FCC/IC Test Report

FOR:

Model Name: A1219
iPad
FCC ID: BCG-E2381A
IC ID: 579C-E2381A

47 CFR Part 15.247 for FHSS Systems

IC RSS-210 Issue 7

TEST REPORT #: EMC_APPLE_055_15.247_FHSS_81A_Rev2
DATE: 2010-03-11

Bluetooth Qualification Test Facility (BQTF)

FCC listed
A2LA Accredited

IC recognized # 3462B

***CETECOM* Inc.**
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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 #
Apple Inc.	**Tablet Computer**	**A1219**

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2010-03-11	Compliance	Heiko Strehlow (Director)	H. Strehlow Digitally signed by Heiko Strehlow Date: 2010.03.11 17:59:55 -08'00'

Responsible for the Report:

Date	Section	Name	Signature
2010-03-11	Compliance	Marc Douat (Test Lab Manager)	

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:	Heiko Strehlow
Responsible Project Leader:	Marc Douat

2.2 Identification of the Client

Applicant's Name:	Apple Inc.
Street Address:	1 Infinite Loop Mail Stop26A
City/Zip Code	Cupertino, California 95014
Country	USA
Contact Person:	Mike Kriege
Phone No.	408-974-0560
Fax:	408-862-5061
e-mail:	kriege@apple.com

2.3 Identification of the Manufacturer

Same as above applicant.

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	iPad
Model No:	A1219
Product Type:	Tablet Computer
Hardware Revision :	A
Software Revision :	06.12.50 (7B293)
FCC-ID:	BCG-E2381A
IC-ID :	579C-E2381A
Frequency:	ISM Band 2400-2483.5 MHz
Type(s) of Modulation:	GFSK, π/4 DQPSK, 8- DPSK (FHSS)
Number of channels:	79
Antenna Type:	PIFA, 1.9dBi
Equipment Classification:	☐Fixed ☐Vehicular ■Portable ☐Module
Power Supply:	4.2 VDC battery, 110VAC Adapter
Temperature Range:	0ºC to 35ºC

3.1 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version
1	YM950003DYW	A	06.12.50 (7B293)

3.2 Identification of Accessory equipment

AE #	Type	Manufacturer	Model
1	10W USB Power Adapter	Foxlink Technology, Ltd.	A1357 W010A051

3.3 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 BCG-E2381A and IC ID 579C-E2381A.
Radiated measurements were performed on the product referred to in Section 3 as EUT, conducted measurements were performed on the radio installed on a test fixture. This test report contains full radiated and conducted testing results as per FCC15.247.

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 polarization measurements.

4 Measurements

4.1 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.

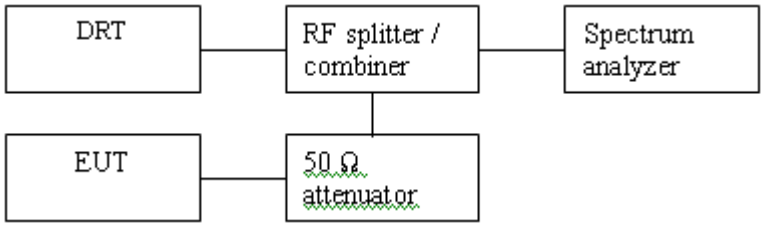
This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency spectrum investigation, particular focus should be made on 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.

4.2 Conducted Measurement Procedure



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

4.3 Maximum Peak Output Power

4.3.1 Limits: §15.247 (b)(1)

Nominal Peak Output Power < 30 dBm (1W)
EIRP < 36 dBm

4.3.2 Test Conditions:

Tnom: 21ºC; Vnom

4.3.3 Test Result:

EIRP = conducted output power + antenna gain (1.9 dBi)

Max Peak Output Power- EIRP (dBm)			
Modulation	**Frequency (MHz)**		
	2402	**2442**	**2480**
GFSK	12.5	13.2	13.3
π/4 DQPSK	14.8	15.3	15.2
8-DPSK	13	13.5	13.6
Measurement Uncertainty: ±3dB			

Max Peak Output Power- Conducted (dBm)			
Modulation	**Frequency (MHz)**		
	2402	**2442**	**2480**
GFSK	10.6	11.3	11.4
π/4 DQPSK	12.9	13.4	13.3
8-DPSK	11.1	11.6	11.7
Measurement Uncertainty: ±0.5dB			

Conducted output power measurements performed with peak detector and 3MHz RBW

4.4 Restricted Band Edge Compliance

4.4.1 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			

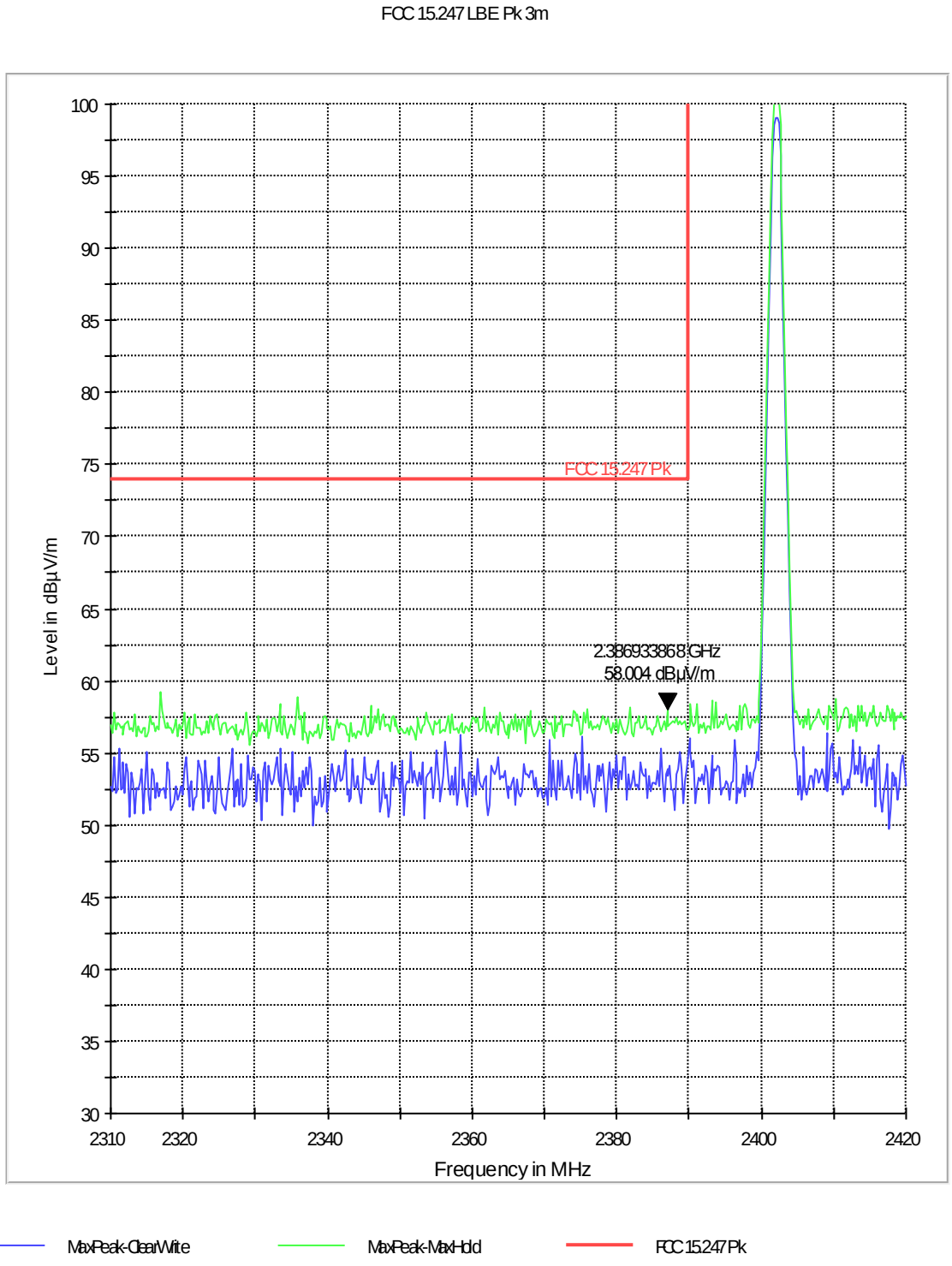
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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= 74dBµV/m
*AVG. LIMIT= 54dBµV/m

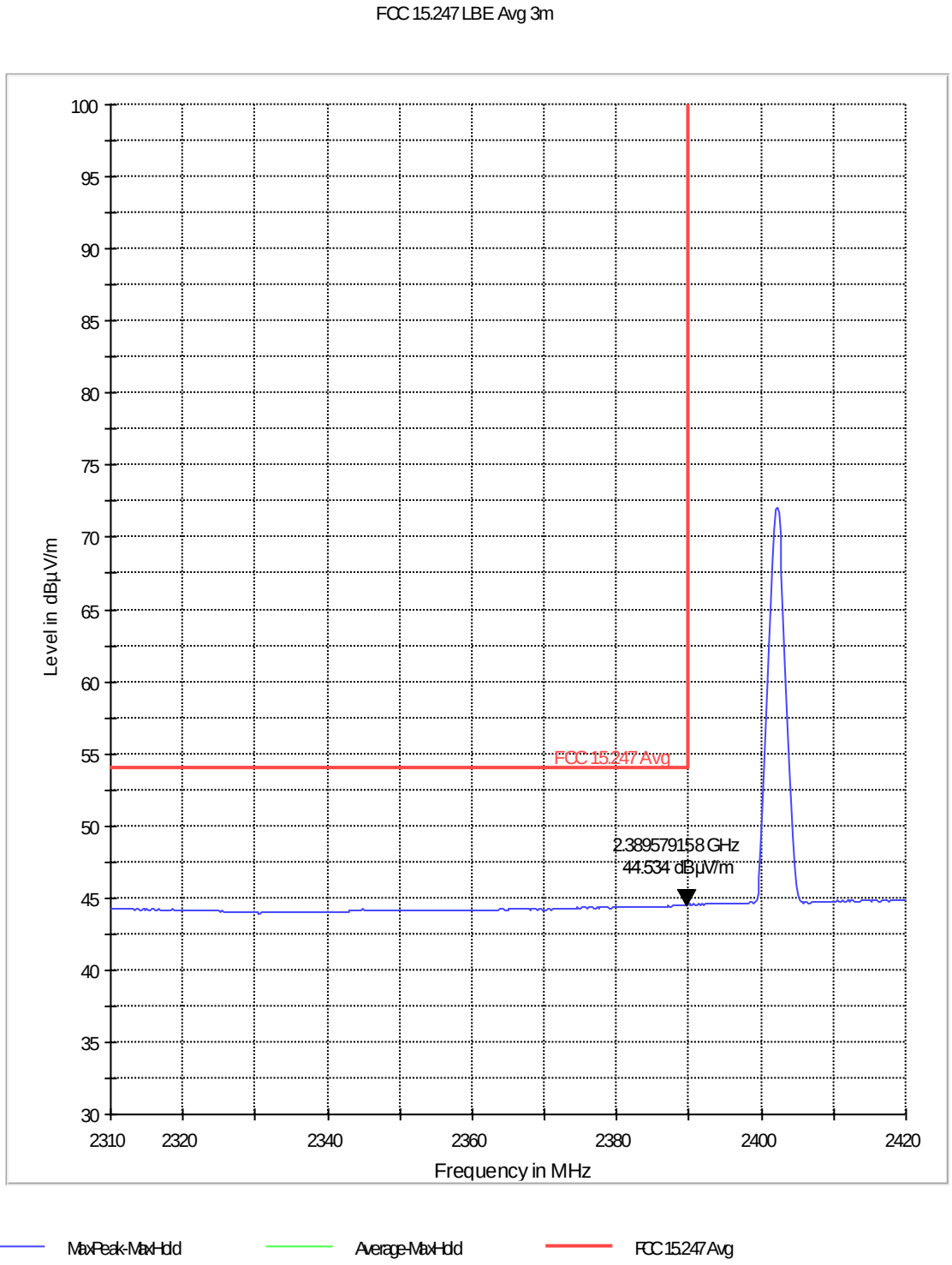
Bandedge measurements were also performed with 802.11a transmitting on the same antenna

4.4.2 Test Data/plots:

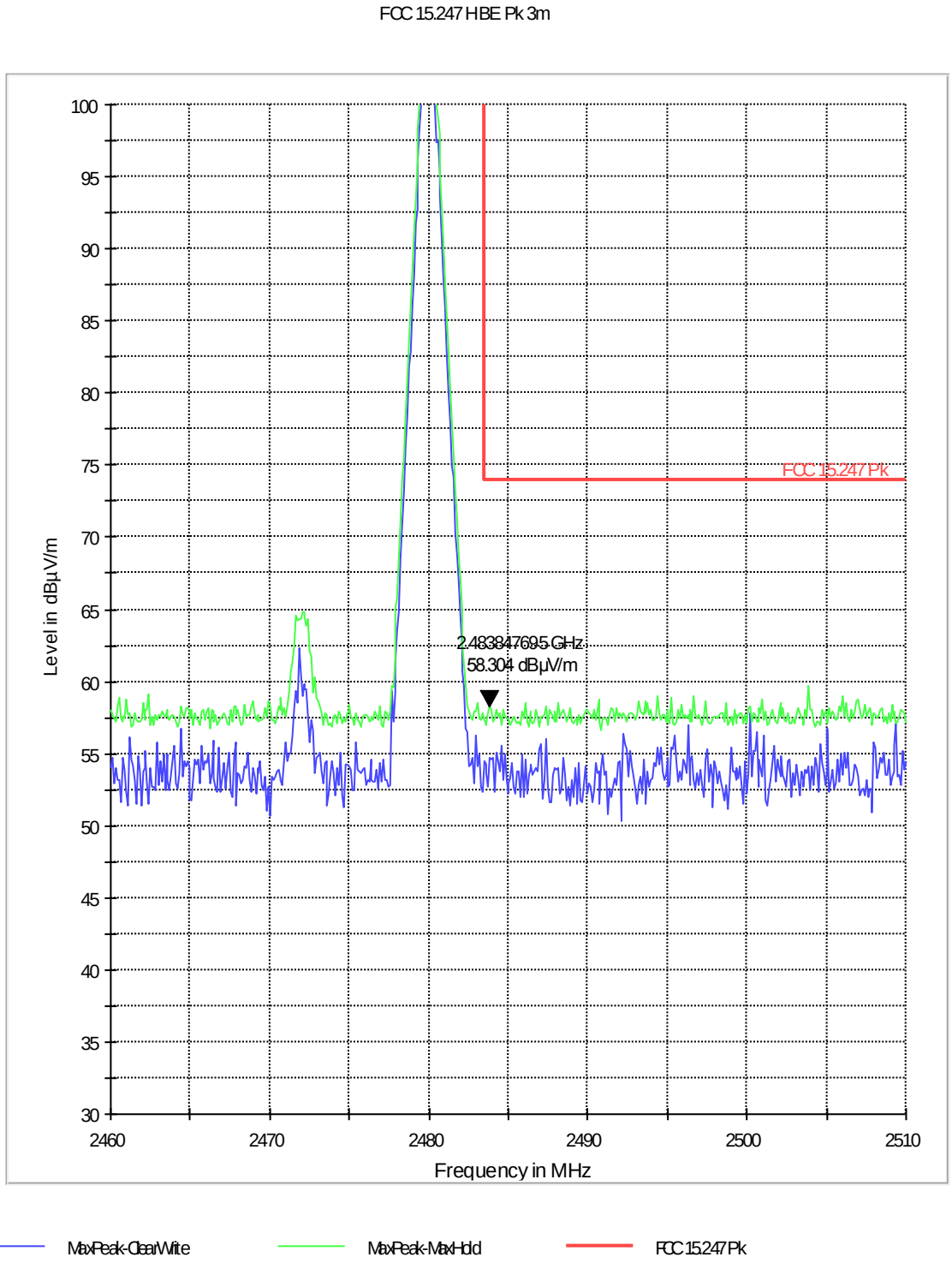
Lower band edge peak -GFSK modulation



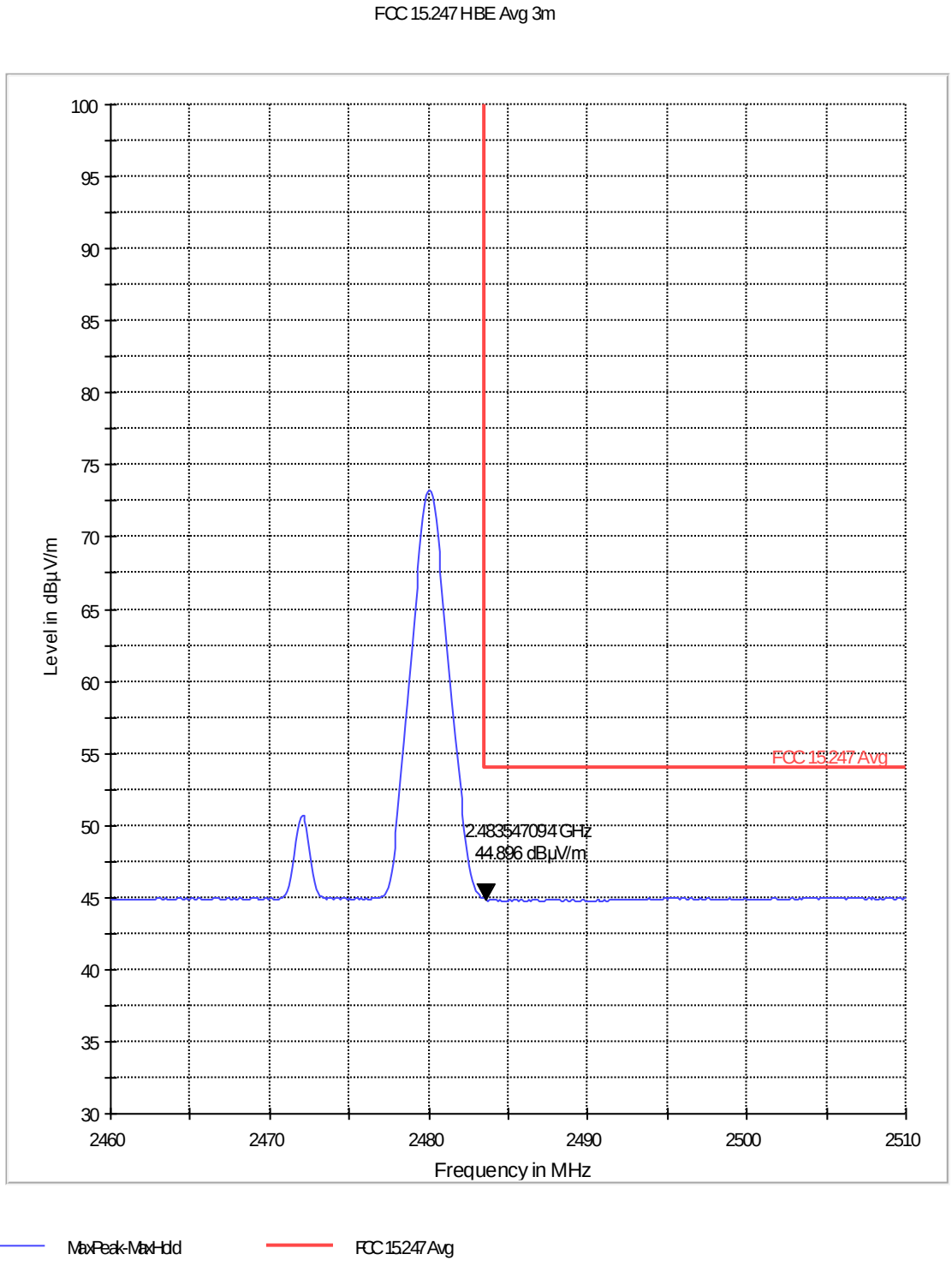
Lower band edge average -GFSK modulation



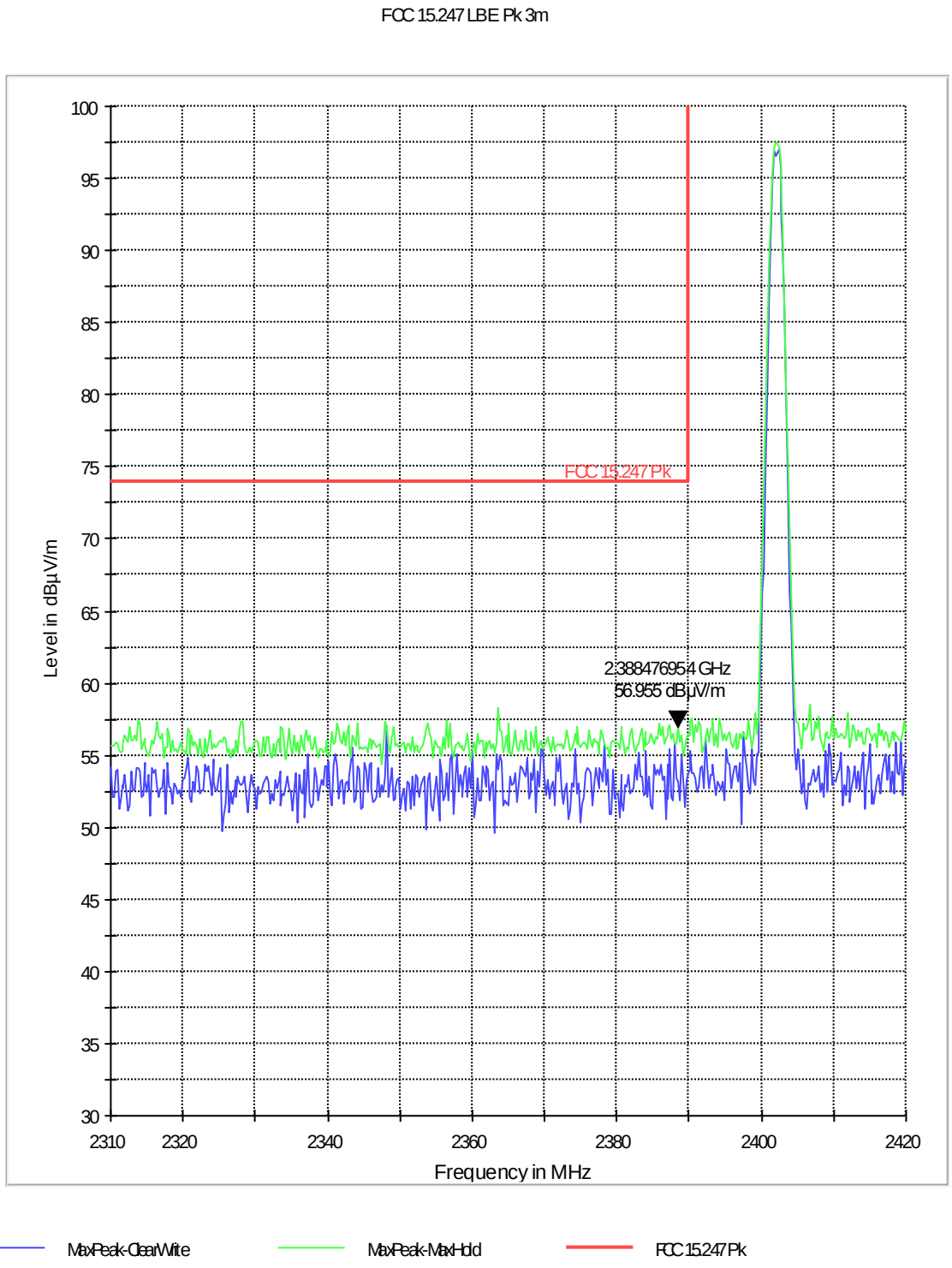
Higher band edge peak -GFSK modulation



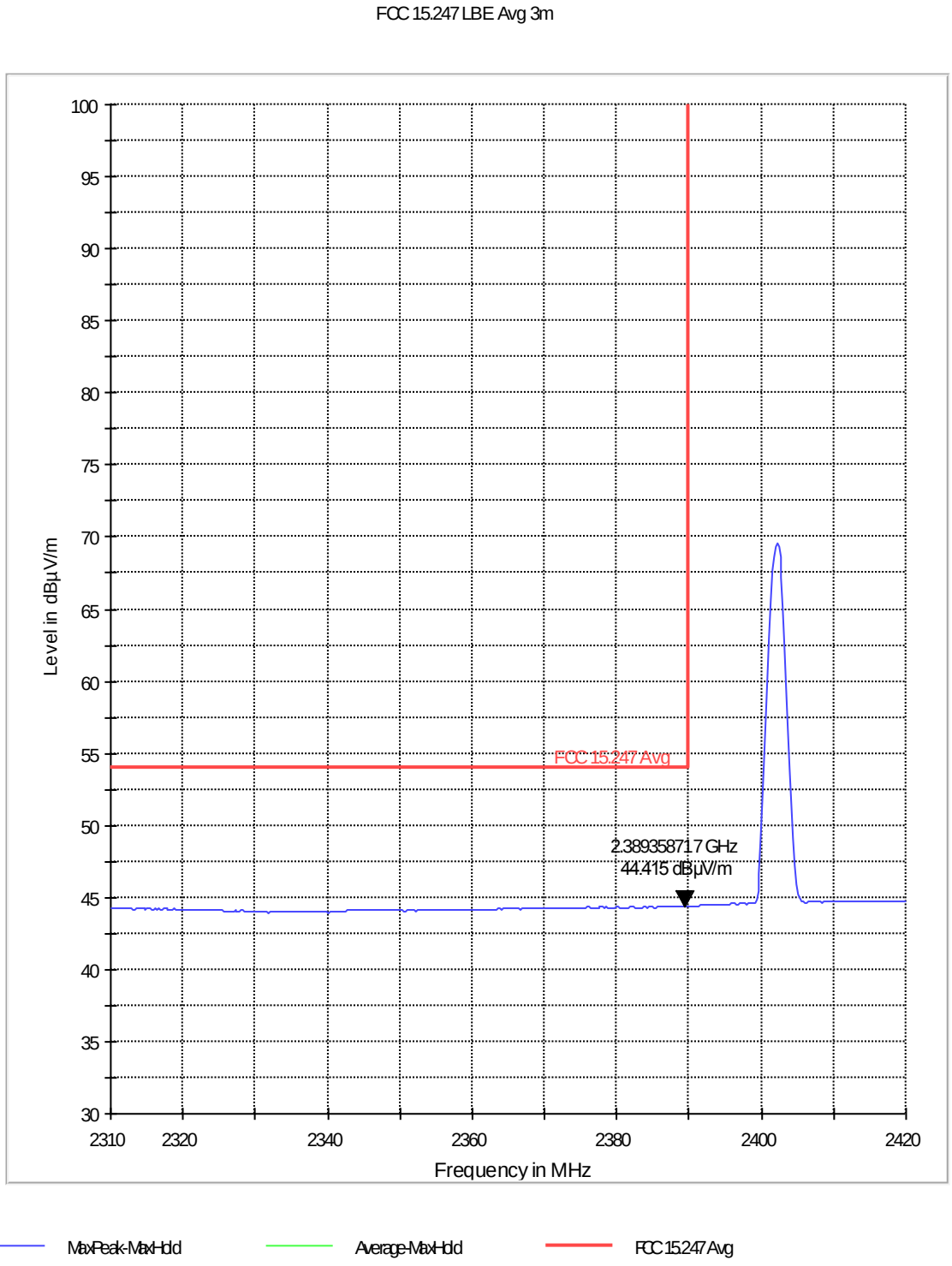
Higher band edge average-GFSK modulation



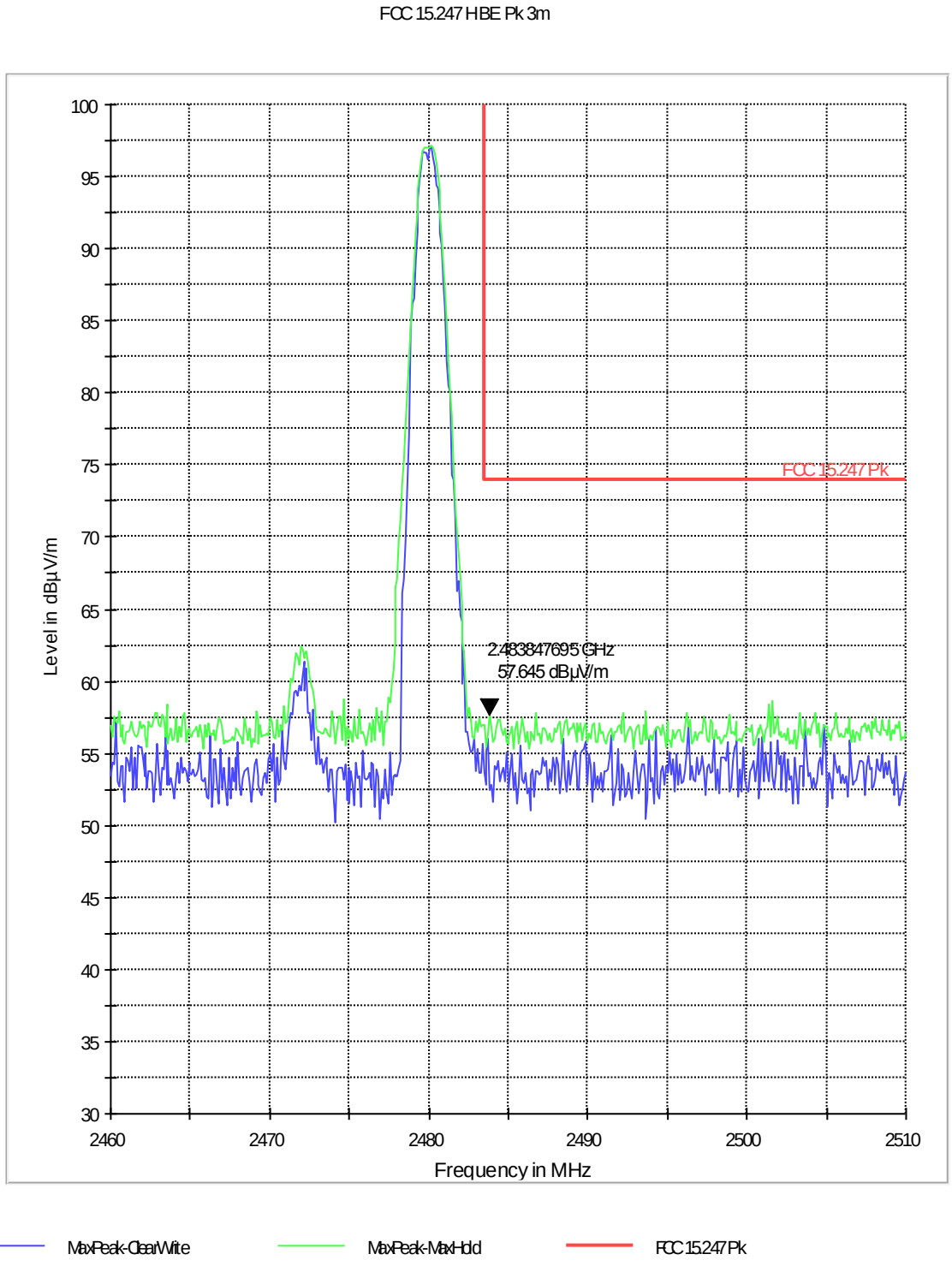
Lower band edge peak - π/4 DQPSK modulation



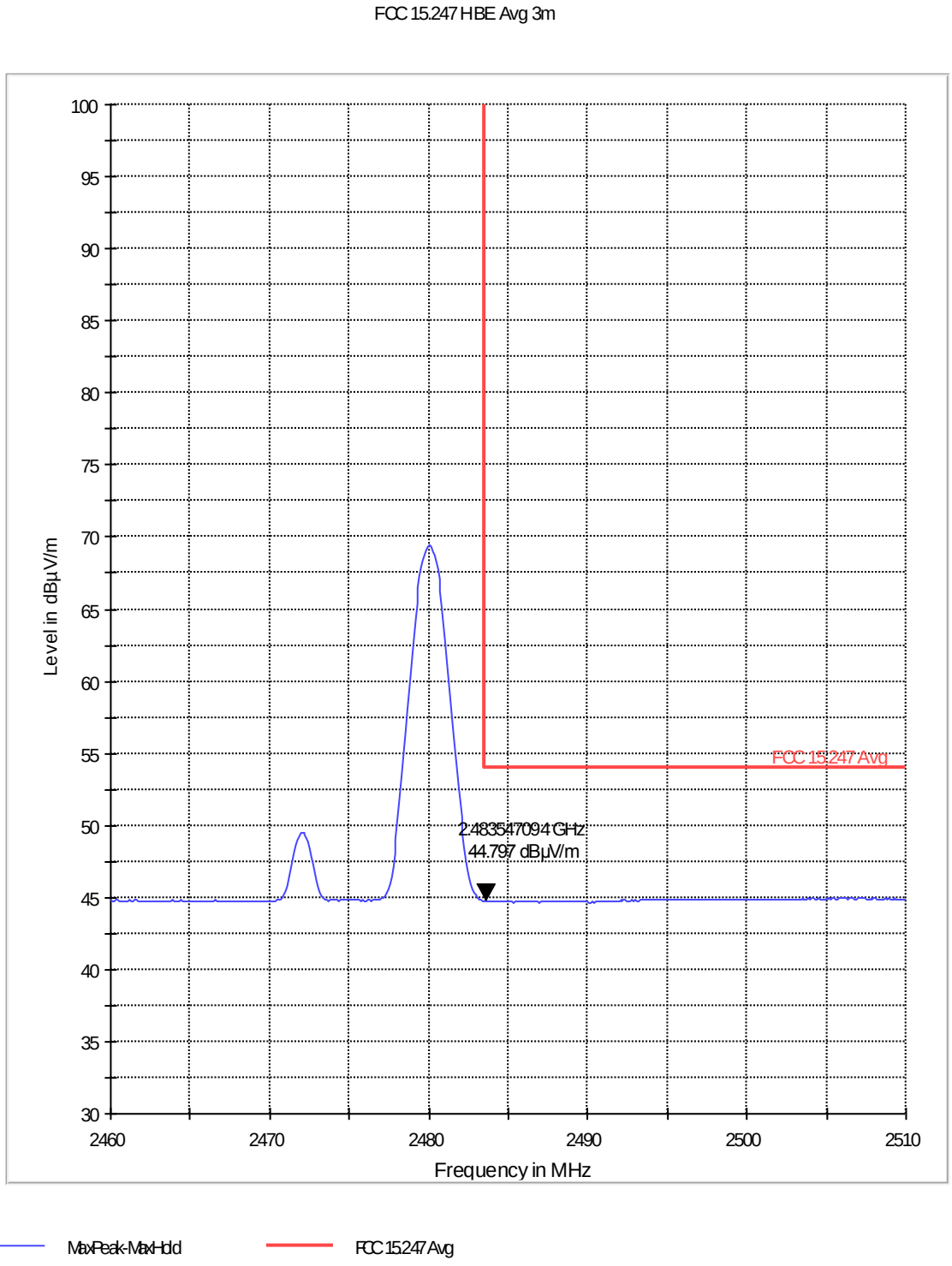
Lower band edge average -π/4 DQPSK modulation



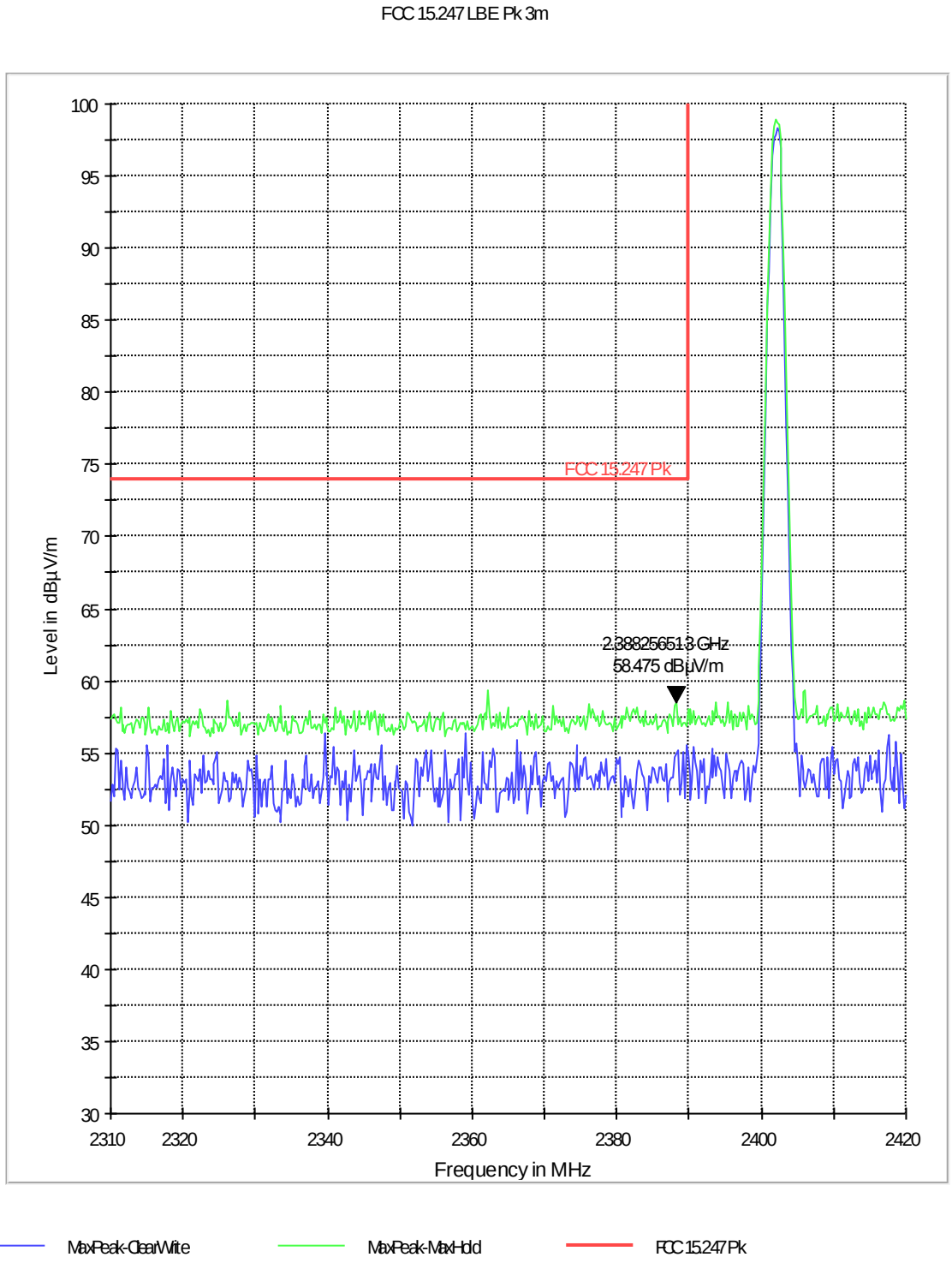
Higher band edge peak -π/4 DQPSK modulation



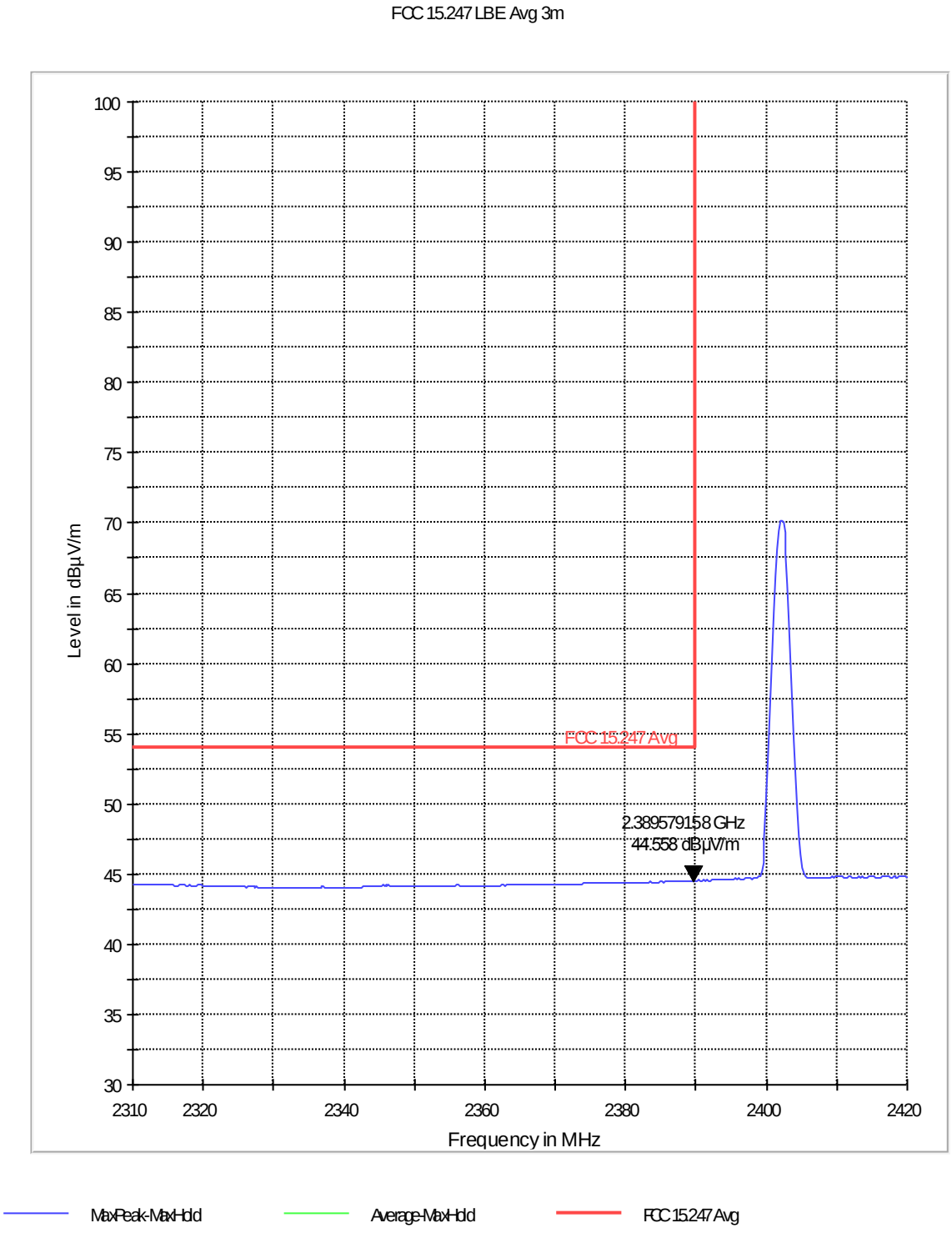
Higher band edge average- π/4 DQPSK modulation



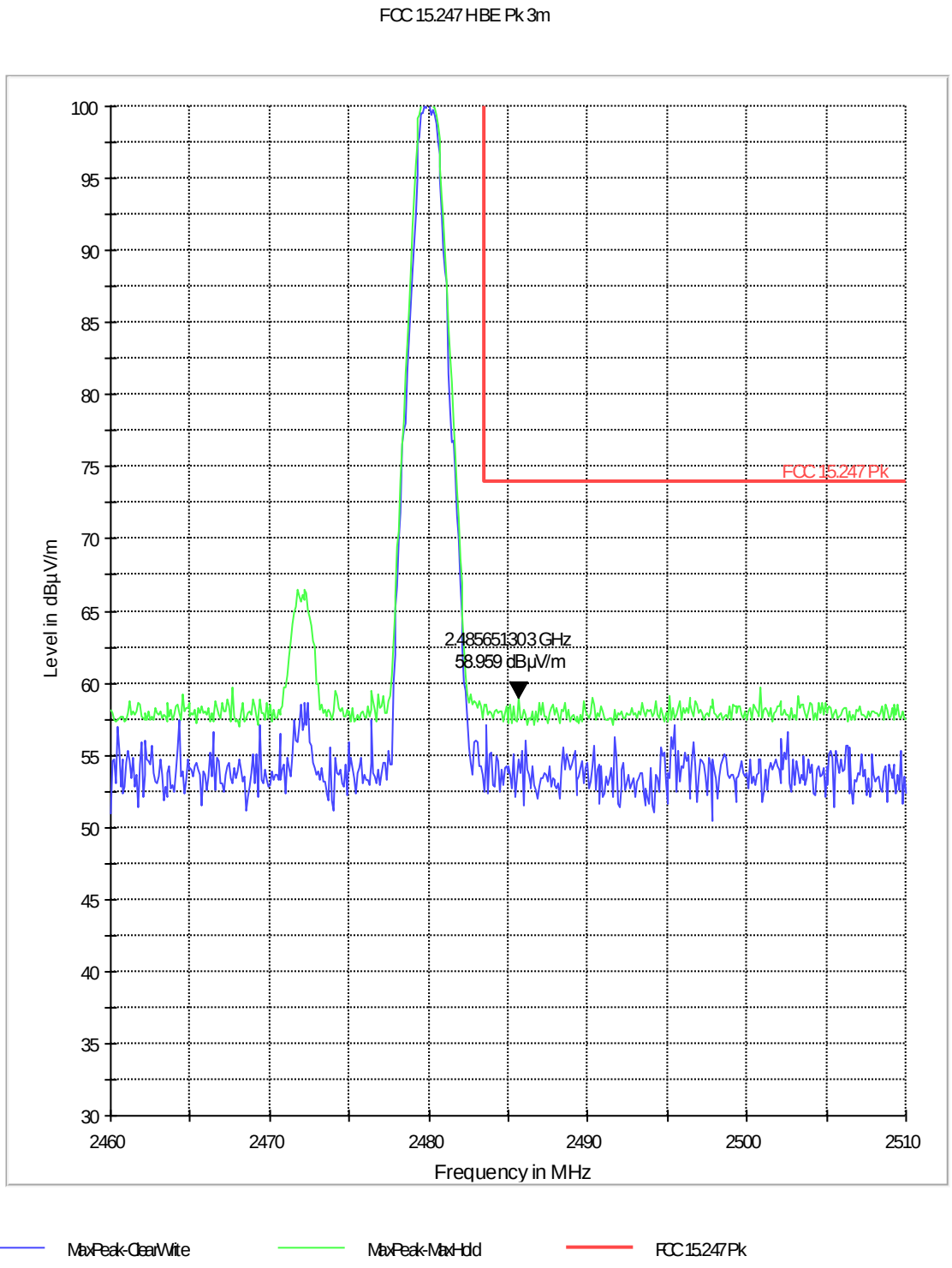
Lower band edge peak - 8DPSK modulation



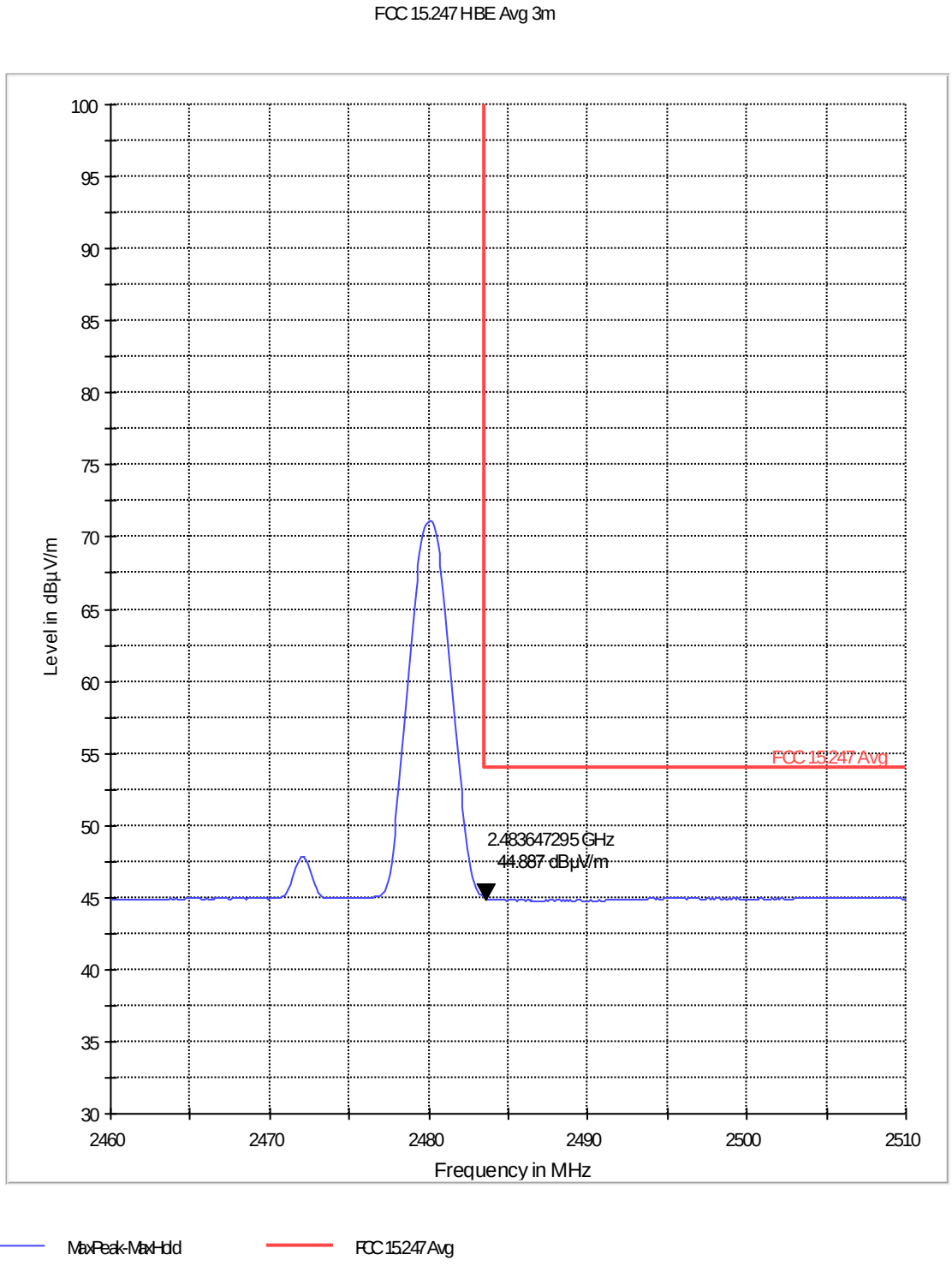
Lower band edge average -8DPSK modulation



Higher band edge peak - 8DPSK modulation

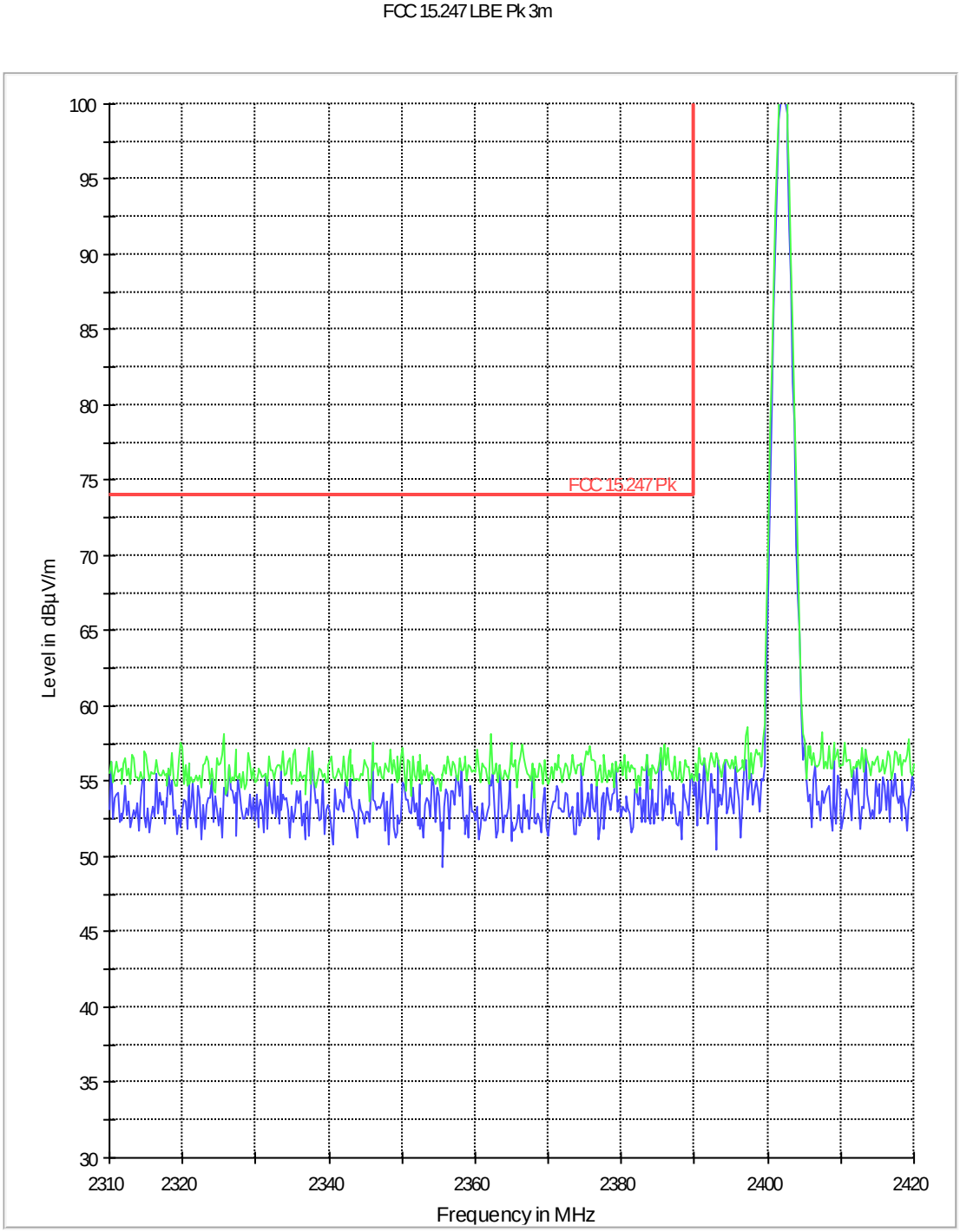


Higher band edge average-8DPSK modulation



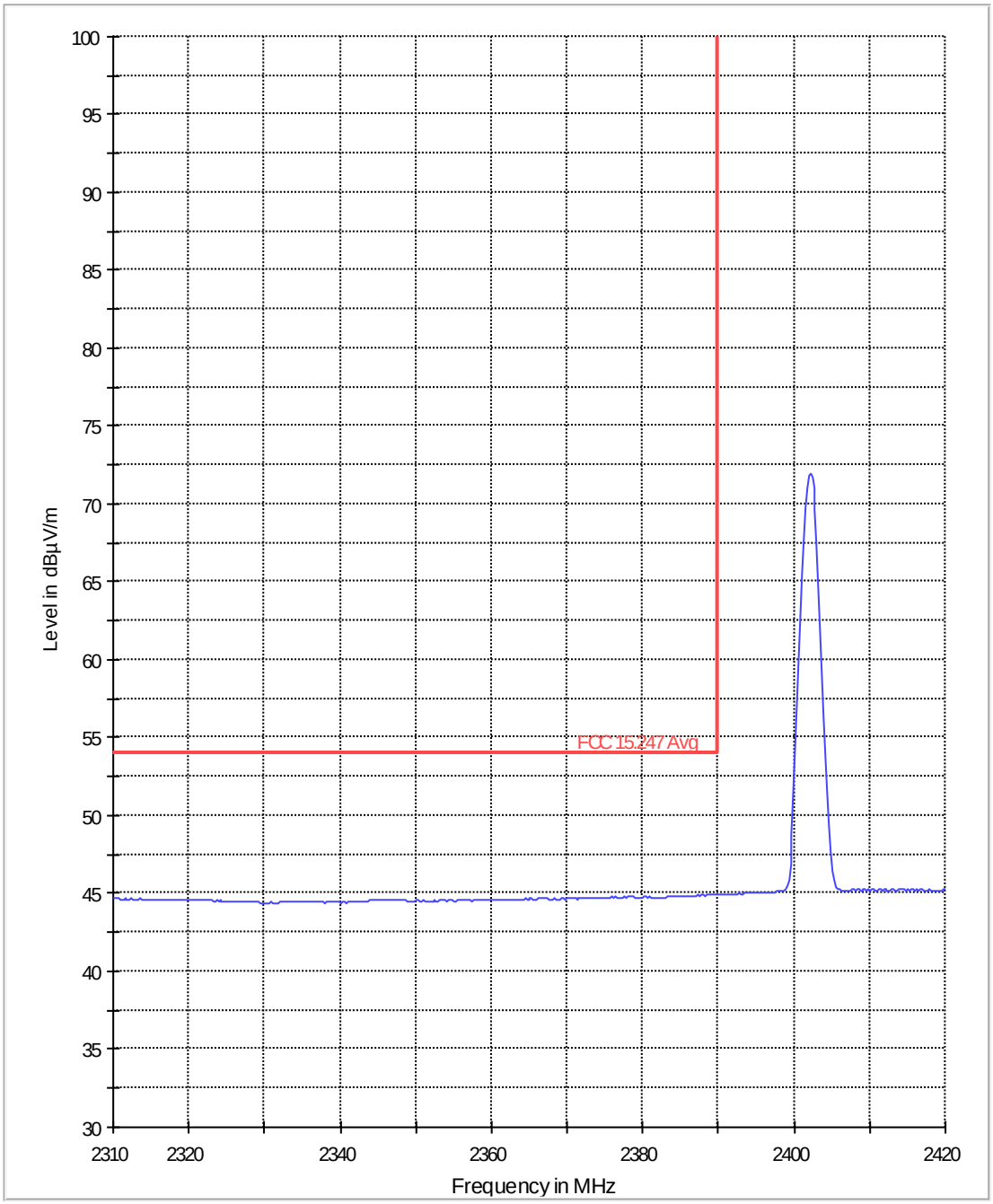
π/4 DQPSK modulation

bt a ch120 LBE PK



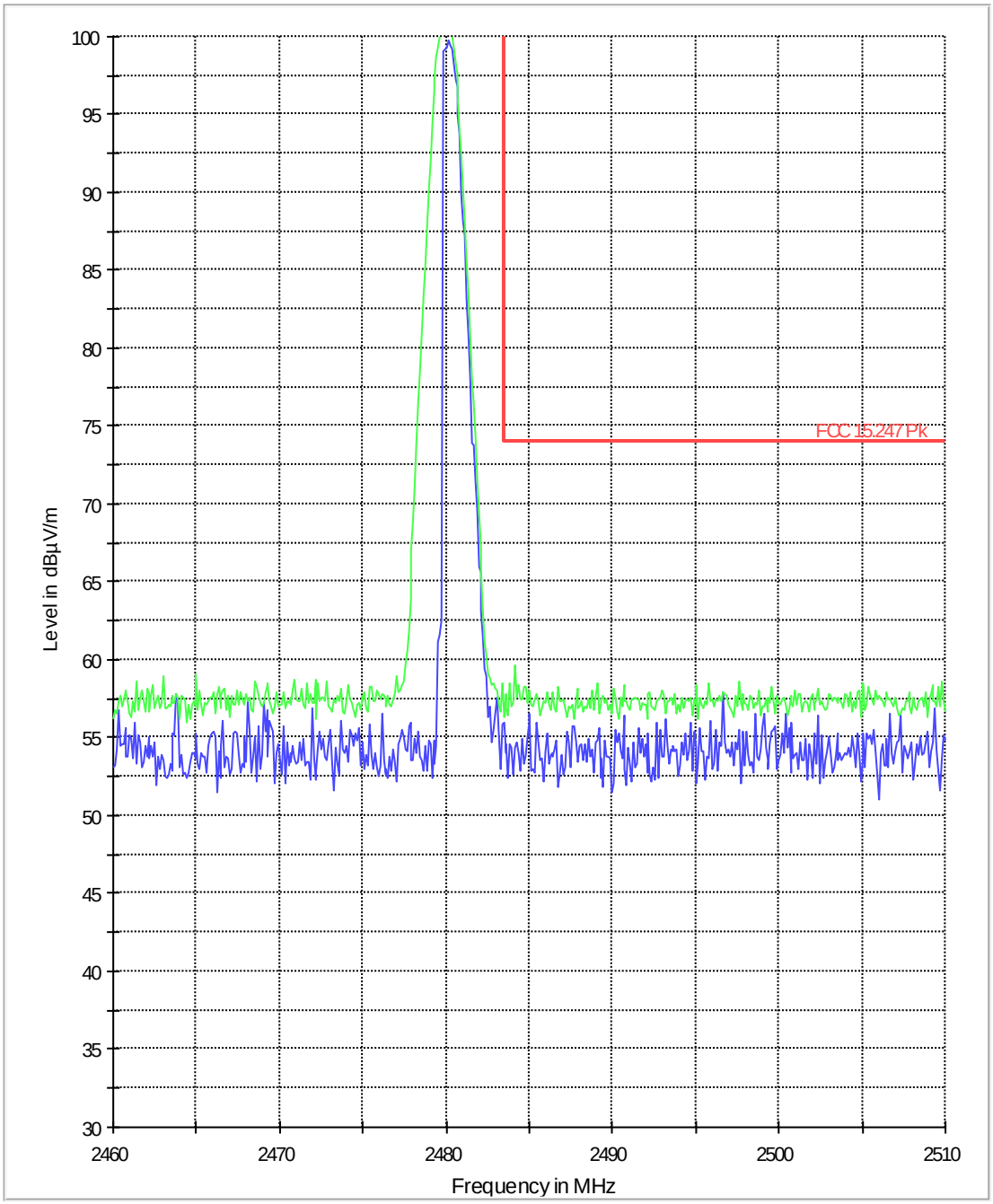
π/4 DQPSK modulation

bt a ch120 LBE AVG



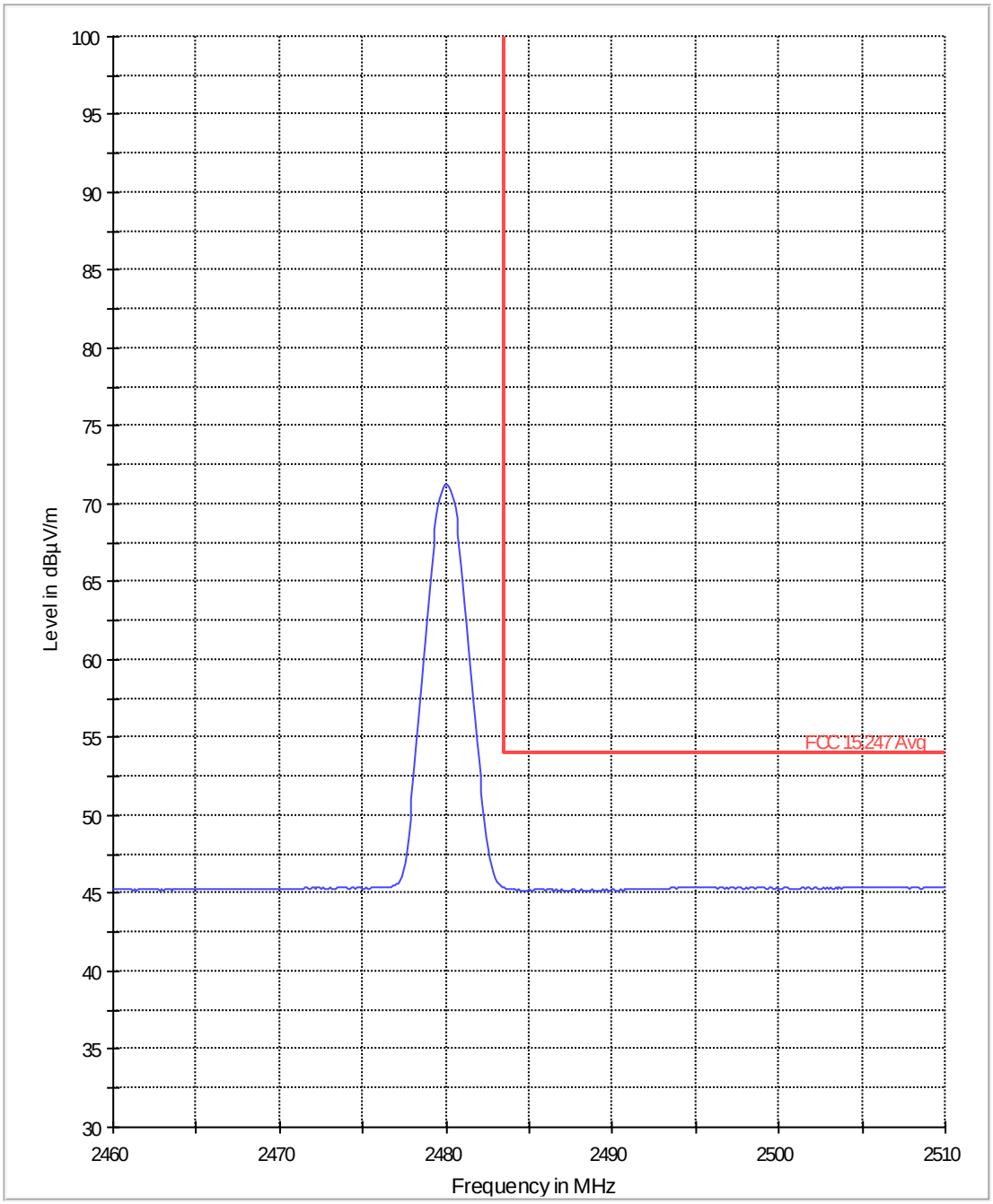
π/4 DQPSK modulation

bt a ch120 HBE PK



π/4 DQPSK modulation

bt a ch120 HBE AVG



4.5 Spectrum Bandwidth/ 20dB Bandwidth

4.5.1 Limits: § 15.247 (a)(1)

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.

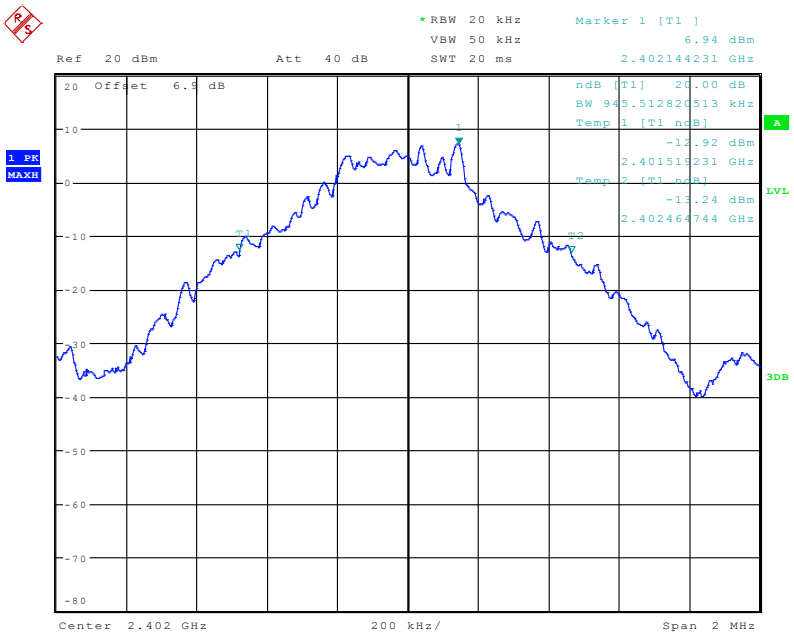
GFSK < 1000 kHz
π / 4 DQPSK < 1500 kHz
8 dPSK < 1500kHz

4.5.2 Test Result:

20dB Bandwidth (MHz)			
Modulation	**Frequency (MHz)**		
	2402	**2442**	**2480**
GFSK	0.946	0.949	0.949
π/4 DQPSK	1.33	1.33	1.32
8-DPSK	1.28	1.28	1.27
Measurement Uncertainty: ±1 kHz			

4.5.3 Test Data/plots:

20dB Bandwidth GFSK 2402MHz



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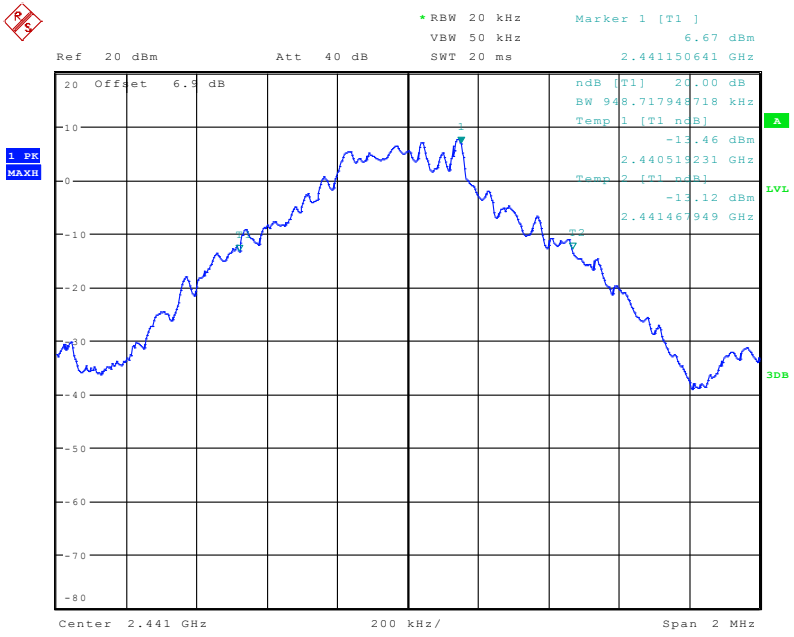
20dB Bandwidth GFSK 2441MHz



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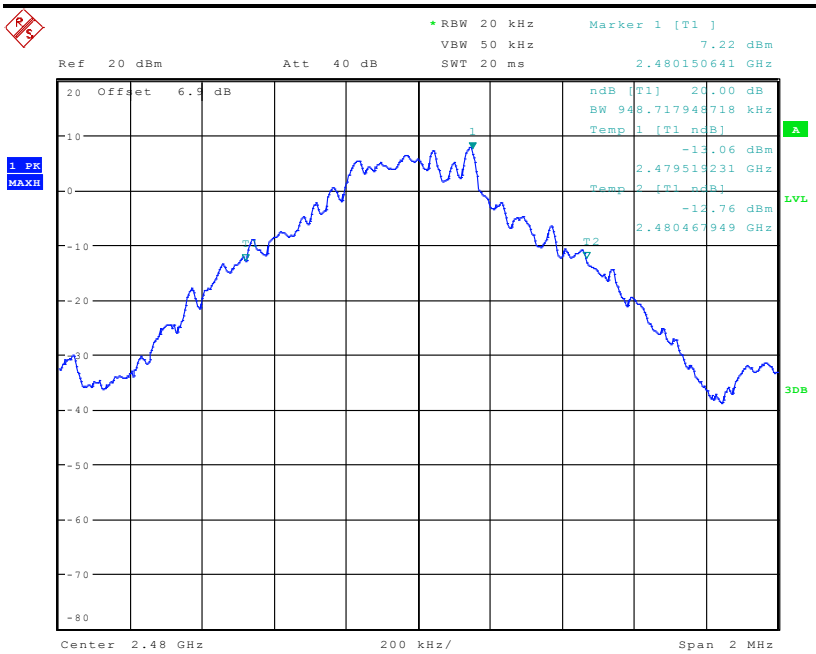
20dB Bandwidth GFSK 2480MHz



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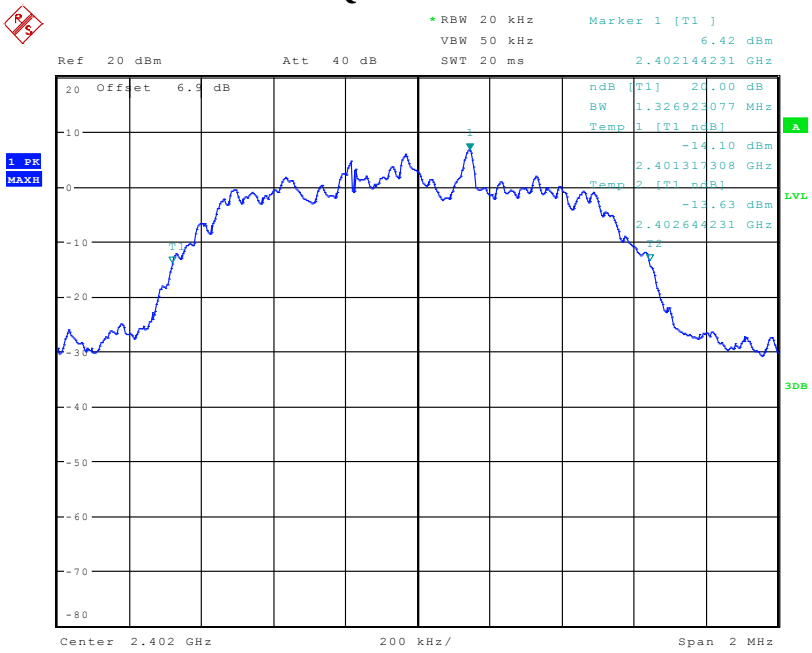
20dB Bandwidth π / 4 DQPSK 2402MHz



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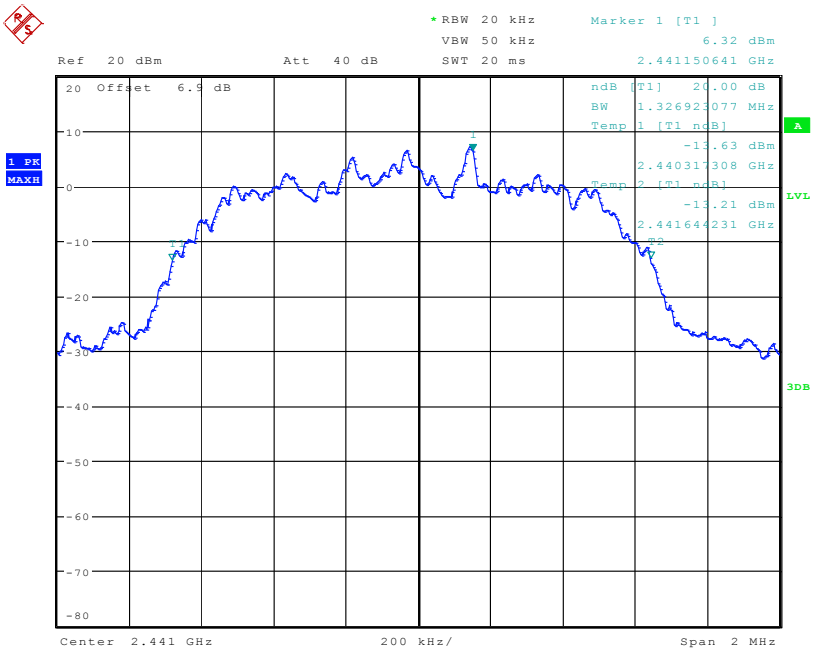
20dB Bandwidth π / 4 DQPSK 2441MHz



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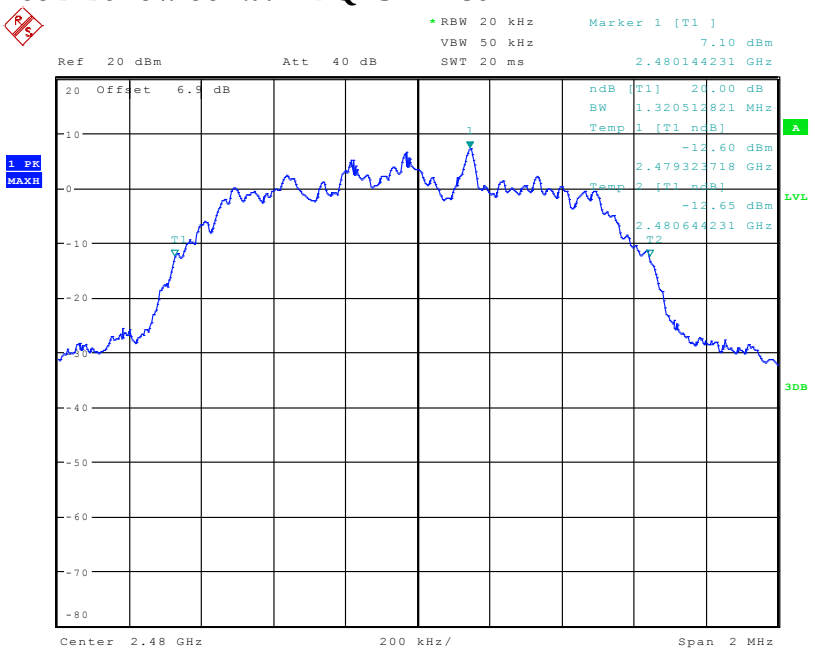
20dB Bandwidth π / 4 DQPSK 2480MHz



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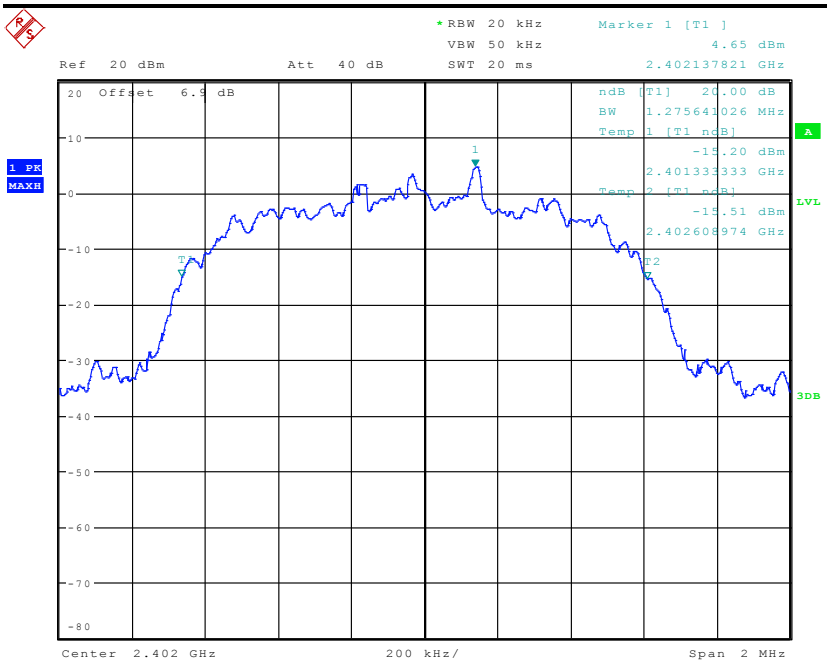
20dB Bandwidth 8PSK 2402MHz



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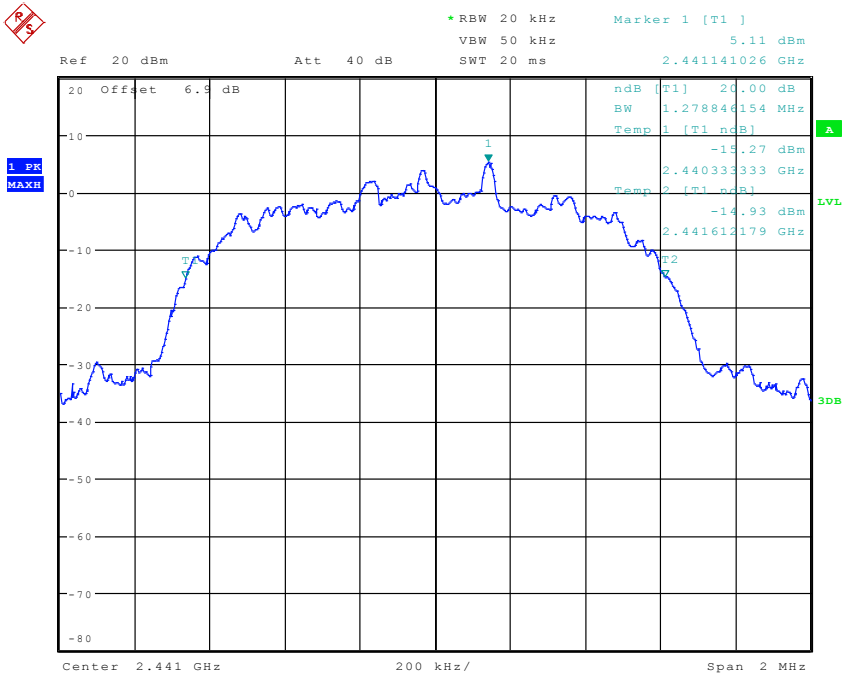
20dB Bandwidth 8PSK 2441MHz



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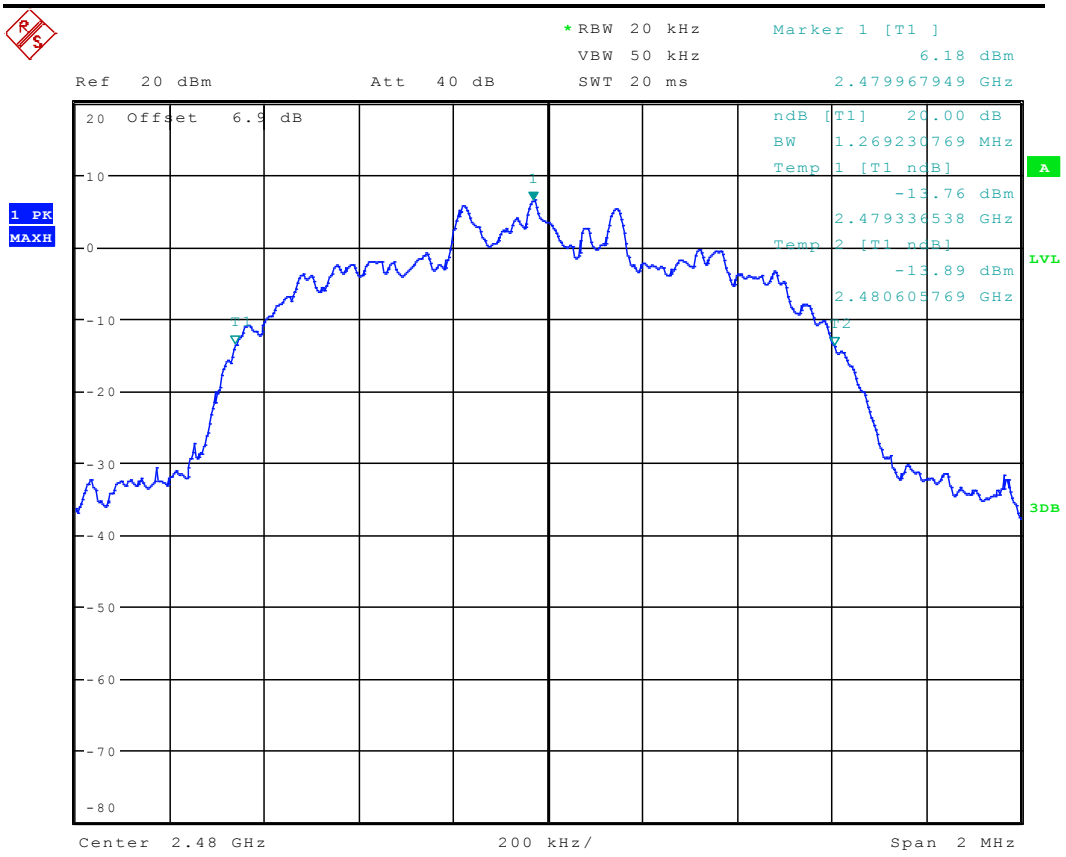
20dB Bandwidth 8PSK 2480MHz



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4.6 Carrier Frequency Separation

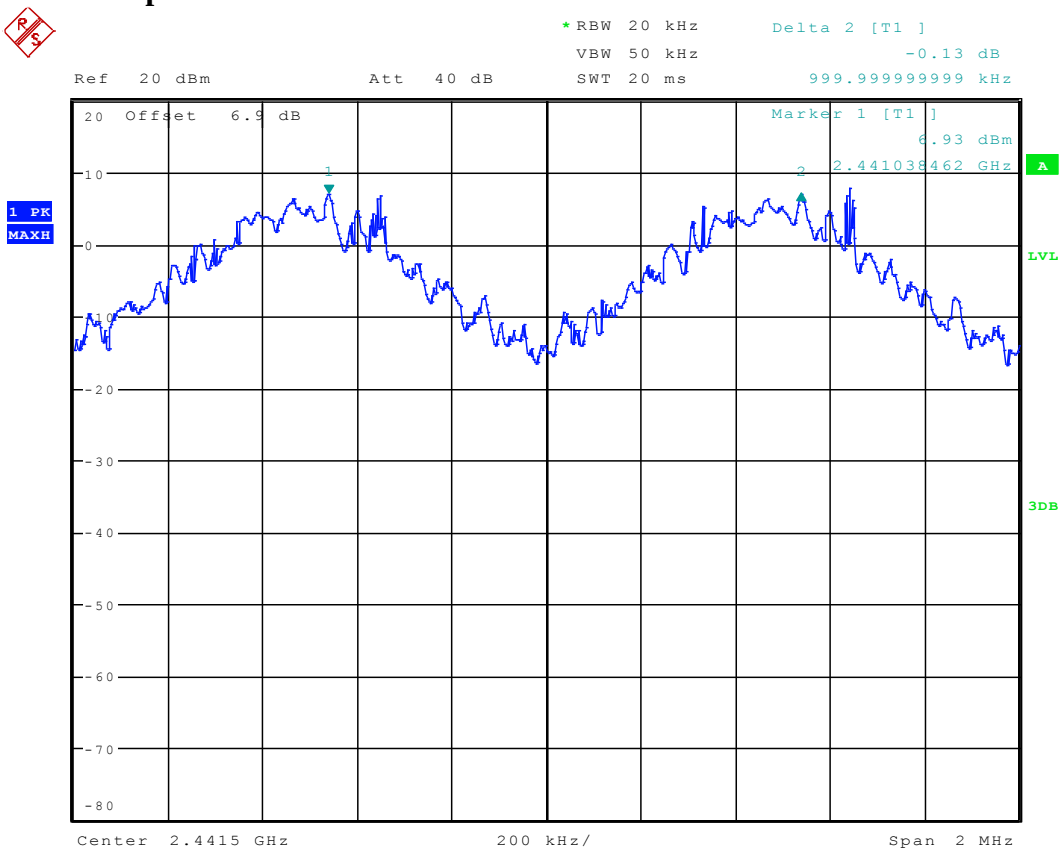
4.6.1 Limits: § 15.247 (a) (1)

Minimum 25kHz or 2/3 of the 20dB bandwidth of the hopping system

4.6.2 Test Result:

Channel Separation: 1 MHz

4.6.3 Test Data/plot:



4.7 Number of hopping channels

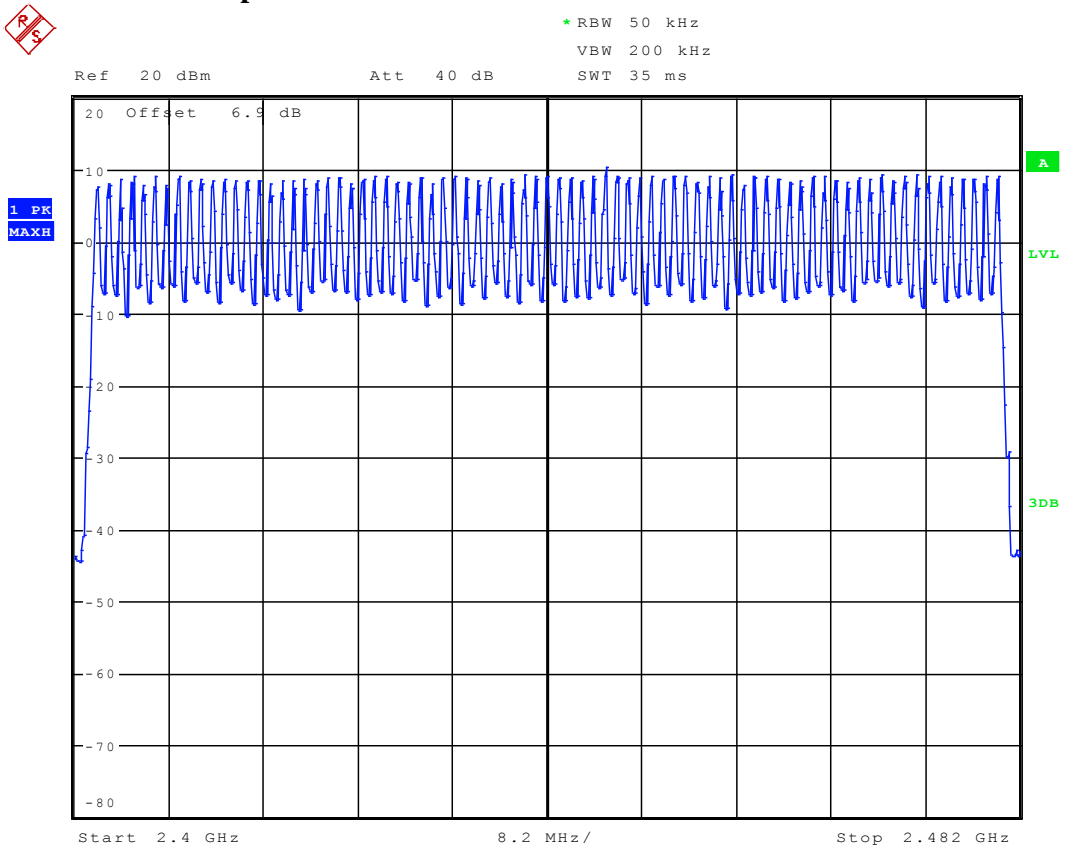
4.7.1 Limits: § 15.247 (a) (1)

Atleast 15 non-overlapping channels

4.7.2 Test Result:

Number of hopping channels: 79

4.7.3 Test Data/plot:



Date: 13.JAN.2010 09:09:07

4.8 Time of occupancy (Dwell time)

4.8.1 Limits: § 15.247 (a) (1) (iii)

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.

4.8.2 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 Bluetooth devices satisfy FCC requirement on time of occupancy (dwell time) in the data mode.

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

4.9.1 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.

4.9.2 Test Result:

Not Applicable.

4.10 Transmitter Spurious Emissions- Conducted

4.10.1 Limits: § 15.247 (d)

30dBm for the transmitter.
-20dBc in the frequency range 30MHz- 25GHz.

4.10.2 Test Conditions:

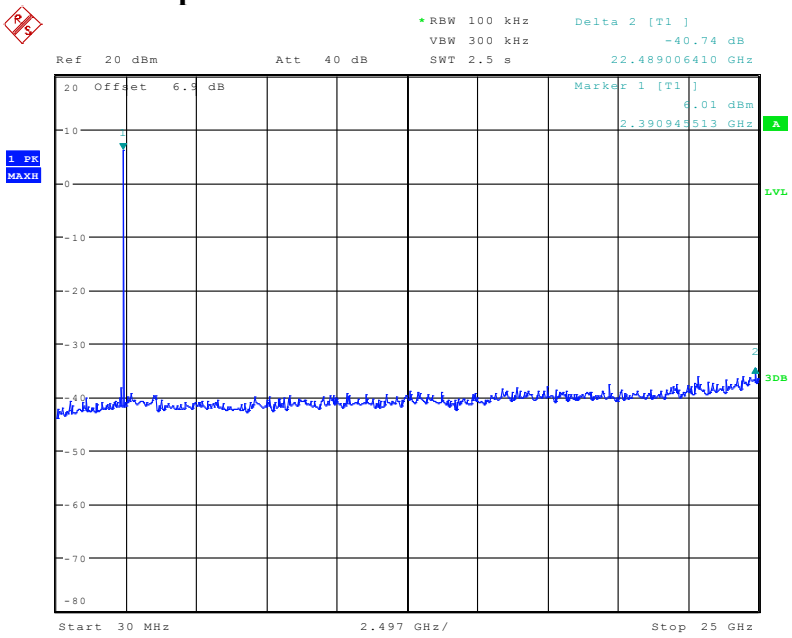
Modulation: π / 4 DQPSK, worst case
Analyzer settings: F<1G: RBW=VBW=100 kHz
F>1G: RBW=VBW=1 MHz.
Spurious emissions were also performed with both Bluetooth and 802.11a transmitting simultaneously.

4.10.3 Test data/ plots:

Conducted Spurious Emissions			
Channel	**Frequency (MHz)**	**Amplitude (dBm)**	**Limits**
Low	**2402**	6.01	30dBm
	No critical peaks		-20dBc
Mid	**2442**	6.67	30 dBm
	No critical peaks		-20dBc
High	**2480**	6.67	30 dBm
	No critical peaks		-20dBc
Measurement Uncertainty: ±1 dB			

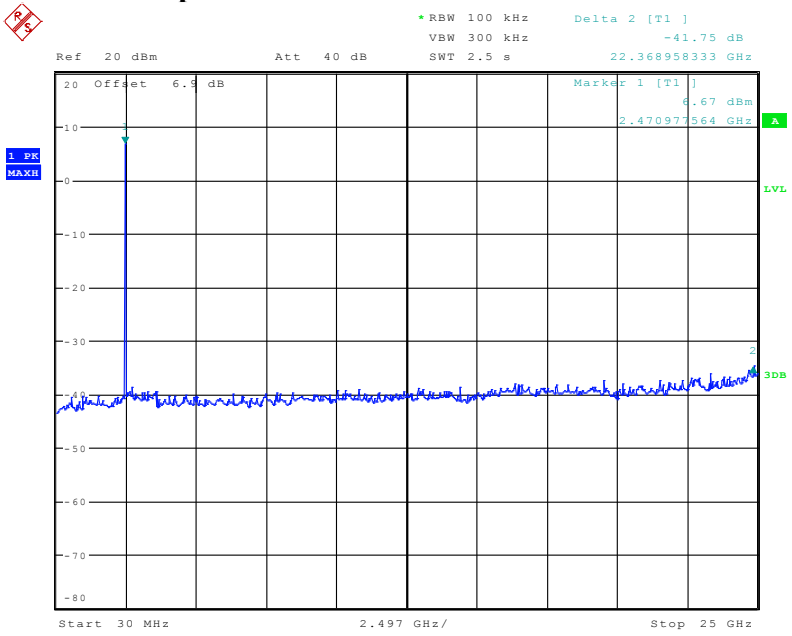
4.10.4 Test data/ plots:

Conducted Spurious Emission 2402MHz



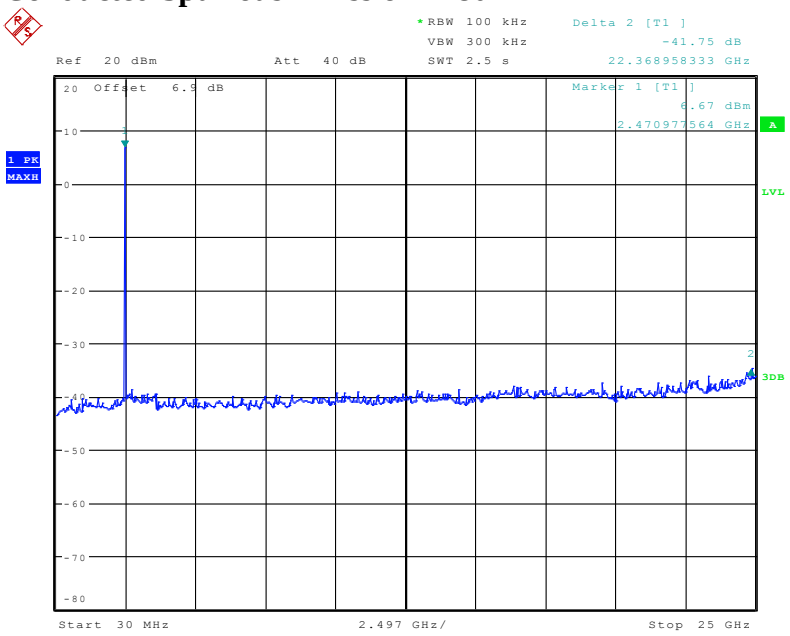
Date: 13.JAN.2010 09:24:48

Conducted Spurious Emission 2441 MHz



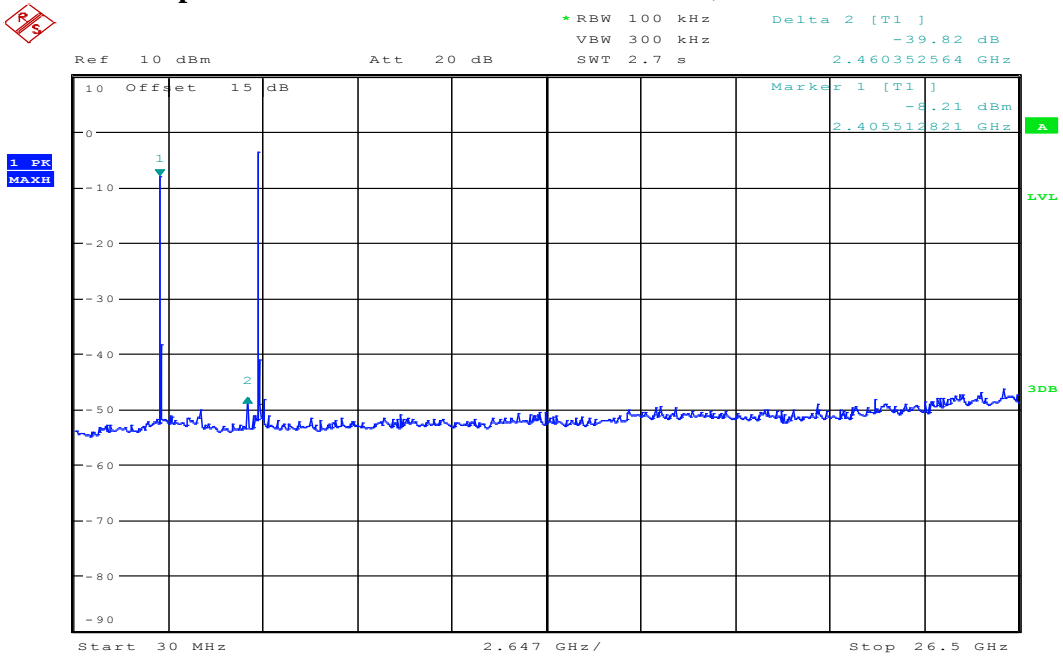
Date: 13.JAN.2010 09:28:25

Conducted Spurious Emission 2480MHz



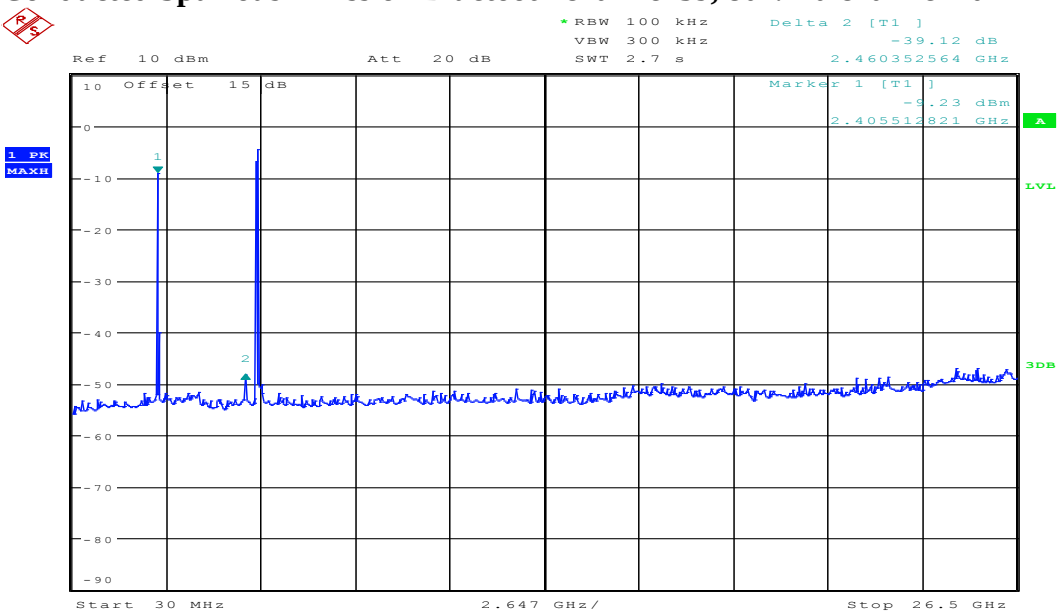
Date: 13.JAN.2010 09:28:25

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 36



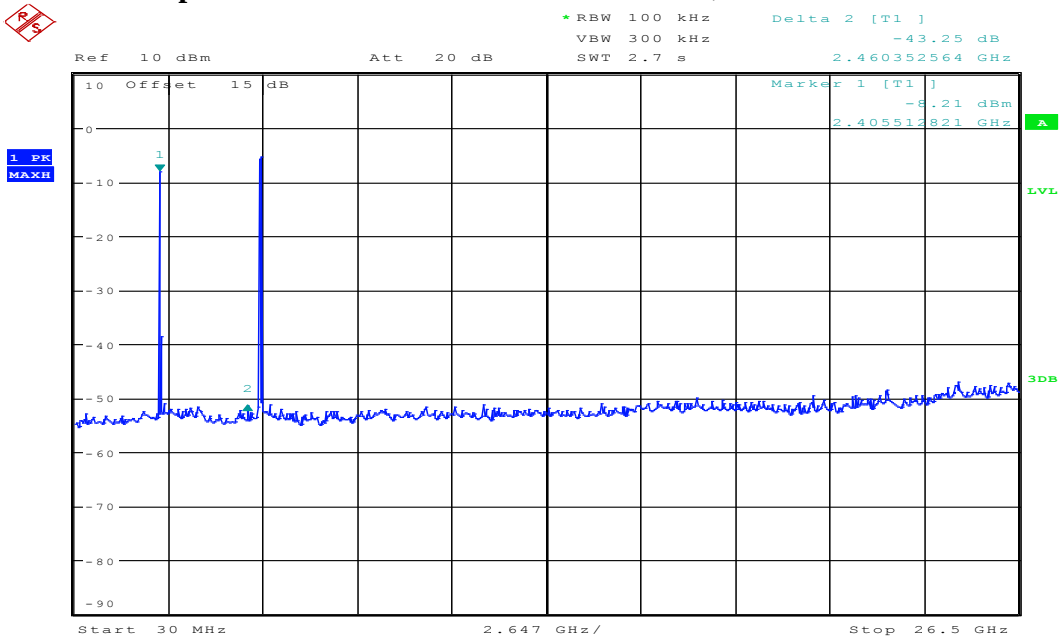
Date: 3.MAR.2010 10:18:15

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 40



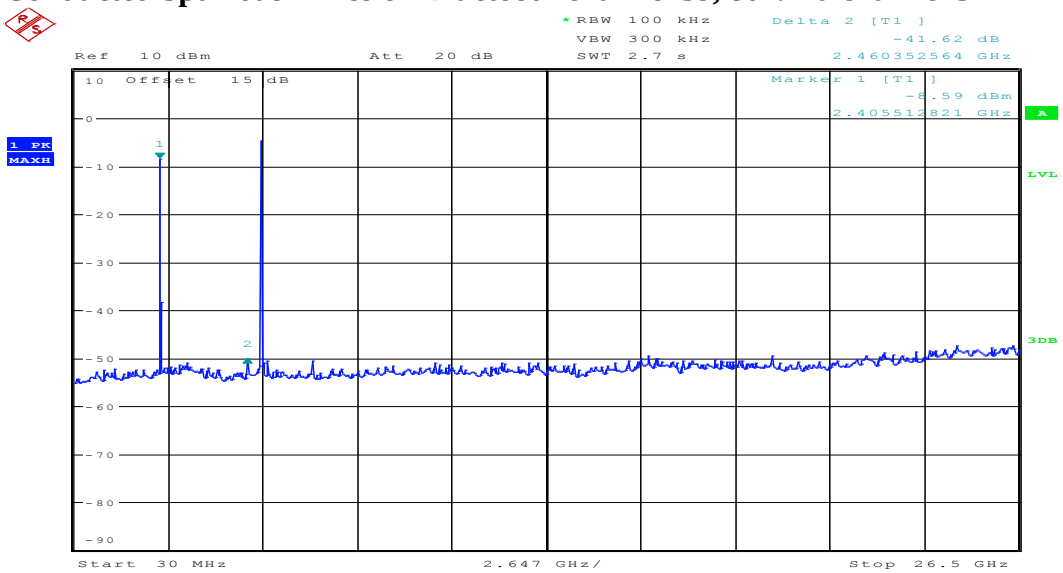
Date: 3.MAR.2010 10:20:16

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 48



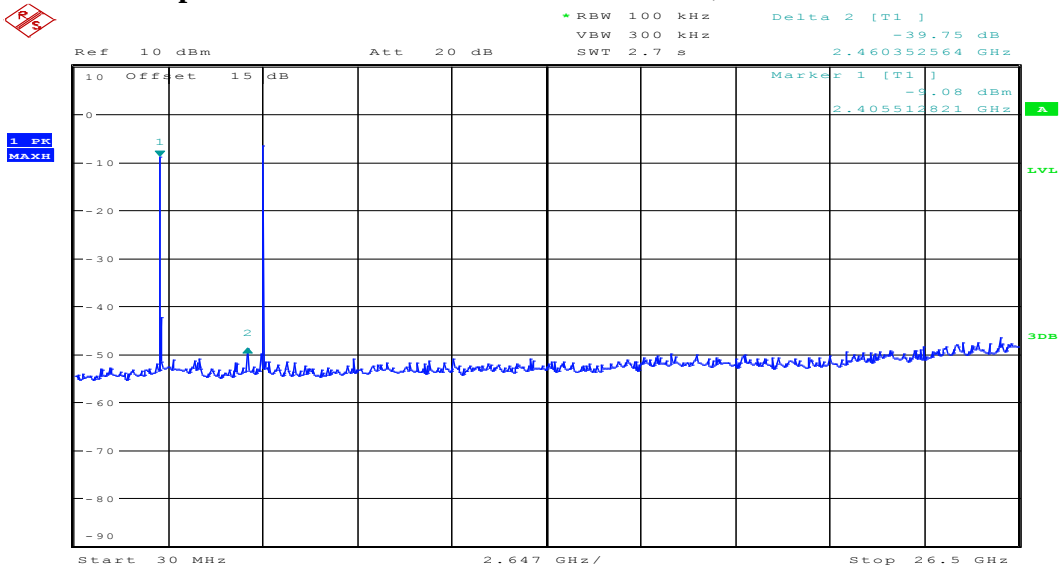
Date: 3.MAR.2010 10:21:05

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 52



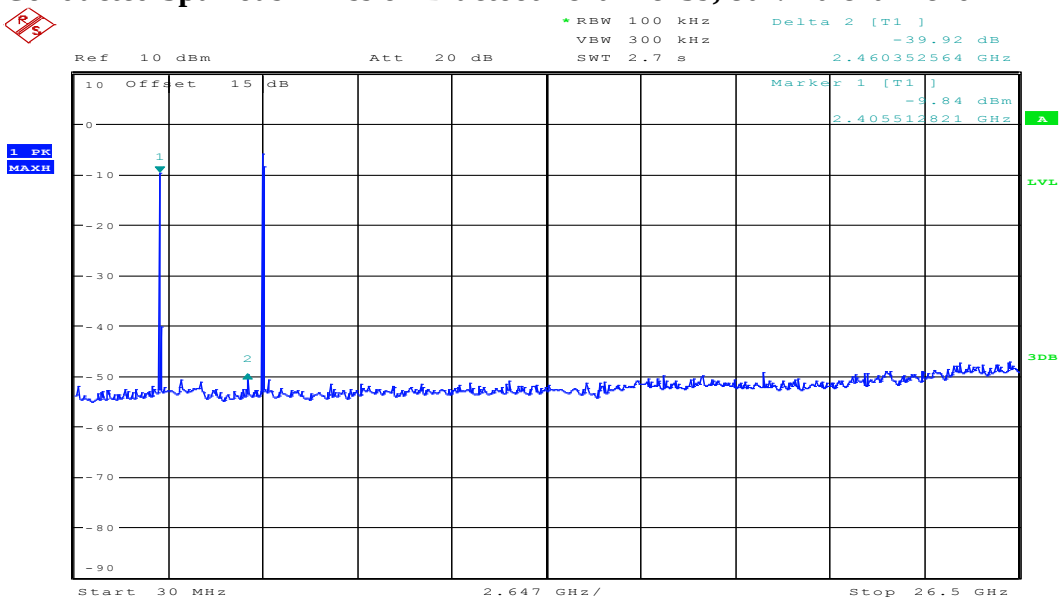
Date: 3.MAR.2010 10:21:58

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 60



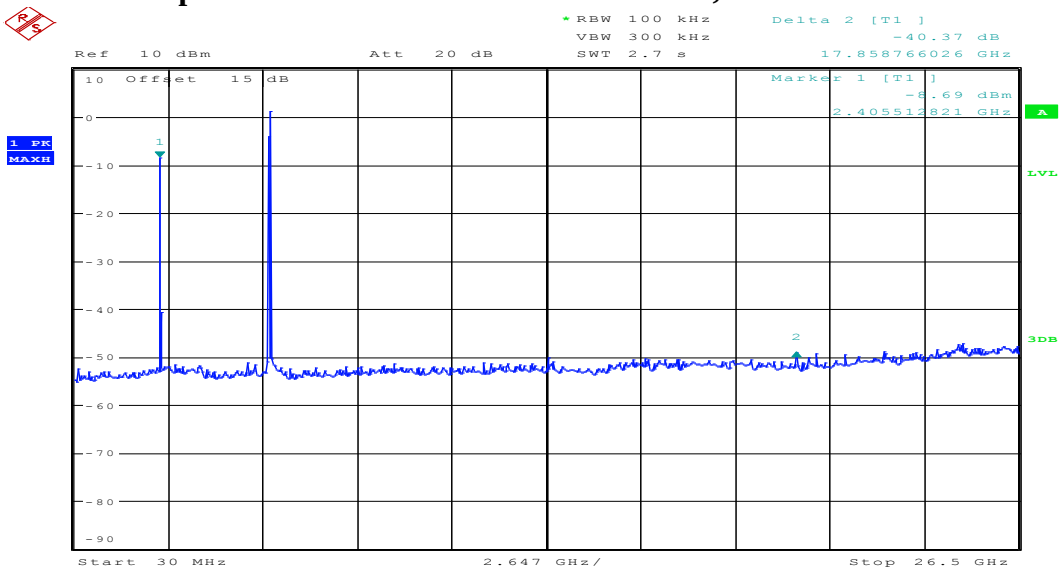
Date: 3.MAR.2010 10:22:42

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 64



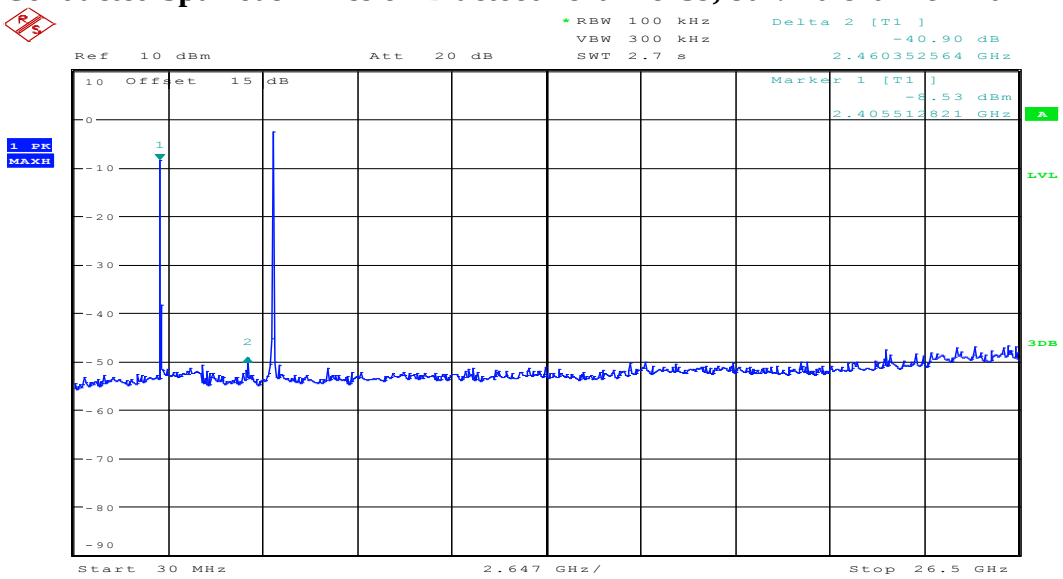
Date: 3.MAR.2010 10:23:29

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 100



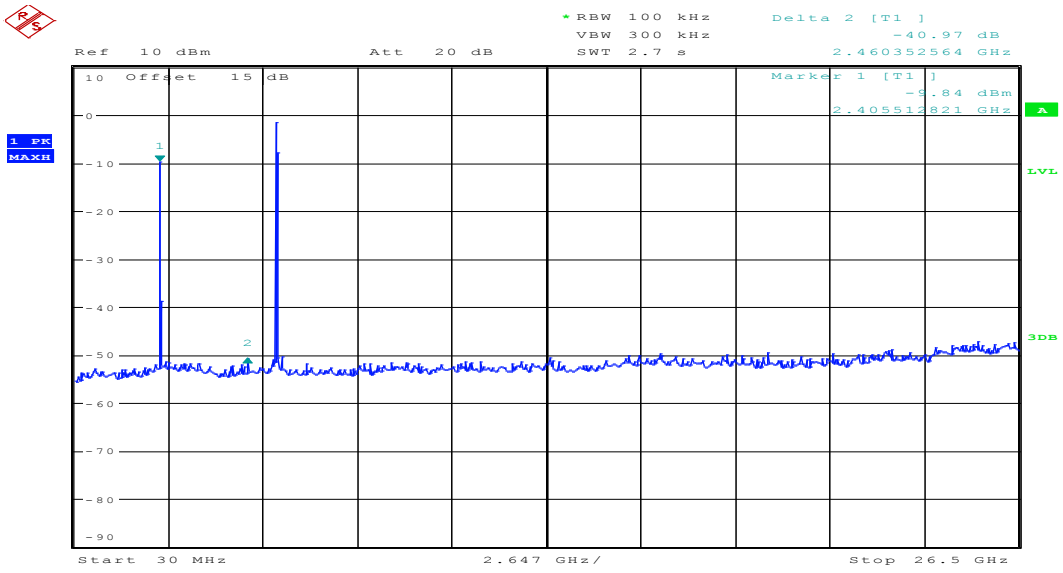
Date: 3.MAR.2010 10:24:36

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 120



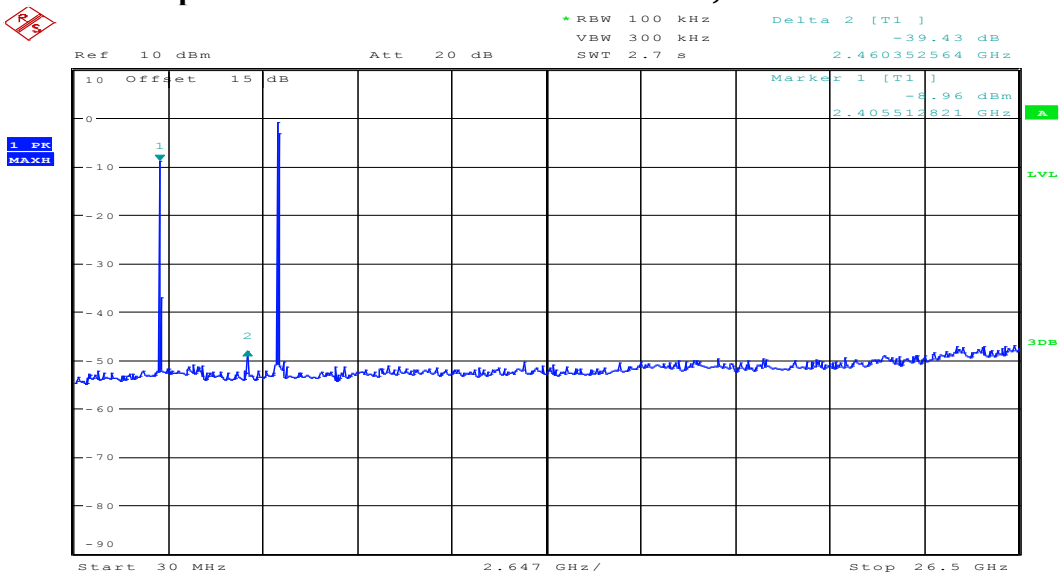
Date: 3.MAR.2010 10:25:18

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 140



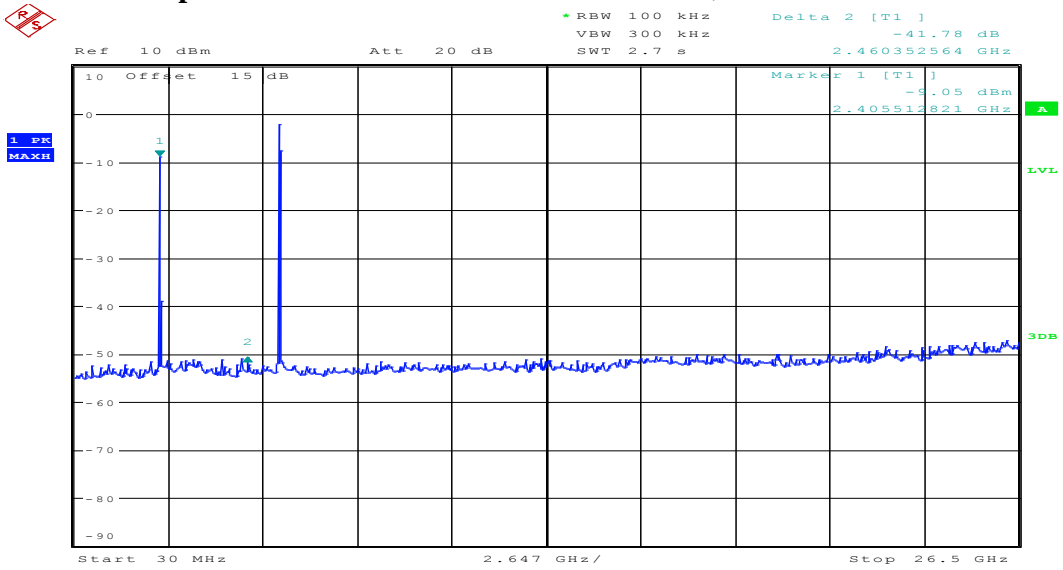
Date: 3.MAR.2010 10:26:11

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 149



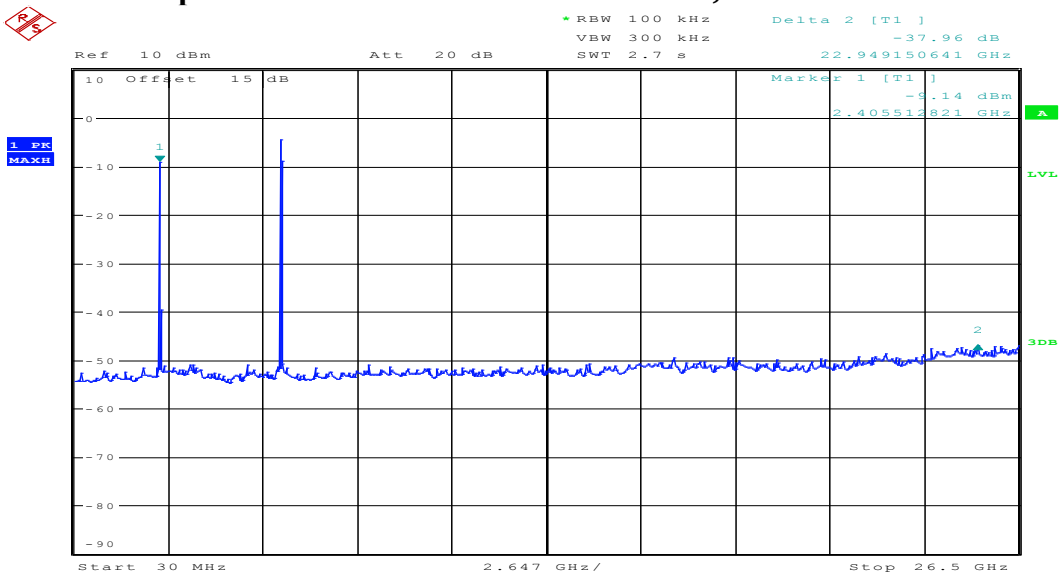
Date: 3.MAR.2010 10:28:06

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 157



Date: 3.MAR.2010 10:28:58

Conducted Spurious Emission Bluetooth channel 39, 802.11a channel 165



Date: 3.MAR.2010 10:30:12

4.11 Transmitter Spurious Emissions- Radiated

4.11.1 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. 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= 74dBµV/m
*AVG. LIMIT= 54dBµV/m

4.11.2 Limits: §15.209

(For measurement distance of 3m)

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)

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.

4.11.3 Limits: §15.209

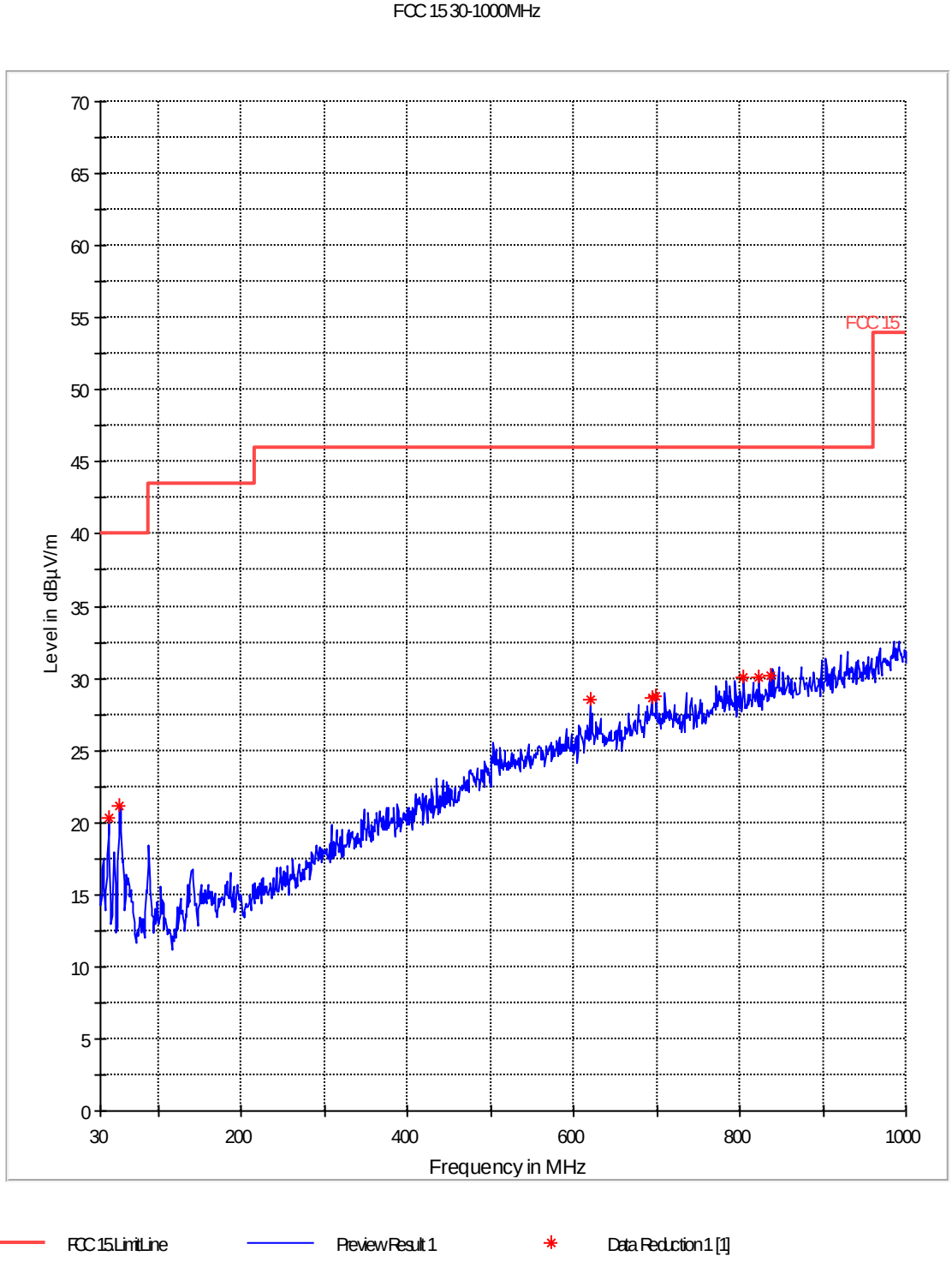
Frequency of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30

4.11.4 Test Result:
No significant emissions measurable. Plots reported here represent the worse case emissions, and represent both Horizontal and Vertical polarizations.

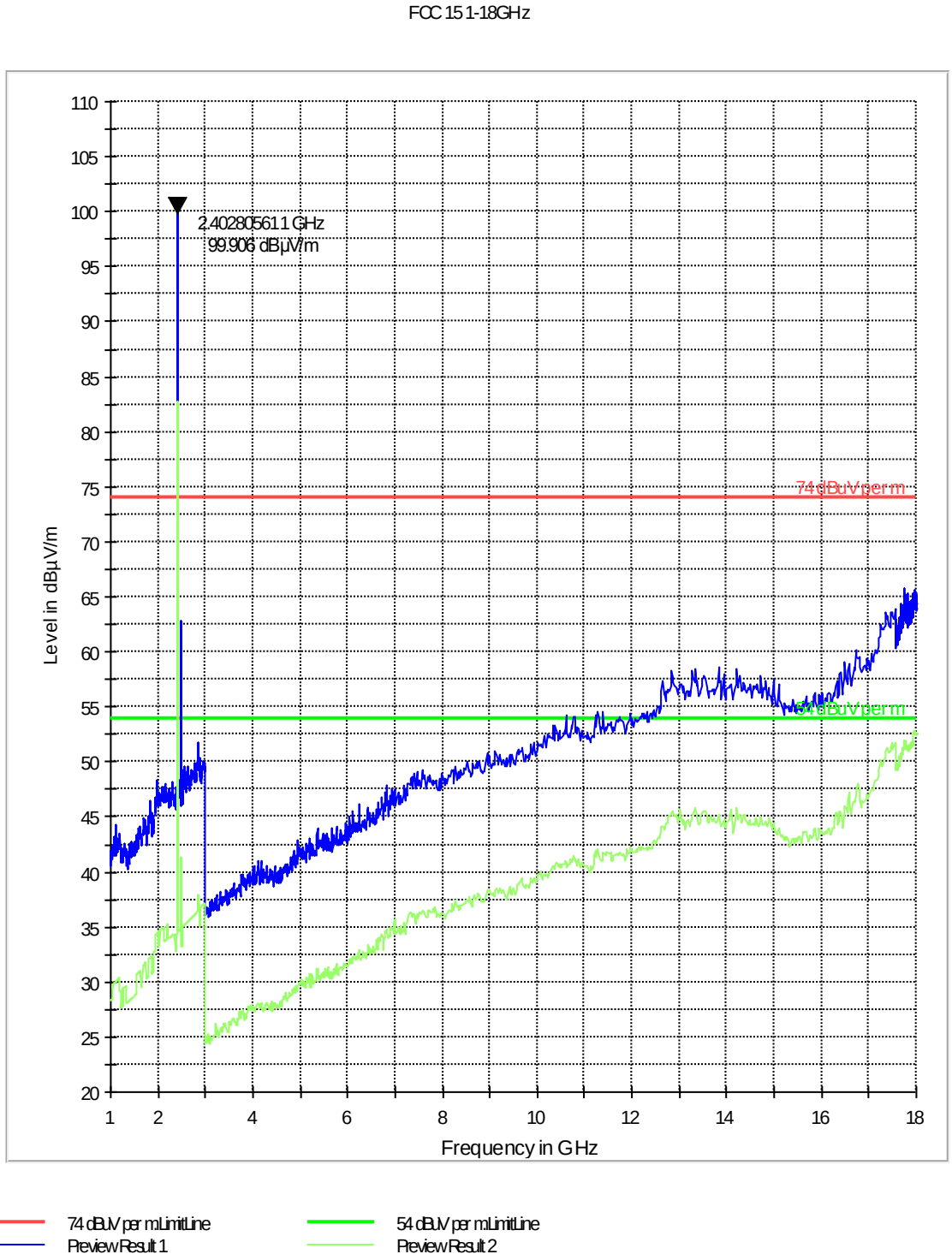
Spurious emissions were also performed with both Bluetooth and 802.11a transmitting on the same antenna.

4.11.5 Test data/ plots:

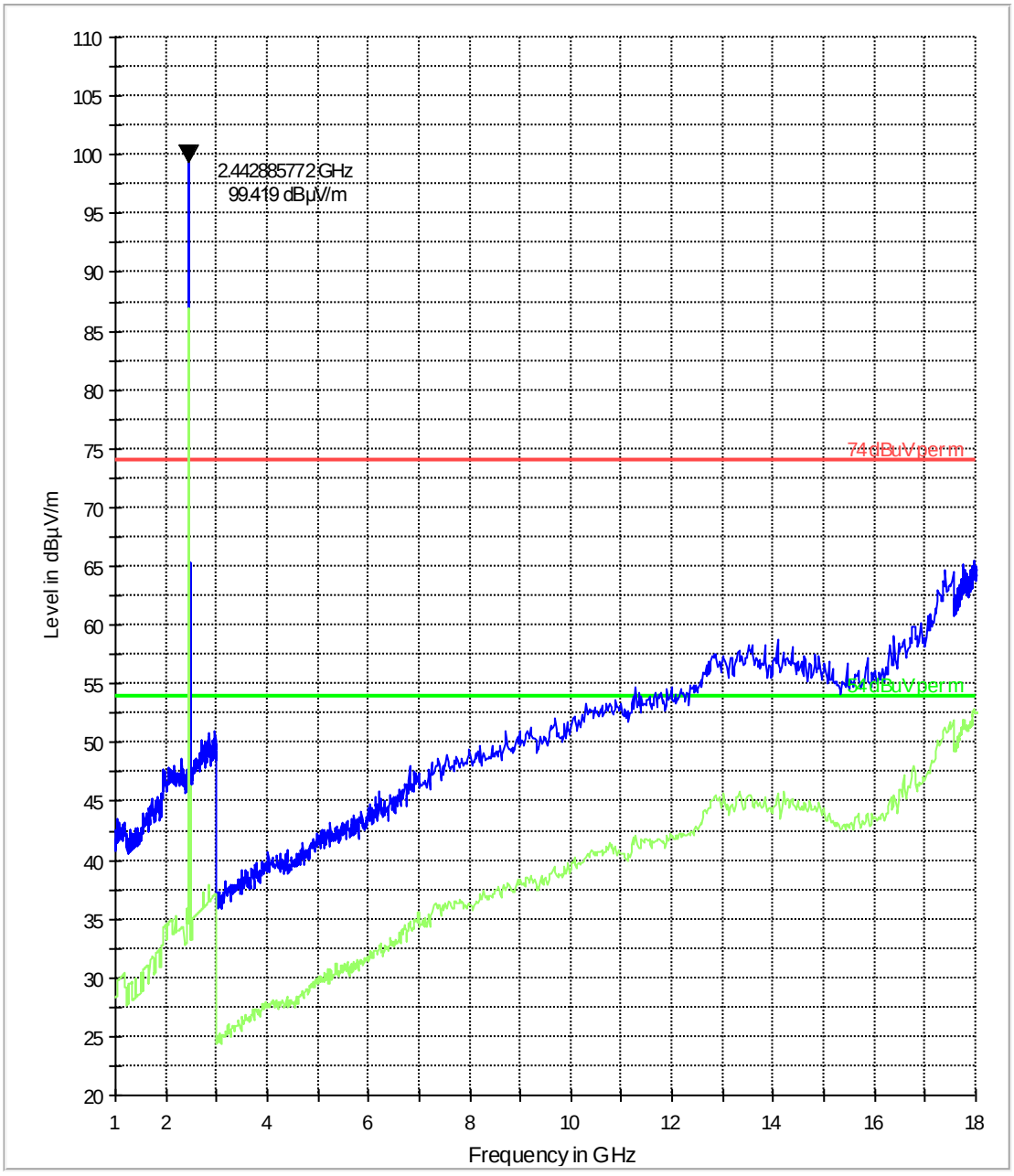
30-1 CH 39



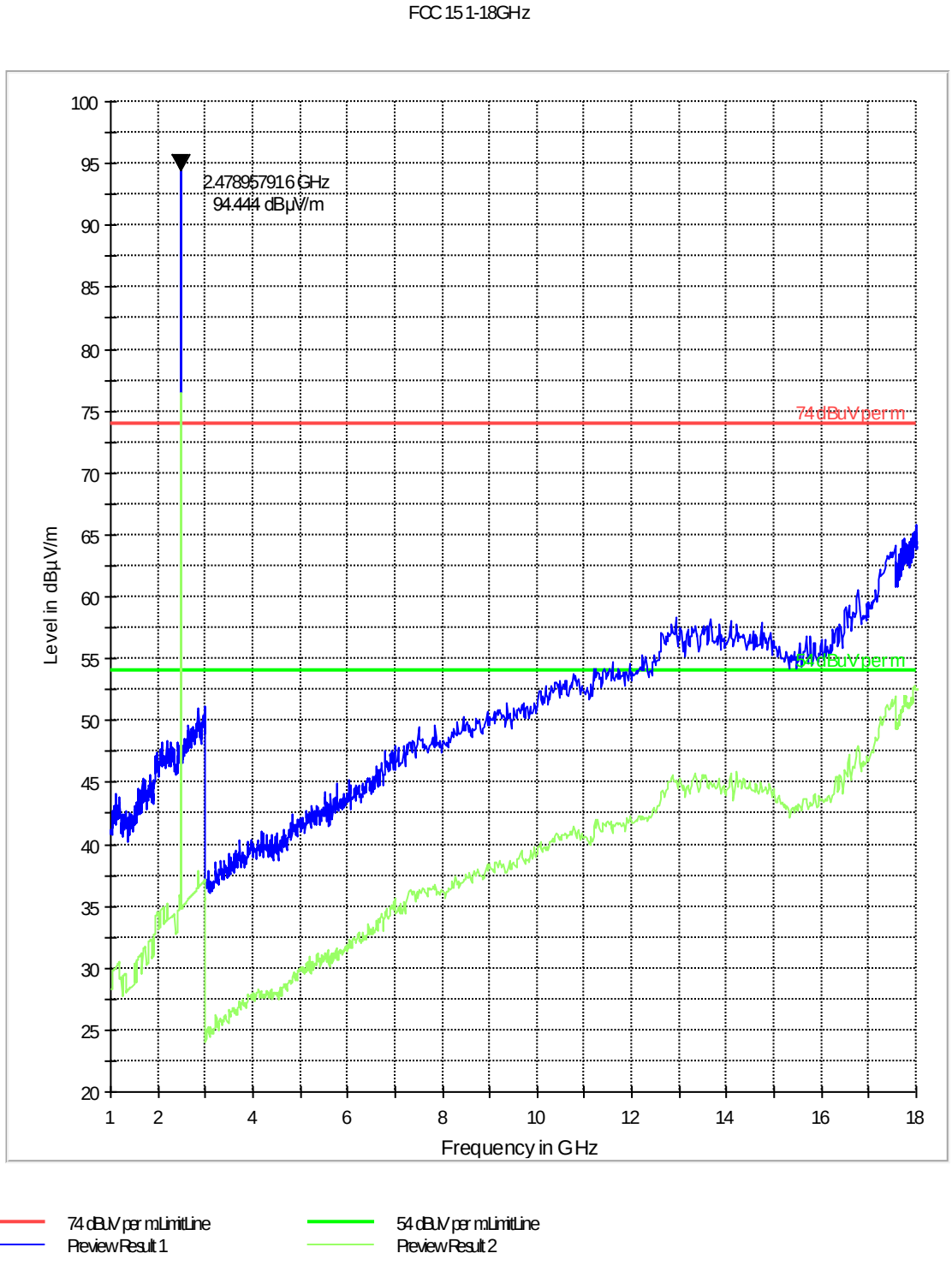
1-18 CH 0


FCC 15 1-18GHz
2.40280561 GHz
99.906 dBµV/m
74 dBuV per m
54 dBuV per m
Level in dBµV/m
Frequency in GHz
74 dBuV per m Limit Line
Preview Result 1
54 dBuV per m Limit Line
Preview Result 2

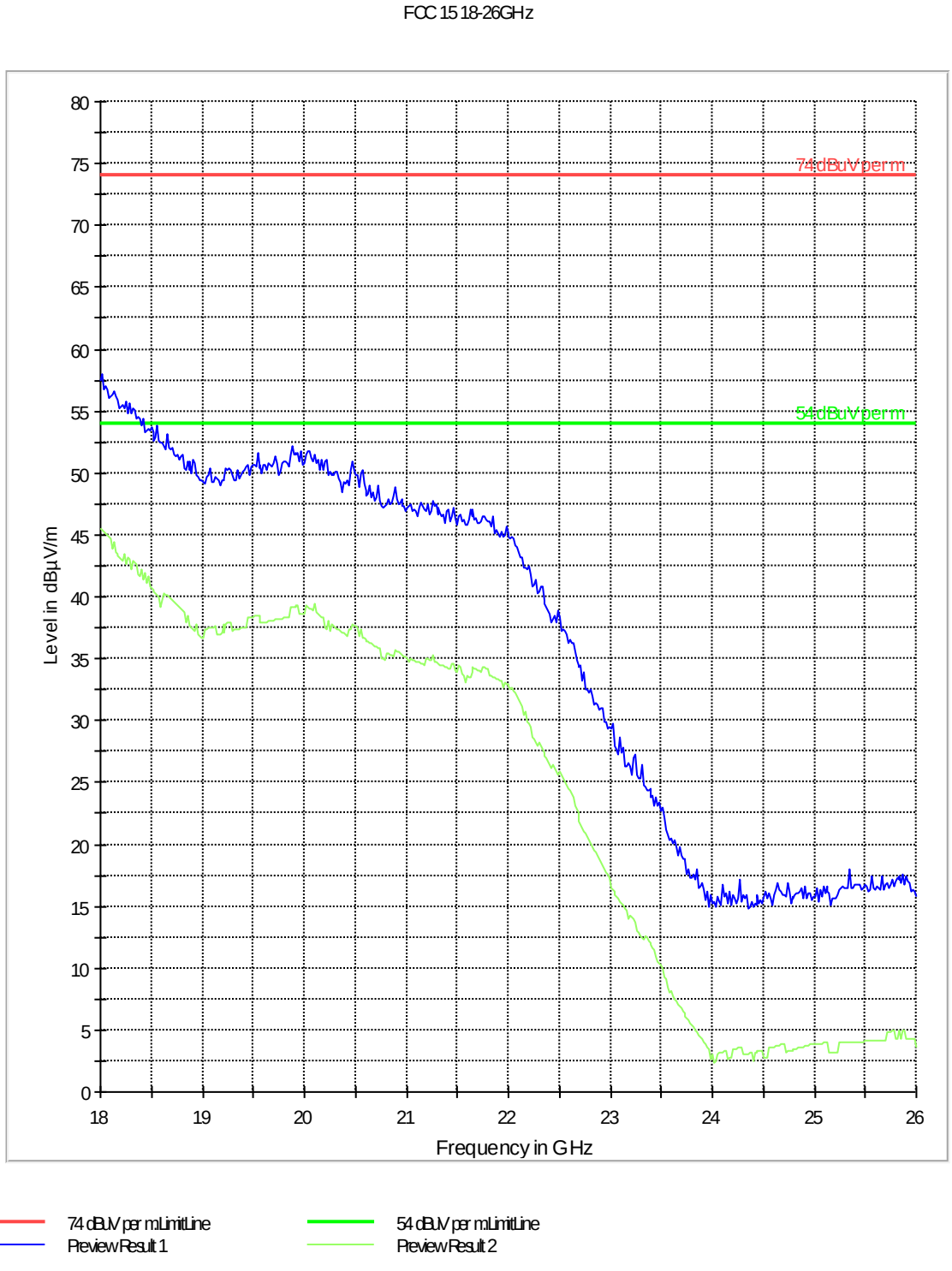
1-18 CH 39


FCC 15 1-18GHz
2.442885772 GHz
99.419 dBµV/m
74 dBuV per m
54 dBuV per m
Level in dBµV/m
Frequency in GHz
74 dBuV per m Limit Line
Preview Result 1
54 dBuV per m Limit Line
Preview Result 2

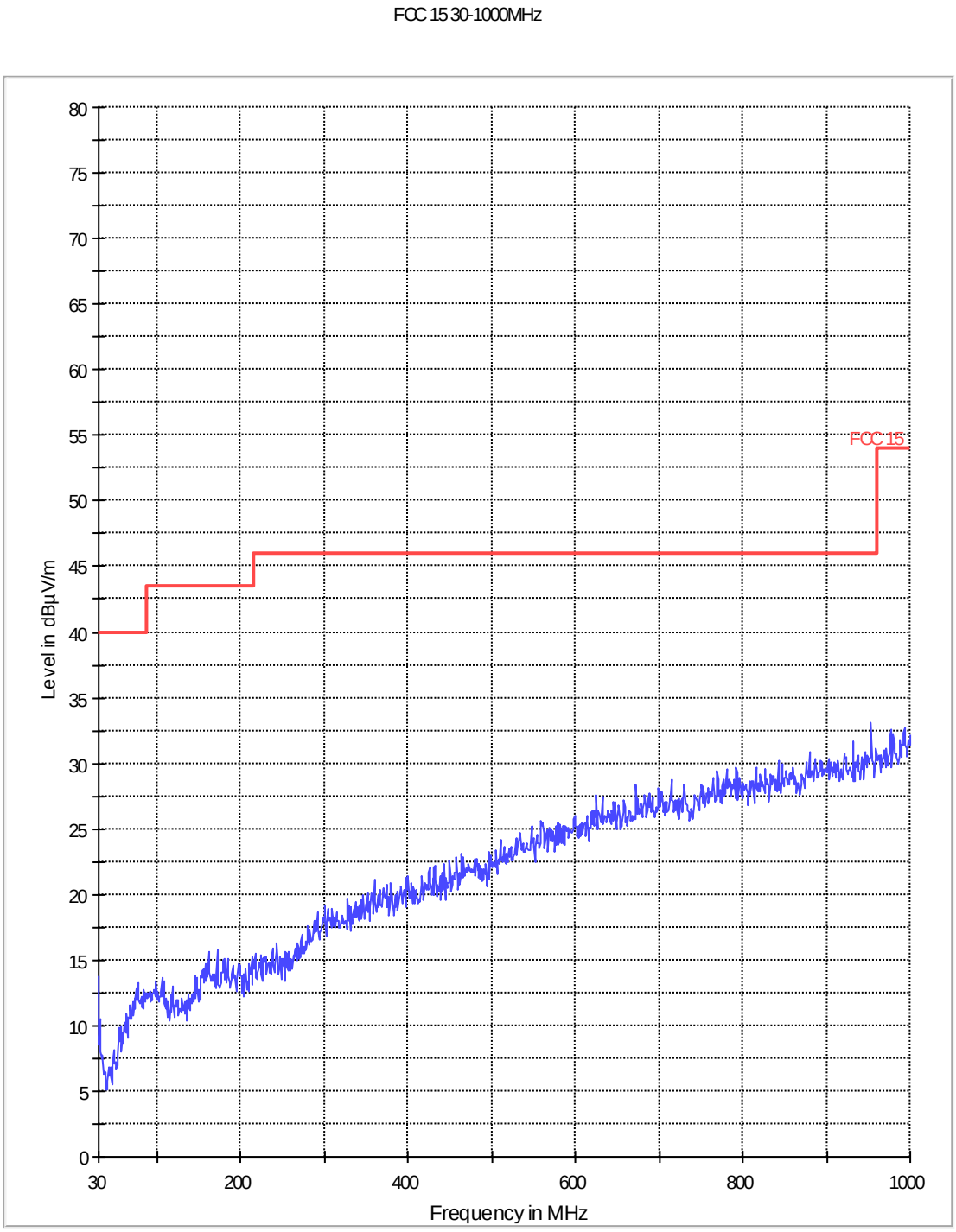
1-18 CH 78


FCC 15 1-18GHz
2.478957916 GHz
94.444 dBµV/m
74 dBuV per m
54 dBuV per m
Level in dBµV/m
Frequency in GHz
74 dBuV per m Limit Line
Preview Result 1
54 dBuV per m Limit Line
Preview Result 2

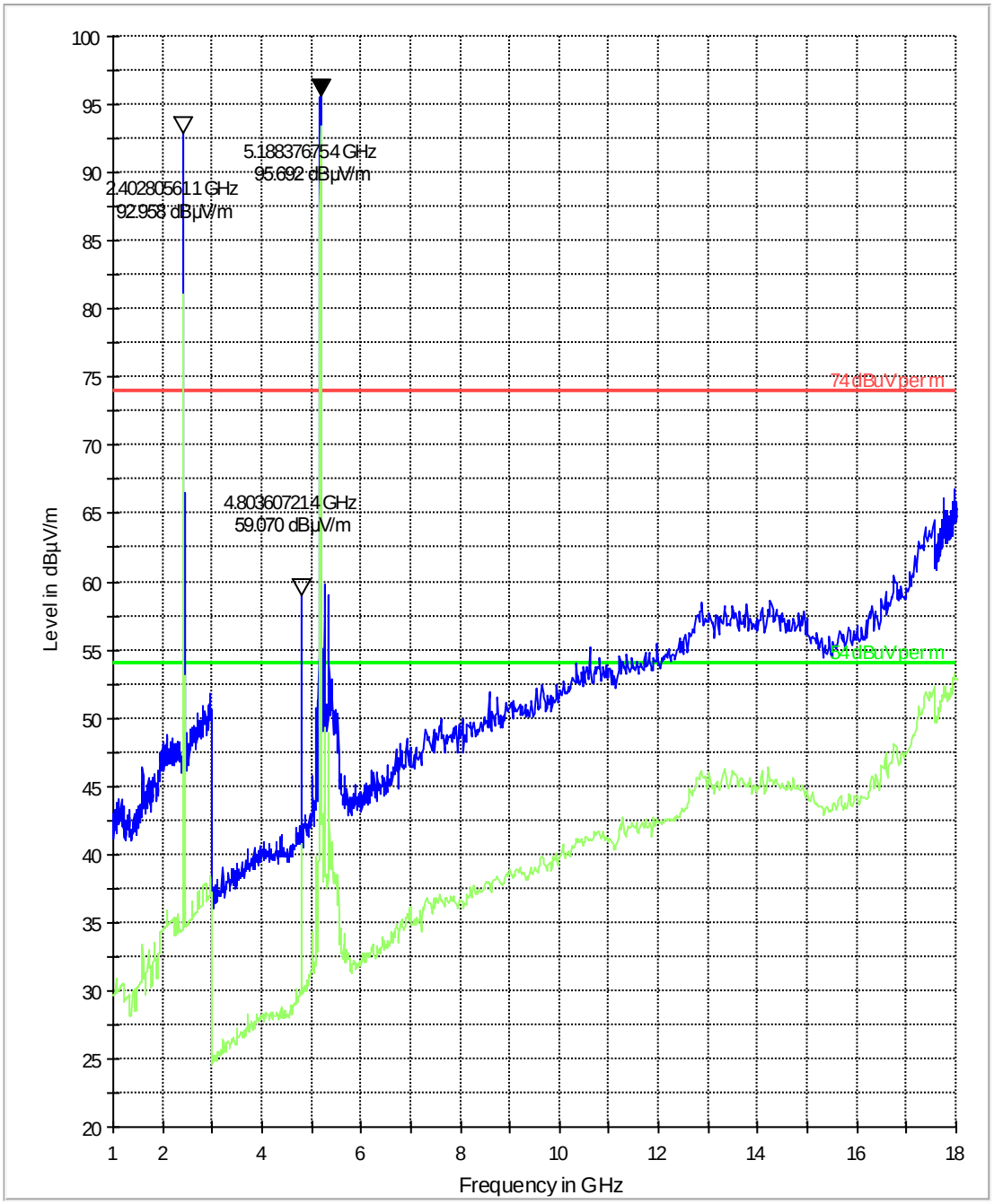
18-25 CH 39


FCC 15 18-26GHz
74dBuV per m
54dBuV per m
Level in dBµV/m
Frequency in GHz
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
18
19
20
21
22
23
24
25
26
74 dBuV per m LimitLine
Preview Result 1
54 dBuV per m LimitLine
Preview Result 2

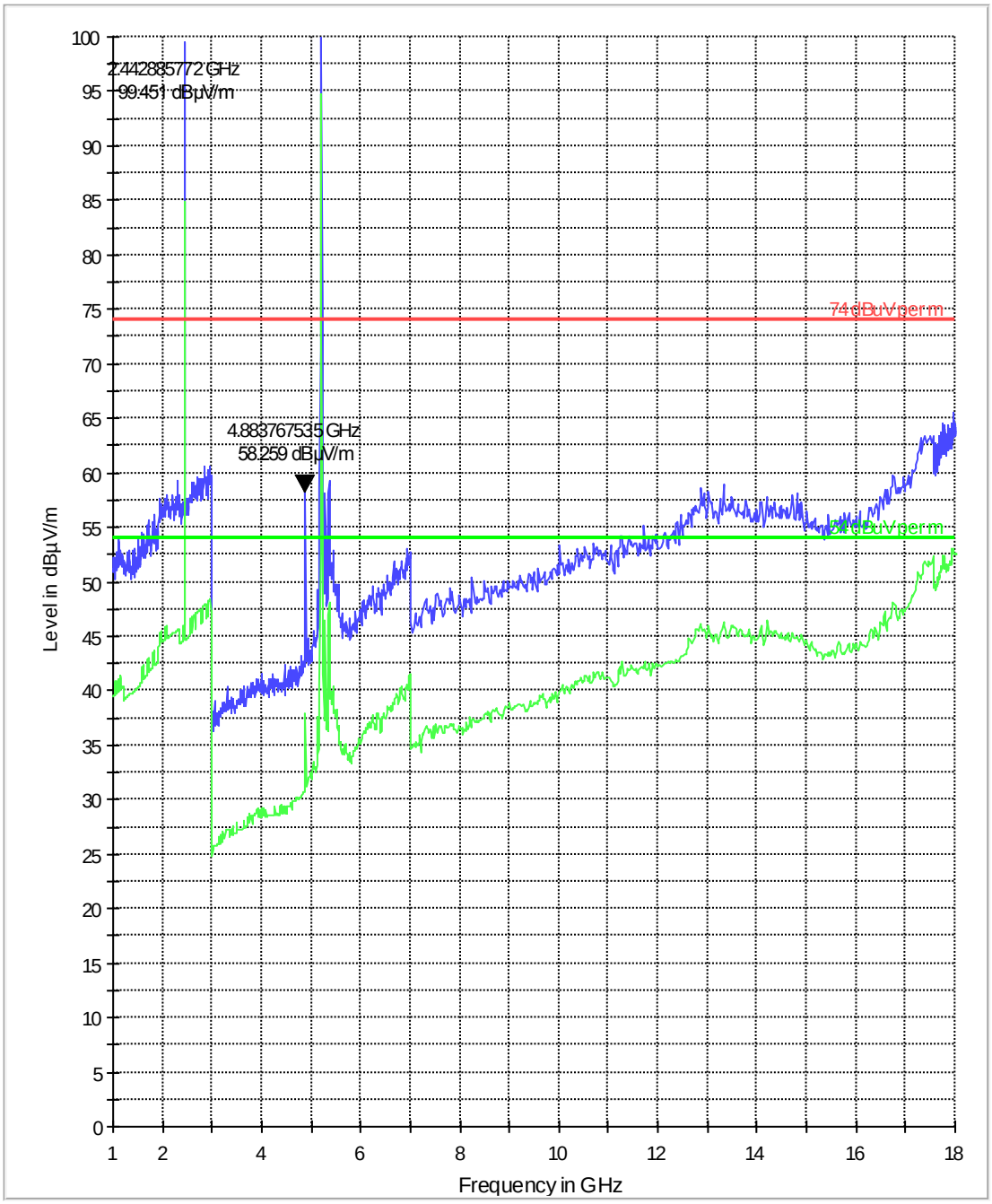
30-1 a ch120 bt ch39



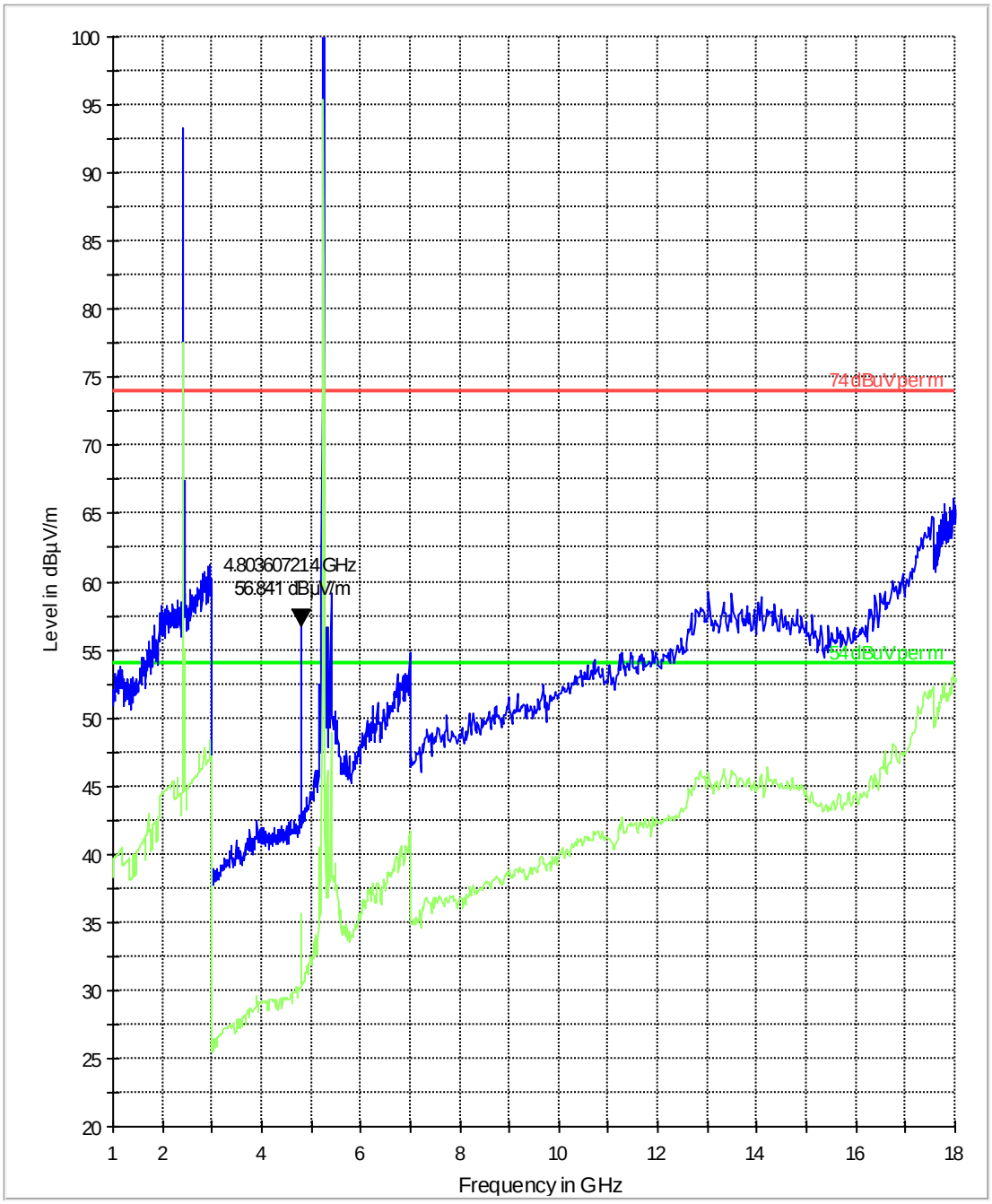
1-18 a ch36 BT ch0



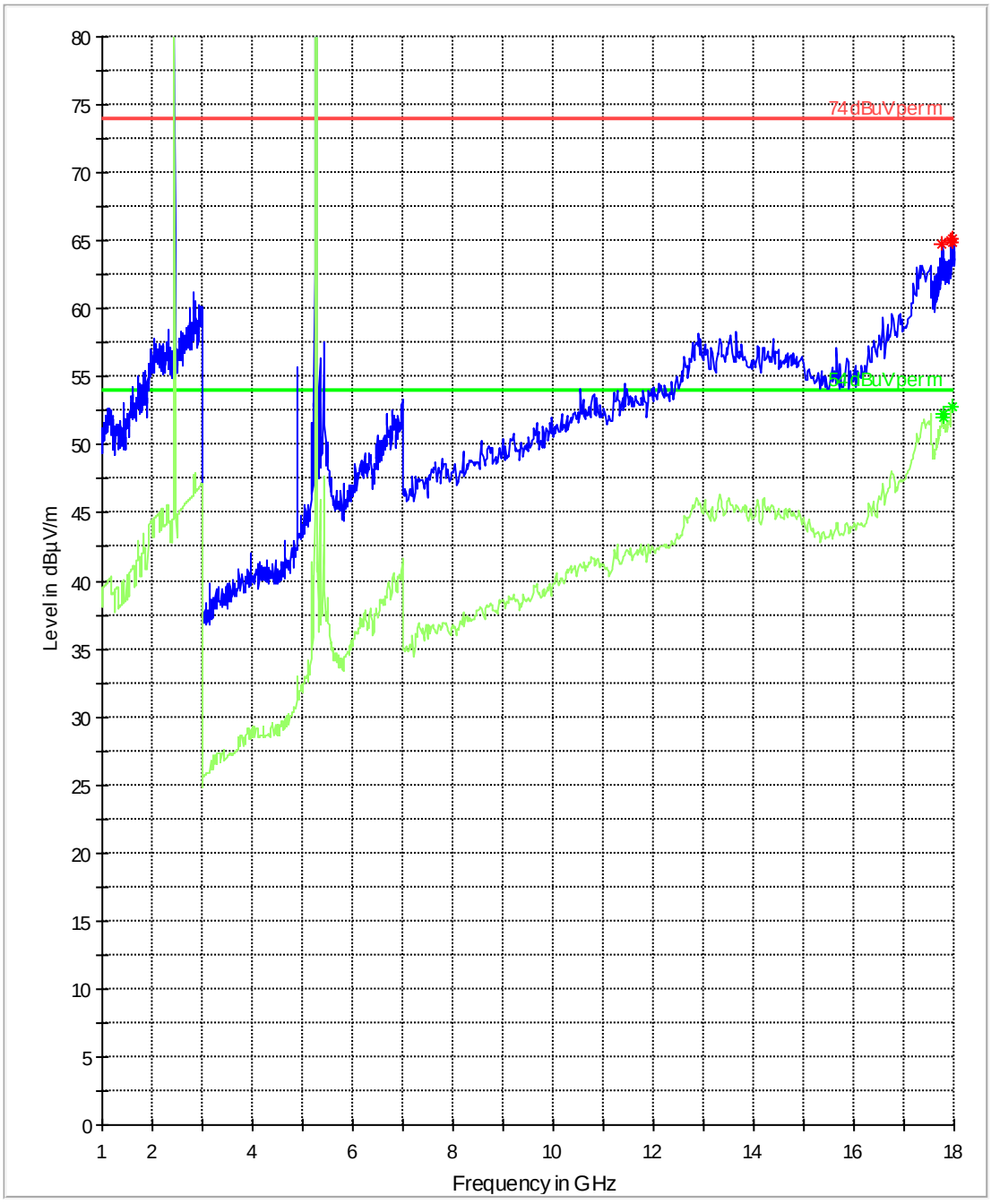
1-18 a ch40 BT ch39



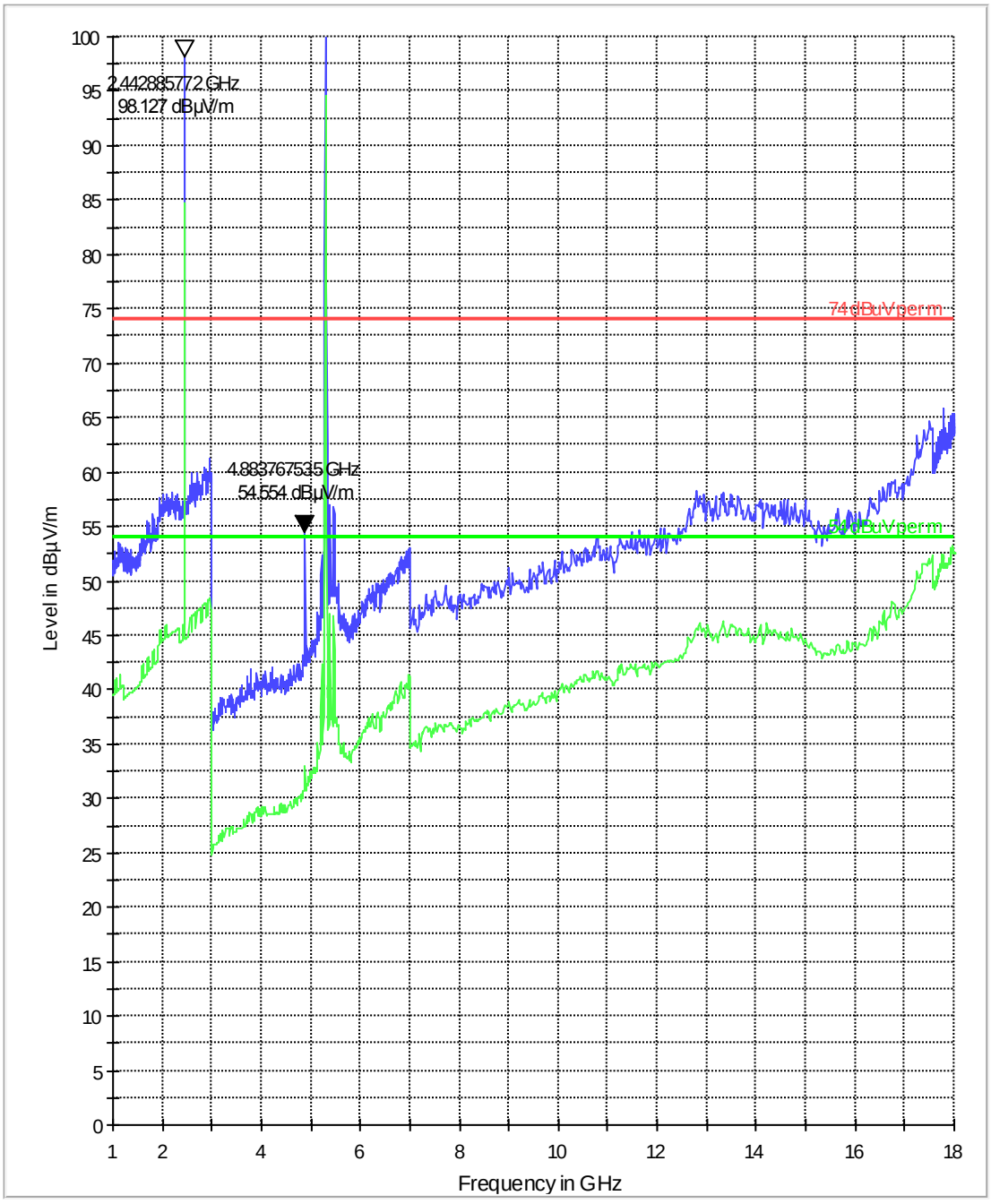
1-18 a ch48 BT ch39



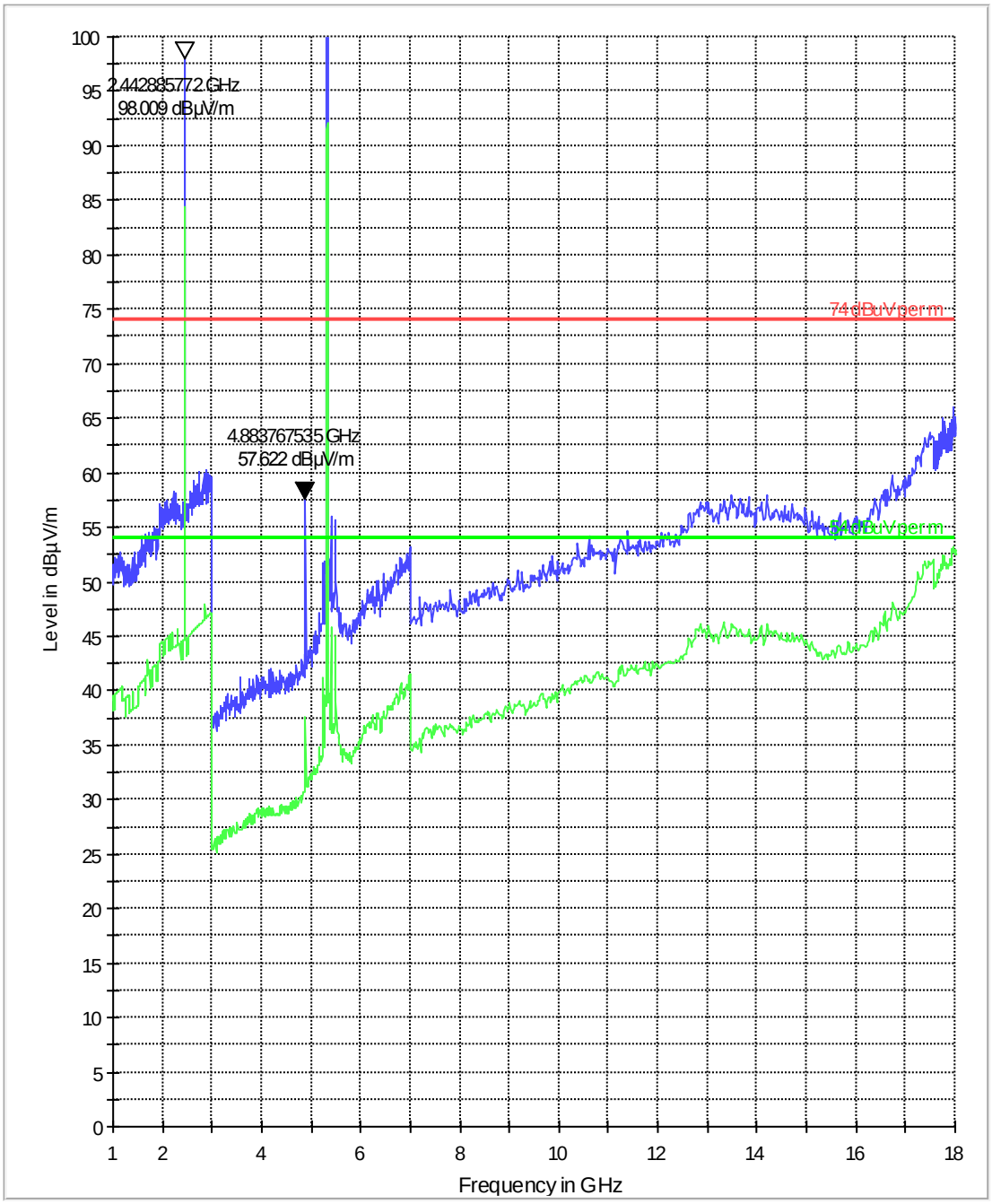
1-18 a ch52 BT ch39



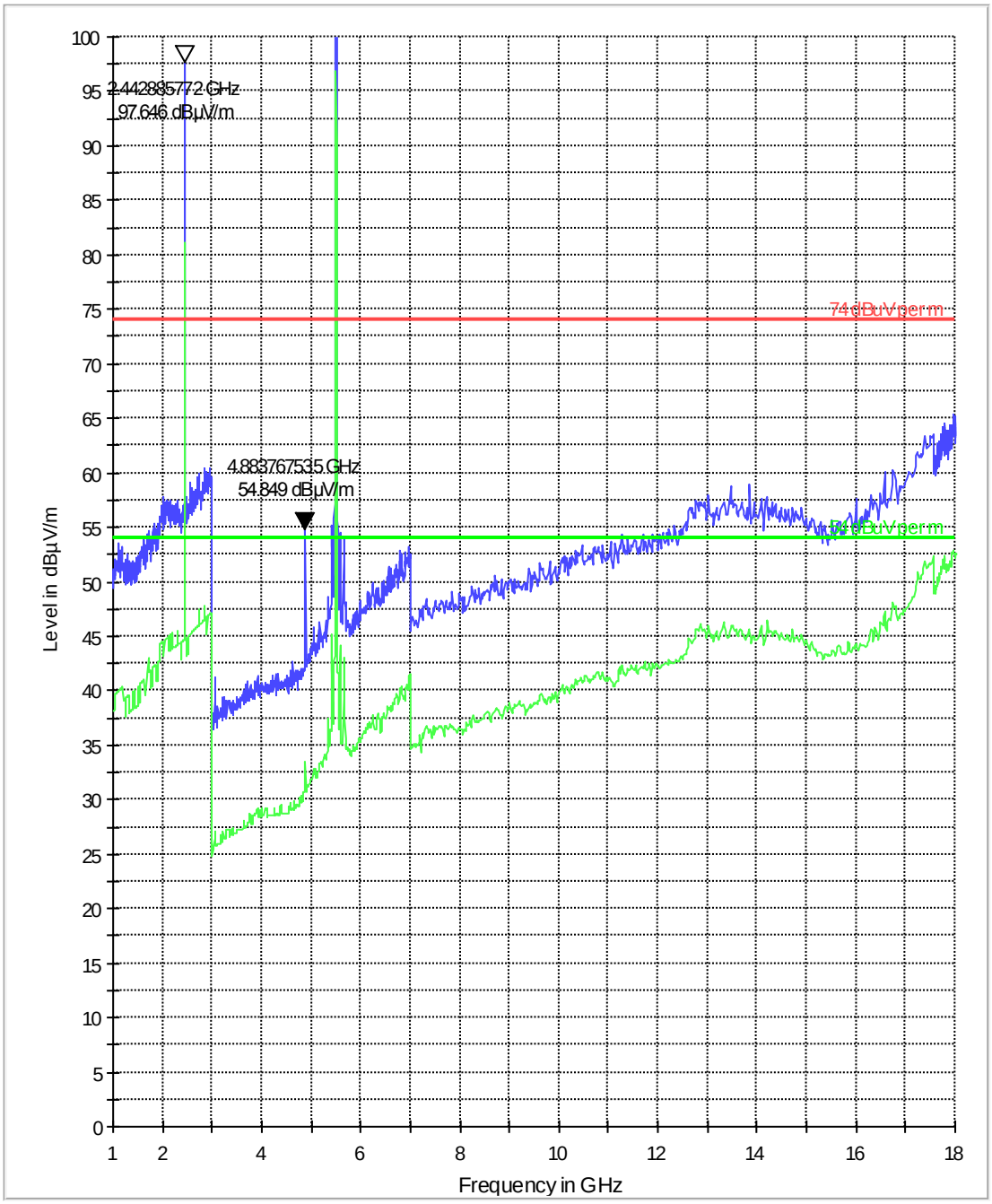
1-18 a ch60 BT ch39



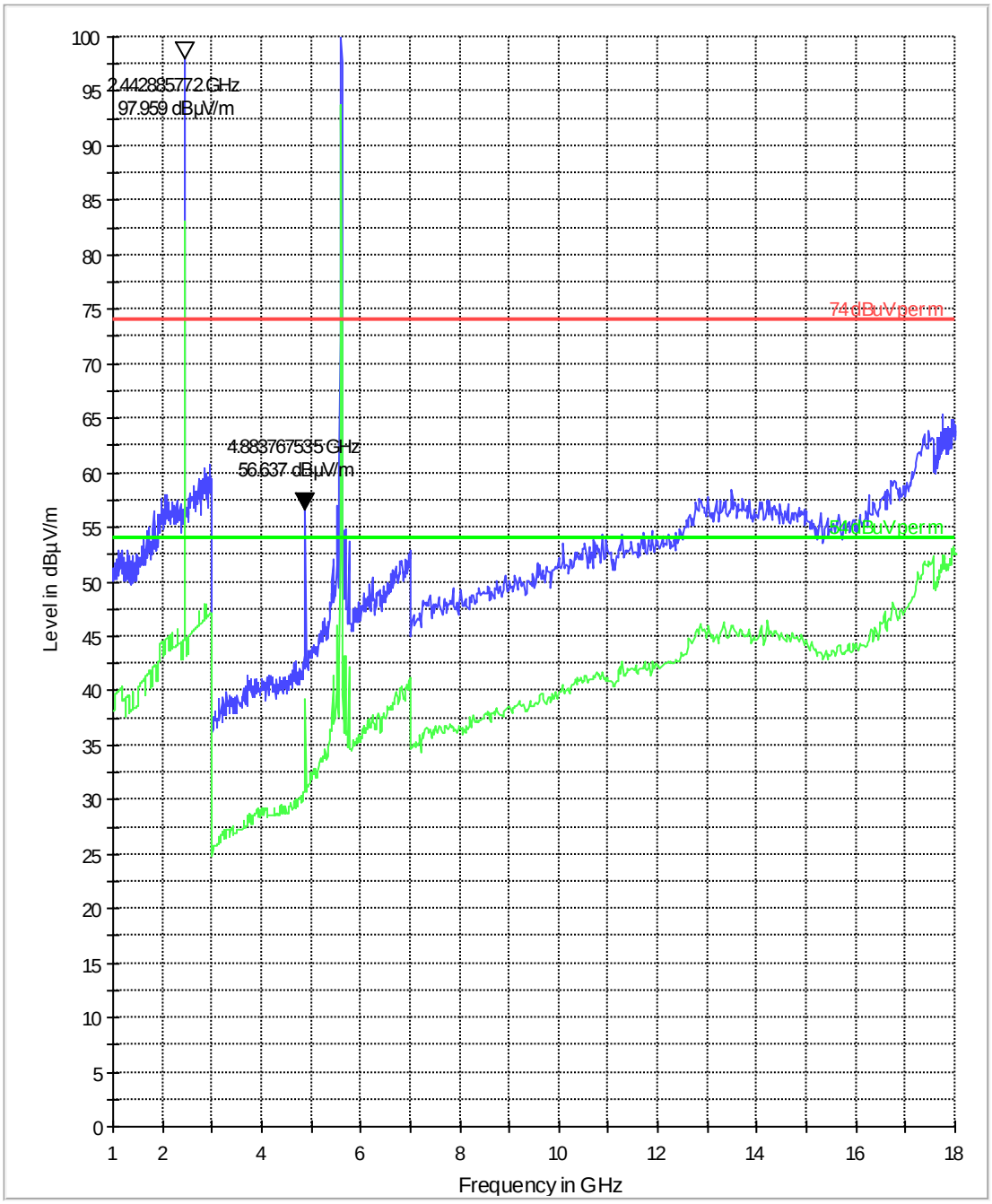
1-18 a ch64 BT ch39



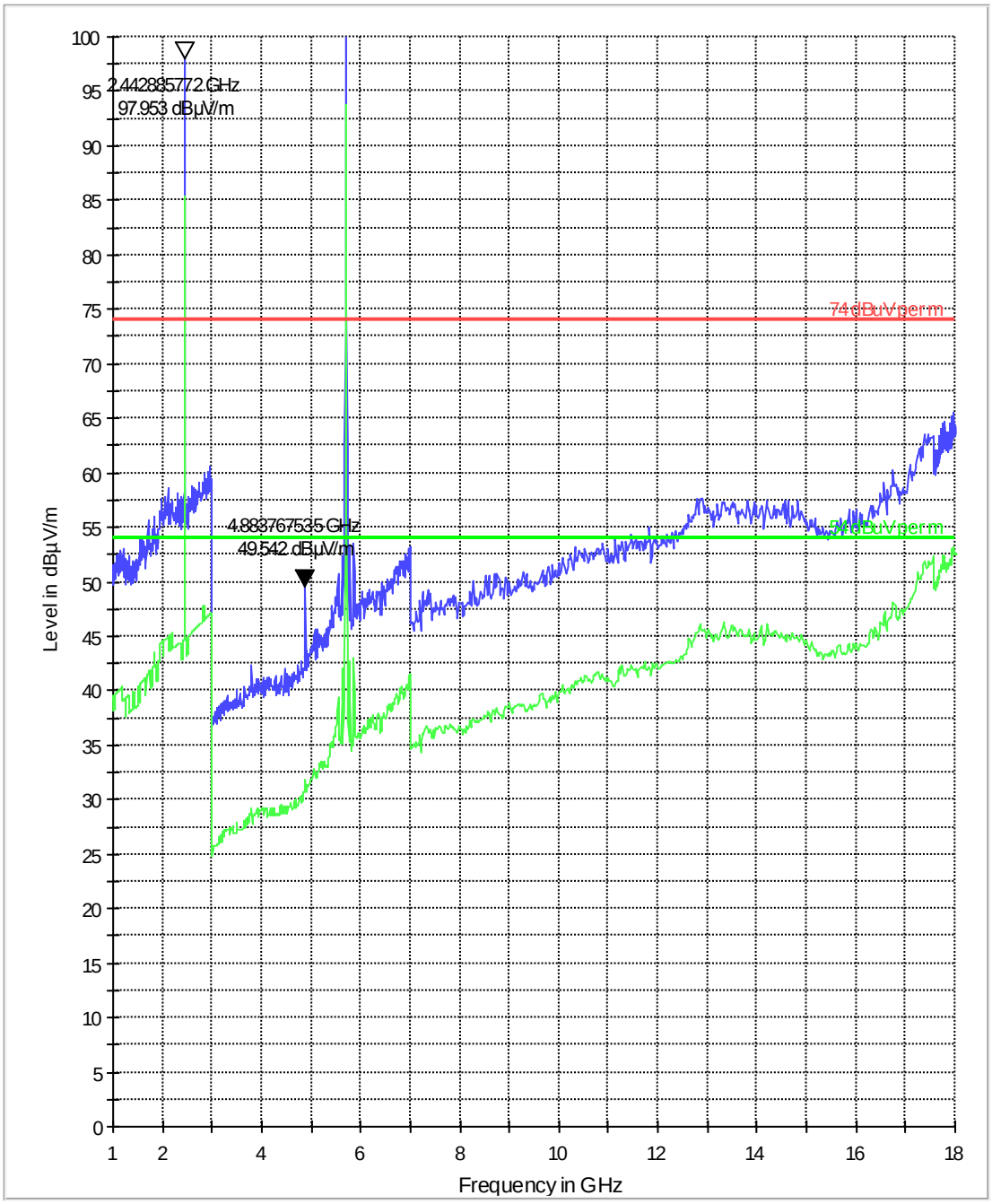
1-18 a ch100 BT ch39



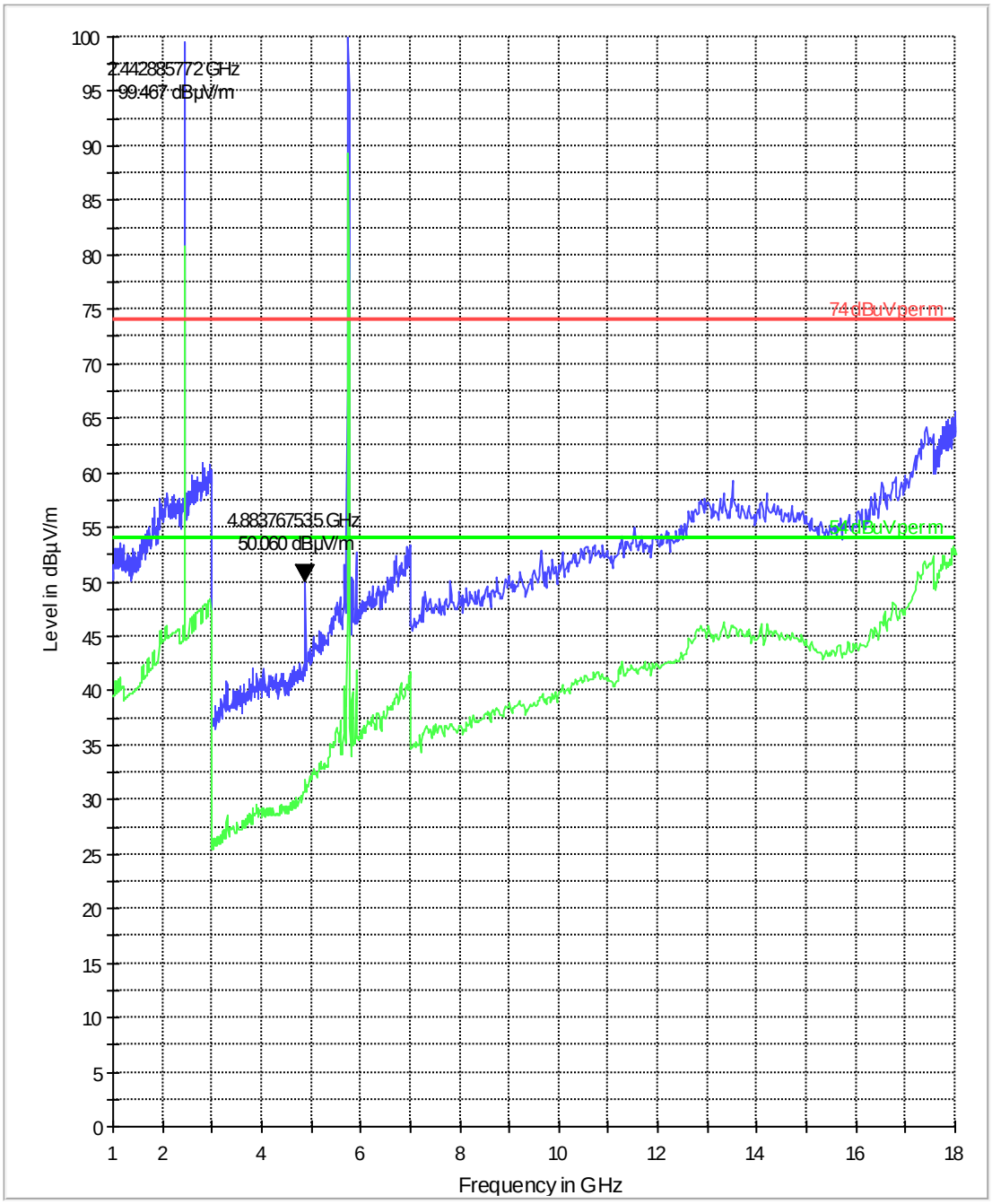
1-18 a ch120 BT ch39



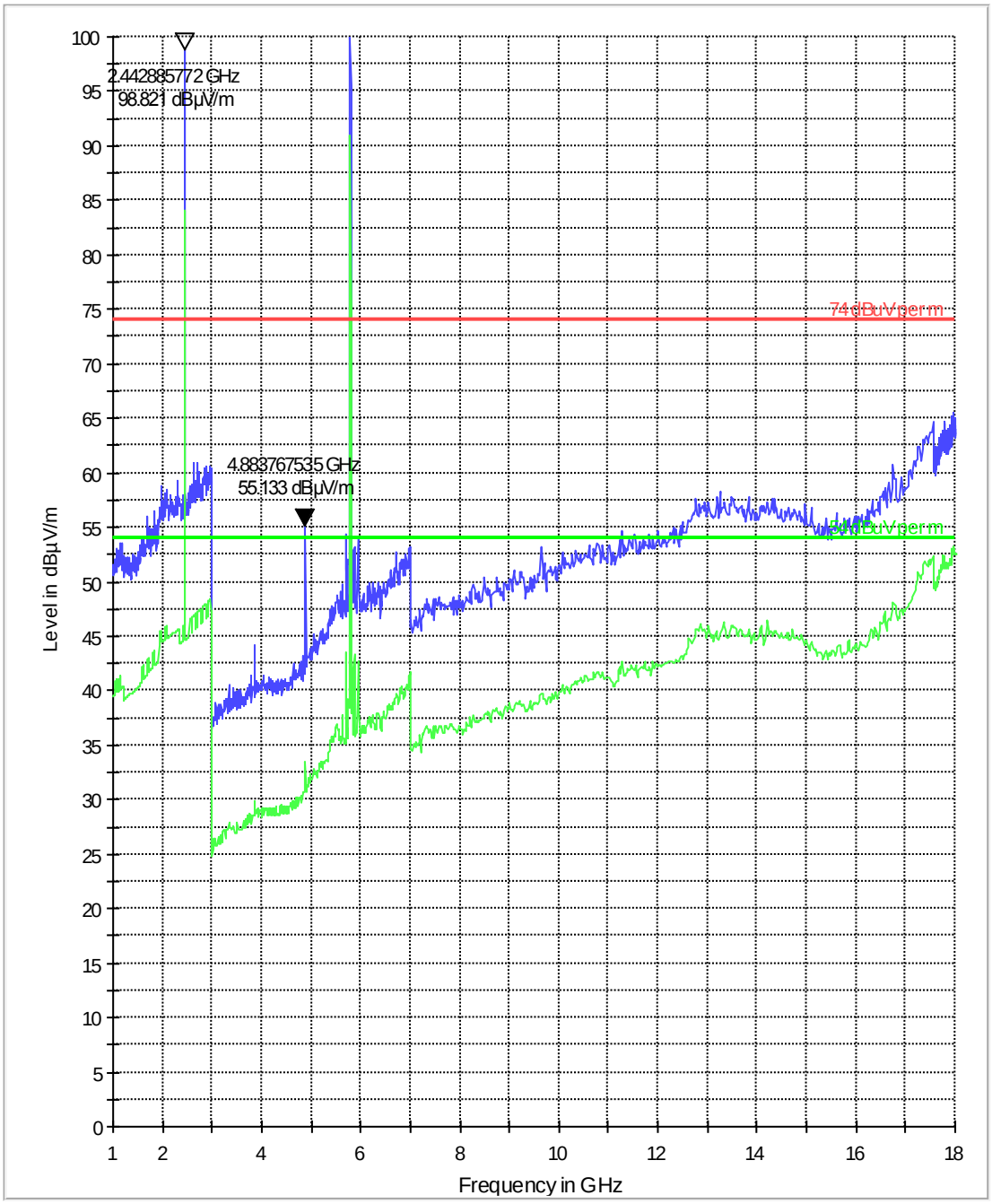
1-18 a ch140 BT ch39



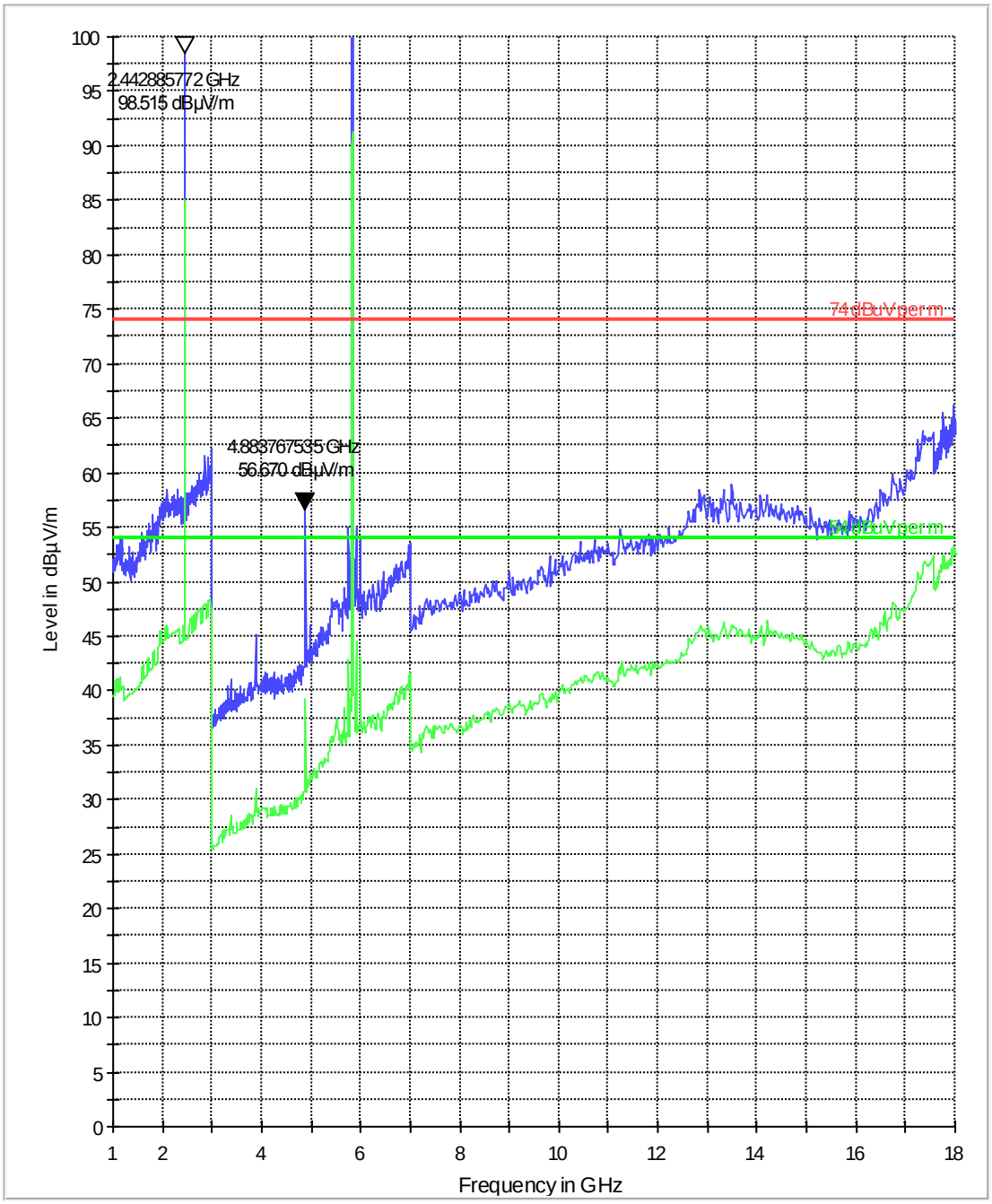
1-18 a ch149 BT ch39



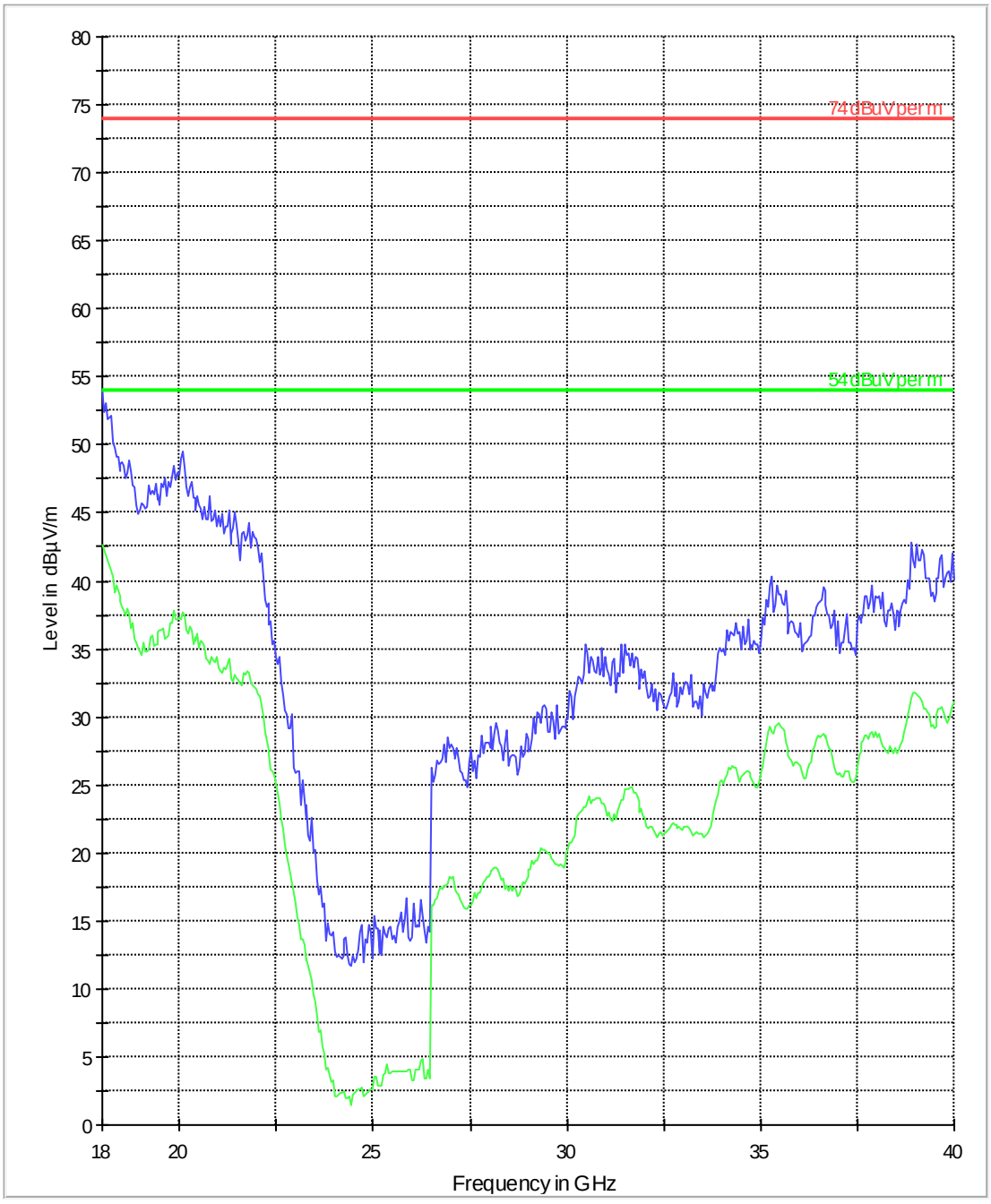
1-18 a ch157 BT ch39



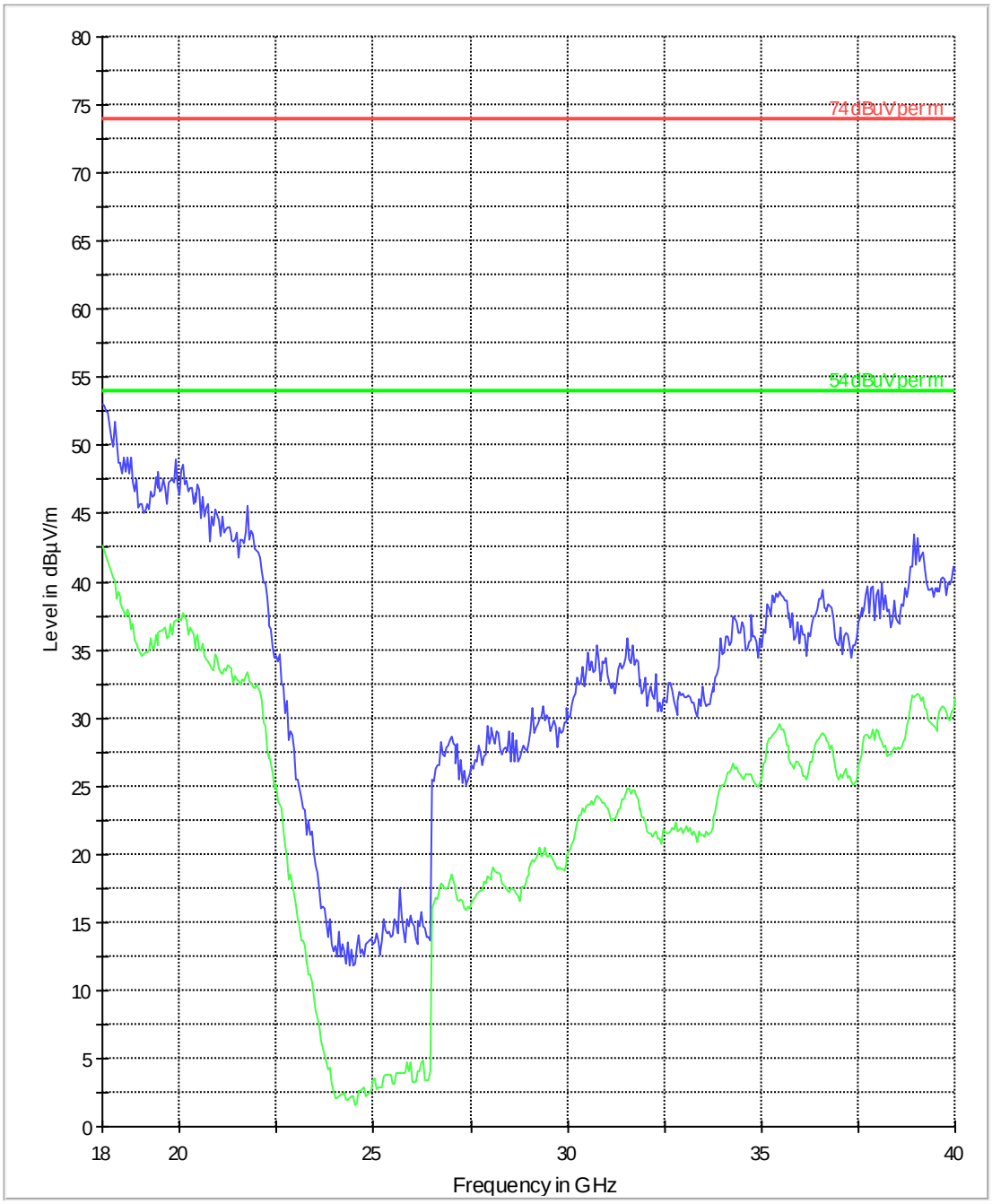
1-18 a ch165 BT ch39



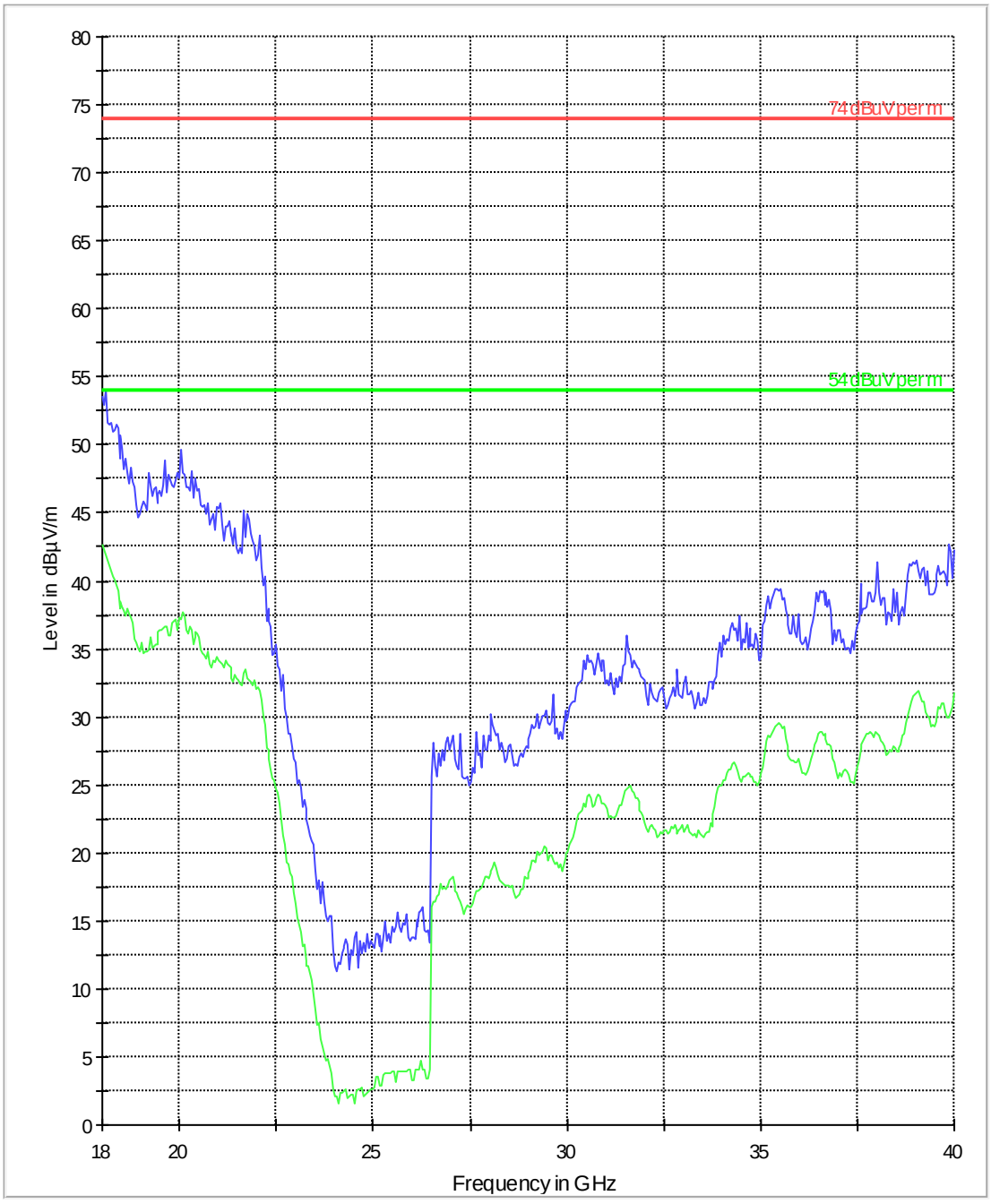
18-40 a ch40 bt ch39



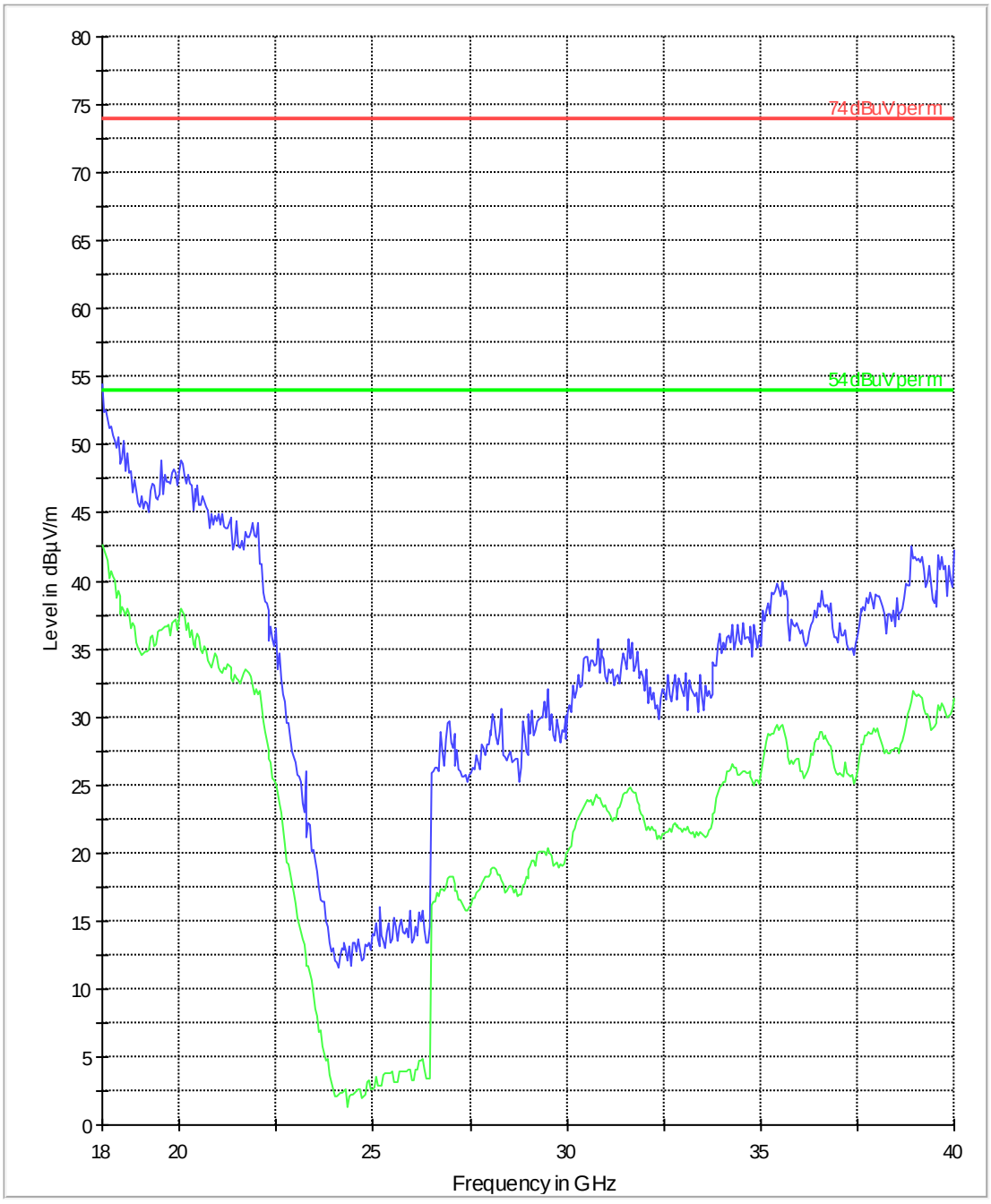
18-40 a ch60 bt ch39



18-40 a ch120 bt ch39



18-40 a ch157 bt ch39



4.12 Receiver Spurious Emissions- Radiated

4.12.1 Limits: §15.109

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

4.12.2 Test Result:

Plots reported here represent the worse case emissions.

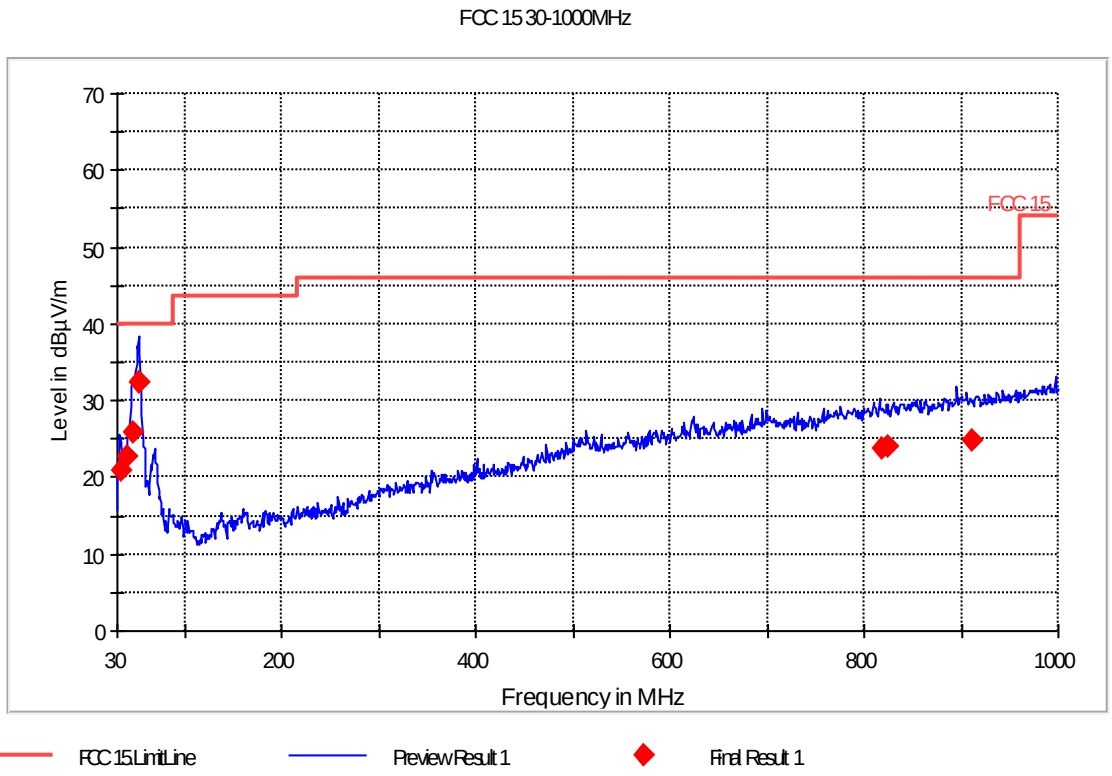
4.12.3 Test data/ plots:

idle 30-1

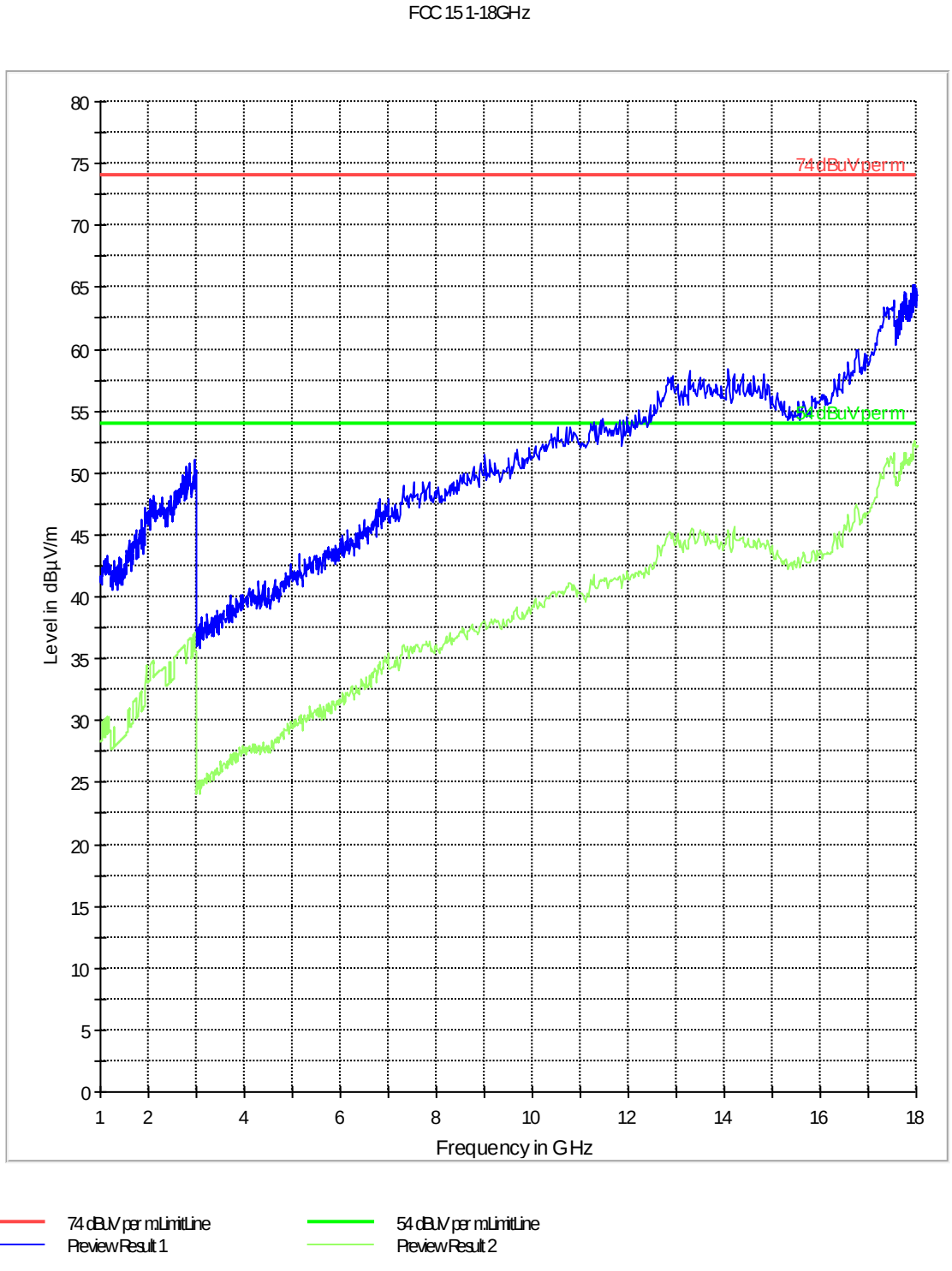
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
33.238367	21.0	20.000	120.000	120.0	V	45.0	6.8	19.0	40.0
41.337368	22.7	20.000	120.000	120.0	V	135.0	5.6	17.3	40.0
46.991909	25.8	20.000	120.000	120.0	V	199.0	6.4	14.2	40.0
51.857307	32.4	20.000	120.000	180.0	V	119.0	6.9	7.6	40.0
53.224499	32.4	20.000	120.000	177.0	V	1.0	7.1	7.6	40.0
818.826841	23.8	20.000	120.000	237.0	H	32.0	25.7	22.2	46.0
823.599690	23.9	20.000	120.000	186.0	H	86.0	25.8	22.1	46.0
911.331354	24.9	20.000	120.000	205.0	H	20.0	26.5	21.1	46.0

(continuation of the "Final Result 1" table from column 10 ...)



idle 1-18


FCC 15 1-18GHz
74 dBuV per m
54 dBuV per m
Level in dBµV/m
Frequency in GHz
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1
2
4
6
8
10
12
14
16
18
74 dBuV per m Limit Line
Preview Result 1
54 dBuV per m Limit Line
Preview Result 2

4.13 AC Power Line Conducted Emissions

4.13.1 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 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.

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.

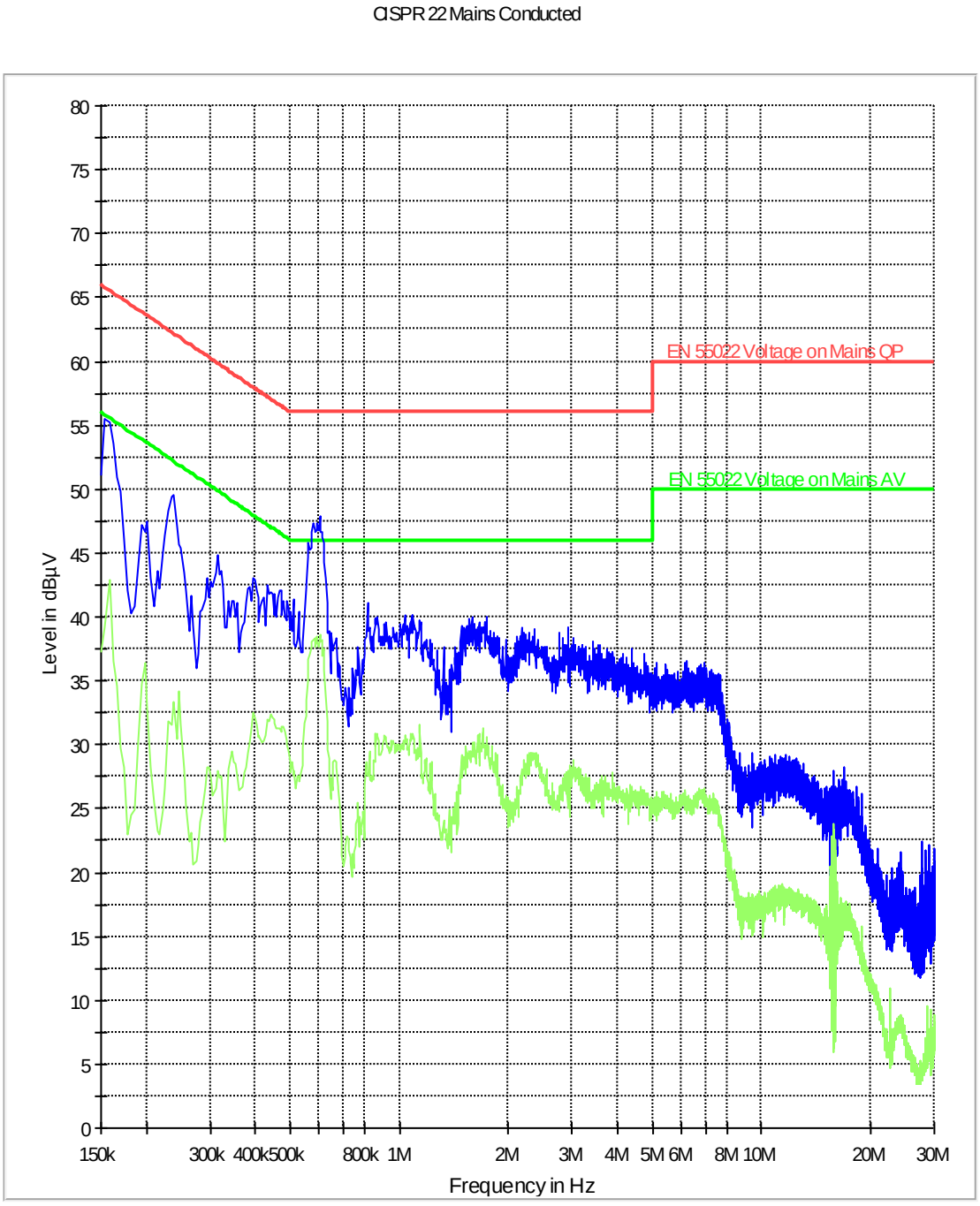
Analyzer Settings: RBW = 10KHz; VBW = 10KHz

4.13.2 Test Result:

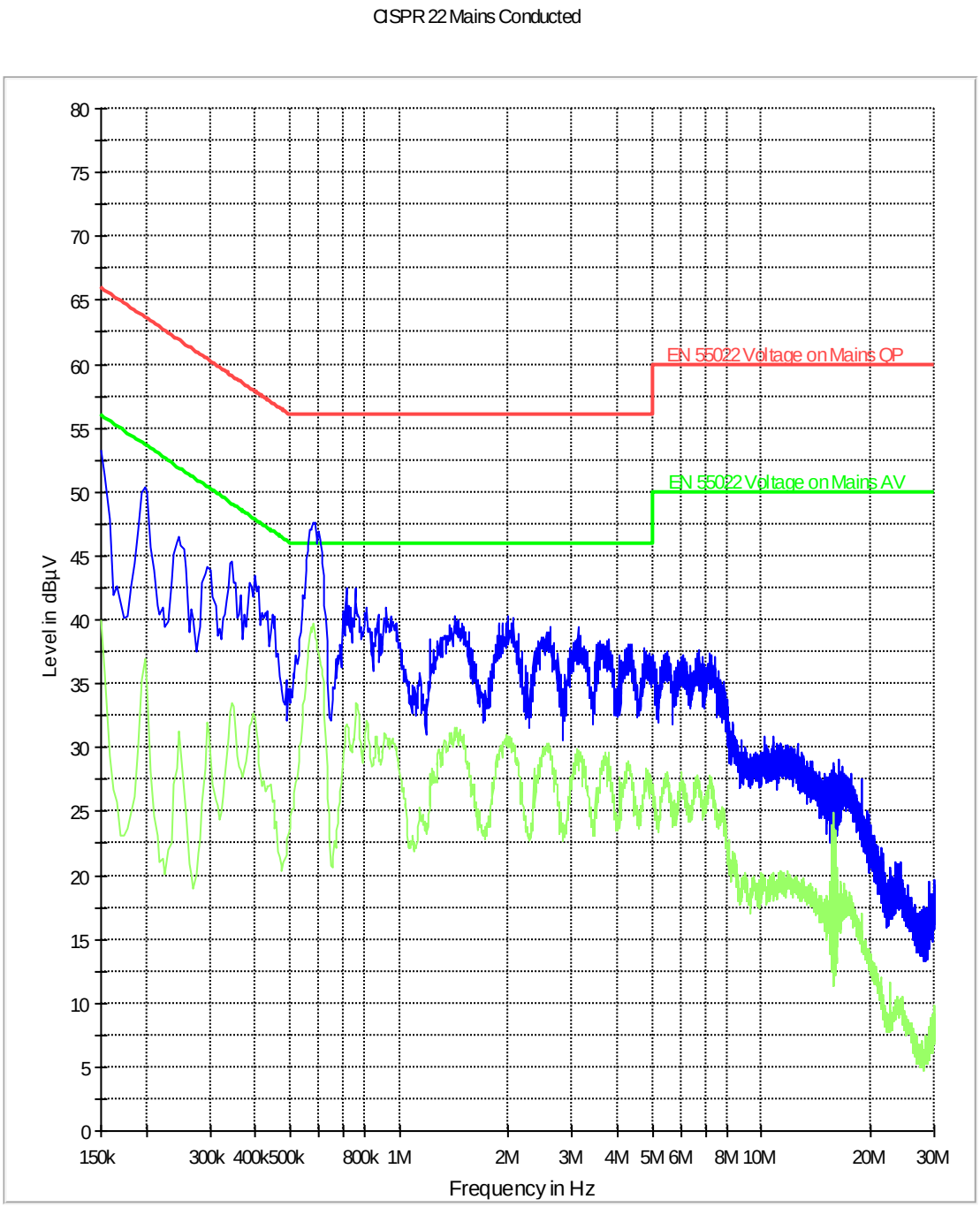
No significant emissions measurable. Plots reported here represent the worse case emissions.

4.13.3 Test data/ plots:

TX Mode- Line & Neutral



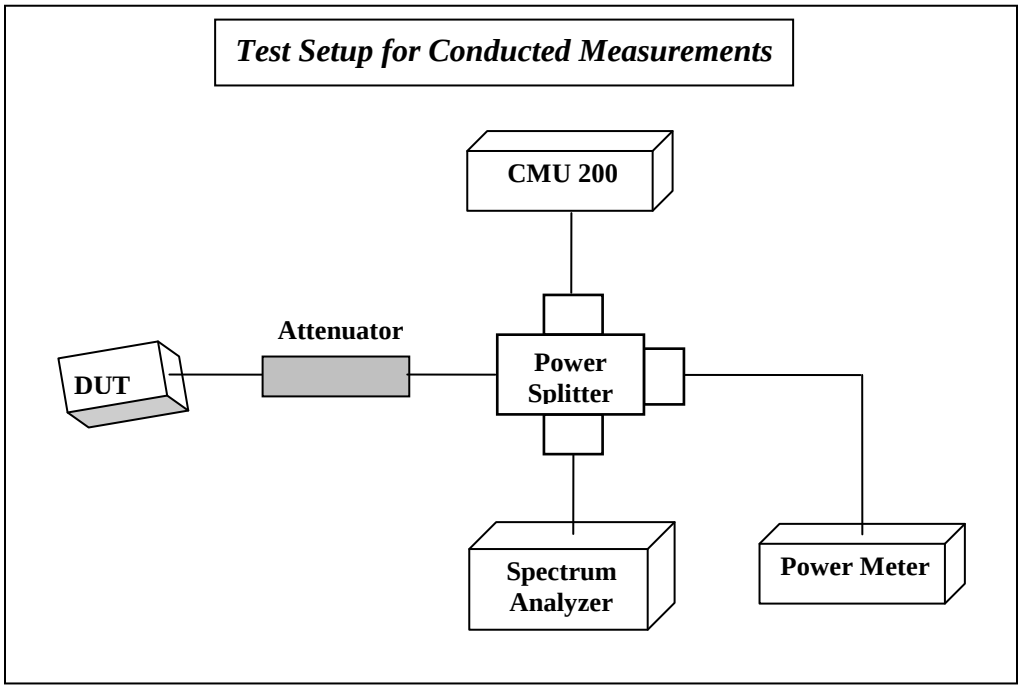
RX Mode- Line & Neutral

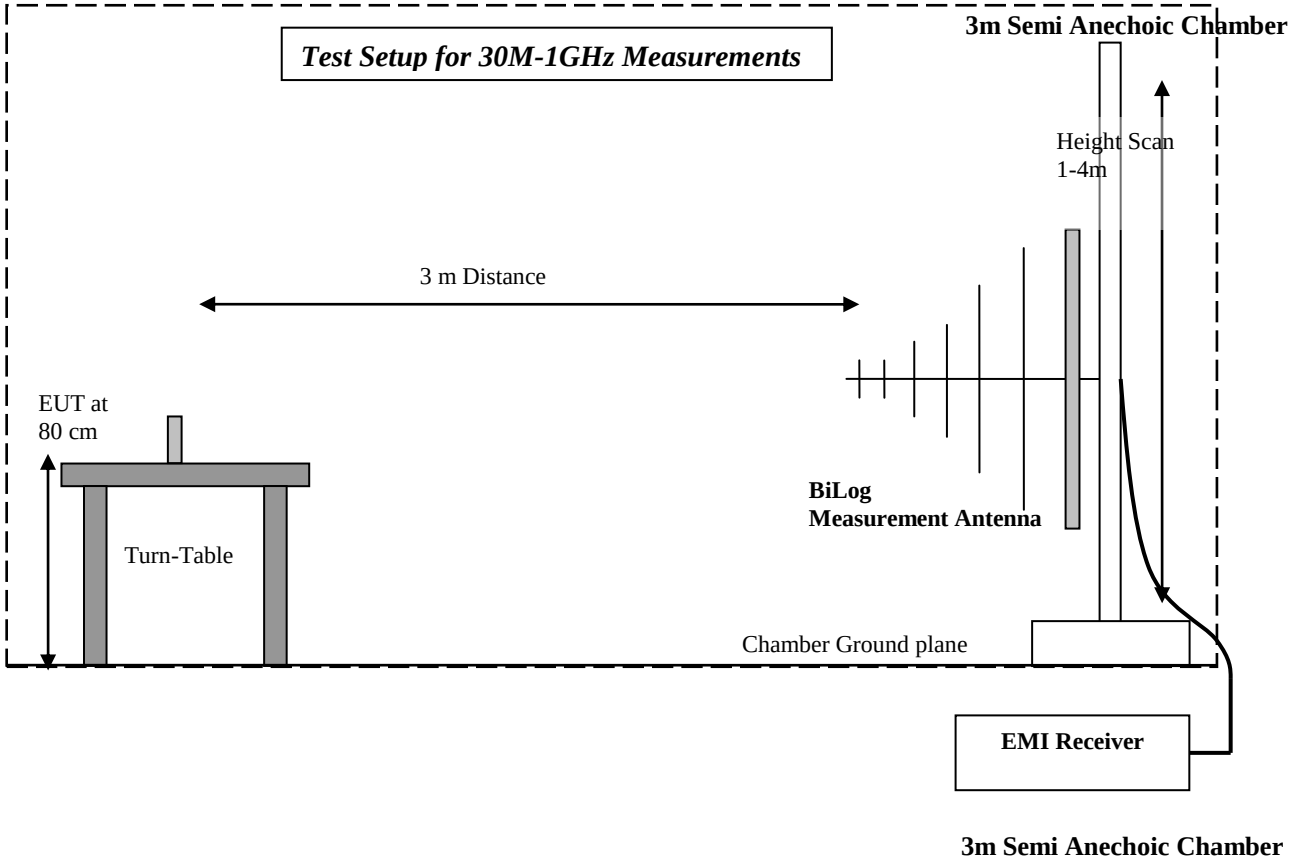


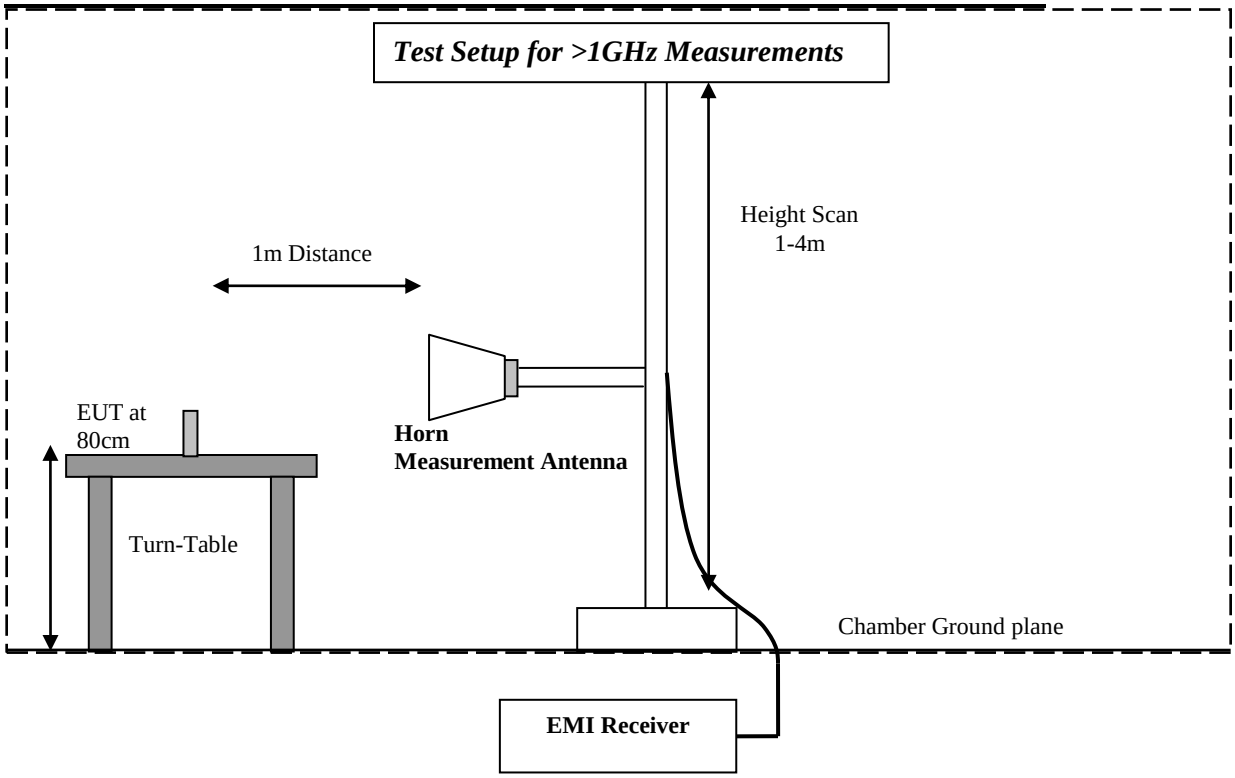
5 Test Equipment and Ancillaries used for tests

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

6 BLOCK DIAGRAMS






Test Setup for >1GHz Measurements
Height Scan
1-4m
1m Distance
EUT at
80cm
Horn
Measurement Antenna
Turn-Table
Chamber Ground plane
EMI Receiver

7 Revision History

Date	Report Name	Changes to report	Report prepared by
2010-02-17	EMC_ APPLE_055_15.247_FHSS_81A	Original	Marc
2010-03-04	EMC_ APPLE_055_15.247_FHSS_81A_Rev1	Corrected plot on page 28, added H/V statement on page 38. Added simultaneous transmission plots.	Marc
2010-03-11	EMC_ APPLE_055_15.247_FHSS_81A_Rev2	Updated radiated measurement procedure	Marc