

9.7 RADIATED SPURIOUS EMISSION

9.7.1 Applicable Standard

According to FCC Part 15.247(d) and 15.209 and DA 00-705

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	2400/F(KHz)	20 log (uV/m)	30
1.705~30.0	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

Remark :1. Emission level in dBuV/m=20 log (uV/m)

2. Measurement was performed at an antenna to the closed point of EUT distance of meters.

3. Distance extrapolation factor =40log(Specific distance/ test distance)(dB);

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

for the frequency ranges below 30 MHz, a narrower RBW is used for these ranges but the measured value should add a RBW correction factor (RBWCF) where RBWCF [dB] =10*Ig(100 [kHz]/narrower RBW [kHz]). , the narrower RBW is 1 kHz and RBWCF is 20 dB for the frequency 9 kHz to 150 kHz, and the narrower RBW is 10 kHz and RBWCF is 10 dB for the frequency 150 kHz to 30 MHz.

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 for peak measurement

VBW = 10Hz for Average measurement

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

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: 24°C
Humidity: 53 %
Test mode: TX Mode

Test Date: June 13, 2015
Test By: KING KONG

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
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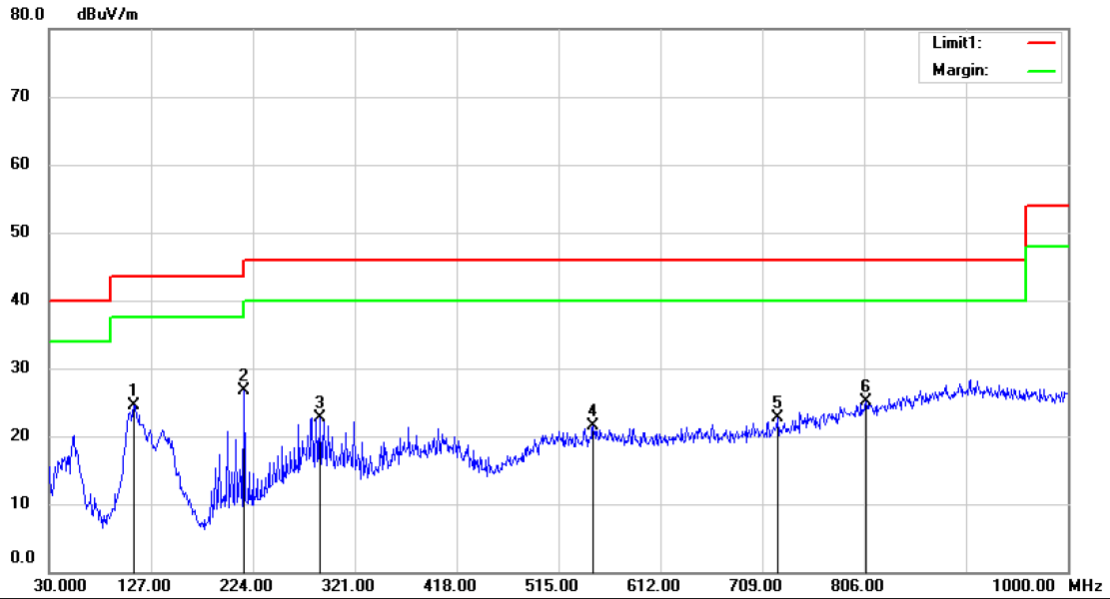
Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

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

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

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

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



Site site #1

Polarization: **Horizontal**

Temperature: 24 C

Limit: (RE)FCC PART 15 CLASS B

Power: AC 120V/60Hz

Humidity: 53 %

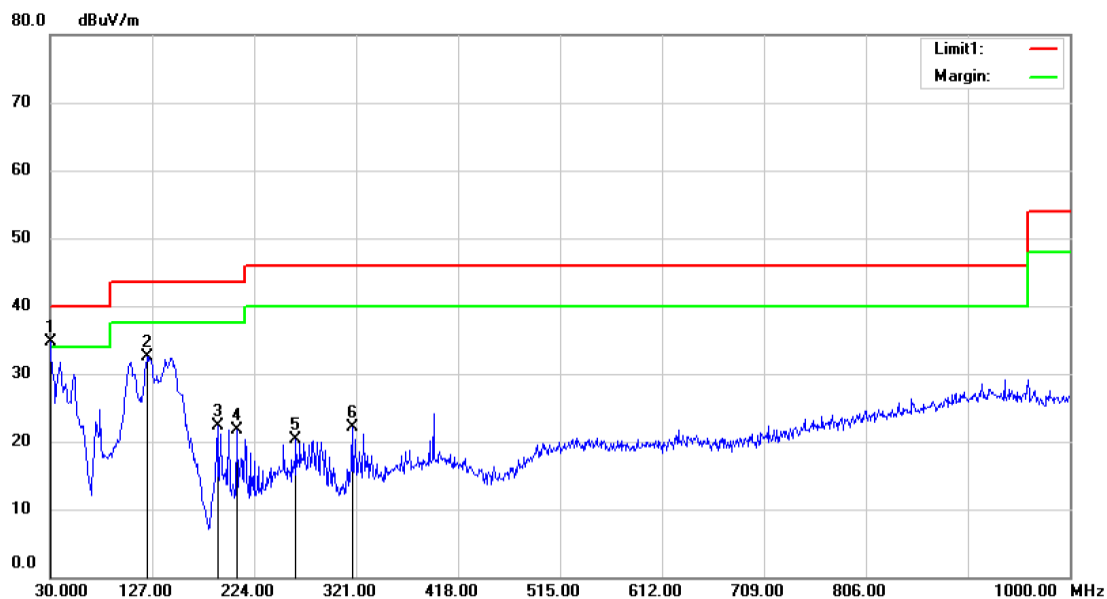
Mode:GFSK TX CH00

Note:

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		110.5100	38.90	-14.33	24.57	43.50	-18.93	QP		
2	*	215.2700	43.13	-16.38	26.75	43.50	-16.75	QP		
3		288.0200	35.77	-13.07	22.70	46.00	-23.30	QP		
4		547.9800	28.99	-7.42	21.57	46.00	-24.43	QP		
5		723.5500	27.88	-5.25	22.63	46.00	-23.37	QP		
6		807.9400	27.89	-2.69	25.20	46.00	-20.80	QP		

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

Operator: CSL

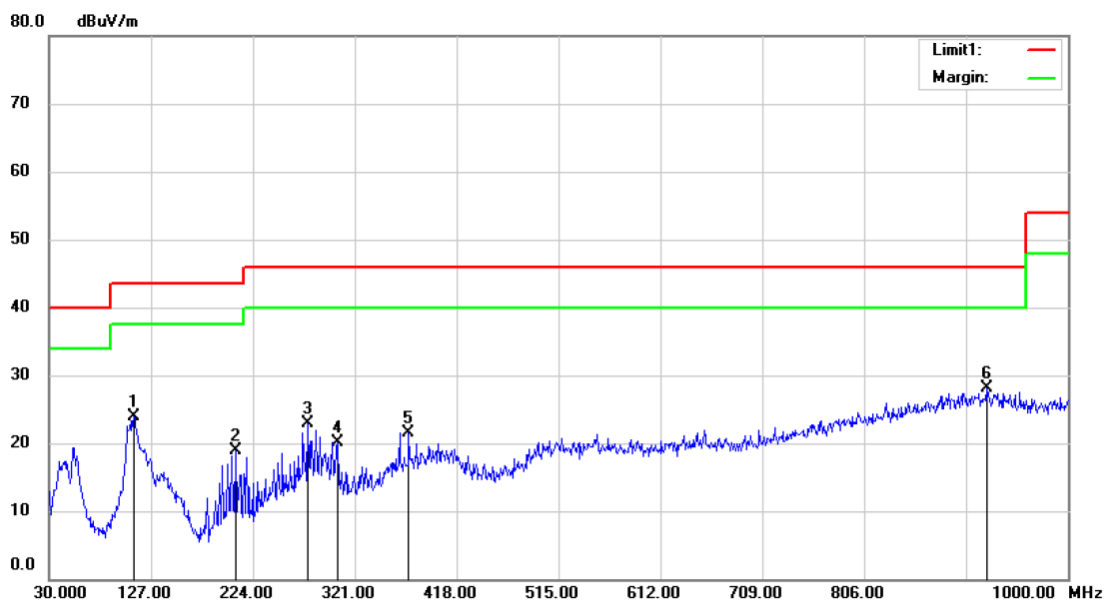


Site site #1
Limit: (RE)FCC PART 15 CLASS B
Mode:GFSK TX CH00
Note:
Polarization: *Vertical*
Power: AC 120V/60Hz
Temperature: 24 C
Humidity: 53 %

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	*	30.0000	51.22	-16.46	34.76	40.00	-5.24	QP		
2		122.1500	48.98	-16.54	32.44	43.50	-11.06	QP		
3		189.0800	39.73	-17.44	22.29	43.50	-21.21	QP		
4		207.5100	38.17	-16.38	21.79	43.50	-21.71	QP		
5		263.7700	33.10	-12.75	20.35	46.00	-25.65	QP		
6		317.1200	35.59	-13.54	22.05	46.00	-23.95	QP		

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

Operator: CSL

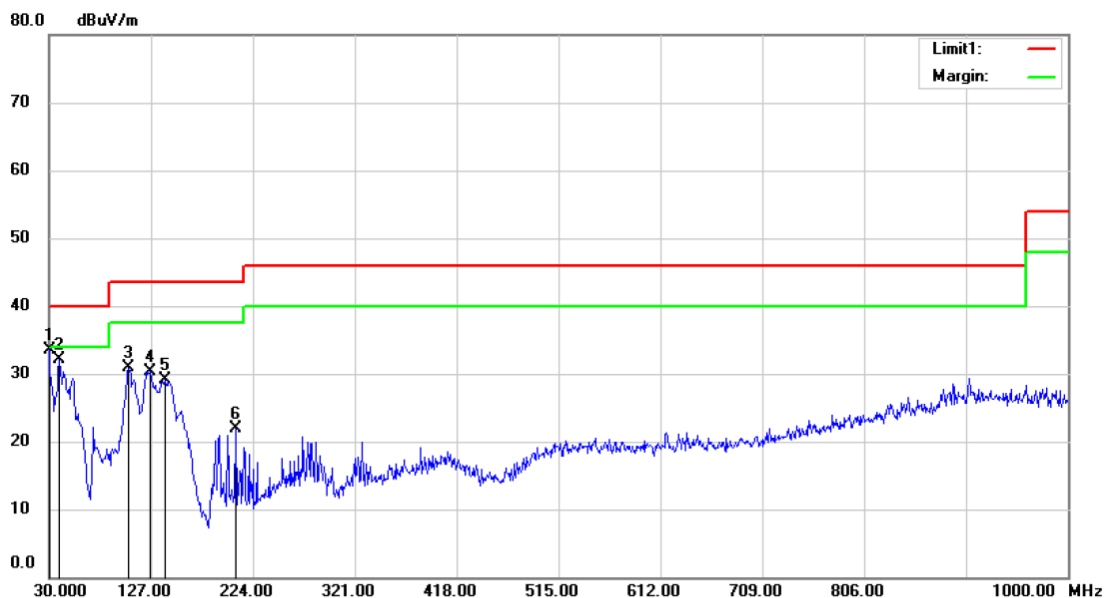


Site site #1 Polarization: **Horizontal** Temperature: 24 C
Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
Mode:GFSK TX CH39
Note:

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		110.5100	38.14	-14.33	23.81	43.50	-19.69	QP		
2		207.5100	35.32	-16.38	18.94	43.50	-24.56	QP		
3		276.3800	35.50	-12.61	22.89	46.00	-23.11	QP		
4		304.5100	33.87	-13.76	20.11	46.00	-25.89	QP		
5		372.4100	31.74	-10.28	21.46	46.00	-24.54	QP		
6	*	922.4000	28.74	-0.65	28.09	46.00	-17.91	QP		

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

Operator: CSL

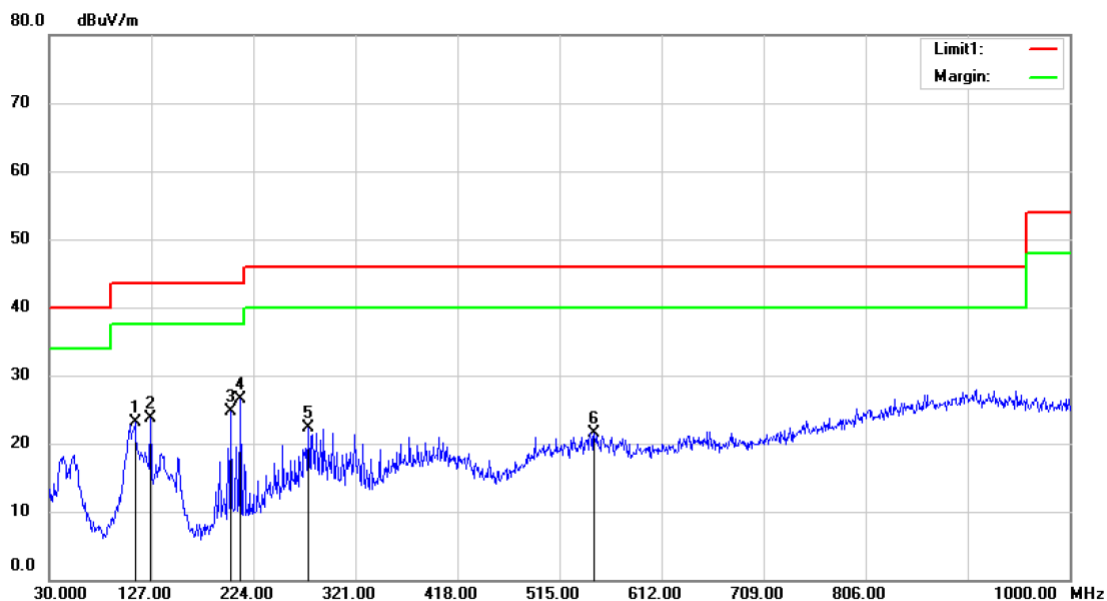


Site site #1 Polarization: **Vertical** Temperature: 24 C
Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
Mode:GFSK TX CH39
Note:

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	*	30.0000	50.06	-16.46	33.60	40.00	-6.40	QP		
2		39.7000	45.22	-13.03	32.19	40.00	-7.81	QP		
3		105.6600	44.94	-14.12	30.82	43.50	-12.68	QP		
4		126.0300	47.17	-16.89	30.28	43.50	-13.22	QP		
5		140.5800	46.81	-17.80	29.01	43.50	-14.49	QP		
6		207.5100	38.26	-16.38	21.88	43.50	-21.62	QP		

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

Operator: CSL

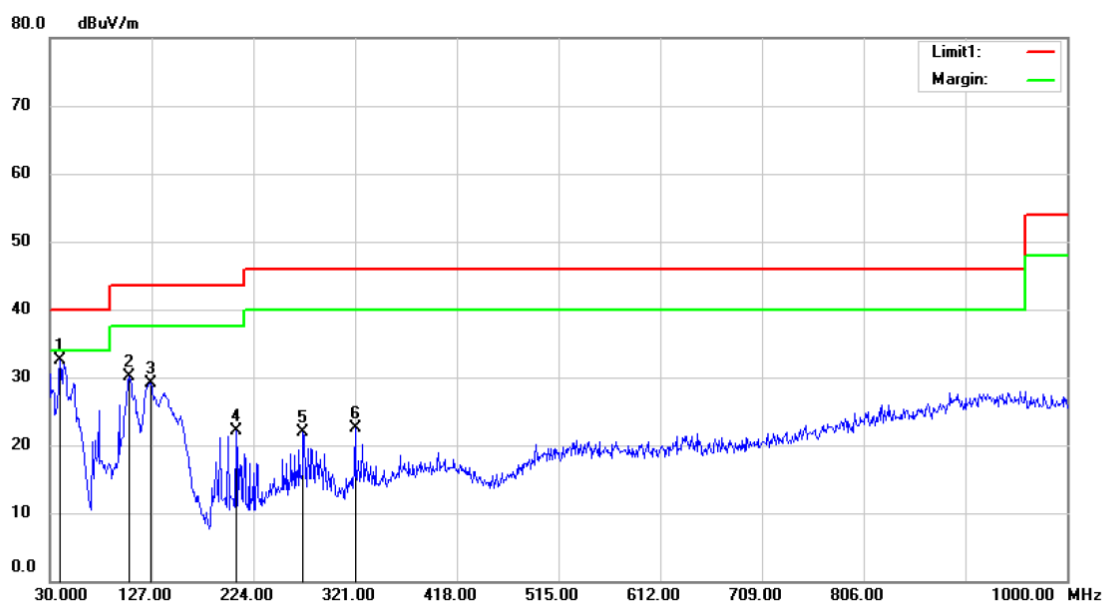


Site site #1 Polarization: **Horizontal** Temperature: 24 C
 Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
 Mode:GFSK TX CH78
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1		111.4800	37.73	-14.54	23.19	43.50	-20.31	QP		
2		126.0300	40.50	-16.89	23.61	43.50	-19.89	QP		
3		202.6600	41.12	-16.40	24.72	43.50	-18.78	QP		
4	*	211.3900	42.89	-16.38	26.51	43.50	-16.99	QP		
5		276.3800	34.84	-12.61	22.23	46.00	-23.77	QP		
6		547.9800	28.93	-7.42	21.51	46.00	-24.49	QP		

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

Operator: CSL



Site site #1 Polarization: **Vertical** Temperature: 24 C
Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
Mode:GFSK TX CH78
Note:

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	*	39.7000	45.58	-13.03	32.55	40.00	-7.45	QP		
2		105.6600	44.29	-14.12	30.17	43.50	-13.33	QP		
3		126.0300	46.08	-16.89	29.19	43.50	-14.31	QP		
4		207.5100	38.53	-16.38	22.15	43.50	-21.35	QP		
5		271.5300	34.53	-12.67	21.86	46.00	-24.14	QP		
6		321.0000	35.89	-13.45	22.44	46.00	-23.56	QP		

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

Operator: CSL

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

Bluetooth v2.0 /v2.1/v3.0 GFSK mode have been tested, and the worst result was report as below:

Temperature: 24℃ Test Date: June 13, 2015
 Humidity: 53 % Test By: KING KONG
 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
10639.00	V	48.95	35.95	74.00	54.00	-25.05	-18.05
13733.00	V	51.72	37.54	74.00	54.00	-22.28	-16.46
15246.00	V	51.43	36.95	74.00	54.00	-22.57	-17.05
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14447.00	H	51.41	36.75	74.00	54.00	-22.59	-17.25
15807.00	H	52.31	38.62	74.00	54.00	-21.69	-15.38
17116.00	H	52.88	36.85	74.00	54.00	-21.12	-17.15

Temperature: 24℃ Test Date: June 13, 2015
 Humidity: 53 % Test By: KING KONG
 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
14141.00	V	51.58	36.75	74.00	54.00	-22.42	-17.25
14753.00	V	52.02	38.42	74.00	54.00	-21.98	-15.58
16402.00	V	52.35	38.26	74.00	54.00	-21.65	-15.74
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
13716.00	H	50.68	37.21	74.00	54.00	-23.32	-16.79
15926.00	H	50.00	36.53	74.00	54.00	-24.00	-17.47
18000.00	H	51.66	36.75	74.00	54.00	-22.34	-17.25

Temperature: 24℃ Test Date: June 13, 2015
 Humidity: 53 % Test By: KING KONG
 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
13716.00	V	51.00	37.23	74.00	54.00	-23.00	-16.77
14821.00	V	51.47	36.94	74.00	54.00	-22.53	-17.06
16283.00	V	51.91	37.63	74.00	54.00	-22.09	-16.37
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
14804.00	H	51.12	36.85	74.00	54.00	-22.88	-17.15
16079.00	H	51.32	36.73	74.00	54.00	-22.68	-17.27
18000.00	H	52.99	38.61	74.00	54.00	-21.01	-15.39

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

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

(3) 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 in Restricted Band 2310-2390MHz and 2483.5-2500MHz

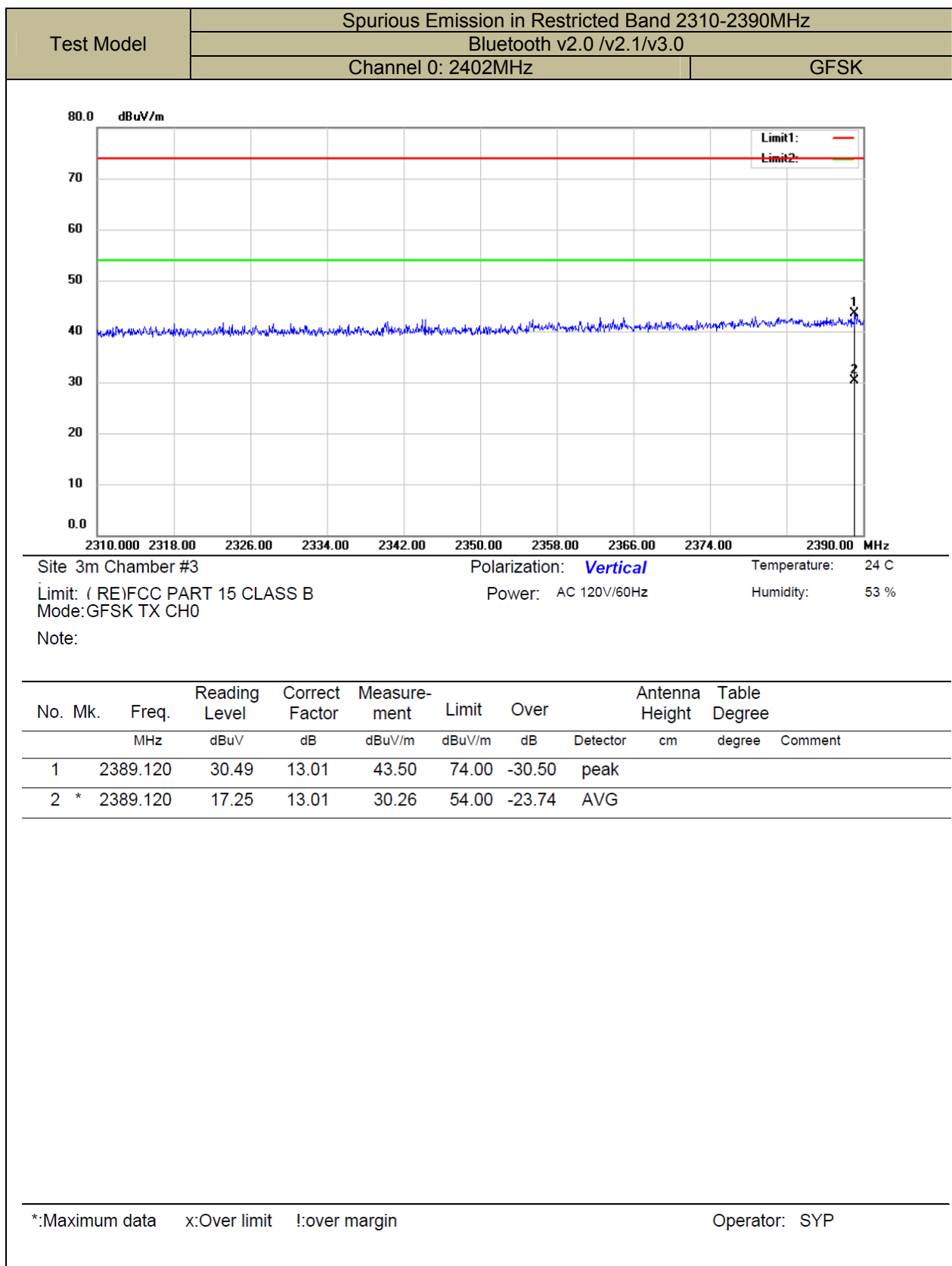
All the modulation modes were tested, the data of the worst mode are described in the following table

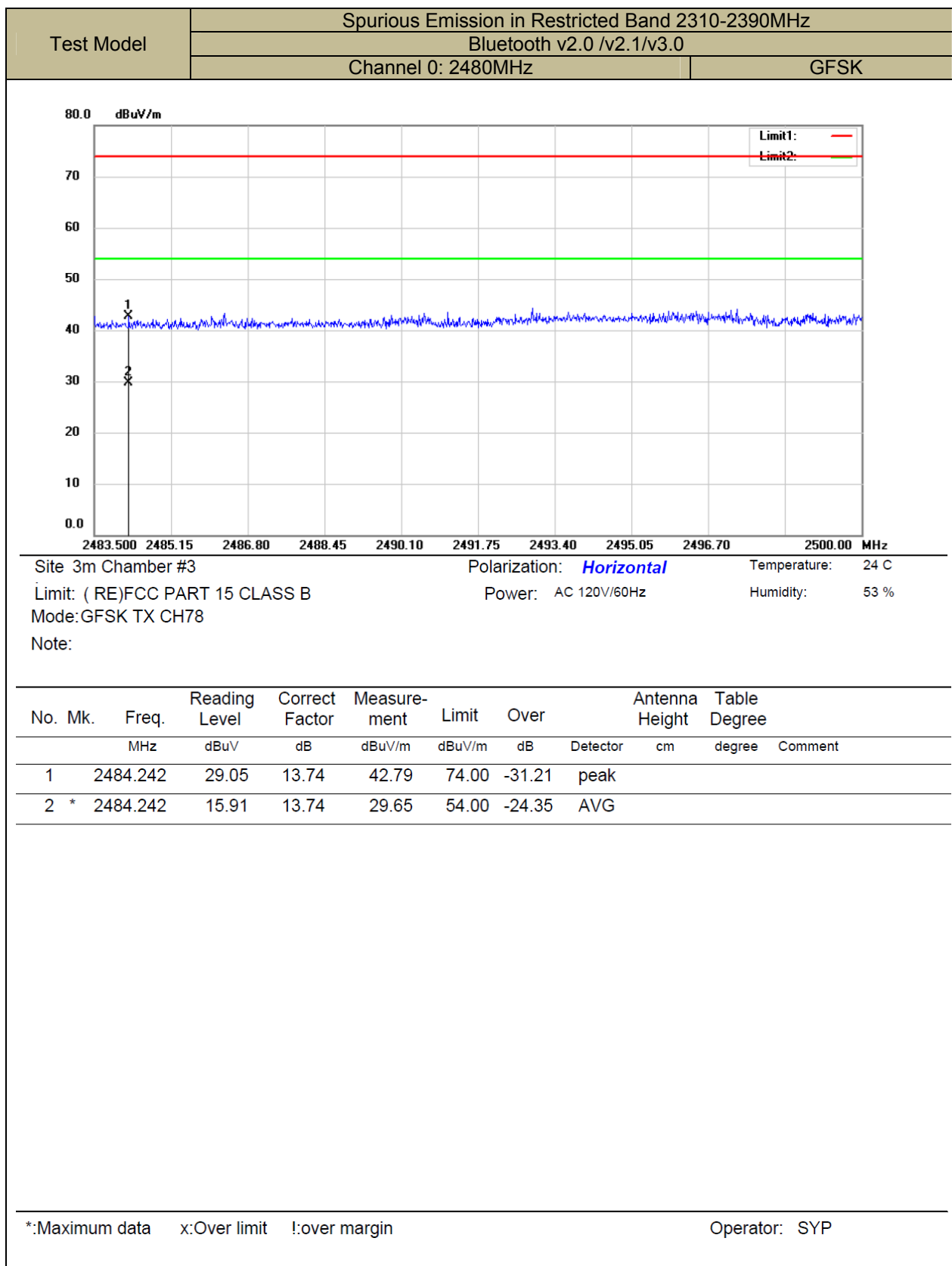
Test Model	Spurious Emission in Restricted Band 2310-2390MHz									
	Bluetooth v2.0 /v2.1/v3.0									
	Channel 0: 2402MHz					GFSK				

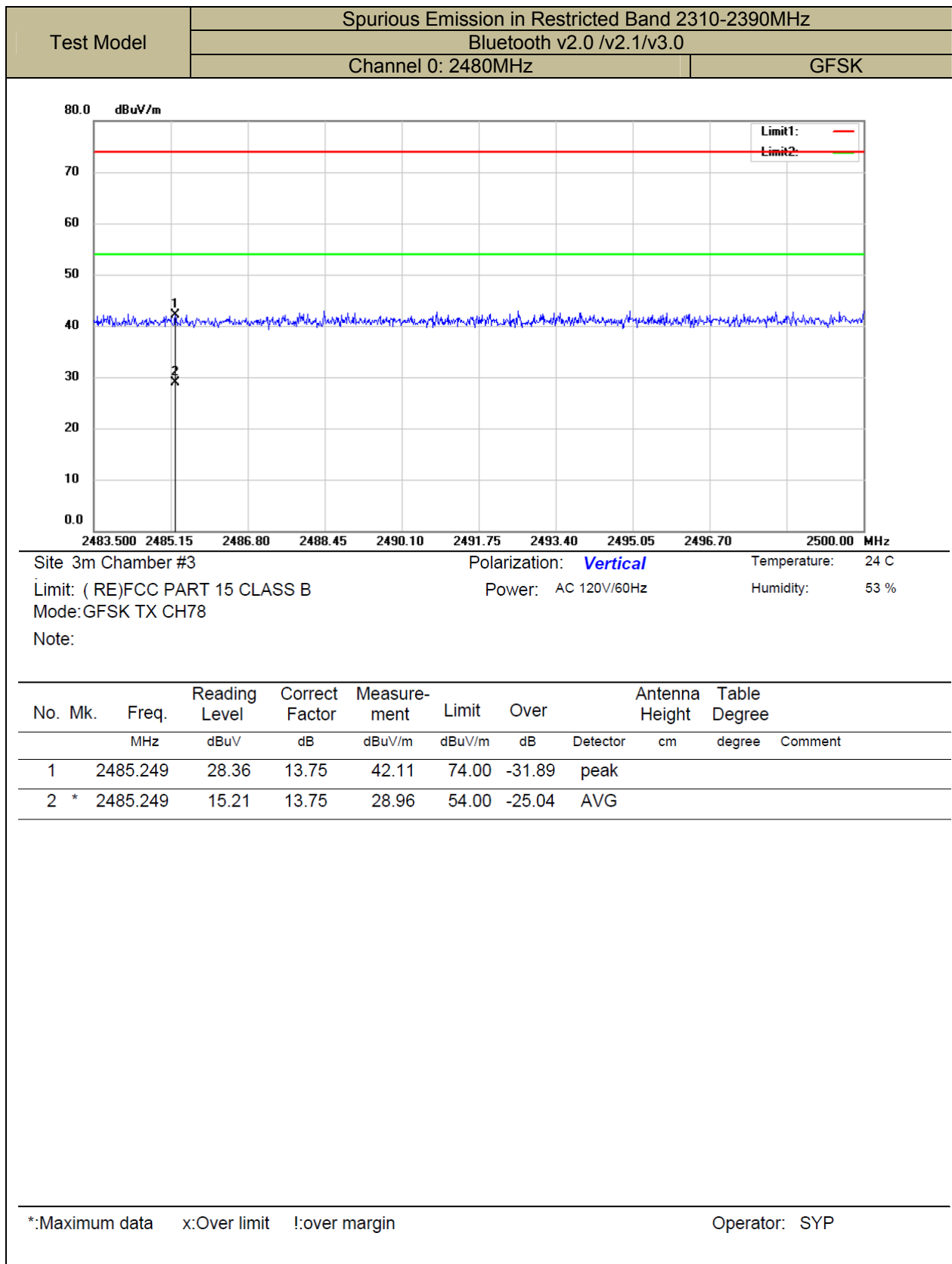
Site: 3m Chamber #3 Polarization: **Horizontal** Temperature: 24 C
Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
Mode:GFSK TX CH0
Note:

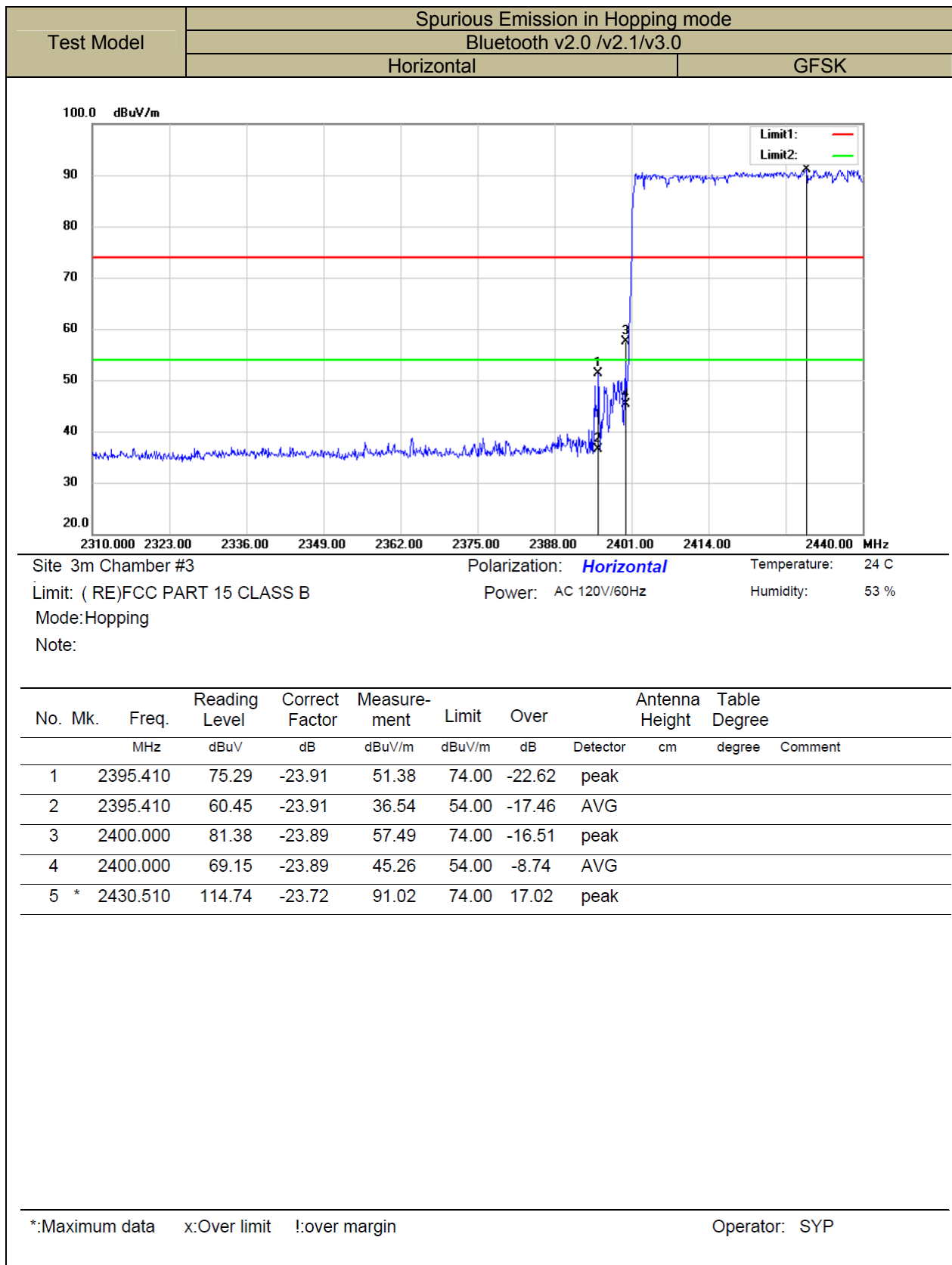
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		2378.720	30.35	12.93	43.28	74.00	-30.72	peak		
2	*	2378.720	17.33	12.93	30.26	54.00	-23.74	AVG		

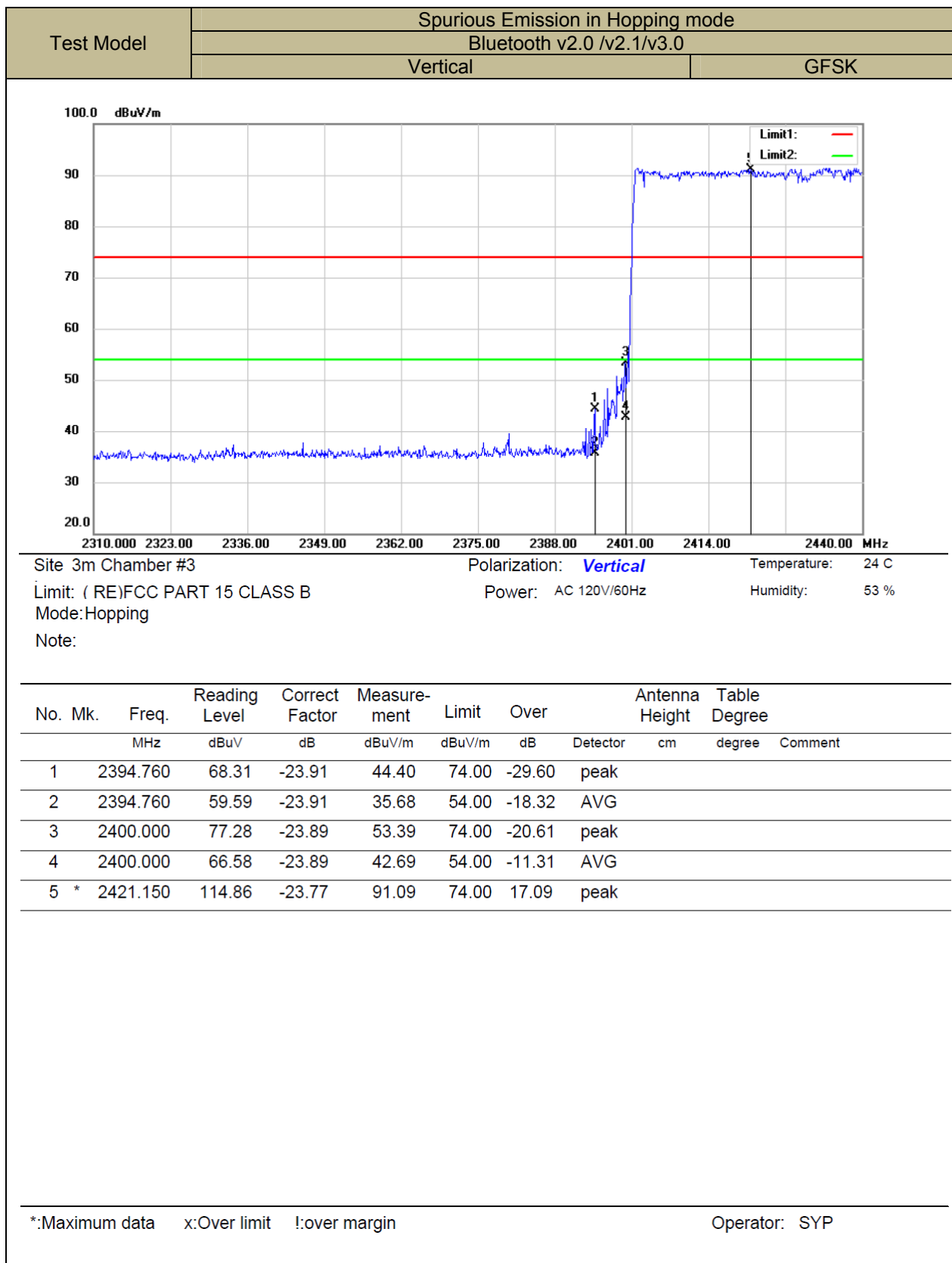
*:Maximum data x:Over limit !:over margin Operator: SYP

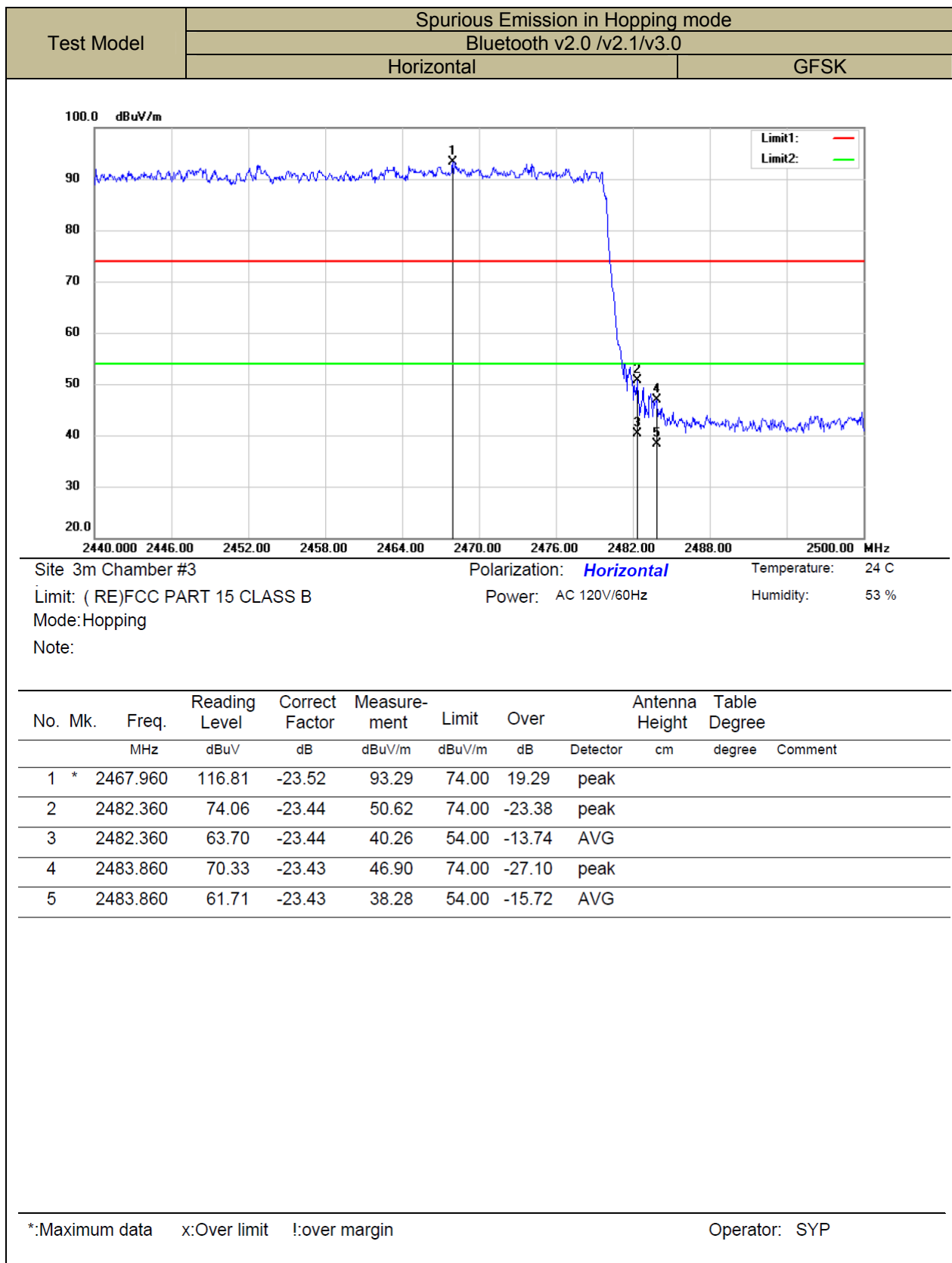


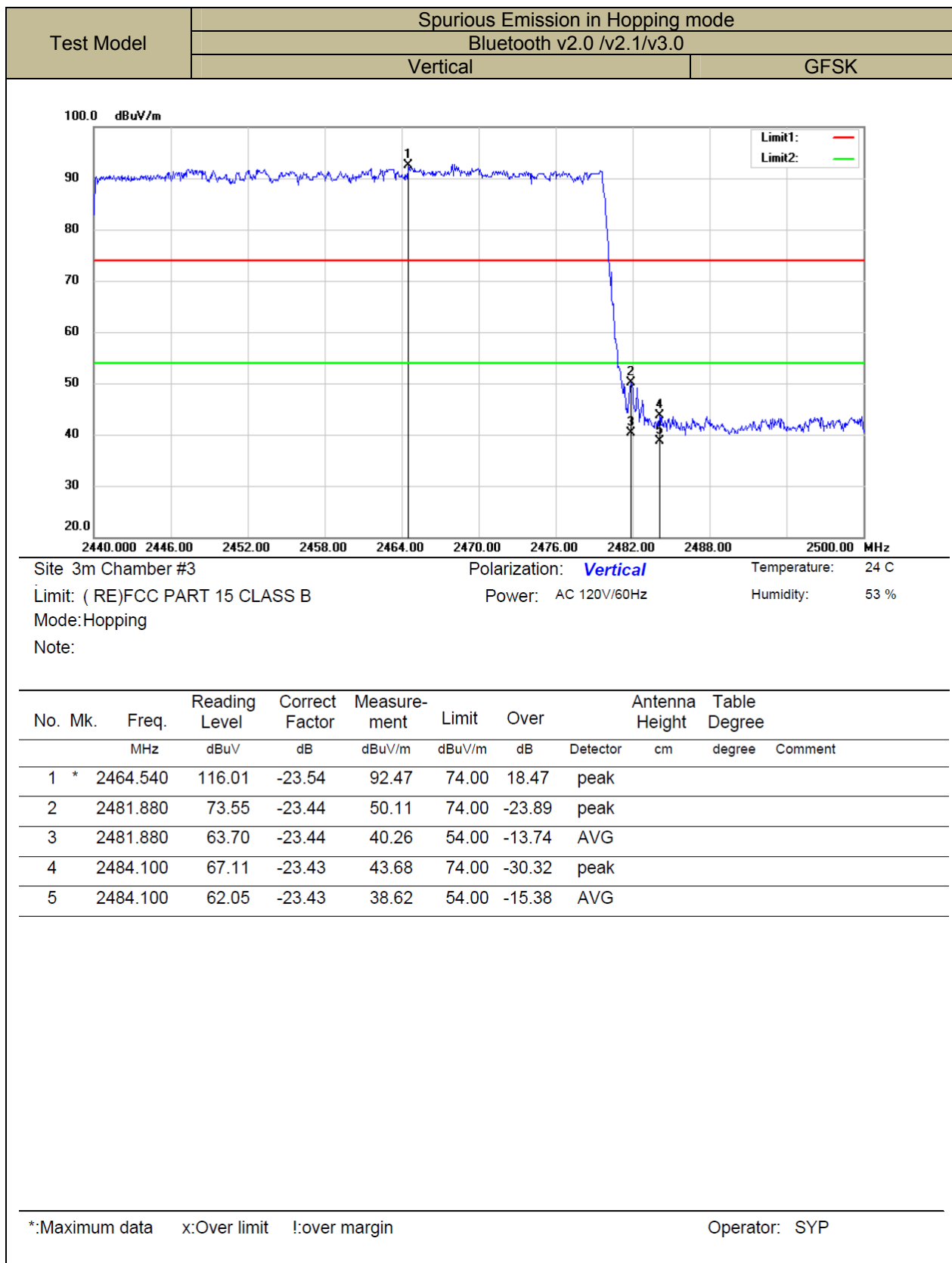












9.8 CONDUCTED EMISSION TEST

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.		

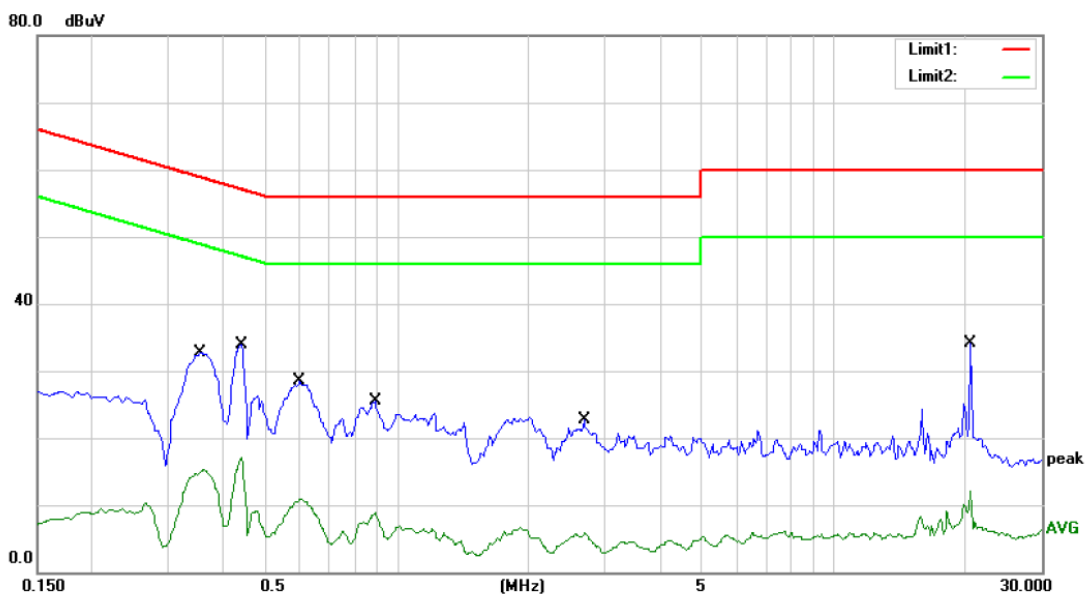
9.8.3 Test Configuration

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



Site Conduction #1

Phase: **L1**

Temperature: 26

Limit: (CE)FCC PART 15 class B_QP

Power: AC 120V/60Hz

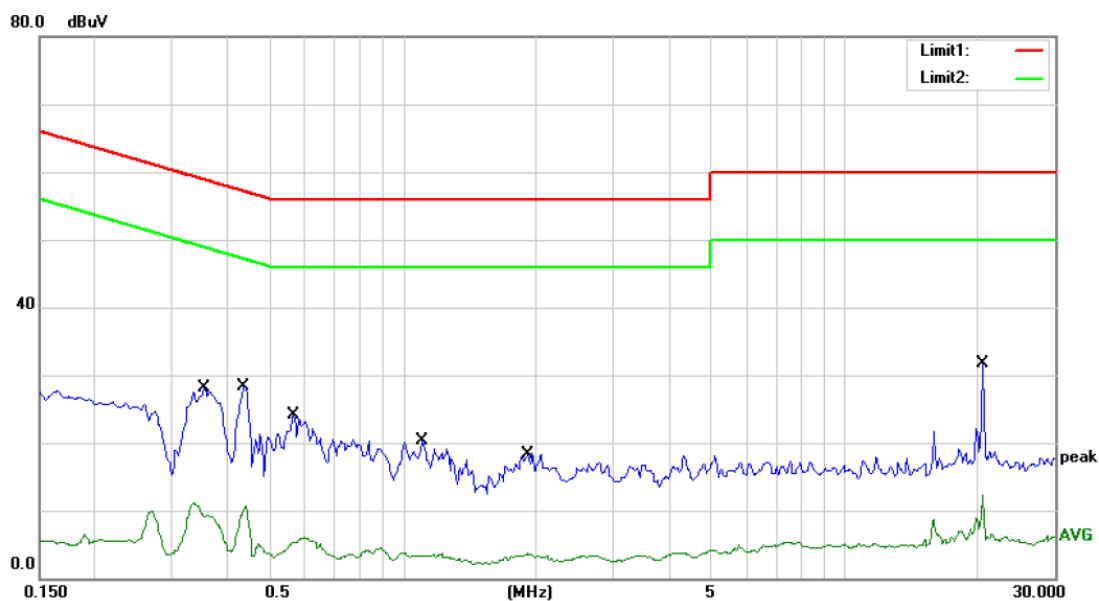
Humidity: 60 %

Mode: Bluetooth ON

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3550	32.67	0.00	32.67	58.84	-26.17	QP	
2		0.3550	15.30	0.00	15.30	48.84	-33.54	AVG	
3	*	0.4400	33.90	0.00	33.90	57.06	-23.16	QP	
4		0.4400	17.08	0.00	17.08	47.06	-29.98	AVG	
5		0.6000	28.43	0.00	28.43	56.00	-27.57	QP	
6		0.6000	10.82	0.00	10.82	46.00	-35.18	AVG	
7		0.8900	25.44	0.00	25.44	56.00	-30.56	QP	
8		0.8900	8.93	0.00	8.93	46.00	-37.07	AVG	
9		2.6850	22.77	0.00	22.77	56.00	-33.23	QP	
10		2.6950	5.84	0.00	5.84	46.00	-40.16	AVG	
11		20.5750	34.06	0.00	34.06	60.00	-25.94	QP	
12		20.5750	12.07	0.00	12.07	50.00	-37.93	AVG	

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



Site Conduction #1

Phase: **N**

Temperature: 26

Limit: (CE)FCC PART 15 class B_QP

Power: AC 120V/60Hz

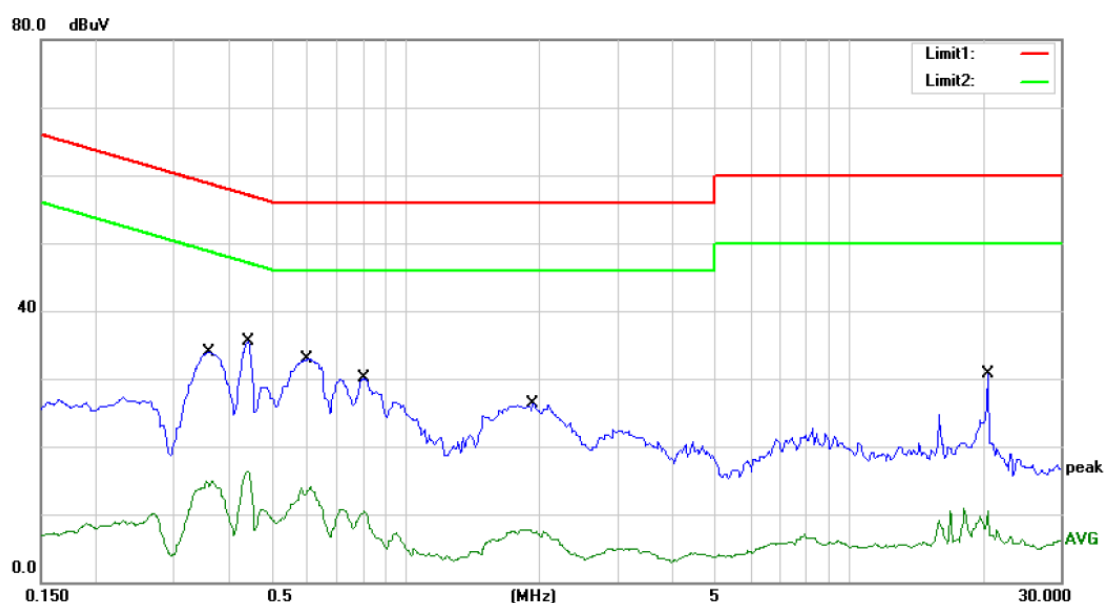
Humidity: 60 %

Mode: Bluetooth ON

Note:

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	0.3550	28.03	0.00	28.03	58.84	-30.81	QP	
2	0.3550	11.08	0.00	11.08	48.84	-37.76	AVG	
3	0.4350	28.31	0.00	28.31	57.16	-28.85	QP	
4	0.4350	10.64	0.00	10.64	47.16	-36.52	AVG	
5	0.5650	24.08	0.00	24.08	56.00	-31.92	QP	
6	0.5650	6.02	0.00	6.02	46.00	-39.98	AVG	
7	1.1050	20.31	0.00	20.31	56.00	-35.69	QP	
8	1.1050	3.74	0.00	3.74	46.00	-42.26	AVG	
9	1.9200	18.55	0.00	18.55	56.00	-37.45	QP	
10	1.9200	3.63	0.00	3.63	46.00	-42.37	AVG	
11 *	20.5750	31.61	0.00	31.61	60.00	-28.39	QP	
12	20.5750	12.29	0.00	12.29	50.00	-37.71	AVG	

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



Site Conduction #1

Phase: **L1**

Temperature: 26

Limit: (CE)FCC PART 15 class B_QP

Power: AC 240V/50Hz

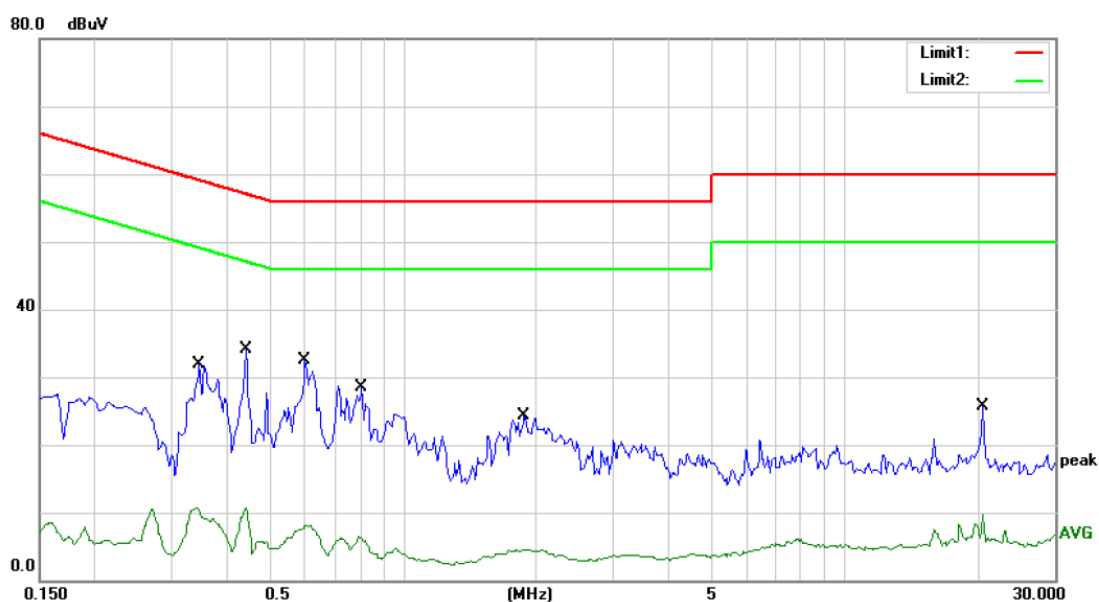
Humidity: 60 %

Mode: Bluetooth ON

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3600	33.87	0.00	33.87	58.73	-24.86	QP	
2		0.3600	14.86	0.00	14.86	48.73	-33.87	AVG	
3	*	0.4400	35.41	0.00	35.41	57.06	-21.65	QP	
4		0.4400	16.37	0.00	16.37	47.06	-30.69	AVG	
5		0.6000	32.85	0.00	32.85	56.00	-23.15	QP	
6		0.6000	14.07	0.00	14.07	46.00	-31.93	AVG	
7		0.8050	30.01	0.00	30.01	56.00	-25.99	QP	
8		0.8050	10.46	0.00	10.46	46.00	-35.54	AVG	
9		1.9350	26.30	0.00	26.30	56.00	-29.70	QP	
10		1.9350	7.75	0.00	7.75	46.00	-38.25	AVG	
11		20.5750	30.73	0.00	30.73	60.00	-29.27	QP	
12		20.5750	10.40	0.00	10.40	50.00	-39.60	AVG	

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



Site Conduction #1

Phase: **N**

Temperature: 26

Limit: (CE)FCC PART 15 class B_QP

Power: AC 240V/50Hz

Humidity: 60 %

Mode: Bluetooth ON

Note:

No. Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.3450	31.84	0.00	31.84	59.08	-27.24	QP	
2	0.3450	10.75	0.00	10.75	49.08	-38.33	AVG	
3 *	0.4400	34.06	0.00	34.06	57.06	-23.00	QP	
4	0.4400	10.79	0.00	10.79	47.06	-36.27	AVG	
5	0.6000	32.58	0.00	32.58	56.00	-23.42	QP	
6	0.6000	8.17	0.00	8.17	46.00	-37.83	AVG	
7	0.8050	28.43	0.00	28.43	56.00	-27.57	QP	
8	0.8050	6.41	0.00	6.41	46.00	-39.59	AVG	
9	1.8850	24.36	0.00	24.36	56.00	-31.64	QP	
10	1.8850	4.54	0.00	4.54	46.00	-41.46	AVG	
11	20.5750	25.65	0.00	25.65	60.00	-34.35	QP	
12	20.5750	9.71	0.00	9.71	50.00	-40.29	AVG	

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

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

The EUT'S antenna is PCB antenna, and the antenna can't be replaced by the user, which in accordance to section 15.203, please refer to the internal photos. The antenna's gain is 0dBi and meets the requirement.

END OF REPORT