Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao′ an District, Shenzhen, China

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No. .....:	**CTA23041900801**
FCC ID. ..... :	**2BBVB-OPP6019**
Compiled by (position+printed name+signature) :	File administrators Zoey Cao
Supervised by (position+printed name+signature) :	Project Engineer Amy Wen
Approved by (position+printed name+signature) :	RF Manager Eric Wang
Date of issue .....:	May 29, 2023

Testing Laboratory Name .....:	**Shenzhen CTA Testing Technology Co., Ltd.**
Address .....:	Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

Applicant's name .....:	**OPP IOT TECHNOLOGIES CO.,LTD**
Address .....:	5th Floor, Building 7, No.196, Zhenxia, Longshan Village, Longshan Industrial park, Xitianwei Town, Licheng District, Putian City, Fujian Province

Test specification .....:	
Standard.....:	**FCC Part 15.247**

Test item description .....:	**RFID TAG**
Trade Mark .....:	N/A
Manufacturer .....:	OPP IOT TECHNOLOGIES CO.,LTD
Model/Type reference .....:	OPP6019
Listed Models .....:	Referring to page 2
Frequency	902.75-927.25 MHz
Ratings .....:	DC 3.3V from host DC 5V From PC
Result .....:	**PASS**

TEST REPORT

Equipment under Test	:	RFID TAG
Model /Type	:	OPP6019
Listed Models	:	OPP2626,OPP087,OPP089,OPP130,OPP069,OPP105,OPP105M, OPP105Dual,OPP4215,OPP2019,DevilM18,DevilD30,Devil5600, Devil3001,Devil6000,Devil4015,OPP510,Heavy120, OPP4601, OPP9018,OPP9018M,OPP7111,OPP6020L,OPP6020LM,OPPD721, OPPM16,OPP3200,CER0404,CER0505,CER525,CER0602,CER1001, CER1002,CER1005,CER1207,CER1309,CER1909,CER2117,CER2509, CER2525,CER3030,CERD10,CERD16,PCBD5,PCBD6,PCBD10, PCBD13,PCBD16,PCBD20,PCBD25,PCBD38, PCBD40,PCB060302, PCB0603,PCB0606,PCB0803,PCB0904,PCB1004,PCB120401, PCB120403,PCB1307,PCB1504,PCB1806, PCB2208,PCB2510, PCB3005,PCB3310,PCB3613,PCB4010,PCB5010,PCB5213,PCB6020, PCB7020,PCB8008,PCB8020,PCB9020,PCB9525,PCB4529,PCB4921, PCB7525,PCB13060,PCB5823
Applicant	:	OPP IOT TECHNOLOGIES CO.,LTD
Address	:	5th Floor, Building 7, No.196, Zhenxia, Longshan Village, Longshan Industrial park, Xitianwei Town, Licheng District, Putian City, Fujian Province
Manufacturer	:	OPP IOT TECHNOLOGIES CO.,LTD
Address	:	5th Floor, Building 7, No.196, Zhenxia, Longshan Village, Longshan Industrial park, Xitianwei Town, Licheng District, Putian City, Fujian Province

Test result	**Pass ***

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

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.

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1. SUMMARY

1.1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ANSI C63.10: 2013: American National Standard for Testing Unlicensed Wireless Devices

558074 D01 15.247 Meas Guidance v05r02: Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spreda Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules

1.2. Test Description

FCC PART 15 Subpart C		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)	20dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious Emission and Band Edge	PASS
FCC Part 15.247(b)	Maximum Peak Output Power	PASS
FCC Part 15.109/ 15.205/ 15.209	Radiated Emissions	PASS
FCC Part 15.247(a)(1)	Frequency Separation	PASS
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency	PASS
FCC Part 15.247(a)(1)(iii)	Time of Occupancy	PASS

Remark: The measurement uncertainty is not included in the test result.

1.3. Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community,Fuhai Street, Bao'an District, Shenzhen, 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 C63.10 and CISPR 32/EN 55032 requirements.

1.3.2 Laboratory accreditation

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

FCC-Registration No.: 517856 Designation Number: CN1318

Shenzhen CTA Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6534.01

Shenzhen CTA Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

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 TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen CTA 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 Shenzhen CTA Testing Technology Co., Ltd. :

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(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. General Remarks

Date of receipt of test sample	:	Apr. 19, 2023
Testing commenced on	:	Apr. 19, 2023
Testing concluded on	:	May 29, 2023

2.2. Environmental conditions

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

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

2.3. General Description of EUT

Product Name:	RFID TAG
Model/Type reference:	OPP6019
Power supply:	DC 3.3V from host DC 5V From PC
Hardware version:	V1.0
Software version:	V1.0
Testing sample ID：	CTA230419008-1# (Engineer sample) CTA230419008-2# (Normal sample)
UHF RFID	
Operation frequency	902.75-927.25 MHz
Modulation Type	GFSK
Channel number:	50
Channel separation:	0.5MHz
Antenna type:	PCB ANT
Antenna gain:	2.00dBi

Note1: For more details, please refer to the user's manual of the EUT.

2.4. Description of Test Modes and Test Frequency

The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. There are 51 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel.

Test Mode	Test Channel	Test Frequency
1	Low Channel	902.75MHz
26	Middle Channel	915.25MHz
50	High Channel	927.25MHz

Operation Frequency：

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	**902.75MHz**	16	910.25MHz	31	917.75MHz	46	925.25MHz
2	903.25MHz	17	910.75MHz	32	918.25MHz	47	925.75MHz
3	903.75MHz	18	911.25MHz	33	918.75MHz	48	926.25MHz
4	904.25MHz	19	911.75MHz	34	919.25MHz	49	926.75MHz
5	904.75MHz	20	912.25MHz	35	919.75MHz	**50**	**927.25MHz**
6	905.25MHz	21	912.75MHz	36	920.25MHz		
7	905.75MHz	22	913.25MHz	37	920.75MHz		
8	906.25MHz	23	913.75MHz	38	921.25MHz		
9	906.75MHz	24	914.25MHz	39	921.75MHz		
10	907.25MHz	25	914.75MHz	40	922.25MHz		
11	907.75MHz	**26**	**915.25MHz**	41	922.75MHz		
12	908.25MHz	27	915.75MHz	42	923.25MHz		
13	908.75MHz	28	916.25MHz	43	923.75MHz		
14	909.25MHz	29	916.75MHz	44	924.25MHz		
15	909.75MHz	30	917.25MHz	45	924.75MHz		

Note: The line display in grey were the channel selected for testing

Power setting during the test:

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power Parameters:

Test Software Version	RRU2889 Demo V2.2		
Channel	Low channel	Mid channel	High channel
Power Level	14	14	14

2.5. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2022/08/03	2023/08/02
LISN	R&S	ENV216	CTA-314	2022/08/03	2023/08/02
EMI Test Receiver	R&S	ESPI	CTA-307	2022/08/03	2023/08/02
EMI Test Receiver	R&S	ESCI	CTA-306	2022/08/03	2023/08/02
Spectrum Analyzer	Agilent	N9020A	CTA-301	2022/08/03	2023/08/02
Spectrum Analyzer	R&S	FSP	CTA-337	2022/08/03	2023/08/02

Vector Signal generator	Agilent	N5182A	CTA-305	2022/08/03	2023/08/02
Analog Signal Generator	R&S	SML03	CTA-304	2022/08/03	2023/08/02
Universal Radio Communication	CMW500	R&S	CTA-302	2022/08/03	2023/08/02
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2022/08/03	2023/08/02
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2021/08/07	2024/08/06
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2021/08/07	2024/08/06
Loop Antenna	Zhinan	ZN30900C	CTA-311	2021/08/07	2024/08/06
Horn Antenna	Beijing Hangwei Dayang	OBH100400	CTA-336	2021/08/07	2024/08/06
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2022/08/03	2023/08/02
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2022/08/03	2023/08/02
Directional coupler	NARDA	4226-10	CTA-303	2022/08/03	2023/08/02
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2022/08/03	2023/08/02
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2022/08/03	2023/08/02
Automated filter bank	Tonscend	JS0806-F	CTA-404	2022/08/03	2023/08/02
Power Sensor	Agilent	U2021XA	CTA-405	2022/08/03	2023/08/02
Amplifier	Schwarzbeck	BBV9719	CTA-406	2022/08/03	2023/08/02

The calibration interval was one year

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

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.7. Modifications

No modifications were implemented to meet testing criteria.

3. TEST CONDITIONS AND RESULTS

3.1. Conducted Emissions Test

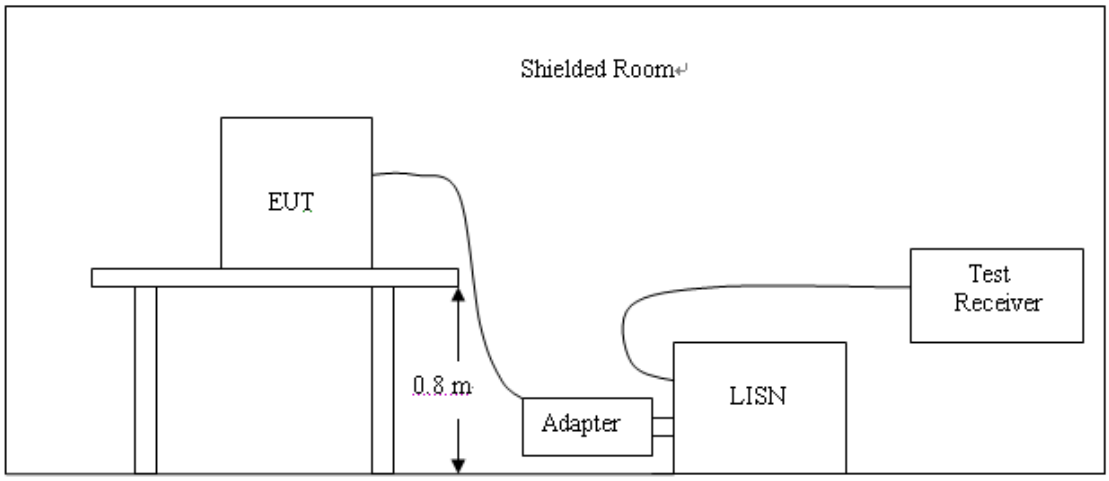
LIMIT

According to FCC CFR Title 47 Part 15 Subpart C Section 15.207 and RSS Gen 8.8, AC Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus as below:

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



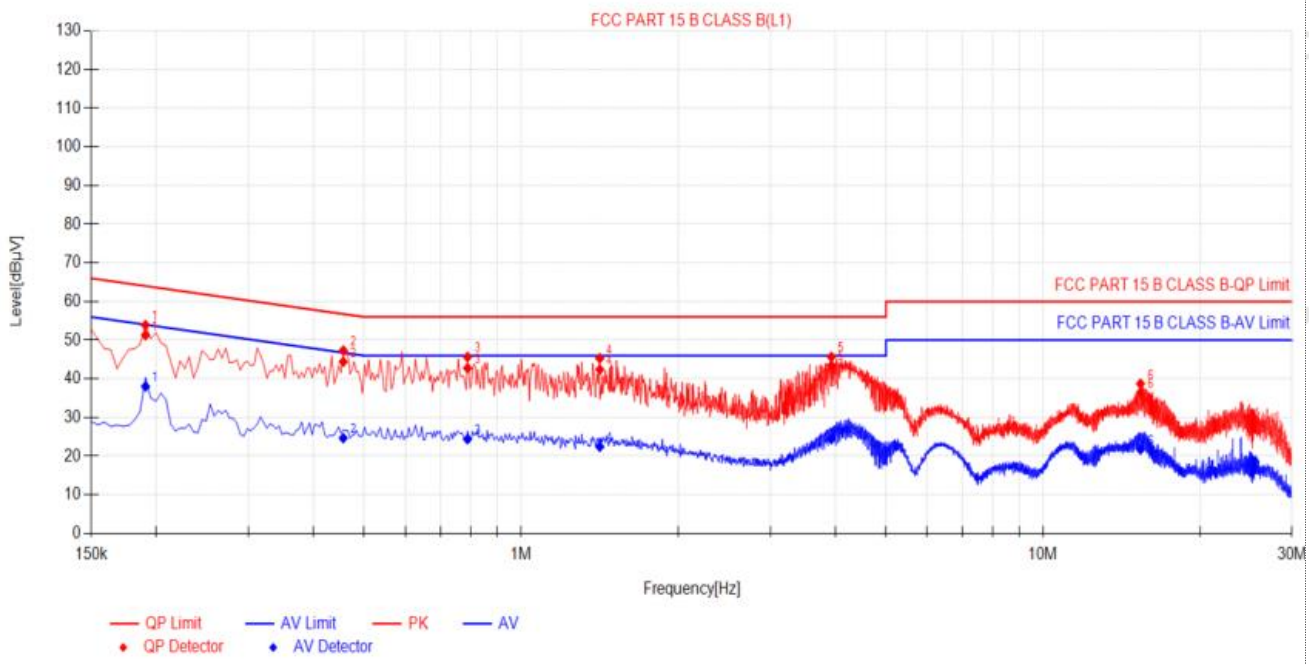
TEST PROCEDURE

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 C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. The 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

Remark:
1. All modes were tested; only the worst result of antenna 4 test mode 1 was reported as below:
2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:
3.

Power supply:	DC 3.3V from host DC 5V From PC AC 120V	Polarization	L

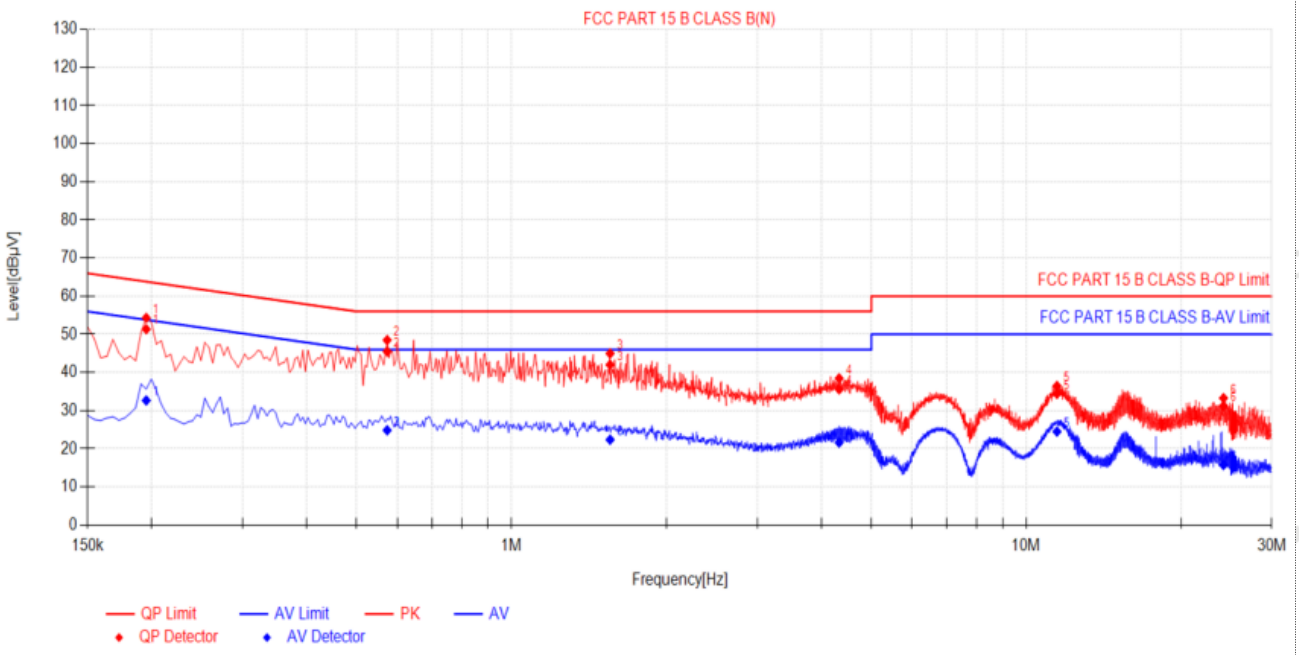


Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1905	10.50	40.78	51.28	64.01	12.73	27.53	38.03	54.01	15.98	PASS
2	0.456	10.50	33.91	44.41	56.77	12.36	14.16	24.66	46.77	22.11	PASS
3	0.789	10.50	32.24	42.74	56.00	13.26	13.89	24.39	46.00	21.61	PASS
4	1.4145	10.50	31.89	42.39	56.00	13.61	11.93	22.43	46.00	23.57	PASS
5	3.93	10.50	32.95	43.45	56.00	12.55	13.93	24.43	46.00	21.57	PASS
6	15.3735	10.50	25.90	36.40	60.00	23.60	11.23	21.73	50.00	28.27	PASS

Note:1).QP Value (dBµV)= QP Reading (dBµV)+ Factor (dB)
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)
3). QPMargin(dB) = QP Limit (dBµV) - QP Value (dBµV)
4). AVMargin(dB) = AV Limit (dBµV) - AV Value (dBµV)

Power supply:	DC 3.3V from host DC 5V From PC AC 120V	Polarization	N



Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.195	10.50	40.85	51.35	63.82	12.47	22.17	32.67	53.82	21.15	PASS
2	0.573	10.50	35.03	45.53	56.00	10.47	14.35	24.85	46.00	21.15	PASS
3	1.554	10.50	31.52	42.02	56.00	13.98	11.87	22.37	46.00	23.63	PASS
4	4.3305	10.50	25.09	35.59	56.00	20.41	11.13	21.63	46.00	24.37	PASS
5	11.4765	10.50	23.88	34.38	60.00	25.62	13.99	24.49	50.00	25.51	PASS
6	24.1755	10.50	20.68	31.18	60.00	28.82	5.25	15.75	50.00	34.25	PASS

Note:1).QP Value (dBµV)= QP Reading (dBµV)+ Factor (dB)

2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBµV) - QP Value (dBµV)

4). AVMargin(dB) = AV Limit (dBµV) - AV Value (dBµV)

3.2. Radiated Emissions and Band Edge

Limit

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

For intentional device, according to RSS-Gen section 8.9, the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

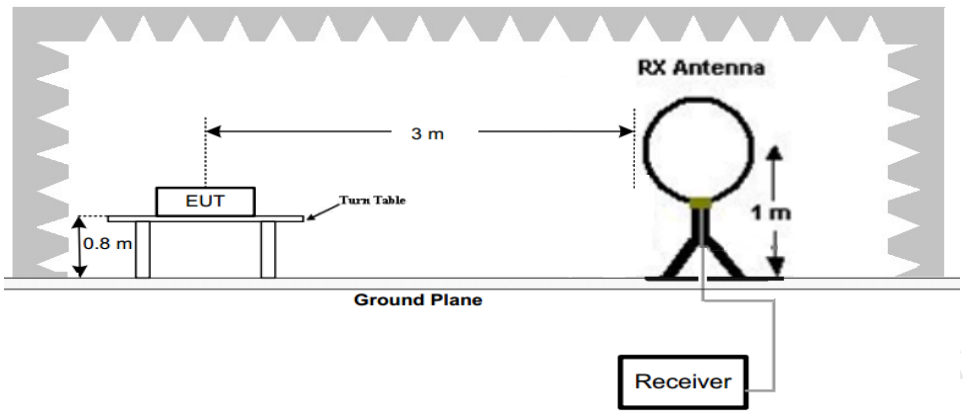
In addition, radiated emissions which fall in the restricted bands, as defined in RSS-Gen section 8.10, must also comply with the radiated emission limits specified in RSS-Gen section 8.9

Radiated emission limits

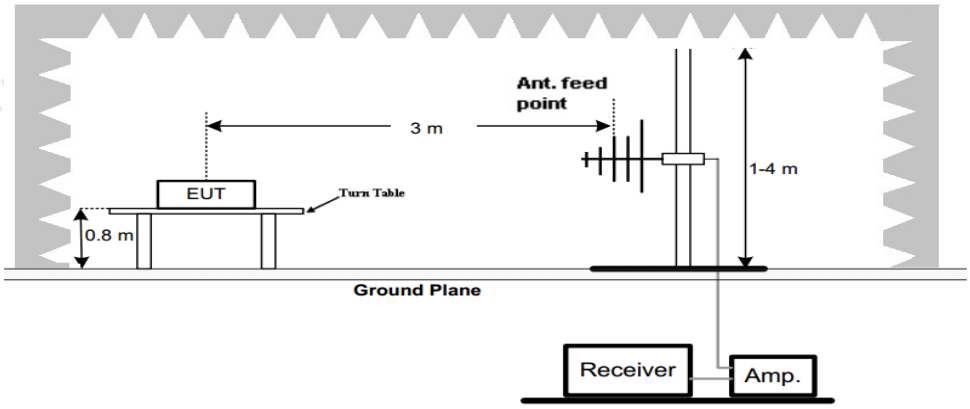
Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

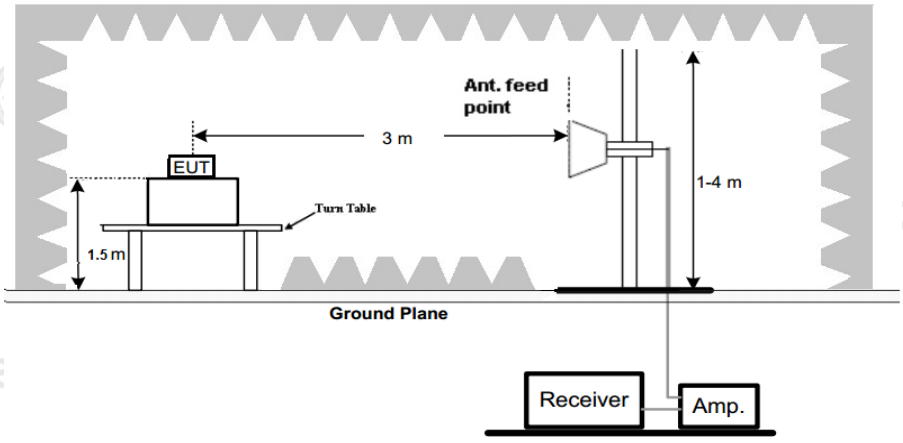
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(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. Radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP

1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

TEST RESULTS

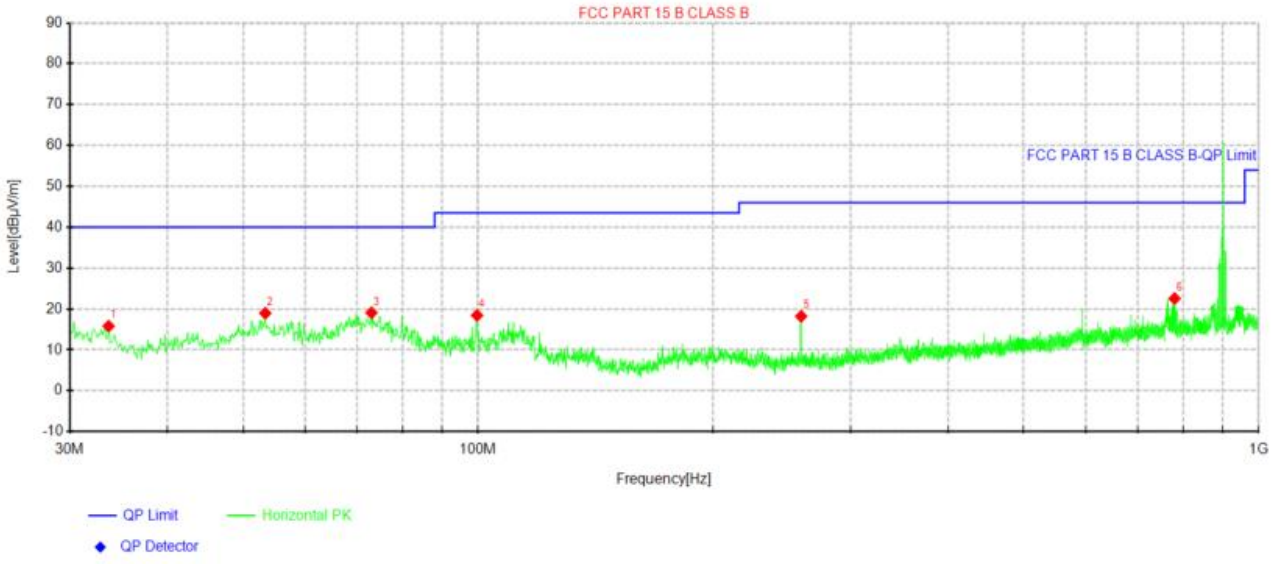
Remark:

1. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and The emission levels from 9kHz to 30MHz are attenuated 20dB below the limit and not recorded in report.
2. For 30MHz to 1GHz measurement all modes were tested; only the worst result of antenna 4 test mode 1 was reported as below.

For 30MHz-1GHz

Low Channel:

Horizontal



Suspected Data List

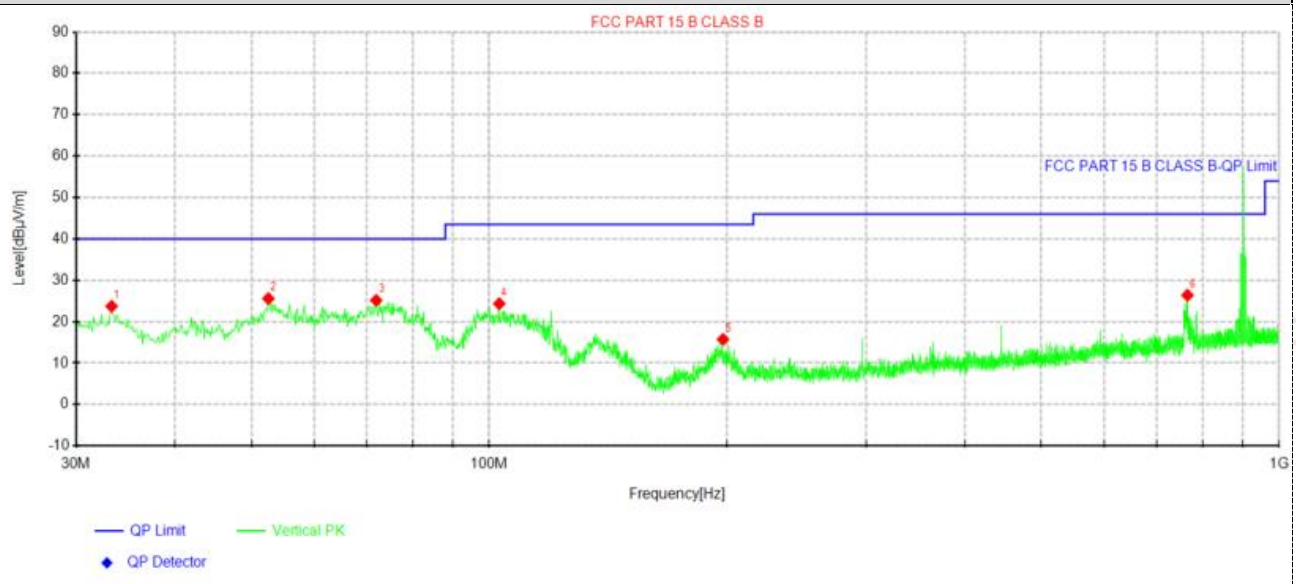
NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.6375	33.89	15.80	-18.09	40.00	24.20	100	110	Horizontal
2	53.4012	35.74	18.95	-16.79	40.00	21.05	100	110	Horizontal
3	73.0438	40.09	19.07	-21.02	40.00	20.93	100	60	Horizontal
4	99.7188	36.83	18.43	-18.40	43.50	25.07	100	120	Horizontal
5	259.405	35.98	18.21	-17.77	46.00	27.79	100	170	Horizontal
6	780.295	33.14	22.54	-10.60	46.00	23.46	100	170	Horizontal

Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.2738	41.89	23.73	-18.16	40.00	16.27	100	10	Vertical
2	52.5525	42.18	25.57	-16.61	40.00	14.43	100	150	Vertical
3	71.9525	46.14	25.17	-20.97	40.00	14.83	100	10	Vertical
4	102.992	42.85	24.35	-18.50	43.50	19.15	100	20	Vertical
5	197.688	35.15	15.72	-19.43	43.50	27.78	100	240	Vertical
6	765.623	37.01	26.39	-10.62	46.00	19.61	100	70	Vertical

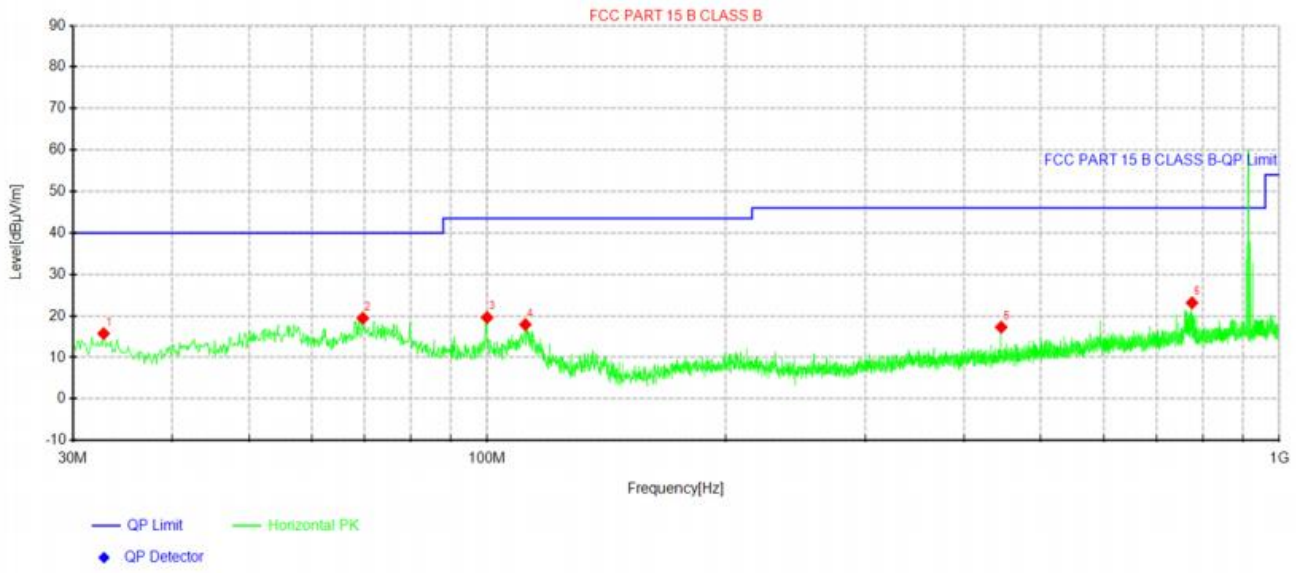
Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

Mid Channel:

Horizontal



Suspected Data List

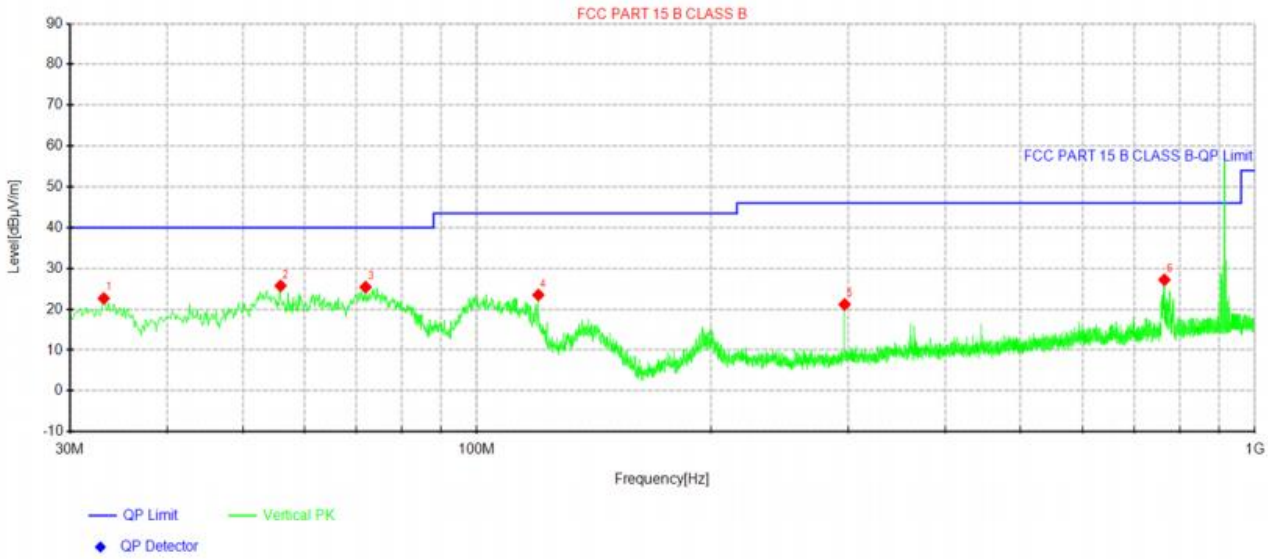
NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	32.7888	33.98	15.73	-18.25	40.00	24.27	100	30	Horizontal
2	69.6488	40.23	19.44	-20.79	40.00	20.56	100	320	Horizontal
3	99.9613	37.98	19.61	-18.37	43.50	23.89	100	300	Horizontal
4	111.722	37.01	17.91	-19.10	43.50	25.59	100	60	Horizontal
5	445.523	32.40	17.29	-15.11	46.00	28.71	100	310	Horizontal
6	775.808	33.75	23.16	-10.59	46.00	22.84	100	160	Horizontal

Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.1525	40.84	22.66	-18.18	40.00	17.34	100	170	Vertical
2	55.9475	43.09	25.75	-17.34	40.00	14.25	100	290	Vertical
3	71.9525	46.40	25.43	-20.97	40.00	14.57	100	70	Vertical
4	119.967	43.80	23.51	-20.29	43.50	19.99	100	40	Vertical
5	296.992	38.57	21.18	-17.39	46.00	24.82	100	100	Vertical
6	765.138	37.83	27.21	-10.62	46.00	18.79	100	60	Vertical

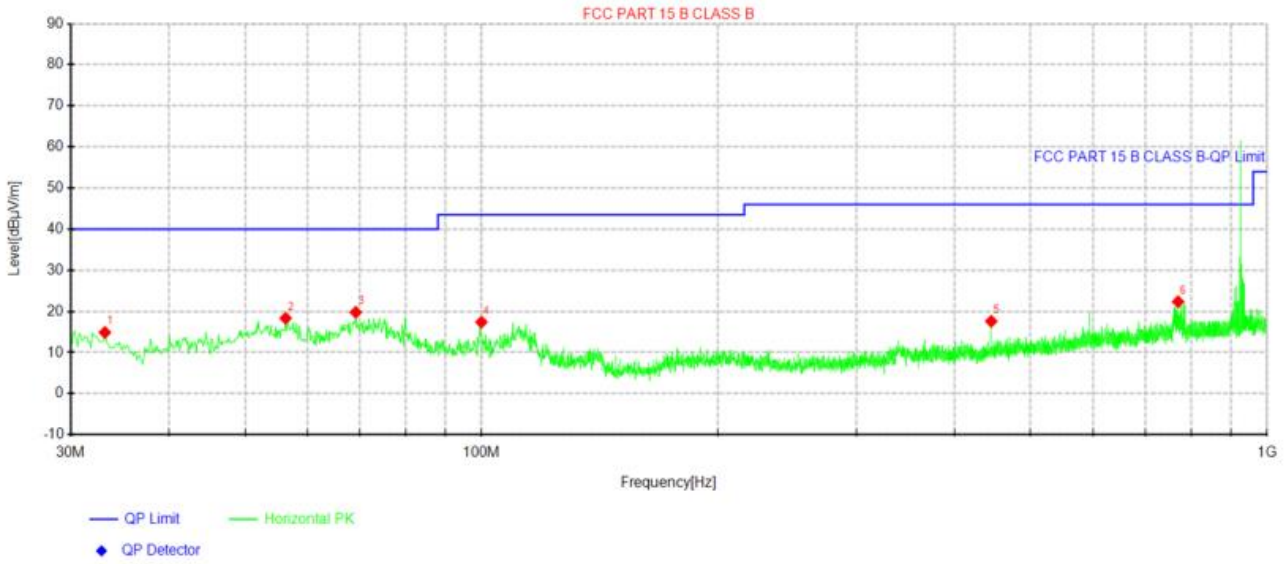
Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

High Channel:

Horizontal



Suspected Data List

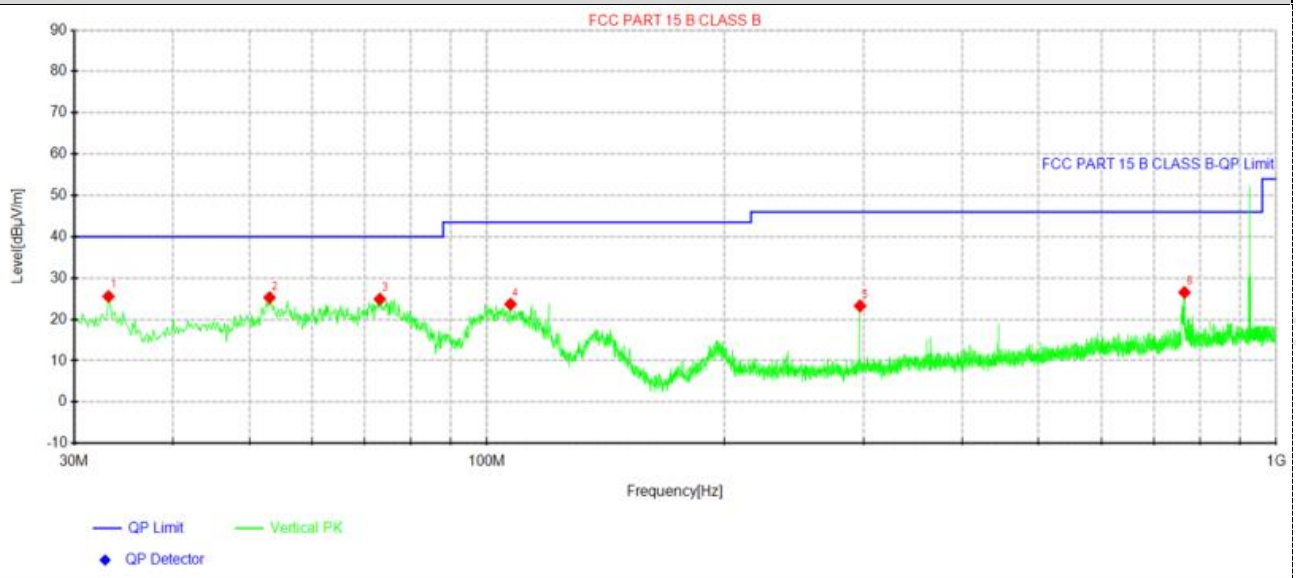
NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.1525	33.05	14.87	-18.18	40.00	25.13	100	270	Horizontal
2	56.3112	35.74	18.33	-17.41	40.00	21.67	100	60	Horizontal
3	69.1637	40.44	19.78	-20.66	40.00	20.22	100	270	Horizontal
4	99.9613	35.77	17.40	-18.37	43.50	26.10	100	100	Horizontal
5	445.523	32.70	17.59	-15.11	46.00	28.41	100	360	Horizontal
6	770.352	32.94	22.35	-10.59	46.00	23.65	100	220	Horizontal

Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.1525	43.73	25.55	-18.18	40.00	14.45	100	350	Vertical
2	53.0375	41.99	25.28	-16.71	40.00	14.72	100	130	Vertical
3	73.165	45.93	24.91	-21.02	40.00	15.09	100	70	Vertical
4	107.115	42.38	23.67	-18.71	43.50	19.83	100	40	Vertical
5	296.992	40.66	23.27	-17.39	46.00	22.73	100	60	Vertical
6	765.26	37.14	26.52	-10.62	46.00	19.48	100	190	Vertical

Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

For 1GHz to 10GHz

Frequency(MHz):			902.75		Polarity:		HORIZONTAL		
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)
1805.5	60.11	PK	74.00	13.89	72.39	25.45	3.6	41.33	-12.28
1805.5	44.50	AV	54.00	9.50	56.78	25.45	3.6	41.33	-12.28
2708.25	51.55	PK	74.00	22.45	60.72	28.3	5.12	42.59	-9.17
2708.25	41.92	AV	54.00	12.08	51.09	28.3	5.12	42.59	-9.17

Frequency(MHz):			902.75		Polarity:		VERTICAL		
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)
1805.5	59.08	PK	74.00	14.92	71.36	25.45	3.6	41.33	-12.28
1805.5	42.92	AV	54.00	11.08	55.20	25.45	3.6	41.33	-12.28
2708.25	50.86	PK	74.00	23.14	60.03	28.3	5.12	42.59	-9.17
2708.25	41.05	AV	54.00	12.95	50.22	28.3	5.12	42.59	-9.17

Frequency(MHz):			915.25		Polarity:		HORIZONTAL		
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)
1830.10	58.80	PK	74.00	15.20	71.08	25.45	3.6	41.33	-12.28
1830.10	41.79	AV	54.00	12.21	54.07	25.45	3.6	41.33	-12.28
2745.15	50.61	PK	74.00	23.39	59.78	28.3	5.12	42.59	-9.17
2745.15	40.60	AV	54.00	13.40	49.77	28.3	5.12	42.59	-9.17

Frequency(MHz):			915.25		Polarity:		VERTICAL		
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)
1830.10	59.75	PK	74.00	14.25	72.03	25.45	3.6	41.33	-12.28
1830.10	42.73	AV	54.00	11.27	55.01	25.45	3.6	41.33	-12.28
2745.15	51.20	PK	74.00	22.80	60.37	28.3	5.12	42.59	-9.17
2745.15	42.08	AV	54.00	11.92	51.25	28.3	5.12	42.59	-9.17

Frequency(MHz):			927.25		Polarity:		HORIZONTAL		
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)
1854.50	59.21	PK	74.00	14.79	71.36	25.62	3.63	41.4	-12.15
1854.50	42.08	AV	54.00	11.92	54.23	25.62	3.63	41.4	-12.15
2781.75	51.99	PK	74.00	22.01	61.09	28.46	5.14	42.7	-9.1
2781.75	40.55	AV	54.00	13.45	49.65	28.46	5.14	42.7	-9.1

Frequency(MHz):			927.25		Polarity:		VERTICAL		
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)
1854.50	60.25	PK	74.00	13.75	72.40	25.62	3.63	41.4	-12.15
1854.50	42.38	AV	54.00	11.62	54.53	25.62	3.63	41.4	-12.15
2781.75	51.23	PK	74.00	22.77	60.33	28.46	5.14	42.7	-9.1
2781.75	40.96	AV	54.00	13.04	50.06	28.46	5.14	42.7	-9.1

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
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

3.3. Maximum Conducted Output Power

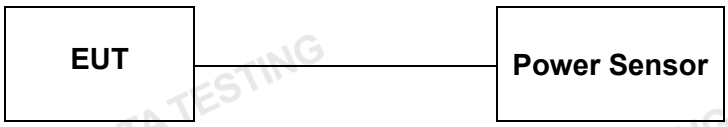
Limit

The Maximum Peak Output Power limit is 28 dBm.

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power Meter.

Test Configuration



Test Results

CH	Peak Output Power (dBm)	Peak Output Power Limit (dBm)	Result
Low	13.286	28	PASS
Mid	13.927	28	PASS
High	14.003	28	PASS

Note: 1.The test results including the cable lose.

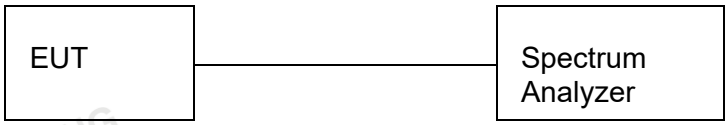
3.4. 20dB Bandwidth

Test Procedure

According to ANSI C63.10: 2013. Use the following spectrum analyzer settings: Span = approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channelRBW ≧ 1% of the 20dB bandwidth, VBW ≧ RBW, Sweep = auto, Detector function = peak, Trace = max holdThe EUT should be transmitting at its maximum data rate. Allow the trace to stabilize.

Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation..

Test Configuration

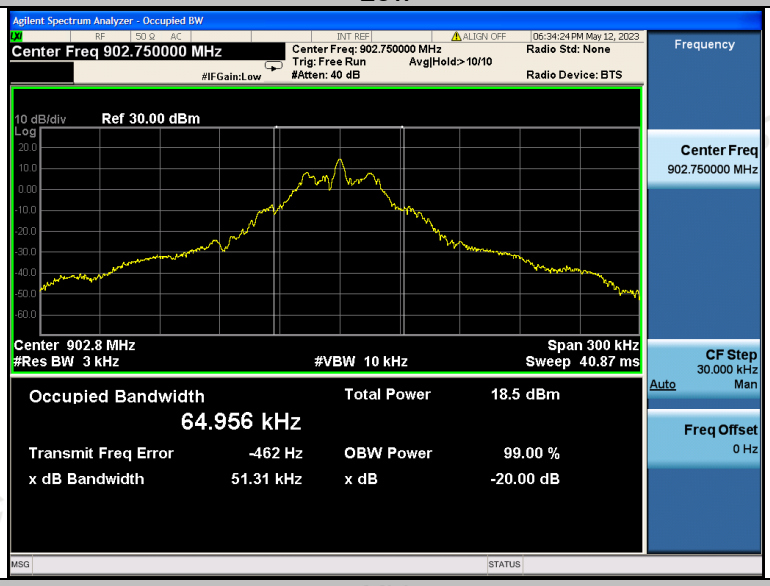


Test Results

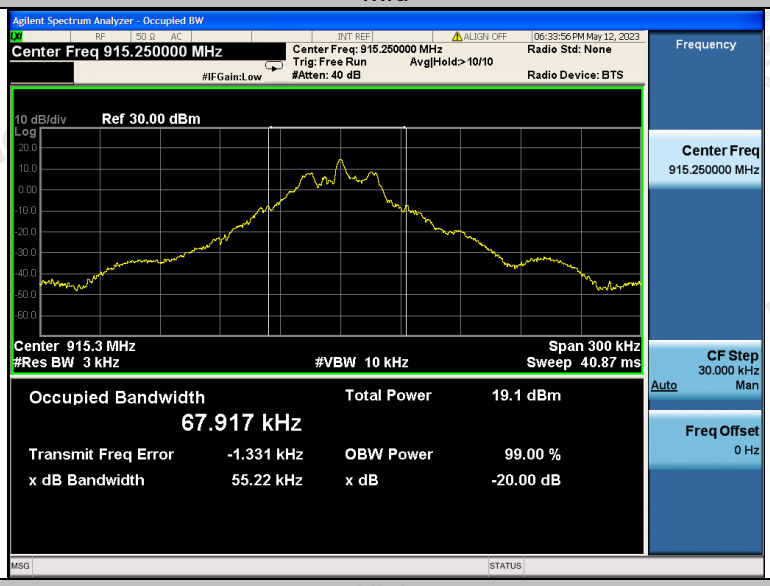
CH	20dB Bandwidth (KHz)	Limit (KHz)	Result
Low	61.94	/	PASS
Mid	61.95	/	PASS
High	70.68	/	PASS

Test Graphs

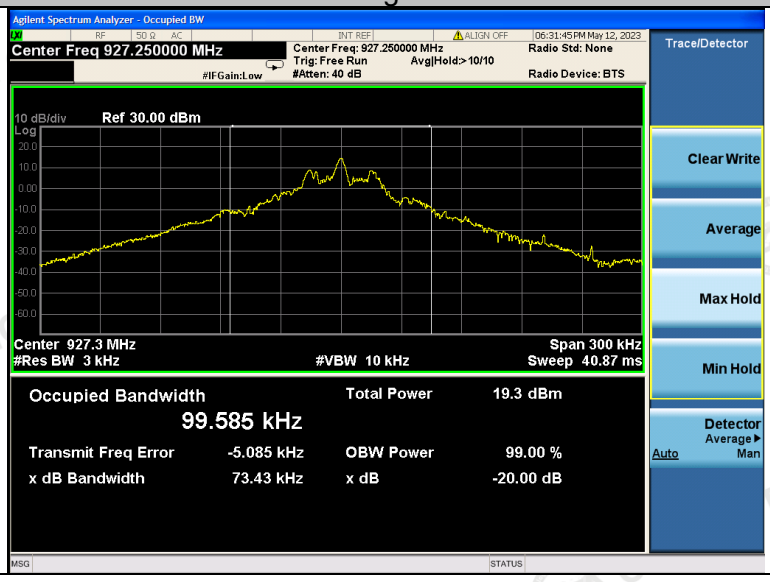
Low



Mid



High



3.5. Frequency Separation

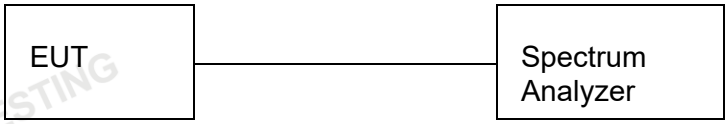
Limit

Per 15.247 (a)(1) At least 25 KHz or 20 dB bandwidth of the hopping Channel, whichever is greater.

Test Procedure

According to ANSI C63.10: 2013.
The EUT must have its hopping function enabled.
Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≧ 1% of the span
Video (or Average) Bandwidth VBW ≧ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

Test Configuration

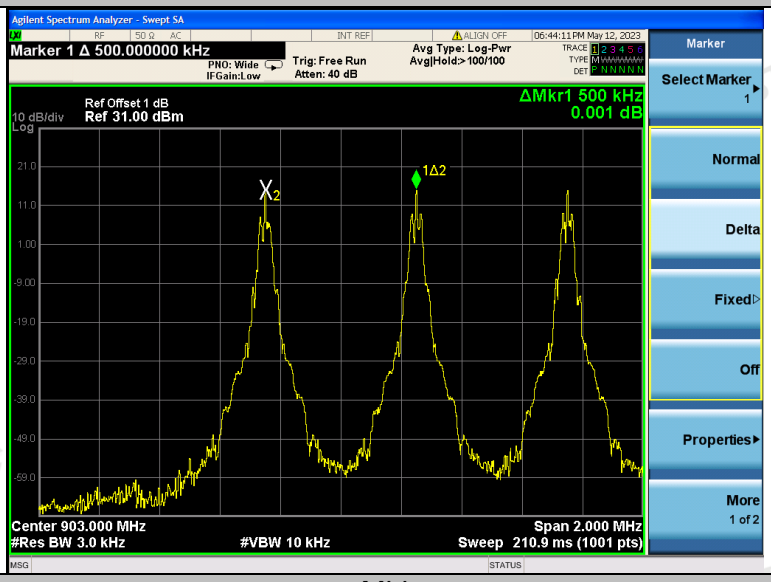


Test Results

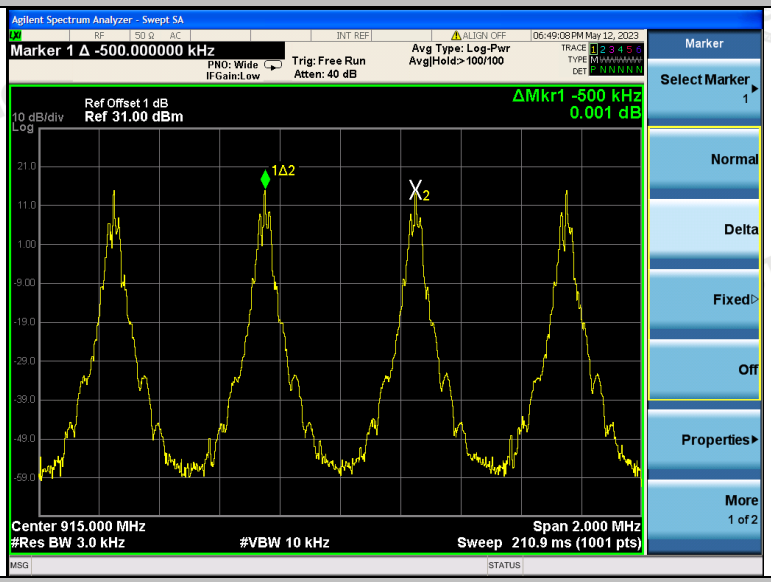
Channel	Channel Separation (MHz)	Limit (MHz)	Result
Low Channel	0.500	0.025MHz or 20dB bandwidth	Pass
Adjacency Channel			
Middle Channel	0.500	0.025MHz or 20dB bandwidth	Pass
Adjacency Channel			
High Channel	0.500	0.025MHz or 20dB bandwidth	Pass
Adjacency Channel			

Test Graphs

Low



Mid



High

3.6. Number of hopping frequency

Limit

if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Test Procedure

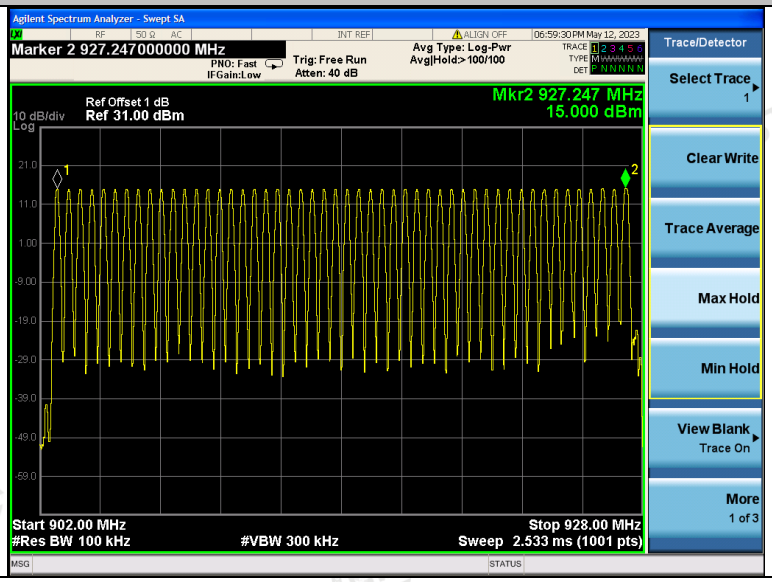
According to ANSI C63.10: 2013.
The EUT must have its hopping function enabled.
Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW ≧ 1% of the span
VBW ≧ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize. It may prove necessary to bread the span up to sections, in order to clearly show all of the hopping frequencies.

Test Configuration

Test Results

Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Limit
902.75-927.25MHz	50	≥50

Test Graphs

GFSK


3.7. Time Of Occupancy(Dwell Time)

Limit

if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Test Procedure

According to ANSI C63.10: 2013.

The EUT must have its hopping function enabled.

Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW = 1MHz

VBW ≧ RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

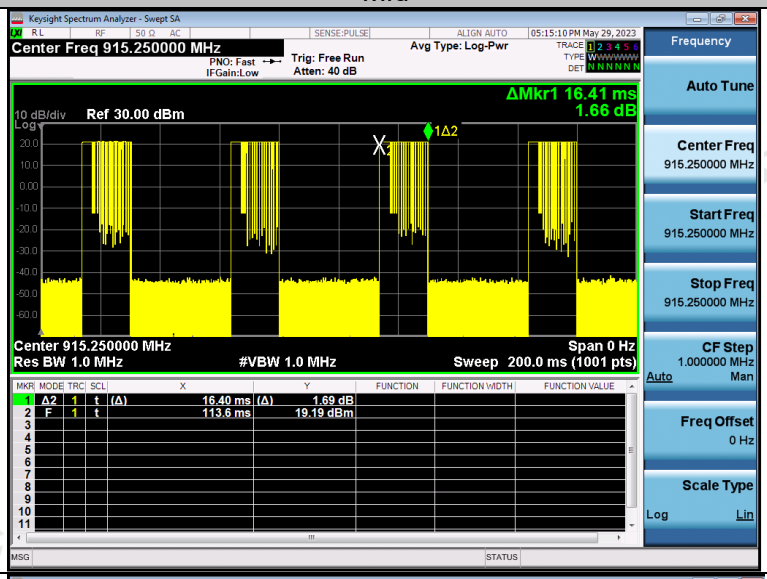
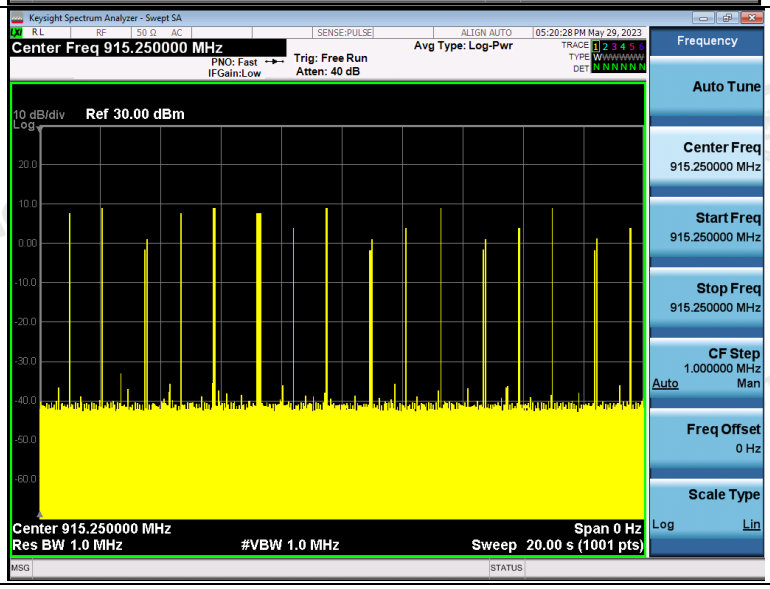
If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

Test Configuration

Test Results

CH	No. of burst	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Result
Mid	21	0.01641	344.61	400	Pass

Test Graphs

Mid



3.8. Spurious RF Conducted Emissions and bandedge

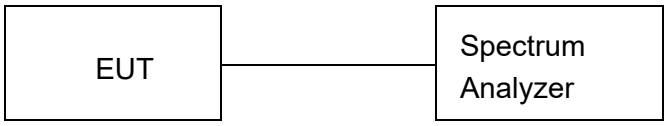
Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

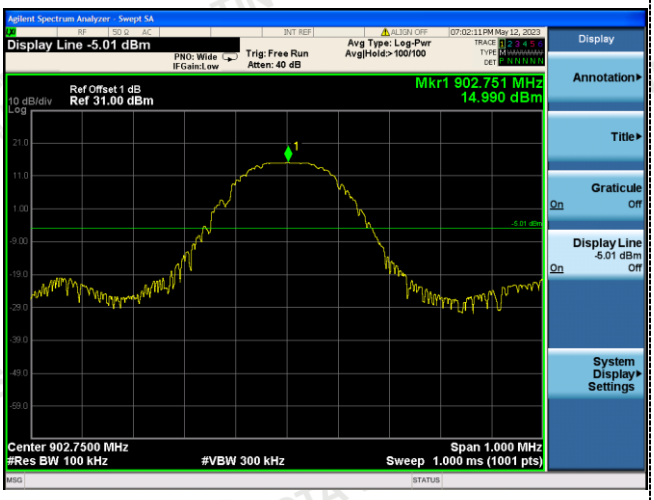
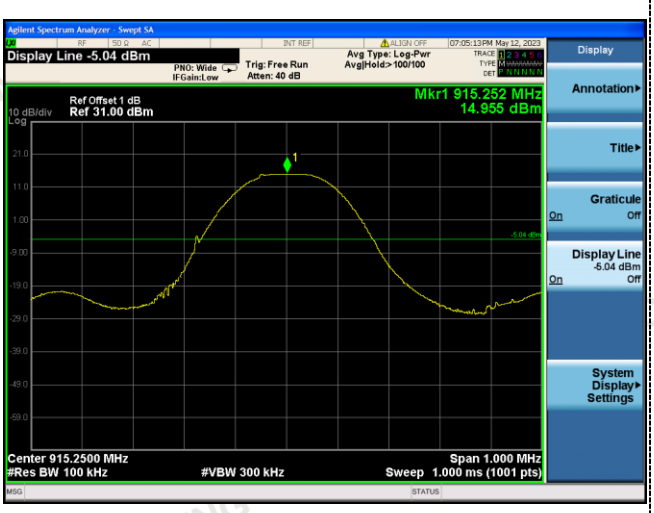
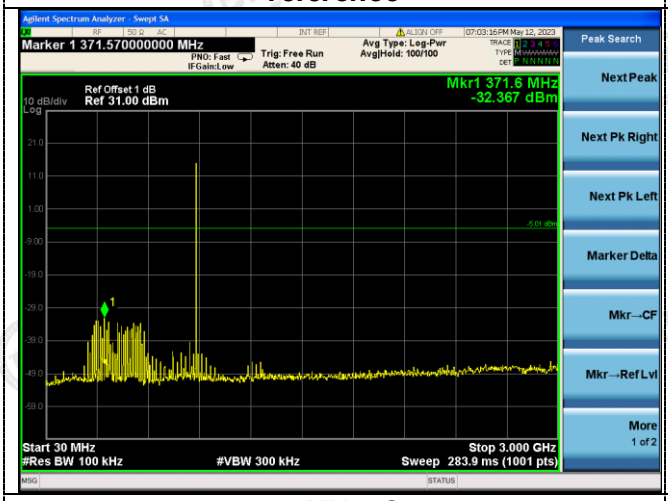
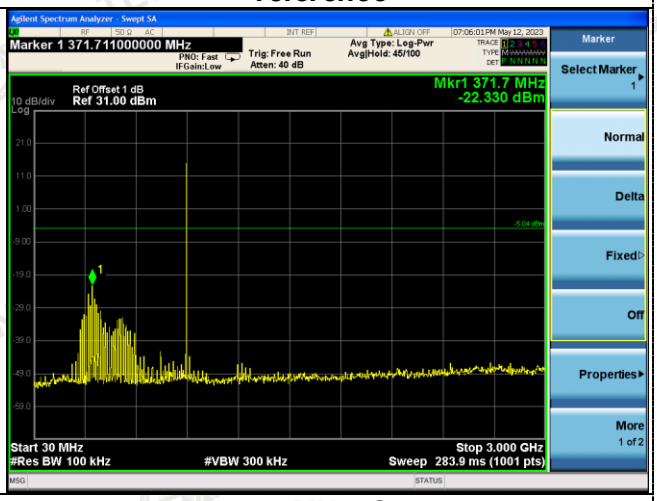
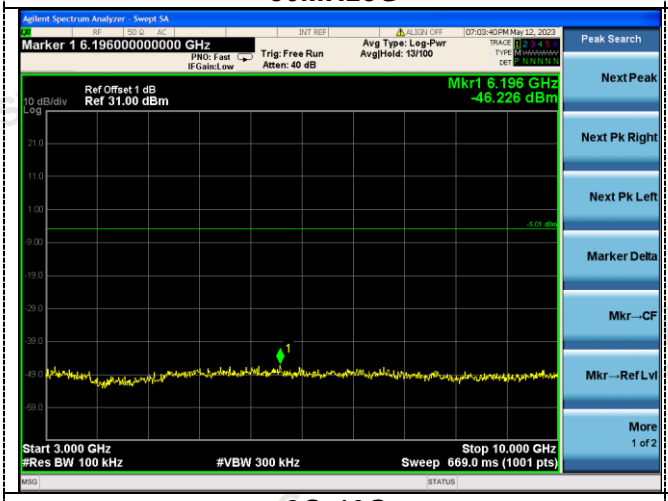
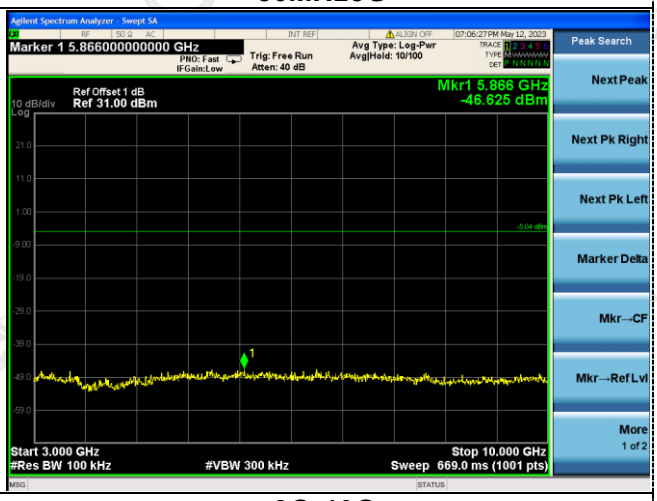
Test Procedure

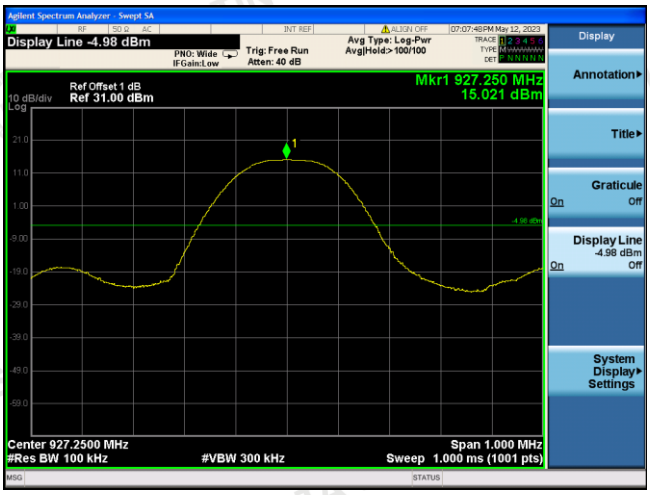
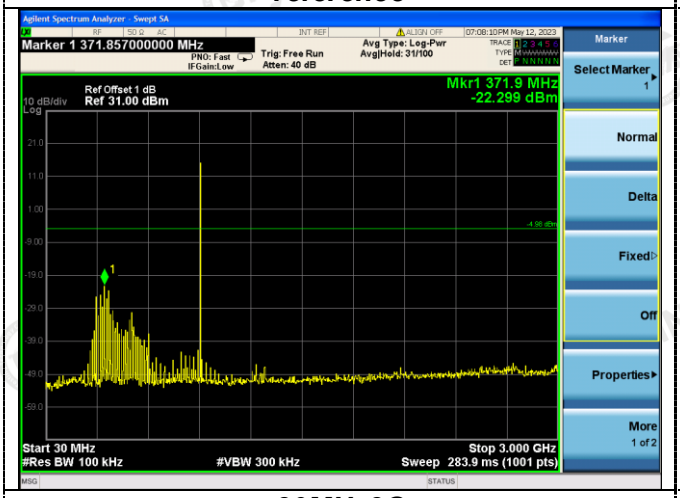
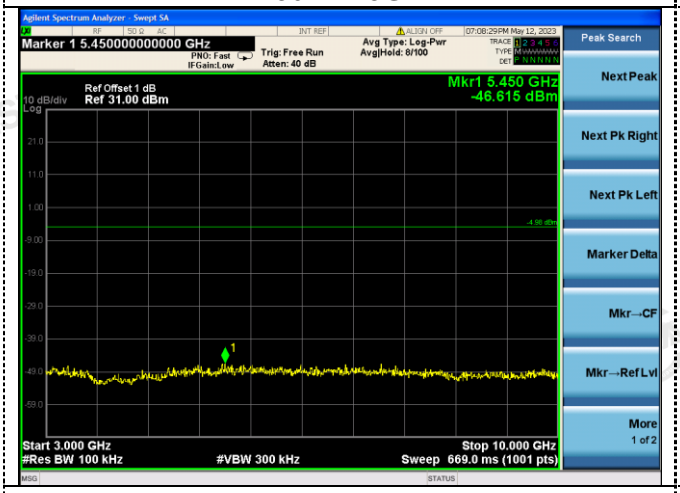
Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

Test Configuration



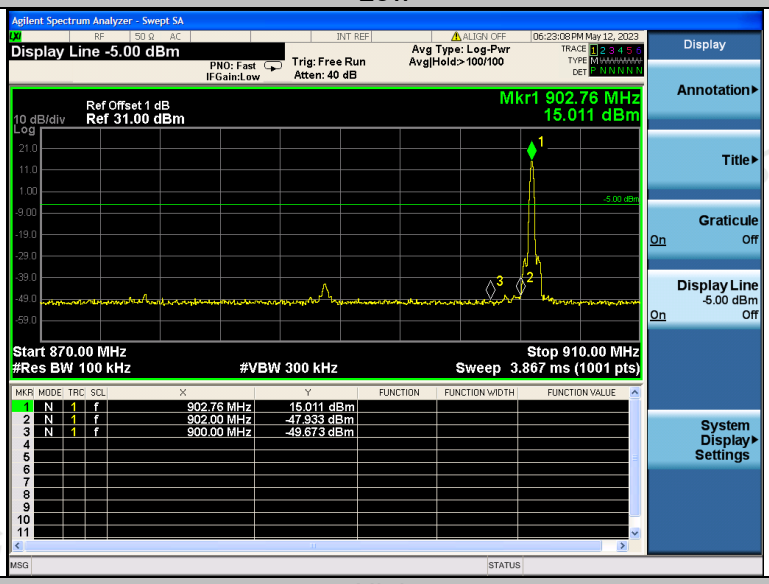
Test Results

Low	Mid
	
reference	***reference***
	
30MHz3G	***30MHz3G***
	
3G-10G	***3G-10G***

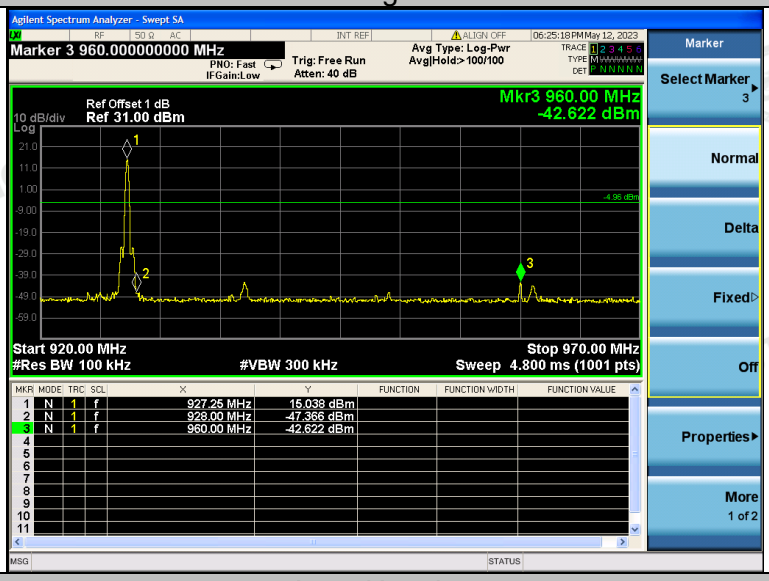
High	
	
reference	
	
30MHz3G	
	
3G-10G	

Band edge measurements

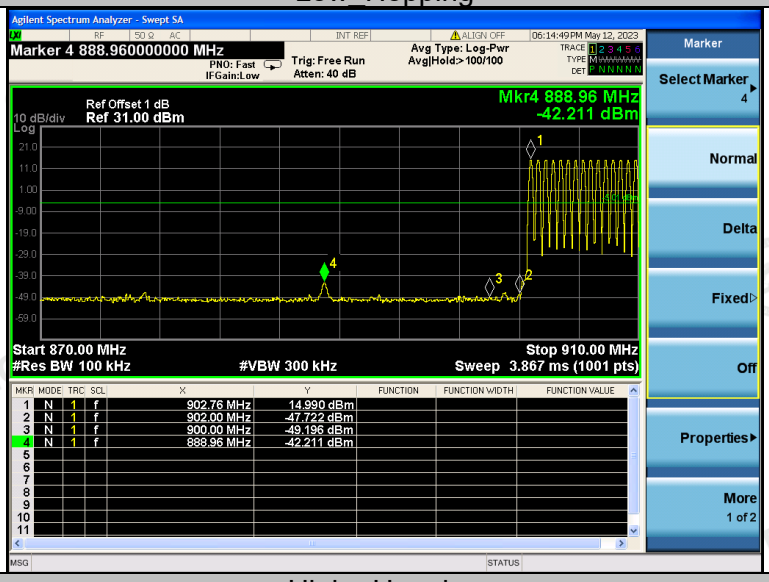
Low



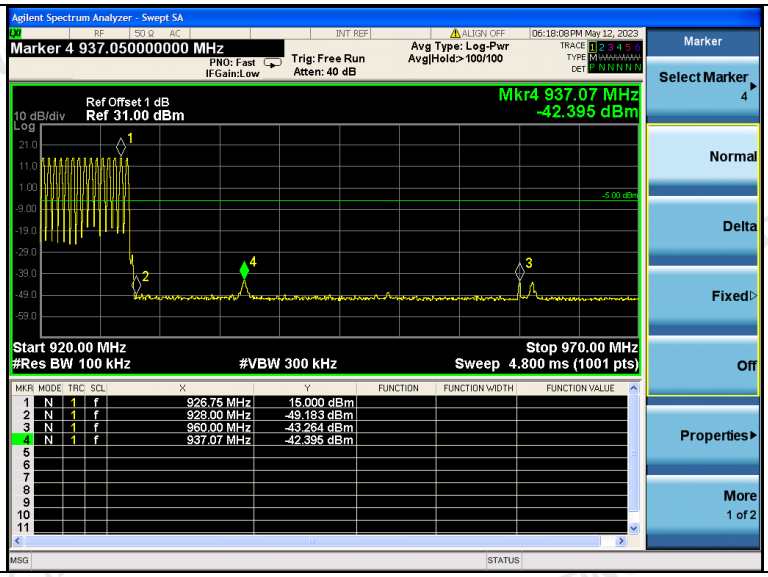
High



Low_Hopping



High _Hopping


Agilent Spectrum Analyzer - Swept SA
Marker 4 937.050000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
05:18:08 PM May 12, 2023
Ref Offset 1 dB
10 dB/div
Log
Ref 31.00 dBm
Mkr4 937.07 MHz
-42.395 dBm
-5.00 dBm
Start 920.00 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 970.00 MHz
Sweep 4.800 ms (1001 pts)
1 N 1 f 926.75 MHz 15.000 dBm
2 N 1 f 928.00 MHz -49.183 dBm
3 N 1 f 960.00 MHz -43.264 dBm
4 N 1 f 937.07 MHz -42.395 dBm
Marker
Select Marker 4
Normal
Delta
Fixed
Off
Properties
More 1 of 2
MSG
STATUS

3.9. 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. 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

FCC CFR Title 47 Part 15 Subpart C Section 15.247(b)(4):

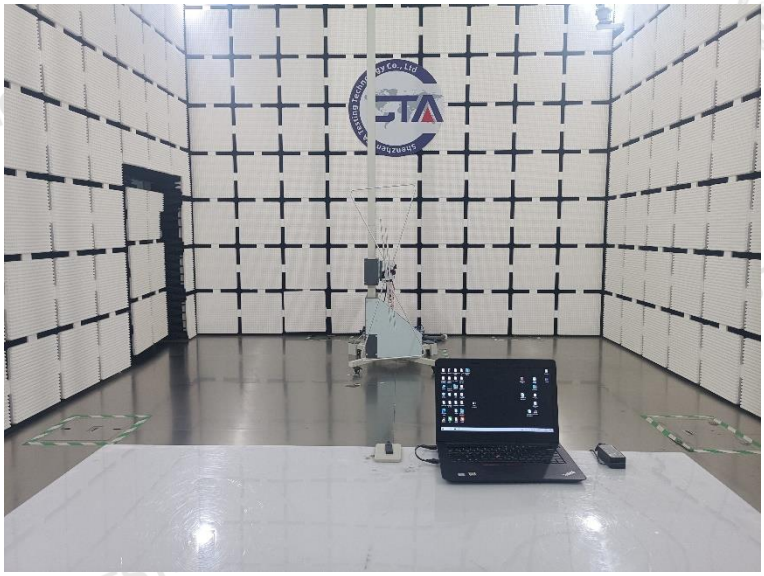
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

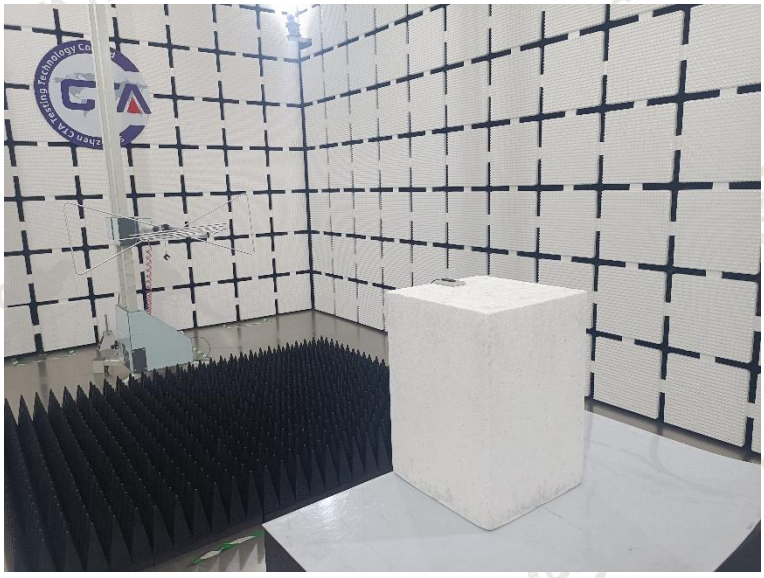
Test Result:

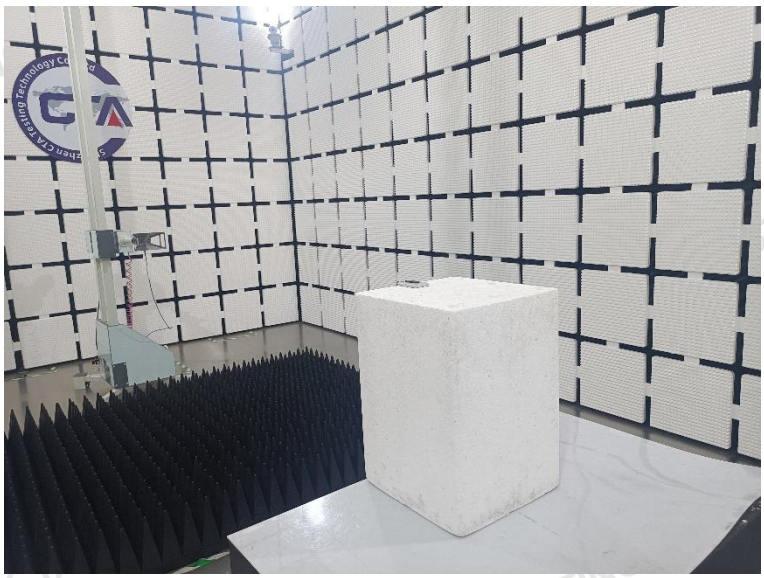
The maximum gain of antenna was 2.00 dBi.

Remark:The antenna gain is provided by the customer , if the data provided by the customer is not accurate, Shenzhen CTA Testing Technology Co., Ltd. does not assume any responsibility.

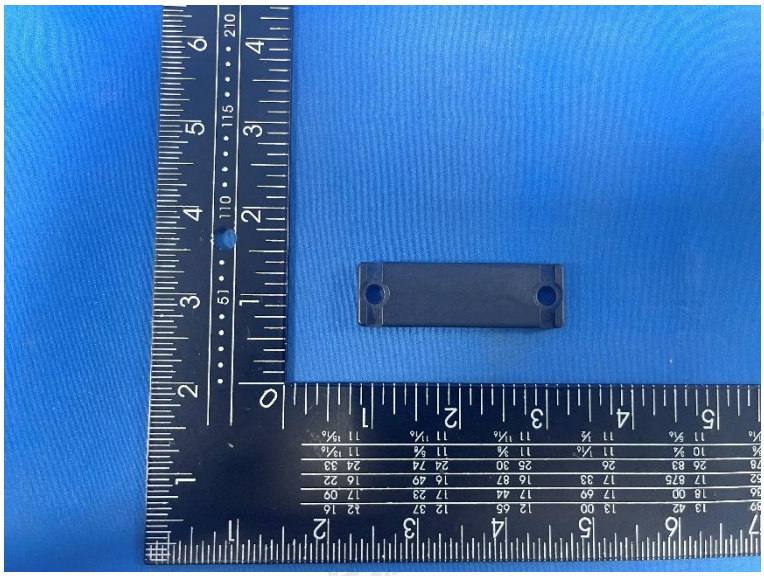
4. Test Setup Photos of the EUT

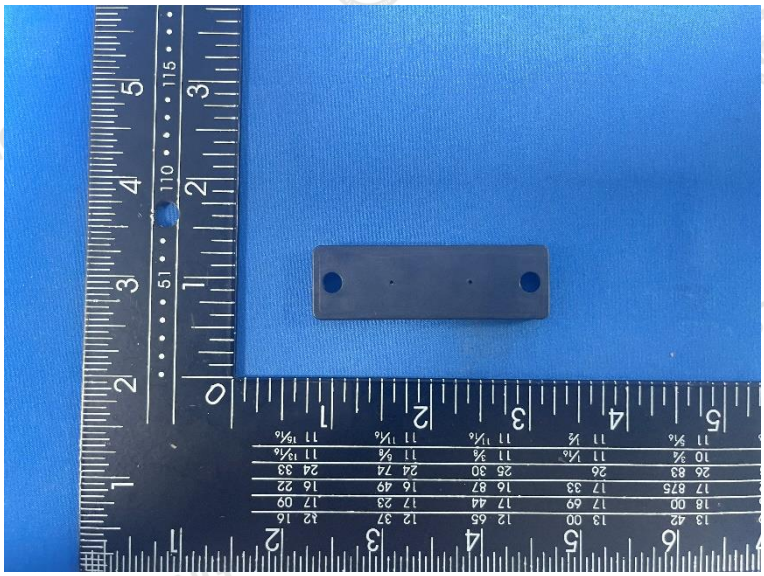


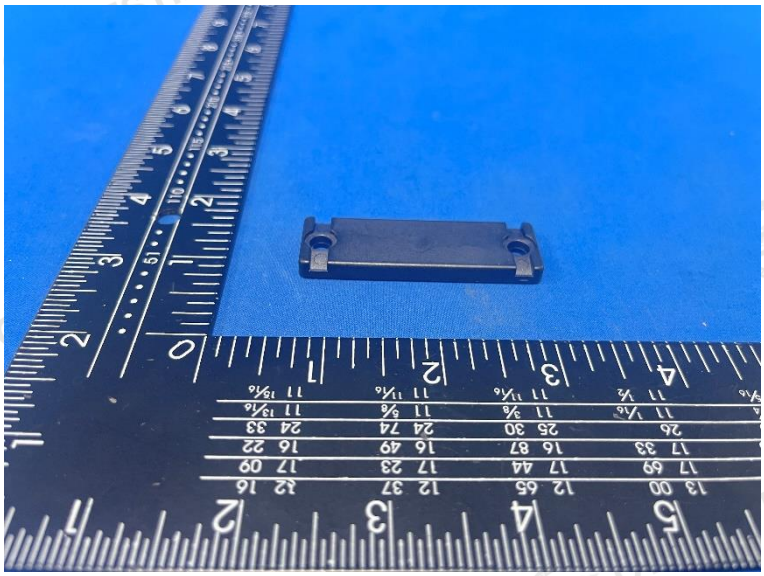


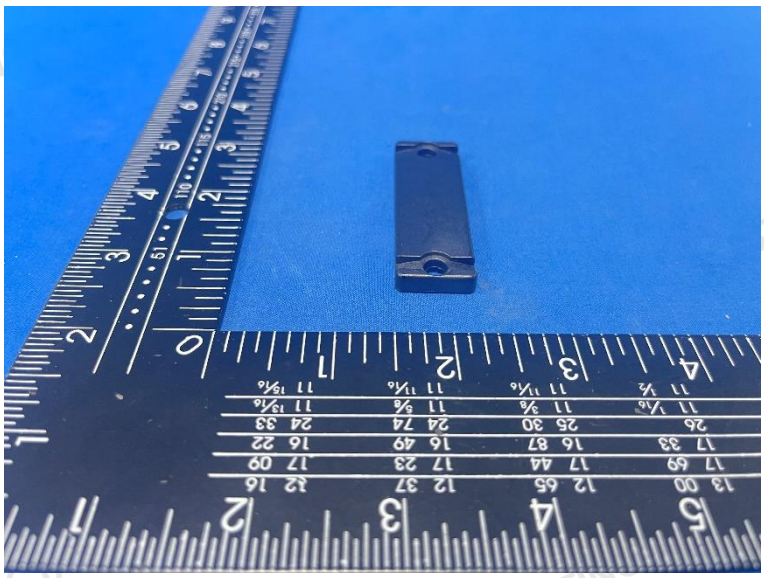


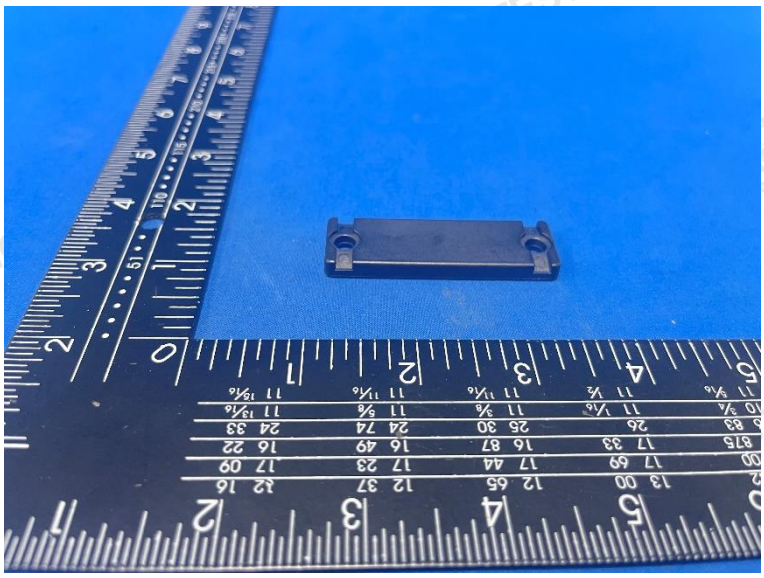
5. Photos of the EUT

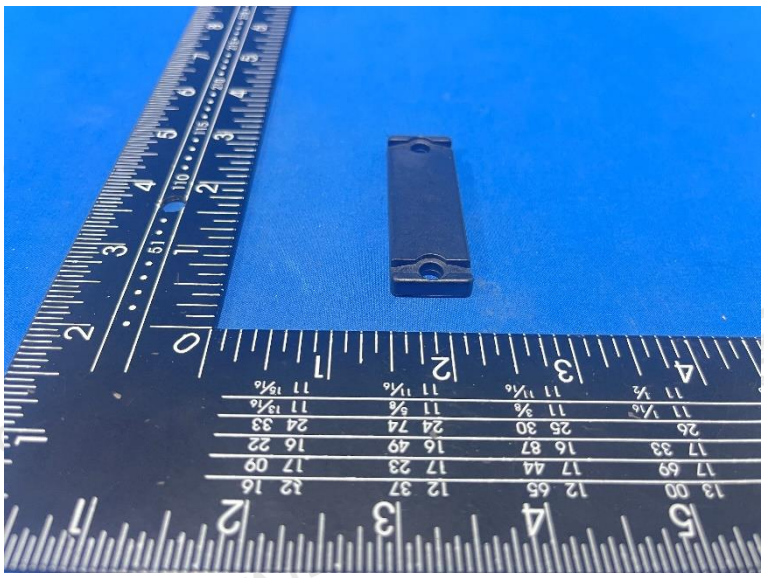


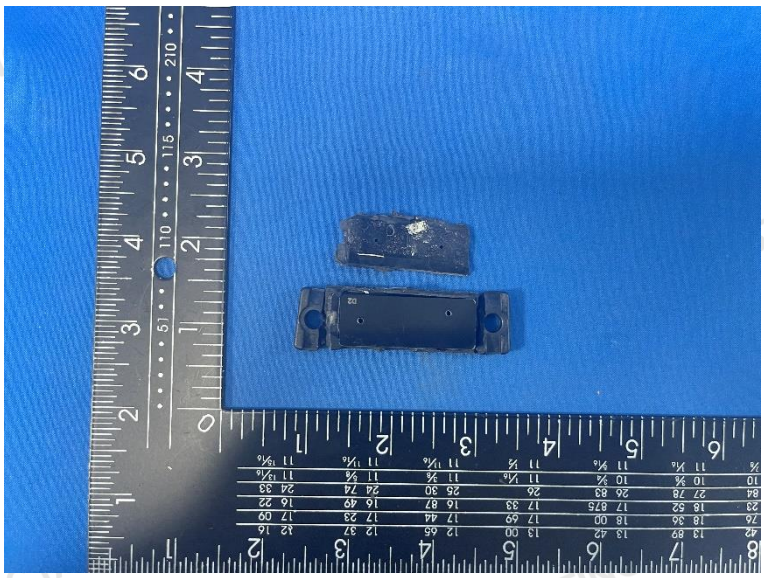


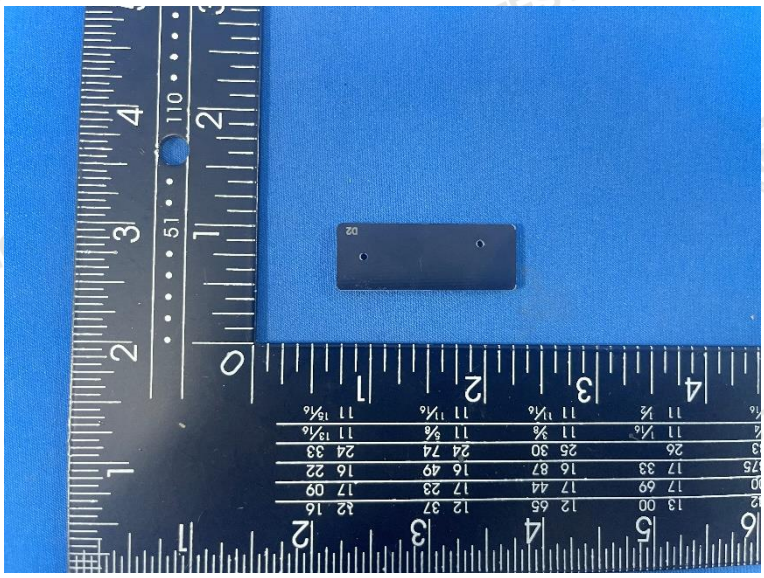


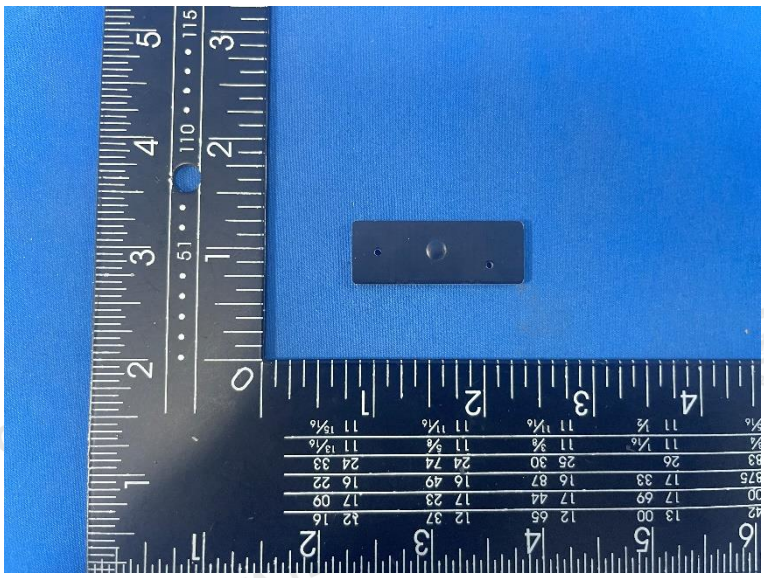


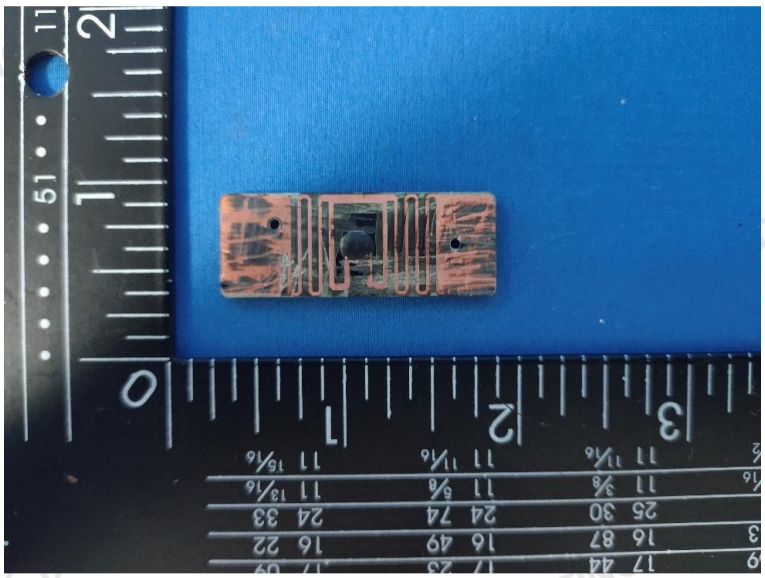












********** End of Report **********