

FCC/IC Test Report

FCC EVALUATION REPORT FOR VERIFICATION	
Project Reference No.	150932
Product	Bluetooth Dongle
Brand Name	
Model	WC6D-D01
Alternate Model	N/A
Tested according to	FCC Rules and Regulations Part 15 Subpart C 2008 15.247, RSS-210 issue 7 ANSI C63.4-2009

Tested in period	2010-06-01 to 2010-07-22		
Issued date	2010-07-30		
Name and address of the Test House	 Nemko Nemko Shanghai Ltd. 9A No. 528 Ruiqing Road, PuDong New Area, Shanghai, China P.C. Phone : +86 21 5072 0988 Fax : +86 21 5072 0950		
Tested by			2010-07-30
	Zone Peng		
Verified by			2010-07-30
	Daria Liu		

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Contents of This Report

1. Client Information	5
1.1 Applicant	5
1.2 Manufacturer	5
1.3 Scope	5
2. Equipment under Test (EUT)	6
2.1 Identification of EUT	6
2.2 Detail spec	6
2.3 Additional Information Related to Testing	6
2.4 Picture Documentation	6
3. General Test Conditions	7
3.1 Location	7
3.2 Operating Environment	7
3.3 Operating During Test	7
3.4 Test Equipment	7
4. Measurement Uncertainty	8
5. Radiated Electromagnetic Disturbances	9
5.1 Test Procedure	9
5.2 Measurement Equipment	9
5.3 Test Result	10
5.3.1 Diagram 5-1	12
5.3.1 Diagram 5-1	12
5.3.2 Diagram 5-2	13
5.3.3 Diagram 5-3	14
5.3.8 Diagram 5-8	19
5.3.9 Diagram 5-9	20
5.3.10 Diagram 5-10	20
5.3.11 Diagram 5-11	21
5.3.12 Diagram 5-12	21
5.3.13 Diagram 5-13	22
5.3.14 Diagram 5-14	22
5.3.15 Diagram 5-15	23
5.3.16 Diagram 5-16	24
5.3.17 Diagram 5-17	25
5.3.18 Diagram 5-18	26
6. 20 dB bandwidth and 99% bandwidth Test	27
6.1 Test Procedure	27
6.2 Measurement Equipment	27
6.3 Test Result:	28
6.3.1 Diagram 6-1	28
6.3.2 Diagram 6-2	29
6.3.3 Diagram 6-3	30
6.3.4 Diagram 6-4	31
6.3.5 Diagram 6-5	32
6.3.6 Diagram 6-6	33

7. Band Edge Compliance Test.....	34
7.1 Test Procedure.....	34
7.2 Measurement Equipment.....	34
7.3 Test Result	34
7.3.1 Diagram 7-1	36
7.3.2 Diagram 7-2	37
7.3.3 Diagram 7-3	38
7.3.4 Diagram 7-4	39
7.3.5 Diagram 7-5.....	40
7.3.6 Diagram 7-6	41
7.3.7 Diagram 7-7	42
7.3.8 Diagram 7-8	43
7.3.9 Diagram 7-9	44
7.3.10 Diagram 7-10	45
7.3.11 Diagram 7-11.....	46
7.3.12 Diagram 7-12	47
8. Carrier Frequency Separation Test.....	48
8.1 Test Procedure.....	48
8.2 Measurement Equipment.....	48
8.3 Test Result	48
8.3.1 Diagram 8-1	49
8.3.2 Diagram 8-2	49
9. Output Power Test.....	50
9.1 Test Procedure.....	50
9.2 Measurement Equipment.....	50
9.3 Test Result	50
10. NUMBER OF HOPPING FREQUENCY TEST.....	51
10.1 Test Procedure.....	51
10.2 Measurement Equipment.....	51
10.3 Test Result	51
10.3.1 Diagram 10-1	51
10.3.2 Diagram 10-2	52
11. DWELL TIME TEST	54
11.1 Test Procedure	54
11.2 Measurement Equipment.....	54
11.3 Test Result	54
11.3.1 Diagram 11-1	55
11.3.2 Diagram 11-2.....	57
11.3.3 Diagram 11-3.....	59
11.3.4 Diagram 11-4.....	61
11.3.5 Diagram 11-5.....	63
11.3.6 Diagram 11-6.....	65
12 POWER LINE CONDUCTED EMISSION TEST.....	67
12.1 Test Procedure.....	67
12.2 Measurement Equipment.....	67



FCCID: QCIWC6D
ICID: 4302A-WC6D
Reference No.: 150932

12.3 Test Result	67
12.3.1 Diagram 12-1	68
12.3.2 Diagram 12-2	69
13 Antenna requirement.....	70
13.1 Requirement.....	70
13.2 Result.....	70
14.MPE	71
Appendix A Duty cycle	72
Appendix B Sample Label.....	73



FCCID: QCIWC6D
ICID: 4302A-WC6D
Reference No.: 150932

1. Client Information

1.1 Applicant

Company Name:	SMART Technologies ULC
Company Address:	3636 Research Road NW Calgary, Alberta, Canada

1.2 Manufacturer

Company Name:	Qingdao Haier Intelligent Electronics Co., Ltd.
Company Address:	No. 99 Chongqing south Road, Qingdao, China

1.3 Scope

- Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15.



FCCID: QCIWC6D
ICID: 4302A-WC6D
Reference No.: 150932

2. Equipment under Test (EUT)

2.1 Identification of EUT

Category: Bluetooth Dongle
Model Name: WC6D-D01
Alternate model: N/A
Brand name: Smart
Technical data (Rating, etc.): As below

2.2 Detail spec

Power input: USB in from PC (DC 5V)

Carrier Frequency: 2402MHz~2480MHz

Number of Channel: 79

Output Power: 3.636 dBm

Modulation Type: Bluetooth(GFSK, $\pi/4$ DQPSK, 8DPSK)

Mode of operation (duplex, simplex, half duplex) : duplex

Bit Rate of Transmission: 1Mbit, 2Mbit, 3Mbit

Antenna Type: CHIP Antenna

Antenna gain: 2 dBi

2.3 Additional Information Related to Testing

CH 1 :2402MHz

CH 39:2441MHz

CH 79:2480MHz

2.4 Picture Documentation

- Pictures can be found in Appendix B and C.

3. General Test Conditions

3.1 Location

AUDIX Technology (Shenzhen) Co.,Ltd-ELA 135

No. 6, Ke Feng Rd., 52 Block, Shenzhen Science & Industrial Park, Nantou, Shenzhen, Guangdong, China

FCC Registration No.:90454

Industry Canada Registration No.: 5183

Note: all test are witnessed by NEMKO engineer

3.2 Operating Environment

All tests and measurements were performed in a shielded enclosure or a controlled environment suitable for the tests conducted. The climatic conditions in the test area are automatically controlled and recorded continuously.

Parameters	Recording during test	Accepted deviation
Ambient temperature	20-25°C	15 – 35 °C
Relative humidity	45-55%	30 - 60%
Atmospheric pressure	101.2 kPa -101.3kPa	86-106kPa

3.3 Operating During Test

Test mode:120V 60Hz for the host PC

TM1 : continuance TX MODE GFSK CH 1 3Mbit

TM2 : continuance TX MODE GFSK CH 39 3Mbit

TM3: continuance TX MODE GFSK CH 79 3Mbit

TM4: continuance TX MODE 8DPSK CH 1 3Mbit

TM5: continuance TX MODE 8DPSK CH 39 3Mbit

TM6: continuance TX MODE 8DPSK CH 79 3Mbit

TM7: Hopping on CH 1

TM8: Hopping on CH 79

Remark : 8DPSK and $\pi/4$ DQPSK are similar kind Modulation type, and by pretest , the GFSK and 8DPSK are the worse mode , and 3Mbit transmitter is the worst mode .When measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, have been performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. No findable change appear.

And only choose the worse mode to be the representative test mode

3.4 Test Equipment

The test equipments used in testing are calibrated on a regular basis. For most of the testing equipments accredited calibration is conducted once a year. For certain equipment the calibration interval is longer. Between the calibrations all test equipment are controlled and verified on a regular basis. The test equipments used are defined in each test section of this report.

AE Equipment:

Power Cord : Unshielded, Detachable, 1.8m (3pins)

1:PERSONAL COMPUTER

EMC CODE : Test PC P; M/N : Studio 540; S/N : 124XK2X



FCCID: QCIWC6D
ICID: 4302A-WC6D
Reference No.: 150932

Manufacturer : DELL
Power cord : Unshielded, Detachable, 1.8m
FCC : DoC; BSMI ID : R33002
Display Card HD3450(VGA+DVI+HDMI)

4. Measurement Uncertainty

The Measurement Uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 with the confidence level of 95 %.

No.	Item	Uncertainty	Remark
1	Conducted Emission Test	1.22 dB	
2	Radiated Emission Test	3.14 dB	3m chamber
3	Radiated Emission Test	3.18 dB	10m chamber
4	RF frequency	$\pm 0.5 \times 10^{-7}$	
5	RF power ,Conducted	± 3 dB	

5. Radiated Electromagnetic Disturbances

5.1 Test Procedure

The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. An antenna was located 3m or 10m from the EUT on an adjustable mast.

The EUT were rotated 0 to 360 degree and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. The test result are reported as below.

For below 1GHz

RBW=120 kHz; VBW=300KHz. The frequency range from 30MHz to 1000MHz is checked.

For above 1GHz. The frequency range from 1GHz to 25GHz(10th harmonics) is checked.

RBW=1MHz ; VBW=1MHz, PK detector for peak emissions measurement above 1GHz

RBW=1MHz ; VBW=10Hz, PK detector for average emissions measure above 1GHz

5.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
☒	EMC Spectrum	May.08,10	E7405A	MY42000131	Agilent
☒	EMC Spectrum	Oct.24,09	E7405A	MY45116588	Agilent
☒	Test Receiver	Oct.24,09	ESCI	100842	R & S
☒	Pre-Amplifier	May.08,10	8447D	2944A10684	Agilent
☒	Pre-Amplifier	May.08,10	8447D	2944A07794	Agilent
☒	Bilog Antenna	Feb.12,10	CBL6112D	25238	Schaffner
☒	Bilog Antenna	Feb.12,10	CBL6112D	25237	Schaffner
☒	RF Cable	May.08,10	8D-FB	10m Chamber No.1	MIYAZAKI
☒	RF Cable	May.08,10	8D-FB	10m Chamber No.2	MIYAZAKI
☒	Coaxial Switch	May.08,10	MP59B	6200766906	Anritsu
☒	Coaxial Switch	May.08,10	MP59B	6200766907	Anritsu
☒	Coaxial Switch	May.08,10	MP59B	M74389	Anritsu
☒	Horn Antenna	May.08,10	3115	9607-4877	EMCO
☒	Horn Antenna	May.08,10	3115	9510-4580	EMCO
☒	Amp	May.08,10	8449B	3008A00863	HP
☒	Signal Generator	May.08,10	83732B	6K00003262	HP
☒	Spectrum Analyzer	Oct.05.09	E4446A	US44300459	Agilent
☒	PRE-Amplifier	Oct.05.09	8449B	3008A02495	Agilent
☒	RF Cable	Oct.05.09	SUCOFLEX 102	28620/2	Hubersuhner
☒	RF Cable	Oct.05.09	SUCOFLEX 102	271471/4	Hubersuhner
☒	RF Cable	Oct.05.09	SUCOFLEX 102	29086/2	Hubersuhner
☒	RF Cable	Oct.05.09	SUCOFLEX 102	271473/4	Hubersuhner
☒	Horn Antenna	Oct.05.09	3116	00060089	EMCO

5.3 Test Result

Connect mode	Antenna Polarity	Remark	Test Data	Test Result
TX mode ¹⁾	Horizontal	30-1000MHz	Diagram 5-1	Pass
	Vertical	30-1000MHz	Diagram 5-2	Pass
TM1	Horizontal	1GHz-18GHz	Diagram 5-3	Pass
	Vertical	1GHz-18GHz	Diagram 5-4	Pass
TM2	Horizontal	1GHz-18GHz	Diagram 5-5	Pass
	Vertical	1GHz-18GHz	Diagram 5-6	Pass
TM3	Horizontal	1GHz-18GHz	Diagram 5-7	Pass
	Vertical	1GHz-18GHz	Diagram 5-8	Pass
TM1	Horizontal	18GHz-25GHz	Diagram 5-9	Pass
	Vertical	18GHz-25GHz	Diagram 5-10	Pass
TM2	Horizontal	18GHz-25GHz	Diagram 5-11	Pass
	Vertical	18GHz-25GHz	Diagram 5-12	Pass
TM3	Horizontal	18GHz-25GHz	Diagram 5-13	Pass
	Vertical	18GHz-25GHz	Diagram 5-14	Pass
RX MODE ¹⁾	Horizontal	30-1000MHz	Diagram 5-15	Pass
	Vertical	30-1000MHz	Diagram 5-16	Pass
RX MODE ²⁾	Horizontal	1GHz-18GHz	Diagram 5-17	Pass
	Vertical	1GHz-18GHz	Diagram 5-18	Pass

Remark:

The EUT was measured on three orthogonal axis. GFSK and 8DPSK are pre-tested, and GFSK mode is the worse case . Only the worse case reported. Test at 100% duty cycle .

If PK value is lower than AV limit , then only show PK value as below .

If PK value is more lower than AV limit for 6dB, then only show PK diagram as below.

1) All modes of operation were investigated and the worst -case emission are reported. See attached Plots.

2) Because no spurious found at 18-25GHz, so no diagram and reading record listed.

NOTES:

1. All modes were measured and the worst case emission was reported.
2. H =Horizontal V=Vertical
3. Emission = Reading +Antenna Factor + Cable Loss –Amp Factor(if exist)
4. Emission level dBµV = 20 log Emission level µV/m
5. The lower limit shall apply at the transition frequencies
6. All the emissions appearing within 15.205 Restricted 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.

Remark :

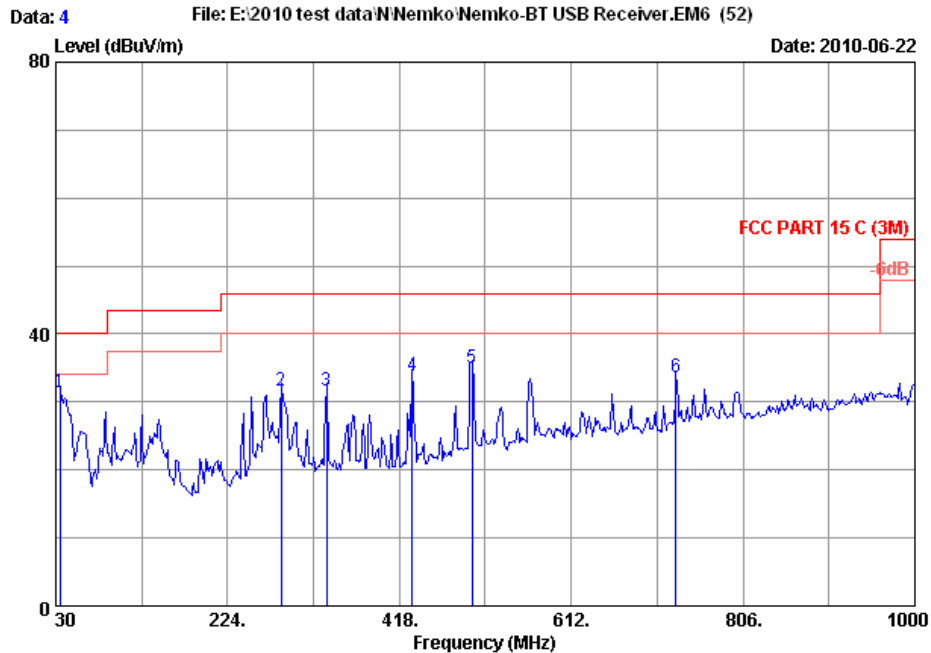
The limit of 15.209(a) of 3 meter distance is

Frequency MHz	Distance m	Field strength		Distance m	Field strength dBµV/m(QP)
		µV/m	dBµV/m(QP)		
30-88	3	100	40.0	10	30.0
88-216	3	150	43.5	10	33.5
216-960	3	200	46.0	10	36.0
960-1000	3	500	54.0	10	44.0
Above 1000	3	74.0 dBµV/m (PK) 54.0 dBµV/m (AV)		/	/

15.205 Restricted bands of operation:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 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	(²)

5.3.1 Diagram 5-1

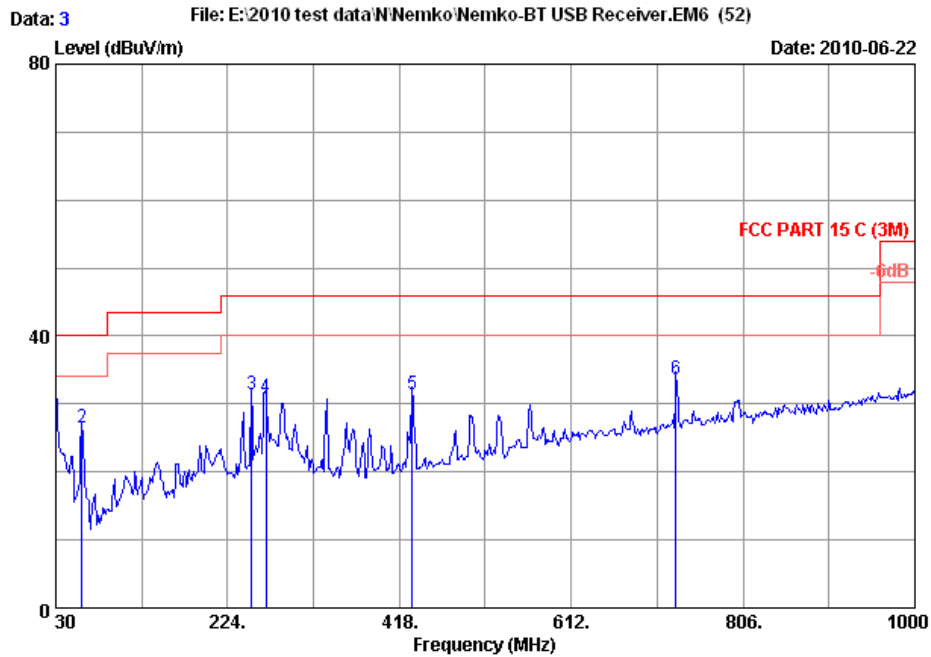


Site no. : 3m Chamber Data no. : 4
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Paul Tian
EUT :
Power :
Test Mode : Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBUV)	Emission Level (dBUV/m)	Limits (dBUV/m)	Margin (dB)	Remark
1	34.850	17.20	0.65	13.55	31.40	40.00	8.60	QP
2	284.140	13.36	2.38	15.96	31.70	46.00	14.30	QP
3	335.550	14.62	2.63	14.43	31.68	46.00	14.32	QP
4	432.550	17.42	3.12	13.22	33.76	46.00	12.24	QP
5	500.450	18.30	3.55	13.18	35.03	46.00	10.97	QP
6	730.340	21.30	4.62	7.64	33.56	46.00	12.44	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.2 Diagram 5-2



Site no. : 3m Chamber Data no. : 3
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Paul Tian
EUT :
Power :
Test mode : Tx Mode
M/N :

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBUV)	Emission Level (dBUV/m)	Limits (dBUV/m)	Margin (dB)	Remark
1	30.000	20.00	0.61	10.65	31.26	40.00	8.74	QP
2	59.100	6.22	0.84	19.45	26.51	40.00	13.49	QP
3	251.160	12.90	2.18	16.33	31.41	46.00	14.59	QP
4	267.650	13.50	2.28	15.25	31.03	46.00	14.97	QP
5	432.550	17.42	3.12	10.94	31.48	46.00	14.52	QP
6	730.340	21.30	4.62	7.80	33.72	46.00	12.28	QP

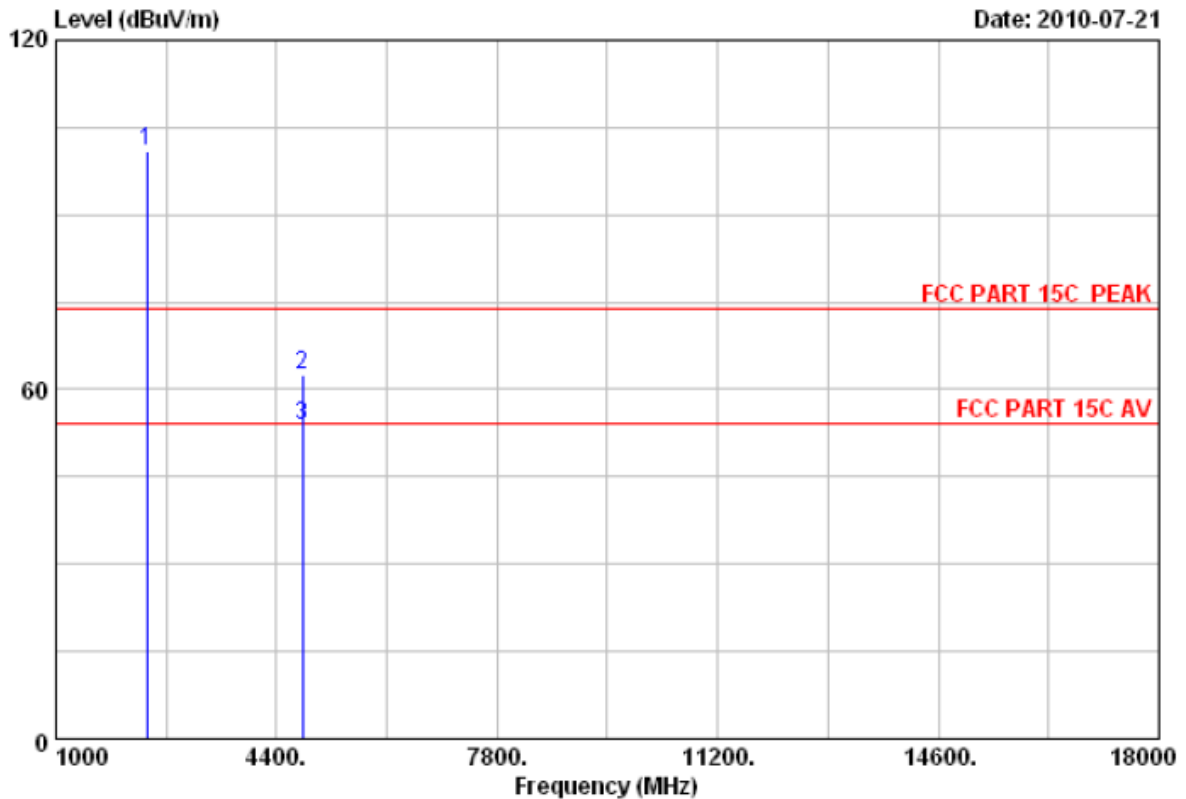
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.3 Diagram 5-3

Data: 8

File: E:\2010 test data\N\Nemko\2010-07-16.EM6 (36)

Date: 2010-07-21



Site no. : 3m Chamber Data no. : 8
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23°C/54% Engineer : Leo-Li
Power : DC 5V From PC
Test mode : Tx 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.000	29.44	7.43	36.62	100.61	100.86			Peak
2	4804.000	34.30	10.62	35.10	52.68	62.50	74.00	11.50	Peak
3	4804.000	34.30	10.62	35.10	43.86	53.68	54.00	0.32	Average

Remarks:

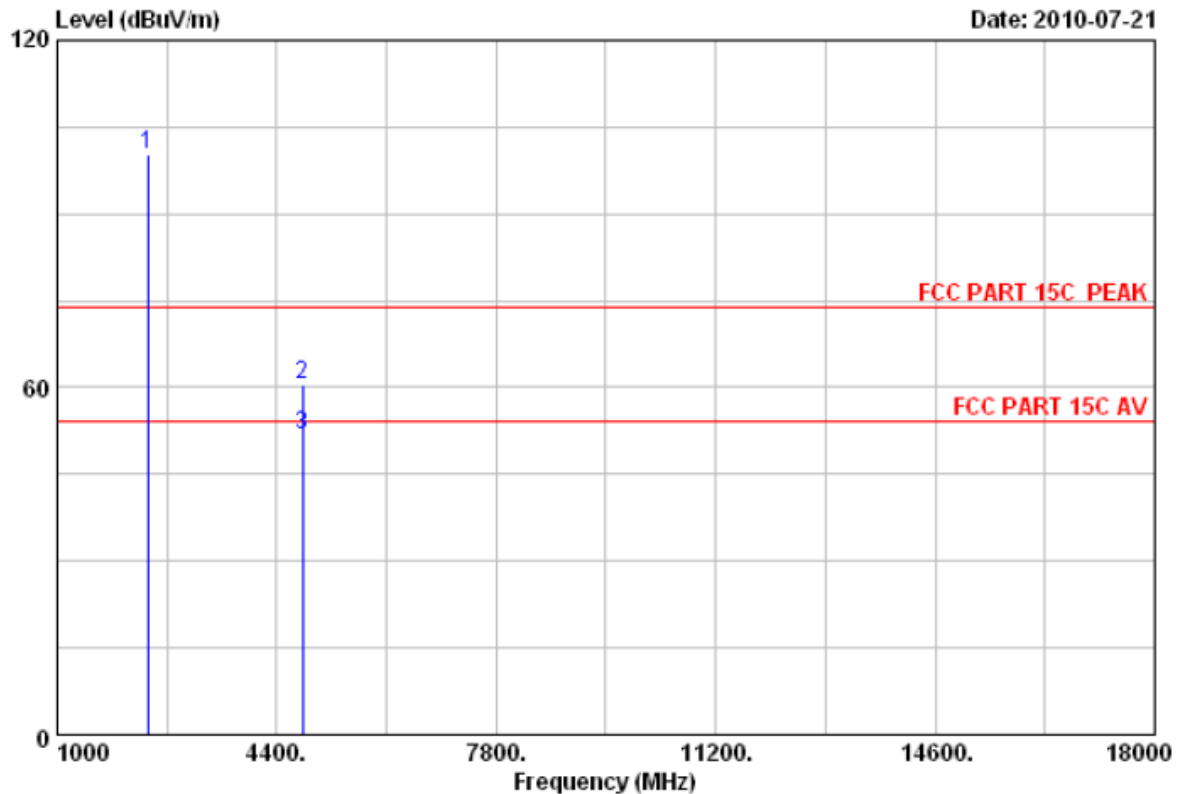
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.4 Diagram 5-4

Data: 6

File: E:\2010 test data\N\Nemko\2010-07-16.EM6 (36)

Date: 2010-07-21



Site no. : 3m Chamber Data no. : 6
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23°C/54% Engineer : Leo-Li
Power : DC 5V From PC
Test mode : Tx 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.000	29.44	7.43	36.62	100.16	100.41			Peak
2	4804.000	34.30	10.62	35.10	50.79	60.61	74.00	13.39	Peak
3	4804.000	34.30	10.62	35.10	41.95	51.77	54.00	2.23	Average

Remarks:

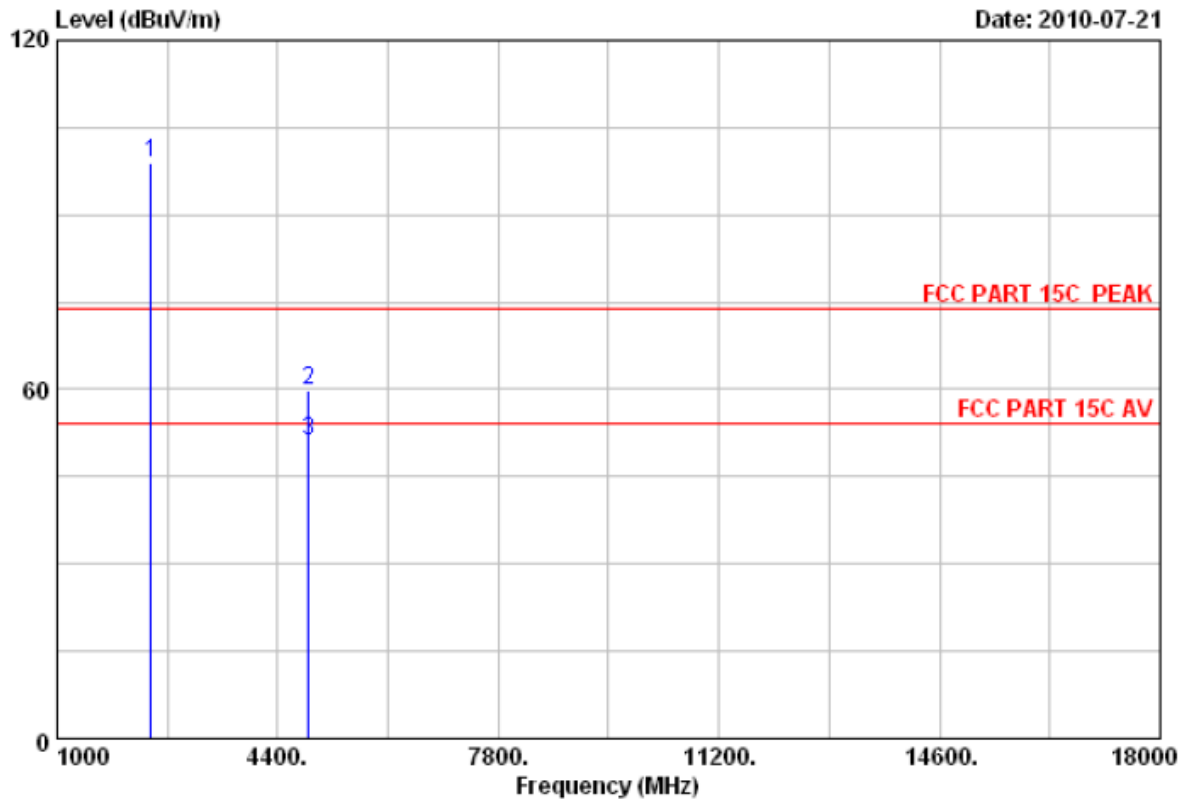
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.5 Diagram 5-5

Data: 14

File: E:\2010 test data\N\Nemko\2010-07-16.EM6 (36)

Date: 2010-07-21



Site no. : 3m Chamber Data no. : 14
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23°C/54% Engineer : Leo-Li
Power : DC 5V From PC
Test mode : Tx 2441MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2441.000	29.47	7.50	36.61	98.61	98.97			Peak
2	4882.000	34.41	10.71	35.03	49.86	59.95	74.00	14.05	Peak
3	4882.000	34.41	10.71	35.03	41.00	51.09	54.00	2.91	Average

Remarks:

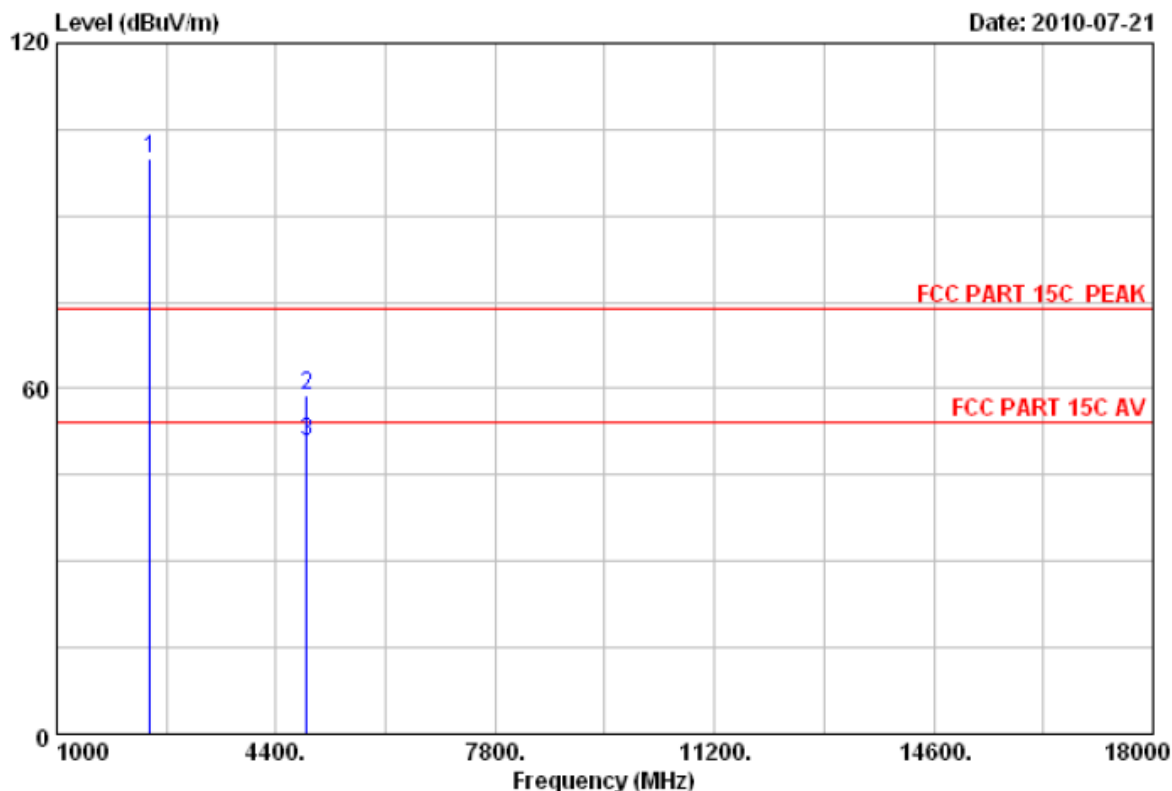
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.6 Diagram 5-6

Data: 4

File: E:\2010 test data\N\Nemko\2010-07-16.EM6 (36)

Date: 2010-07-21



Site no. : 3m Chamber Data no. : 4
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23°C/54% Engineer : Leo-Li
Power : DC 5V From PC
Test mode : Tx 2441MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2441.000	29.47	7.50	36.61	99.57	99.93			Peak
2	4882.000	34.41	10.71	35.03	48.76	58.85	74.00	15.15	Peak
3	4882.000	34.41	10.71	35.03	40.76	50.85	54.00	3.15	Average

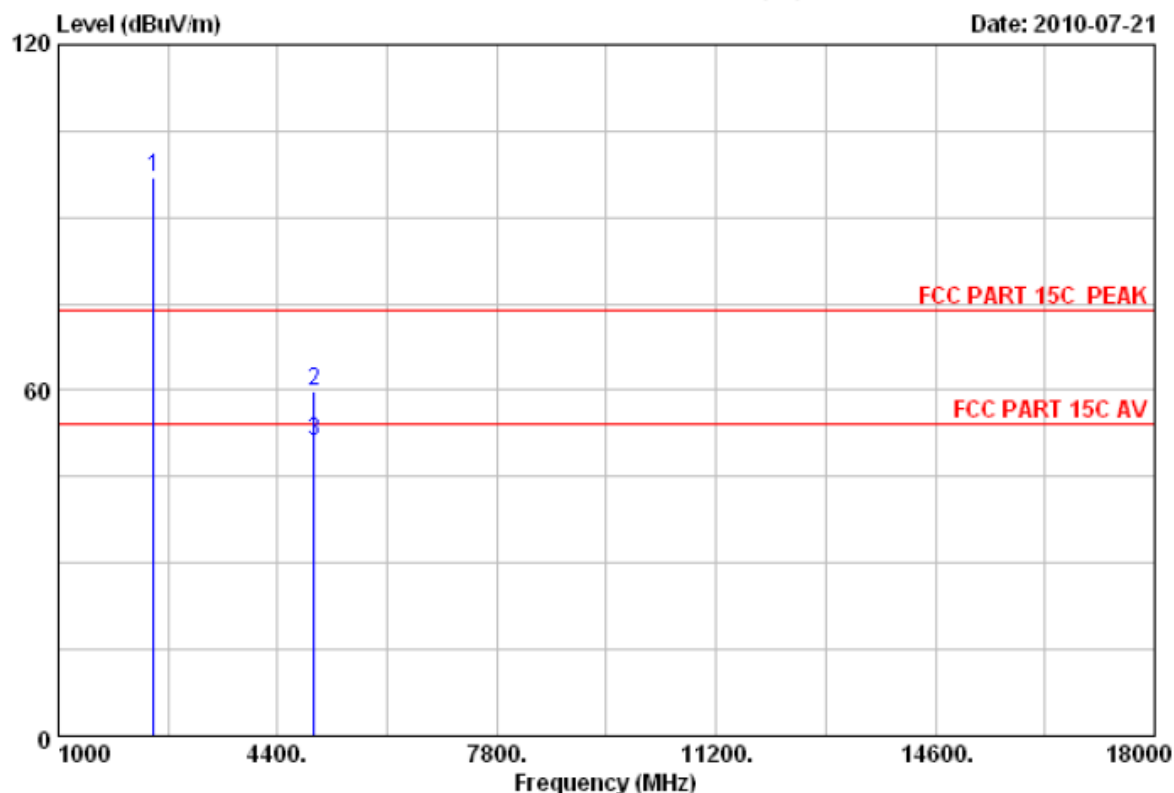
Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.7 Diagram 5-7

Data: 10

File: E:\2010 test data\N\Nemko\2010-07-16.EM6 (36)



Site no.	: 3m Chamber	Data no.	: 10
Dis. / Ant.	: 3m 3115(0911)	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23°C/54%	Engineer	: Leo-Li
Power	: DC 5V From PC		
Test mode	: Tx 2480MHz		

	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.000	29.49	7.58	36.60	96.54	97.01			Peak
2	4960.000	34.54	10.80	34.95	49.33	59.72	74.00	14.28	Peak
3	4960.000	34.54	10.80	34.95	40.75	51.14	54.00	2.86	Average

Remarks:

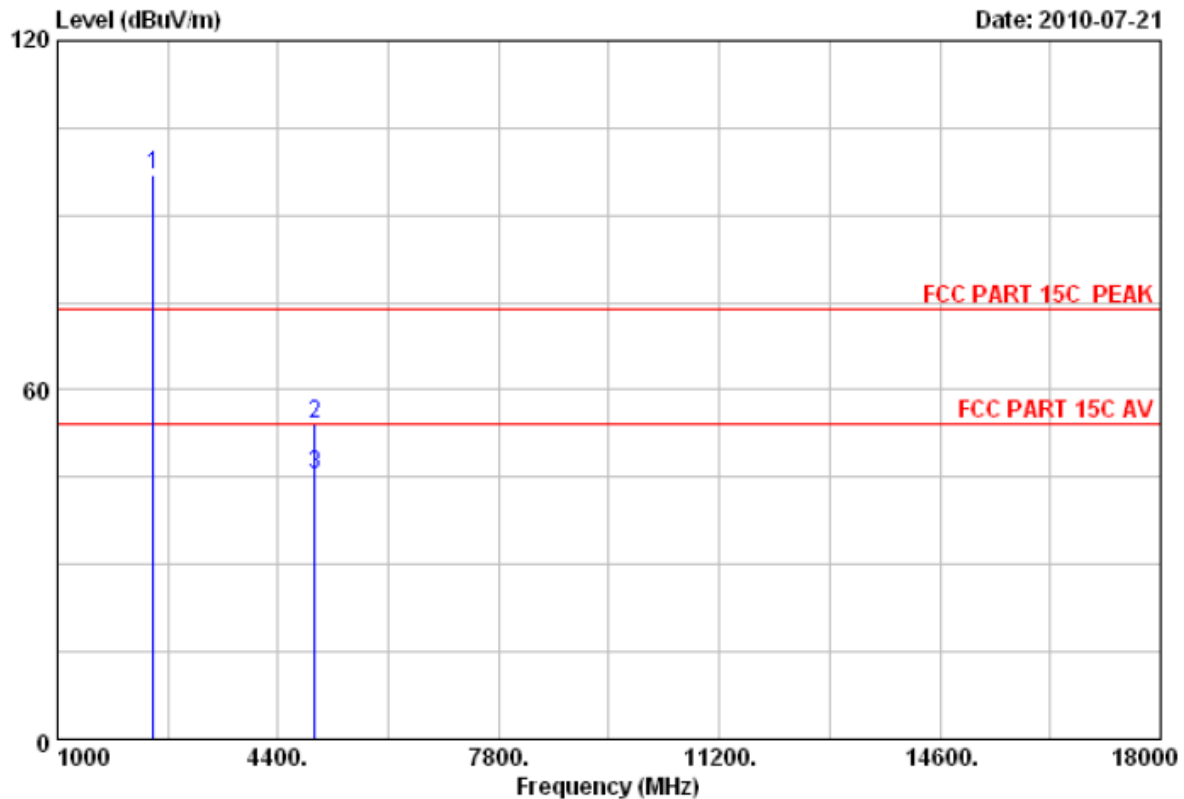
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.8 Diagram 5-8

Data: 12

File: E:\2010 test data\N\Nemko\2010-07-16.EM6 (36)

Date: 2010-07-21



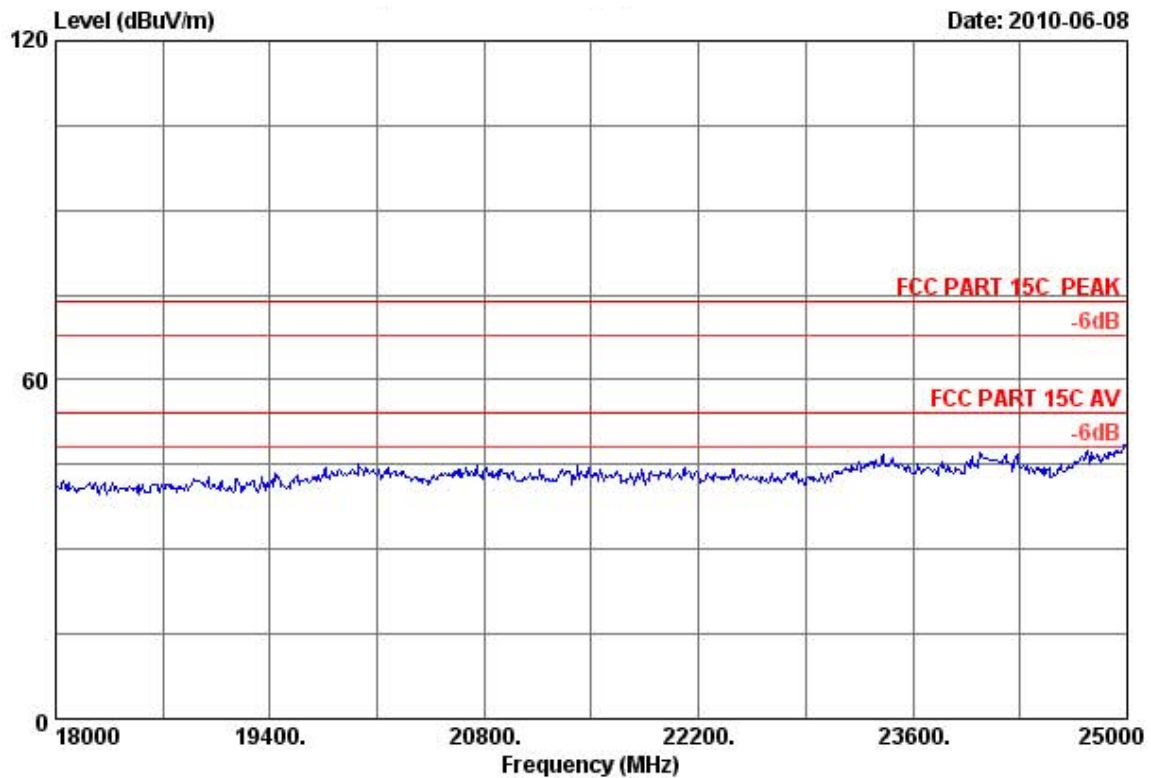
Site no. : 3m Chamber Data no. : 12
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : 23°C/54% Engineer : Leo-Li
Power : DC 5V From PC
Test mode : Tx 2480MHz

	Ant. Freq. (MHz)	Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.000	29.49	7.58	36.60	96.32	96.79			Peak
2	4960.000	34.54	10.80	34.95	43.64	54.03	74.00	19.97	Peak
3	4960.000	34.54	10.80	34.95	35.04	45.43	54.00	8.57	Average

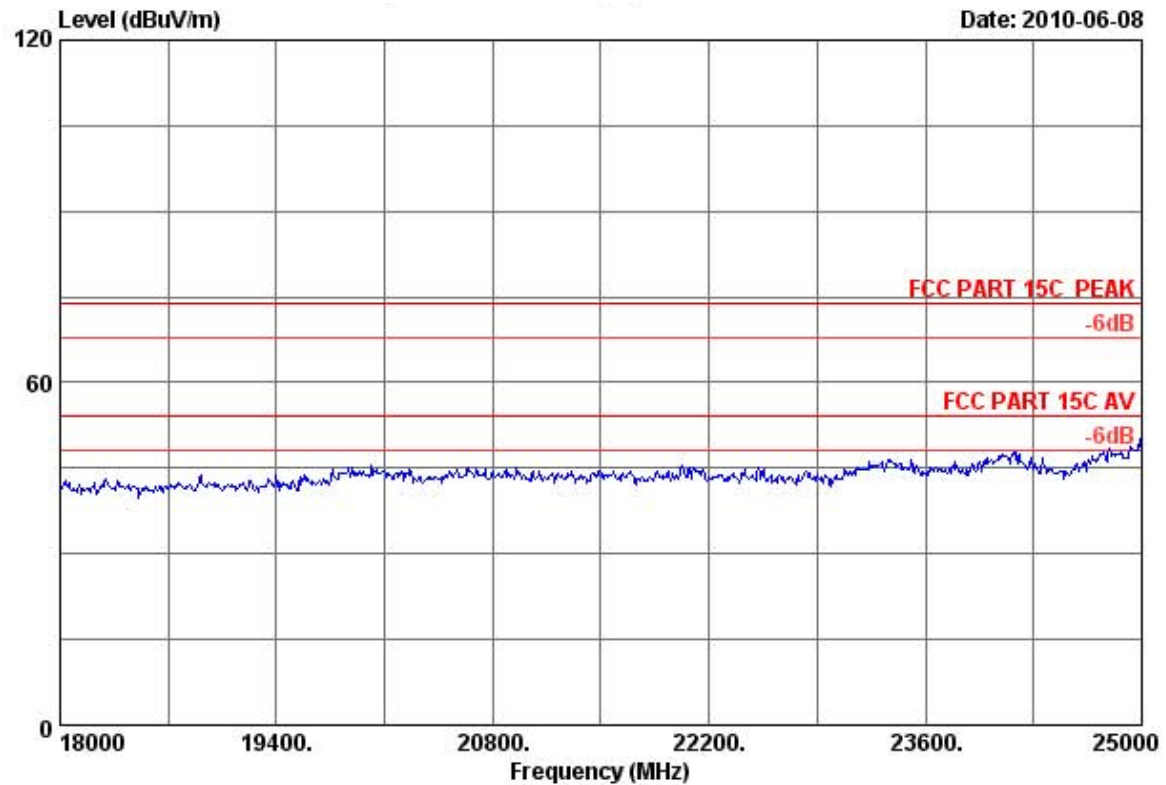
Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

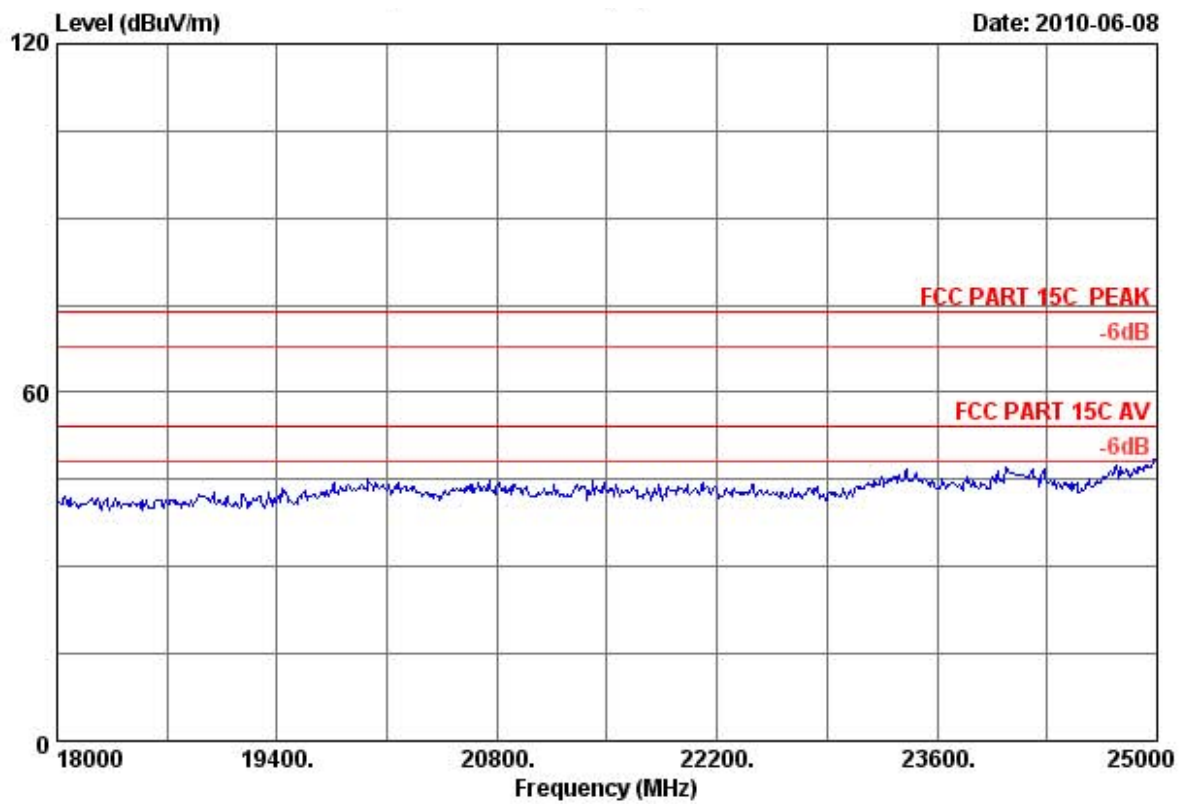
5.3.9 Diagram 5-9



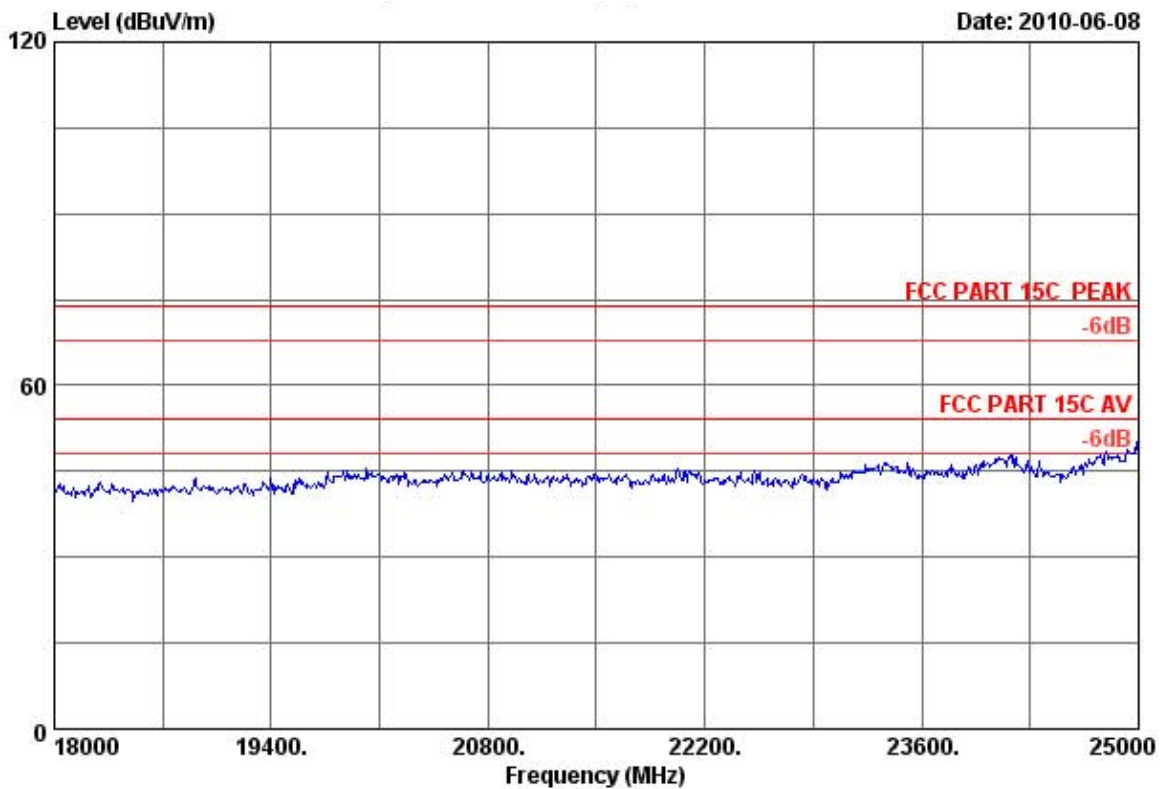
5.3.10 Diagram 5-10



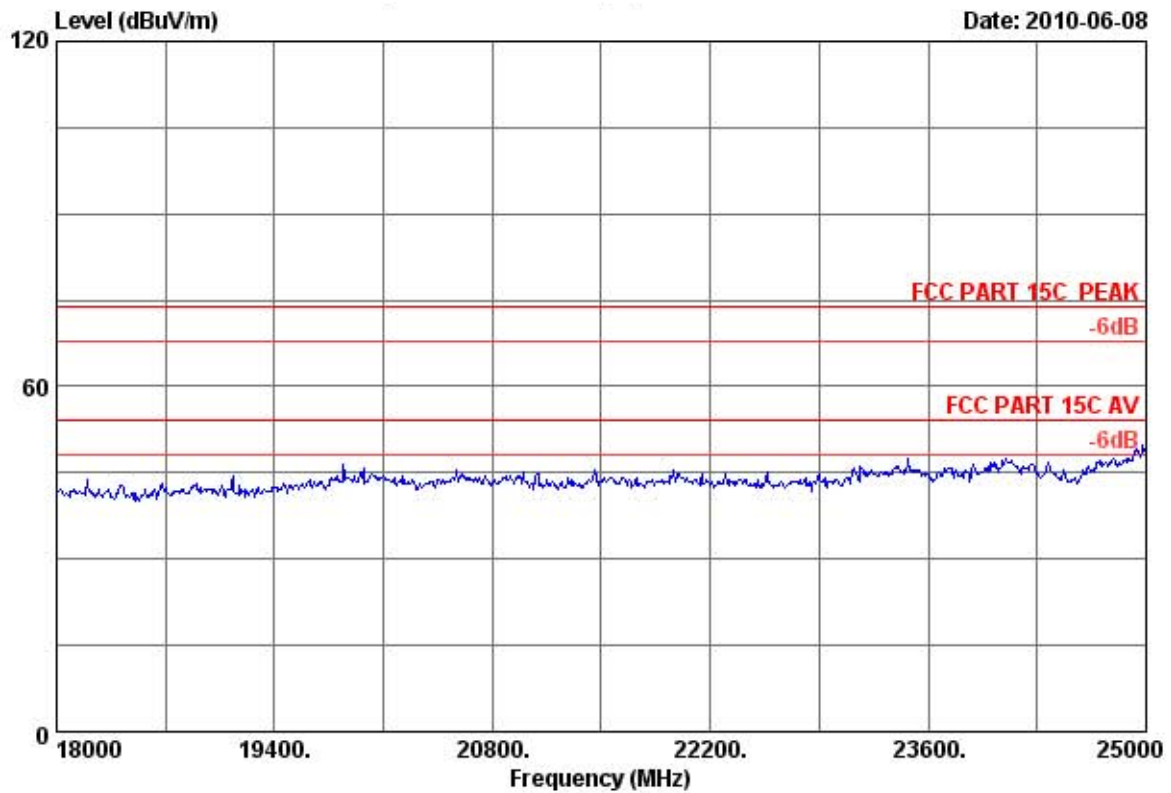
5.3.11 Diagram 5-11



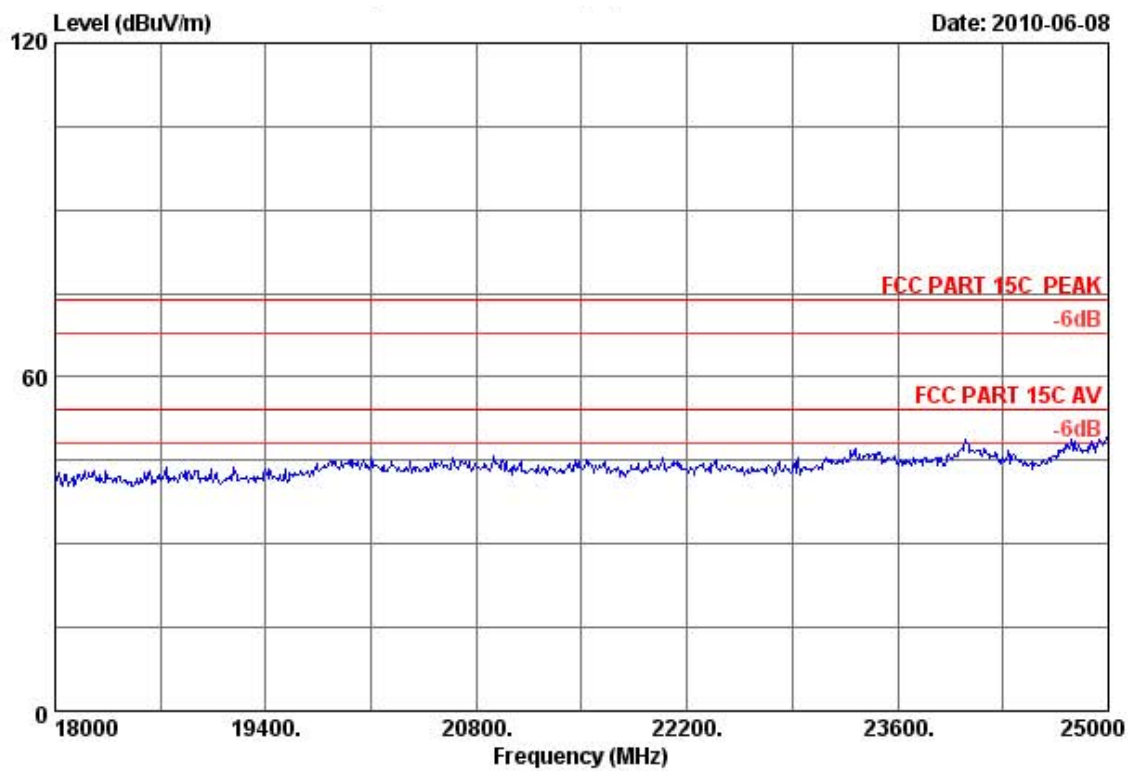
5.3.12 Diagram 5-12



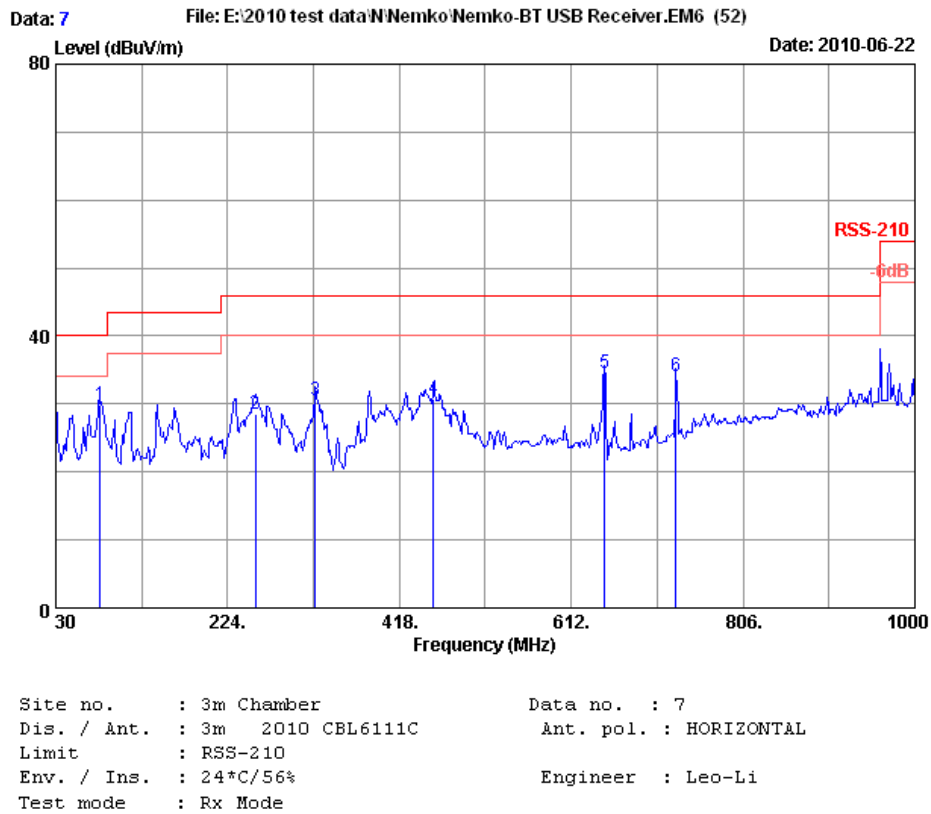
5.3.13 Diagram 5-13



5.3.14 Diagram 5-14



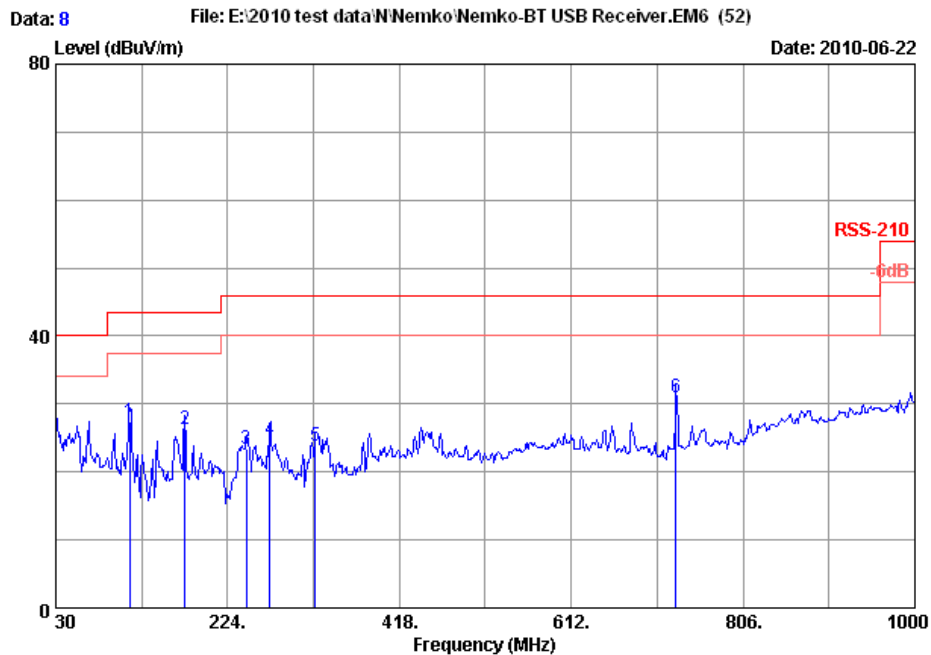
5.3.15 Diagram 5-15



No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	80.440	7.80	0.99	21.08	29.87	40.00	10.13	QP
2	255.040	13.30	2.20	13.00	28.50	46.00	17.50	QP
3	322.940	14.26	2.58	13.63	30.47	46.00	15.53	QP
4	456.800	17.07	3.27	10.39	30.73	46.00	15.27	QP
5	649.830	20.40	4.31	9.91	34.62	46.00	11.38	QP
6	730.340	21.30	4.62	8.27	34.19	46.00	11.81	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.16 Diagram 5-16



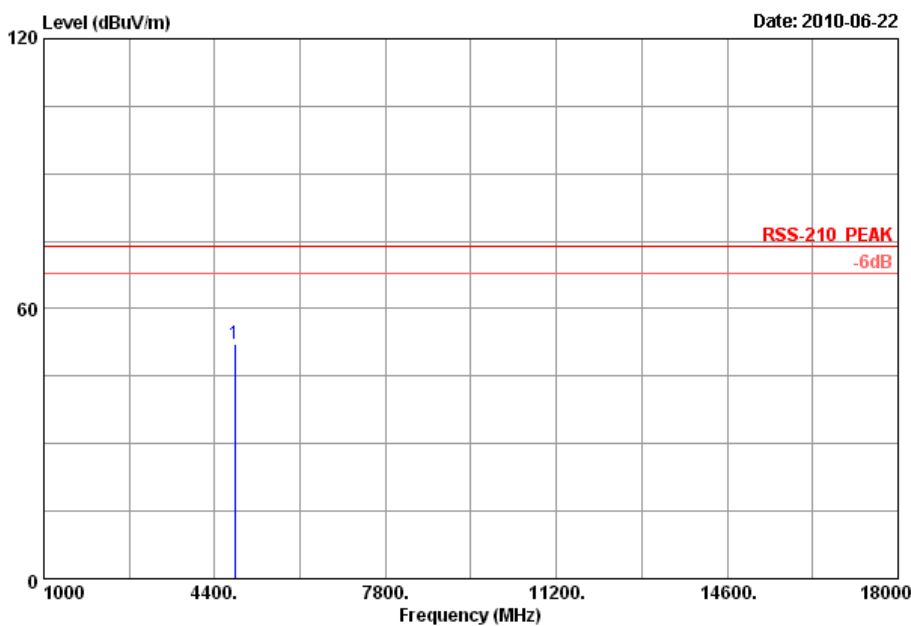
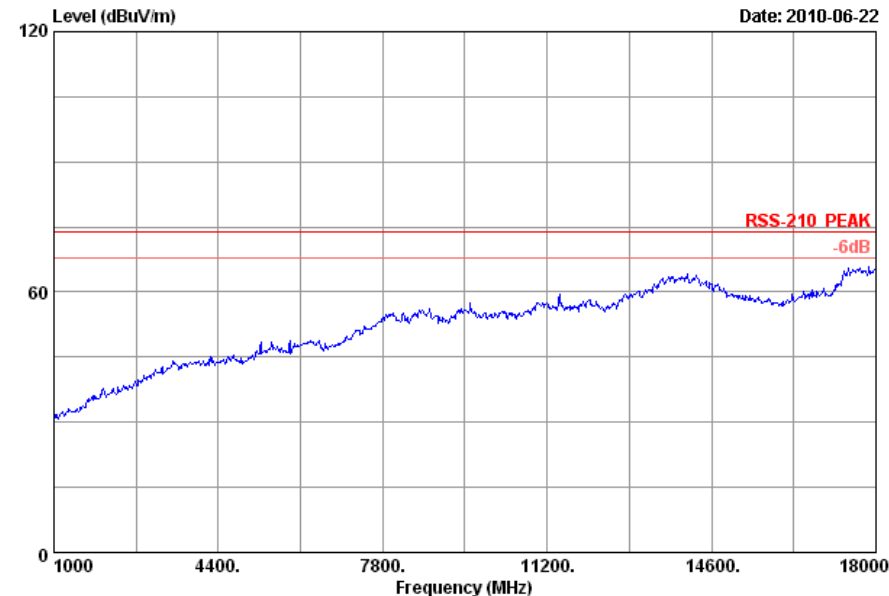
Site no. : 3m Chamber Data no. : 8
Dis. / Ant. : 3m 2010 CBL6111C Ant. pol. : VERTICAL
Limit : RSS-210
Env. / Ins. : 24°C/56% Engineer : Leo-Li
Test mode : Rx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBUV)	Emission Level (dBUV/m)	Limits (dBUV/m)	Margin (dB)	Remark
1	113.420	11.60	1.13	14.60	27.33	43.50	16.17	QP
2	175.500	9.65	1.44	15.16	26.25	43.50	17.25	QP
3	245.340	12.20	2.13	9.16	23.49	46.00	22.51	QP
4	271.530	13.27	2.30	9.23	24.80	46.00	21.20	QP
5	322.940	14.26	2.58	7.11	23.95	46.00	22.05	QP
6	730.340	21.30	4.62	5.05	30.97	46.00	15.03	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.17 Diagram 5-17

Data: 29 File: E:\2010 test data\N\Nemko\Nemko-BT USB Receiver.EM6 (52)



Site no. : 3m Chamber Data no. : 30
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : RSS-210 PEAK
Env. / Ins. : 23°C/54% Engineer : Leo-Li
Test mode : Rx Mode

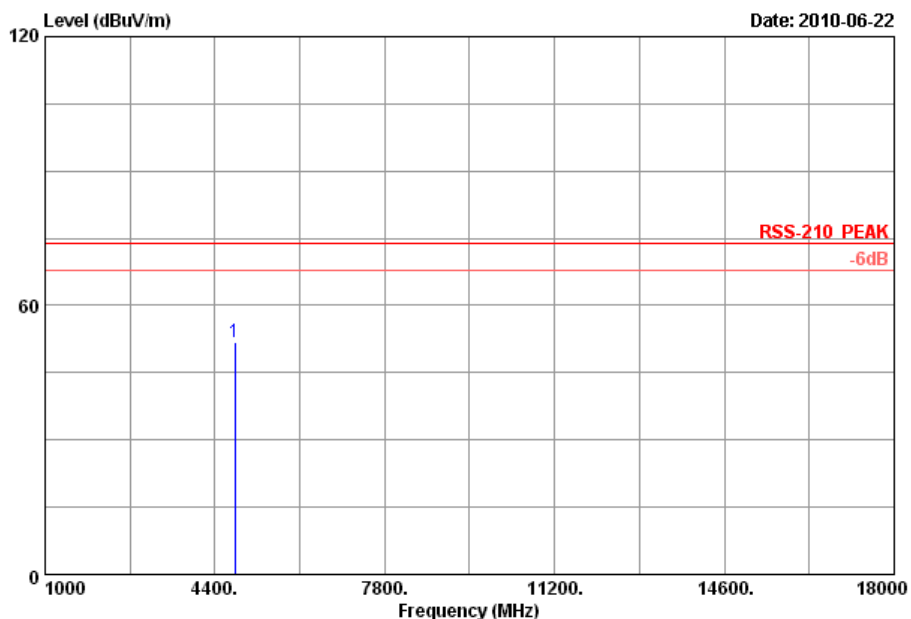
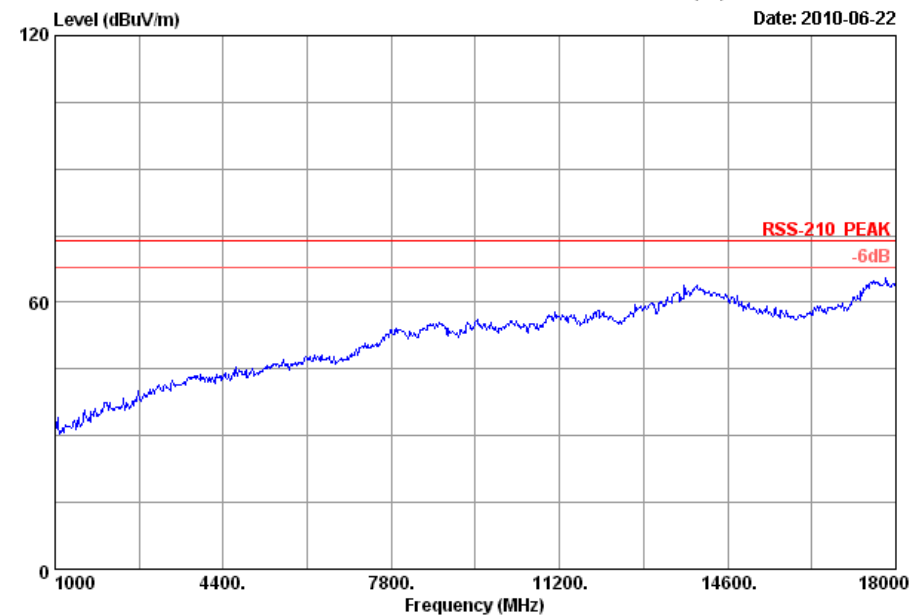
	Ant.	Cable	Amp.		Emission				
	Freq.	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark
	(MHz)	(dB/m)	(dB)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)	
1	4804.000	34.30	12.35	35.37	40.98	52.26	74.00	21.74	Peak

Remarks:

1. Emission Level= Antenna Factor + Cable Loss -amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

5.3.18 Diagram 5-18

Data: 27 File: E:\2010 test data\N\Nemko\Nemko-BT USB Receiver.EM6 (52)



Site no.	: 3m Chamber	Data no.	: 28
Dis. / Ant.	: 3m 3115(0911)	Ant. pol.	: VERTICAL
Limit	: RSS-210 PEAK		
Env. / Ins.	: 23°C/54%	Engineer	: Leo-Li
Test mode	: Rx Mode		

	Freq.	Ant.	Cable	Amp.		Emission			
	(MHz)	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark
		(dB/m)	(dB)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)	
1	4804.000	34.30	12.35	35.37	40.69	51.97	74.00	22.03	Peak

Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

6. 20 dB bandwidth and 99% bandwidth Test

6.1 Test Procedure

Clause 15.215(c) 20dB Bandwidth:

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

99% bandwidth test of RSS-GEN:

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

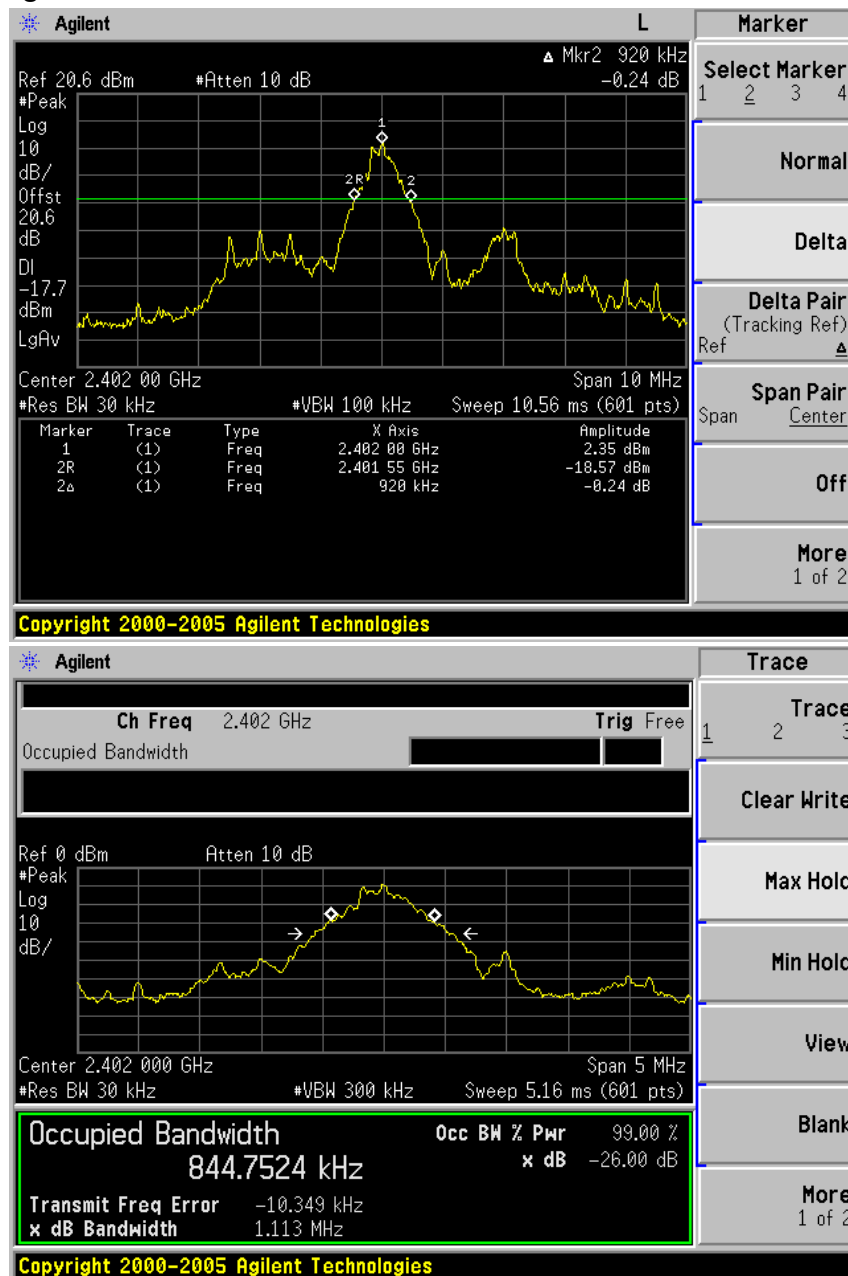
6.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
☒	Spectrum	May 15, 10	E4407B	MY41440292	Agilent
☒	Amp	May 15, 10	8449B	3008A00863	HP
☒	Antenna	Jan. 23, 10	3115	9607-4877	EMCO
☒	HF Cable	May 15, 10	Sucoflex104	N/A	Hubersuhne

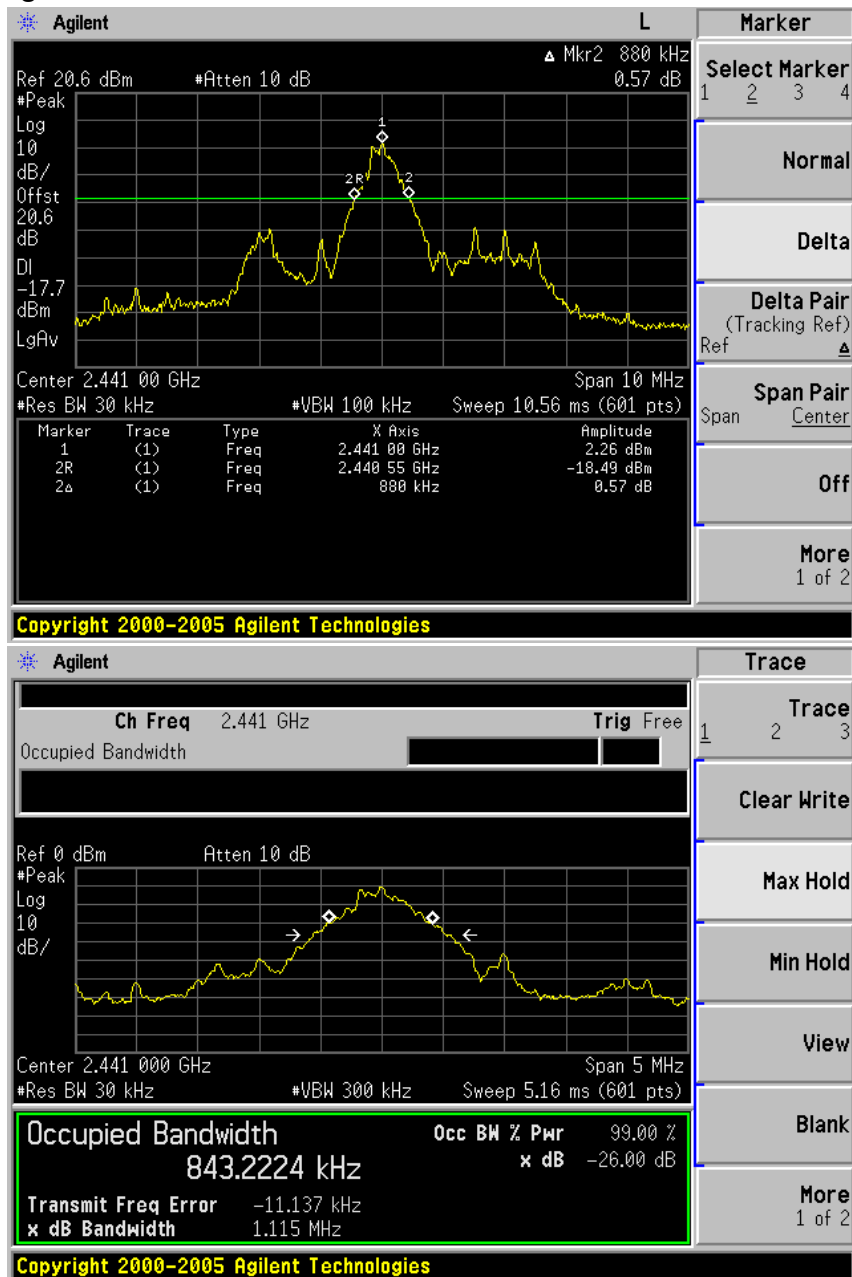
6.3 Test Result:

Test mode	Diagram	20dB bandwidth	99% bandwidth
TM1	6-1	920kHz	844.75kHz
TM2	6-2	880kHz	843.22kHz
TM3	6-3	880kHz	842.34kHz
TM4	6-4	1230kHz	1155.8kHz
TM5	6-5	1230kHz	1154.2kHz
TM6	6-6	1230kHz	1154.2kHz

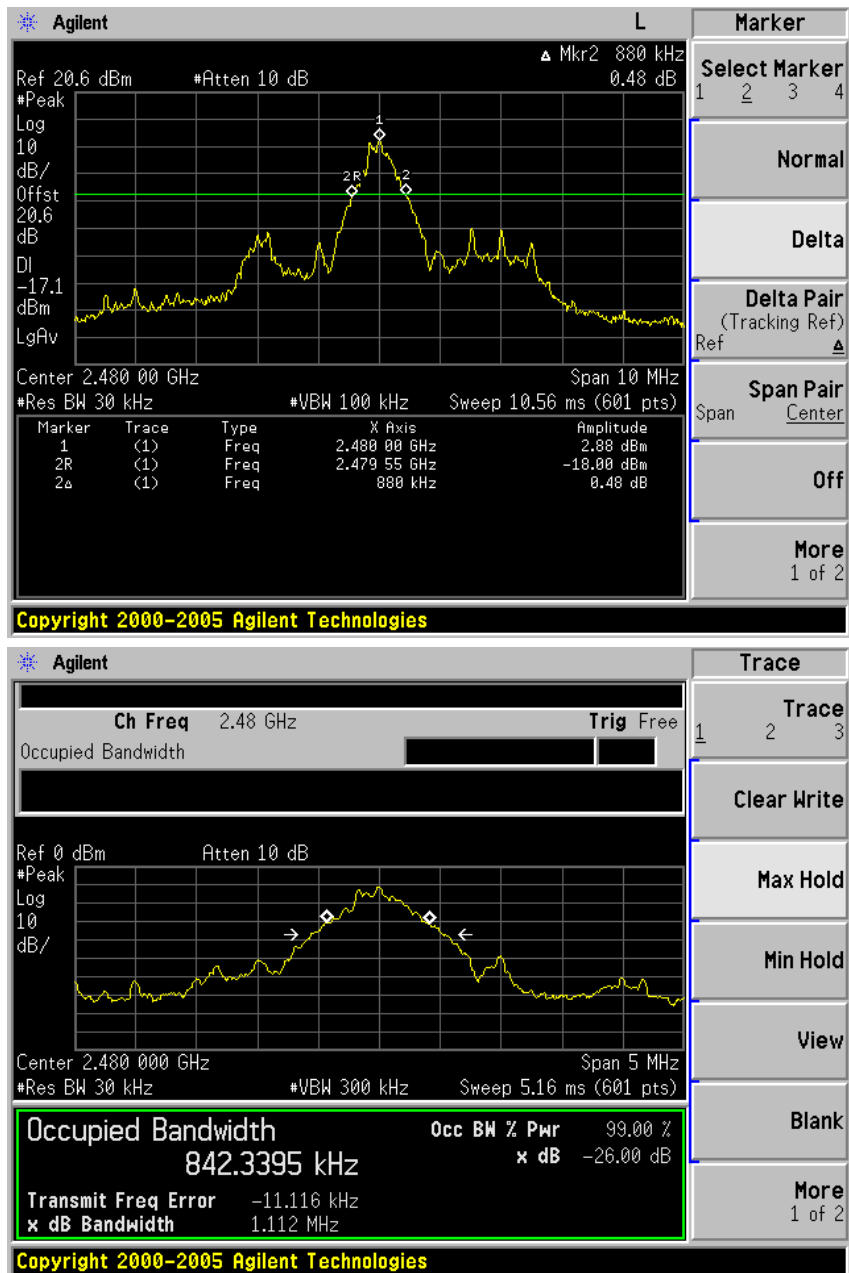
6.3.1 Diagram 6-1



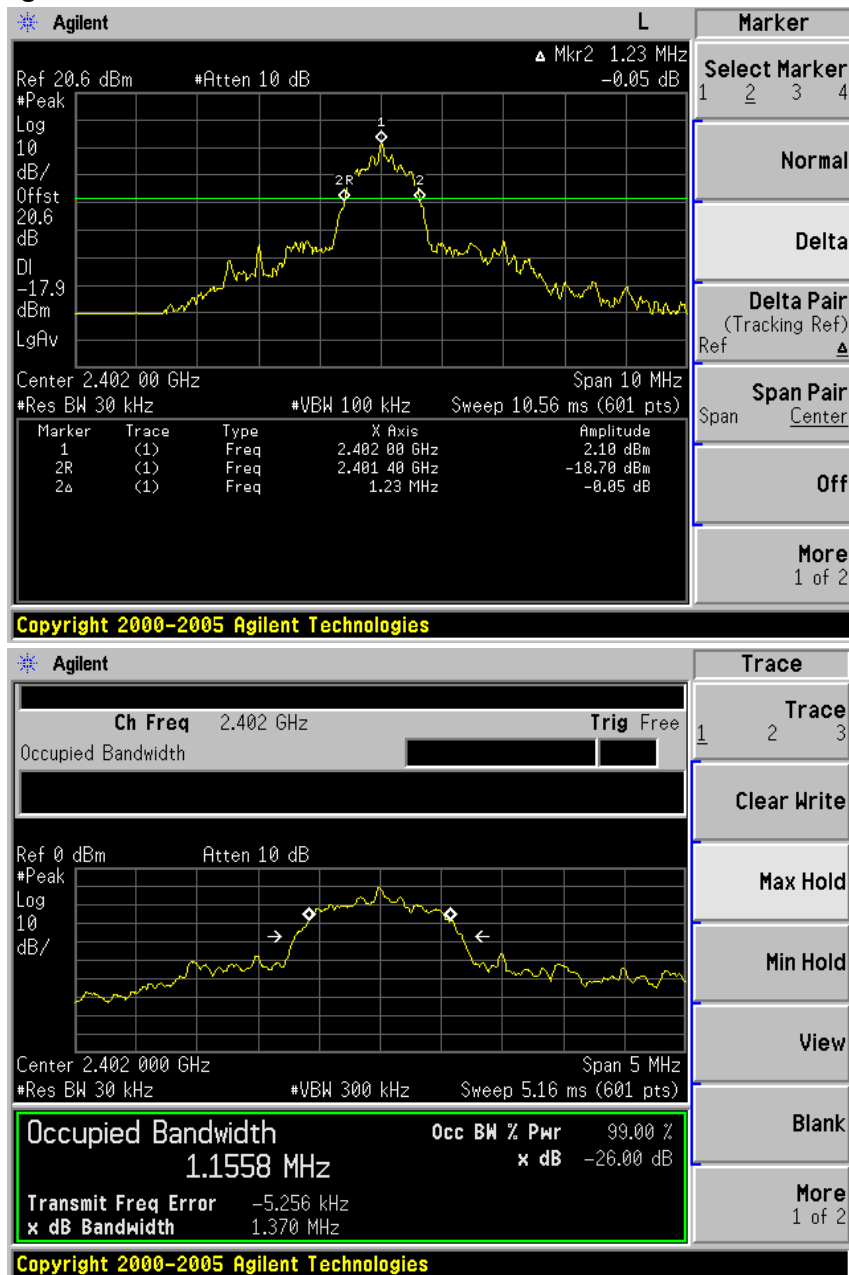
6.3.2 Diagram 6-2



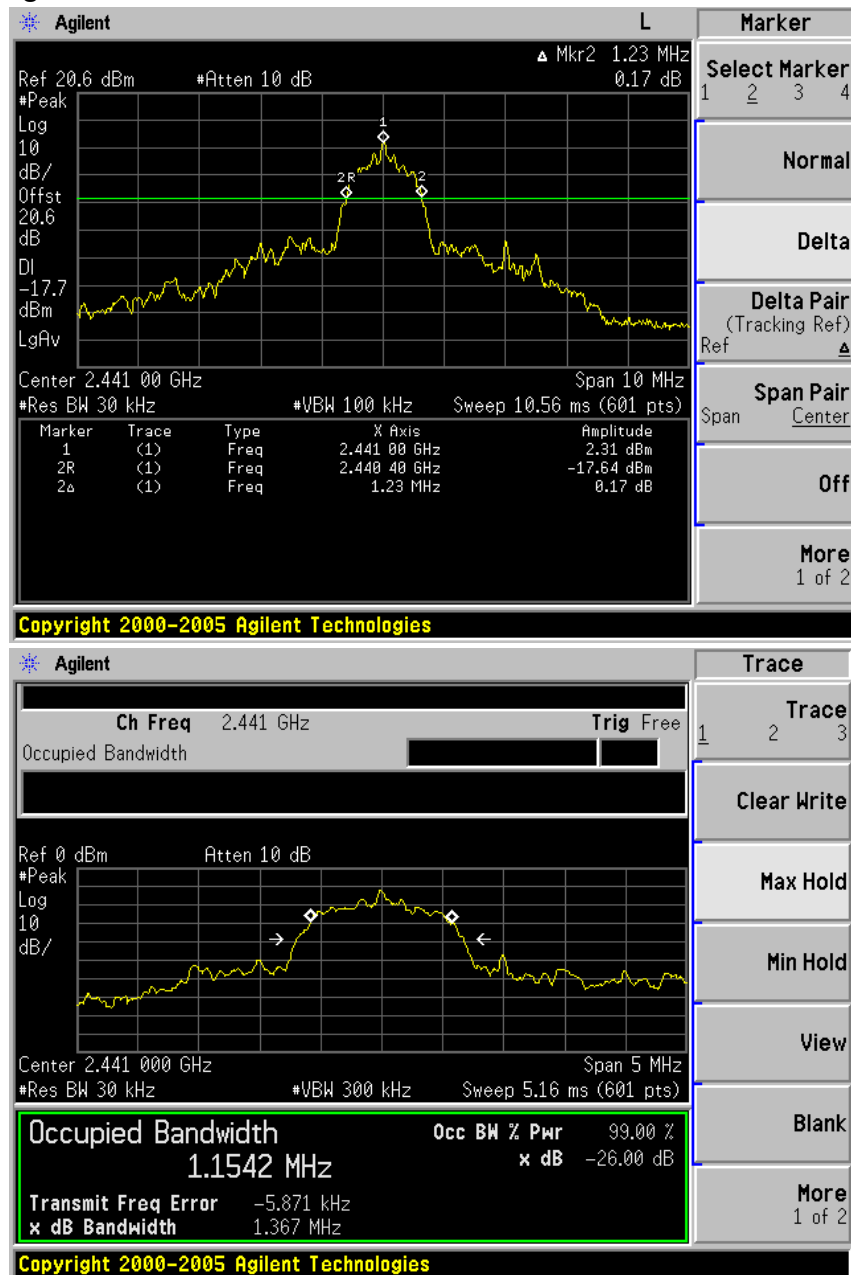
6.3.3 Diagram 6-3



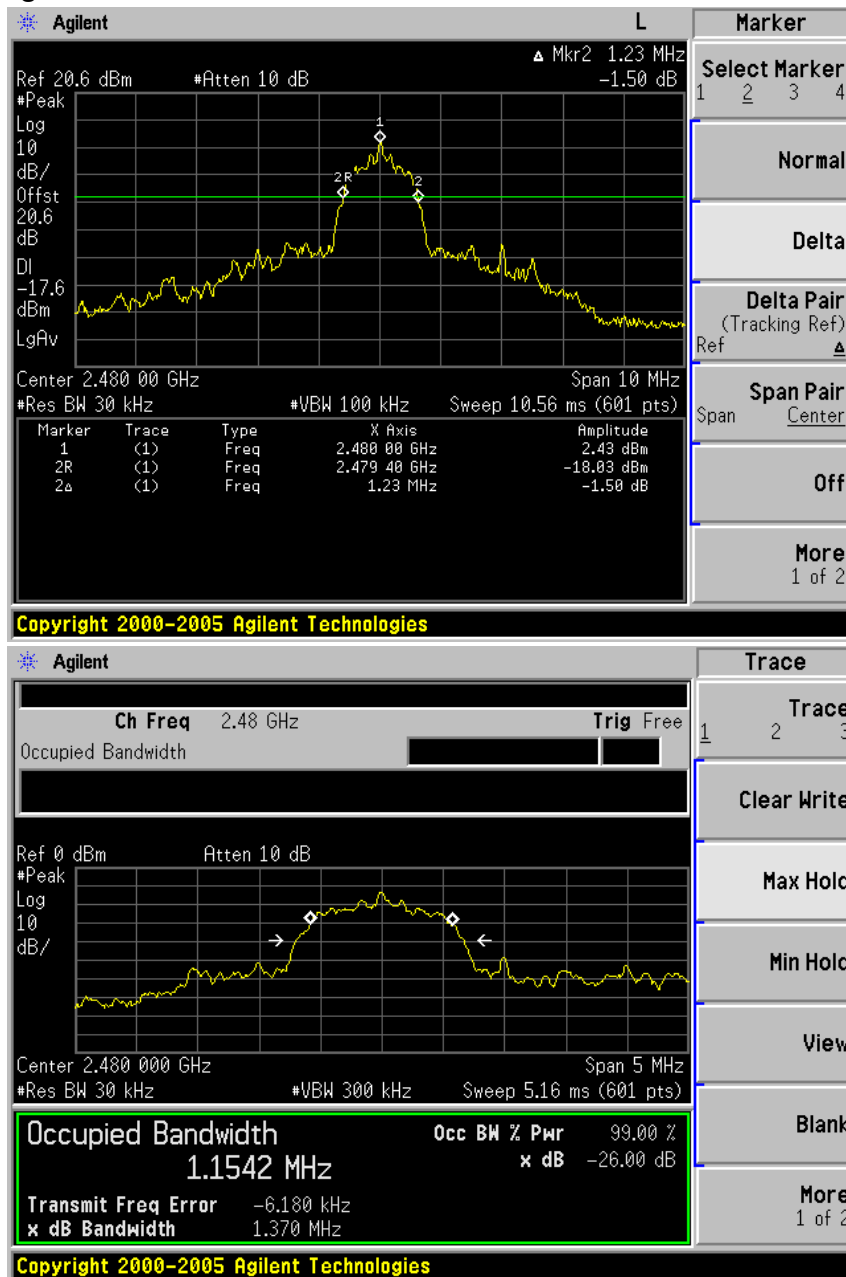
6.3.4 Diagram 6-4



6.3.5 Diagram 6-5



6.3.6 Diagram 6-6



7. Band Edge Compliance Test

7.1 Test Procedure

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. An antenna was located 3m from the EUT on an adjustable mast.

The EUT were rotated 0 to 360 degree and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. The test result are reported as below.

RBW=1MHz ; VBW=1MHz, Sweep=AUTO, PK detector for peak emissions measurement

The duty cycle factor is $20\log 1/0.44 = 7.13\text{dB}$, the duty cycle is referred to Appendix A

So AV value can be Peak value subtract the duty cycle factor .

7.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
☒	Spectrum	May 15, 10	E4407B	MY41440292	Agilent
☒	Amp	May 15, 10	8449B	3008A00863	HP
☒	Antenna	Jan. 23, 10	3115	9607-4877	EMCO
☒	HF Cable	May 15, 10	Sucoflex104	N/A	Hubersuhne

7.3 Test Result

Connect mode	Antenna Polarity	Remark	Test Data	Test Result
TM1	Horizontal	Hopping off	Diagram 7-1	Pass
	Vertical	Hopping off	Diagram 7-2	Pass
TM3	Horizontal	Hopping off	Diagram 7-3	Pass
	Vertical	Hopping off	Diagram 7-4	Pass
TM4	Horizontal	Hopping off	Diagram 7-5	Pass
	Vertical	Hopping off	Diagram 7-6	Pass
TM6	Horizontal	Hopping off	Diagram 7-7	Pass
	Vertical	Hopping off	Diagram 7-8	Pass
TM7	Horizontal	Hopping on	Diagram 7-9	Pass
	Vertical	Hopping on	Diagram 7-10	Pass
TM8	Horizontal	Hopping on	Diagram 7-11	Pass
	Vertical	Hopping on	Diagram 7-12	Pass

NOTES:

1. All modes were measured and the worst case emission was reported.
2. H =Horizontal V=Vertical
3. Emission = Reading +Antenna Factor + Cable Loss –Amp Factor(if exist)
4. Emission level dBµV = 20 log Emission level µV/m
5. All the emissions appearing within 15.205 Restricted 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.

Remark :

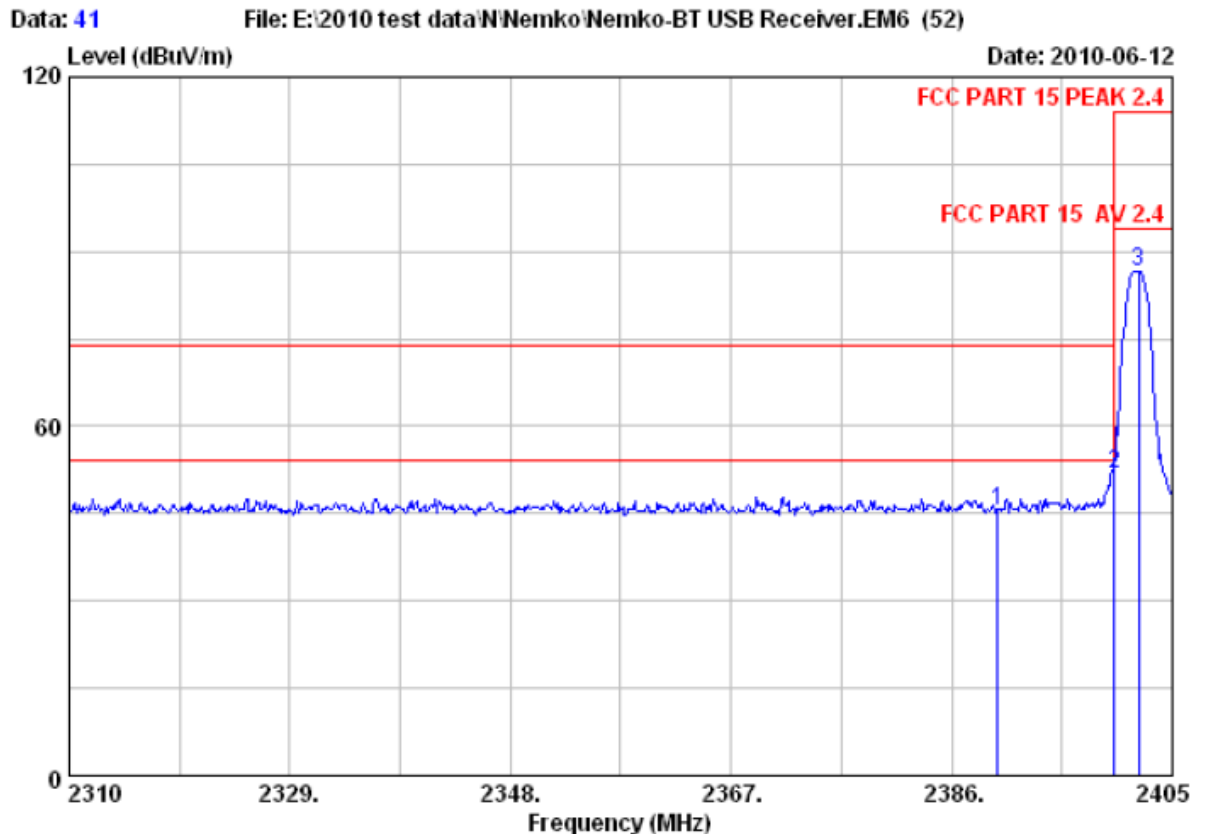
The limit of 15.209(a) of 3 meter distance is

Frequency MHz	Distance m	Field strength		Distance m	Field strength dBµV/m(QP)
		µV/m	dBµV/m(QP)		
30-88	3	100	40.0	10	30.0
88-216	3	150	43.5	10	33.5
216-960	3	200	46.0	10	36.0
960-1000	3	500	54.0	10	44.0
Above 1000	3	74.0 dBµV/m (PK) 54.0 dBµV/m (AV)		/	/

15.205 Restricted bands of operation:

MHz	MHz	MHz	GHz
0.090 - 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	(²)

7.3.1 Diagram 7-1



Site no. : 3m Chamber Data no. : 41
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : GFSK Tx 2402MHz

	Ant.	Cable	Amp.		Emission				
Freq.	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark	
(MHz)	(dB/m)	(dB)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)		
1 2390.000	29.44	8.67	36.09	43.58	45.60	74.00	28.40	Peak	
2 2400.000	29.44	8.72	36.09	49.75	51.82	74.00	22.18	Peak	
3 2402.150	29.44	8.72	36.09	84.67	86.74	114.00	27.26	Peak	

Remarks:

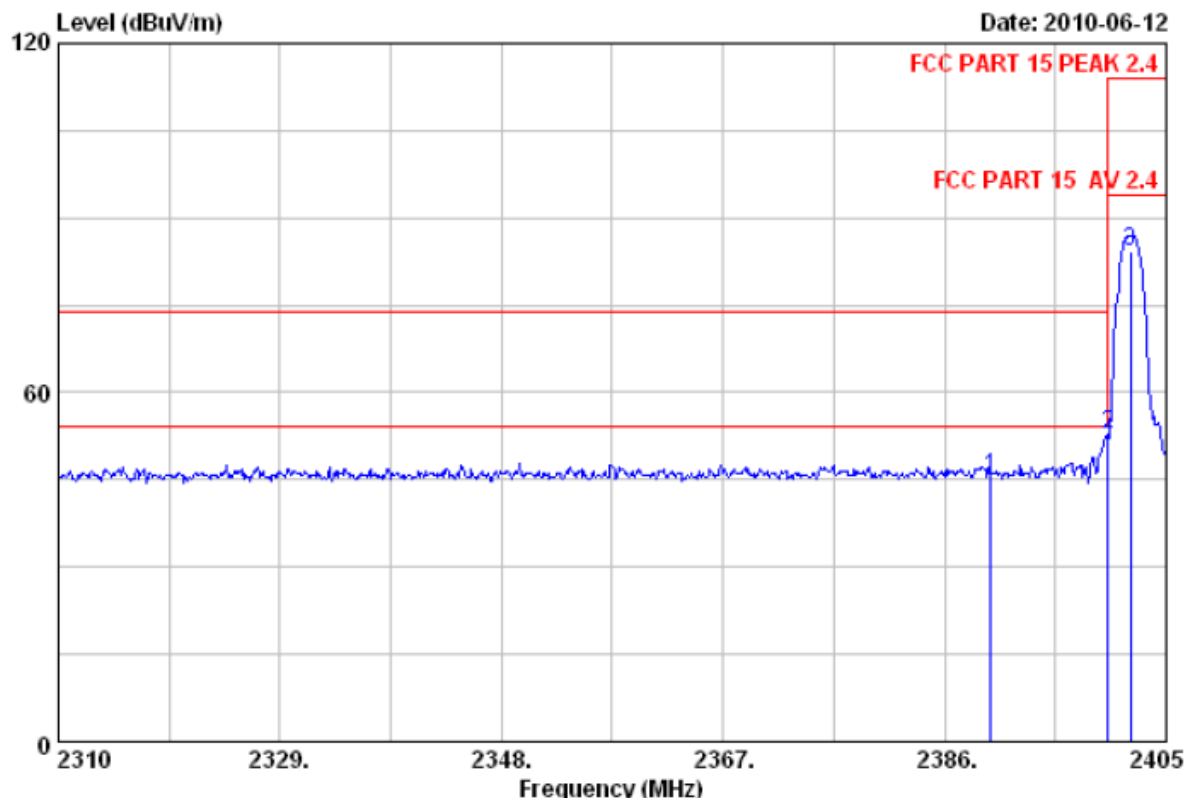
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.2 Diagram 7-2

Data: 42

File: E:\2010 test data\N\Nemko\Nemko-BT USB Receiver.EM6 (52)

Date: 2010-06-12



Site no. : 3m Chamber Data no. : 42
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : GFSK Tx 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBUV)	Emission Level (dBUV/m)	Limits (dBUV/m)	Margin (dB)	Remark
1	2390.000	29.44	8.67	36.09	43.58	45.60	74.00	28.40	Peak
2	2400.000	29.44	8.72	36.09	50.89	52.96	74.00	21.04	Peak
3	2401.960	29.44	8.72	36.09	82.00	84.07	114.00	29.93	Peak

Remarks:

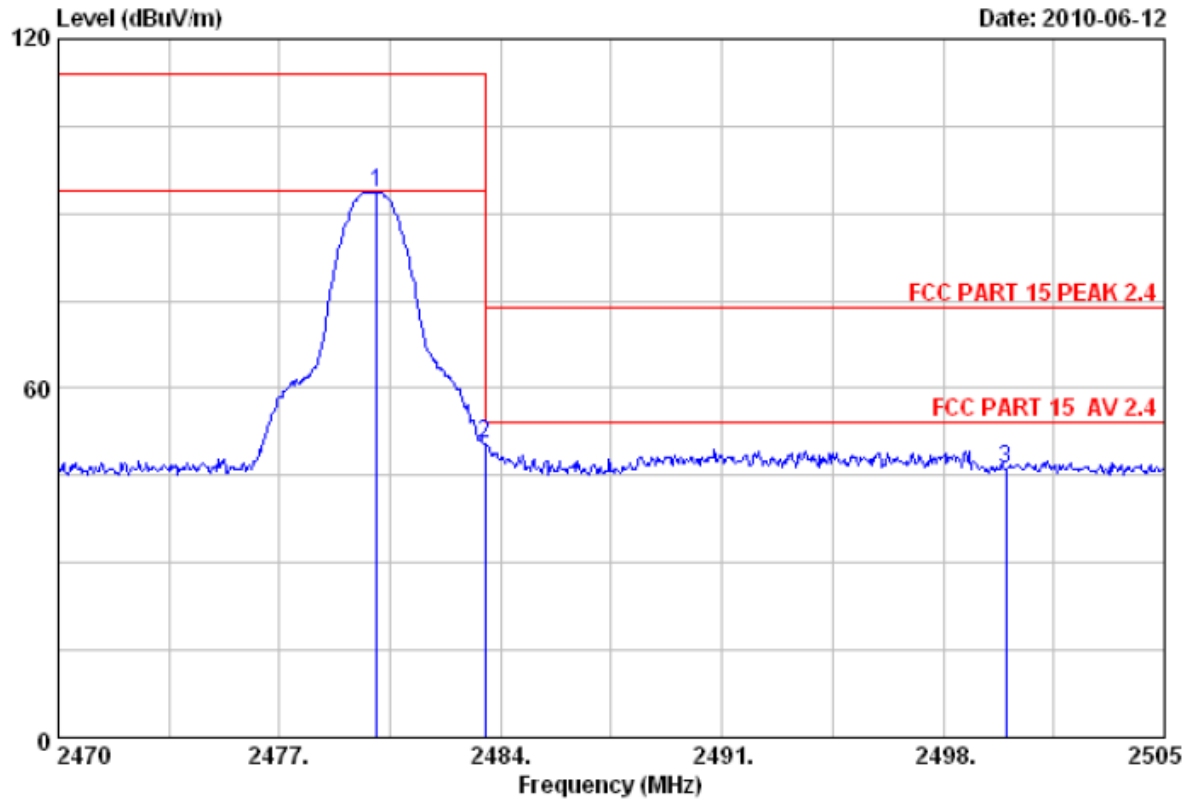
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.3 Diagram 7-3

Data: 44

File: E:\2010 test data\N\Nemko\Nemko-BT USB Receiver.EM6 (52)

Date: 2010-06-12



Site no. : 3m Chamber Data no. : 44
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : GFSK Tx 2480MHz

	Ant.	Cable	Amp.		Emission				
Freq.	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark	
(MHz)	(dB/m)	(dB)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)		
1 2480.080	29.49	8.87	35.97	91.32	93.71	114.00	20.29	Peak	
2 2483.500	29.49	8.87	35.97	48.05	50.44	74.00	23.56	Peak	
3 2500.000	29.50	8.92	36.00	43.55	45.97	74.00	28.03	Peak	

Remarks:

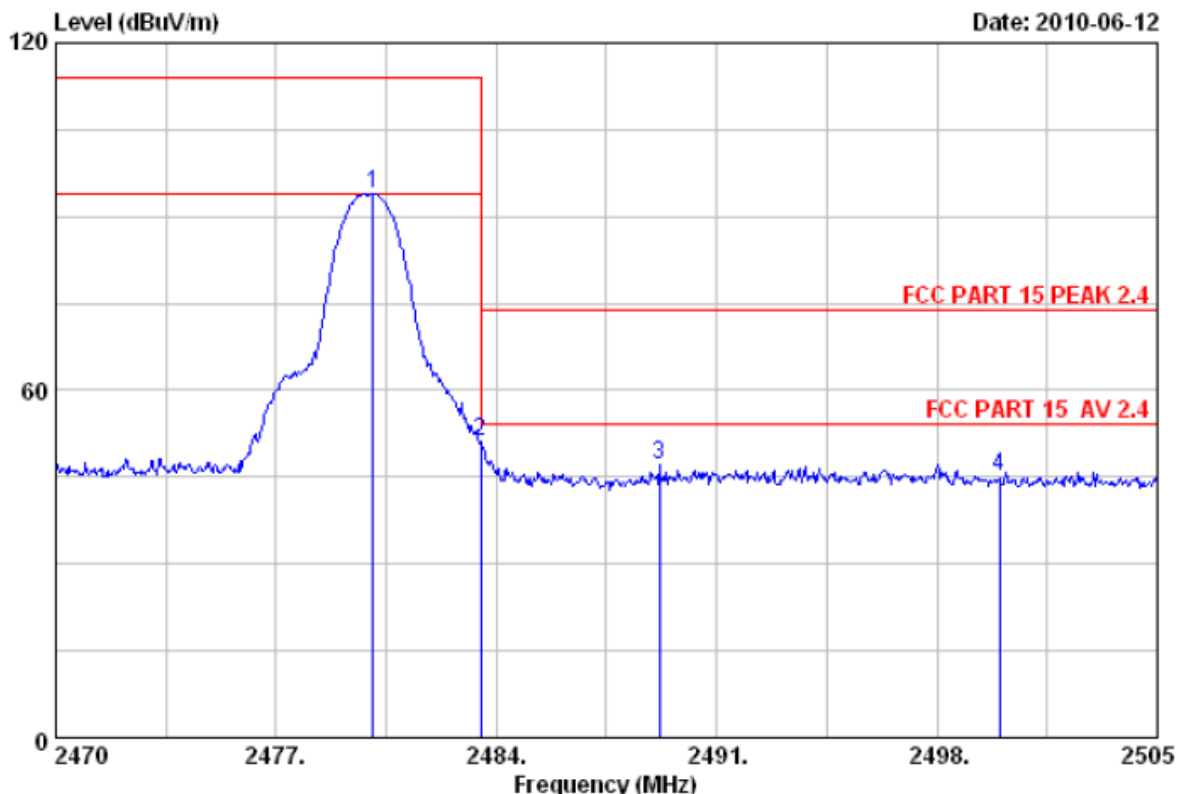
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.4 Diagram 7-4

Data: 43

File: E:\2010 test data\N\Nemko\Nemko-BT USB Receiver.EM6 (52)

Date: 2010-06-12



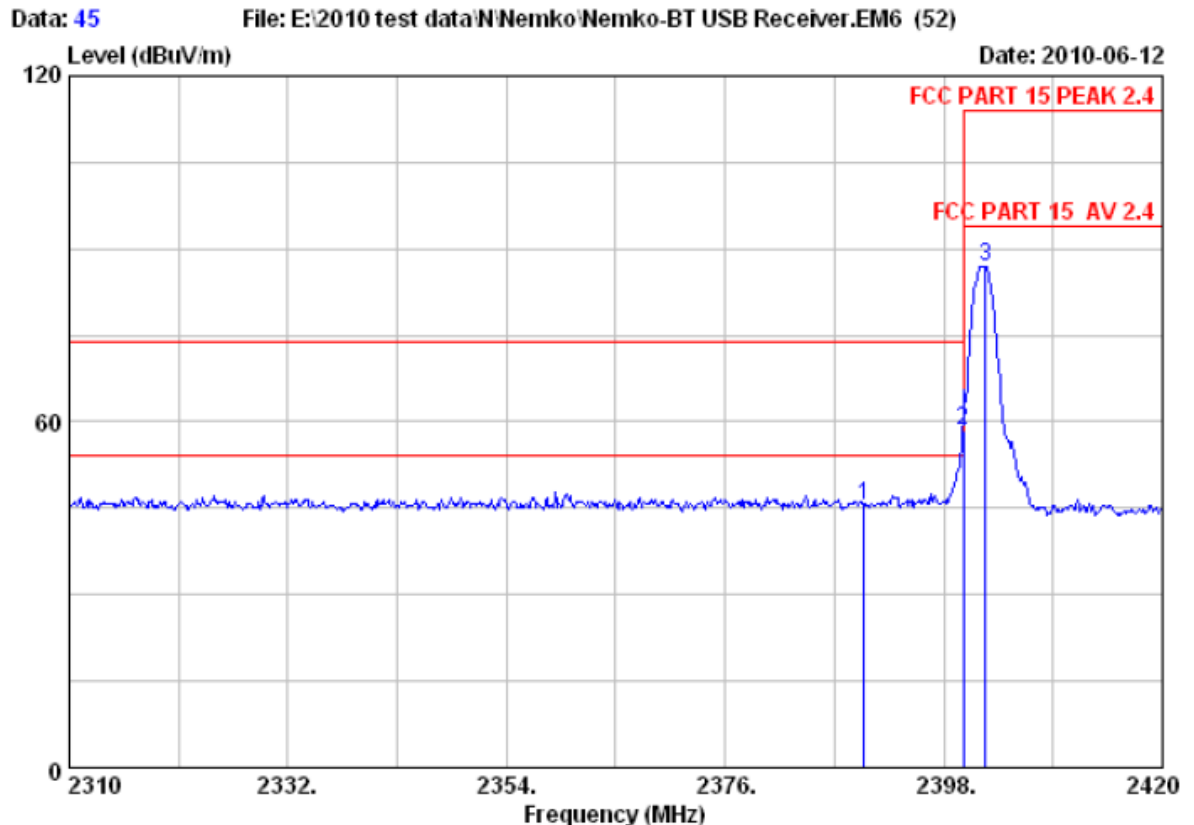
Site no. : 3m Chamber Data no. : 43
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : GFSK Tx 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.080	29.49	8.87	35.97	91.45	93.84	114.00	20.16	Peak
2	2483.500	29.49	8.87	35.97	48.61	51.00	74.00	23.00	Peak
3	2489.180	29.50	8.87	36.00	44.71	47.08	74.00	26.92	Peak
4	2500.000	29.50	8.92	36.00	42.73	45.15	74.00	28.85	Peak

Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.5 Diagram 7-5



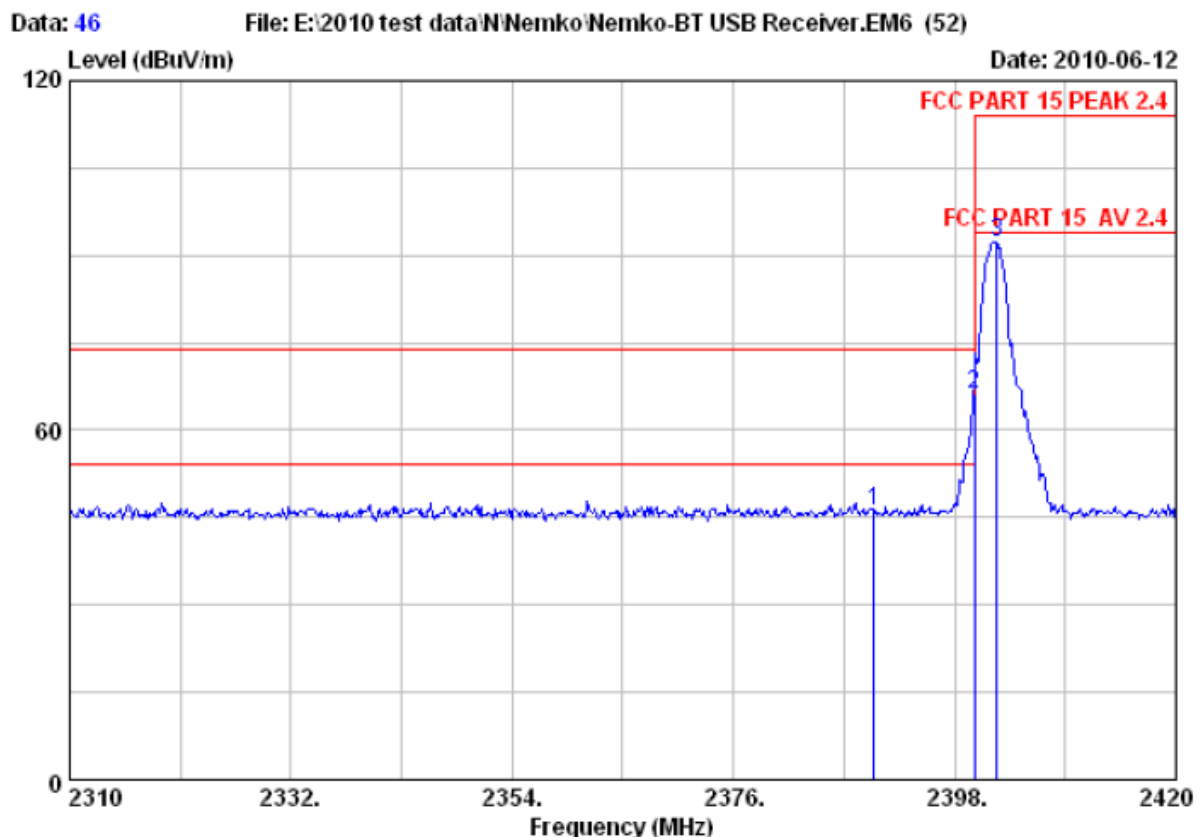
Site no. : 3m Chamber Data no. : 45
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : 8DPSK Tx 2402MHz

		Ant.	Cable	Amp.		Emission			
	Freq.	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark
	(MHz)	(dB/m)	(dB)	(dB)	(dBUV)	(dBUV/m)	(dBUV/m)	(dB)	
1	2390.000	29.44	8.67	36.09	43.43	45.45	74.00	28.55	Peak
2	2399.980	29.44	8.72	36.09	56.56	58.63	74.00	15.37	Peak
3	2402.180	29.44	8.72	36.09	84.99	87.06	114.00	26.94	Peak

Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.6 Diagram 7-6



Site no. : 3m Chamber Data no. : 46
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : 8DPSK Tx 2402MHz

		Ant.	Cable	Amp.		Emission			
	Freq.	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark
	(MHz)	(dB/m)	(dB)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)	
1	2390.000	29.44	8.67	36.09	44.25	46.27	74.00	27.73	Peak
2	2400.000	29.44	8.72	36.09	64.19	66.26	74.00	7.74	Peak
3	2402.180	29.44	8.72	36.09	90.23	92.30	114.00	21.70	Peak

Remarks:

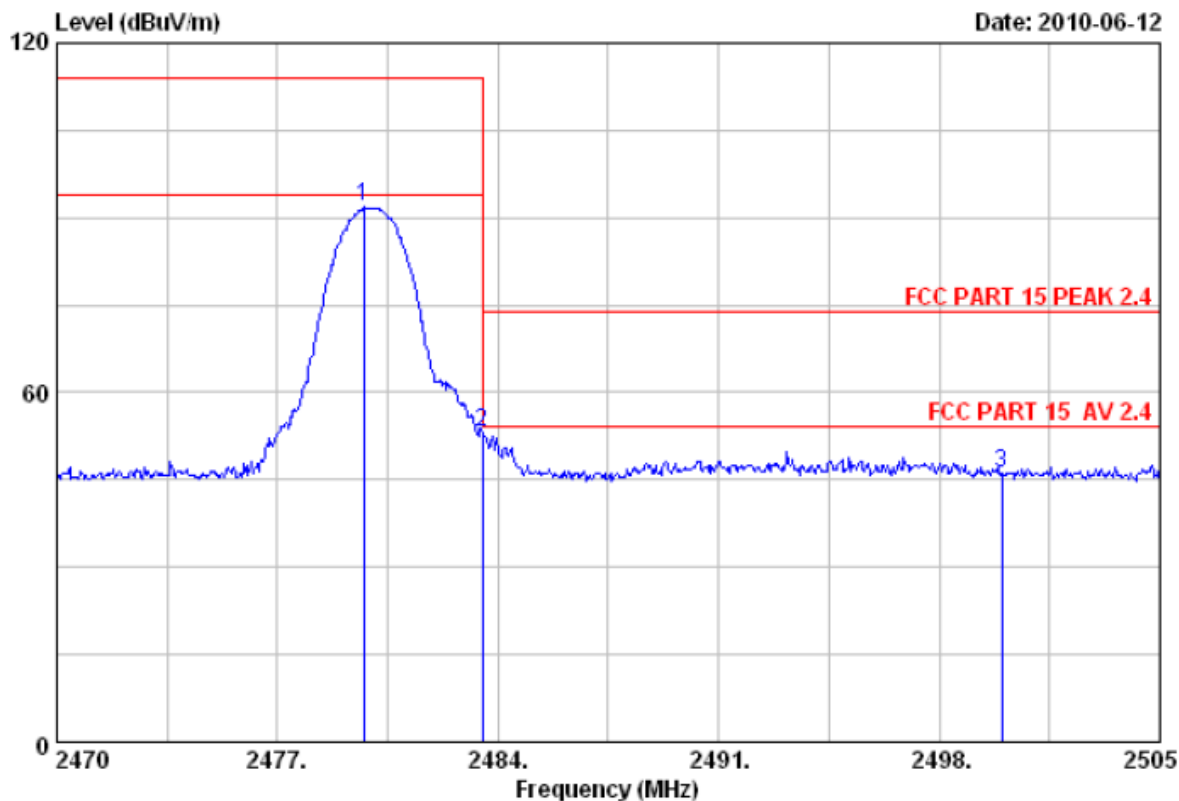
1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.7 Diagram 7-7

Data: 48

File: E:\2010 test data\N\Nemko\Nemko-BT USB Receiver.EM6 (52)

Date: 2010-06-12



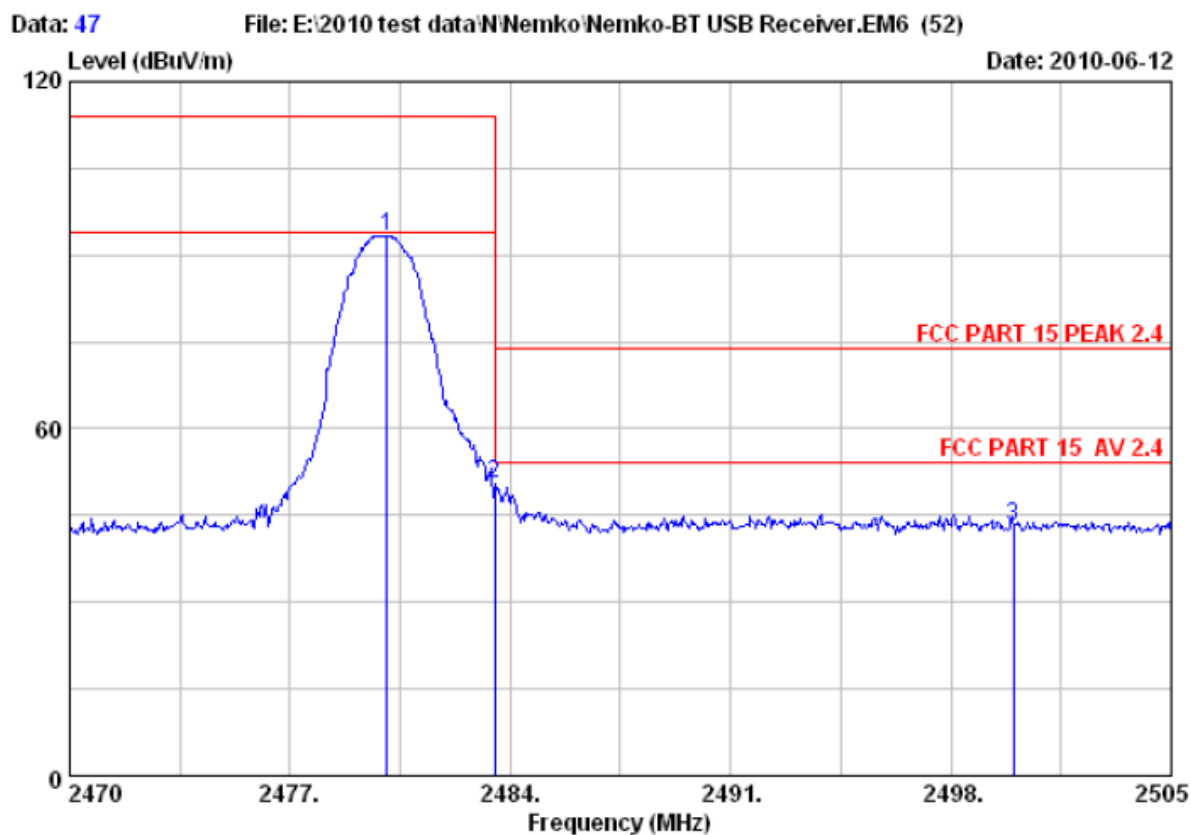
Site no. : 3m Chamber Data no. : 48
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : 8DPSK Tx 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.730	29.49	8.87	35.97	89.42	91.81	114.00	22.19	Peak
2	2483.500	29.49	8.87	35.97	50.67	53.06	74.00	20.94	Peak
3	2500.000	29.50	8.92	36.00	43.86	46.28	74.00	27.72	Peak

Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.8 Diagram 7-8



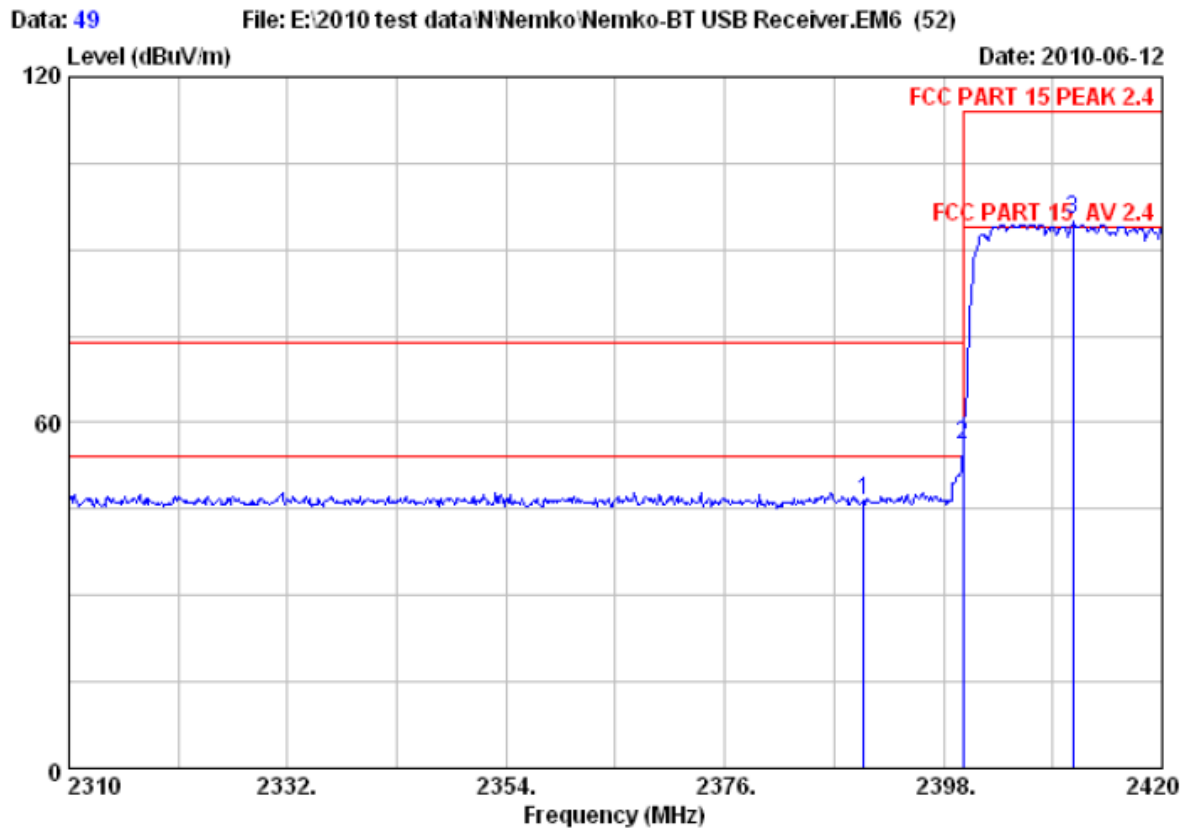
Site no. : 3m Chamber Data no. : 47
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : 8DPSK Tx 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable loss (dB)	Amp. Factor (dB)	Reading (dBUV)	Emission Level (dBUV/m)	Limits (dBUV/m)	Margin (dB)	Remark
1	2480.080	29.49	8.87	35.97	91.00	93.39	114.00	20.61	Peak
2	2483.500	29.49	8.87	35.97	48.00	50.39	74.00	23.61	Peak
3	2500.000	29.50	8.92	36.00	40.78	43.20	74.00	30.80	Peak

Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.9 Diagram 7-9



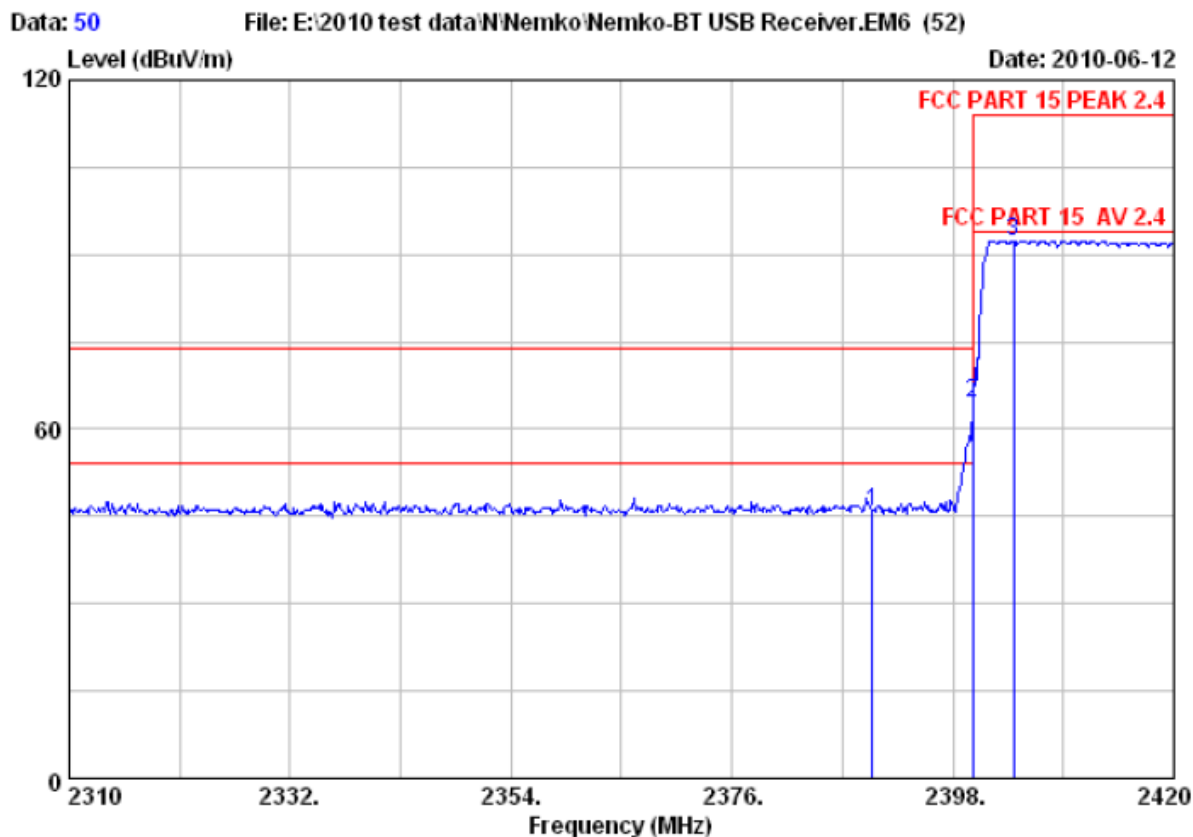
Site no. : 3m Chamber Data no. : 49
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : Hopping on

		Ant.	Cable	Amp.		Emission			
	Freq.	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark
	(MHz)	(dB/m)	(dB)	(dB)	(dBUV)	(dBUV/m)	(dBUV/m)	(dB)	
1	2390.000	29.44	8.67	36.09	44.39	46.41	74.00	27.59	Peak
2	2400.000	29.44	8.72	36.09	54.09	56.16	74.00	17.84	Peak
3	2410.980	29.45	8.72	35.95	93.14	95.36	114.00	18.64	Peak

Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.10 Diagram 7-10



Site no. : 3m Chamber Data no. : 50
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : Hopping on

	Ant.	Cable	Amp.		Emission				
Freq.	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark	
(MHz)	(dB/m)	(dB)	(dB)	(dBUV)	(dBUV/m)	(dBUV/m)	(dB)		
1 2390.000	29.44	8.67	36.09	43.79	45.81	74.00	28.19	Peak	
2 2400.000	29.44	8.72	36.09	62.45	64.52	74.00	9.48	Peak	
3 2404.050	29.45	8.72	35.95	90.08	92.30	114.00	21.70	Peak	

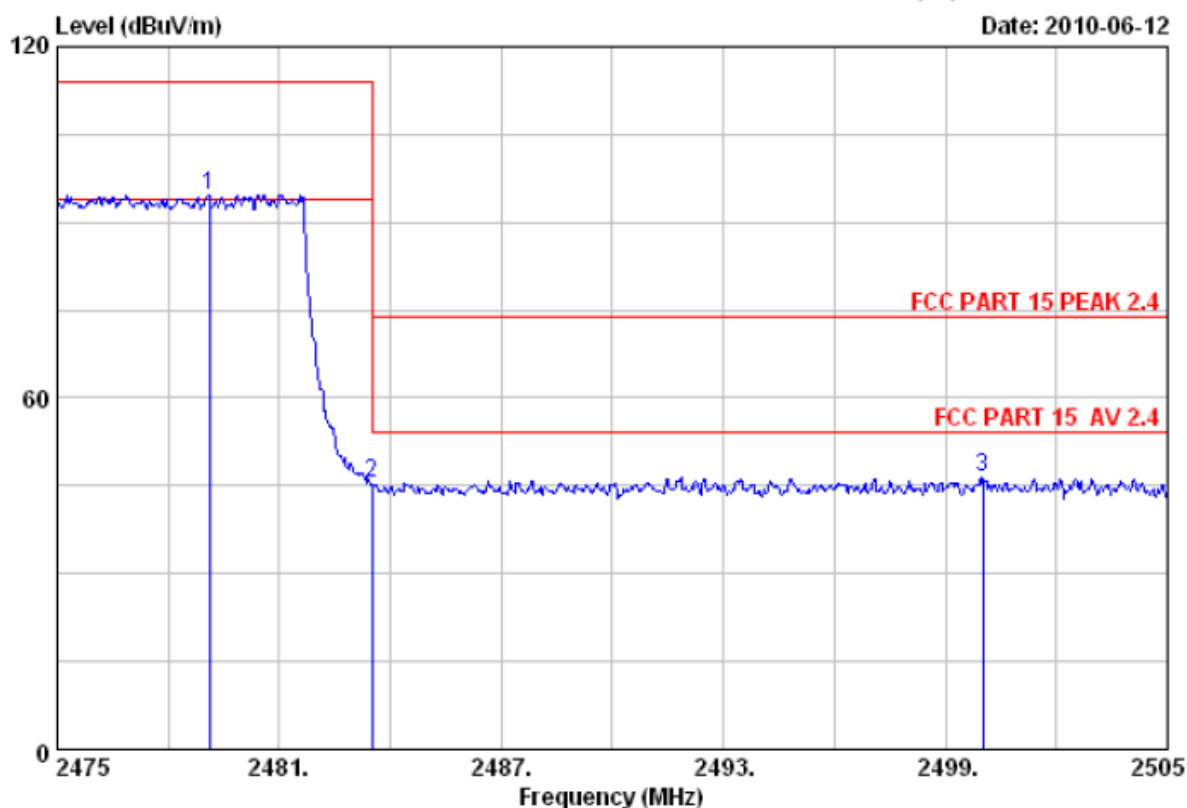
Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.11 Diagram 7-11

Data: 52

File: E:\2010 test data\N\Nemko\Nemko-BT USB Receiver.EM6 (52)



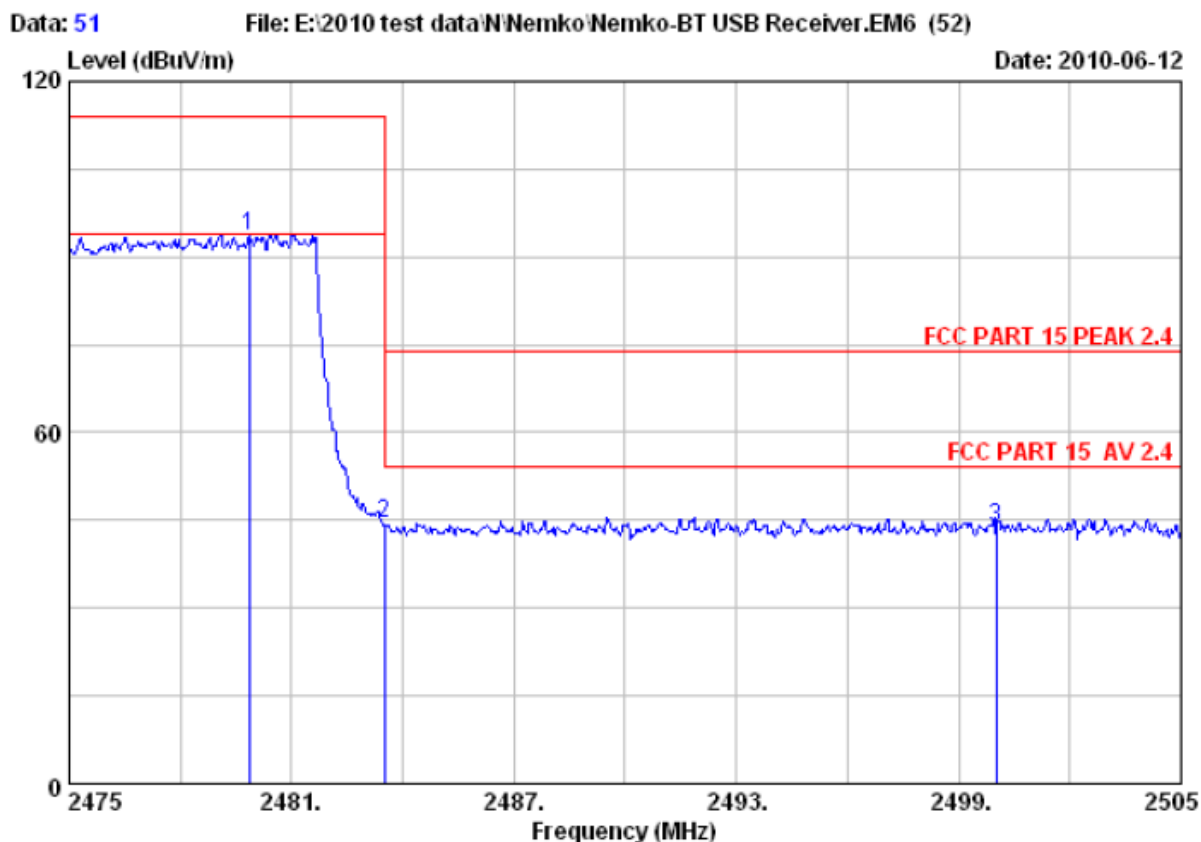
Site no. : 3m Chamber Data no. : 52
Dis. / Ant. : 3m 3115(0911) Ant. pol. : HORIZONTAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : Hopping on

	Ant.	Cable	Amp.		Emission				
Freq.	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark	
(MHz)	(dB/m)	(dB)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)		
1 2479.110	29.49	8.87	35.97	92.25	94.64	114.00	19.36	Peak	
2 2483.500	29.49	8.87	35.97	43.02	45.41	74.00	28.59	Peak	
3 2500.000	29.50	8.92	36.00	43.95	46.37	74.00	27.63	Peak	

Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

7.3.12 Diagram 7-12



Site no. : 3m Chamber Data no. : 51
Dis. / Ant. : 3m 3115(0911) Ant. pol. : VERTICAL
Limit : FCC PART 15 PEAK 2.4
Env. / Ins. : 23°C/54% Engineer : Sunny-lu
Test mode : Hopping on

	Ant.	Cable	Amp.		Emission				
	Freq.	Factor	loss	Factor	Reading	Level	Limits	Margin	Remark
	(MHz)	(dB/m)	(dB)	(dB)	(dBUV)	(dBUV/m)	(dBUV/m)	(dB)	
1	2479.860	29.49	8.87	35.97	91.32	93.71	114.00	20.29	Peak
2	2483.500	29.49	8.87	35.97	42.02	44.41	74.00	29.59	Peak
3	2500.000	29.50	8.92	36.00	41.42	43.84	74.00	30.16	Peak

Remarks:

1. Emission Level= Antenna Factor + Cable Loss -Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

8. Carrier Frequency Separation Test

8.1 Test Procedure

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

The peak detector was used with 100 kHz/300 kHz RBW/VBW

8.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
☒	Spectrum	May 15, 10	E4407B	MY41440292	Agilent
☒	Amp	May 15, 10	8449B	3008A00863	HP
☒	Antenna	Jan. 23, 10	3115	9607-4877	EMCO
☒	HF Cable	May 15, 10	Sucoflex104	N/A	Hubersuhne

8.3 Test Result

Pass

Channel separation is referred to 8.3.1 and 8.3.2

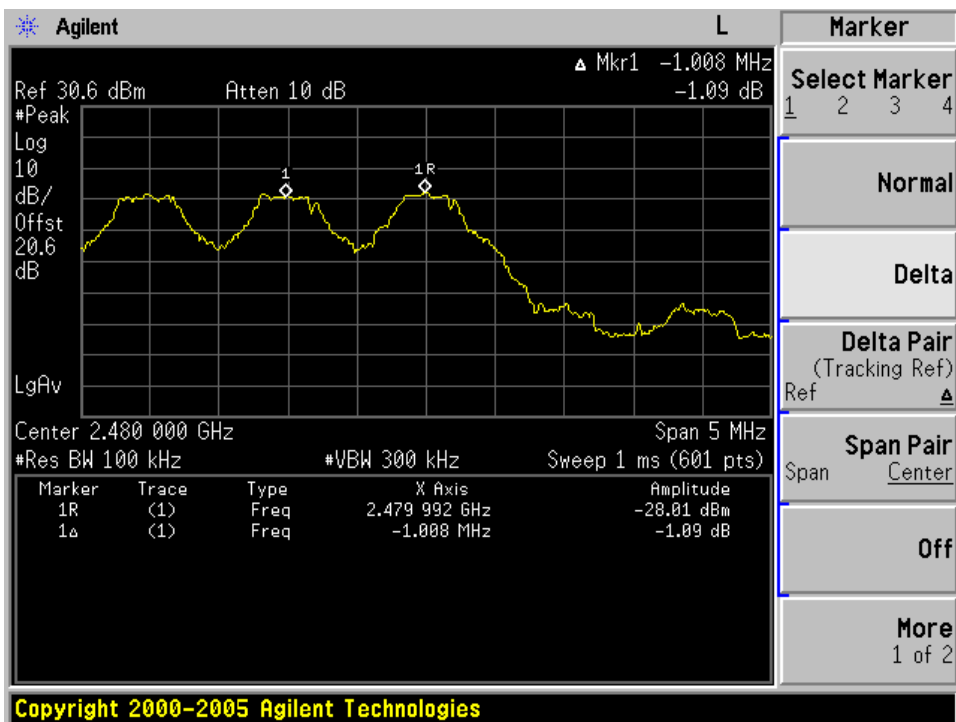
Widest channel bandwidth was 1230kHz. refer to 6.3

Two-thirds is 820kHz and greater than 25kHz .

Modulation	Channel separation, kHz	Minimum limit, kHz	Margin, kHz
GFSK	1008kHz	820kHz	188kHz
8DPSK	1000kHz	820kHz	180kHz

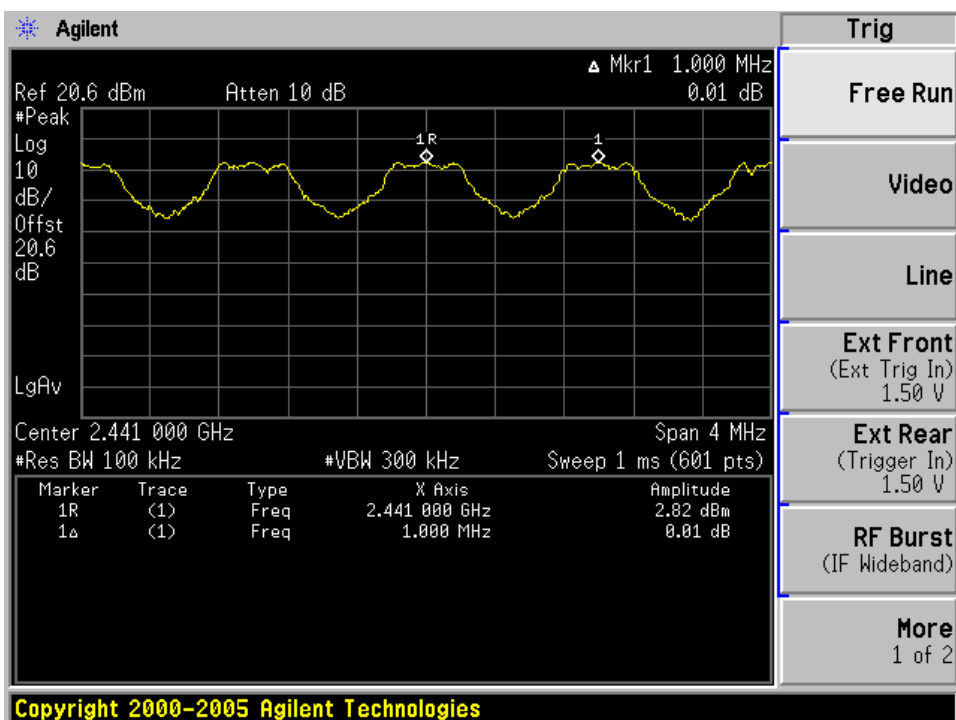
8.3.1 Diagram 8-1

GFSK :



8.3.2 Diagram 8-2

8DPSK :



9. Output Power Test

9.1 Test Procedure

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) 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 W. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 W.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

9.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
☒	Spectrum	May 15, 10	E4407B	MY41440292	Agilent
☒	Amp	May 15, 10	8449B	3008A00863	HP
☒	Antenna	Jan. 23, 10	3115	9607-4877	EMCO
☒	HF Cable	May 15, 10	Sucoflex104	N/A	Hubersuhne

9.3 Test Result

Modulation	Freq(MHz)	Polarity	Emission level (dBμV/m)	Detector
GFSK	2402	H	100.86 dBμV/m @3m	PK
GFSK	2402	V	100.41 dBμV/m @3m	PK
GFSK	2441	H	98.97 dBμV/m @3m	PK
GFSK	2441	V	99.93 dBμV/m @3m	PK
GFSK	2480	H	97.01 dBμV/m @3m	PK
GFSK	2480	V	96.79 dBμV/m @3m	PK
Remark	GFSK is the worse case .			

Remark :

1:RBW=2MHz VBW=6MHz PK detector

Output power calculation

Frequency, MHz	Field strength, dBμV/m	Output power dBm	Output power Limit, dBm
2402	100.86	3.636	30.00
2441	99.93	2.706	30.00
2480	97.01	-0.214	30.00

Remark :

Antenna Gain =2dBi

$P(w) = \{(E(v/m) \cdot D(m))^2\} / 30G(\text{numeric antenna gain})$

EIRP calculation

Frequency, MHz	Output power dBm	Antenna gain, dBi	EIRP power, dBm	Power Limit, dBm
2402	3.636	2	5.636	36.00
2441	2.706	2	4.706	36.00
2480	-0.214	2	1.786	36.00

Output power [dBm] = EIRP [dBm] - antenna gain [dBi]

10. NUMBER OF HOPPING FREQUENCY TEST

10.1 Test Procedure

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 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
☒	Spectrum	May 15, 10	E4407B	MY41440292	Agilent
☒	Amp	May 15, 10	8449B	3008A00863	HP
☒	Antenna	Jan. 23, 10	3115	9607-4877	EMCO
☒	HF Cable	May 15, 10	Sucoflex104	N/A	Hubersuhne

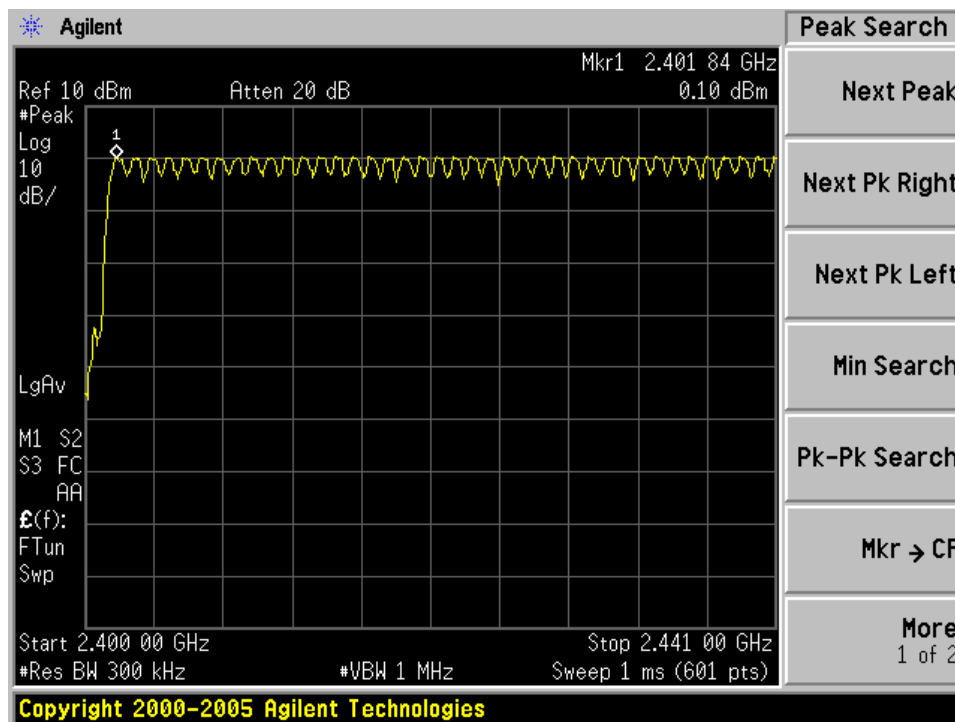
10.3 Test Result

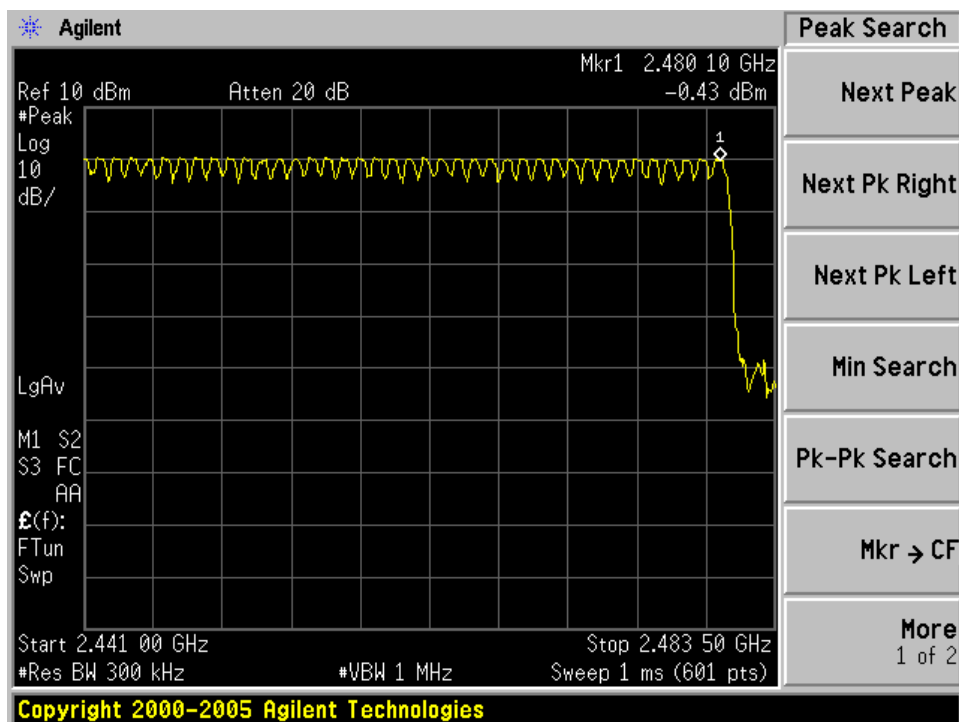
Test mode: Transmitter Hopping on

Number of channels used	Minimum number of channels limit	Margin
79	15	64

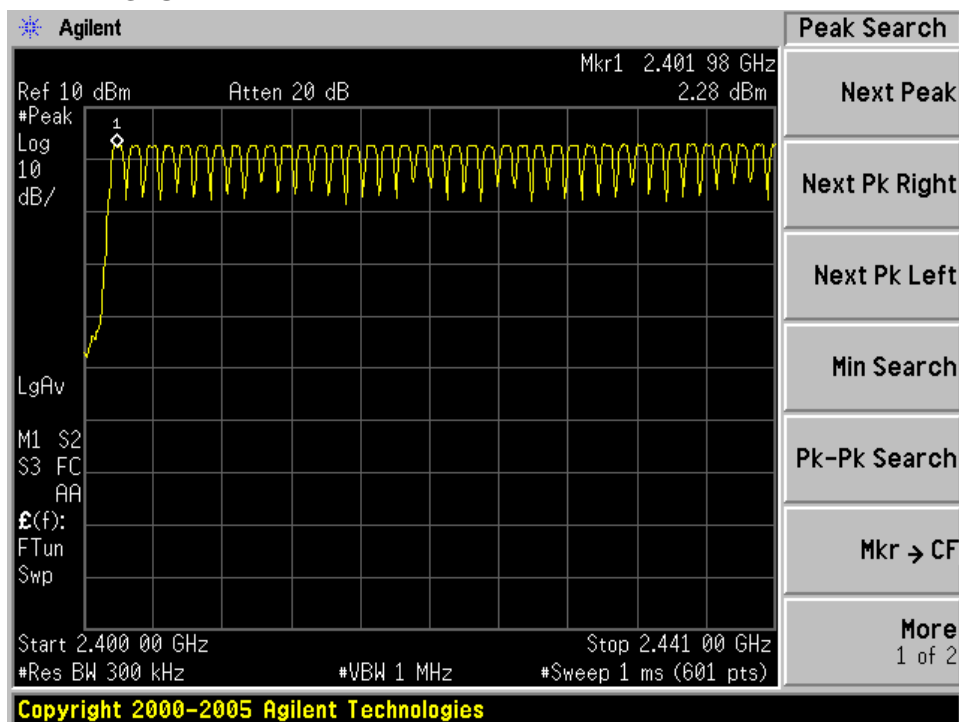
10.3.1 Diagram 10-1

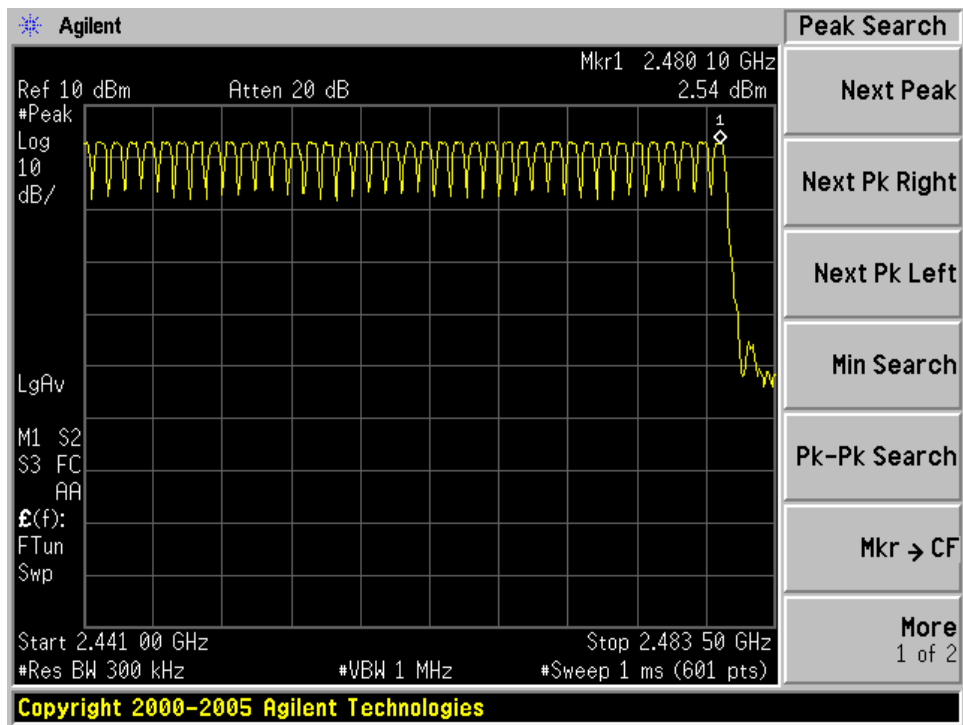
8DPSK





10.3.2 Diagram 10-2
GFSK





11. DWELL TIME TEST

11.1 Test Procedure

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.

11.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
☒	Spectrum	May 15, 10	E4407B	MY41440292	Agilent
☒	Amp	May 15, 10	8449B	3008A00863	HP
☒	Antenna	Jan. 23, 10	3115	9607-4877	EMCO
☒	HF Cable	May 15, 10	Sucoflex104	N/A	Hubersuhne

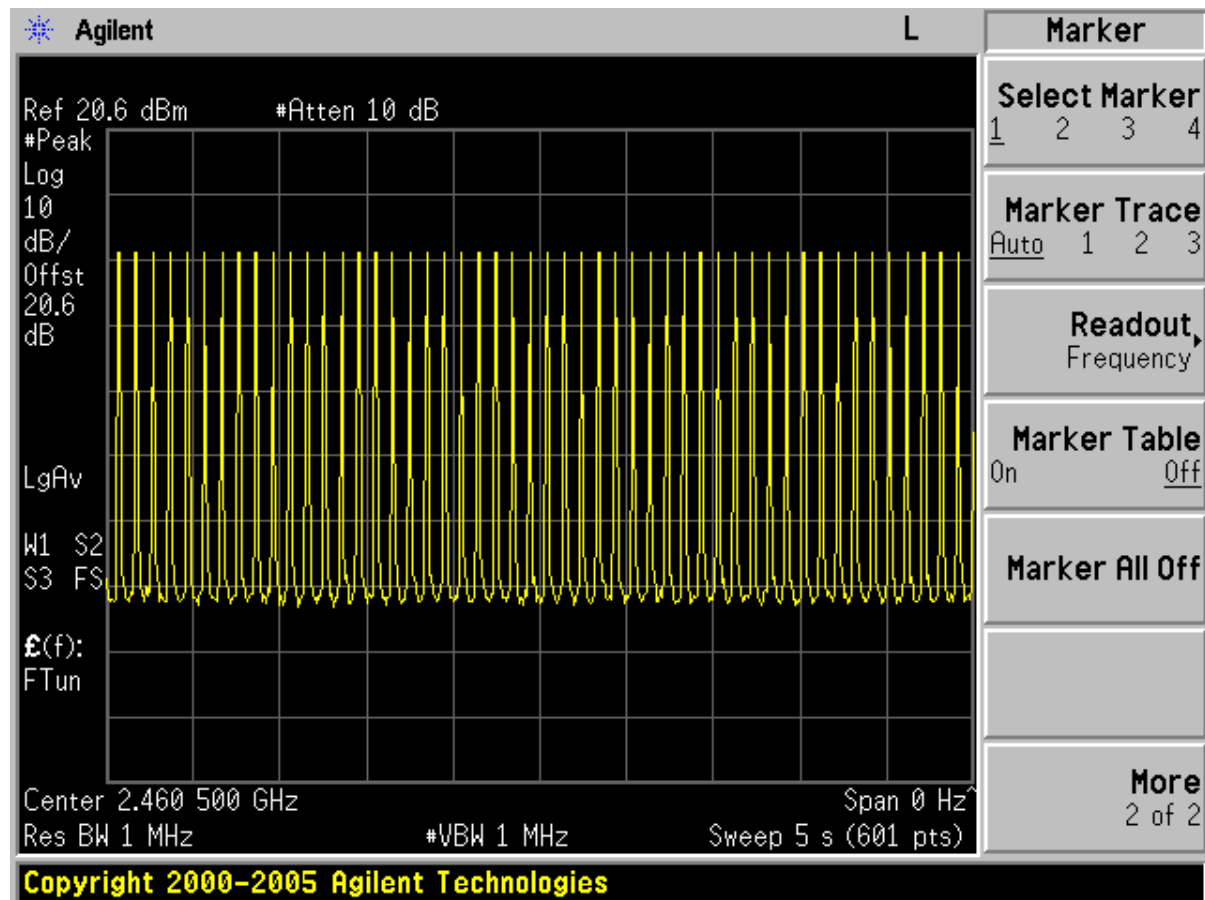
11.3 Test Result

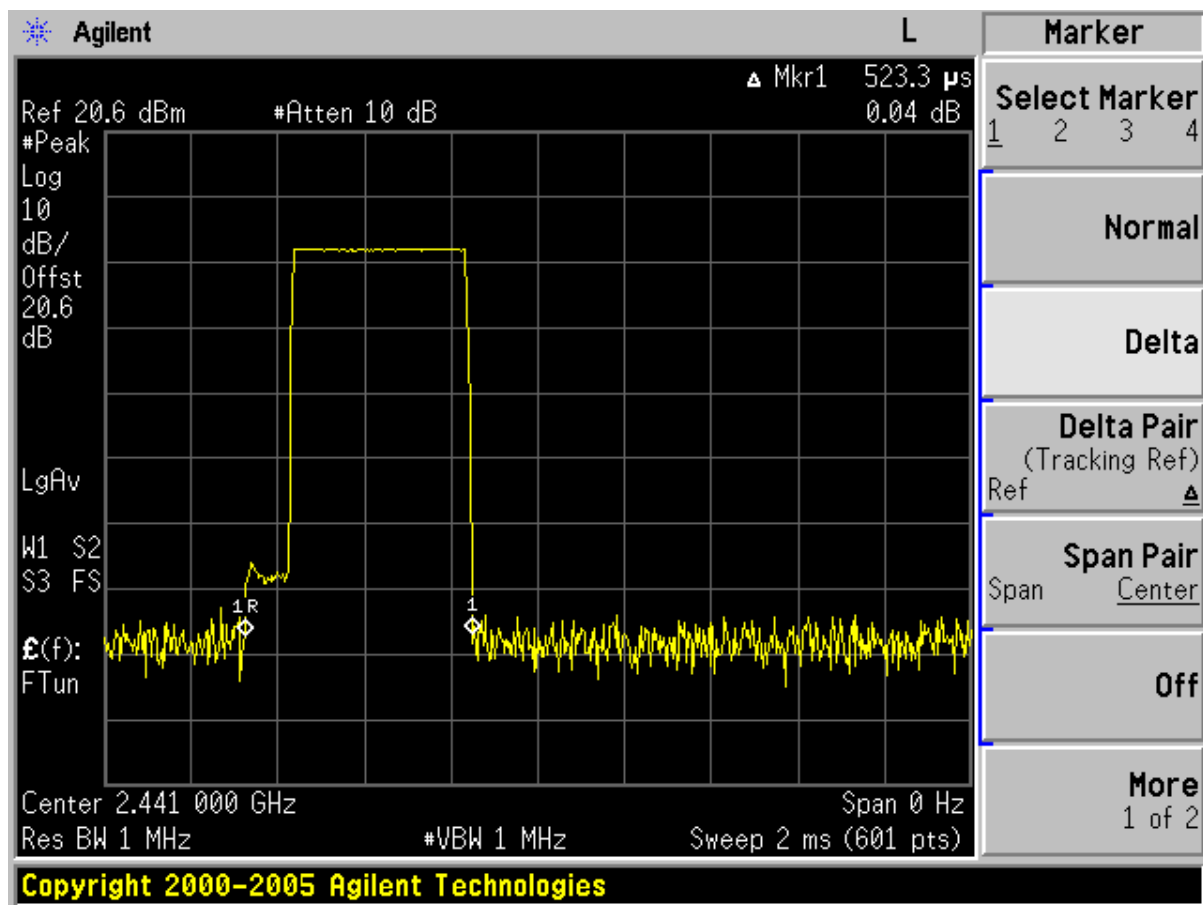
Limit:

Total time of occupancy is 0.4 s within a period of time equals number of hopping channels employed multiplied by 0.4 s, which is 0.4 s within the period of time $0.4 \times 79 = 31.6$ s

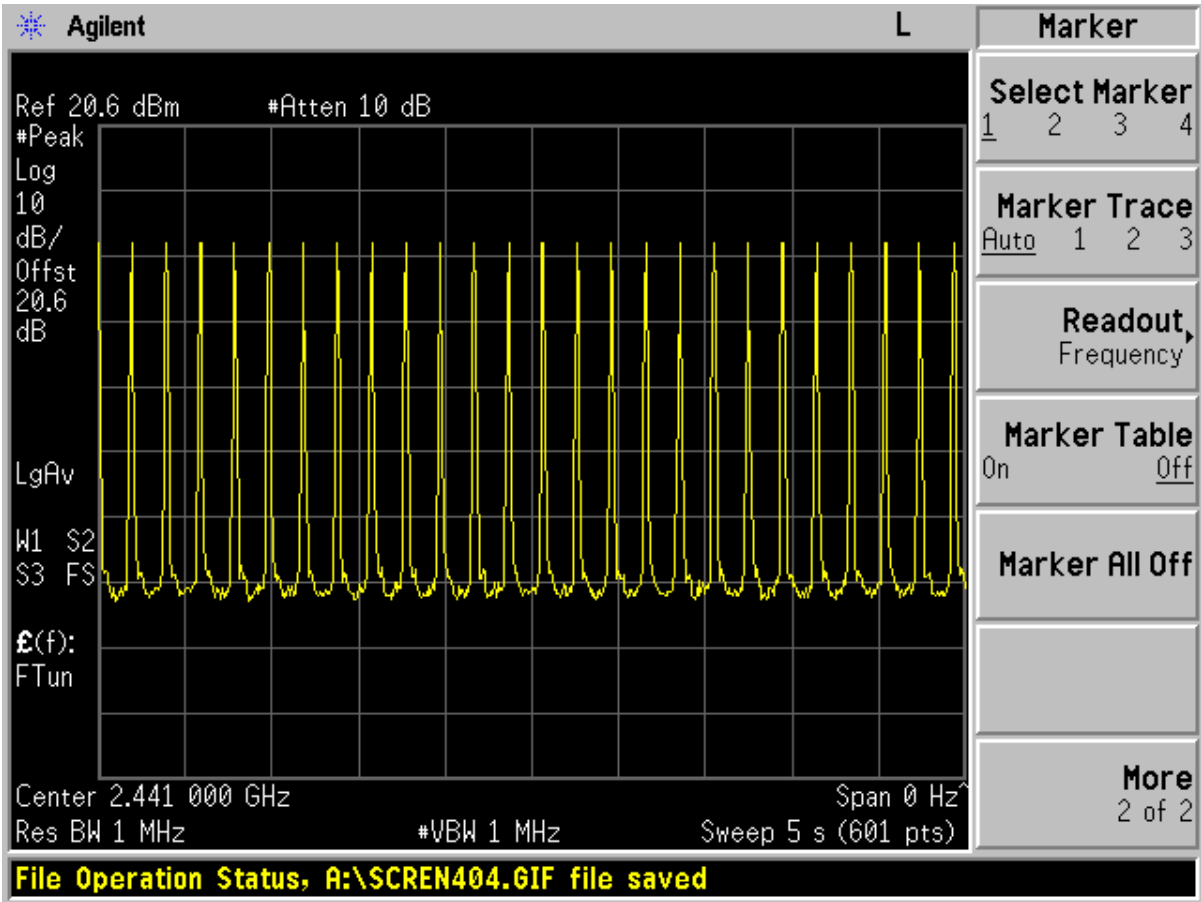
Modulation	Grouping	Diagram	Time of occupancy ms	Limit ms	Margin ms	Remark
GFSK	DH1	11-1	165	400	235	50hits per 5s So $(31.6/5) * 50 * 0.523 = 165$
	DH3	11-2	293	400	107	26hits per 5s So $(31.6/5) * 26 * 1.783 = 293$
	DH5	11-3	328	400	72	17hits per 5s So $(31.6/5) * 17 * 3.05 = 328$
8DPSK	DH1	11-4	173	400	227	51hits per 5s So $(31.6/5) * 51 * 0.5367 = 173$
	DH3	11-5	286	400	114	25hits per 5s So $(31.6/5) * 25 * 1.808 = 286$
	DH5	11-6	333	400	67	17hits per 5s So $(31.6/5) * 17 * 3.1 = 333$

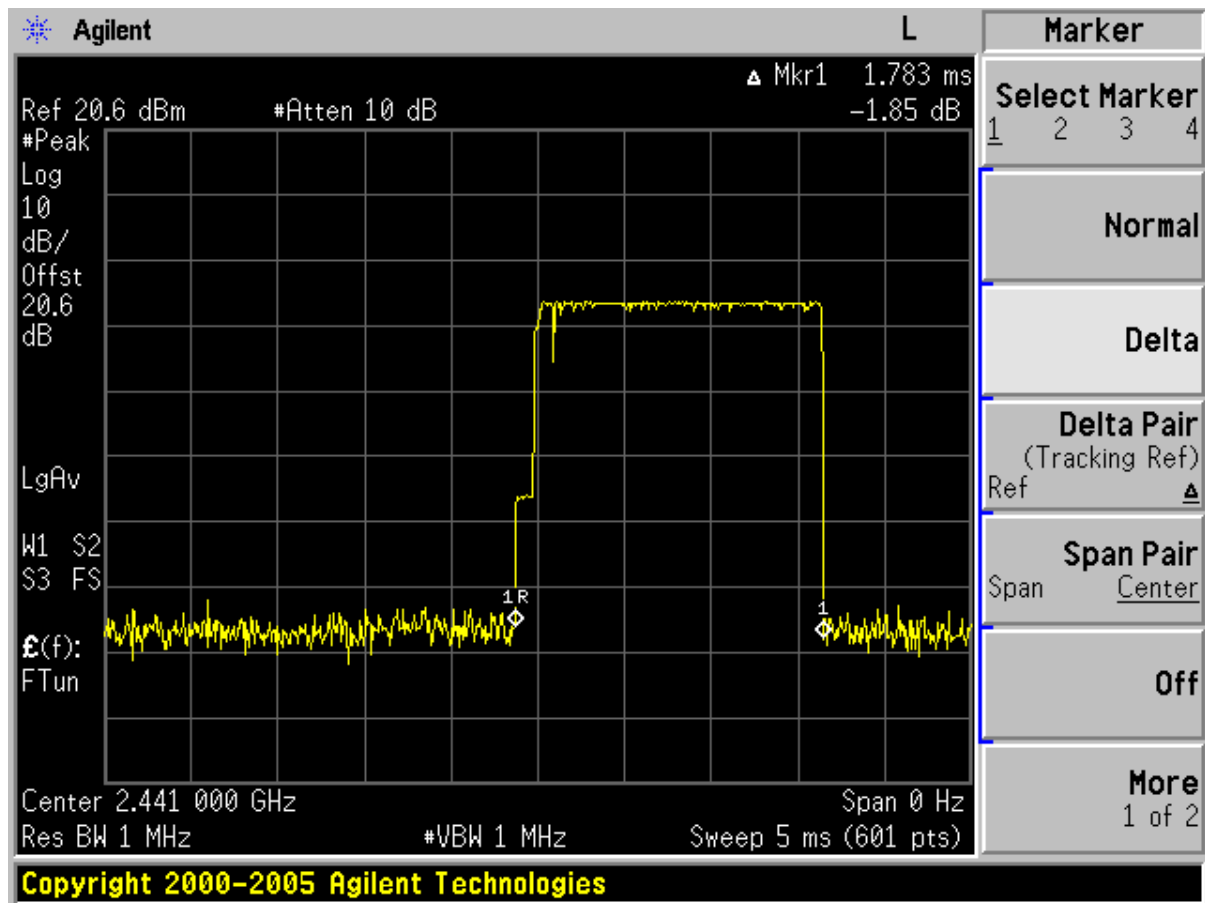
11.3.1 Diagram 11-1



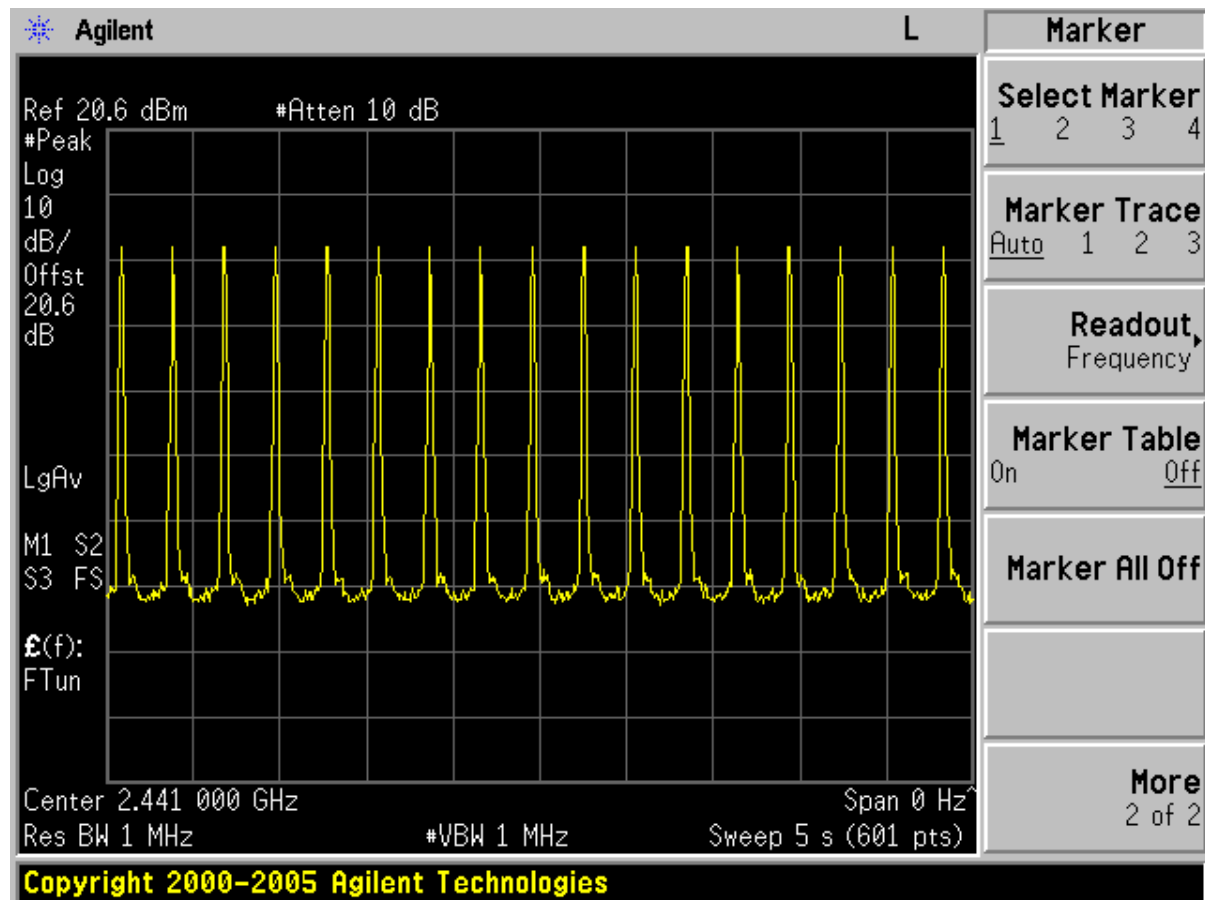


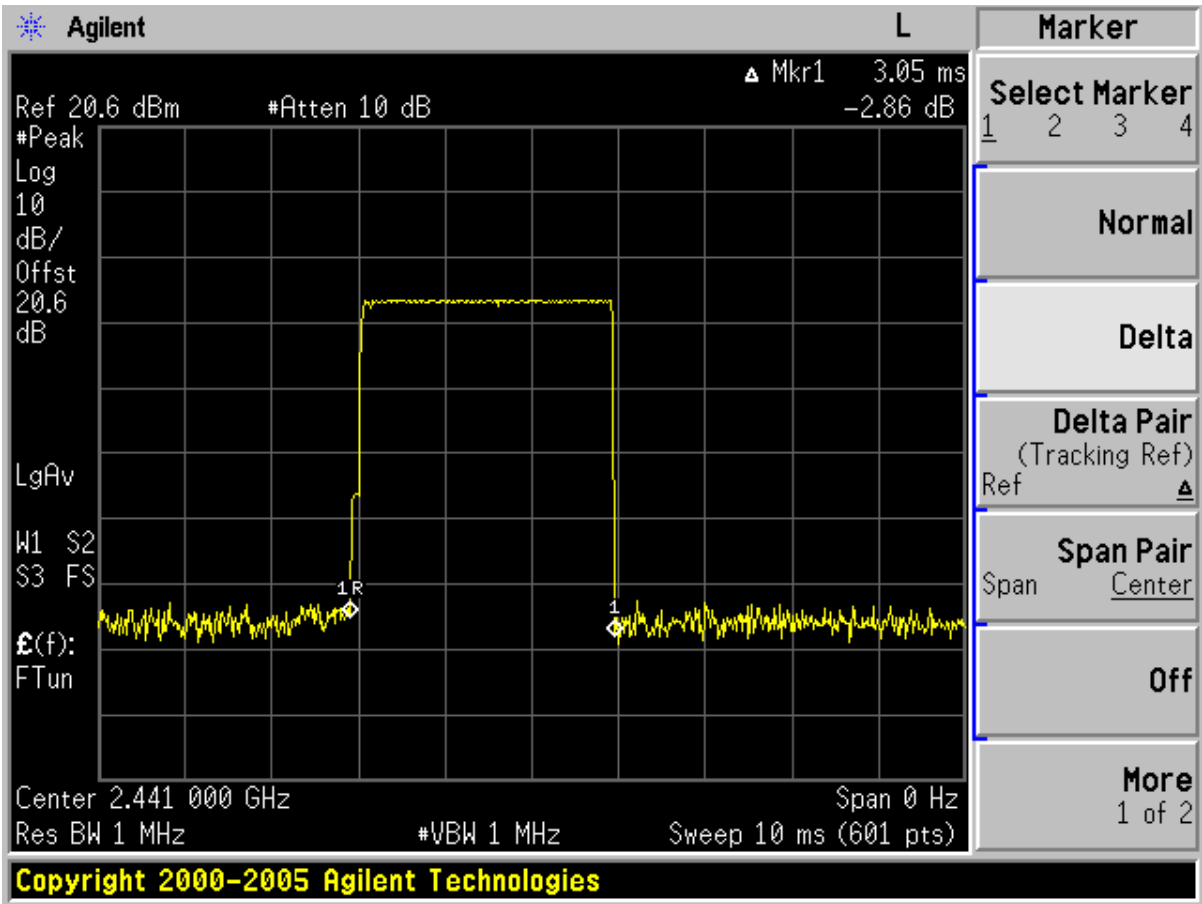
11.3.2 Diagram 11-2



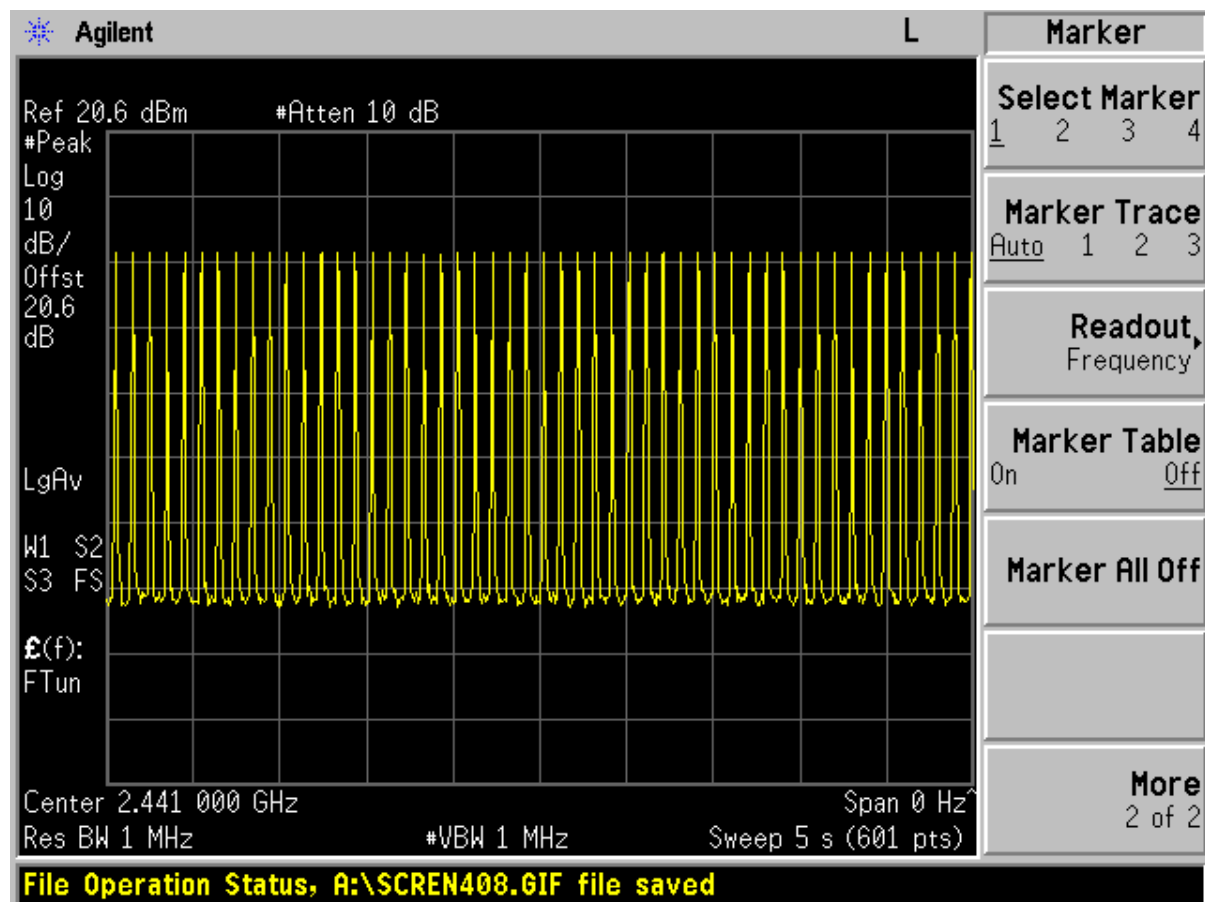


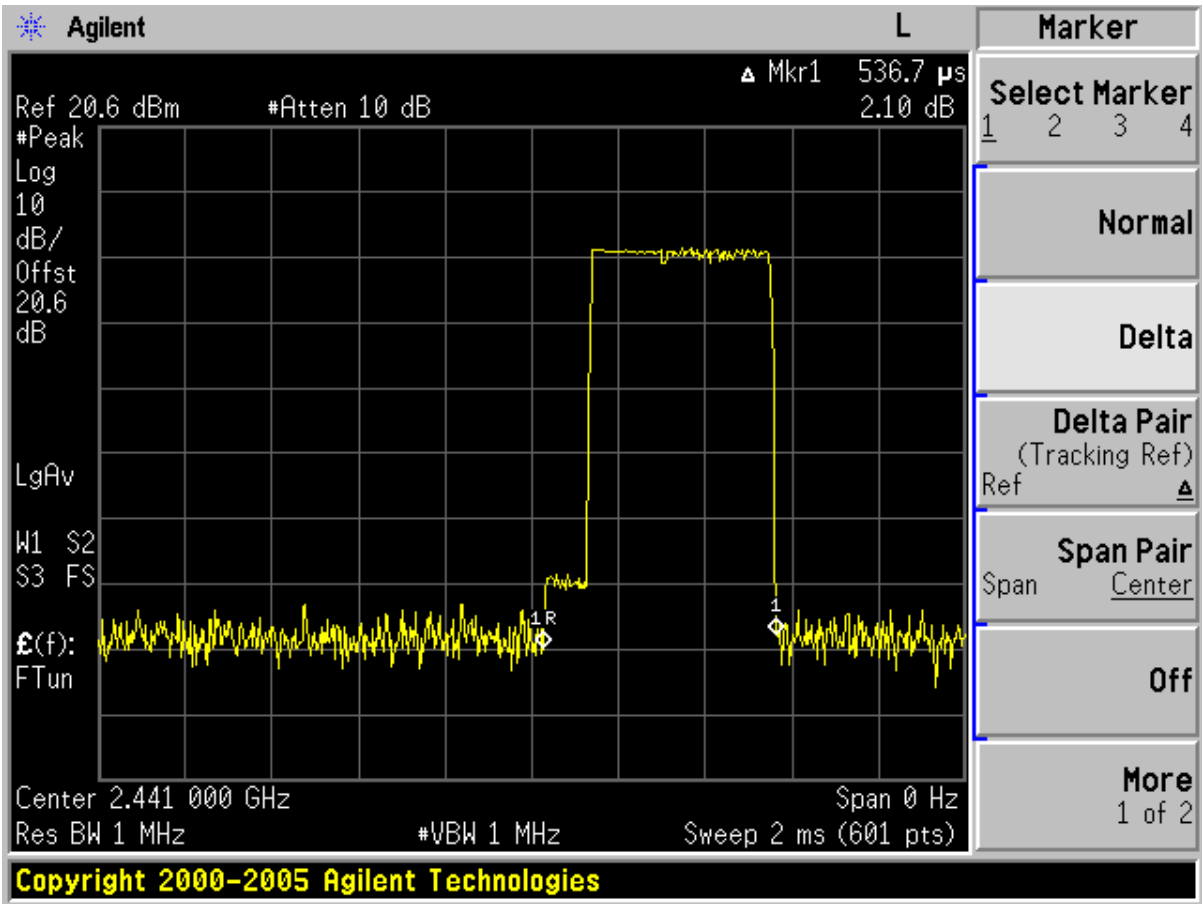
11.3.3 Diagram 11-3



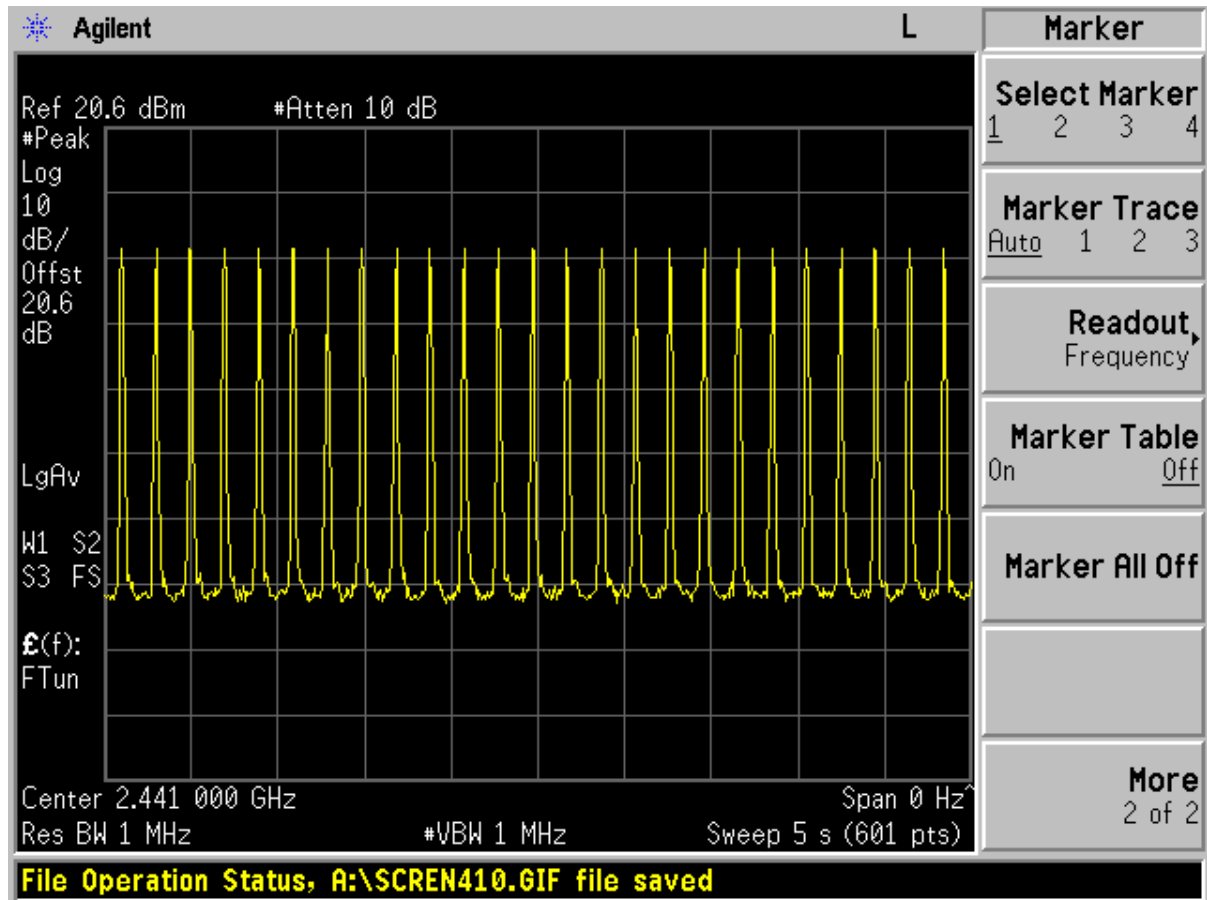


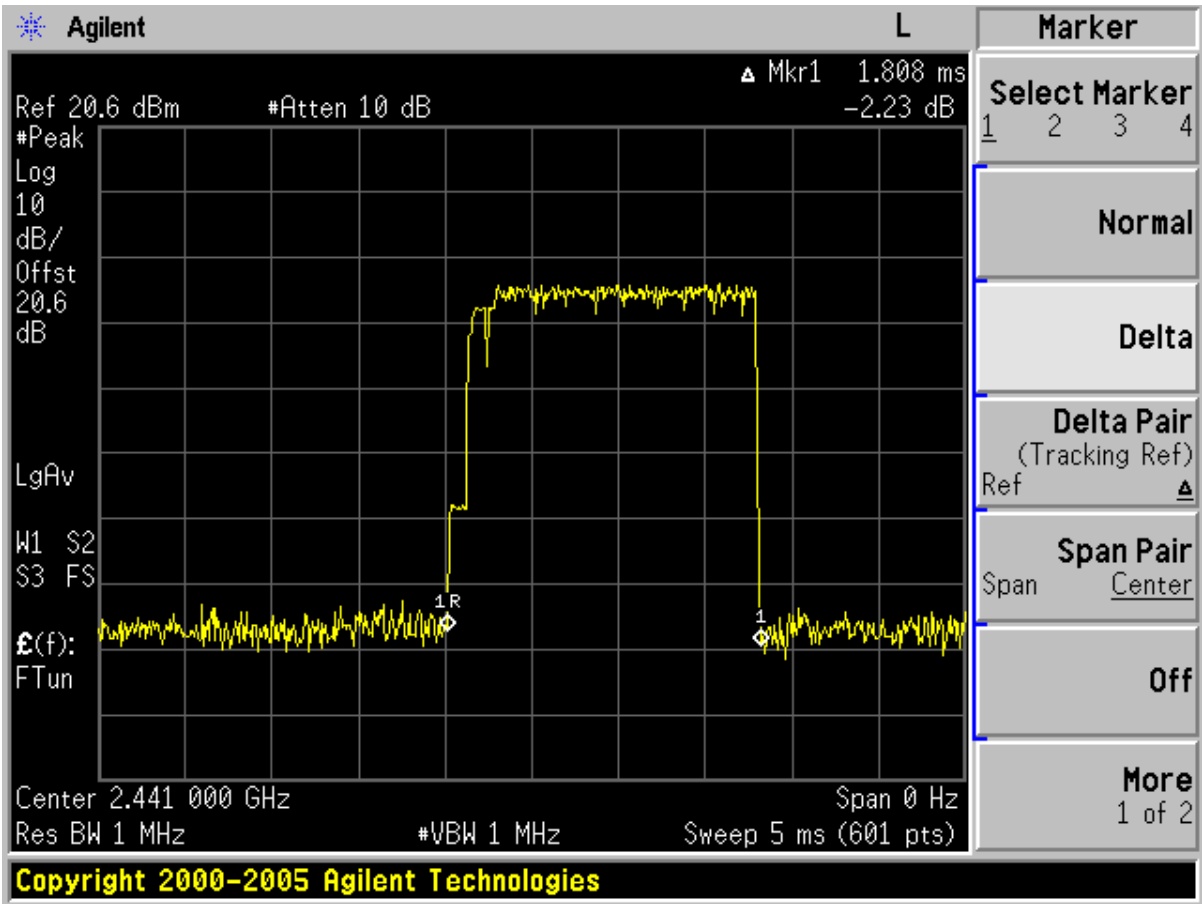
11.3.4 Diagram 11-4



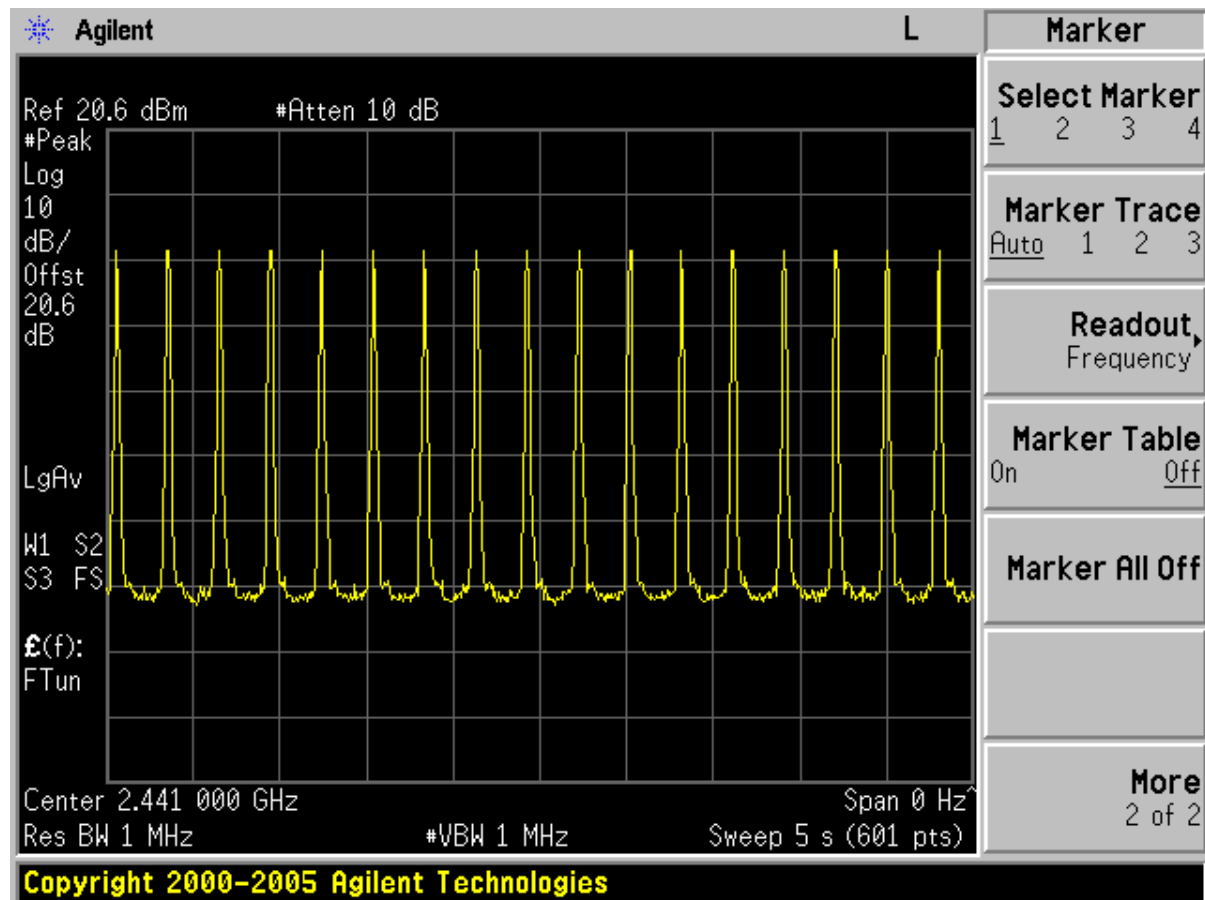


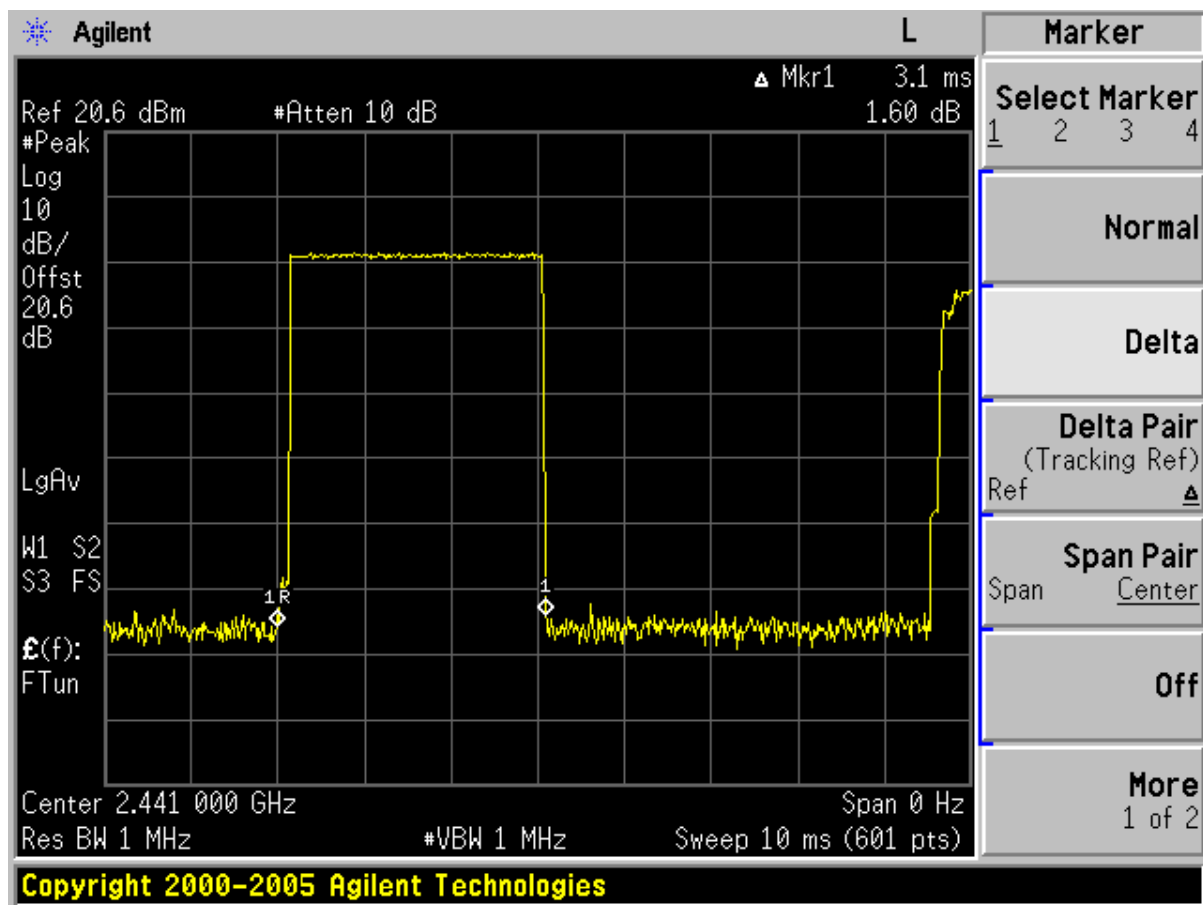
11.3.5 Diagram 11-5





11.3.6 Diagram 11-6





12 POWER LINE CONDUCTED EMISSION TEST

12.1 Test Procedure

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*-Decreases with the logarithm of the frequency.

12.2 Measurement Equipment

	Equipment	Last Calibration	Type	Serial No.	Manufacturer
☒	EMI Test Receiver	10.05.2009	ESHS10	844077/020	R&S
☒	LISN	10.05.2009	ESH2-Z5	834066/011	R&S
☒	LISN	10.05.2009	3825/2	9006-1660	EMCO
☒	Terminator	10.05.2009	50 Ω	No.1	Hubersuhner
☒	RF cable	09.07.2009	3D-2W	LISN Cable1#	Fujikura
☒	Coaxial switch	09.07.2009	MP59B	M55367	Anritsu
☒	Pulse Limiter	09.07.2009	ESH3-Z2	100340	R&S

12.3 Test Result

The EUT was placed on a non-metallic table, 80cm above the ground plane. The other peripheral devices power cord connected to the power mains through another line impedance stabilization network. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.4-2009 on conducted Emission test.

Preview measurements:

0.15 MHz to 30 MHz

Receiver settings: PK&AV detector

Final measurement:

0.15 MHz to 30 MHz

Receiver settings: QP&AV detector

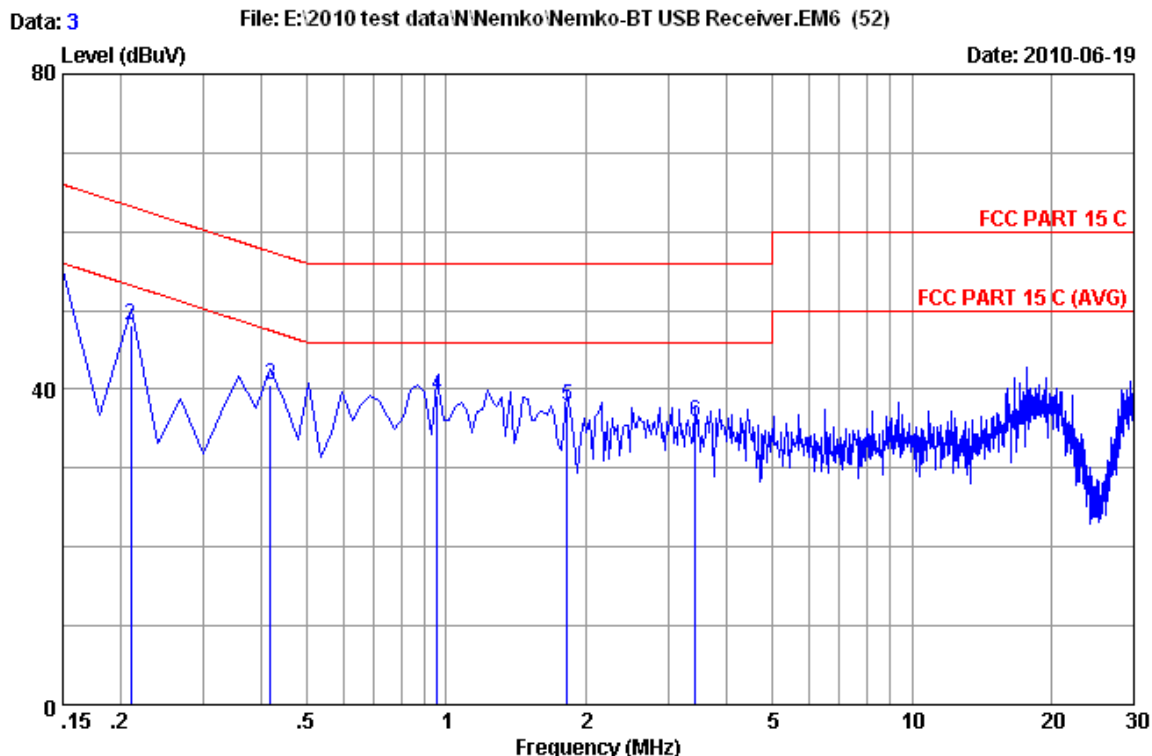
RBW: 9 kHz

Test mode	Power Line	Test Data	Test Result
TX MODE	Line	Diagram 12-1	Pass
	Neutral	Diagram 12-2	Pass

NOTES:

- Measurements using CISPR quasi-peak mode & average mode.
- All modes of operation were investigated and the worst -case emission are reported. See attached Plots.
- If PK value is lower than AV limit then no reading value listed in report .If QP value is Lower than AV limit ,then AV value don't listed in report.

12.3.1 Diagram 12-1

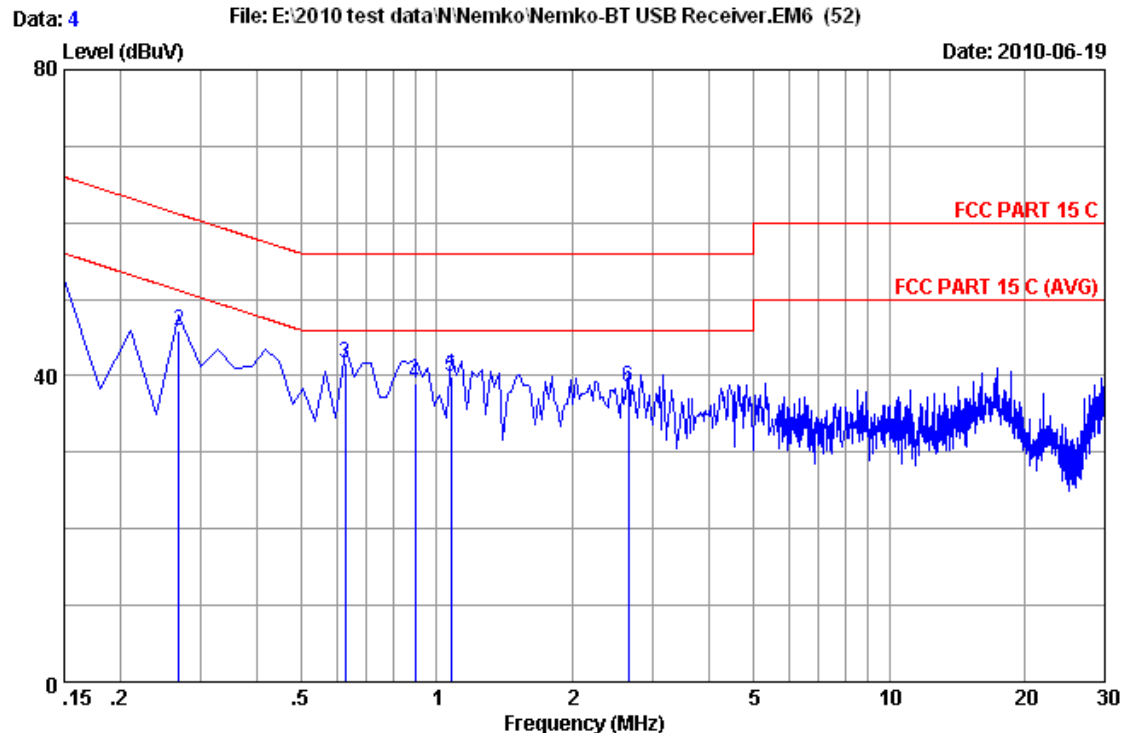


Site no : Audix No.1 Conduction Data no : 3
Dis./Ant. : ** 2010 ESH2-Z5 LINE
Limit : FCC PART 15 C
Env. / Ins. : 23°C/54% Engineer : Paul Tian
Test mode : Tx Mode

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBUV)	Emission Level (dBUV)	Limits (dBUV)	Margin (dB)	Remark
1	0.15000	0.23	9.88	42.82	52.93	66.00	13.07	QP
2	0.20970	0.22	9.88	38.02	48.12	63.22	15.10	QP
3	0.41865	0.24	9.88	30.45	40.57	57.47	16.90	QP
4	0.95595	0.22	9.89	29.19	39.30	56.00	16.70	QP
5	1.822	0.25	9.90	27.77	37.92	56.00	18.08	QP
6	3.434	0.26	9.93	25.74	35.93	56.00	20.07	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.
2.If the average limit is met when using a quasi-peak detector.
the EUT shall be deemed to meet both limits and measurement
with average detector is unnecessary.

12.3.2 Diagram 12-2



Site no : Audix No.1 Conduction Data no : 4
Dis./Ant. : ** 2010 ESH2-Z5 NEUTRAL
Limit : FCC PART 15 C
Env. / Ins. : 23°C/54% Engineer : Paul Tian
Test mode : Tx Mode

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBUV)	Emission Level (dBUV)	Limits (dBUV)	Margin (dB)	Remark
1	0.15000	0.21	9.88	39.50	49.59	66.00	16.41	QP
2	0.26940	0.21	9.88	35.84	45.93	61.14	15.21	QP
3	0.62760	0.23	9.88	31.55	41.66	56.00	14.34	QP
4	0.89625	0.25	9.89	28.92	39.06	56.00	16.94	QP
5	1.075	0.25	9.89	29.74	39.88	56.00	16.12	QP
6	2.657	0.26	9.93	28.35	38.54	56.00	17.46	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.
2.If the average limit is met when using a quasi-peak detector.
the EUT shall be deemed to meet both limits and measurement
with average detector is unnecessary.



FCCID: QCIWC6D
ICID: 4302A-WC6D
Reference No.: 150932

13 Antenna requirement

13.1 Requirement

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

13.2 Result

The antenna used for this product is Internal Patch antenna that no antenna other than that furnished by the responsible party shall be used with the device, The maximum peak gain of this antenna is 2dBi.



FCCID: QCIWC6D
ICID: 4302A-WC6D
Reference No.: 150932

14.MPE

Applicable Standard

According to §1.1307(b)(5), systems operating under the provisions of this section shall be operated in a manner

that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Portable device. **KDB616217 was used as the guidance.**

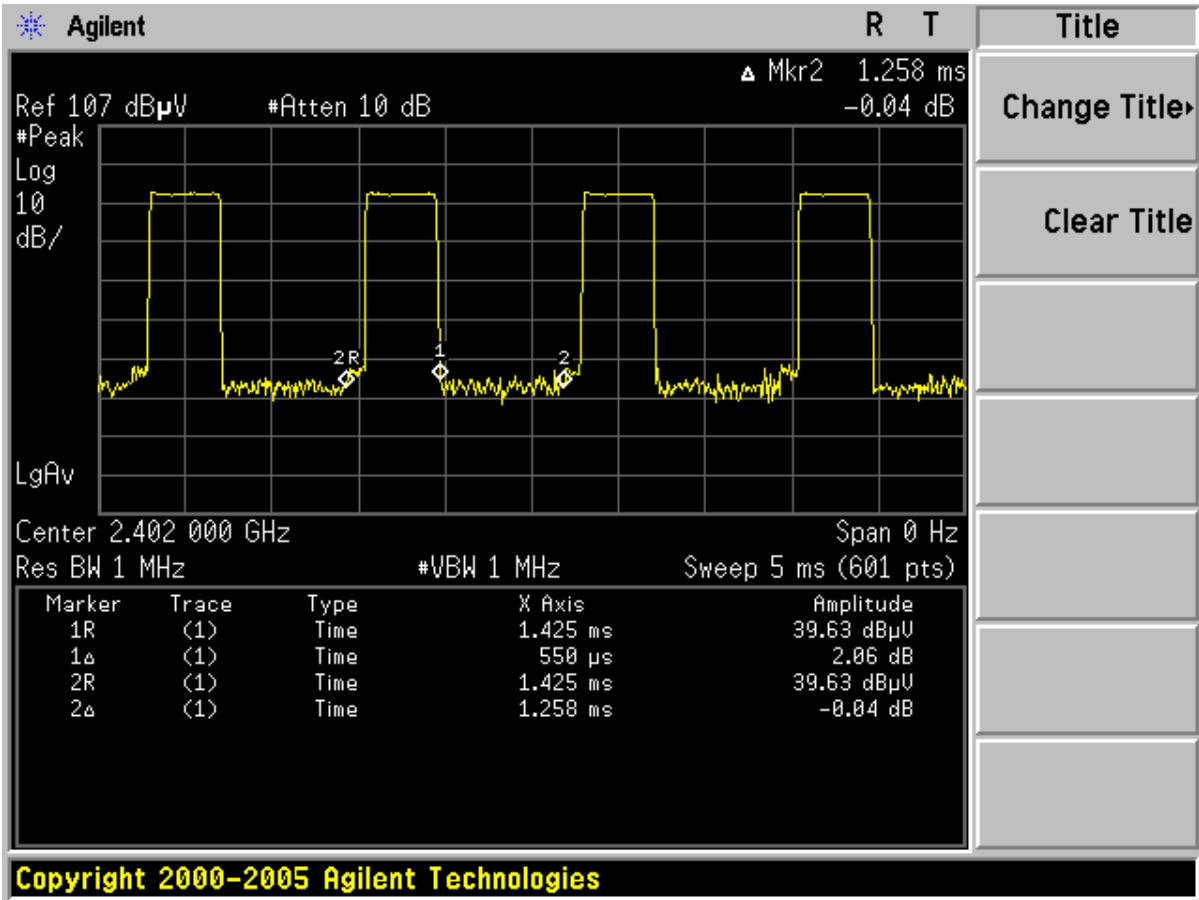
According to §1.1310 and §2.1093 RF exposure is calculated.

Measurement Result

This is a USB device and the conducted output power is 3.636dBm (2.31mW), which is lower than low threshold 60/fGHz mW ($60/2.441\text{GHz}=24.58\text{mW}$), and the antenna is 2.0dBi which is less than 6dBi.

The SAR measurement is not necessary.

Appendix A Duty cycle



So the duty cycle is $0.55 \times (4 \times 100 / 5) / 100 = 44\%$



FCCID: QCIWC6D
ICID: 4302A-WC6D
Reference No.: 150932

Appendix B Sample Label

Labelling Requirements

The sample label shown shall be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.

*** The following paragraph specified in the user manual.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

END OF REPORT