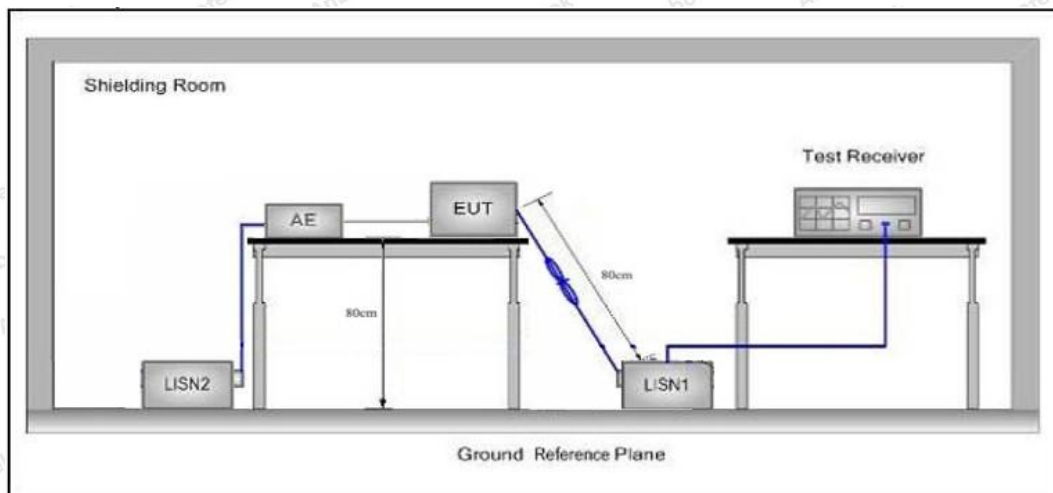
3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50

Remark: (1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequency.

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2020 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

Not applicable.

The EUT is powered by DC power, so there is no need to conduct this test.

4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209, 15.205 and 15.225(a)				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

- (1) The lower limit shall apply at the transition frequency.
- (2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Note:

(1) The tighter limit shall apply at the boundary between two frequency range.

(2) Limitation expressed in dBuV/m is calculated by $20\log$ Emission Level (uV/m).

(3) If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula of $Ld1 = Ld2 * (d2/d1)^2$.

Example:

F.S Limit at 30m distance is 30uV/m , then F.S Limitation at 3m distance is adjusted as $Ld1 = L1 = 30uV/m * (10)^2 = 100 * 30 uV/m$

4.2. Test Setup

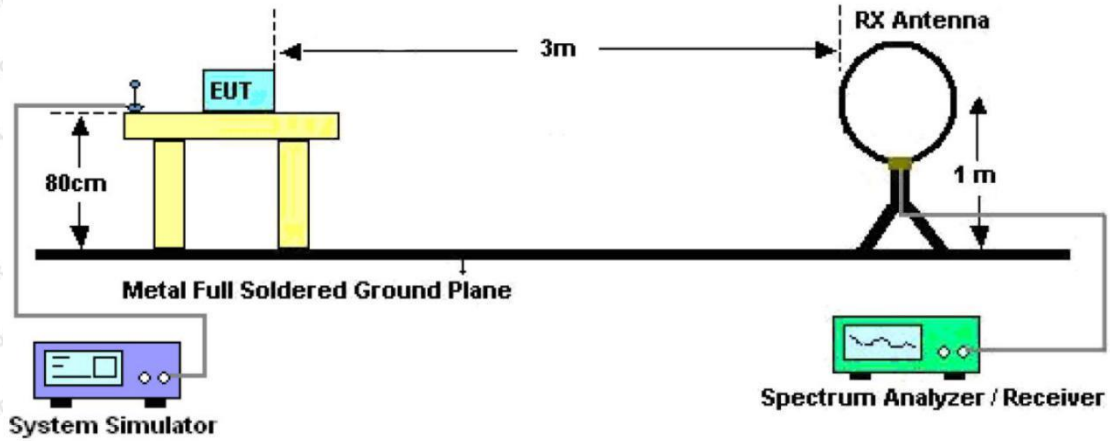


Figure 1. Below 30MHz

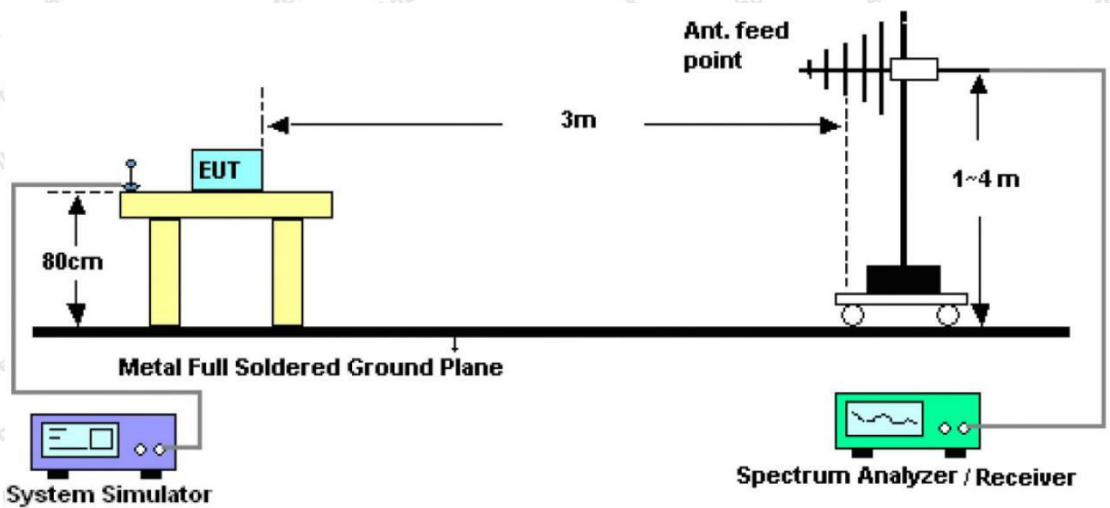


Figure 2. 30MHz to 1GHz

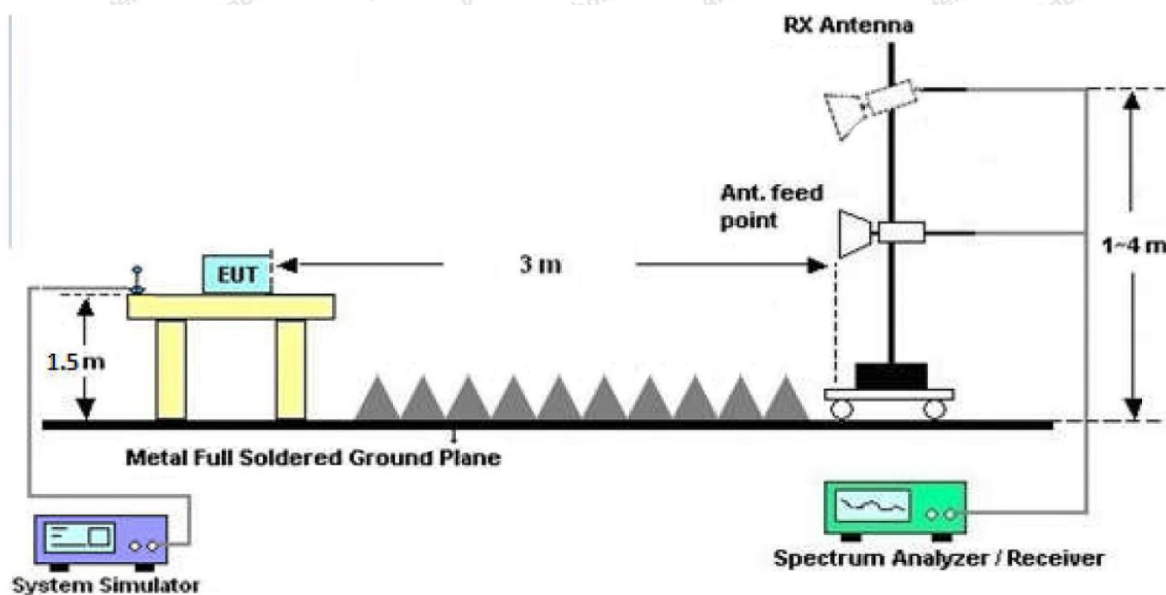


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW = 1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9KHz, VBW = 30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW = 300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz, Set the spectrum analyzer as:

RBW = 1MHz, VBW = 1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

RBW = 1MHz, VBW = 10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

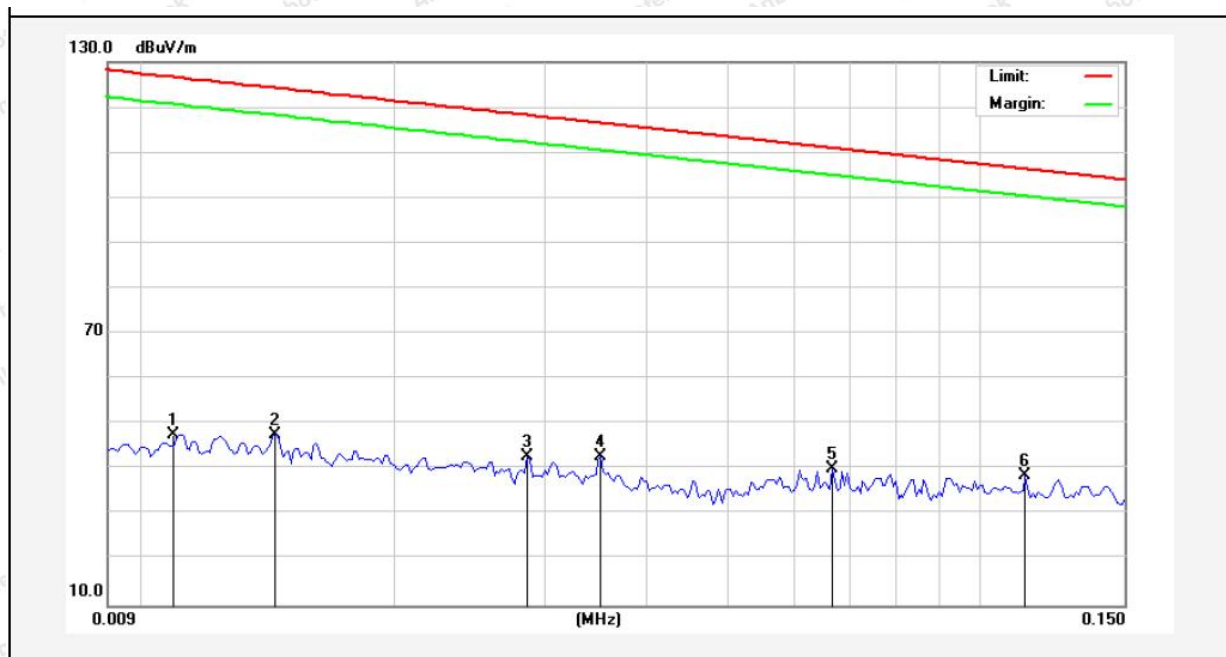
4.4. Test Data

PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

Test Results (9KHz~150KHz)

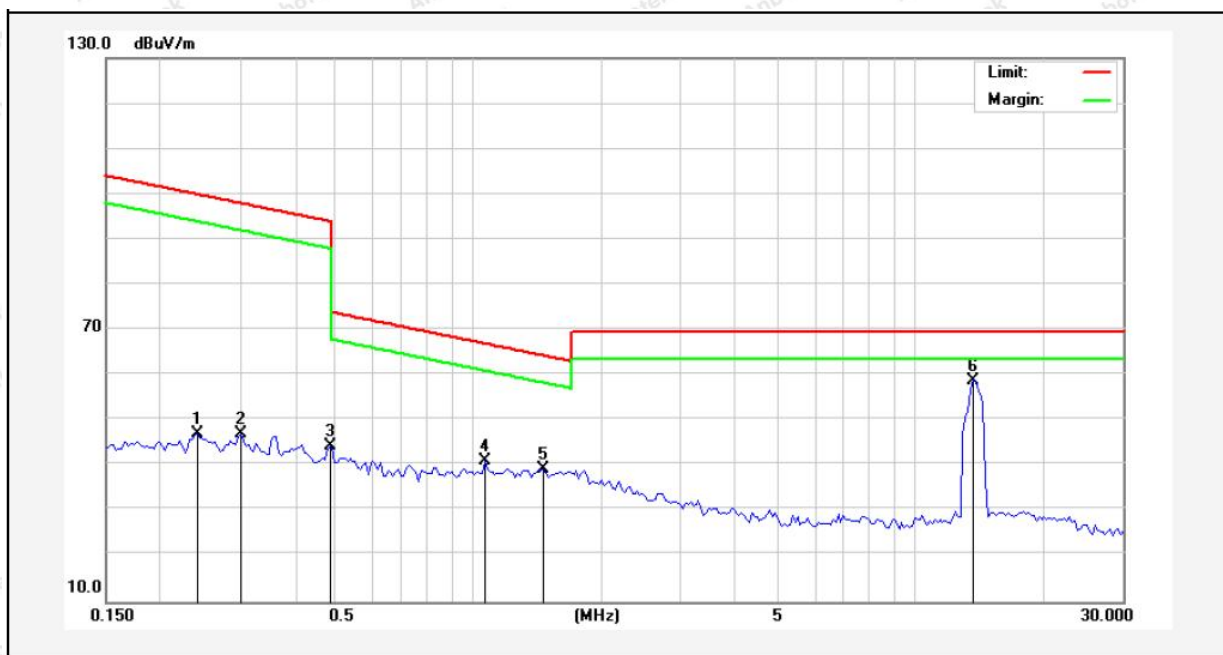
Test Mode: Mode 1
Power Source: DC 14.4V battery inside
Polarization: X
Temp.(°C)/Hum.(%RH): 24.1°C/48%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	0.0108	27.61	20.06	47.67	126.73	-79.06	AV			
2	0.0143	27.42	20.22	47.64	124.31	-76.67	AV			
3	0.0286	22.38	20.40	42.78	118.32	-75.54	AV			
4	0.0352	22.32	20.48	42.80	116.53	-73.73	AV			
5	0.0666	19.77	20.38	40.15	111.03	-70.88	AV			
6	0.1140	18.22	20.30	38.52	106.39	-67.87	AV			

Test Results (150KHz~30MHz)

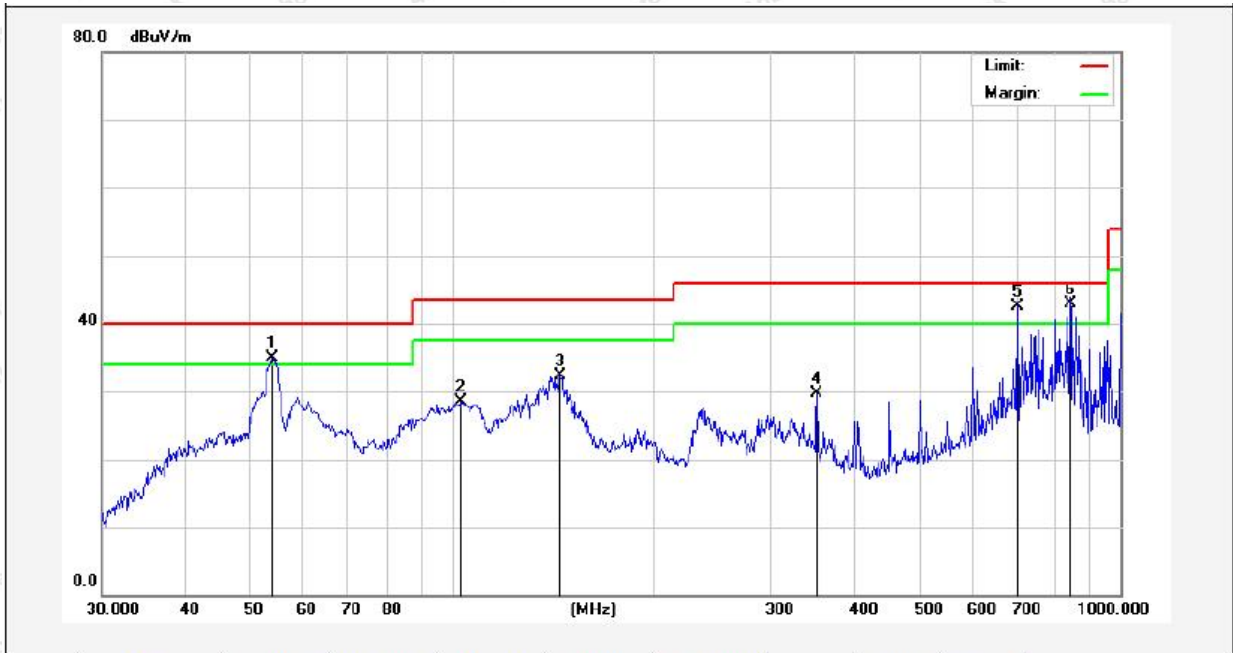
Test Mode: Mode 1
Power Source: DC 14.4V battery inside
Polarization: X
Temp.(°C)/Hum.(%RH): 24.1°C/48%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	0.2416	26.61	20.30	46.91	99.90	-52.99	AV			
2	0.3027	26.89	20.30	47.19	97.96	-50.77	AV			
3	0.4812	24.08	20.27	44.35	93.95	-49.60	AV			
4	1.0786	20.82	20.25	41.07	66.97	-25.90	QP			
5	1.4637	19.11	20.27	39.38	64.32	-24.94	QP			
6	13.5600	38.37	20.53	58.90	69.50	-10.60	QP			

Test Results (30~1000MHz)

Test Mode: Mode 1
Power Source: DC 14.4V battery inside
Polarization: Vertical
Temp.(°C)/Hum.(%RH): 23.6°C/47%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	53.8818	52.11	-17.21	34.90	40.00	-5.10	QP			
2	103.4421	45.57	-17.12	28.45	43.50	-15.05	QP			
3	145.3506	54.38	-22.13	32.25	43.50	-11.25	QP			
4	351.7079	44.60	-14.98	29.62	46.00	-16.38	QP			
5	701.7610	52.38	-9.89	42.49	46.00	-3.51	QP			
6	842.1296	50.52	-7.61	42.91	46.00	-3.09	QP			

Test Results (30~1000MHz)

Test Mode: Mode 1
Power Source: DC 14.4V battery inside
Polarization: Horizontal
Temp.(°C)/Hum.(%RH): 23.6°C/47%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	141.3298	58.92	-23.05	35.87	43.50	-7.63	QP			
2	152.6641	55.62	-23.17	32.45	43.50	-11.05	QP			
3	250.3012	59.61	-21.47	38.14	46.00	-7.86	QP			
4	701.7610	49.57	-9.89	39.68	46.00	-6.32	QP			
5	801.7863	45.20	-8.24	36.96	46.00	-9.04	QP			
6	830.4002	45.99	-7.80	38.19	46.00	-7.81	QP			

Test Results (Inband)

Indicated			Table Angle Degree	Antenna Height (m)	Detector	Correction Factor			Corrected Amplitude (dBuV/m) @3m	FCC part 15.225	
Frequency Range (MHz)	Mark Point (MHz)	Corrected Amplitude (dBuV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre- Amp. Gain (dB)		Limit (dBuV/m) @3m	Result
13.110~13.410	13.387	73.32	0	1.0	QP	20.8	0.2	30.2	64.12	80.5	PASS
13.410~13.553	13.547	74.94	0	1.0	QP	20.9	0.2	30.2	65.84	90.5	PASS
13.553~13.567	13.558	94.08	0	1.0	QP	20.9	0.2	30.2	84.98	124	PASS
13.567~13.710	13.576	73.84	0	1.0	QP	21.1	0.2	30.2	64.94	90.5	PASS
13.710~14.010	13.889	69.71	0	1.0	QP	21.2	0.2	30.2	60.91	80.5	PASS

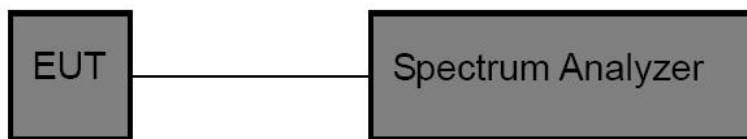


5. Frequency Tolerance

5.1. Test Requirement

According to FCC section 15.225, the devices operating in the 13.553~13.567 MHz shall maintain the carrier frequency within 0.01% of the operating frequency over the temperature variation of -20°C to +50°C using an environmental chamber. The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

5.2. Test Setup



5.3. Test Procedure

Let the EUT works on temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.4. Test Data

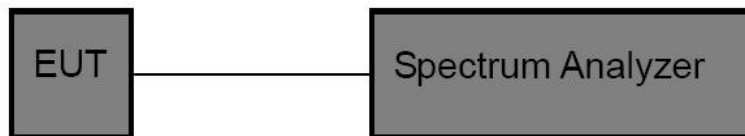
Test Condition					
	Voltage (VDC)	Temperature (°C)	Measured frequency (MHz)	Error (ppm)	Limit (ppm)
Normal Condition	14.40	-20	13.560708	52.21	100
		+20	13.560655	48.32	100
		+50	13.560622	45.84	100
Extreme Condition	12.24	+20	13.560710	52.39	100
	16.56	+20	13.560674	49.73	100

6. 20DB Occupy Bandwidth Test

6.1. Test Standard and Limit

According to FCC section 15.215(c), the 20dB bandwidth should be contained within the frequency band designated in the rule section under which the EUT is operated, it was measured with a spectrum analyzer connected the EUT while the EUT is operating in transmission mode.

6.2. Test Setup



6.3. Test Procedure

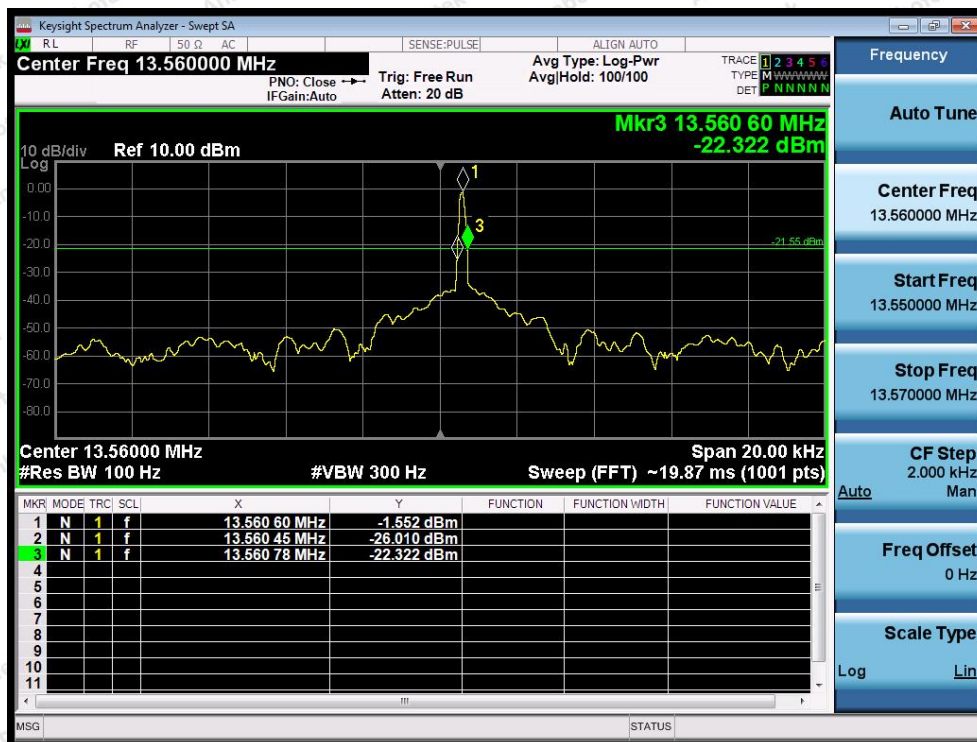
The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3kHz RBW and $VBW \geq 3 \times RBW$. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

6.4. Test Data

Test Item	: 20dB Bandwidth
Test Voltage	: DC 14.4V battery inside
Test Result	: PASS

Test Mode	: Continuously transmitting
Temperature	: 24℃
Humidity	: 55%RH

Freq. (MHz)	Bandwidth (kHz)	Results
13.56	0.33	PASS



13.56MHz



7. Antenna Requirement

7.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
Requirement	1) 15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. Antenna requirement must meet at least one of the following: 1) Antenna must be permanently attached to device. 2) The antenna must use a unique type of connector to attach to the device. 3) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.

7.2. Antenna Connected Construction

The antenna is a Inductive loop coil Antenna which permanently attached, and the best case gain of the antenna is 0 dBi. It complies with the standard requirement.

APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files for Test Setup Photos

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files for External Photos

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files for Internal Photos

----- End of Report -----

