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TEST REPORT

FOR FCC PART 15 SUBPART C 15.239

Report Reference No.....: **CTL2202182111-WF02**

Compiled by: (position+printed name+signature)	Happy Guo (File administrators)	Happy Guo
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Approved by: (position+printed name+signature)	Ivan Xie (Manager)	Ivan Xie

Product Name..... :	Car Bluetooth FM transmitter
Model/Type reference.....:	BT96
List Model(s).....:	KM20
Trade Mark..... :	N/A
FCC ID..... :	**2AJ5B-BT96**
Applicant's name..... :	**SAGE HUMAN ELECTRONICS INTERNATIONAL CO.,LTD.**
Address of applicant.....:	4F.,A Building,Rongli Industrial Park,No.2 Guiyuan Rd.Guihua Community,Guanlan Town,Longhua New Dist, Shenzhen, China
Test Firm.....:	**Shenzhen CTL Testing Technology Co., Ltd.**
Address of Test Firm.....:	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Test specification.....:	
Standard.....:	**FCC Part 15.239:** Operation in the band 88–108 MHz.
TRF Originator.....:	Shenzhen CTL Testing Technology Co., Ltd.
Master TRF..... :	Dated 2011-01
Date of receipt of test item..... :	Feb. 23, 2022
Date of sampling..... :	Feb. 23, 2022
Date of Test Date..... :	Feb. 23, 2022-Mar. 01, 2022
Date of Issue.....:	Mar. 01, 2022
Result..... :	**Pass**

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TEST REPORT

Test Report No. :	CTL2202182111-WF02	Mar. 01, 2022 Date of issue

Equipment under Test	:	Car Bluetooth FM transmitter
Sample No	:	CTL220218211-1-S001
Model /Type	:	BT96
Listed Models	:	KM20
Applicant	:	**SAGE HUMAN ELECTRONICS INTERNATIONAL CO.,LTD.**
Address	:	4F.,A Building,Rongli Industrial Park,No.2 Guiyuan Rd.Guihua Community,Guanlan Town,Longhua New Dist, Shenzhen, China
Manufacturer	:	**SAGE HUMAN ELECTRONICS INTERNATIONAL CO.,LTD.**
Address	:	4F.,A Building,Rongli Industrial Park,No.2 Guiyuan Rd.Guihua Community,Guanlan Town,Longhua New Dist, Shenzhen, China

Test result	**Pass ***

∗ In the configuration tested, the EUT complied with the standards specified page 5.

The device (Product Name: Car Bluetooth FM transmitter) Models Name: BT96, KM20 have same electrical, PCB and BOM, only the colour and model's names are different for marketing requirements.

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

** Modified History **

Revisions	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	2022-03-01	CTL2202182111-WF02	Tracy Qi

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1. SUMMARY

1.1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.239: Operation in the band 88–108 MHz.

ANSI C63.10:2020 : American National Standard for Testing Unlicensed Wireless Devices

ANSI C63.4: 2014: –American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40GHz Range of 9 kHz to 40GHz

1.2. Test Description

FCC PART 15.239		
FCC Part 15.239(b)	Field Strength of Fundamental	PASS
FCC Part 15.209/15.239(c)	Spurious Emission	PASS
FCC Part 15.215	20dB bandwidth	PASS
FCC Part 15.207	Conducted Emission	N/A
FCC Part 15.203	Antenna Requirement	PASS

1.3. Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China
There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

1.3.2 Laboratory accreditation

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

CNAS-Lab Code: L7497

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No. 4343.01

Shenzhen CTL Testing Technology Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

IC Registration No.: 9618B

CAB identifier: CN0041

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9618B on Jan. 22, 2019.

FCC-Registration No.: 399832

Designation No.: CN1216

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 399832, December 08, 2017.

1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	Above 1GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2. GENERAL INFORMATION

2.1. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

2.2. General Description of EUT

Product Name:	Car Bluetooth FM transmitter
Model/Type reference:	BT96
Power supply:	DC 12V-24V
Bluetooth:	
Version:	Supported BR/EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	PCB Antenna
Antenna gain:	0.0dBi
FM	
Modulation:	FM
Operation frequency:	88.1-107.9MHz
Channel number:	199
Channel separation:	100KHz
Antenna type:	PCB Antenna
Antenna gain:	0.0dBi

Note1: For more details, please refer to the user's manual of the EUT.
Note2: Antenna gain provided by the applicant.
Note3: This report is for FM only.

2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .

In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Operation Frequency List：

Channel	Frequency (MHz)
01	**88.1**
02	88.2
⋮	⋮
100	98.0
101	**98.1**
102	98.2
⋮	⋮
198	107.8
199	**107.9**

Note: The line display in grey is the channel selected to perform test.

2.4. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ESH2-Z5	860014/010	2021/05/10	2022/05/09
Double cone logarithmic antenna	Schwarzbeck	VULB 9168	824	2020/04/07	2023/04/06
Horn Antenna	Ocean Microwave	OBH100400	26999002	2019/11/28	2022/11/27
EMI Test Receiver	R&S	ESCI	1166.5950.03	2021/05/10	2022/05/09
Spectrum Analyzer	Agilent	E4407B	MY41440676	2021/05/14	2022/05/13
Spectrum Analyzer	Agilent	N9020A	US46220290	2021/05/14	2022/05/13
Spectrum Analyzer	Keysight	N9020A	MY53420874	2021/05/14	2022/05/13
Controller	EM Electronics	EM 1000	060859	2021/05/21	2022/05/20
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2020/09/22	2023/09/21
Active Loop Antenna	Da Ze	ZN30900A	/	2021/05/13	2024/05/12
Amplifier	Agilent	8449B	3008A02306	2021/05/10	2022/05/09
Amplifier	Agilent	8447D	2944A10176	2021/05/10	2022/05/09
Amplifier	Brief&Smart	LNA-4018	2104197	2021/05/10	2022/05/09
Temperature/Humidity Meter	Gangxing	CTH-608	02	2021/05/11	2022/05/10
Power Sensor	Agilent	U2021XA	MY55130004	2021/05/14	2022/05/13
Power Sensor	Agilent	U2021XA	MY55130006	2021/05/14	2022/05/13
Power Sensor	Agilent	U2021XA	MY54510008	2021/05/14	2022/05/13
Power Sensor	Agilent	U2021XA	MY55060003	2021/05/14	2022/05/13
Spectrum Analyzer	RS	FSP	1164.4391.38	2021/05/14	2022/05/13

Test Software

Name of Software	Version
TST-PASS	1.1.0
EZ_EMC(Below 1GHz)	V1.1.4.2
EZ_EMC((Above 1GHz)	V1.1.4.2

The calibration interval was one year

2.5. Related Submittal(s) / Grant(s)

This submittal(s) (test report) is intended to comply with Section 15.239 of the FCC Part 15, Subpart C Rules.

2.6. Modifications

No modifications were implemented to meet testing criteria.

3. TEST CONDITIONS AND RESULTS

3.1. Conducted Emissions Test

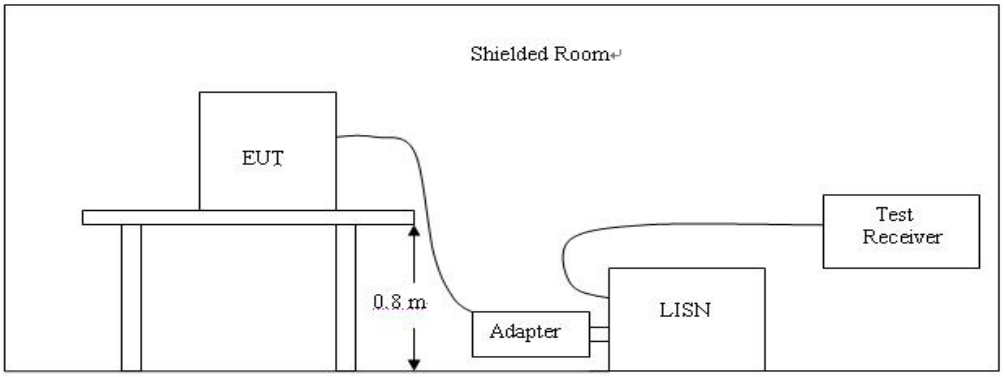
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2020.
2. Support equipment, if needed, was placed as per ANSI C63.10:2020.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2020.
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST RESULTS

Not applicable to this device, for it is powered by car battery.

3.2. Radiated Emissions

Limit

15.239(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 §15.35 for limiting peak emissions apply.
Unless otherwise specified, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

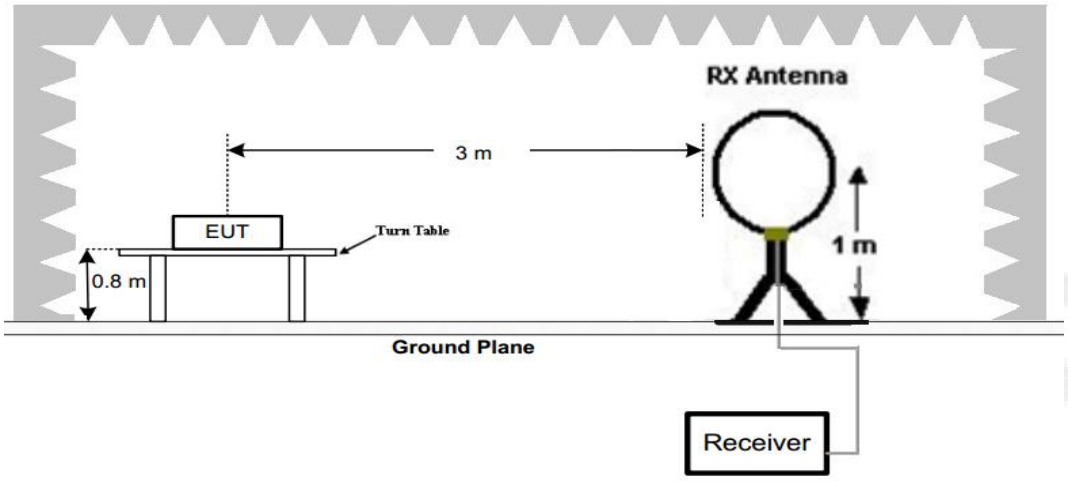
The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed the general radiated emission limits in § 15.209 as table below:

Radiated emission limits

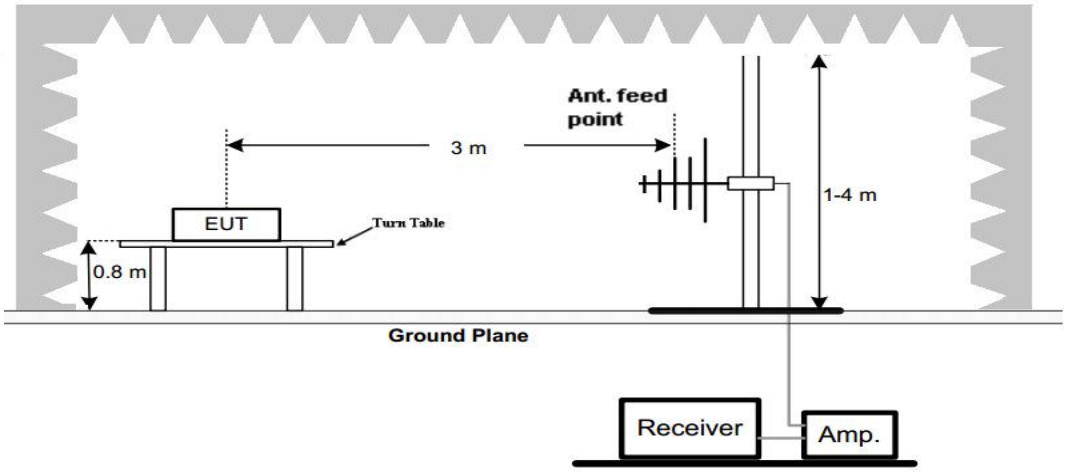
Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

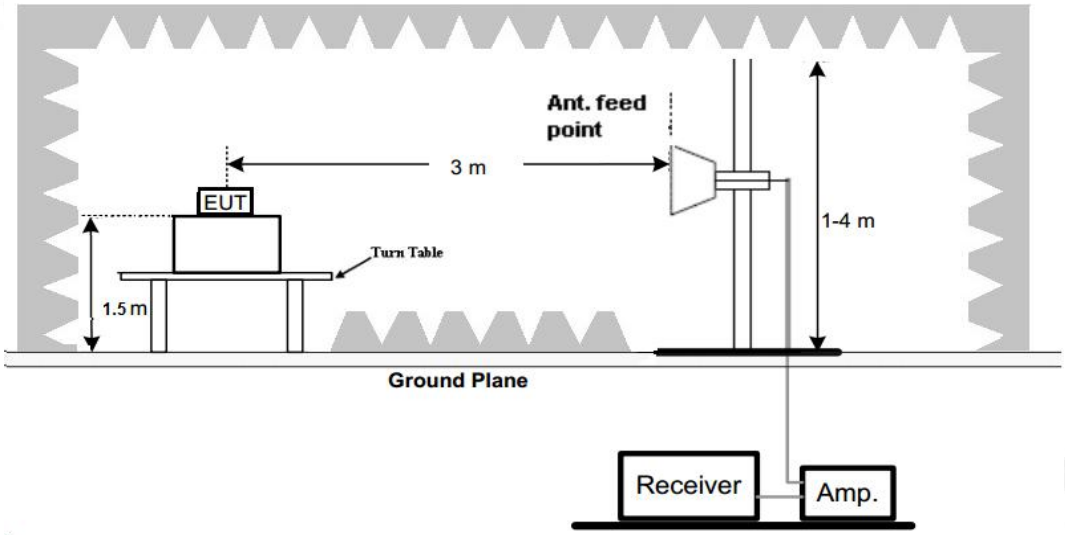
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement –X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.

TEST RESULTS

Remark: Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9KHz to 30MHz and not recorded in this report.

30MHz- 10th Harmonic of Fundamental

Frequency(MHz):				88.1		Polarity:			HORIZONTAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	88.10	52.36	PK	68.00	15.64	71.89	8.72	0.56	28.81	-19.53
1	88.10	42.15	AV	48.00	5.85	61.68	8.72	0.56	28.81	-19.53
2	88.00	36.56	QP	40.00	3.44	56.12	8.70	0.55	28.81	-19.56
3	176.20	38.15	QP	43.50	5.35	53.81	11.95	1.05	28.66	-15.66
4	264.30	41.62	QP	46.00	4.38	56.02	12.86	1.48	28.74	-14.40
5	352.40	41.18	QP	46.00	4.82	53.23	14.32	1.95	28.32	-12.05
6	440.50	40.28	QP	46.00	5.72	50.49	16.57	2.18	28.96	-10.21
7	616.70	42.81	QP	46.00	3.19	51.12	18.32	2.24	28.87	-8.31
8	704.80	41.74	QP	46.00	4.26	47.15	20.19	3.09	28.69	-5.41

Frequency(MHz):				88.1		Polarity:			Vertical	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	88.10	53.32	PK	68.00	14.68	72.85	8.72	0.56	28.81	-19.53
1	88.10	42.48	AV	48.00	5.52	62.01	8.72	0.56	28.81	-19.53
2	88.00	31.65	QP	40.00	8.35	51.21	8.70	0.55	28.81	-19.56
3	176.20	37.18	QP	43.50	6.32	52.84	11.95	1.05	28.66	-15.66
4	264.30	41.64	QP	46.00	4.36	56.04	12.86	1.48	28.74	-14.40
5	352.40	41.47	QP	46.00	4.53	53.52	14.32	1.95	28.32	-12.05
6	440.50	38.98	QP	46.00	7.02	49.19	16.57	2.18	28.96	-10.21
7	616.70	41.25	QP	46.00	4.75	49.56	18.32	2.24	28.87	-8.31
8	704.80	43.68	QP	46.00	2.32	49.09	20.19	3.09	28.69	-5.41

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) =Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level
4. -- Mean the PK detector measured value is below QP limit
5. The other emission levels were very low against the limit
6. For fundamental frequency, RBW 100KHz VBW 300 Hz Peak detectors is for PK Value; RMS detector is for AV value

Frequency(MHz):				98.1		Polarity:			HORIZONTAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	98.10	54.32	PK	68.00	13.68	73.82	8.78	0.57	28.85	-19.50
1	98.10	41.48	AV	48.00	6.52	60.98	8.78	0.57	28.85	-19.50
2	196.20	37.29	QP	43.50	6.21	53.08	11.98	1.11	28.88	-15.79
3	294.30	40.27	QP	46.00	5.73	54.53	13.11	1.54	28.91	-14.26
4	490.50	39.62	QP	46.00	6.38	51.89	14.58	2.20	29.05	-12.27
5	588.60	41.78	QP	46.00	4.22	53.01	15.64	2.23	29.10	-11.23
6	686.70	40.36	QP	46.00	5.64	48.54	18.69	2.28	29.15	-8.18
7	882.90	41.59	QP	46.00	4.41	46.36	21.59	3.26	29.62	-4.77

Frequency(MHz):				98.1		Polarity:			Vertical	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	98.10	53.62	PK	68.00	14.38	73.12	8.78	0.57	28.85	-19.50
1	98.10	44.28	AV	48.00	3.72	63.78	8.78	0.57	28.85	-19.50
2	196.20	38.84	QP	43.50	4.66	54.63	11.98	1.11	28.88	-15.79
3	294.30	42.23	QP	46.00	3.77	56.49	13.11	1.54	28.91	-14.26
4	490.50	41.75	QP	46.00	4.25	54.02	14.58	2.20	29.05	-12.27
5	588.60	39.62	QP	46.00	6.38	50.85	15.64	2.23	29.10	-11.23
6	686.70	38.58	QP	46.00	7.42	46.76	18.69	2.28	29.15	-8.18
7	882.90	40.47	QP	46.00	5.53	45.24	21.59	3.26	29.62	-4.77

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) =Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level
4. -- Mean the PK detector measured value is below QP limit
5. The other emission levels were very low against the limit
6. For fundamental frequency, RBW 100KHz VBW 300 Hz Peak detectors is for PK Value; RMS detector is for AV value

Frequency(MHz):				107.9		Polarity:			HORIZONTAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	107.90	54.26	PK	68.00	13.74	73.55	8.78	0.57	28.98	-19.29
1	107.90	42.74	AV	48.00	5.26	62.03	9.04	0.65	28.98	-19.29
2	108.00	36.15	QP	43.50	7.35	55.43	9.05	0.65	28.98	-19.28
3	215.80	37.54	QP	43.50	5.96	52.95	12.14	1.35	28.90	-15.41
4	323.70	42.22	QP	46.00	3.78	55.91	13.58	1.68	28.95	-13.69
5	431.60	43.18	QP	46.00	2.82	55.91	14.25	2.04	29.02	-12.73
6	539.50	42.52	QP	46.00	3.48	54.00	15.47	2.13	29.08	-11.48
7	755.30	40.47	QP	46.00	5.53	48.19	19.11	2.39	29.22	-7.72

Frequency(MHz):				107.9		Polarity:			Vertical	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	107.90	53.36	PK	68.00	14.64	72.65	9.04	0.65	28.98	-19.29
1	107.90	42.18	AV	48.00	5.82	61.47	9.04	0.65	28.98	-19.29
2	108.00	39.05	QP	43.50	4.45	58.33	9.05	0.65	28.98	-19.28
3	215.80	39.62	QP	43.50	3.88	55.03	12.14	1.35	28.90	-15.41
4	323.70	41.18	QP	46.00	4.82	54.87	13.58	1.68	28.95	-13.69
5	431.60	40.06	QP	46.00	5.94	52.79	14.25	2.04	29.02	-12.73
6	539.50	40.78	QP	46.00	5.22	52.26	15.47	2.13	29.08	-11.48
7	755.30	43.94	QP	46.00	2.06	51.66	19.11	2.39	29.22	-7.72

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) =Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level
4. -- Mean the PK detector measured value is below QP limit
5. The other emission levels were very low against the limit
6. For fundamental frequency, RBW 100KHz VBW 300 Hz Peak detectors is for PK Value; RMS detector is for AV value

3.3. Occupied Bandwidth

Limit

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.

Test Configuration

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100 KHz VBW.

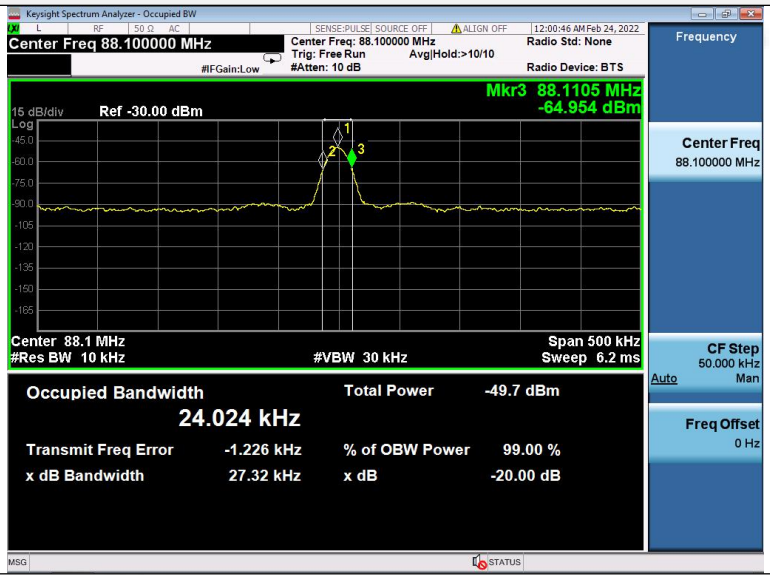
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Results

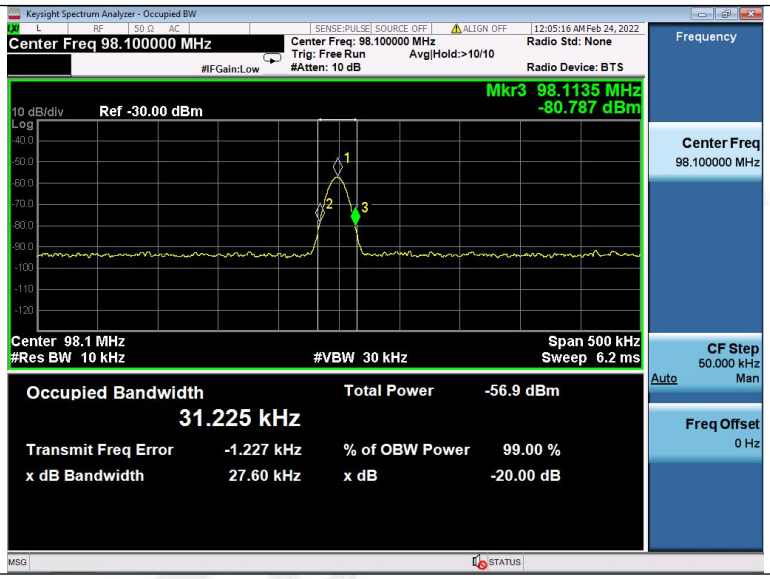
Modulation	Channel	99% OBW (KHz)	20dB bandwidth (KHz)	Result
FM	CH01	24.024	27.32	Pass
	CH101	31.225	27.60	
	CH199	23.758	27.07	

Test plot as follows:

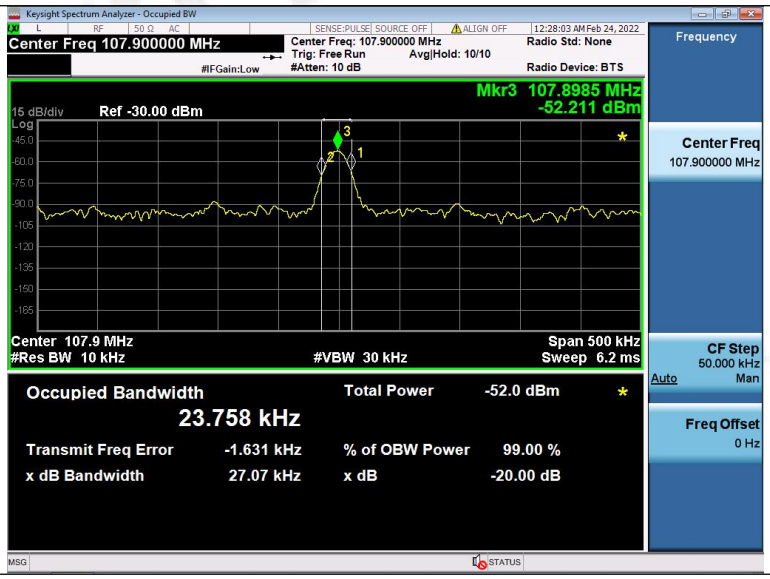
FM Modulation



CH01



CH101



CH199

3.4. Antenna Requirement

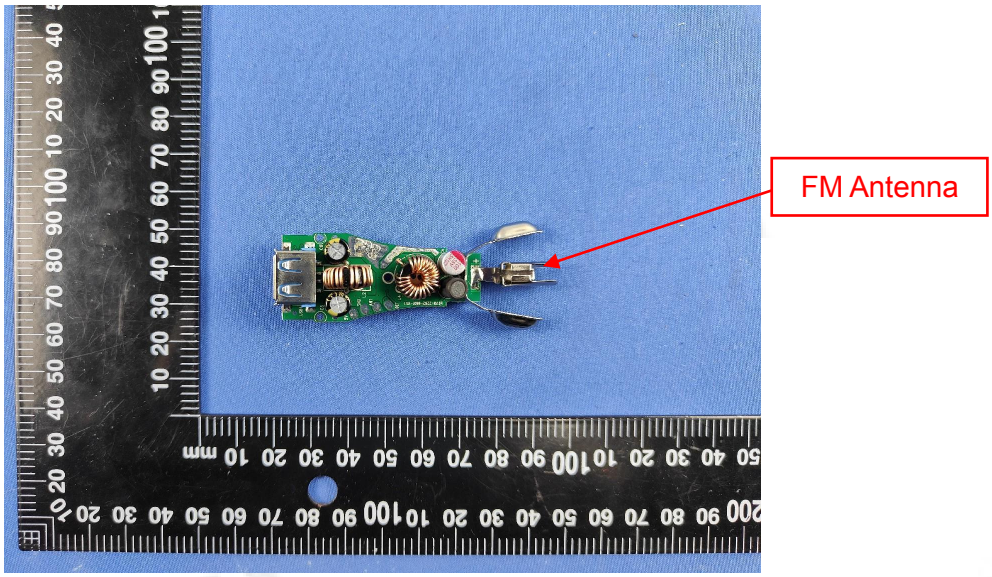
Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, 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.

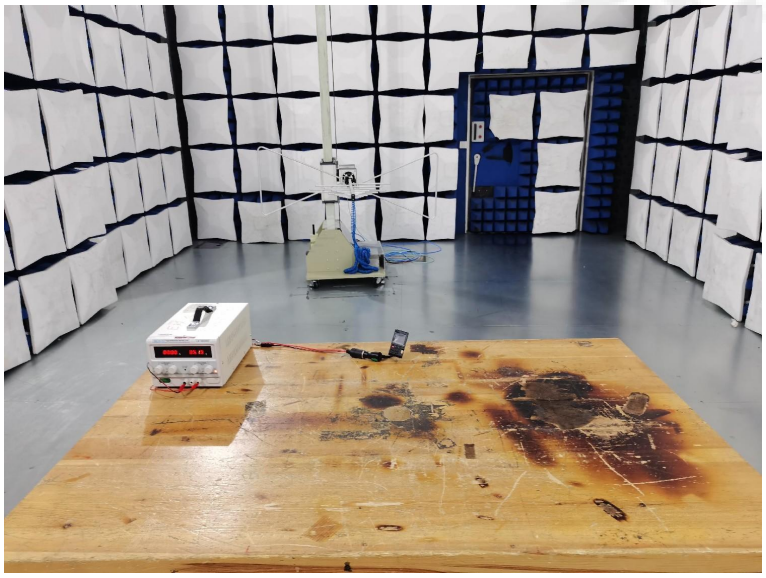
Refer to statement below for compliance.
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

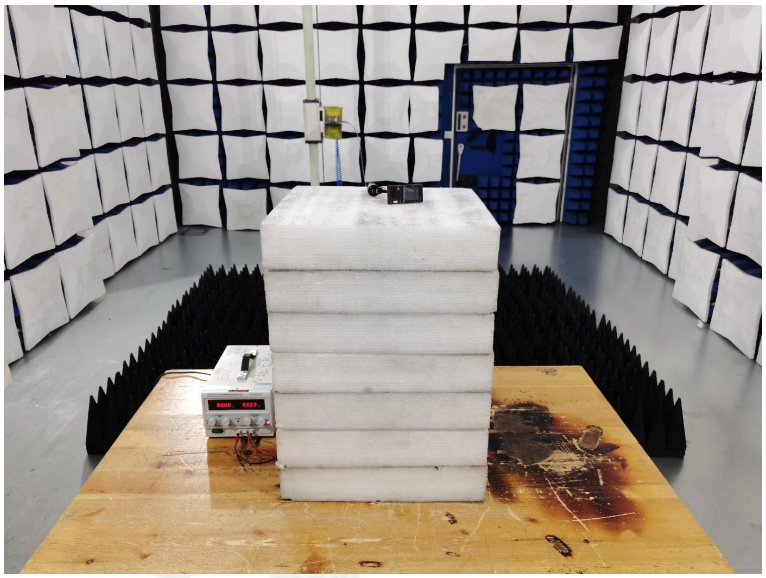
Antenna Connected Construction

The antenna used in this product is an Internal Antenna, The directional gains of antenna used for transmitting is 0.0dBi.



4. Test Setup Photos of the EUT





5. External and Internal Photos of the EUT

Reference to the test report No. CTL2202182111-WF01

********** **End of Report** **********