FCC/IC Test Report

FOR:

Company: Trimble Navigation Limited
Model Name: 88951

FCC ID: JUP616
IC ID: 1756A-616

47 CFR Part 15.247 for FHSS Systems

IC RSS-210 Issue 8

TEST REPORT #: EMC_TRIM2_001_09001_15.247_616_rev1
DATE: 2011-03-03

ACCREDITED
TESTING LABORATORY
Certificate #2135.01

Bluetooth Qualification Test Facility (BQTF)

CTIA Authorized Test Lab
LAB CODE 20020328-00

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, Hans Peter May

The BLUETOOTH trademarks are owned by Bluetooth SIG, Inc., U.S.A. and licensed to CETECOM Inc.
© Copyright by *CETECOM*

TABLE OF CONTENTS

1 Assessment

The following device was tested against 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 8 and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Trimble Navigation Limited	GeoExplorer 6000 Series: GeoXH / GeoXT Handheld	88951

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2011-03-03	Compliance	Heiko Strehlow (Director of Compliance)	H. Strehlow Digitally signed by Heiko Strehlow Date: 2011.03.05 22:50:55 -08'00'

Responsible for the Report:

Date	Section	Name	Signature
2011-03-03	Compliance	Josie Sabado (Project Engineer)	Josie Sabado I am the author of this document

The test results of this test report relate exclusively to the test item specified in Section3.
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 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
Test Lab Director:	Heiko Strehlow
Responsible Project Leader:	Josie Sabado

2.2 Identification of the Client

Applicant's Name:	Trimble Navigation Limited
Street Address:	935 Stewart Drive
City/Zip Code	Sunnyvale, CA 94088-3642
Country	United States
Contact Person:	Roy Cann
Phone No.	+1-408-481-8284
e-mail:	Roy.Cann@Trimble.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Trimble Navigation New Zealand Ltd
Manufacturers Address:	11 Birmingham Drive, Riccarton
City/Zip Code	Christchurch, Canterbury 8024
Country	New Zealand

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	GeoExplorer 6000 Series
Model No:	88951
Product Type:	Portable
Product Description:	GeoExplorer 6000 Series: GeoXH / GeoXT Handheld
Modes of Operation:	GSM/(E)GPRS/WCDMA 802.11 b/g Bluetooth + 2.1 EDR GPS (Receive only)
Hardware Revision :	1
Software Revision :	OS 6.5.1 (Build 20192) Nov 8 2010
FCC-ID:	JUP616
IC-ID :	1756A-616
Frequency:	GSM 850: 824.2-848.8MHz PCS 1900: 1850.2-1909.8MHz FDD V: 826.4-846.6MHz FDD II: 1852.4-1907.6MHz 802.11 b/g: 2400-2483.5MHz Bluetooth: 2400-2483.5MHz GPS: 1575.42MHz, 1227.60MHz
Type(s) of Modulation:	802.11b/g: CCK, BPSK, QPSK, 16QAM, 64QAM Bluetooth: GFSK, DQPSK, 8DPSK WWAN 2G: GMSK, 8PSK WWAN 3G: QPSK, 16QAM
Number of channels:	GSM850: 125 PCS 1900: 300 FDD II: 278 FDD V: 103 802.11 b/g: 11 Bluetooth: 79
Antenna Type:	Cellular: Cirocom PiFA Foil Antenna 802.11 b/g, Bluetooth: Pulse Antenna W3008 Omnidirectional, 1.7dBi
Power Supply:	11.1 VDC Li Ion Batt, AC Adapter
Prototype /Production Unit:	Production

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version
1	5043452638	1	OS 6.5.1 (Build 20192) Nov 8 2010

3.3 Identification of Accessory equipment

No accessory equipment

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 **JUP616** and IC ID **1756A-616.**
All testing was performed on the product referred to in Section 3 as EUT.
This test report contains full radiated and conducted testing results as per

- 47 CFR Part 15: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter A- General, Part 15- Radio Frequency Devices.
- RSS-210 Issue 7: Spectrum Management and Telecommunications- Radio Standards Specification. Low-power Licence-exempt radio communication devices (All frequency bands): Category 1 equipment.

During the testing process the EUT was tested on a single channel using PRBS payload using DH5, 2DH5 or 3DH5 packets, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(b)(4) RSS210 A8.4(2)	Antenna Gain	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(e) RSS210 A8.2(b)	Power Spectral Density	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	■	☐	-
§15.247(a)(1) RSS210 A8.1(b)	Carrier Frequency Separation	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(a)(1) RSS210 A8.1(d)	Number of Hopping Channels	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(a)(1)(iii) RSS210 A8.3(1)	Time of occupancy	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(a)(1) RSS210 A8.2(a)	Spectrum Bandwidth	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(b)(1) RSS210 A8.4(2)	Maximum Output Power	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	Band edge compliance-Conducted	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	☐	■	-
§15.247(d) RSS210 A8.5	Band edge compliance-Radiated	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	TX Spurious emissions-Conducted	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	TX Spurious emissions-Radiated	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.209(a) RSS Gen	TX Spurious Emissions Radiated<30MHz	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.109 RSS Gen	RX Spurious Emissions Radiated	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.107(a)	Conducted Emissions <30MHz	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

1. Band Edge compliance-conducted is NOT PERFORMED as the device passes radiated measurement.
2. Power Spectral Density is NOT APPLICABLE for devices with hopping functionality.

6 Measurements

6.1 Radiated Measurement Procedure

ANSI C63.4 Section 8.3.1.1: Exploratory radiated emission measurements

Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT. At near distances, for EUTs of comparably small size, it is relatively easy to determine the spectrum signature of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. A shielded room may be used for exploratory testing, but may have anomalies that can lead to significant errors in amplitude measurements.

Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of testing. It is recommended that either a headset or loudspeaker be connected as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT when the exploratory and final testing is performed in an OATS with strong ambient signals. Caution should be taken if either antenna height between 1 and 4 meters or EUT azimuth is not fully explored. Not fully exploring these parameters during exploratory testing may require complete testing at the OATS or semi-anechoic chamber when the final full spectrum testing is conducted.

The EUT should be set up in its typical configuration and arrangement, and operated in its various modes. For tabletop systems, cables or wires should be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for their respective setups and cable manipulation. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions.

For each mode of operation required to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) shall be explored to produce the emission that has the highest amplitude relative to the limit. A step-by-step technique for determining this emission can be found in Annex C.

When measuring emissions above 1 GHz, the frequencies of maximum emission shall be determined by manually positioning the antenna close to the EUT and by moving the antenna over all sides of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1 GHz. If the EUT is a device with dimensions approximately equal to that of the measurement antenna beamwidth, the measurement antenna shall be aligned with the EUT.

ANSI C63.4 Section 8.3.1.2: Final radiated emission measurements

Based on the measurement results in 8.3.1.1, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement. The final measurement is then performed on a site meeting the requirements of 5.3, 5.4, or 5.5 as appropriate without variation of the EUT arrangement or EUT mode of operation. If the EUT is relocated from an exploratory test site to a final test site, the highest emission shall be remaximized at the final test location before final radiated emissions measurements are performed. However, antenna height and polarity and EUT azimuth are to be varied. In addition, the full frequency spectrum (for the range to be checked for meeting compliance) shall be investigated.

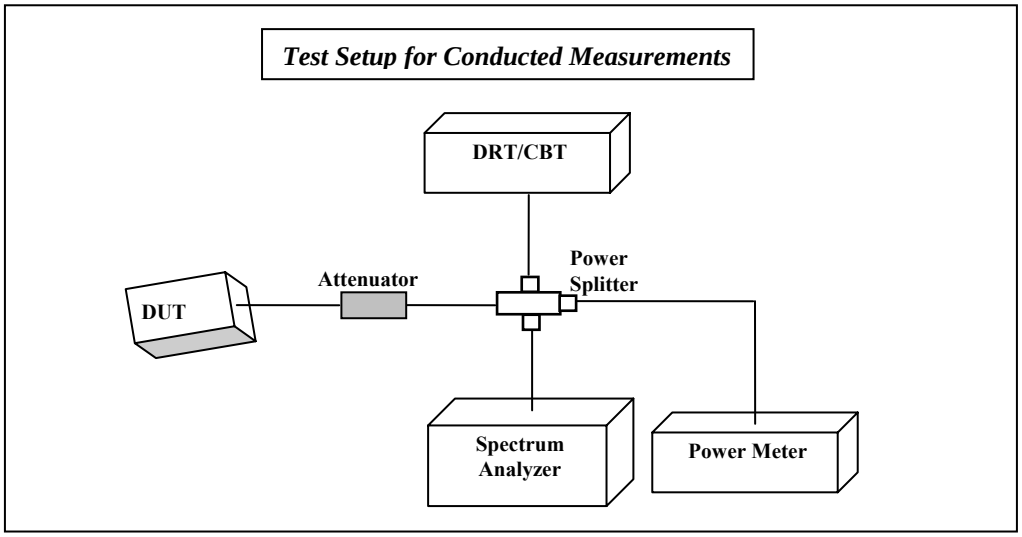
This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency spectrum investigation, particular focus should be made on those frequencies found in exploratory testing that were used to find the final test configuration, mode of operation, and arrangement (associated with achieving the least margin with respect to the limit). This full spectrum test constitutes the compliance measurement.

For measurements above 1 GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the antenna in the “cone of radiation” from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response. The antenna may have to be higher or lower than the EUT, depending on the EUT’s size and mounting height, but the antenna should be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. If the transmission line for the measurement antenna restricts its range of height and polarization, the steps needed to ensure the correct measurement of the maximum emissions, shall be described in detail in the report of measurements. Data collected shall satisfy the report requirements of Clause 10.

NOTES

1— Where limits are specified by agencies for both average and peak (or quasi-peak) detection, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.
2—Use of waveguide and flexible waveguide may be necessary at frequencies above 10 GHz to achieve usable signal-to noise ratios at required measurement distances. If so, it may be necessary to restrict the height search of the antenna, and special care should be taken to ensure that maximum emissions are correctly measured.
3—All presently known devices causing emissions above 10 GHz are physically small compared with the beam-widths of typical horn antennas used for EMC measurements. For such EUTs and frequencies, it may be preferable to vary the height and polarization of the EUT instead of the receiving antenna to maximize the measured emissions.

6.2 Conducted Measurement Procedure



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to connect the EUT at the required channel.
3. Measurements are to be performed with the EUT set to the low, middle and high channels.

6.3 Maximum Peak Output Power

6.3.1 References:

FCC CFR §2.1046
RSS-Gen 4.8

6.3.2 Measurement requirements:

6.3.2.1 FCC 2.1046: RF power output.

Power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on circuit elements as specified. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

6.3.2.2 RSS-Gen 4.8: RF power output.

Transmitter output power measurements shall be carried out before the unwanted emissions test. The transmitter output power value, obtained from this test, serves as the reference level used to determine the unwanted emissions.

6.3.3 Limits:

6.3.3.1 §15.247 (b)(1)

The maximum peak conducted output power of the intentional radiator shall not exceed the following: 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 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

6.3.3.2 RSS 210- A8.4(2)

Nominal Peak Output Power < 30 dBm (1W)

6.3.4 Test Conditions:

Tnom: 25°C; Vnom: AC
Hopping OFF
Spectrum Analyzer settings:
RBW=VBW=3MHz, Detector: Peak- Max Hold.
Sweep Time: Auto
Span=3MHz
Antenna Gain (dBi): 1.7dBi

6.3.5 Test Result:

Max Peak Output Power- Conducted (dBm)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	-5.0	-4.66	-4.71
π/4 DQPSK	-6.99	-6.59	-6.54
8-DPSK	-6.93	-6.67	-6.49
Measurement Uncertainty: ±0.5dB			

Max Peak Output Power- Radiated (dBm)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	-3.3	-2.96	-3.01
π/4 DQPSK	-5.29	-4.89	-4.84
8-DPSK	-5.23	-4.97	-4.79
Measurement Uncertainty: ±3.0dB			

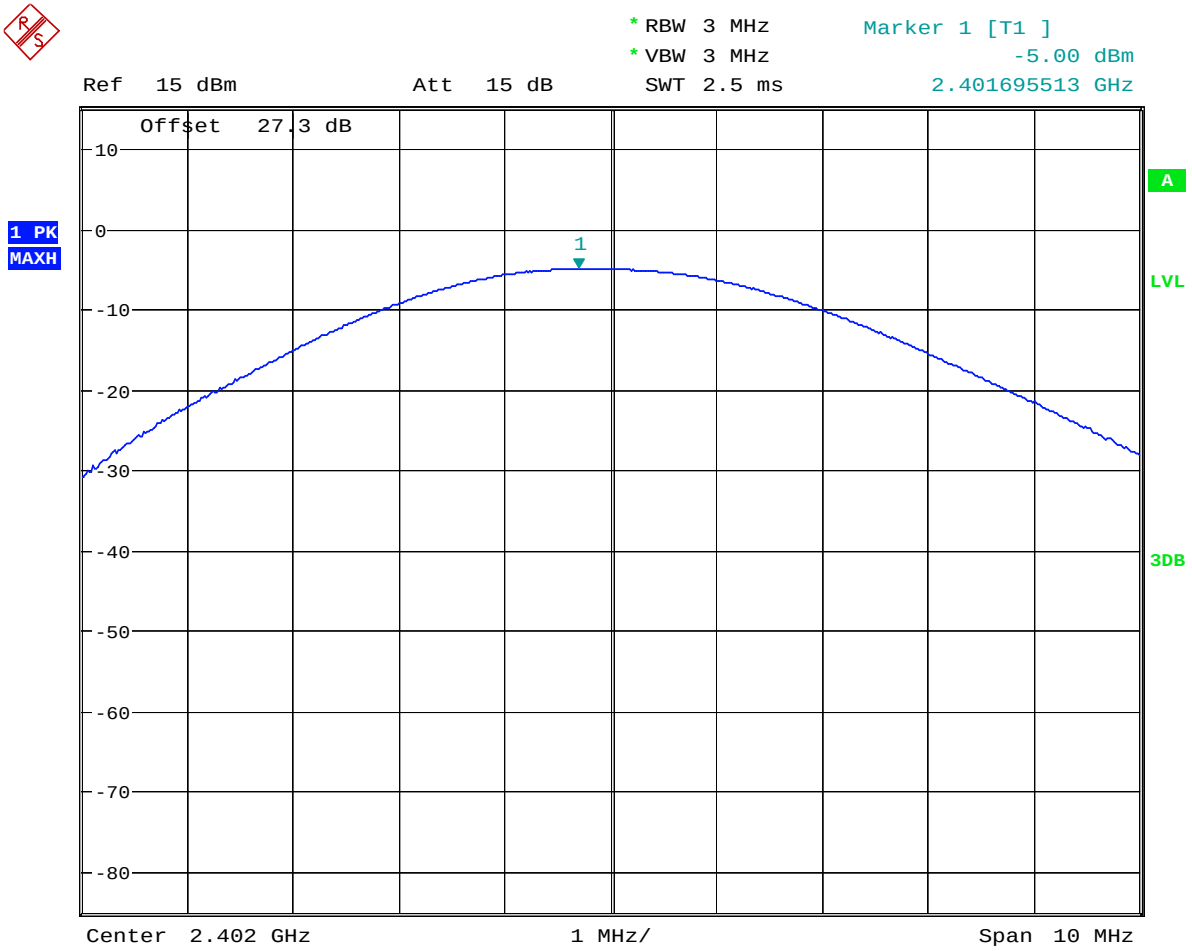
Note: Radiated EIRP is calculated as
Conducted Measurement + Antenna Gain

6.3.5.1 Measurement Result

Pass.

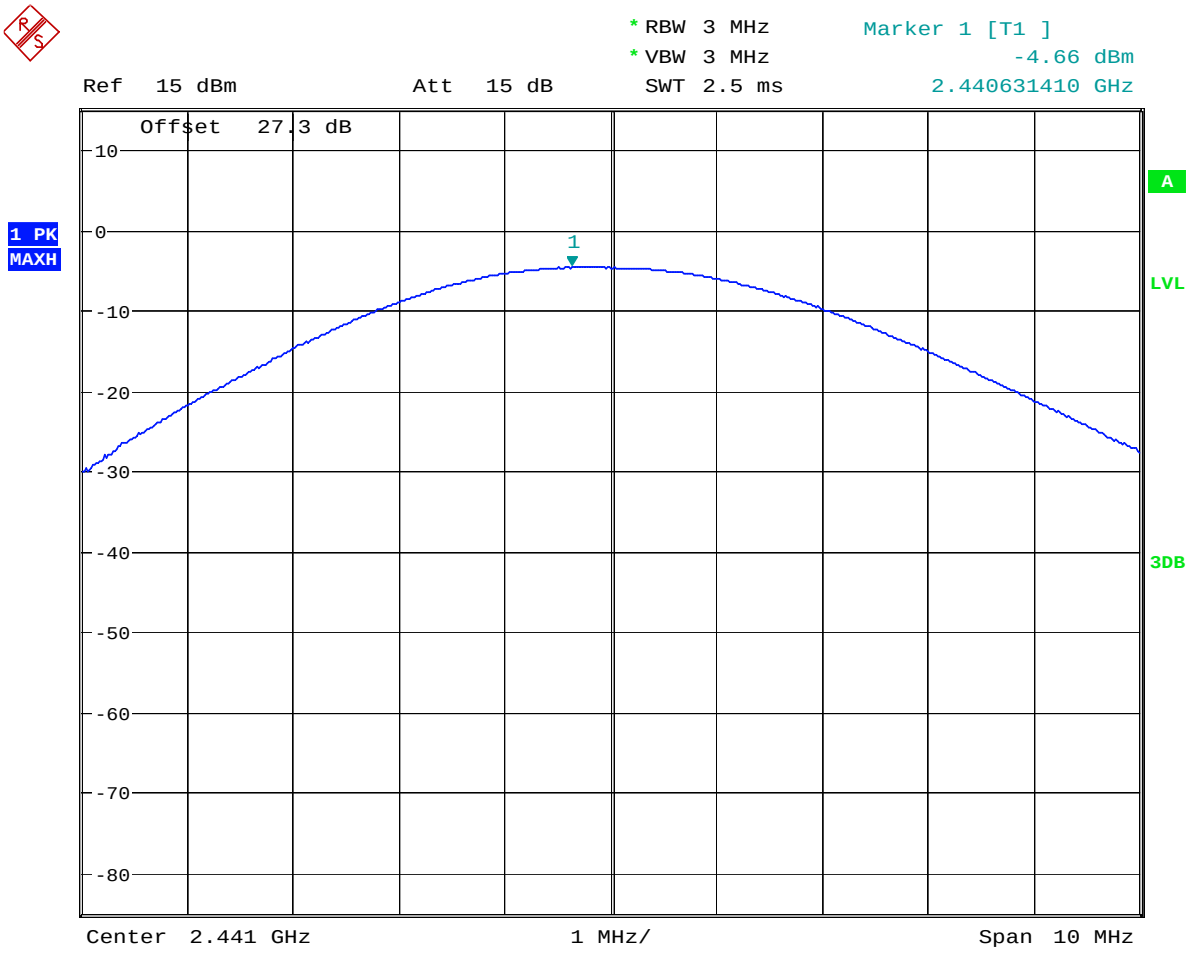
6.3.6 Test Data/plots:

Conducted Peak Power GFSK 2402 MHz



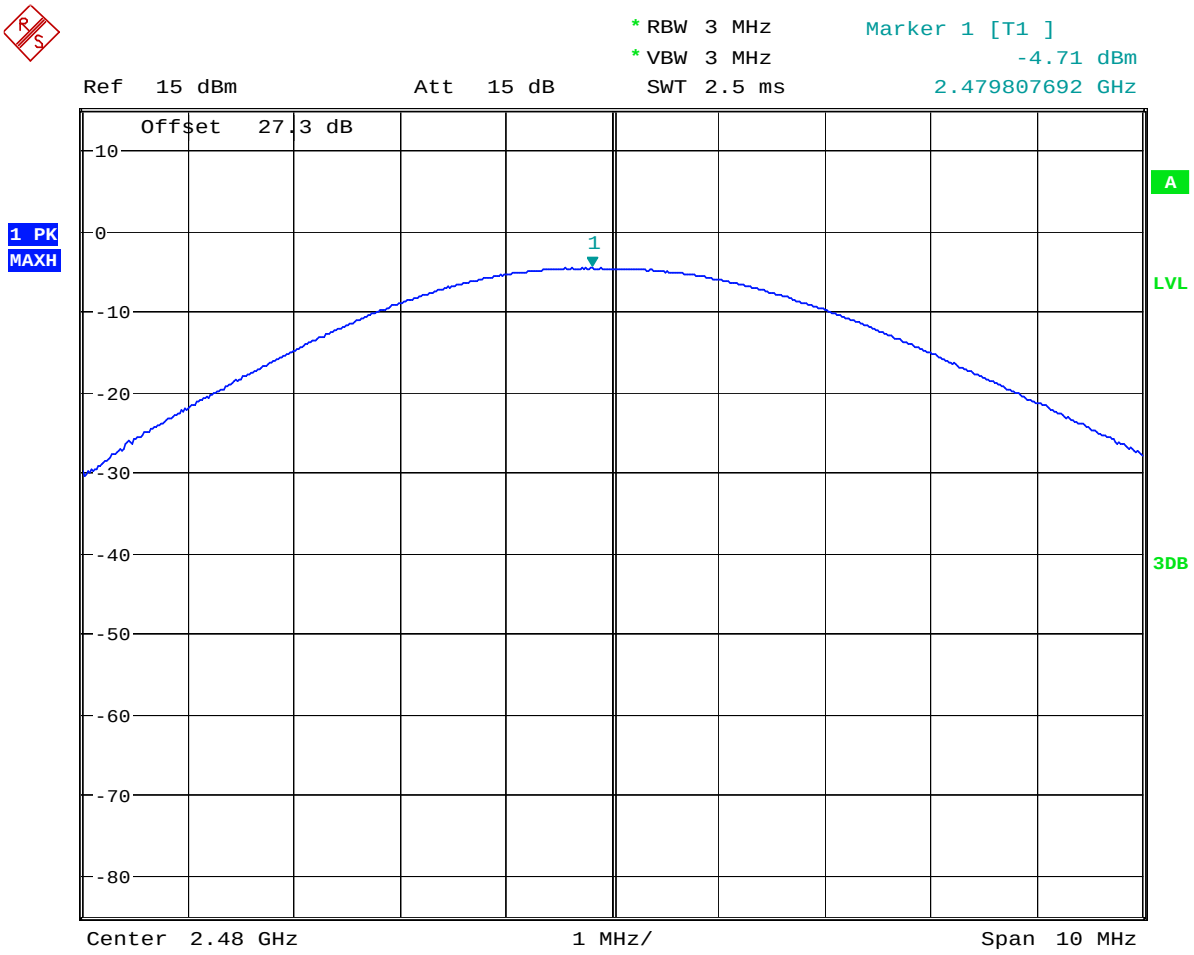
Date: 14.DEC.2010 14:13:53

Conducted Peak Power GFSK 2441 MHz



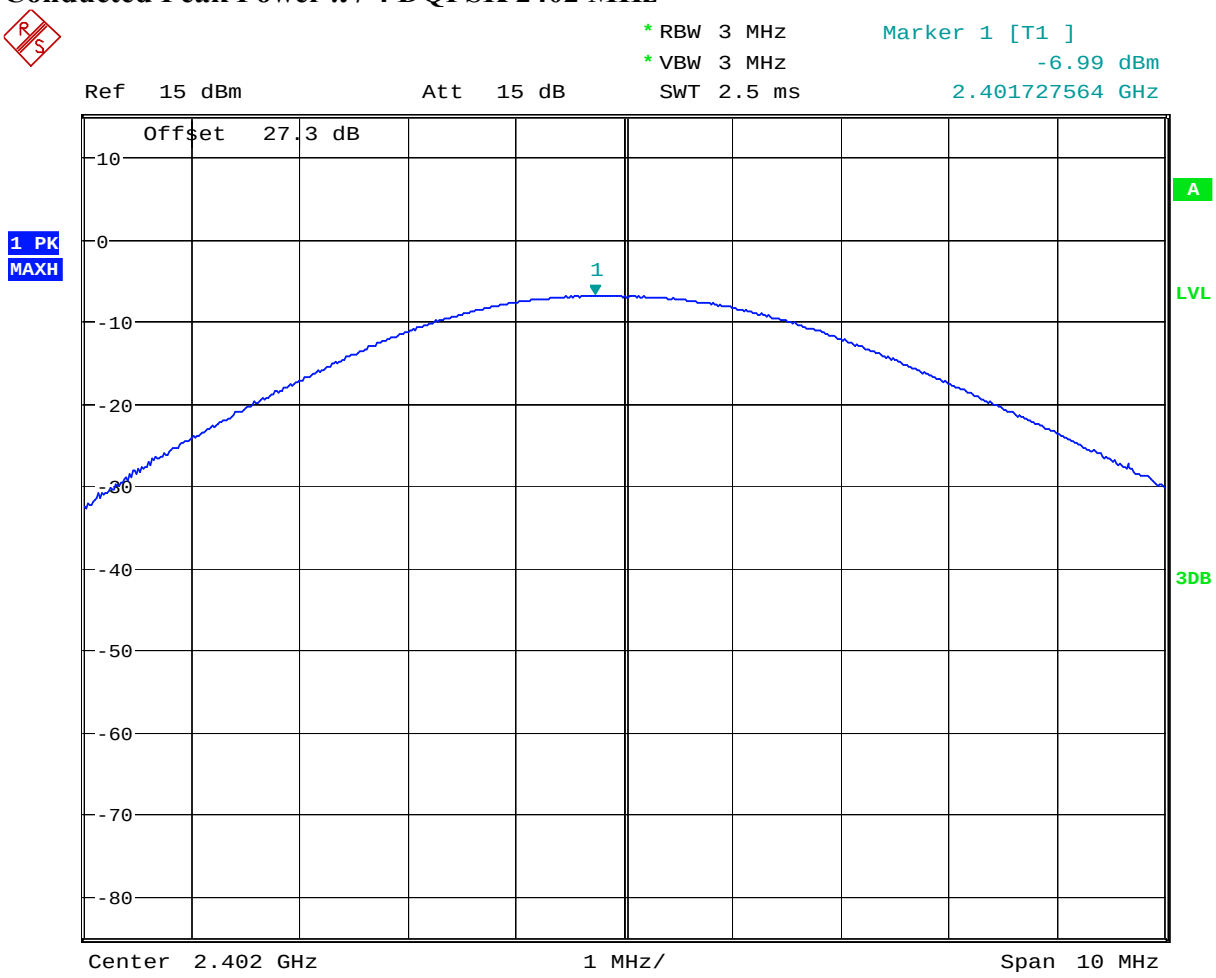
Date: 14.DEC.2010 14:06:42

Conducted Peak Power GFSK 2480 MHz



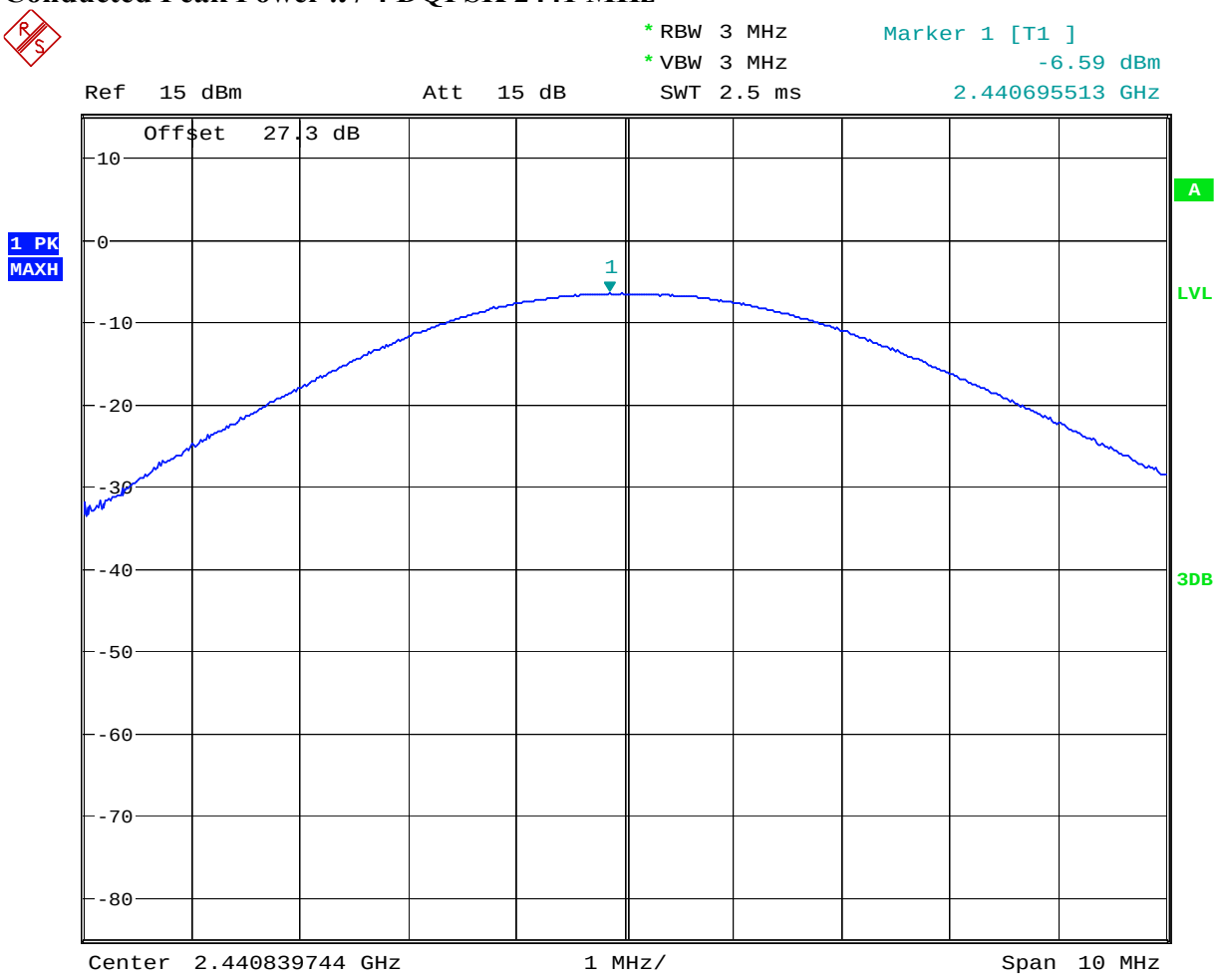
Date: 14.DEC.2010 14:20:27

Conducted Peak Power π / 4 DQPSK 2402 MHz



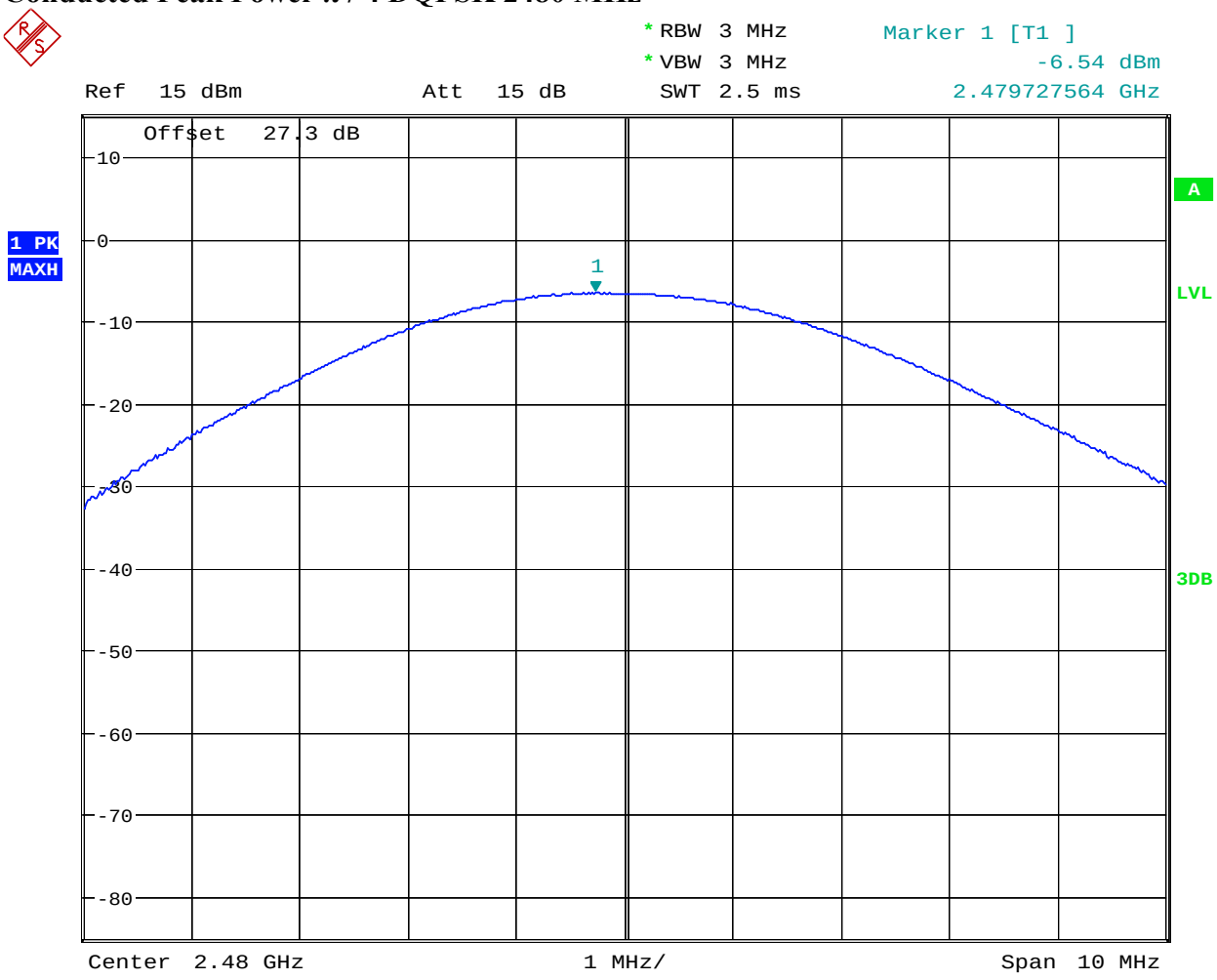
Date: 14.DEC.2010 14:16:35

Conducted Peak Power π / 4 DQPSK 2441 MHz



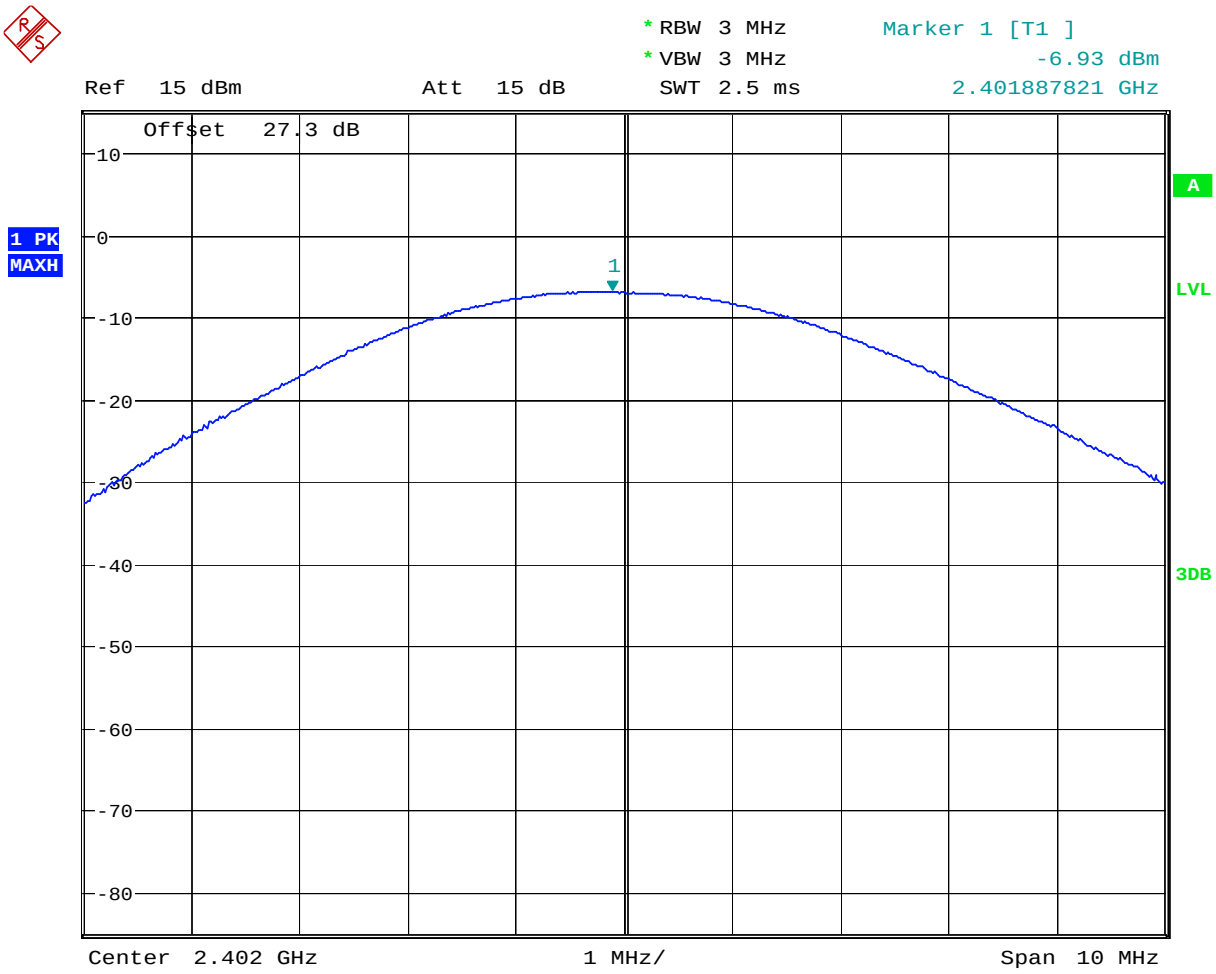
Date: 14.DEC.2010 14:09:46

Conducted Peak Power π / 4 DQPSK 2480 MHz



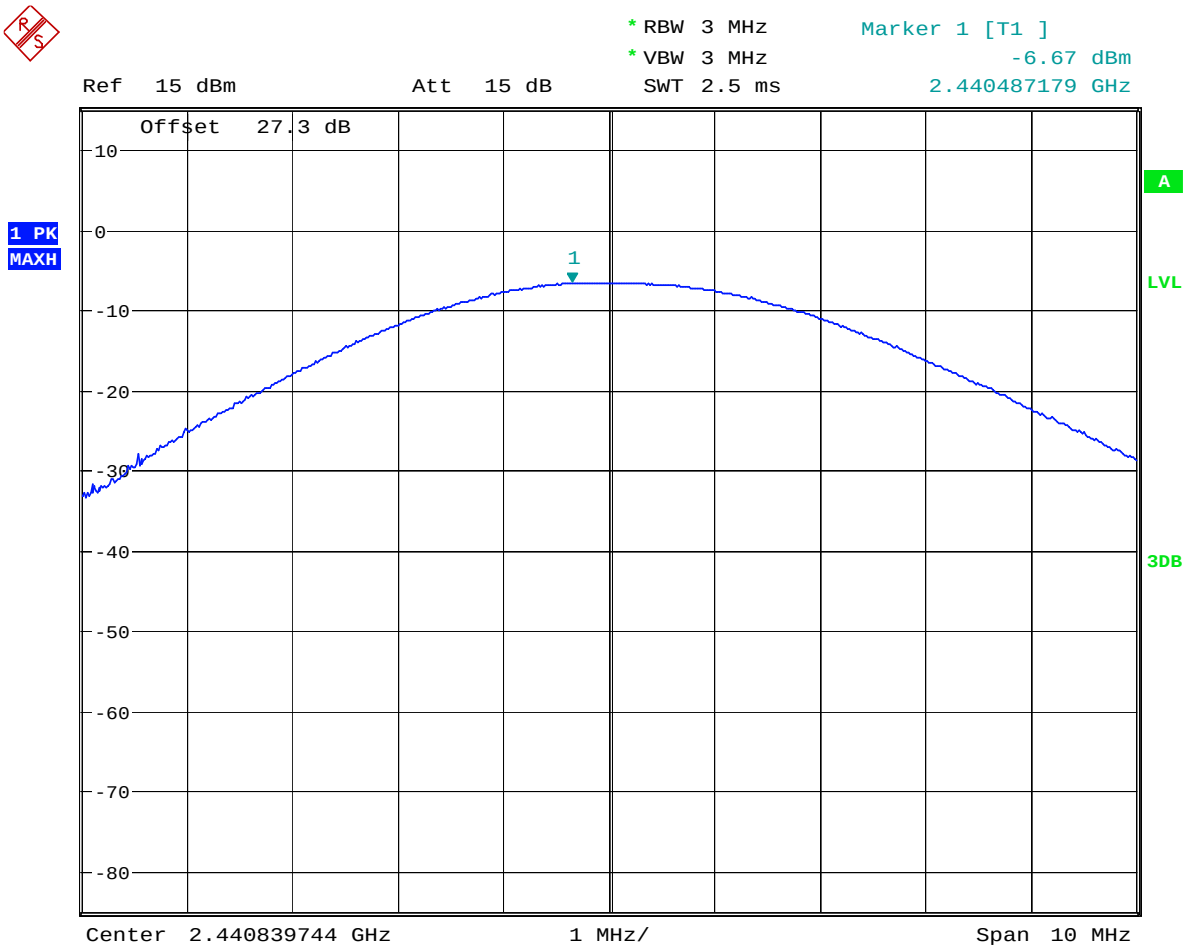
Date: 14.DEC.2010 14:22:39

Conducted Peak Power 8DPSK 2402 MHz



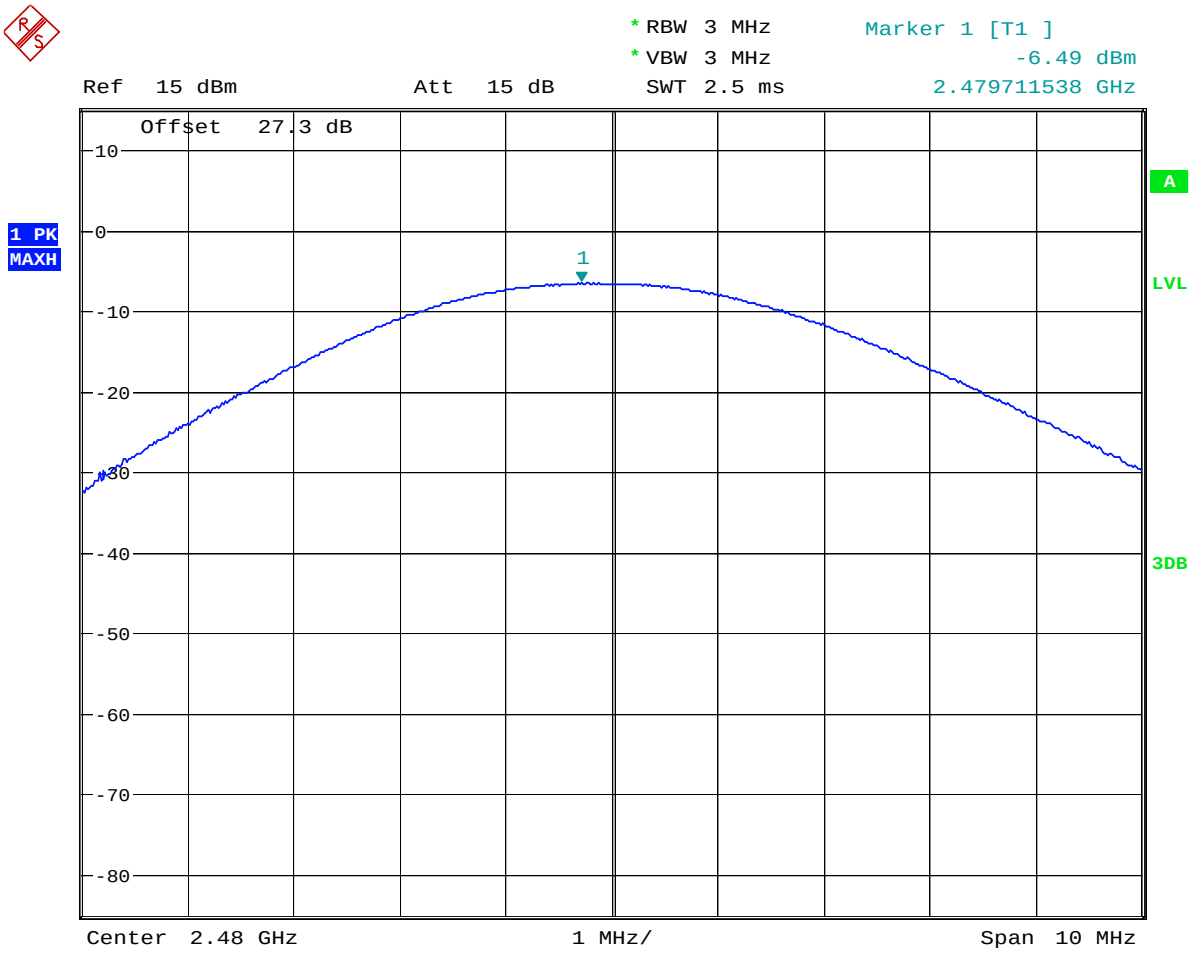
Date: 14.DEC.2010 14:17:32

Conducted Peak Power 8DPSK 2441 MHz



Date: 14.DEC.2010 14:10:43

Conducted Peak Power 8DPSK 2480 MHz



Date: 14.DEC.2010 14:23:24

6.4 Restricted Band Edge Compliance

6.4.1 References:

FCC CFR §2.1053
RSS-210 A8.5

6.4.2 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.

6.4.3 Measurement Procedure:

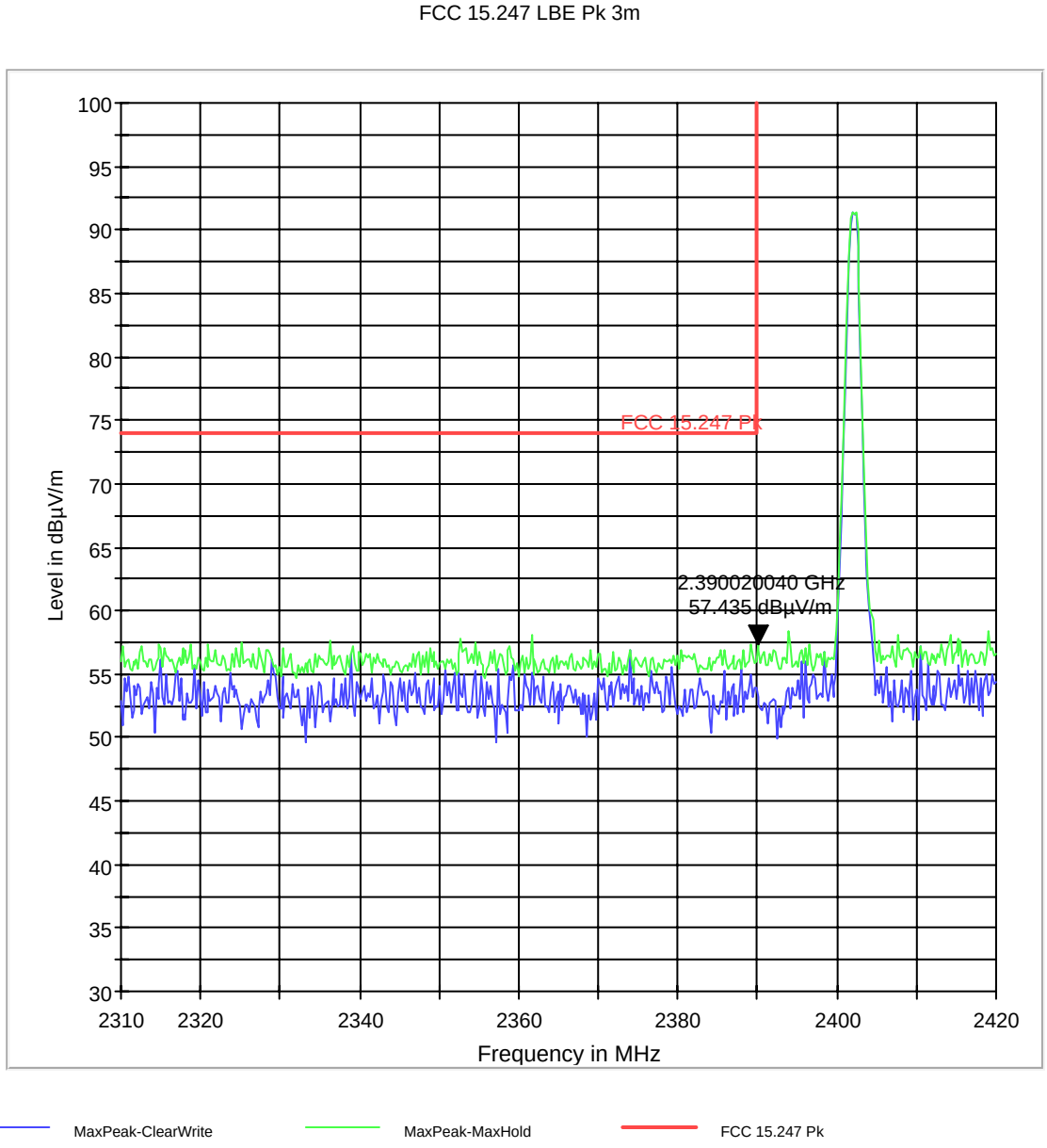
Peak measurements are made using a peak detector and RBW=1MHz.
Average measurements performed using a peak detector and according to video averaging procedure with RBW=1MHz and VBW=10Hz.
*PEAK LIMIT= 74dBµV/m
*AVG. LIMIT= 54dBµV/m
Measurement Uncertainty: ±3.0dB

6.4.3.1 Measurement Result

Pass.

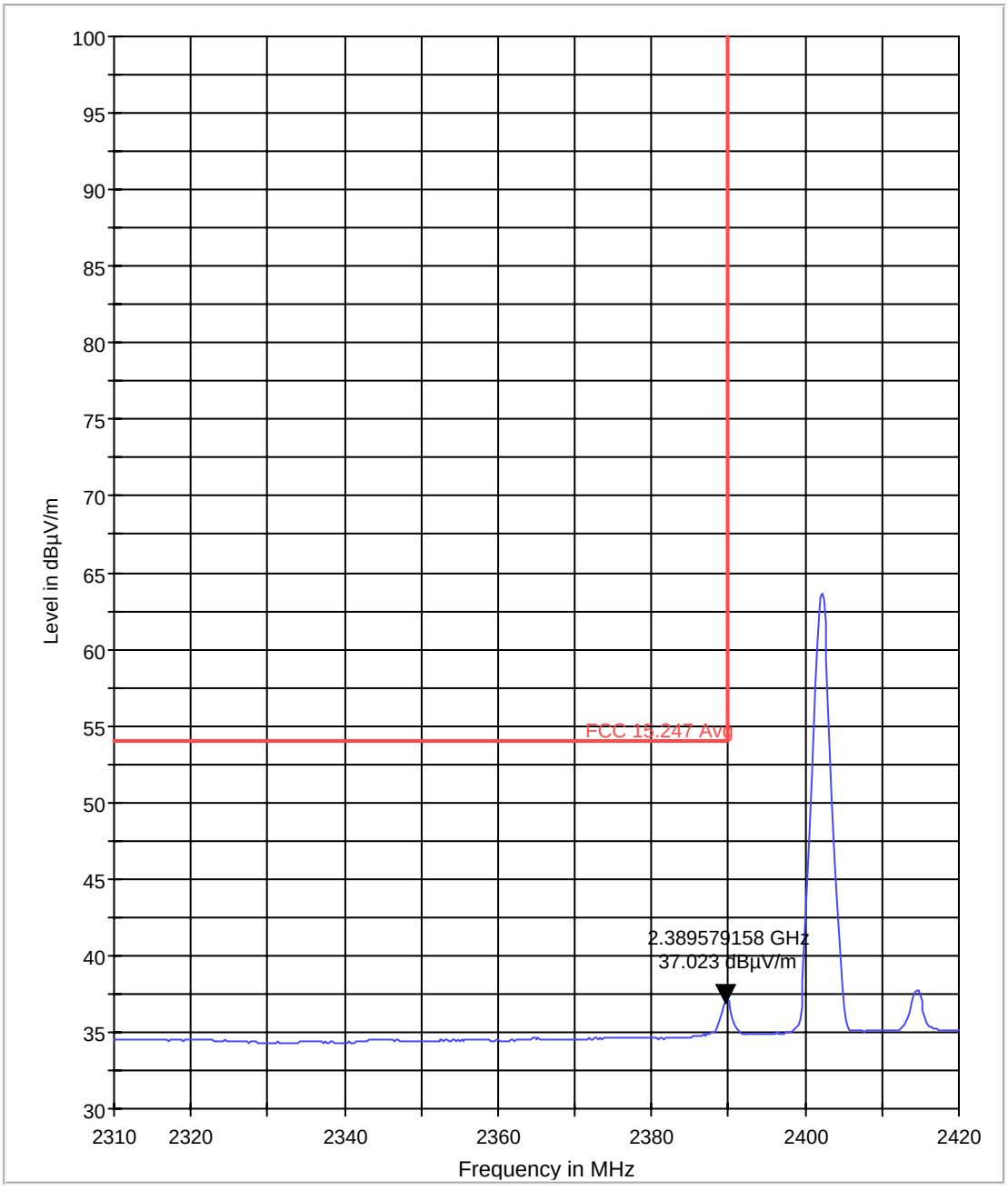
6.4.4 Test Data/plots:

Lower band edge peak -GFSK modulation

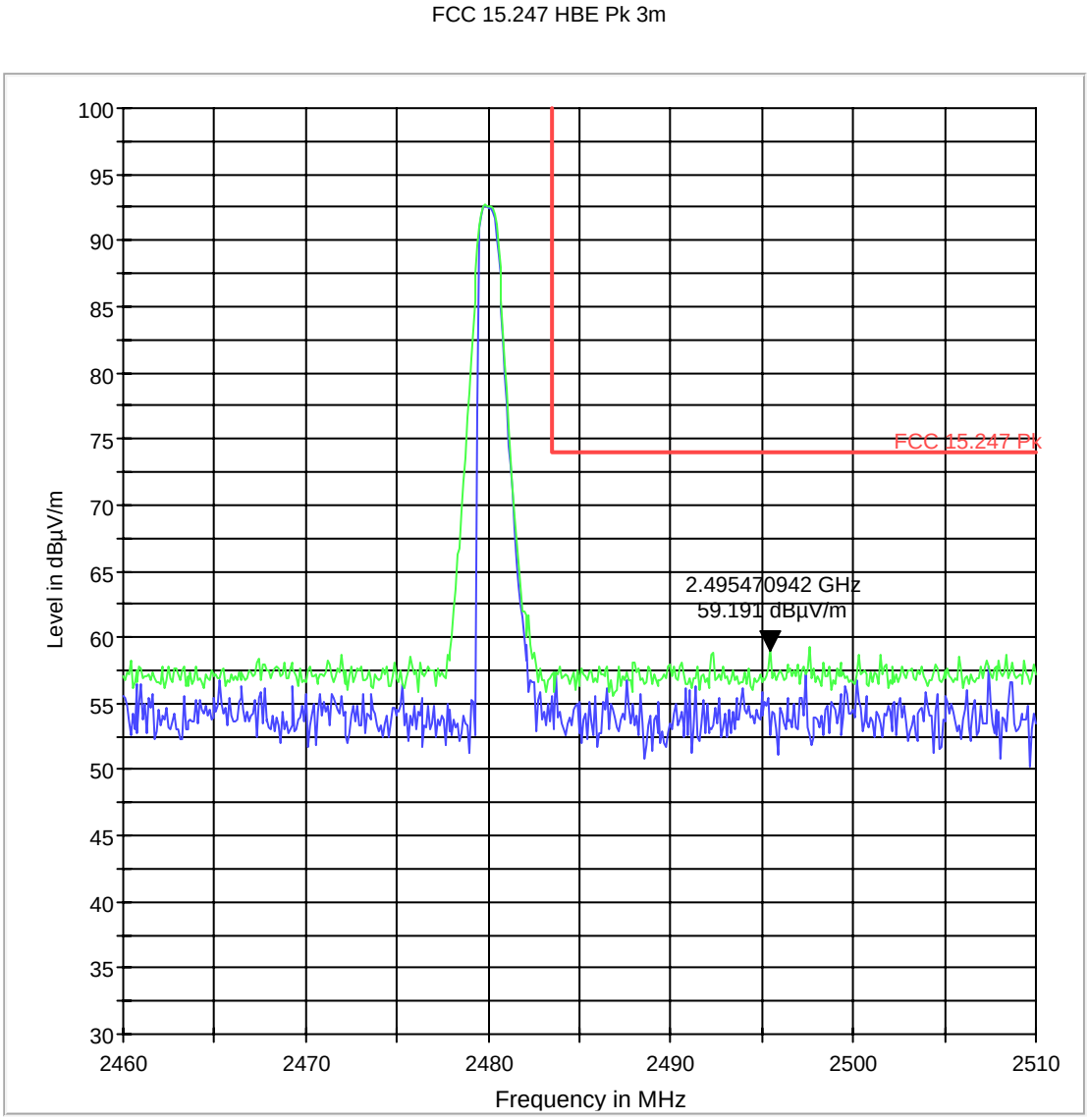


Lower band edge average -GFSK modulation

FCC 15.247 LBE Avg 3m

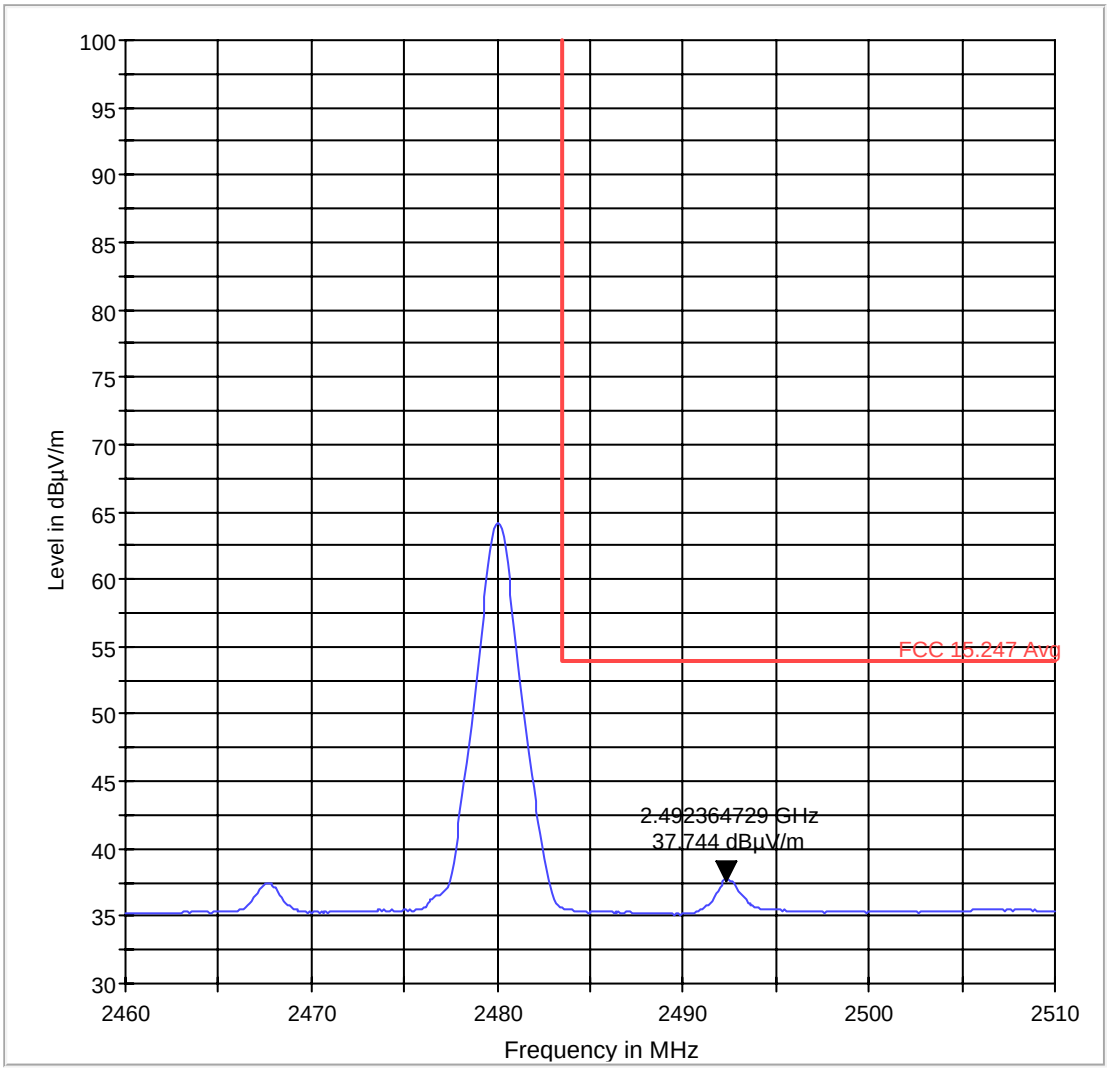


Higher band edge peak -GFSK modulation



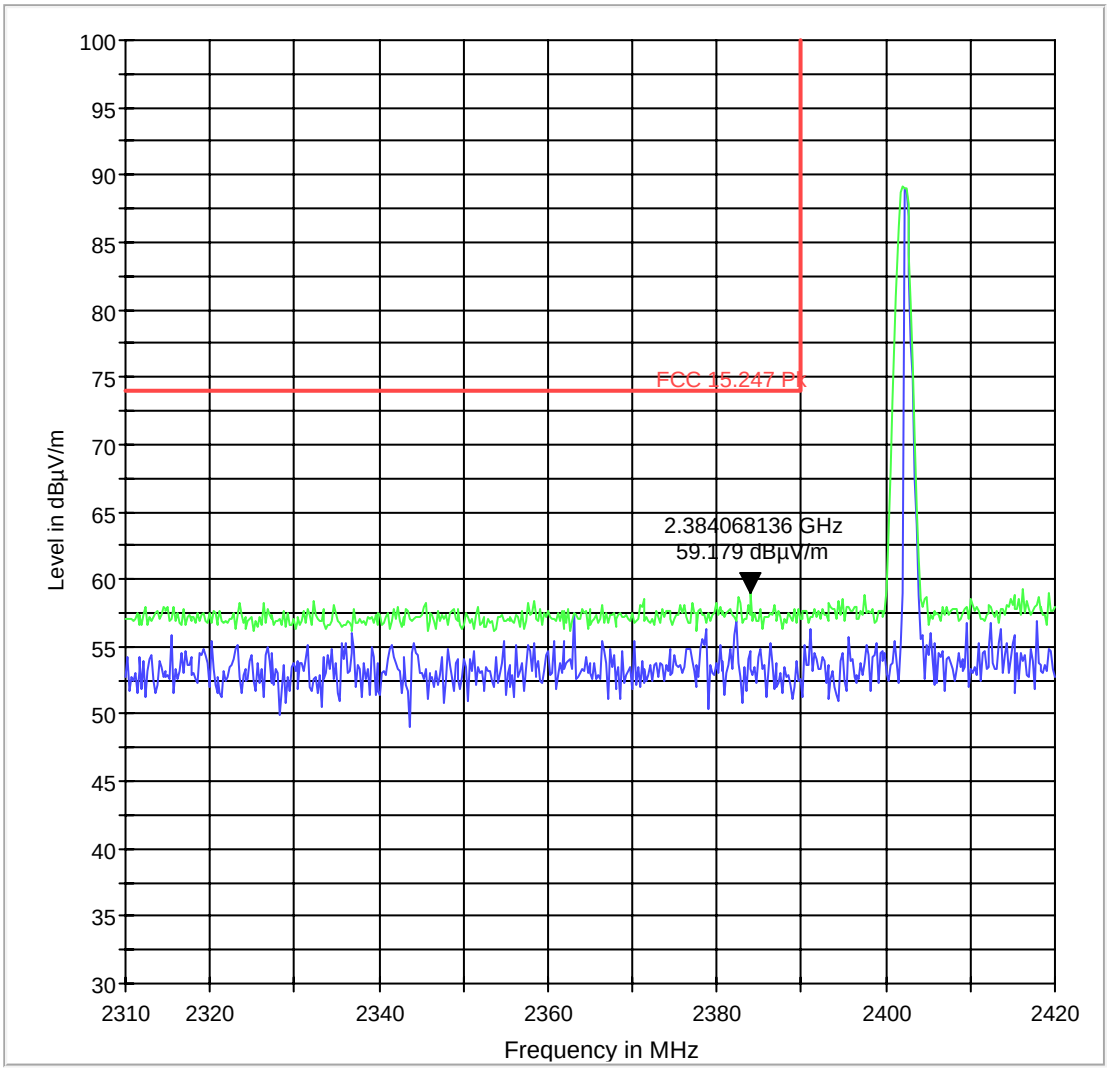
Higher band edge average-GFSK modulation

FCC 15.247 HBE Avg 3m



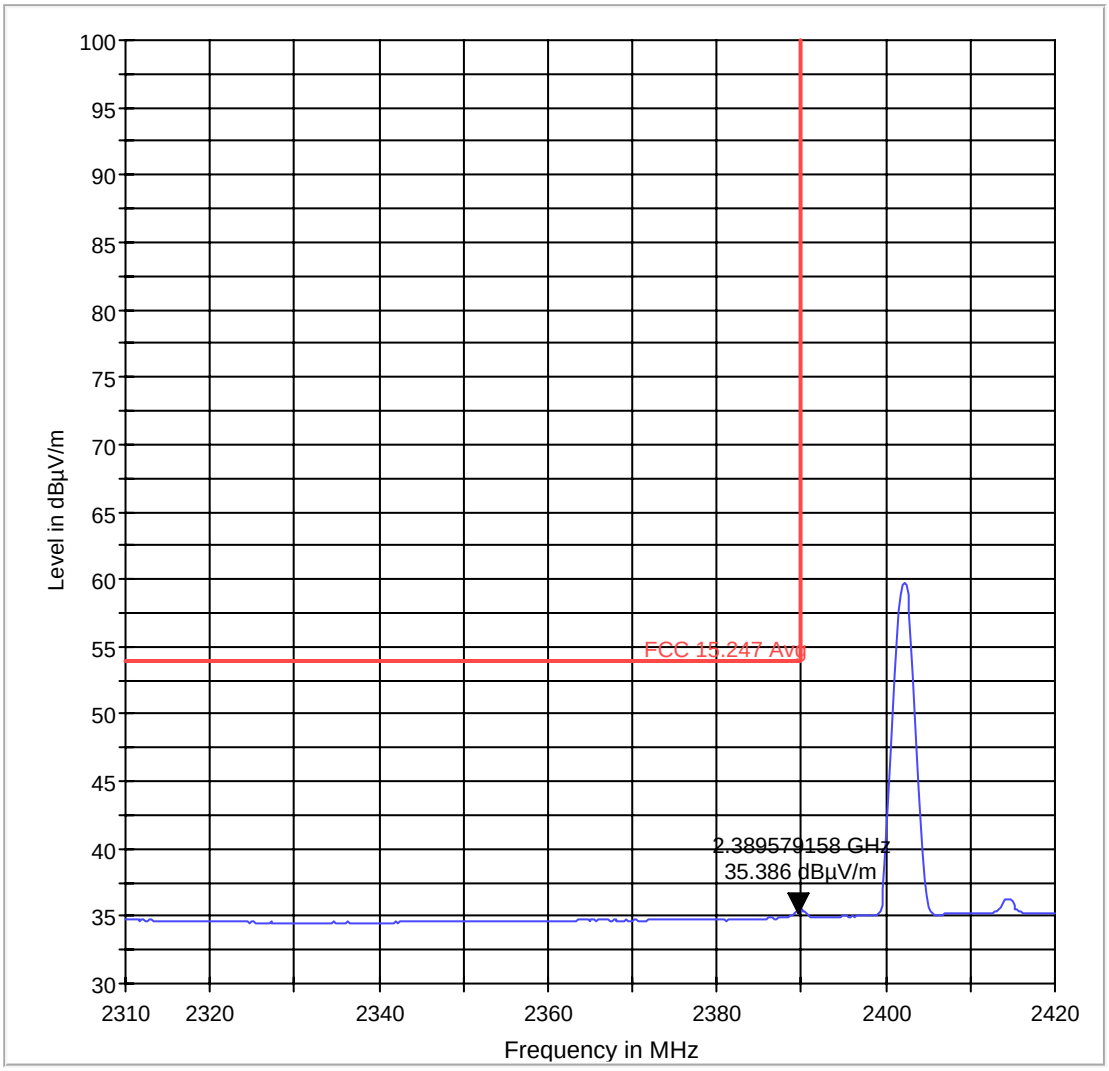
Lower band edge peak - π/4 DQPSK modulation

FCC 15.247 LBE Pk 3m

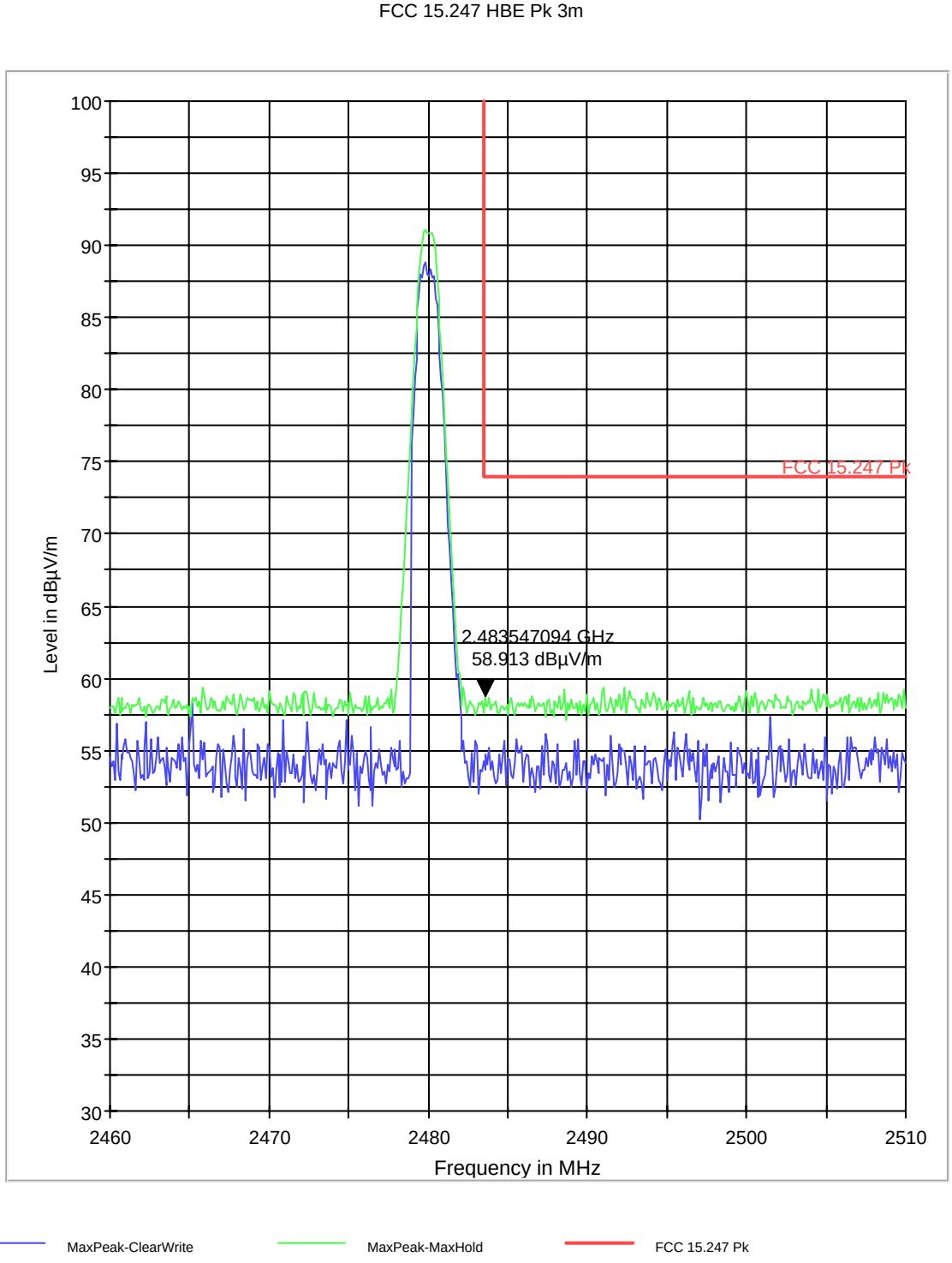


Lower band edge average -π/4 DQPSK modulation

FCC 15.247 LBE Avg 3m

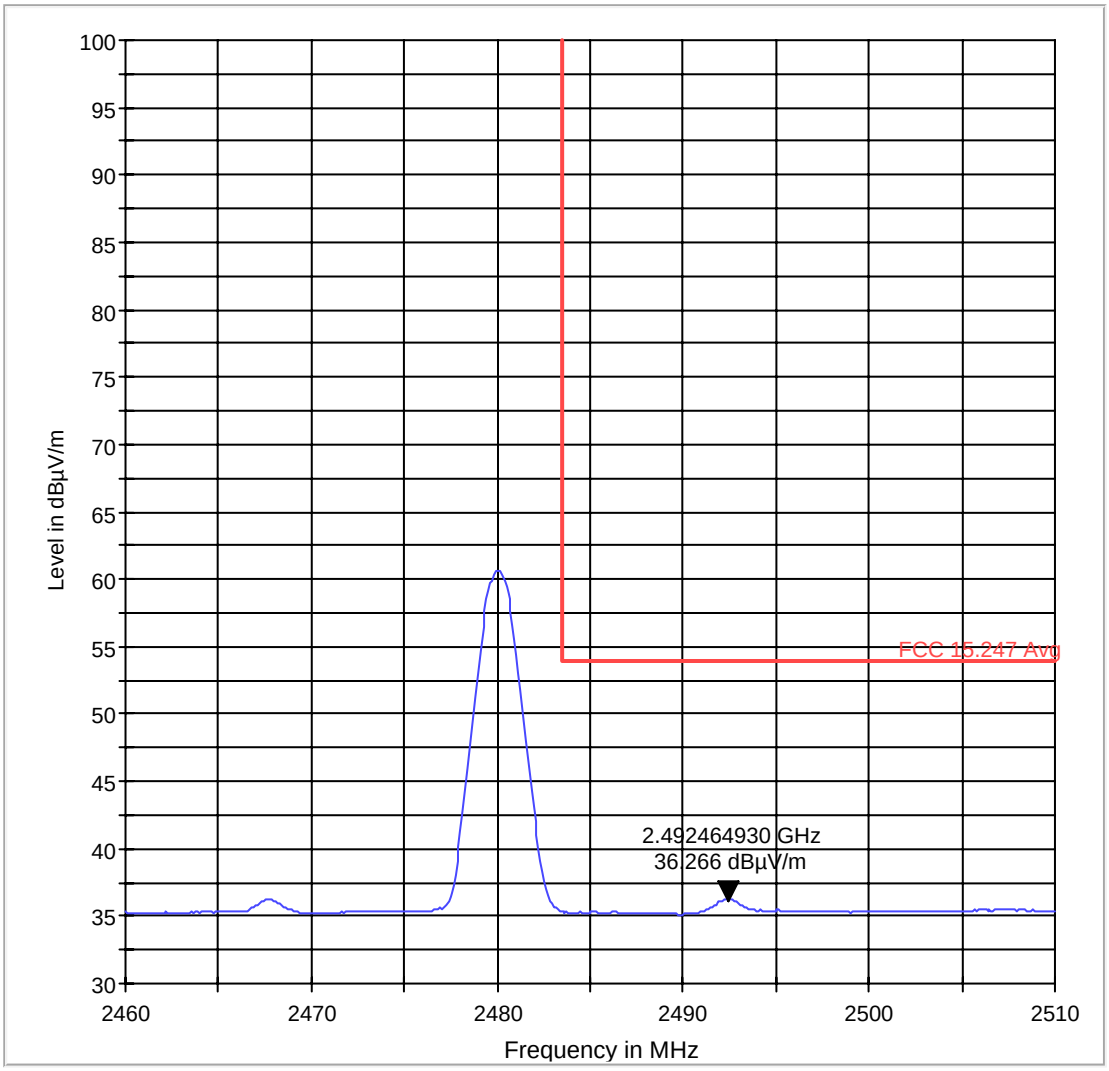


Higher band edge peak -π/4 DQPSK modulation

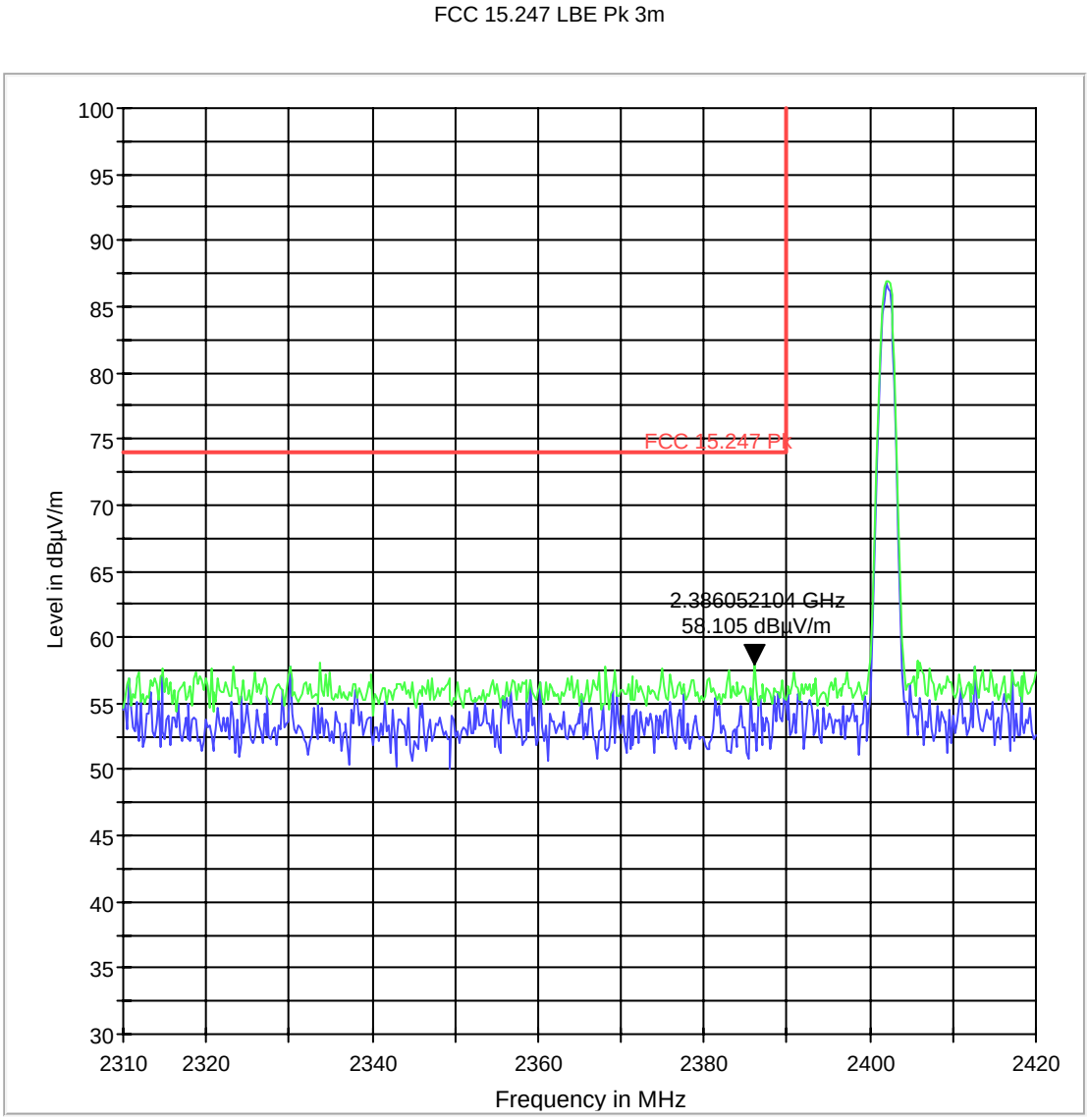


Higher band edge average- π/4 DQPSK modulation

FCC 15.247 HBE Avg 3m

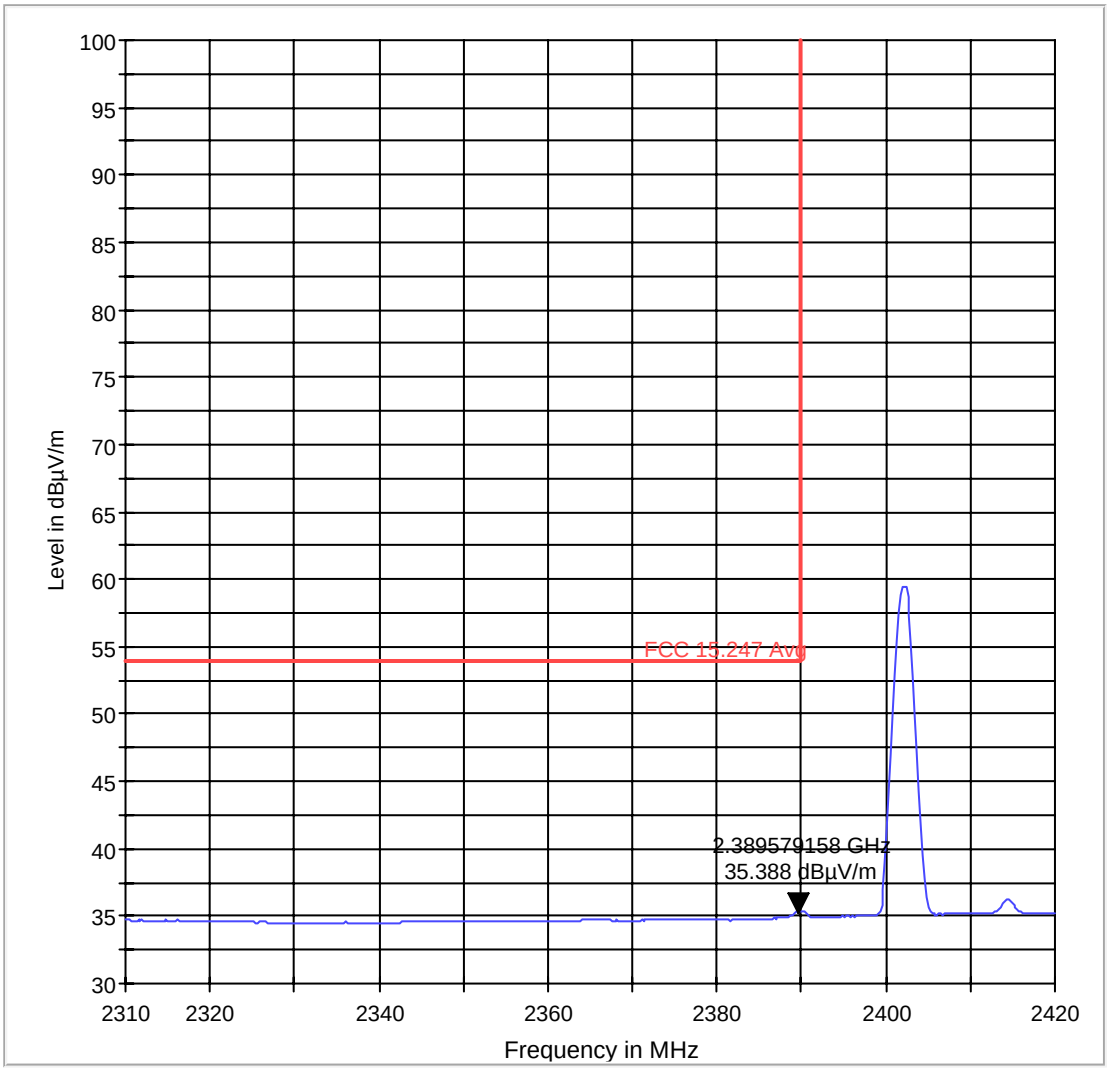


Lower band edge peak - 8DPSK modulation

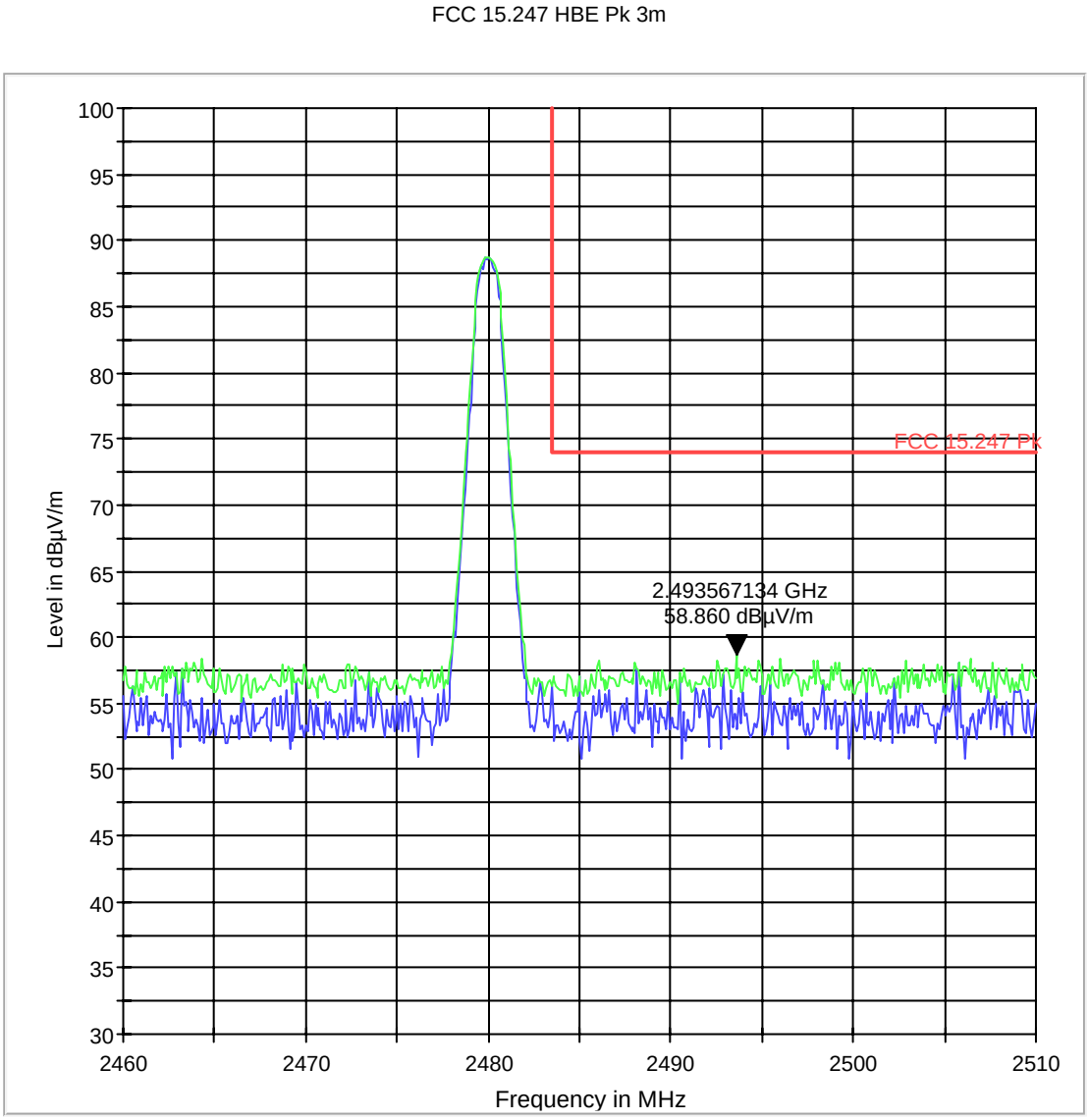


Lower band edge average -8DPSK modulation

FCC 15.247 LBE Avg 3m

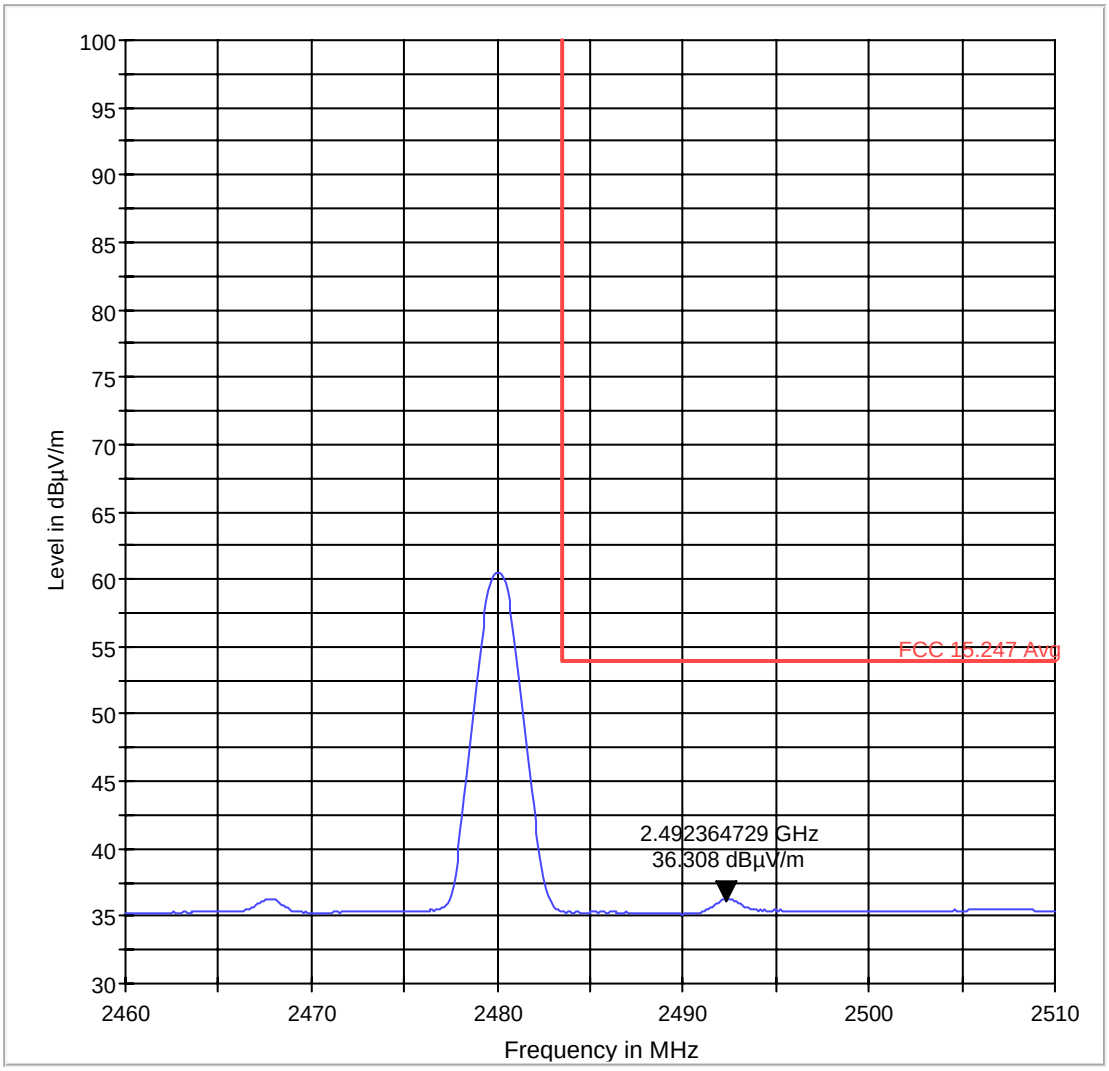


Higher band edge peak - 8DPSK modulation



Higher band edge average-8DPSK modulation

FCC 15.247 HBE Avg 3m



6.5 Spectrum Bandwidth/ 20dB Bandwidth

6.5.1 References:

FCC CFR §2.1049
RSS-Gen Section 4.6.1

6.5.2 Measurement requirements:

6.5.2.1 FCC 2.1049: Occupied bandwidth

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable.
(h) Transmitters employing digital modulation techniques-when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated.

6.5.2.2 RSS-Gen 4.6: Occupied bandwidth

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 percent emission bandwidth, as calculated or measured.
The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

6.5.3 Limits:

6.5.3.1 §15.247 (a)(1)
6.5.3.2 RSS 210- A8.1(b)
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.

GFSK < 1000 kHz
π / 4 DQPSK < 1500 kHz
8 dPSK < 1500kHz

6.5.4 Test Conditions:

Tnom: 25°C; Vnom: AC
Hopping OFF
Spectrum Analyzer settings:
RBW=10kHz, VBW=30kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=2MHz

6.5.5 Test Result:

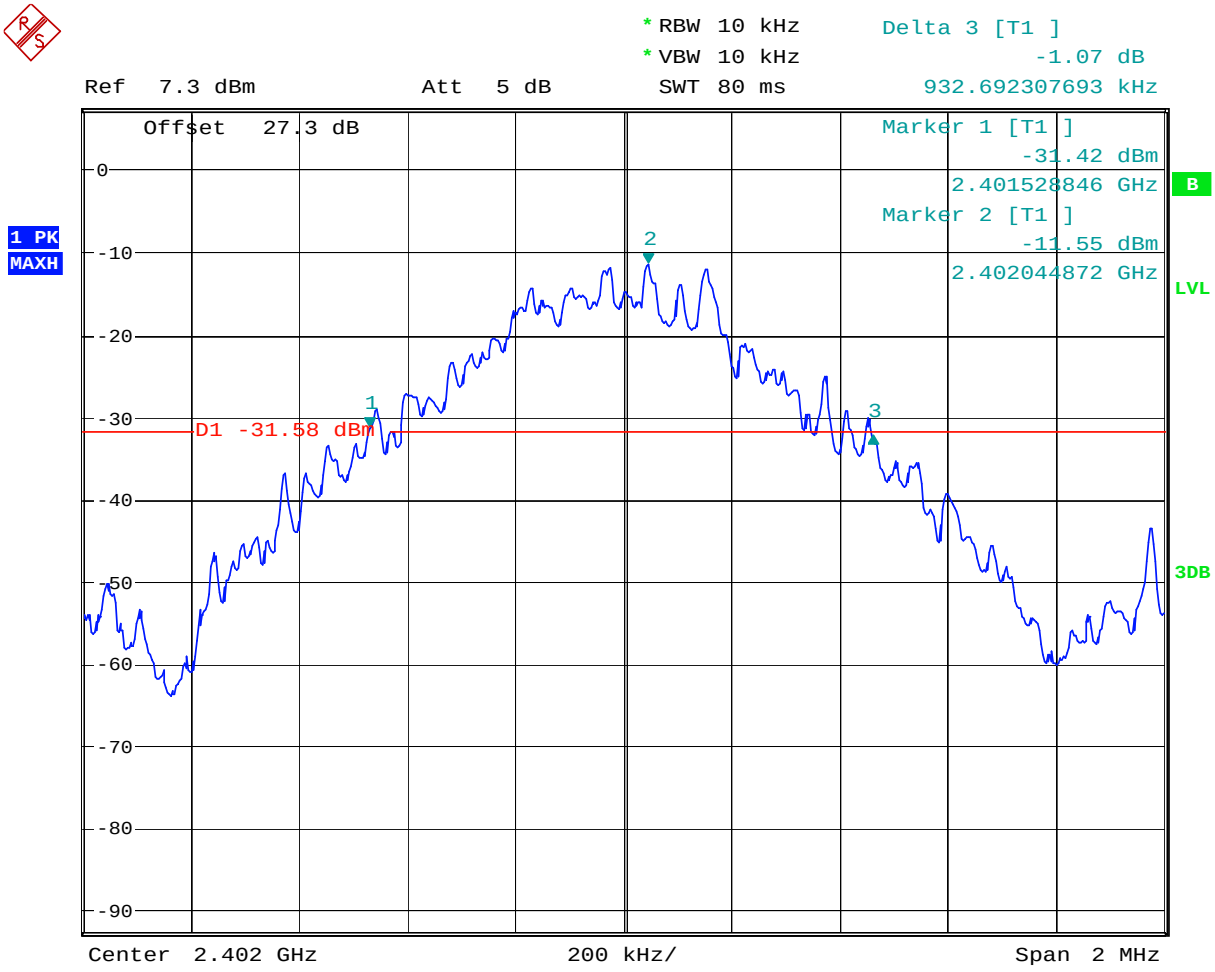
20dB Bandwidth (MHz)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	0.932	0.929	0.929
π/4 DQPSK	1.17	1.18	1.19
8-DPSK	1.17	1.17	1.17
Measurement Uncertainty: ±10 kHz			

6.5.5.1 Measurement Result

Pass.

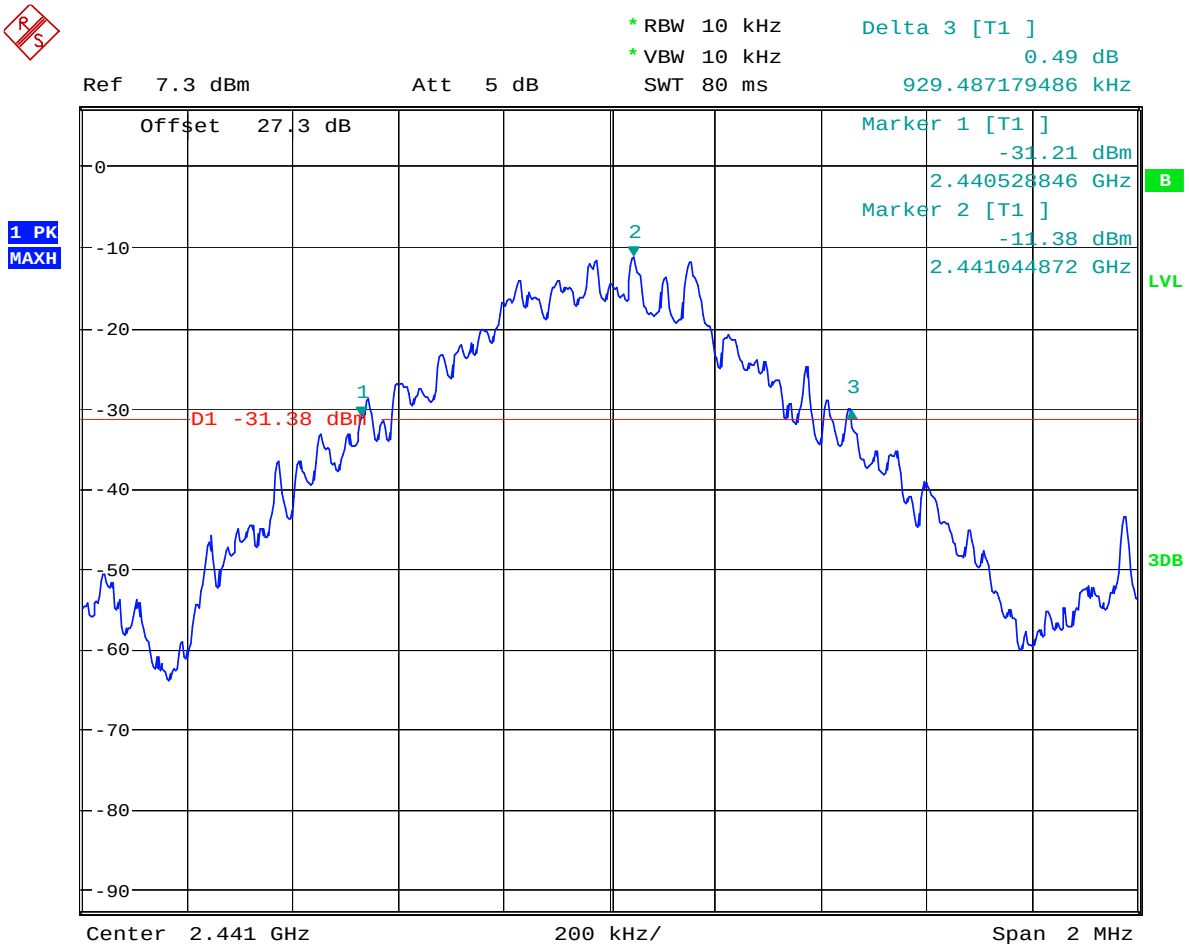
6.5.6 Test Data/plots:

20dB Bandwidth GFSK 2402MHz



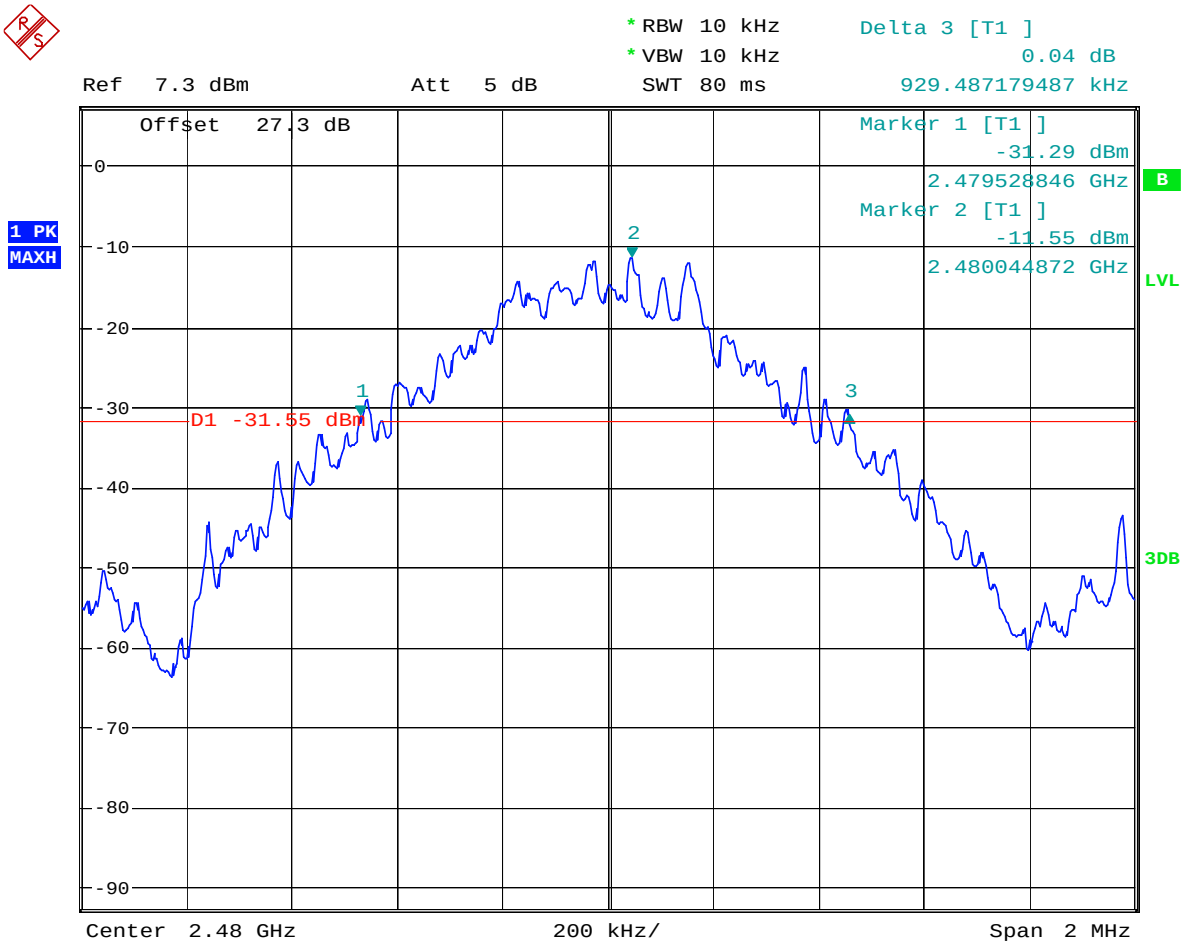
Date: 14.DEC.2010 15:43:22

20dB Bandwidth GFSK 2441MHz



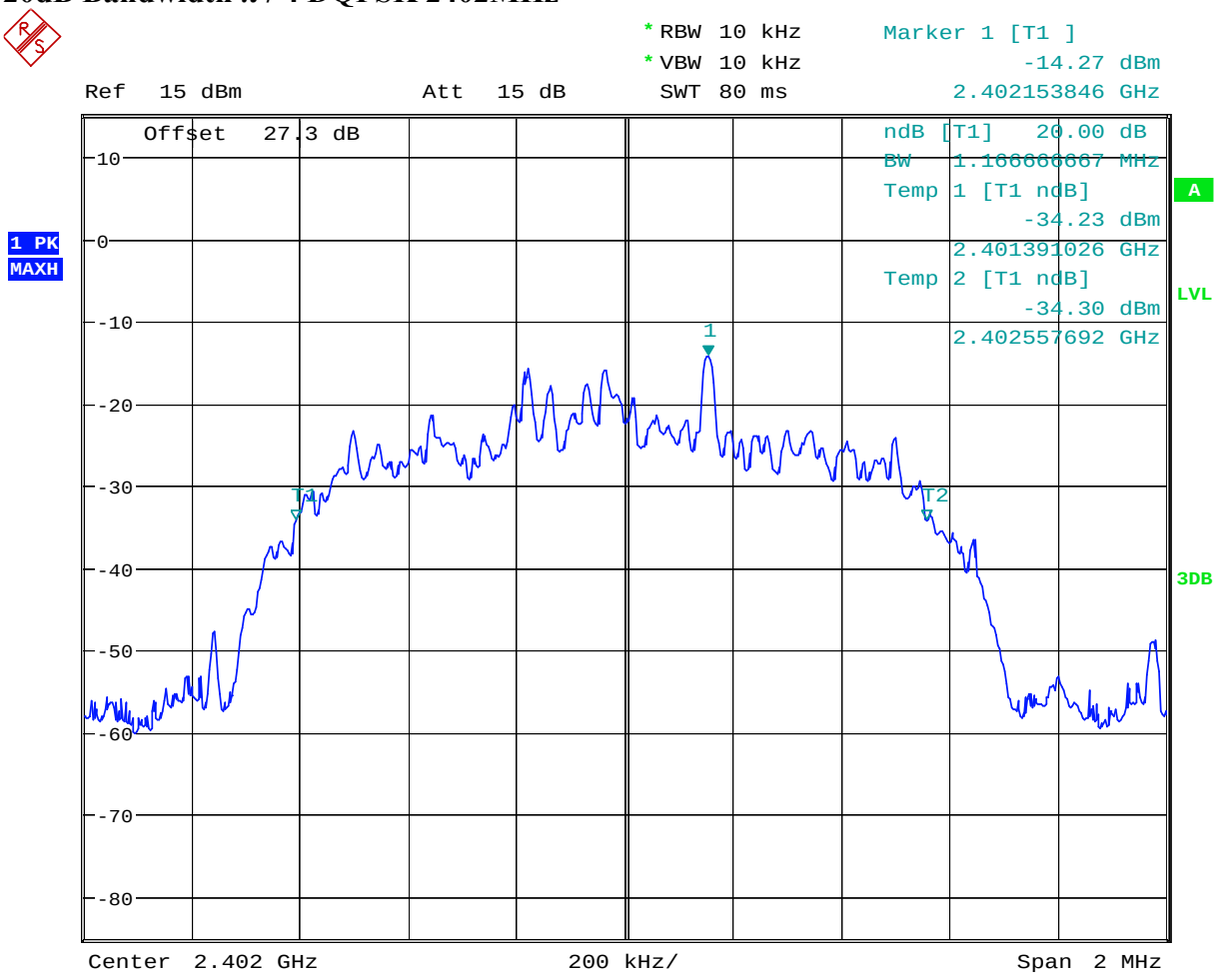
Date: 14.DEC.2010 15:44:48

20dB Bandwidth GFSK 2480MHz



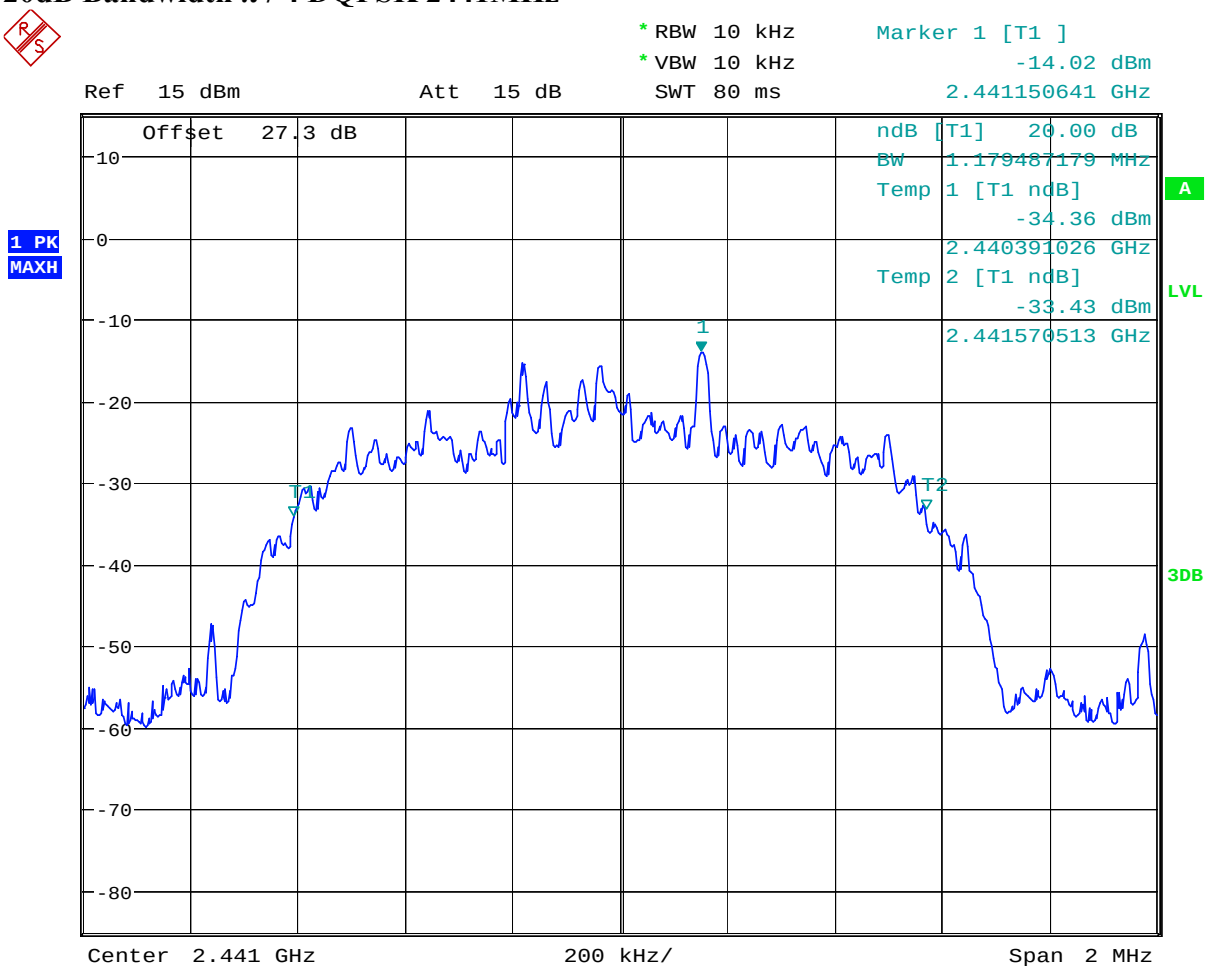
Date: 14.DEC.2010 15:46:23

20dB Bandwidth π / 4 DQPSK 2402MHz



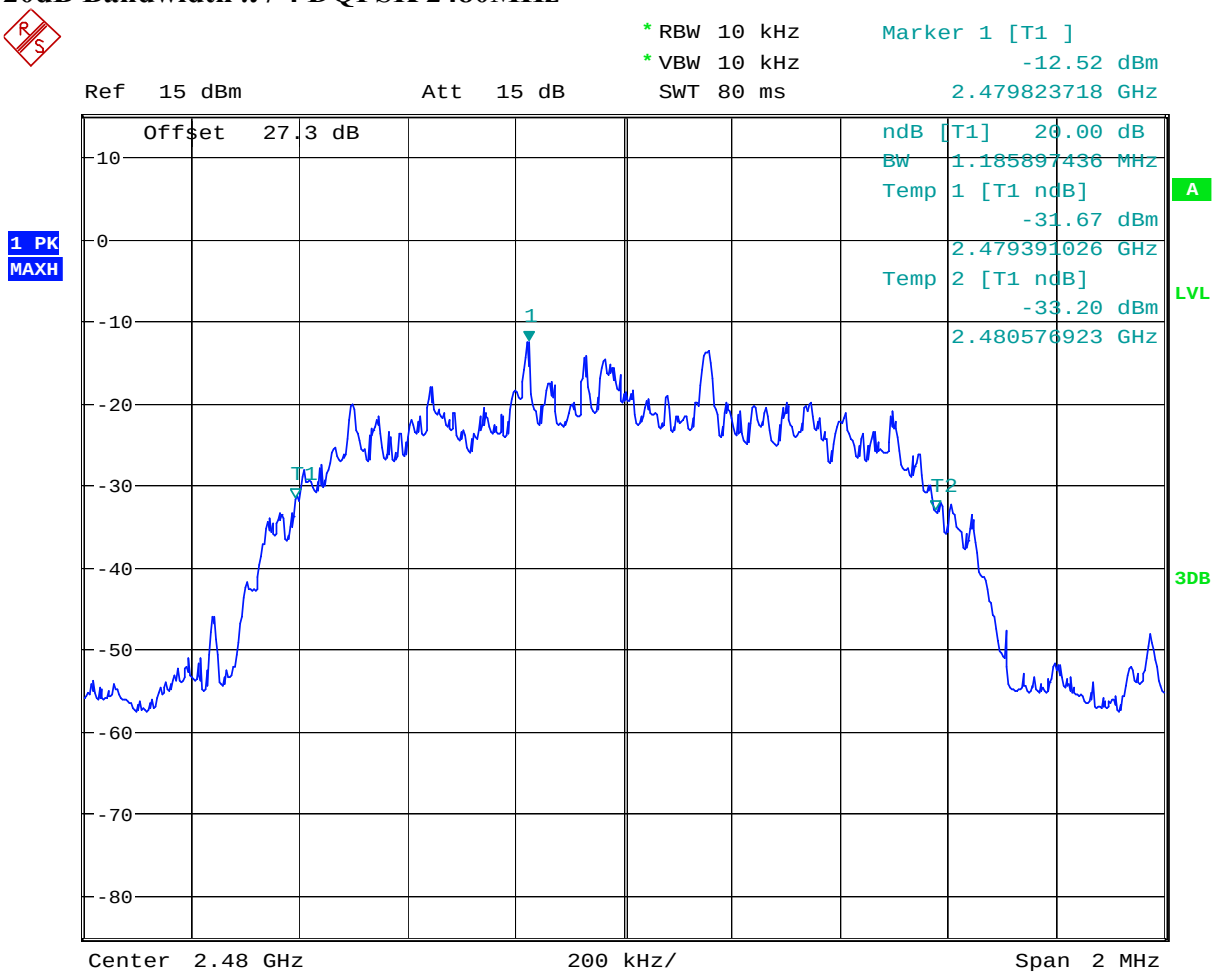
Date: 14.DEC.2010 15:28:02

20dB Bandwidth π / 4 DQPSK 2441MHz



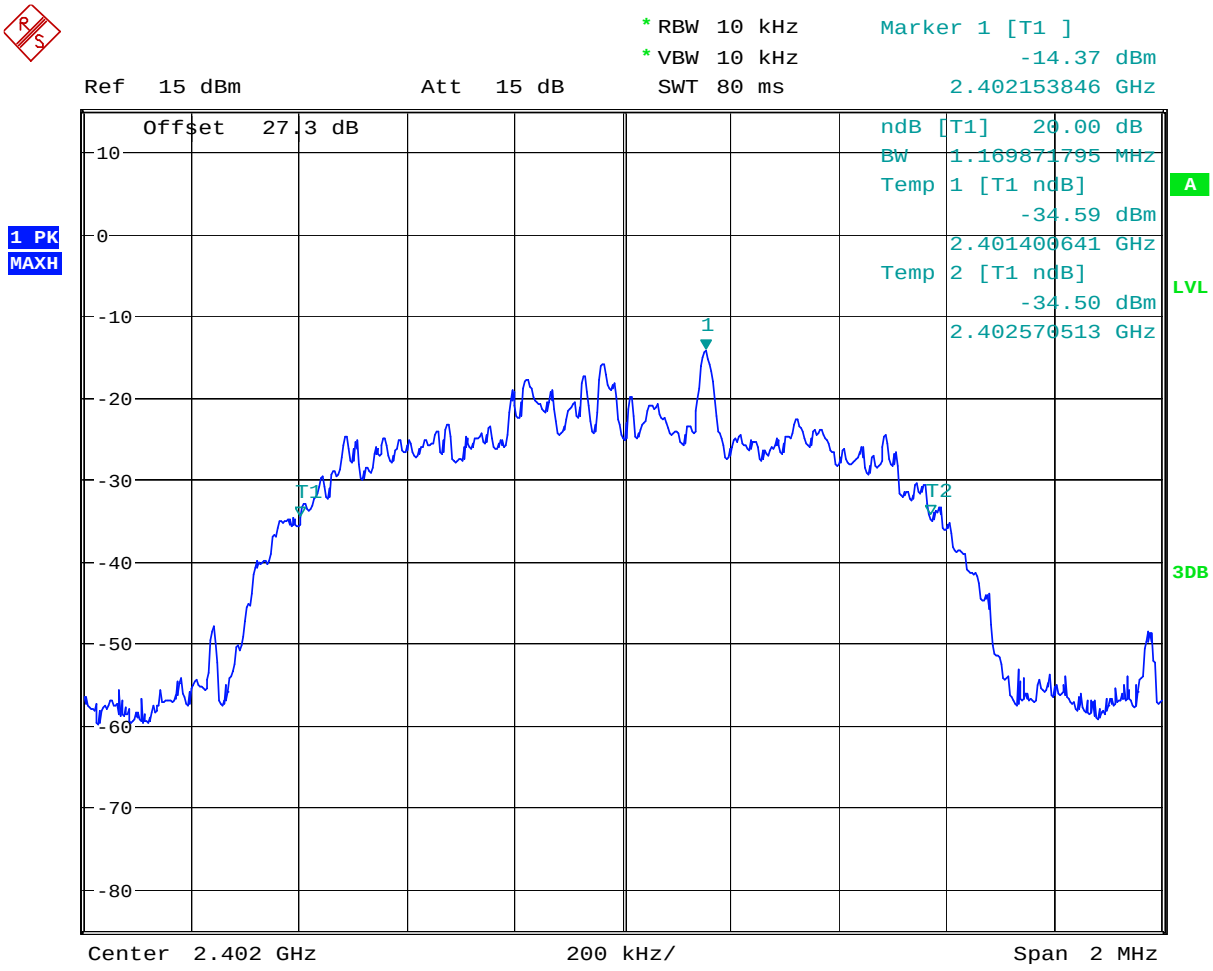
Date: 14.DEC.2010 15:25:47

20dB Bandwidth π / 4 DQPSK 2480MHz



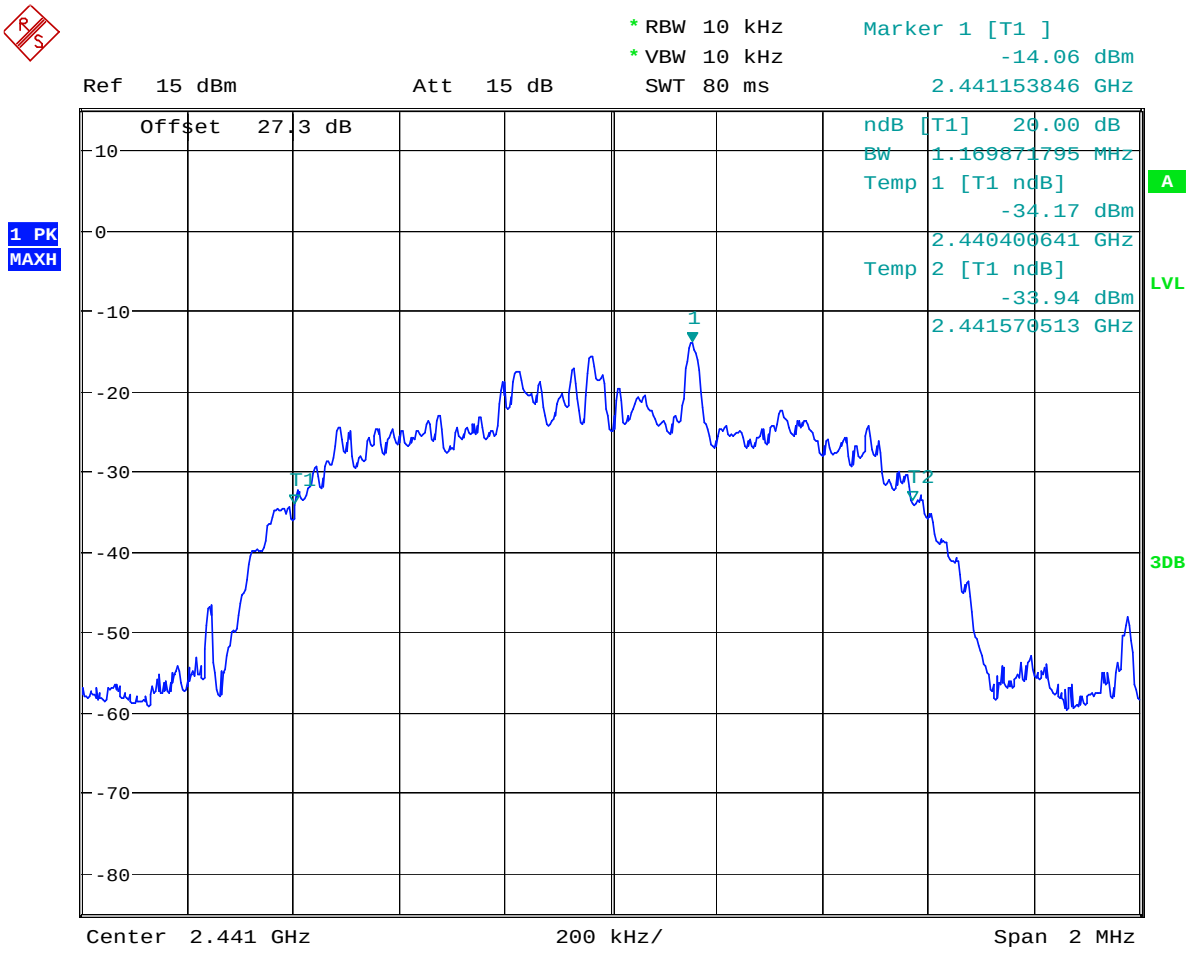
Date: 14.DEC.2010 14:42:48

20dB Bandwidth 8PSK 2402MHz



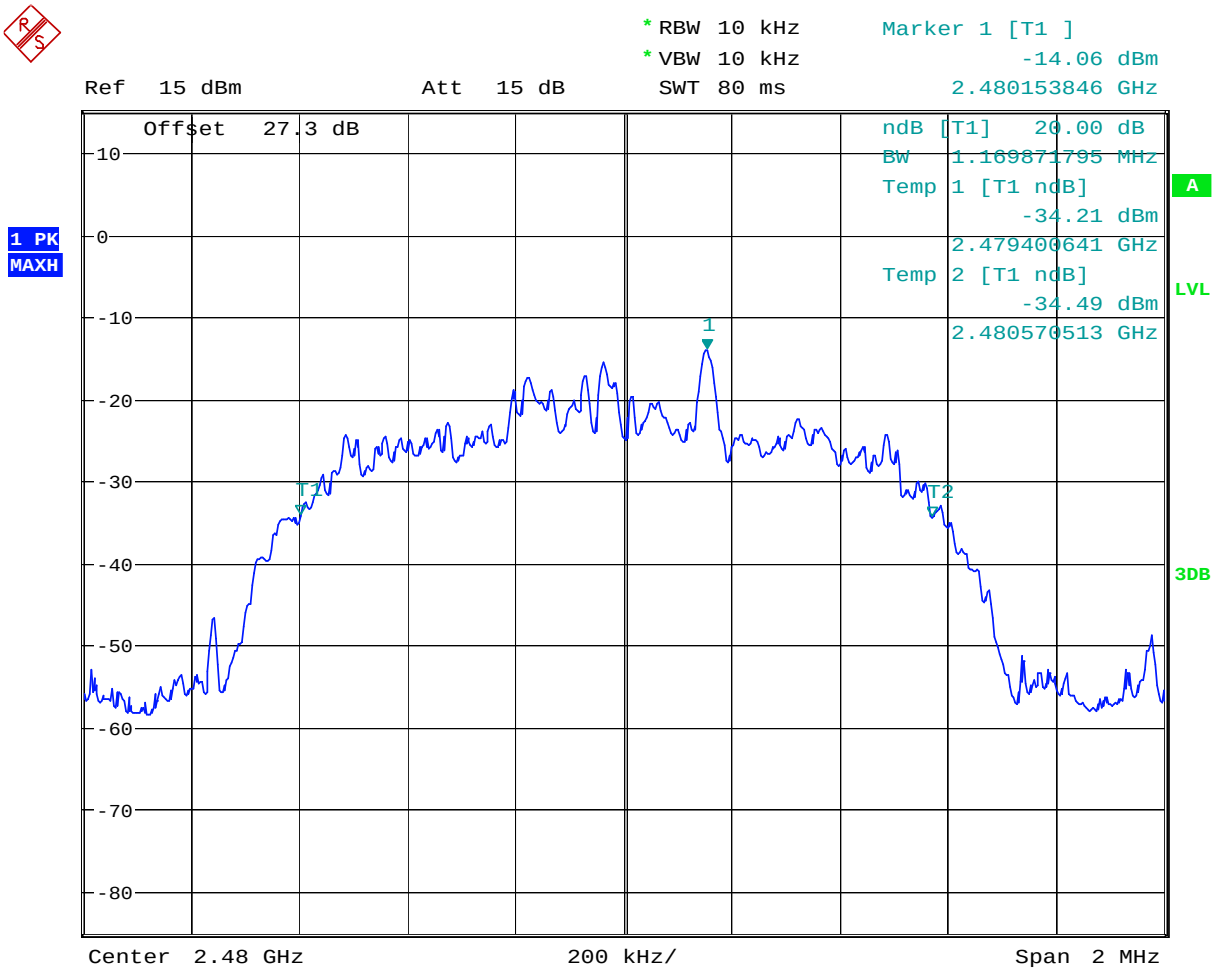
Date: 14.DEC.2010 15:27:19

20dB Bandwidth 8PSK 2441MHz



Date: 14.DEC.2010 15:26:38

20dB Bandwidth 8PSK 2480MHz



Date: 14.DEC.2010 14:31:14

6.6 Carrier Frequency Separation

6.6.1 Limits:

§ 15.247 (a) (1)
RSS 210- A8.1(b)
Minimum 25kHz or 2/3 of the 20dB bandwidth of the hopping system

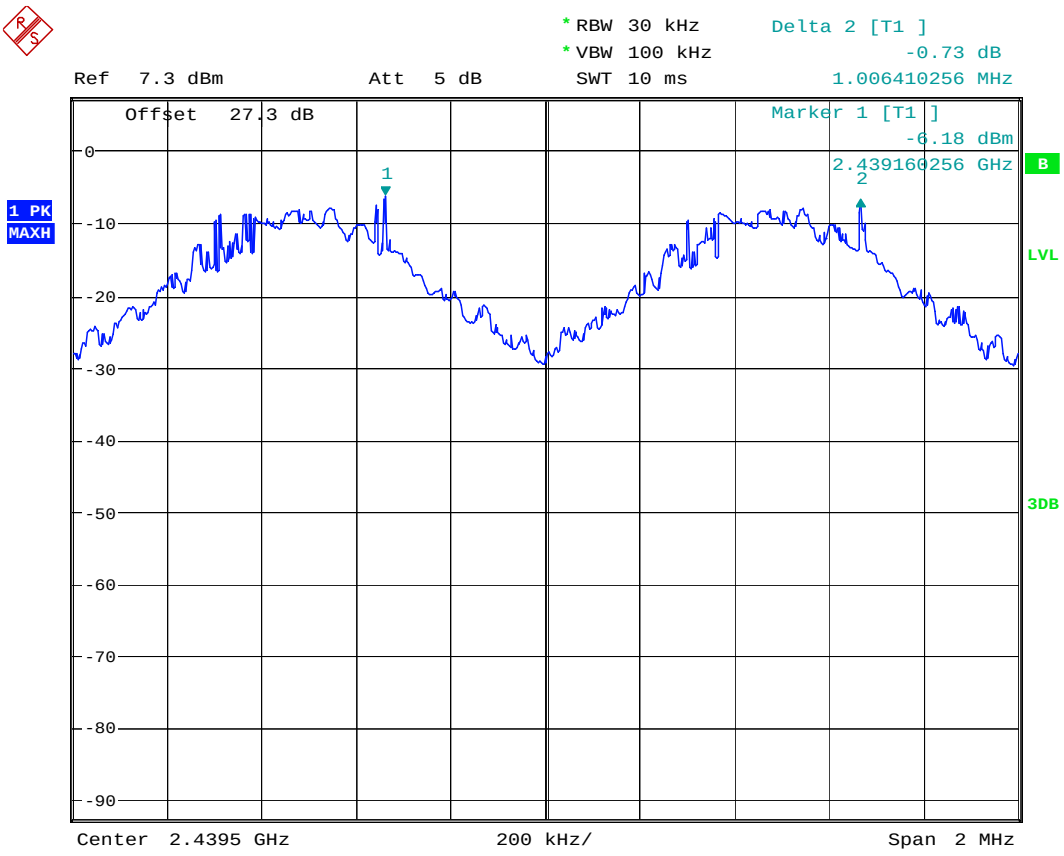
6.6.2 Test Result:

Modulation: GFSK
Channel Separation: 1.006 MHz

6.6.3 Test Conditions:

Tnom: 25°C; Vnom: AC
Hopping ON
Spectrum Analyzer settings:
RBW=30kHz, VBW=100kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=2MHz

6.6.4 Test Data/plot:



Date: 14.DEC.2010 16:14:12

6.6.4.1 Measurement Result

Pass.

6.7 Number of hopping channels

6.7.1 Limits:

§ 15.247 (a) (1)
RSS 210- A8.1(d)
Atleast 15 non-overlapping channels

6.7.2 Test Result:

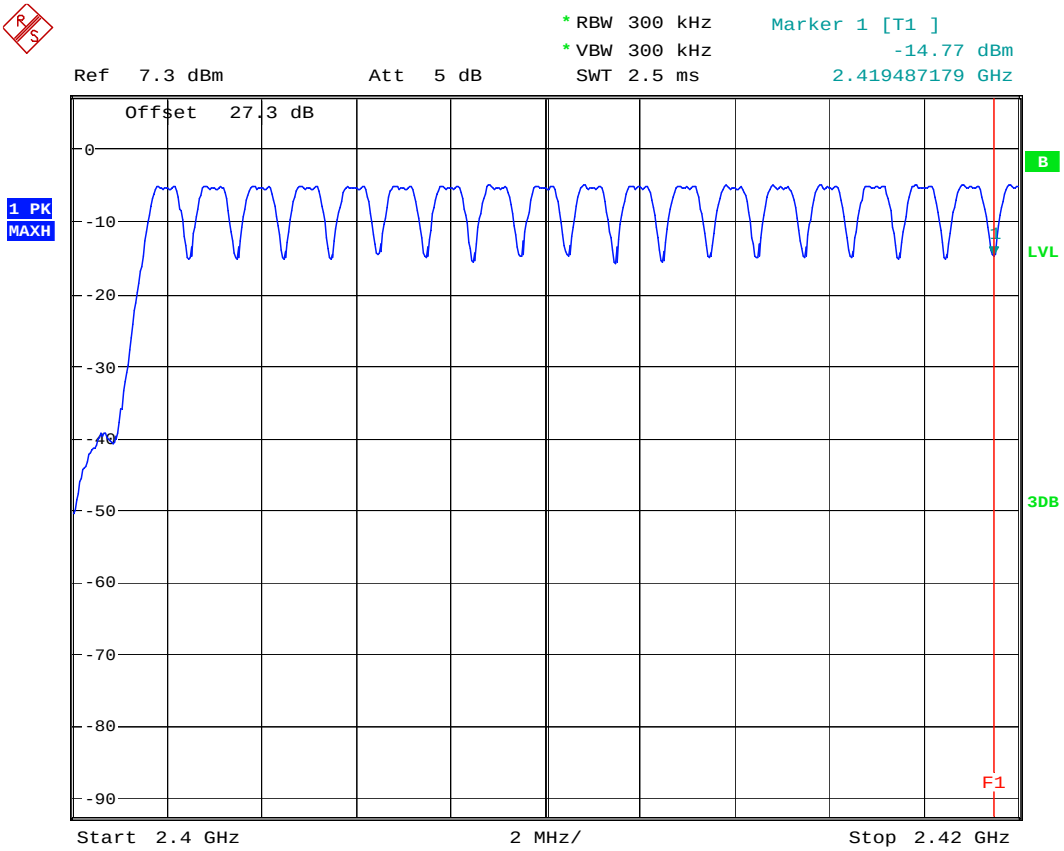
Modulation: GFSK
Number of hopping channels: 79

6.7.3 Test Conditions:

Tnom: 25°C; Vnom: AC
Hopping ON
Spectrum Analyzer settings:
RBW=30kHz, VBW=100kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=Full range

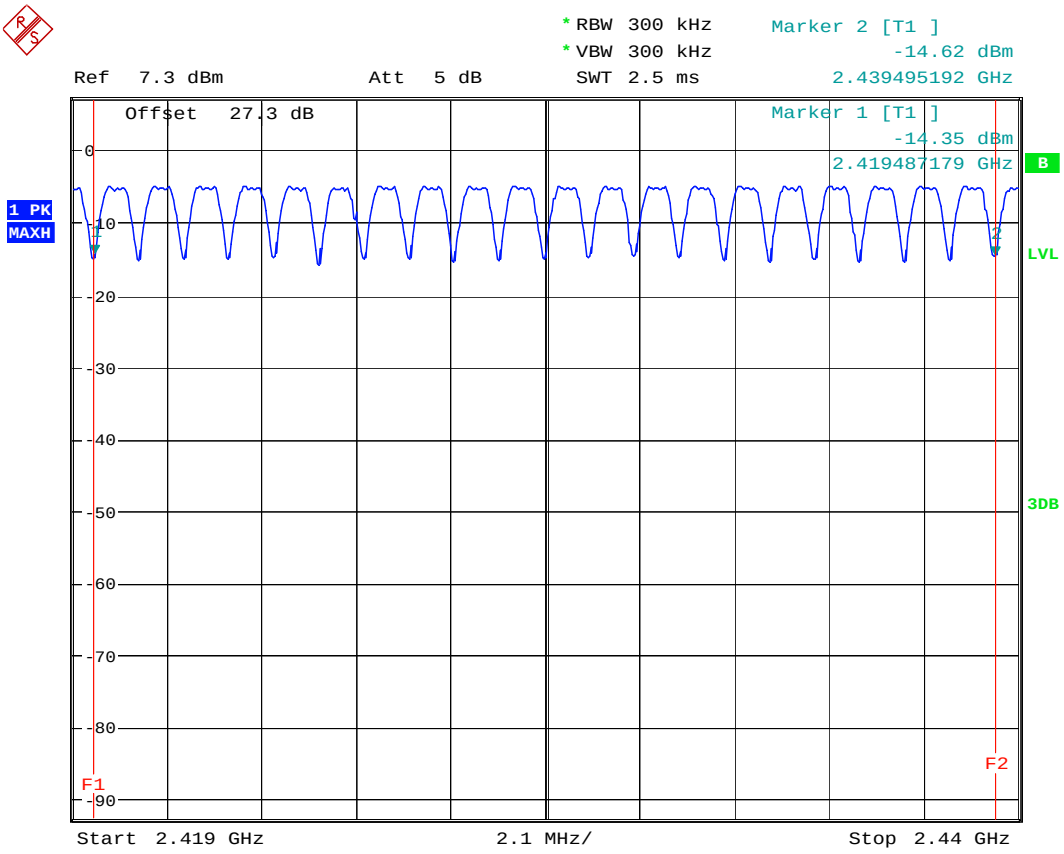
6.7.4 Test Data/plots:

2400-2420 MHz: 18 Channels



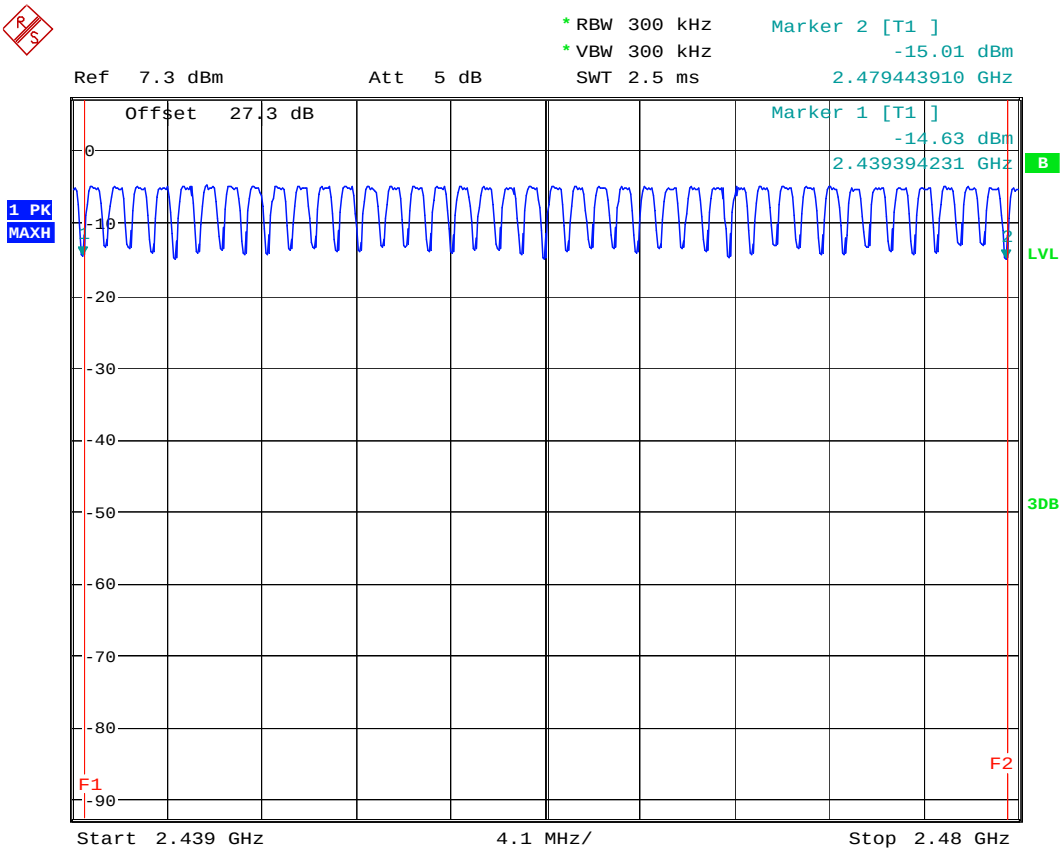
Date: 14.DEC.2010 15:52:23

2420-2440 MHz: 20 Channels



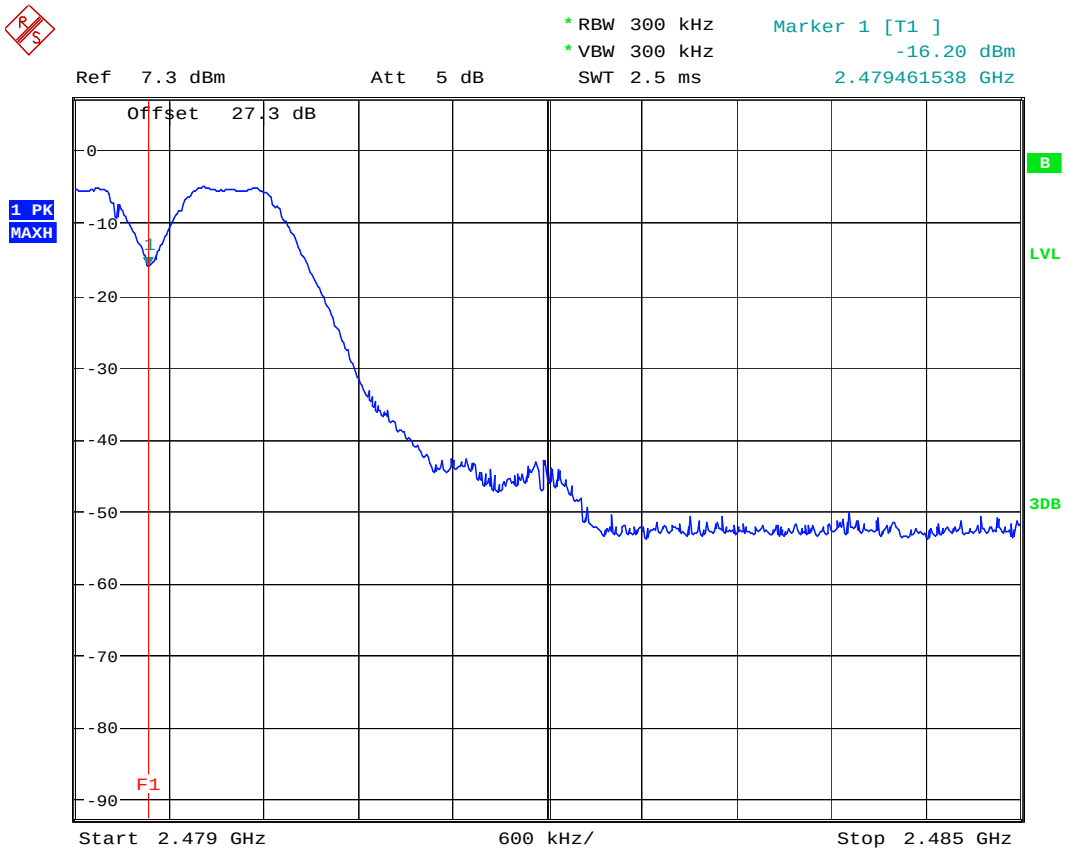
Date: 14.DEC.2010 15:54:02

2440-2480 MHz: 40 Channels



Date: 14.DEC.2010 15:56:19

2480-2485 MHz: 1



Date: 14.DEC.2010 15:57:32

6.7.4.1 Measurement Result

Pass.

6.8 Time of occupancy (Dwell time)

6.8.1 Limits:

§ 15.247 (a) (1) (iii)
RSS 210- A8.1(d)
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.

6.8.2 Test Result:

For Bluetooth devices:

The dwell time of 0.4 s within a 31.6 second period in data mode is independent from the packet type (packet length). The calculation for a 31.6 second period is a follows:

Dwell time = time slot length * hop rate / number of hopping channels *31.6 s

Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = 625 µs * 1600 1/s / 79 * 31.6 s = 0.4 s (in a 31.6 s period)

For multi-slot packet the hopping is reduced according to the length of the packet.
Example for a DH5 packet (with a maximum length of five time slots)
Dwell time = 5 * 625 µs * 1600 * 1/5 *1/s / 79 * 31.6 s = 0.4 s (in a 31.6 s period)

This is according to Bluetooth Core Specification for all Bluetooth devices. Therefore all BT devices satisfy FCC requirement on time of occupancy (dwell time) in the data mode.

6.8.2.1 Test Result
Pass.

6.9 Power Spectral Density (Hybrid system in Inquiry mode/ Page scan)

6.9.1 Limits: § 15.247 (e)

For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

6.9.2 Test Result:

Not Applicable for FHSS systems.

6.10 Transmitter Spurious Emissions- Conducted

6.10.1 Reference and Limits:

6.10.1.1 § 15.247 (d)
6.10.1.2 RSS 210-A8.5
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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.
30dBm for the transmitter.
-20dBc in the frequency range 30MHz- 25GHz.

6.10.2 Test Conditions:

Tnom: 25°C; Vnom: AC
Hopping OFF
Spectrum Analyzer settings:
RBW=100kHz, VBW=300kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=Full range

6.10.3 Test Result:

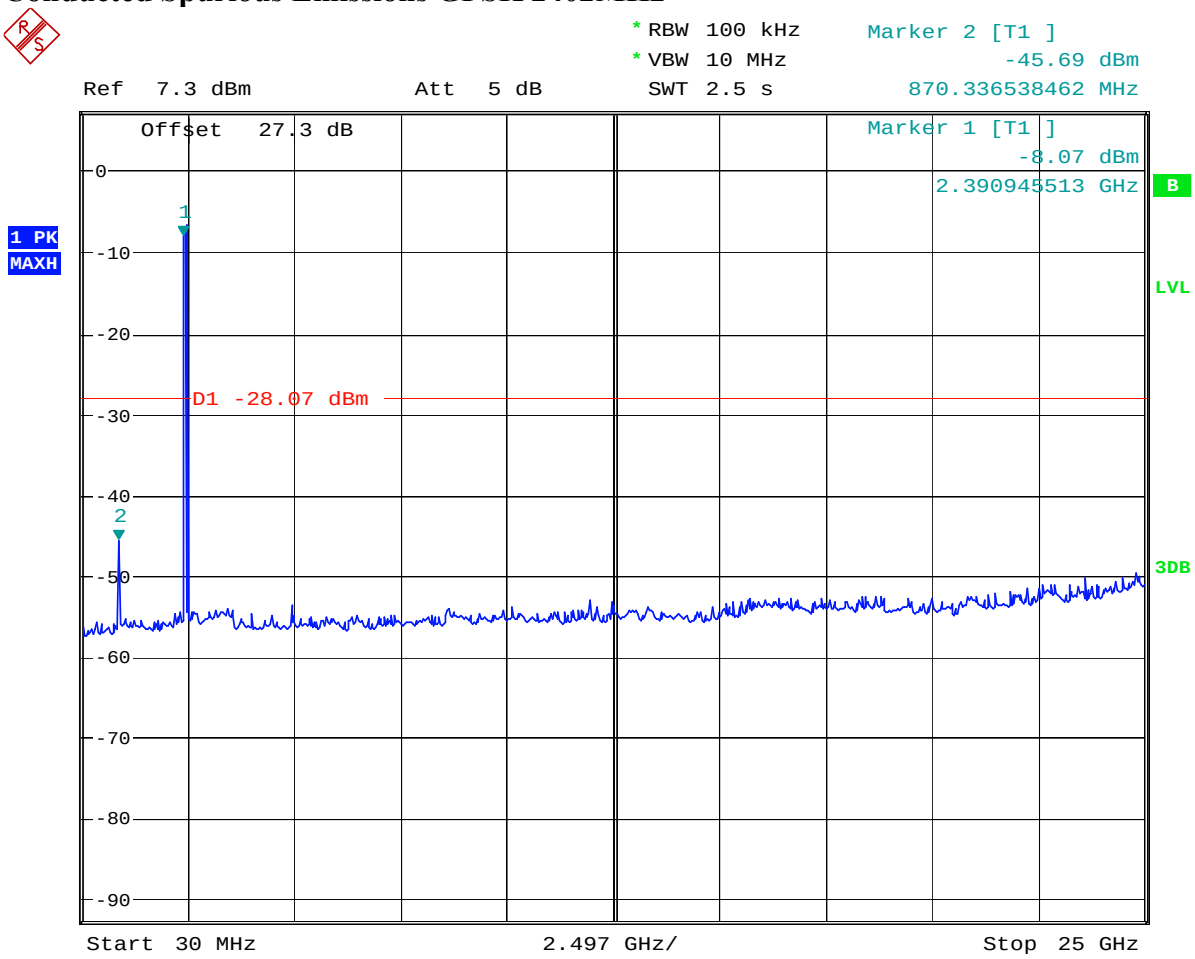
Modulation: GFSK

Conducted Spurious Emissions			
Channel	**Frequency (MHz)**	**Amplitude (dBm)**	**Limits**
		GFSK	
Low	**2412**	-8.07	30dBm
	Spurious	All other peaks >20dB below limit	-20dBc
Mid	**2437**	-6.31	30 dBm
	Spurious	All other peaks >20dB below limit	-20dBc
High	**2462**	-6.45	30 dBm
	Spurious	All other peaks >20dB below limit	-20dBc
Measurement Uncertainty: ±1.0 dB			

6.10.3.1 Measurement Result
Pass.

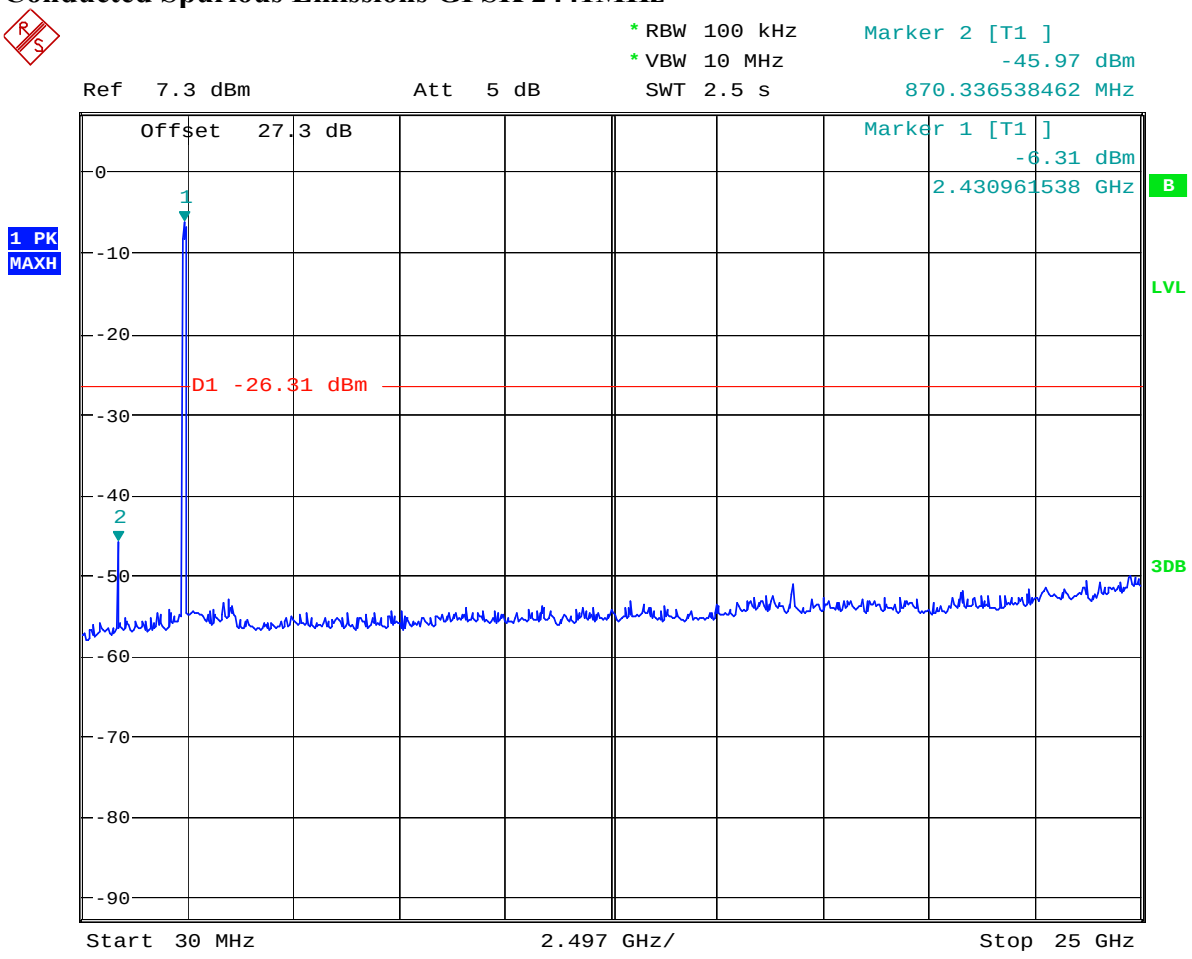
6.10.4 Test data/ plots:

Conducted Spurious Emissions GFSK 2402MHz



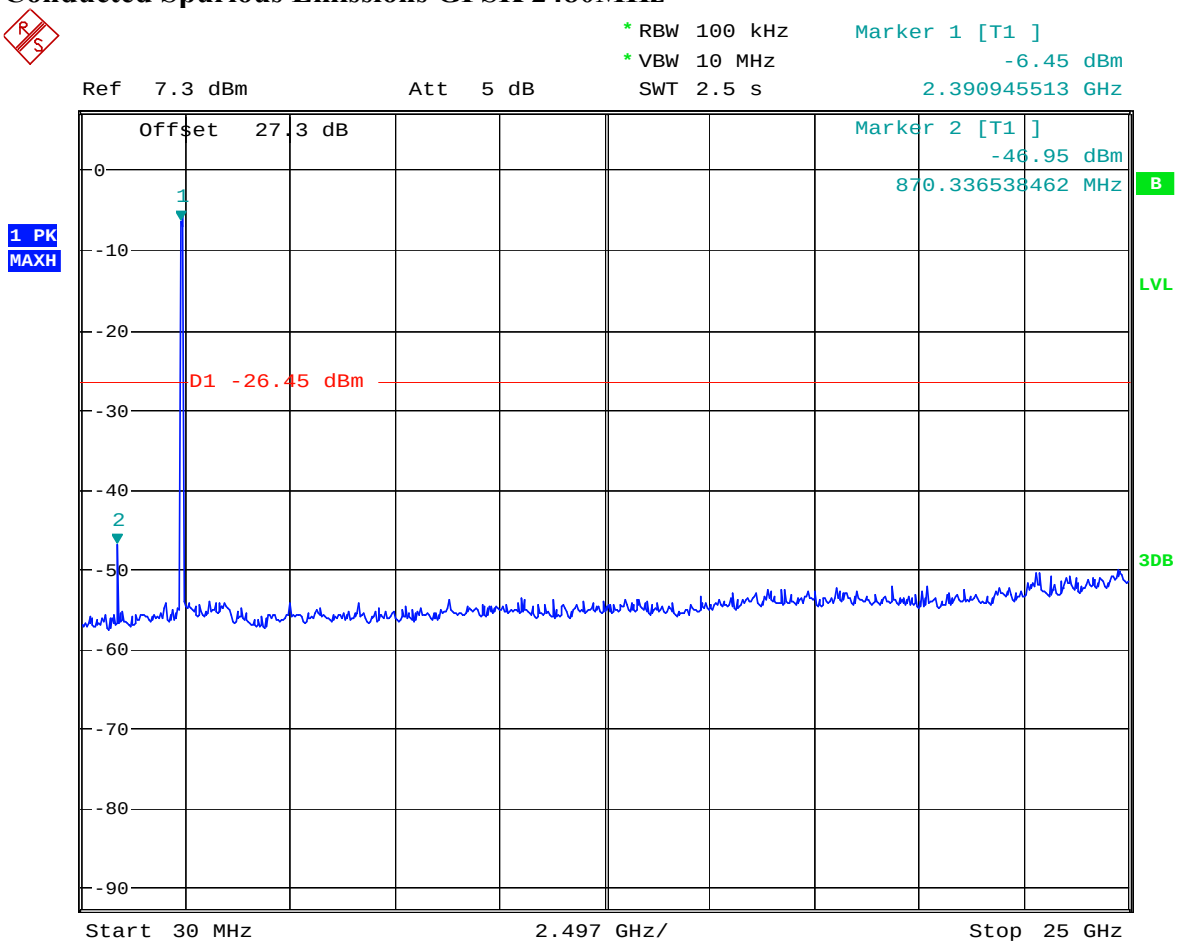
Date: 14.DEC.2010 16:23:01

Conducted Spurious Emissions GFSK 2441MHz



Date: 14.DEC.2010 16:24:52

Conducted Spurious Emissions GFSK 2480MHz



Date: 14.DEC.2010 16:25:50

6.11 Transmitter Spurious Emissions- Radiated

6.11.1 References:

FCC CFR 2.1053
RSS-Gen Section 4.9; RSS 210-A8.5

6.11.2 Measurement requirements:

6.11.2.1 FCC 2.1053: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

6.11.2.2 RSS-Gen 4.9: Transmitter unwanted spurious emissions

The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements.
The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

6.11.2.3 FCC KDB 520657

Testing of spurious emissions should be performed with all transmitters functioning. This ensures that additional spurs are not generated. Testing must also check for the non-coordination requirement in Section 15.247(h). Which prohibits the system from monopolizing the entire frequency band.
Each transmitter must also meet all of the FHSS requirements individually. For instance, each transmitter must individually use the minimum number of channels, use each frequency equally on average and transmit from a pseudo random list. If the device complies with all of the above, the proposed system is acceptable.

6.11.3 Limits:

§15.247/15.205

RSS 210-A8.5

(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 Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB.

*PEAK LIMIT= 74dBµV/m

*AVG. LIMIT= 54dBµV/m

Table 1:

Frequency of emission (MHz)	Field strength (µV/m)
30–88	100 (40dBµV/m)
88–216	150 (43.5 dBµV/m)
216–960	200 (46 dBµV/m)
Above 960	500 (54 dBµV/m)

Table 2:

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

6.11.4 Test Result:

Test mode: *Modulation:* GFSK

Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.

Plots reported here represent the worse case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

Measurement Uncertainty: ±3.0dB

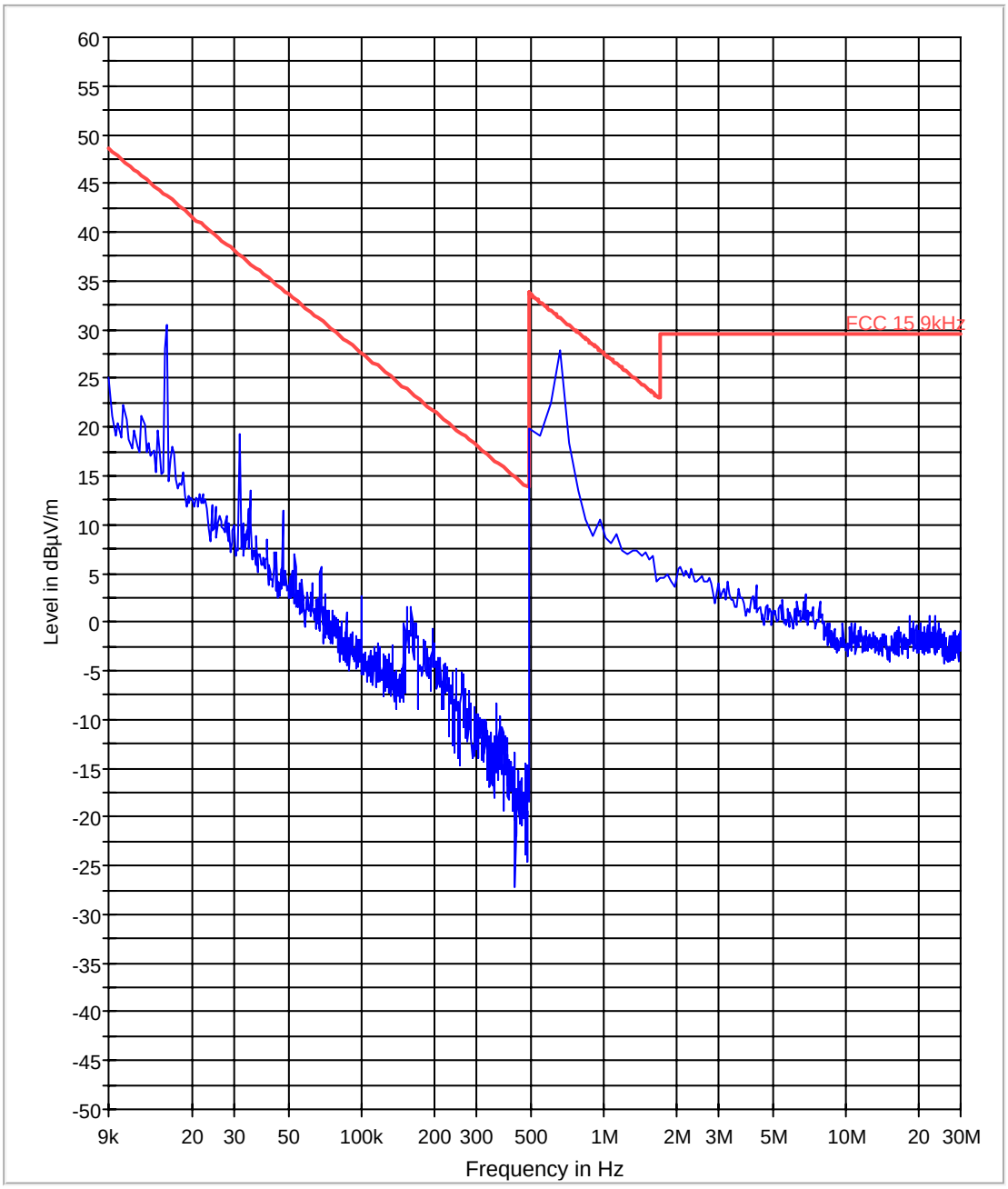
6.11.4.1 Measurement Result

Pass.

6.11.5 Test data/ plots:

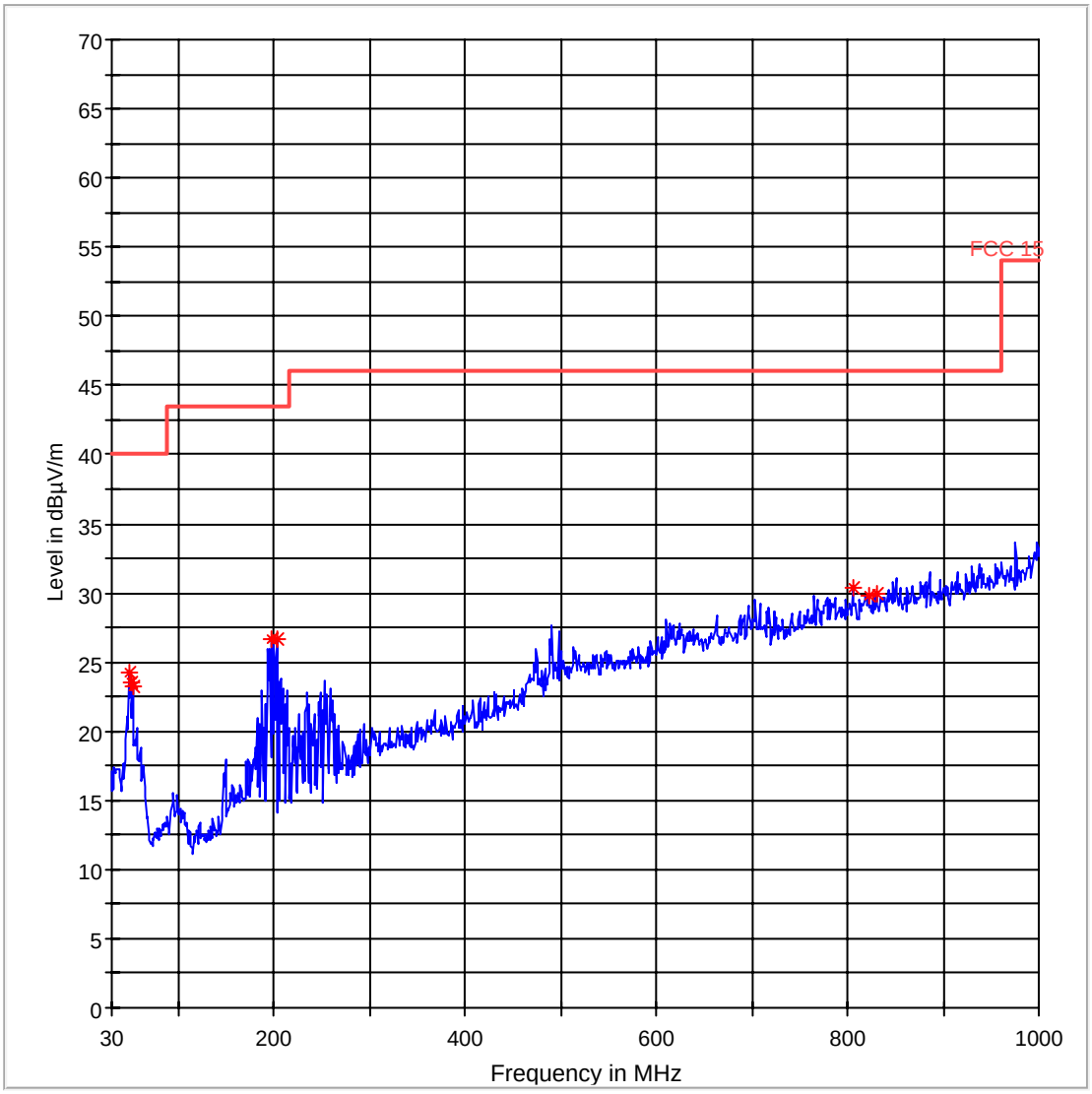
Transmitter Radiated Spurious Emission- 9kHz-30MHz
Note: Represents worst case for all channels

FCC 15 9kHz - 30 MHz



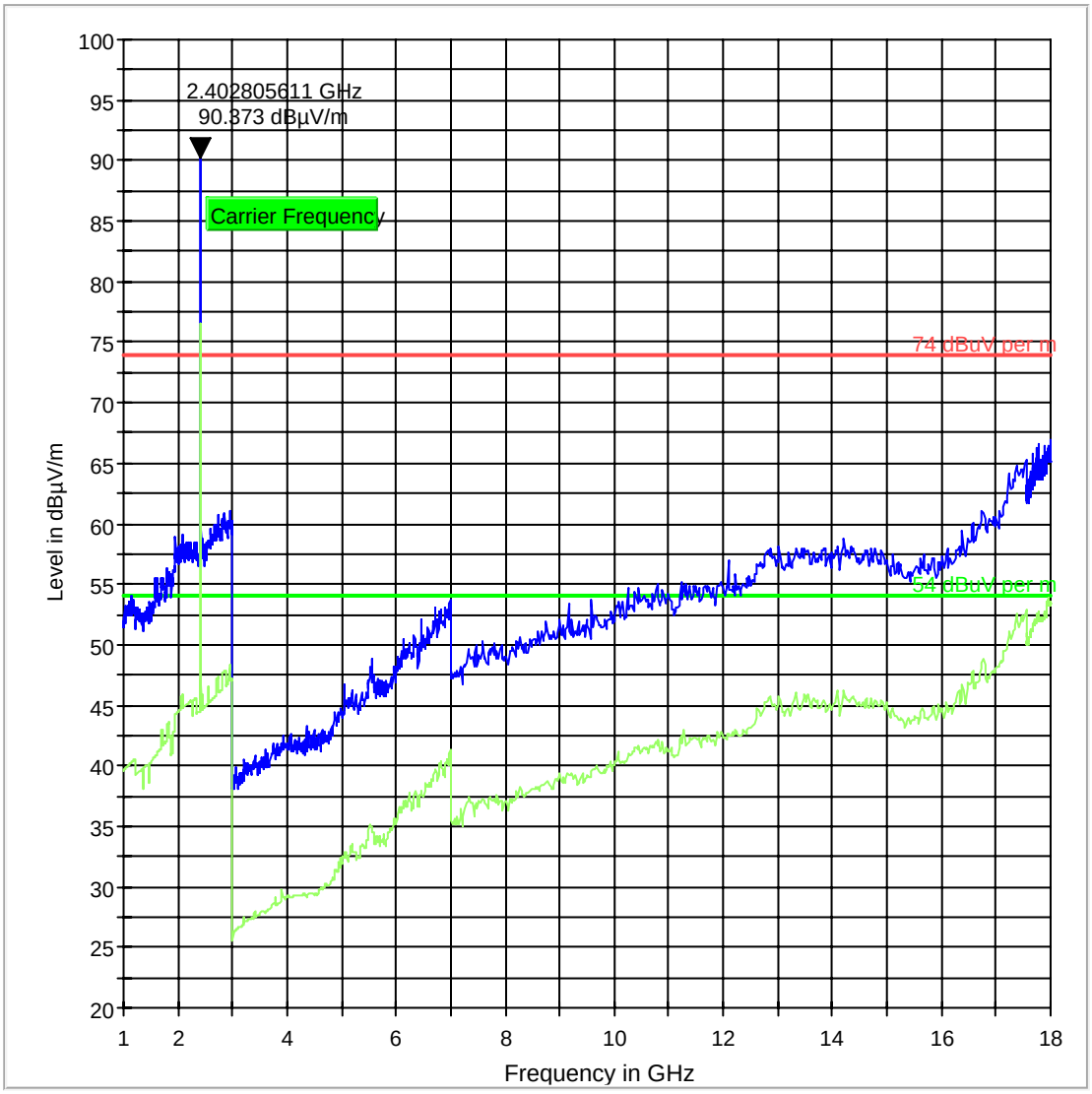
Transmitter Radiated Spurious Emission- Ch0- 30M-1GHz

FCC 15 30-1000MHz



Transmitter Radiated Spurious Emission- Ch0- 1G-18GHz

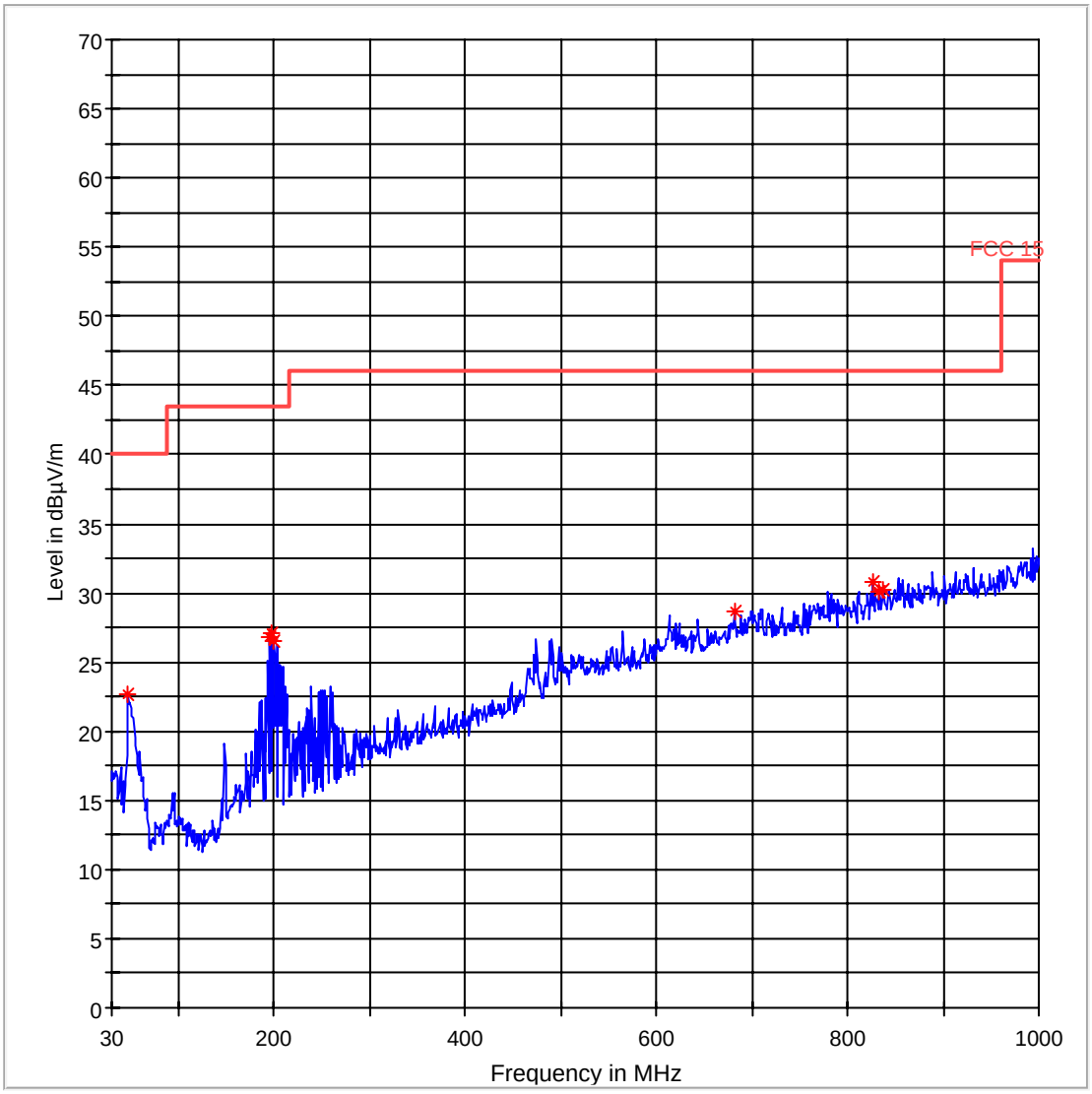
FCC 15 1-18GHz



74 dBuV per m
54 dBuV per m
MaxPeak-ClearWrite
Average-ClearWrite

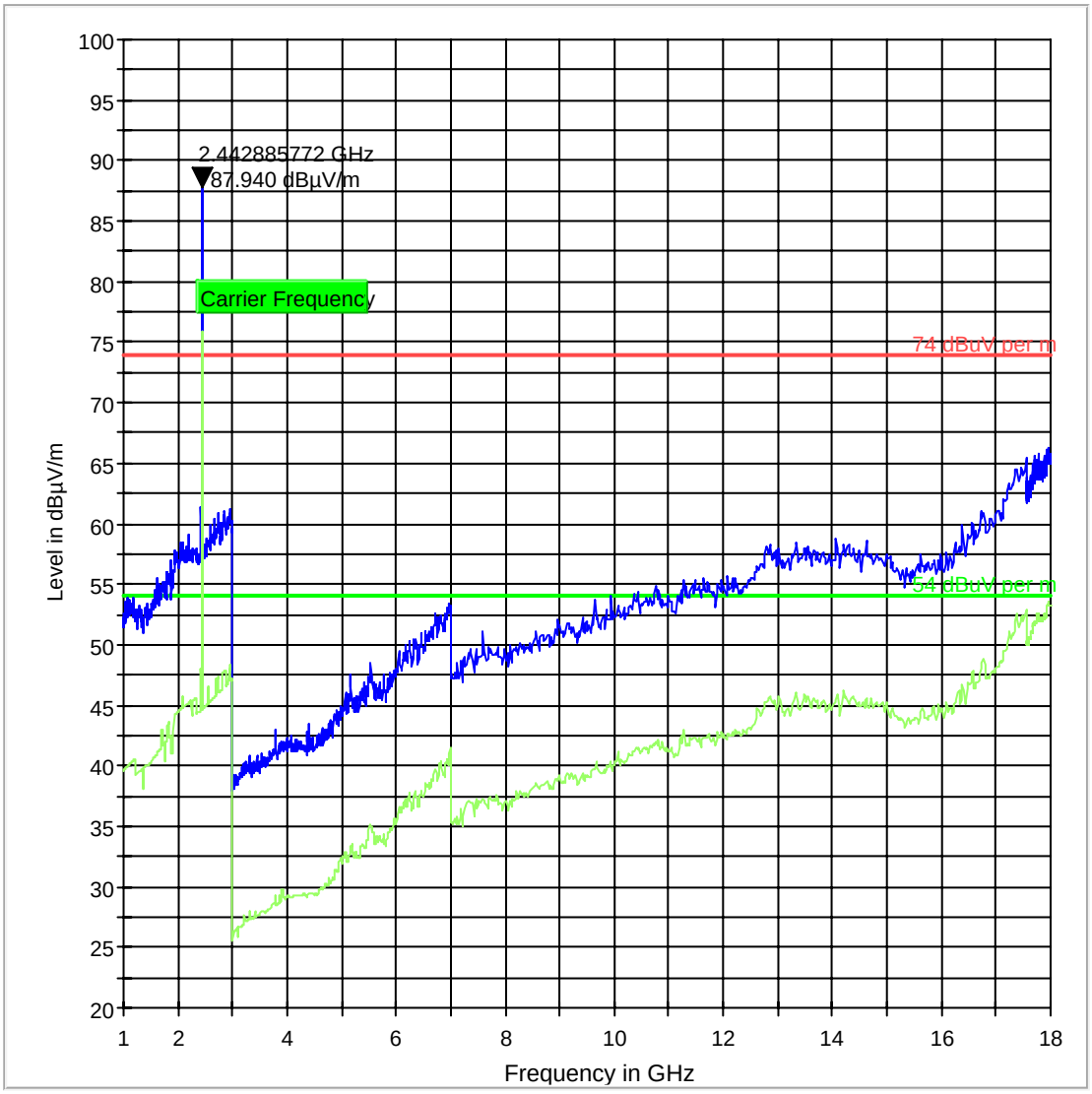
Transmitter Radiated Spurious Emission- Ch39- 30M-1GHz

FCC 15 30-1000MHz



Transmitter Radiated Spurious Emission- Ch39- 1G-18GHz

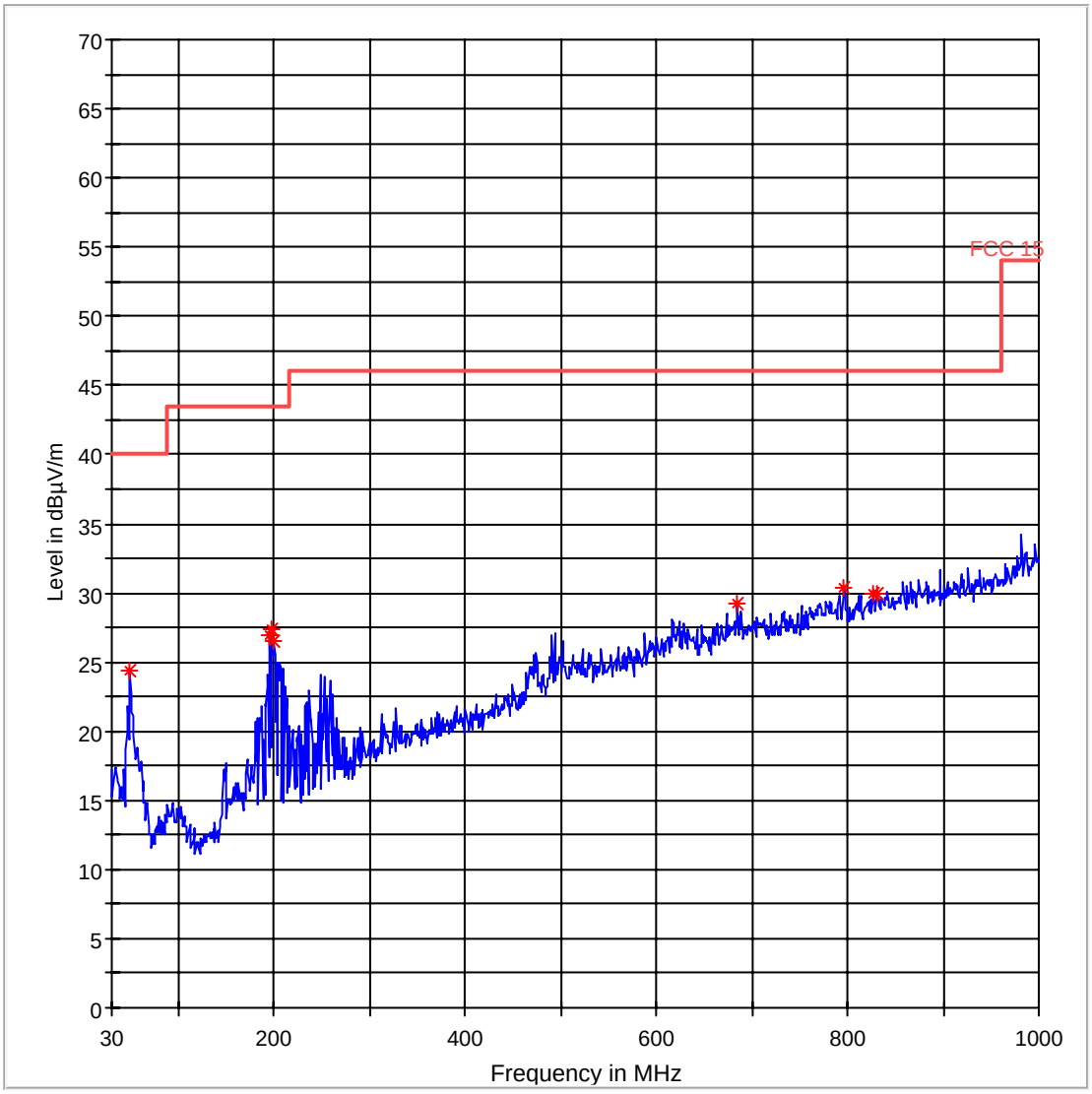
FCC 15 1-18GHz



74 dBuV per m
54 dBuV per m
MaxPeak-ClearWrite
Average-ClearWrite

Transmitter Radiated Spurious Emission- Ch78- 30M-1GHz

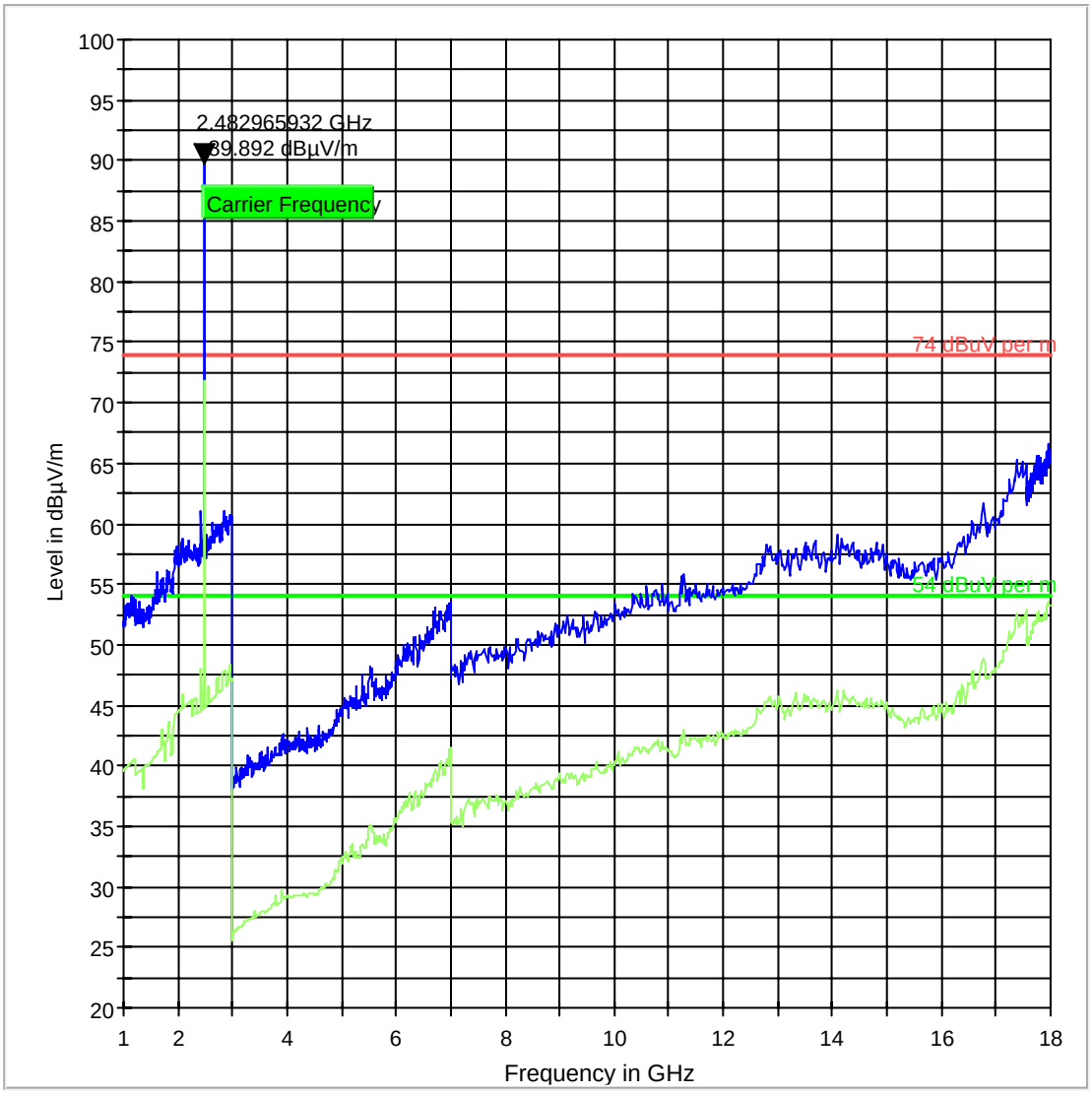
FCC 15 30-1000MHz



FCC 15.LimitLine
MaxPeak-ClearWrite
Data Reduction Result
Final Measurement Result

Transmitter Radiated Spurious Emission- Ch78- 1G-18GHz

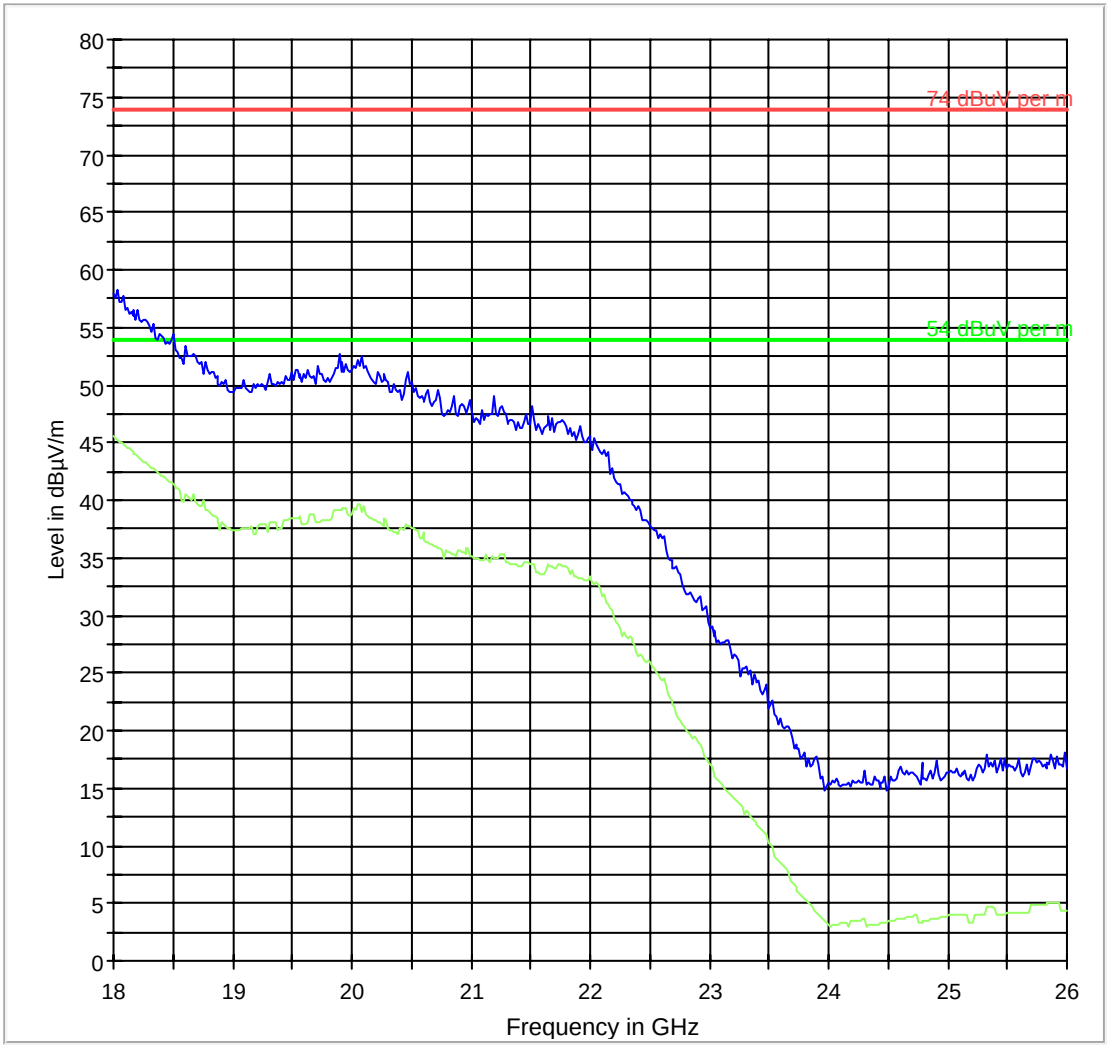
FCC 15 1-18GHz



74 dBuV per m
54 dBuV per m
MaxPeak-ClearWrite
Average-ClearWrite

Transmitter Radiated Spurious Emission - 18G-26GHz
Represents worst case channel

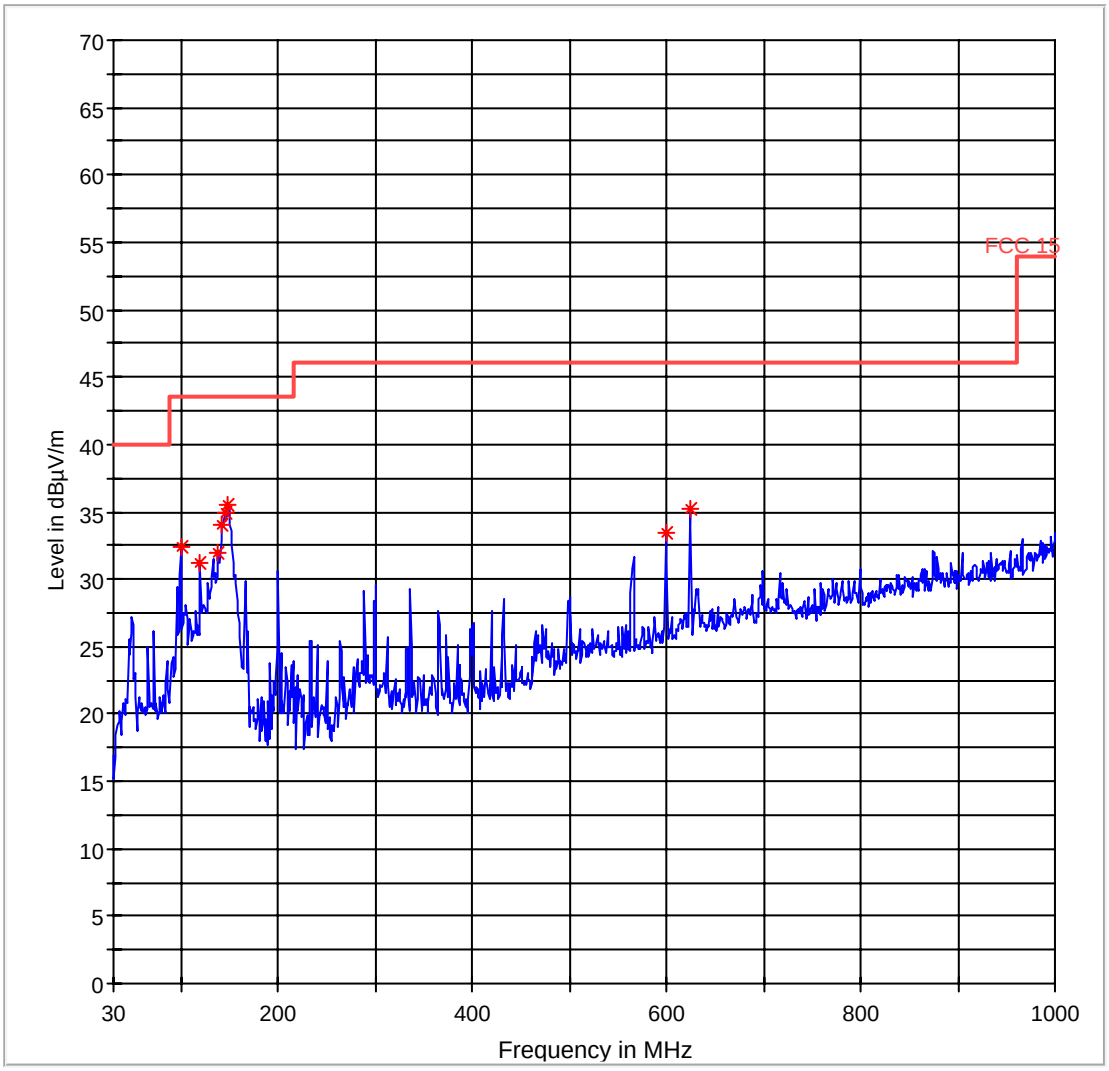
FCC 15 18-26GHz



74 dBuV per m.LimitLine
Preview Result 1
54 dBuV per m.LimitLine
Preview Result 2

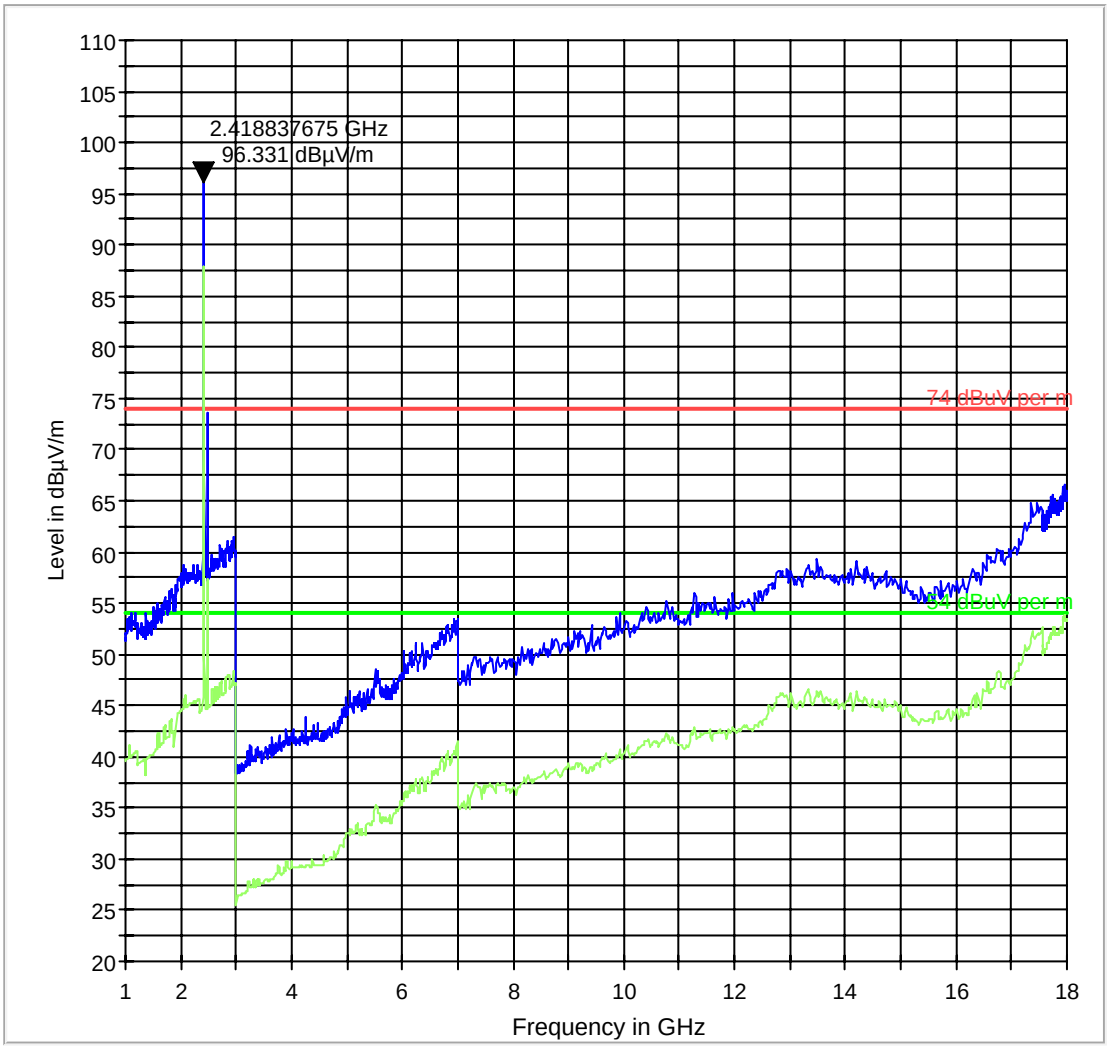
Transmitter Radiated Spurious Emission- 802.11g Ch1, Bluetooth GFSK Ch79- 30M-1GHz

FCC 15 30-1000MHz



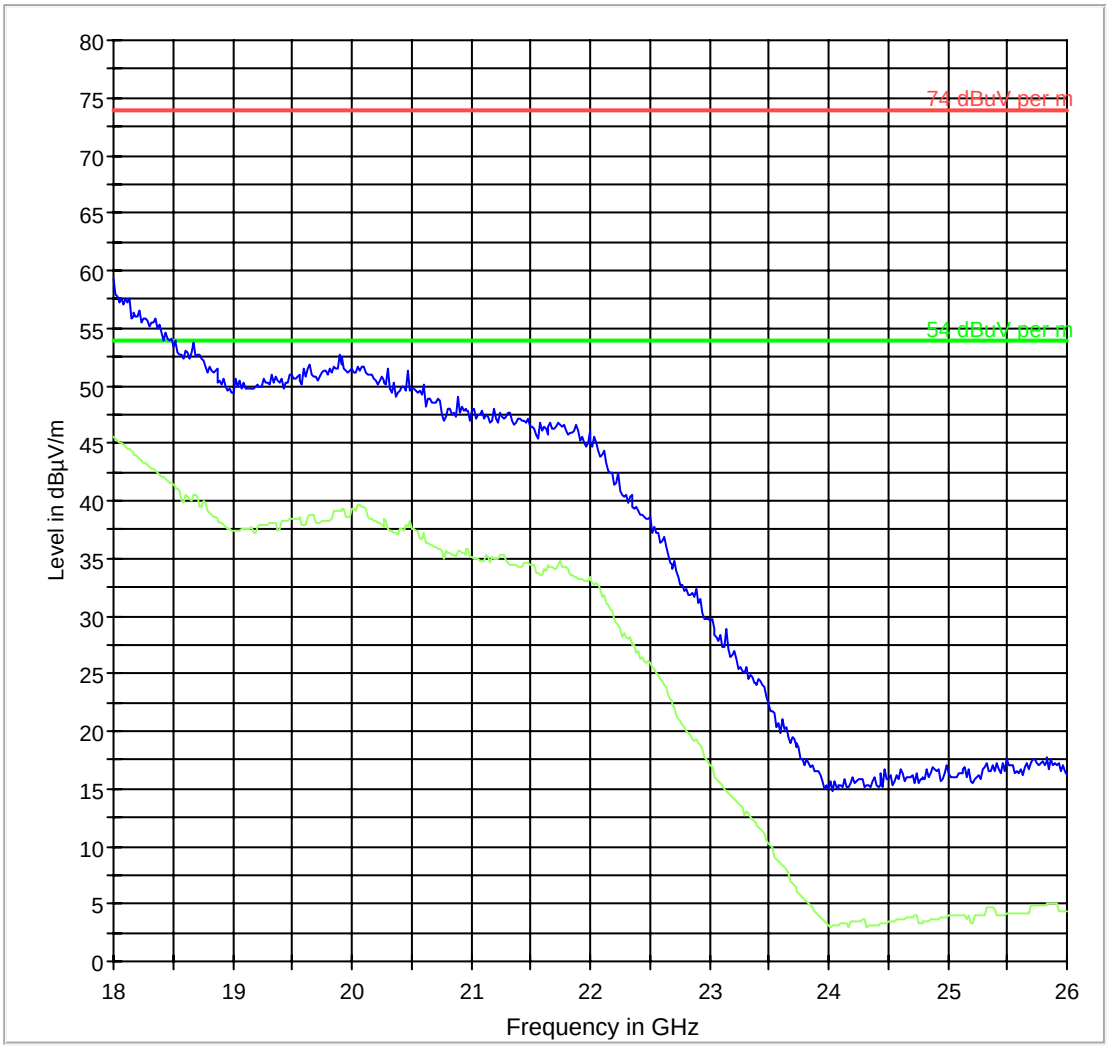
Transmitter Radiated Spurious Emission- 802.11g Ch1, Bluetooth GFSK Ch79- 1G-18GHz

FCC 15 1-18GHz



Transmitter Radiated Spurious Emission- 802.11g Ch1, Bluetooth GFSK Ch79- 18G-26GHz

FCC 15 18-26GHz



6.12 Receiver Spurious Emissions- Radiated

6.12.1 Limits:

6.12.1.1 FCC CFR §15.109
6.12.1.2 RSS-Gen

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
30–88	100 (40dBµV/m)	3
88–216	150 (43.5 dBµV/m)	3
216–960	200 (46 dBµV/m)	3
Above 960	500 (54 dBµV/m)	3

6.12.2 Test Conditions:

Modulation: GFSK
Measurement Uncertainty: ±3.0dB

6.12.3 Test Result:

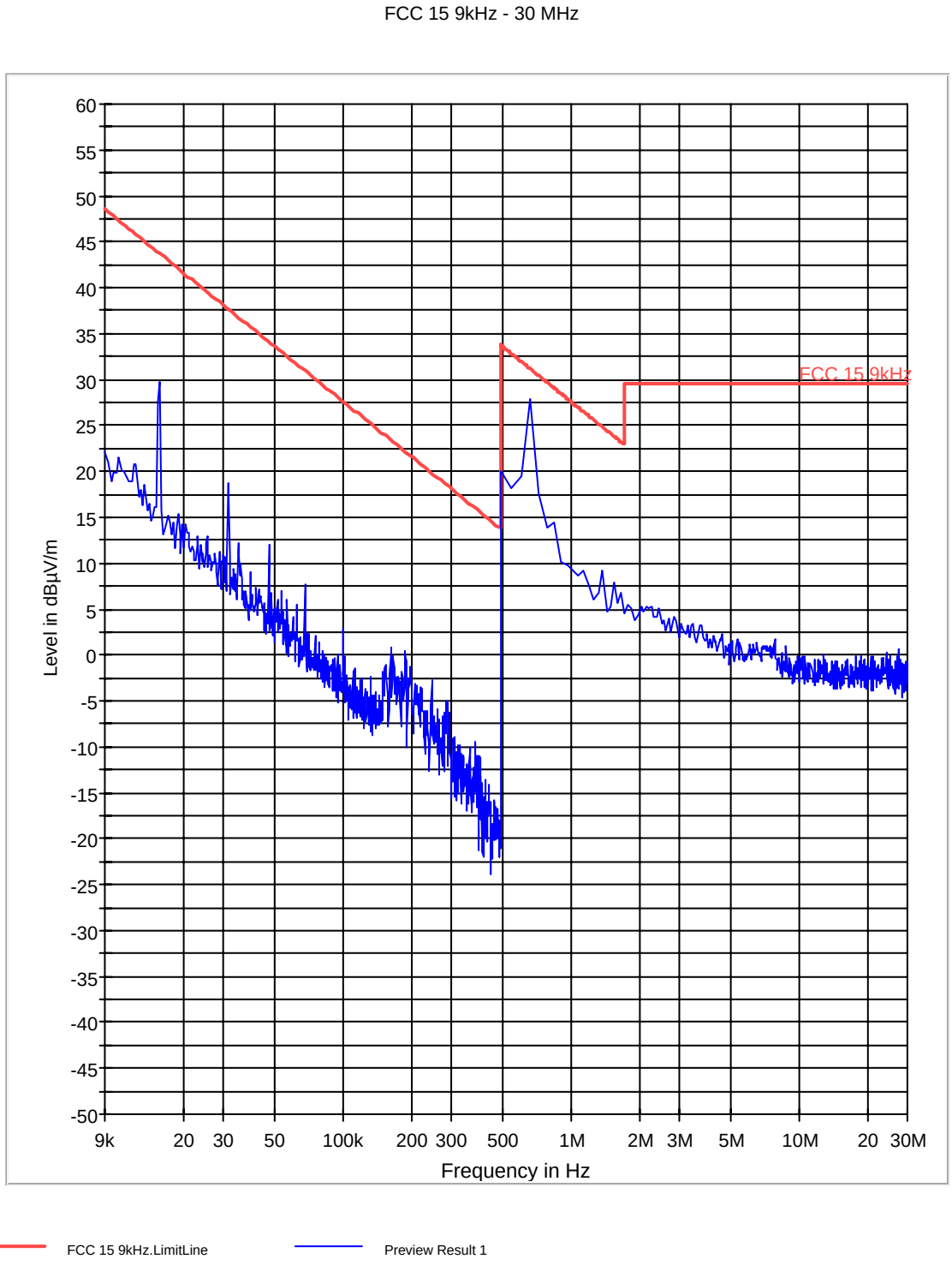
No significant emissions measurable. Plots reported here represent the worse case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

6.12.3.1 Measurement Result

Pass.

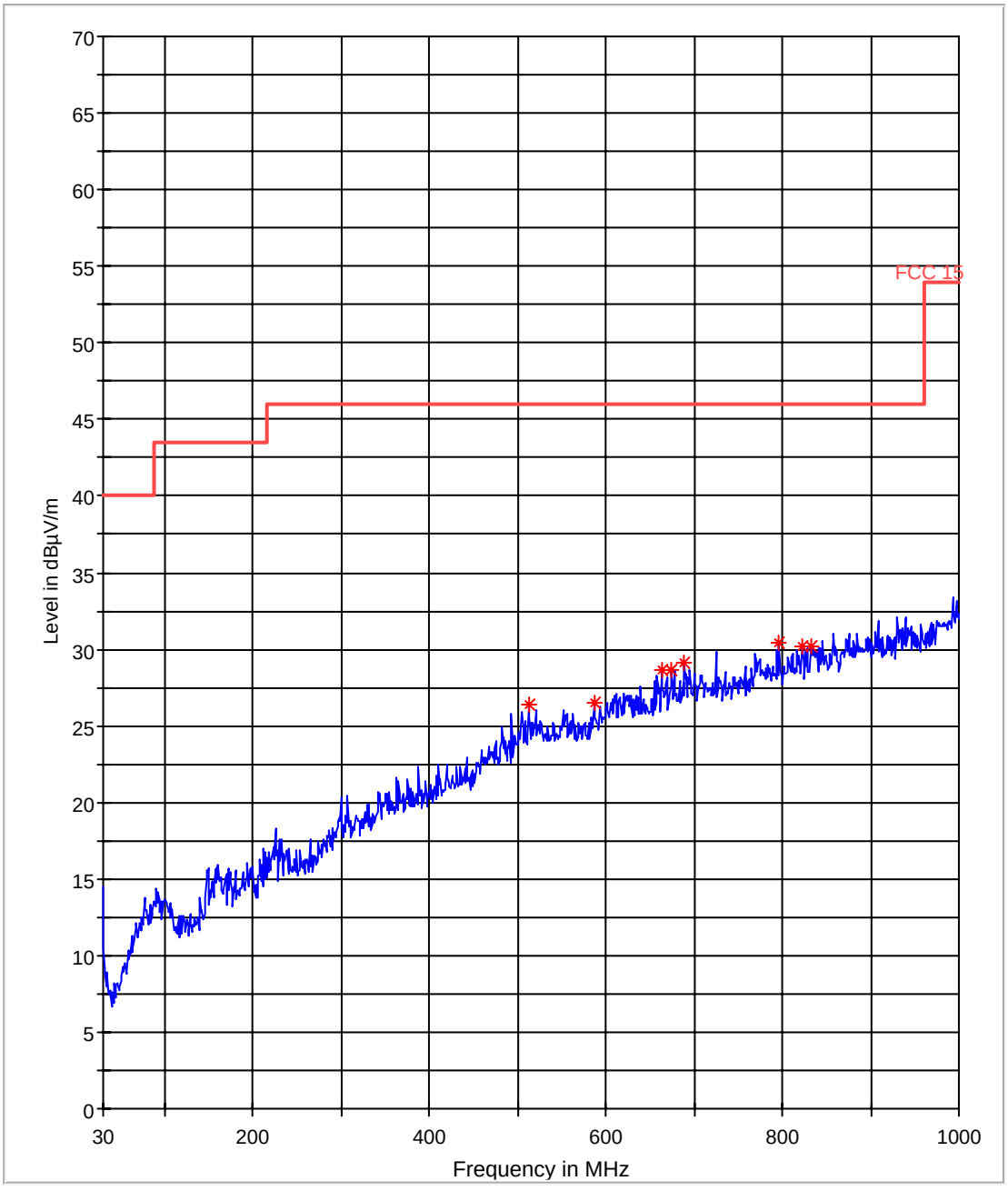
6.12.4 Test data/ plots:

Receive Mode: 9kHz-30MHz



Receive Mode: 30MHz-1GHz

FCC 15 30-1000MHz

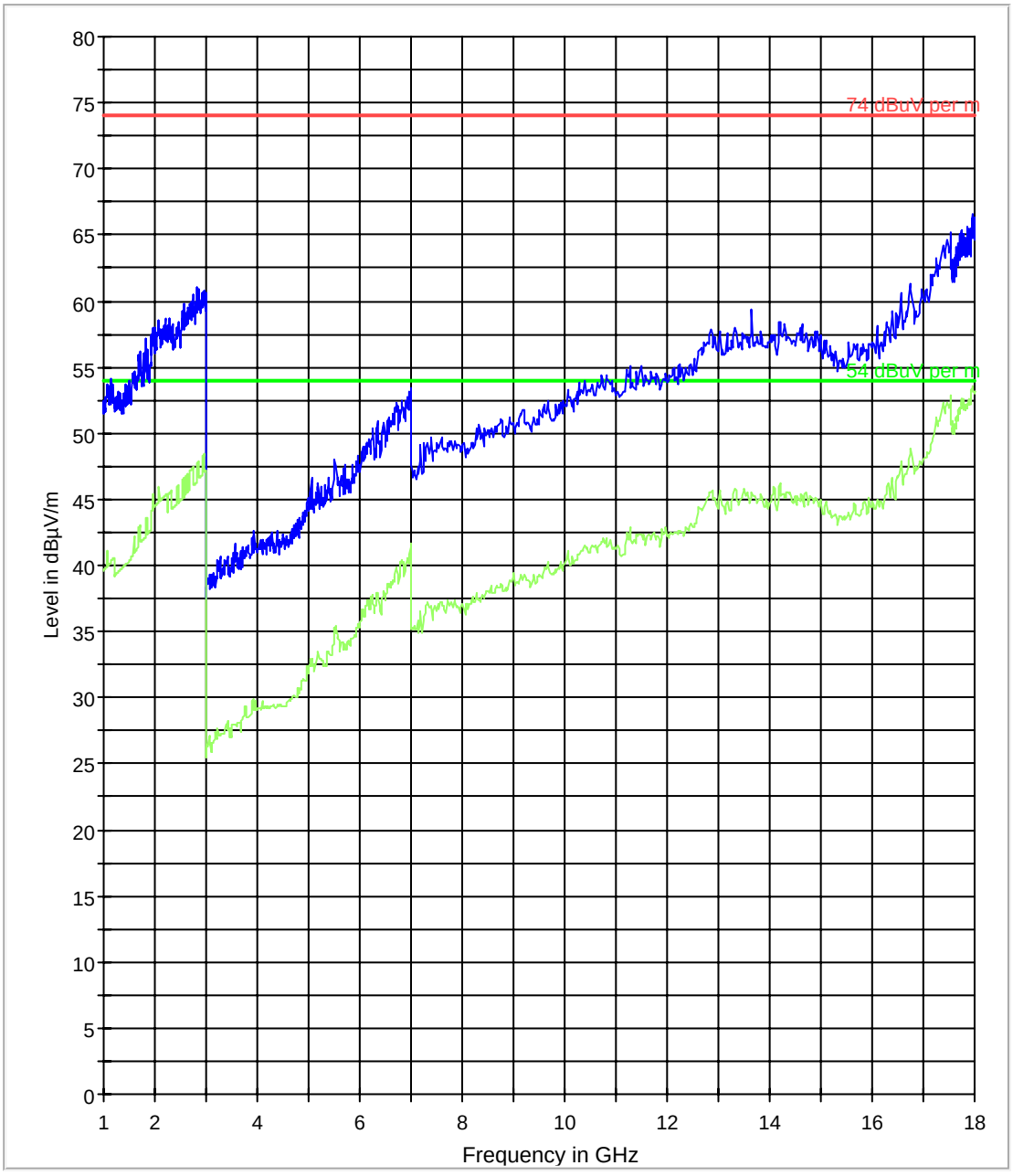


FCC 15.LimitLine Preview Result 1 Data Reduction Result 1 [3]

FCC 15.LimitLine MaxPeak-ClearWrite
Data Reduction Result Final Measurement Result

Receive Mode: 1GHz-18GHz

FCC 15 1-18GHz



74 dBuV per m.LimitLine
Preview Result 1
54 dBuV per m.LimitLine
Preview Result 2

6.13 AC Power Line Conducted Emissions

6.13.1 References:

FCC: CFR Part 15.207
IC: RSS-Gen Section 7.2.2
The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

6.13.2 Limits:

6.13.2.1 §15.207 Conducted limits- Intentional Radiators:

(a) Except as shown in paragraphs (b) and (c) of this section of the CFR, 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 (1), as measured using a 50 µH/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.

6.13.2.2 RSS-Gen 7.2.2

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The tighter limit applies at the frequency range boundaries.

Table 1:

Frequency of emission (MHz)	Conducted limit (dBµV)	
	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: CISPR Bandwidth- 9KHz.

6.13.3 Test Conditions:

Modulation: GFSK
Measurement Uncertainty: ±3.0dB

6.13.4 Results

Plots shown here represent the combined worse case emissions for power lines, phases and neutral line.

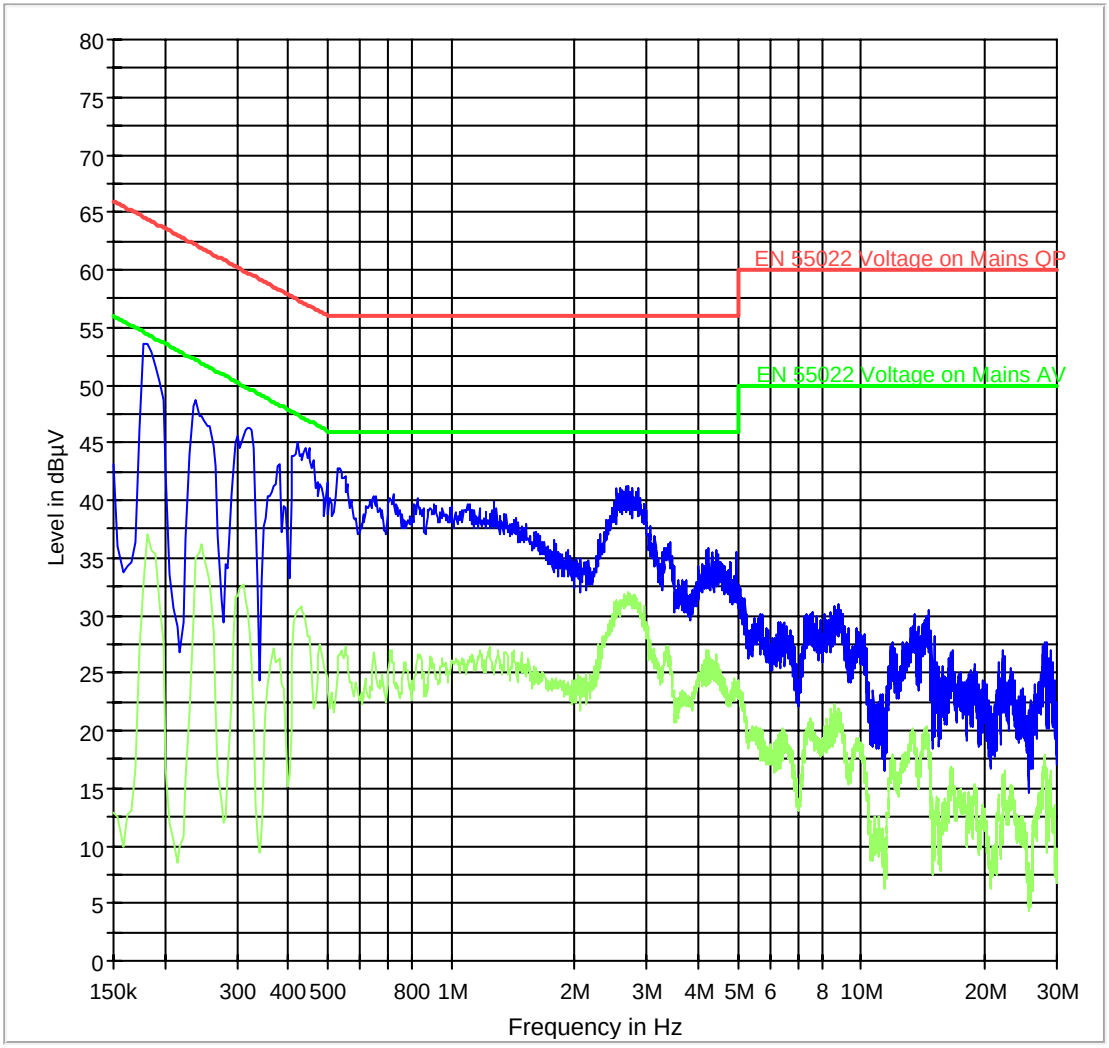
6.13.4.1 Measurement Result

Pass.

6.13.5 Test Results:

BT TX Mode:

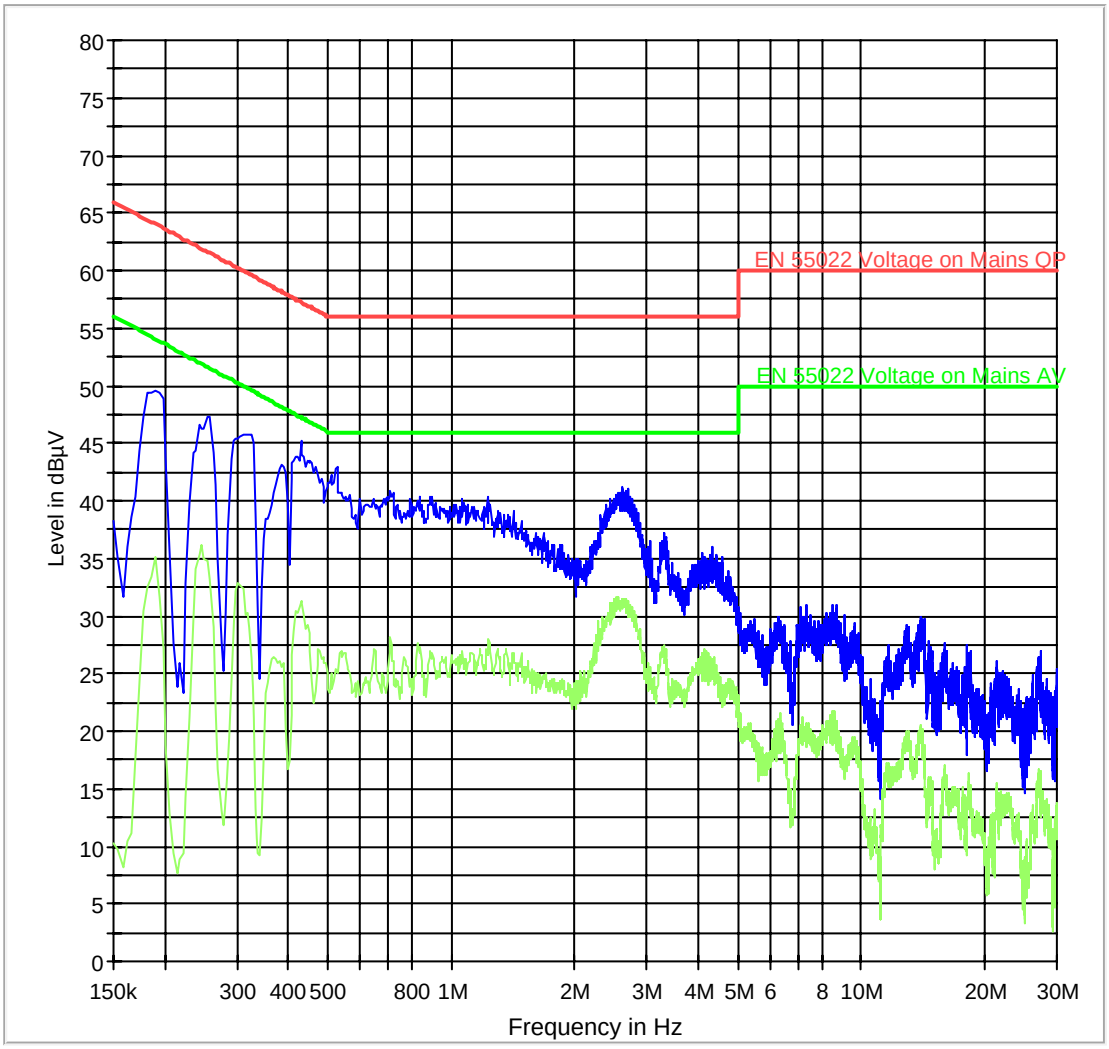
CISPR 22 Mains Conducted



EN 55022 Voltage on Mains QP.LimitLine
Preview Result 1
EN 55022 Voltage on Mains AV.LimitLine
Preview Result 2

BT RX Mode:

CISPR 22 Mains Conducted

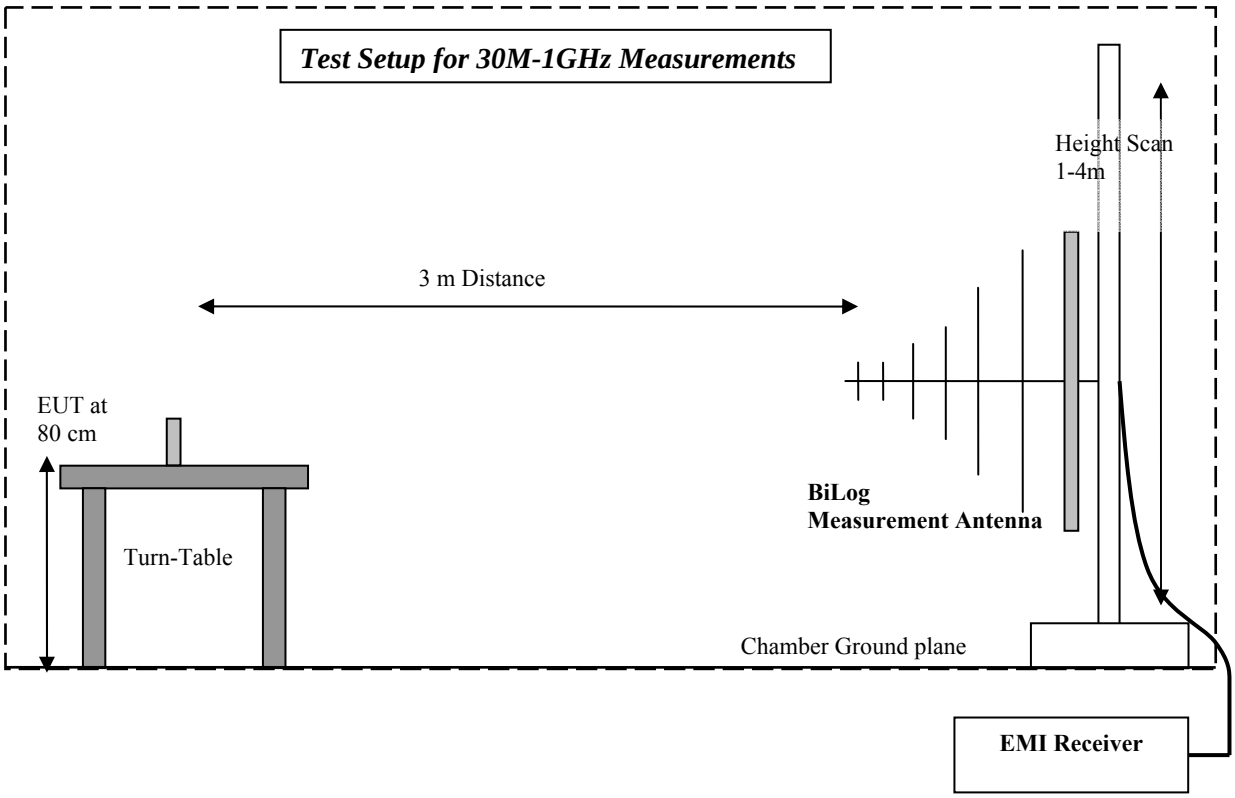


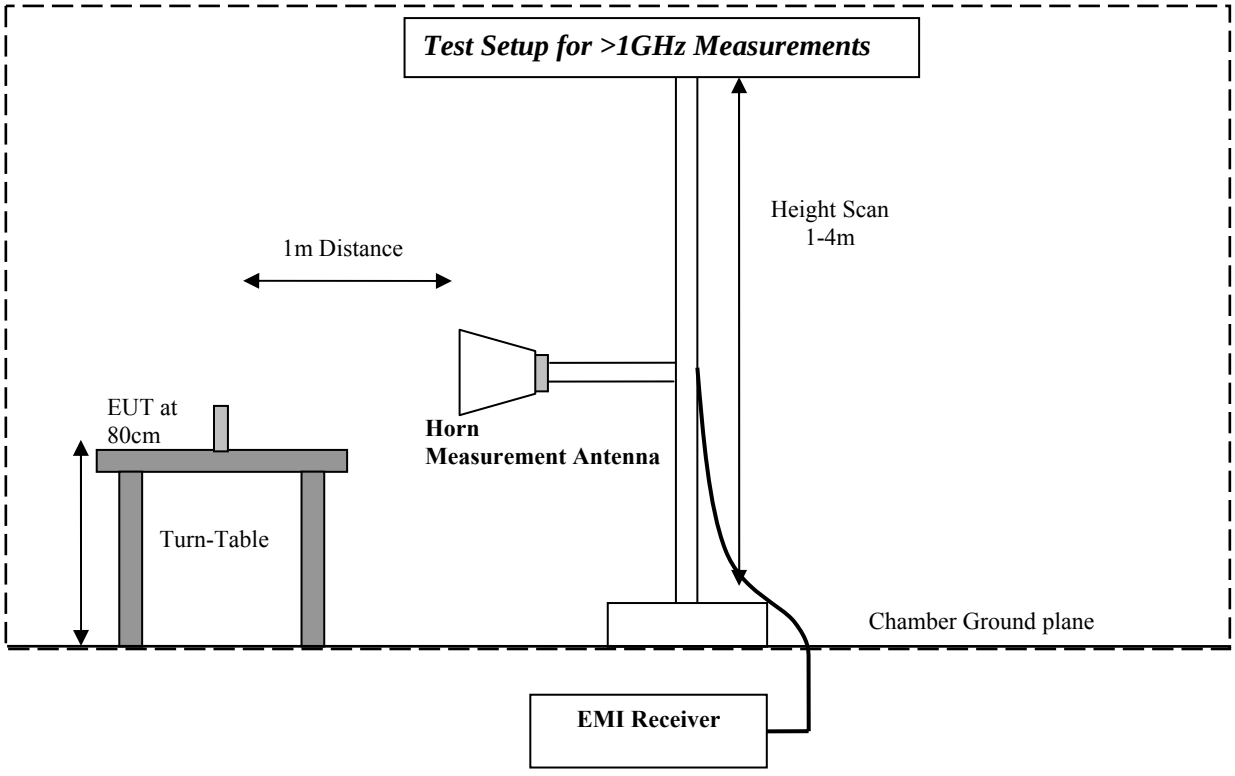
EN 55022 Voltage on Mains QP.LimitLine
Preview Result 1
EN 55022 Voltage on Mains AV.LimitLine
Preview Result 2

7 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
Bluetooth Tester	CBT	Rohde & Schwarz	100212	May 2009	2 Years
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2010	1 year
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	Jul 2010	1 year
Loop Antenna	6512	EMCO	00049838	April 2009	2 years
Biconilog Antenna	3141	EMCO	0005-1186	June 2009	2 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Jan 2009	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Jan 2009	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
LISN	50-25-2-08	FCC	08014	June 2010	1 year
Power Smart Sensor	R&S	NRP-Z81	100161	June 2010	1 Year
Multimeter	179	Fluke	N/A	Feb 2010	1 Year
Temp Hum Logger	TM320	Dickson	03280063	Feb 2010	1 Year
Temp Hum Logger	TM325	Dickson	5285354	Feb 2010	1 Year

8 Test Setup Info:





9 Revision History

Date	Report Name	Changes to report	Report prepared by
2011-01-27	**EMC_TRIM2_001_09001_15.247BT_616**	**First Version**	**Josie Sabado**
2011-03-03	**EMC_TRIM2_001_09001_15.247BT_616_rev1**	**Updated EUT information. Added measurement for radiated spurious emissions 9kHz to 30MHz. Replaces previous report number**	**Josie Sabado**