

TEST REPORT

FCC ID. :	2A578-T02	
Test Report No..... :	TCT230103E020	
Date of issue..... :	Feb. 01, 2023	
Testing laboratory	SHENZHEN TONGCE TESTING LAB	
Testing location/ address:	2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China	
Applicant's name..... :	INTRO UNION ELECTRONICS CO., LIMITED	
Address..... :	501, 2 Building, NO.280-2, Dabutou Village, Songyuansha Community, Guanhu Sub-district, Longhua District, Shenzhen, China	
Manufacturer's name ... :	INTRO UNION ELECTRONICS CO., LIMITED	
Address..... :	501, 2 Building, NO.280-2, Dabutou Village, Songyuansha Community, Guanhu Sub-district, Longhua District, Shenzhen, China	
Standard(s)	FCC CFR Title 47 Part 15 Subpart C Section 15.239	
Product Name..... :	Bluetooth FM transmitter	
Trade Mark	N/A	
Model/Type reference..... :	MTG BT FM Transmitter, 6132512, T02	
Rating(s)..... :	Input:DC 12V-24V Output:PD30W-5V/2.4A	
Date of receipt of test item	Jan. 03, 2022	
Date (s) of performance of test..... :	Dec. 28, 2022 - Feb. 01, 2023	
Tested by (+signature) ... :	Yannie ZHONG	
Check by (+signature).... :	Beryl ZHAO	
Approved by (+signature):	Tomsin	



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1. General Product Information

1.1.EUT description

Product Name.....:	Bluetooth FM transmitter
Model/Type reference.....:	MTG BT FM Transmitter
Sample Number.....:	TCT230103E019-0101
Operation Frequency	88.1MHz – 107.9MHz
Channel Separation.....:	100 kHz
Number of Channel	199CH
Modulation Technology	FM
Antenna Type.....:	Internal Antenna
Antenna Gain.....:	2.12dBi
Rating(s).....:	Input:DC 12V-24V Output:PD30W-5V/2.4A

Note: The antenna gain listed in this report is provided by applicant, and the test laboratory is not responsible for this parameter.

1.2.Model(s) list

No.	Model No.	Tested with
1	MTG BT FM Transmitter	<input checked="" type="checkbox"/>
Other models	6132512, T02	<input type="checkbox"/>

Note: MTG BT FM Transmitter is tested model, other models are derivative models. The models are identical in circuit and PCB layout, only different on the model names. So the test data of MTG BT FM Transmitter can represent the remaining models.

1.3. Operation Frequency

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	88.1 MHz	49	93.9 MHz	197	107.7 MHz
2	88.2 MHz	50	94.0 MHz	198	107.8 MHz
3	88.3 MHz	51	94.1 MHz	199	107.9 MHz
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Note:

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:

Channel	Frequency
The lowest channel	88.1 MHz
The middle channel	98.1 MHz
The Highest channel	107.9 MHz

2. Test Result Summary

Requirement	CFR 47 Section IC Paragraph	Result
Antenna requirement	§15.203	PASS
AC Power Line Conducted Emission	§15.207	N/A
Field strength of the fundamental signal	§15.239 (b)	PASS
Spurious emissions	§15.239 (b) (c)/ §15.209	PASS
20dB Bandwidth & 99% Bandwidth	§15.215 (c)	PASS

Note:

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

3. General Information

3.1. Test Environment and Mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	55 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation
<p>The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.</p>	

3.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID/DOC	Trade Name
Sealed Rechargeble Battery	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4. Facilities and Accreditations

4.1. Facilities

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

- FCC - Registration No.: 645098

SHENZHEN TONGCE TESTING LAB

Designation Number: CN1205

The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

SHENZHEN TONGCE TESTING LAB

CAB identifier: CN0031

The testing lab has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

4.2. Location

SHENZHEN TONGCE TESTING LAB

Address: 2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China

TEL: +86-755-27673339

4.3. Measurement Uncertainty

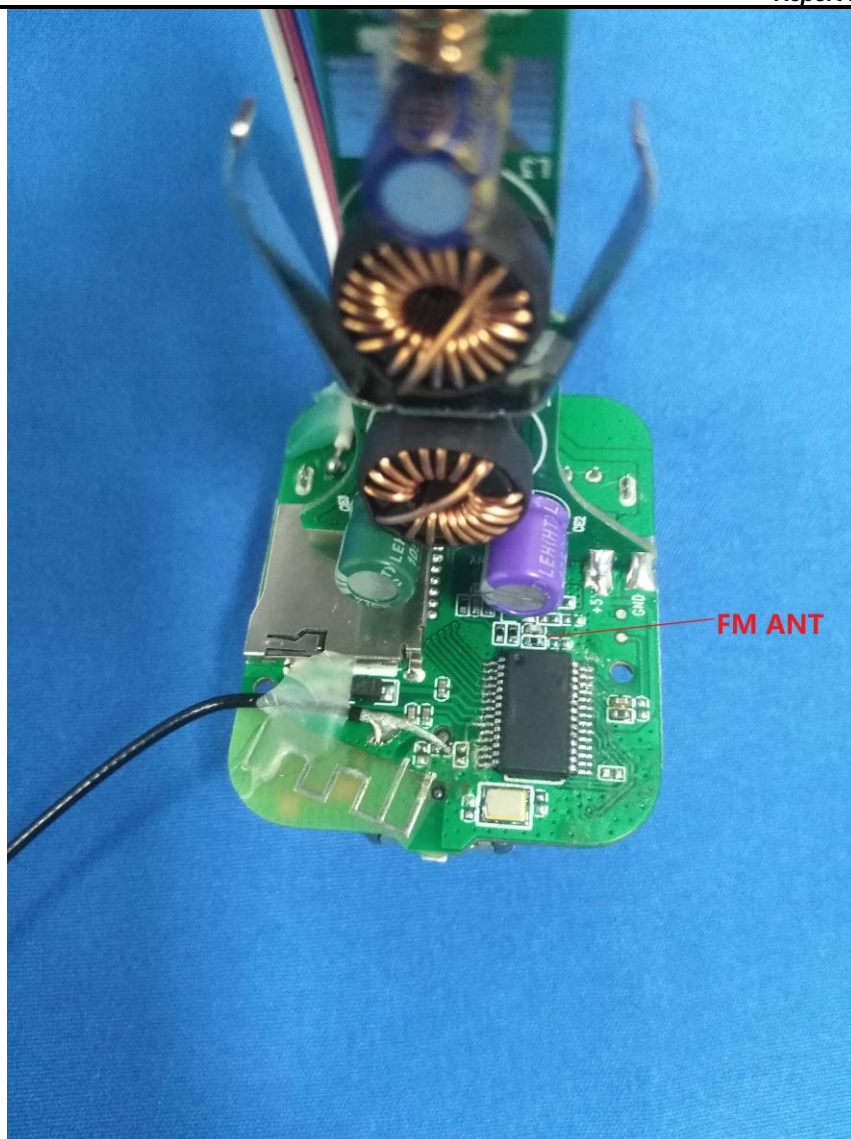
The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	± 3.10 dB
2	RF power, conducted	± 0.12 dB
3	Spurious emissions, conducted	± 0.11 dB
4	All emissions, radiated(<1 GHz)	± 4.56 dB

5. Test Results and Measurement Data

5.1. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
<p>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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, 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.</p> <p>15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.</p>	
E.U.T Antenna:	
The FM antenna is Internal antenna which permanently attached, and the best case gain of the antenna is 2.12dBi.	



5.2. Conducted Emission

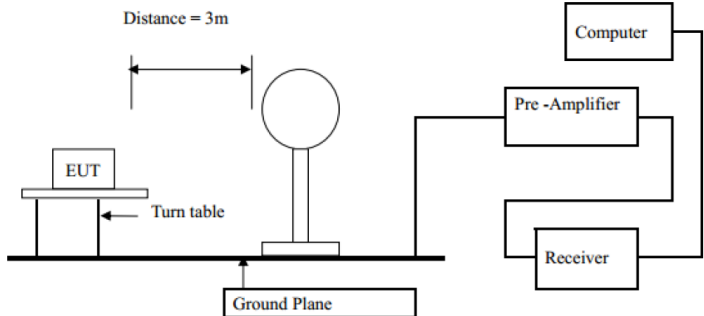
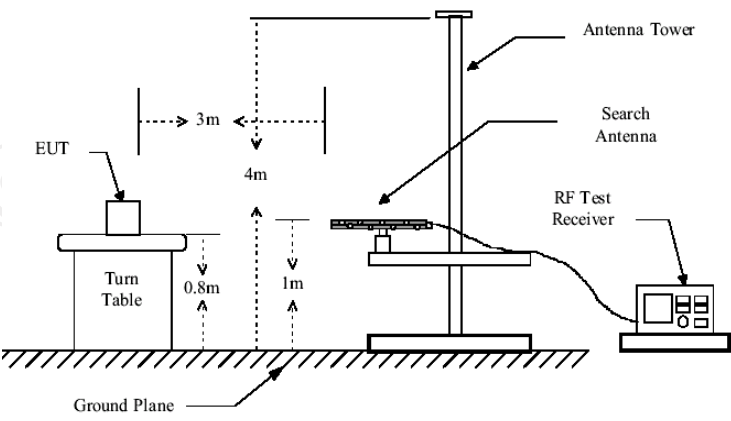
5.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207														
Test Method:	ANSI C63.10:2013														
Frequency Range:	150 kHz to 30 MHz														
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
Limits:	<table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBUV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table>	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
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													
Test Setup:	<div><p>Reference Plane</p><p>40cm 80cm</p><p>LISN</p><p>AUX Equipment</p><p>E.U.T.</p><p>Test table/Insulation plane</p><p>Filter</p><p>AC power</p><p>EMI Receiver</p><p>Remark E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p></div>														
Test Mode:	Transmitting Mode														
Test Procedure:	<div><div>1. The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</div><div>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</div><div>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.</div></div>														
Test Result:	N/A;The EUT is powered by car's power, So not applicable.														

5.3. Radiated Emission Measurement

5.3.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10: 2013				
Frequency Range:	9 kHz to 1 GHz				
Measurement Distance:	3 m				
Antenna Polarization:	Horizontal & Vertical				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value
Limit(Field strength of the fundamental signal):	Frequency		Limit (dBuV/m @3m)		Remark
	88-108MHz		48		Average Value
			68		Peak Value
Note: 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.					
Limit(Spurious Emissions):	Frequency		Limit (dBuV/m @3m)		Remark
	30MHz-88MHz		40.0		Quasi-peak Value
	88MHz-216MHz		43.5		Quasi-peak Value
	216MHz-960MHz		46.0		Quasi-peak Value
	960MHz-1GHz		54.0		Quasi-peak Value
Limit (band edge) :	Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.				
Test Procedure:	<div>1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber in below 1GHz, 1.5m above the ground in above 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation.</div> <div>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</div> <div>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make</div>				

	<p>the measurement.</p> <ol style="list-style-type: none"> For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
<p>Test setup:</p>	<p>For radiated emissions below 30MHz</p>  <p>30MHz to 1GHz</p> 
<p>Test Mode:</p>	<p>Refer to section 3.1 for details</p>
<p>Test results:</p>	<p>PASS</p>

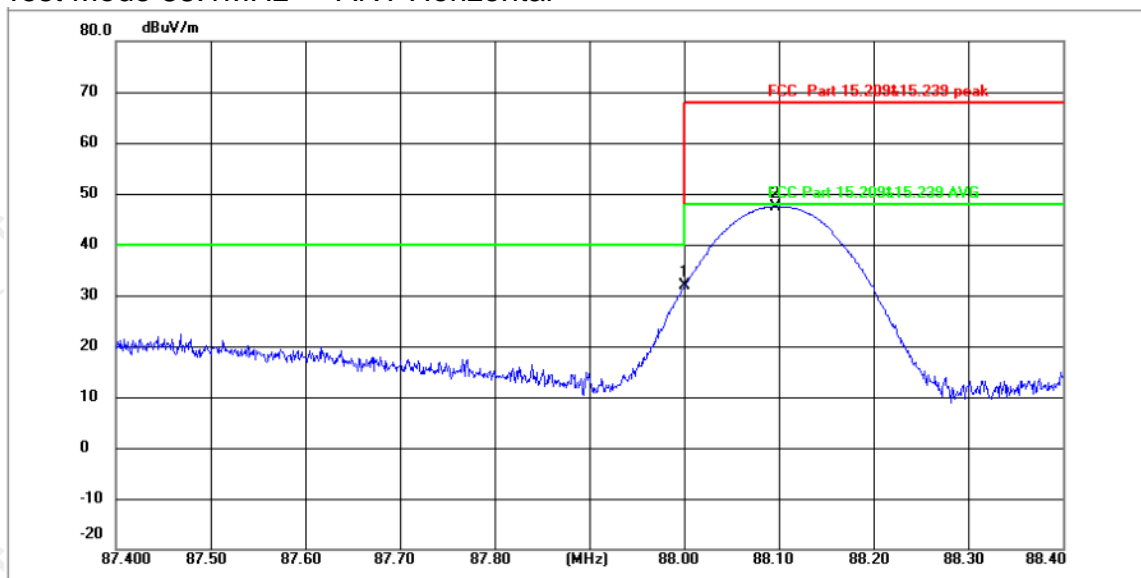
5.3.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESIB7	100197	Jul. 03, 2023
Spectrum Analyzer	R&S	FSQ40	200061	Jul. 03, 2023
Pre-amplifier	SKET	LNPA_0118G-45	SK2021012102	Feb. 24, 2023
Pre-amplifier	SKET	LNPA_1840G-50	SK202109203500	Feb. 24, 2023
Pre-amplifier	HP	8447D	2727A05017	Jul. 03, 2023
Loop antenna	Schwarzbeck	FMZB1519B	00191	Jun. 11, 2024
Broadband Antenna	Schwarzbeck	VULB9163	340	Jul. 05, 2024
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Jul. 05, 2024
Horn Antenna	Schwarzbeck	BBHA 9170	00956	Apr. 10, 2023
Antenna Mast	Keleto	RE-AM	/	/
Coaxial cable	SKET	RC-18G-N-M	/	Feb. 24, 2024
Coaxial cable	SKET	RC_40G-K-M	/	Feb. 24, 2024
EMI Test Software	Shurple Technology	EZ-EMC	/	/

5.3.3. Test Data

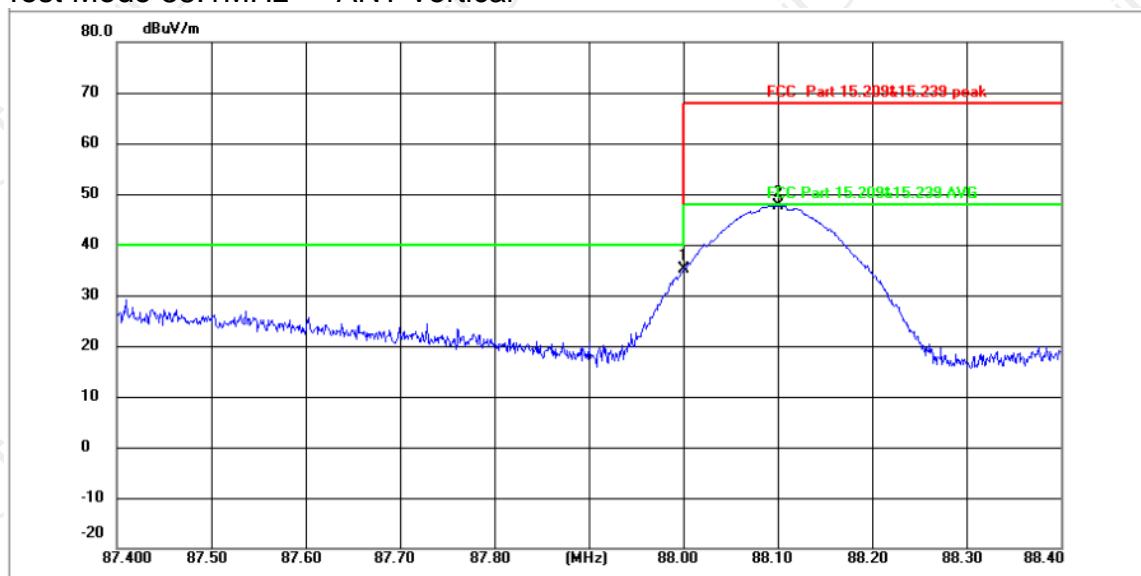
Field Strength of Fundamental

Test Mode 88.1MHz ANT Horizontal



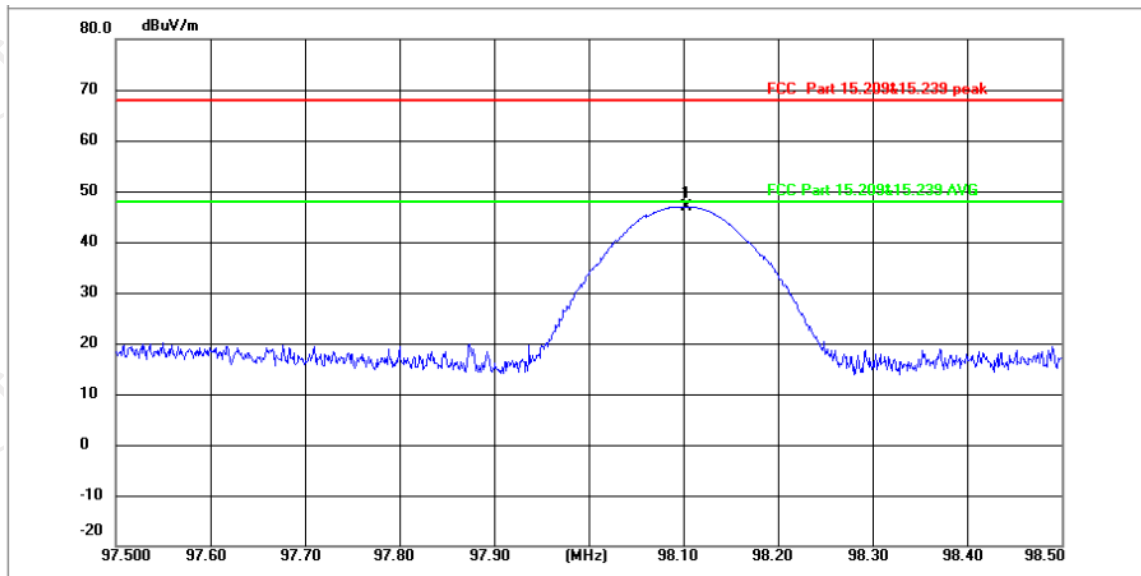
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	88.0000	74.60	-42.84	31.76	40.00	-8.24	peak	P
2	88.0970	90.34	-42.84	47.50	67.96	-20.46	peak	P

Test Mode 88.1MHz ANT Vertical



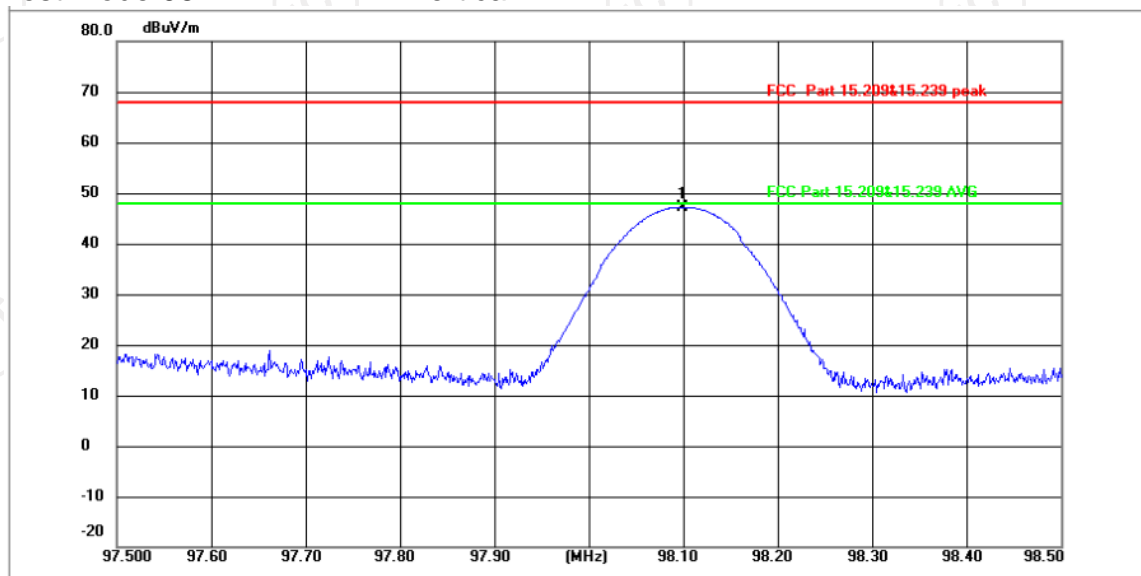
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	88.0000	63.04	-27.84	35.20	40.00	-4.80	peak	P
2	88.1010	75.41	-27.84	47.57	67.96	-20.39	peak	P

Test Mode 98.1MHz ANT Horizontal



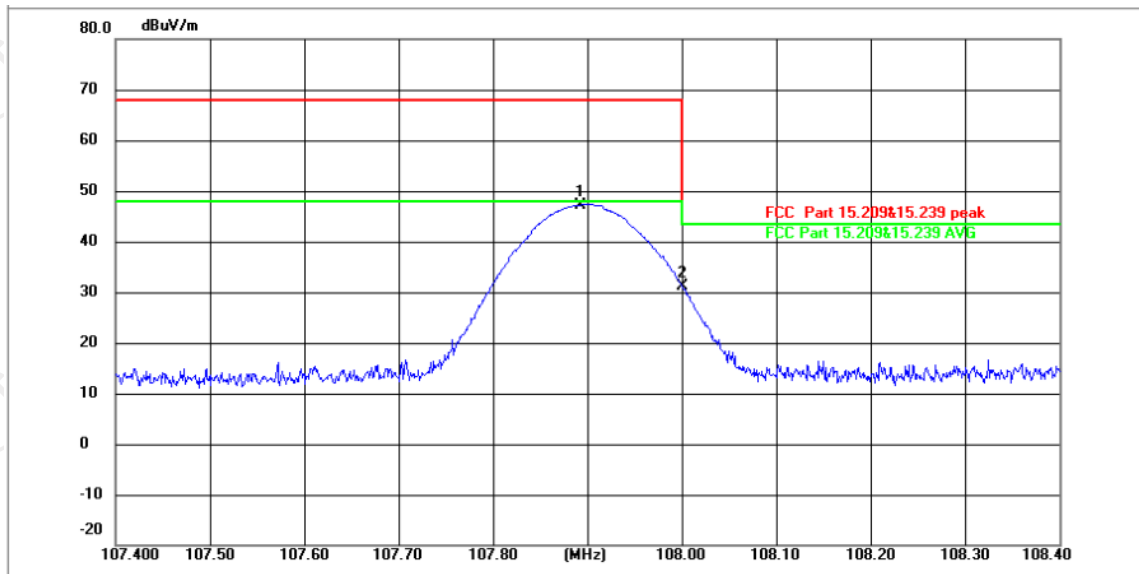
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	98.1030	74.75	-27.76	46.99	67.96	-20.97	peak	P

Test Mode 98.1MHz ANT Vertical



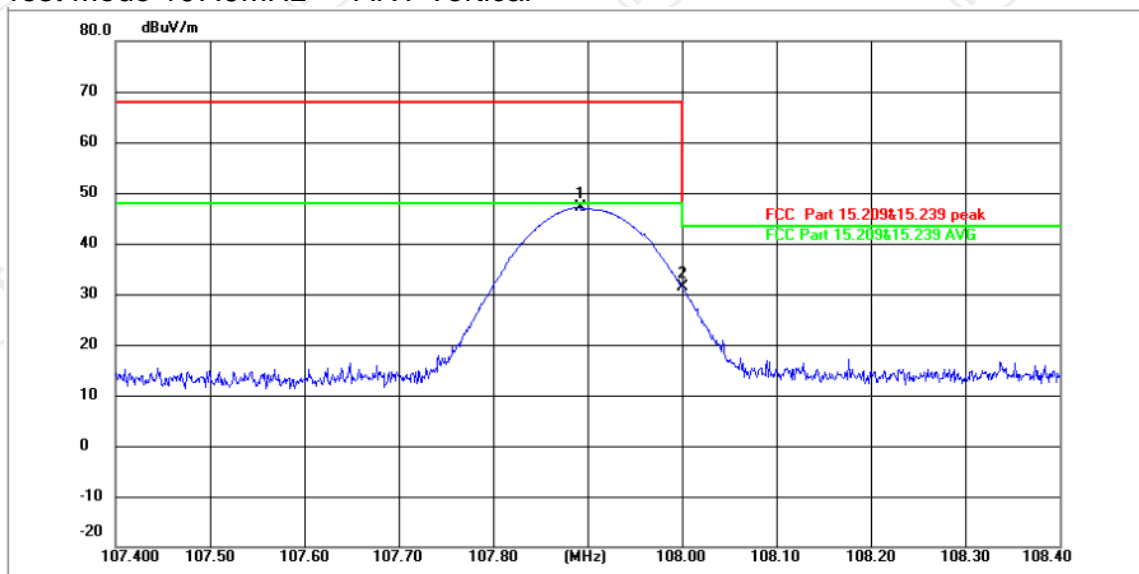
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1 *	98.0990	74.99	-27.76	47.23	67.96	-20.73	peak	P

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	107.8930	69.53	-22.28	47.25	67.96	-20.71	peak	P
2 *	108.0000	53.51	-22.26	31.25	43.50	-12.25	peak	P

Test Mode 107.9MHz ANT Vertical

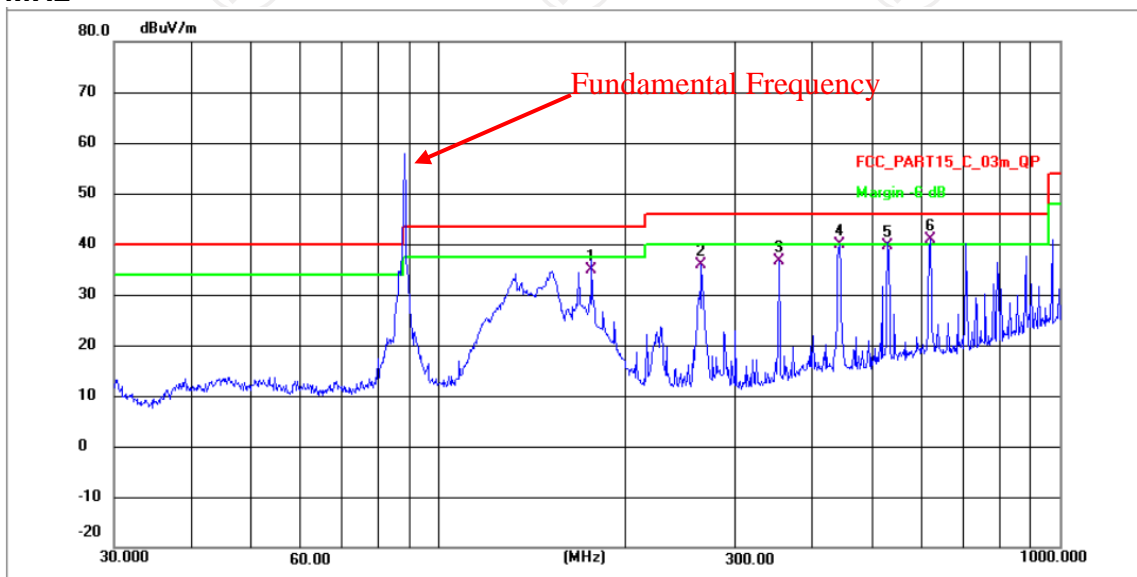


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	107.8920	69.51	-22.28	47.23	67.96	-20.73	peak	P
2 *	108.0000	53.69	-22.26	31.43	43.50	-12.07	peak	P

Frequency Range (30MHz-1GHz)

Horizontal:

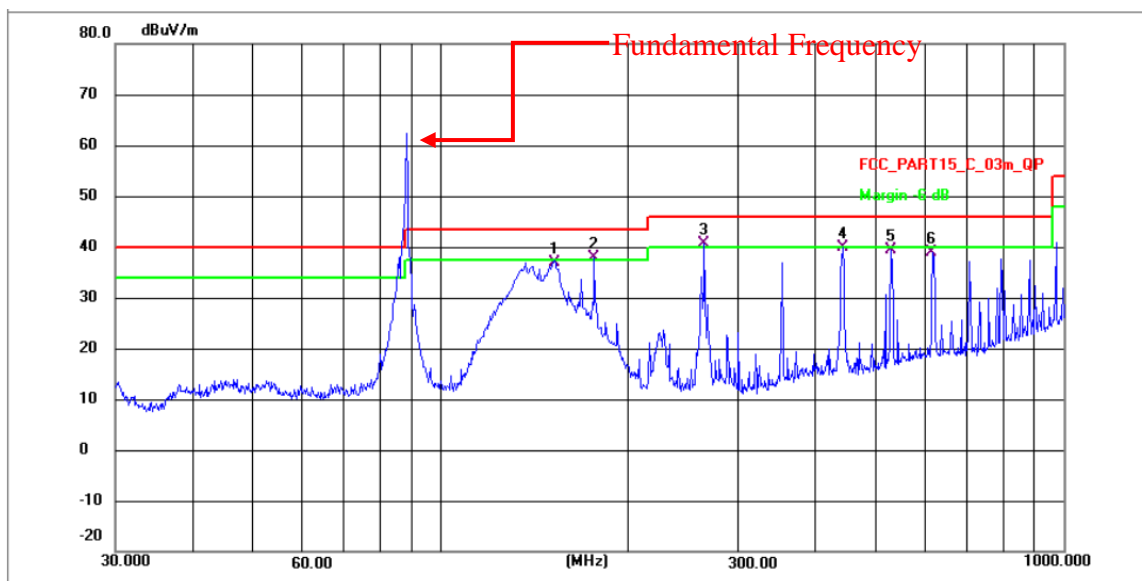
88.1 MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	176.2686	62.15	-27.15	35.00	43.50	-8.50	QP	P
2	264.7457	62.43	-26.62	35.81	46.00	-10.19	QP	P
3	352.9433	62.87	-26.13	36.74	46.00	-9.26	QP	P
4	441.7426	65.51	-25.62	39.89	46.00	-6.11	QP	P
5	528.2458	65.10	-25.37	39.73	46.00	-6.27	QP	P
6 *	618.5369	66.02	-25.07	40.95	46.00	-5.05	QP	P

Vertical:

88.1 MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	152.1297	64.00	-27.24	36.76	43.50	-6.74	QP	P
2 !	176.2686	65.02	-27.15	37.87	43.50	-5.63	QP	P
3 *	264.7457	67.23	-26.62	40.61	46.00	-5.39	QP	P
4	441.7425	65.40	-25.62	39.78	46.00	-6.22	QP	P
5	528.2458	64.67	-25.37	39.30	46.00	-6.70	QP	P
6	616.3716	64.02	-25.08	38.94	46.00	-7.06	QP	P

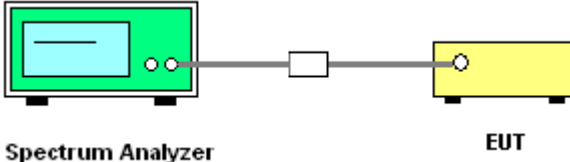
Note: 1) QP= Quasi-peak

2) Emission Level = Reading Level + Antenna Factor + Cable Loss.

3) Measurements were conducted in all three channels (high, middle, low) and the worst case Mode (low channel) was submitted only.

5.4. 20dB Bandwidth & 99% Bandwidth

5.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.215(c)
Test Method:	ANSI C63.10: 2013
Limit:	200kHz
Test Procedure:	<ol style="list-style-type: none">1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.2. Set to the maximum power setting and enable the EUT transmit continuously.3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; RBW\geq1% of the 20 dB bandwidth; VBW\geqRBW; Sweep = auto; Detector function = peak; Trace = max hold.4. Measure and record the results in the test report.
Test setup:	 <p>The diagram illustrates the test setup. On the left is a green Spectrum Analyzer with a screen and two ports. A cable connects one of its ports to a small white rectangular component. This component is then connected to a yellow rectangular box labeled 'EUT' (Equipment Under Test) which has a single port.</p>
Test Mode:	Refer to section 3.1 for details
Test results:	PASS

5.4.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 04, 2023

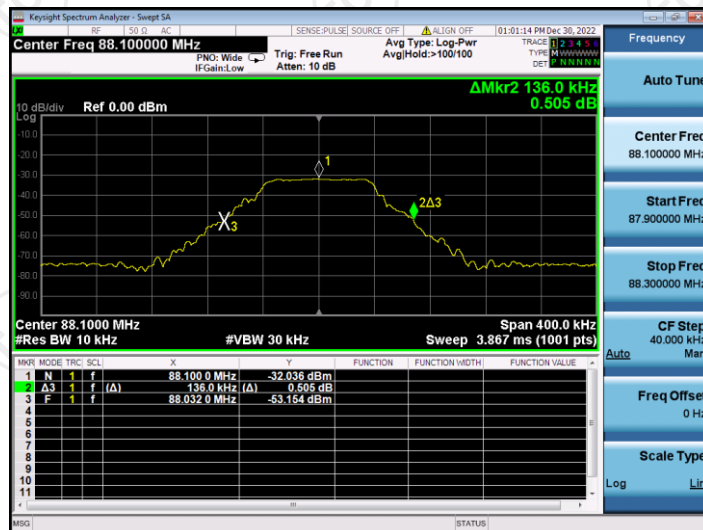
5.4.3. Test data

Test Channel	20dB Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
Lowest	136	200	PASS
Middle	112.4	200	PASS
Highest	98.4	200	PASS

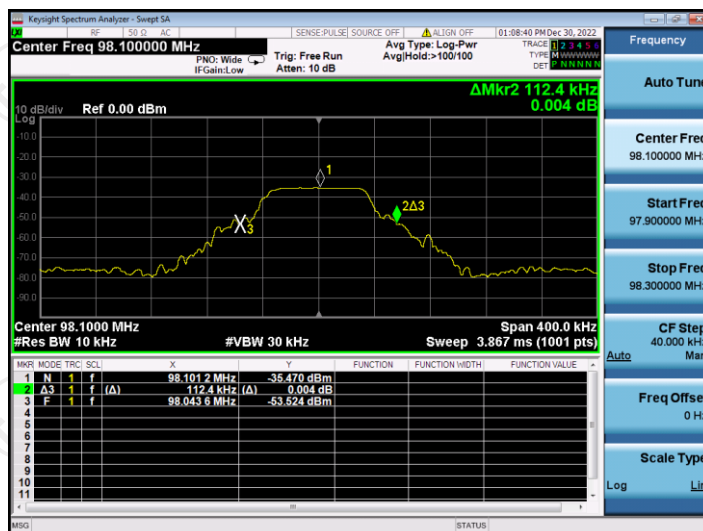
Test Channel	99% Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
Lowest	90.969	200	PASS
Middle	101.49	200	PASS
Highest	83.715	200	PASS

Test plots as follows:

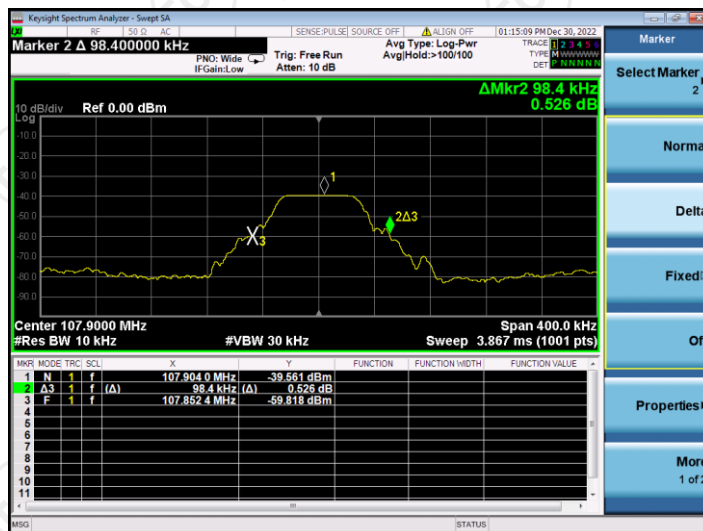
20dB Occupy Bandwidth Lowest channel



Middle channel



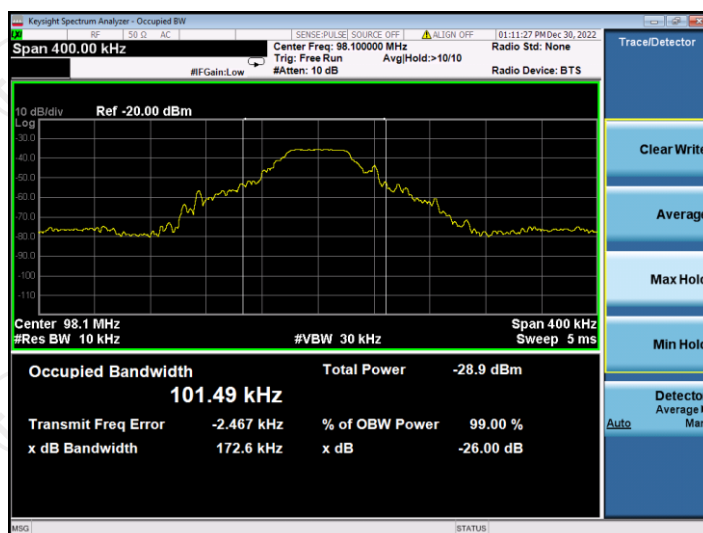
Highest channel



99% Occupy Bandwidth Lowest channel



Middle channel

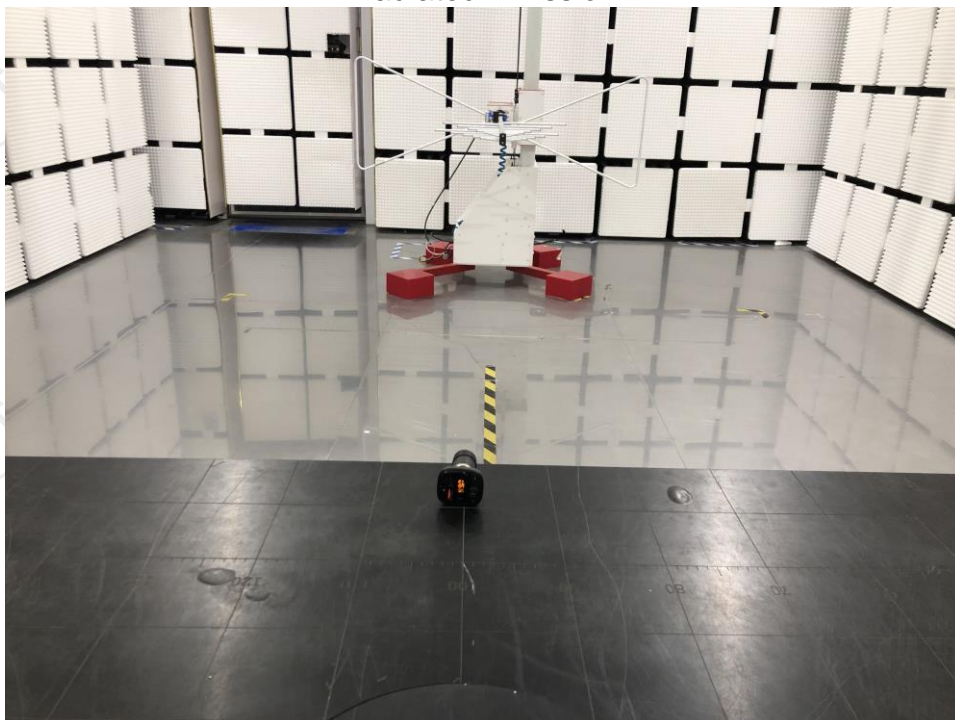


Highest channel



Appendix A: Photographs of Test Setup

Radiated Emission



Appendix B: Photographs of EUT

Refer to the test report No. TCT230103E019

*******END OF REPORT*******