



FCC/IC Test Report

FOR:

Model Name: PCG-31112L

Personal Computer

FCC ID: AK8PCG31112L

IC ID: 409B-PCG31112L

47 CFR Part 15.247 for FHSS Systems

IC RSS-210 Issue 7

TEST REPORT #: EMC_SONYE_034_09002_15.247FHSS_PCG-31112L

DATE: 2009-12-01



**FCC listed
A2LA Accredited**

**IC recognized #
3462B**

CETECOM Inc.

411 Dixon Landing Road ♦ Milpitas, CA 95035 ♦ U.S.A.

Phone: + 1 (408) 586 6200 ♦ Fax: + 1 (408) 586 6299 ♦ E-mail: info@cetecomusa.com ♦ <http://www.cetecom.com>

CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686

Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

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1 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and Industry Canada Standards RSS 210 Issue 7.

Company	Description	Model #
Sony Corporation	Personal Computer	PCG-31112L

Responsible for Testing Laboratory:

Marc Douat

2009-12-01 Compliance (Test Lab Manager)

Date	Section	Name	Signature
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Responsible for the Report:

Satya Radhakrishna

2009-12-01 Compliance (EMC Project Engineer)

Date	Section	Name	Signature
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The test results of this test report relate exclusively to the test item specified in Section 3.

CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Responsible Test Lab Manager:	Marc Douat
Responsible Project Leader:	Satya Radhakrishna

2.2 Identification of the Client

APPLICANT	
Applicant (Company Name)	Sony Corporation
Street Address	1-7-1 Konan, Minato-ku,
City/Zip Code	Tokyo, 108-0075
Country	Japan
Contact Person	Michio Kobayashi
Telephone	+81-263-72-5696
Fax	+81-263-72-9755
e-mail	<u>Michio.Kobayashi@jp.sony.com</u>

2.3 Identification of the Manufacturer

MANUFACTURER (If different from Applicant)	
Applicant (Firm Name):	Sony EMCS Corporation
Contact Person:	Michio Kobayashi
Telephone:	+81-263-72-5696
Fax:	+81-263-72-9755
Address Line 1:	5432 Toyoshima,
City:	Azumino-shi, Nagano
Postal Code:	399-8282,
Country:	Japan
e-mail:	<u>Michio.Kobayashi@jp.sony.com</u>

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	PCG-31112L
Model No:	PCG-31112L
Product Type:	Personal Computer
FCC-ID:	AK8PCG31112L
IC-ID :	409B-PCG31112L
Frequency:	2400-2483.5 MHz
Type(s) of Modulation:	GFSK, $\pi/4$ DQPSK, 8- DPSK (FHSS)
Number of channels:	79
Antenna Type:	Inverted-F; 2400-2500 MHz (-3.20 dBi Peak Gain)
Output Power:	Radiated GFSK: -4.082 dBm, 0.391 mW Radiated $\pi/4$ DQPSK: -2.655 dBm, 0.543 mW Radiated 8- DPSK: -2.048 dBm, 0.624 mW
Equipment Classification:	☐ Fixed ☐ Vehicular ☒ Portable ☐ Module

3.2 Identification of the Equipment under Test (EUT)

EUT #	TYPE	MANF.	MODEL	SERIAL #
1	EUT	Sony Corporation	PCG-31112L	DVT 14920 1100004 IMEI: 980004000203030

3.3 Identification of Accessory equipment

AE #	TYPE	MANF.	MODEL	SERIAL #
1	AC/DC ADAPTER	Sony Corporation	VGP-AC19V32	1480955310064148



4 Subject Of Investigation

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Industry Canada rules RSS-210 Issue 7.

This test report is to support a request for new equipment authorization under the FCC ID AK8PCG31112L and IC ID 409B-PCG31112L. The EUT integrates an FCC approved Bluetooth module with FCC ID: MCLT77H114 and IC ID: 2878D-T77H114. This report contains findings from radiated measurements only. All the conducted measurements are referenced from the test report of the module, report number RF980731H01.

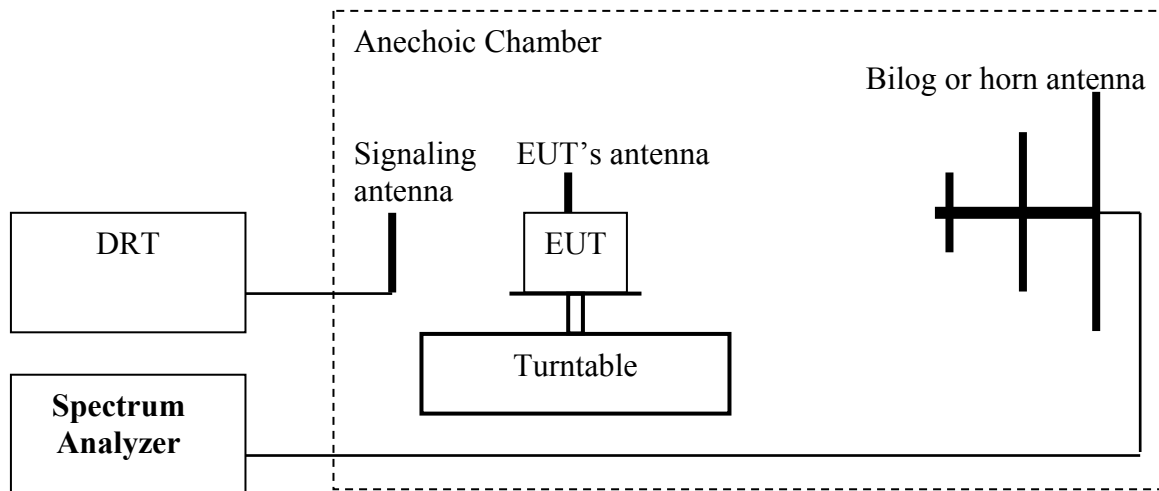
During the testing process the EUT was tested on low, mid, and high channels using PRBS9 payload using DH5, 2DH5, and 3DH5 packets, all data in this report shows the worst case between horizontal and vertical polarization for above 1GHz.

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Industry Canada rules RSS210. The maximization of portable equipment is conducted in accordance with ANSI C63.4.

5 Measurements

5.1 Radiated Measurement Procedure

Ref: TIA-603C 2004 -2.2.17.2 Effective Radiated Power (ERP) or Effective Isotropic Radiated Power (EIRP)



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a vertical orientation.
 2. Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
 3. Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
 4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
 5. Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
 6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
 7. Determine the ERP using the following equation:
ERP (dBm) = LVL (dBm) + LOSS (dB)
 8. Determine the EIRP using the following equation:
EIRP (dBm) = ERP (dBm) + 2.14 (dB)
 9. Measurements are to be performed with the EUT set to the low, middle and high channels.
- Spectrum analyzer settings: RBW=VBW=3MHz**

6 Maximum Peak Output Power (Radiated)

6.1.1 Limits: §15.247 (b)(1)

Nominal Peak Output Power < 30 dBm (1W)

6.1.2 Test Conditions:

Tnom: 23°C; Vnom: 19.5 VDC

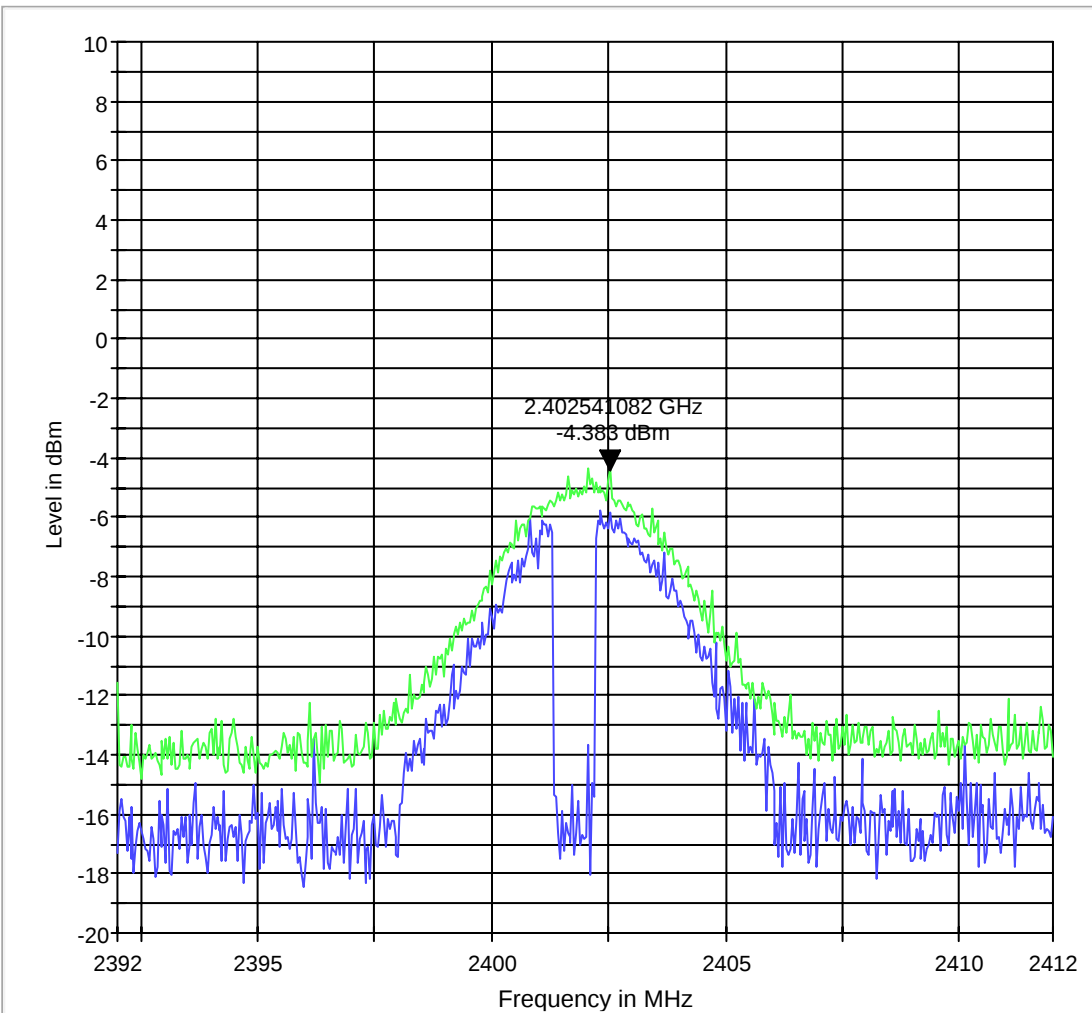
6.1.3 Test Result:

EIRP: Max Peak Output Power- Radiated (dBm)			
Modulation	Frequency (MHz)		
	2402	2441	2480
GFSK	-4.383	-4.082	-5.053
$\pi/4$ DQPSK	-3.932	-2.655	-3.286
8-DPSK	-2.238	-2.048	-2.964
Measurement Uncertainty: ± 3 dB			

6.1.4 Test Data/plots:

EIRP GFSK 2402 MHz

EIRP BT L

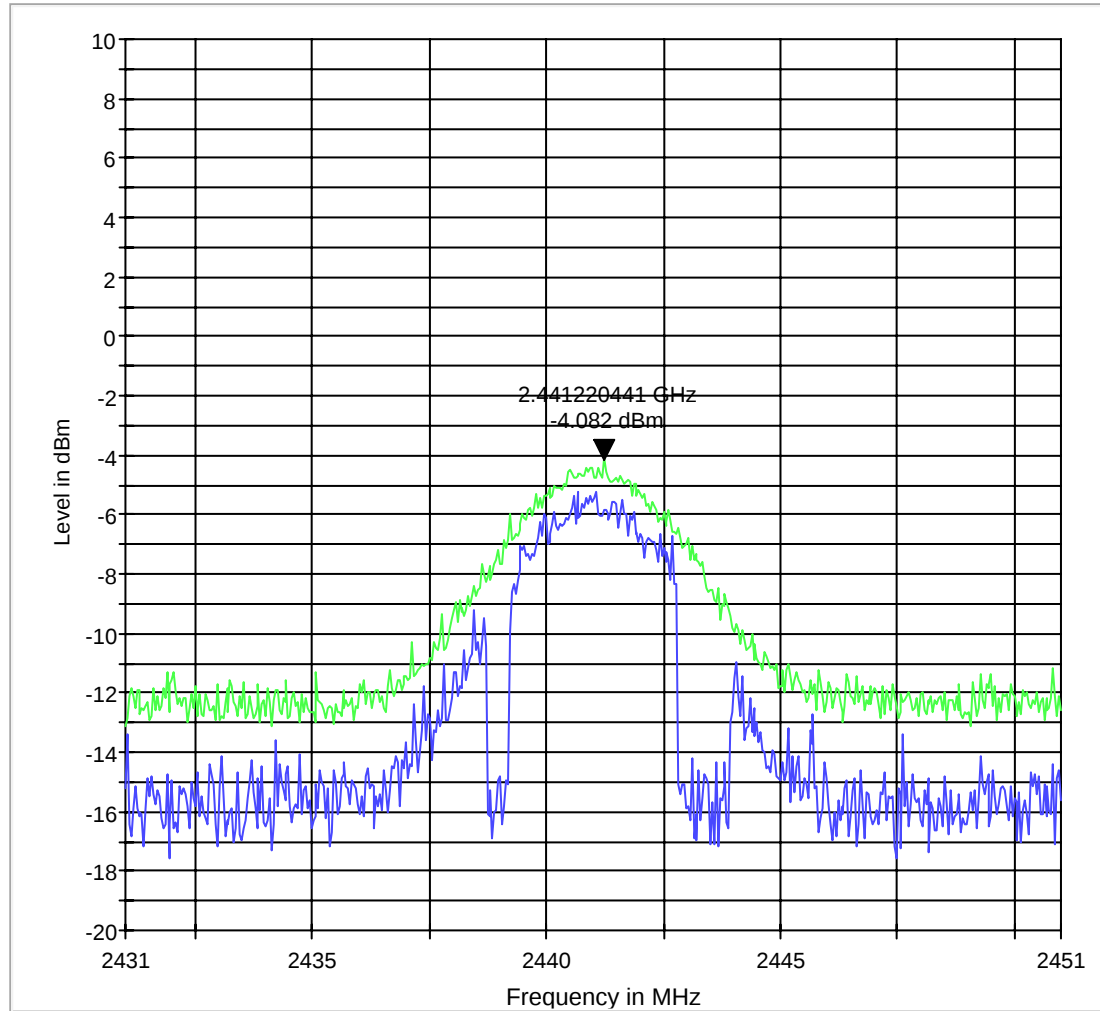


MaxPeak-ClearWrite

MaxPeak-MaxHold

EIRP GFSK 2441 MHz

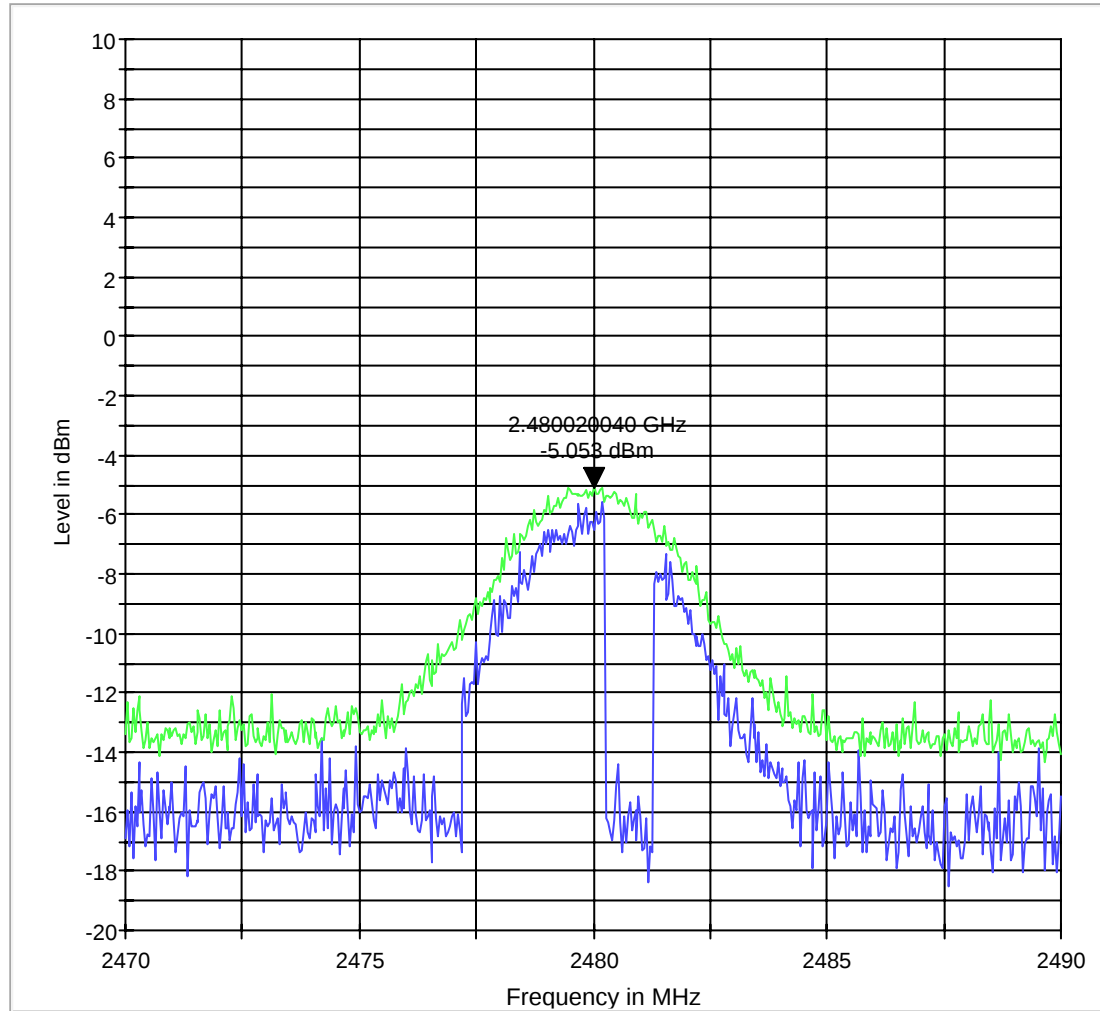
EIRP BT M



MaxPeak-ClearWrite MaxPeak-MaxHold

EIRP GFSK 2480 MHz

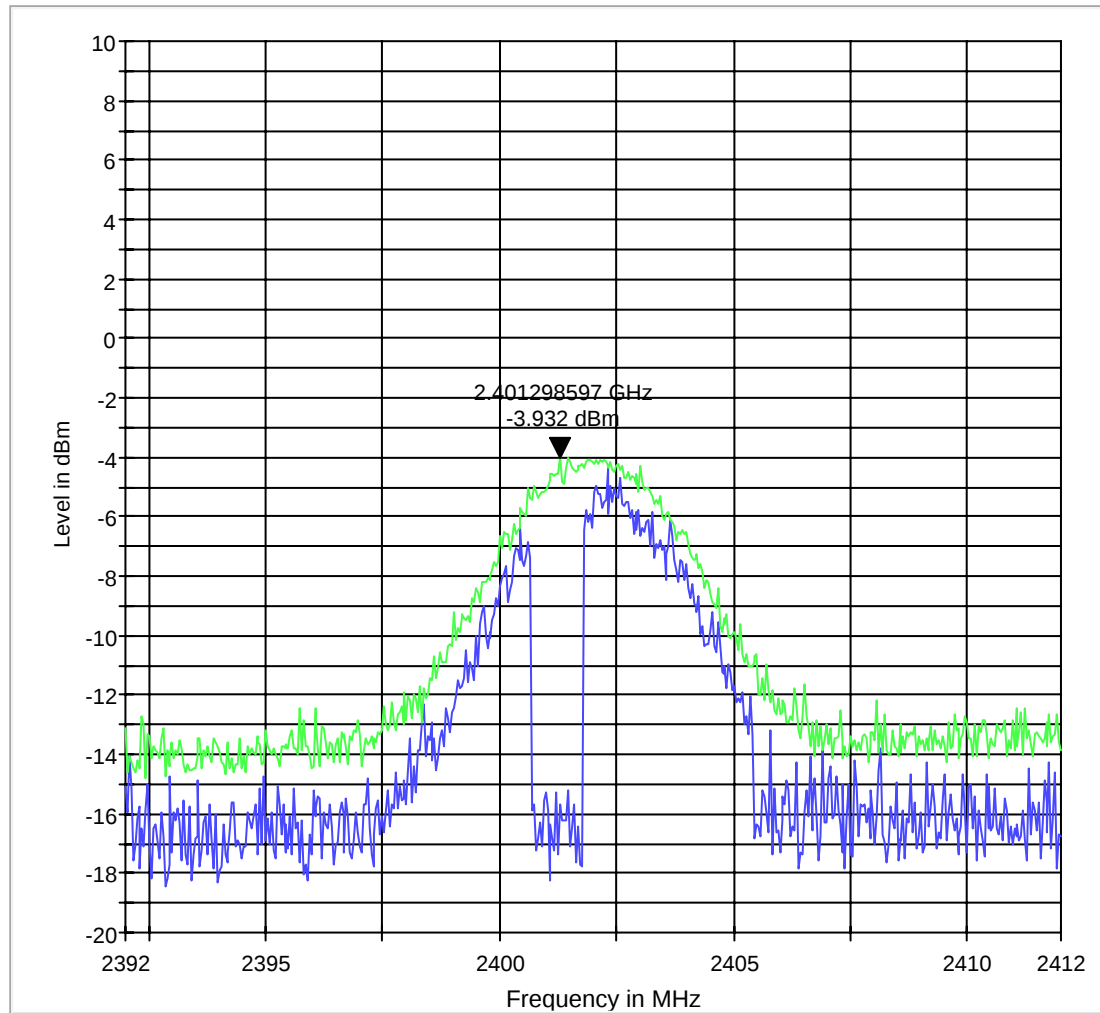
EIRP BT H



MaxPeak-ClearWrite MaxPeak-MaxHold

EIRP $\pi / 4$ DQPSK 2402 MHz

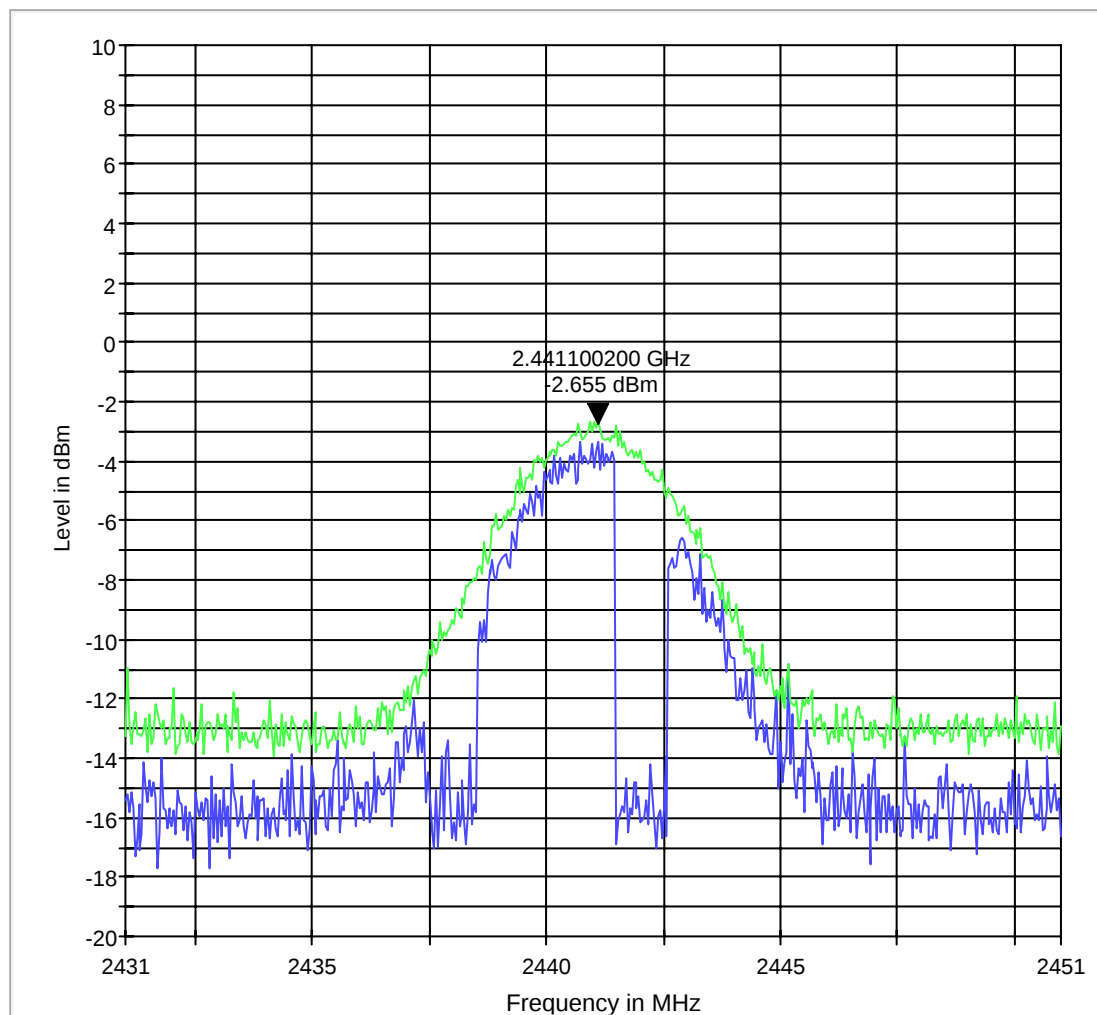
EIRP BT L



MaxPeak-ClearWrite MaxPeak-MaxHold

EIRP $\pi / 4$ DQPSK 2441 MHz

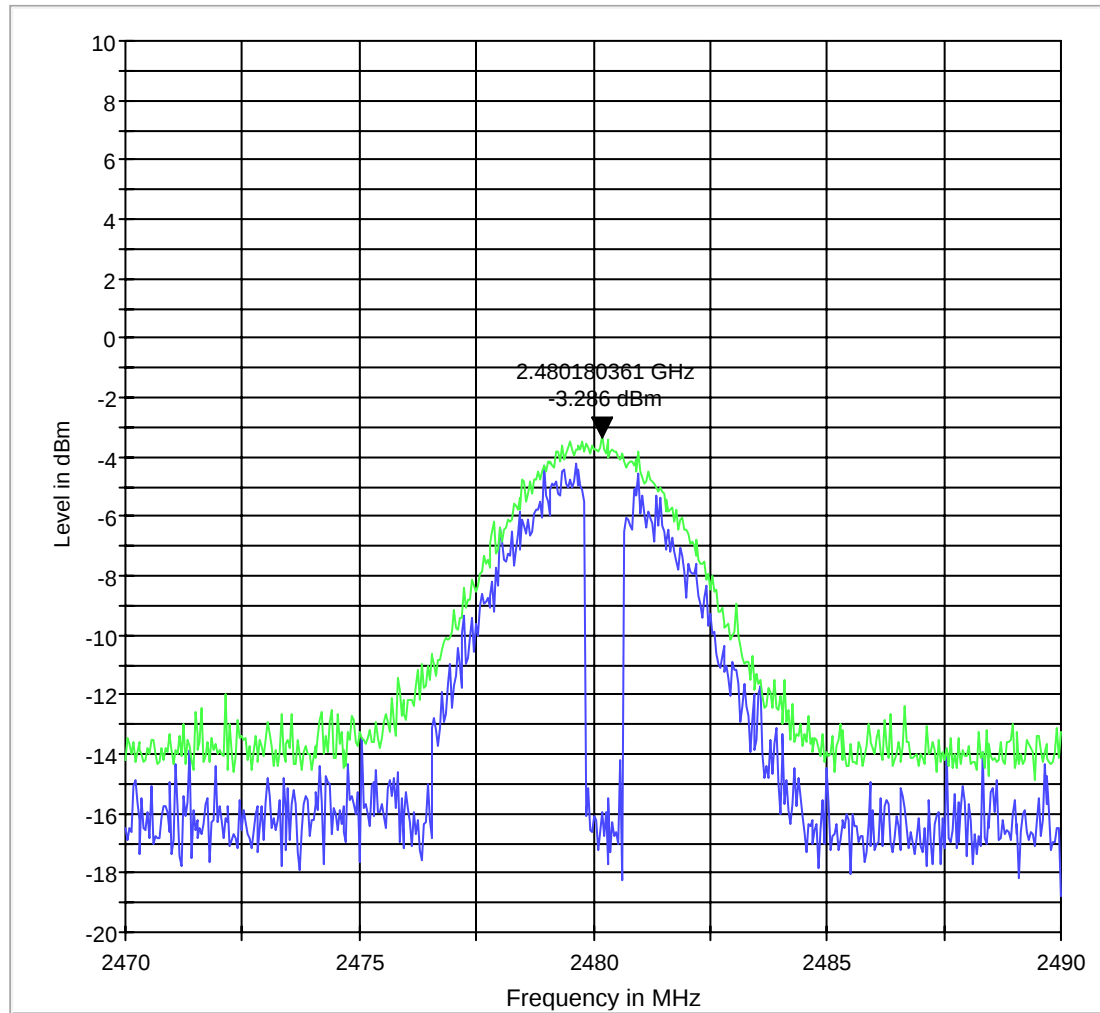
EIRP BT M



MaxPeak-ClearWrite MaxPeak-MaxHold

EIRP $\pi / 4$ DQPSK 2480 MHz

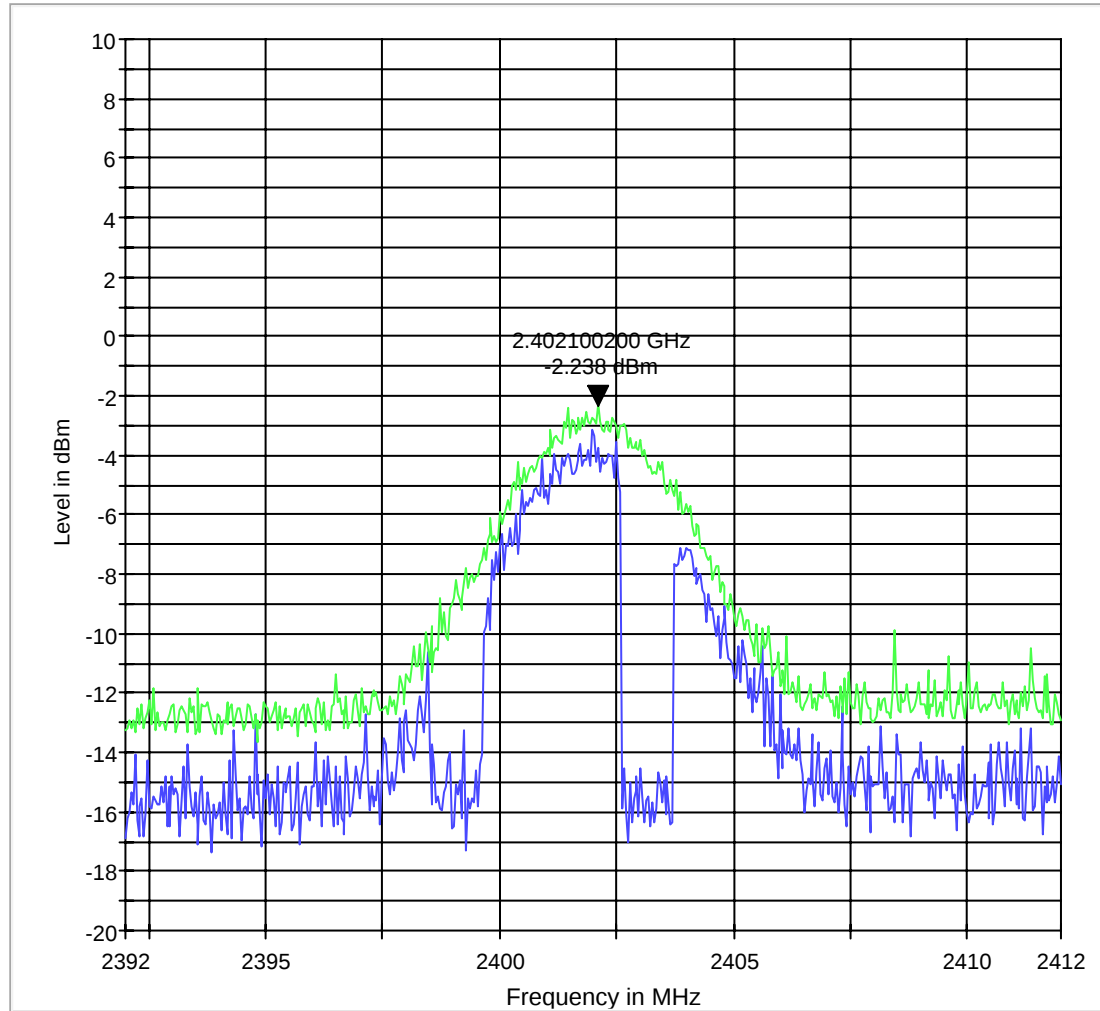
EIRP BT H



MaxPeak-ClearWrite MaxPeak-MaxHold

EIRP 8DPSK 2402 MHz

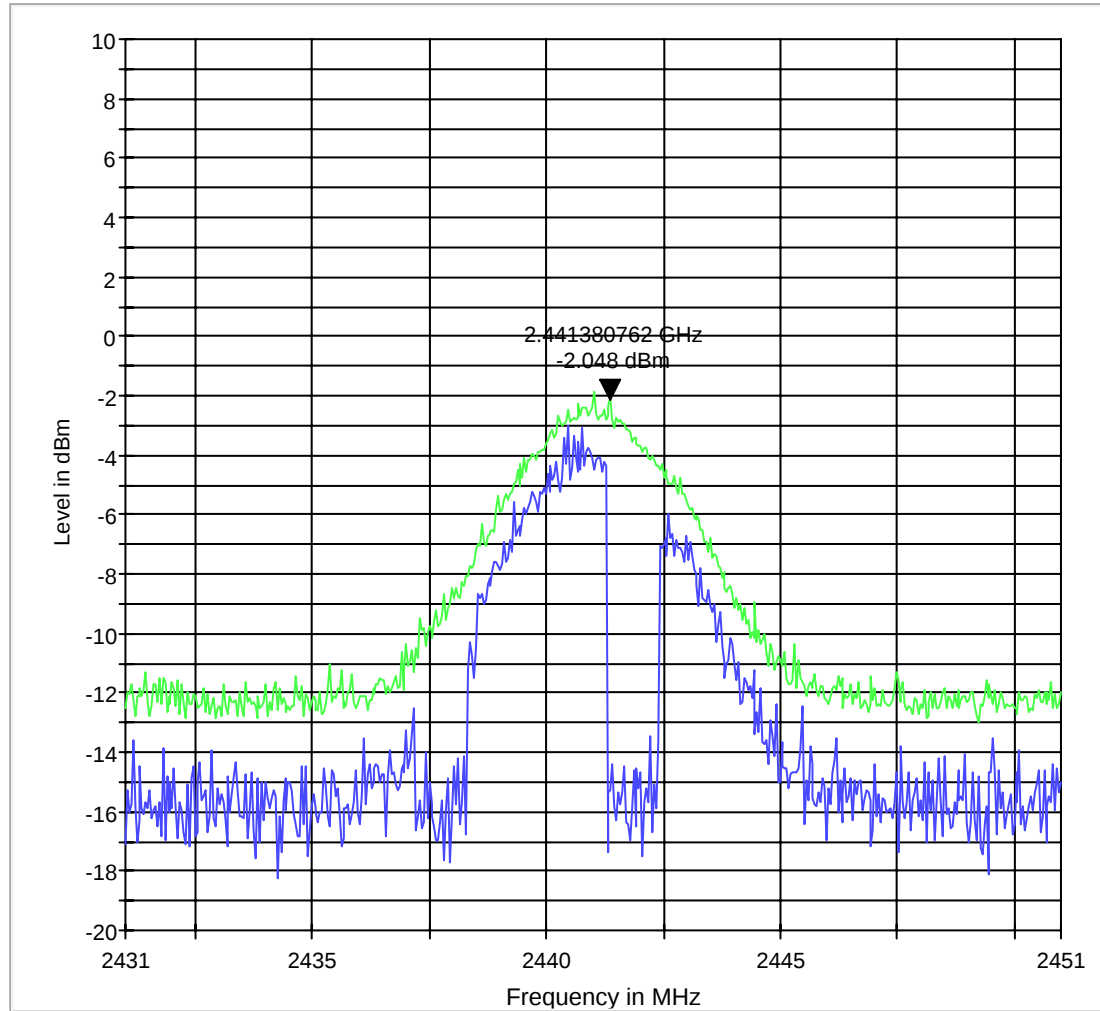
EIRP BT L



MaxPeak-ClearWrite MaxPeak-MaxHold

EIRP 8DPSK 2441 MHz

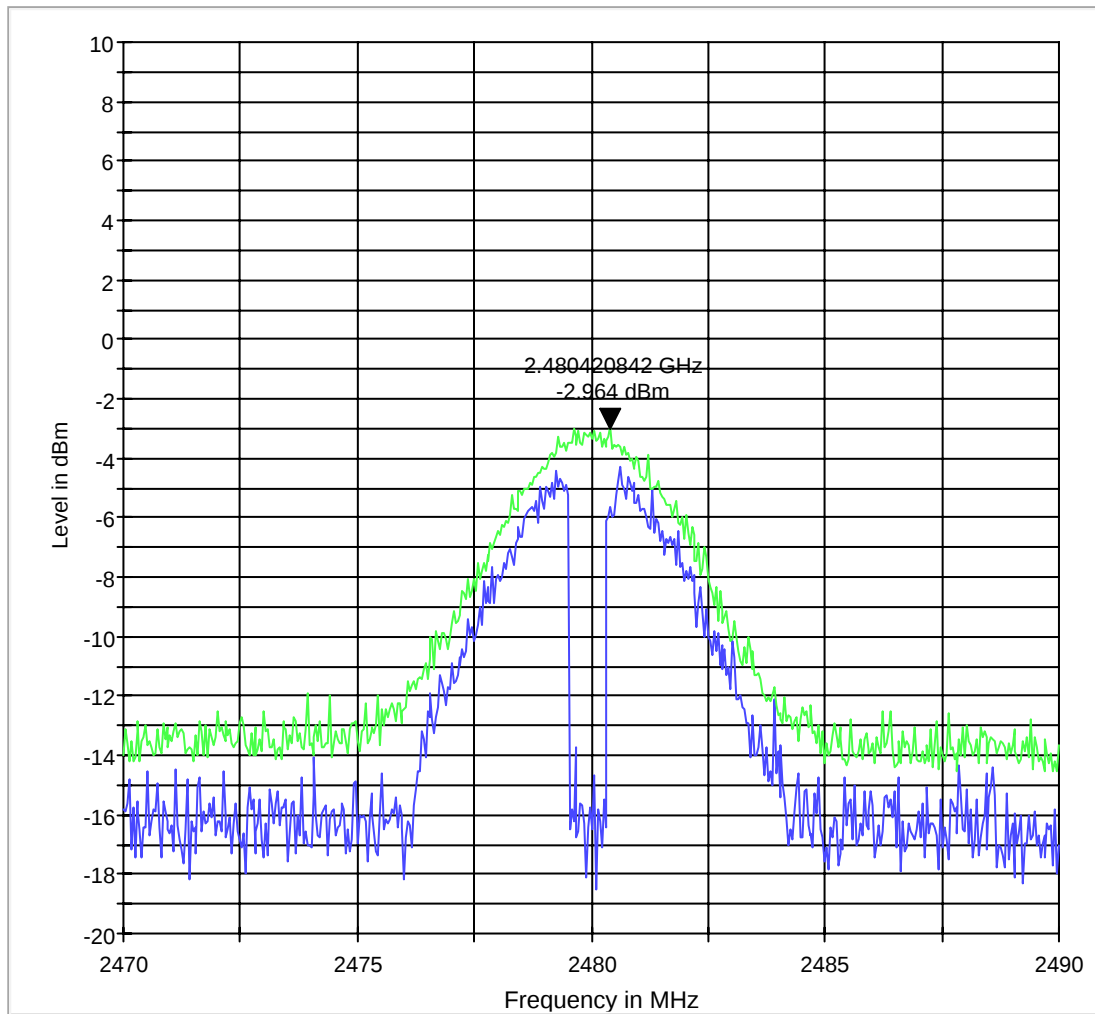
EIRP BT M



MaxPeak-ClearWrite MaxPeak-MaxHold

EIRP 8DPSK 2480 MHz

EIRP BT H



MaxPeak-ClearWrite

MaxPeak-MaxHold

6.2 Restricted Band Edge Compliance

6.2.1 Limits: §15.247/15.205

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

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)
13.36 - 13.41			

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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) (see §15.205(c)).

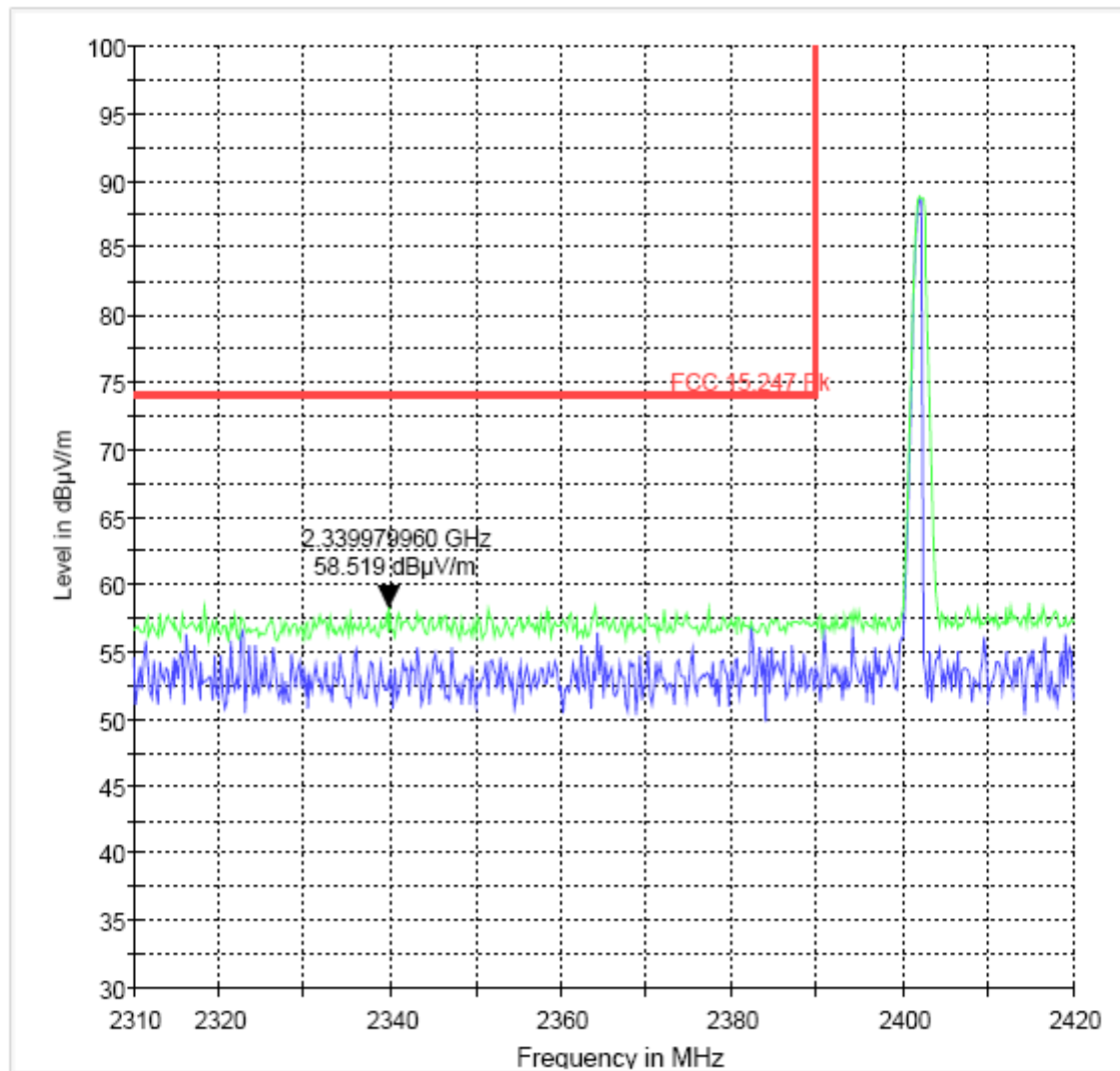
*PEAK LIMIT= 74dB μ V/m

*AVG. LIMIT= 54dB μ V/m

6.2.2 Test Data/plots:

Lower band edge peak -GFSK modulation

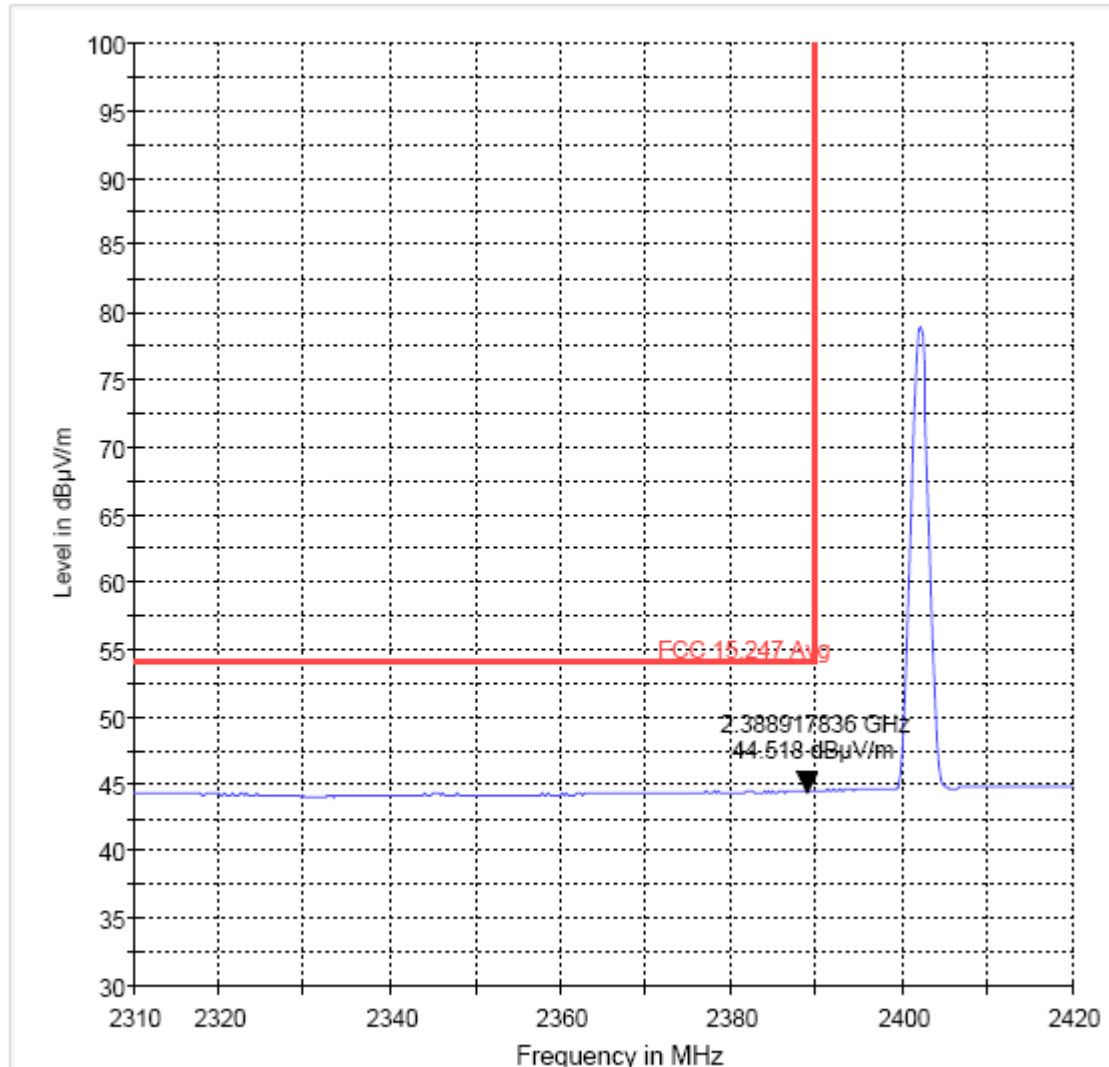
FCC 15.247 LBE Pk 3m



MaxPeak-ClearWrite MaxPeak-MaxHold FCC 15.247 Pk

Lower band edge average -GFSK modulation

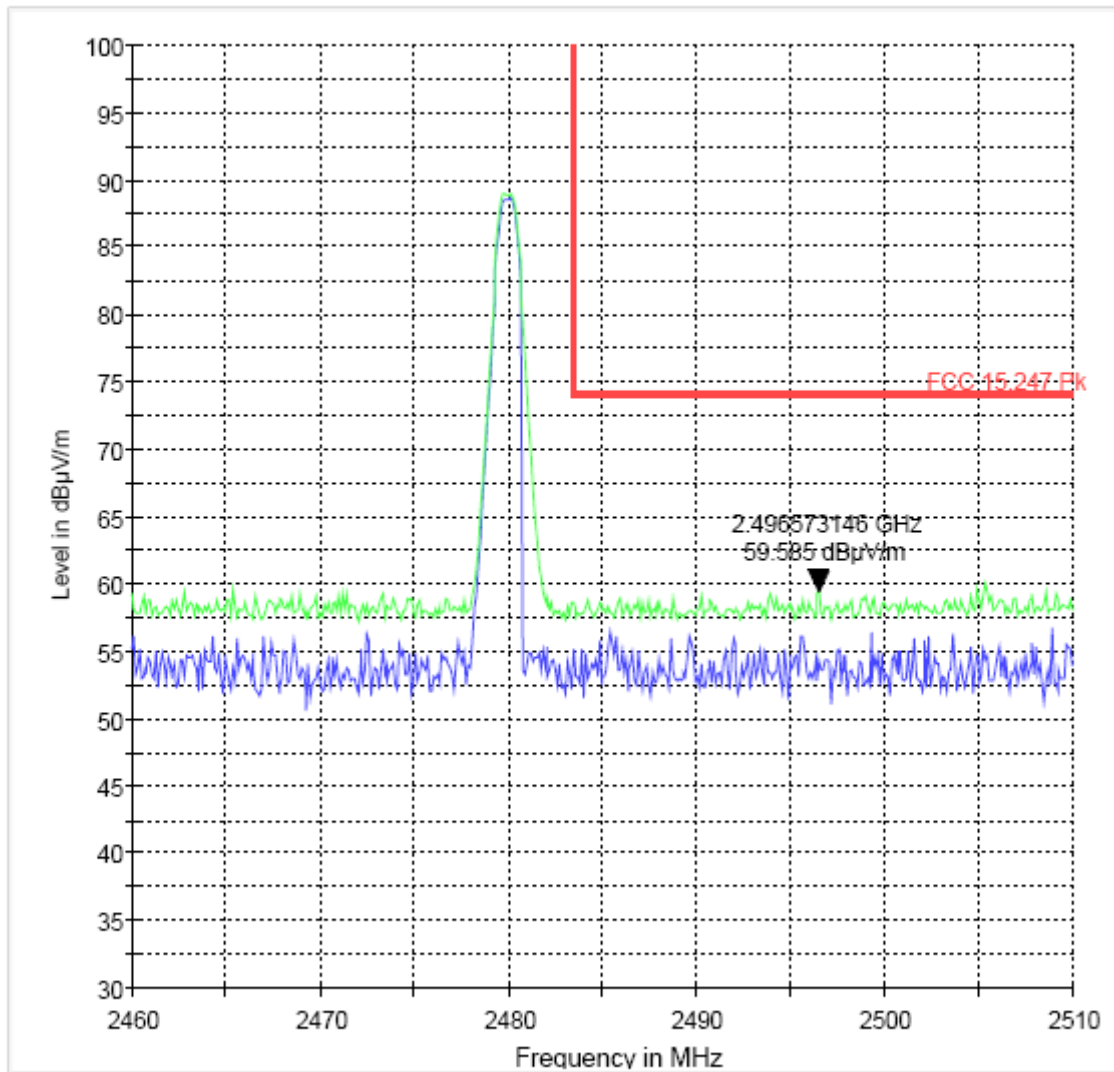
FCC 15.247 LBE Avg 3m



MaxPeak-MaxHold Average-MaxHold FCC 15.247 Avg

Higher band edge peak -GFSK modulation

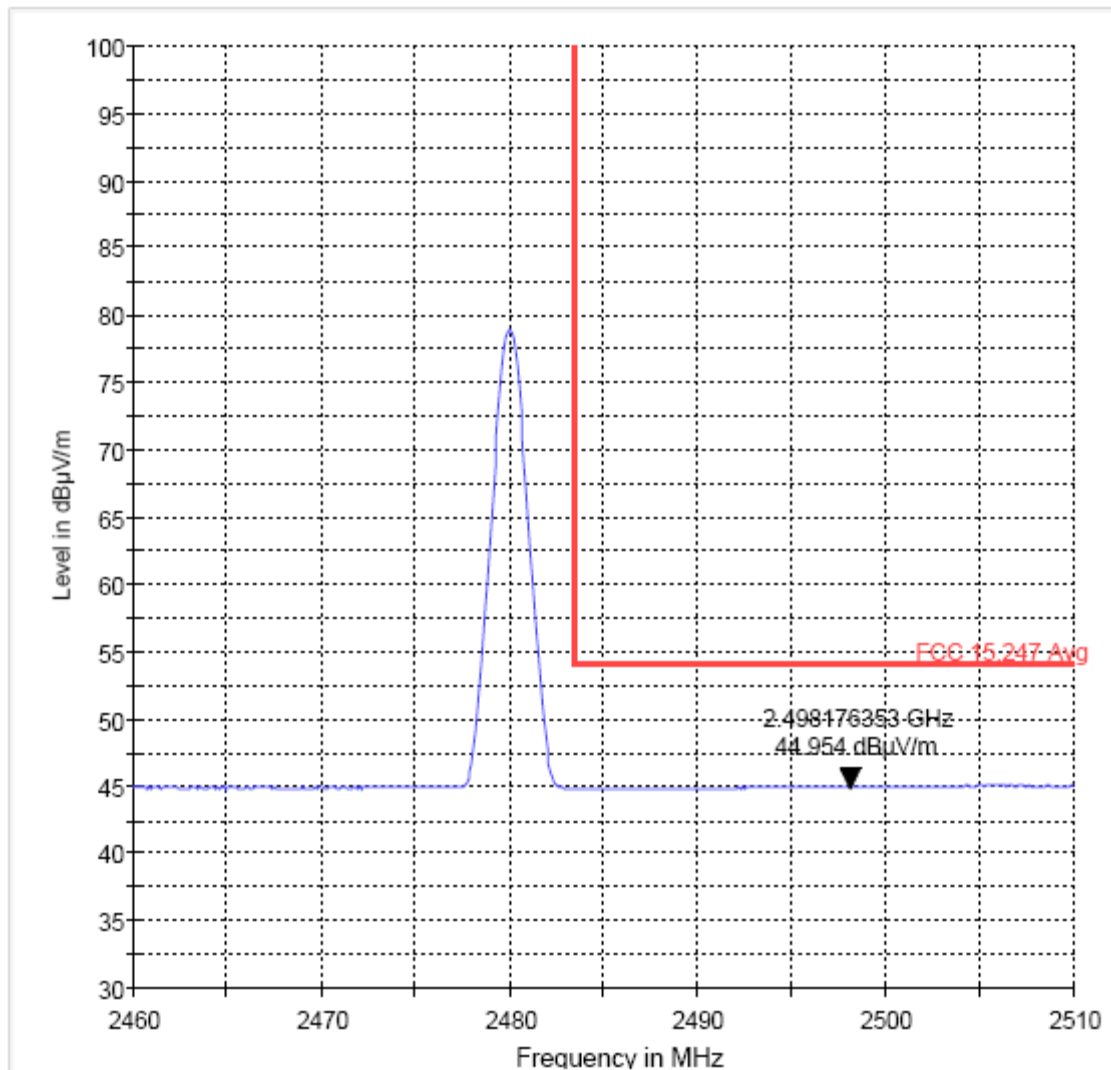
FCC 15.247 HBE Pk 3m



— MaxPeak-ClearWrite — MaxPeak-MaxHold — FCC 15.247 Pk

Higher band edge average-GFSK modulation

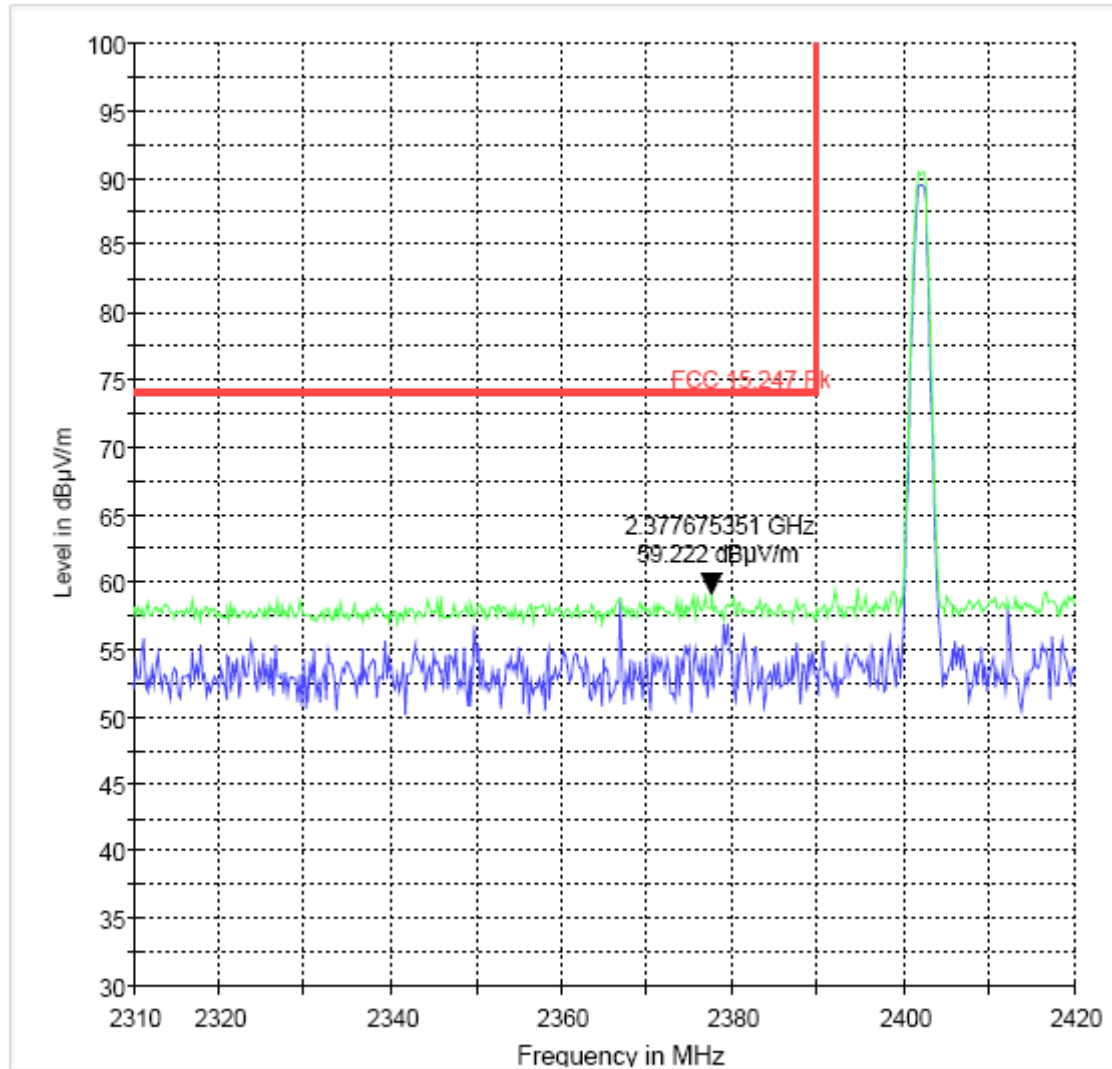
FCC 15.247 HBE Avg 3m



— MaxPeak-MaxHold — FCC 15.247 Avg

Lower band edge peak - $\pi/4$ DQPSK modulation

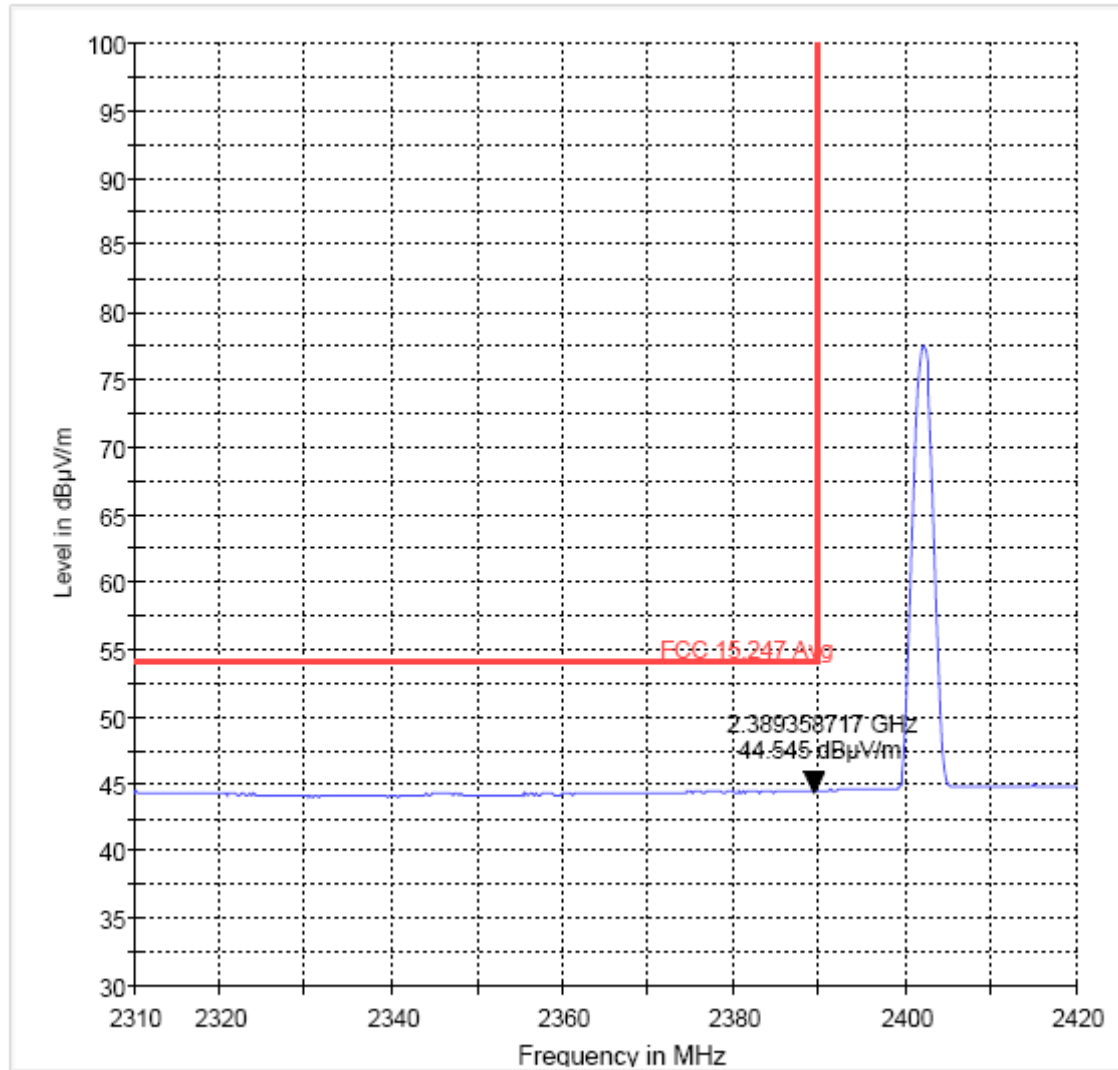
FCC 15.247 LBE Pk 3m



MaxPeak-ClearWrite MaxPeak-MaxHold FCC 15.247 Pk

Lower band edge average $-\pi/4$ DQPSK modulation

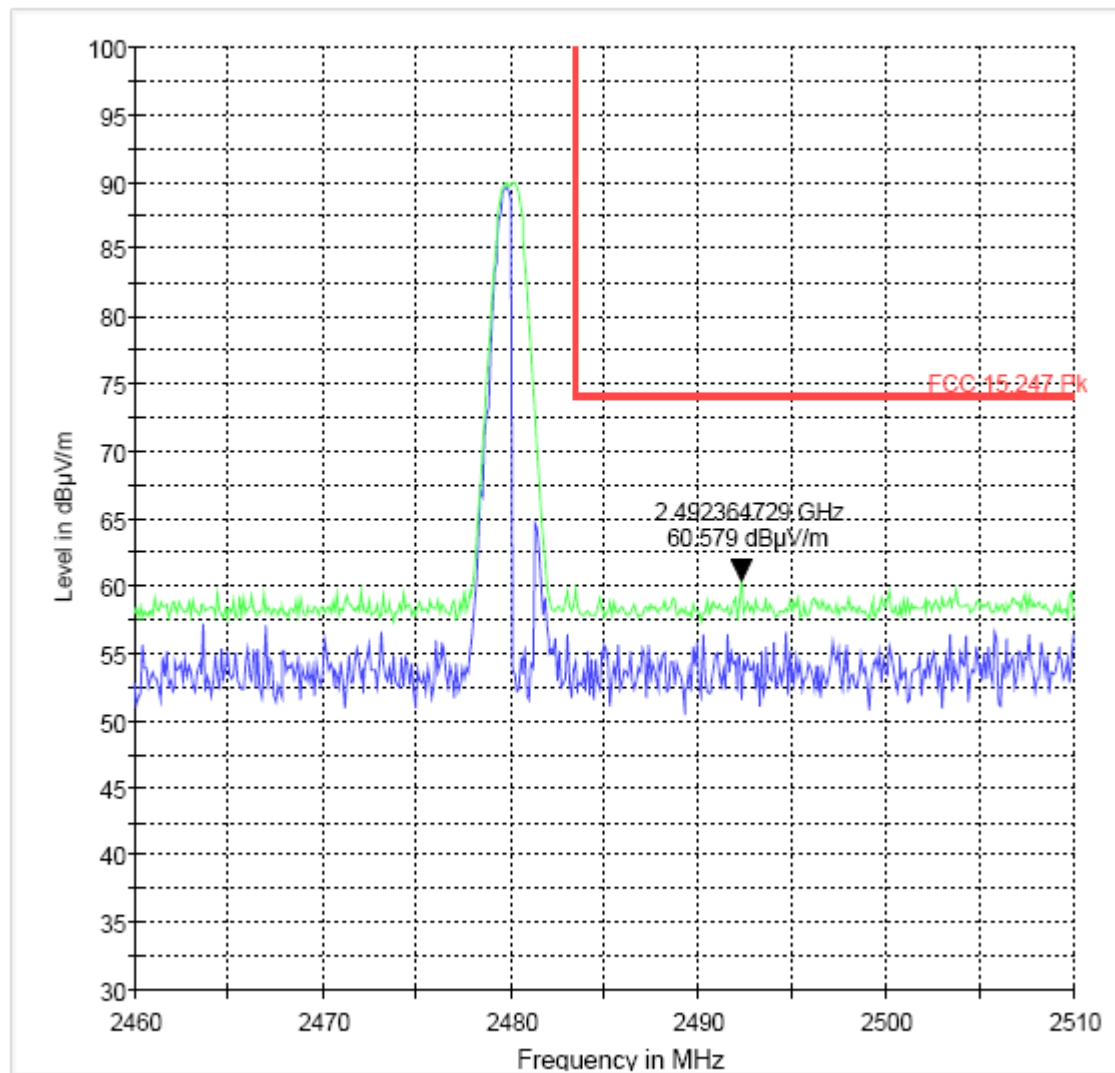
FCC 15.247 LBE Avg 3m



MaxPeak-MaxHold Average-MaxHold FCC 15.247 Avg

Higher band edge peak $-\pi/4$ DQPSK modulation

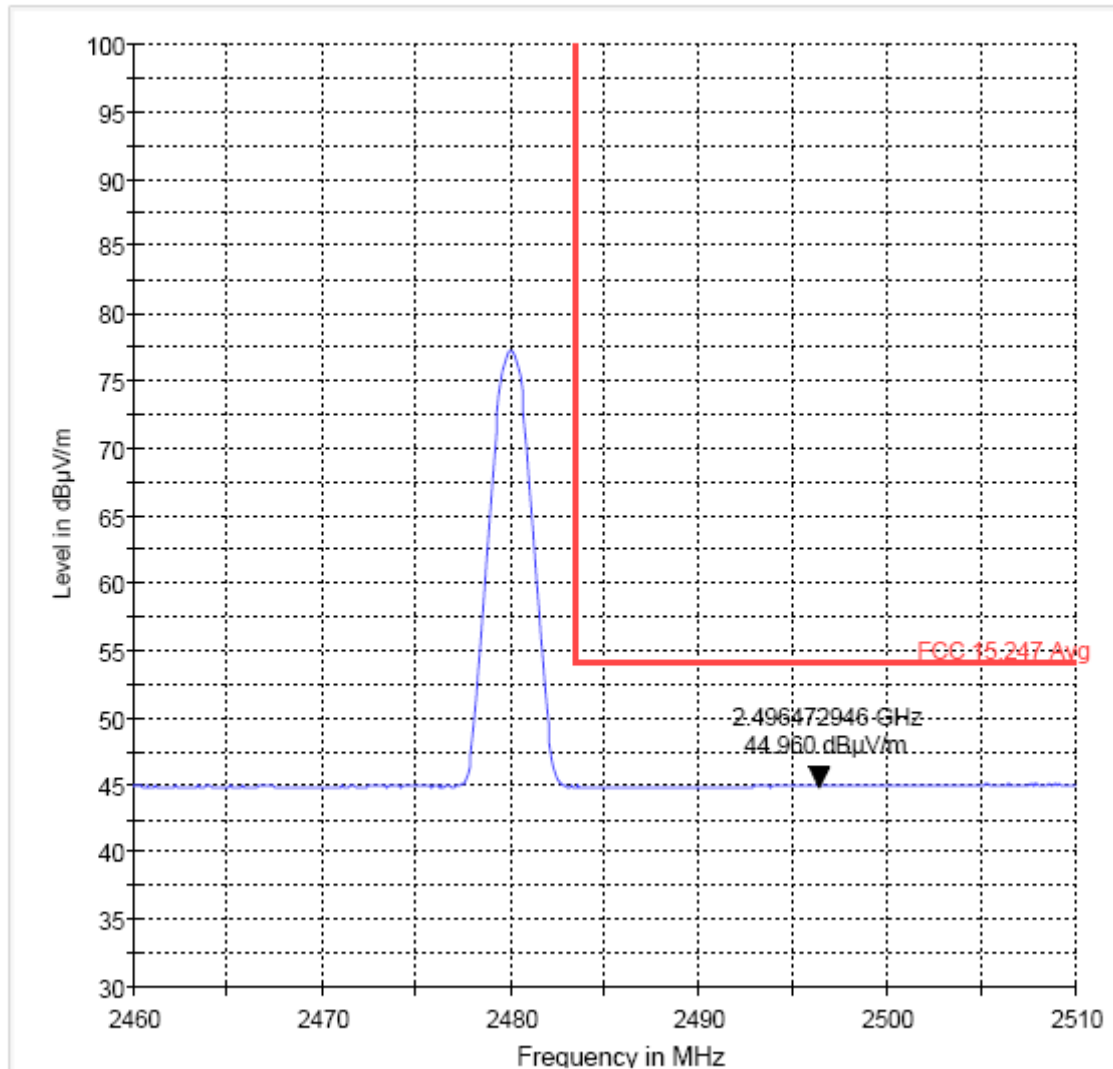
FCC 15.247 HBE Pk 3m



MaxPeak-ClearWrite MaxPeak-MaxHold FCC 15.247 Pk

Higher band edge average- $\pi/4$ DQPSK modulation

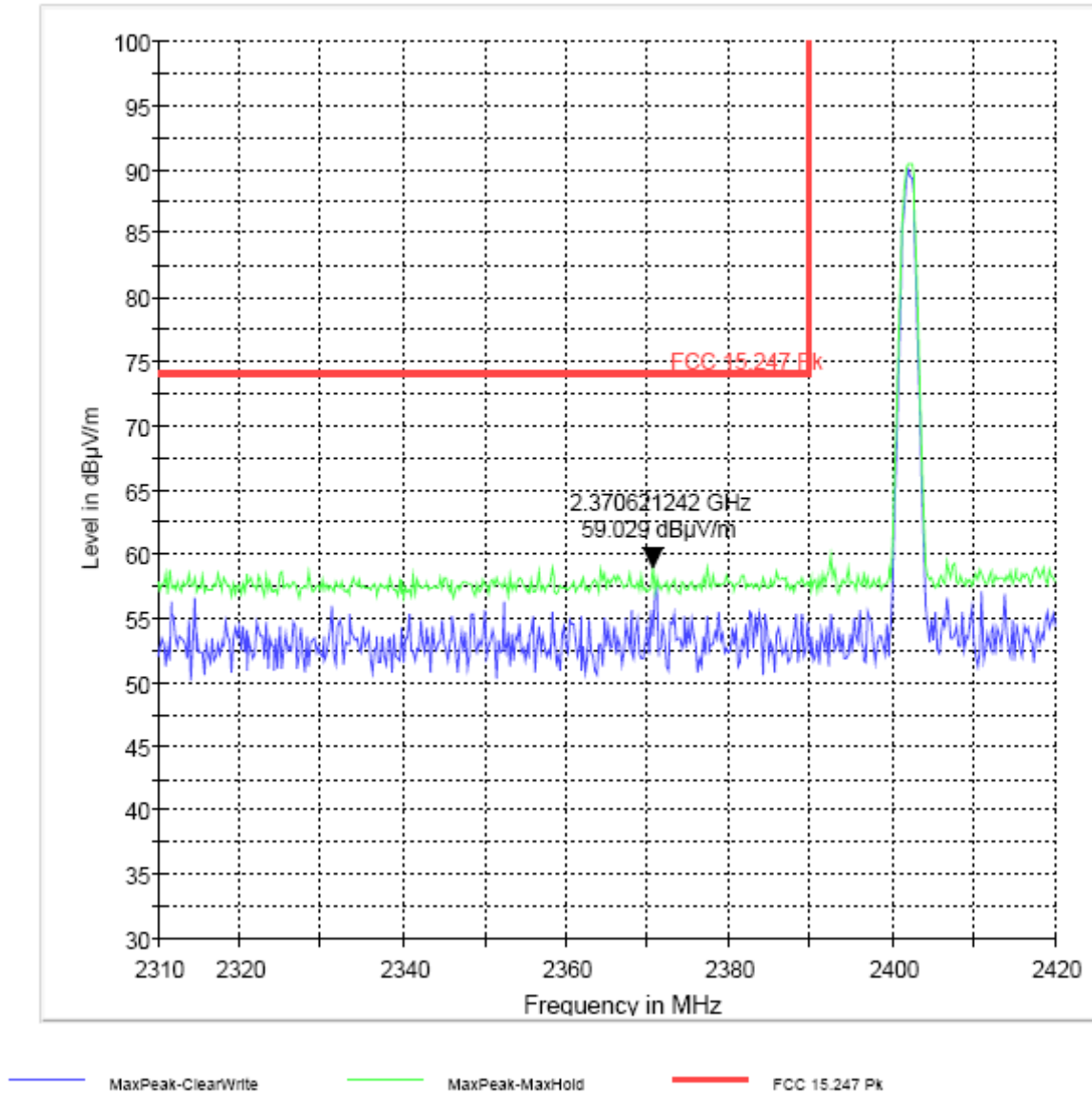
FCC 15.247 HBE Avg 3m



— MaxPeak-MaxHold — FCC 15.247 Avg

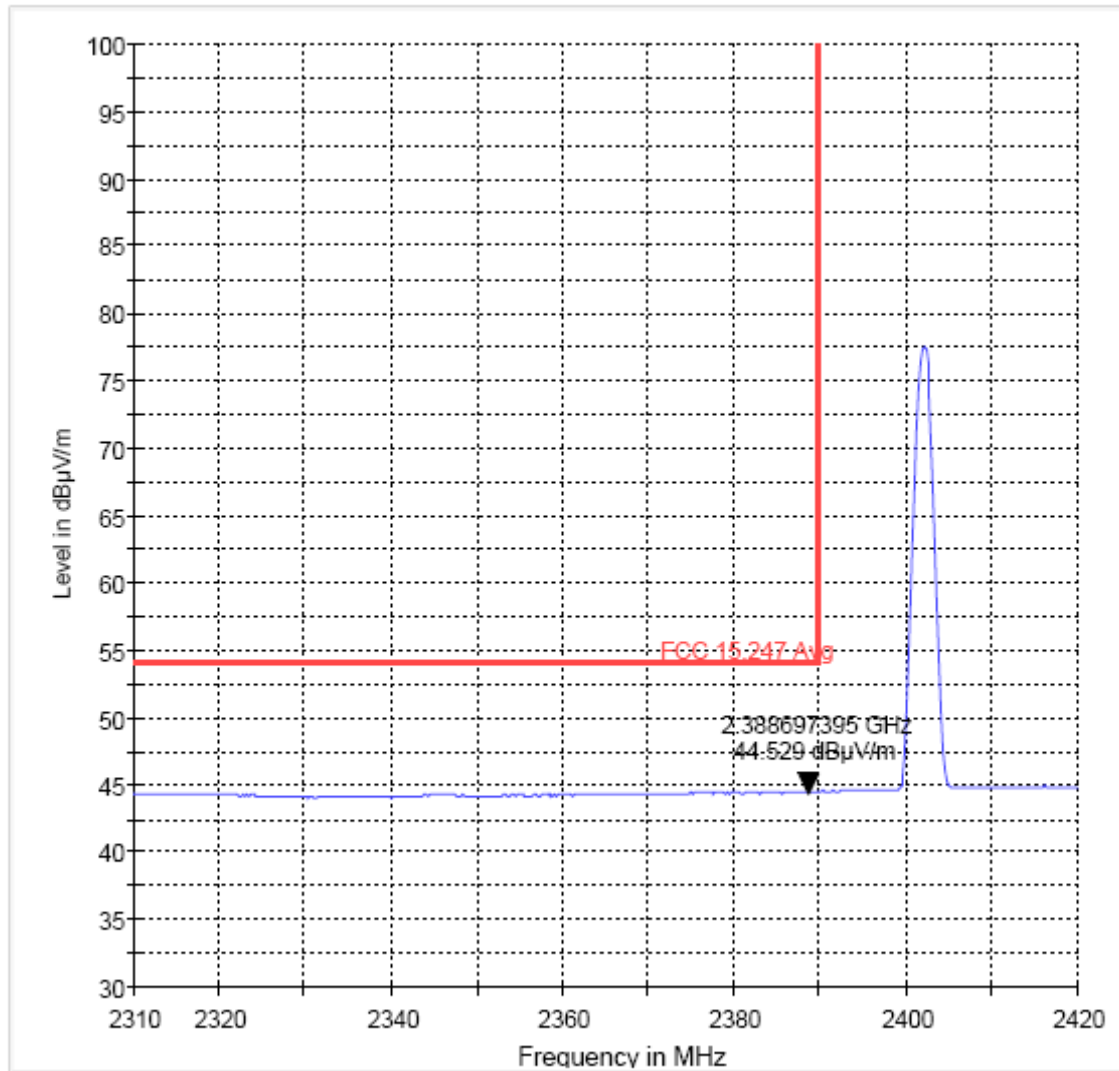
Lower band edge peak - 8DPSK modulation

FCC 15.247 LBE Pk 3m



Lower band edge average -8DPSK modulation

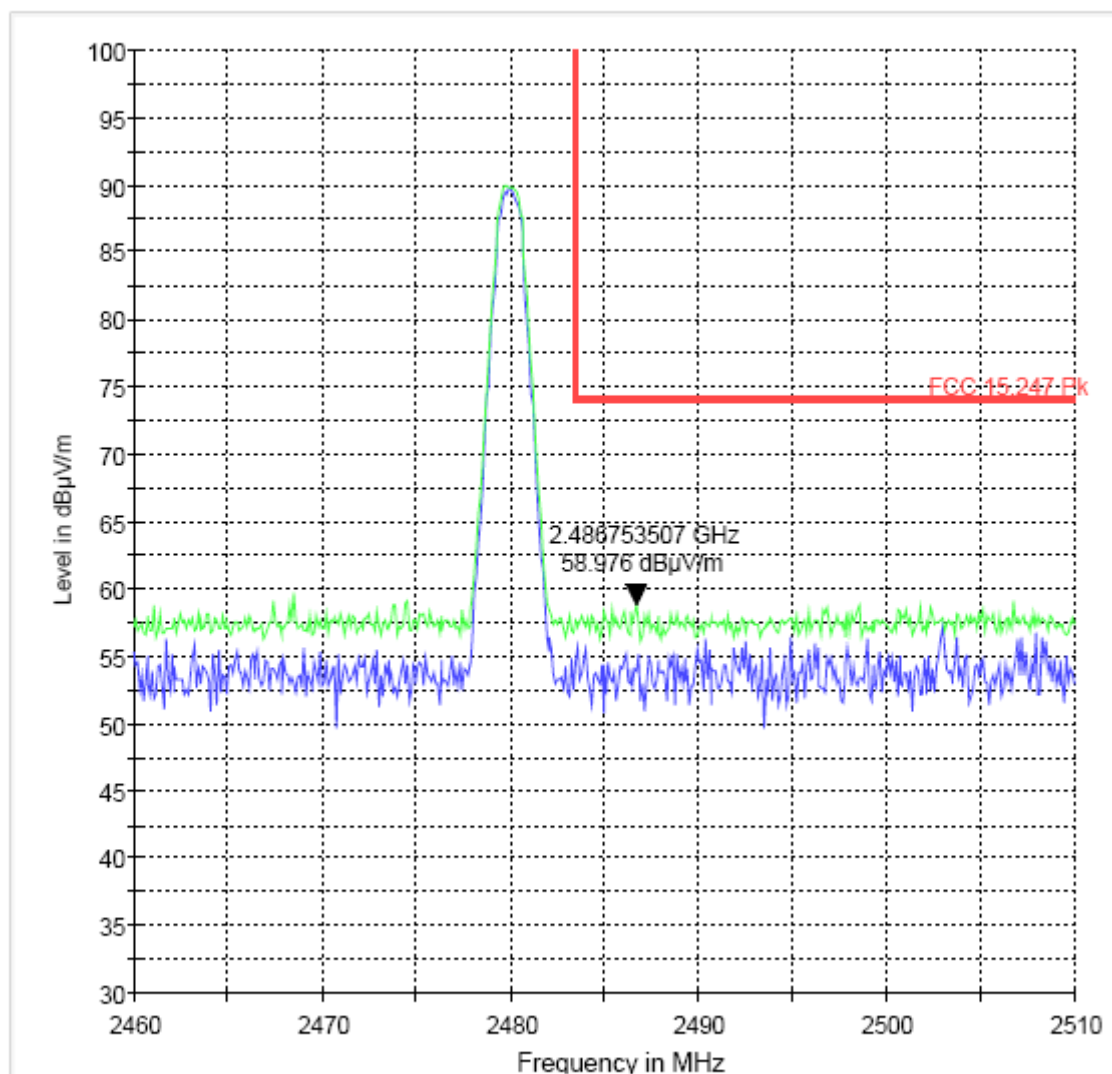
FCC 15.247 LBE Avg 3m



MaxPeak-MaxHold Average-MaxHold FCC 15.247 Avg

Higher band edge peak - 8DPSK modulation

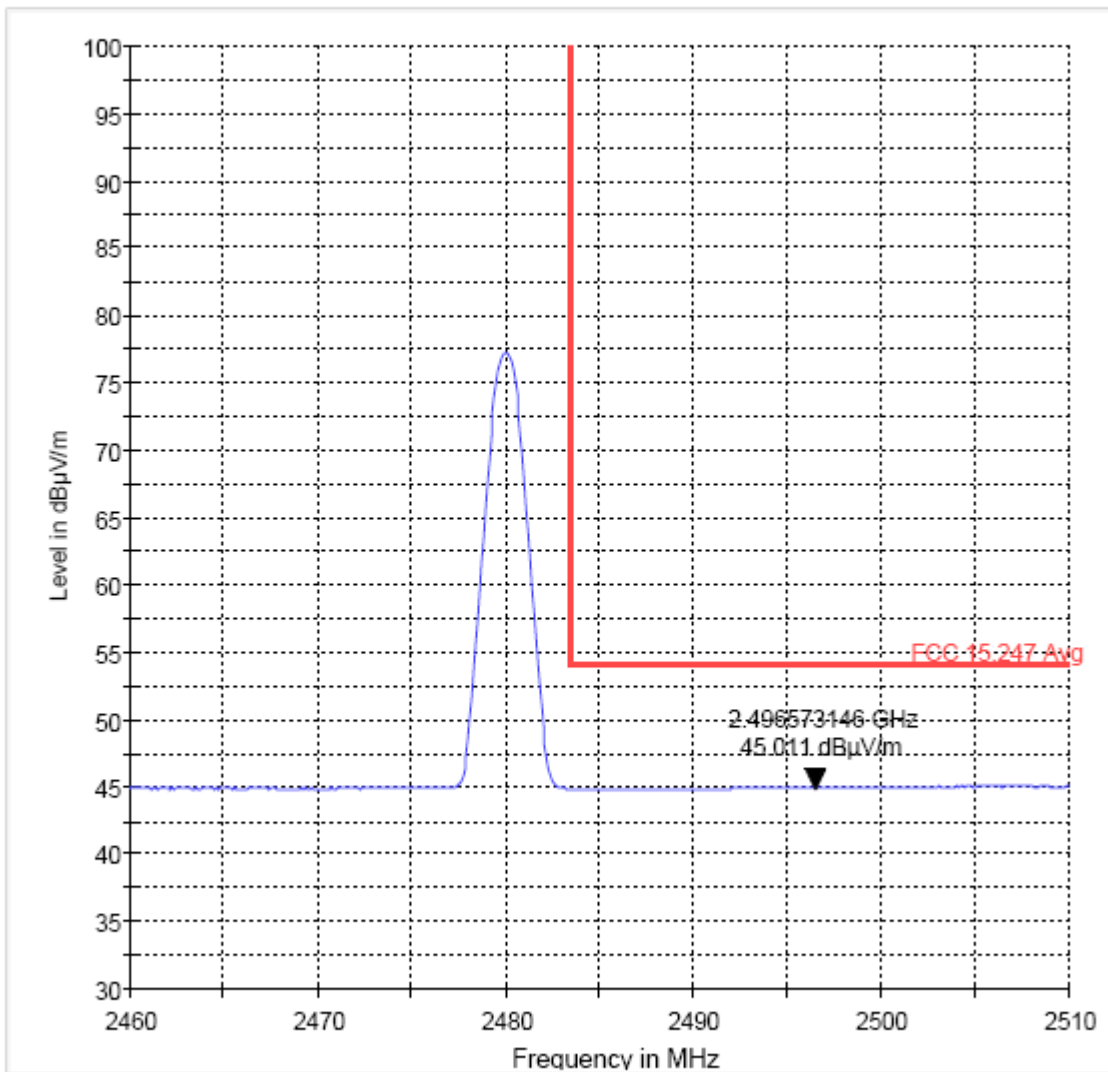
FCC 15.247 HBE Pk 3m



MaxPeak-ClearWrite MaxPeak-MaxHold FCC 15.247 Pk

Higher band edge average-8DPSK modulation

FCC 15.247 HBE Avg 3m



MaxPeak-MaxHold FCC 15.247 Avg

6.3 Transmitter Spurious Emissions- Radiated

6.3.1 Limits: §15.247/15.205

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

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)
13.36 - 13.41			

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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) (see §15.205(c)).

*PEAK LIMIT= 74dB μ V/m

*AVG. LIMIT= 54dB μ V/m

6.3.2 Limits: §15.209

(For measurement distance of 3m)

Frequency of emission (MHz)	Field strength (μ V/m)
30-88	100 (40dB μ V/m)
88-216	150 (43.5 dB μ V/m)
216-960	200 (46 dB μ V/m)
Above 960	500 (54 dB μ V/m)

NOTE:

1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 25 GHz very short cable connections to the antenna was used to minimize the noise level.

2. All measurements are done in Peak mode using an Average limit, unless specified within the plots.

6.3.3 Limits: §15.209

Frequency of emission (MHz)	Field strength (μV/m)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30

6.3.4 Test Result:

No significant emissions measurable. Plots reported here represent the worse case emissions.

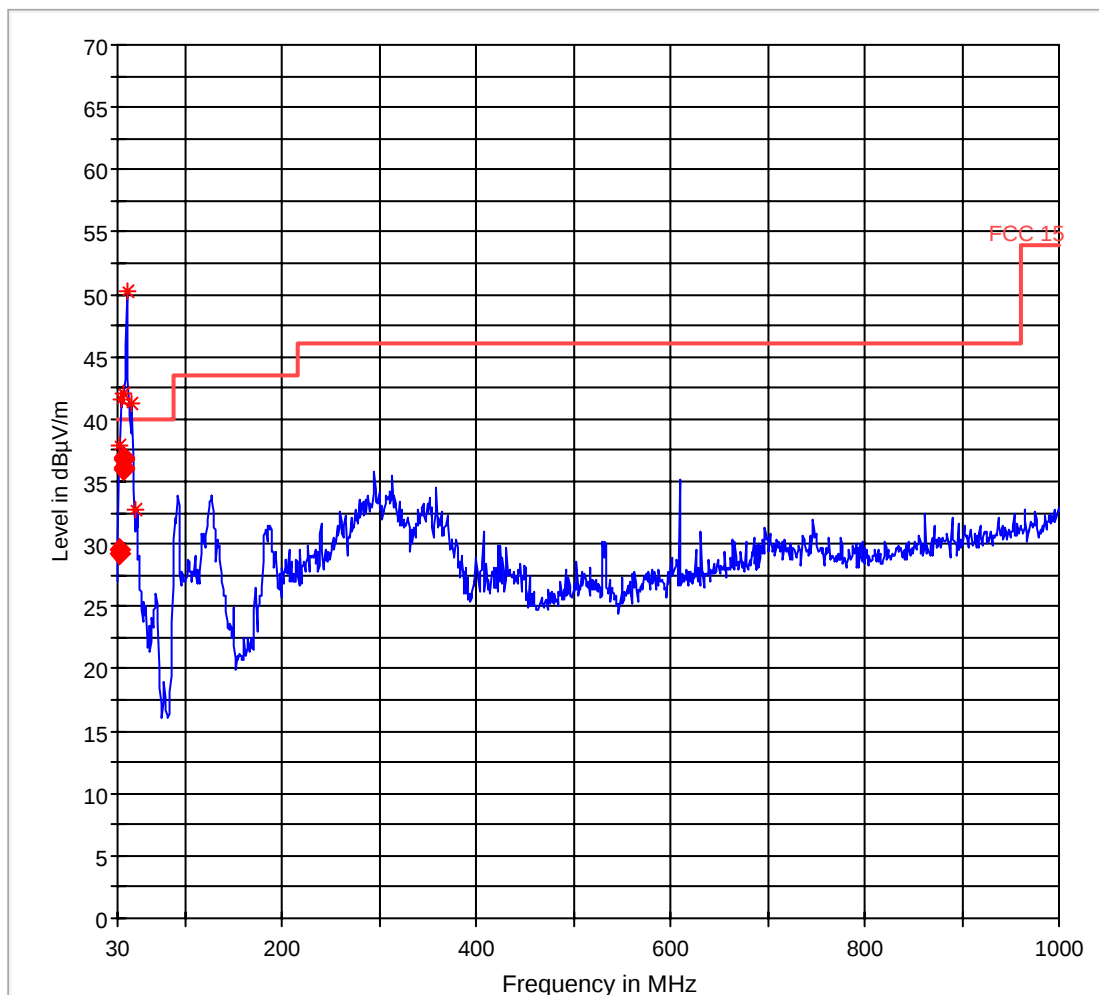
6.3.5 Test data/ plots:**30MHz-1GHz:BT TX : 8DPSK modulation: CH 0**

Note: Plot contains results of measurements with antenna in horizontal and vertical polarizations

Final Measurement Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Comment
32.202606	29.5	20.000	120.000	120.0	V	0.0	7.0	
32.202606	29.2	20.000	120.000	120.0	V	0.0	7.0	
35.833489	36.8	20.000	120.000	120.0	V	45.0	6.3	
35.833489	36.0	20.000	120.000	120.0	V	45.0	6.3	
35.992190	36.1	20.000	120.000	120.0	V	82.0	6.2	
36.252574	36.9	20.000	120.000	144.0	V	127.0	6.2	

FCC 15 30-1000MHz



FCC 15.LimitLine
Data Reduction 1 [1]

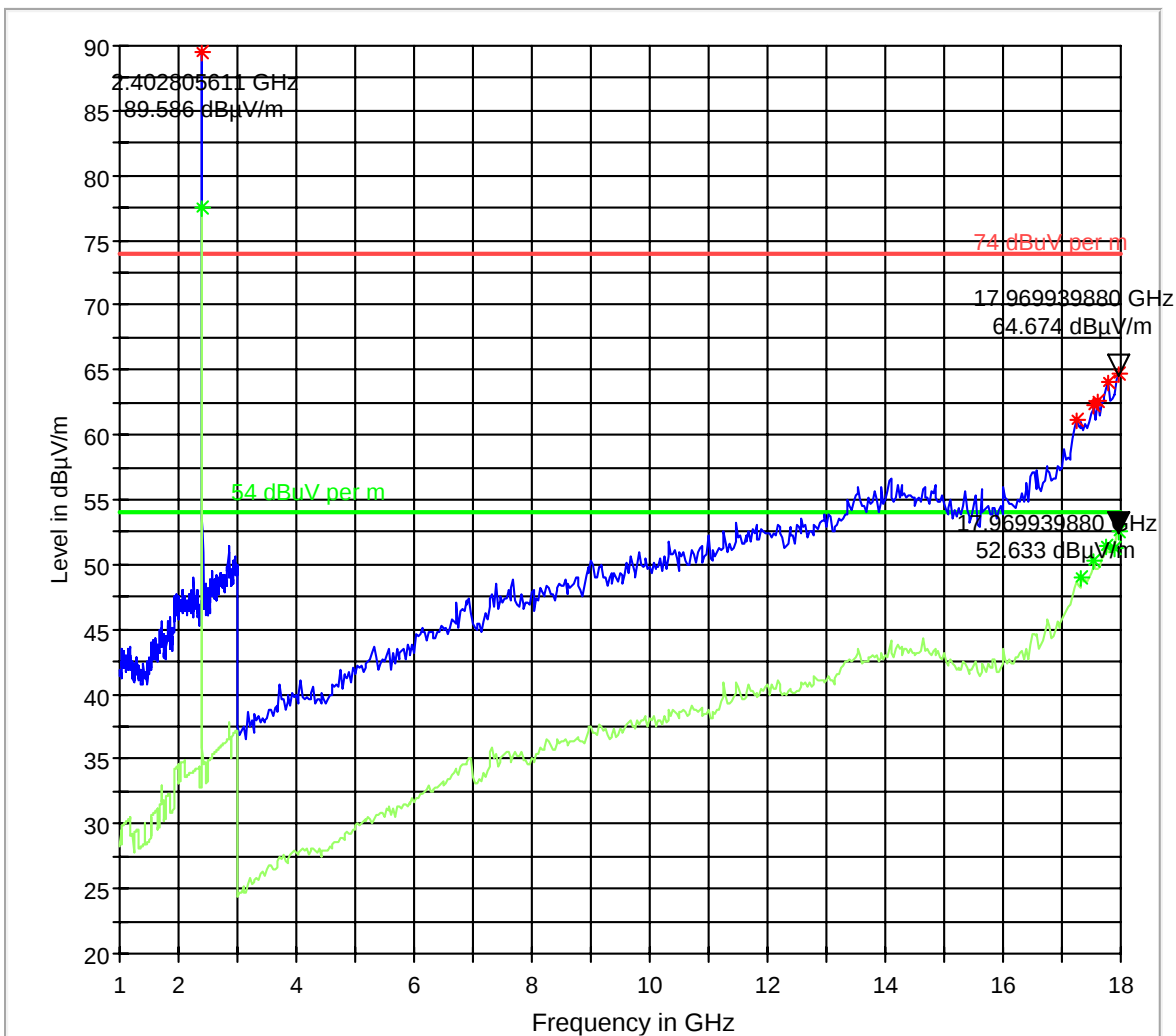


Preview Result 1
Final Measurement Result 1

TX 1GHz-18GHz 8DPSK modulation: CH 0

Note: Signal over the limit is the carrier frequency. Plot contains results of measurements with antenna in horizontal and vertical polarizations

FCC 15 1-18GHz



74 dBuV per m.LimitLine
Preview Result 2

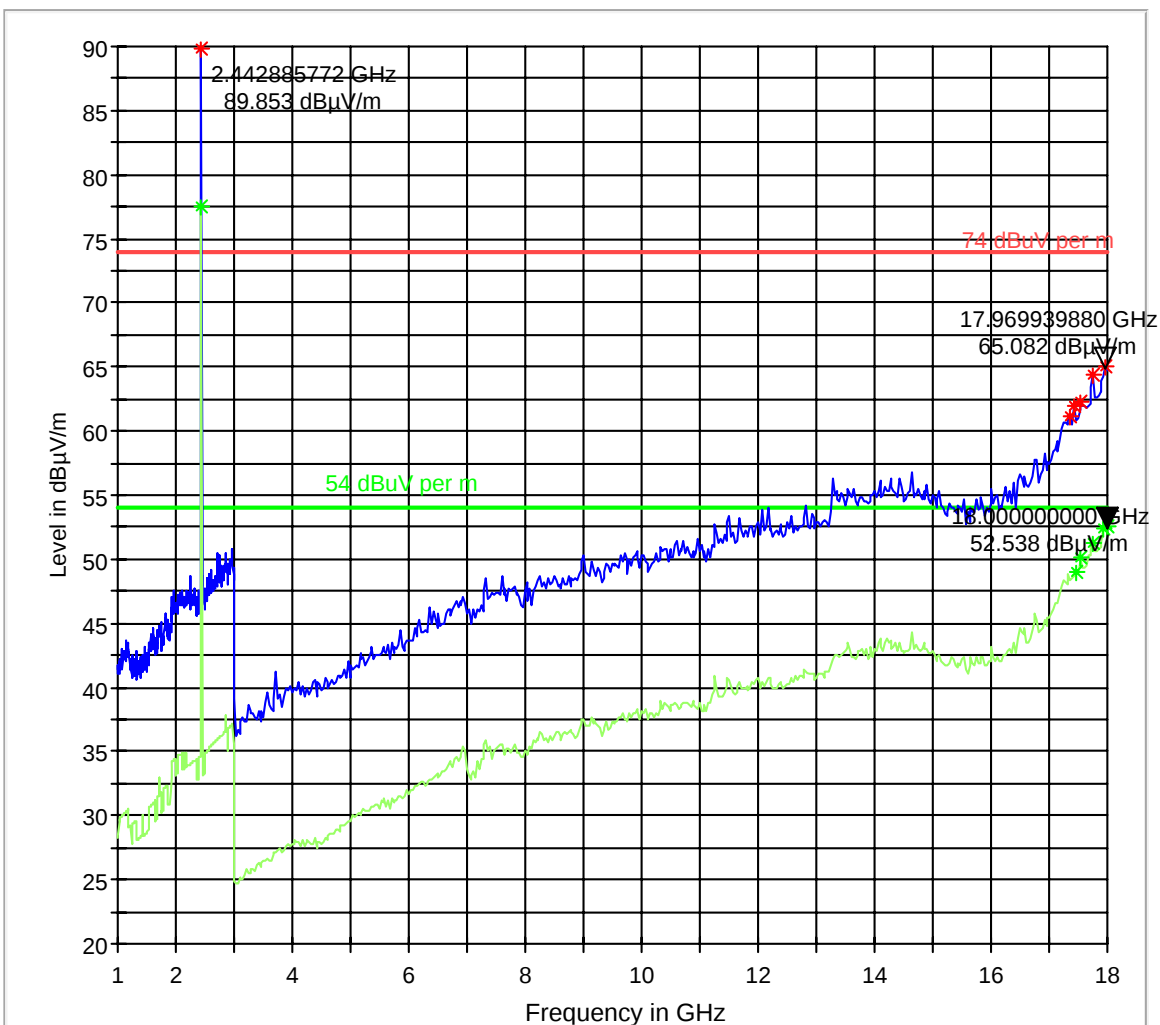
54 dBuV per m.LimitLine
Data Reduction 1 [2]

Preview Result 1
Data Reduction 2 [2]

TX 1GHz-18GHz : 8DPSK modulation: CH 39

Note: Signal over the limit is the carrier frequency. Plot contains results of measurements with antenna in horizontal and vertical polarizations

FCC 15 1-18GHz



74 dBμV per m.LimitLine
Preview Result 2

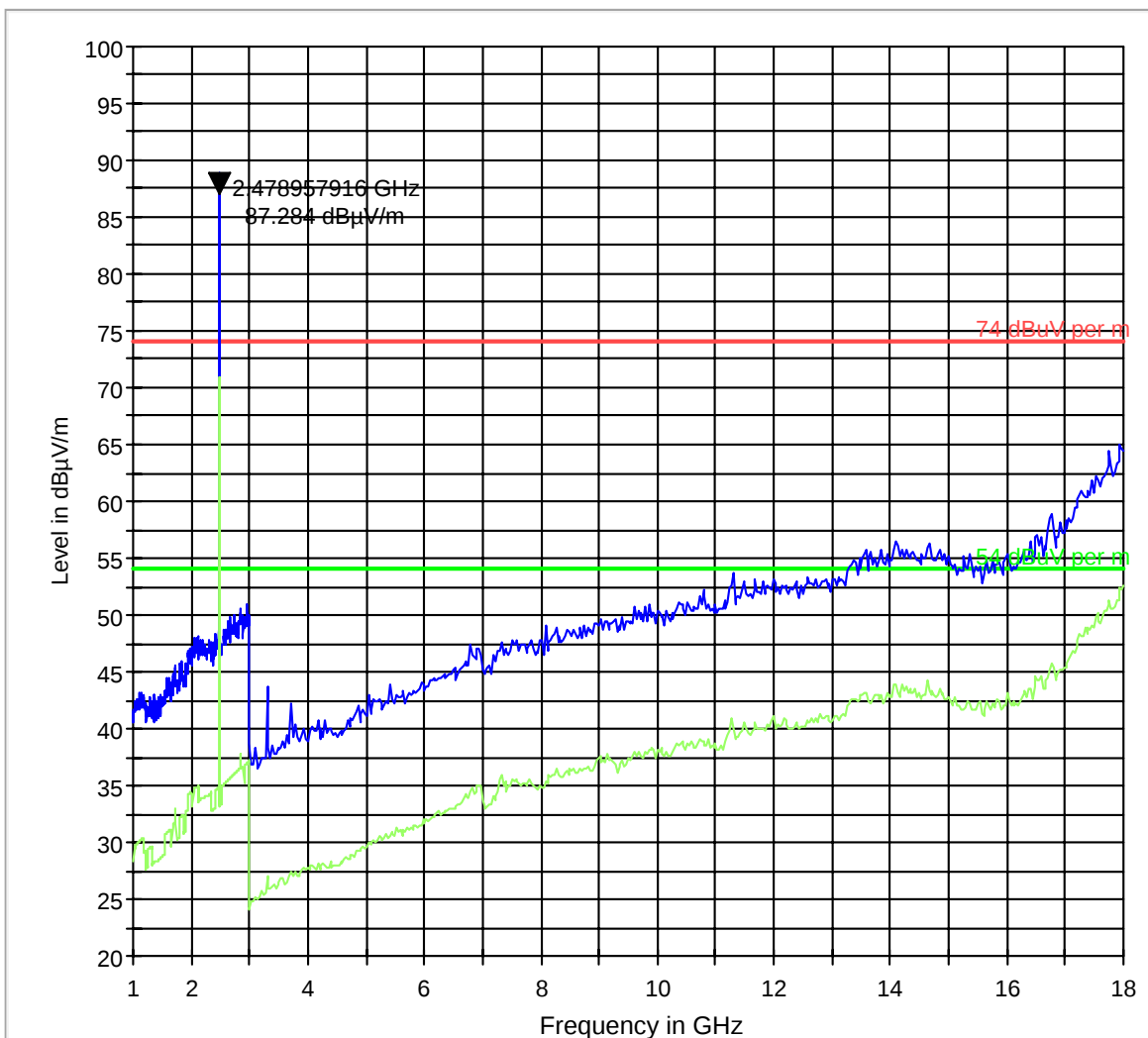
54 dBμV per m.LimitLine
* Data Reduction 1 [2]

Preview Result 1
* Data Reduction 2 [2]

TX 1GHz-18GHz : 8DPSK modulation: CH 78

Note: Signal over the limit is the carrier frequency. Plot contains results of measurements with antenna in horizontal and vertical polarizations

FCC 15 1-18GHz



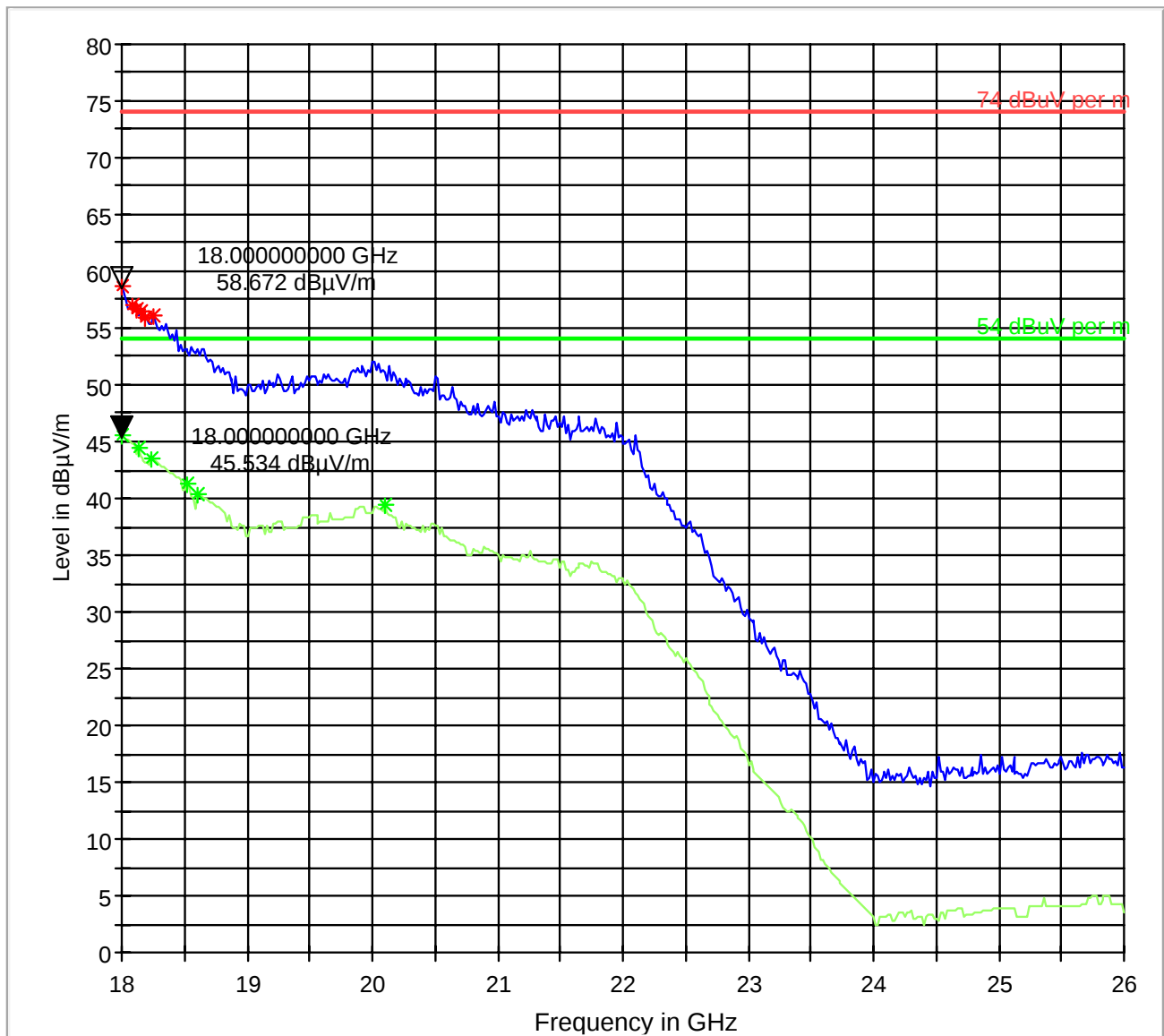
74 dBuV per m.LimitLine
Preview Result 1

54 dBuV per m.LimitLine
Preview Result 2

TX 18-26.5 GHz : 8DPSK modulation: CH 39

Note: Plot contains results of measurements with antenna in horizontal and vertical polarizations

FCC 15 18-26GHz



74 dBuV per m.LimitLine
Preview Result 2

54 dBuV per m.LimitLine
Data Reduction 1 [4]

Preview Result 1
Data Reduction 2 [4]

6.4 Receiver Spurious Emissions- Radiated

6.4.1 Limits: §15.109

Frequency of emission (MHz)	Field strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 (40dB $\mu\text{V/m}$)	3
88–216	150 (43.5 dB $\mu\text{V/m}$)	3
216–960	200 (46 dB $\mu\text{V/m}$)	3
Above 960	500 (54 dB $\mu\text{V/m}$)	3

6.4.2 Test Conditions:

Test mode: RX mode

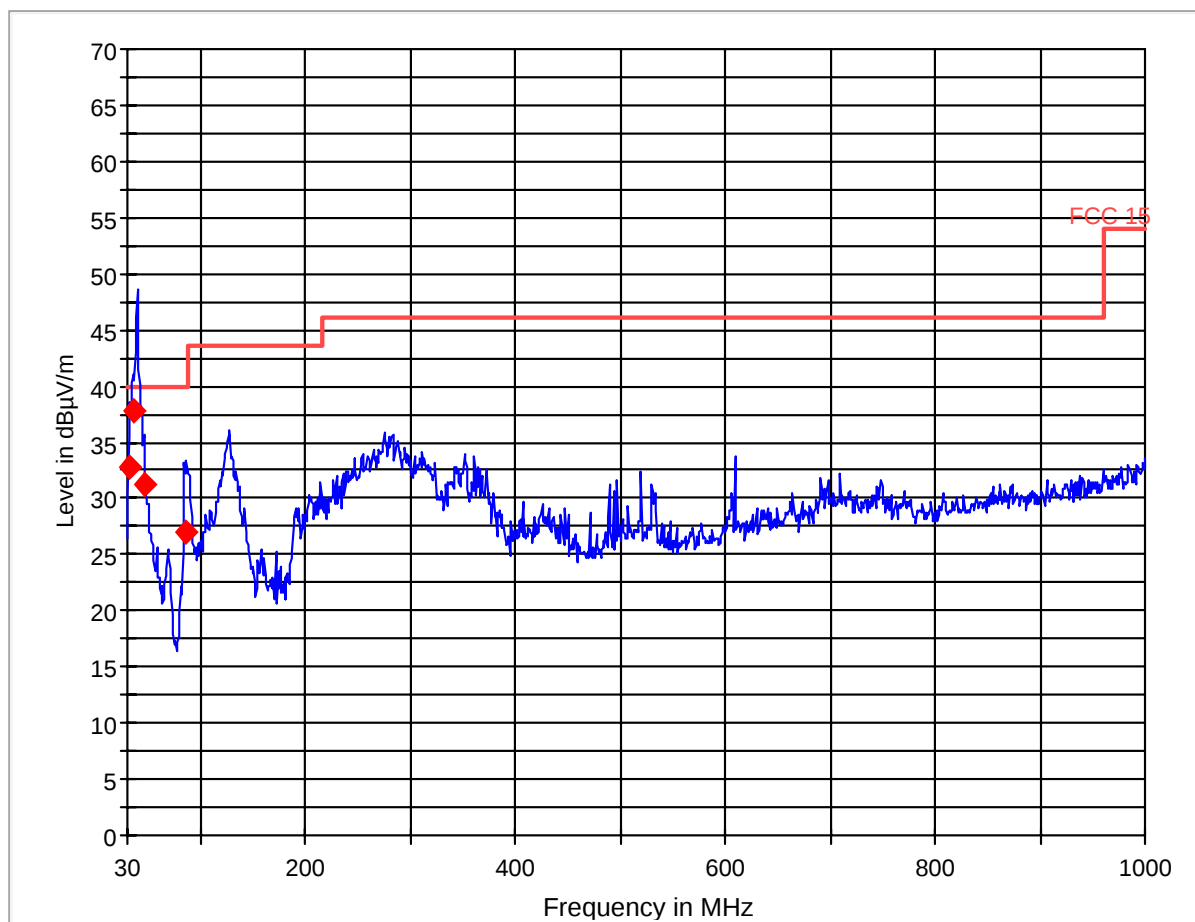
6.4.3 Test Result:

No significant emissions measurable. Plots reported here represent the worse case emissions.

6.4.4 Test data/ plots:**30 MHz-1GHz****Final Result 1**

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
32.825651	32.8	20.000	120.000	120.0	V	270.0	6.9	7.2	40.0
35.651303	37.8	20.000	120.000	120.0	V	270.0	6.3	2.2	40.0
46.012024	31.2	20.000	120.000	120.0	V	270.0	6.3	8.8	40.0
86.513026	26.9	20.000	120.000	120.0	V	270.0	10.0	13.1	40.0

FCC 15 30-1000MHz



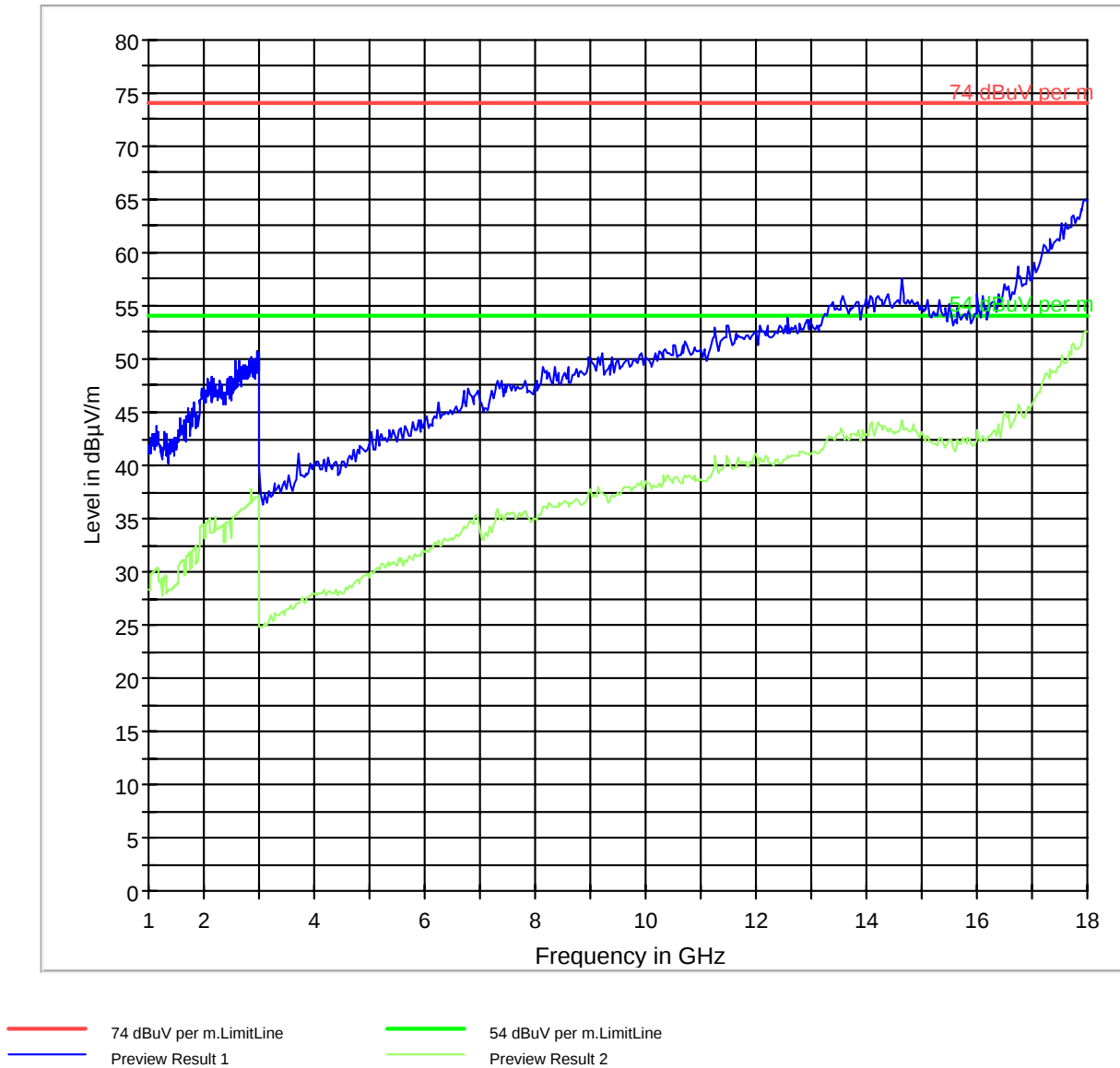
— FCC 15.LimitLine

— Preview Result 1

◆ Final Result 1

1-18 GHz

FCC 15 1-18GHz



6.5 AC Power Line Conducted Emissions

6.5.1 Limits: §15.107/15.207

(a) Except as shown in paragraphs (b) and (c) of this section, for 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 ohms 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.

Analyzer Settings: RBW = 10 kHz; VBW = 10 kHz

6.5.2 Test Conditions:

Modulation: GFSK

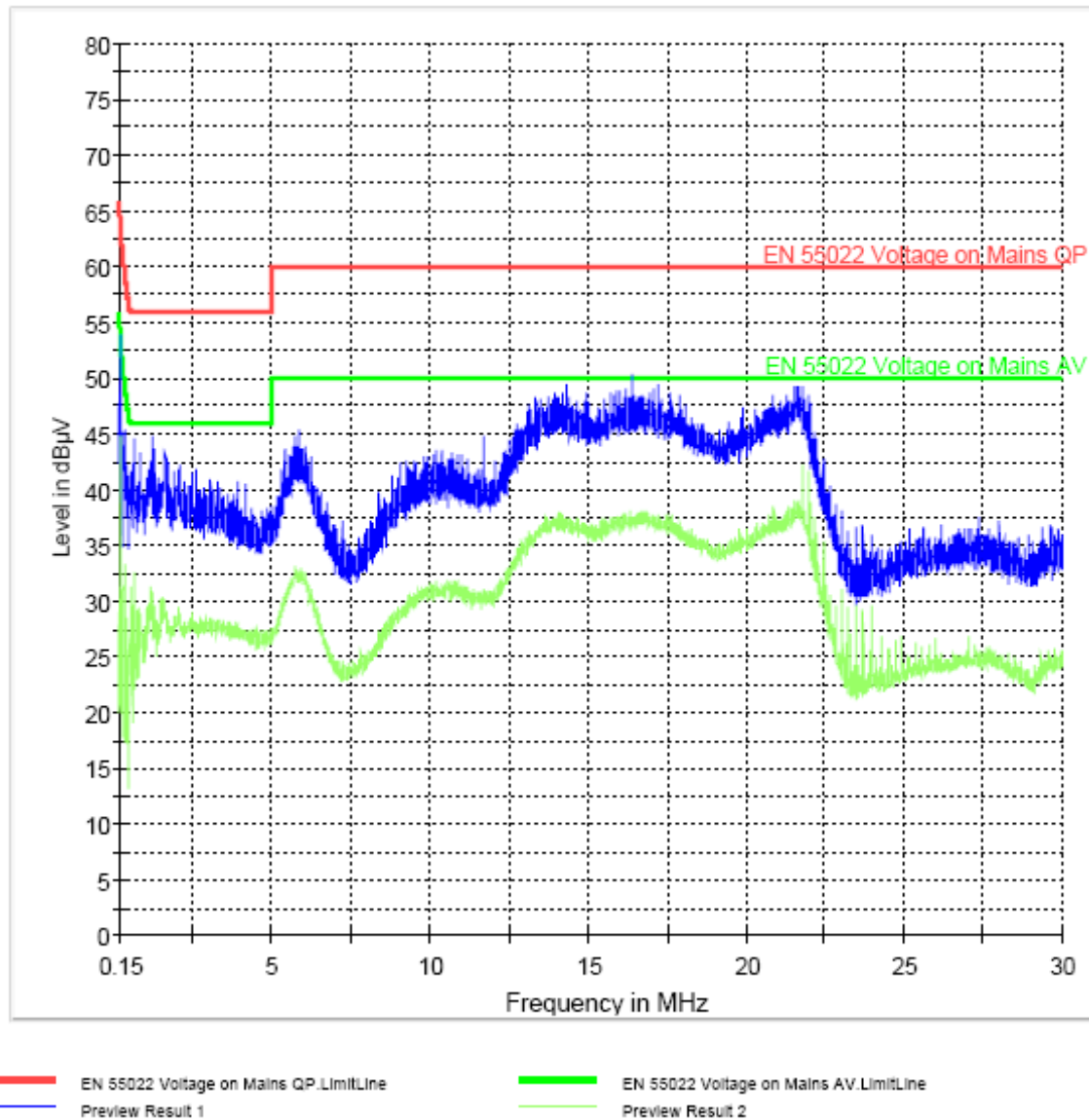
6.5.3 Test Result:

No significant emissions measurable. Plots reported here represent the worse case emissions.

6.5.4 Test data/ plots:

TX Mode GFSK CHO

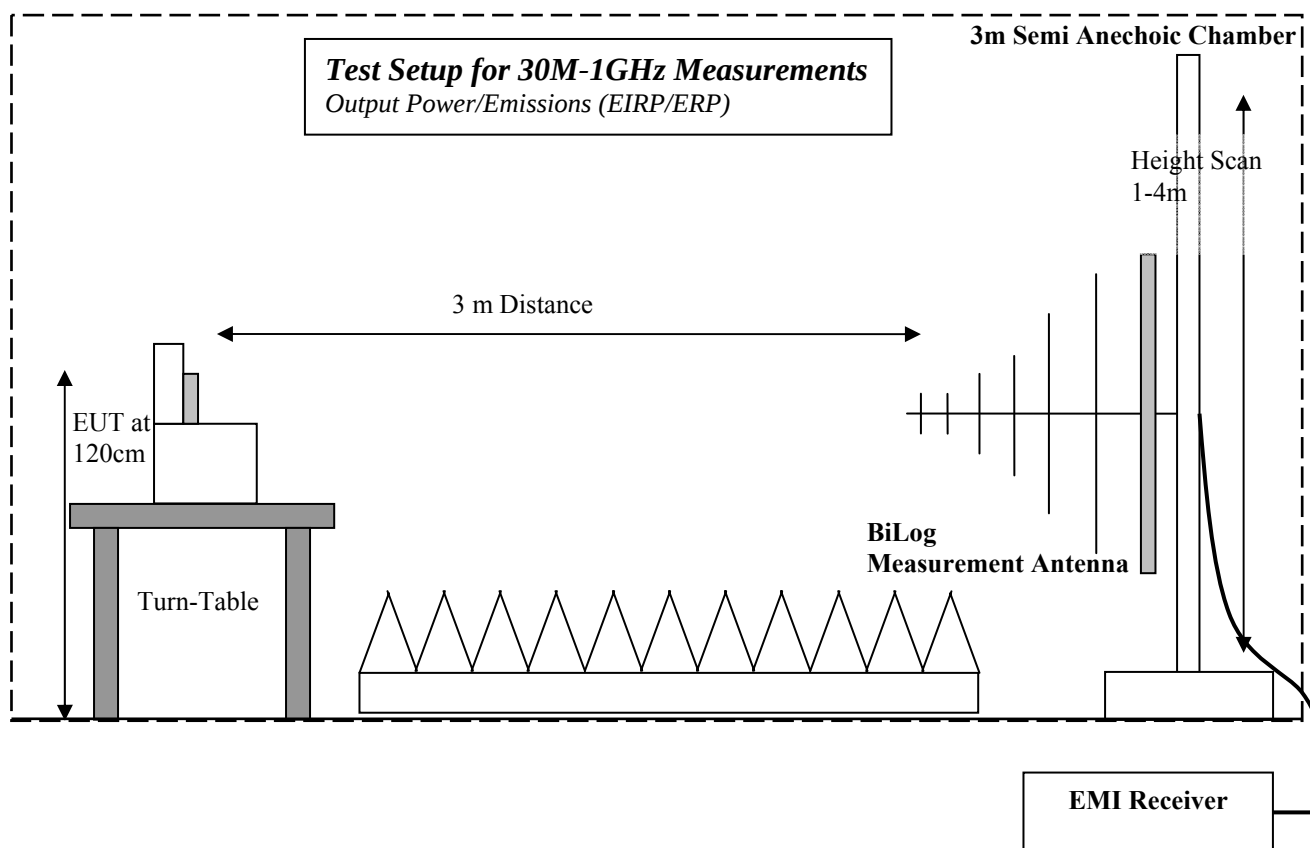
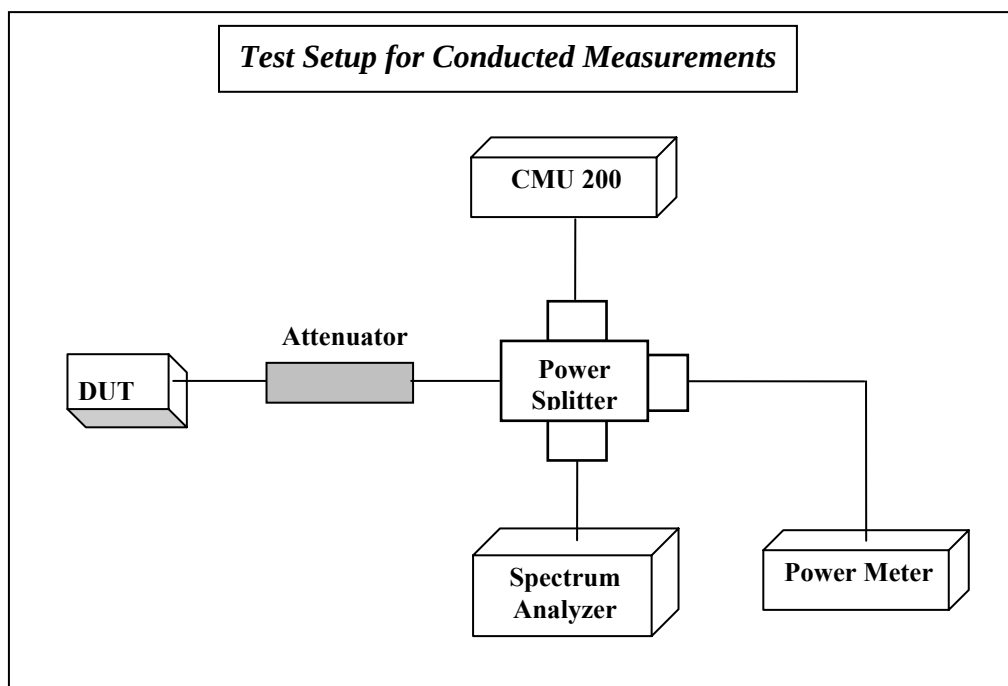
CISPR 22 Mains Conducted

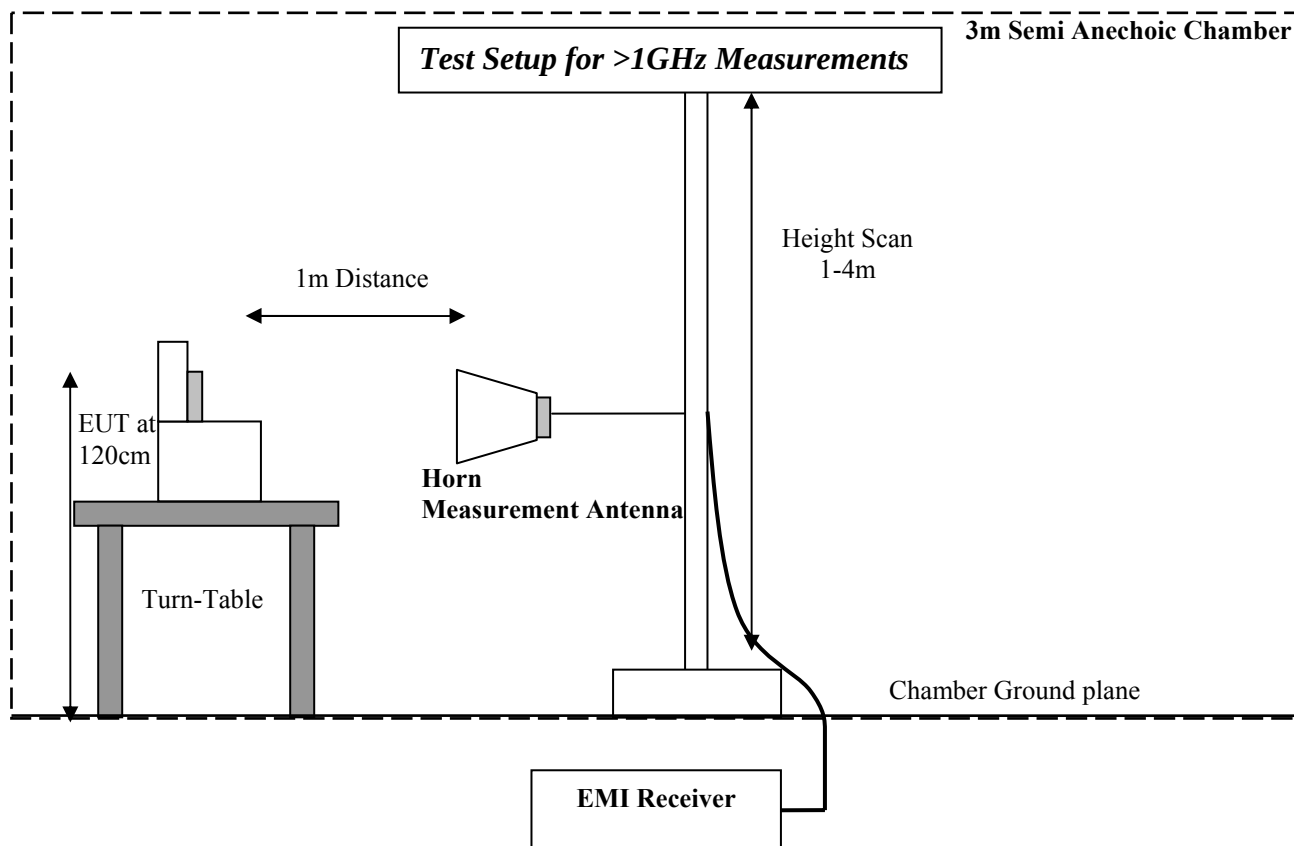


7 Test Equipment and Ancillaries used for tests

No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due	Interval
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2010	1 year
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	100017	May 2010	1 year
03	Signal Generator	SMY02	Rohde & Schwarz	836878/011	May 2010	1 year
04	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02	May 2010	1 year
05	Biconilog Antenna	3141	EMCO	0005-1186	June 2010	1 year
06	Horn Antenna (1-18GHz)	SAS-200/571	AH Systems	325	June 2010	1 year
07	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	June 2010	1 year
08	Power Splitter	11667B	Hewlett Packard	645348	n/a	n/a
09	Climatic Chamber	VT4004	Voltsch	G1115	May 2010	1 year
10	High Pass Filter	5HC2700	Trilithic Inc.	9926013	n/a	n/a
11	High Pass Filter	4HC1600	Trilithic Inc.	9922307	n/a	n/a
12	Pre-Amplifier	JS4-00102600	Miteq	00616	May 2010	1 year
13	Power Sensor	URV5-Z2	Rohde & Schwarz	DE30807	May 2010	1 year
14	Digital Radio Comm. Tester	CMD-55	Rohde & Schwarz	847958/008	May 2010	1 year
15	Universal Radio Comm. Tester	CMU 200	Rohde & Schwarz	832221/06	May 2010	1 year
16	LISN	ESH3-Z5	Rohde & Schwarz	836679/003	May 2010	1 year
17	Loop Antenna	6512	EMCO	00049838	July 2010	2 years

8 BLOCK DIAGRAMS





Test Report #: EMC_SONYE_034_09002_15.247FHSS_PCG-31112L

Date of Report : 2009-12-01

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9 Revision History

Date	Report Name	Changes to report	Report prepared by
2009-12-01	EMC_SONYE_034_09002_15.247 FHSS_PCG-31112L	Original	Satya Radhakrishna