FCC TEST REPORT

FCC ID: QOB-70643

Product	:	Galaxy Wave smart projector Wi-Fi
Model Name	:	70643, 70643-1, 70643-DK1
Brand	:	ecoscapes, enbrighten, Ultrapro, GE, Philips
Report No.	:	PTC22072901501E-FC01

Prepared for

Jasco Products Company LLC

10 e memorial road Building B Attn M Simpkins, oklahoma city, Oklahoma 73114 United States

Prepared by

Precise Testing & Certification Co., Ltd

Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China

1 TEST RESULT CERTIFICATION

Applicant's name	:	Jasco Products Company LLC
Address	:	10 e memorial road Building B Attn M Simpkins, oklahoma city, Oklahoma 73114 United States
Manufacture's name	:	Quang Dong Vu Hao Electronics Co.,Ltd
Address	:	TOAN MY VILLAGE, VOI TOWN,LANG GIANG DISTRICT, BAC,GIANG PROVINCE,VIETNAM
Product name	:	Galaxy Wave smart projector Wi-Fi
Model name	:	70643, 70643-1, 70643-DK1
Standards	:	FCC CFR47 Part 15 Section 15.247
Test procedure	:	ANSI C63.10:2013
Test Date	:	Aug. 01, 2022 to Aug. 08, 2022
Date of Issue	:	Aug. 08, 2022
Test Result	:	Pass

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
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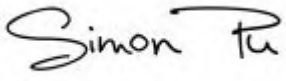
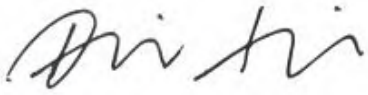
Test Engineer:



Simon Pu / Engineer

Technical Manager:



Ronnie Liu / Manager

Contents

2 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207	PASS
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Conducted Spurious Emission	15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(3)	PASS
Power Spectral Density	15.247(e)	PASS
Antenna Requirement	15.203	PASS
Remark: N/A: Not Applicable		

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Galaxy Wave smart projector Wi-Fi
Model Name	:	70643, 70643-1, 70643-DK1
Specification	:	802.11b/g/n HT20
Operating frequency	:	2412-2462MHz for 802.11b/g/ n(HT20)
Numbers of Channel	:	11 channels
Antenna Type	:	PCB Antenna
Antenna Gain	:	0 dBi
Type of Modulation	:	DSSS with DBPSK/DQPSK/CCK for 802.11b; OFDM with BPSK/QPSK/16QAM/64QAM for 802.11g/n;
Power supply	:	DC 5V 2A
Hardware Version	:	N/A
Software Version	:	N/A

Declaration on model difference

70643, 70643-1 and 70643-DK1 are the same product except model name,-1 means a pack.

3.2 Channel List

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (802.11b: 1 Mbps; 802.11g: 6 Mbps; 802.11n (HT20): MCS0;) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list for 802.11 b/g/n (HT20)

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	5	2432	9	2452
2	2417	6	2437	10	2457
3	2422	7	2442	11	2462
4	2427	8	2447		

The maximum duty cycle as following table:

Test Mode	Duty Cycle(%)
802.11b	100%
802.11g	100%
802.11n(HT20)	100%

3.3 Test Site

Precise Testing & Certification Co., Ltd

Address: Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A

4 Equipment During Test

4.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due	Calibration period
MXG Signal Analyzer	Agilent	N9020A	SER MY5111038	10Hz-30GHz	Aug. 21, 2022	1 year
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Aug. 21, 2022	1 year
Power Meter	Anritsu	ML2495A	0949003	300MHz-40GHz	Aug. 21, 2022	1 year
Power Sensor	Anritsu	MA2411B	0917017	300MHz-40GHz	Aug. 21, 2022	1 year

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due	Calibration period
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Aug. 21, 2022	1 year
Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	Aug. 21, 2022	1 year
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Aug. 21, 2022	1 year
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Aug. 21, 2022	1 year
Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	Aug. 21, 2022	1 year
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-40GHz	Aug. 21, 2022	1 year
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Aug. 21, 2022	1 year
Power Amplifier	LUNAR EM	LNA1G18-40	J1010000008 1	1GHz-26.5GHz	Aug. 21, 2022	1 year

Horn Antenna	SCHWARZBECK	BBHA 9170	9170-181	14GHz-40GHz	Aug. 21, 2022	1 year
Amplifier	SCHWARZBECK	BBV 9721	9721-205	18GHz-40GHz	Aug. 21, 2022	1 year
Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Aug. 21, 2022	1 year
RF Cable	R&S	R204	R21X	1GHz-40GHz	Aug. 21, 2022	1 year

Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due	Calibration period
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Aug. 21, 2022	1 year
Artificial Mains Network	Rohde&Schwarz	ENV216	102453	9KHz-300MHz	Aug. 21, 2022	1 year
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	9KHz-300MHz	Aug. 21, 2022	1 year

4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10^{-6}
Bandwidth	± 1.5 x 10^{-6}
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(9kHz~30MHz)	±3.15dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB

4.3 Description of Support Units

Equipment	Model No.	Series No.
N/A	N/A	N/A

5 Conducted Emission

Test Requirement:	:	FCC CFR 47 Part 15 Section 15.207
Test Method	:	ANSI C63.10: 2013
Test Result	:	PASS
Frequency Range	:	150kHz to 30MHz
Class/Severity	:	Class B

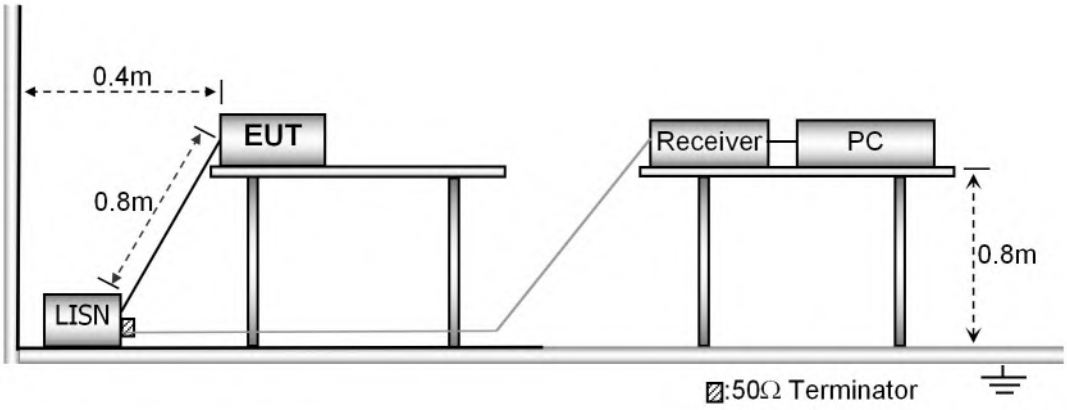
5.1 E.U.T. Operation

Operating Environment :

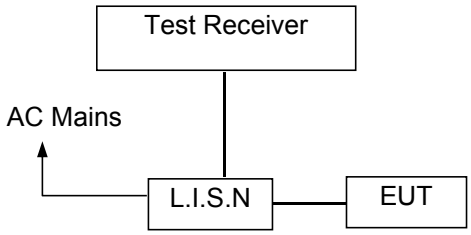
Temperature	:	23.9 °C
Humidity	:	51.4 % RH
Atmospheric Pressure	:	101.21kPa

5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



5.3 Test SET-UP (Block Diagram of Configuration)



5.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

5.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:
1. The lower limit shall apply at the transition frequencies
2.The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

5.6 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

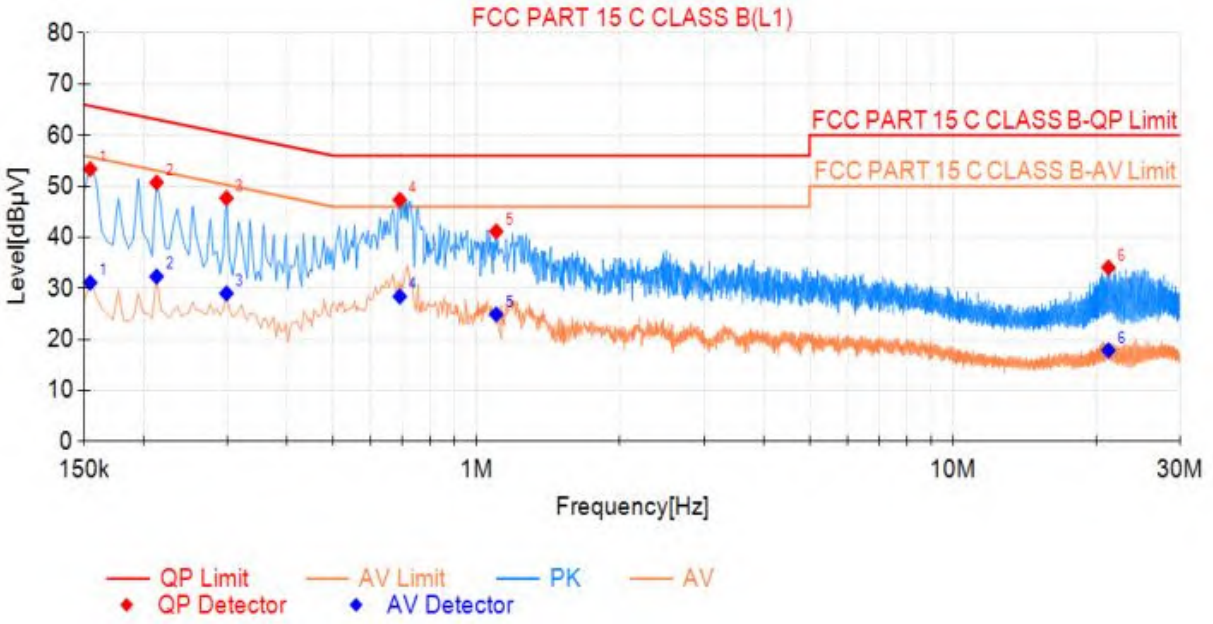
5.7 Conducted Emission Test Result

Pass.

During the test, the 120Vac/60Hz and 240Vac/60Hz power supplies were scanned in advance, and it was found that (120Vac/60Hz, TX 802.11b Low Channel) was a poor mode, and the report only reflected the poor mode.

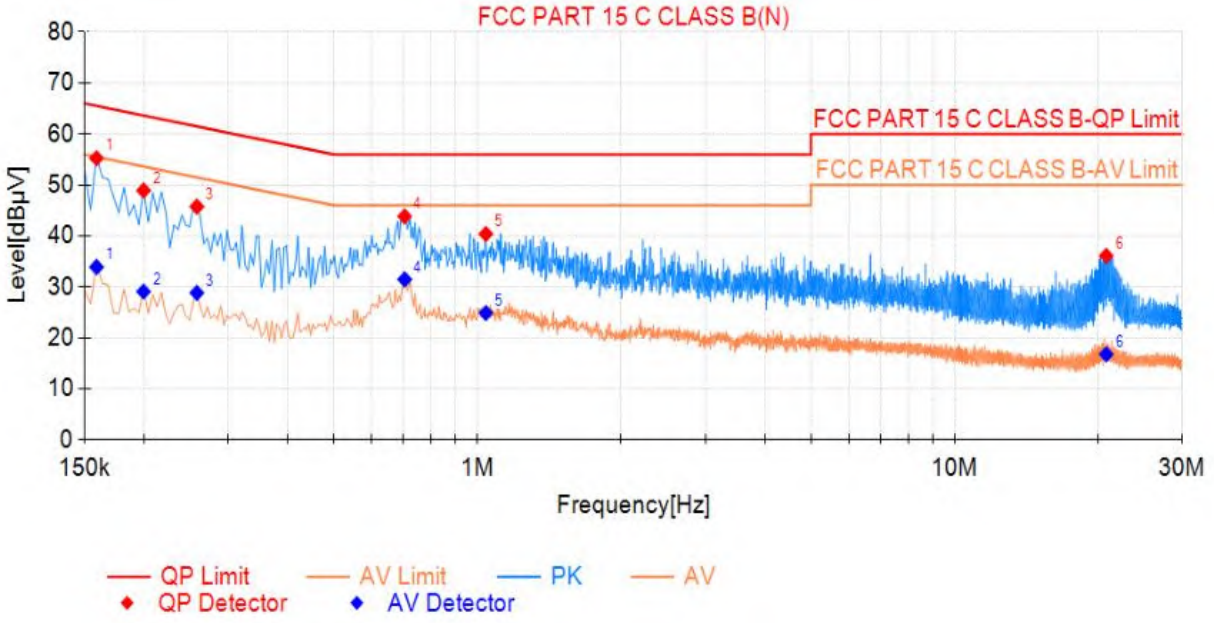
Please refer to the following pages.

Line- AC 120V/60Hz



Final Data List								
NO.	Freq. [MHz]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.155	53.38	65.75	12.37	31.13	55.75	24.62	PASS
2	0.213	50.74	63.09	12.35	32.33	53.09	20.76	PASS
3	0.299	47.68	60.28	12.60	29.02	50.28	21.26	PASS
4	0.690	47.35	56.00	8.65	28.42	46.00	17.58	PASS
5	1.100	41.16	56.00	14.84	24.92	46.00	21.08	PASS
6	21.192	34.10	60.00	25.90	17.87	50.00	32.13	PASS

Neutral-AC 120V/60Hz



Final Data List								
NO.	Freq. [MHz]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.159	55.26	65.52	10.26	33.91	55.52	21.61	PASS
2	0.200	48.92	63.63	14.71	29.10	53.63	24.53	PASS
3	0.258	45.76	61.50	15.74	28.84	51.50	22.66	PASS
4	0.704	43.85	56.00	12.15	31.48	46.00	14.52	PASS
5	1.041	40.40	56.00	15.60	24.90	46.00	21.10	PASS
6	20.792	36.12	60.00	23.88	16.80	50.00	33.20	PASS

6 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method : ANSI C63.10:2013

Test Result : PASS

Measurement Distance : 3m

Limit : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

6.1 EUT Operation

Operating Environment :

Temperature: : 24.5 °C

Humidity: : 52 % RH

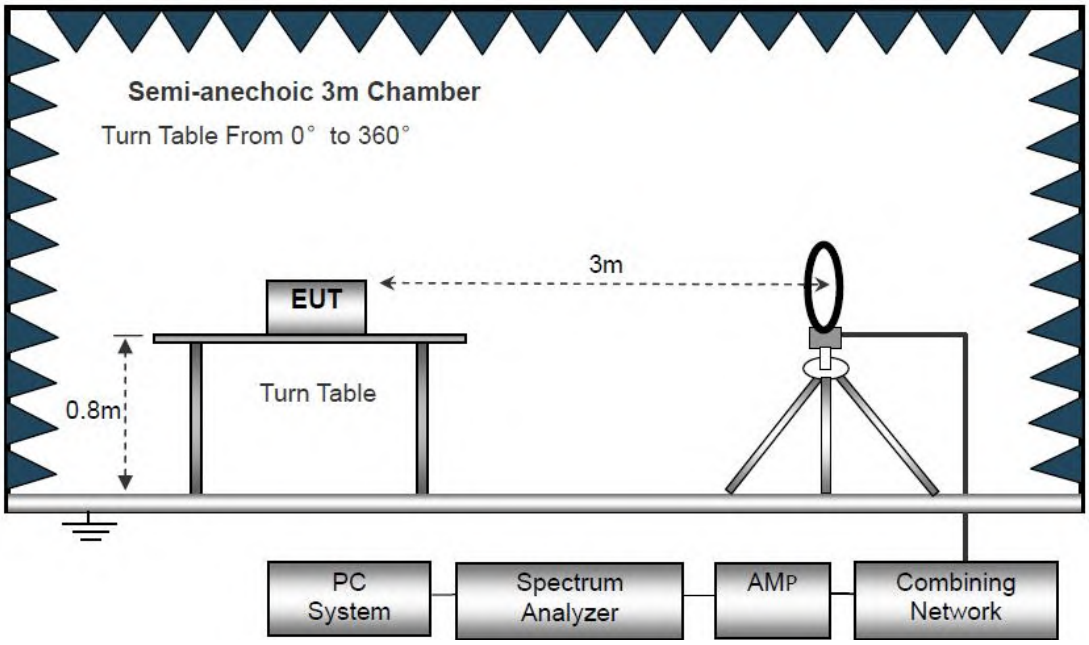
Atmospheric Pressure: : 101.3kPa

Test Voltage : AC 120V 60Hz

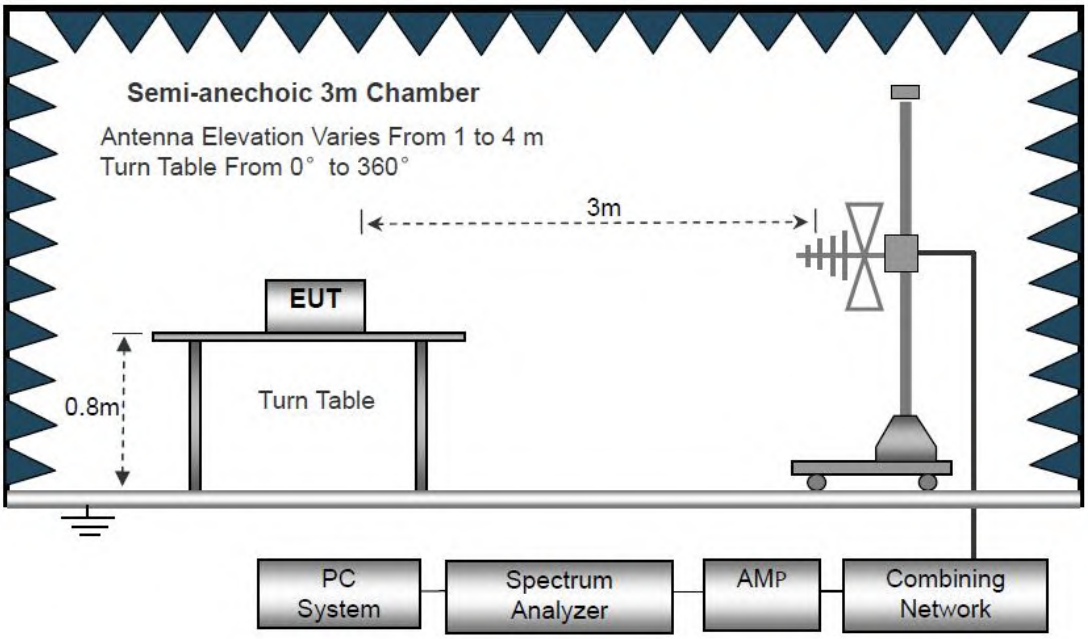
6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

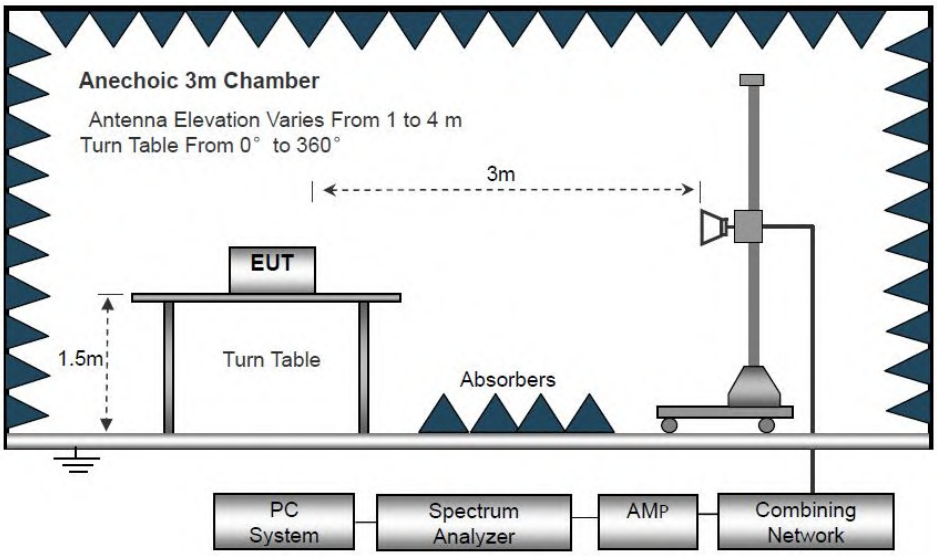
The test setup for emission measurement below 30MHz



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz



6.3 Spectrum Analyzer Setup

	Frequency	Detector	RBW	VBW	Remark
Receiver Setup	Below 30MHz	--	10kHz	10kHz	--
	30MHz ~ 1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value

6.4 Test Procedure

1. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane, And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.

3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.

5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

6. Repeat above procedures until the measurements for all frequencies are complete.

7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

8. The test above 1GHz must be use the fully anechoic room, and the test below 1GHz use the half anechoic room

6.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	>20

Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

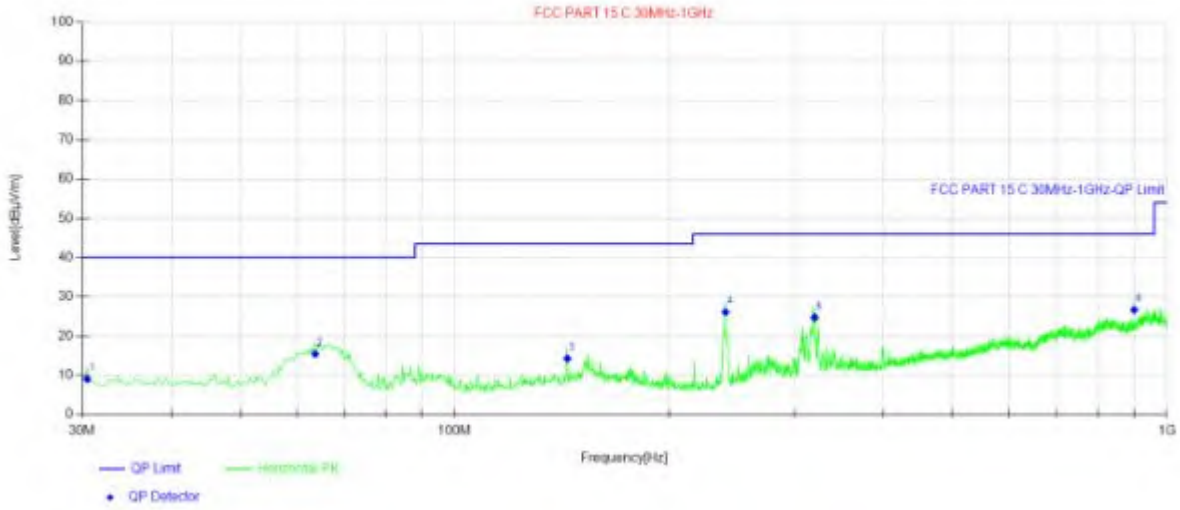
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

All the modulation modes were tested the data of the worst mode (TX 802.11b Low Channel) are recorded in the following pages and the others modulation methods do not exceed the limits.

Please refer to the following test plots:

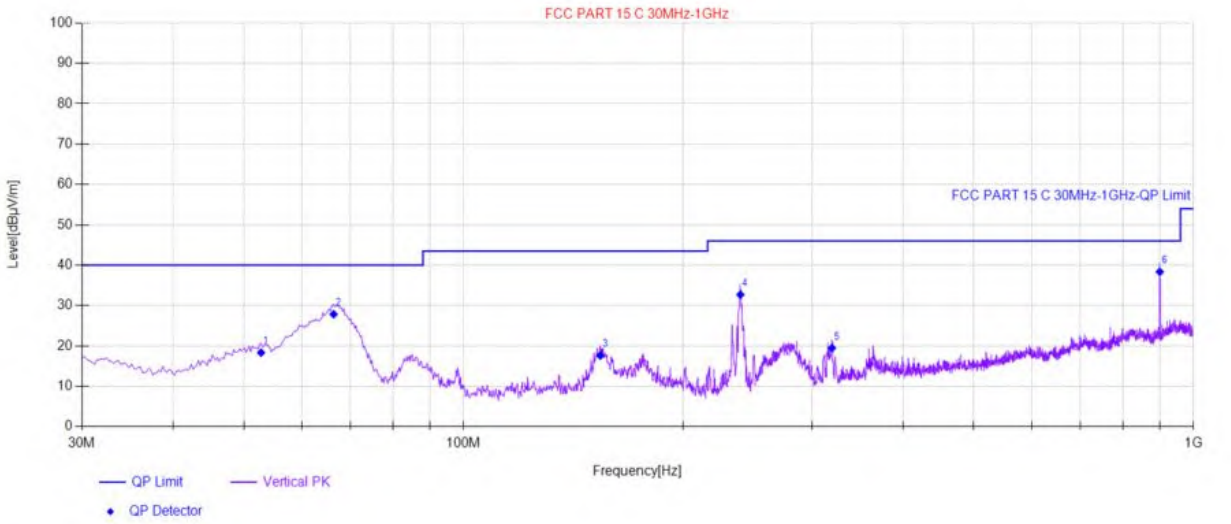
Antenna Polarization: Horizontal



Final Data List[QP]							
NO.	Freq. [MHz]	QP Reading [dBµV/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Polarity
1	30.49	27.37	-18.32	9.05	40.00	30.95	Horizontal
2	63.71	33.81	-18.36	15.45	40.00	24.55	Horizontal
3	143.98	30.76	-16.46	14.30	43.50	29.20	Horizontal
4	240.01	43.74	-17.62	26.12	46.00	19.88	Horizontal
5	320.03	39.63	-14.86	24.77	46.00	21.23	Horizontal
6	899.36	29.73	-3.02	26.71	46.00	19.29	Horizontal

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Antenna Polarization: Vertical



Final Data List[QP]							
NO.	Freq. [MHz]	QP Reading [dBµV/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Polarity
1	52.80	36.14	-17.80	18.34	40.00	21.66	Vertical
2	66.38	46.6	-18.74	27.86	40.00	12.14	Vertical
3	153.92	33.73	-16.11	17.62	43.50	25.88	Vertical
4	239.52	50.36	-17.66	32.70	46.00	13.30	Vertical
5	319.79	34.37	-14.87	19.50	46.00	26.50	Vertical
6	899.36	41.38	-3.02	38.36	46.00	7.64	Vertical

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Test Frequency: From 1GHz to 18GHz

Worst case 802.11b

Test Mode: 2412				Test channel: Lowest				
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4824	47.13	32.35	4.12	28.44	55.16	74	-18.84	V
7236	38.08	36.08	6.3	27.74	52.72	74	-21.28	V
9648	35.99	38.25	7.91	24.65	57.50	74	-16.50	V
4824	43.01	32.35	4.12	28.44	51.04	74	-22.96	H
7236	38.97	36.08	6.3	27.74	53.61	74	-20.39	H
9648	34.49	38.25	7.91	24.65	56.00	74	-18.00	H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4824	31.25	32.35	4.12	28.44	39.28	54	-14.72	V
7236	23.38	36.08	6.3	27.74	38.02	54	-15.98	V
9648	21.20	38.25	7.91	24.65	42.71	54	-11.29	V
4824	30.57	32.35	4.12	28.44	38.60	54	-15.40	H
7236	24.76	36.08	6.3	27.74	39.40	54	-14.60	H
9648	20.46	38.25	7.91	24.65	41.97	54	-12.03	H

Worst case 802.11b

Test Mode: 2437				Test channel: Middle				
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4874	47.18	32.35	4.12	28.44	55.21	74	-18.79	V
7311	38.55	36.08	6.3	27.74	53.19	74	-20.81	V
9748	35.56	38.25	7.91	24.65	57.07	74	-16.93	V
4874	42.58	32.35	4.12	28.44	50.61	74	-23.39	H
7311	39.03	36.08	6.3	27.74	53.67	74	-20.33	H
9748	34.79	38.25	7.91	24.65	56.30	74	-17.70	H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4874	31.79	32.35	4.12	28.44	39.82	54	-14.18	V
7311	24.98	36.08	6.3	27.74	39.62	54	-14.38	V
9748	20.01	38.25	7.91	24.65	41.52	54	-12.48	V
4874	30.90	32.35	4.12	28.44	38.93	54	-15.07	H
7311	24.38	36.08	6.3	27.74	39.02	54	-14.98	H
9748	21.89	38.25	7.91	24.65	43.40	54	-10.60	H

Worst case 802.11b

Test Mode: 2462				Test channel: High				
Peak Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4924	46.32	32.41	4.14	28.42	54.45	74	-19.55	V
7386	38.60	36.15	6.36	27.68	53.43	74	-20.57	V
9848	35.23	38.35	7.97	24.33	57.22	74	-16.78	V
4924	43.04	32.41	4.14	28.42	51.17	74	-22.83	H
7386	37.84	36.15	6.36	27.68	52.67	74	-21.33	H
9848	34.65	38.35	7.97	24.33	56.64	74	-17.36	H
Average Value								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.
4924	31.78	32.41	4.14	28.42	39.91	54	-14.09	V
7386	23.25	36.15	6.36	27.68	38.08	54	-15.92	V
9848	21.07	38.35	7.97	24.33	43.06	54	-10.94	V
4924	30.68	32.41	4.14	28.42	38.81	54	-15.19	H
7386	25.17	36.15	6.36	27.68	40.00	54	-14.00	H
9848	21.23	38.35	7.97	24.33	43.22	54	-10.78	H

Note:

1. The testing has been conformed to 10*2462MHz=24620MHz.
2. All other emissions more than 30dB below the limit.
3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
   Emission Level = Reading + Factor
   Margin=Emission Level-Limit
4. X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

2.4G WiFi (802.11b/g/n)mode have been tested, and the worst result(802.11g) was report as below
Test Mode: Worst case 802.11g Low Channel 2412MHz

Test Mode: 802.11g Low Channel 2412MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2390	48.87	27.39	2.77	34.01	45.02	74	-28.98	H	Peak
2400	60.26	27.42	2.78	34.01	56.45	74	-17.55	H	
2390	47.17	27.39	2.77	34.01	43.32	74	-30.68	V	
2400	55.88	27.42	2.78	34.01	52.07	74	-21.93	V	
2390	40.27	27.39	2.77	34.01	36.42	54	-17.58	H	Average
2400	43.65	27.42	2.78	34.01	39.84	54	-14.16	H	
2390	39.36	27.39	2.77	34.01	35.51	54	-18.49	V	
2400	44.47	27.42	2.78	34.01	40.66	54	-13.34	V	

Test Mode: Worst case 802.11g High Channel 2462MHz

Test Mode: 802.11g High Channel 2462MHz									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	Polarity H/V	Test Value
2483.5	60.83	27.39	2.77	34.01	56.98	74	-17.02	H	Peak
2500	49.04	27.42	2.78	34.01	45.23	74	-28.77	H	
2483.5	59.09	27.39	2.77	34.01	55.24	74	-18.76	V	
2500	48.49	27.42	2.78	34.01	44.68	74	-29.32	V	
2483.5	42.23	27.39	2.77	34.01	38.38	54	-15.62	H	Average
2500	40.26	27.42	2.78	34.01	36.45	54	-17.55	H	
2483.5	43.94	27.39	2.77	34.01	40.09	54	-13.91	V	
2500	39.52	27.42	2.78	34.01	35.71	54	-18.29	V	

Test Frequency: From 18GHz to 25GHz

The measurements were more than 20dB below the limit and not reported.

7 Conducted Spurious Emission

Test Requirement : FCC CFR47 Part 15 Section 15.247
Test Method : ANSI C63.10:2013
Test Limit : Regulation 15.247 (d),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 conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies 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. 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) (see §15.205(c)).

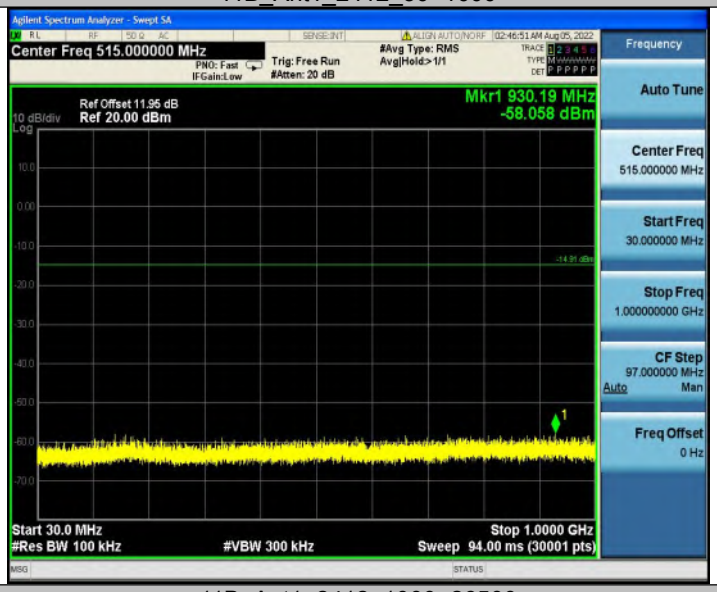
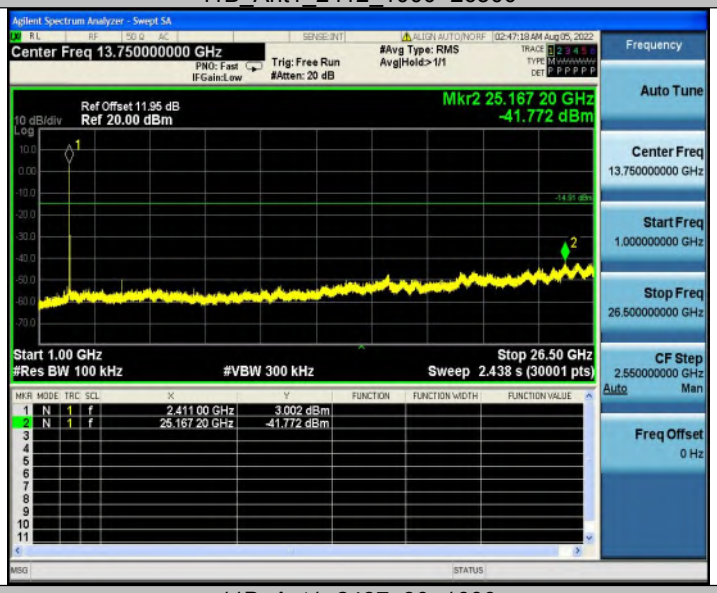
7.1 Test Procedure

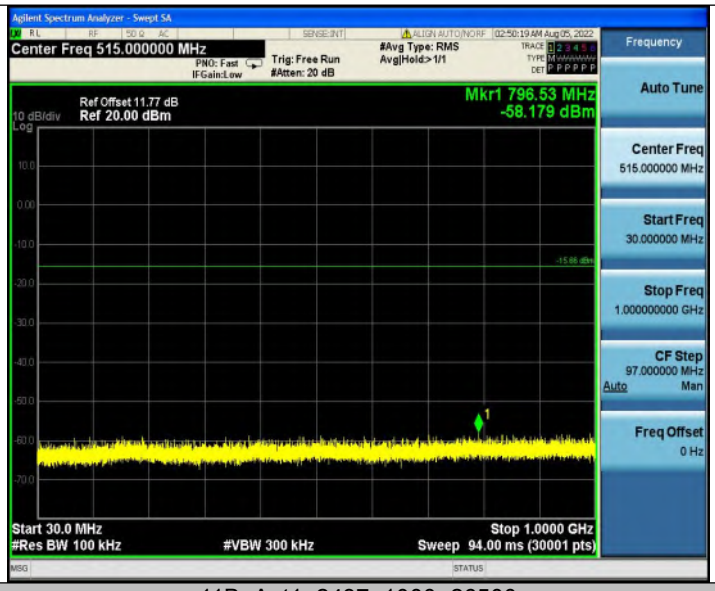
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

7.2 Test Result

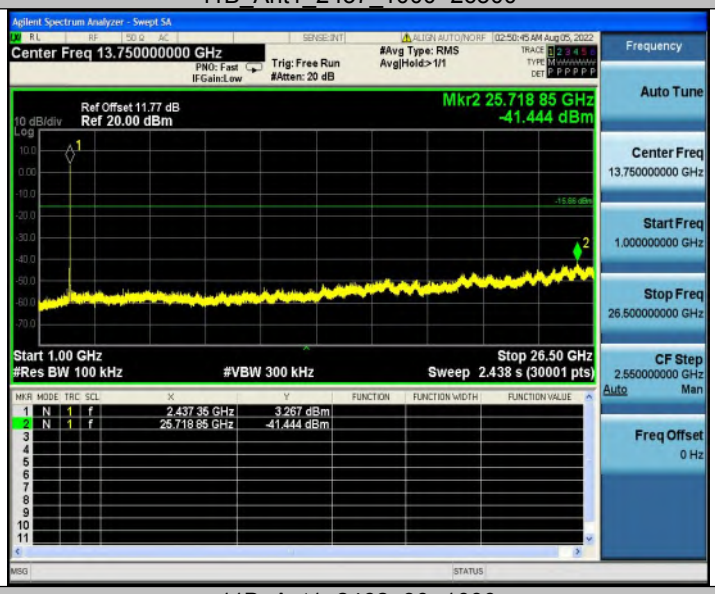
TestMode	Antenna	Frequency[MHz]	FreqRange [Mhz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	30~1000	5.09	-58.06	≤-14.91	PASS
			1000~26500	5.09	-41.77	≤-14.91	PASS
		2437	30~1000	4.34	-58.18	≤-15.66	PASS
			1000~26500	4.34	-41.44	≤-15.66	PASS
		2462	30~1000	5.51	-58	≤-14.49	PASS
			1000~26500	5.51	-41.74	≤-14.49	PASS
11G	Ant1	2412	30~1000	1.95	-57.69	≤-18.05	PASS
			1000~26500	1.95	-41.48	≤-18.05	PASS
		2437	30~1000	1.66	-57.24	≤-18.34	PASS
			1000~26500	1.66	-41.53	≤-18.34	PASS
		2462	30~1000	2.56	-58	≤-17.44	PASS
			1000~26500	2.56	-42.04	≤-17.44	PASS
11N20SISO	Ant1	2412	30~1000	-0.97	-57.13	≤-20.97	PASS
			1000~26500	-0.97	-41.77	≤-20.97	PASS
		2437	30~1000	-2.02	-57.94	≤-22.02	PASS
			1000~26500	-2.02	-41.9	≤-22.02	PASS
		2462	30~1000	-2.61	-57.86	≤-22.61	PASS
			1000~26500	-2.61	-41.26	≤-22.61	PASS

Test Graphs:

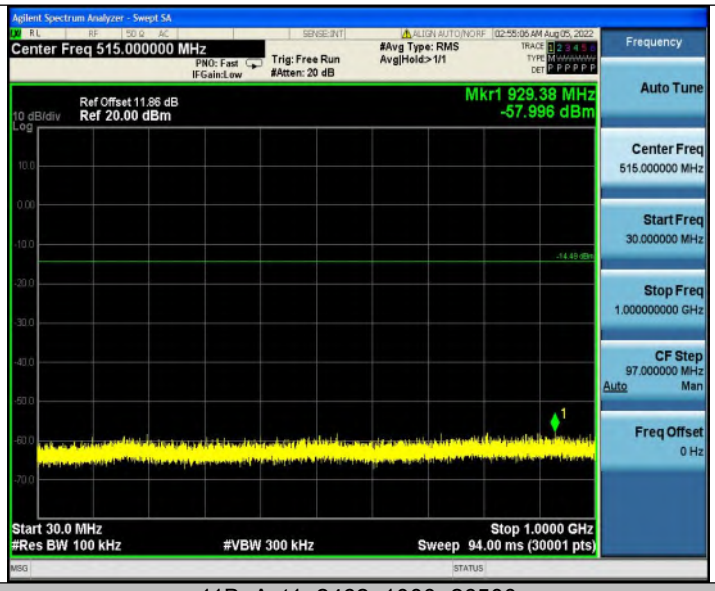
11B_Ant1_2412_30~1000

11B_Ant1_2412_1000~26500

11B_Ant1_2437_30~1000



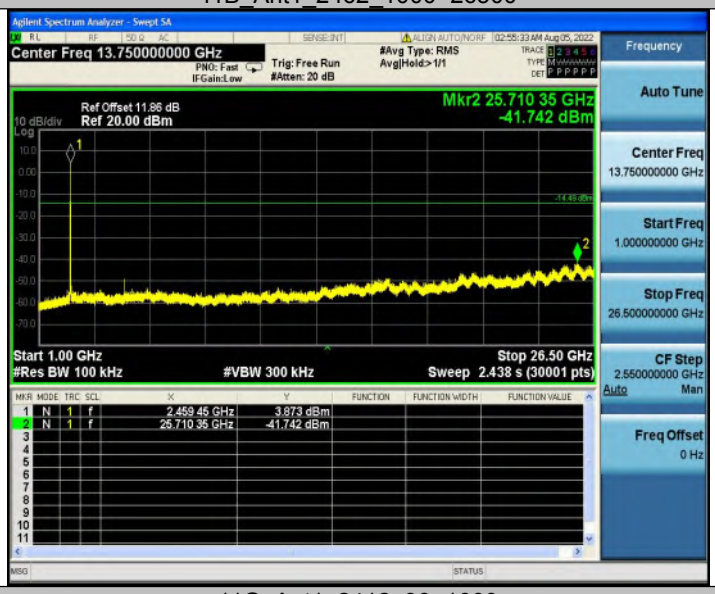
11B_Ant1_2437_1000~26500



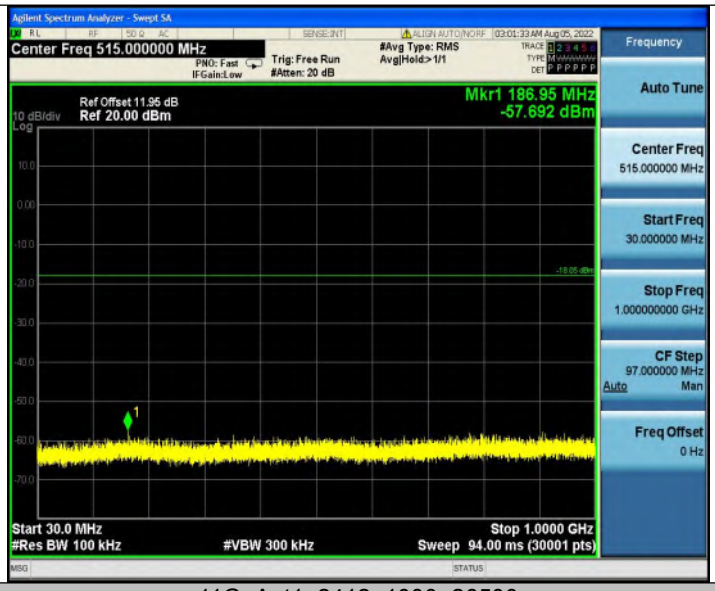
11B_Ant1_2462_30~1000



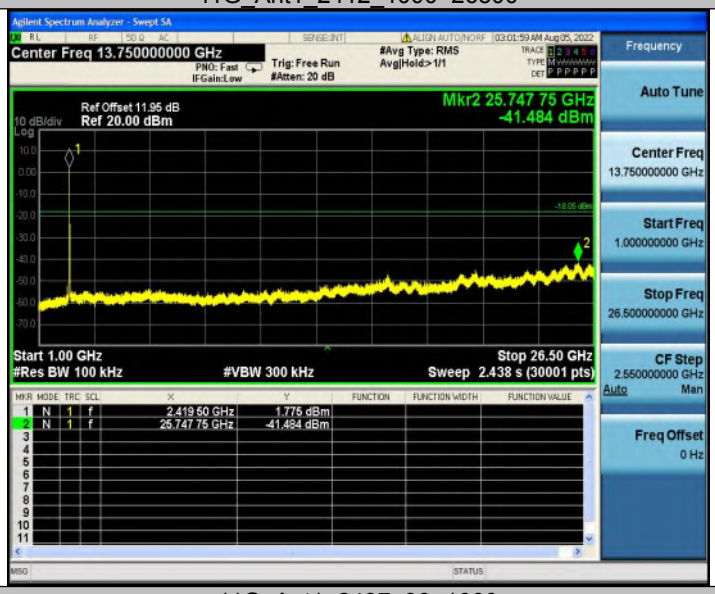
11B_Ant1_2462_1000~26500



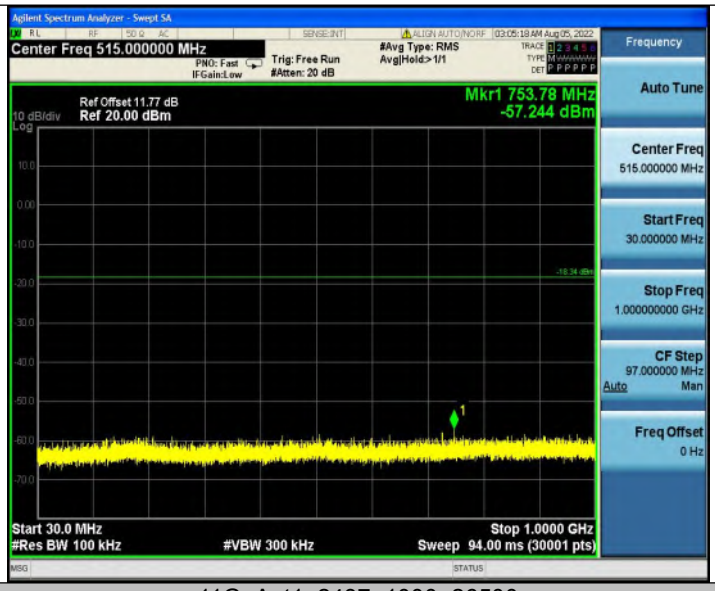
11G_Ant1_2412_30~1000



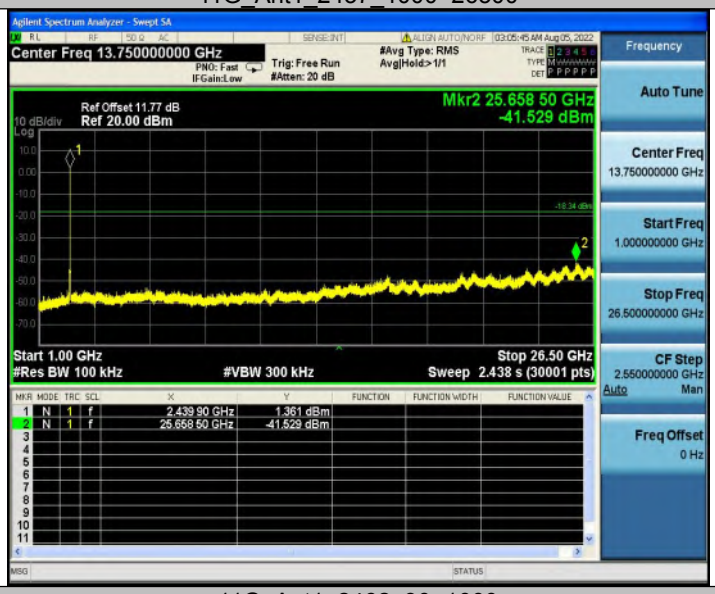
11G_Ant1_2412_1000~26500



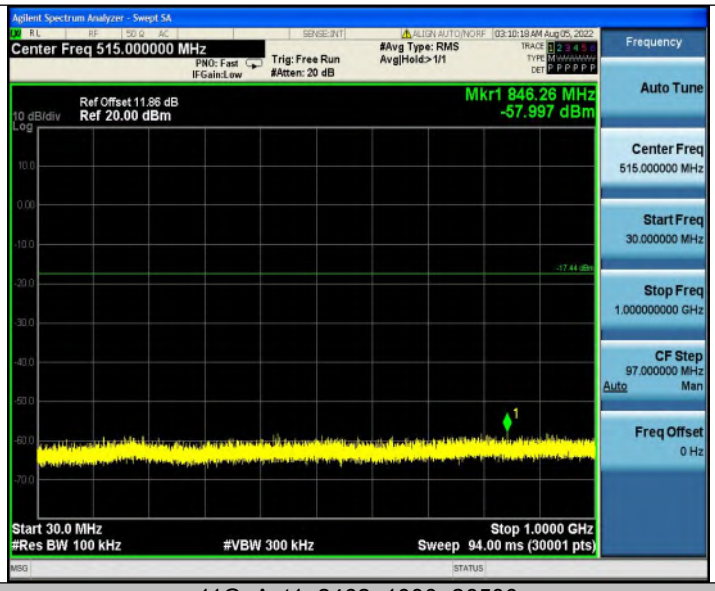
11G_Ant1_2437_30~1000



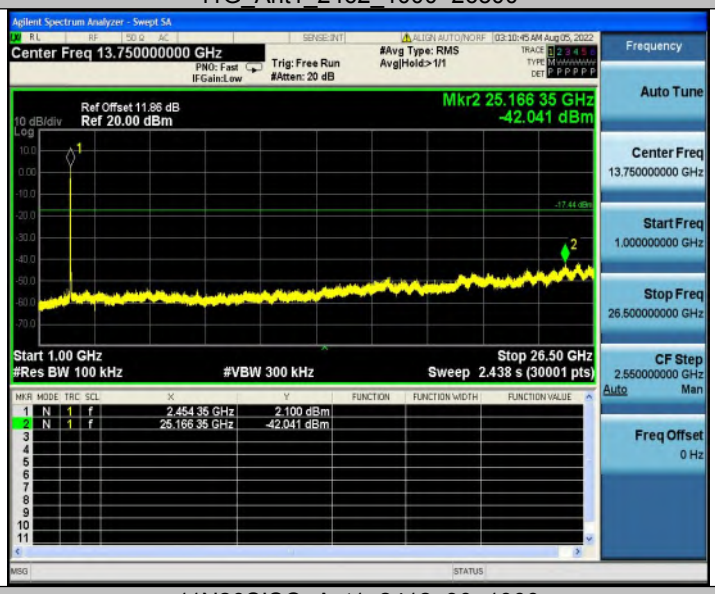
11G_Ant1_2437_1000~26500



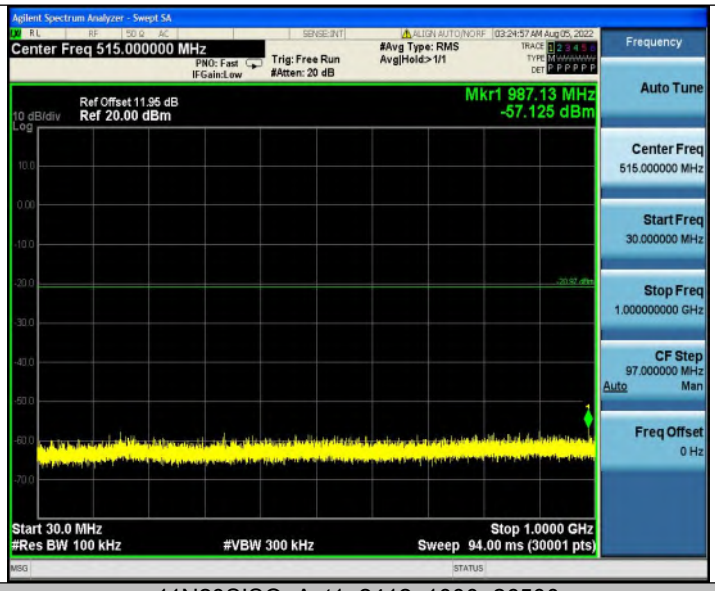
11G_Ant1_2462_30~1000



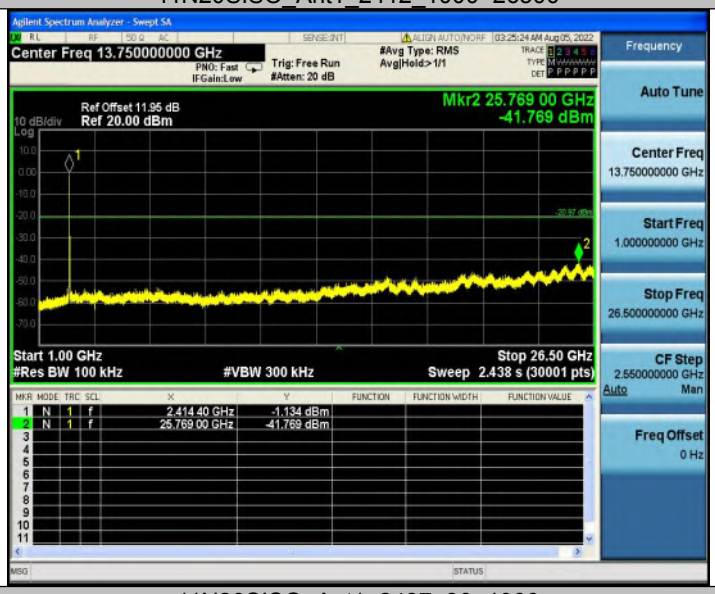
11G_Ant1_2462_1000~26500



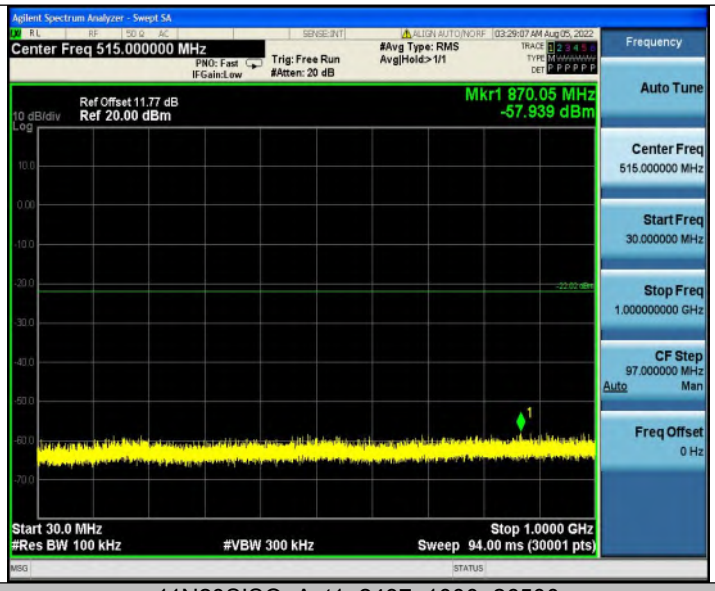
11N20SISO_Ant1_2412_30~1000



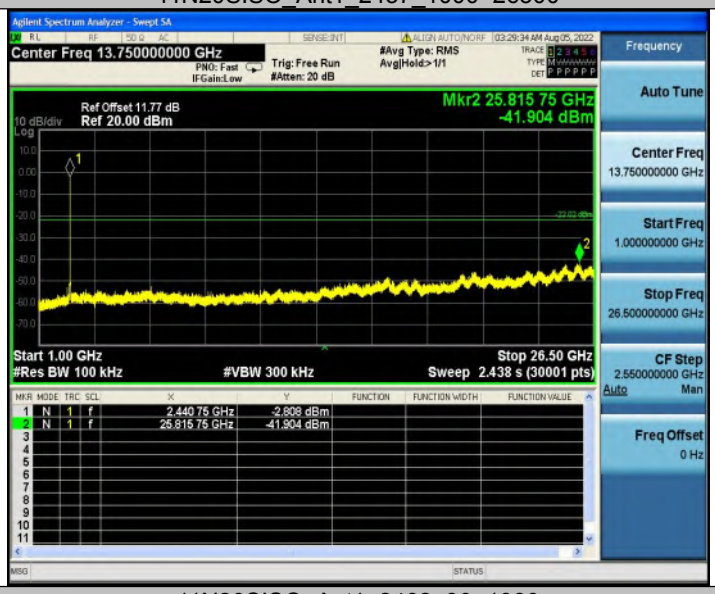
11N20SISO_Ant1_2412_1000~26500



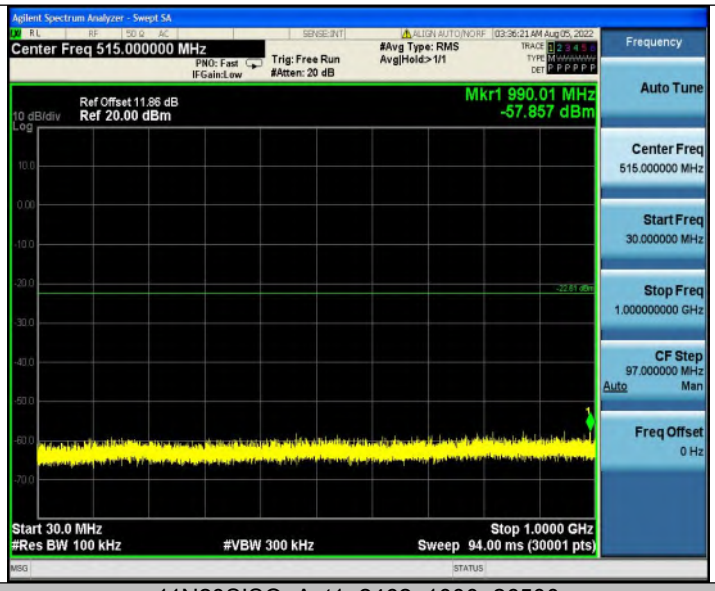
11N20SISO_Ant1_2437_30~1000



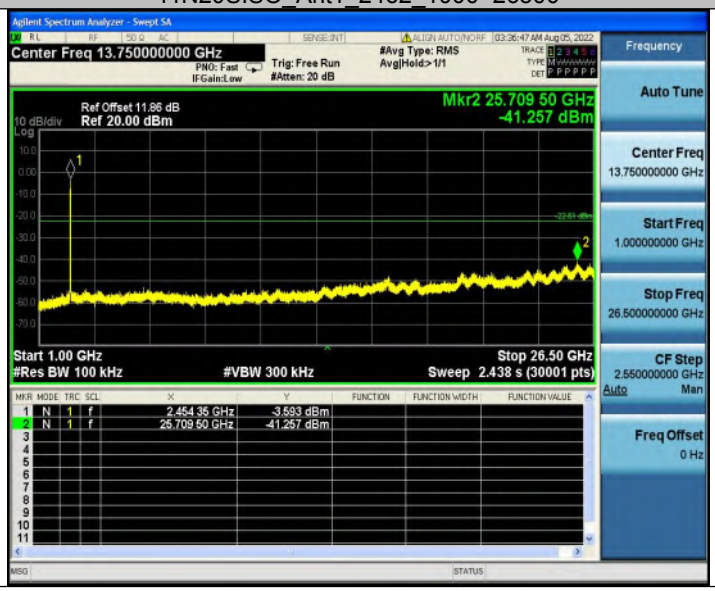
11N20SISO_Ant1_2437_1000~26500



11N20SISO_Ant1_2462_30~1000



11N20SISO_Ant1_2462_1000~26500



8 Band Edge Measurement

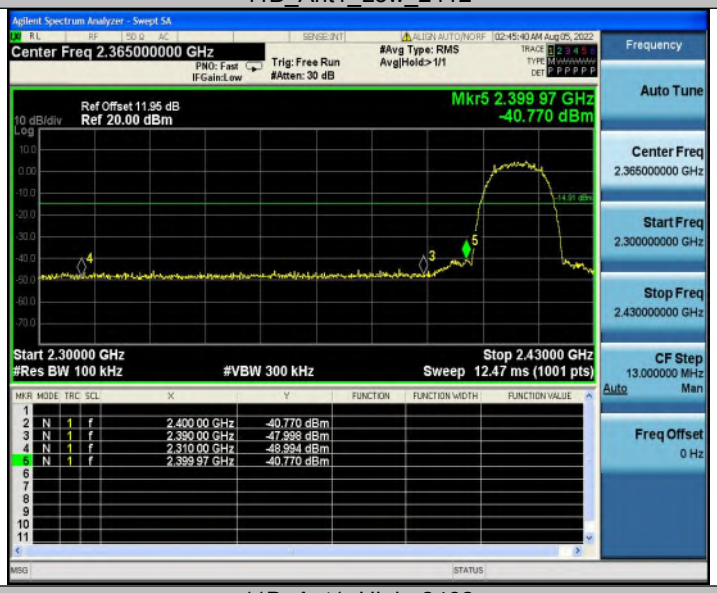
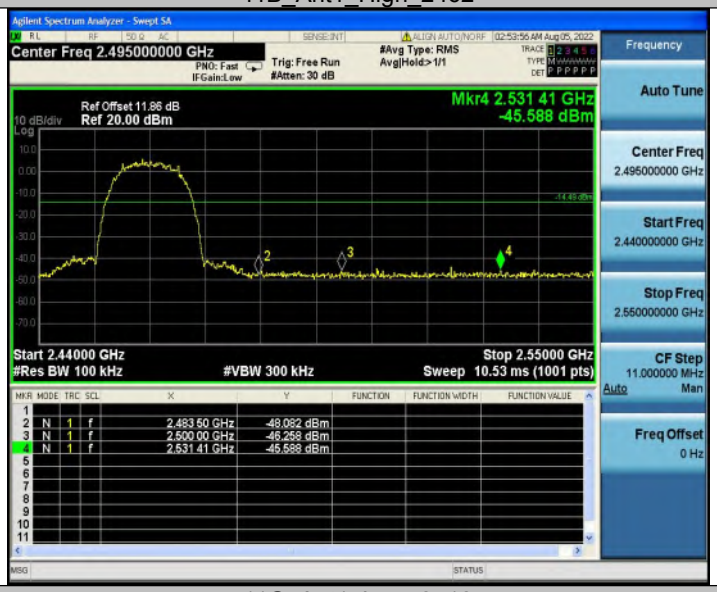
Test Requirement	:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method	:	ANSI C63.10:2013
Test Limit	:	Regulation 15.247 (d),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 conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies 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. 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) (see §15.205(c)).

8.1 Test Procedure

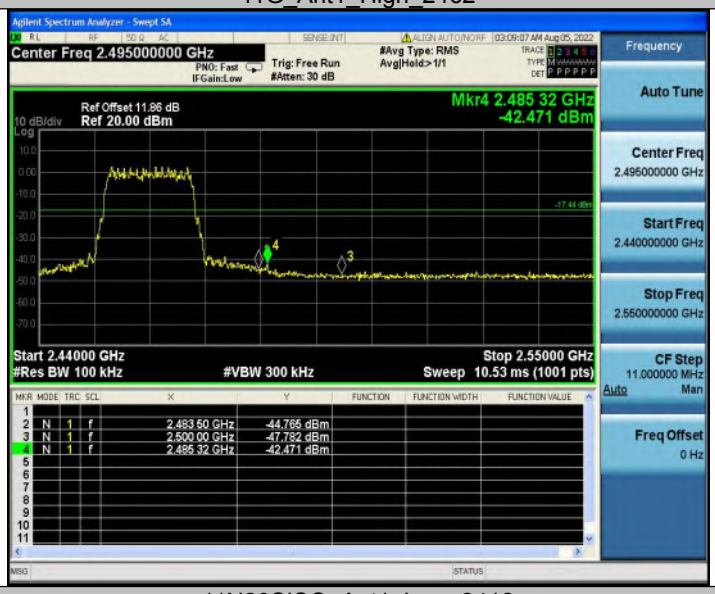
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

8.2 Test Result

TestMode	Antenna	ChName	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	5.09	-40.77	≤-14.91	PASS
		High	2462	5.51	-45.59	≤-14.49	PASS
11G	Ant1	Low	2412	1.95	-39.77	≤-18.05	PASS
		High	2462	2.56	-42.47	≤-17.44	PASS
11N20SISO	Ant1	Low	2412	-0.97	-41.98	≤-20.97	PASS
		High	2462	-2.61	-45.63	≤-22.61	PASS

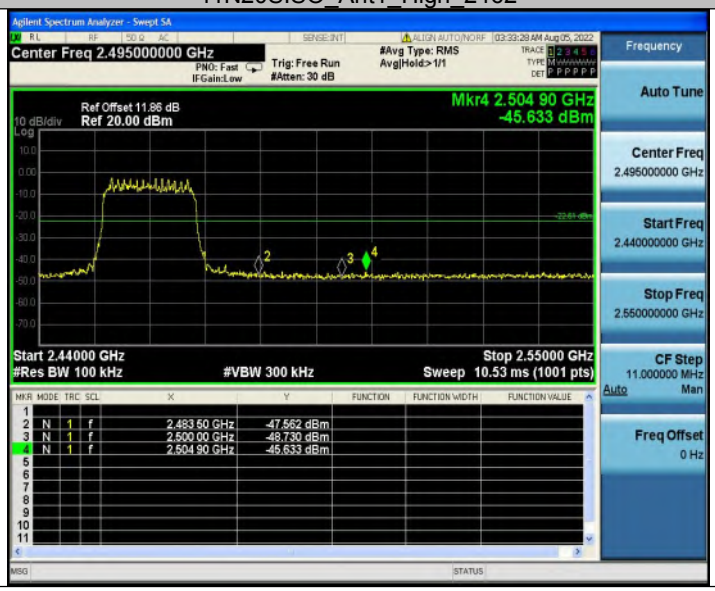
11B_Ant1_Low_2412

11B_Ant1_High_2462

11G_Ant1_Low_2412

11G_Ant1_High_2462



11N20SISO_Ant1_Low_2412

11N20SISO_Ant1_High_2462



9 6dB Bandwidth Measurement

Test Requirement	:	FCC CFR47 Part 15 Section 15.247
Test Method	:	ANSI C63.10:2013
Test Limit		Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

9.1 Test Procedure

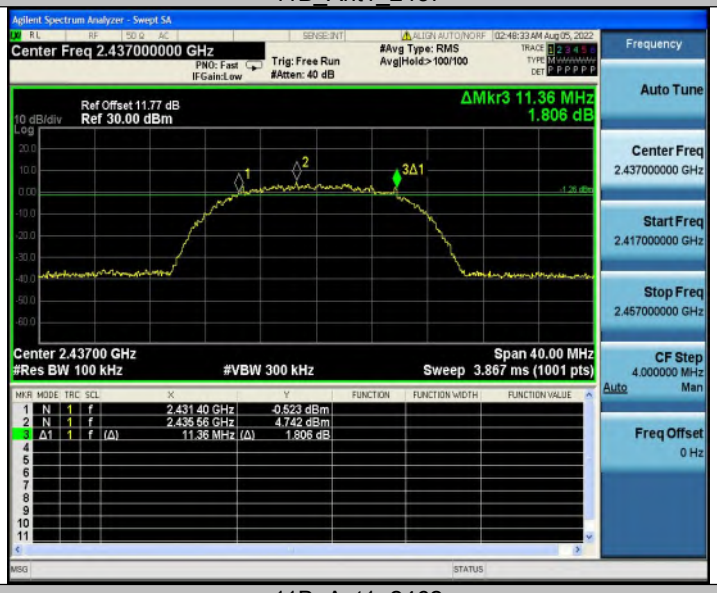
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

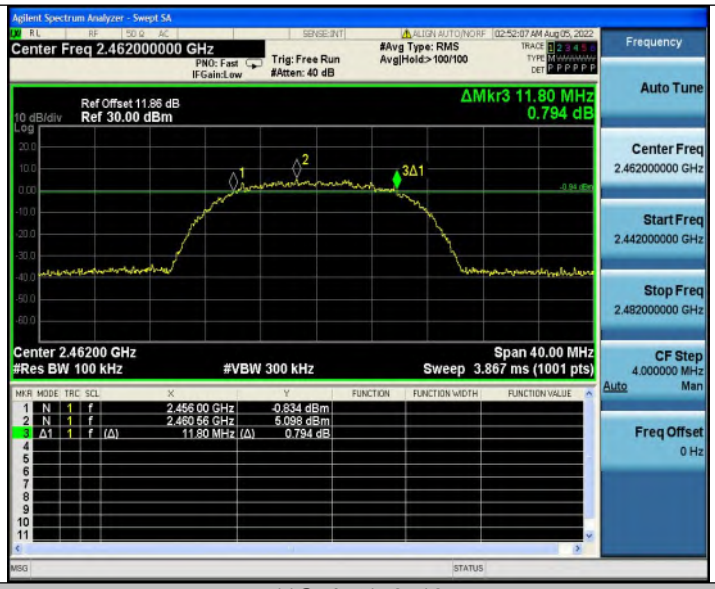
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

9.2 Test Result

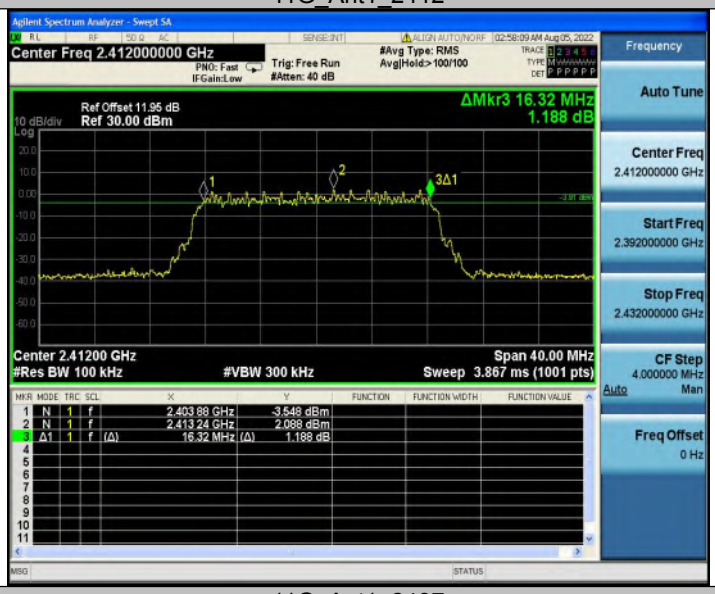
TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	11.400	2406.400	2417.800	0.5	PASS
		2437	11.360	2431.400	2442.760	0.5	PASS
		2462	11.800	2456.000	2467.800	0.5	PASS
11G	Ant1	2412	16.320	2403.880	2420.200	0.5	PASS
		2437	16.400	2428.800	2445.200	0.5	PASS
		2462	16.400	2453.800	2470.200	0.5	PASS
11N20SISO	Ant1	2412	16.920	2403.520	2420.440	0.5	PASS
		2437	16.960	2428.480	2445.440	0.5	PASS
		2462	16.920	2453.480	2470.400	0.5	PASS

11B_Ant1_2412

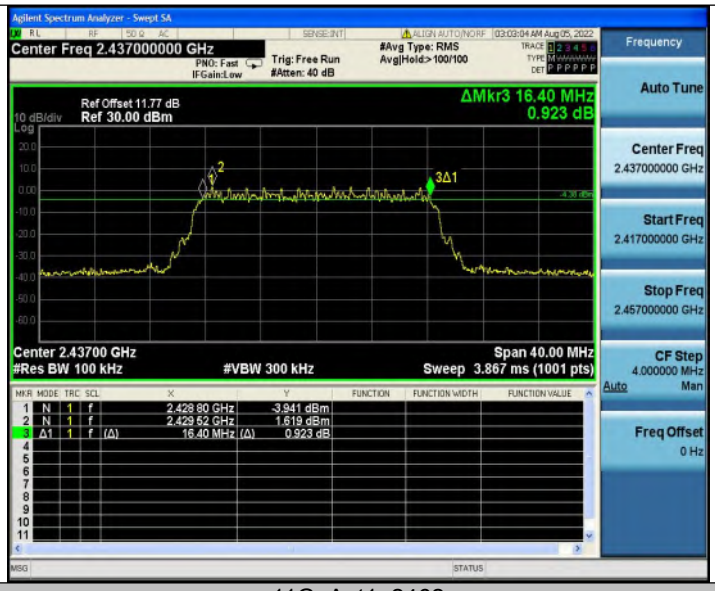
11B_Ant1_2437

11B_Ant1_2462



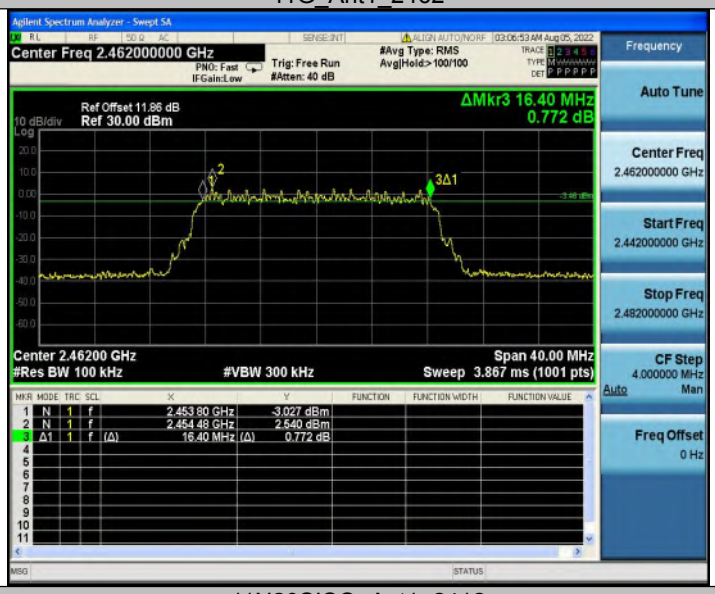
11G_Ant1_2412



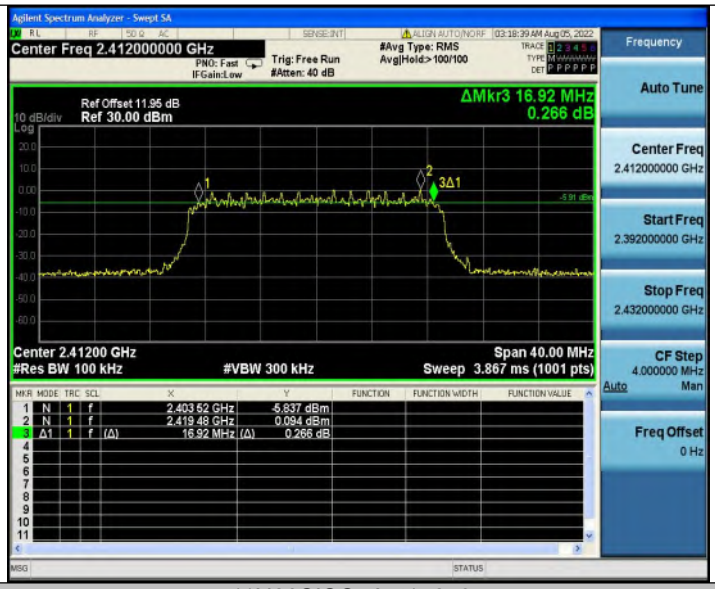
11G_Ant1_2437



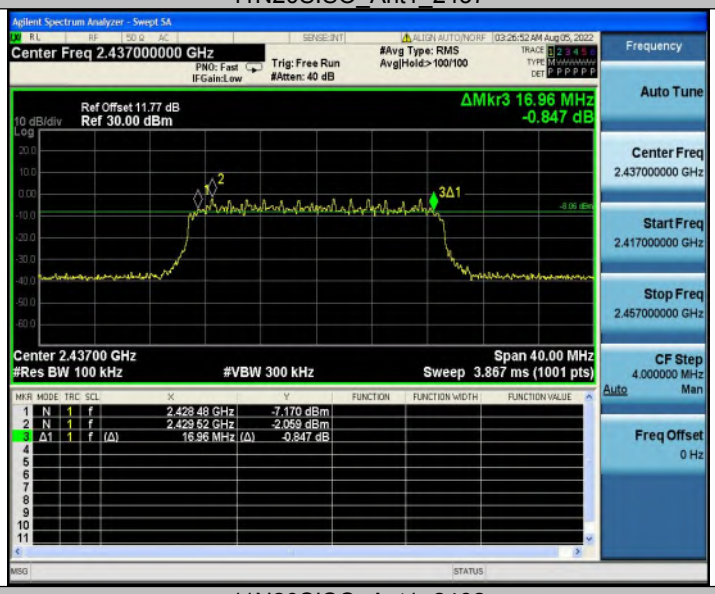
11G_Ant1_2462



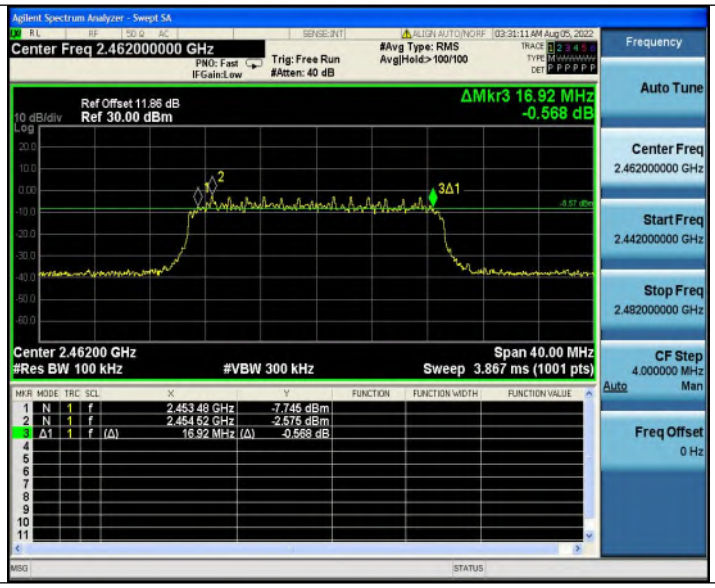
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold:>100/100
Ref Offset 11.86 dB
10 dB/div
Ref 30.00 dBm
ΔMkr3 16.92 MHz
-0.568 dB
Center 2.46200 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 40.00 MHz
Sweep 3.867 ms (1001 pts)
1 N 1 f 2.453 48 GHz -7.745 dBm
2 N 1 f 2.454 52 GHz -2.575 dBm
3 Δ1 1 f (Δ) 16.92 MHz (Δ) -0.568 dB
Frequency
Auto Tune
Center Freq
2.462000000 GHz
Start Freq
2.442000000 GHz
Stop Freq
2.482000000 GHz
CF Step
4.000000 MHz
Auto
Man
Freq Offset
0 Hz

10 Maximum conducted output power

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

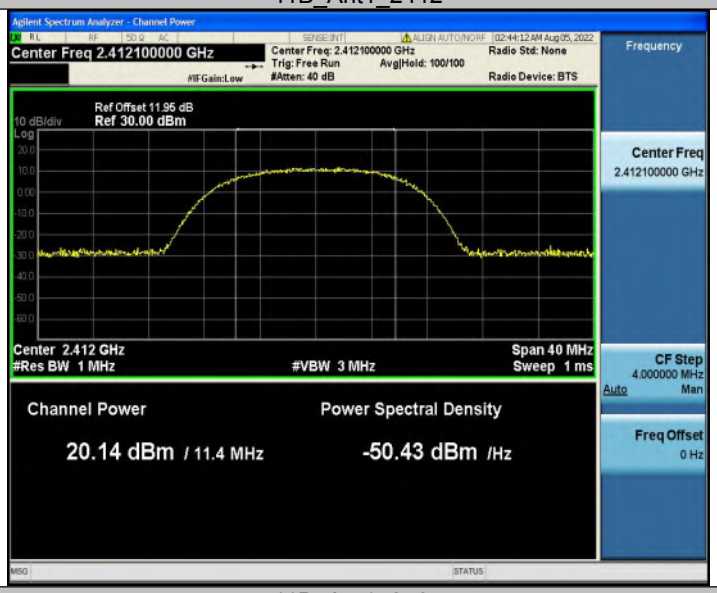
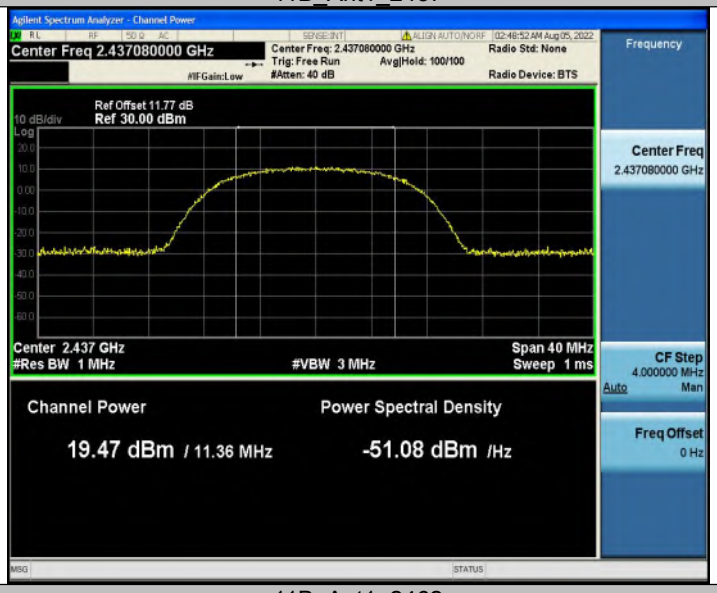
Test Limit : Regulation 15.247 (b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

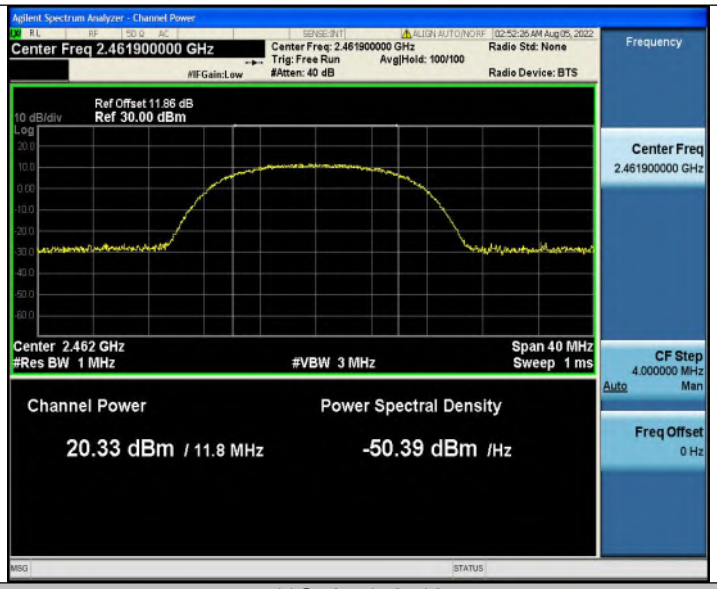
10.1 Test Procedure

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 D01 15.247 Meas Guidance v05 section 8.3.2.2.
2. The RF output of EUT Connect the antenna port(s) to the spectrum analyzer input. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

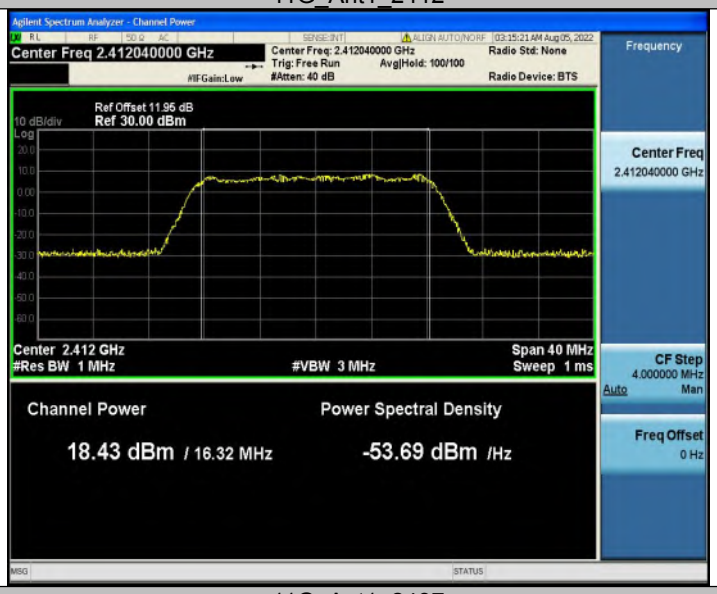
10.2 Test Result

TestMode	Antenna	Frequency[MHz]	Set Power	Peak Powert[dBm]	Conducted Limit[dBm]	EIRP [dBm]	EIRP Limit[dBm]	Verdict
11B	Ant1	2412	---	20.14	≤30.00	20.14	≤36.00	PASS
		2437	---	19.47	≤30.00	19.47	≤36.00	PASS
		2462	---	20.33	≤30.00	20.33	≤36.00	PASS
11G	Ant1	2412	---	18.43	≤30.00	18.43	≤36.00	PASS
		2437	---	17.45	≤30.00	17.45	≤36.00	PASS
		2462	---	16.82	≤30.00	16.82	≤36.00	PASS
11N20SISO	Ant1	2412	---	17.06	≤30.00	17.06	≤36.00	PASS
		2437	---	16.14	≤30.00	16.14	≤36.00	PASS
		2462	---	15.38	≤30.00	15.38	≤36.00	PASS

11B_Ant1_2412

11B_Ant1_2437

11B_Ant1_2462



11G_Ant1_2412



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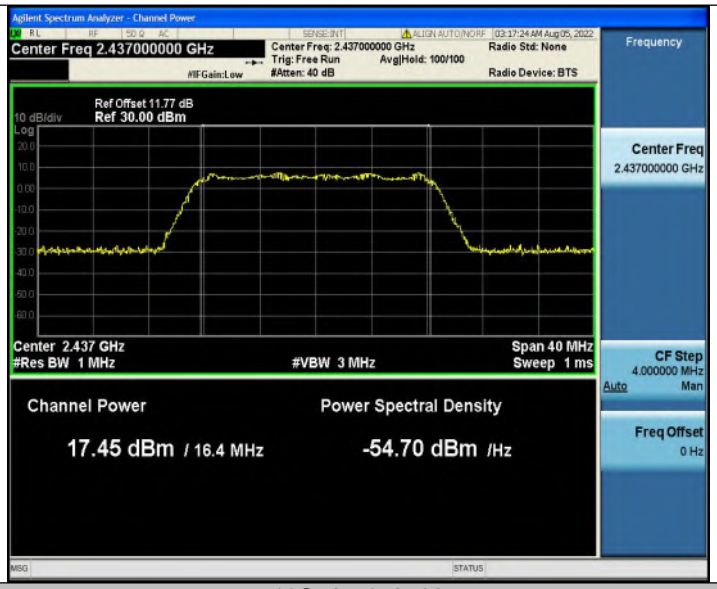
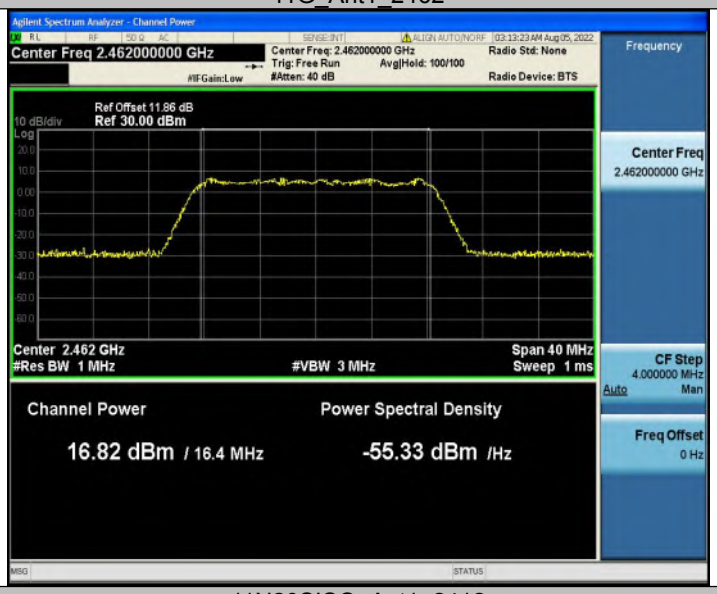
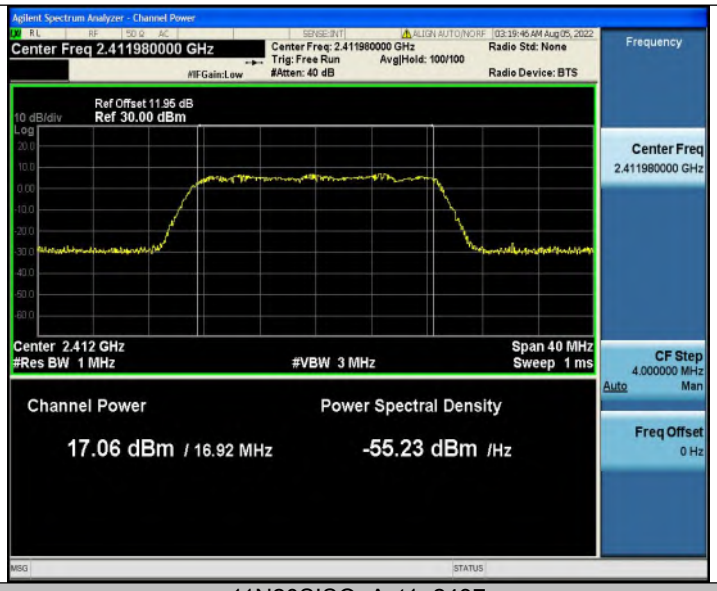


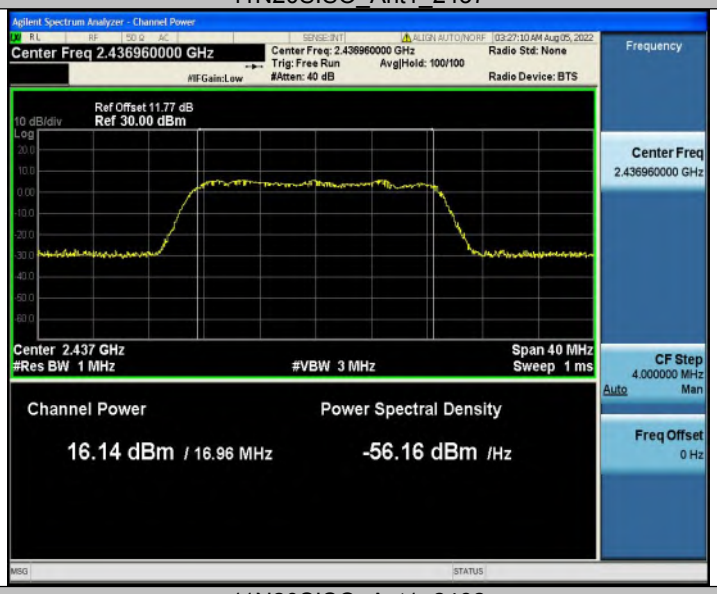
11G_Ant1_2462



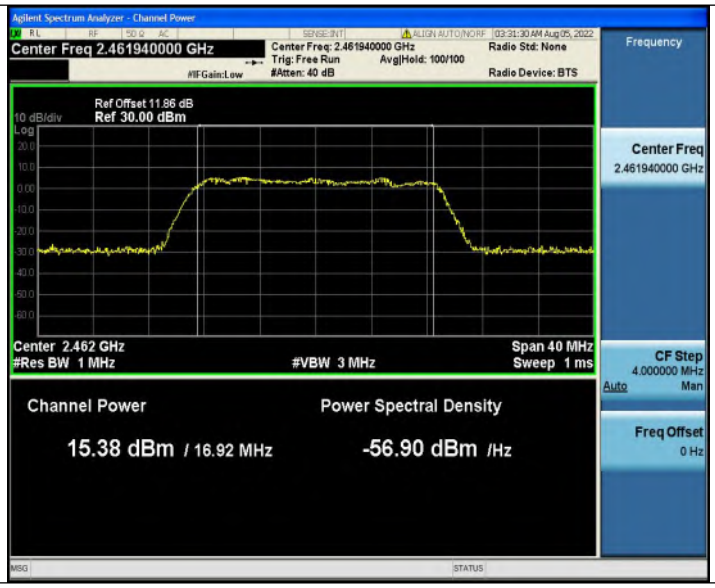
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462


Agilent Spectrum Analyzer - Channel Power
Center Freq 2.461940000 GHz
Center Freq: 2.461940000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 40 dB
Radio Std: None
Radio Device: BTS
Ref Offset 11.86 dB
10 dB/div
Ref 30.00 dBm
Log
Center 2.462 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 40 MHz
Sweep 1 ms
Channel Power
15.38 dBm / 16.92 MHz
Power Spectral Density
-56.90 dBm /Hz
Frequency
Center Freq
2.461940000 GHz
CF Step
4.000000 MHz
Auto
Man
Freq Offset
0 Hz

11 Power Spectral density

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

Test Limit : Regulation 15.247(f) The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

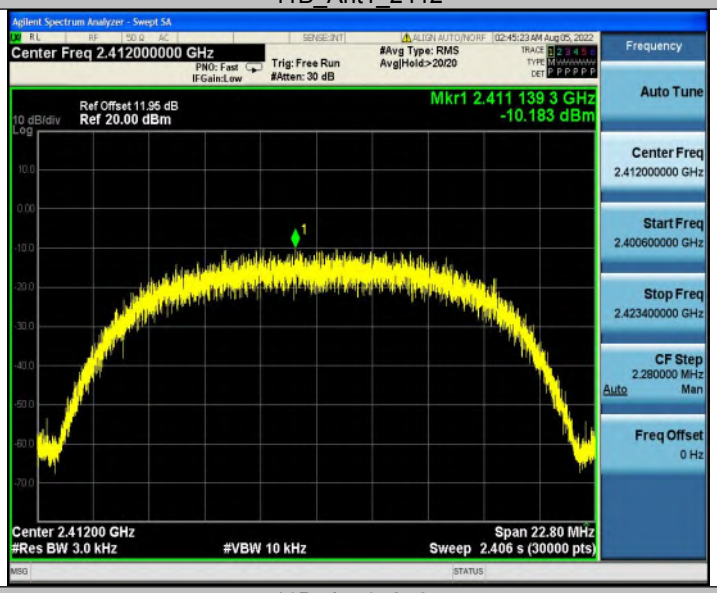
11.1 Test Procedure

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below:
   Center frequency=DTS channel center frequency
   Span = 1.5 times the DTS bandwidth
   RBW = 3KHz, VBW = 10KHz
   Sweep time = auto couple
   Detector = peak
   Trace mode =max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. Use the peak marker function to determine the maximum amplitude level within the RBW.
5. If measured value exceeds limit, reduce RBW(no less than 3KHz) and repeat.

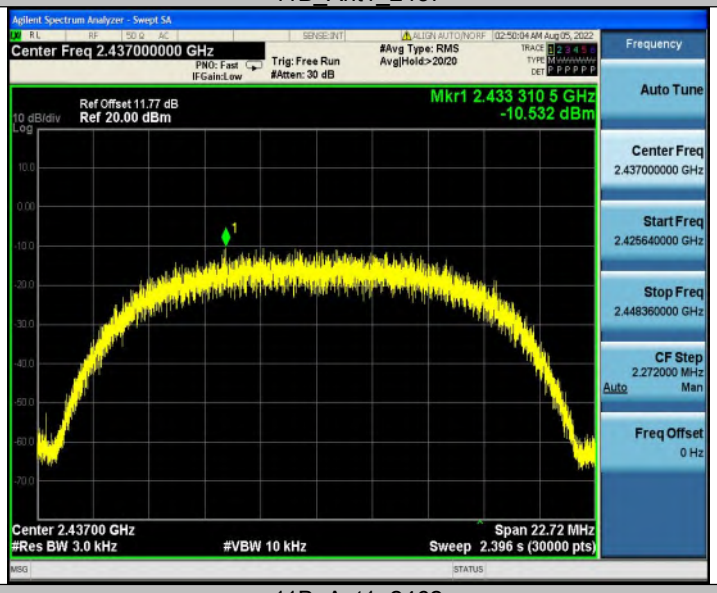
11.2 Test Result

TestMode	Antenna	Frequency[MHz]	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-10.18	≤8.00	PASS
		2437	-10.53	≤8.00	PASS
		2462	-9.7	≤8.00	PASS
11G	Ant1	2412	-11.95	≤8.00	PASS
		2437	-11.92	≤8.00	PASS
		2462	-10.93	≤8.00	PASS
11N20SISO	Ant1	2412	-14.04	≤8.00	PASS
		2437	-15.17	≤8.00	PASS
		2462	-15.86	≤8.00	PASS

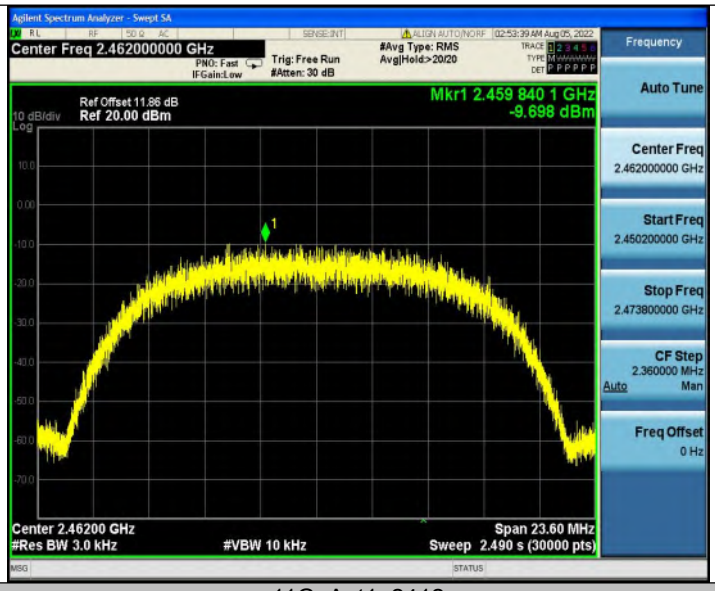
11B_Ant1_2412



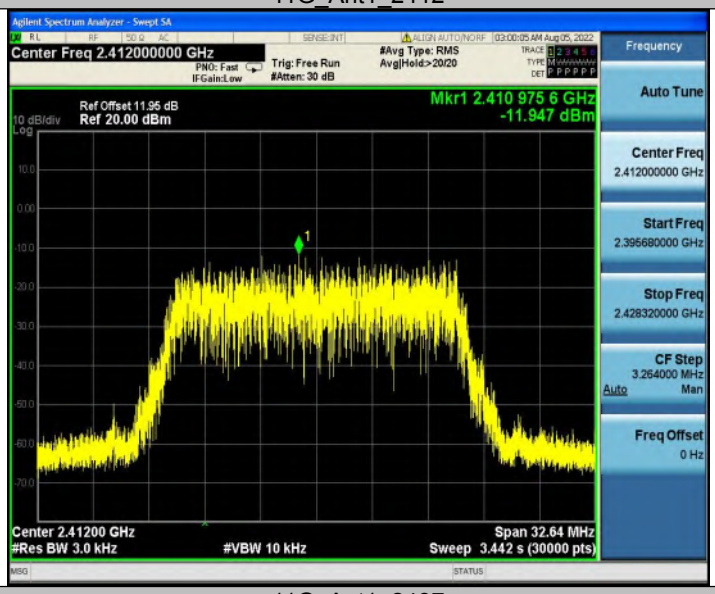
11B_Ant1_2437



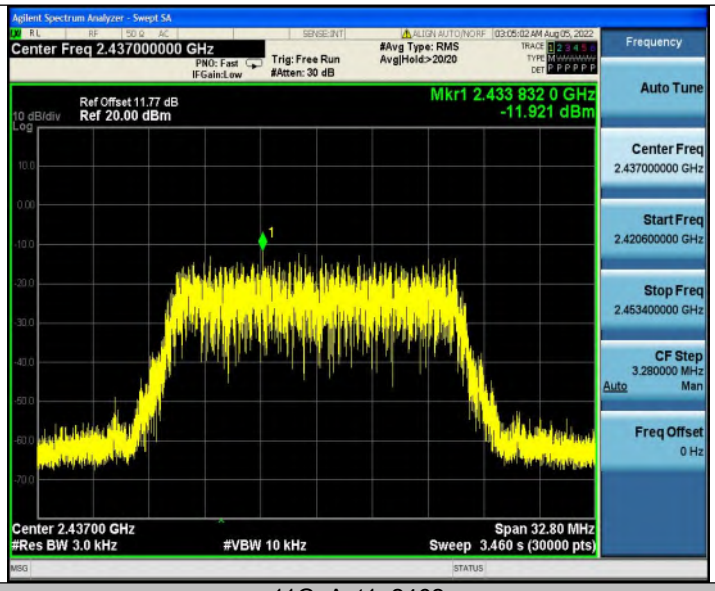
11B_Ant1_2462



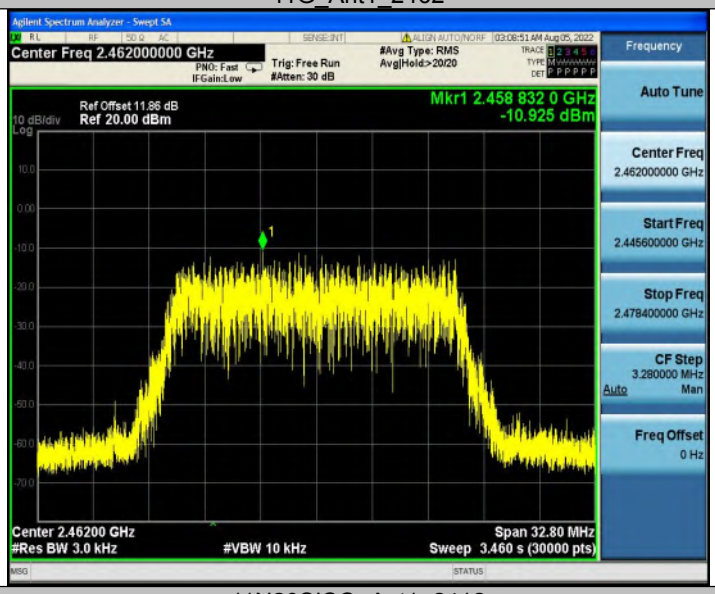
11G_Ant1_2412



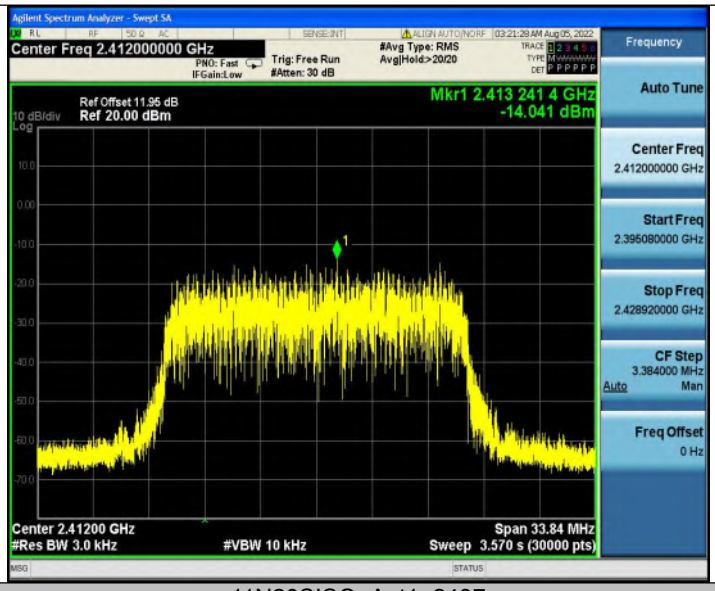
11G_Ant1_2437



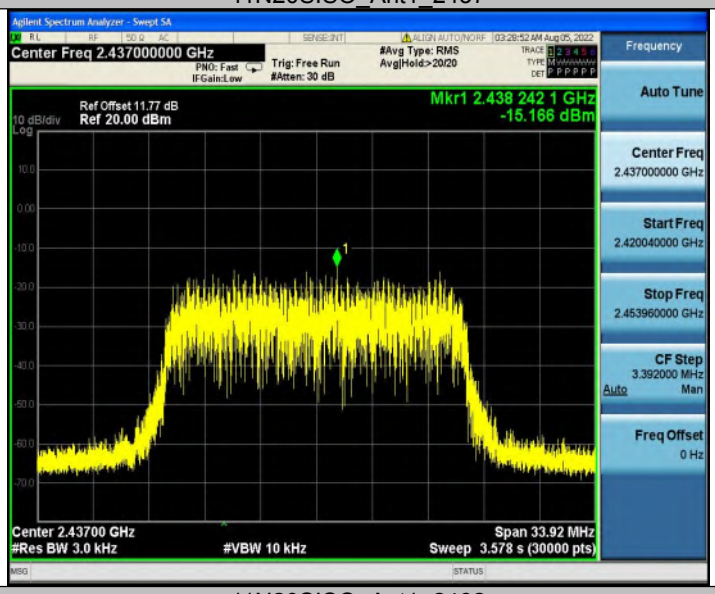
11G_Ant1_2462



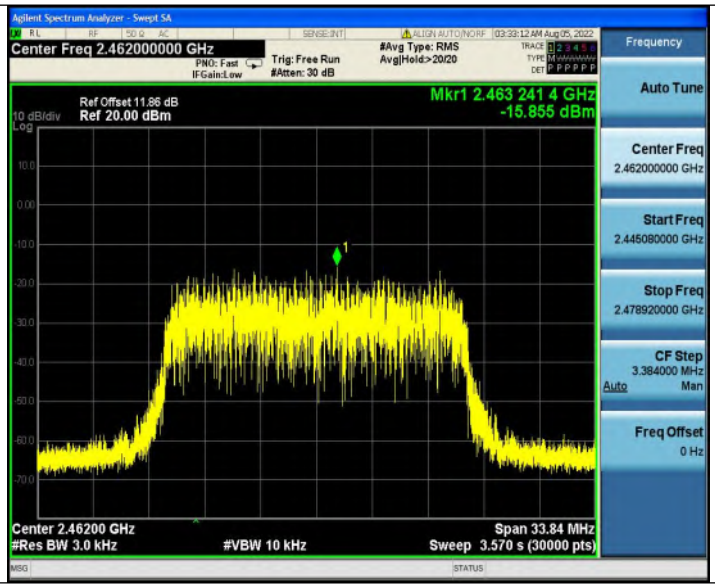
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Avg|Hold:>20/20
Ref Offset 11.86 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.463 241 4 GHz
-15.855 dBm
Center 2.46200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 33.84 MHz
Sweep 3.570 s (30000 pts)
Frequency
Auto Tune
Center Freq
2.462000000 GHz
Start Freq
2.445080000 GHz
Stop Freq
2.478920000 GHz
CF Step
3.384000 MHz
Auto
Man
Freq Offset
0 Hz

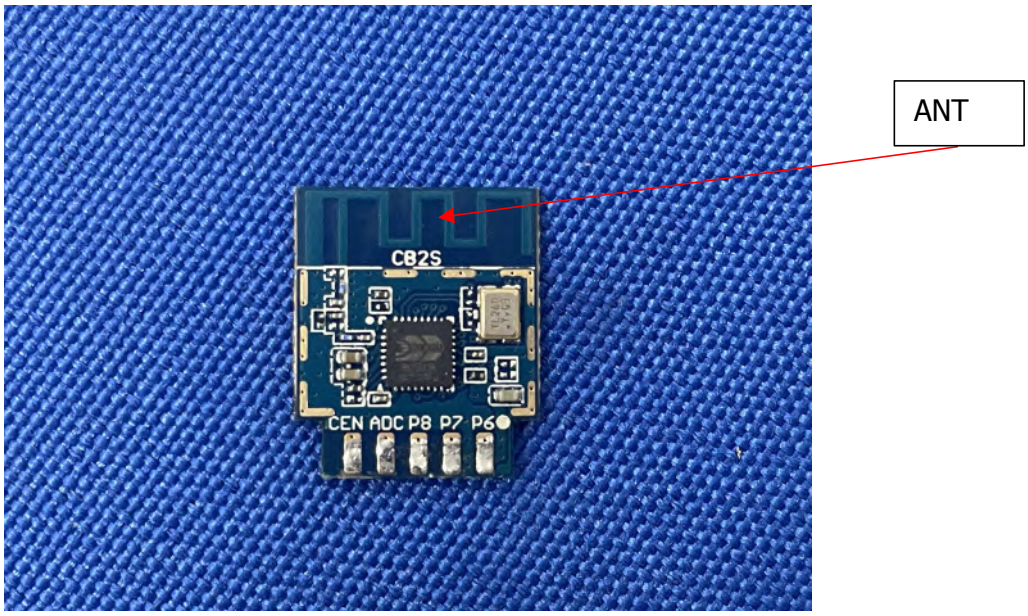
12 Antenna Application

12.1 Antenna Requirement

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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

12.2 Result

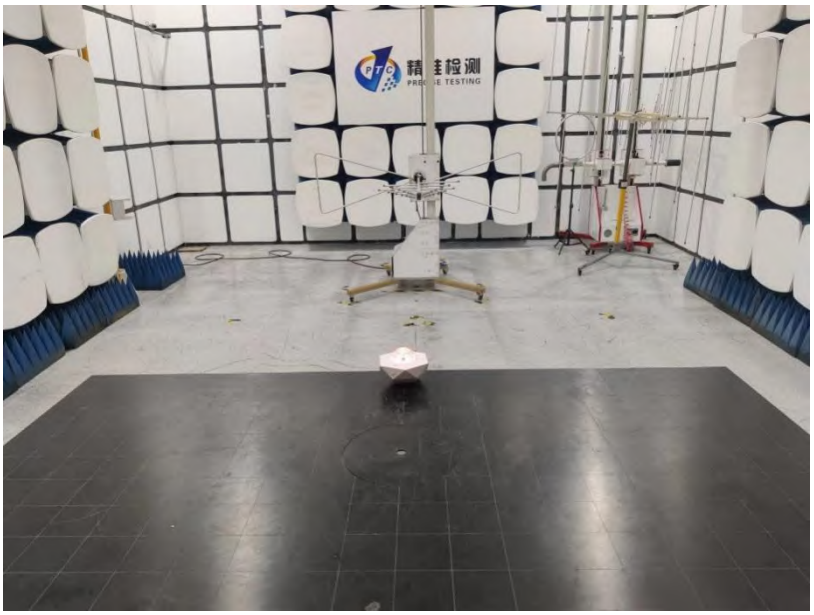
The EUT'S antenna, permanent attached antenna,is PCB Antenna. The antenna's gain is 0 dBi and meets the requirement.



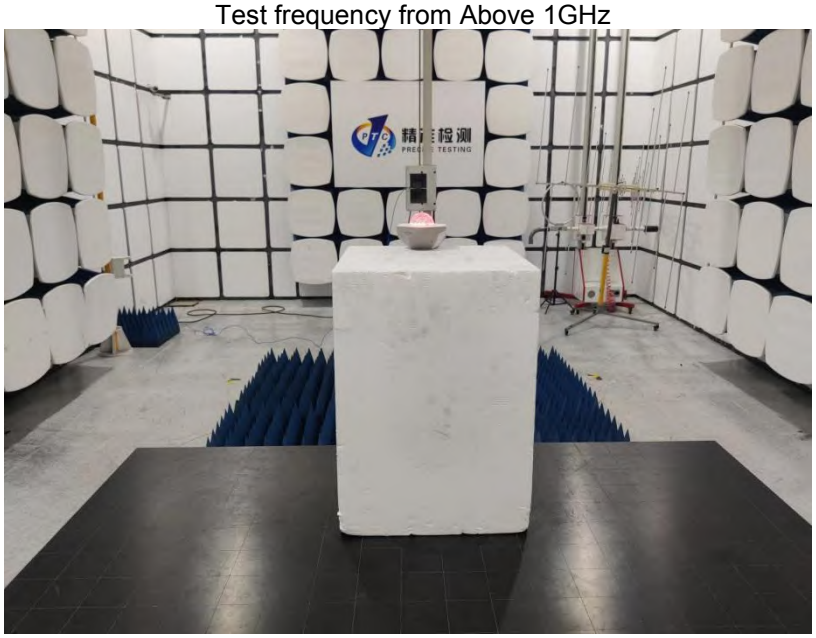
13 Test Setup

Conducted Emissions

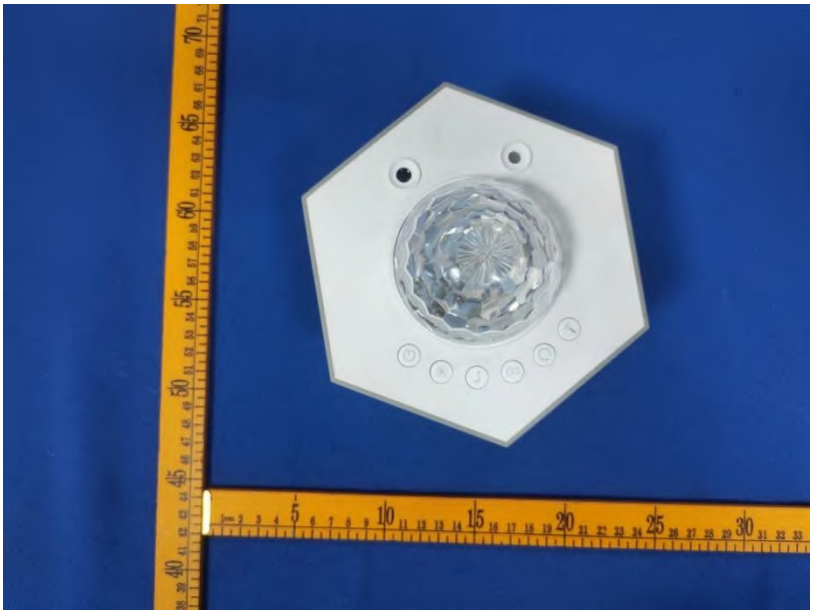
Radiated Spurious Emissions
From 30MHz-1000MHz

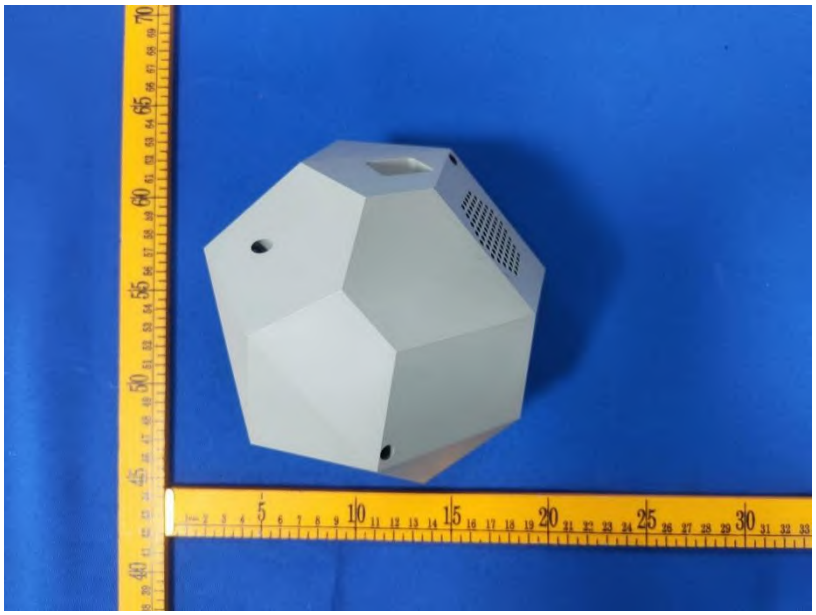


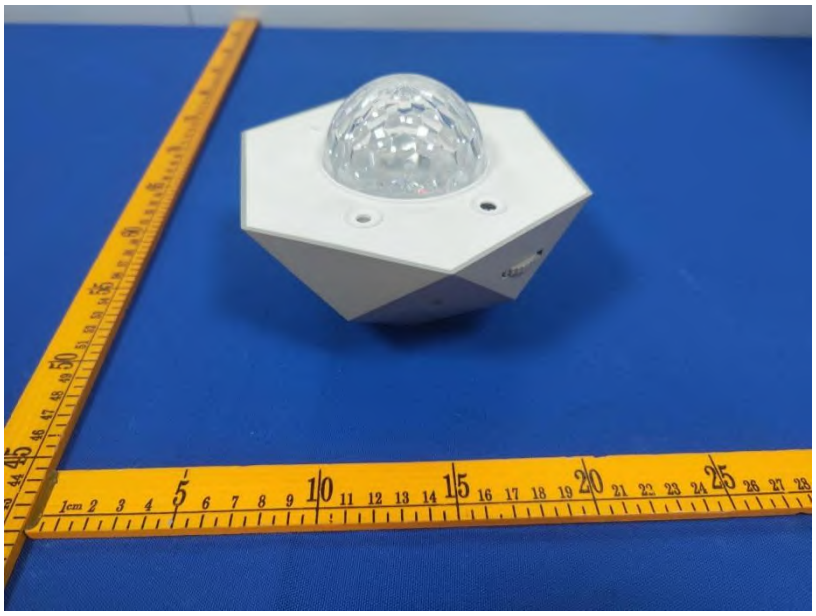
Test frequency from Above 1GHz

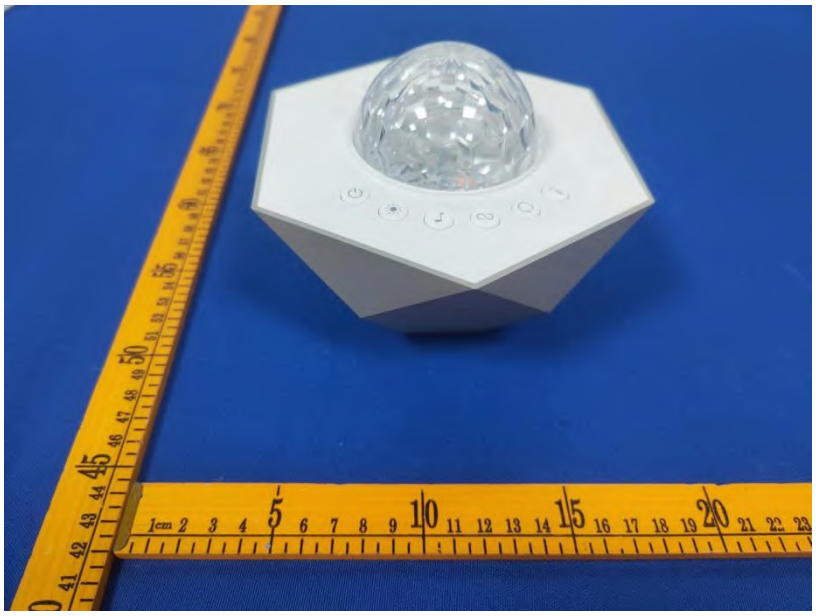


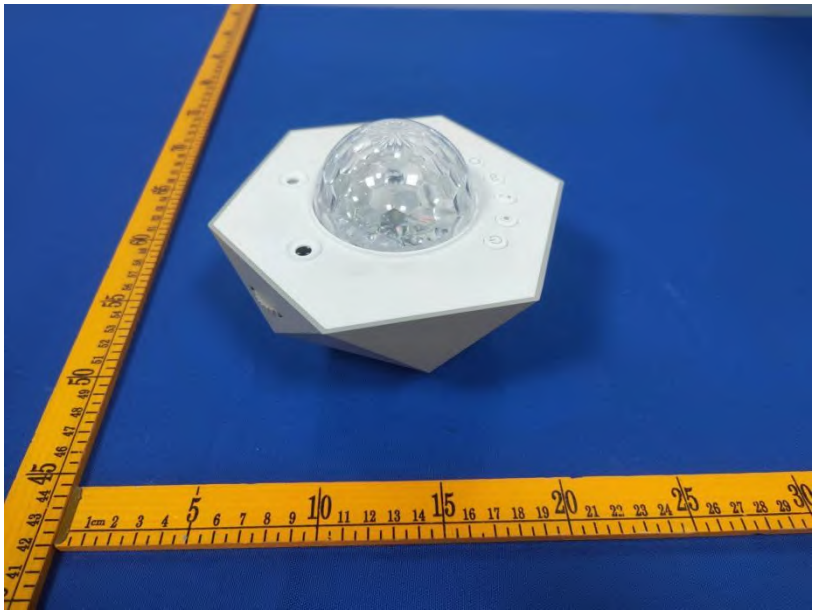
14 EUT PHOTOS

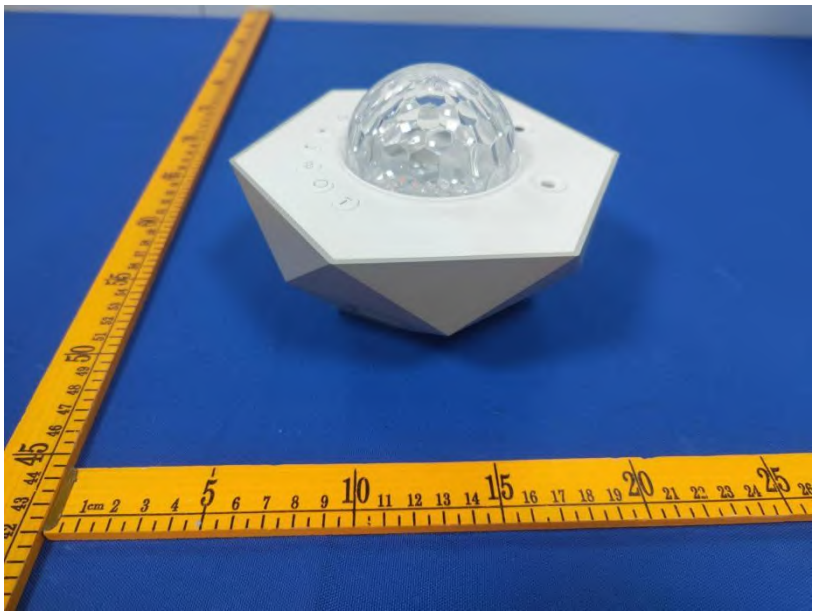


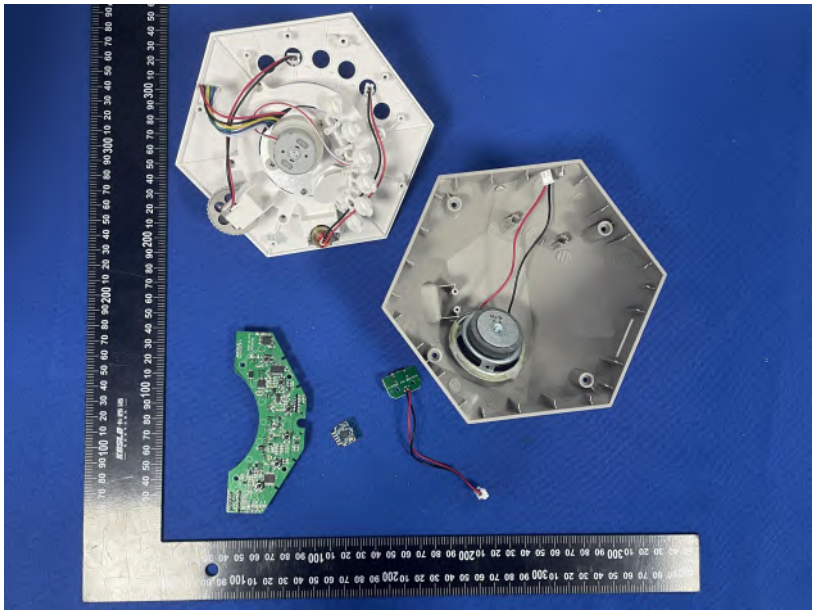


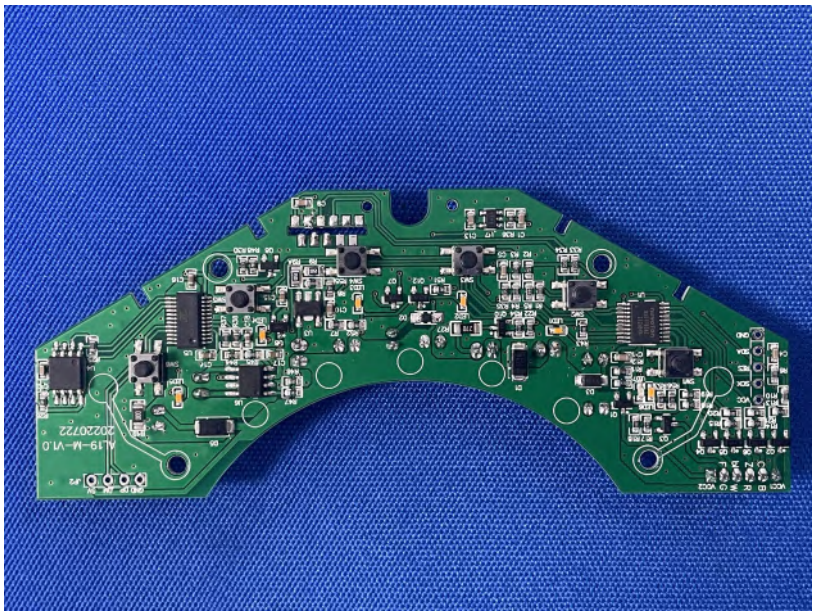


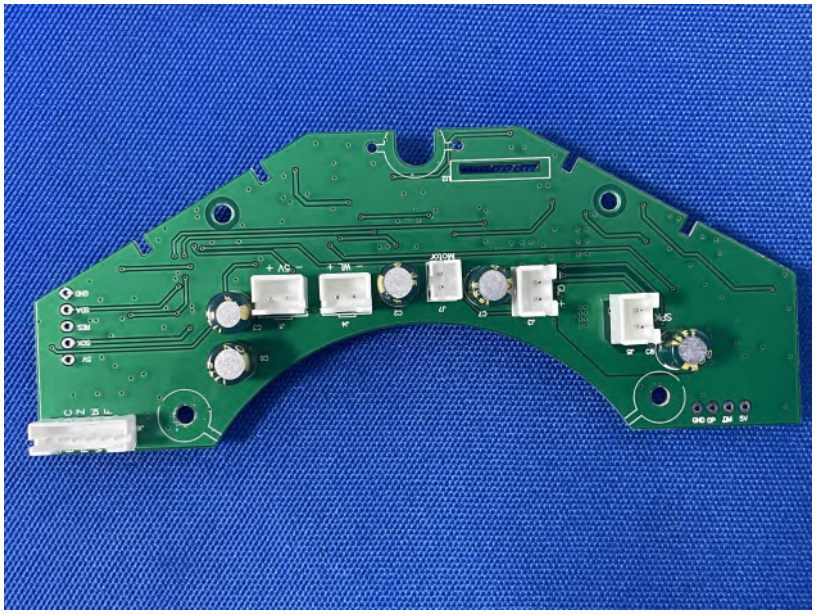


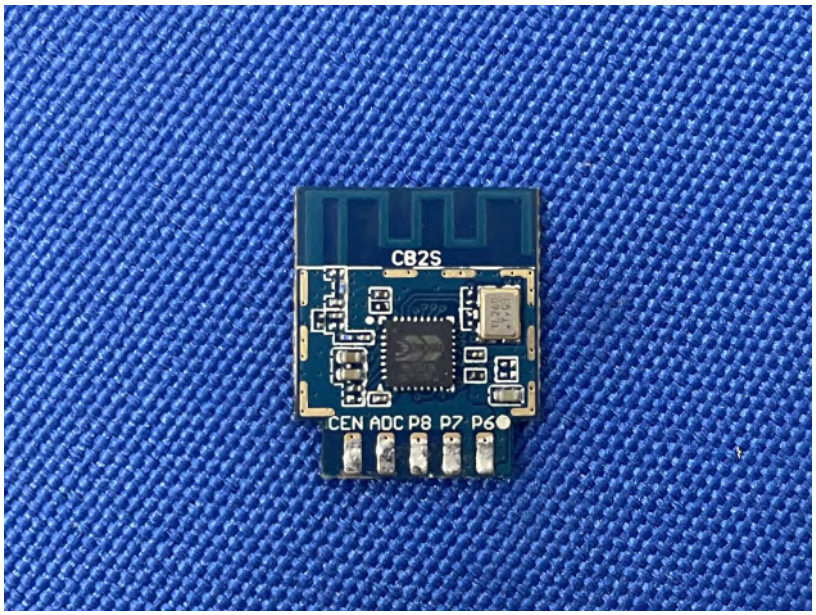


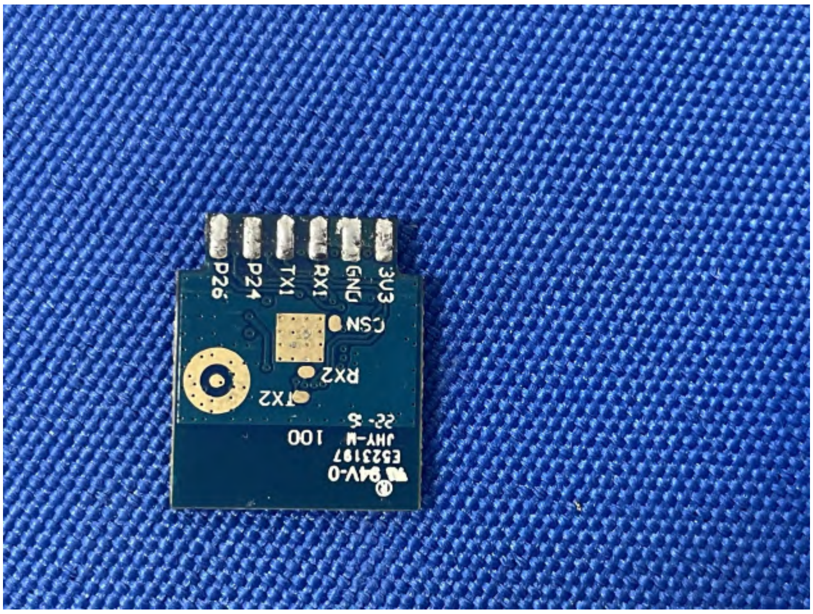


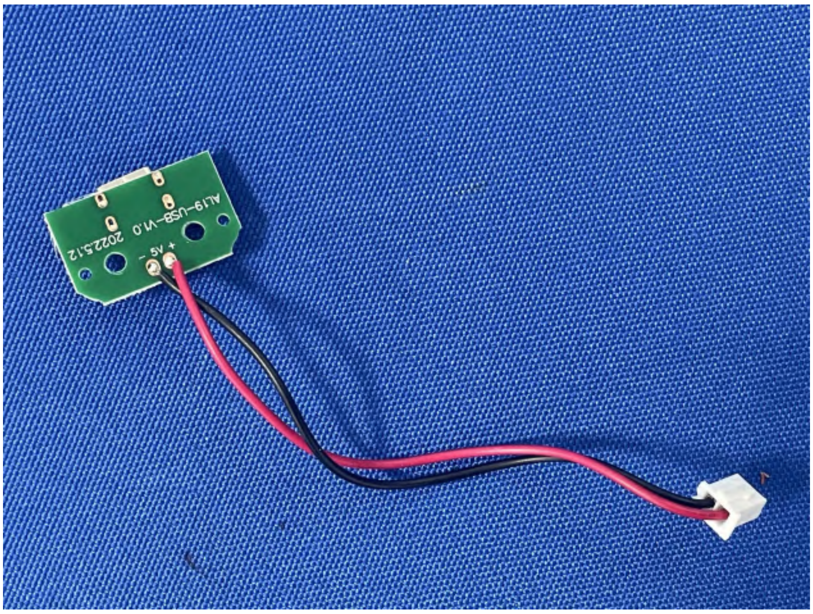


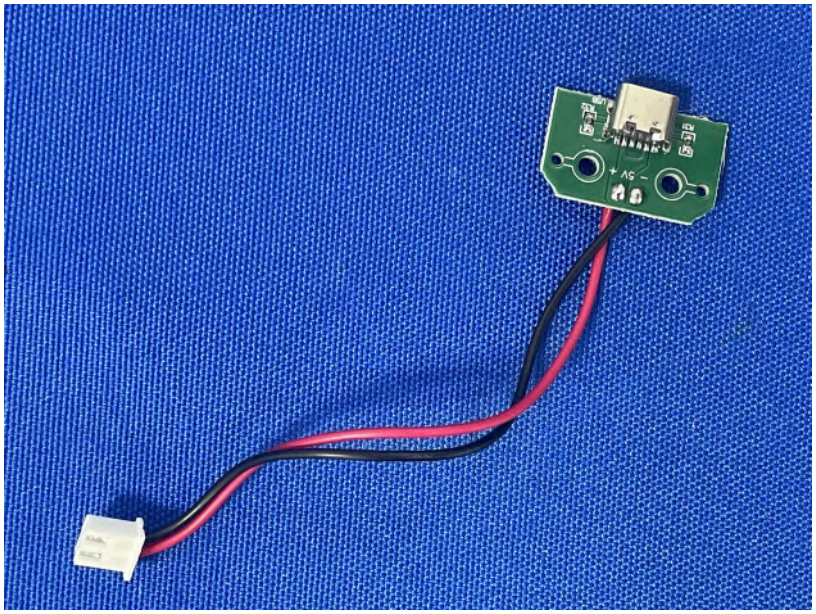





CB2S
CEN ADC P8 P7 P6


P26
P24
TX1
RX1
GND
3V3
CSN
RX2
TX2


AL19-USB-V1.0
2022.5.12



********THE END REPORT********