

TEST REPORT

FCC ID: 2AG87RM-5800

Product: Smart Radio

Model No.: RM-5800

Additional Model No.: N/A

Trade Mark: N/A

Report No.: TCT200624E025

Issued Date: Aug. 28, 2020

Issued for:

Doodle Labs (SG) Pte Ltd

150 Kampong Ampat, KA Center, Suite 05-03, Singapore 368324, Singapore

Issued By:

Shenzhen Tongce Testing Lab.

**1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District,
Shenzhen, Guangdong, China**

TEL: +86-755-27673339

FAX: +86-755-27673332

Note: This report shall not be reproduced except in full, without the written approval of Shenzhen Tongce Testing Lab.

This document may be altered or revised by Shenzhen Tongce Testing Lab. personnel only, and shall be noted in the revision section of the document. The test results in the report only apply to the tested sample.

TABLE OF CONTENTS

1. Test Certification.....	3
2. Test Result Summary	4
3. EUT Description	5
4. General Information.....	7
4.1. Test environment and mode.....	7
4.2. Description of Support Units.....	8
5. Facilities and Accreditations	9
5.1. Facilities	9
5.2. Location	9
5.3. Measurement Uncertainty.....	9
6. Test Results and Measurement Data	10
6.1. Antenna requirement	10
6.2. Conducted Emission.....	11
6.3. Maximum Conducted Output Power.....	15
6.4. 6dB Emission Bandwidth	18
6.5. 99% Occupied Bandwidth.....	22
6.6. Power Spectral Density.....	26
6.7. Band edge	30
6.8. Unwanted Emission	35

Appendix A: Photographs of Test Setup

Appendix B: Photographs of EUT

1. Test Certification

Product:	Smart Radio
Model No.:	RM-5800
Additional Model No.:	N/A
Trade Mark:	N/A
Applicant:	Doodle Labs (SG) Pte Ltd
Address:	150 Kampong Ampat, KA Center, Suite 05-03, Singapore 368324, Singapore
Manufacturer:	Doodle Labs (SG) Pte Ltd
Address:	150 Kampong Ampat, KA Center, Suite 05-03, Singapore 368324, Singapore
Date of Test:	Jun. 25, 2020 – Aug. 27, 2020
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart E Section 15.407: 2016 KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General U-NII Test Procedures New Rules v02r01

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:



Rleo

Date:

Aug. 27, 2020

Reviewed By:



Beryl Zhao

Date:

Aug. 28, 2020

Approved By:



Tomsin

Date:

Aug. 28, 2020

2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203	PASS
AC Power Line Conducted Emission	§15.207	PASS
Maximum Conducted Output Power	§15.407(a)	PASS
6dB Emission Bandwidth	§15.407(a)	PASS
99% Occupied Bandwidth	§15.407(a)	PASS
Power Spectral Density	§15.407(a)	PASS
Restricted Bands around fundamental frequency	§15.407(a)	PASS
Radiated Emission	§15.407(a)	PASS
Frequency Stability	§15.407(g)	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. EUT Description

Product:	Smart Radio
Model No.:	RM-5800
Additional Model No.:	N/A
Trade Mark:	N/A
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	5735 MHz - 5840 MHz
Channel Bandwidth:	20MHz
Modulation Technology:	Orthogonal Frequency Division Multiplexing(OFDM)
Modulation Type	256QAM, 64QAM, 16QAM, BPSK, QPSK
Antenna Type:	External Antenna
Antenna Gain:	3dBi
Power Supply:	Input: AC120V/60Hz, Output: DC 5V from adapter (voltage range: 5V up to 42V)

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

Test Frequency each of channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	5735MHz	28	5762MHz	55	5789MHz	82	5816MHz
2	5736MHz	29	5763MHz	56	5790MHz	83	5817MHz
...	...	...	...	...	...	...	...
13	5747MHz	40	5774MHz	67	5801MHz	94	5828MHz
14	5748MHz	41	5775MHz	68	5802MHz	95	5829MHz
...	...	...	...	...	...	...	...
25	5759MHz	52	5786MHz	79	5813MHz	106	5840MHz
26	5760MHz	53	5787MHz	80	5814MHz		
27	5761MHz	54	5788MHz	81	5815MHz		-

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	5735MHz
The Middle channel	5787MHz
The Highest channel	5840MHz

4. General Information

4.1. Test environment and mode

Operating Environment:

Condition	Conducted Emission	Radiated Emission
Temperature:	25.0 °C	25.0 °C
Humidity:	55 % RH	55 % RH
Atmospheric Pressure:	1010 mbar	1010 mbar

Test Mode:

Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 100%)
-------------------	--

The sample was placed 0.8m & 1.5m for the measurement below & 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(Z axis) are shown in Test Results of the following pages.

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	Data rate
HT OFDM	6.5 Mbps

Final Test Mode:

Operation mode:	Keep the EUT in continuous transmitting with modulation
-----------------	---

4.2. 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	Trade Name
Notebook Computer	XiaoXin CHAO5000	PF0WZYD9	/	Lenovo
Adapter	GST00A18	EB89950668	/	MEAN WELL
JIB Interface board	E320829MUL-ST 1	S400-200M-40 64-03	/	/

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.
3. For conducted measurements (Output Power, Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

5. Facilities and Accreditations

5.1. Facilities

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

- FCC - Registration No.: 645098

Shenzhen Tongce Testing Lab.

The 3m Semi-anechoic chamber 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

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

5.2. Location

Shenzhen Tongce Testing Lab.

Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China

TEL: +86-755-27673339

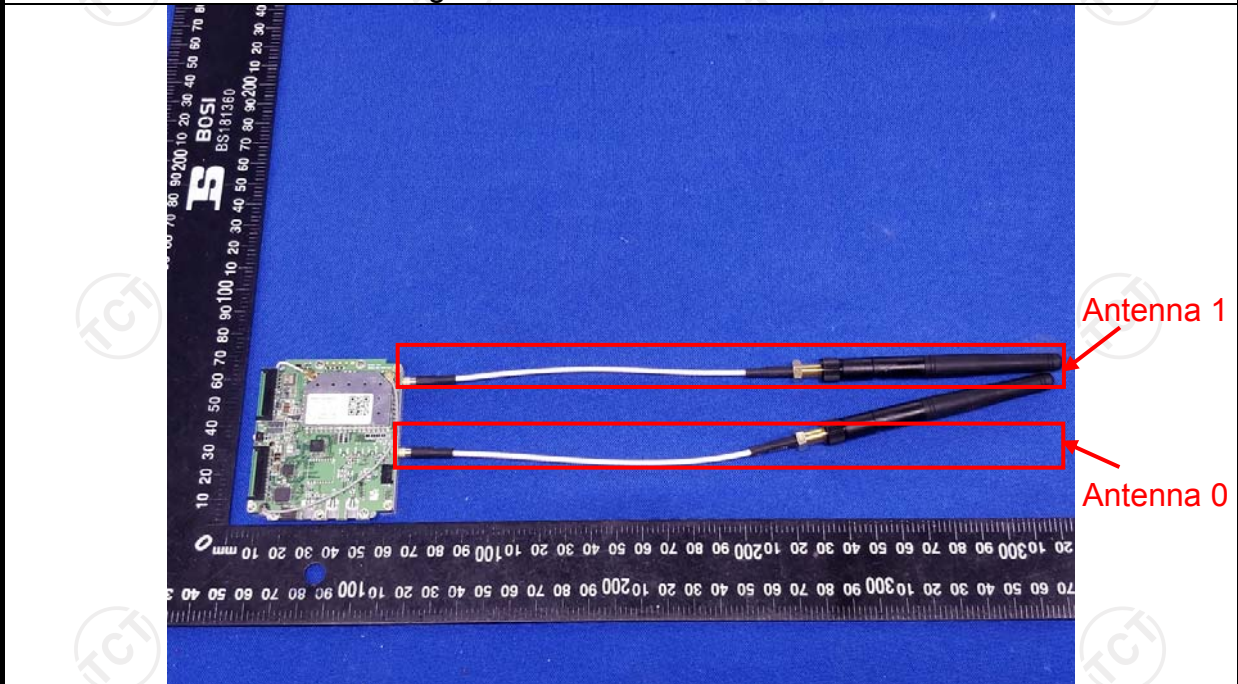
5.3. Measurement Uncertainty

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	$\pm 2.56\text{dB}$
2	RF power, conducted	$\pm 0.12\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^{\circ}\text{C}$
7	Humidity	$\pm 1.0\%$

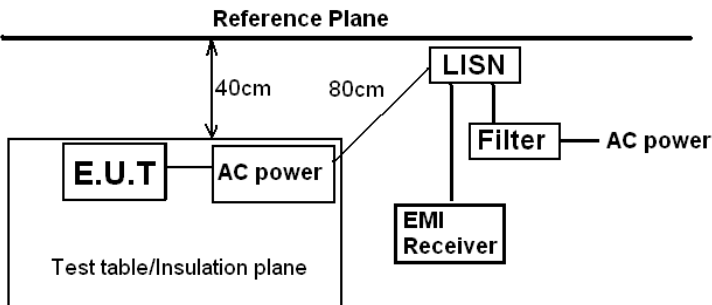
6. Test Results and Measurement Data

6.1. Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
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.	
E.U.T Antenna:	
The EUT has two external antennas, EUT connect the antennas with special interfaces. and the best case gains of the both antennas are 3dBi.	
	

6.2. Conducted Emission

6.2.1. 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:	Reference Plane  Remark E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m														
Test Mode:	Tx Mode														
Test Procedure:	1. The E.U.T and simulators are 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. 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). 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.														
Test Result:	PASS														

6.2.2. Test Instruments

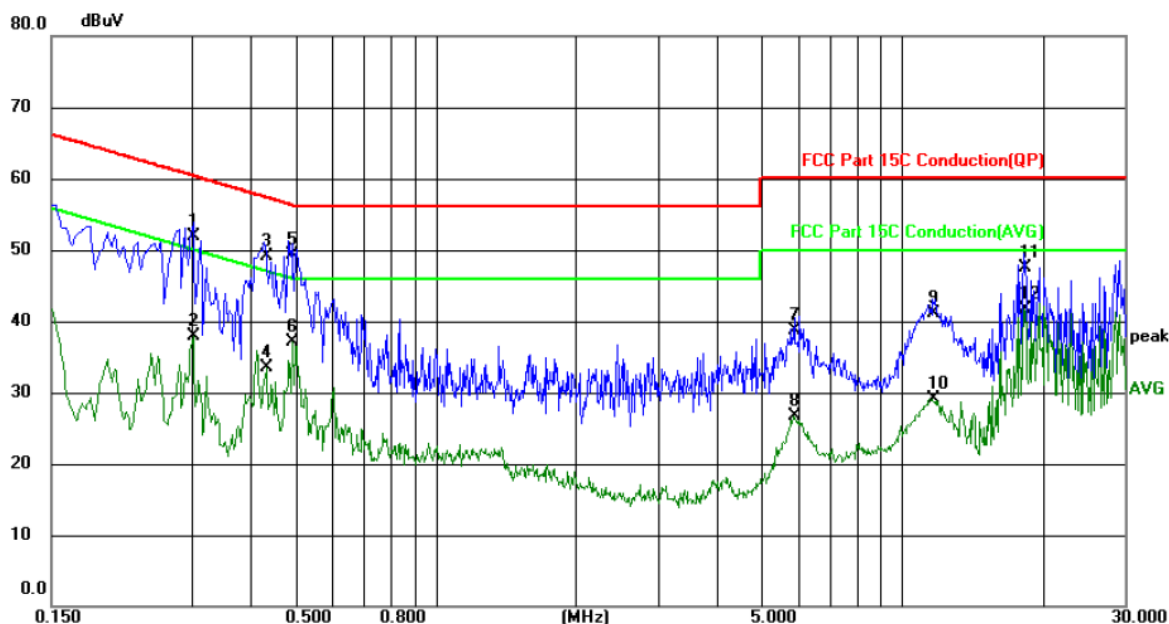
Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	R&S	ESPI	101402	Jul. 27, 2021
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 11, 2020
Coax cable (9KHz-30MHz)	TCT	CE-05	N/A	Sep. 08, 2020
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.2.3. Test data

Please refer to following diagram for individual

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



Site					Phase:		L1		Temperature:		25 (C)	
Limit: FCC Part 15C Conduction(QP)					Power:		AC 120V/60Hz		Humidity:		55 %RH	
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over					
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment			
1		0.3020	41.62	10.23	51.85	60.19	-8.34	QP				
2		0.3020	27.61	10.23	37.84	50.19	-12.35	AVG				
3		0.4340	38.89	10.22	49.11	57.18	-8.07	QP				
4		0.4340	23.23	10.22	33.45	47.18	-13.73	AVG				
5	*	0.4940	39.14	10.22	49.36	56.10	-6.74	QP				
6		0.4940	26.89	10.22	37.11	46.10	-8.99	AVG				
7		5.8620	28.30	10.49	38.79	60.00	-21.21	QP				
8		5.8620	16.19	10.49	26.68	50.00	-23.32	AVG				
9		11.6540	30.55	10.61	41.16	60.00	-18.84	QP				
10		11.6540	18.47	10.61	29.08	50.00	-20.92	AVG				
11		18.2420	36.53	10.97	47.50	60.00	-12.50	QP				
12		18.2420	30.72	10.97	41.69	50.00	-8.31	AVG				

Note:

Freq. = Emission frequency in MHz

Reading level (dBμV) = Receiver reading

Corr. Factor (dB) = LISN factor + Cable loss

Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)

Limit (dBμV) = Limit stated in standard

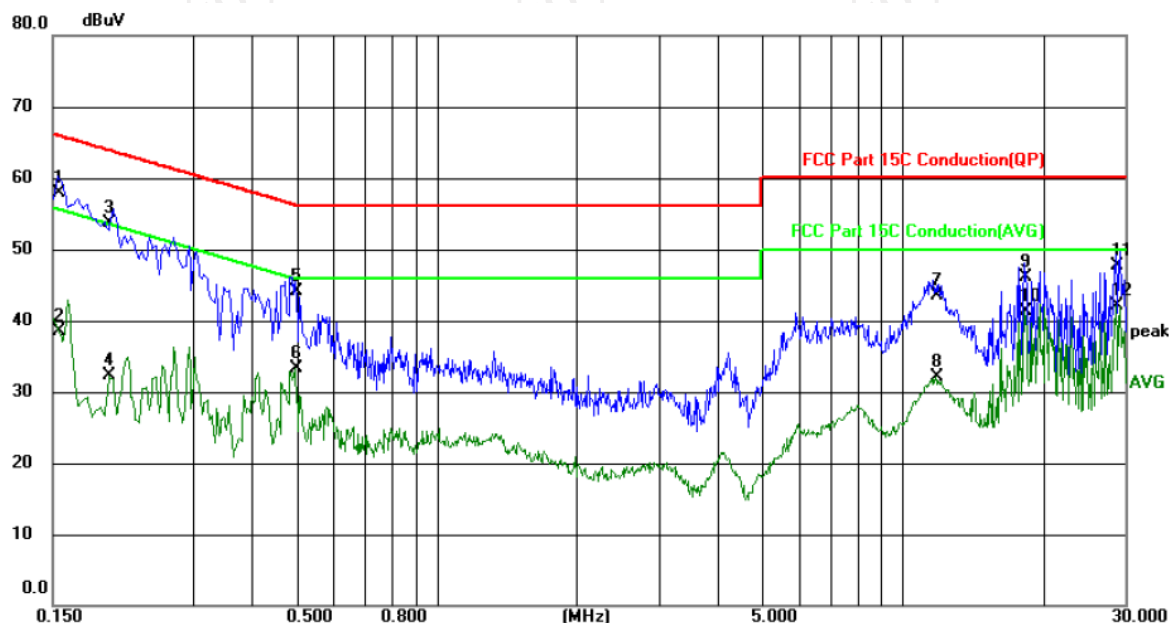
Margin (dB) = Measurement (dBμV) – Limits (dBμV)

Q.P. =Quasi-Peak

AVG =average

* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



Site: Phase: **N** Temperature: 25 (C)
 Limit: FCC Part 15C Conduction(QP) Power: AC 120V/60Hz Humidity: 55 %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBμV	dB	dBμV	dBμV	dB	Detector	Comment
1	*	0.1548	47.66	10.22	57.88	65.74	-7.86	QP	
2		0.1548	28.26	10.22	38.48	55.74	-17.26	AVG	
3		0.1980	43.41	10.22	53.63	63.69	-10.06	QP	
4		0.1980	22.00	10.22	32.22	53.69	-21.47	AVG	
5		0.4980	33.96	10.22	44.18	56.03	-11.85	QP	
6		0.4980	23.06	10.22	33.28	46.03	-12.75	AVG	
7		11.7580	32.93	10.61	43.54	60.00	-16.46	QP	
8		11.7580	21.48	10.61	32.09	50.00	-17.91	AVG	
9		18.2420	35.21	10.97	46.18	60.00	-13.82	QP	
10		18.2420	30.41	10.97	41.38	50.00	-8.62	AVG	
11		28.6860	36.60	11.05	47.65	60.00	-12.35	QP	
12		28.6860	30.98	11.05	42.03	50.00	-7.97	AVG	

Note:

Freq. = Emission frequency in MHz

Reading level (dBμV) = Receiver reading

Corr. Factor (dB) = LISN factor + Cable loss

Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)

Limit (dBμV) = Limit stated in standard

Margin (dB) = Measurement (dBμV) – Limits (dBμV)

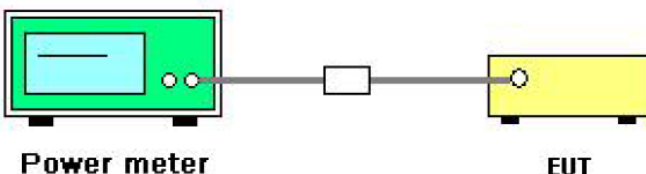
Q.P. =Quasi-Peak

AVG =average

* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

6.3. Maximum Conducted Output Power

6.3.1. Test Specification

Test Requirement:	FCC Part15 E Section 15.407(a)& Part 2 J Section 2.1046		
Test Method:	KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section E		
Limit:	Frequency (MHz)	Band	Limit
	5735 - 5840		30dBm(1W)
Test Setup:	 The diagram illustrates the test setup. On the left is a green box labeled 'Power meter'. A cable connects it to a small white box (attenuator), which is then connected to a yellow box labeled 'EUT' (Equipment Under Test).		
Test Mode:	Transmitting mode with modulation		
Test Procedure:	1. The testing follows the Measurement Procedure of KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section E, 3, a 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 5. Measure the conducted output power and record the results in the test report.		
Test Result:	PASS		
Remark:	Conducted output power= measurement power +10log(1/x) X is duty cycle=1, so 10log(1/1)=0 Conducted output power= measurement power		

6.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 11, 2020
Power Meter	Agilent	E4418B	GB43312526	Sep. 08, 2020
Power Sensor	Agilent	E9301A	MY41497725	Sep. 08, 2020
RF Cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Sep. 08, 2020
Antenna Connector	TCT	RFC-03	N/A	Sep. 08, 2020

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.3.3. Test Data

Configuration (5735 - 5840 MHz) / Antenna 0+Antenna 1					
Test channel	Maximum Conducted (Average) Output Power (dBm)			Limit (dBm)	Result
	Ant0	Ant1	Total		
Lowest	25.17	25.12	28.16	29.99	PASS
Middle	25.15	25.06	28.12	29.99	PASS
Highest	25.24	25.13	28.20	29.99	PASS

Note : $G_{ANT}=3\text{dBi}$, $\text{Array Gain}=10\log(N_{ANT}/N_{SS})=3.01\text{dBi}$, $\text{Directional Gain}=G_{ANT} + \text{Array Gain}=6.01\text{dBi}$,
 $6.01\text{dBi} > 6\text{dBi}$ so $\text{limit}=30-(6.01-6)=29.99\text{dBm/MHz}$

6.4. 6dB Emission Bandwidth

6.4.1. Test Specification

Test Requirement:	FCC CFR47 Part 15 Section 15.407(e)& Part 2 J Section 2.1049
Test Method:	KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C
Limit:	>500kHz
Test Setup:	 Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz. 4. Measure and record the results in the test report.
Test Result:	PASS

6.4.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 11, 2020
RF Cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Sep. 08, 2020
Antenna Connector	TCT	RFC-03	N/A	Sep. 08, 2020

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.4.3. Test data**ANT 0**

(5735 - 5840 MHz)				
Test channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
Lowest	5735	15.06	0.5	PASS
Middle	5787	15.06	0.5	PASS
Highest	5840	15.19	0.5	PASS

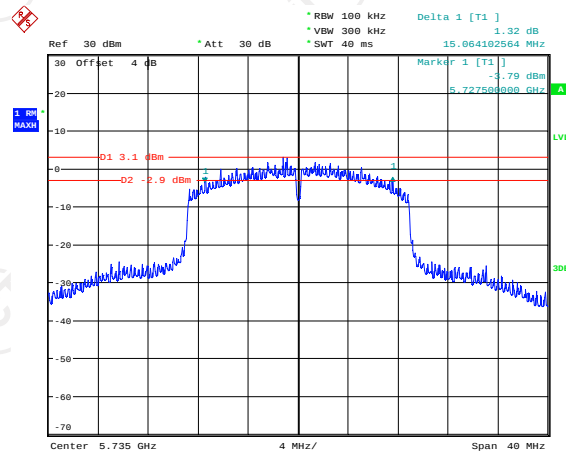
ANT 1

(5735 - 5840 MHz)				
Test channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
Lowest	5735	15.71	0.5	PASS
Middle	5787	15.64	0.5	PASS
Highest	5840	15.13	0.5	PASS

Test plots as follows:

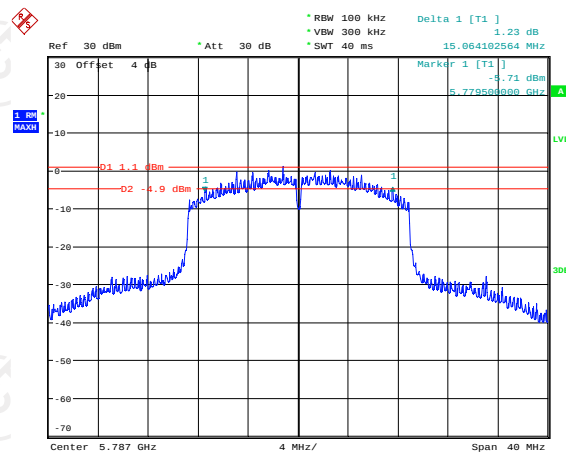
ANT 0

Lowest channel



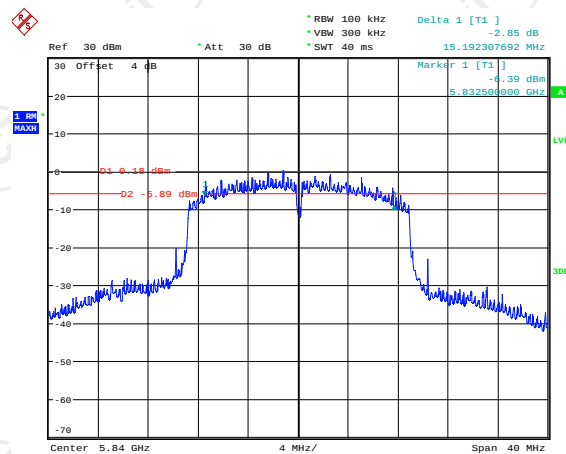
Date: 28.JUL.2020 17:28:10

Middle channel



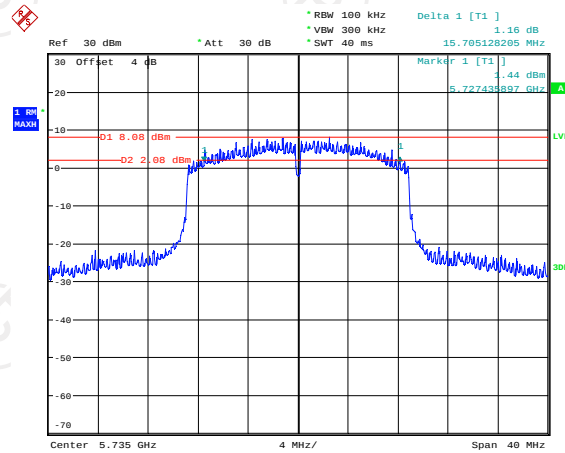
Date: 28.JUL.2020 17:29:51

Highest channel



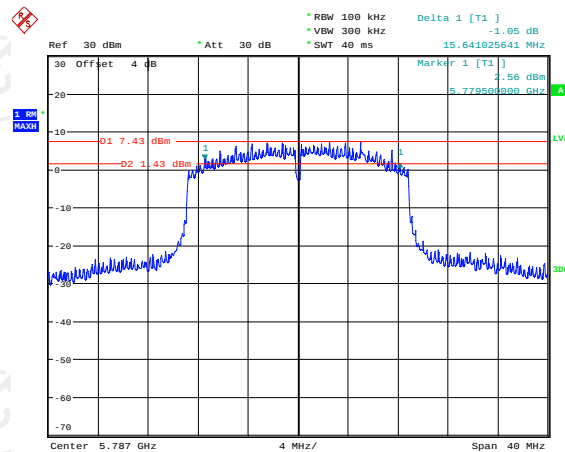
Date: 28.JUL.2020 17:30:58

Lowest channel



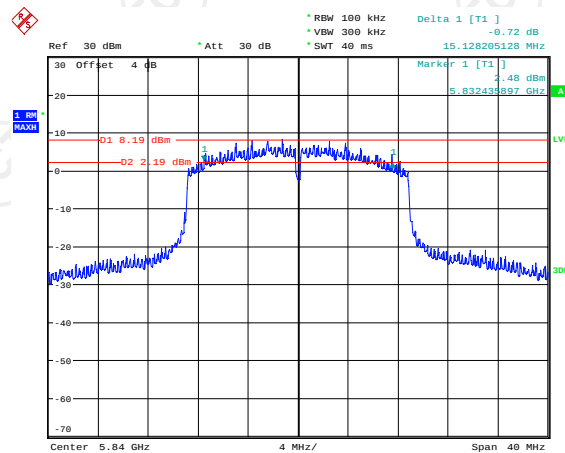
Date: 28.JUL.2020 18:11:28

Middle channel



Date: 28.JUL.2020 18:07:12

Highest channel



Date: 28.JUL.2020 18:06:06

6.5. 99% Occupied Bandwidth

6.5.1. Test Specification

Test Requirement:	47 CFR Part 15C Section 15.407 (a)& Part 2 J Section 2.1049
Test Method:	KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section D
Limit:	No restriction limits
Test Setup:	 Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section D 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. 4. Measure and record the results in the test report.
Test Result:	PASS

6.5.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 11, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-high-02	N/A	Sep. 08, 2020
Antenna Connector	TCT	RFC-03	N/A	Sep. 08, 2020

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.5.3. Test data**ANT 0**

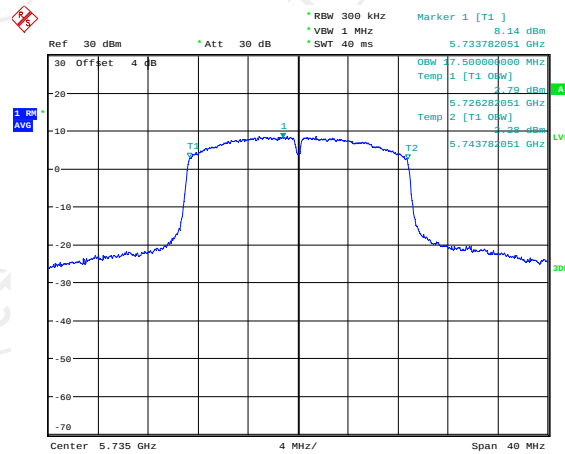
Test channel	Frequency (MHz)	99% Bandwidth (MHz)
Lowest	5735	17.50
Middle	5787	17.31
Highest	5840	17.31

ANT 1

Test channel	Frequency (MHz)	99% Bandwidth (MHz)
Lowest	5735	17.44
Middle	5787	17.44
Highest	5840	17.44

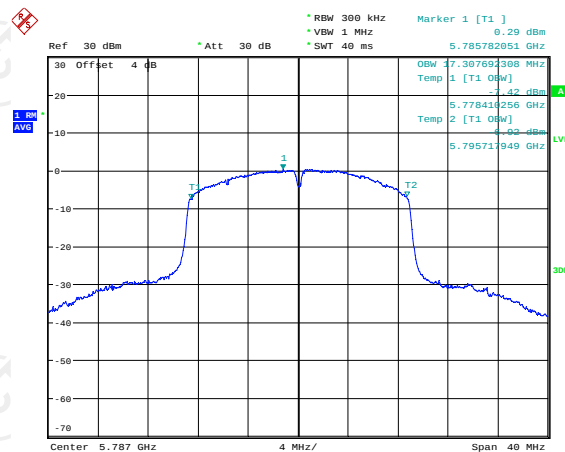
Test plots as follows:
ANT 0

Lowest channel



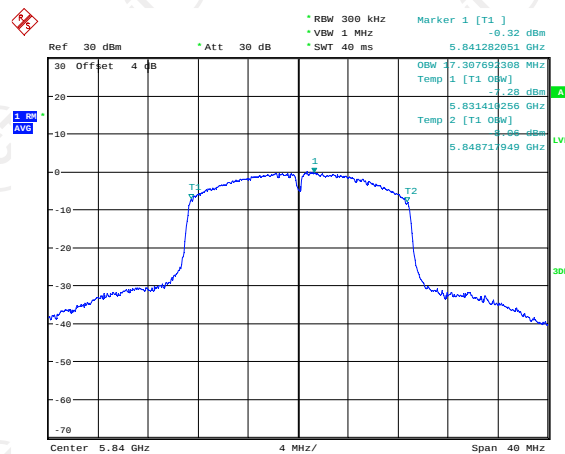
Date: 28.JUL.2020 17:55:43

Middle channel



Date: 28.JUL.2020 17:35:06

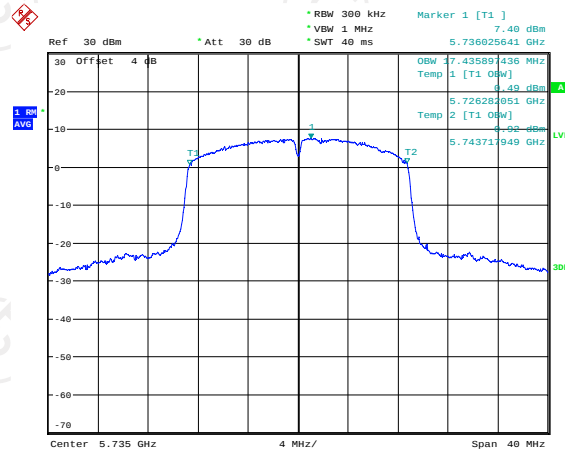
Highest channel



Date: 28.JUL.2020 17:34:25

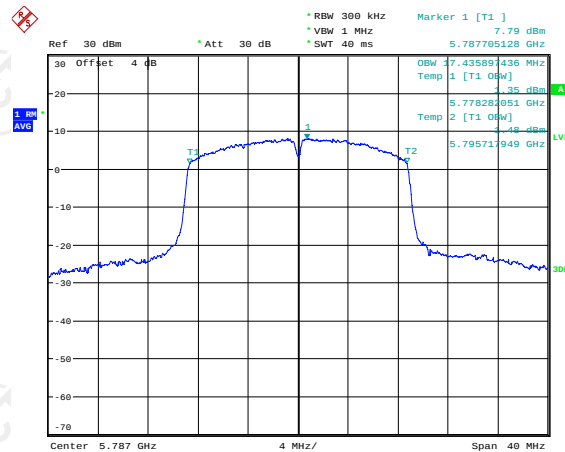
ANT 1

Lowest channel



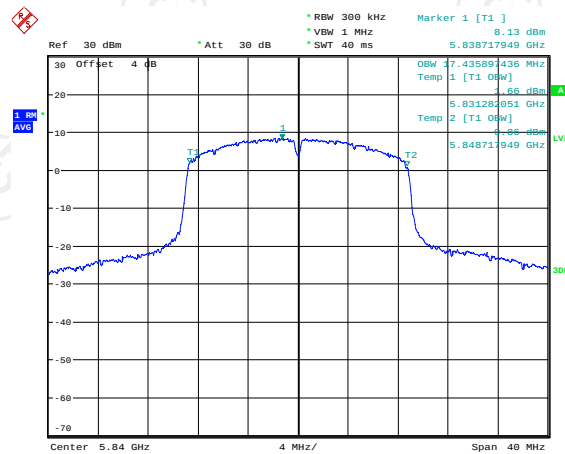
Date: 28.JUL.2020 18:03:08

Middle channel



Date: 28.JUL.2020 18:03:48

Highest channel



Date: 28.JUL.2020 18:04:16

6.6. Power Spectral Density

6.6.1. Test Specification

Test Requirement:	FCC Part15 E Section 15.407 (a)
Test Method:	KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section F
Limit:	≤30.00dBm/500KHz for 5725MHz-5850MHz
Test Setup:	 Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. Set the spectrum analyzer or EMI receiver span to view the entire emission bandwidth. 1. Set RBW = 510 kHz/1 MHz, VBW ≥ 3*RBW, Sweep time = Auto, Detector = RMS. 2. Allow the sweeps to continue until the trace stabilizes. 3. Use the peak marker function to determine the maximum amplitude level. 4. The E.I.R.P spectral density used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment.
Test Result:	PASS

6.6.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 11, 2020
RF Cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Sep. 08, 2020
Antenna Connector	TCT	RFC-03	N/A	Sep. 08, 2020

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.6.3. Test data

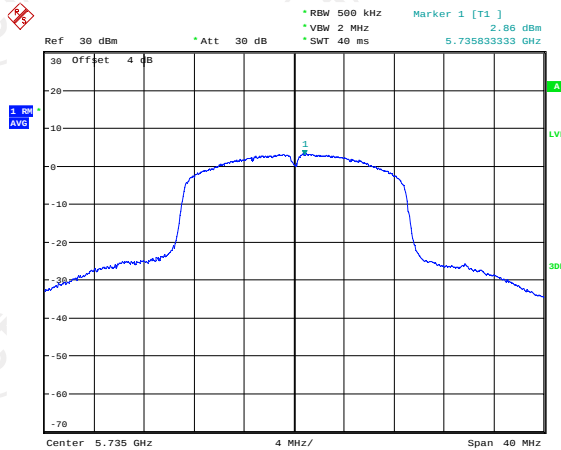
Configuration (5735-5840MHz) / Antenna 0+Antenna 1					
Test channel	Power Spectral Density			Limit (dBm/500kHz)	Result
	Ant0	Ant1	Total		
Lowest	2.86	9.57	10.41	29.99	PASS
Middle	1.98	9.79	10.46	29.99	PASS
Highest	1.53	10.10	10.67	29.99	PASS

Note: 1.The total PSD method used the sum spectra maxima across the outputs.

2. $G_{ANT}=3\text{dBi}$, Array Gain= $10\log(N_{ANT}/N_{SS})=3.01\text{dBi}$, Directional Gain= $G_{ANT} + \text{Array Gain}=6.01\text{dBi}$, $6.01\text{dBi} > 6\text{dBi}$ so limit= $30-(6.01-6)=29.99\text{dBm/MHz}$

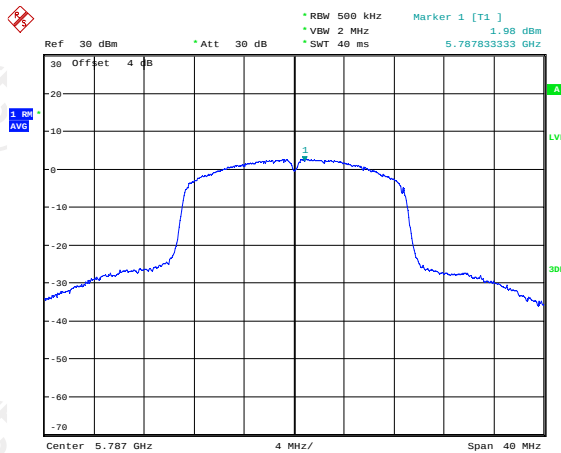
Test plots as follows:

Lowest channel



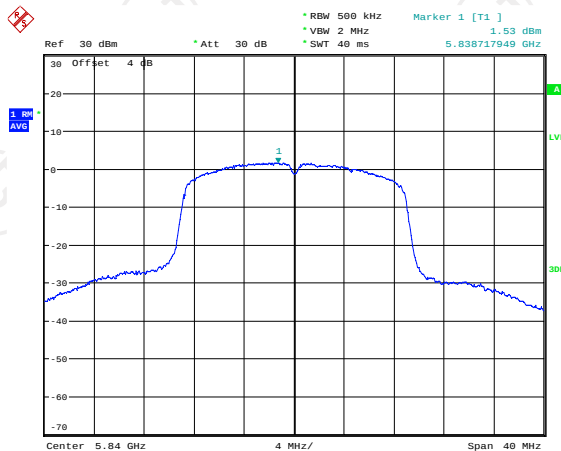
Date: 28.JUL.2020 17:21:59

Middle channel



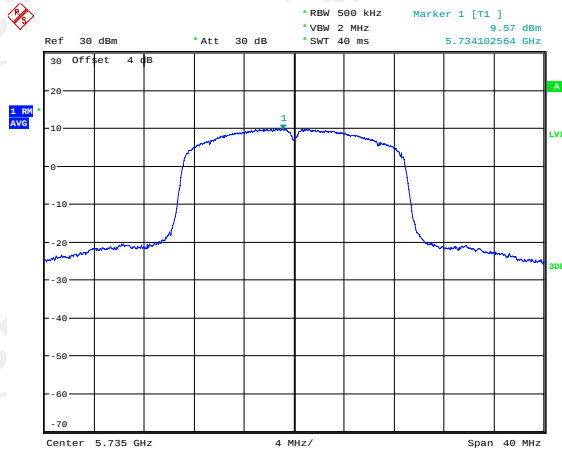
Date: 28.JUL.2020 17:20:52

Highest channel



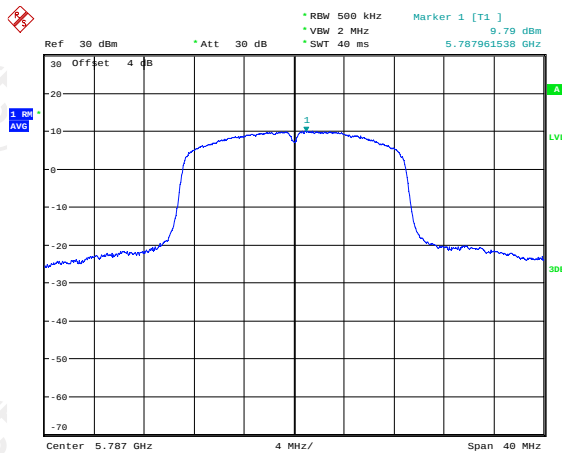
Date: 28.JUL.2020 17:21:25

Lowest channel



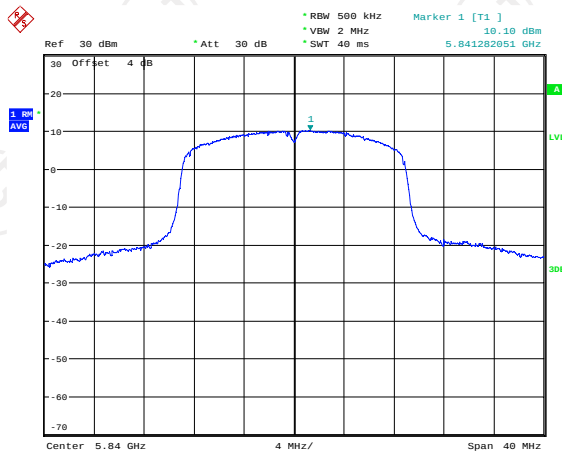
Date: 28.JUL.2020 18:17:02

Middle channel



Date: 28.JUL.2020 18:16:38

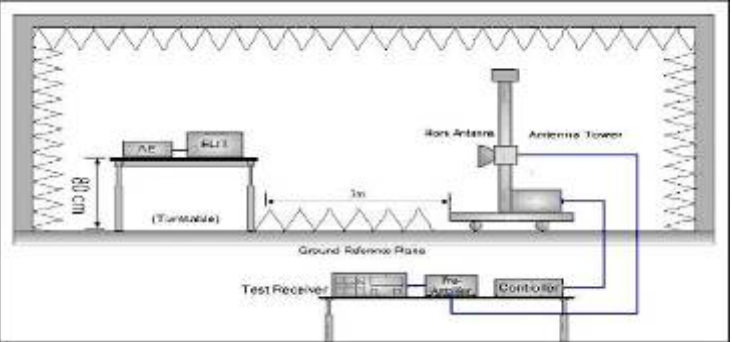
Highest channel



Date: 28.JUL.2020 18:16:02

6.7. Band edge

6.7.1. Test Specification

Test Requirement:	FCC CFR47 Part 15E Section 15.407
Test Method:	ANSI C63.10 2013
Limit:	For Band 3(5715-5725MHz&5850-5860MHz): $E[dB\mu V/m] = EIRP[dBm] + 95.2 = 78.2 \text{ dB}\mu V/m$, for $EIRP(dBm) = -17dBm$; For Band 3(other un-restricted band): $E[dB\mu V/m] = EIRP[dBm] + 95.2 = 68.2 \text{ dB}\mu V/m$, for $EIRP(dBm) = -27dBm$
Test Setup:	 The diagram illustrates the test setup. A Turntable is positioned on a stand, with an EUT (Equipment Under Test) placed on top. The EUT is 30cm above the turntable surface. The turntable is 3m away from a Ground Reference Plane. A 30cm Antenna Tower is positioned on the Ground Reference Plane, with a 30cm Antenna at the top. The Test Receiver is connected to the Controller, which is also connected to the Antenna Tower.
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 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. 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 the measurement. 4. 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. 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.

Test Result:

PASS

6.7.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	ROHDE&SCHWARZ	ESIB7	100197	Jul. 27, 2021
Spectrum Analyzer	ROHDE&SCHWARZ	FSQ40	200061	Sep. 11, 2020
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 11, 2020
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 08, 2020
Pre-amplifier	HP	8447D	2727A05017	Sep. 08, 2020
Loop antenna	ZHINAN	ZN30900A	12024	Oct. 27, 2020
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 06, 2020
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 06, 2020
Horn Antenna	A-INFO	LB-180400-KF	J211020657	Sep. 06, 2020
Coax cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Sep. 08, 2020
Coax cable (9KHz-40GHz)	TCT	RE-high-04	N/A	Sep. 08, 2020
Antenna Mast	Keleto	CC-A-4M	N/A	N/A
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

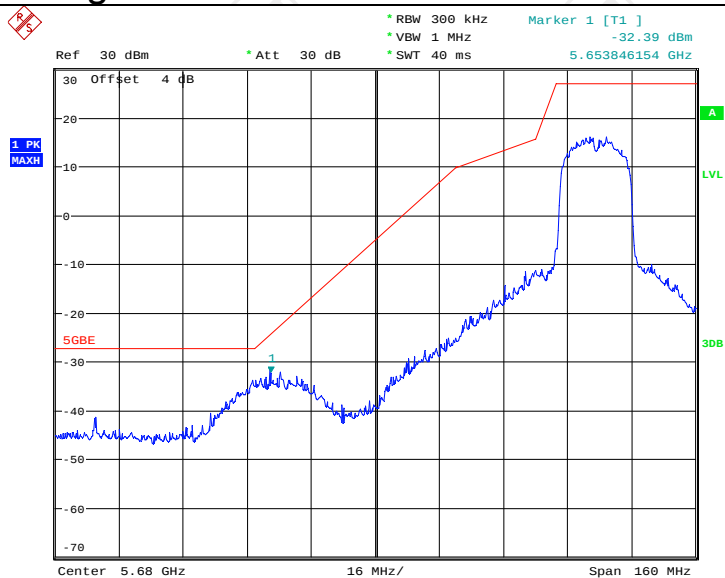
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.7.3. Test Data

Test channel	Freq. (MHz)	Read_level (dBuV/m)	Factor (dB)	Peak (dBuV/m)	Limit (dBuV/m) (Peak)	Limit (dBuV/m) (Avg)	Over	Ant. Pol. H/V
Lowest	5735	43.32	5.82	49.14	68.2	/	-19.06	H
	5735	37.46	5.82	43.28	68.2	/	-24.92	V
Highest	5840	45.97	6.52	52.49	68.2	/	-15.71	H
	5840	42.62	6.52	49.14	68.2	/	-19.06	V
Remark: Factor(dB)=Ant. Factor+Cable Loss-Amp. Factor								

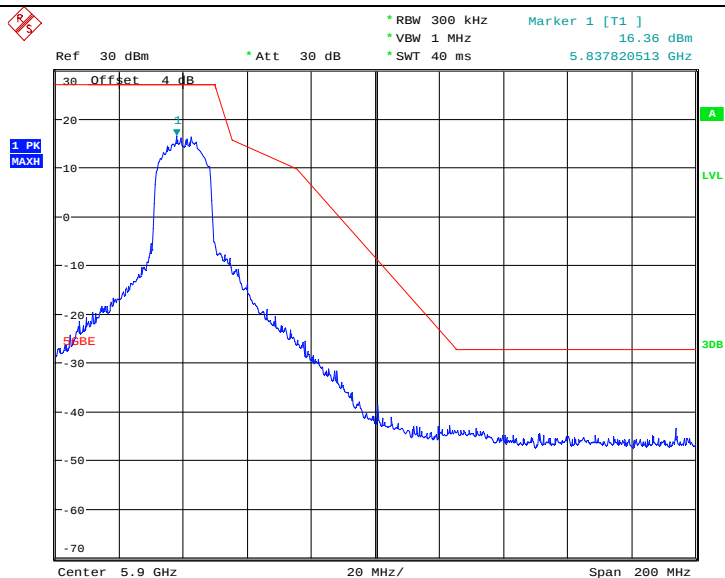
Band-edge for RF Conducted Emissions

Lowest channel



Date: 28.JUL.2020 17:57:44

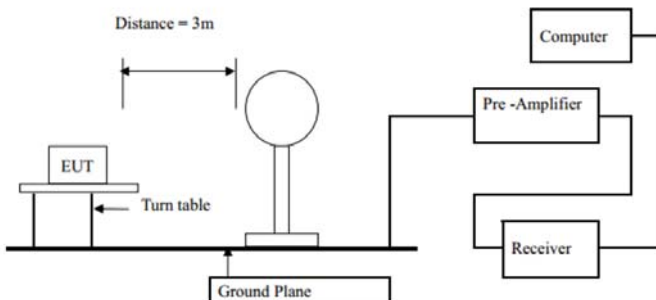
Highest channel

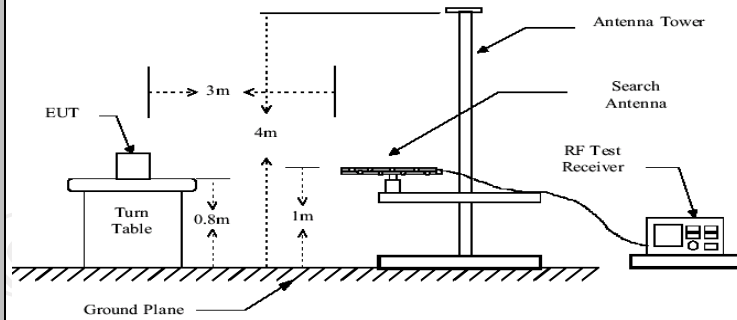


Date: 28.JUL.2020 17:58:49

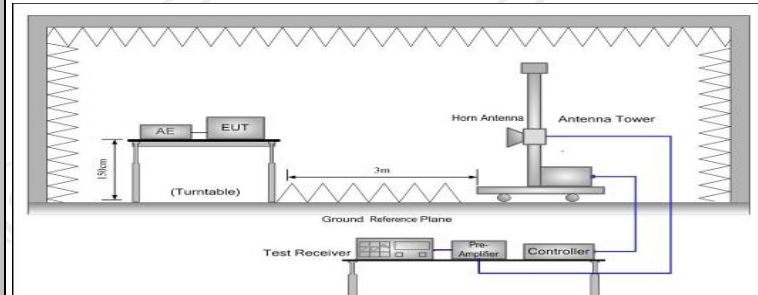
6.8. Unwanted Emission

6.8.1. Test Specification

Test Requirement:	FCC CFR47 Part 15 Section 15.407 & 15.209 & 15.205				
Test Method:	KDB 789033 D02 v02r01				
Frequency Range:	9kHz to 40GHz				
Measurement Distance:	3 m				
Antenna Polarization:	Horizontal & Vertical				
Operation mode:	Transmitting mode with modulation				
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	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
Peak		1MHz	10Hz	Average Value	
Limit:	Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table,				
	Frequency	Field Strength (microvolts/meter)		Measurement Distance (meters)	
	0.009-0.490	2400/F(KHz)		300	
	0.490-1.705	24000/F(KHz)		30	
	1.705-30	30		30	
	30-88	100		3	
	88-216	150		3	
	216-960	200		3	
	Above 960	500		3	
	Frequency	Limit (dBuV/m @3m)		Detector	
Above 1G	74.0		Peak		
	54.0		Average		
Test setup:	For radiated emissions below 30MHz				
					
	30MHz to 1GHz				



Above 1GHz



Test Procedure:

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
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.
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 the measurement.
4. 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 rotating table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. 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.

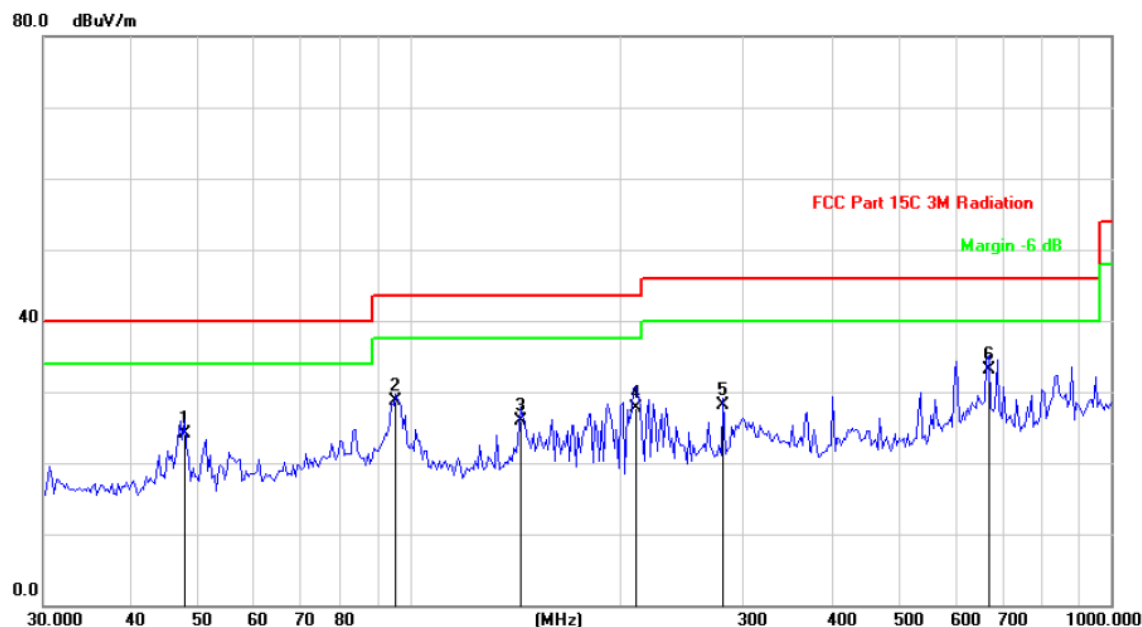
Test results:

PASS

6.8.2. Test Data

Please refer to following diagram for individual
Below 1GHz

Horizontal:



Site

Polarization: *Horizontal*

Temperature: 25

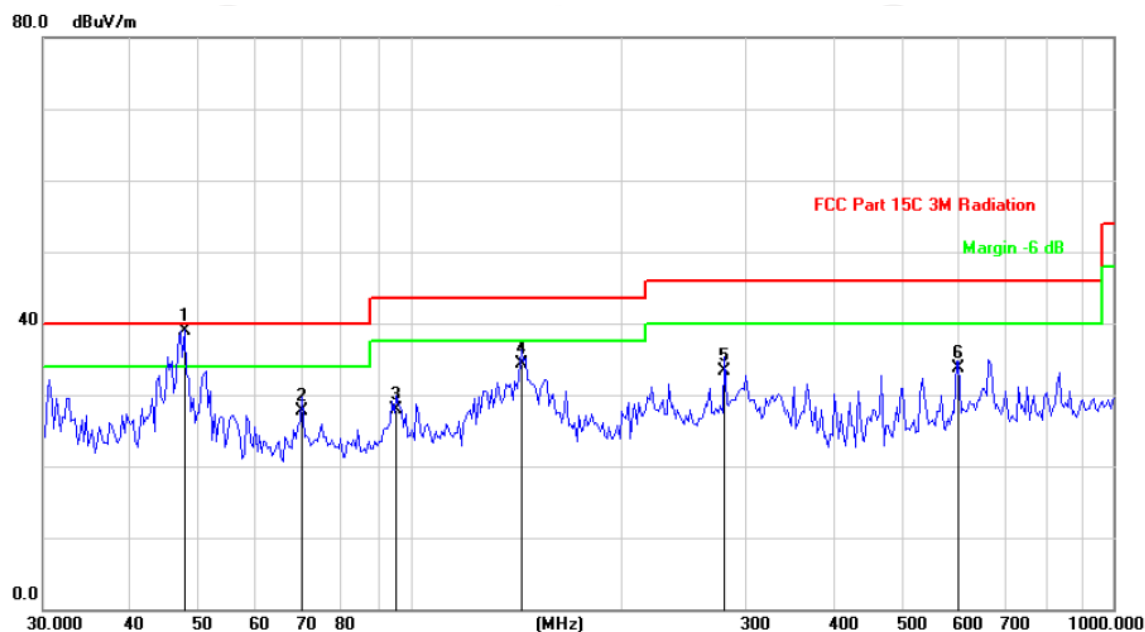
Limit: FCC Part 15C 3M Radiation

Power: AC 120V/60Hz

Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		47.7028	34.40	-10.37	24.03	40.00	-15.97	QP
2		95.6485	38.21	-9.47	28.74	43.50	-14.76	QP
3		143.7760	42.39	-16.52	25.87	43.50	-17.63	QP
4		210.1294	41.69	-13.97	27.72	43.50	-15.78	QP
5		280.2936	39.89	-11.71	28.18	46.00	-17.82	QP
6	*	669.9523	38.26	-5.08	33.18	46.00	-12.82	QP

Vertical:



Site: Polarization: **Vertical** Temperature: 25
 Limit: FCC Part 15C 3M Radiation Power: AC 120V/60Hz Humidity: 55 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1	*	47.7028	49.20	-10.37	38.83	40.00	-1.17	QP
2		70.2095	43.52	-15.91	27.61	40.00	-12.39	QP
3		95.6484	37.34	-9.47	27.87	43.50	-15.63	QP
4		143.7760	50.90	-16.52	34.38	43.50	-9.12	QP
5		280.2936	44.92	-11.71	33.21	46.00	-12.79	QP
6		602.9287	39.21	-5.42	33.79	46.00	-12.21	QP

Note: 1. The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

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

3. Measurement (dBμV) = Reading level + Correction Factor, correction Factor= Antenna Factor + Cable loss – Pre-amplifier.

Lowest channel: 5735MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
11470	H	40.63	---	8.09	48.72	---	74	54	-5.28
17205	H	37.24	---	9.67	46.91	---	74	54	-7.09
---	H	---	---	---	---	---	---	---	---
11470	V	40.26	---	8.09	48.35	---	74	54	-5.65
17205	V	37.89	---	9.67	47.56	---	74	54	-6.44
---	V	---	---	---	---	---	---	---	---

Middle channel: 5787MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
11574	H	41.49	---	8.10	49.59	---	74	54	-4.41
17361	H	39.37	---	9.65	49.02	---	74	54	-4.98
---	H	---	---	---	---	---	---	---	---
11574	V	40.20	---	8.10	48.30	---	74	54	-5.70
17361	V	36.82	---	9.65	46.47	---	74	54	-7.53
---	V	---	---	---	---	---	---	---	---

Highest channel: 5840MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
11680	H	40.89	---	8.12	49.01	---	74	54	-4.99
17520	H	38.35	---	9.62	47.97	---	74	54	-6.03
---	H	---	---	---	---	---	---	---	---
11680	V	41.34	---	8.12	49.46	---	74	54	-4.54
17520	V	38.75	---	9.62	48.37	---	74	54	-5.63
---	V	---	---	---	---	---	---	---	---

Note:

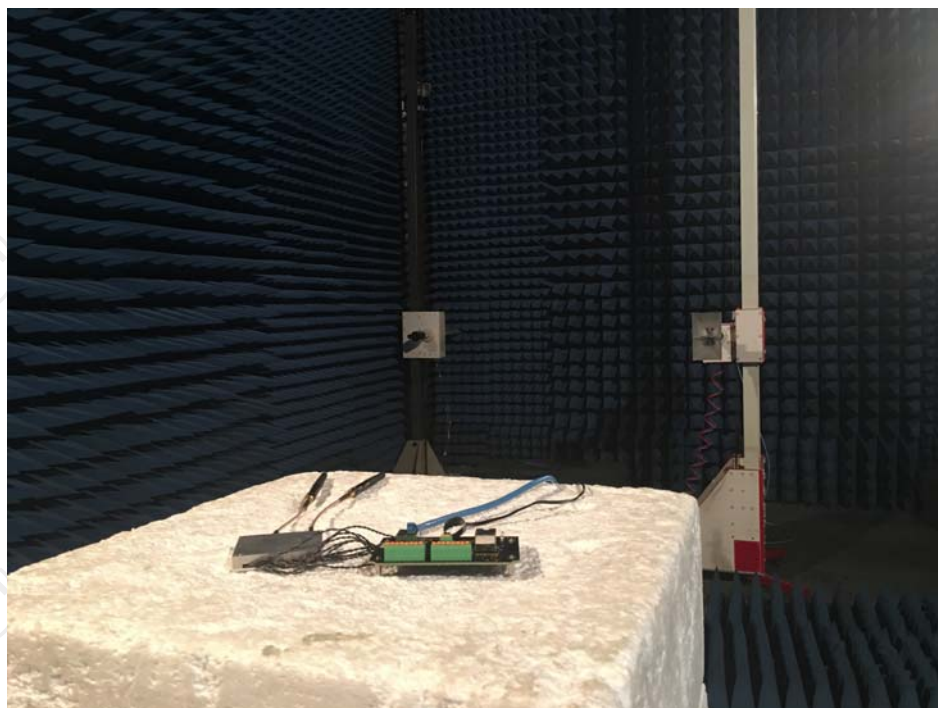
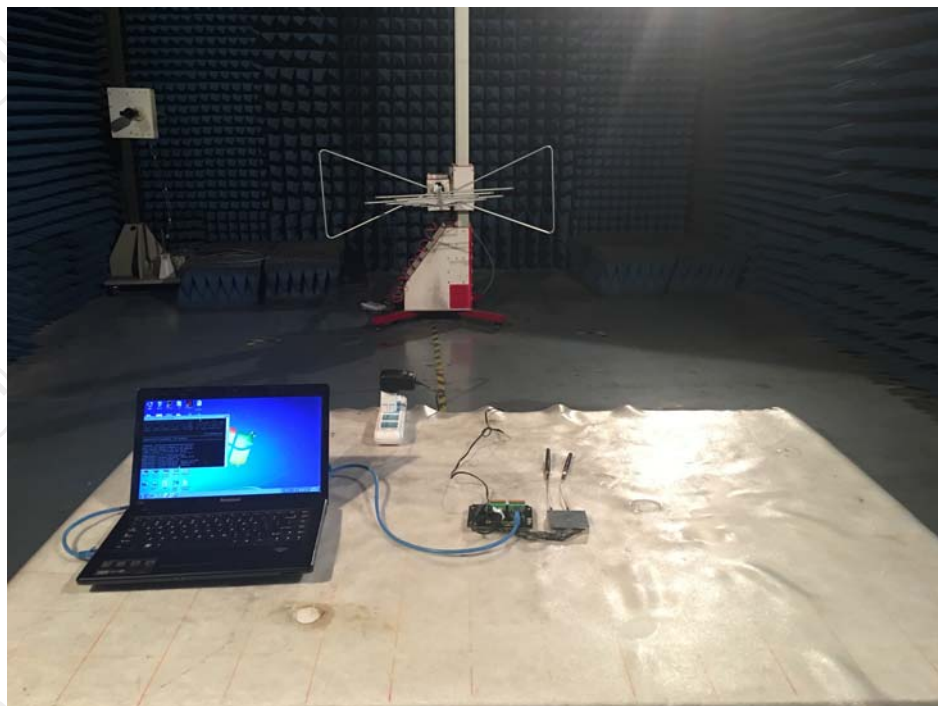
1. Emission Level=Peak Reading + Correction Factor; Correction Factor=Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 40GHz.
5. Data of measurement shown "---" in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

Appendix A: Photographs of Test Setup

Product: Smart Radio

Model: RM-5800

Radiated Emission



Conducted Emission



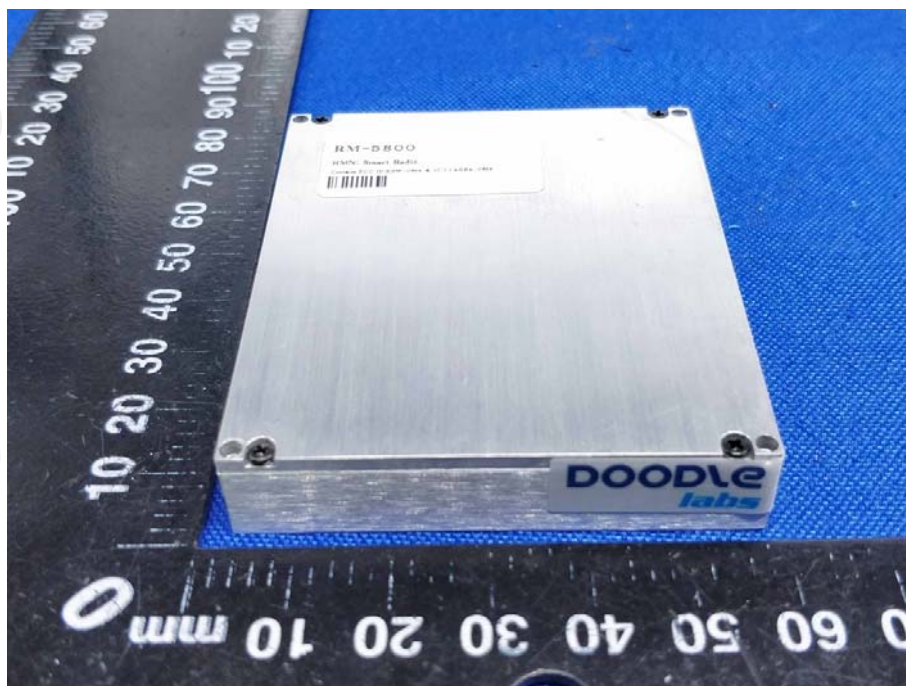
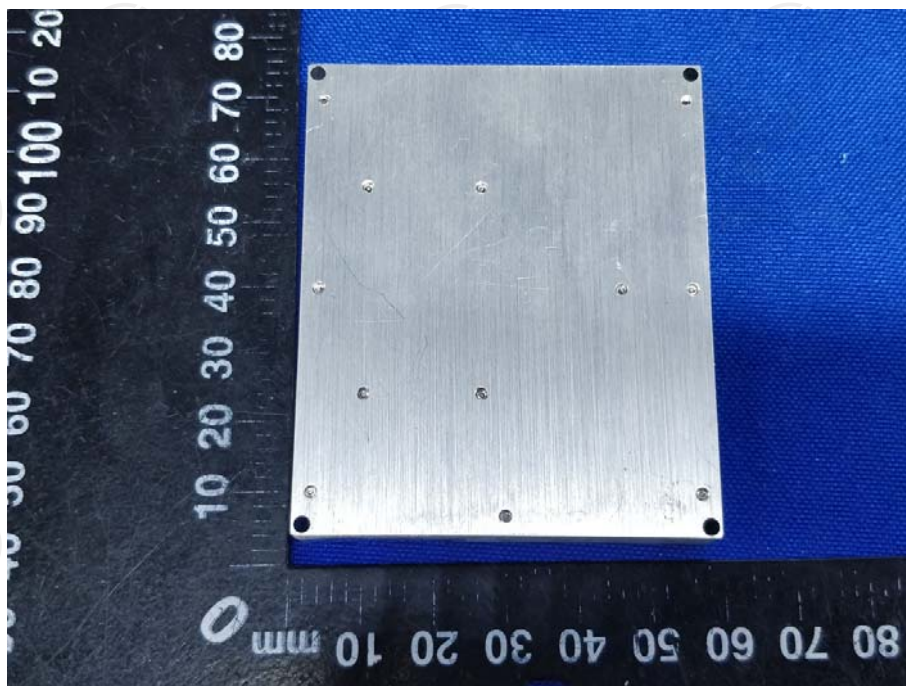
Appendix B: Photographs of EUT

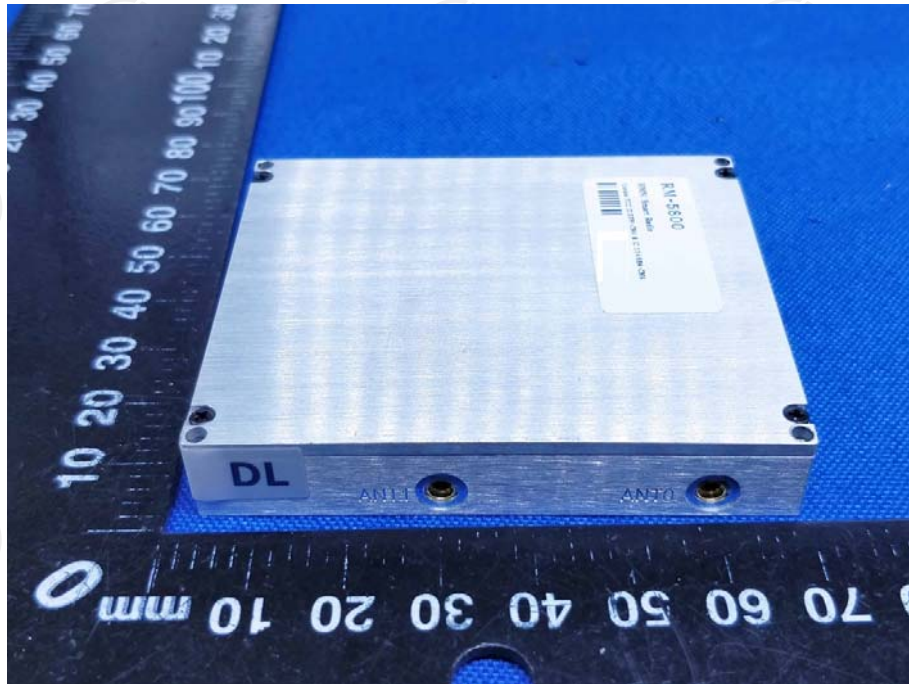
Product: Smart Radio

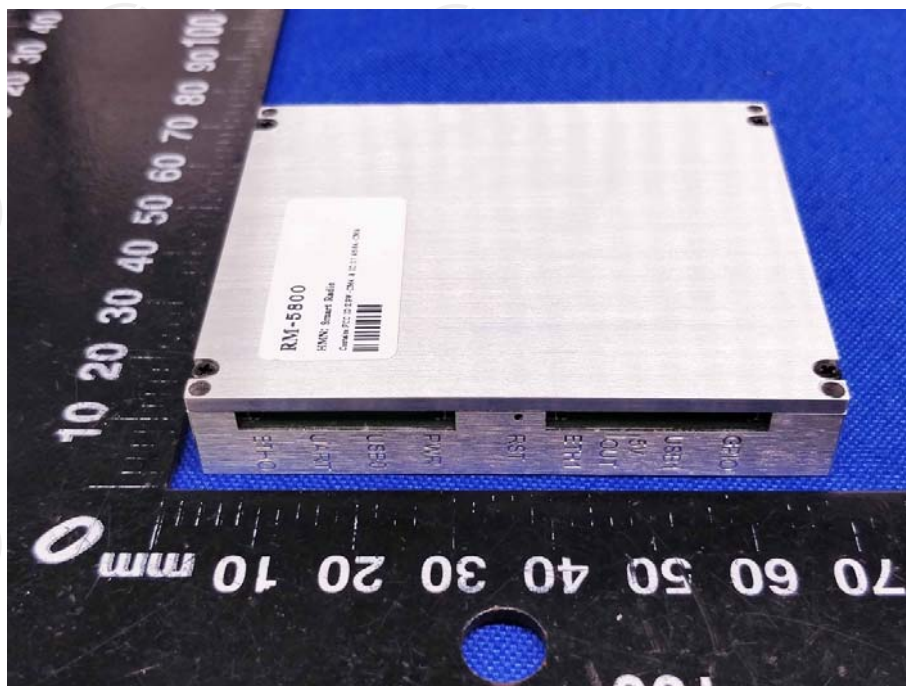
Model: RM-5800

External Photos

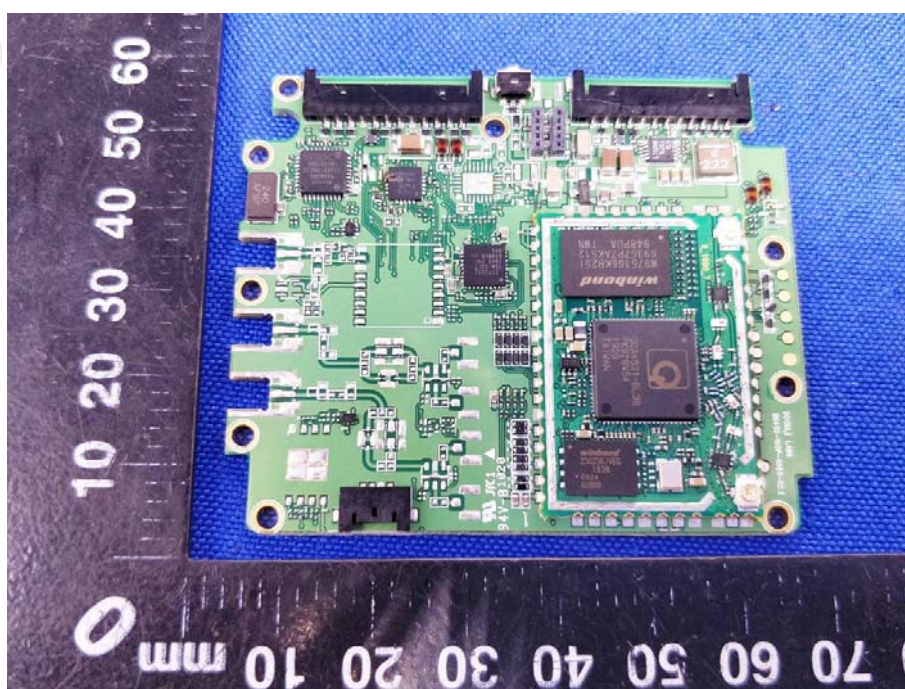
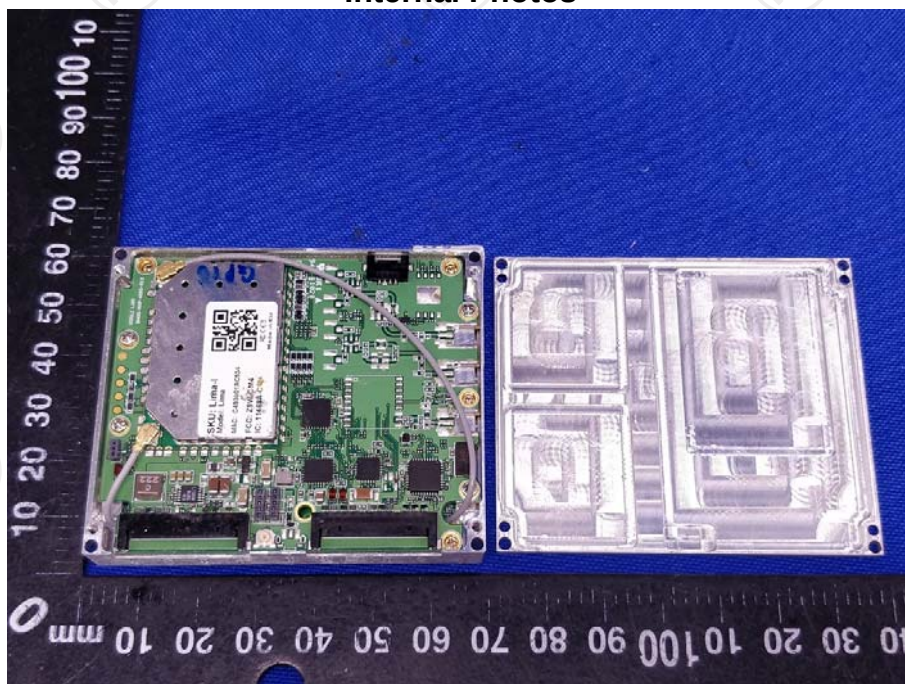


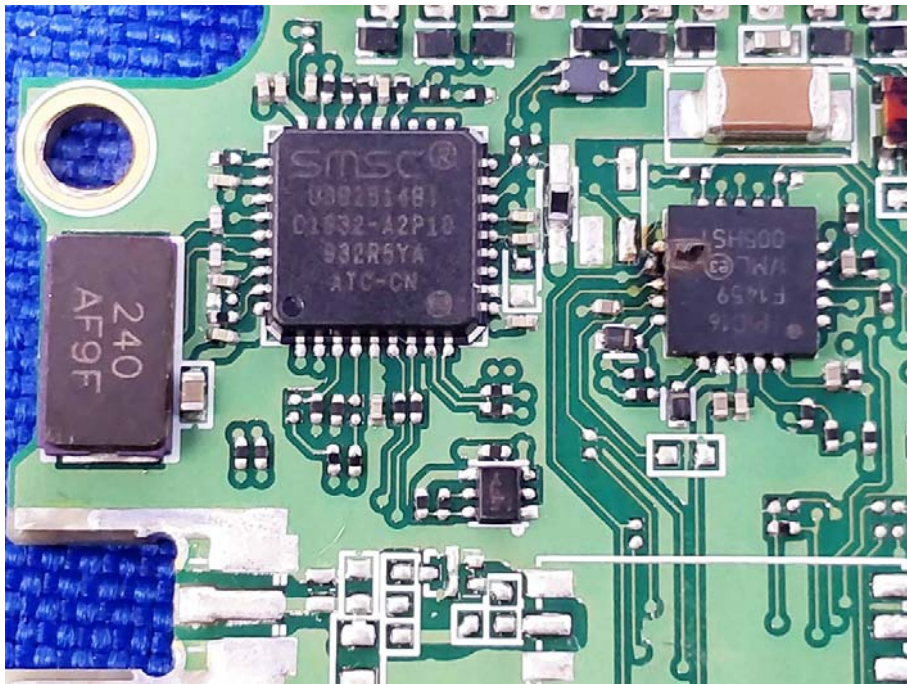
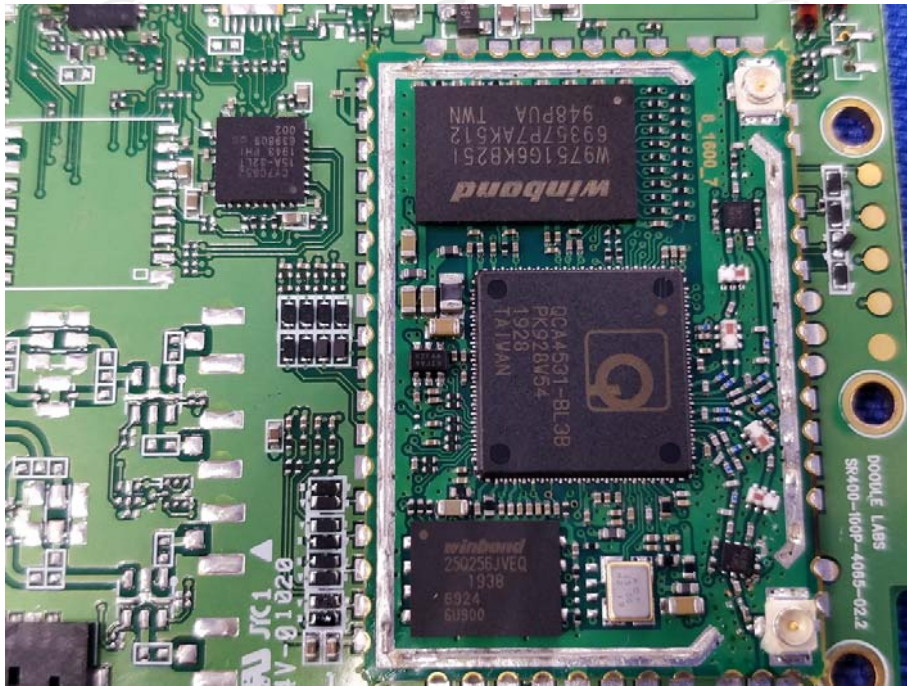


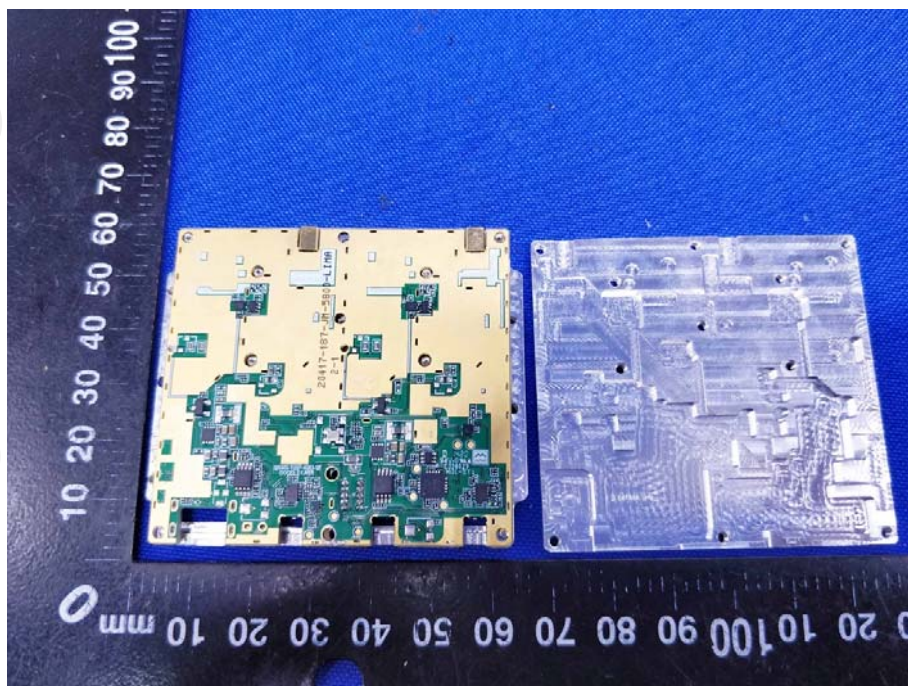
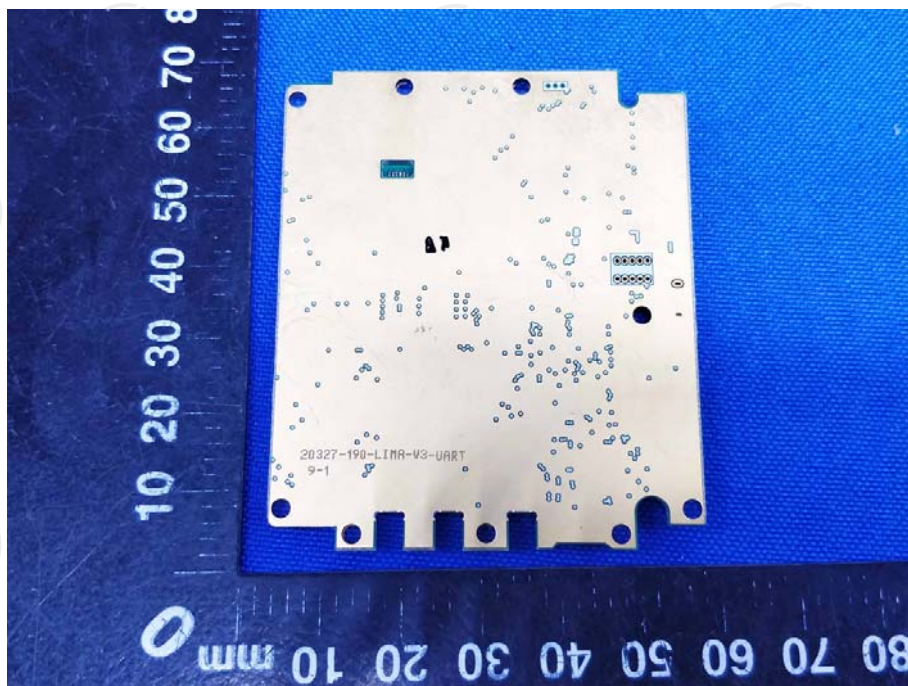


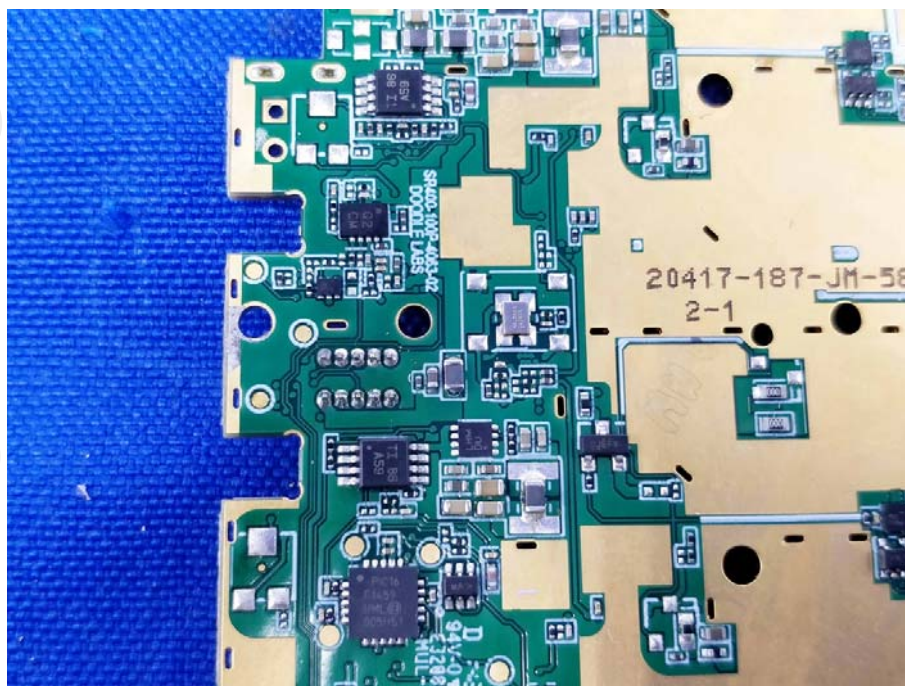
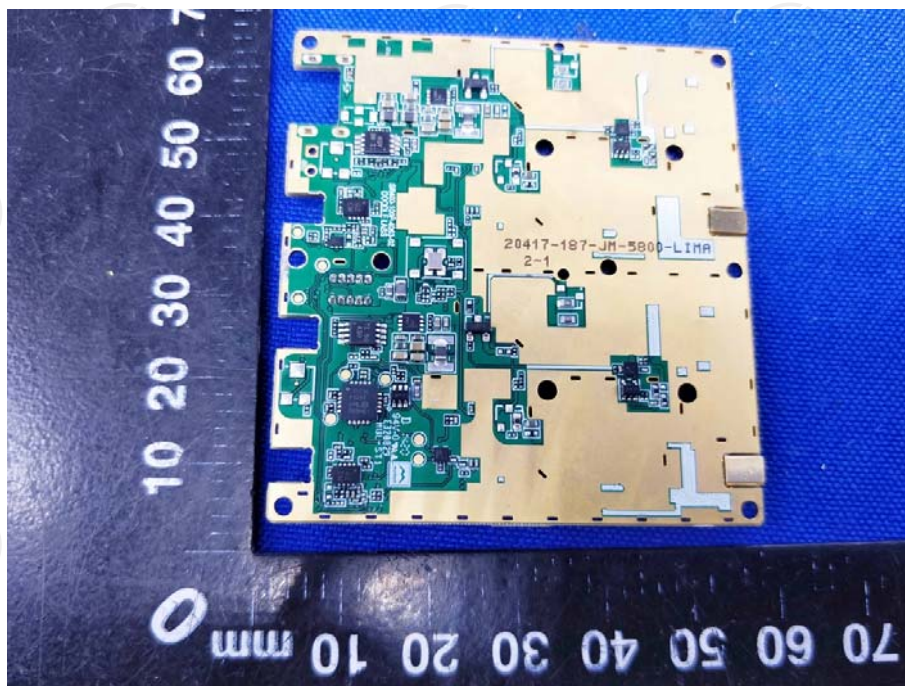


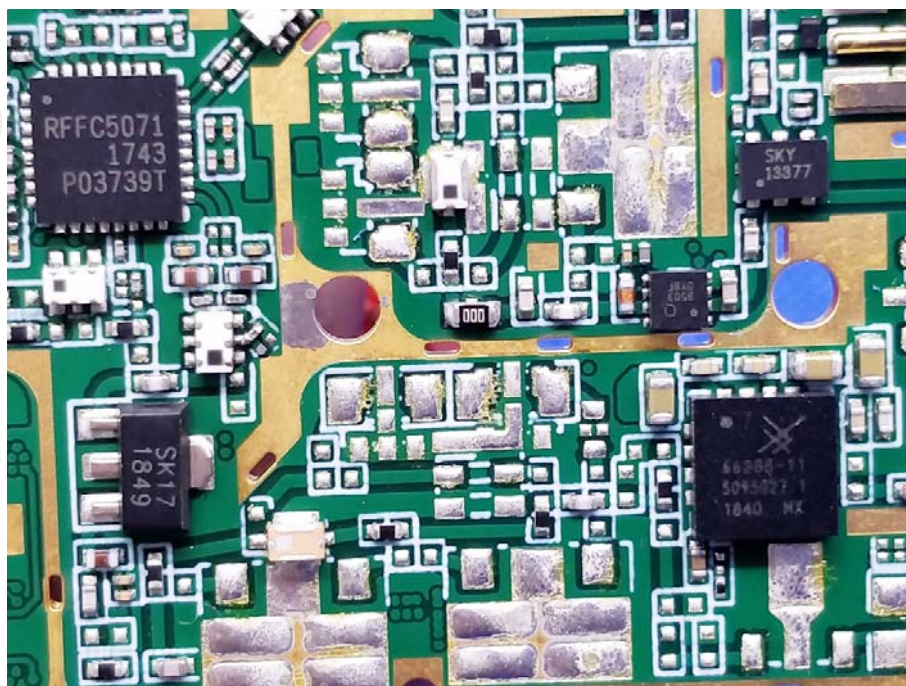
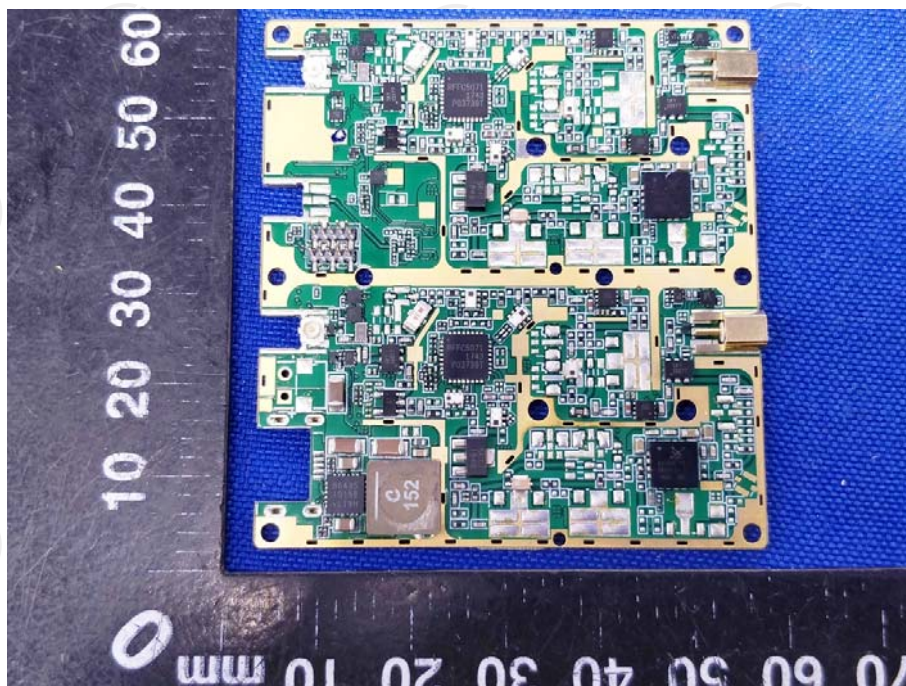
Product: Smart Radio
Model: RM-5800
Internal Photos

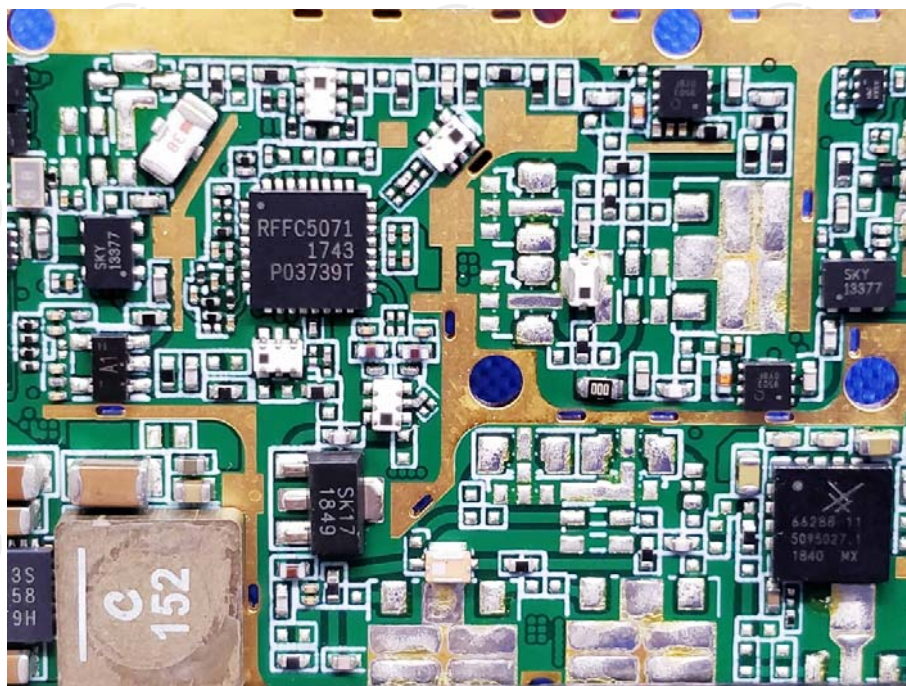












*******END OF REPORT*******