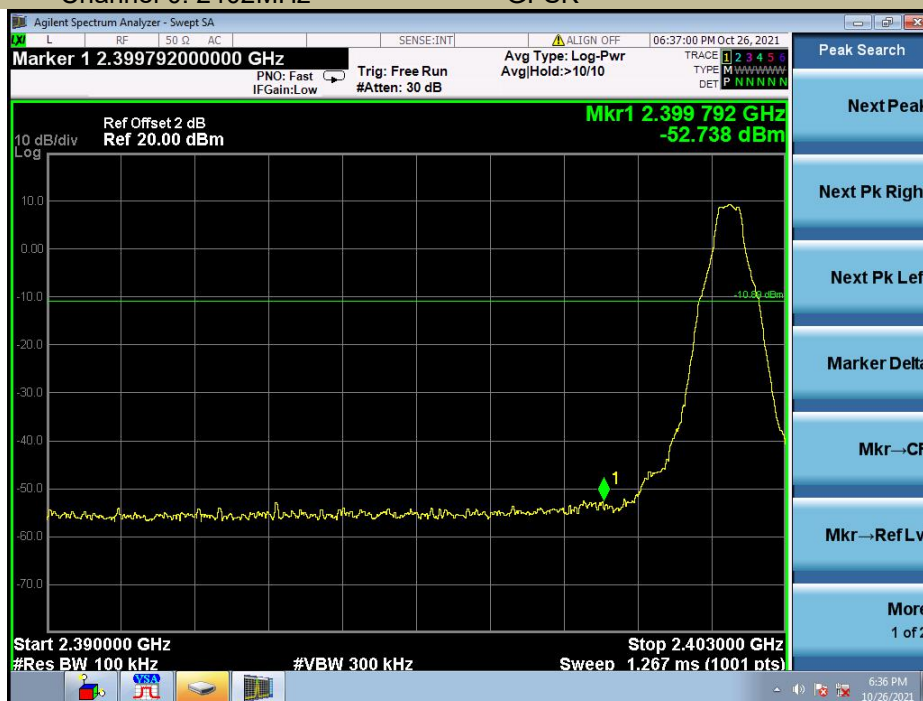


Test Model

Band-edge Conducted Emissions
Bluetooth DSS
Channel 0: 2402MHz

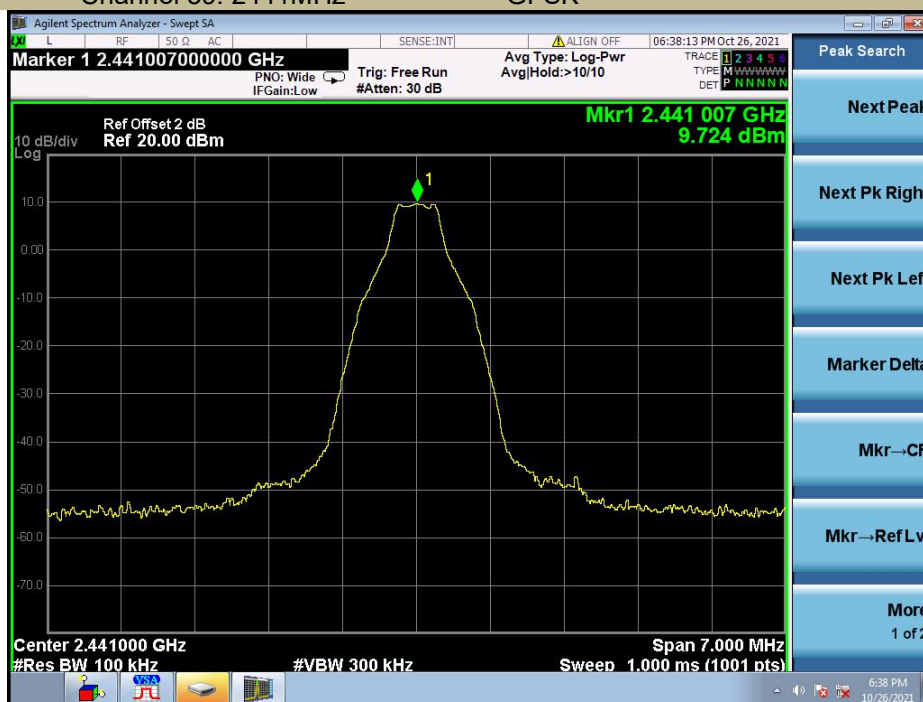
GFSK



Test Model

Maximum Conducted Level RBW=100kHz
Bluetooth DSS
Channel 39: 2441MHz

GFSK



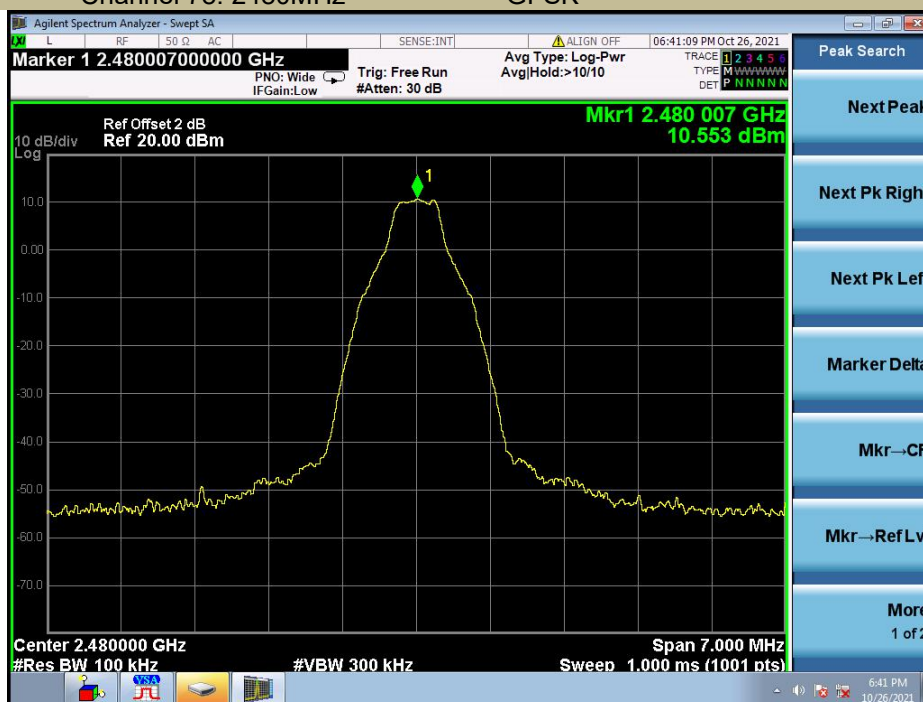
Test Model

Conduceted Spurious RF Conducted Emission
Bluetooth DSS
Channel 39: 2441MHz GFSK



Test Model

Maximum Conduceted Level RBW=100kHz
Bluetooth DSS
Channel 78: 2480MHz GFSK



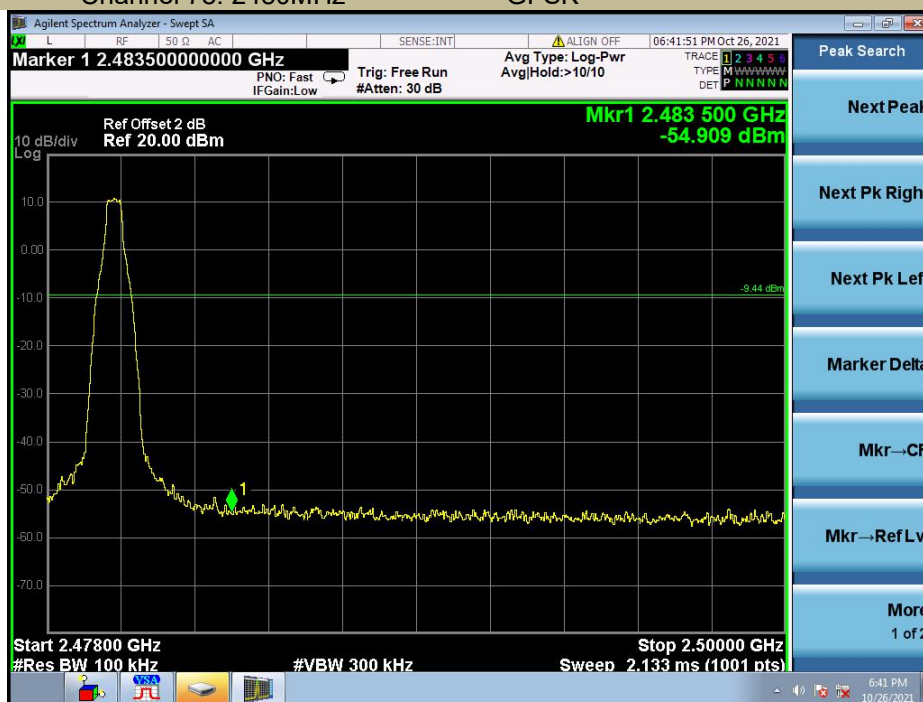
Test Model

Conducted Spurious RF Conducted Emission
Bluetooth DSS
Channel 78: 2480MHz GFSK

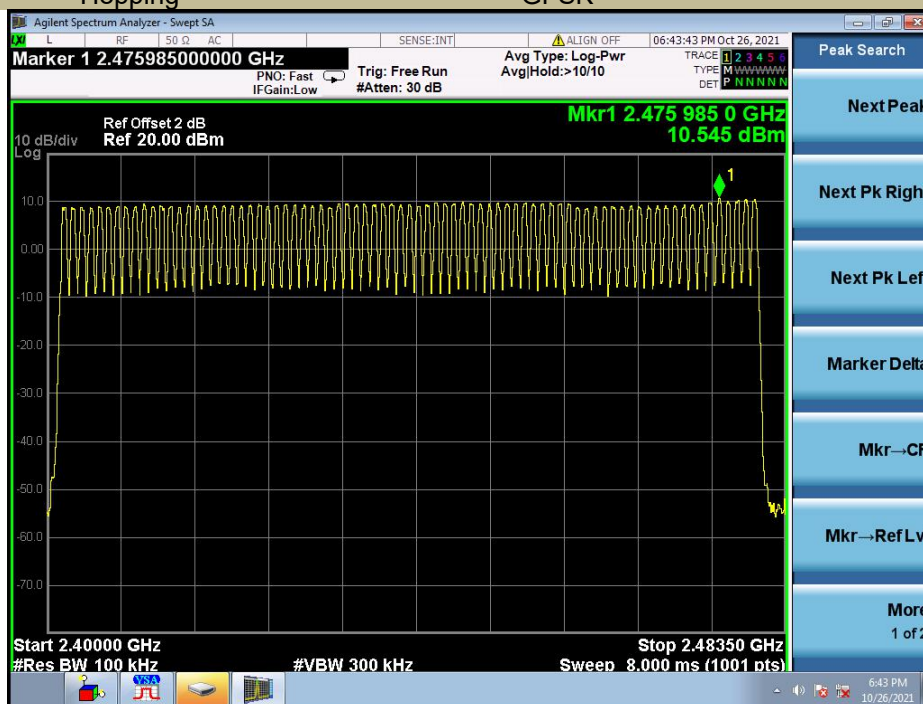


Test Model

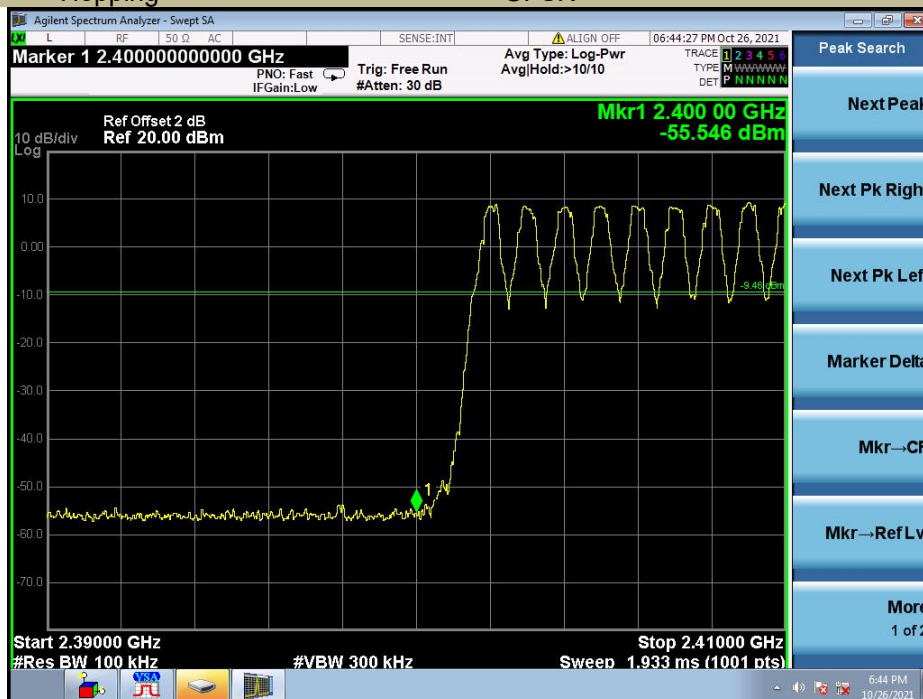
Band-edge Conducted Emissions
Bluetooth DSS
Channel 78: 2480MHz GFSK



Test Model Maximum Conducted Level RBW=100kHz
Bluetooth DSS
Hopping GFSK



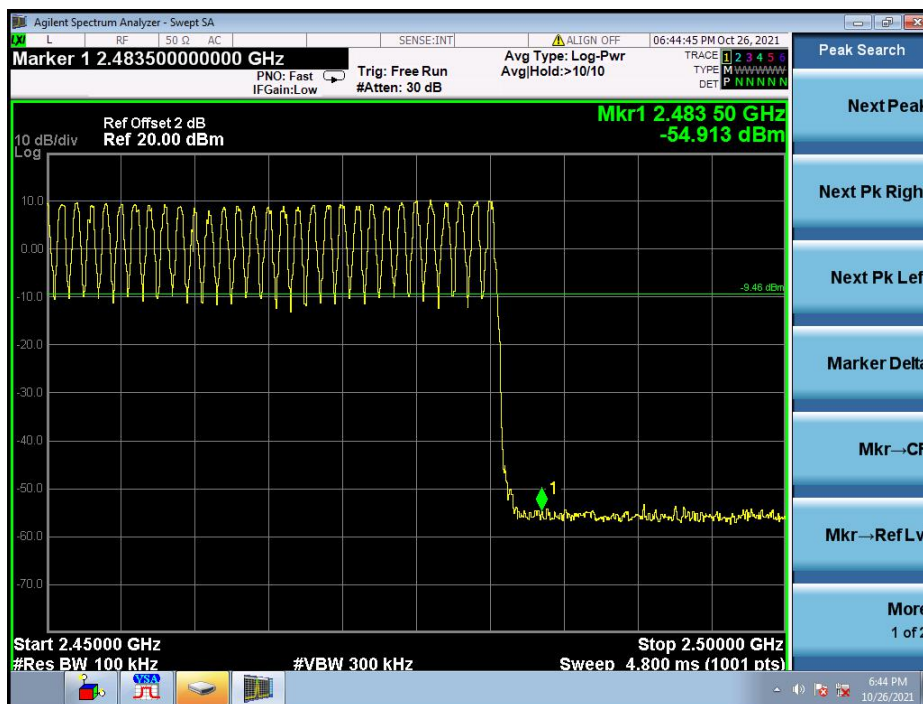
Test Model Conducted Spurious RF Conducted Emission
Bluetooth DSS
Hopping GFSK



Test Model

Band-edge Conducted Emissions
Bluetooth DSS
Hopping

GFSK



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 ≥ 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 for

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

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

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

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

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 = $40 \log(\text{Specific distance} / \text{test distance})$ (dB);

Limit line = Specific limits (dBuV) + distance extrapolation factor

■ 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. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
5797.03	V	47.37	30.86	74	54	-26.63	-23.14
12079.38	V	57.87	40.19	74	54	-16.13	-13.81
18000.00	V	60.40	42.63	74	54	-13.60	-11.37
4804.11	H	47.05	30.14	74	54	-26.95	-23.86
10980.46	H	55.81	38.74	74	54	-18.19	-15.26
17948.04	H	61.02	43.89	74	54	-12.98	-10.11

Test mode: GFSK Frequency: Channel 39: 2441MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4804.11	V	46.09	29.81	74	54	-27.91	-24.19
7875.25	V	53.28	35.48	74	54	-20.72	-18.52
17948.04	V	59.54	41.62	74	54	-14.46	-12.38
5104.74	H	46.54	28.51	74	54	-27.46	-25.49
12184.58	H	58.07	40.89	74	54	-15.93	-13.11
17948.04	H	61.02	43.77	74	54	-12.98	-10.23

Test mode: GFSK Frequency: Channel 78: 2480MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4804.11	V	46.57	28.41	74	54	-27.43	-25.59
11500.19	V	56.71	38.69	74	54	-17.29	-15.31
17844.59	V	59.82	41.86	74	54	-14.18	-12.14
5224.15	H	45.08	28.32	74	54	-28.92	-25.68
11566.86	H	57.63	40.03	74	54	-16.37	-13.97
17948.04	H	59.85	41.73	74	54	-14.15	-12.27

- Note:**
- (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
 - (2) Emission Level= Reading Level+Correct Factor.
 - (3) Correct Factor= Ant_F + Cab_L - Preamp
 - (4) 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

Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2388.72	H	52.19	74	36.80	54
2387.62	V	52.09	74	37.20	54

Test mode: GFSK Frequency: Channel 78: 2480MHz

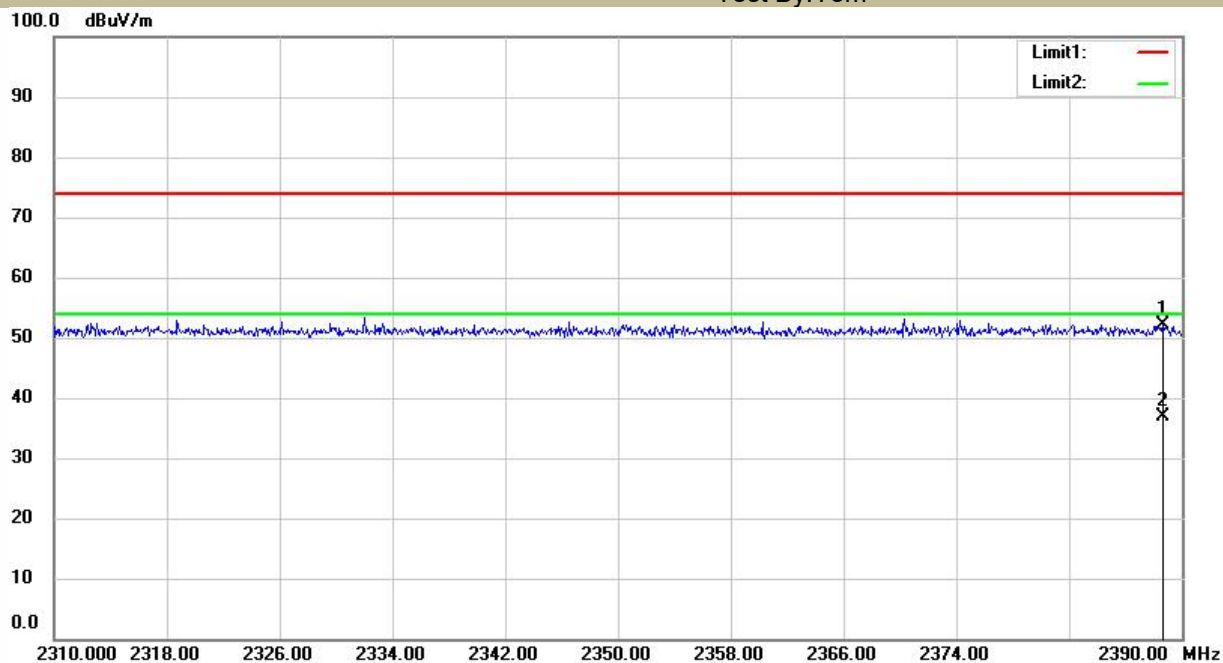
Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2483.88	H	51.99	74	36.50	54
2483.65	V	52.56	74	37.40	54

Test mode: GFSK Frequency: Hopping

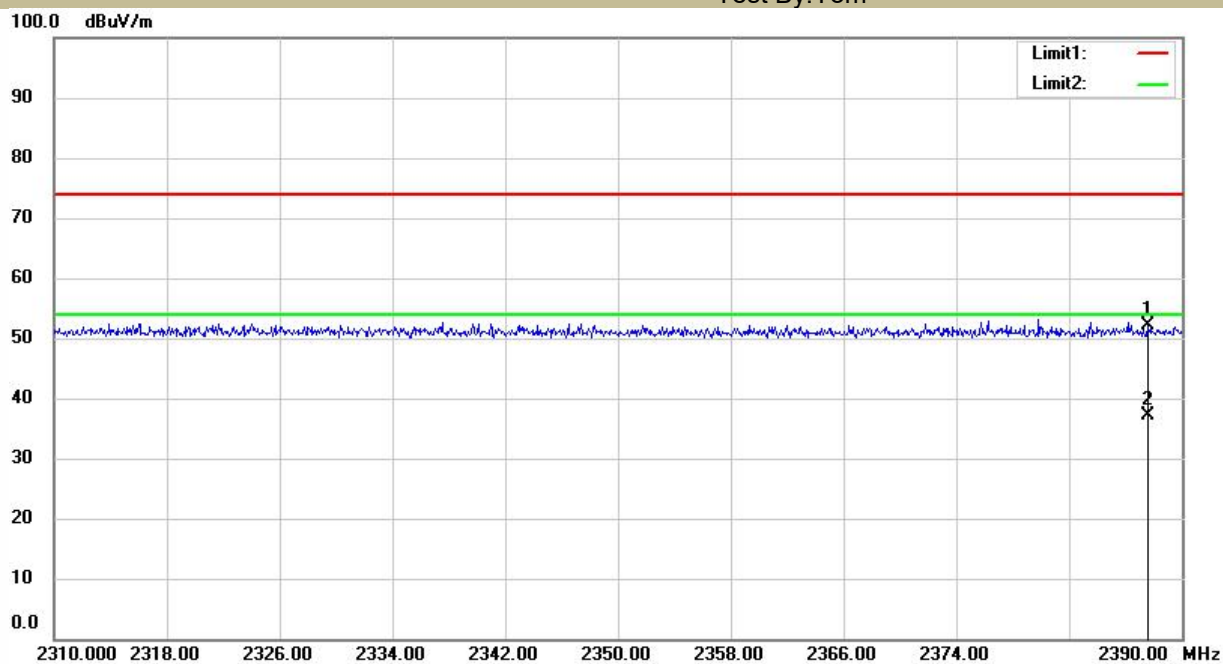
Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2400.00	H	59.96	74	40.50	54
2483.50	H	51.94	74	36.50	54
2400.00	V	51.01	74	38.25	54
2483.50	V	51.35	74	35.13	54

- Note:** (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) 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
	Bluetooth
	Channel 0: 2402MHz
	GFSK
	Test By:Tom
	H



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



Test Model

Spurious Emission in Restricted Band 2483.5-2500MHz

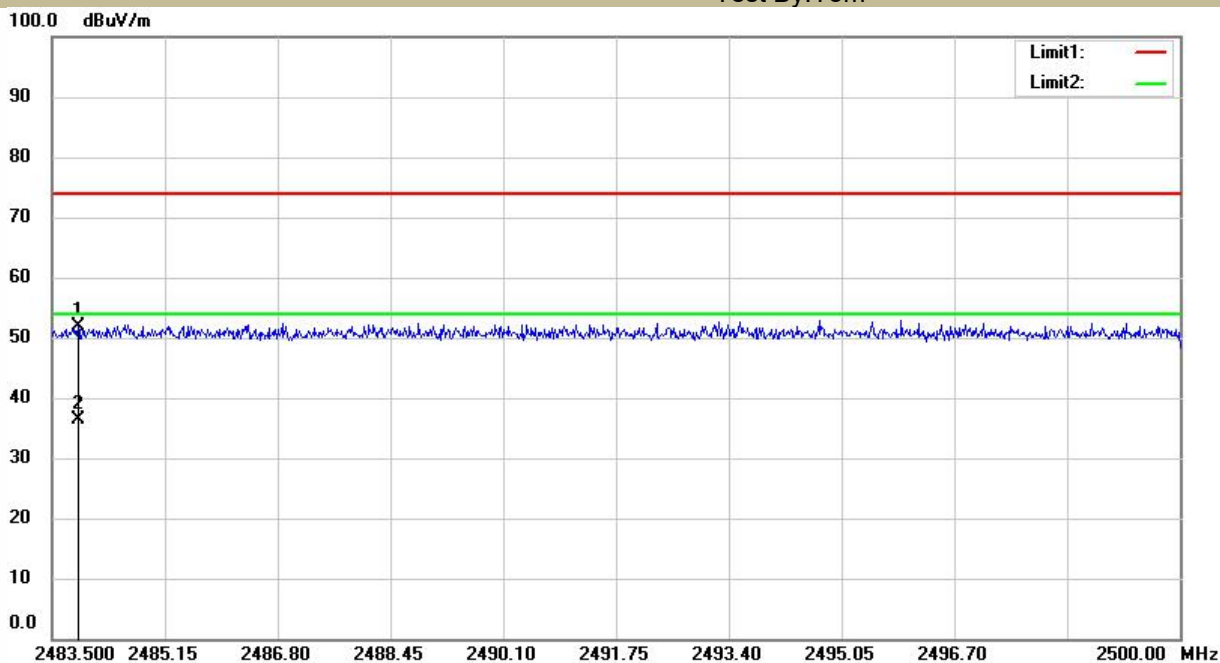
Bluetooth

Channel 78: 2480MHz

GFSK

H

Test By:Tom



Test Model

Spurious Emission in Restricted Band 2483.5-2500MHz

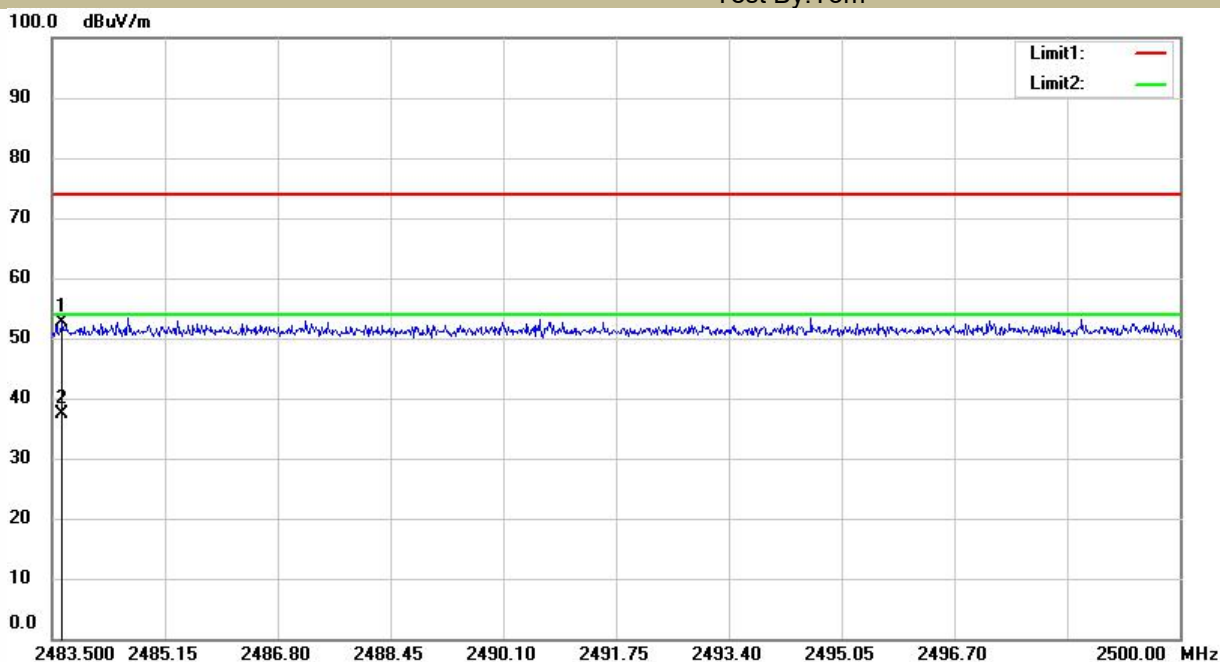
Bluetooth

Channel 78: 2480MHz

GFSK

V

Test By:Tom

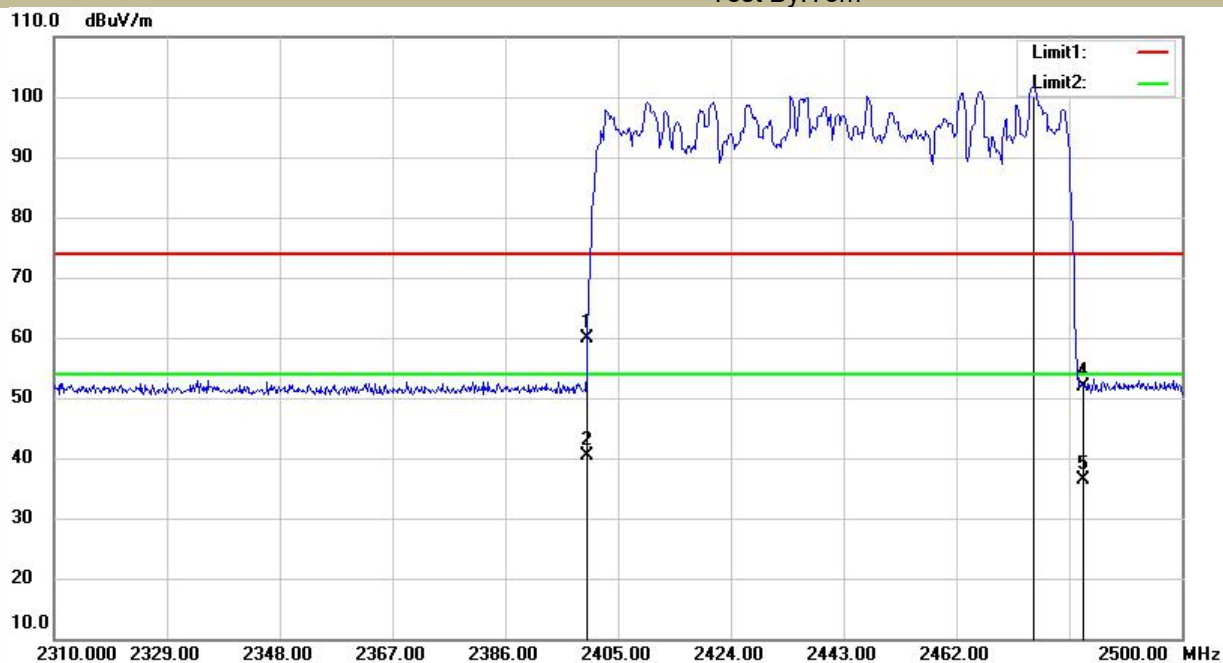


Test Model

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

GFSK
Test By:Tom

H

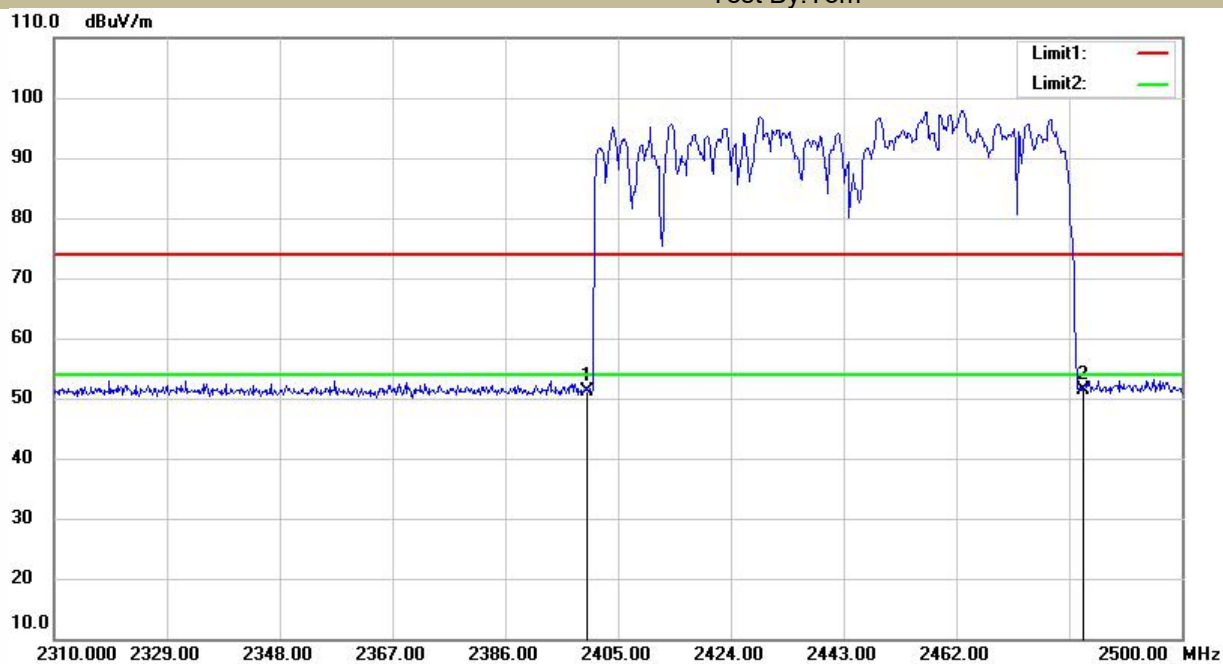


Test Model

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

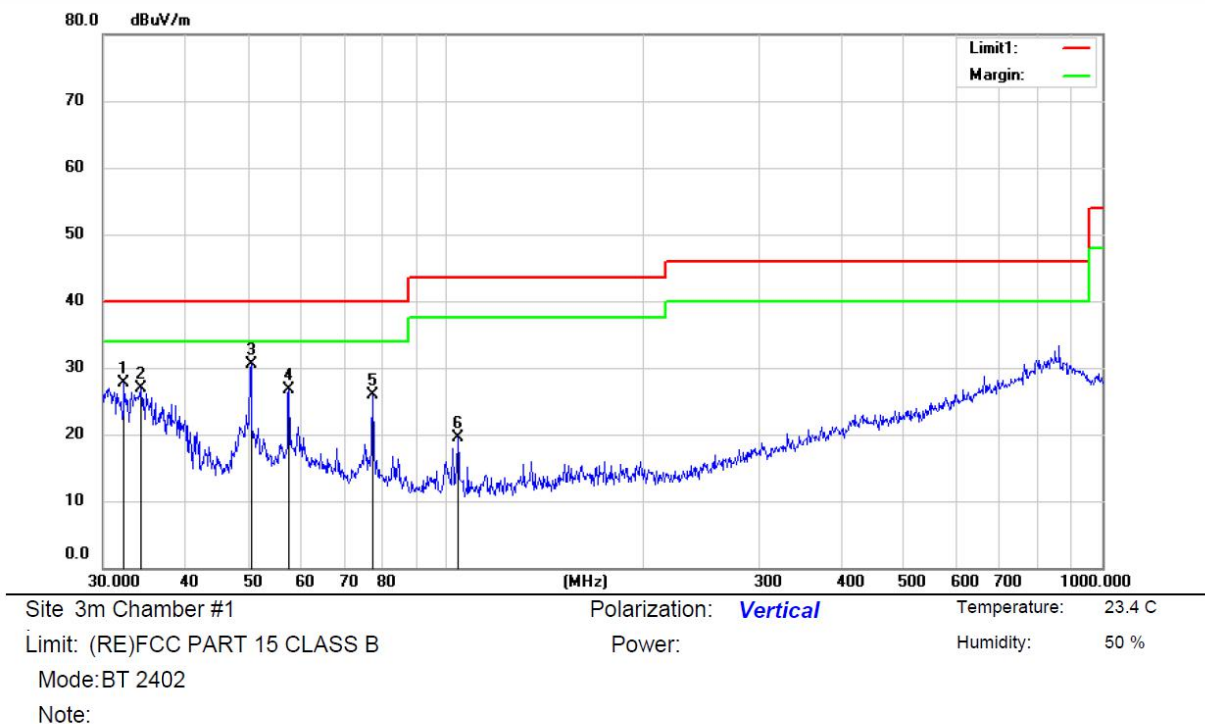
GFSK
Test By:Tom

V



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

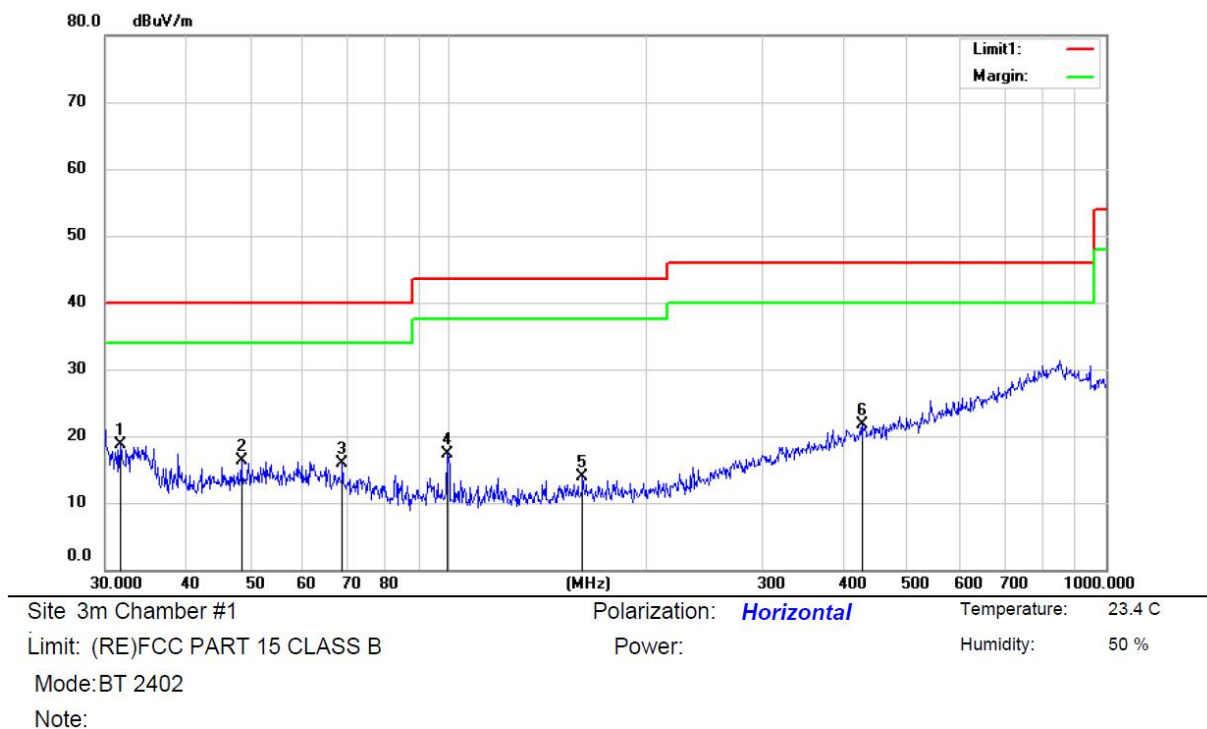
Bluetooth (GFSK, pi/4-DQPSK, 8DPSK) mode have been tested, and the worst result(GFSK) was report as below:



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	
		MHz	Level	Factor	ment			Height	Degree	
			dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		32.3492	42.18	-14.41	27.77	40.00	-12.23	QP		
2		34.3061	40.96	-14.05	26.91	40.00	-13.09	QP		
3	*	50.4310	42.53	-11.96	30.57	40.00	-9.43	QP		
4		57.5940	38.78	-12.08	26.70	40.00	-13.30	QP		
5		77.4230	40.36	-14.55	25.81	40.00	-14.19	QP		
6		104.4445	33.81	-14.36	19.45	43.50	-24.05	QP		

*:Maximum data x:Over limit !:over margin

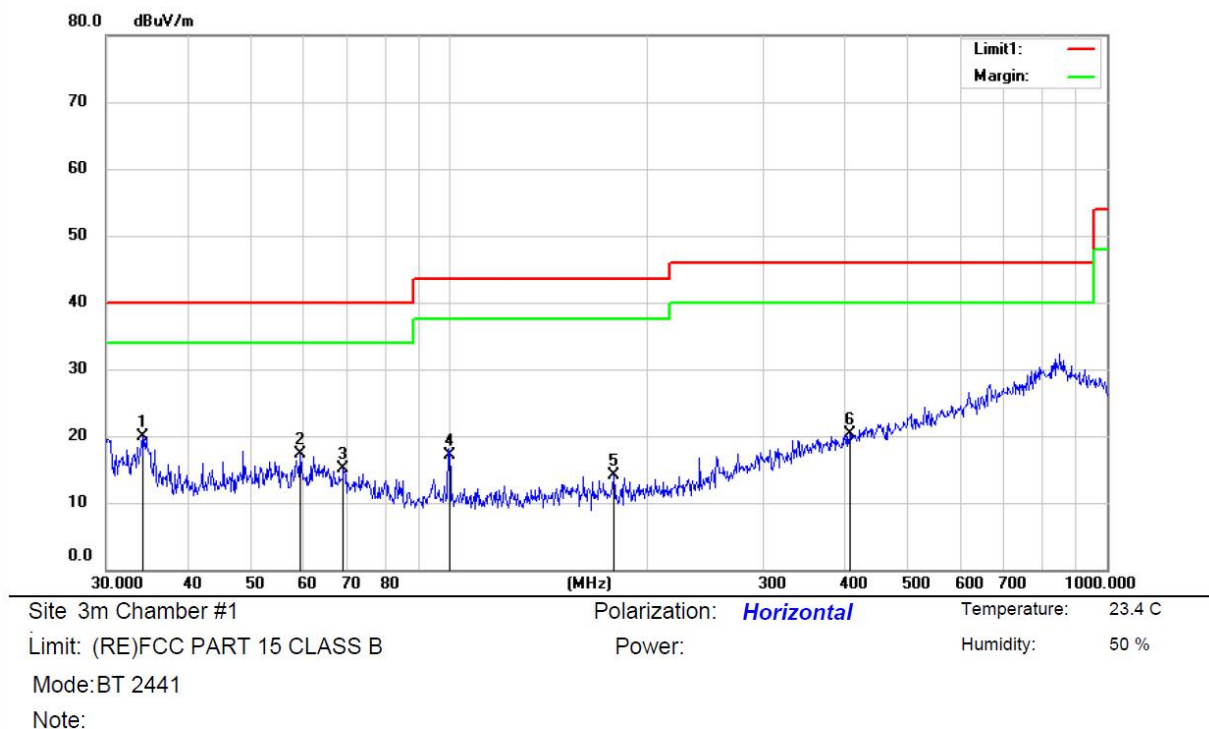
Operator: WHZ



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1	*	31.7035	33.17	-14.47	18.70	40.00	-21.30	QP		
2		48.4803	28.66	-12.39	16.27	40.00	-23.73	QP		
3		69.0232	28.92	-12.96	15.96	40.00	-24.04	QP		
4		99.8340	32.02	-14.76	17.26	43.50	-26.24	QP		
5		159.9947	27.85	-13.88	13.97	43.50	-29.53	QP		
6		427.6442	27.47	-5.74	21.73	46.00	-24.27	QP		

*:Maximum data x:Over limit !:over margin

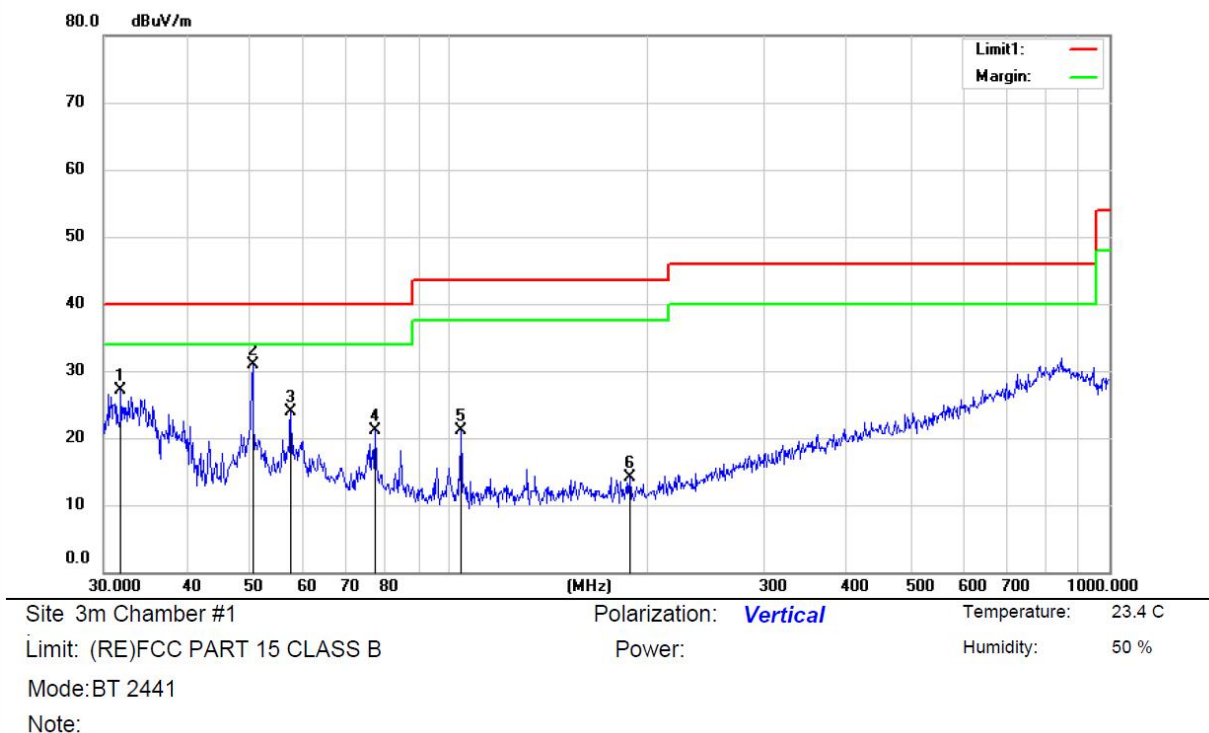
Operator: WHZ



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	34.1112	34.02	-14.11	19.91	40.00	-20.09	QP		
2		59.3624	29.40	-12.02	17.38	40.00	-22.62	QP		
3		69.0535	28.01	-12.96	15.05	40.00	-24.95	QP		
4		99.9653	31.91	-14.77	17.14	43.50	-26.36	QP		
5		177.5092	28.02	-13.93	14.09	43.50	-29.41	QP		
6		407.3360	26.53	-6.25	20.28	46.00	-25.72	QP		

*:Maximum data x:Over limit !:over margin

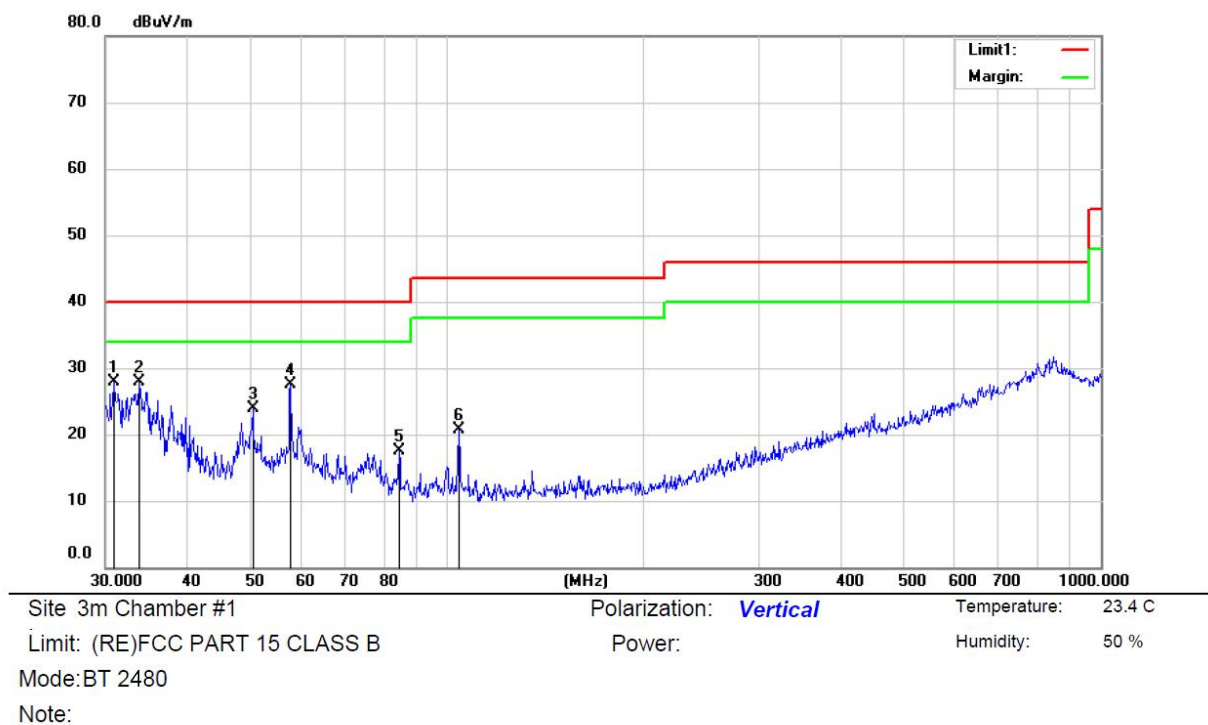
Operator: WHZ



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	
		MHz	Level	Factor	ment			Height	Degree	
			dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		31.8706	41.48	-14.47	27.01	40.00	-12.99	QP		
2	*	50.4090	42.82	-11.96	30.86	40.00	-9.14	QP		
3		57.6192	36.04	-12.08	23.96	40.00	-16.04	QP		
4		77.4230	35.68	-14.55	21.13	40.00	-18.87	QP		
5		104.3987	35.55	-14.37	21.18	43.50	-22.32	QP		
6		187.7530	27.97	-13.78	14.19	43.50	-29.31	QP		

*:Maximum data x:Over limit !:over margin

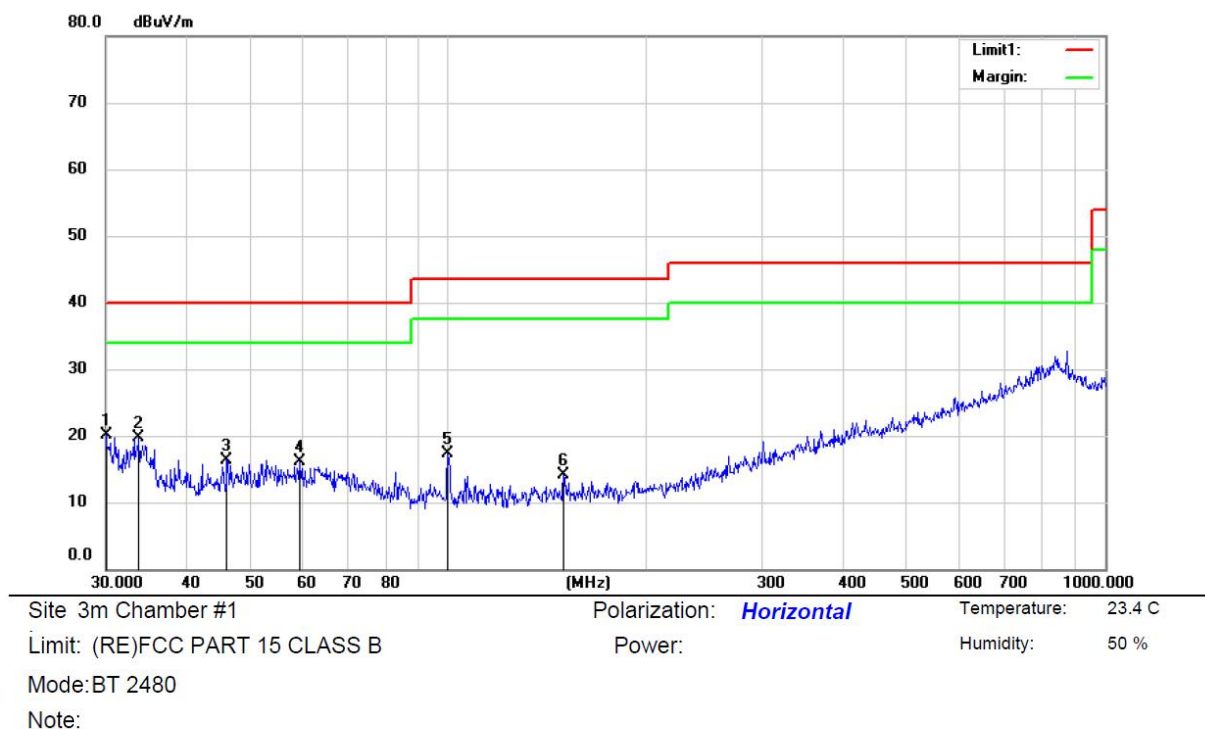
Operator: WHZ



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	31.0026	42.49	-14.52	27.97	40.00	-12.03	QP		
2		33.8728	42.09	-14.17	27.92	40.00	-12.08	QP		
3		50.4090	35.92	-11.96	23.96	40.00	-16.04	QP		
4		57.5940	39.56	-12.08	27.48	40.00	-12.52	QP		
5		84.5906	32.83	-15.42	17.41	40.00	-22.59	QP		
6		104.3987	35.14	-14.37	20.77	43.50	-22.73	QP		

*:Maximum data x:Over limit !:over margin

Operator: WHZ



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1	*	30.0790	34.63	-14.58	20.05	40.00	-19.95	QP		
2		33.7838	33.91	-14.18	19.73	40.00	-20.27	QP		
3		45.9962	28.68	-12.44	16.24	40.00	-23.76	QP		
4		59.2584	28.10	-12.03	16.07	40.00	-23.93	QP		
5		99.7902	32.11	-14.76	17.35	43.50	-26.15	QP		
6		149.9451	27.86	-13.77	14.09	43.50	-29.41	QP		

*:Maximum data x:Over limit !:over margin

Operator: WHZ

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
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.		

9.8.3 Test Configuration

Test according to clause 7.3 conducted emission test setup

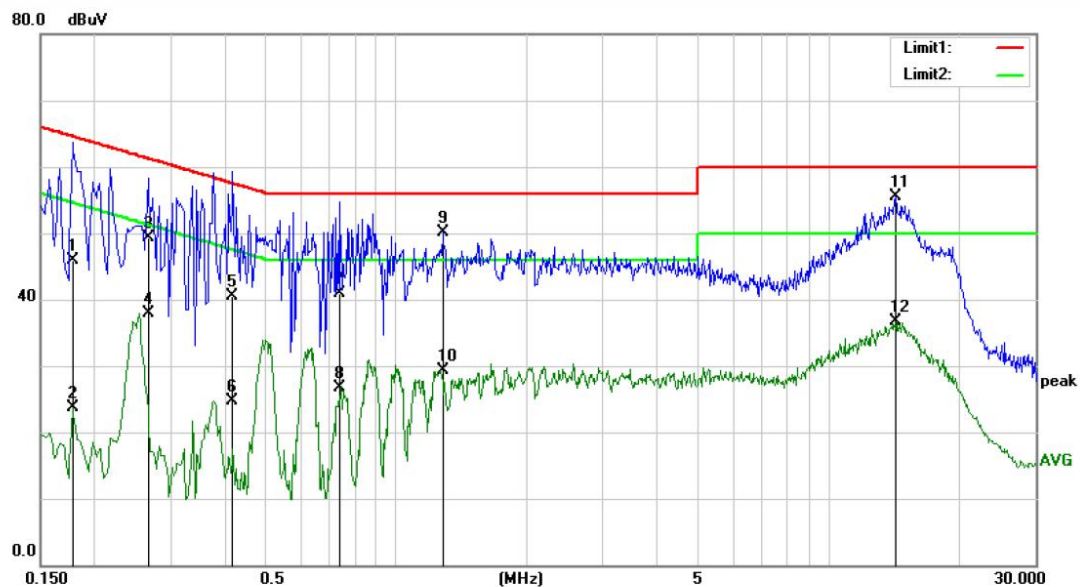
9.8.4 Test Procedure

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 #2

Phase: **L1**

Temperature: 25.3

Limit: (CE)FCC PART 15 class B_QP

Power: AC 120V/60Hz

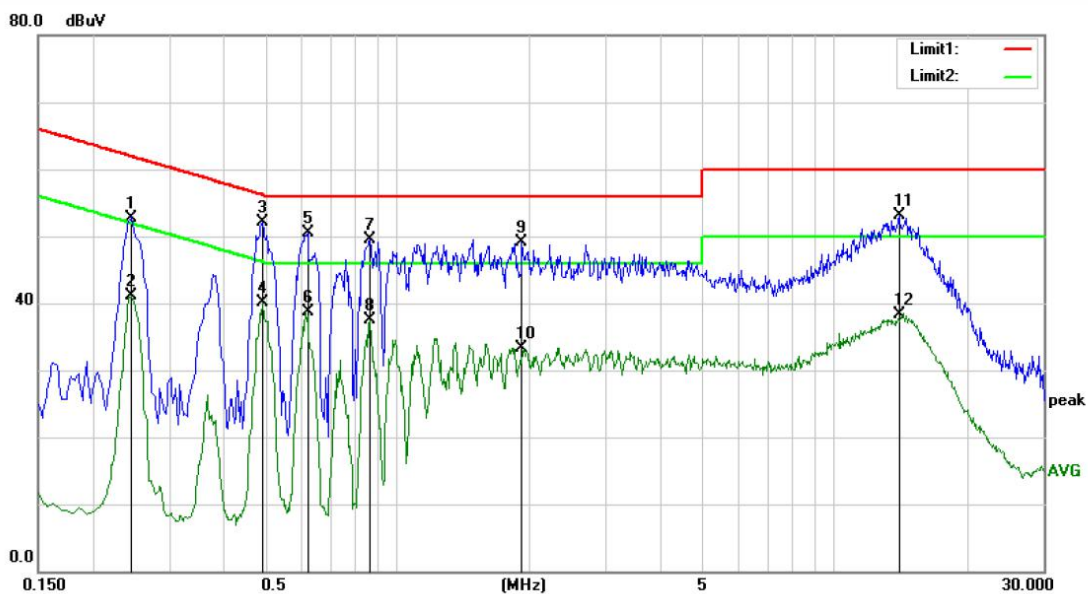
Humidity: 37 %

Mode: BT Mode

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1780	35.43	10.47	45.90	64.58	-18.68	QP	
2		0.1780	13.21	10.47	23.68	54.58	-30.90	AVG	
3		0.2660	38.89	10.41	49.30	61.24	-11.94	QP	
4		0.2660	27.53	10.41	37.94	51.24	-13.30	AVG	
5		0.4180	30.25	10.35	40.60	57.49	-16.89	QP	
6		0.4180	14.27	10.35	24.62	47.49	-22.87	AVG	
7		0.7380	30.59	10.31	40.90	56.00	-15.10	QP	
8		0.7380	16.38	10.31	26.69	46.00	-19.31	AVG	
9		1.2820	39.79	10.37	50.16	56.00	-5.84	QP	
10		1.2820	18.84	10.37	29.21	46.00	-16.79	AVG	
11	*	14.2180	44.85	10.65	55.50	60.00	-4.50	QP	
12		14.2180	26.05	10.65	36.70	50.00	-13.30	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: XZJ



Site Conduction #2

Phase: **N**

Temperature: 25.3

Limit: (CE)FCC PART 15 class B_QP

Power: AC 120V/60Hz

Humidity: 37 %

Mode: BT Mode

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2460	42.39	10.41	52.80	61.89	-9.09	QP	
2		0.2460	30.69	10.41	41.10	51.89	-10.79	AVG	
3	*	0.4900	41.71	10.32	52.03	56.17	-4.14	QP	
4		0.4900	29.73	10.32	40.05	46.17	-6.12	AVG	
5		0.6220	40.20	10.31	50.51	56.00	-5.49	QP	
6		0.6220	28.42	10.31	38.73	46.00	-7.27	AVG	
7		0.8620	39.17	10.35	49.52	56.00	-6.48	QP	
8		0.8620	27.14	10.35	37.49	46.00	-8.51	AVG	
9		1.9220	38.72	10.30	49.02	56.00	-6.98	QP	
10		1.9220	23.02	10.30	33.32	46.00	-12.68	AVG	
11		14.0180	42.40	10.65	53.05	60.00	-6.95	QP	
12		14.0180	27.75	10.65	38.40	50.00	-11.60	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: XZJ

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 has 1 antenna: a Internal Antenna for BT, the gain is 3.87 dBi;

Note: ☒ Antennas 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 -----