



RF Test Report

For

Applicant Name: Shenzhen Sino Electronics Co., Ltd.
Address: 201, GongKenglang Industrial Park, Xintian Community, Guanhu Street, Longhua District, Shenzhen
EUT Name: Car Bluetooth Handsfree
Brand Name: N/A
Model Number: BT24
Series Model Number: Refer to section 2

Issued By

Company Name: BTF Testing Lab (Shenzhen) Co., Ltd.
Address: F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China

Report Number: BTF231102R00102
Test Standards: 47 CFR Part 15 Subpart C Section 15.239
FCC ID: 2BDXF-BT24
Test Conclusion: Pass
Test Date: 2023-11-03 to 2023-11-15
Date of Issue: 2023-11-16

Prepared By: Aria Zhang

Date: 2023-11-16

Approved By: Ryan.CJ / EMC Manager

Date: 2023-11-16



Note: All the test results in this report only related to the testing samples. Which can be duplicated completely for the legal use with approval of applicant; it shall not be reproduced except in full without the written approval of BTF Testing Lab (Shenzhen) Co., Ltd., All the objections should be raised within thirty days from the date of issue. To validate the report, you can contact us.

Revision History		
Version	Issue Date	Revisions Content
R_V0	2023-11-16	Original
Note:		Once the revision has been made, then previous versions reports are invalid.

Table of Contents

1. Introduction	4
1.1 Identification of Testing Laboratory	4
1.2 Identification of the Responsible Testing Location	4
1.3 Laboratory Condition	4
1.4 Announcement	4
2. Product Information	5
2.1 Application Information	5
2.2 Manufacturer Information	5
2.3 Factory Information	5
2.4 General Description of Equipment under Test (EUT)	5
2.5 Technical Information	5
3. Summary of Test Results	7
3.1 Test Standards	7
3.2 Summary of Test Result	7
3.3 Uncertainty of Test	7
4. Test Configuration	8
4.1 Environment Condition	8
4.2 Test Equipment List	8
4.3 Test Auxiliary Equipment	9
4.4 Test Setup	10
5. Test Items	12
5.1 Antenna Requirements	12
5.2 20dB bandwidth & 99% bandwidth	13
5.3 Field Strength of the Fundamental and Band Edge	14
5.4 Radiated Spurious Emission	16
ANNEX A Test Results	18
A.1 20dB bandwidth & 99% bandwidth	18
A.2 Field Strength of the Fundamental and Band Edge	22
A.3 Radiated Spurious Emission	25
ANNEX B TEST SETUP PHOTOS	26
ANNEX CEUT EXTERNAL PHOTOS	26
ANNEX DEUT INTERNAL PHOTOS	26

1. Introduction

1.1 Identification of Testing Laboratory

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130

1.2 Identification of the Responsible Testing Location

Test Location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Description:	All measurement facilities used to collect the measurement data are located at F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
FCC Registration Number:	518915
Designation Number:	CN1330

1.3 Laboratory Condition

Ambient Temperature:	20°C to 25°C
Ambient Relative Humidity:	45% to 55%
Ambient Pressure:	100 kPa to 102 kPa

1.4 Announcement

- (1) The test report reference to the report template version v0.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) This document may not be altered or revised in any way unless done so by BTF and all revisions are duly noted in the revisions section.
- (5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- (6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

2. Product Information

2.1 Application Information

Company Name:	Shenzhen Sino Electronics Co., Ltd.
Address:	201, GongKenglang Industrial Park, Xintian Community, Guanhu Street, Longhua District, Shenzhen

2.2 Manufacturer Information

Company Name:	Shenzhen Sino Electronics Co., Ltd.
Address:	201, GongKenglang Industrial Park, Xintian Community, Guanhu Street, Longhua District, Shenzhen

2.3 Factory Information

Company Name:	Shenzhen Sino Electronics Co., Ltd.
Address:	201, GongKenglang Industrial Park, Xintian Community, Guanhu Street, Longhua District, Shenzhen

2.4 General Description of Equipment under Test (EUT)

EUT Name	Car Bluetooth Handsfree
Under Test Model Name	BT24
Series Model Name	BT25
Description of Model name differentiation	Only the model name is different, the others are the same.
Hardware Version	V1.3
Software and Firmware Version	V2.0

2.5 Technical Information

Modulation Type	FM
Product Type	Low Power Communication Device Transmitter
Frequency Range	The frequency range used is 88.1 MHz – 107.9 MHz; The frequency block is 88 MHz to 108 MHz.
Number of Channel	199 (at intervals of 100 KHz)
Tested Channel	01 (88.1 MHz), 101 (98.1 MHz), 199 (107.9 MHz)
Antenna Type	Internal Antenna
Antenna Gain#	0 dBi

Note:

#: The antenna gain provided by the applicant, and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.

All channel was listed on the following table:

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

3. Summary of Test Results

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C Section 15.239	Intentional Radiators
2	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

3.2 Summary of Test Result

No.	Description	IC Part No.	Test Result	Test By	Verdict
1	Antenna Requirement	Part 15.203	Section 5.1	--	Pass
2	20dB bandwidth & 99% bandwidth	Part 15.239(a)	ANNEX A.1	Aria Zhang	Pass
3	Field Strength of the Fundamental and Band Edge	Part 15.239(b)	ANNEX A.3	Aria Zhang	Pass
4	Radiated Spurious Emission	Part 15.209 Part 15.239(c)	ANNEX A.4	Aria Zhang	Pass

3.3 Uncertainty of Test

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2 and TR100 028-1/-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Occupied Channel Bandwidth	69 KHz
All emissions, radiated(<1GHz)	4.12 dB
All emissions, radiated(>1GHz)	4.16 dB
Temperature	0.82 °C
Humidity	4.1 %

4. Test Configuration

4.1 Environment Condition

Environment Parameter	Selected Values During Tests			
	Temperature	Voltage	Relative Humidity	Ambient Pressure
Normal Temperature, Normal Voltage (NTNV)	20°C to 25°C	DC 12V from battery	30% to 60%	100 kPa to 102 kPa

4.2 Test Equipment List

Conducted Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022.11.24	2023.11.23	☑
WIDEBAND RADIO COMMUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022.11.24	2023.11.23	☑
ESG VECTOR SIGNAL GENERATOR	Agilent	E4438C	MY45094854	2022.11.24	2023.11.23	☑
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2022.11.24	2023.11.23	☑
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2022.11.25	2023.11.24	☑
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022.11.24	2023.11.23	☑

Radiated Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2022.11.24	2023.11.23	☑
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2022.11.24	2023.11.23	☑
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2021.11.28	2023.11.27	☑
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2021.11.28	2023.11.27	☑
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/	☑
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2022.11.24	2023.11.23	☑
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	2022.11.24	2023.11.23	☑
RE Cable	REBES Talent	UF2-NMNM-1m	21101576	2022.11.24	2023.11.23	☑
Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023.3.24	2024.3.23	☑

RE Cable	Talent Microwave	A40-2.92M2.92 M-14M	22080539	2022.11.24	2023.11.23	☑
RE Cable	Talent Microwave	A81-SMAMNM- 14M	22080538	2022.11.24	2023.11.23	☑
Preamplifier	SCHWARZBECK	BBV9744	00246	2022.11.24	2023.11.23	☑
Horn Antenna	Schwarzbeck	BBHA9120D	2597	2022.5.22	2024.5.21	☑
Broadband Preamplifier	Schwarzbeck	BBV9718D	00008	2023.3.24	2024.3.23	☑

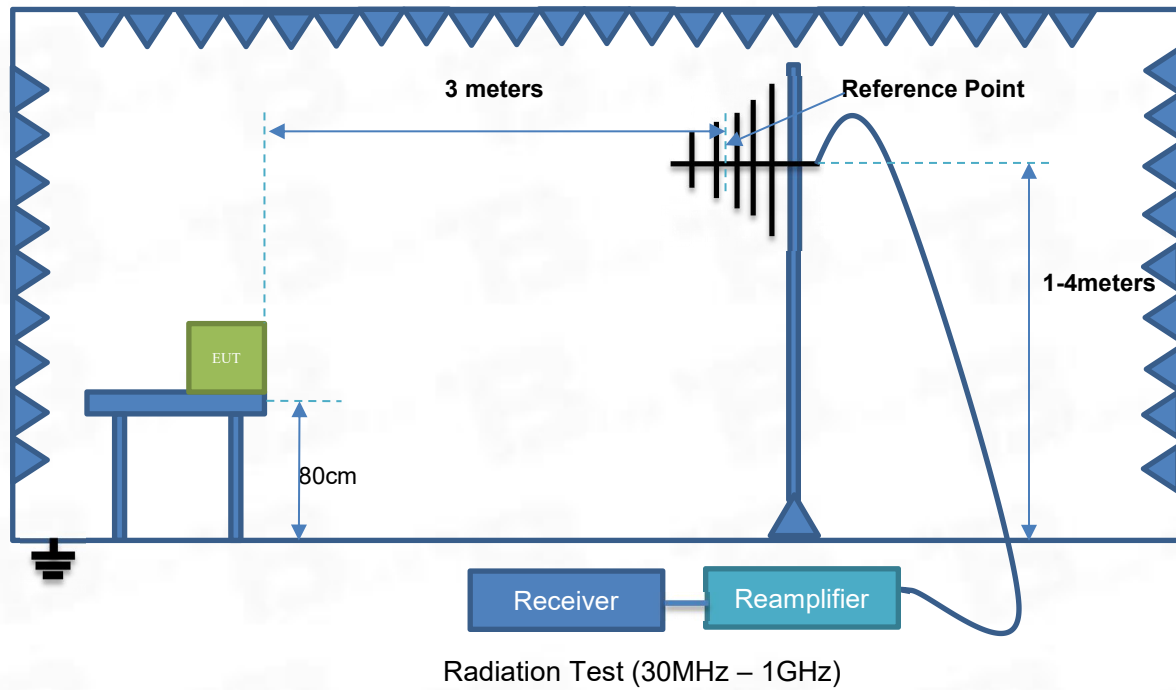
Conducted disturbance Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESCI3	101422	2022.11.24	2023.11.23	☑
V-LISN	SCHWARZBECK	NSLK 8127	01073	2022.11.24	2023.11.23	☑
LISN	AFJ	LS16/110VAC	16010020076	2022.11.24	2023.11.23	☑
Coaxial Switcher	SCHWARZBECK	CX210	CX210	2022.11.24	2023.11.23	☑
Pulse Limiter	SCHWARZBECK	VTSD 9561-F	00953	2022.11.24	2023.11.23	☑
EZ_EMC	Frad	EMC-CON 3A1.1+	/	/	/	☑

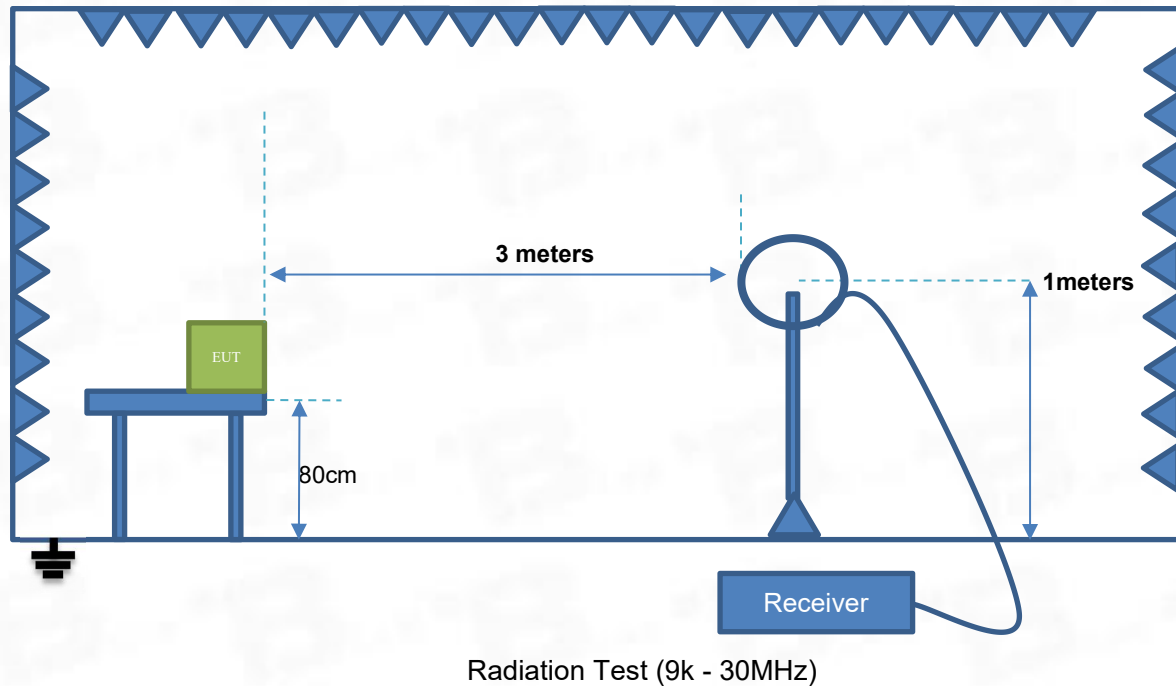
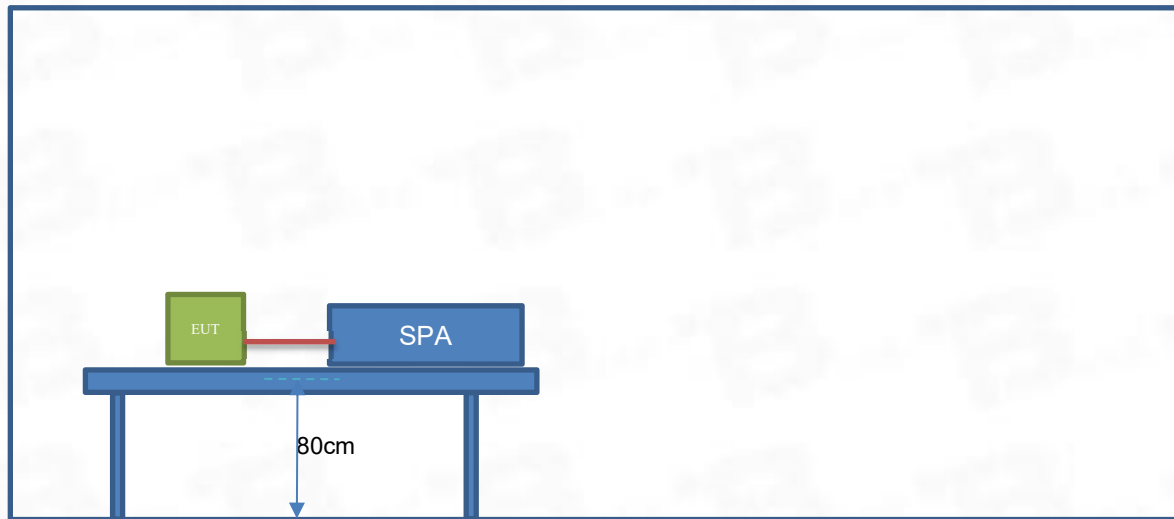
4.3 Test Auxiliary Equipment

Description	Manufacturer	Model	Serial No.	Length	Description
/	/	/	/	/	/

4.4 Test Setup

Test Setup 1



Test Setup 2**Test Setup 43**

5. Test Items

5.1 Antenna Requirements

5.1.1 Relevant Standards

Part 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of 15.211, 15.213, 15.217, 15.219, 15.221, or 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

5.1.2 Antenna Anti-Replacement Construction

Protected Method	Description
The antenna is embedded in the product.	An embedded in antenna design is used.

Reference Documents	Item
Photo	Please refer to the EUT Photo documents.

5.2 20dB bandwidth & 99% bandwidth

5.2.1 Limit

Part 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.

5.2.2 Test Setup

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the EUT bandwidth.

Set the RBW = 1%~5%OBW. Set VBW $\geq 3 \times$ RBW.

Set span $\geq 3 \times$ RBW, Sweep time = auto couple. Detector = peak.

Trace mode = max hold.

Allow trace to fully stabilize, view the transmitter waveform on the spectrum analyzer.

5.2.3 Test Result

Please refer to ANNEX A.1

5.3 Field Strength of the Fundamental and Band Edge

5.3.1 Limit

Part 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.

The field strength of emissions from the intentional radiators operated under these frequency bands shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBuV/m@3m)	
	Peak	Average
88 to 108	67.96	47.96

Field strength of outside of the frequency bands limit show in below table.

Outside Frequency Band Edge	Distance Meters(dBuV/m@3m)
Below 88 MHz	40.0 (QP)
Above 108 MHz	43.5 (QP)

5.3.2 Test Setup

See section 4.4 for test setup description for setup 1. The photo of test setup please refer to ANNEX B

5.3.3 Test Procedure

- (1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz. The EUT was placed on a rotating 0.8m high above the ground, the table was rotated 360 degrees to determine the position of the highest radiation.
- (2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
- (3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
- (4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

- (5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
- (6) Testing frequency range below 1GHz the measuring instrument use RBW=100 kHz, VBW=300 kHz with Quasi-peak detection.
- (7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Average Detector for Average Values.
- (8) For the actual test configuration, please see the test setup photo.

5.3.4 Test Result

Please refer to ANNEX A.2

5.4 Radiated Spurious Emission

5.4.1 Limit

Part 15.209

Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80,

Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)= Limit dBuV/m @30m + 40.

Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

Part 15.239(c)

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.

5.4.2 Test Setup

See section 4 for test setup description for setup 1. The photo of test setup please refer to ANNEX B

5.4.3 Test Procedure

- (1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz. The EUT was placed on a rotating 0.8m high above the ground, the table was rotated 360 degrees to determine the position of the highest radiation.
- (2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
- (3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
- (4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning

the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

(6) Testing frequency range below 1GHz the measuring instrument use RBW=100 kHz, VBW=300 kHz with Quasi-peak detection.

(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Average Detector for Average Values.

(8) For the actual test configuration, please see the test setup photo.

5.4.4 Test Result

Please refer to ANNEX A.3

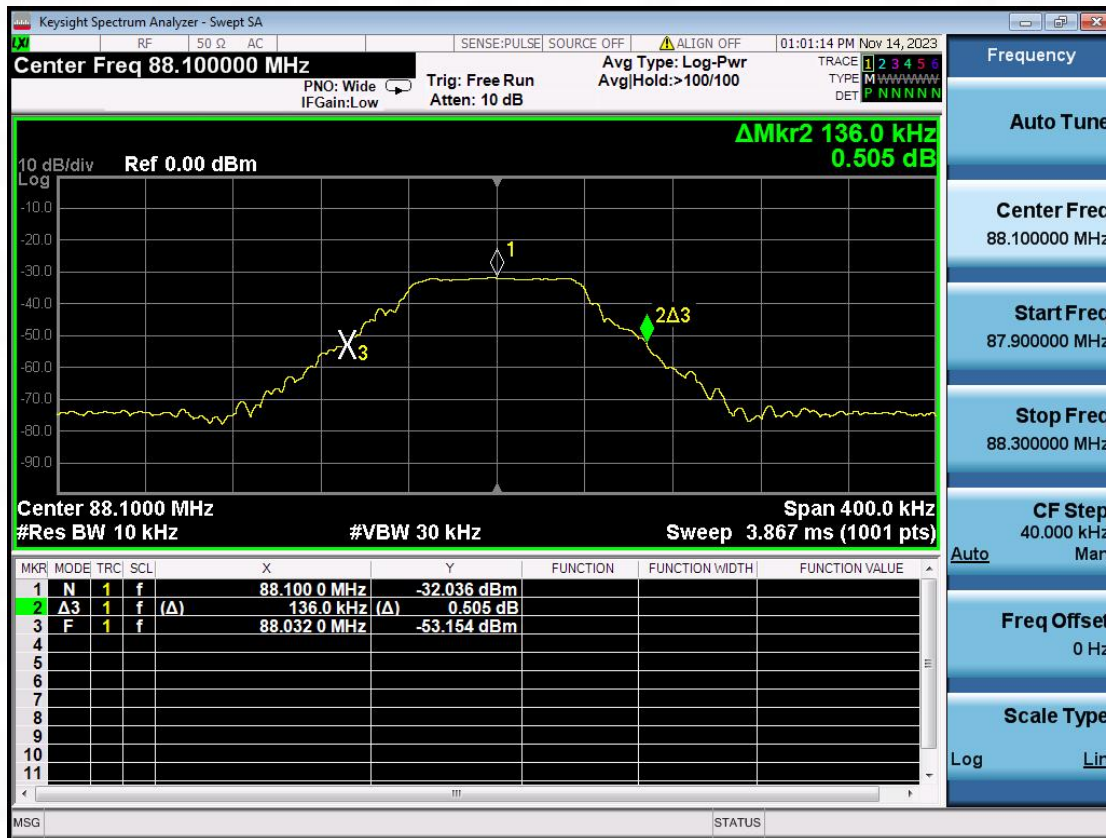
ANNEX A Test Results

A.1 20dB bandwidth & 99% bandwidth

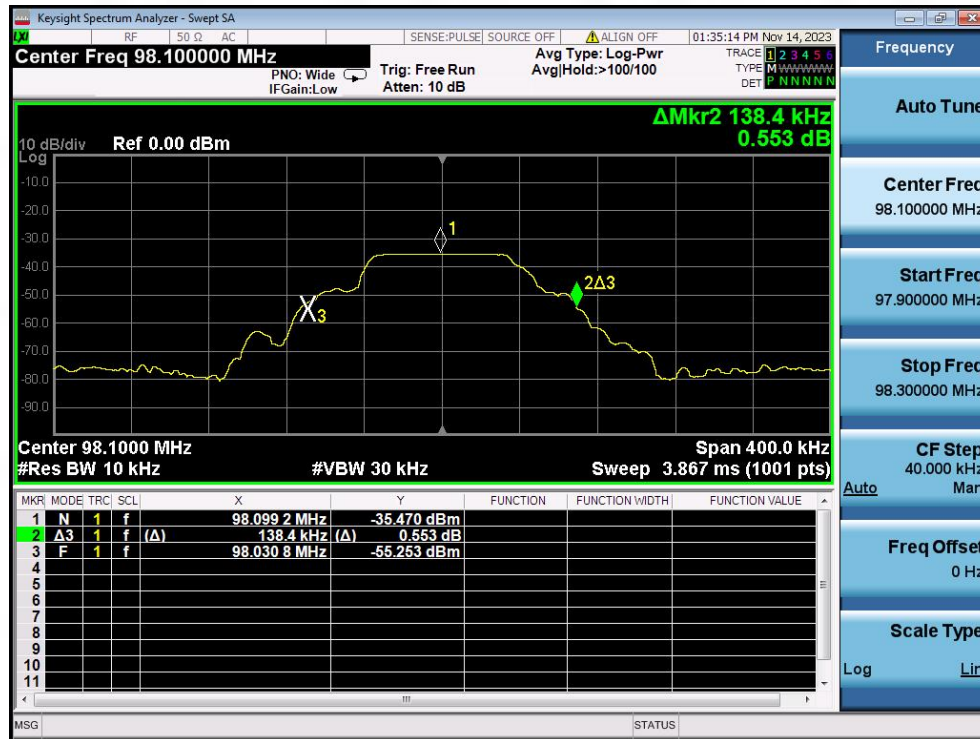
Test Channel	20dB Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
Lowest	136.0	200	PASS
Middle	138.4	200	PASS
Highest	98.4	200	PASS

Test plots as follows:

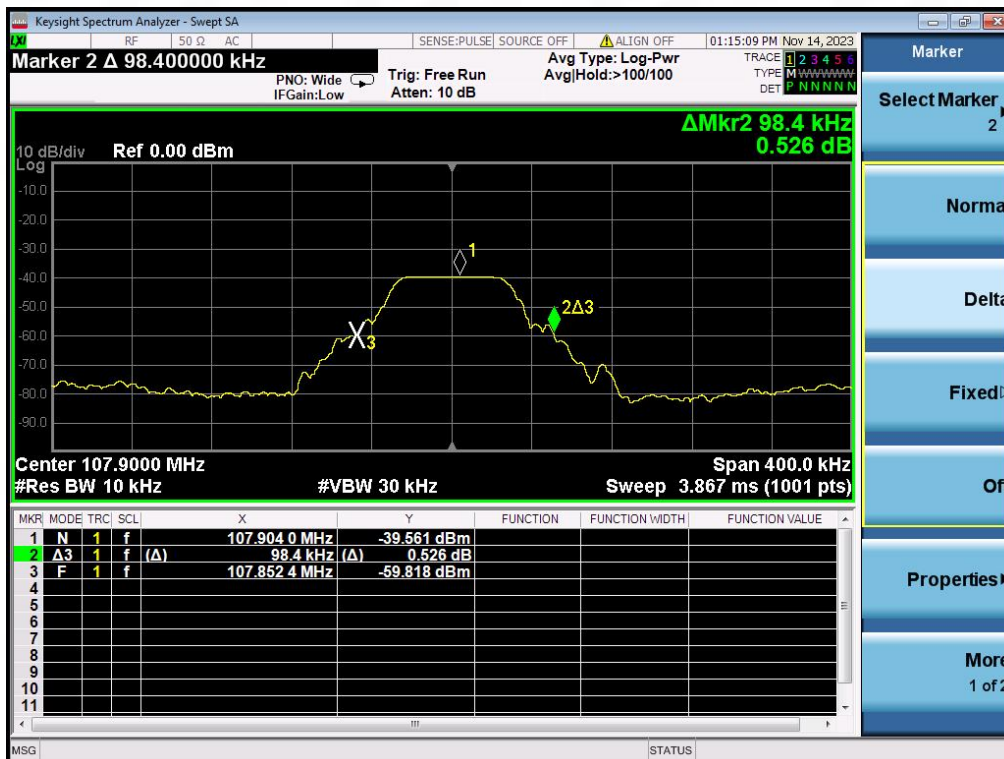
Lowest channel



Middle channel



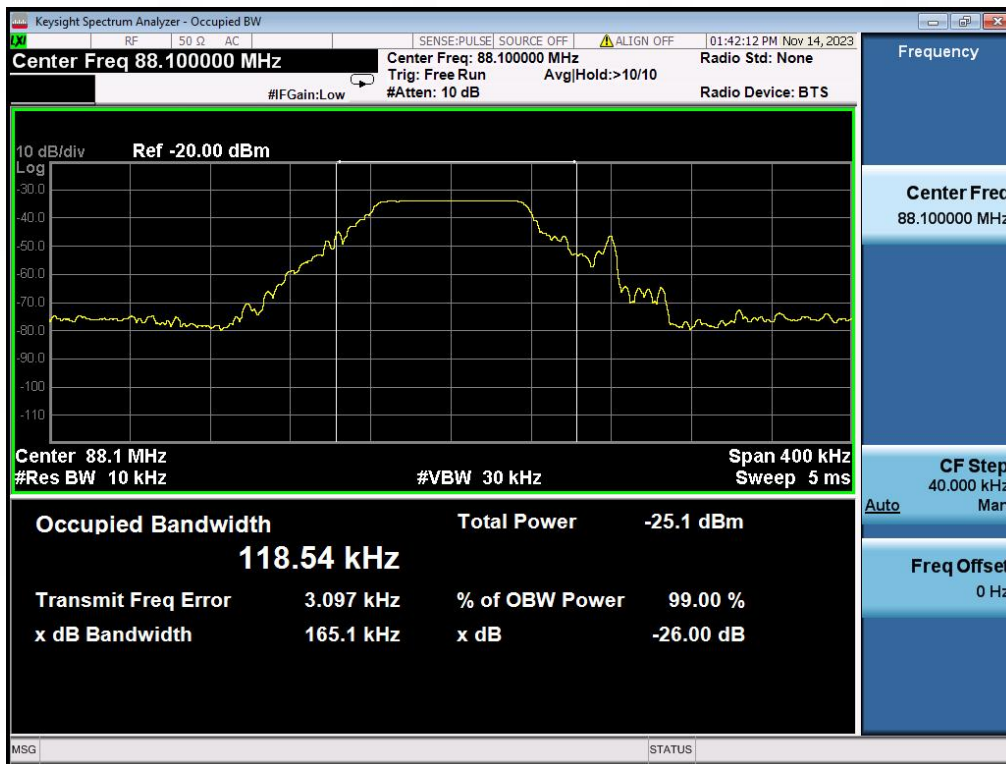
Highest channel



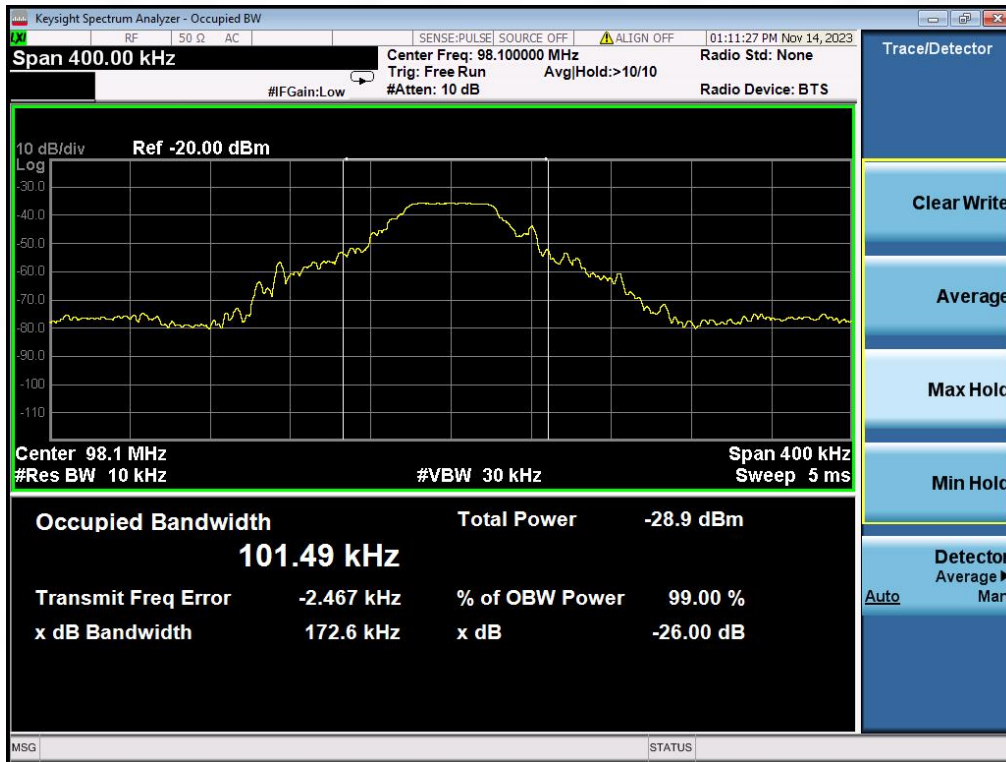
Test Channel	99% Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
Lowest	118.54	200	PASS
Middle	101.49	200	PASS
Highest	95.241	200	PASS

Test plots as follows:

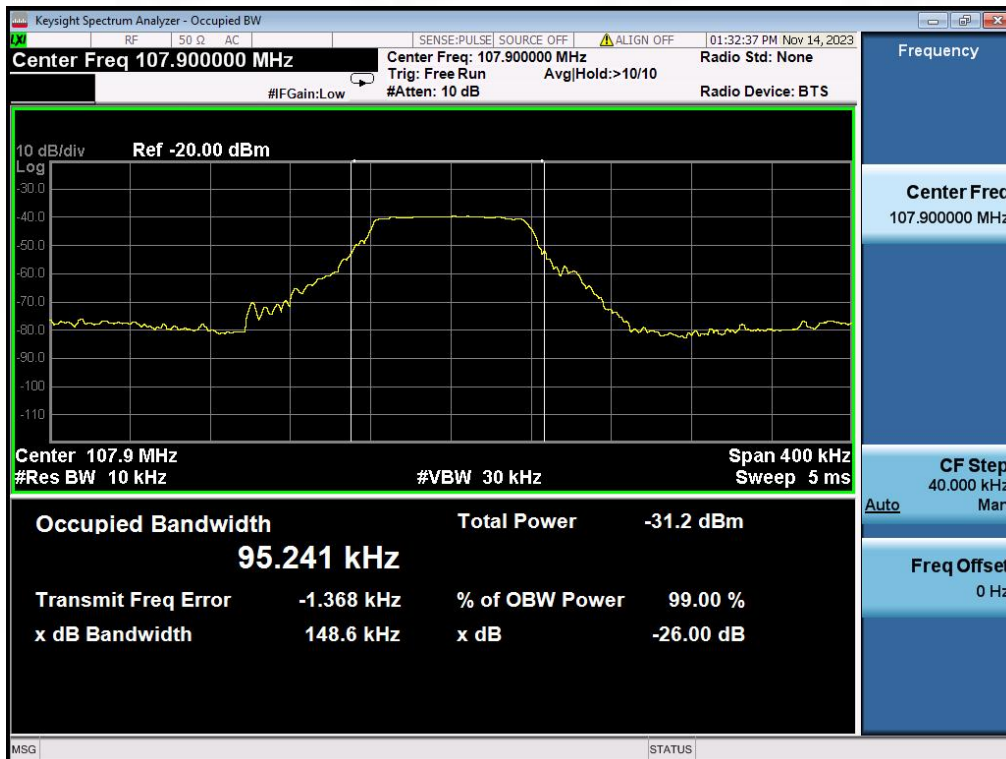
Lowest channel



Middle channel

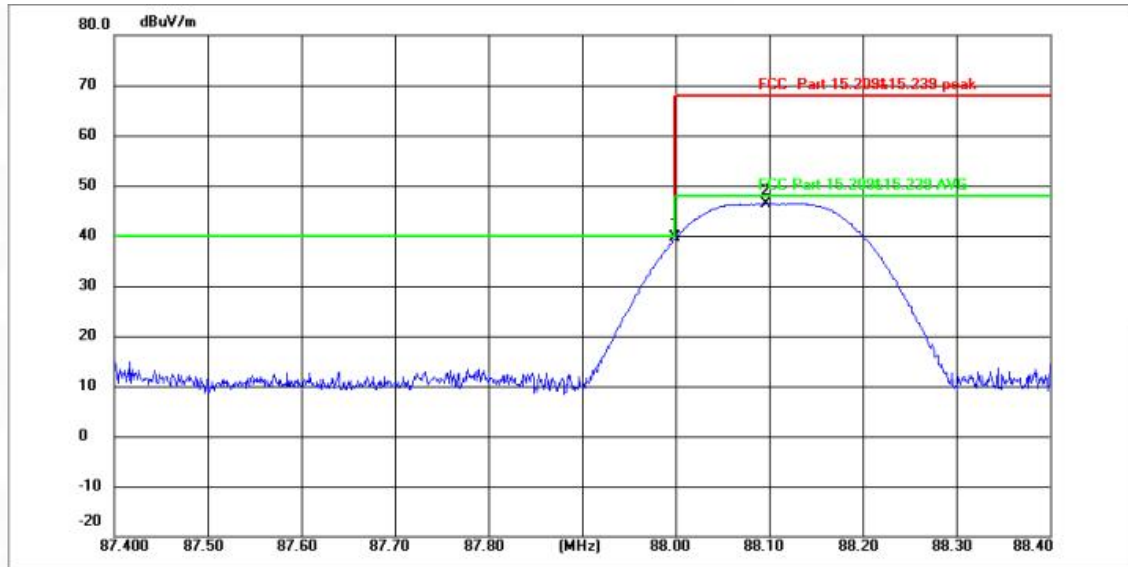


Highest channel



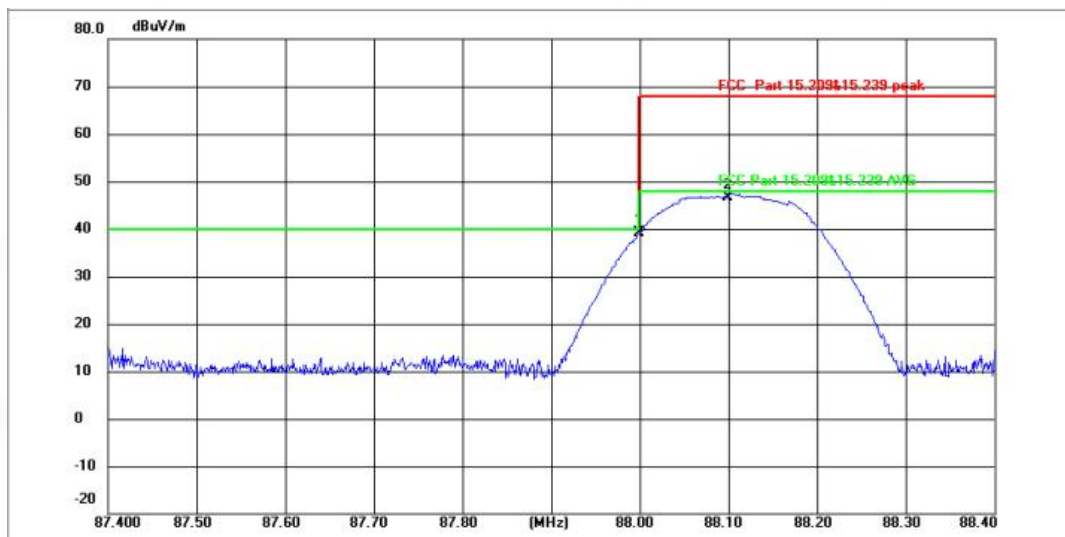
A.2 Field Strength of the Fundamental and Band Edge

Test Mode 88.1MHz ANT Horizontal



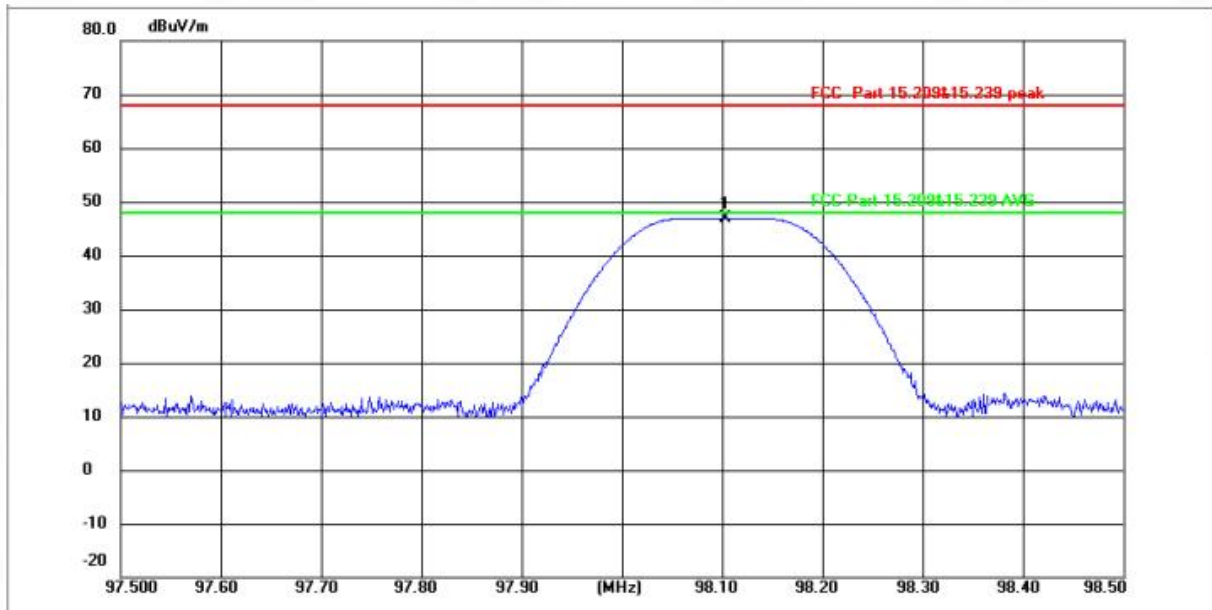
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	88.0000	60.28	-20.71	39.57	40.00	-0.43	peak	P
2	88.0970	66.91	-20.65	46.26	67.96	-21.70	peak	P

Test Mode 88.1MHz ANT Vertical



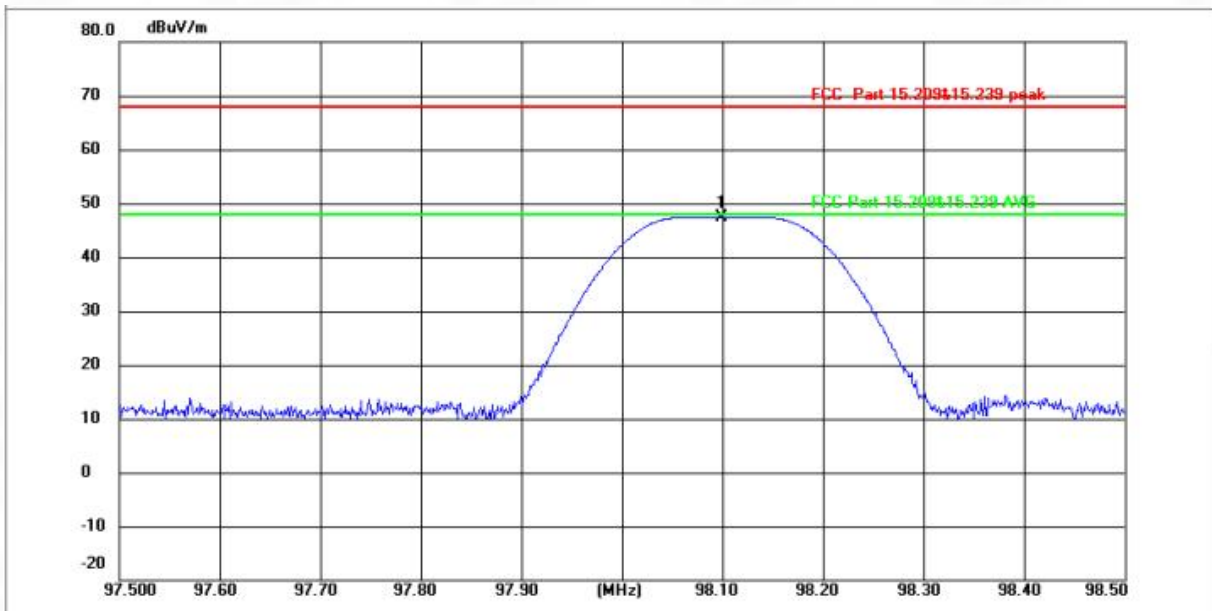
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	88.0000	59.78	-20.71	39.07	40.00	-0.93	peak	P
2	88.0990	67.39	-20.65	46.74	67.96	-21.22	peak	P

Test Mode 98.1MHz ANT Horizontal



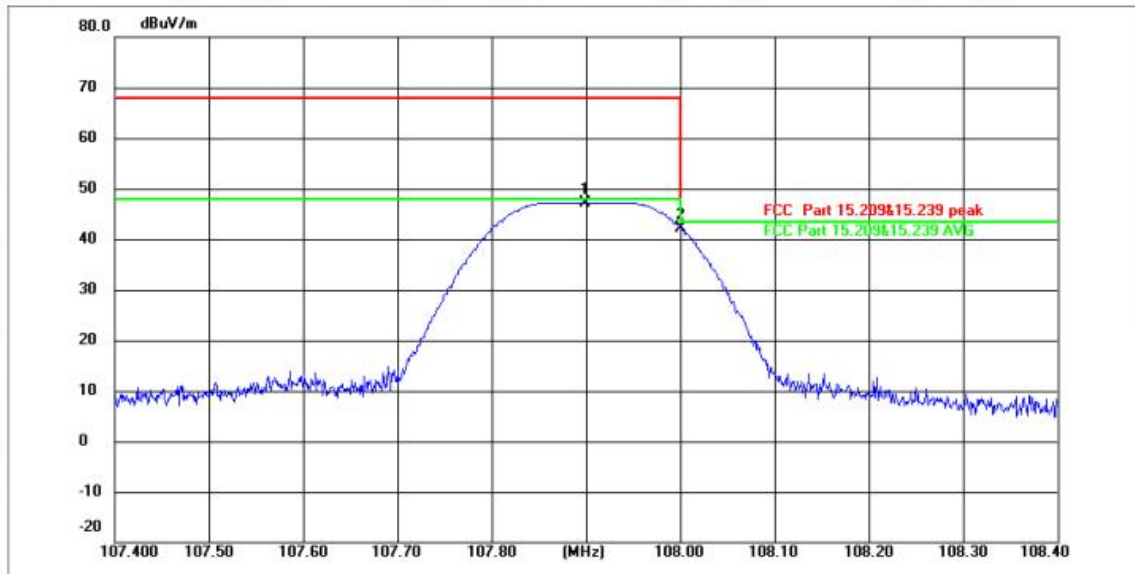
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	98.1030	75.38	-28.54	46.84	67.96	-21.12	peak	P

Test Mode 98.1MHz ANT Vertical



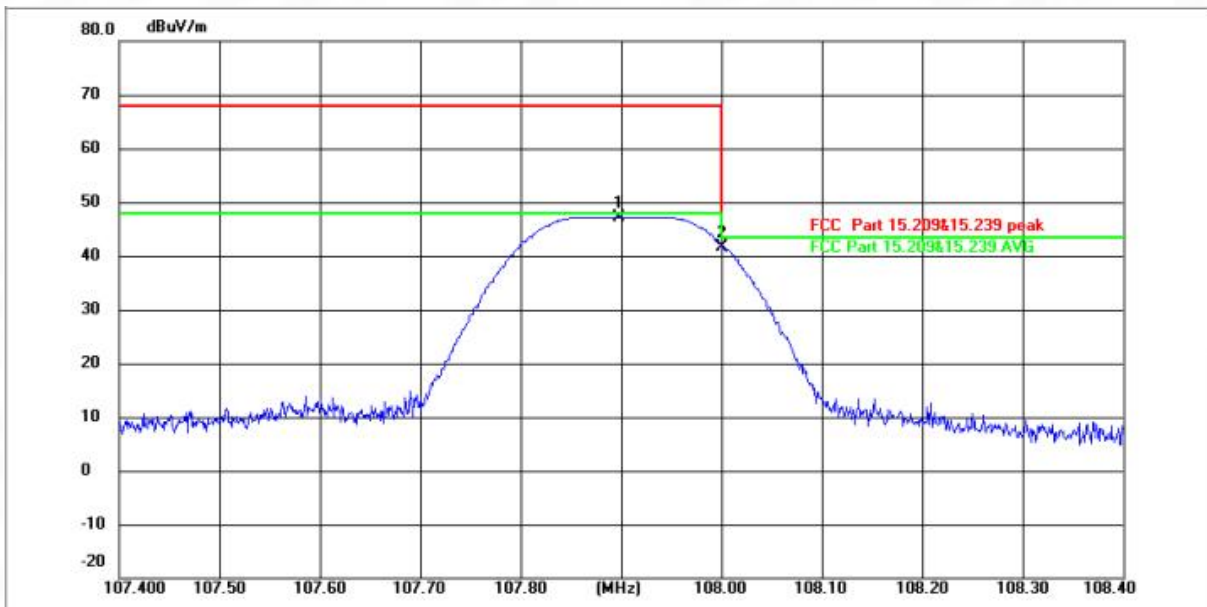
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	98.0990	75.90	-28.55	47.35	67.96	-20.61	peak	P

Test Mode 107.9MHz ANT Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	107.8990	64.23	-17.10	47.13	67.96	-20.83	peak	P
2 *	108.0000	59.11	-17.05	42.06	43.50	-1.44	peak	P

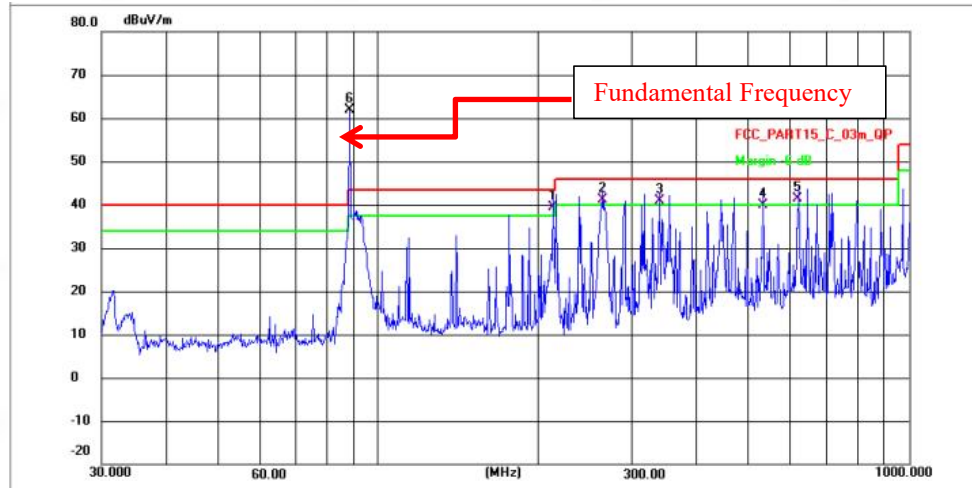
Test Mode 107.9MHz ANT Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	107.8984	64.24	-17.10	47.14	67.96	-20.82	peak	P
2 *	108.0000	58.61	-17.05	41.56	43.50	-1.94	peak	P

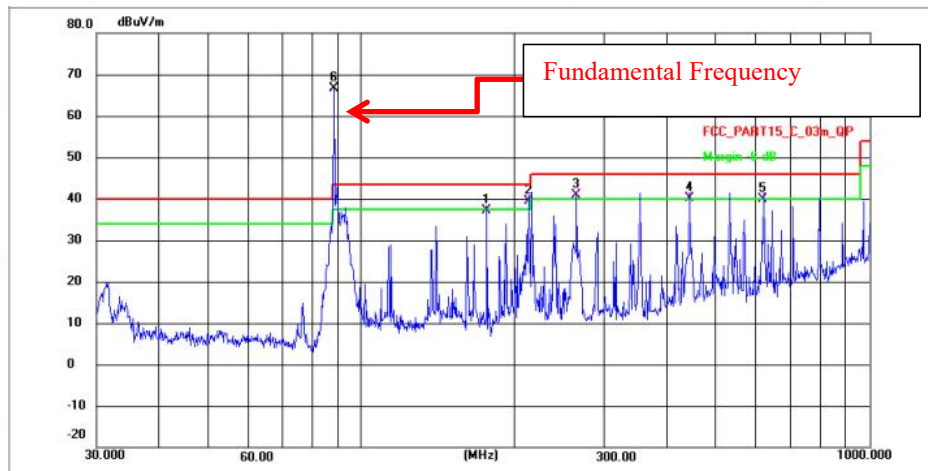
A.3 Radiated Spurious Emission

Horizontal:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 !	213.3890	66.15	-26.75	39.40	43.50	-4.10	QP	P
2 !	265.2102	66.92	-25.72	41.20	46.00	-4.80	QP	P
3 !	338.4000	66.02	-25.12	40.90	46.00	-5.10	QP	P
4	531.0316	61.27	-21.47	39.80	46.00	-6.20	QP	P
5 !	619.6221	63.94	-22.44	41.50	46.00	-4.50	QP	P
6 *	88.1872	92.17	-30.17	62.00	43.50	18.50	peak	F

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	176.8875	64.64	-27.54	37.10	43.50	-6.40	QP	P
2 !	213.3890	66.25	-26.75	39.50	43.50	-4.00	QP	P
3 !	265.2102	66.52	-25.72	40.80	46.00	-5.20	QP	P
4 !	442.5176	62.84	-22.64	40.20	46.00	-5.80	QP	P
5	619.6221	62.34	-22.44	39.90	46.00	-6.10	QP	P
6 *	88.1872	96.91	-30.17	66.74	43.50	23.24	peak	F

ANNEX B TEST SETUP PHOTOS

Please refer to the report No.BTF231102R00101

ANNEX C EUT EXTERNAL PHOTOS

Please refer to the report No.BTF231102R00101

ANNEX D EUT INTERNAL PHOTOS

Please refer to the report No.BTF231102R00101



Test Report Number: BTF231102R00102



BTF Testing Lab (Shenzhen) Co., Ltd.

F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street,
Bao'an District, Shenzhen, China

www.btf-lab.com

--END OF REPORT--