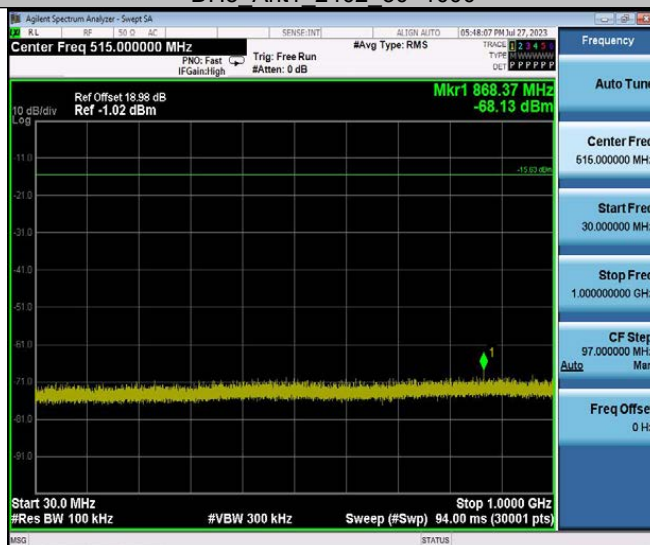


Conducted Spurious Emission

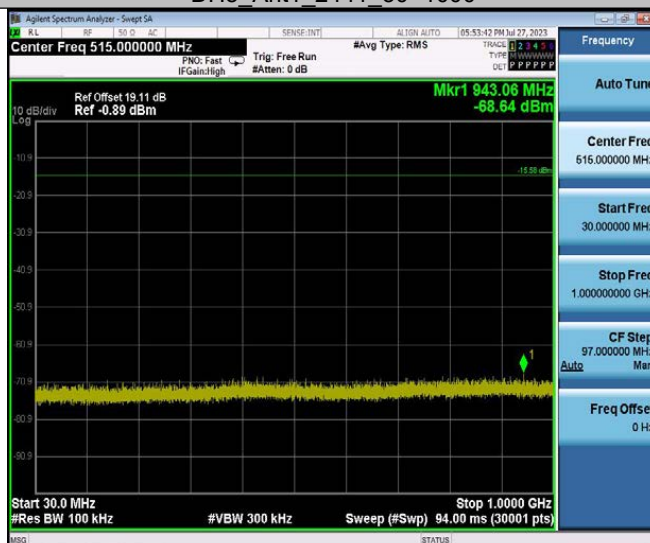
DH5 Ant1 2402 30~1000



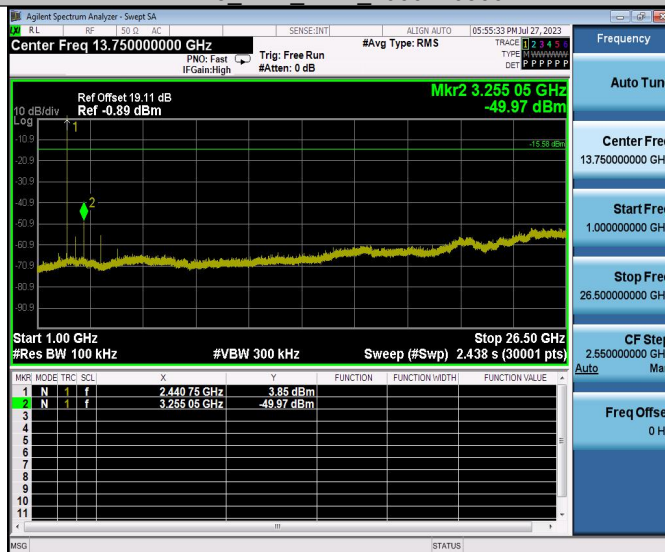
DH5 Ant1 2402 1000~26500



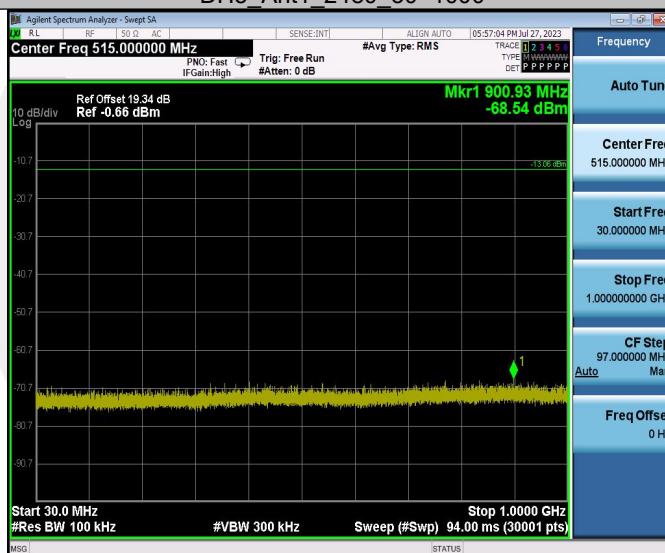
DH5 Ant1 2441 30~1000



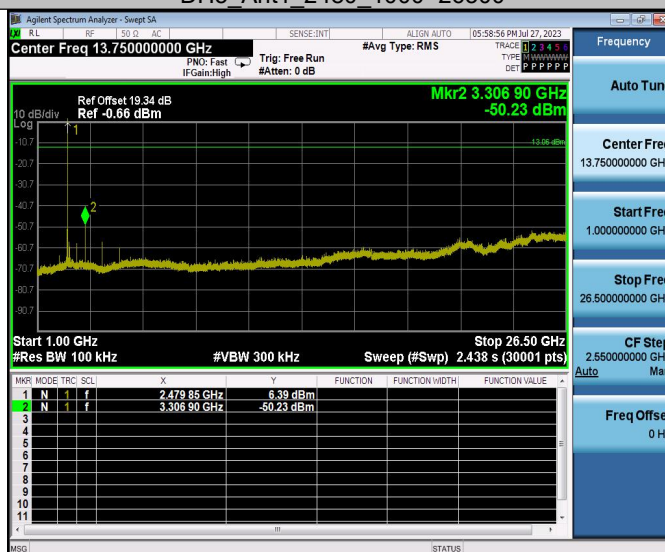
DH5_Ant1_2441_1000~26500



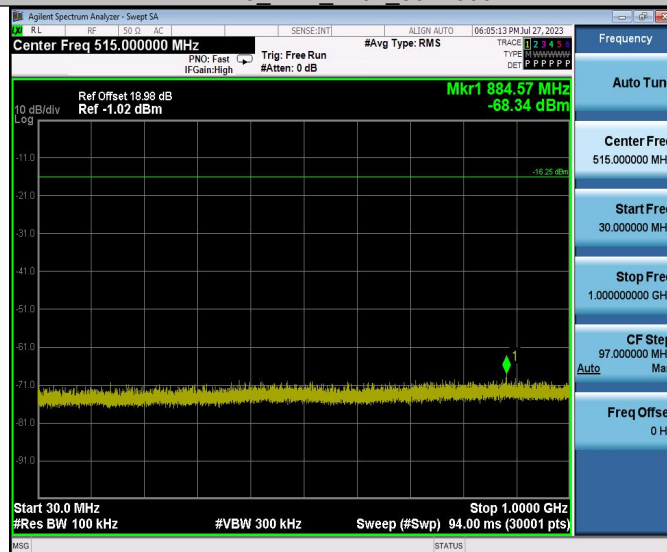
DH5_Ant1_2480_30~1000



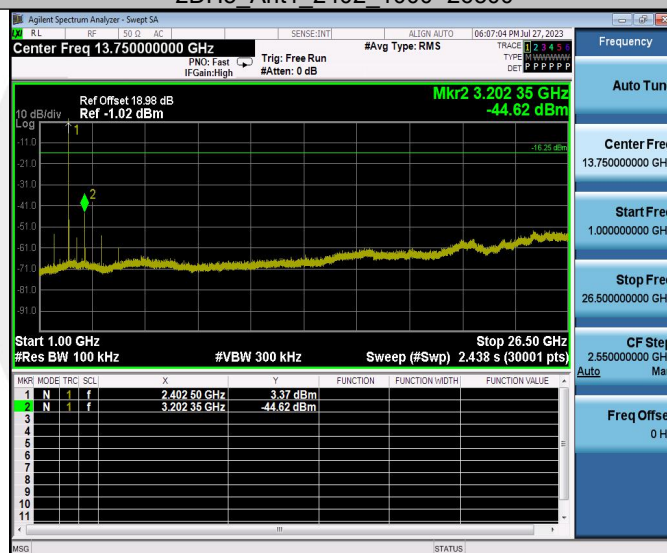
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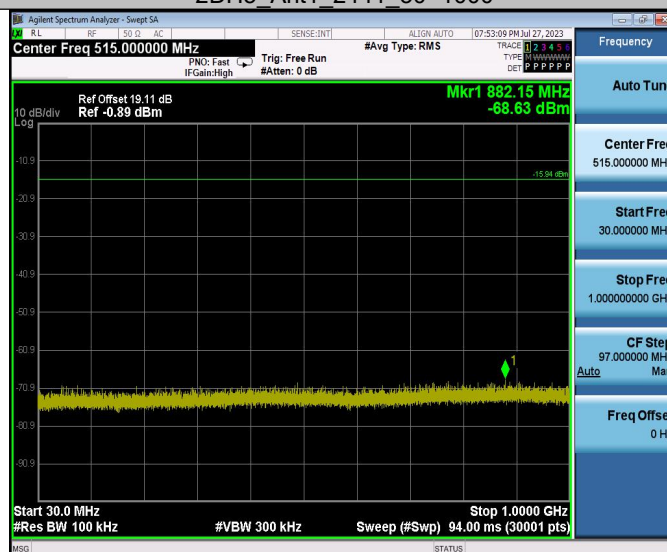
2DH5_Ant1_2402_30~1000



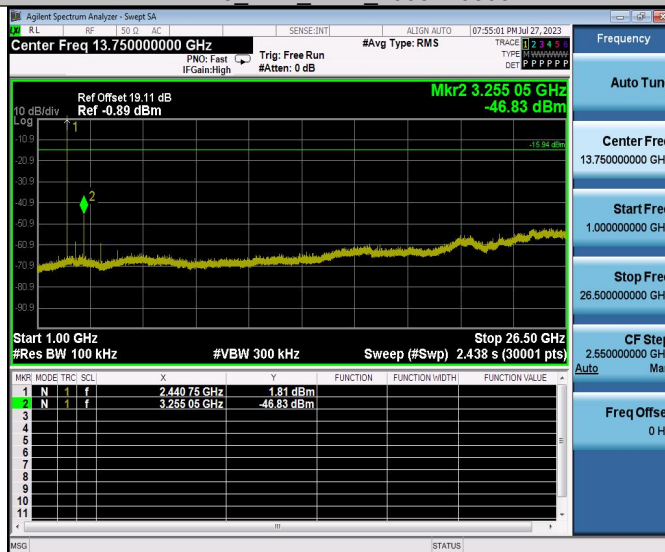
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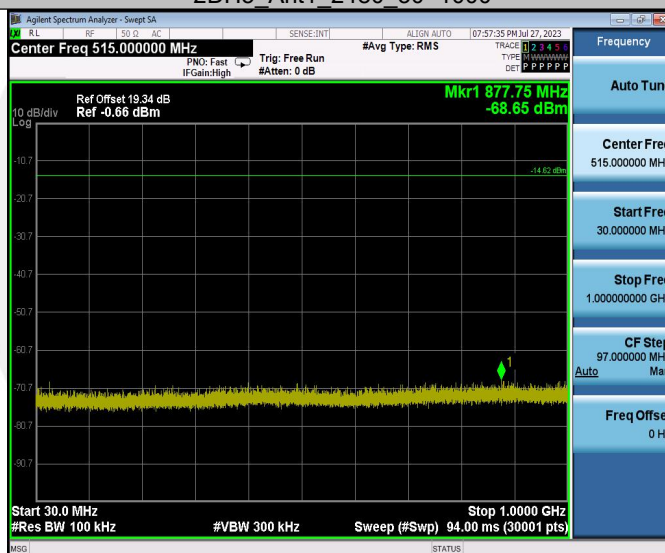
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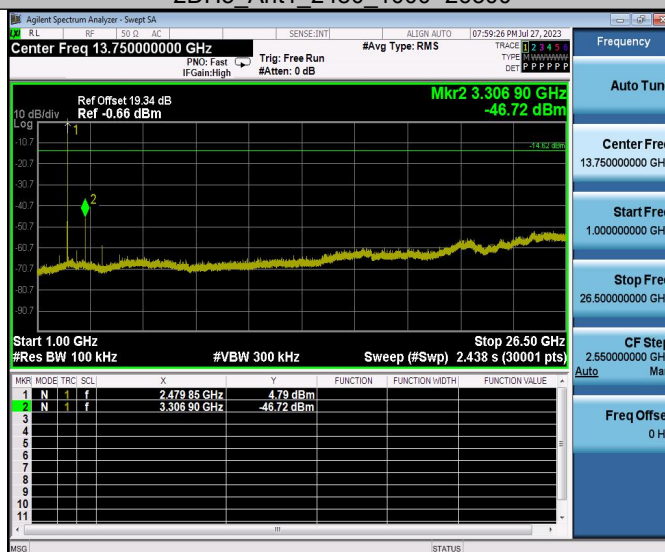
2DH5_Ant1_2441_1000~26500



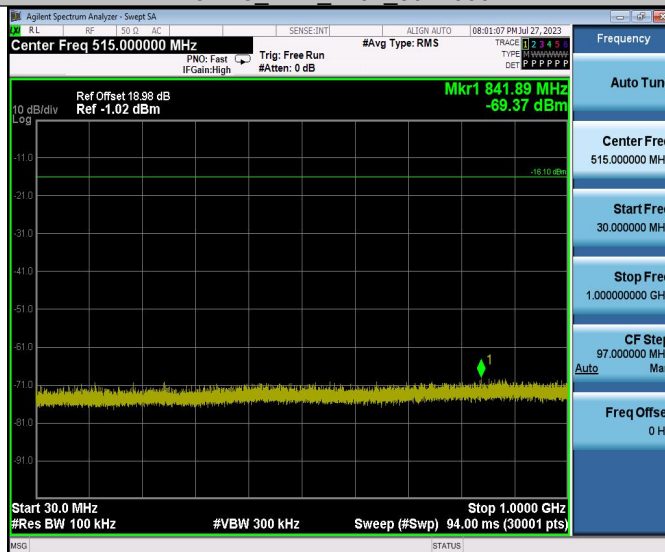
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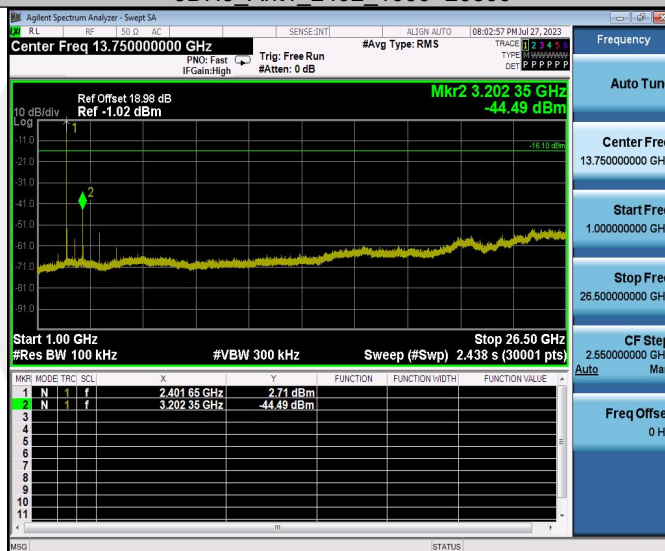
2DH5_Ant1_2480_1000~26500



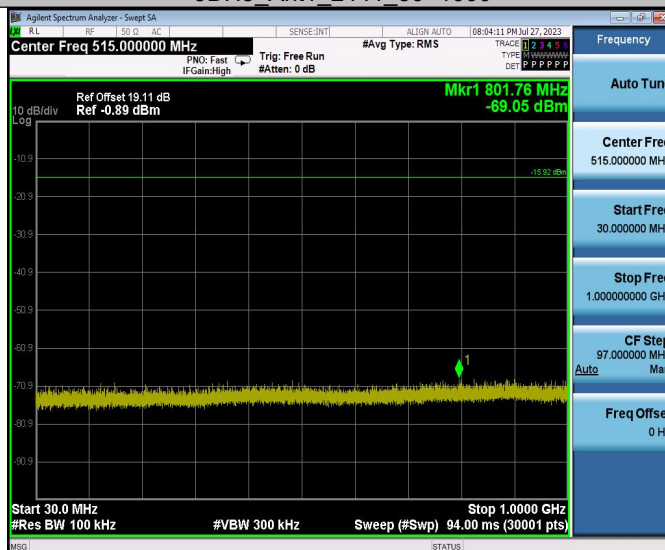
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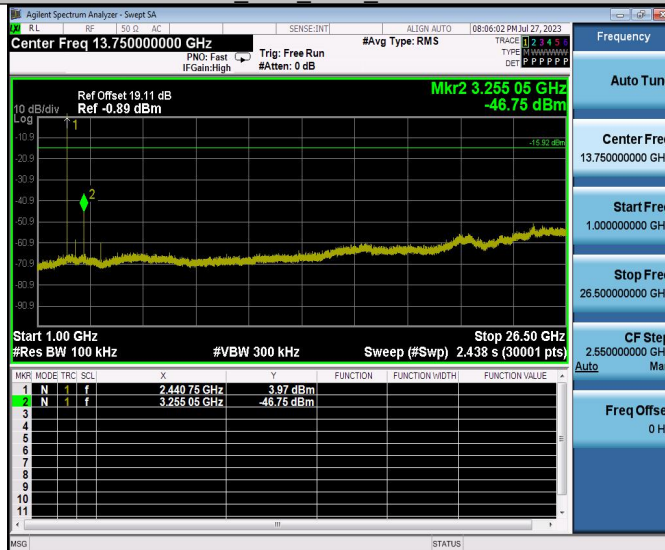
3DH5_Ant1_2402_1000~26500



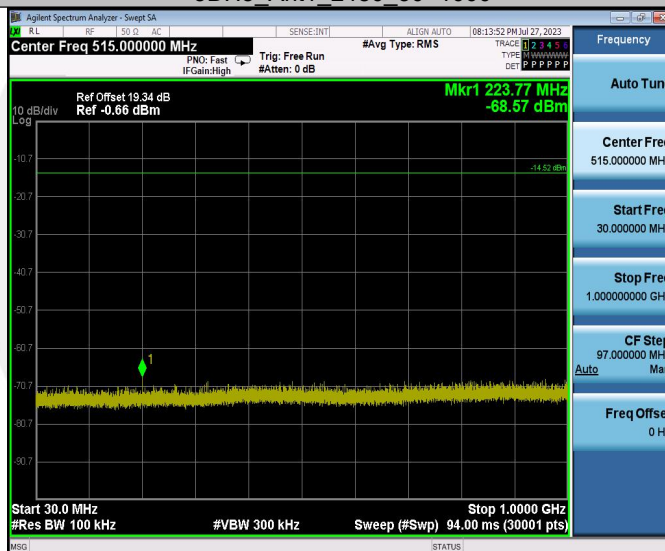
3DH5_Ant1_2441_30~1000



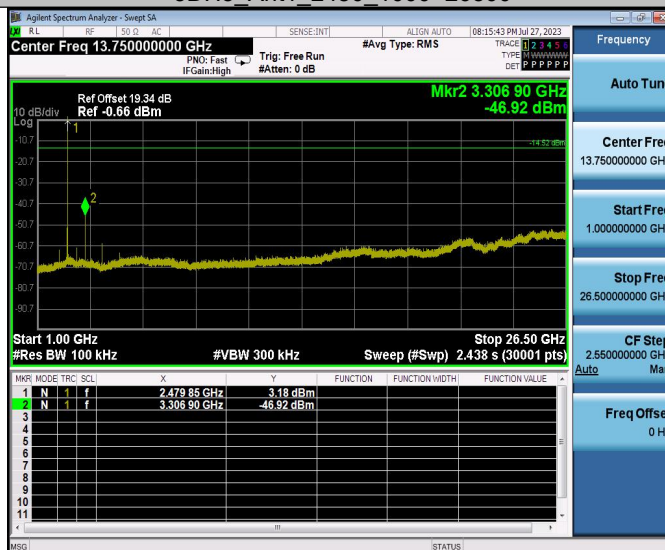
3DH5_Ant1_2441_1000~26500



3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500



9.7 RADIATED SPURIOUS EMISSION

9.7.1 Applicable Standard

According to FCC Part 15.247(d) and 15.209 and KDB 558074 D01 15.247 MEAS GUIDANCE v05r02.

9.7.2 Conformance Limit

According to FCC Part 15.247(d): 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)).

According to FCC Part 15.205, Restricted bands.

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	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	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	(2)
13.36-13.41			

According to FCC Part 15.205, the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table.

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	24000/F(KHz)	20 log (uV/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

9.7.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2.

9.7.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

For Above 1GHz:

The EUT was placed on a turn table which is 1.5m above ground plane.

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

Span = wide enough to fully capture the emission being measured.

RBW = 1 MHz.

VBW $\geq$ RBW.

Sweep = auto.

Detector function = peak.

Trace = max hold.

For Below 1GHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

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

Span = wide enough to fully capture the emission being measured.

RBW = 100 kHz.

VBW $\geq$ RBW.

Sweep = auto.

Detector function = peak.

Trace = max hold.

For Below 30MHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

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

Span = wide enough to fully capture the emission being measured.

RBW = 9kHz.

VBW $\geq$ RBW.

Sweep = auto.

Detector function = peak.

Trace = max hold.

For Below 150KHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

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

Span = wide enough to fully capture the emission being measured.

RBW = 200Hz.

VBW $\geq$ RBW.

Sweep = auto.

Detector function = peak.

Trace = max hold.

Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Repeat above procedures until all frequency measured was complete.

9.7.5 Test Results

■ Spurious Emission below 30MHz (9KHz to 30MHz)

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

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

Note: Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission Above 1GHz (1GHz to 25GHz)

Bluetooth (GFSK, pi/4-DQPSK, 8DPSK) mode have been tested, and the worst result(GFSK) was report as below:

Test mode: GFSK Frequency: Channel 0: 2402MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
11505	V	59.19	74.00	14.81	peak
14583.75	V	63.01	74.00	10.99	peak
17979.375	V	68.73	74.00	5.27	peak
11505	V	48.12	54.00	5.88	AVG
14583.75	V	48.38	54.00	5.62	AVG
17979.375	V	48.13	54.00	5.87	AVG
11437.5	H	58.98	74.00	15.02	peak
14707.5	H	64.14	74.00	9.86	peak
17602.5	H	67.88	74.00	6.12	peak
11437.5	H	47.47	54.00	6.53	AVG
14707.5	H	46.22	54.00	7.78	AVG
17602.5	H	50.27	54.00	3.73	AVG

Test mode: GFSK Frequency: Channel 39: 2441MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
11343.75	V	59.03	74.00	14.97	peak
14711.25	V	63.29	74.00	10.71	peak
17621.25	V	67.69	74.00	6.31	peak
11343.75	V	46.76	54.00	7.24	AVG
14711.25	V	46.63	54.00	7.37	AVG
17621.25	V	49.67	54.00	4.33	AVG
11493.75	H	59.17	74.00	14.83	peak
14739.375	H	63.29	74.00	10.71	peak
17611.875	H	67.94	74.00	6.06	peak
11493.75	H	48.24	54.00	5.76	AVG
14739.375	H	46.40	54.00	7.60	AVG
17611.875	H	49.97	54.00	4.03	AVG

Test mode: GFSK Frequency: Channel 78: 2480MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
12420	V	58.48	74.00	15.52	peak
14621.25	V	64.08	74.00	9.92	peak
17977.5	V	67.33	74.00	6.67	peak
12420	V	49.26	54.00	4.74	AVG
14621.25	V	48.32	54.00	5.68	AVG
17977.5	V	48.11	54.00	5.89	AVG
12425.625	H	58.90	74.00	15.10	peak
14679.375	H	63.17	74.00	10.83	peak
17621.25	H	67.90	74.00	6.10	peak
12425.625	H	49.16	54.00	4.84	AVG
14679.375	H	47.03	54.00	6.97	AVG
17621.25	H	50.01	54.00	3.99	AVG

- Note:** (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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

Bluetooth (GFSK, pi/4-DQPSK, 8DPSK, Hopping) mode have been tested, and the worst result(GFSK, Hopping) was report as below:

Test mode: GFSK Frequency: Channel 0: 2402MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
2341.26	V	44.95	74.00	29.05	peak
2341.26	V	42.64	54.00	11.36	AVG
2334.23	H	44.88	74.00	29.12	peak
2334.23	H	42.51	54.00	11.49	AVG

Test mode: GFSK Frequency: Channel 78: 2480MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
2486.60	V	45.56	74.00	28.44	peak
2486.60	V	42.72	54.00	11.28	AVG
2485.12	H	49.96	74.00	24.04	peak
2485.12	H	42.56	54.00	11.44	AVG

Test mode: GFSK Frequency: Hopping

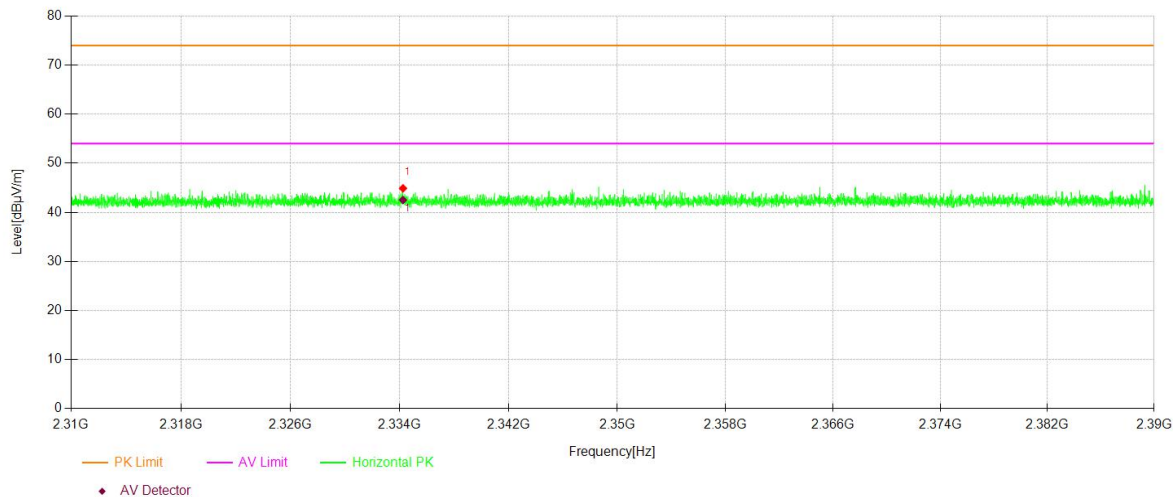
Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
2397.63	V	46.42	74.00	27.58	peak
2484.04	V	44.96	74.00	29.04	peak
2397.637	V	42.52	54.00	11.48	AVG
2484.04	V	44.14	54.00	9.86	AVG
2393.31	H	44.11	74.00	29.89	peak
2484.56	H	47.05	74.00	26.95	peak
2393.315	H	43.11	54.00	10.89	AVG
2484.562	H	44.09	54.00	9.91	AVG

Note: (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).

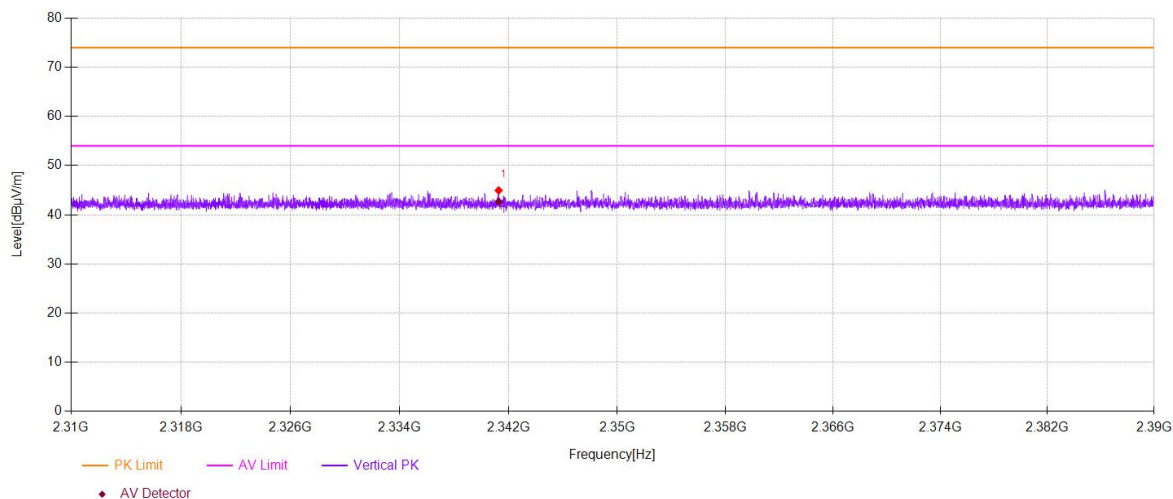
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.

(3) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

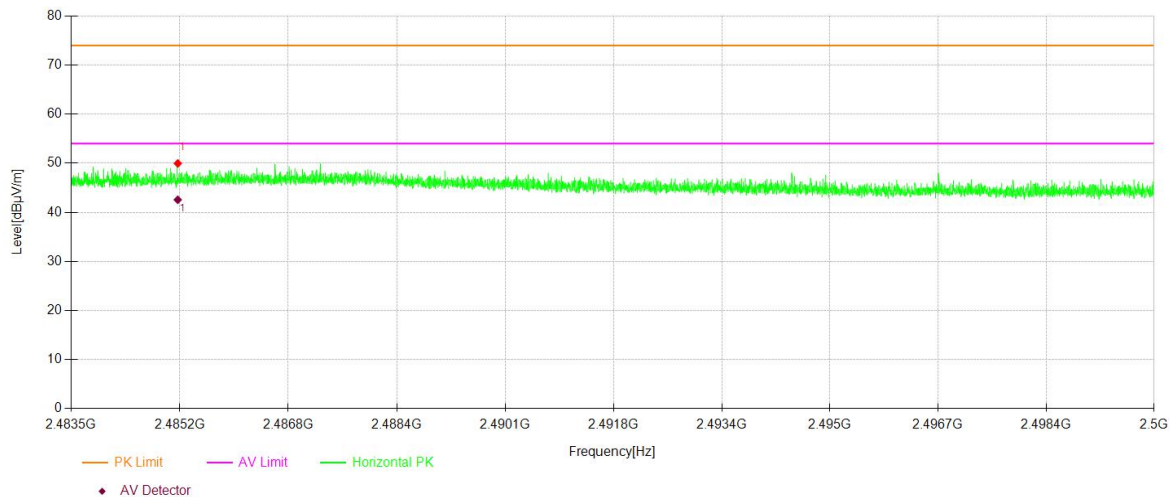
Test Model	Spurious Emission in Restricted Band 2310-2390MHz		
	BT		
	Channel 0: 2402MHz	GFSK	H
		Test By: HZB	



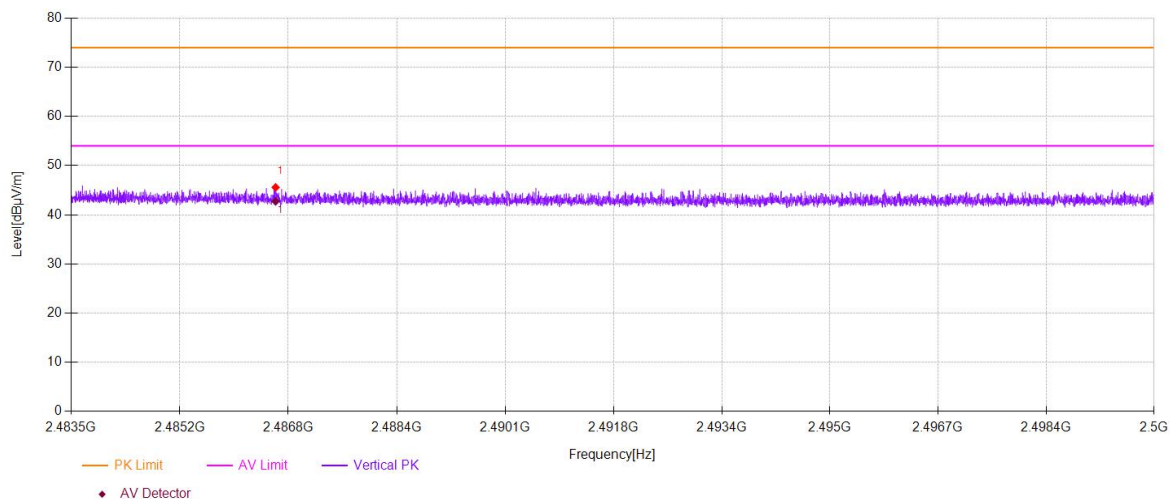
Test Model	Spurious Emission in Restricted Band 2310-2390MHz		
	BT		
	Channel 0: 2402MHz	GFSK	V
		Test By: HZB	



Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz		
	BT		
	Channel 78: 2480MHz	GFSK	H
		Test By: HZB	



Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz		
	BT		
	Channel 78: 2480MHz	GFSK	V
		Test By: HZB	



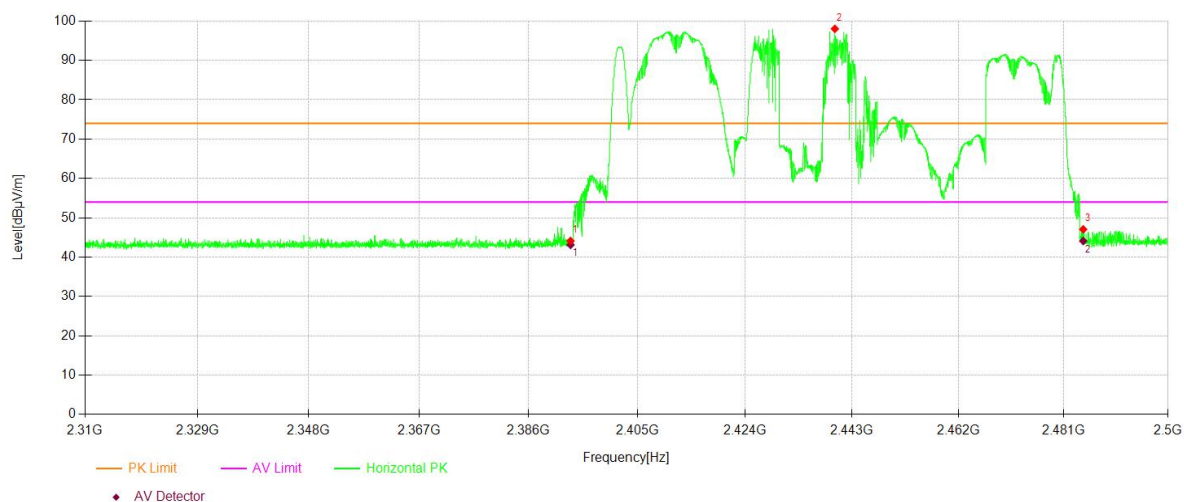
Test Model

Spurious Emission in Restricted Band 2310-2390MHz and 2400-2483.5MHz
BT
Hopping

GFSK

H

Test By: HZB



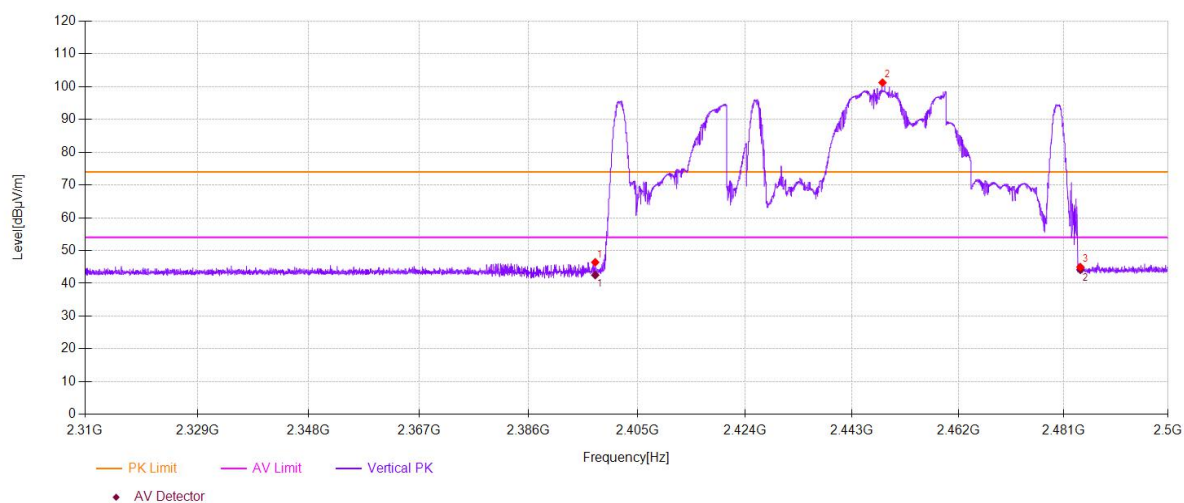
Test Model

Spurious Emission in Restricted Band 2310-2390MHz and 2400-2483.5MHz
BT
Hopping

GFSK

V

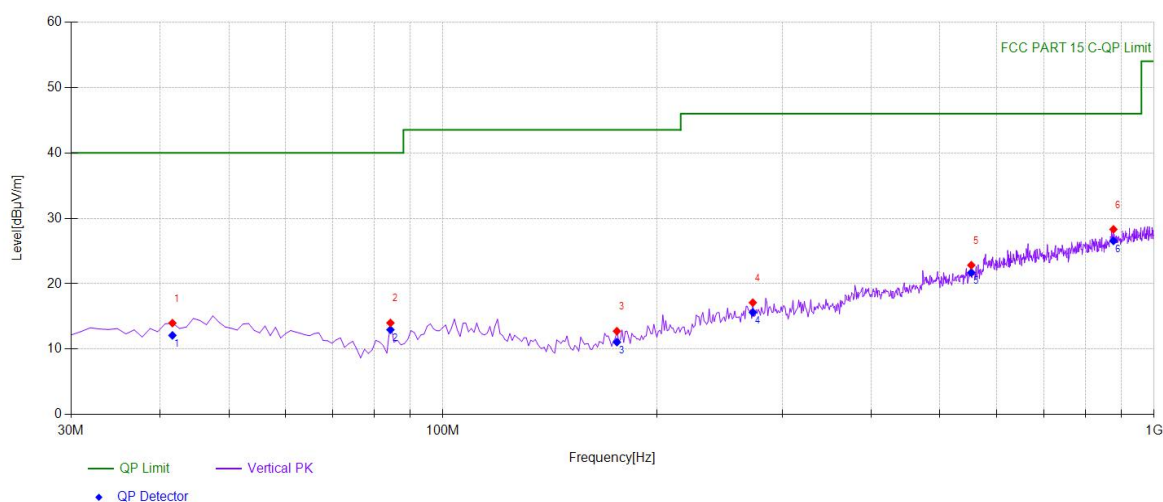
Test By: HZB



■ Spurious Emission below 1GHz (30MHz to 1GHz)

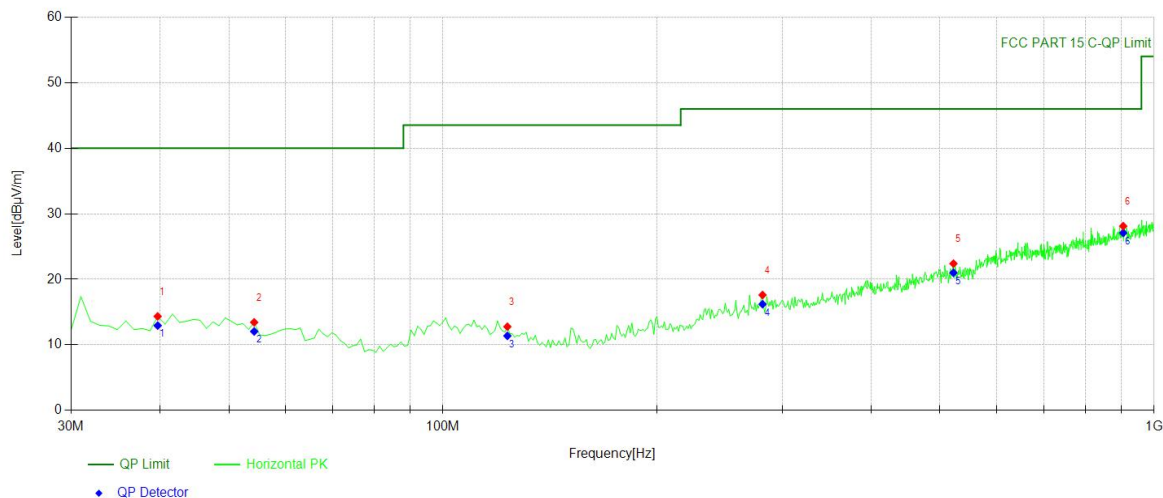
Bluetooth (GFSK, pi/4-DQPSK, 8DPSK) mode have been tested, and the worst result(GFSK) was report as below:

Test mode: GFSK Frequency: Channel 0: 2402MHz



Suspected Data List

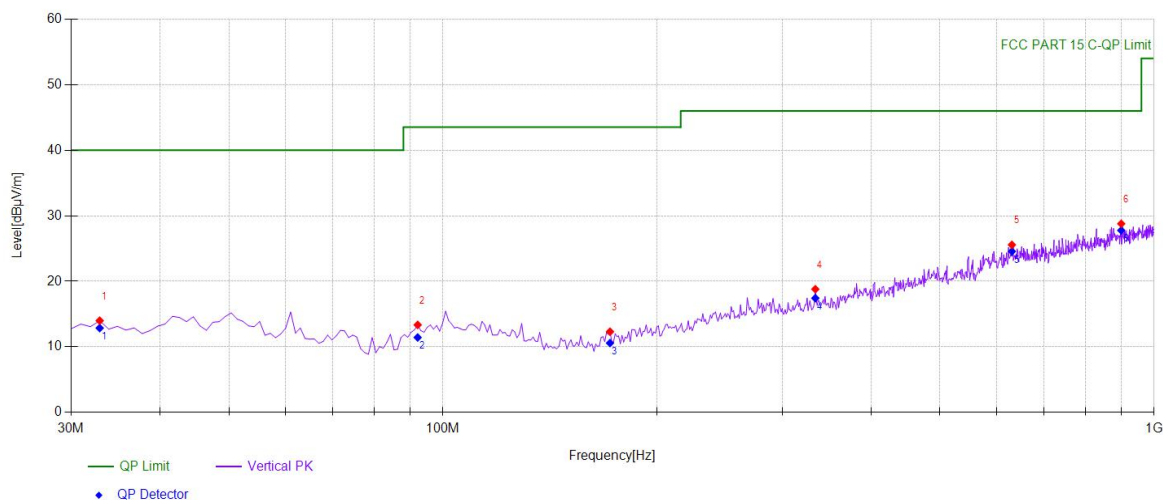
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	41.6517	31.79	-17.80	13.99	PK	40.00	26.01	Vertical
2	84.3744	34.49	-20.47	14.02	PK	40.00	25.98	Vertical
3	175.645	31.40	-18.64	12.76	PK	43.50	30.74	Vertical
4	272.742	31.72	-14.60	17.12	PK	46.00	28.88	Vertical
5	553.353	31.98	-9.14	22.84	PK	46.00	23.16	Vertical
6	876.686	31.47	-3.15	28.32	PK	46.00	17.68	Vertical



Suspected Data List

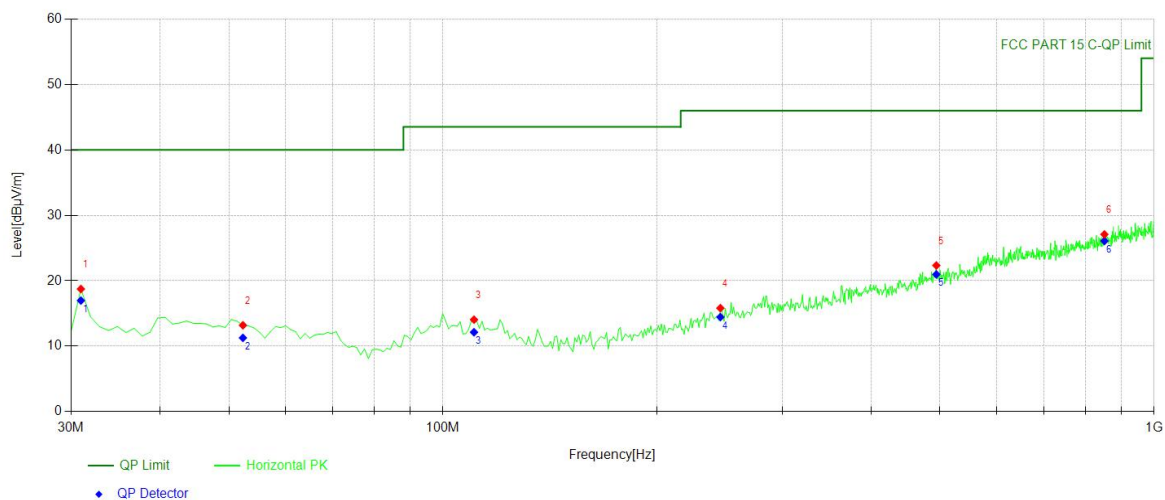
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	39.7097	32.28	-17.93	14.35	PK	40.00	25.65	Horizontal
2	54.2743	31.23	-17.78	13.45	PK	40.00	26.55	Horizontal
3	123.213	31.05	-18.27	12.78	PK	43.50	30.72	Horizontal
4	281.481	31.79	-14.18	17.61	PK	46.00	28.39	Horizontal
5	522.282	32.10	-9.70	22.40	PK	46.00	23.60	Horizontal
6	904.844	30.94	-2.82	28.12	PK	46.00	17.88	Horizontal

Test mode: GFSK Frequency: Channel 39: 2441MHz



Suspected Data List

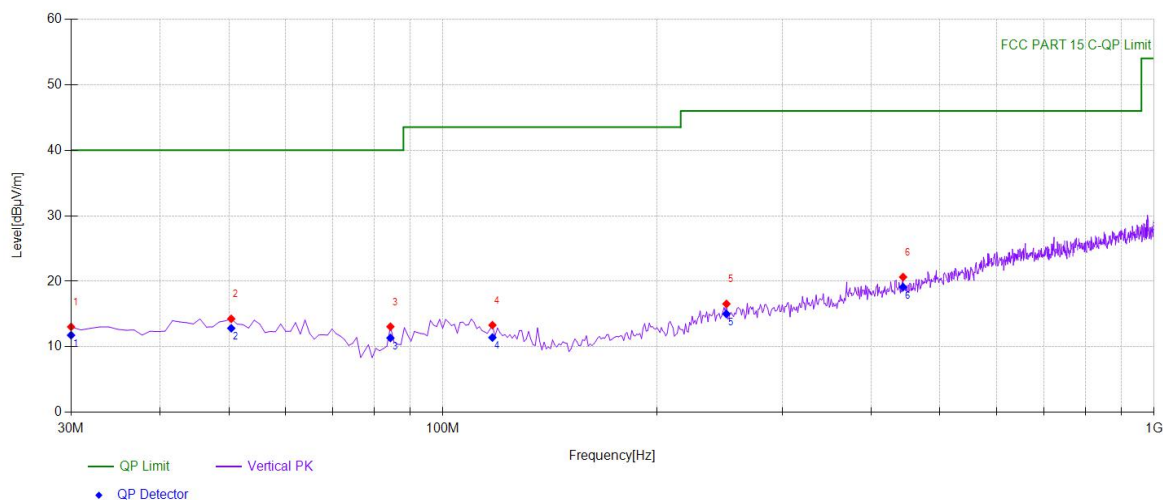
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	32.9129	32.35	-18.35	14.00	PK	40.00	26.00	Vertical
2	92.1421	32.02	-18.66	13.36	PK	43.50	30.14	Vertical
3	171.761	31.18	-18.86	12.32	PK	43.50	31.18	Vertical
4	333.913	32.44	-13.64	18.80	PK	46.00	27.20	Vertical
5	631.031	32.25	-6.68	25.57	PK	46.00	20.43	Vertical
6	899.019	31.60	-2.82	28.78	PK	46.00	17.22	Vertical



Suspected Data List

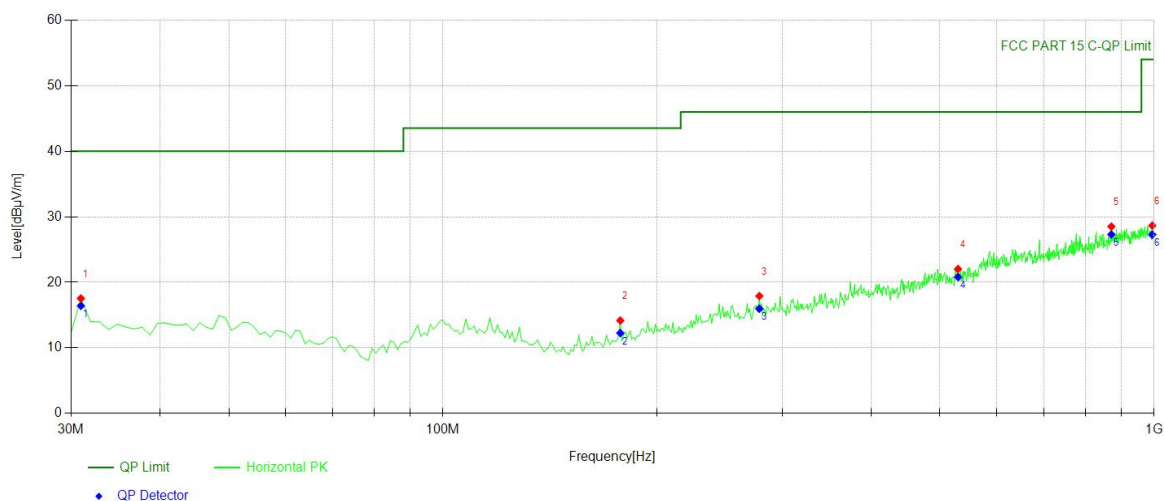
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	30.971	37.21	-18.47	18.74	PK	40.00	21.26	Horizontal
2	52.3323	30.72	-17.52	13.20	PK	40.00	26.80	Horizontal
3	110.590	31.41	-17.35	14.06	PK	43.50	29.44	Horizontal
4	245.555	31.00	-15.18	15.82	PK	46.00	30.18	Horizontal
5	494.124	32.12	-9.78	22.34	PK	46.00	23.66	Horizontal
6	851.441	30.89	-3.80	27.09	PK	46.00	18.91	Horizontal

Test mode: GFSK Frequency: Channel 78: 2480MHz



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	30	31.59	-18.53	13.06	PK	40.00	26.94	Vertical
2	50.3904	31.54	-17.26	14.28	PK	40.00	25.72	Vertical
3	84.3744	33.56	-20.47	13.09	PK	40.00	26.91	Vertical
4	117.387	31.09	-17.77	13.32	PK	43.50	30.18	Vertical
5	250.410	31.73	-15.17	16.56	PK	46.00	29.44	Vertical
6	443.633	31.81	-11.16	20.65	PK	46.00	25.35	Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	30.971	36.01	-18.47	17.54	PK	40.00	22.46	Horizontal
2	177.587	32.70	-18.52	14.18	PK	43.50	29.32	Horizontal
3	278.568	32.17	-14.26	17.91	PK	46.00	28.09	Horizontal
4	530.050	31.52	-9.50	22.02	PK	46.00	23.98	Horizontal
5	870.860	31.94	-3.43	28.51	PK	46.00	17.49	Horizontal
6	994.174	30.37	-1.71	28.66	PK	54.00	25.34	Horizontal

9.8 CONDUCTED EMISSION TEST

9.8.1 Applicable Standard

According to FCC Part 15.207(a).

9.8.2 Conformance Limit

Conducted Emission Limit		
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

Note1: The lower limit shall apply at the transition frequencies.
 Note2: The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

9.8.3 Test Configuration

Test according to clause 7.3 conducted emission test setup.

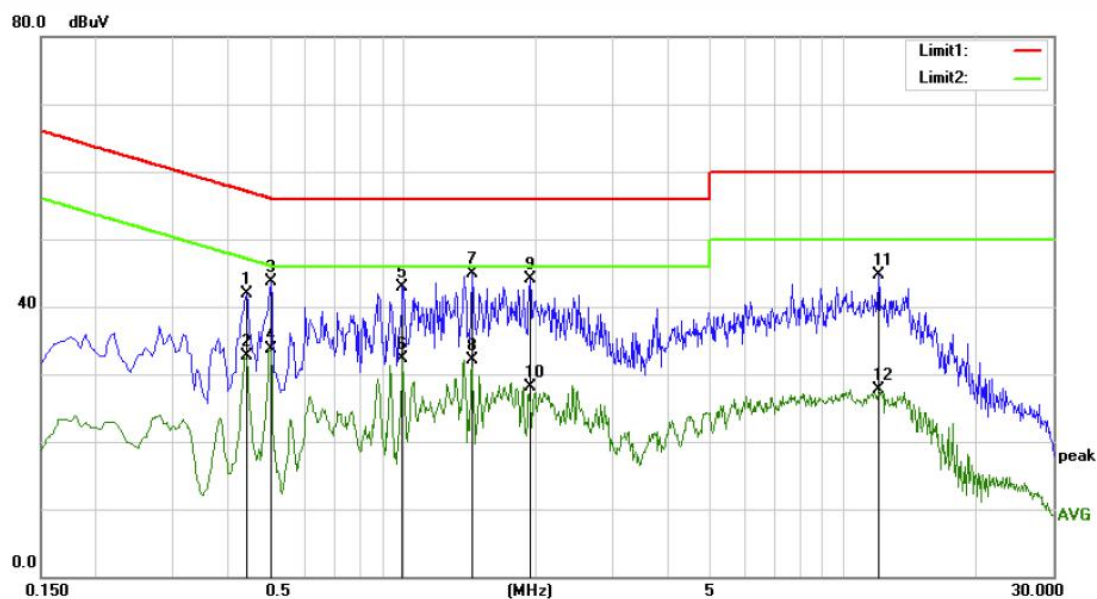
9.8.4 Test Procedure

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

9.8.5 Test Results

Pass

The 120V & 240V voltage have been tested, and the worst result recorded was report as below:

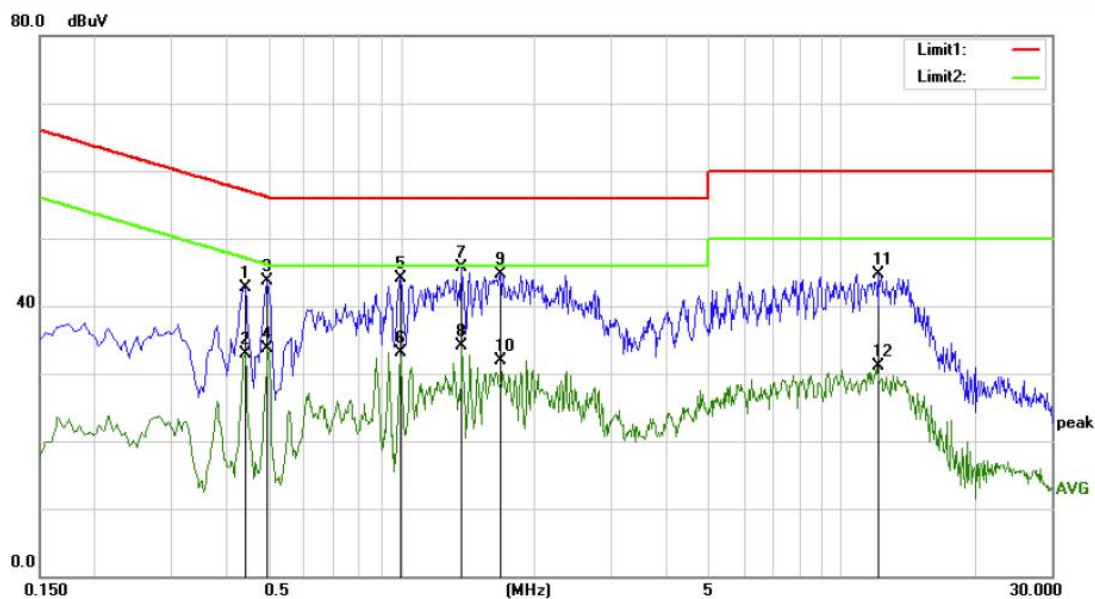


Site Conduction #1

Phase: L1

Temperature: 21.9

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.4400	32.15	9.76	41.91	57.06	-15.15	QP	
2		0.4400	22.85	9.76	32.61	47.06	-14.45	AVG	
3		0.5000	34.06	9.67	43.73	56.00	-12.27	QP	
4		0.5000	23.99	9.67	33.66	46.00	-12.34	AVG	
5		0.9950	32.98	9.85	42.83	56.00	-13.17	QP	
6		0.9950	22.53	9.85	32.38	46.00	-13.62	AVG	
7	*	1.4350	35.19	9.78	44.97	56.00	-11.03	QP	
8		1.4350	22.31	9.78	32.09	46.00	-13.91	AVG	
9		1.9400	34.30	9.71	44.01	56.00	-11.99	QP	
10		1.9400	18.46	9.71	28.17	46.00	-17.83	AVG	
11		12.0050	34.66	9.98	44.64	60.00	-15.36	QP	
12		12.0050	17.65	9.98	27.63	50.00	-22.37	AVG	



Site Conduction #1 Phase: **N** Temperature: 21.9

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.4400	33.03	9.76	42.79	57.06	-14.27	QP	
2		0.4400	23.09	9.76	32.85	47.06	-14.21	AVG	
3		0.4950	34.00	9.68	43.68	56.08	-12.40	QP	
4		0.4950	24.09	9.68	33.77	46.08	-12.31	AVG	
5		0.9900	34.17	9.84	44.01	56.00	-11.99	QP	
6		0.9900	23.32	9.84	33.16	46.00	-12.84	AVG	
7	*	1.3700	36.00	9.79	45.79	56.00	-10.21	QP	
8		1.3700	24.32	9.79	34.11	46.00	-11.89	AVG	
9		1.6800	34.90	9.75	44.65	56.00	-11.35	QP	
10		1.6800	22.07	9.75	31.82	46.00	-14.18	AVG	
11		12.1550	34.79	9.99	44.78	60.00	-15.22	QP	
12		12.1550	21.08	9.99	31.07	50.00	-18.93	AVG	

9.9 ANTENNA APPLICATION

9.9.1 Antenna Requirement

Standard	Requirement
FCC CRF Part 15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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.

9.9.2 Result

PASS

The EUT is integrated antenna, the antenna gain is 1.05 dBi.

- ☒ Antenna use a permanently attached antenna which is not replaceable.
- ☐ Not using a standard antenna jack or electrical connector for antenna replacement
- ☐ The antenna has to be professionally installed (please provide method of installation)

which in accordance to section 15.203, please refer to the internal photos.

Detail of factor for radiated emission:

Frequency(MHz)	Ant_F(dB)	Cab_L(dB)	Preamp(dB)	Correct Factor(dB)
0.009	20.6	0.03	\	20.63
0.15	20.7	0.1	\	20.8
1	20.9	0.15	\	21.05
10	20.1	0.28	\	20.38
30	18.8	0.45	\	19.25
30	11.7	0.62	27.9	-15.58
100	12.5	1.02	27.8	-14.28
300	12.9	1.91	27.5	-12.69
600	19.2	2.92	27	-4.88
800	21.1	3.54	26.6	-1.96
1000	22.3	4.17	26.2	0.27
1000	25.6	1.76	41.4	-14.04
3000	28.9	3.27	43.2	-11.03
5000	31.1	4.2	44.6	-9.3
8000	36.2	5.95	44.7	-2.55
10000	38.4	6.3	43.9	0.8
12000	38.5	7.14	42.3	3.34
15000	40.2	8.15	41.4	6.95
18000	45.4	9.02	41.3	13.12
18000	37.9	1.81	47.9	-8.19
21000	37.9	1.95	48.7	-8.85
25000	39.3	2.01	42.8	-1.49
28000	39.6	2.16	46.0	-4.24
31000	41.2	2.24	44.5	-1.06
34000	41.5	2.29	46.6	-2.81
37000	43.8	2.30	46.4	-0.3
40000	43.2	2.50	42.2	3.5

--- End of Report ---