

FCC TEST REPORT

Client Name : Anker Innovations Limited

Address : Room 1318-19, Hollywood Plaza, 610 Nathan Road,
Mongkok, Kowloon, Hong Kong

Product Name : Roav SmartCharge T1

Date : Mar. 12, 2019

Shenzhen Anbotech Compliance Laboratory Limited

Contents

1. General Information.....	4
1.1. Client Information.....	4
1.2. Description of Device (EUT).....	4
1.3. Auxiliary Equipment Used During Test.....	4
1.4. Description of Test Modes.....	5
1.5. List of channels.....	5
1.6. Description Of Test Setup.....	7
1.7. Test Equipment List.....	8
1.8. Measurement Uncertainty.....	9
1.9. Description of Test Facility.....	9
2. Summary of Test Results.....	10
3. Conducted Emission Test.....	11
3.1. Test Standard and Limit.....	11
3.2. Test Setup.....	11
3.3. Test Procedure.....	11
3.4. Test Data.....	11
4. Radiation Spurious Emission and Band Edge.....	12
4.1. Test Standard and Limit.....	12
4.2. Test Setup.....	13
4.3. Test Procedure.....	14
4.4. Test Data.....	15
5. 20DB Occupy Bandwidth Test.....	22
5.1. Test Standard and Limit.....	22
5.2. Test Setup.....	22
5.3. Test Procedure.....	22
5.4. Test Data.....	22
6. Antenna Requirement.....	25
6.1. Test Standard and Requirement.....	25
6.2. Antenna Connected Construction.....	25

TEST REPORT

Applicant : Anker Innovations Limited
Manufacturer : Anker Innovations Limited
Product Name : Roav SmartCharge T1
Model No. : R5133
Trade Mark : ROAV
Input: 12-24V=== 2A
Rating(s) : Output: 5V=== 0.5A
IQ Output: 3.6V-6.5V=== 3A/ 6.5V-9V=== 2A/ 9V-12V=== 1.5A
Test Standard(s) : FCC Part15 Subpart C 2018, Section 15.239
Test Method(s) : ANSI C63.10: 2013

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

Feb. 19, 2019

Date of Test

Feb. 19~Mar. 12, 2019

Prepared by



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Reviewer

Snowy Meng

(Supervisor / Snowy Meng)

Approved & Authorized Signer

Sally Zhang

(Manager / Sally Zhang)

1. General Information

1.1. Client Information

Applicant	:	Anker Innovations Limited
Address	:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong
Manufacturer	:	Anker Innovations Limited
Address	:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong
Factory	:	HU NAN GIANTSUN POWER ELECTRONICS CO., LTD
Address	:	Building 16&17, Taiwan Industrial Zone, Nonferrous Metals Industrial Park, Chenzhou, Hunan, China

1.2. Description of Device (EUT)

Product Name	:	Roav SmartCharge T1	
Model No.	:	R5133	
Trade Mark	:	ROAV	
Test Power Supply	:	DC 12V-24V (Note: Except RE, the rest items only reflect the data of the worst test voltage, namely "DC 12V".)	
Product Description	:	Operation Frequency:	88.1-107.9MHz
	:	Number of Channel:	199 Channels
	:	Modulation Type:	FM
	:	Antenna Type:	Spring Antenna
	:	Antenna Gain(Peak):	1.2 dBi
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 FM module.			

1.3. Auxiliary Equipment Used During Test

N/A	
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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	88.1MHz
Mode 2	98.1MHz
Mode 3	107.9MHz

For Radiated Emission	
Final Test Mode	Description
Mode 1	88.1MHz
Mode 2	98.1MHz
Mode 3	107.9MHz

Note:

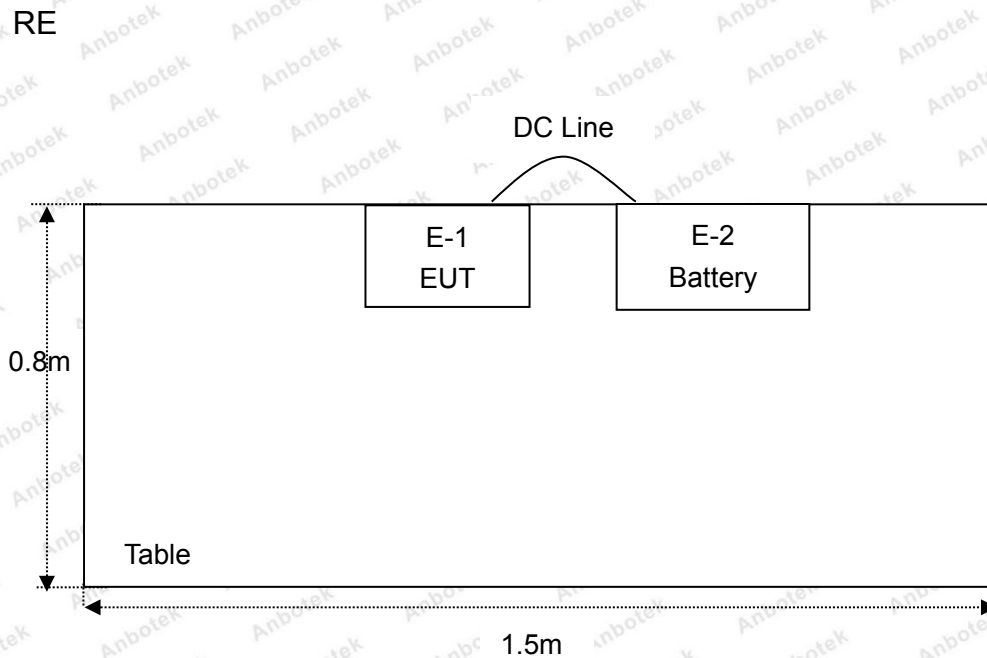
1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

1.5. List of channels

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	88.10	51	93.10	101	98.10	151	103.10
2	88.20	52	93.20	102	98.20	152	103.20
3	88.30	53	93.30	103	98.30	153	103.30
4	88.40	54	93.40	104	98.40	154	103.40
5	88.50	55	93.50	105	98.50	155	103.50
6	88.60	56	93.60	106	98.60	156	103.60
7	88.70	57	93.70	107	98.70	157	103.70
8	88.80	58	93.80	108	98.80	158	103.80
9	88.90	59	93.90	109	98.90	159	103.90
10	89.00	60	94.00	110	99.00	160	104.00
11	89.10	61	94.10	111	99.10	161	104.10
12	89.20	62	94.20	112	99.20	162	104.20
13	89.30	63	94.30	113	99.30	163	104.30
14	89.40	64	94.40	114	99.40	164	104.40

15	89.50	65	94.50	115	99.50	165	104.50
16	89.60	66	94.60	116	99.60	166	104.60
17	89.70	67	94.70	117	99.70	167	104.70
18	89.80	68	94.80	118	99.80	168	104.80
19	89.90	69	94.90	119	99.90	169	104.90
20	90.00	70	95.00	120	100.00	170	105.00
21	90.10	71	95.10	121	100.10	171	105.10
22	90.20	72	95.20	122	100.20	172	105.20
23	90.30	73	95.30	123	100.30	173	105.30
24	90.40	74	95.40	124	100.40	174	105.40
25	90.50	75	95.50	125	100.50	175	105.50
26	90.60	76	95.60	126	100.60	176	105.60
27	90.70	77	95.70	127	100.70	177	105.70
28	90.80	78	95.80	128	100.80	178	105.80
29	90.90	79	95.90	129	100.90	179	105.90
30	91.00	80	96.00	130	101.00	180	106.00
31	91.10	81	96.10	131	101.10	181	106.10
32	91.20	82	96.20	132	101.20	182	106.20
33	91.30	83	96.30	133	101.30	183	106.30
34	91.40	84	96.40	134	101.40	184	106.40
35	91.50	85	96.50	135	101.50	185	106.50
36	91.60	86	96.60	136	101.60	186	106.60
37	91.70	87	96.70	137	101.70	187	106.70
38	91.80	88	96.80	138	101.80	188	106.80
39	91.90	89	96.90	139	101.90	189	106.90
40	92.00	90	97.00	140	102.00	190	107.00
41	92.10	91	97.10	141	102.10	191	107.10
42	92.20	92	97.20	142	102.20	192	107.20
43	92.30	93	97.30	143	102.30	193	107.30
44	92.40	94	97.40	144	102.40	194	107.40
45	92.50	95	97.50	145	102.50	195	107.50
46	92.60	96	97.60	146	102.60	196	107.60
47	92.70	97	97.70	147	102.70	197	107.70
48	92.80	98	97.80	148	102.80	198	107.80
49	92.90	99	97.90	149	102.90	199	107.90
50	93.00	100	98.00	150	103.00		

1.6. Description Of Test Setup



1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Nov. 05, 2018	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESPI3	101604	Nov. 05, 2018	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 05, 2018	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	Nov. 05, 2018	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30 D	KD17503	Nov. 05, 2018	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 20, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 19, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Nov. 20, 2018	1 Year
10.	Horn Antenna	A-INFO	LB-180400-K F	J211060628	Nov. 20, 2018	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Nov. 05, 2018	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	Nov. 05, 2018	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov. 05, 2018	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov. 05, 2018	1 Year
16.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 05, 2018	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 05, 2018	1 Year
19.	DC Power Supply	IVYTECH	IV3605	1804D360510	Apr. 02, 2018	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80 B	N/A	Nov. 01, 2018	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, July 31, 2017.

ISED-Registration No.: 8058A-1

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-1, June 13, 2016.

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
15.205/15.209/15.239	Spurious Emission	PASS
15.205	Band Edge Emission	PASS
15.239 (c)	Occupied Bandwidth	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

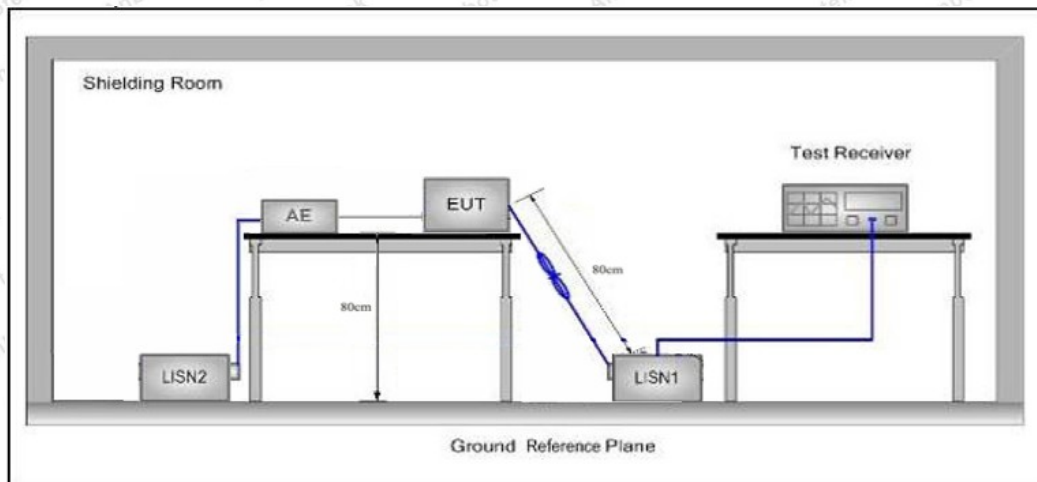
3. Conducted Emission Test

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 C63.10-2013 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

The EUT is powered DC 12V/ DC 24V, so there is no need to conduct this test.

The device is vehicle used only.

4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209, 15.205 and 15.239(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.

According to §15.239(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

$$\text{Emission Level (dBuV/m)} = 20 \log \text{Emission Level (uV/m)}$$

The field strength of emission limits have been calculated in below table:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBuV/m)@3m
88.1-107.9	48 (AVG)
	68 (Peak)

NOTE:

1. The lower limit shall apply at the transition frequencies.

2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

3. FCC part15.239(b) The field strength of any emissions within the permitted 200 KHz band shall not exceed 250 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

4.2. Test Setup

Figure 1. Below 30MHz

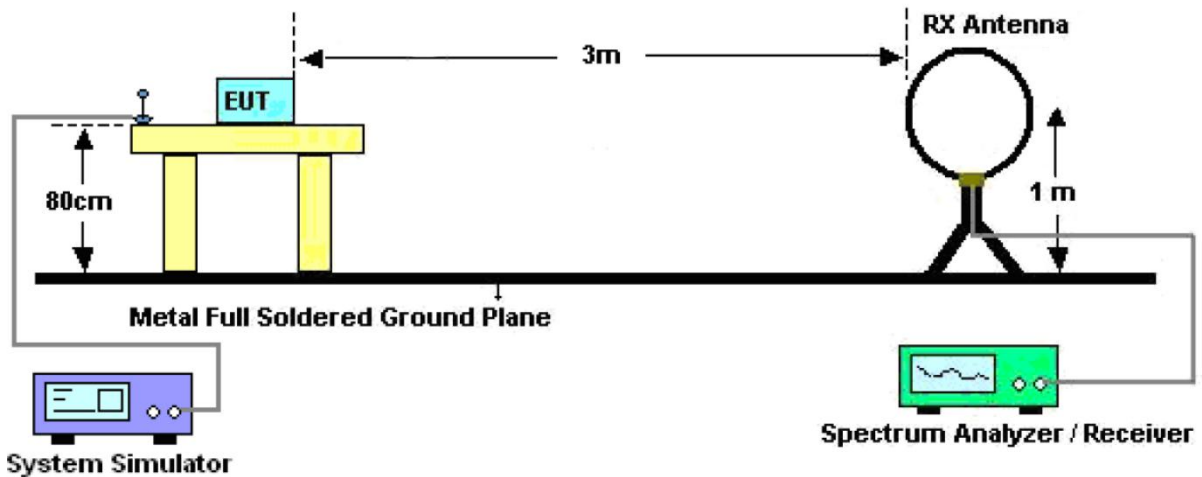


Figure 2. 30MHz to 1GHz

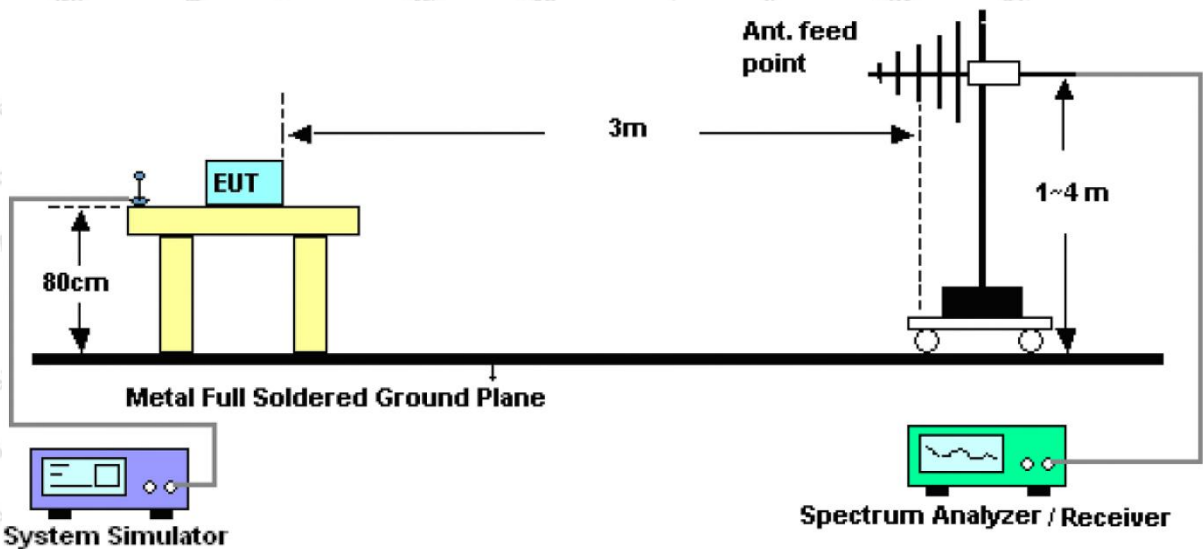
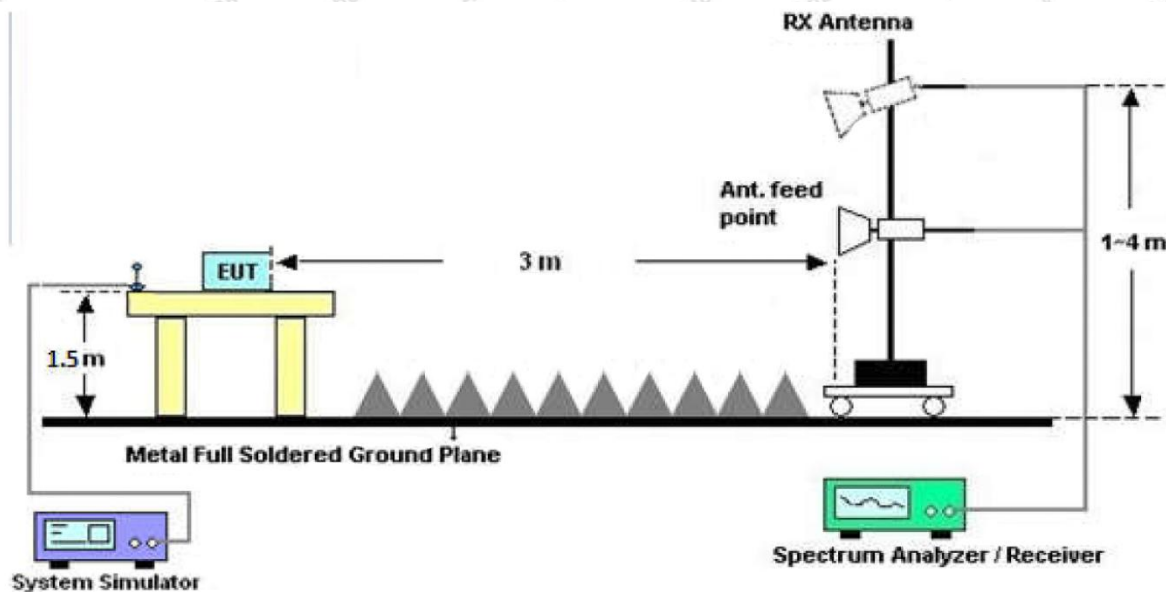


Figure 3. Above 1 GHz



4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m 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 the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

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 = 120kHz, VBW = 360kHz, 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.

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

worst case: Mode1, only the worst case is recorded in the report.

Report No.: SZAWW190219002-02

FCC ID: 2AOKB-R5133

Page 16 of 25

Test Results (30~1000MHz)

Job No.: SZAWW190219002-02

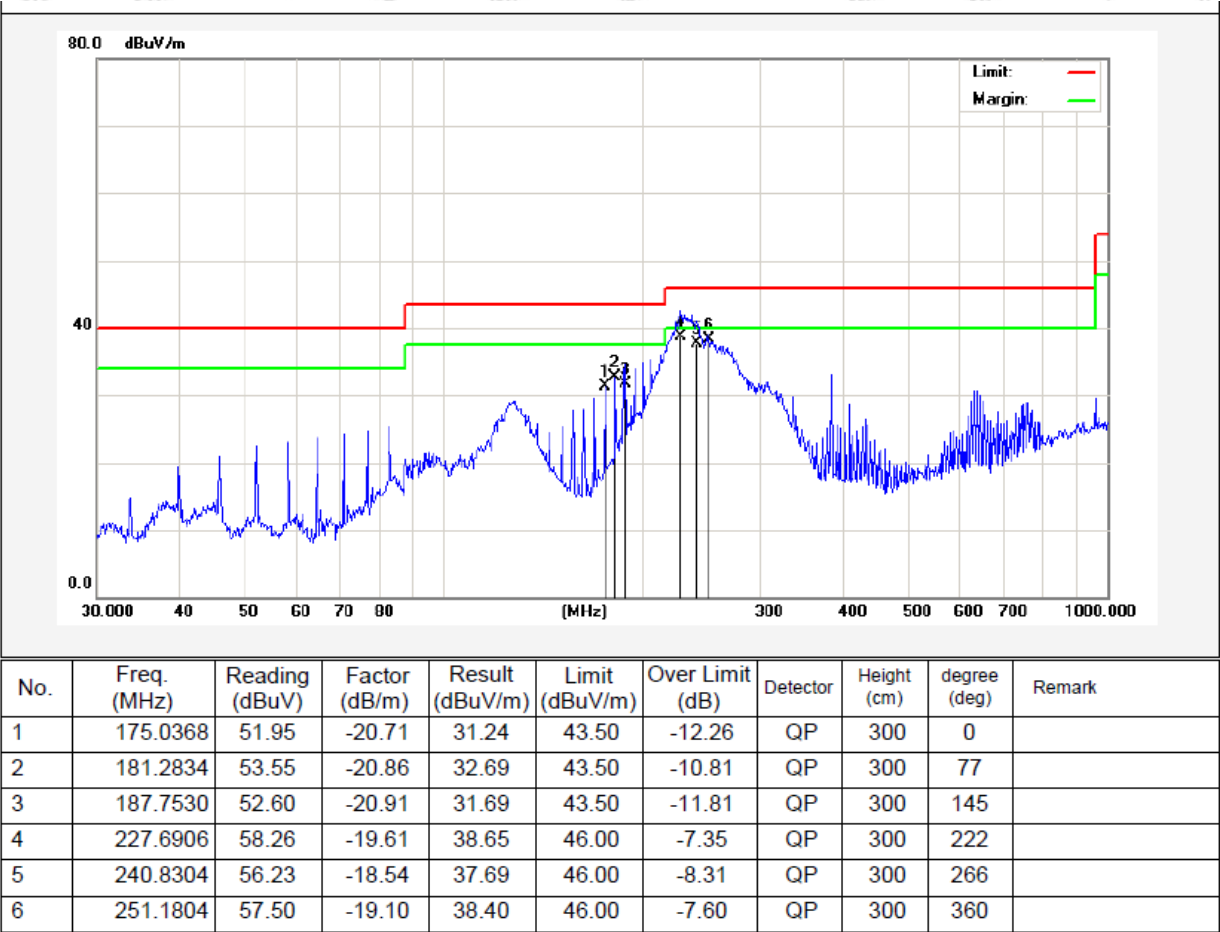
Temp.(°C)/Hum.(%RH): 21.6°C/55%RH

Standard: FCC PART 15C

Power Source: DC 12V

Test Mode: Mode 1

Polarization: Horizontal



Test Results (30~1000MHz)

Job No.:
SZAWW190219002-02

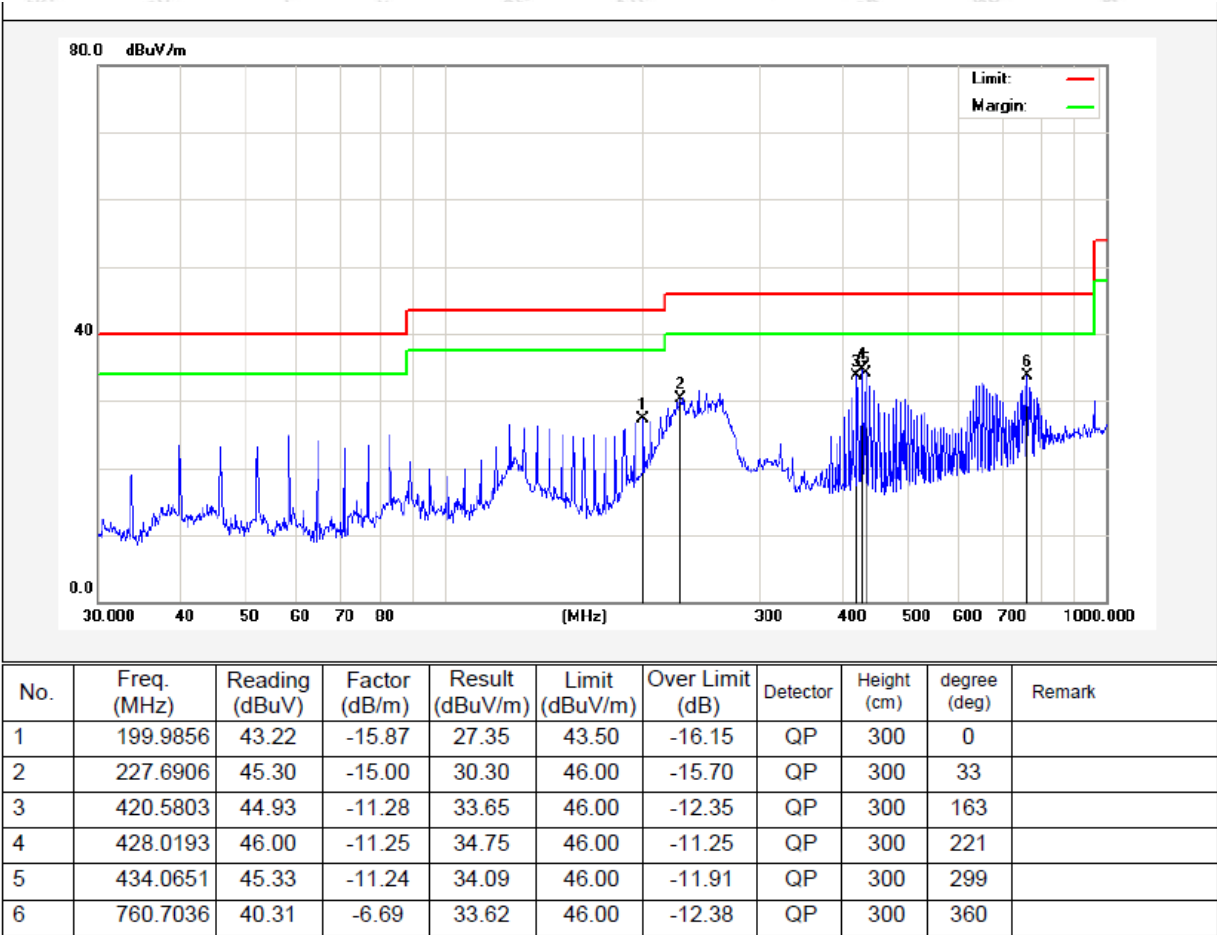
Temp.(°C)/Hum.(%RH):
21.6°C/55%RH

Standard:
FCC PART 15C

Power Source:
DC 12V

Test Mode:
Mode 1

Polarization:
Vertical



Report No.: SZAWW190219002-02

FCC ID: 2AOKB-R5133

Page 18 of 25

Test Results (30~1000MHz)

Job No.: SZAWW190219002-02

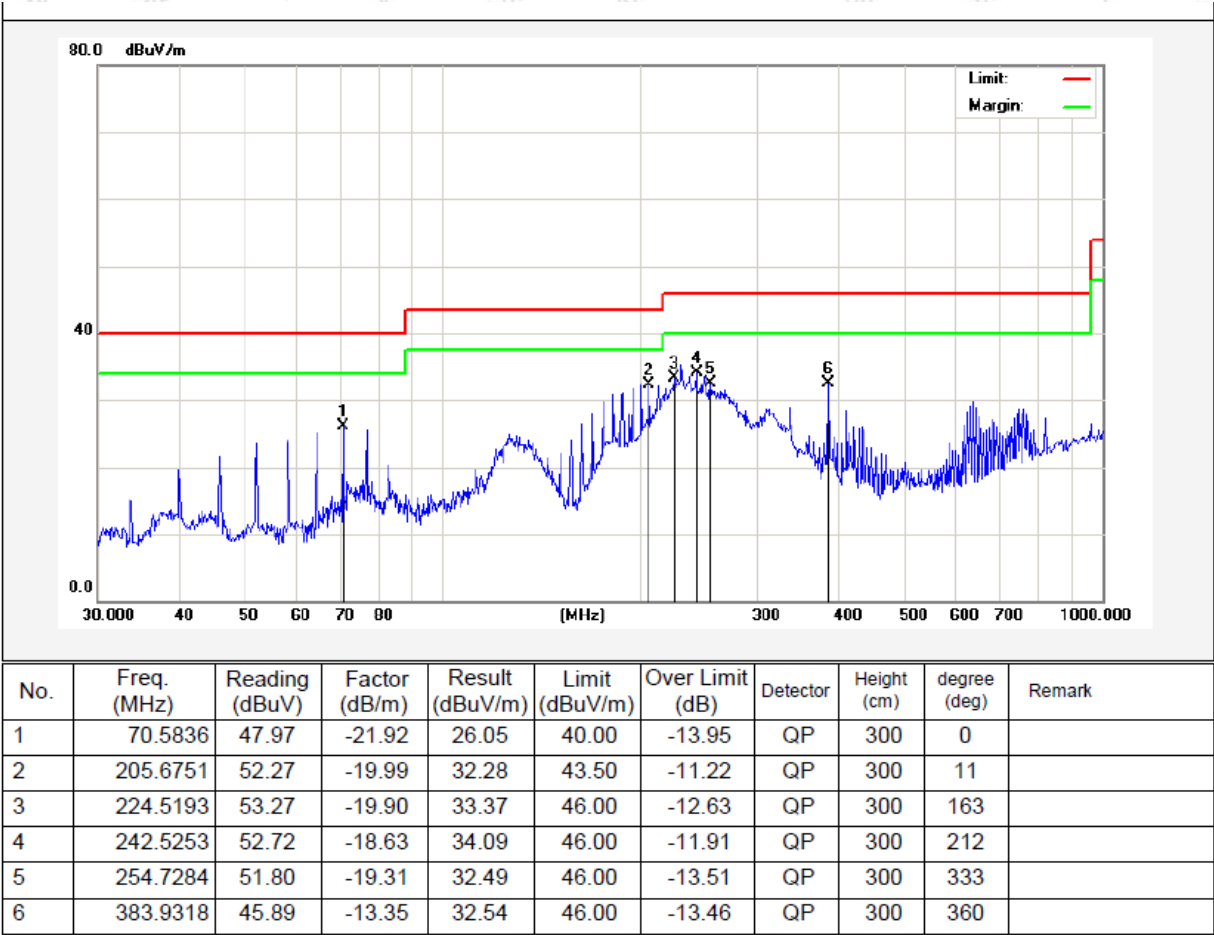
Temp.(°C)/Hum.(%RH): 21.6°C/55%RH

Standard: FCC PART 15C

Power Source: DC 24V

Test Mode: Mode 1

Polarization: Horizontal



Test Results (30~1000MHz)

Job No.:
SZAWW190219002-02

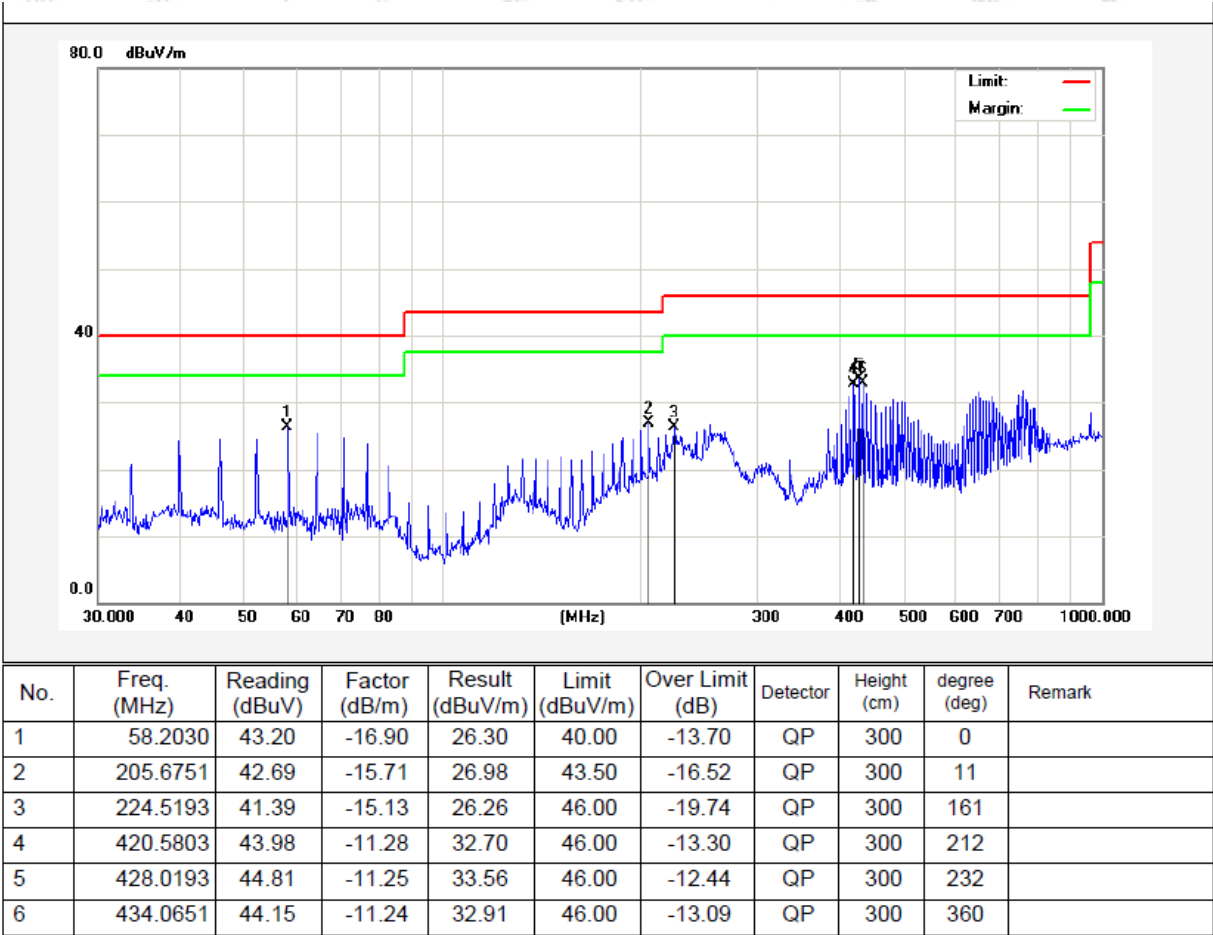
Temp.(°C)/Hum.(%RH):
21.6°C/55%RH

Standard:
FCC PART 15C

Power Source:
DC 24V

Test Mode:
Mode 1

Polarization:
Vertical



TEST RESULT FOR FIELD STRENGTH OF FUNDAMENTAL

Horizontal					
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Pass/Fail
88.1	46.98	68.00	-21.02	Peak	Pass
88.1	36.98	48.00	-11.02	AV	Pass
98.1	53.65	68.00	-14.35	Peak	Pass
98.1	40.21	48.00	-7.79	AV	Pass
107.9	64.02	68.00	-3.98	Peak	Pass
107.9	44.29	48.00	-3.71	AV	Pass

Vertical					
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Pass/Fail
88.1	42.21	68.00	-25.79	Peak	Pass
88.1	32.95	48.00	-15.05	AV	Pass
98.1	46.32	68.00	-21.68	Peak	Pass
98.1	36.22	48.0	-11.78	AV	Pass
107.9	50.21	68.00	-17.79	Peak	Pass
107.9	41.98	48.00	-6.02	AV	Pass

TEST RESULT FOR FIELD STRENGTH OF BAND EDGE EMISSION

Frequency (MHz)	Polarization	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Pass/Fail
88	V	32.21	40.00	-7.79	QP	Pass
88	H	35.95	40.00	-5.05	QP	Pass
108	V	34.32	43.50	-9.18	QP	Pass
108	H	38.22	43.50	-5.28	QP	Pass

TEST RESULT(1~25GHz)

Test Mode: 107.9MHz					Test channel: Highest			
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
1079.00	35.86	34.72	6.79	34.09	43.28	74.00	-30.72	V
1186.90	30.87	37.34	7.82	34.57	41.46	74.00	-32.54	V
1294.80	30.61	39.62	9.46	34.81	44.88	74.00	-29.12	V
1402.70	*					74.00		V
1510.60	*					74.00		V
1079.00	39.85	34.72	6.79	34.09	47.27	74.00	-26.73	H
1186.90	32.50	37.34	7.82	34.57	43.09	74.00	-30.91	H
1294.80	29.90	39.62	9.46	34.81	44.17	74.00	-29.83	H
1402.70	*					74.00		H
1510.60	*					74.00		H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
1079.00	24.99	34.72	6.79	34.09	32.41	54.00	-21.59	V
1186.90	19.75	37.34	7.82	34.57	30.34	54.00	-23.66	V
1294.80	18.91	39.62	9.46	34.81	33.18	54.00	-20.82	V
1402.70	*					54.00		V
1510.60	*					54.00		V
1079.00	29.06	34.72	6.79	34.09	36.48	54.00	-17.52	H
1186.90	21.83	37.34	7.82	34.57	32.42	54.00	-21.58	H
1294.80	18.53	39.62	9.46	34.81	32.80	54.00	-21.20	H
1402.70	*					54.00		H
1510.60	*					54.00		H

Remark: 1. Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

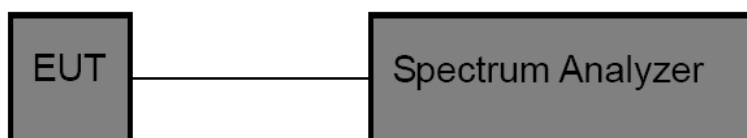
2. Only Worse case is reported.

5. 20DB Occupy Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.239
Test Limit	§ 15.239 (a): Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-108 MHz. Limit: 200 KHz

5.2. Test Setup



5.3. Test Procedure

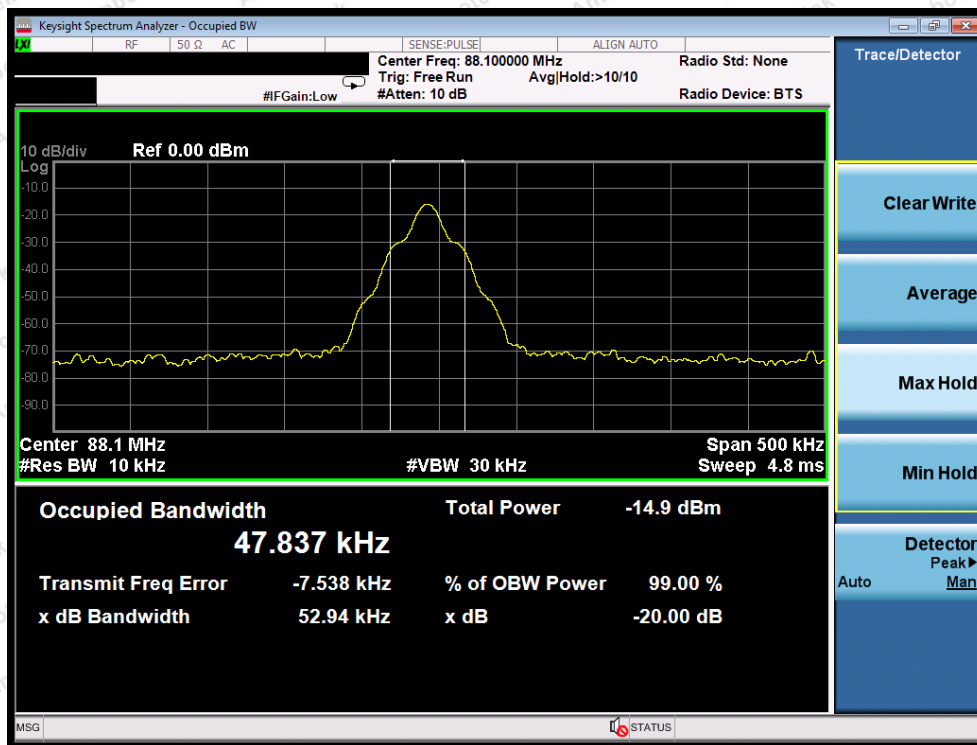
1. Place the EUT on the table and set it in the continuously transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:
RBW = 30kHz, VBW≥3*RBW =100kHz,
Span= 3MHz
Detector= Peak
Trace mode= Max hold.
Sweep- auto couple.
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

5.4. Test Data

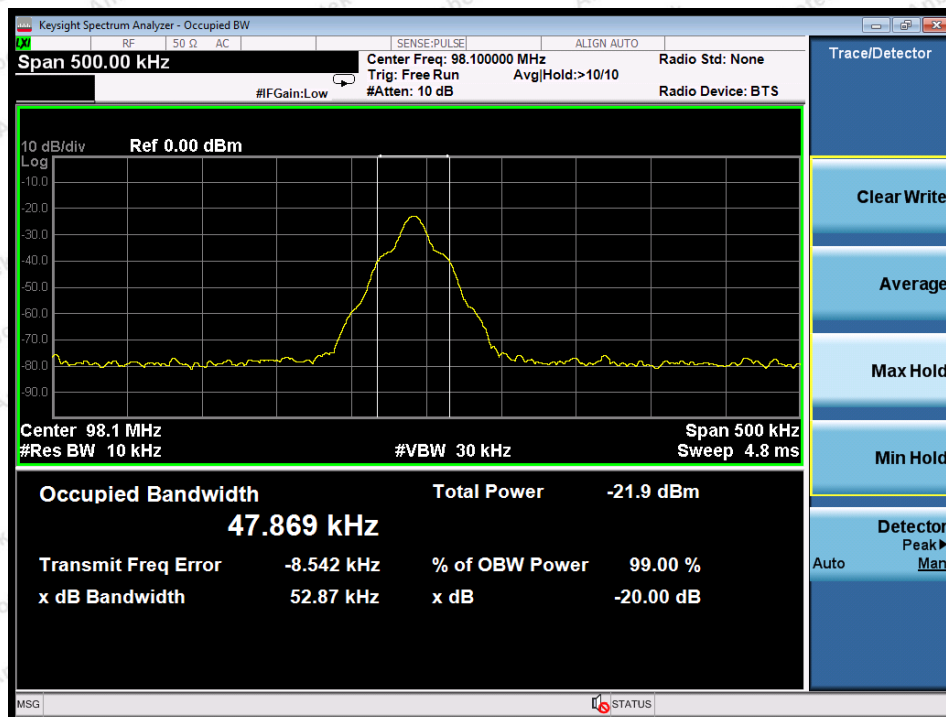
Test Item : 20dB Bandwidth
Test Voltage : DC 12V
Test Result : PASS

Test Mode : TX Mode
Temperature : 24℃
Humidity : 55%RH

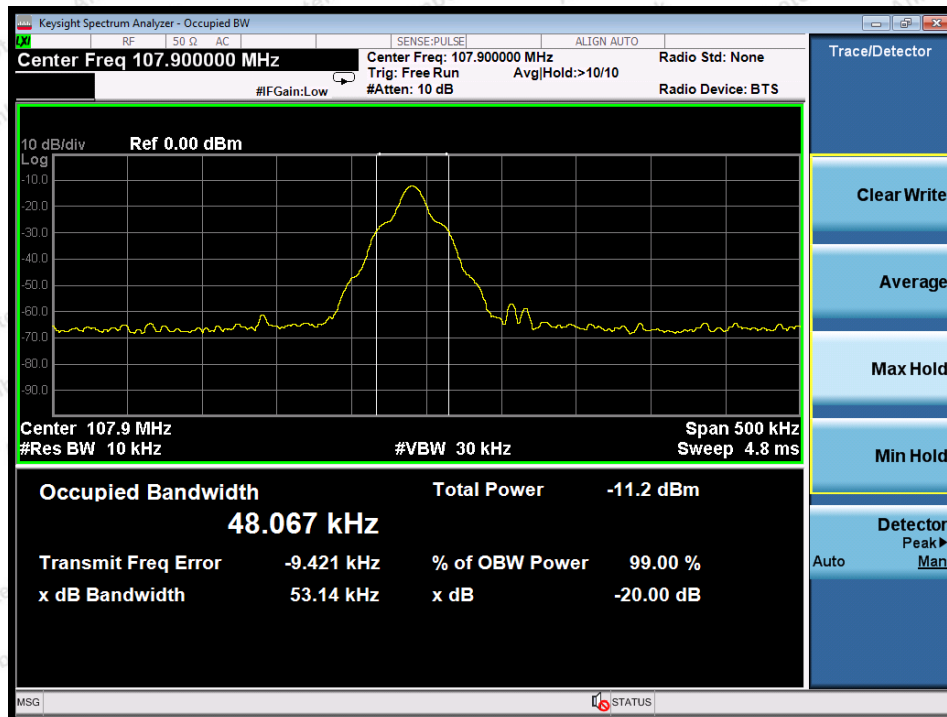
Test Channel	Frequency (MHz)	20 dBc Bandwidth (KHz)	Limit (KHz)
Low	88.1	52.94	200
Mid	98.1	52.87	200
High	107.9	53.14	200



The Low Channel



The Mid Channel



The High Channel

6. Antenna Requirement

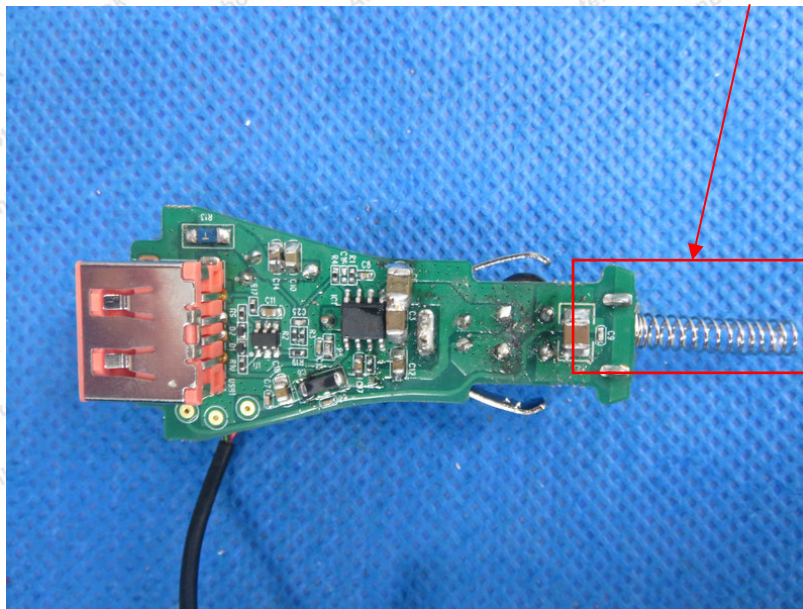
6.1. Test Standard and Requirement

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.

6.2. Antenna Connected Construction

The antenna is a Spring Antenna which permanently attached, and the best case gain of the antenna is 1.2 dBi. It complies with the standard requirement.

FM Antenna



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