

FCC TEST REPORT

for

Soundcast LLC

Bluetooth audio transmitter

Model Number: VGtx

Brand: Soundcast

FCC ID: SUD-VGTX

Prepared for : Soundcast LLC
Address : 9771 CLAIREMONT MESA BLVD ,SUITE E, SAN
DIEGO CA 92124-1300

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Keyway Testing Technology Co., Ltd.

Applicant:	Soundcast LLC		
Address:	9771 CLAIREMONT MESA BLVD ,SUITE E, SAN DIEGO CA 92124-1300		
Manufacturer:	Dongguan Longjoin Electronics Co. Ltd.		
Address:	Shuilang Village Dalingshan Town, Dongguan City Guangdong Province, PRC		
E.U.T:	Bluetooth audio transmitter		
Model Number:	VGtx		
Trade Name:	Soundcast	Serial No.:	-----
Date of Receipt:	Jun. 30, 2017	Date of Test:	Jul. 01~08, 2017
Test Specification:	FCC Part 15, Subpart C Section 15.247: 2017 ANSI C63.10:2013		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.		
		Issue Date: Jul. 09, 2017	
Tested by	Reviewed by	Approved by	
			
Keven Wu / Engineer	Mark Li / Supervisor	Andy Gao / Supervisor	
Other Aspects:	None.		
<i>Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested</i>			
<i>This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.</i>			

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1. Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Spurious Emission	15.205(a) 15.209 15.247(d)	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Emissions from out of band	15.247(d)	PASS
Antenna Requirement	15.203	PASS

2. General Product Information

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Product Name:	Bluetooth audio transmitter
Model No.:	VGtx
Operation Frequency:	2402MHz~2480MHz
Channel numbers:	79 Channels
Modulation technology:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Antenna Type:	PCB Antenna
Antenna gain:	0dBi
Power supply:	AC 100-240V, 50/60Hz

Operation Frequency each of channel									
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402	16	2418	32	2434	48	2450	64	2466
1	2403	17	2419	33	2435	49	2451	65	2467
2	2404	18	2420	34	2436	50	2452	66	2468
3	2405	19	2421	35	2437	51	2453	67	2469
4	2406	20	2422	36	2438	52	2454	68	2470
5	2407	21	2423	37	2439	53	2455	69	2471
6	2408	22	2424	38	2440	54	2456	70	2472
7	2409	23	2425	39	2441	55	2457	71	2473
8	2410	24	2426	40	2442	56	2458	72	2474
9	2411	25	2427	41	2443	57	2459	73	2475
10	2412	26	2428	42	2444	58	2460	74	2476
11	2413	27	2429	43	2445	59	2461	75	2477
12	2414	28	2430	44	2446	60	2462	76	2478
13	2415	29	2431	45	2447	61	2463	77	2479
14	2416	30	2432	46	2448	62	2464	78	2480
15	2417	31	2433	47	2449	63	2465		

2.3. Test Facilities

Lab Qualifications Certified by Industry Canada
 Registration No.: 9868A
 Date of registration: December 8, 2011

Certificated by FCC, USA
 Registration No.: 370994
 Date of registration: February 21, 2012

Certificated by CNAS China
 Registration No.: CNAS L5783
 Date of registration: August 8, 2012

2.4. List of Test and Measurement Instruments

For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 08,17	Apr. 08,18
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 08,17	Apr. 08,18
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 08,17	Apr. 08,18
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 08,17	Apr. 08,18

For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 08,17	Apr. 08,18
System Simulator	Agilent	E5515C	GB43130245	Apr. 08,17	Apr. 08,18
Power Splitter	Weinschel	1506A	NW425	Apr. 08,17	Apr. 08,18
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 09,17	Apr. 09,18
Spectrum Analyzer	Agilent	E4411B	MY4511304	Apr. 08,17	Apr. 08,18
Spectrum Analyzer	R&S	FSV40	132.1.3008K3 9-100967	Apr. 08,17	Apr. 08,18
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 09,17	Apr. 09,18
Signal Amplifier	SONOMA	310	187016	Apr. 08,17	Apr. 08,18
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 08,17	Apr. 08,18
RF Cable	IMRO	IMRO-400	966 Cable 1#	N/A	N/A
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	N/A	N/A
Horn Antenna	DAZE	ZN30701	11003	Apr. 09,17	Apr. 09,18
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 09,17	Apr. 09,18
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 08,17	Apr. 08,18
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 08,17	Apr. 08,18
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 08,17	Apr. 08,18
High Pass filter	Micro	HPM50111	324216	Apr. 08,17	Apr. 08,18
Filter	COM-MW	ZBSF-C836.5-25-X	KW032	Apr. 08,17	Apr. 08,18
Filter	COM-MW	ZBSF-C1747.5-75-X 2	KW035	Apr. 08,17	Apr. 08,18
Filter	COM-MW	ZBSF-C1880-60-X2	KW037	Apr. 08,17	Apr. 08,18
DC Power Supply	LongWei	PS-305D	010964729	Apr. 08,17	Apr. 08,18
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 08,17	Apr. 08,18
Splitter	Agilent	11636B	0025164	Apr. 08,17	Apr. 08,18
Loop Antenna	ARA	PLA-1030/B	1029	Apr. 08,17	Apr. 08,18
Power Meter	Anritsu	ML2495A	1204003	Apr. 08,17	Apr. 08,18
Power Sensor	Anritsu	MA2411B	1126150	Apr. 08,17	Apr. 08,18

3. Test Setup And Operation Modes

3.1. Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up

Conducted Emission: AC 120V/60Hz



Radiated Emission: AC 120V/60Hz



3.3. Test Operation Mode and Test Software

For conducted test items and radiated spurious emissions

Mode 1	TX CH00
Mode 2	TX CH39
Mode 3	TX CH78
Test Software	BlueTest3

For AC Conducted Emission

Mode 4	Link Mode
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3.4. Special Accessories

USB cable	N/A
Adapter	Model: GPE053B-V050050-Z Input: AC 100-240V~50/60Hz, 0.2A Output: 5V/500mA, 2.5W

3.5. Auxiliary Equipment

Audio Generator	Manufacturer: TRONSON Model Number: TAG-101 Equip No.: Tr11025396
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3.6. Countermeasures to Achieve EMC Compliance

N/A

4. Emission Test Results

4.1. Conducted Emission Test

4.1.1. Limits

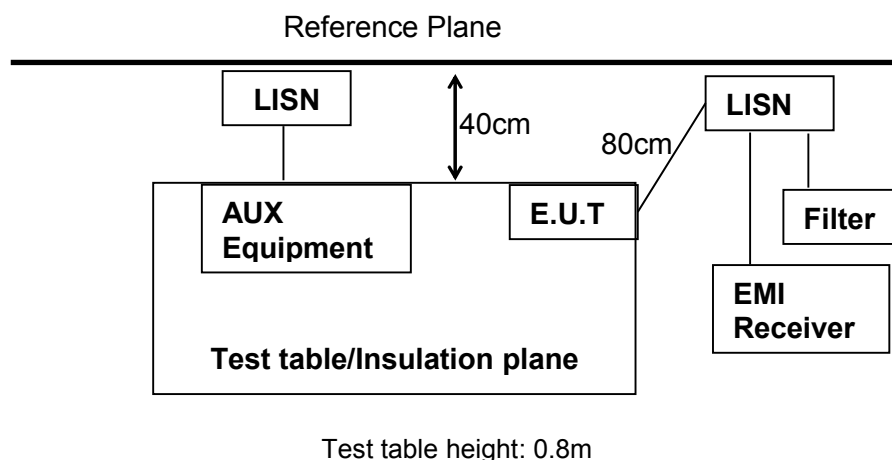
Frequency MHz	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

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

4.1.2. Test Procedure

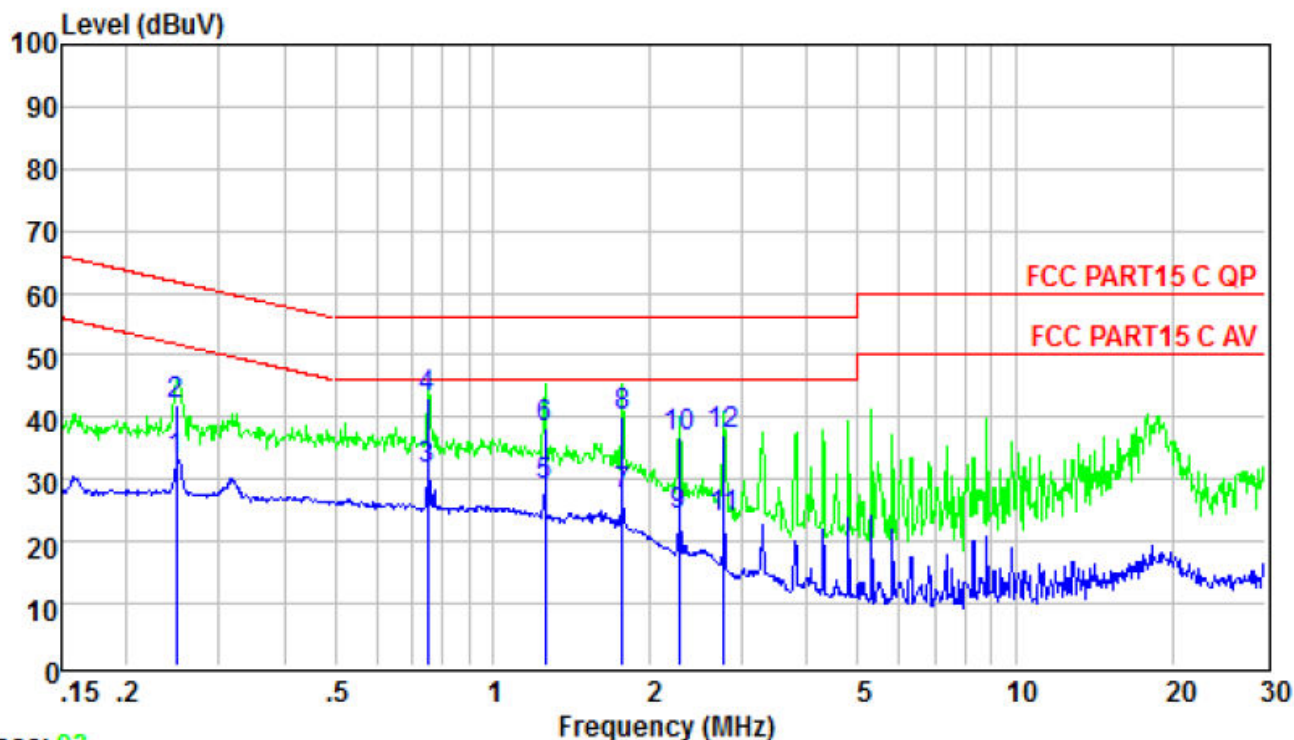
1. The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to form a bundle no longer than 0.4 m.
2. The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.
3. The frequency range from 150 kHz to 30 MHz was investigated.
4. The bandwidth of the test receiver was set at 9 kHz.
5. Pretest for all mode, the test data of the worst case condition(s) was reported on the following page.

4.1.3. Test Setup



Test results

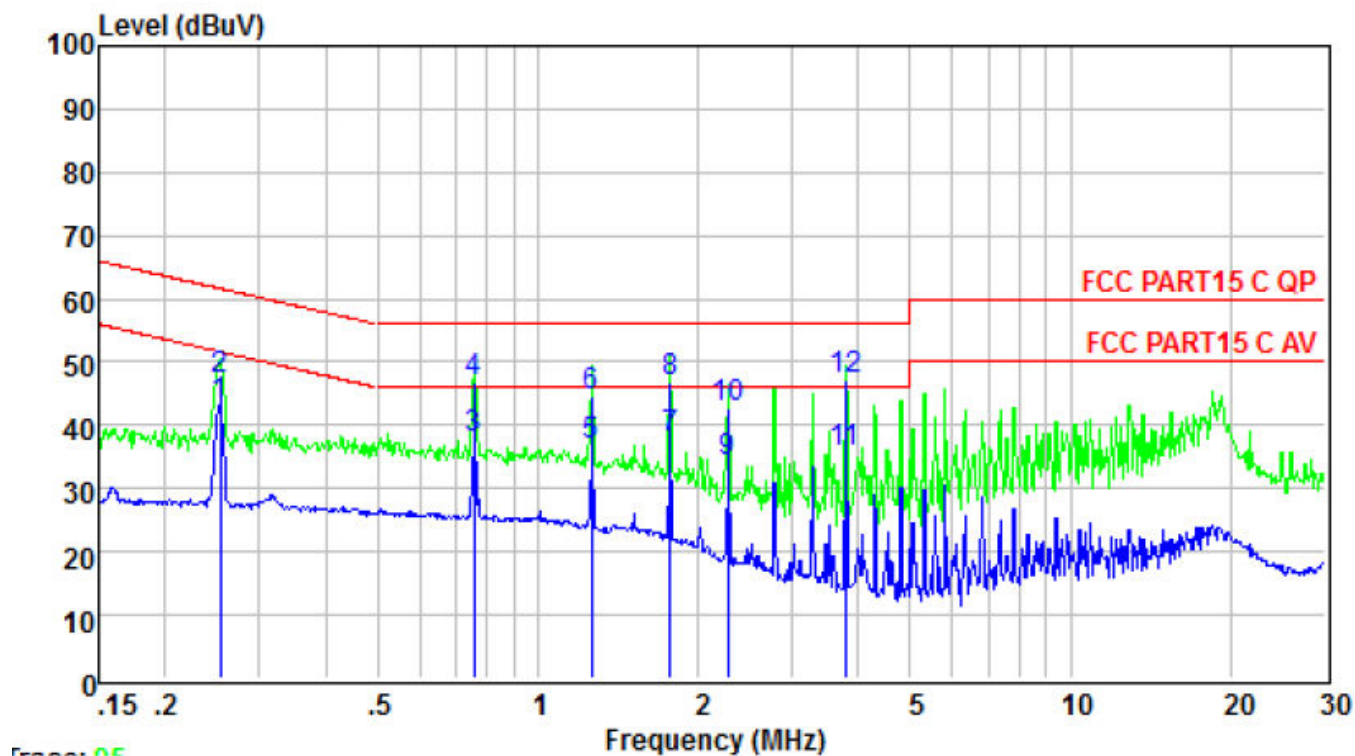
Phase: N (120V/60Hz)



Trace: 03

	Freq	Level	Limit	Over	Remark
	MHz	dBuV	Line	Limit	
			dBuV	dB	
1	0.248	33.07	51.82	-18.75	Average
2	0.248	42.10	61.82	-19.72	QP
3	0.751	31.47	46.00	-14.53	Average
4	0.751	43.20	56.00	-12.80	QP
5	1.262	28.97	46.00	-17.03	Average
6	1.262	38.40	56.00	-17.60	QP
7	1.772	27.37	46.00	-18.63	Average
8	1.772	40.30	56.00	-15.70	QP
9	2.273	24.32	46.00	-21.68	Average
10	2.273	36.80	56.00	-19.20	QP
11	2.765	23.70	46.00	-22.30	Average
12	2.765	37.10	56.00	-18.90	QP

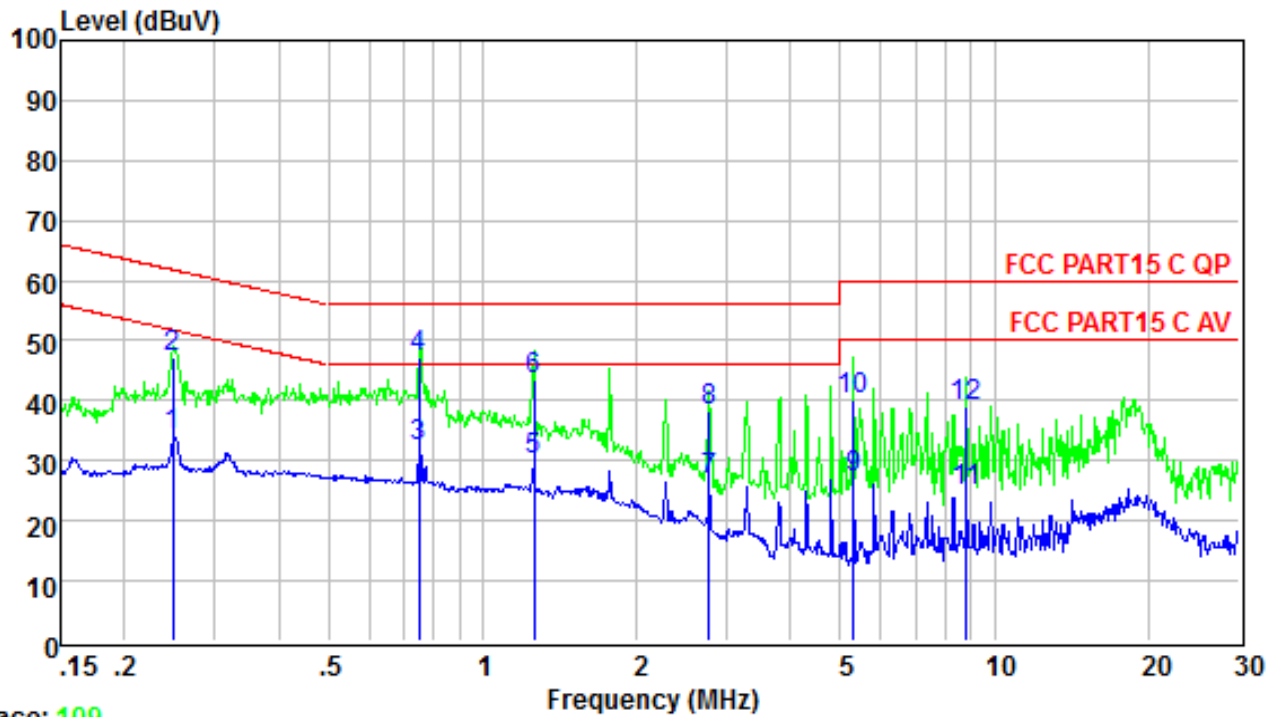
Phase: L (120V/60Hz)



	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.253	43.22	51.64	-8.42	Average
2	0.253	47.30	61.64	-14.34	QP
3	0.759	38.02	46.00	-7.98	Average
4	0.759	46.80	56.00	-9.20	QP
5	1.262	36.68	46.00	-9.32	Average
6	1.262	44.60	56.00	-11.40	QP
7	1.772	37.82	46.00	-8.18	Average
8	1.772	46.80	56.00	-9.20	QP
9	2.273	34.37	46.00	-11.63	Average
10	2.273	42.90	56.00	-13.10	QP
11	3.779	35.52	46.00	-10.48	Average
12	3.779	47.20	56.00	-8.80	QP

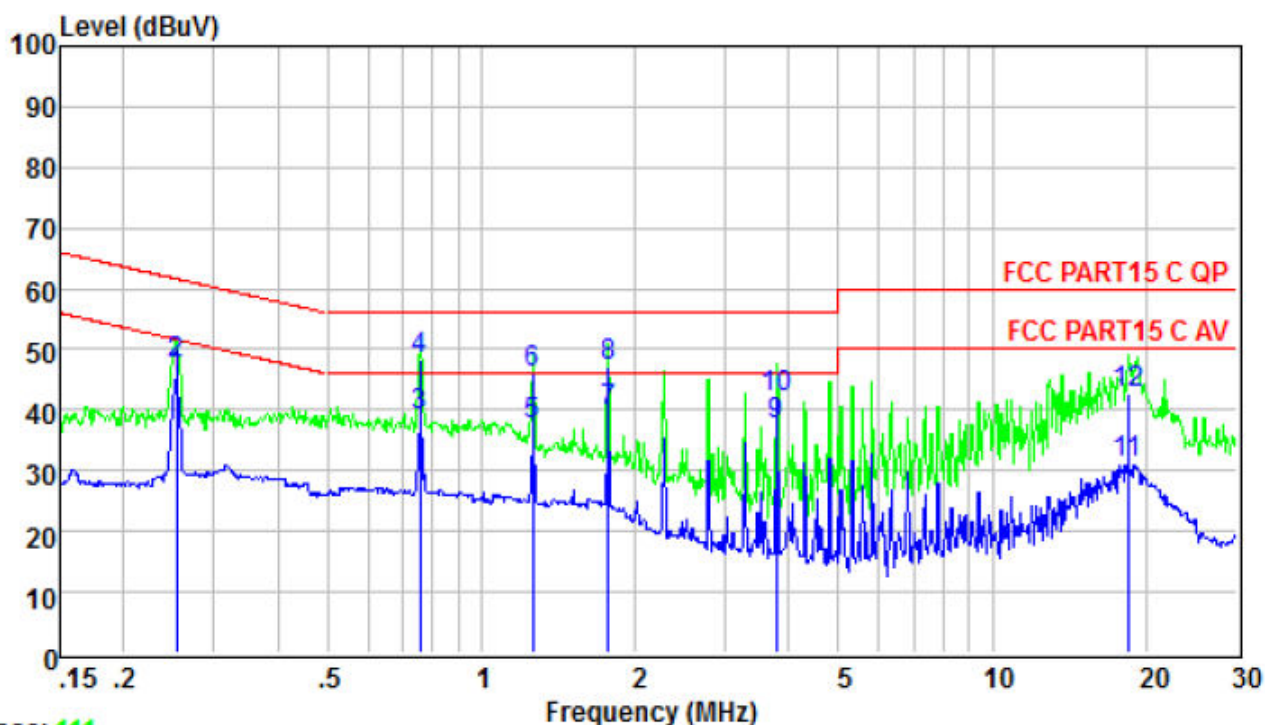
Test results

Phase: N (240V/50Hz)



	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.248	34.07	51.82	-17.75	Average
2	0.248	47.10	61.82	-14.72	QP
3	0.751	32.47	46.00	-13.53	Average
4	0.751	47.30	56.00	-8.70	QP
5	1.262	29.97	46.00	-16.03	Average
6	1.262	43.60	56.00	-12.40	QP
7	2.765	26.70	46.00	-19.30	Average
8	2.765	38.40	56.00	-17.60	QP
9	5.305	27.24	50.00	-22.76	Average
10	5.305	40.20	60.00	-19.80	QP
11	8.822	24.87	50.00	-25.13	Average
12	8.822	38.90	60.00	-21.10	QP

Phase: L (240V/50Hz)



Trace: 111

	Freq	Level	Limit	Over	Remark
	MHz	dBuV	Line	Limit	
			dBuV	dB	
1	0.253	45.22	51.64	-6.42	Average
2	0.253	47.50	61.64	-14.14	QP
3	0.759	39.02	46.00	-6.98	Average
4	0.759	48.20	56.00	-7.80	QP
5	1.262	37.68	46.00	-8.32	Average
6	1.262	46.20	56.00	-9.80	QP
7	1.772	39.82	46.00	-6.18	Average
8	1.772	47.30	56.00	-8.70	QP
9	3.779	37.52	46.00	-8.48	Average
10	3.779	42.10	56.00	-13.90	QP
11	18.426	31.33	50.00	-18.67	Average
12	18.426	42.80	60.00	-17.20	QP

4.2. Radiated Emission Test

4.2.1. Limits

Frequency MHz	Distance Meters	Filed Strengths Limit	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
30~88	3	100	40.0
88~216	3	150	43.5
216~960	3	200	46.0
960~1000	3	500	54.0
Above 1000	3	74.0dB(μV)/m(Peak) 54.0dB(μV)/m(Average)	

4.2.2. Restricted bands of operation

MHz	MHz	MHz	GHz
0.009-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

4.2.3. Test Procedure

The EUT was placed on a turn table which was 0.8 m (above 1GHz, the table was 1.5m) above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz. The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, Both PK and AV measure, PK detector is used.

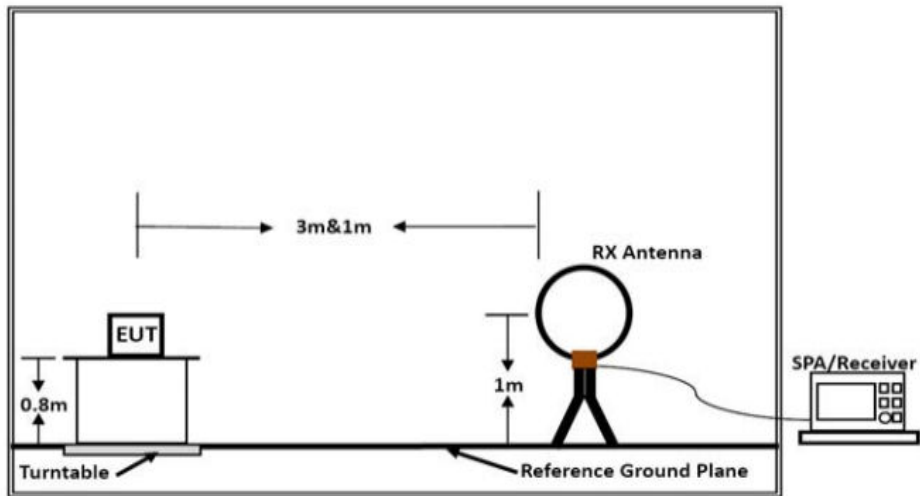
The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

Notes:

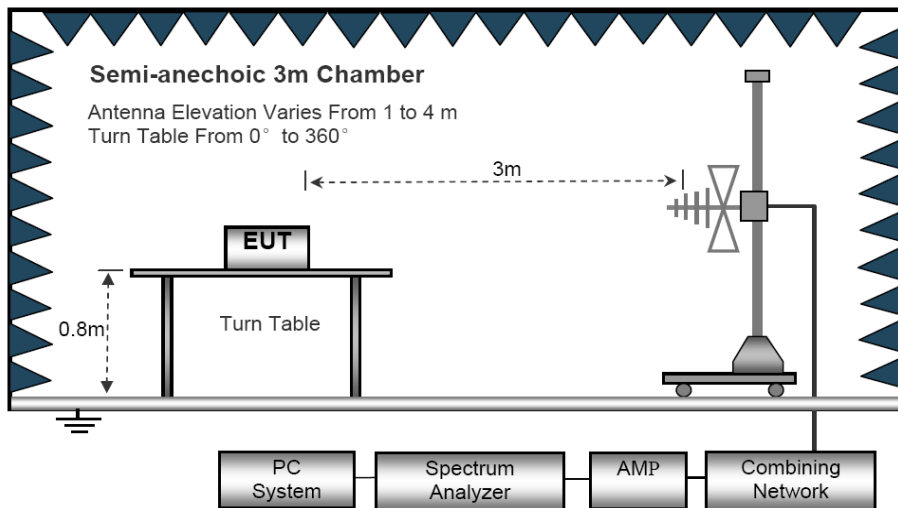
1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.
2. Measurement Uncertainty: ± 3.2 dB at a level of confidence of 95%.
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.
5. For Both PK and AV value above 1GHz, PK detector is used.
6. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation).

4.2.4. Test Setup

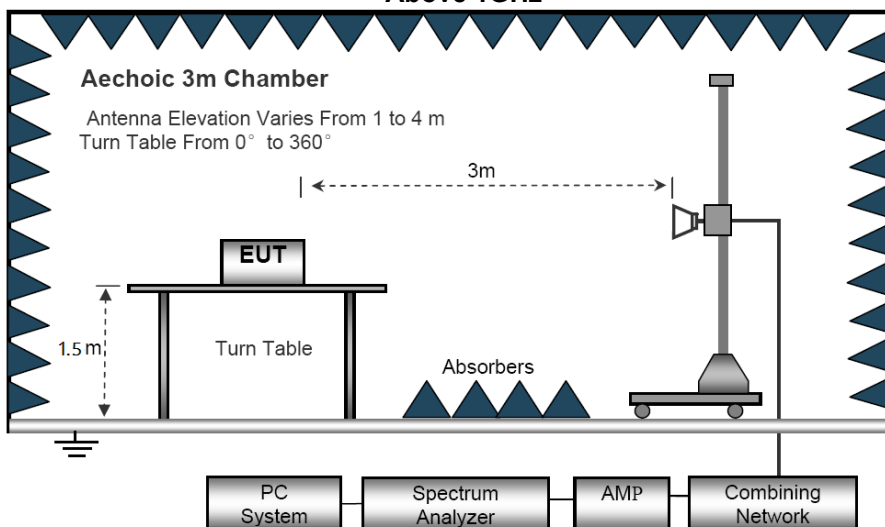
Below 30MHz



30MHz-1GHz



Above 1GHz



Test results**Below 30MHz**

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State P/F
--	--	--	--	P
--	--	--	--	P

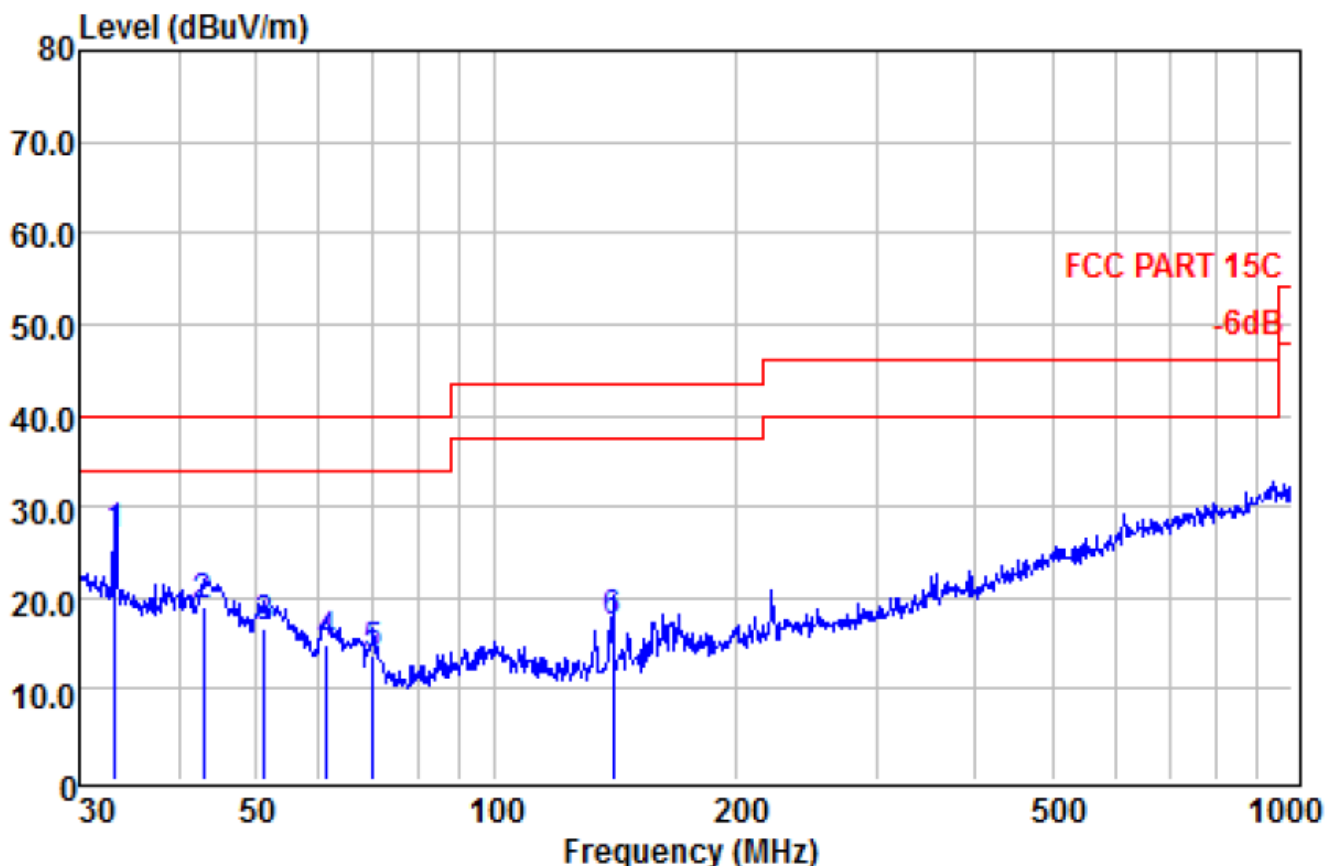
Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log(\text{specific distance}/\text{test distance})$ (dB);

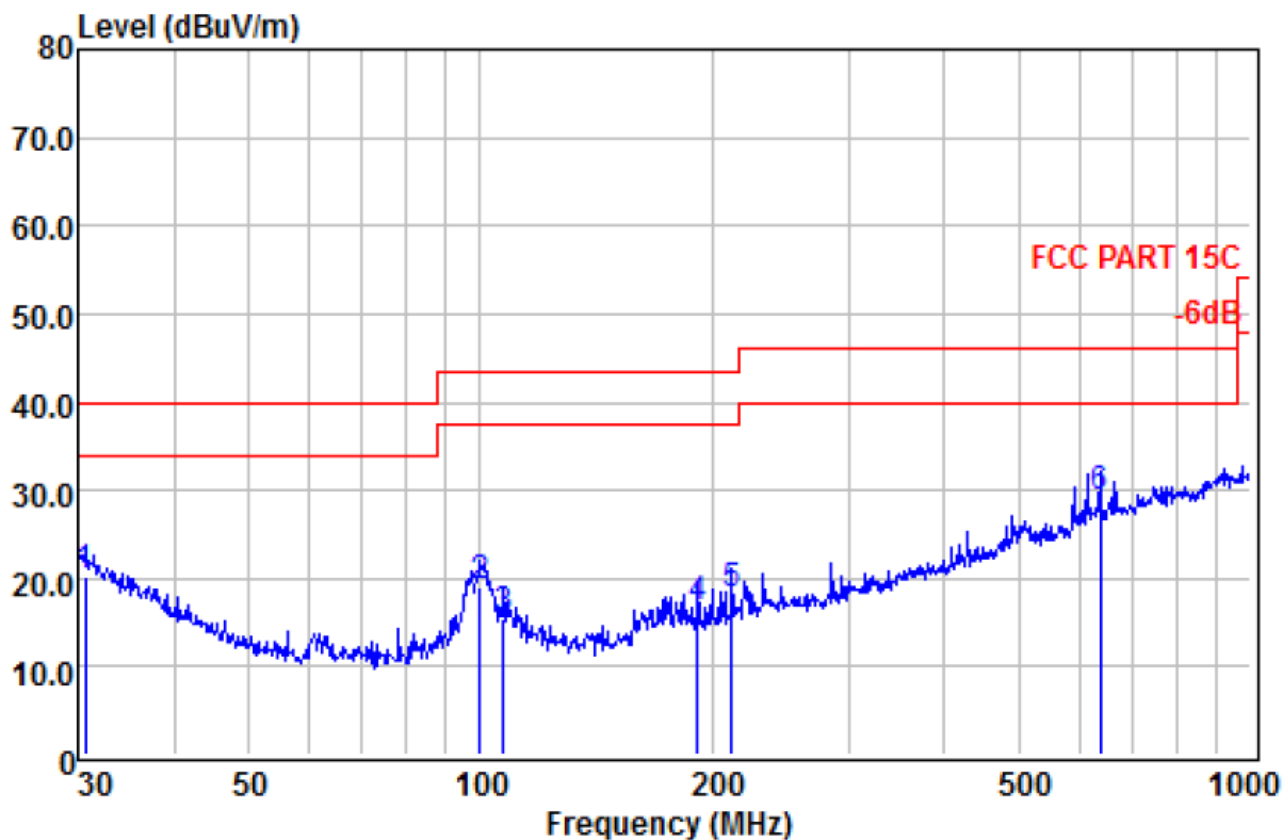
Limit line = specific limits(dBuv) + distance extrapolation factor.

30MHz-1GHz
Vertical (120V/60Hz)



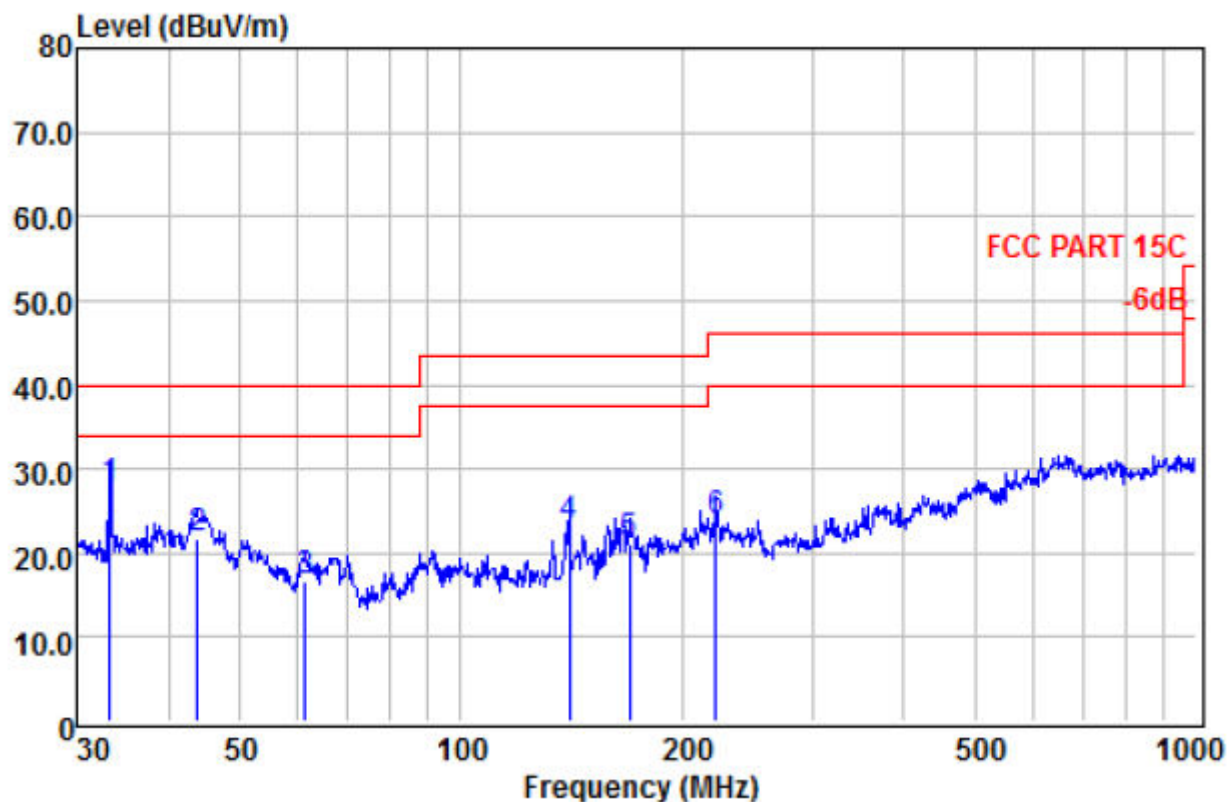
	ReadAntenna	Cable	Limit	Over			
Freq	Level	Factor	Line	Limit	Remark		
MHz	dBuV	dB/m	dBuV/m	dB			
1	33.33	9.68	16.84	0.26	26.78	40.00	-13.22 QP
2	42.90	7.25	11.71	0.13	19.09	40.00	-20.91 QP
3	51.30	7.82	8.60	0.12	16.54	40.00	-23.46 QP
4	61.35	7.33	7.33	0.13	14.79	40.00	-25.21 QP
5	70.09	5.92	7.50	0.14	13.56	40.00	-26.44 QP
6	140.34	8.55	8.42	0.23	17.20	43.50	-26.30 QP

Horizontal (120V/60Hz)



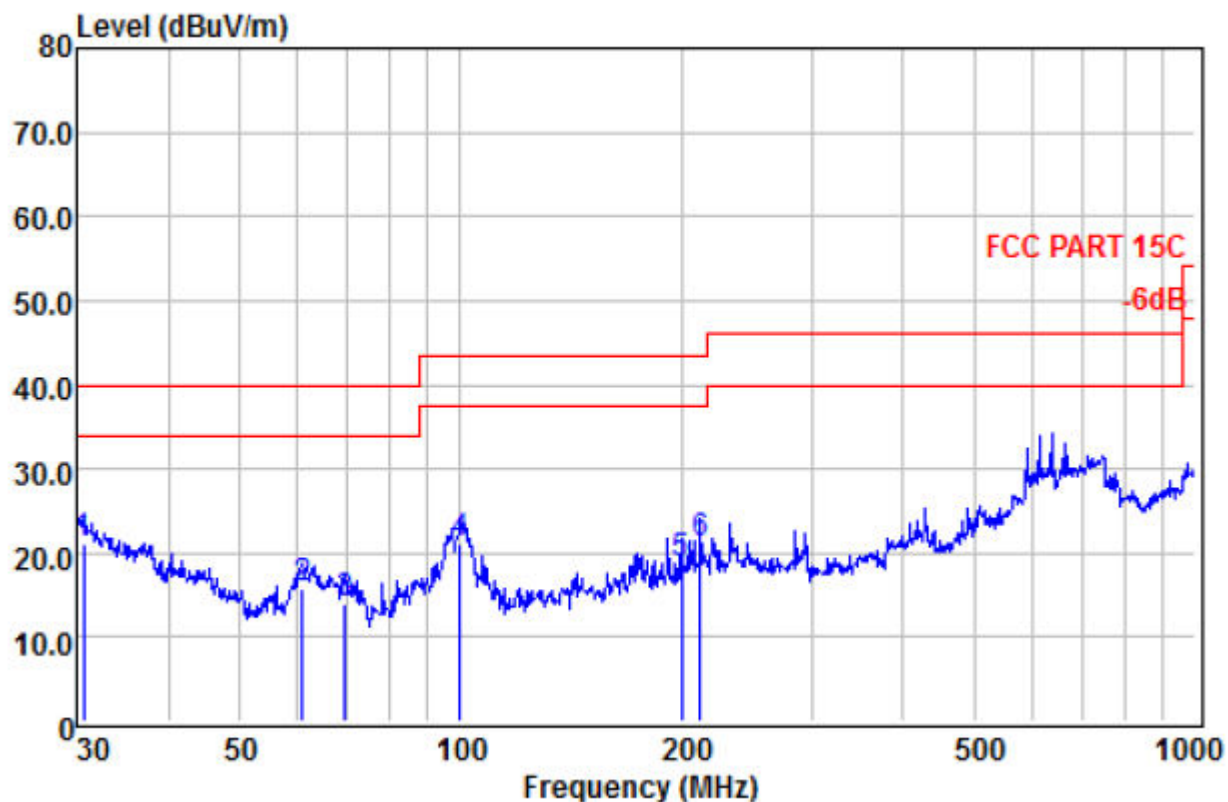
	Read	Antenna	Cable		Limit	Over	
Freq	Level	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	30.64	1.43	18.42	0.33	20.18	40.00	-19.82 QP
2	99.88	9.25	9.59	0.17	19.01	43.50	-24.49 QP
3	107.13	6.03	9.39	0.18	15.60	43.50	-27.90 QP
4	191.75	6.16	10.26	0.29	16.71	43.50	-26.79 QP
5	212.27	6.07	11.59	0.37	18.03	43.50	-25.47 QP
6	638.37	6.68	21.35	1.16	29.19	46.00	-16.81 QP

30MHz-1GHz
Vertical (240V/50Hz)



	ReadAntenna	Cable	Limit	Over			
Freq	Level	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	33.33	10.68	16.84	0.26	27.78	40.00	-12.22 QP
2	43.81	10.37	11.34	0.13	21.84	40.00	-18.16 QP
3	61.35	9.33	7.33	0.13	16.79	40.00	-23.21 QP
4	140.34	14.55	8.42	0.23	23.20	43.50	-20.30 QP
5	169.60	10.85	10.06	0.23	21.14	43.50	-22.36 QP
6	222.17	11.23	12.06	0.40	23.69	46.00	-22.31 QP

Horizontal (240V/50Hz)



	Read	Antenna	Cable		Limit	Over	
Freq	Level	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	30.64	2.43	18.42	0.33	21.18	40.00	-18.82 QP
2	60.92	8.32	7.32	0.13	15.77	40.00	-24.23 QP
3	69.60	6.48	7.49	0.14	14.11	40.00	-25.89 QP
4	99.88	11.25	9.59	0.17	21.01	43.50	-22.49 QP
5	199.99	7.51	11.00	0.32	18.83	43.50	-24.67 QP
6	212.27	9.07	11.59	0.37	21.03	43.50	-22.47 QP

Above 1GHz

Frequency (MHz)	Meter Reading (dBμV)	Antenna Factor (dB)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
TX(1Mbps)-2402									
4804	27.54	32.94	11.94	27.49	44.93	54.00	-9.07	Average	Vertical
4804	38.76	32.94	11.94	27.49	56.15	74.00	-17.85	peak	Vertical
7206	24.27	25.28	18.04	27.94	39.65	54.00	-14.35	Average	Vertical
7206	39.11	25.28	18.04	27.94	54.49	74.00	-19.51	peak	Vertical
4804	25.52	32.94	11.94	27.49	42.91	54.00	-11.09	Average	Horizontal
4804	35.17	32.94	11.94	27.49	52.56	74.00	-21.44	peak	Horizontal
7206	23.63	25.28	18.04	27.94	39.01	54.00	-14.99	Average	Horizontal
7206	37.45	25.28	18.04	27.94	52.83	74.00	-21.17	peak	Horizontal
TX(1Mbps)-2441									
4882	29.25	32.11	12.15	27.53	45.98	54.00	-8.02	Average	Vertical
4882	40.49	32.11	12.15	27.53	57.22	74.00	-16.78	peak	Vertical
7323	25.55	24.33	18.09	27.96	40.01	54.00	-13.99	Average	Vertical
7323	41.10	24.33	18.09	27.96	55.56	74.00	-18.44	peak	Vertical
4882	28.47	32.11	12.15	27.53	45.20	54.00	-8.80	Average	Horizontal
4882	38.57	32.11	12.15	27.53	55.30	74.00	-18.70	peak	Horizontal
7323	25.53	24.33	18.09	27.96	39.99	54.00	-14.01	Average	Horizontal
7323	38.46	24.33	18.09	27.96	52.92	74.00	-21.08	peak	Horizontal
TX(1Mbps)-2480									
4960	28.41	31.32	12.31	27.58	44.46	54.00	-9.54	Average	Vertical
4960	37.56	31.32	12.31	27.58	53.61	74.00	-20.39	peak	Vertical
7440	25.28	24.38	18.16	27.99	39.83	54.00	-14.17	Average	Vertical
7440	37.39	24.38	18.16	27.99	51.94	74.00	-22.06	peak	Vertical
4960	27.67	31.32	12.31	27.58	43.72	54.00	-10.28	Average	Horizontal
4960	39.42	31.32	12.31	27.58	55.47	74.00	-18.53	peak	Horizontal
7440	24.33	24.38	18.16	27.99	38.88	54.00	-15.12	Average	Horizontal
7440	37.52	24.38	18.16	27.99	52.07	74.00	-21.93	peak	Horizontal

NOTE:

- 1.Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor.
- 2.Over Limit= Absolute Level – Limit.
- 3.The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.
- 4.EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation)

Frequency (MHz)	Meter Reading (dBμV)	Antenna Factor (dB)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
TX(3Mbps)-2402									
4804	27.46	32.94	11.94	27.49	44.85	54.00	-9.15	Average	Vertical
4804	39.23	32.94	11.94	27.49	56.62	74.00	-17.38	peak	Vertical
7206	24.77	25.28	18.04	27.94	40.15	54.00	-13.85	Average	Vertical
7206	39.82	25.28	18.04	27.94	55.20	74.00	-18.80	peak	Vertical
4804	27.16	32.94	11.94	27.49	44.55	54.00	-9.45	Average	Horizontal
4804	36.24	32.94	11.94	27.49	53.63	74.00	-20.37	peak	Horizontal
7206	24.34	25.28	18.04	27.94	39.72	54.00	-14.28	Average	Horizontal
7206	38.72	25.28	18.04	27.94	54.10	74.00	-19.90	peak	Horizontal
TX(3Mbps)-2441									
4882	26.12	32.11	12.15	27.53	42.85	54.00	-11.15	Average	Vertical
4882	38.48	32.11	12.15	27.53	55.21	74.00	-18.79	peak	Vertical
7323	25.55	24.33	18.09	27.96	40.01	54.00	-13.99	Average	Vertical
7323	38.72	24.33	18.09	27.96	53.18	74.00	-20.82	peak	Vertical
4882	27.41	32.11	12.15	27.53	44.14	54.00	-9.86	Average	Horizontal
4882	39.28	32.11	12.15	27.53	56.01	74.00	-17.99	peak	Horizontal
7323	25.60	24.33	18.09	27.96	40.06	54.00	-13.94	Average	Horizontal
7323	37.83	24.33	18.09	27.96	52.29	74.00	-21.71	peak	Horizontal
TX(3Mbps)-2480									
4960	29.34	31.32	12.31	27.58	45.39	54.00	-8.61	Average	Vertical
4960	37.72	31.32	12.31	27.58	53.77	74.00	-20.23	peak	Vertical
7440	24.69	24.38	18.16	27.99	39.24	54.00	-14.76	Average	Vertical
7440	37.72	24.38	18.16	27.99	52.27	74.00	-21.73	peak	Vertical
4960	27.28	31.32	12.31	27.58	43.33	54.00	-10.67	Average	Horizontal
4960	37.47	31.32	12.31	27.58	53.52	74.00	-20.48	peak	Horizontal
7440	23.67	24.38	18.16	27.99	38.22	54.00	-15.78	Average	Horizontal
7440	36.49	24.38	18.16	27.99	51.04	74.00	-22.96	peak	Horizontal

NOTE:

1. Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor.
2. Over Limit= Absolute Level – Limit.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.
4. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation)

5. Band Edge Compliance Test

5.1. Limits

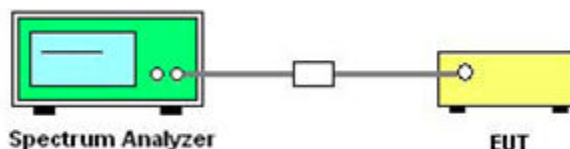
All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 30dB below the fundamental emissions, or comply with 15.209 limits.

5.2. Test Procedure

For Conducted Test		
1.	The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.	
2.	The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.	
EMI Test receiver	Setting	
Attenuation	Auto	
RBW	100KHz	
VBW	300KHz	
Detector	Peak	
trace	Max hold	
For Radiated Emission Test		
1.	The EUT was placed on a styrofoam table which is 1.5m above ground plane.	
2.	The measurement procedure at the ban edges was simplified by performing the measurement in just one plot. Both, the in-band-emission and the unwanted emission were be encompassed by the span. After trace stabilization, the maxium peak was be determined by a peak detector and the value was marked by an appropriate limit line. The second limit line, which is 20dB below the first, marks the limits for the emissions in the unrestricted band next to the band edge.	
3.	The measurements were performed at the lower end of the 2.4GHz band.	
4.	Use the following spectrum analyzer settings	
EMI Test receiver	Setting	
Attenuation	Auto	Auto
RBW	1MHz	1MHz
VBW	3MHz	10Hz
Detector	Peak	Average
trace	Max hold	Max hold

5.3. Test Setup

For Conducted Test

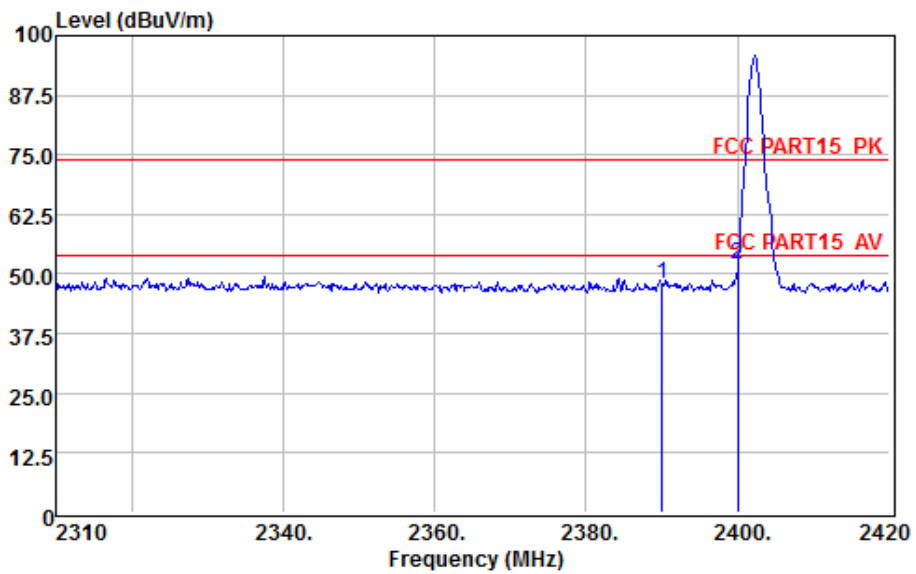


For Radiated Test

Same as section 4.2.4 Above 1GHz

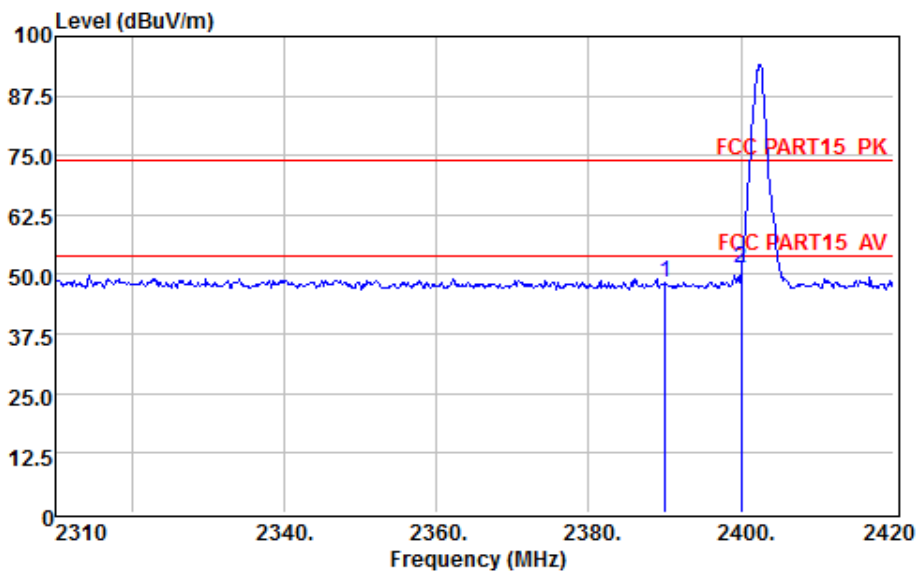
Test results

Radiated
1Mbps
Vertical



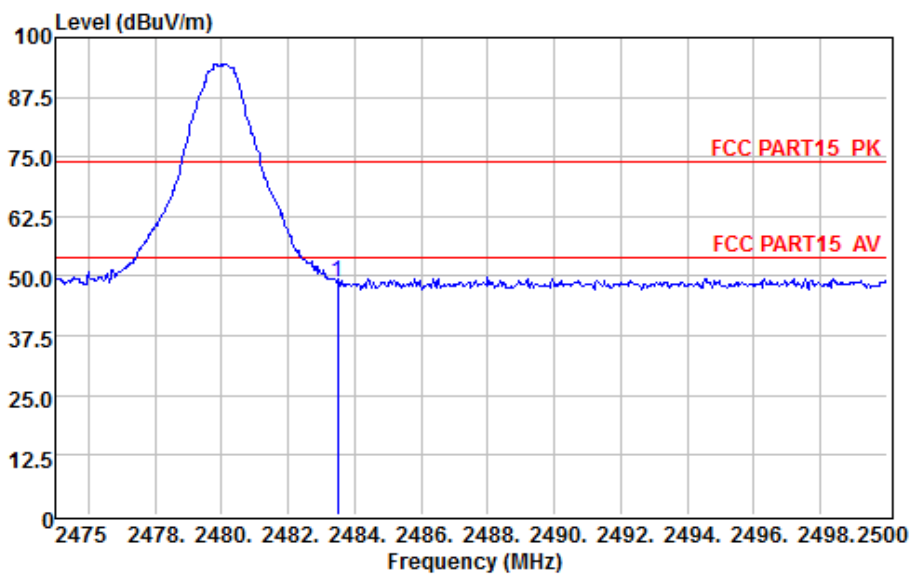
	Freq	ReadAntenna	Cable	Limit	Over		
	MHz	Level	Loss	Line	Limit	Remark	
	MHz	dBuV	dB/m	dB	dBuV/m	dB	
1	2390.00	42.27	28.72	3.36	48.03	74.00	-25.97 Peak
2	2400.00	46.39	28.72	3.38	52.17	74.00	-21.83 Peak

Horizontal



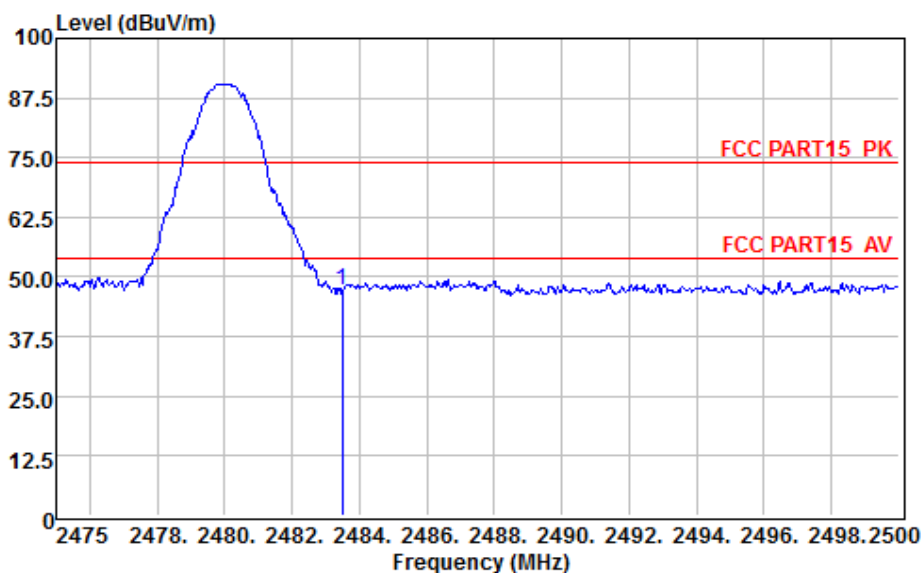
	Freq	ReadAntenna	Cable	Limit	Over		
	MHz	Level	Loss	Line	Limit	Remark	
	MHz	dBuV	dB/m	dB	dBuV/m	dB	
1	2390.00	42.60	28.72	3.36	48.36	74.00	-25.64 Peak
2	2400.00	45.40	28.72	3.38	51.18	74.00	-22.82 Peak

Vertical



	ReadAntenna	Cable	Limit	Over			
Freq	Level	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1 2483.50	42.69	28.79	3.48	48.62	74.00	-25.38	Peak

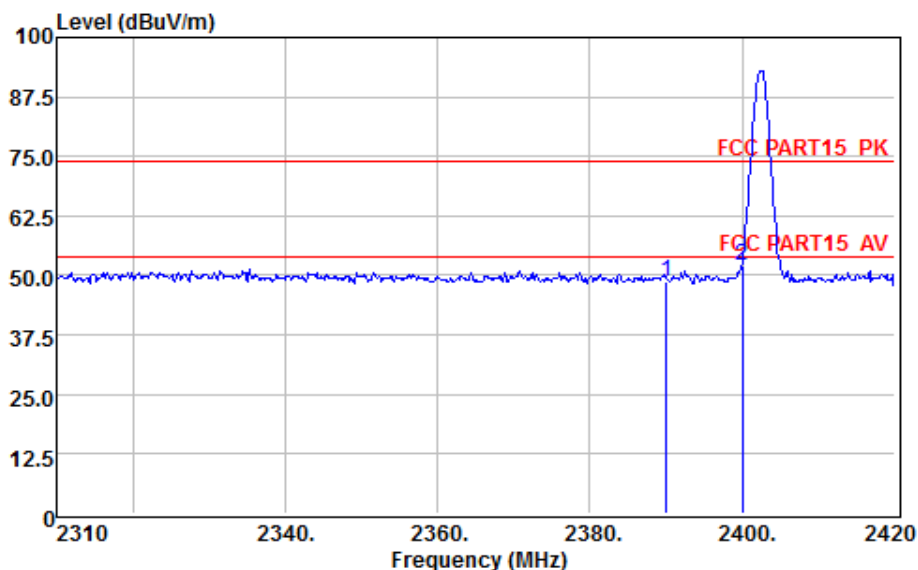
Horizontal



	ReadAntenna	Cable	Limit	Over			
Freq	Level	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1 2483.50	41.45	28.79	3.48	47.38	74.00	-26.62	Peak

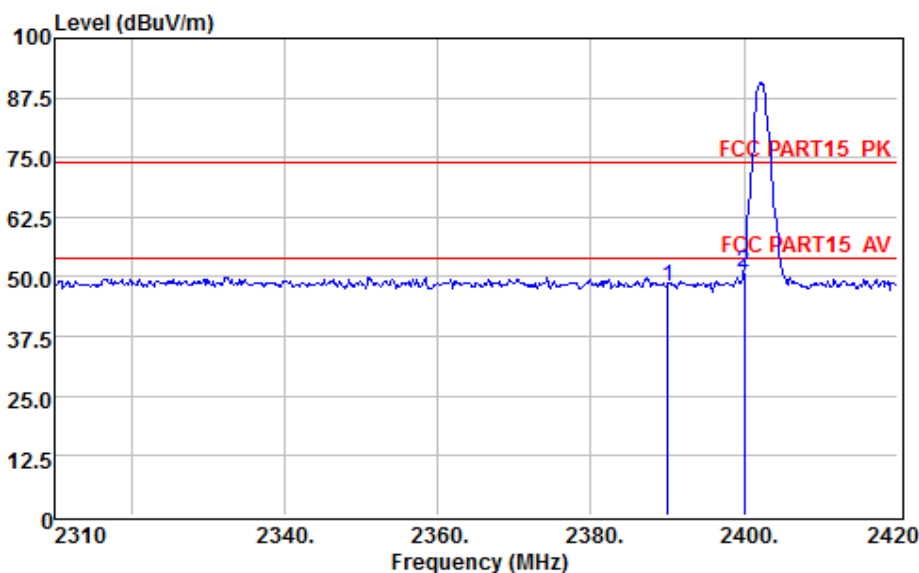
Test results

**Radiated
2Mbps
Vertical**



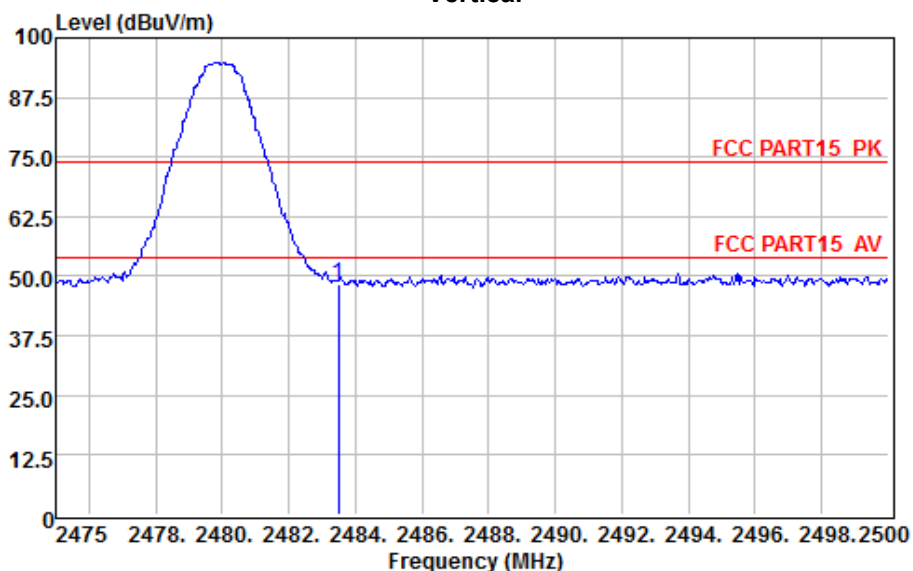
	Freq	ReadAntenna	Cable	Limit	Over	Remark
	MHz	Level	Factor	Line	Limit	
	MHz	dBuV	dB/m	dB	dBuV/m	dB
1	2390.00	43.08	28.72	3.36	48.84	74.00 -25.16 Peak
2	2400.00	46.37	28.72	3.38	52.15	74.00 -21.85 Peak

Horizontal



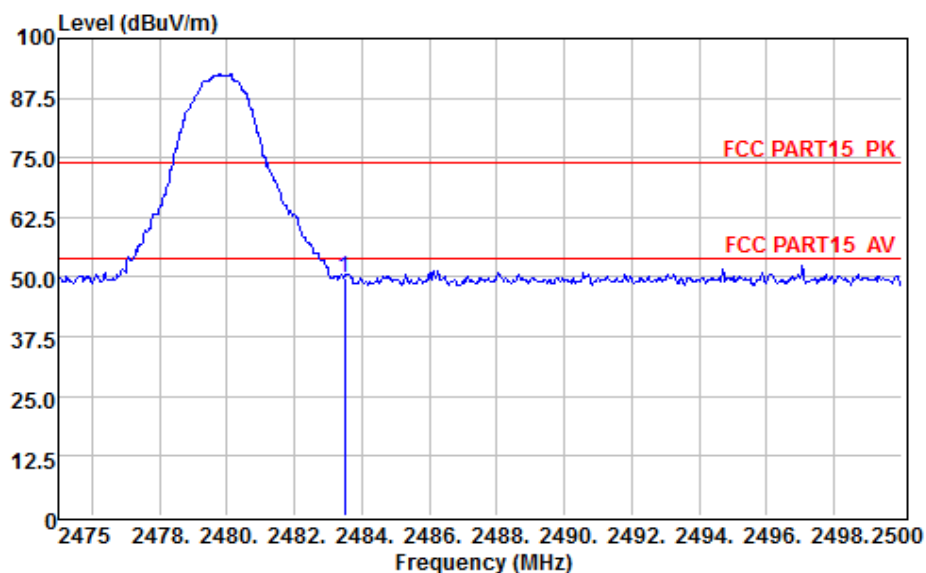
	Freq	ReadAntenna	Cable	Limit	Over	Remark
	MHz	Level	Factor	Line	Limit	
	MHz	dBuV	dB/m	dB	dBuV/m	dB
1	2390.00	42.37	28.72	3.36	48.13	74.00 -25.87 Peak
2	2400.00	45.01	28.72	3.38	50.79	74.00 -23.21 Peak

Vertical



	Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2483.50	42.46	28.79	3.48	48.39	74.00	-25.61	Peak

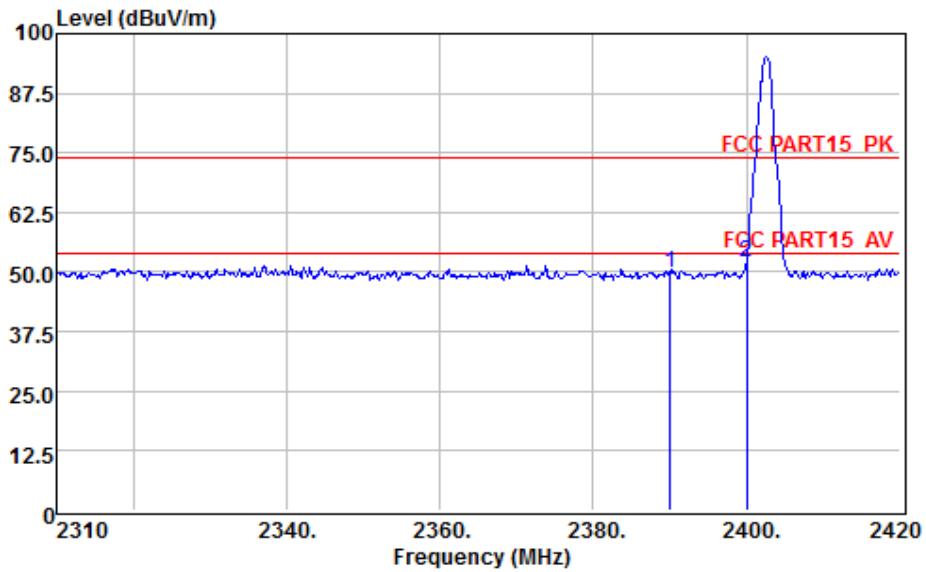
Horizontal



	Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2483.50	43.79	28.79	3.48	49.72	74.00	-24.28	Peak

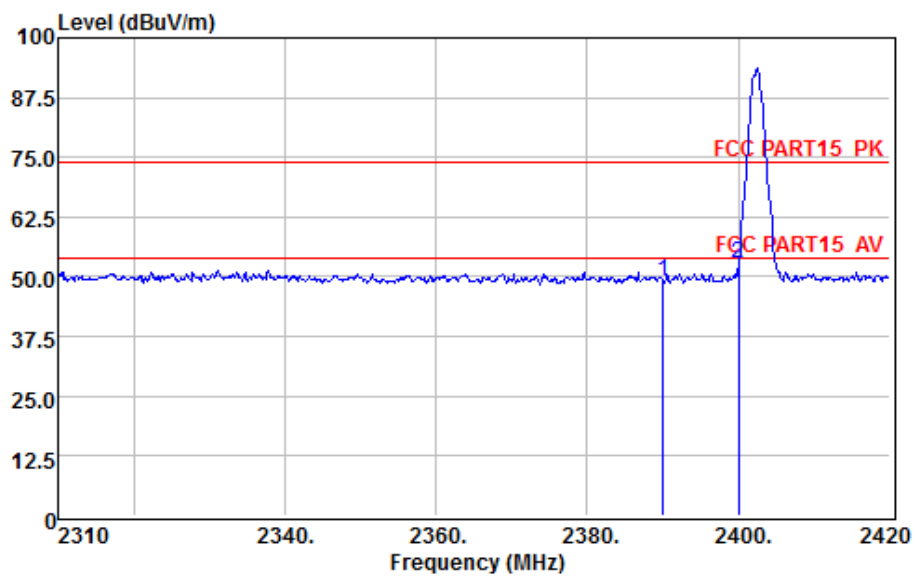
Test results

**Radiated
3Mbps
Vertical**



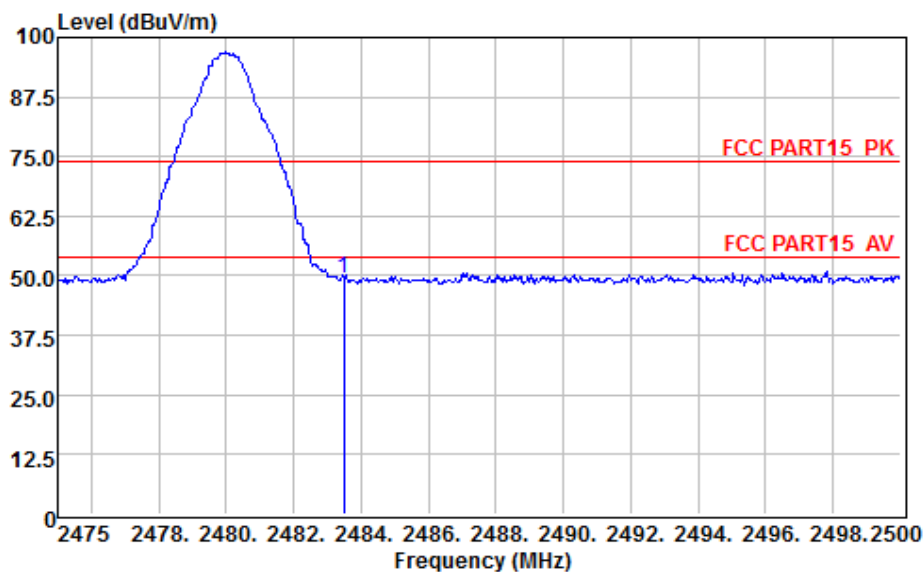
	ReadAntenna	Cable	Limit	Over			
Freq	Level	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2390.00	44.10	28.72	3.36	49.86	74.00	-24.14 Peak
2	2400.00	46.09	28.72	3.38	51.87	74.00	-22.13 Peak

Horizontal



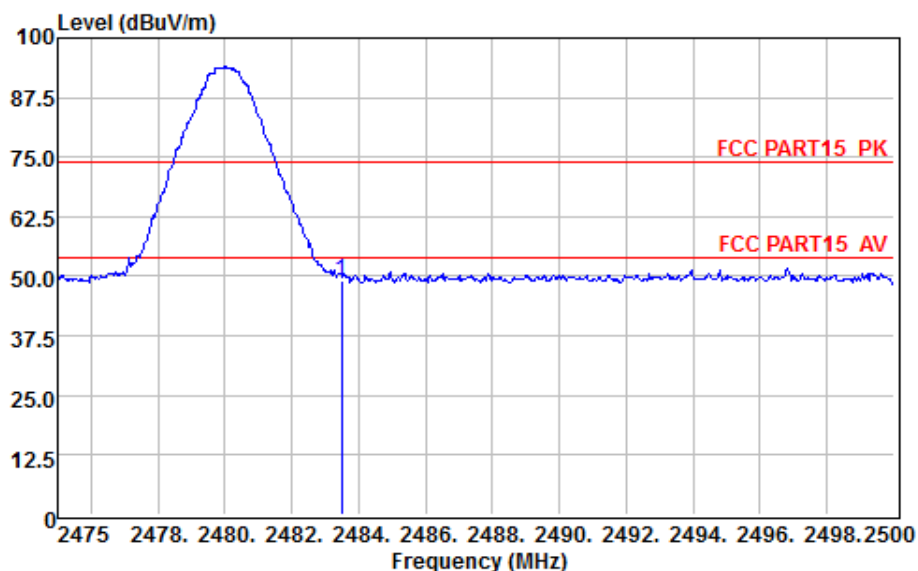
	ReadAntenna	Cable	Limit	Over			
Freq	Level	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2390.00	43.49	28.72	3.36	49.25	74.00	-24.75 Peak
2	2400.00	47.00	28.72	3.38	52.78	74.00	-21.22 Peak

Vertical



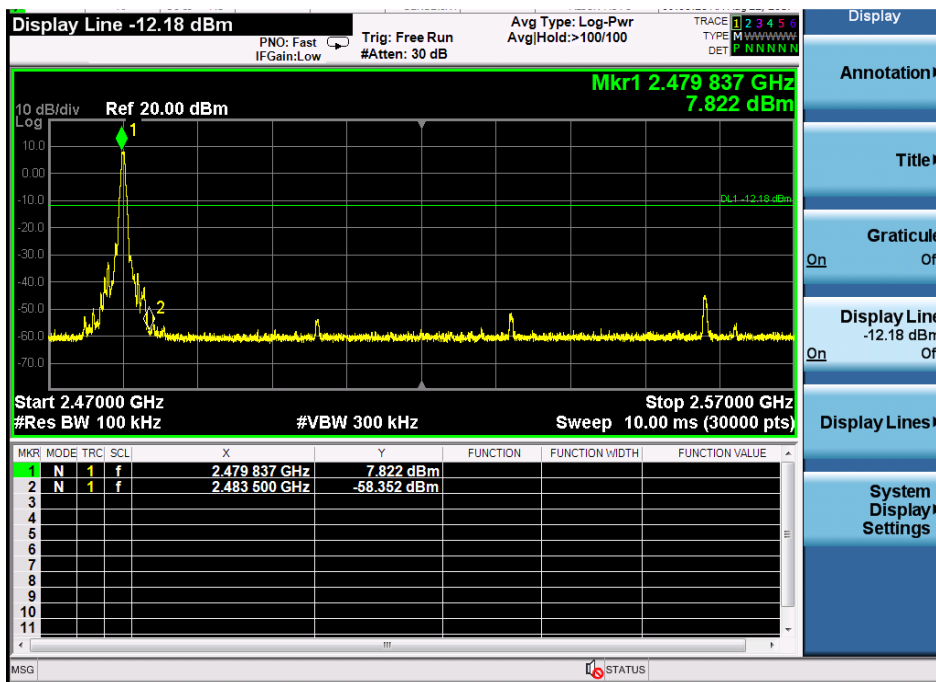
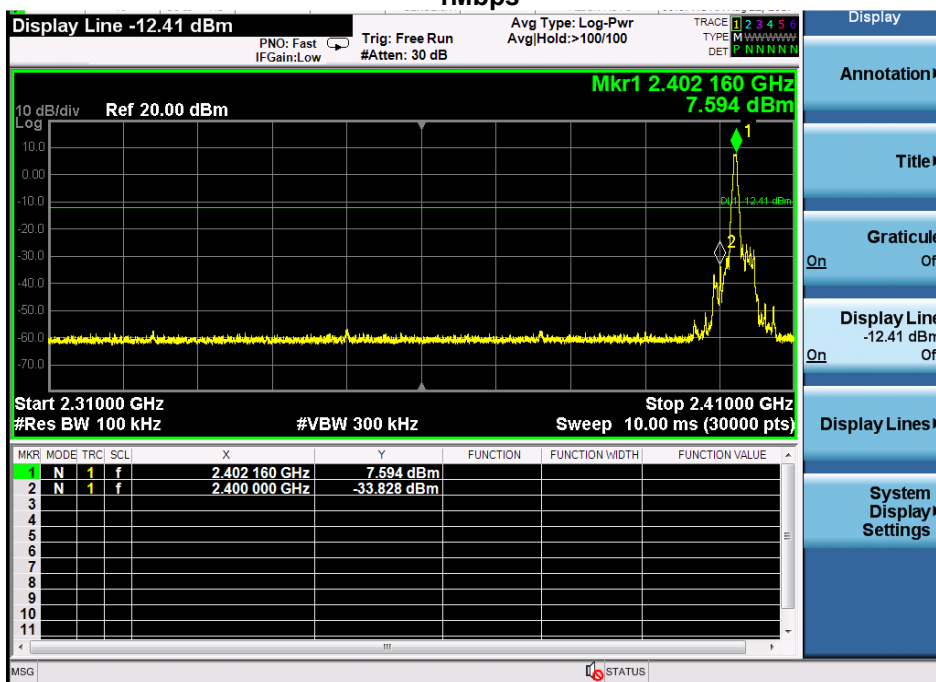
	Freq	ReadAntenna Level	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dB	
1	2483.50	43.65	28.79	3.48	49.58	74.00	-24.42 Peak

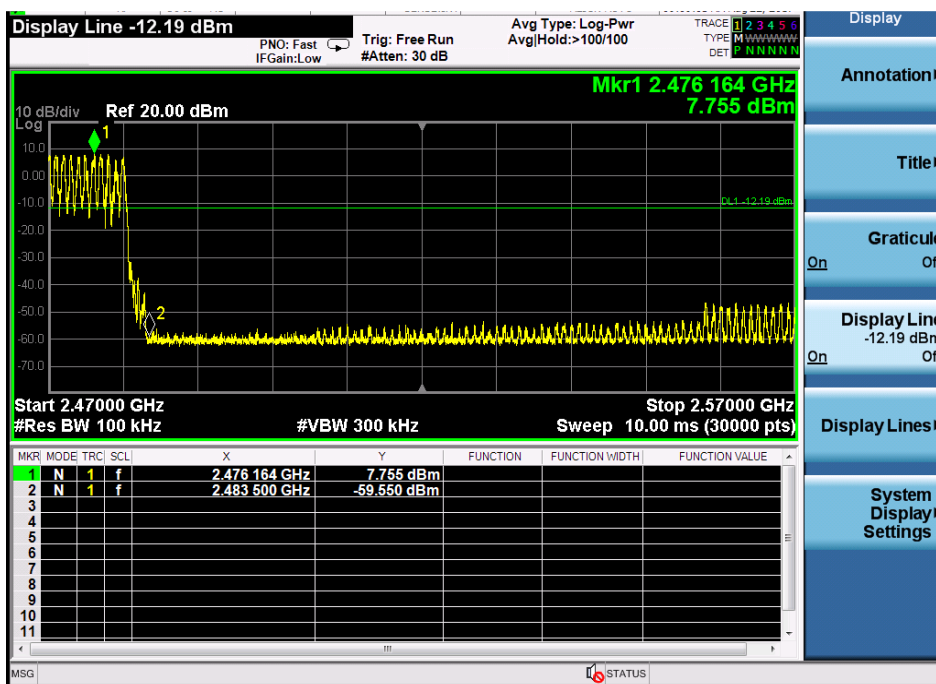
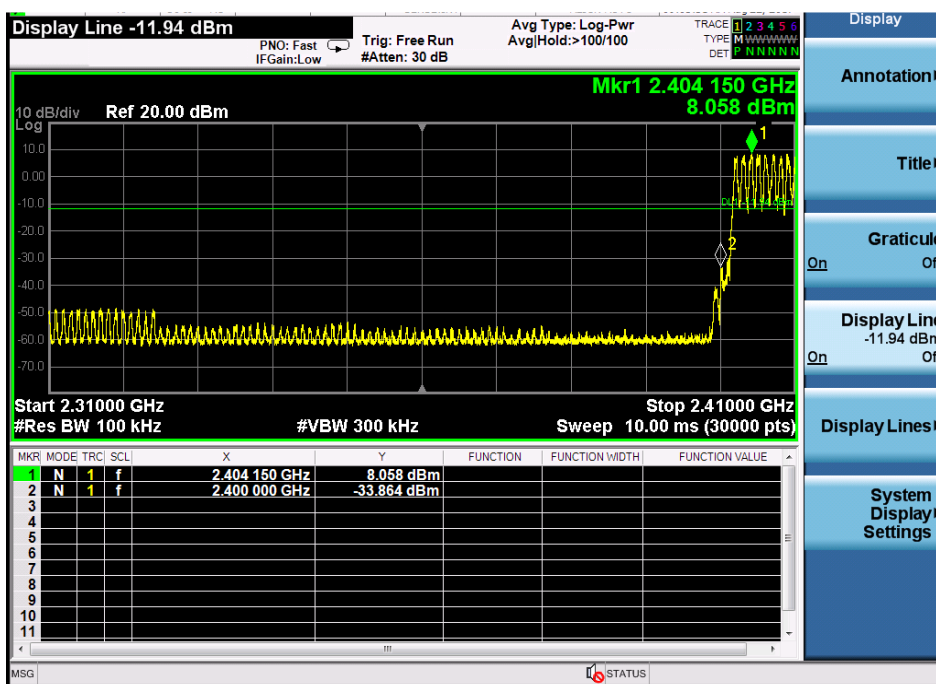
Horizontal



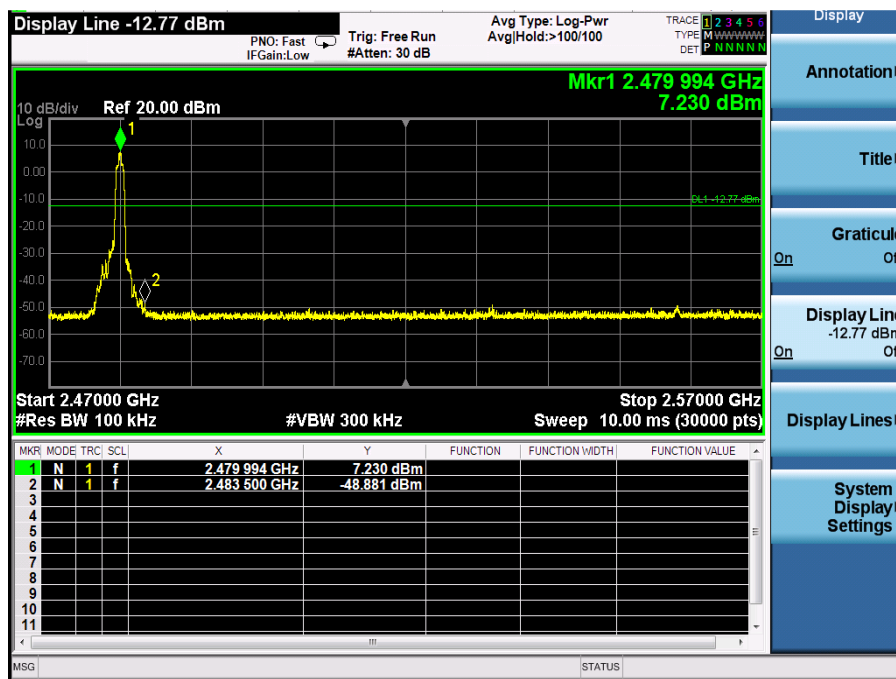
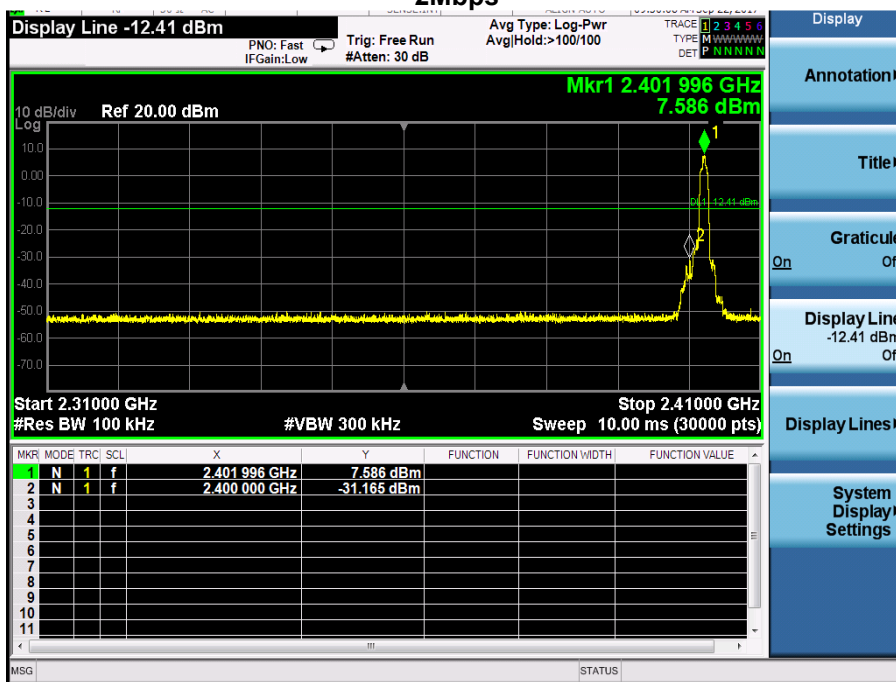
	Freq	ReadAntenna Level	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dB	
1	2483.50	43.25	28.79	3.48	49.18	74.00	-24.82 Peak

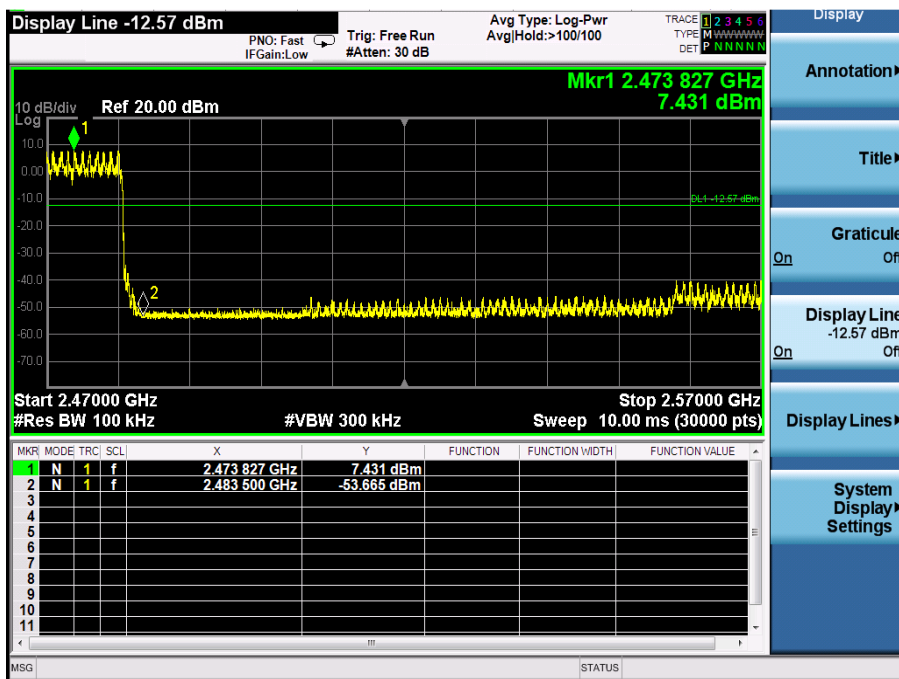
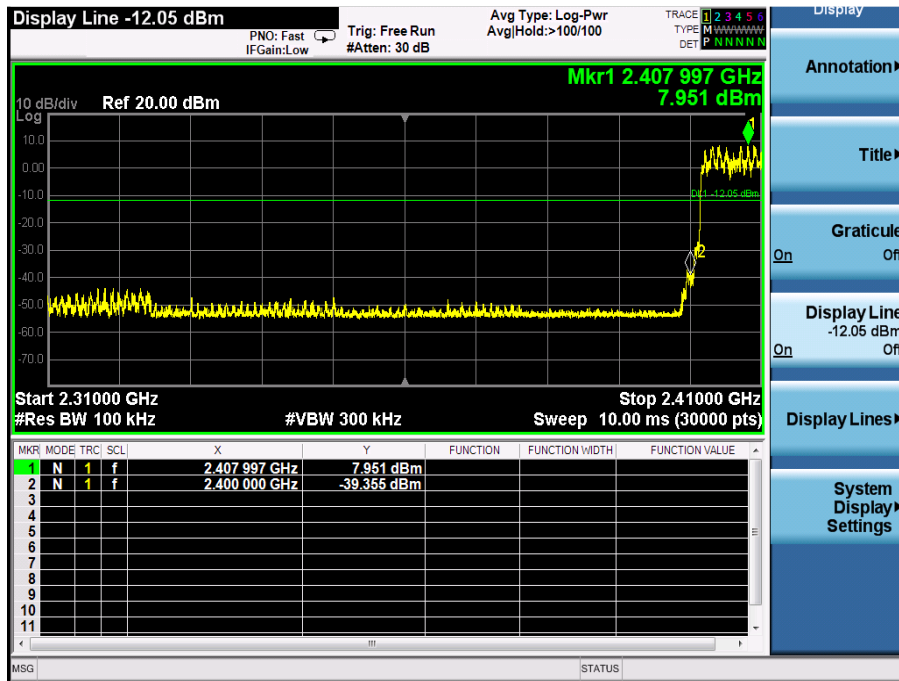
Conducted 1Mbps



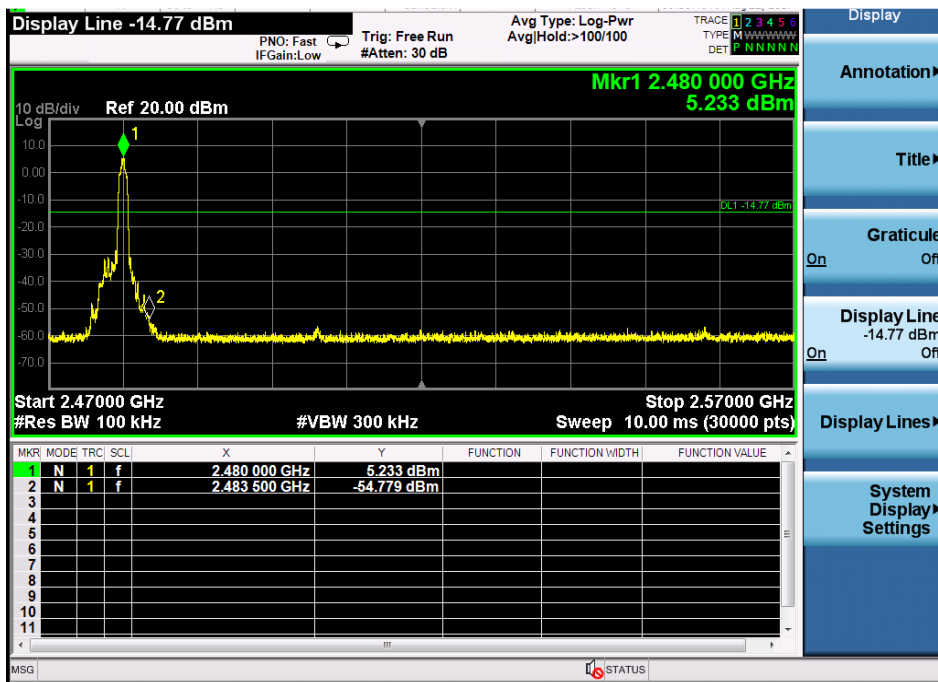
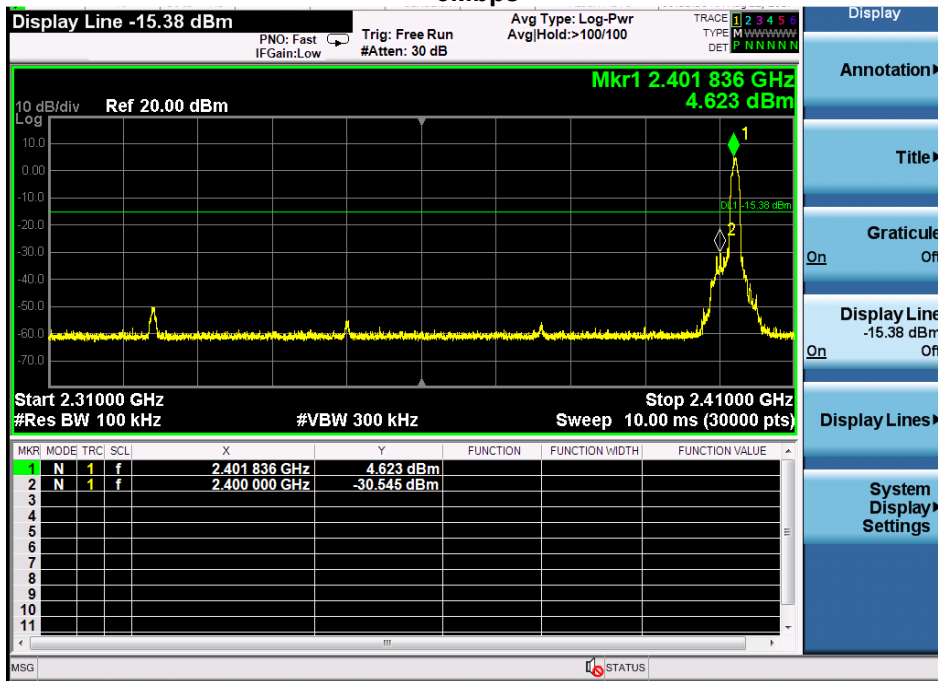


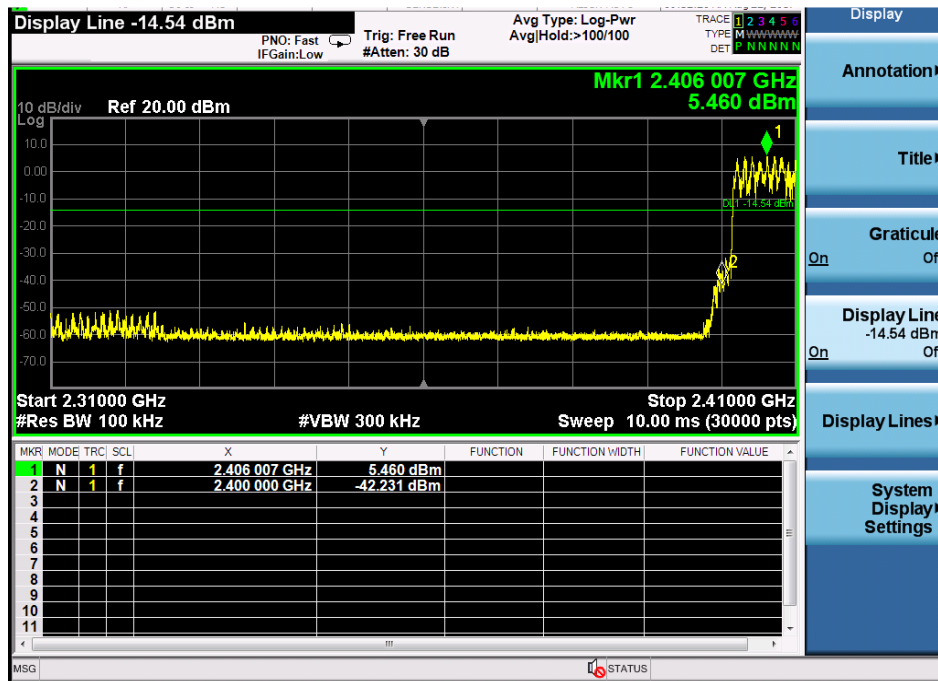
2Mbps





3Mbps





Display

Annotation

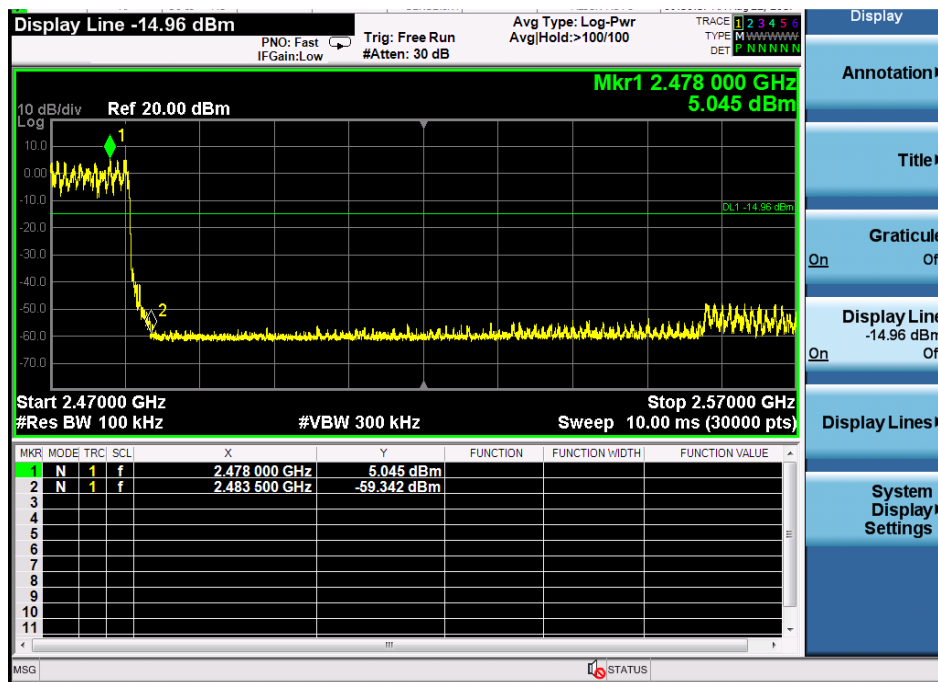
Title

Graticule
On Off

Display Line
On Off
-14.54 dBm

Display Lines

System Display Settings



Display

Annotation

Title

Graticule
On Off

Display Line
On Off
-14.96 dBm

Display Lines

System Display Settings

6. 20dB Bandwidth

6.1. Limits

According to FCC Section 15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth($10 \cdot \log 1\% = 20\text{dB}$)taking the RF output power

6.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, during the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting.

2. Set the spectrum analyzer:

Span: approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

RBW $\geq 1\%$ of the span(30KHz)

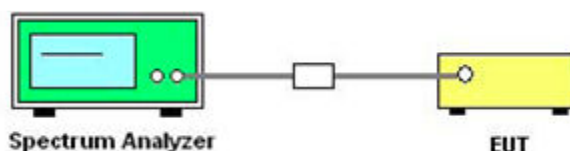
VBW \geq RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold

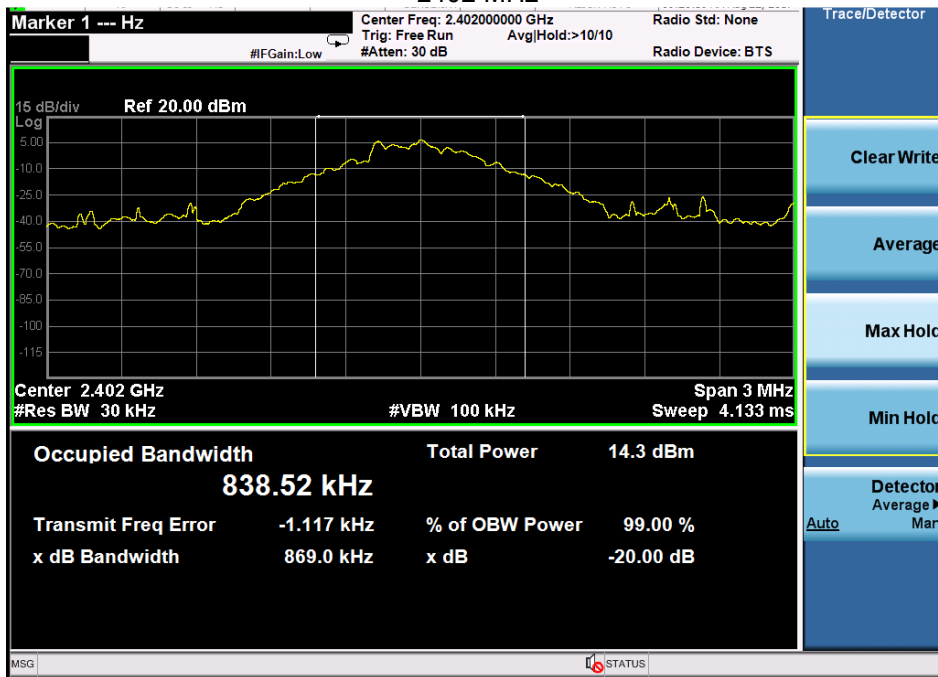
6.3. Test Setup



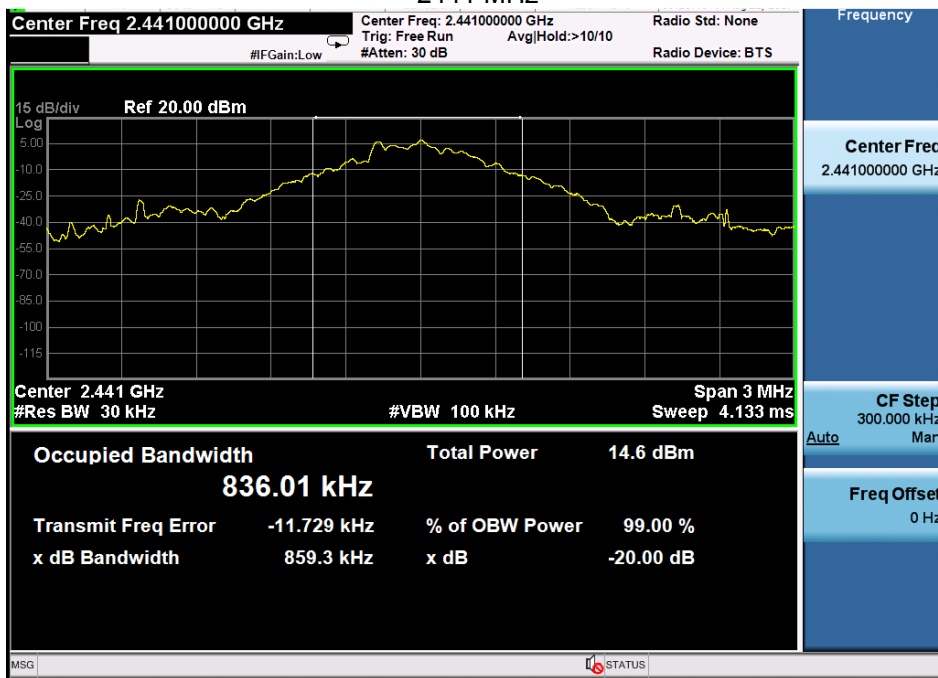
Test results

Test Mode	Channel Frequency (MHz)	20dB Bandwidth (KHz)	Result
1Mbps	2402	869	Pass
	2441	859.3	Pass
	2480	853.7	Pass
2Mbps	2402	1215	Pass
	2441	1213	Pass
	2480	1216	Pass
3Mbps	2402	1207	Pass
	2441	1207	Pass
	2480	1208	Pass

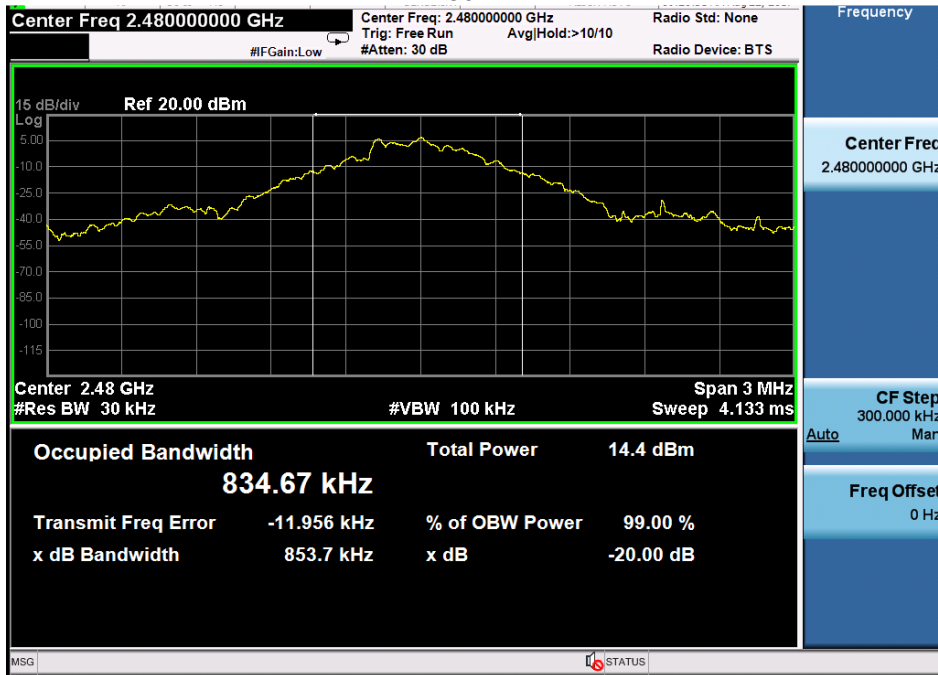
1Mbps
2402 MHz



2441 MHz

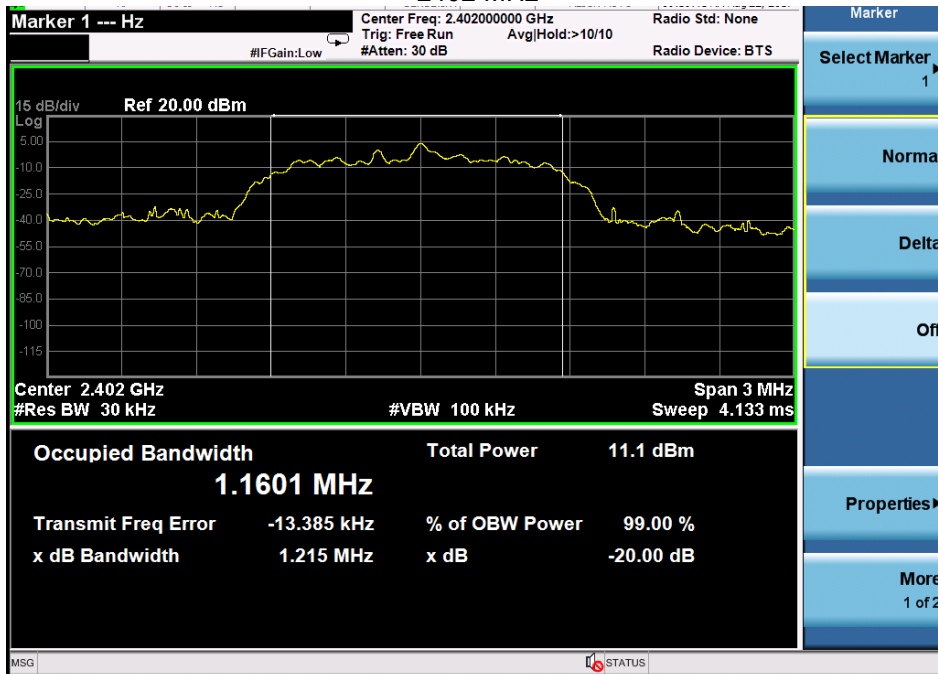


2480 MHz

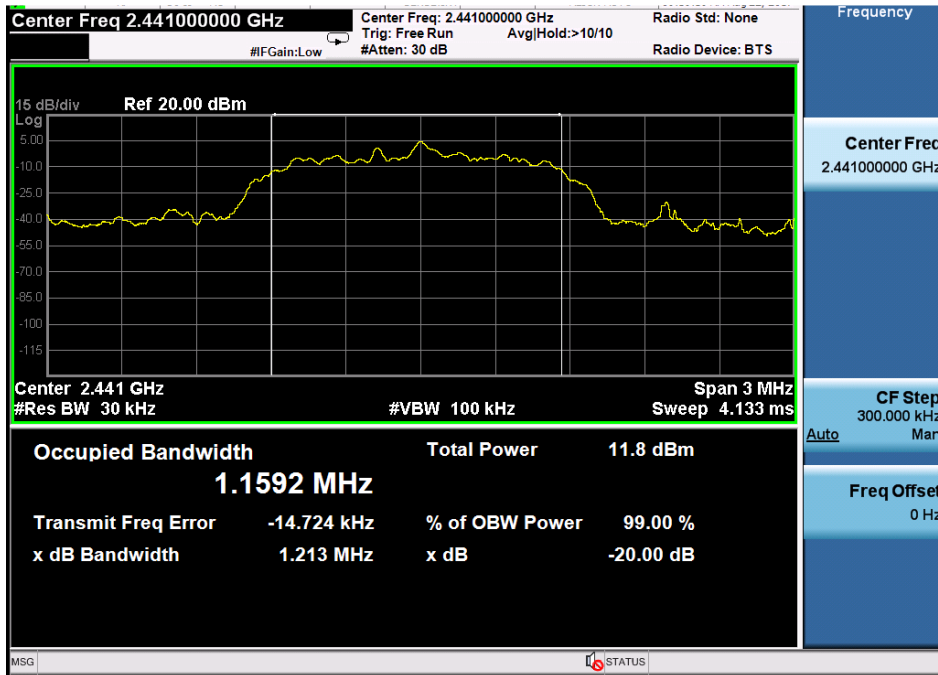


2Mbps

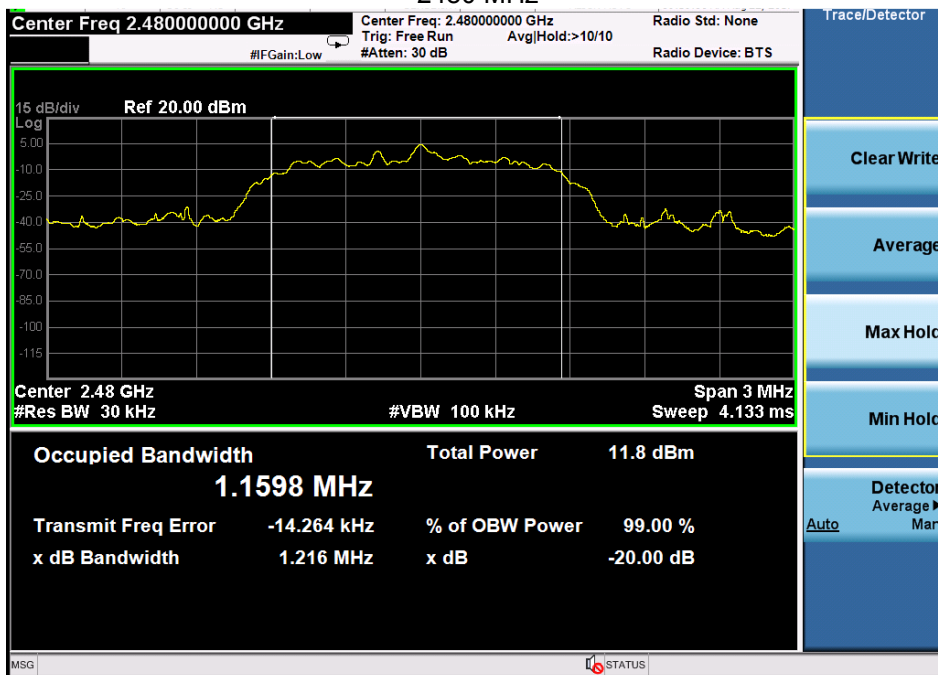
2402 MHz



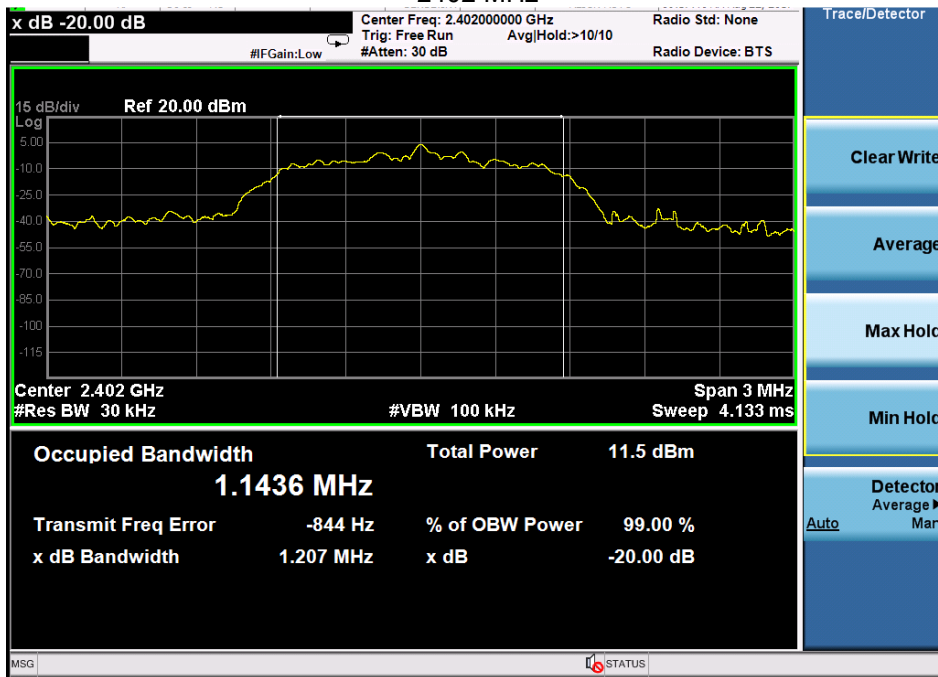
2441 MHz



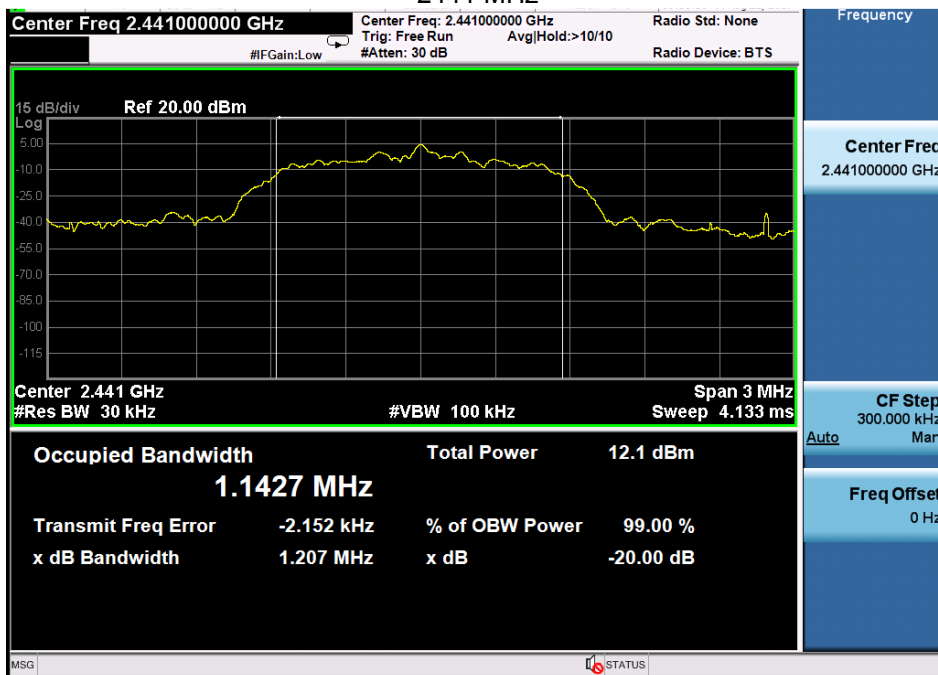
2480 MHz

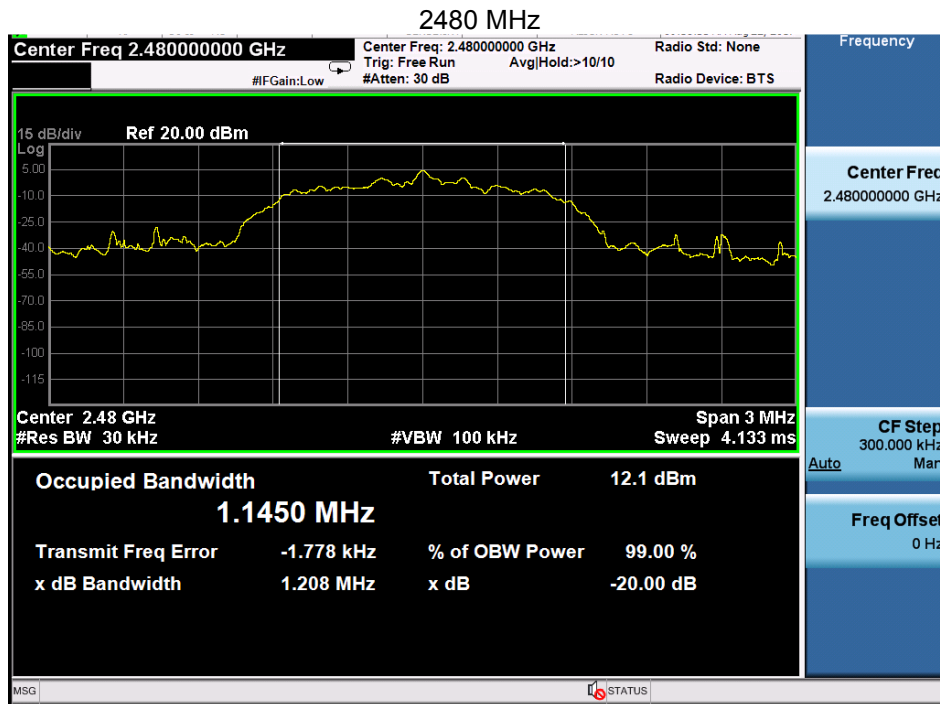


3Mbps
2402 MHz



2441 MHz





7. Frequency Separation

7.1. Limits

According to FCC Section 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

7.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: wide enough to capture the peaks of two adjacent channels

RBW \geq 1% of the span(30KHz)

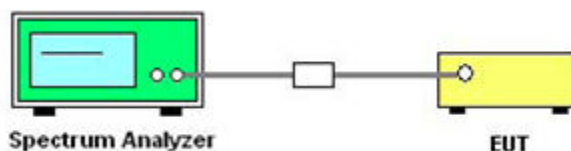
VBW \geq RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold

7.3. Test Setup



Test results

Test Mode	Channel Frequency (MHz)	20dB Bandwidth (KHz)	Limit (KHz)	Result
1Mbps	2402	993.8	579.3333	Pass
	2441	1005.1	572.8667	Pass
	2480	1000	569.1333	Pass
3Mbps	2402	1000.4	810	Pass
	2441	1002.8	808.6667	Pass
	2480	999.2	810.6667	Pass

1Mbps
2402 MHz



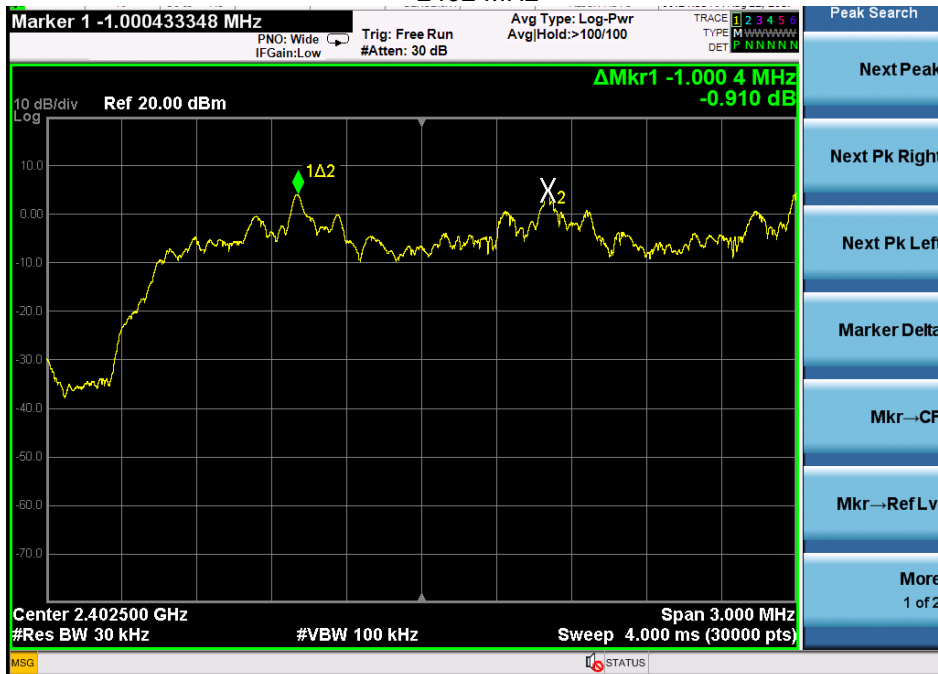
2441 MHz



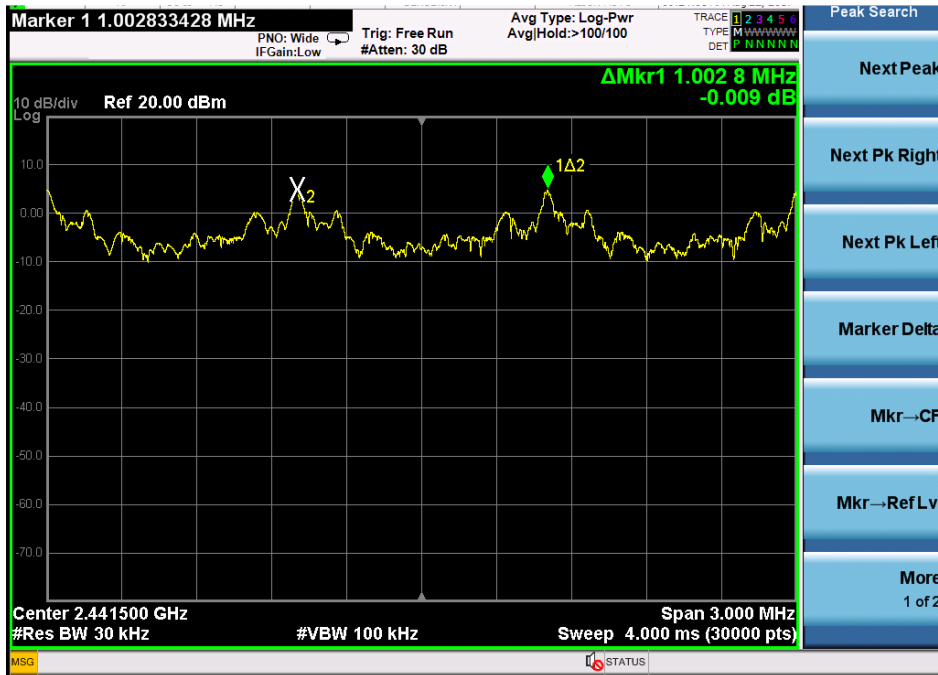
2480 MHz



3Mbps
2402 MHz



2441 MHz



2480 MHz



8. Maximum Peak Output Power

8.1. Limits

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.
 For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

8.2. Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below

2. Set the spectrum analyzer:

Spectrum Setting : RBW > the 20 dB bandwidth of the emission being measured

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

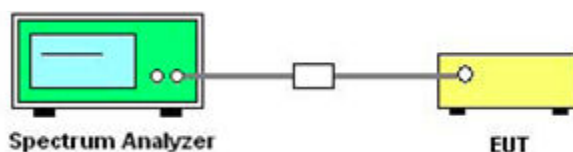
VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

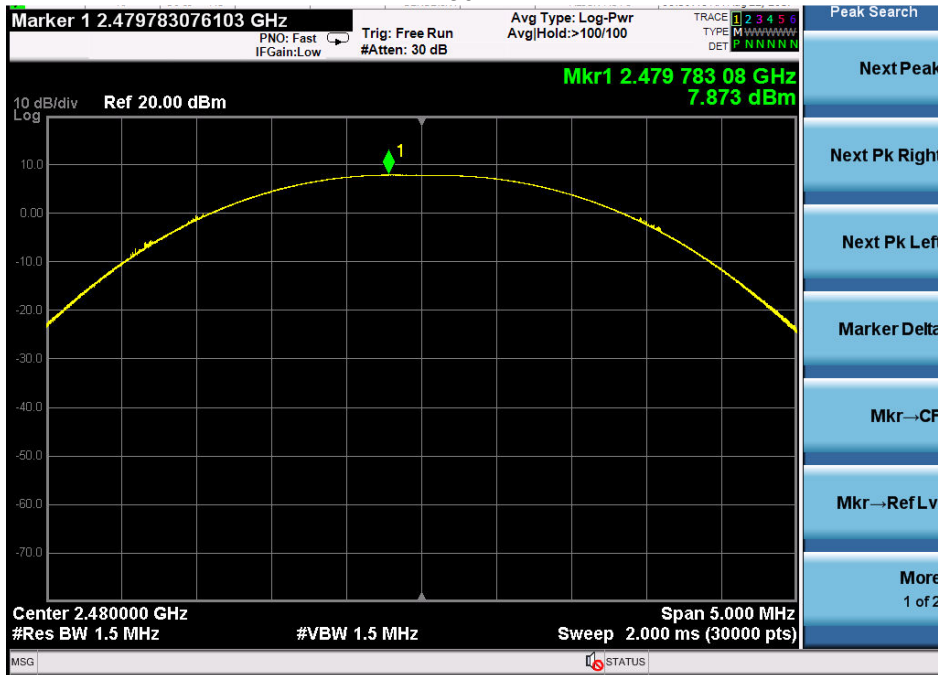
8.3. Test Setup



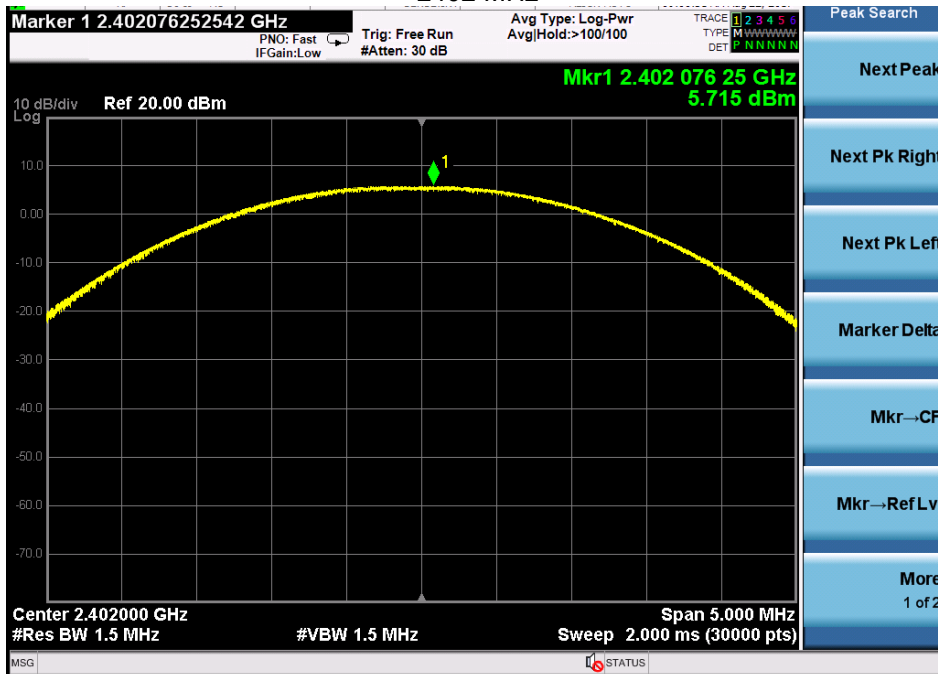
Test results

Test Mode	Channel Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Result
1Mbps	2402	7.721	30	Pass
	2441	8.031	30	Pass
	2480	7.873	30	Pass
2Mbps	2402	5.715	20.96	Pass
	2441	6.342	20.96	Pass
	2480	6.291	20.96	Pass
3Mbps	2402	6.180	20.96	Pass
	2441	6.761	20.96	Pass
	2480	6.688	20.96	Pass

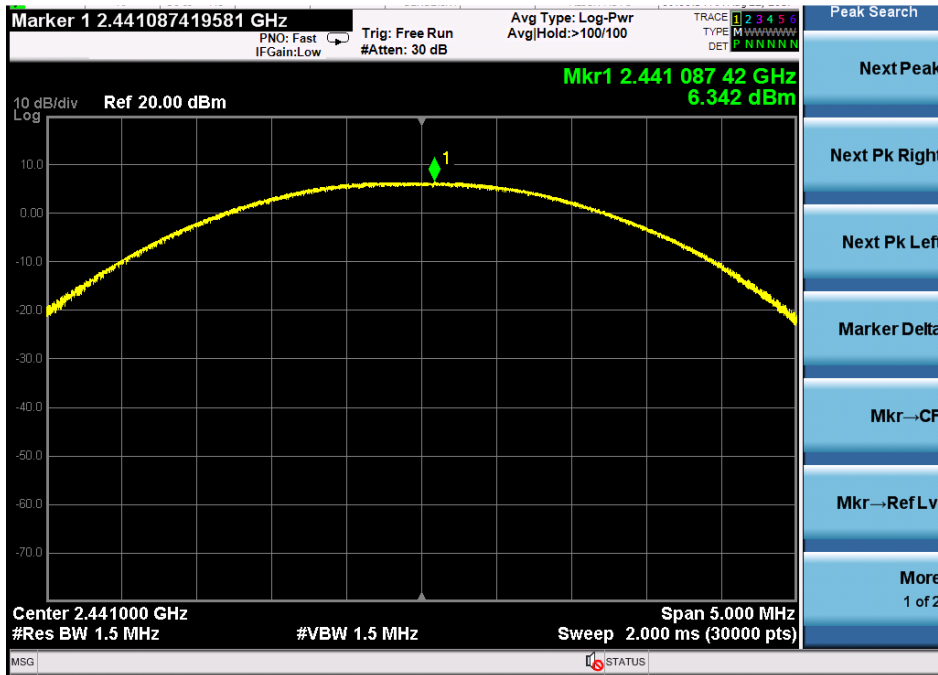
2480 MHz



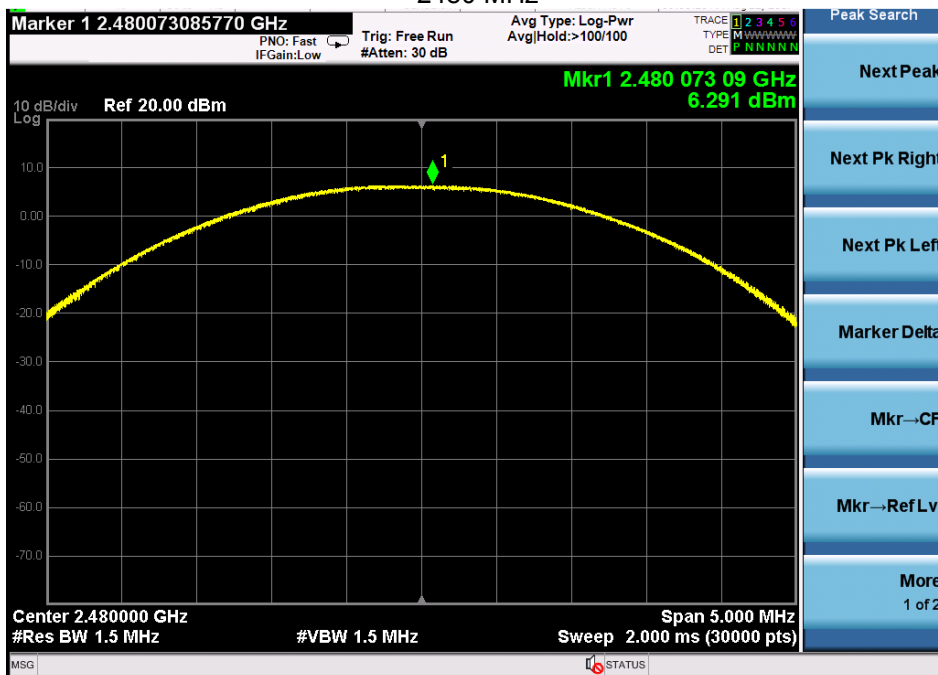
2Mbps
2402 MHz



2441 MHz



2480 MHz



9. Number of Hopping Frequency

9.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

9.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: the frequency band of operation

RBW =100KHz

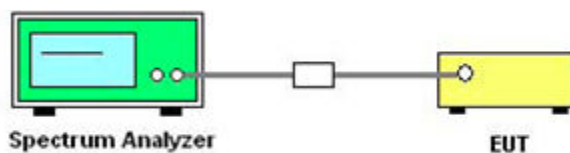
VBW=300KHz

Sweep=auto

Detector function=peak

Trace=max hold

9.3. Test Setup



Test results

Test Mode	Measured channel numbers	Limit	Result
1Mbps	79	≥ 15	Pass
3Mbps	79	≥ 15	Pass

10. Dwell time

10.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

10.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode power.

2. Set the spectrum analyzer:

Span= 0Hz, RBW =1000 kHz, VBW = 3000 kHz

Use a video trigger with the trigger level set to enable triggering only on full pulses.

Detector function=peak, Sweep Time is more than once pulse time.

Set the EUT for DH5, DH3 and DH1 packet transmitting

Measure the maximum time duration of one single pulse.

A Period Time = (channel number)*0.4

DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)

DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)

DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

For Example:

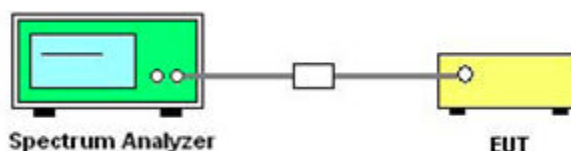
BT hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.

With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),

Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.

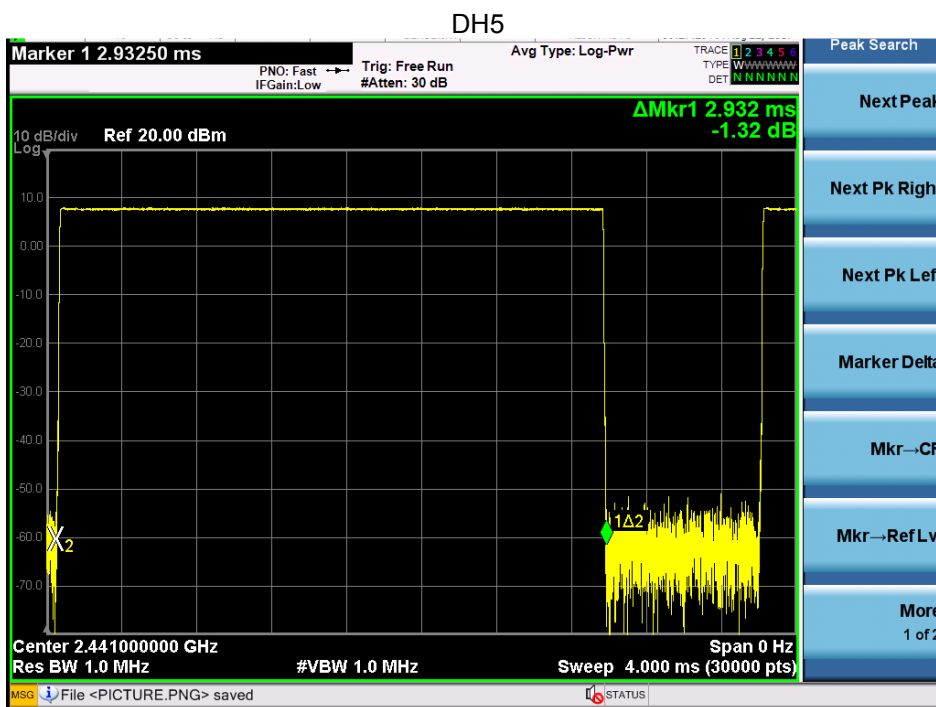
Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

10.3. Test Setup



Test results

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)
DH5	2441	2.932	0.313	0.4
3DH5	2441	2.949	0.315	0.4



11. Antenna Requirements

11.1. Limits

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.

Test results

The antennas used for this product is PCB antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0dBi.

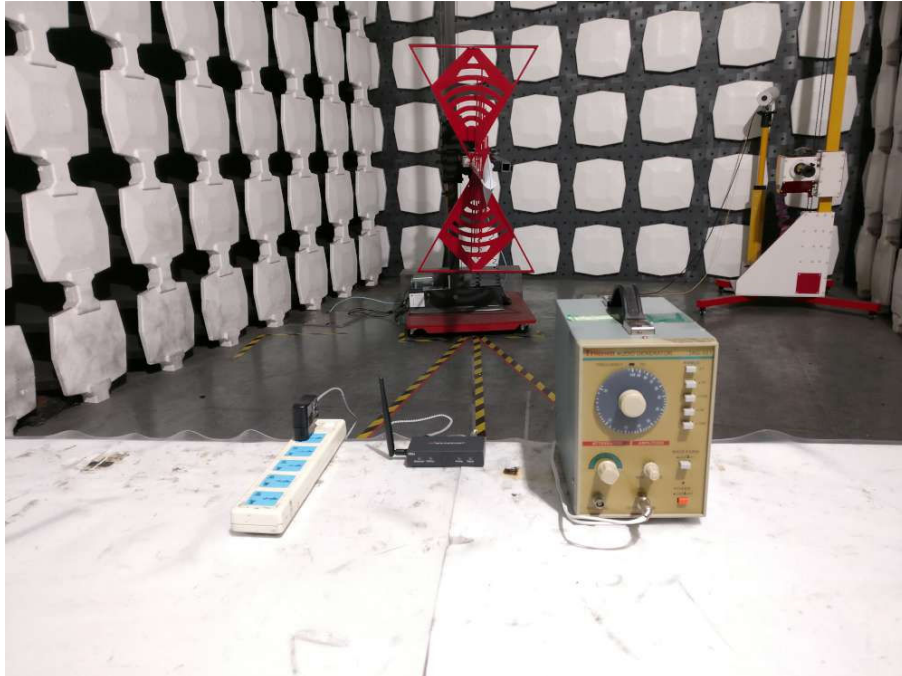
12. Photographs of Test Setup

Conducted Emission

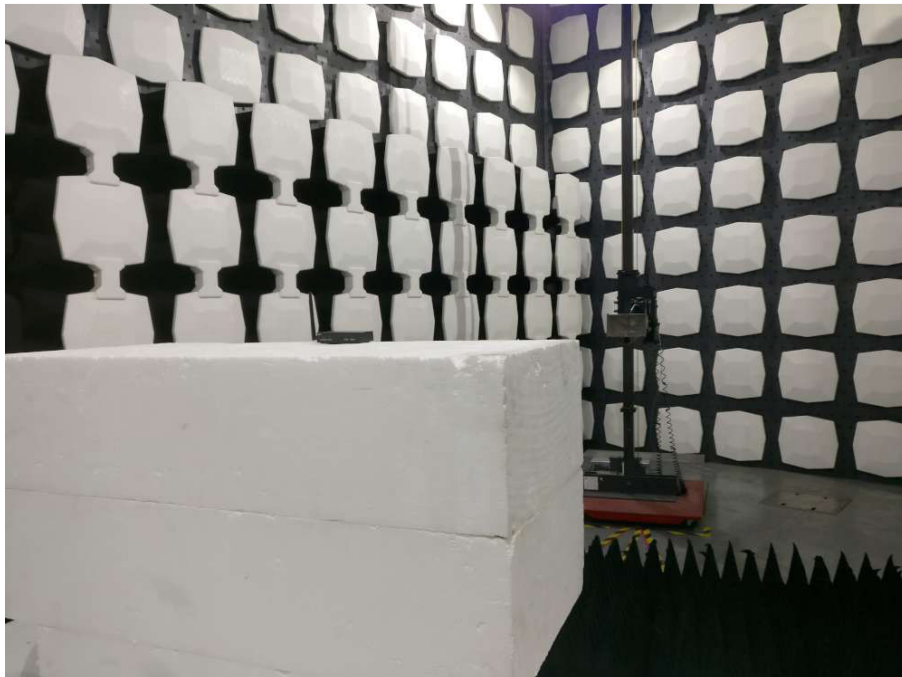


Radiated

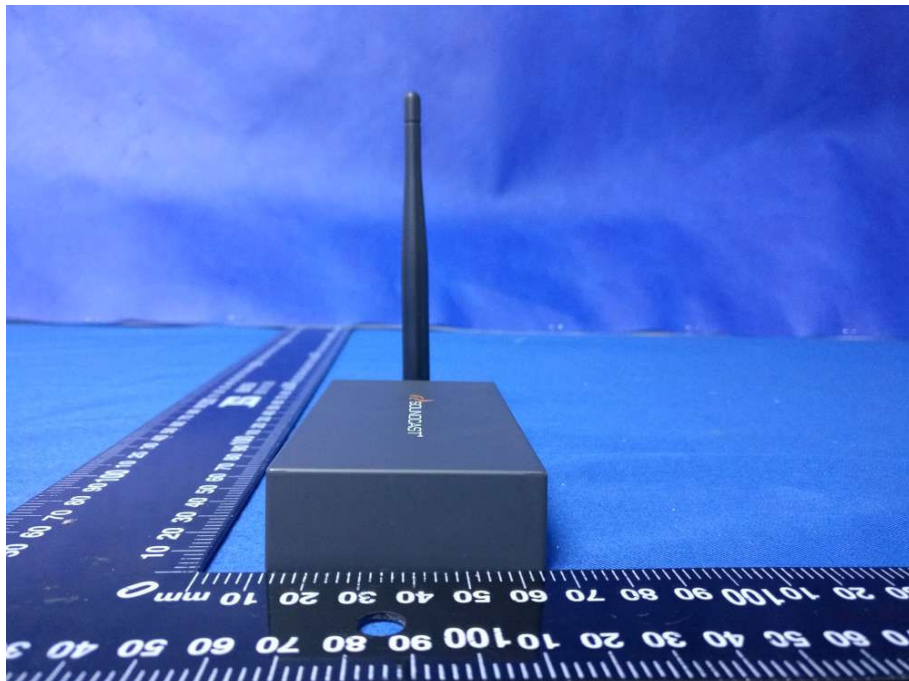
Below 1GHz

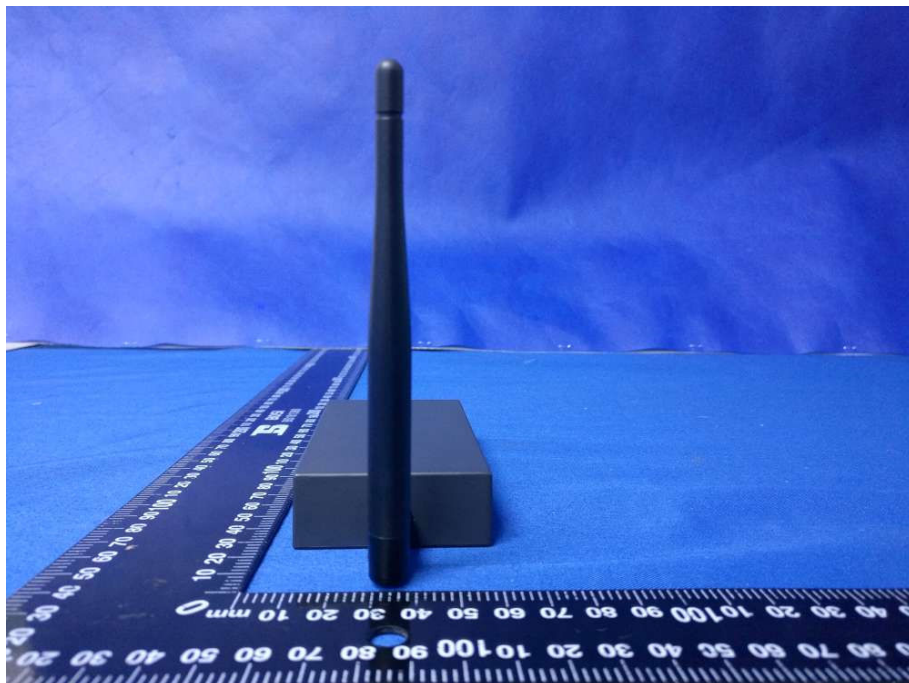


Above 1GHz

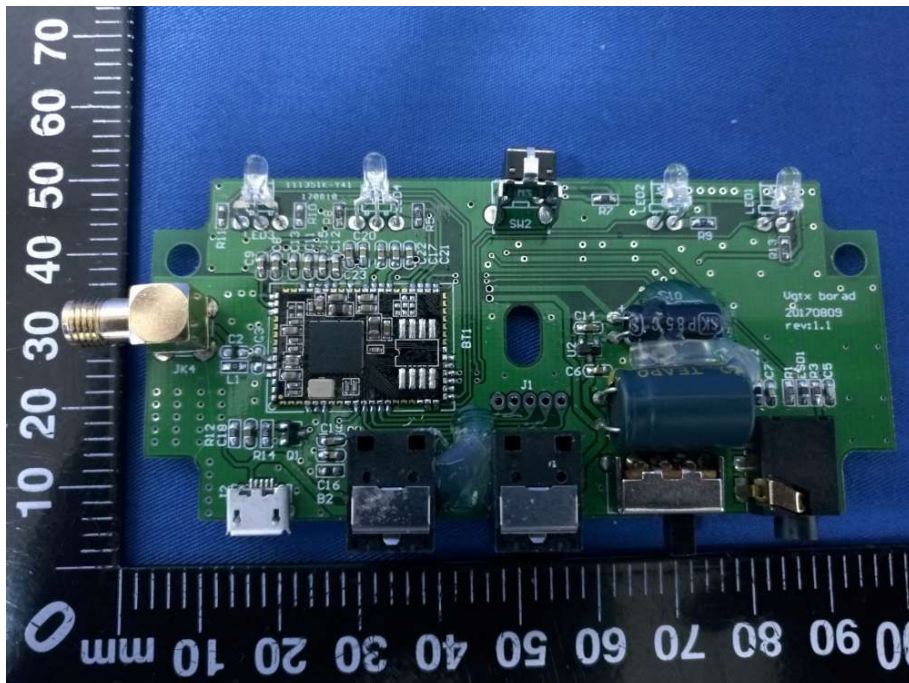


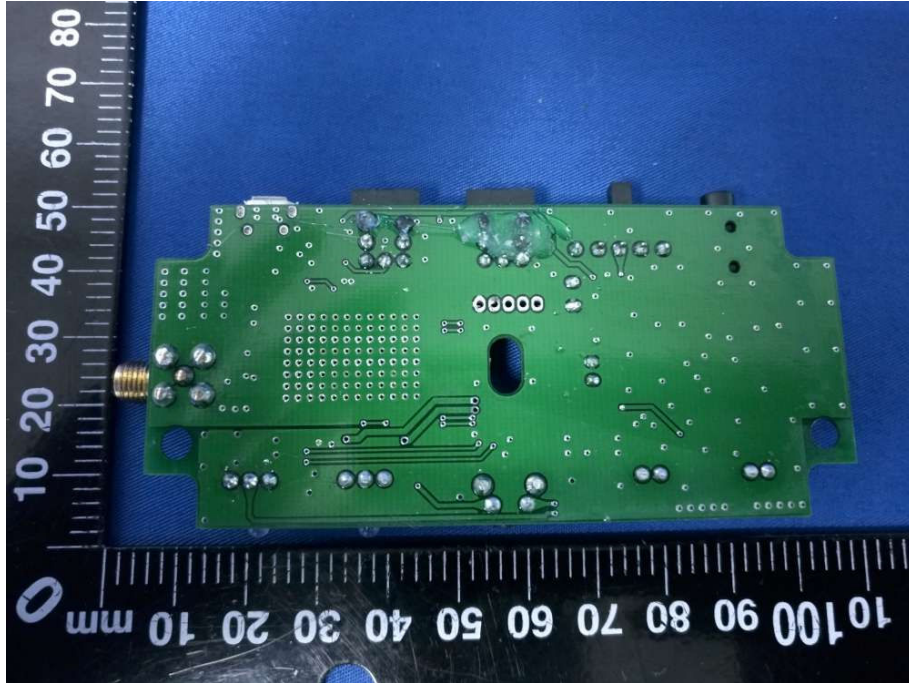
13. Photographs of the EUT











*** The end of report ***