FCC/IC Test Report

FOR:

Model Number: 98850

Trimble Pro Series Receivers with high-performance GNSS integrated antenna and receiver, user-removable battery, and Bluetooth® wireless technology for connectivity with field computers.

FCC ID: JUP98850

IC ID: 1756A-98850

47 CFR Part 15.247 for FHSS Systems

IC RSS-210 Issue 8

TEST REPORT #: EMC_TRIMB_083_11001_FCC_IC_FHSS
DATE: 2012-03-30

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

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	Trimble Pro Series Receivers with high-performance GNSS integrated antenna and receiver, user-removable battery, and Bluetooth® wireless technology for connectivity with field computers.	98850

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2012-03-30	Compliance	Sajay Jose (Test Lab Manager)	Sajay Jose 2012.03.30 16:09:15 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2012-03-30	Compliance	Tunji Yusuf (EMC Engineer)	Tunji Yusuf Digitally signed by Tunji Yusuf DN: cn=Tunji Yusuf, c=US, o=CETECOM Inc, ou=Compliance, email=tunji.yusuf@cetecomusa.com Date: 2012.03.30 16:11:35 -07'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the 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:	Tunji Yusuf

2.2 Identification of the Client

Applicant's Name:	Trimble Navigation New Zealand
Street Address:	11 Birmingham Drive P.O. Box 8729
City/Zip Code	Christchurch
Country	New Zealand
Contact Person:	Bruce Maule
Phone No.	+64 3.963.5628
Fax:	+1 408.481.6885
e-mail:	Bruce_maule@trimble.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as above
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Model No:	98850
HW / SW Revision :	98850-XX / 98850-0X 00, [Build 1.0.X]
FCC-ID / IC-ID:	JUP98850 / 1756A-98850
Product Description:	Trimble Pro Series Receivers with high-performance GNSS integrated antenna and receiver, user-removable battery, and Bluetooth® wireless technology for connectivity with field computers.
Frequency Range / number of channels:	Bluetooth: 2400-2483.5MHz / 79; GPS: 1575.42MHz, 1227.60MHz
Type(s) of Modulation:	Bluetooth: GFSK, π/4 DQPSK, 8DPSK
Antenna Type / gain / position / min. distance to other antenna (if appl):	Reported Antenna gain at: 2402 MHz: 0.7dBi 2441 MHz: 1.7dBi 2480 MHz: 0.7dBi
Output Powers:	Max calculated EIRP in GFSK mode: 2402 MHz: -3.9dBm 2441 MHz: -3.1dBm 2480 MHz: -4.3dBm
Power supply	Rechargeable Lithium Ion Battery: 11.1VDC, 2.5Ah
Operating temperature range	-20˚C to +60˚C
Prototype / Production unit	Production

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	5149400045	98850-01	98850-0X 00, [Build 1.0.X]	NA

3.3 Identification of the Auxiliary equipment

EUT #	Serial Number	HW Version	Model	Notes/Comments
1	990679-004315	Rev A	88004-03	Battery
2	-	N/A	88014-00	Switch mode power supply

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 8.

This test report is to support a request for new equipment authorization under the FCC ID **JUP98850** and IC ID **1756A-98850**
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 8: Spectrum Management and Telecommunications- Radio Standards Specification. Low-power License-exempt radio communication devices (All frequency bands): Category 1 equipment.

The EUT was tested on individual channels with PRBS payload DH5 (GFSK Modulation), 2DH5 (π/4 DQPSK Modulation) or 3DH5 (8-DPSK Modulation) packets. A test SW provided by the manufacturer is used to set the device to transmit in individual channels during test. Low, Mid and High channels were tested separately and measurement results included in this report.
For Radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all 3 orthogonal 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	■	☐	☐	☐	Complies
§15.247(e) RSS210 A8.2(b)	Power Spectral Density	Nominal	-	☐	☐	■	☐	-
§15.247(a)(1) RSS210 A8.1(b)	Carrier Frequency Separation	Nominal	Hopping	■	☐	☐	☐	Complies
§15.247(a)(1) RSS210 A8.1(d)	Number of Hopping Channels	Nominal	Hopping	■	☐	☐	☐	Complies
§15.247(a)(1)(iii) RSS210 A8.3(1)	Time of occupancy	Nominal	Hopping	■	☐	☐	☐	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	-	☐	☐	☐	■	-
§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	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	TX Spurious emissions-Radiated	Nominal	GFSK	■	☐	☐	☐	Complies
§15.209(a) RSS Gen	TX Spurious Emissions Radiated<30MHz	Nominal	GFSK	■	☐	☐	☐	Complies
§15.207(a)	Conducted Emissions <30MHz	Nominal	GFSK	■	☐	☐	☐	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 (2003) 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 (2003) 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 Sample Calculations for Radiated Measurements

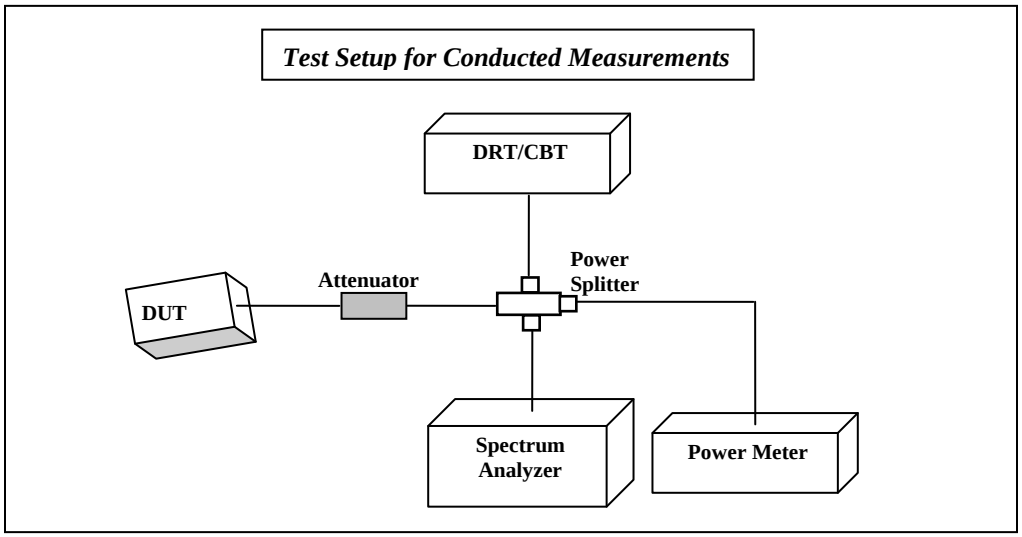
6.2.1 Field Strength Measurements:

Field Strength measurements are directly taken from the Spectrum Analyzer/ Receiver, taking into account the cable loss between the Receiving Antenna and the Spectrum Analyzer/ Receiver. Antenna Factor is accounted for by the test SW.

FS (dBµV/m)= Measured Value on SA (dBµV)+ Cable Loss (dB)
Eg:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Field Strength Result (dBµV/m)
1000	95.5	3.5	99.0

6.3 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.

6.4 Maximum Peak Output Power

6.4.1 Limits:

6.4.1.1 §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.

6.4.1.2 RSS 210- A8.4(2)

Nominal Peak Output Power < 30 dBm (1W)

6.4.2 Test Conditions:

Tnom: 25°C; Vnom: 11.1V
Hopping OFF
Spectrum Analyzer settings:
RBW=VBW=3MHz, Detector: Peak- Max Hold.
Sweep Time: Auto
Span=3MHz
Antenna Gain (dBi):
2402 MHz: 0.7dBi
2441 MHz: 1.7dBi
2481 MHz: 0.7dBi

6.4.3 Test Result:

Max Peak Output Power- Conducted (dBm) (Measured)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	-4.6	-4.8	-5.0
π/4 DQPSK	-6.5	-6.6	-6.8
8-DPSK	-6.5	-6.6	-6.8
Measurement Uncertainty: ±0.5dB			

Max Peak Output Power- Radiated (dBm) (Calculated)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	-3.9	-3.1	-4.3
π/4 DQPSK	-5.8	-4.9	-6.1
8-DPSK	-5.8	-4.9	-6.1
Measurement Uncertainty: ±3.0dB			

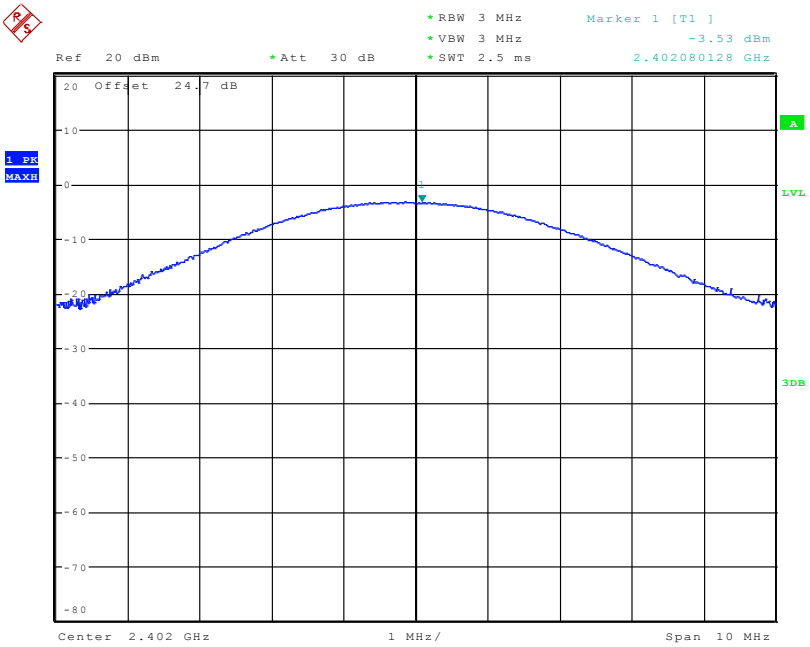
Note: Radiated EIRP is calculated as
Conducted Measurement + Antenna Gain

6.4.3.1 Measurement Result

Pass.

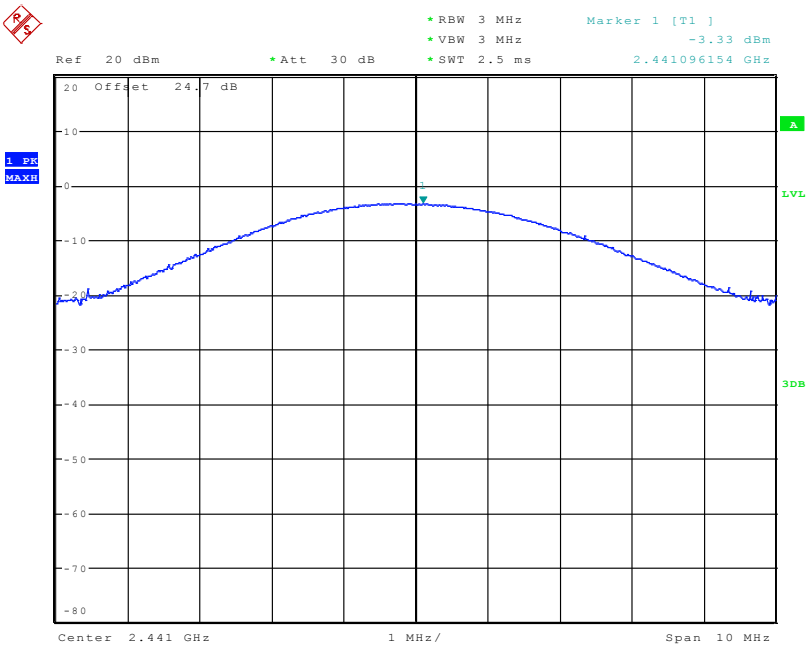
6.4.4 Test Data/plots:

Conducted Peak Power GFSK 2402 MHz



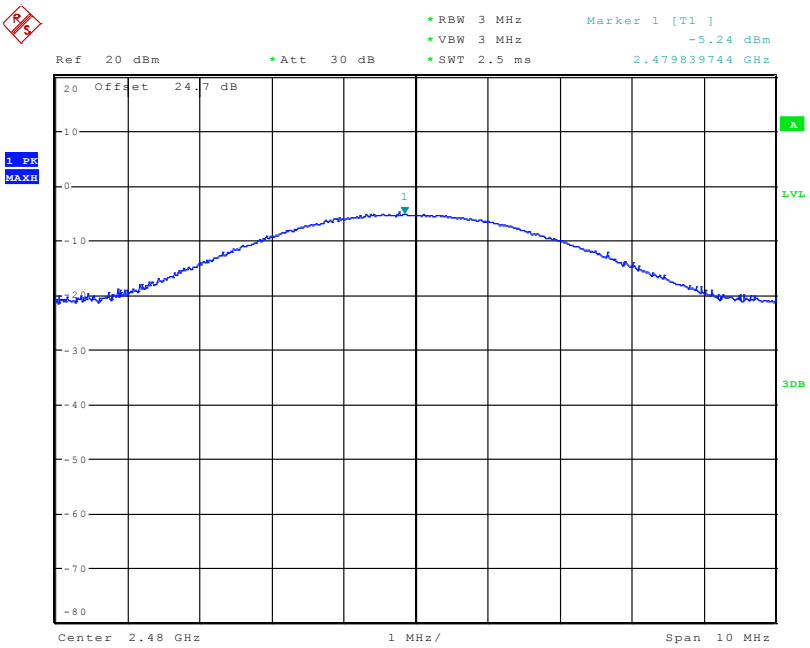
Date: 22.FEB.2012 13:05:17

Conducted Peak Power GFSK 2441 MHz



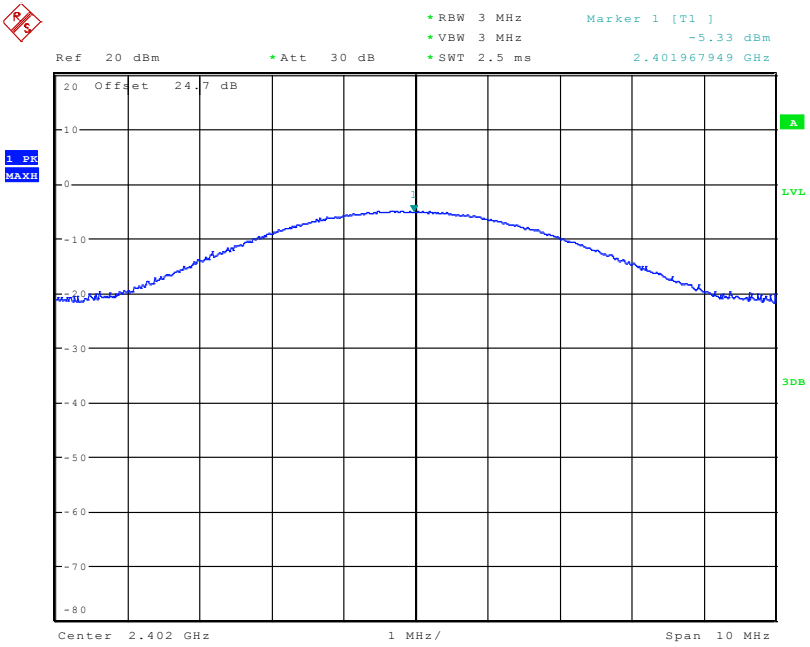
Date: 22.FEB.2012 13:12:51

Conducted Peak Power GFSK 2480 MHz



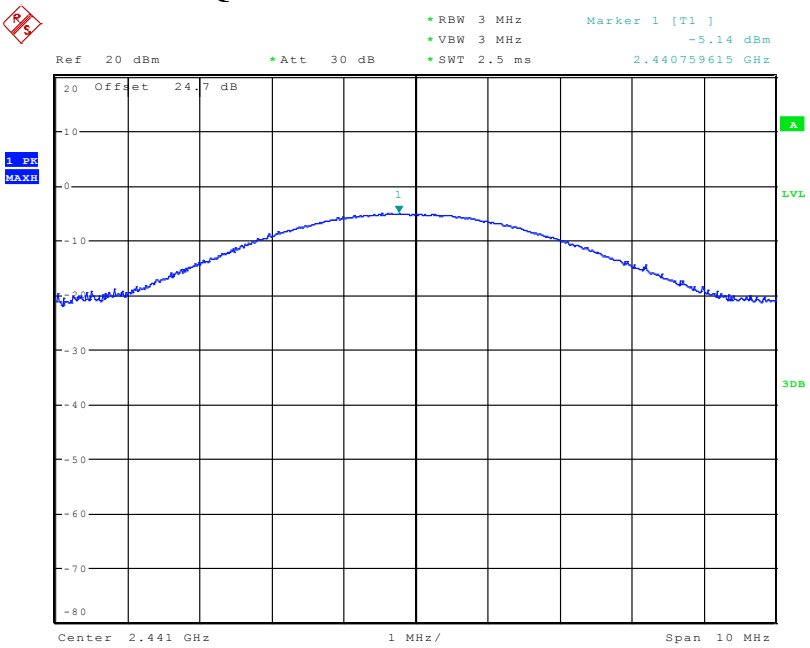
Date: 22.FEB.2012 13:18:24

Conducted Peak Power π / 4 DQPSK 2402 MHz



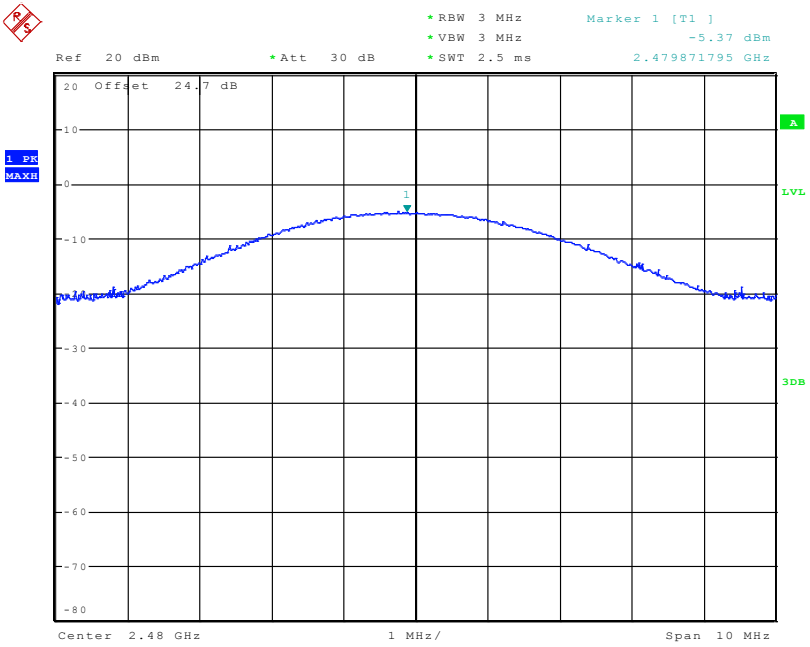
Date: 22.FEB.2012 13:23:54

Conducted Peak Power π / 4 DQPSK 2441 MHz



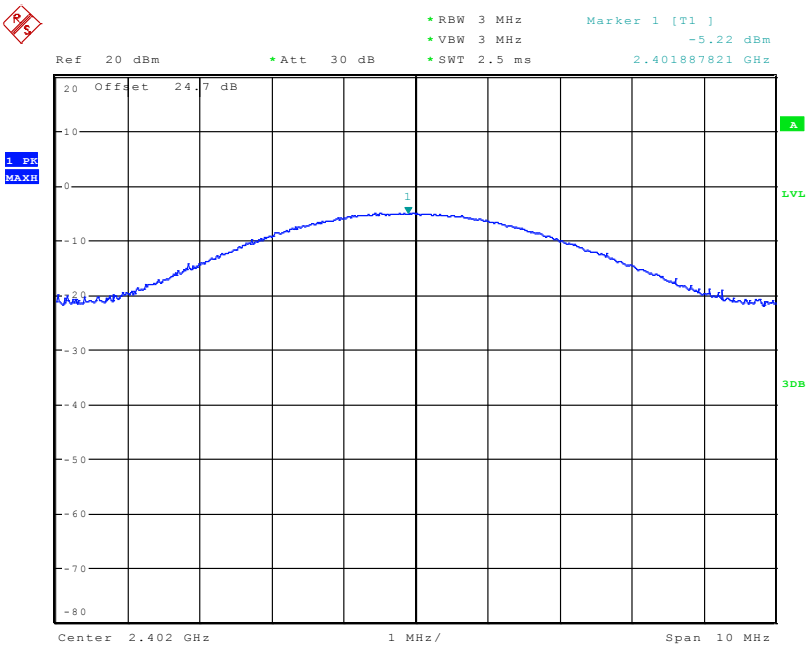
Date: 22.FEB.2012 13:21:54

Conducted Peak Power π / 4 DQPSK 2480 MHz



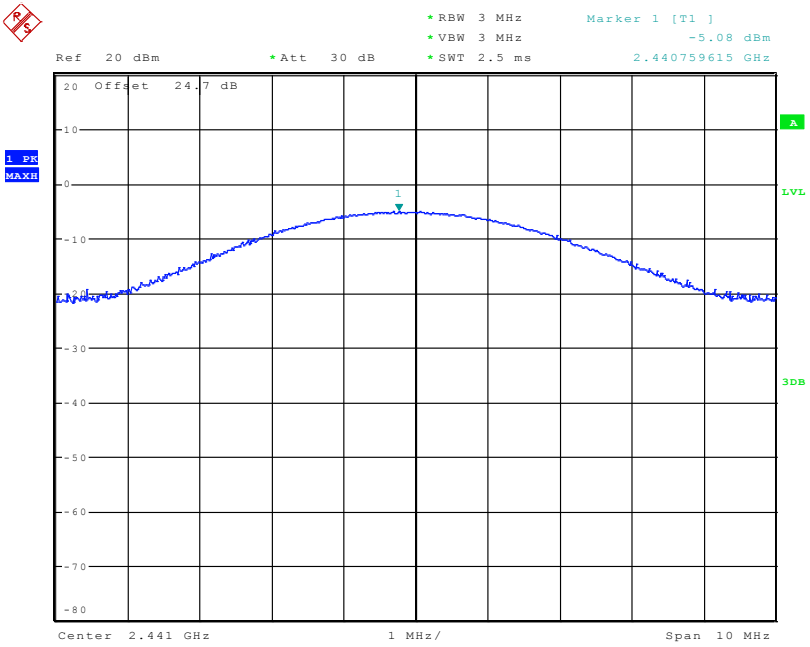
Date: 22.FEB.2012 13:19:41

Conducted Peak Power 8DPSK 2402 MHz



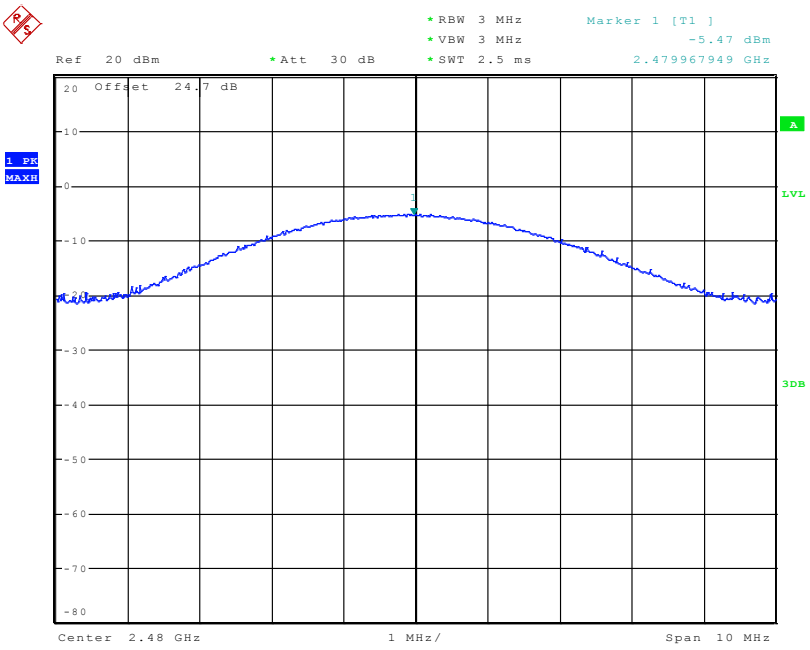
Date: 22.FEB.2012 13:25:17

Conducted Peak Power 8DPSK 2441 MHz



Date: 22.FEB.2012 13:27:15

Conducted Peak Power 8DPSK 2480 MHz



Date: 22.FEB.2012 13:28:49

6.5 Restricted Band Edge Compliance

6.5.1 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			

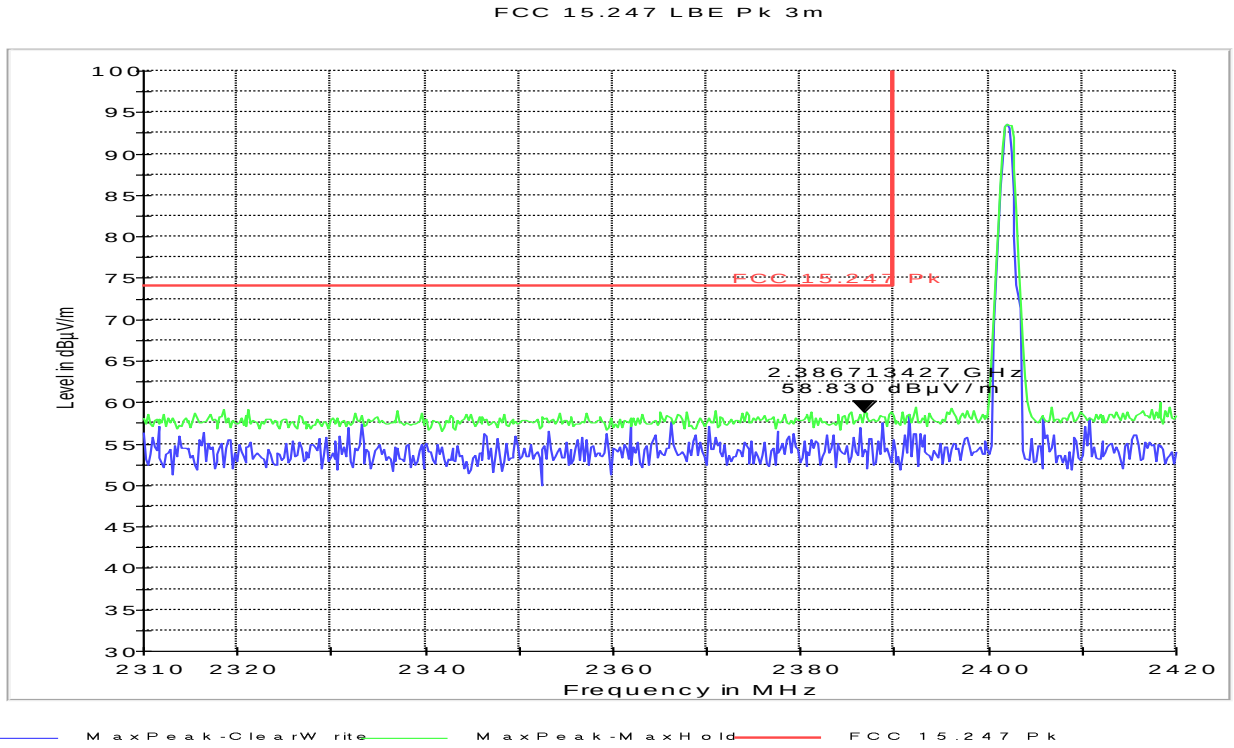
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

6.5.2 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

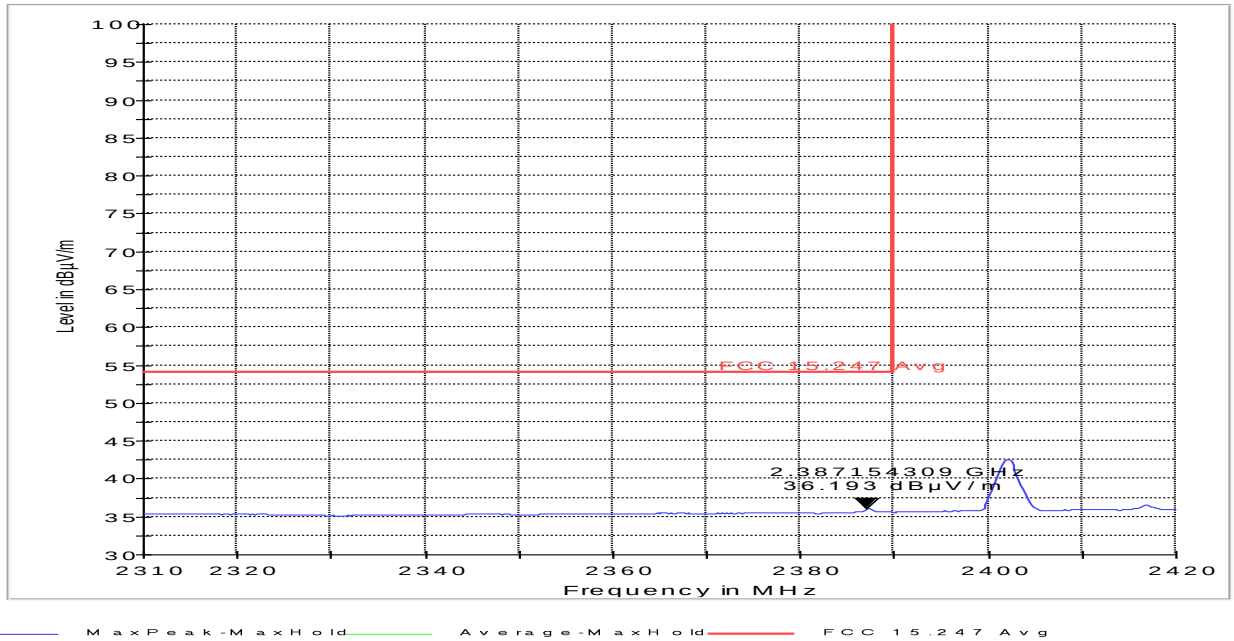
6.5.2.1 Measurement Result
Pass.

6.5.3 Test Data/plots:

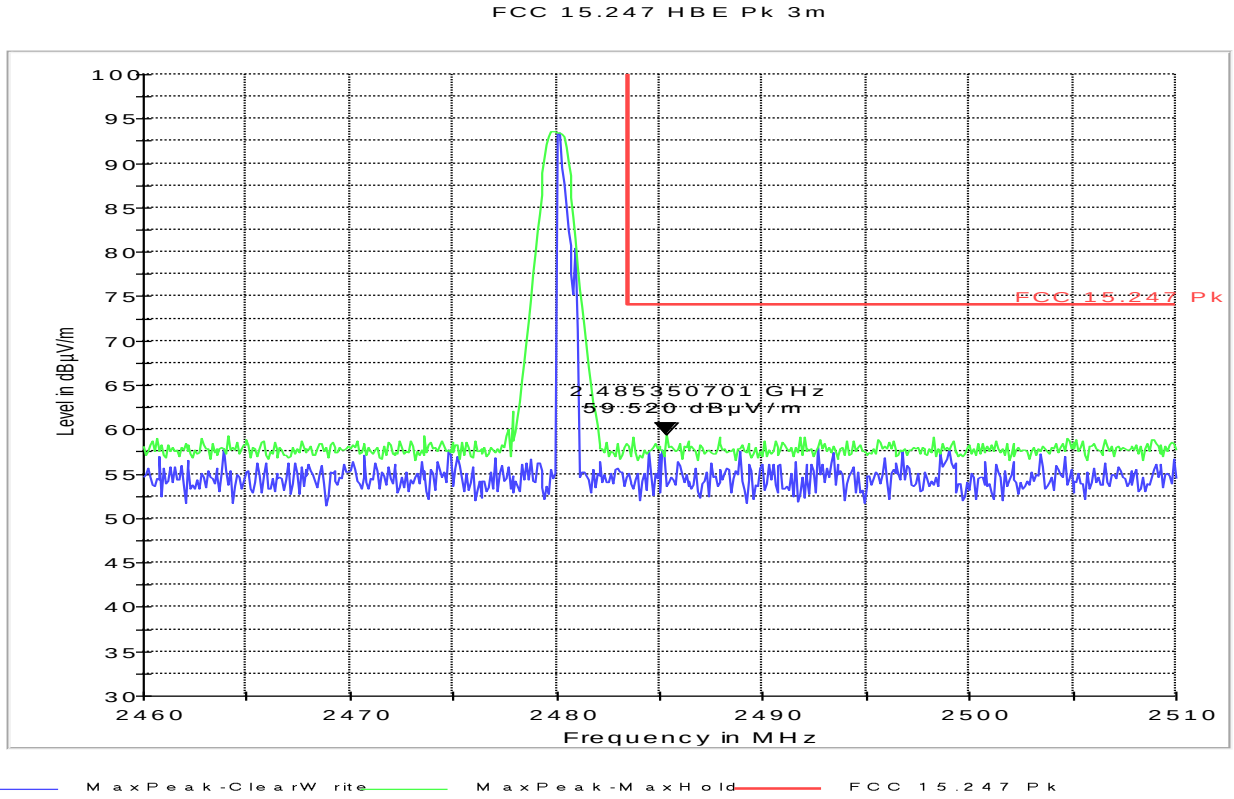
Lower band edge peak -GFSK modulation



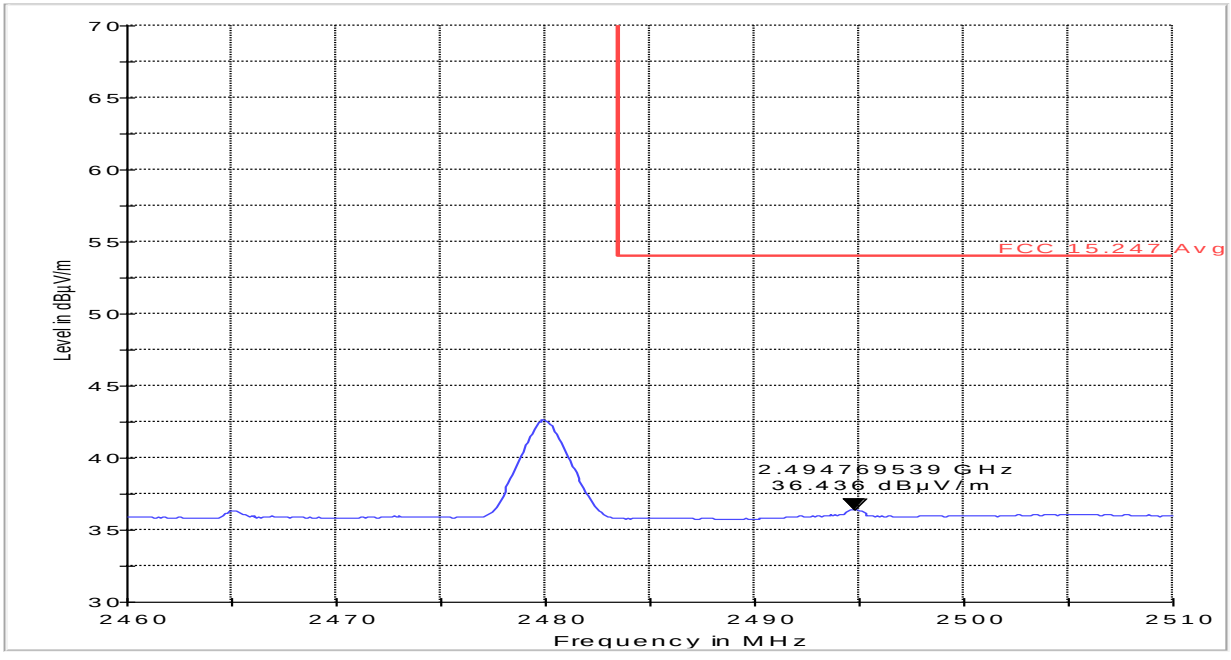
Lower band edge average -GFSK modulation



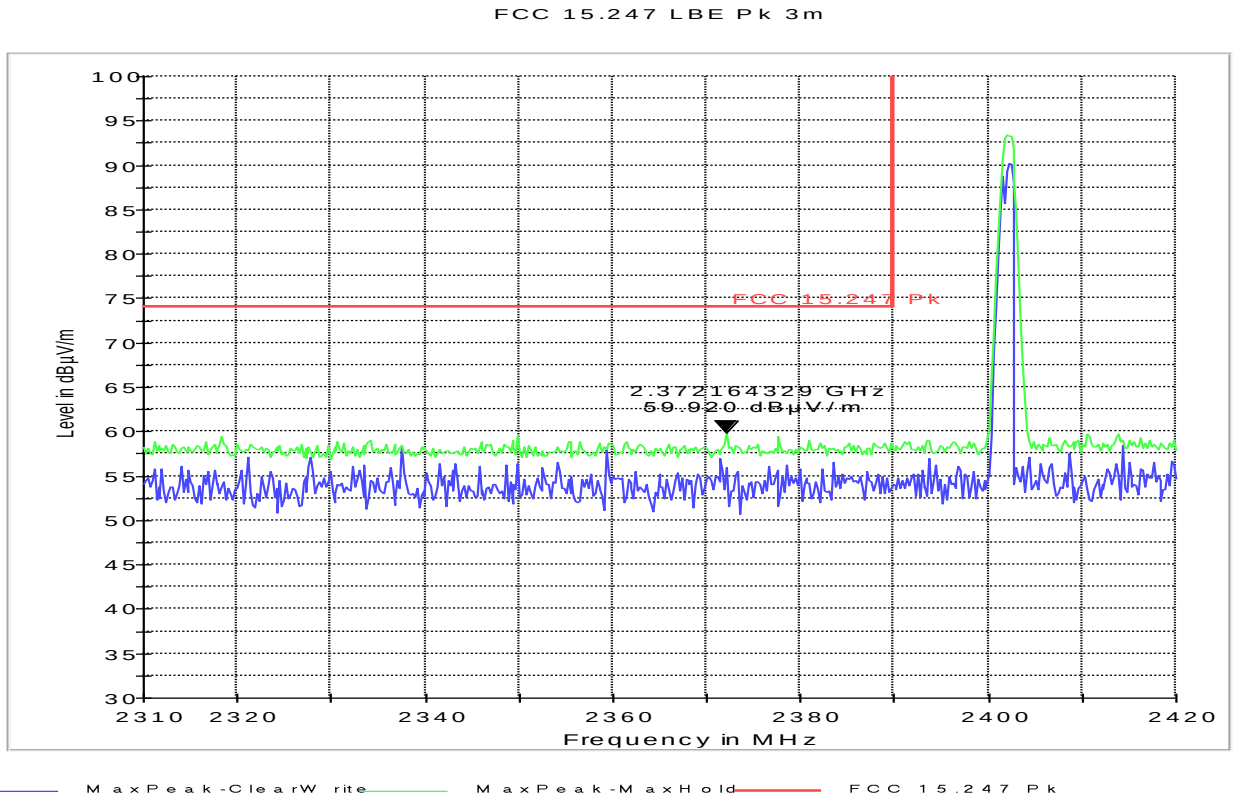
Higher band edge peak -GFSK modulation



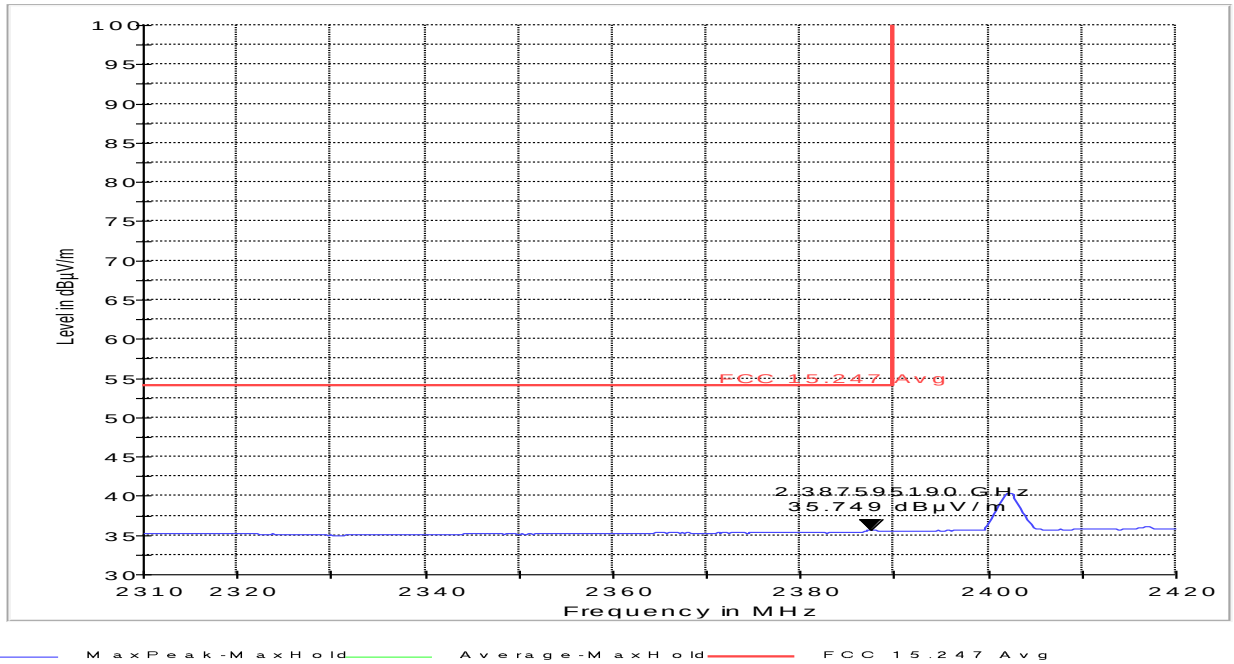
Higher band edge average-GFSK modulation



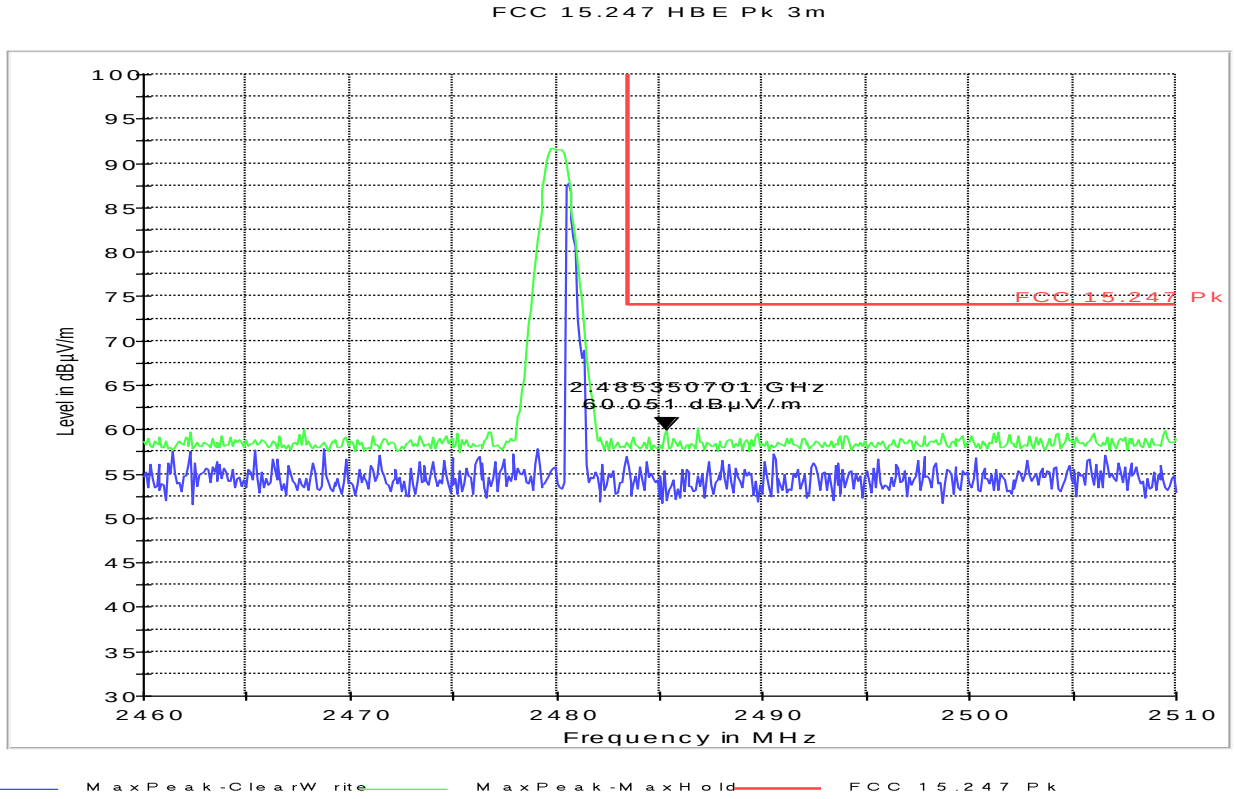
Lower band edge peak - π/4 DQPSK modulation



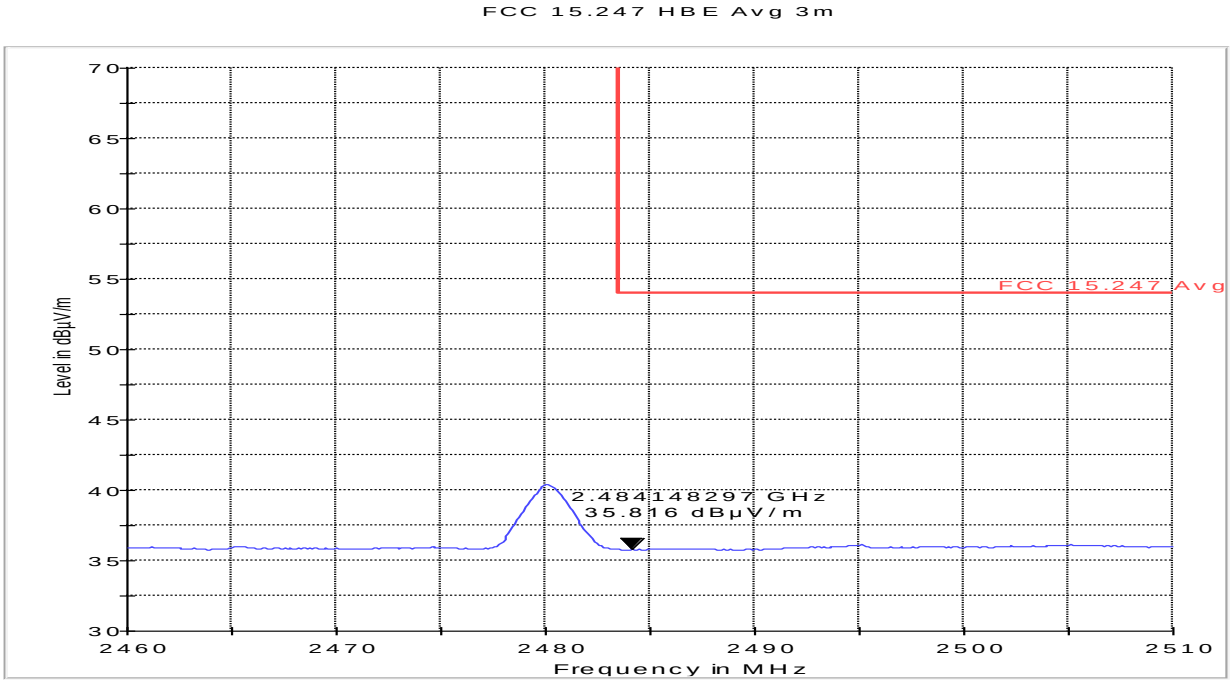
Lower band edge average -π/4 DQPSK modulation



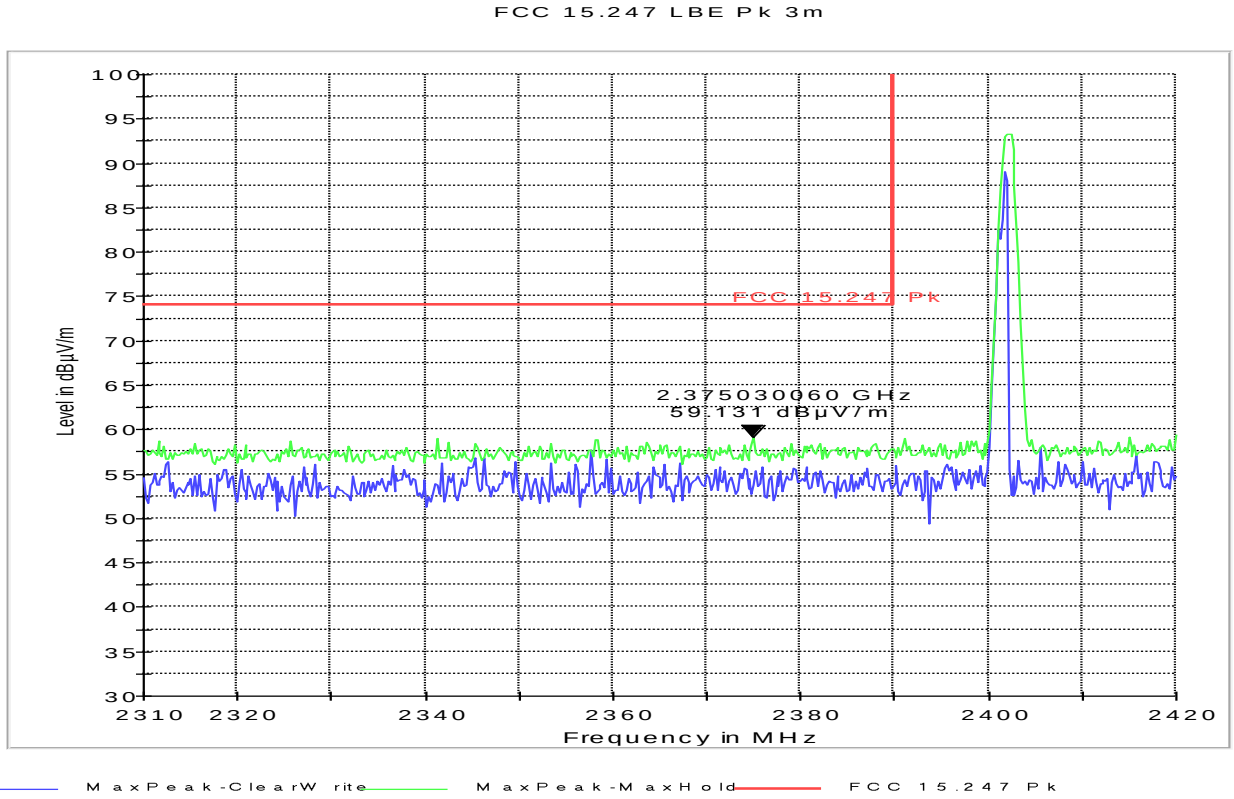
Higher band edge peak -π/4 DQPSK modulation



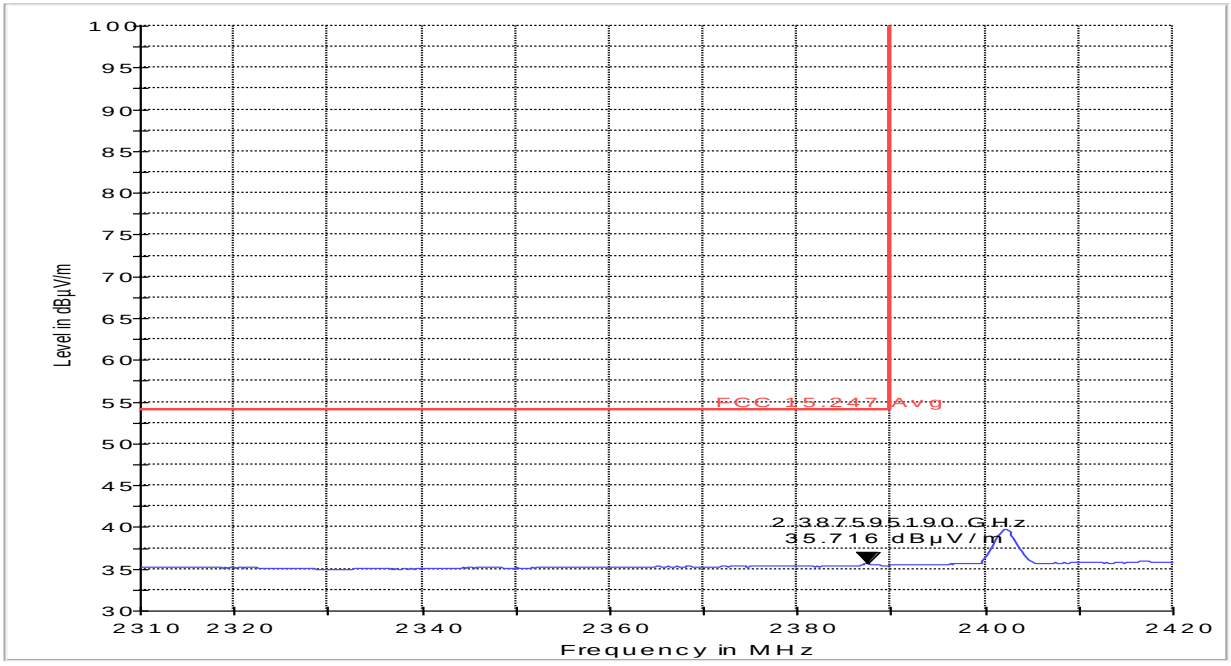
Higher band edge average- π/4 DQPSK modulation



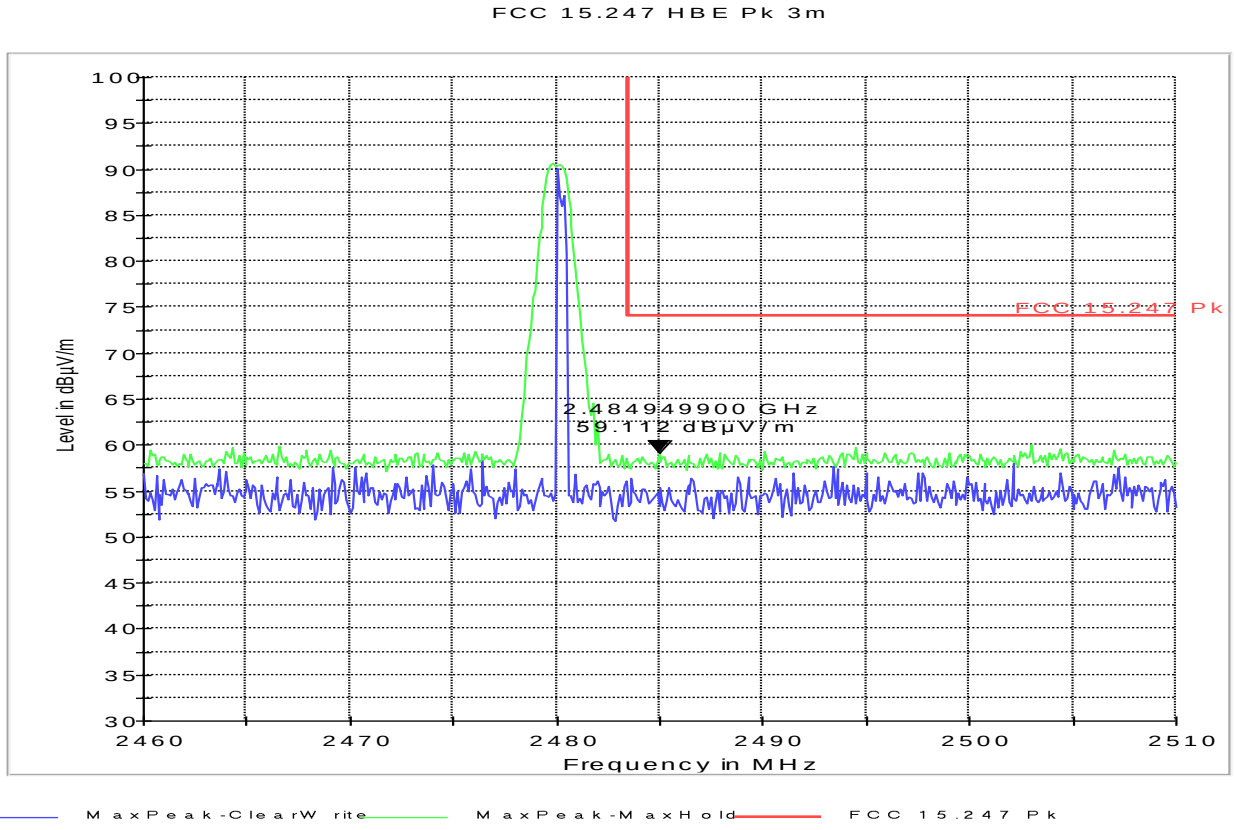
Lower band edge peak - 8DPSK modulation



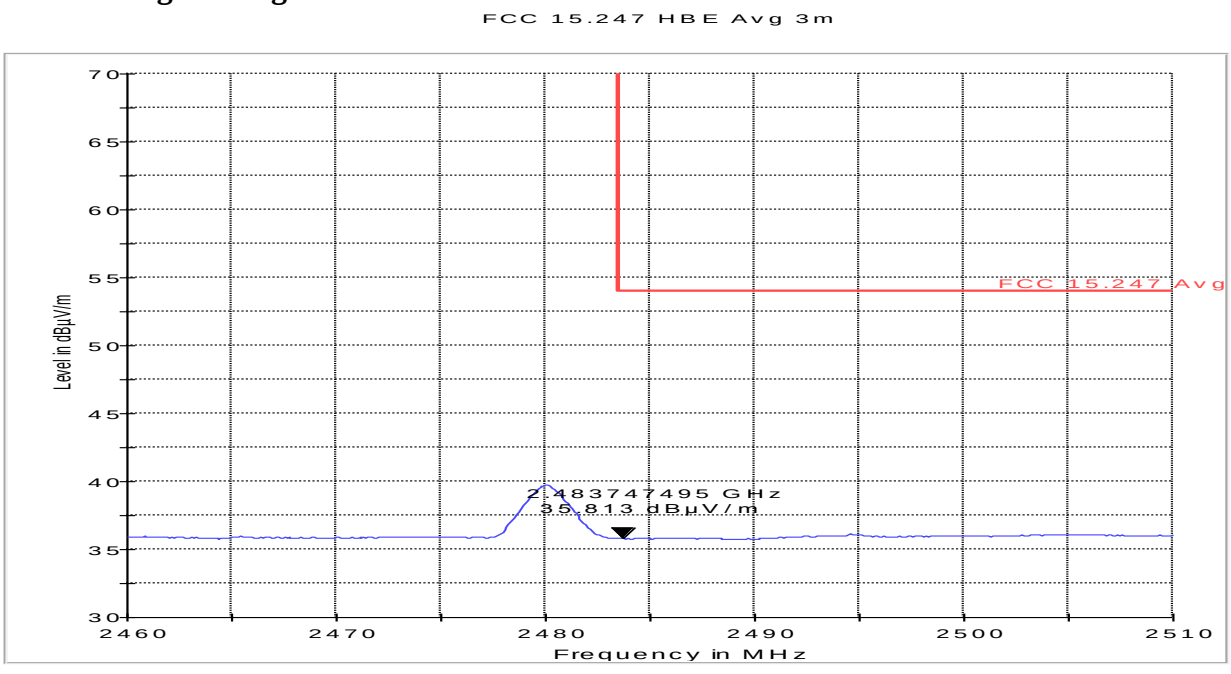
Lower band edge average -8DPSK modulation



Higher band edge peak - 8DPSK modulation



Higher band edge average-8DPSK modulation



6.6 Spectrum Bandwidth/ 20dB Bandwidth

6.6.1 Limits:

6.6.1.1 §15.247 (a)(1)
6.6.1.2 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

6.6.2 Test Conditions:

Tnom: 25°C; Vnom: 11.1V
Hopping OFF
Spectrum Analyzer settings:
RBW=10kHz, VBW=30kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=2MHz

6.6.3 Test Result:

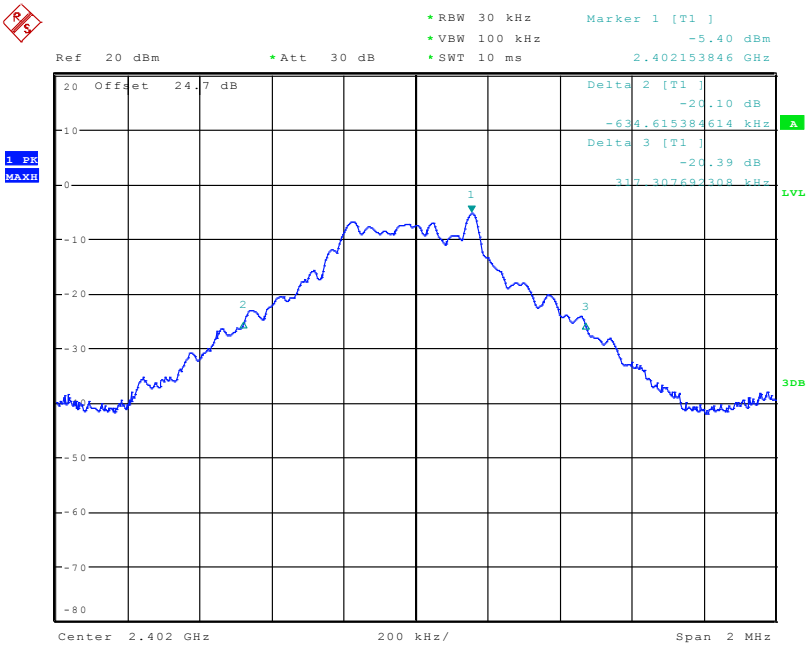
20dB Bandwidth (kHz)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	951.92	956.41	951.92
π/4 DQPSK	1230.77	1243.59	1233.97
8-DPSK	1243.59	1237.18	1233.97
Measurement Uncertainty: ±10 kHz			

6.6.3.1 Measurement Result

Pass.

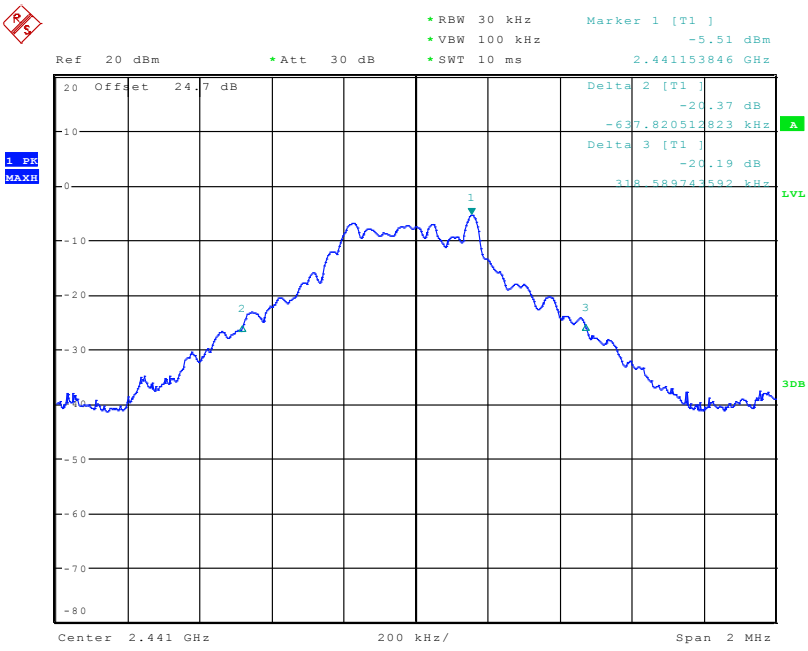
6.6.4 Test Data/plots:

20dB Bandwidth GFSK 2402MHz



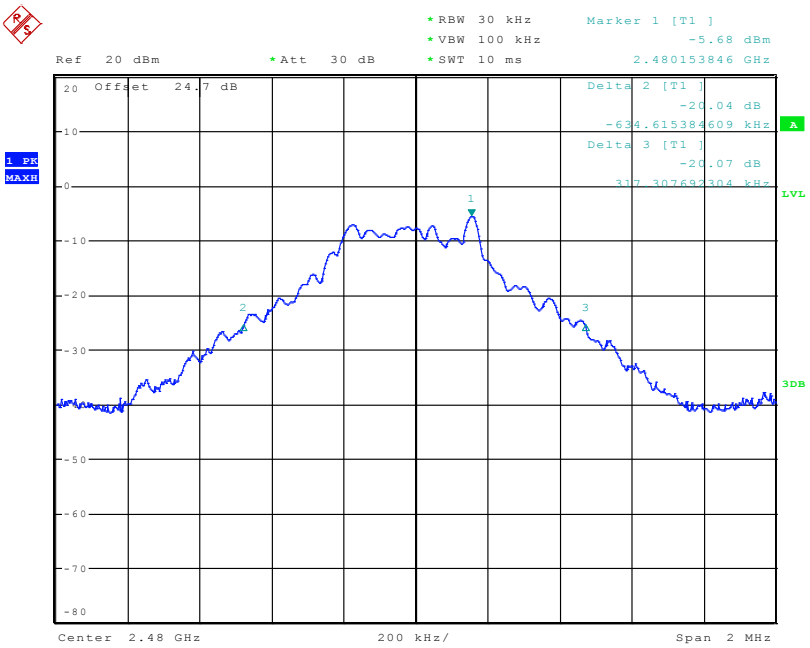
Date: 22.FEB.2012 16:57:48

20dB Bandwidth GFSK 2441MHz



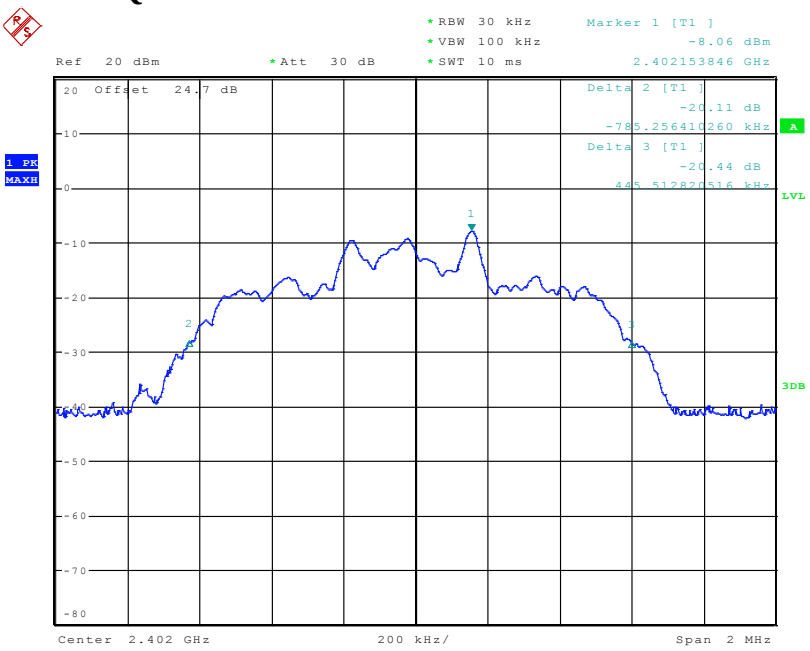
Date: 22.FEB.2012 13:46:06

20dB Bandwidth GFSK 2480MHz



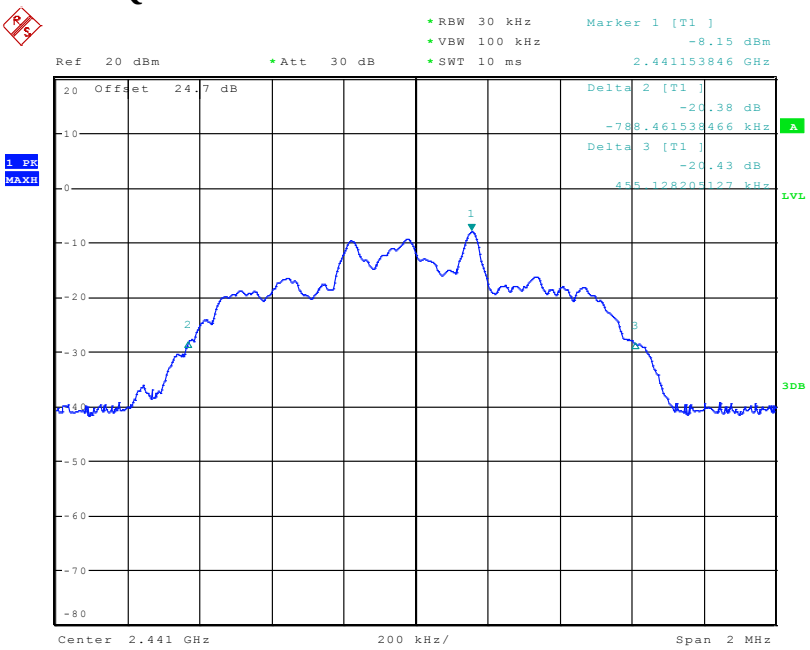
Date: 22.FEB.2012 13:56:18

20dB Bandwidth π / 4 DQPSK 2402MHz



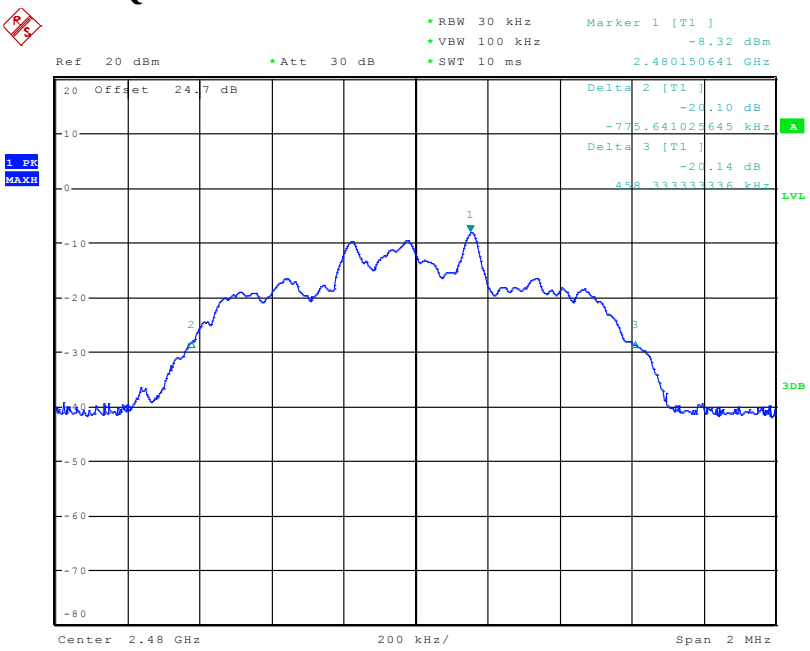
Date: 22.FEB.2012 14:04:24

20dB Bandwidth π / 4 DQPSK 2441MHz



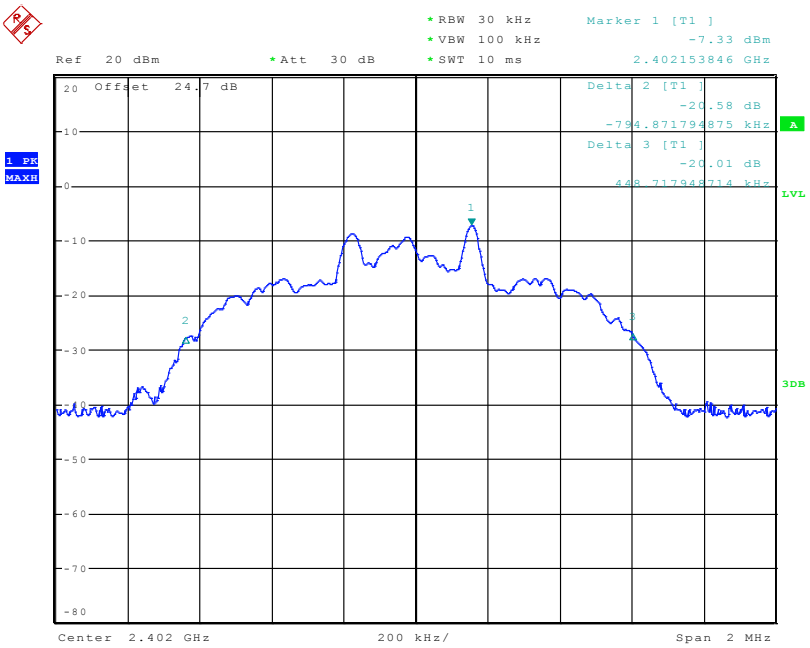
Date: 22.FEB.2012 17:11:31

20dB Bandwidth π / 4 DQPSK 2480MHz



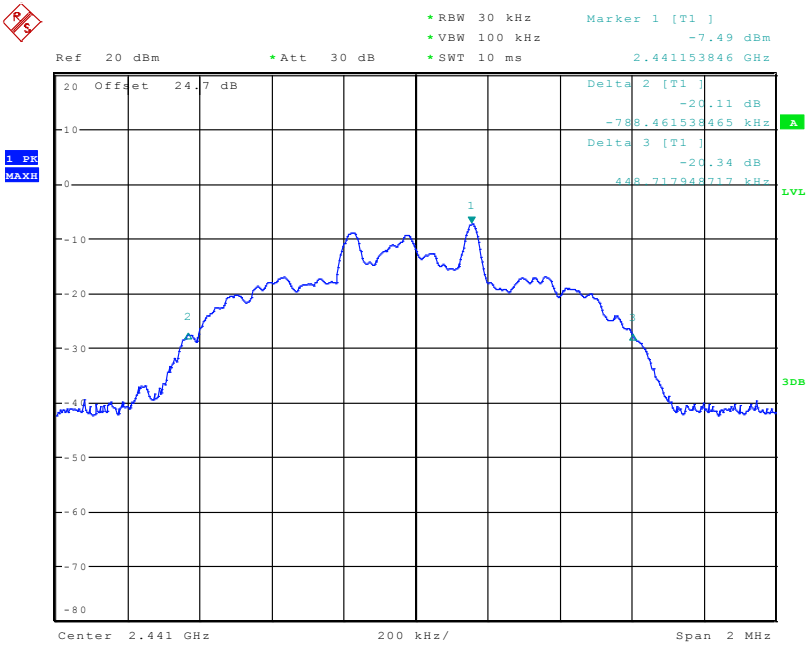
Date: 22.FEB.2012 17:02:52

20dB Bandwidth 8PSK 2402MHz



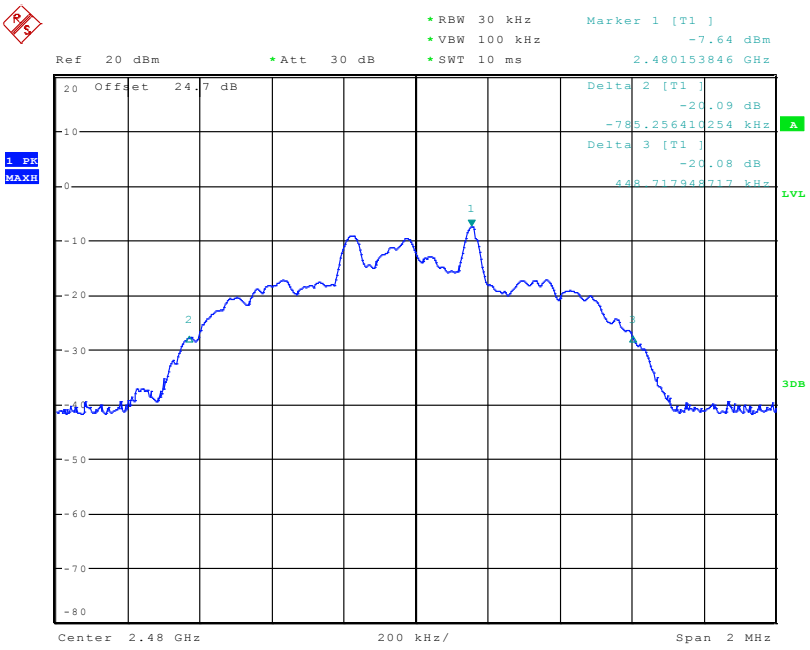
Date: 22.FEB.2012 14:33:46

20dB Bandwidth 8PSK 2441MHz



Date: 22.FEB.2012 14:29:18

20dB Bandwidth 8PSK 2480MHz



Date: 22.FEB.2012 14:26:10

6.7 Carrier Frequency Separation

6.7.1 Limits:

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

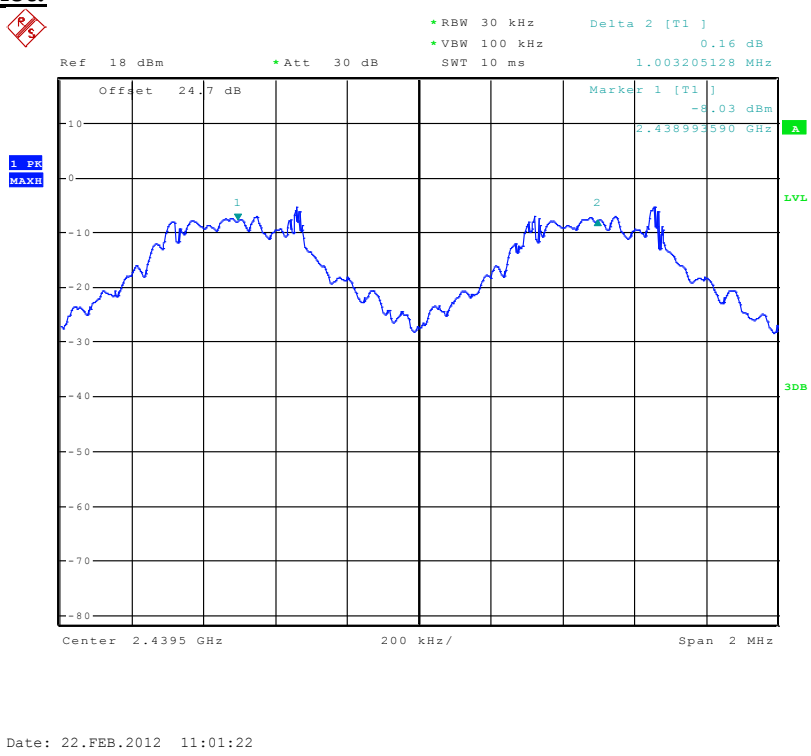
6.7.2 Test Result:

Modulation: GFSK
Channel Separation: 1.003 MHz

6.7.3 Test Conditions:

Tnom: 25°C; Vnom: 11.1V
Hopping ON
Spectrum Analyzer settings:
RBW=30kHz, VBW=100kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=2MHz

6.7.4 Test Data/plot:



6.7.4.1 Measurement Result

Pass.

6.8 Number of hopping channels

6.8.1 Limits:

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

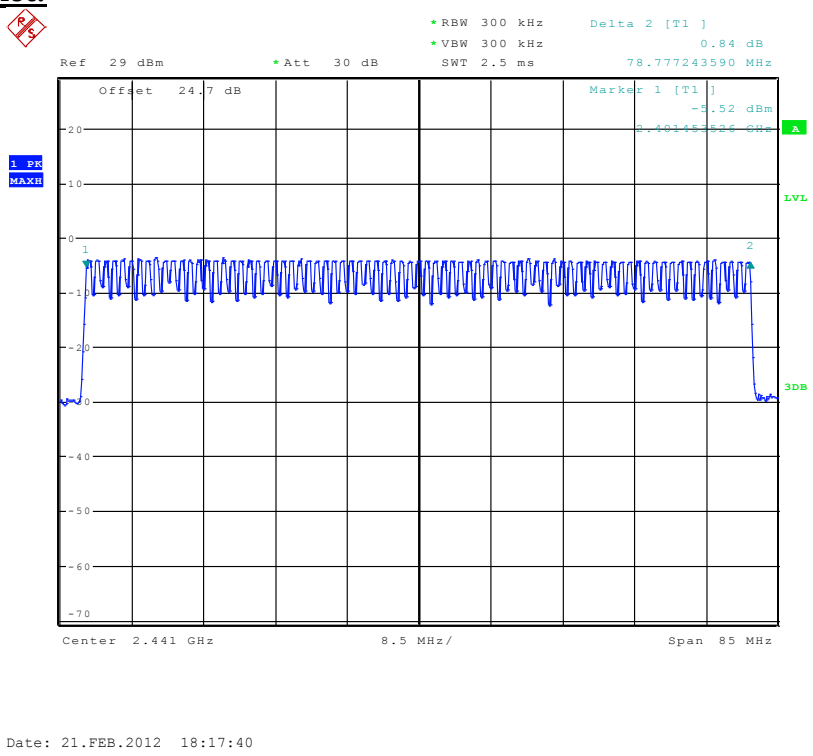
6.8.2 Test Result:

Modulation: GFSK
Number of hopping channels: 79

6.8.3 Test Conditions:

Tnom: 25°C; Vnom: 11.1V
Hopping ON
Spectrum Analyzer settings:
RBW=300kHz, VBW=300kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=Full range

6.8.4 Test Data/plot:



6.8.4.1 Measurement Result

Pass.

6.9 Time of occupancy (Dwell time)

6.9.1 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.

6.9.2 Test Result:

Based on the standard the limit of 0.4 seconds is within a time period of 0.4 seconds multiplied by number of hopping channels.

Since the number of hopping channels is 79, this time period=0.4 seconds x 79
=31.6 seconds

Each channel is divided into timeslots that are 625µs in width.
So in one second the maximum number of timeslots= 1s/625µs=1600 timeslots

DH1 packet type needs 1 timeslot for transmit and 1 timeslot for receive so the maximum number of transmissions for 79 channels in one second=1600/2=800 transmissions

The number of transmissions per channel per second =800/79=10.13 transmissions

The number of transmissions per channel in 31.6 seconds=10.13x31.6=320.108 transmissions

DH3 packet type needs 3 timeslots for transmit and 1 timeslot for receive so the maximum number of transmissions for 79 channels in one second=1600/4= 400 transmissions

The number of transmissions per channel per second =400/79=5.06 transmissions

The number of transmissions per channel in 31.6 seconds=5.06x31.6=159.9 transmissions

DH5 packet type needs 5 timeslots for transmit and 1 timeslot for receive so the maximum number of transmissions for 79 channels in one second=1600/6= 266.67 transmissions

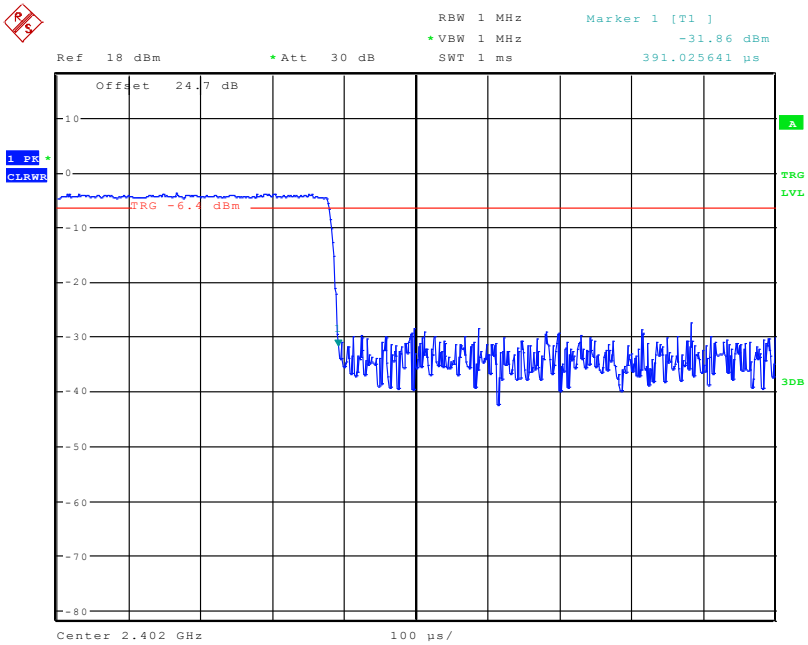
The number of transmissions per channel per second =266.67/79=3.38 transmissions

The number of transmissions per channel in 31.6 seconds=3.38x31.6=106.81 transmissions

Since the dwell time is independent of the channel used, mid channel data is reported here.

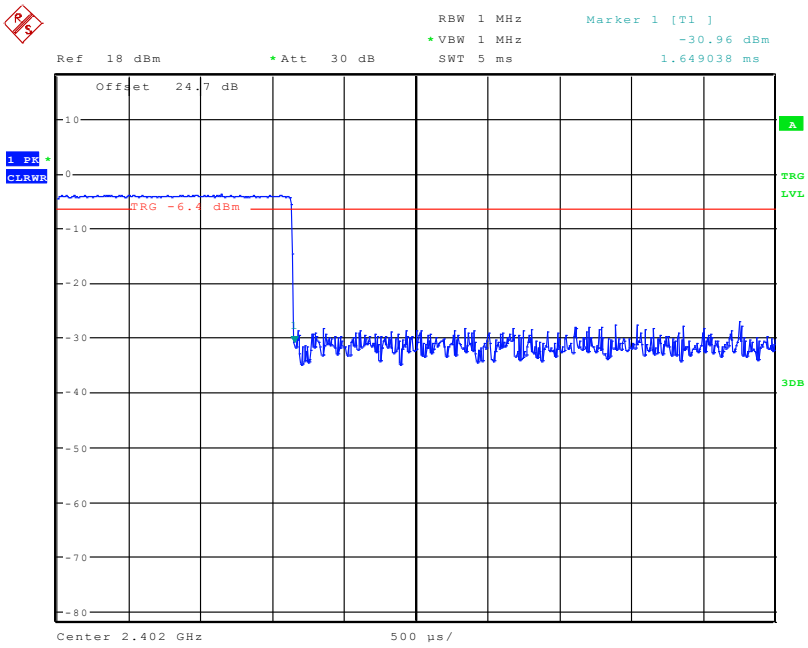
6.9.3 Test Data/plot:

DH1: Ch 39: 2441 MHz



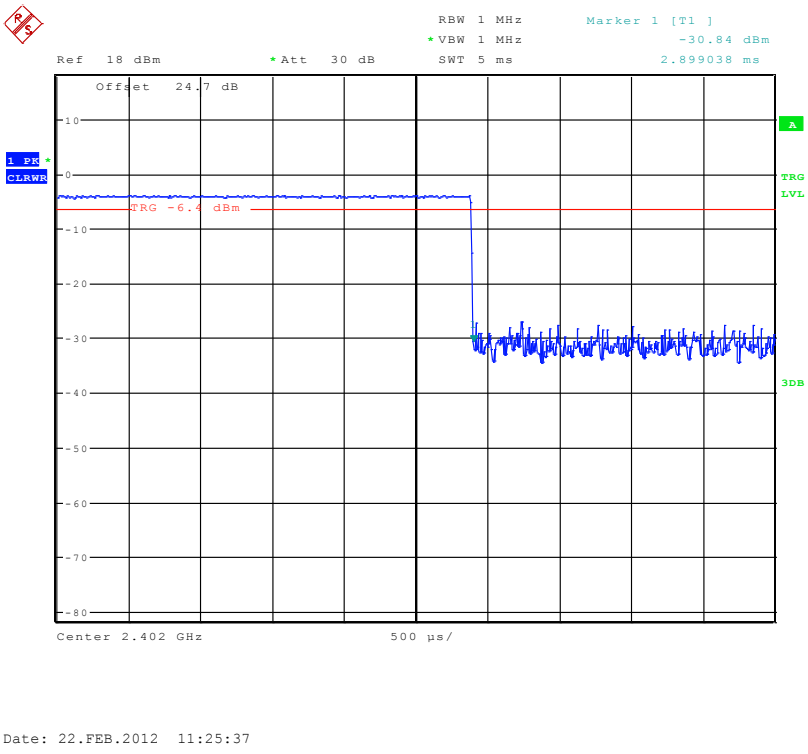
Date: 22.FEB.2012 11:21:13

DH3: Ch 39: 2441 MHz



Date: 22.FEB.2012 11:24:46

DH5: Ch 39: 2441 MHz



6.9.4 Test Verdict

Pass

Mode	Number of transmissions/hops in a 31.6 seconds time period(N)	Length of transmission time, L (msec)	Result(NxL) (msec)	Limit (msec)
DH1	320.108	0.39	124.84	400
DH3	159.90	1.64	262.24	400
DH5	106.81	2.89	308.68	400

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

6.10.1 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.

6.10.2 Test Result:

Not Applicable for FHSS systems.

6.11 Transmitter Spurious Emissions- Conducted

6.11.1 Reference and Limits:

6.11.1.1 § 15.247 (d)
6.11.1.2 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.

6.11.2 Test Conditions:

Tnom: 25°C; Vnom: 11.1 V
Hopping OFF
Spectrum Analyzer settings:
RBW=100kHz, VBW=300kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=Full range

6.11.3 Test Result:

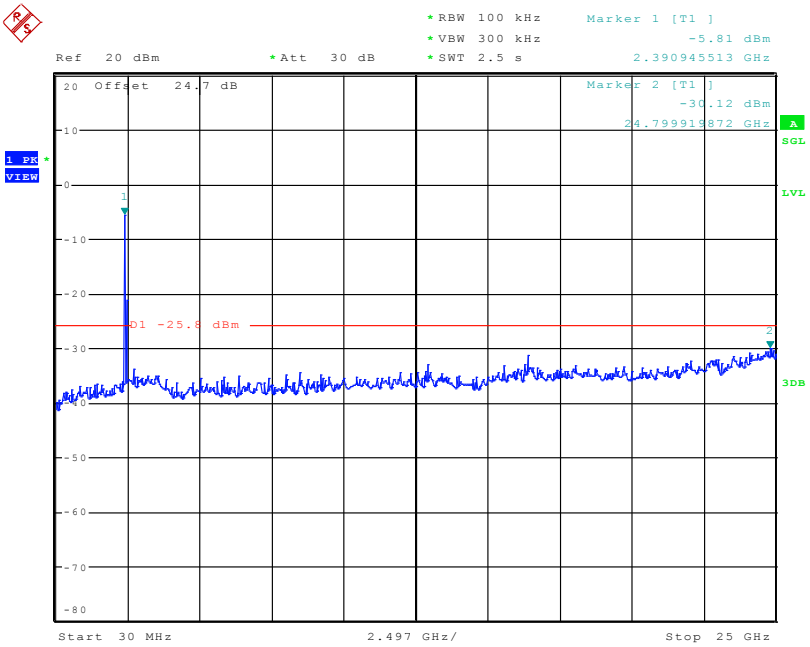
Worst case GFSK mode only reported here.

Conducted Spurious Emissions			
Channel	**Frequency (MHz)**	**Amplitude (dBm)**	**Limits**
		GFSK	
Low	**2402**	-5.81	30dBm
	Spurious	All other peaks >20dB below limit	-20dBc
Mid	**2441**	-6.71	30 dBm
	Spurious	All other peaks >20dB below limit	-20dBc
High	**2480**	-6.61	30 dBm
	Spurious	All other peaks >20dB below limit	-20dBc
Measurement Uncertainty: ±1.0 dB			

6.11.3.1 Measurement Result
Pass.

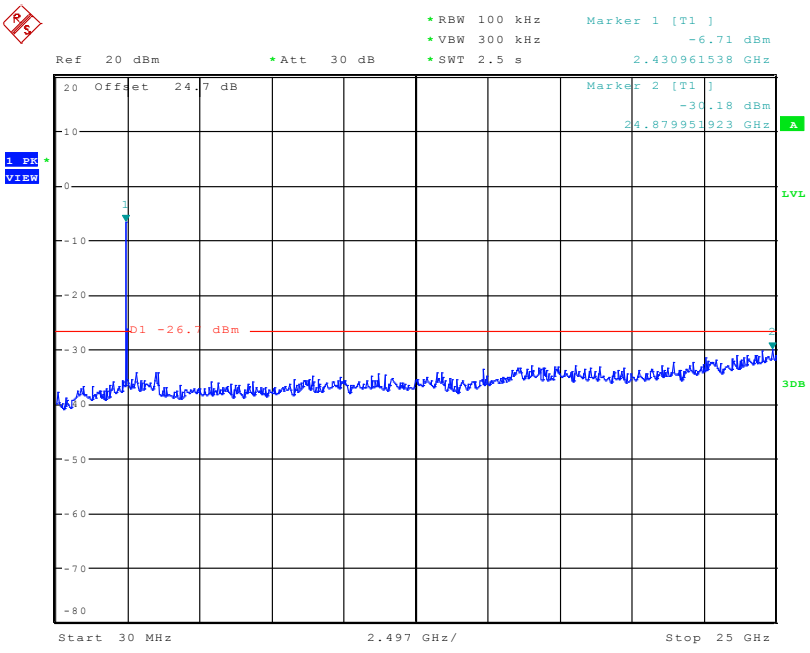
6.11.4 Test data/ plots:

Conducted Spurious Emissions GFSK 2402MHz



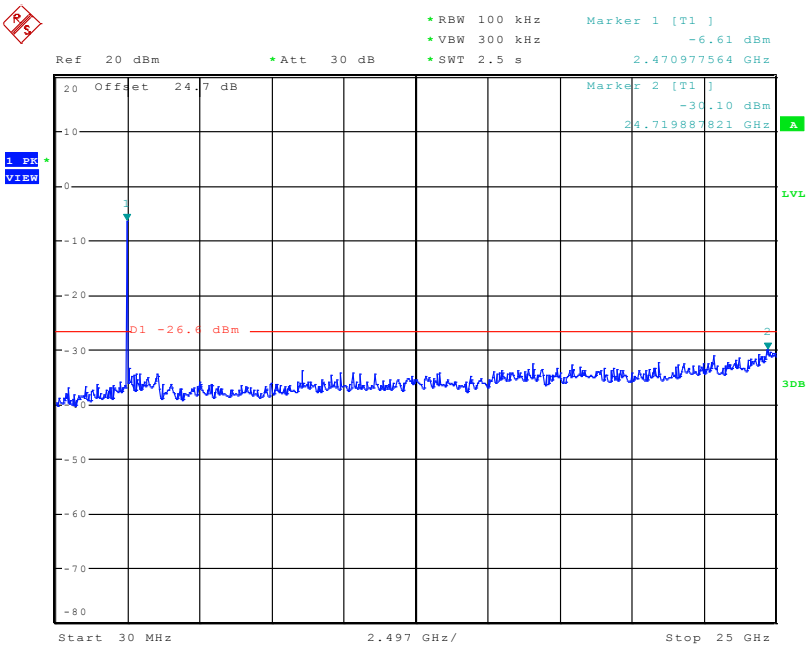
Date: 22.FEB.2012 15:44:55

Conducted Spurious Emissions GFSK 2441MHz



Date: 22.FEB.2012 15:42:28

Conducted Spurious Emissions GFSK 2480MHz



Date: 22.FEB.2012 15:46:44

6.12 Transmitter Spurious Emissions- Radiated

6.12.1 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

6.12.2 Test Result:

Test mode: *Modulation:* GFSK – Worst case-since highest conducted power

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 all 3 orthogonal orientations of the EUT.

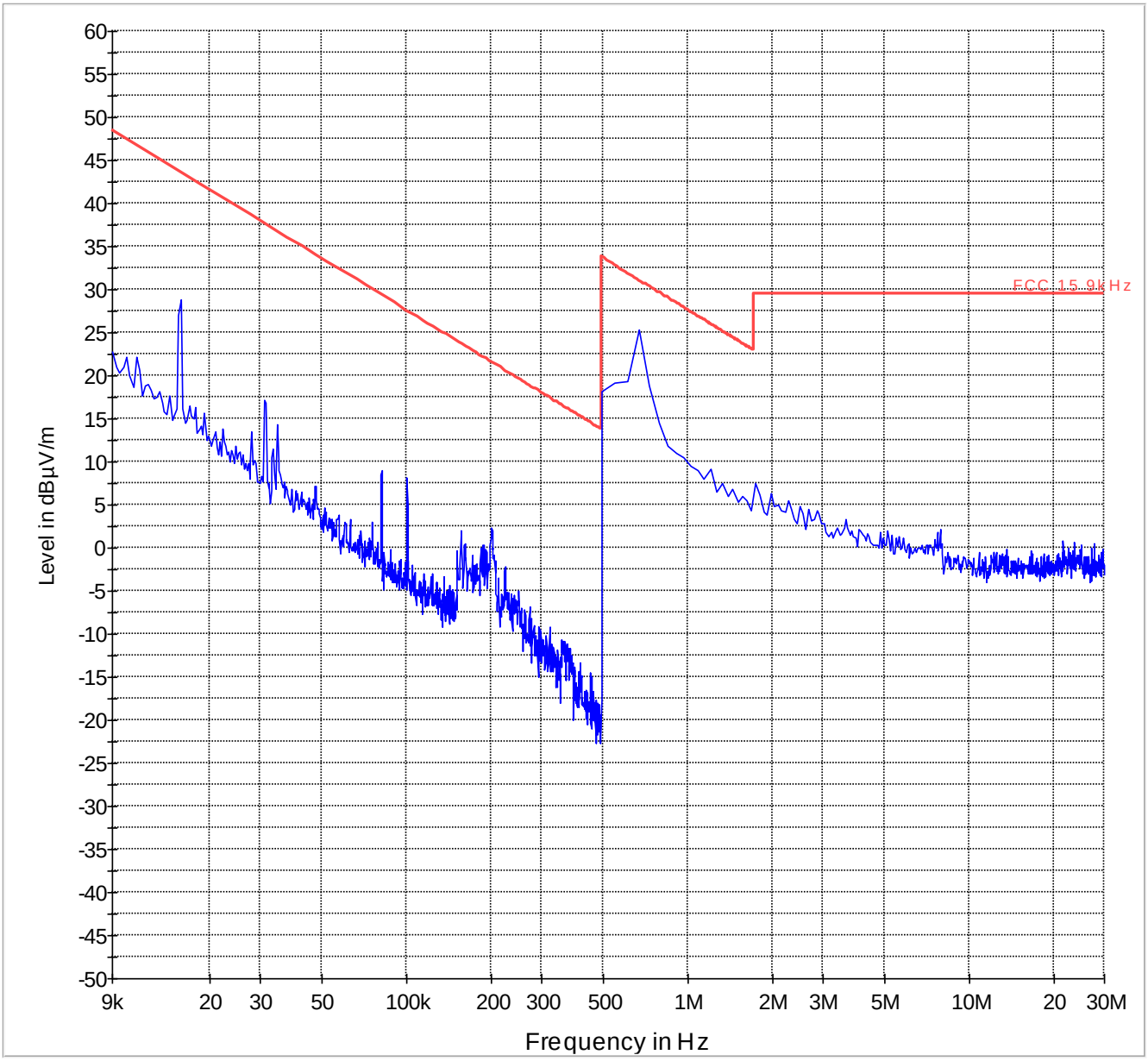
Measurement Uncertainty: ±3.0dB

6.12.2.1 Measurement Result

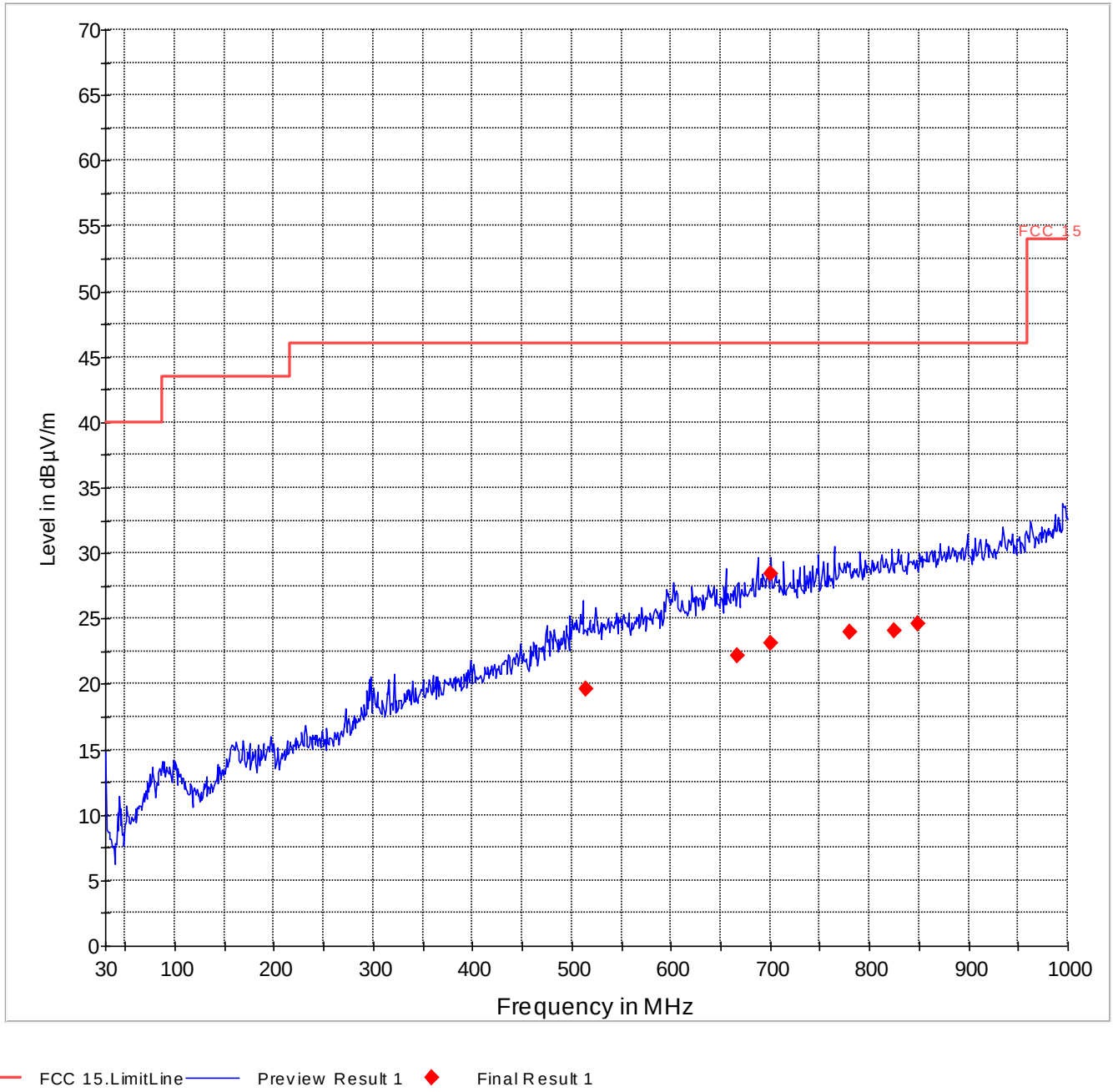
Pass.

6.12.3 Test data/ plots:

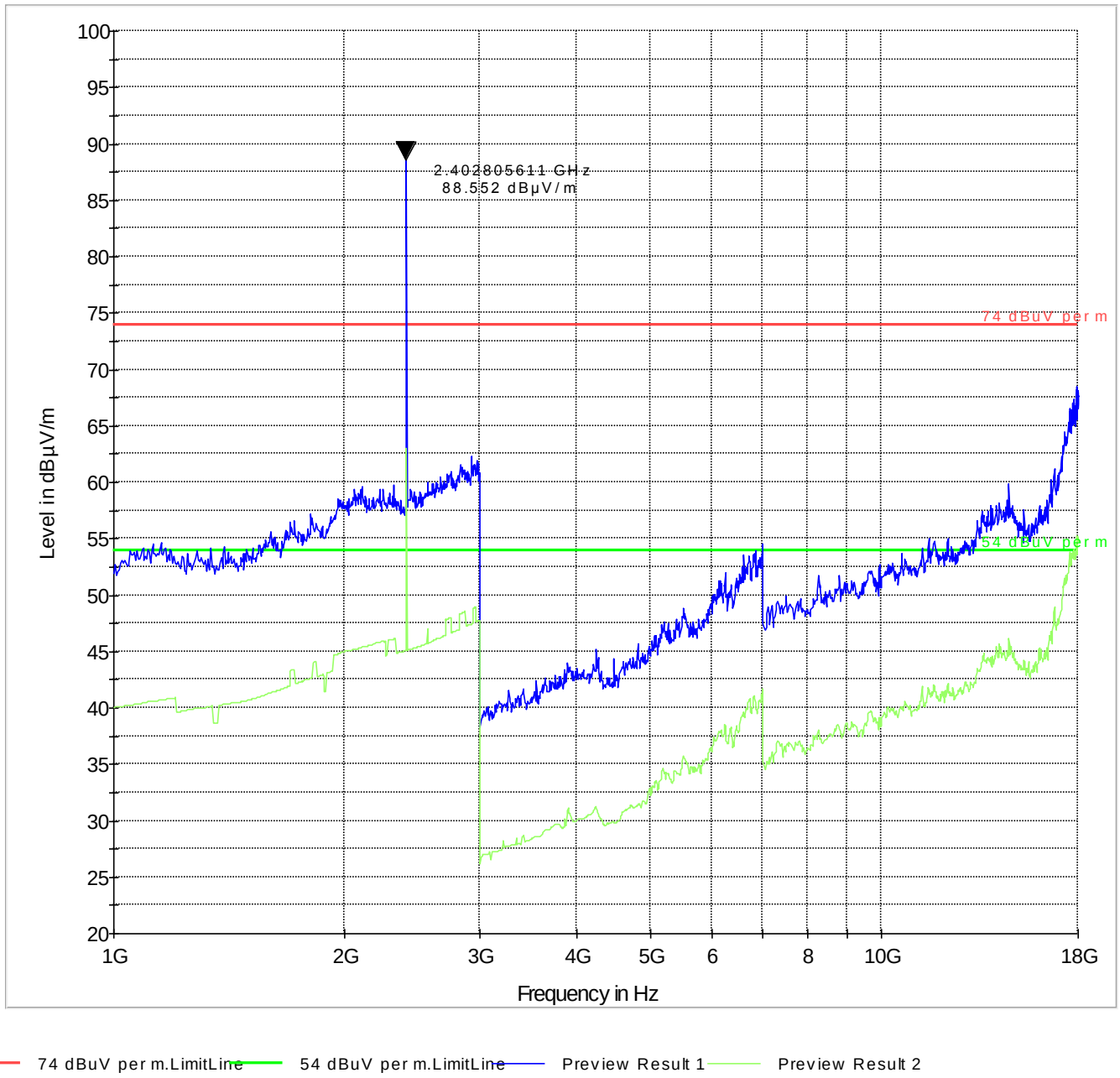
Transmitter Radiated Spurious Emission:<30MHz
Note: Worst case representation for all modes of operation in this frequency range-
Limits adjusted for 3m measurement.



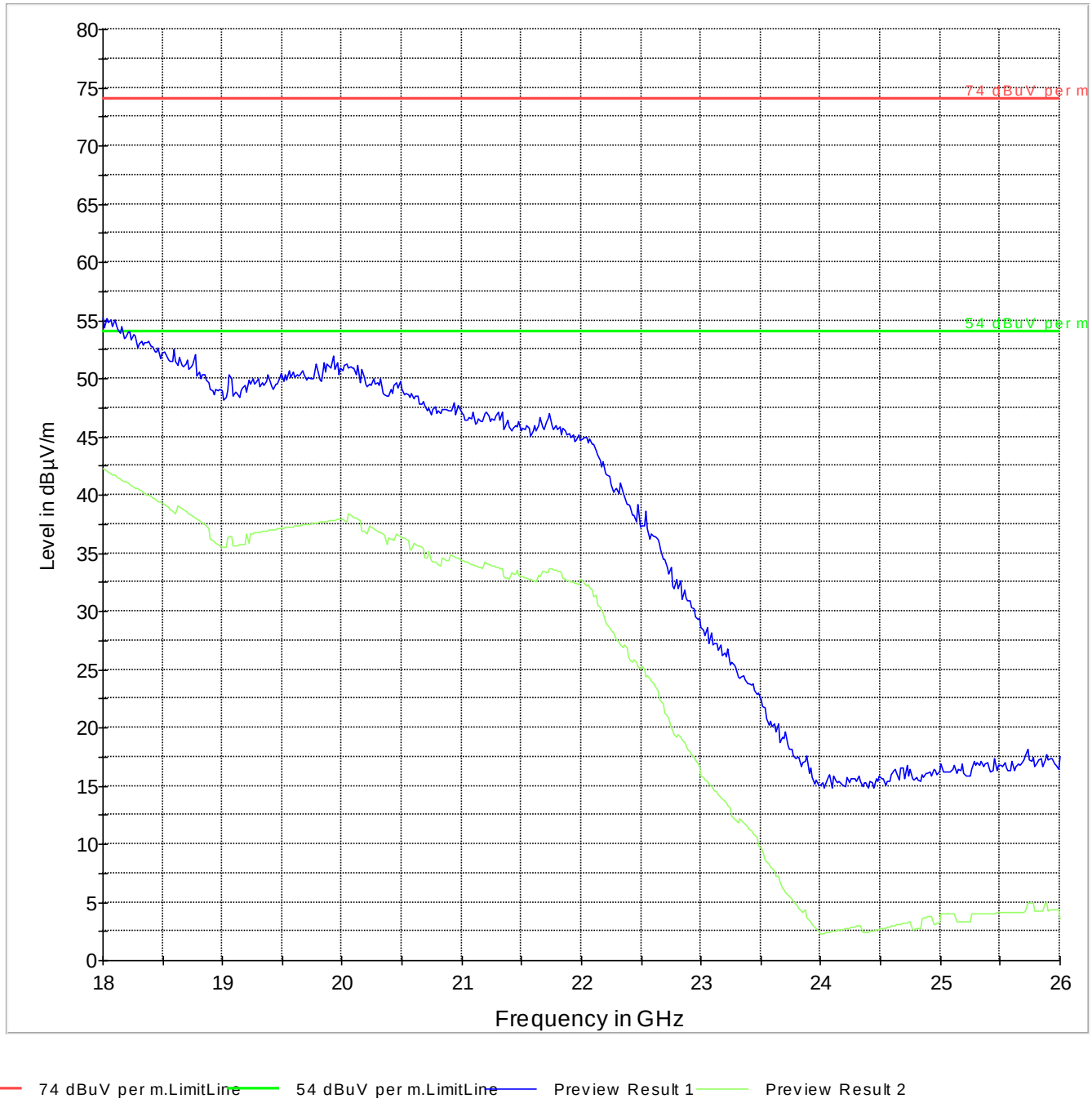
Transmitter Radiated Spurious Emission- Ch0- 30M-1GHz



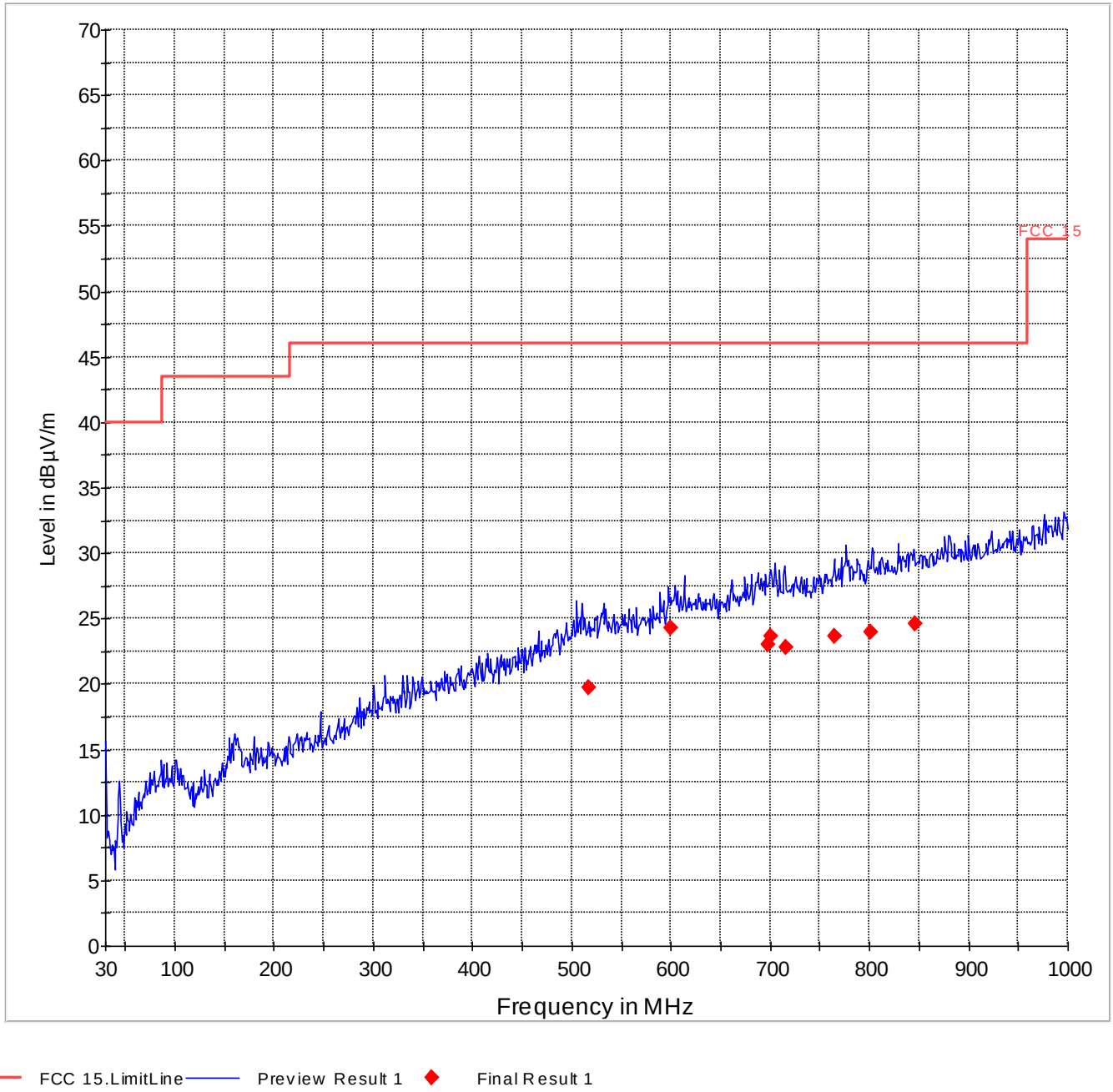
Transmitter Radiated Spurious Emission- Ch0- 1G-18GHz



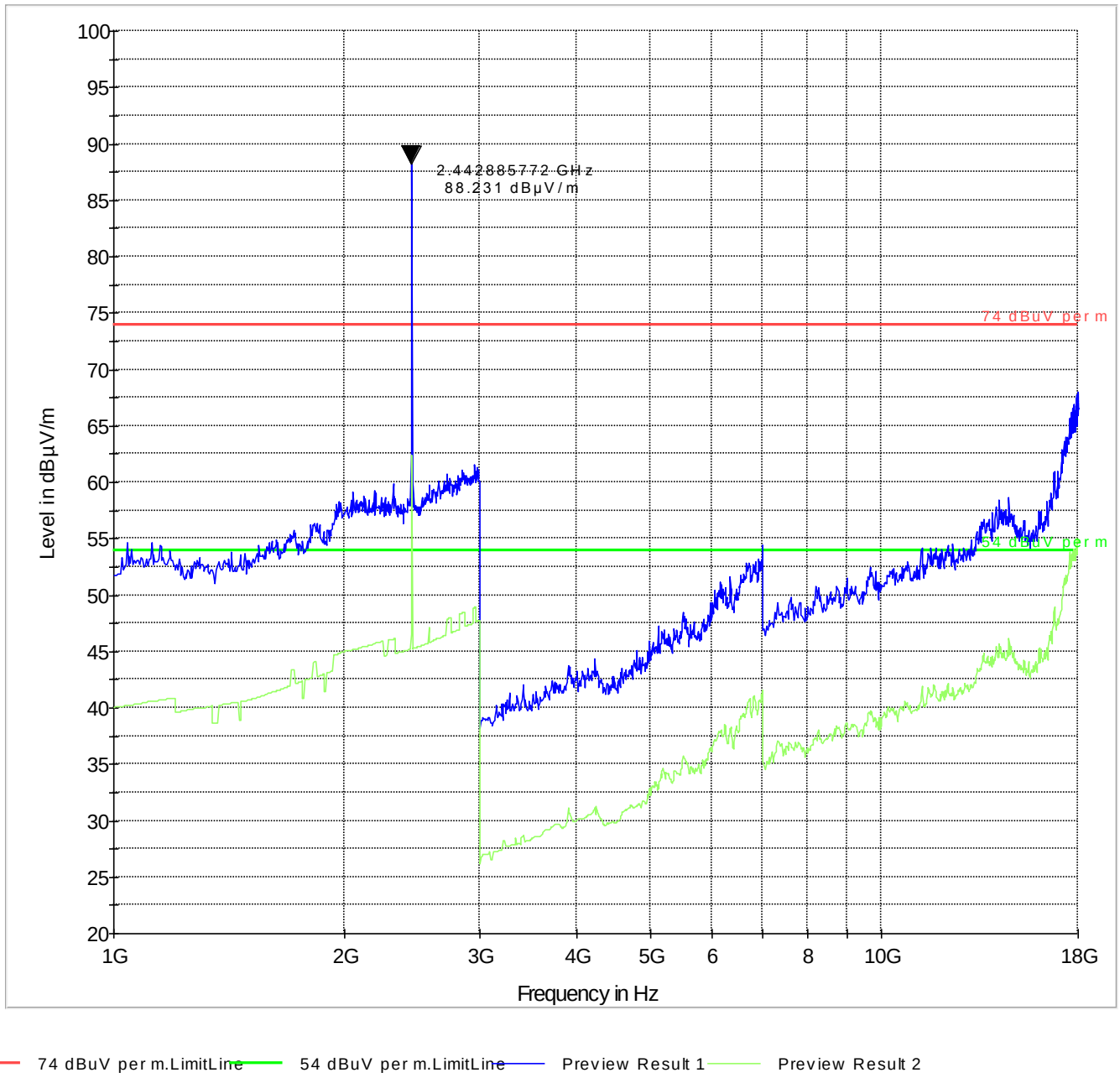
Transmitter Radiated Spurious Emission- Ch0- 18G-26GHz
Worst case representation for all channels in this frequency band.



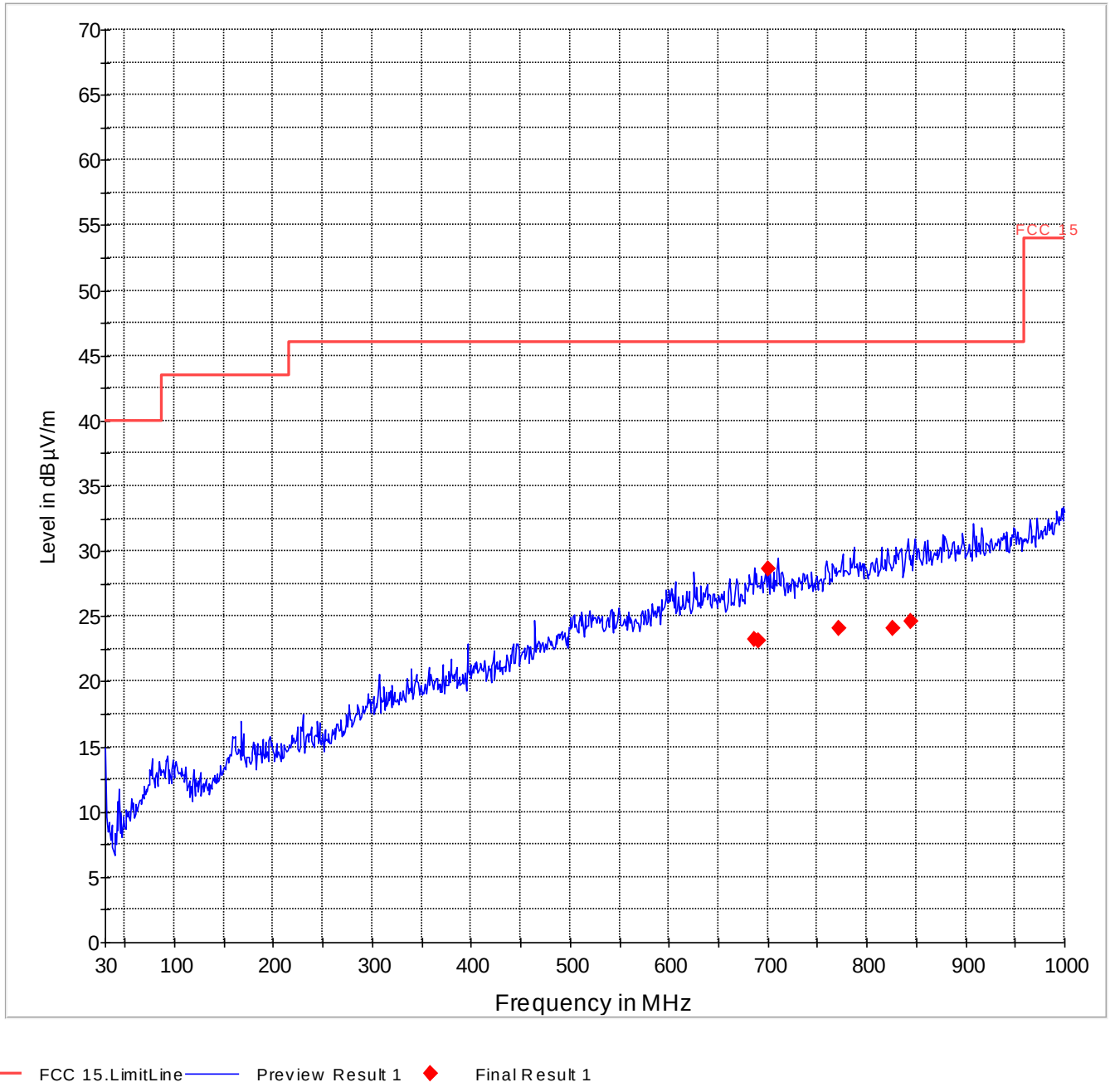
Transmitter Radiated Spurious Emission- Ch39- 30M-1GHz



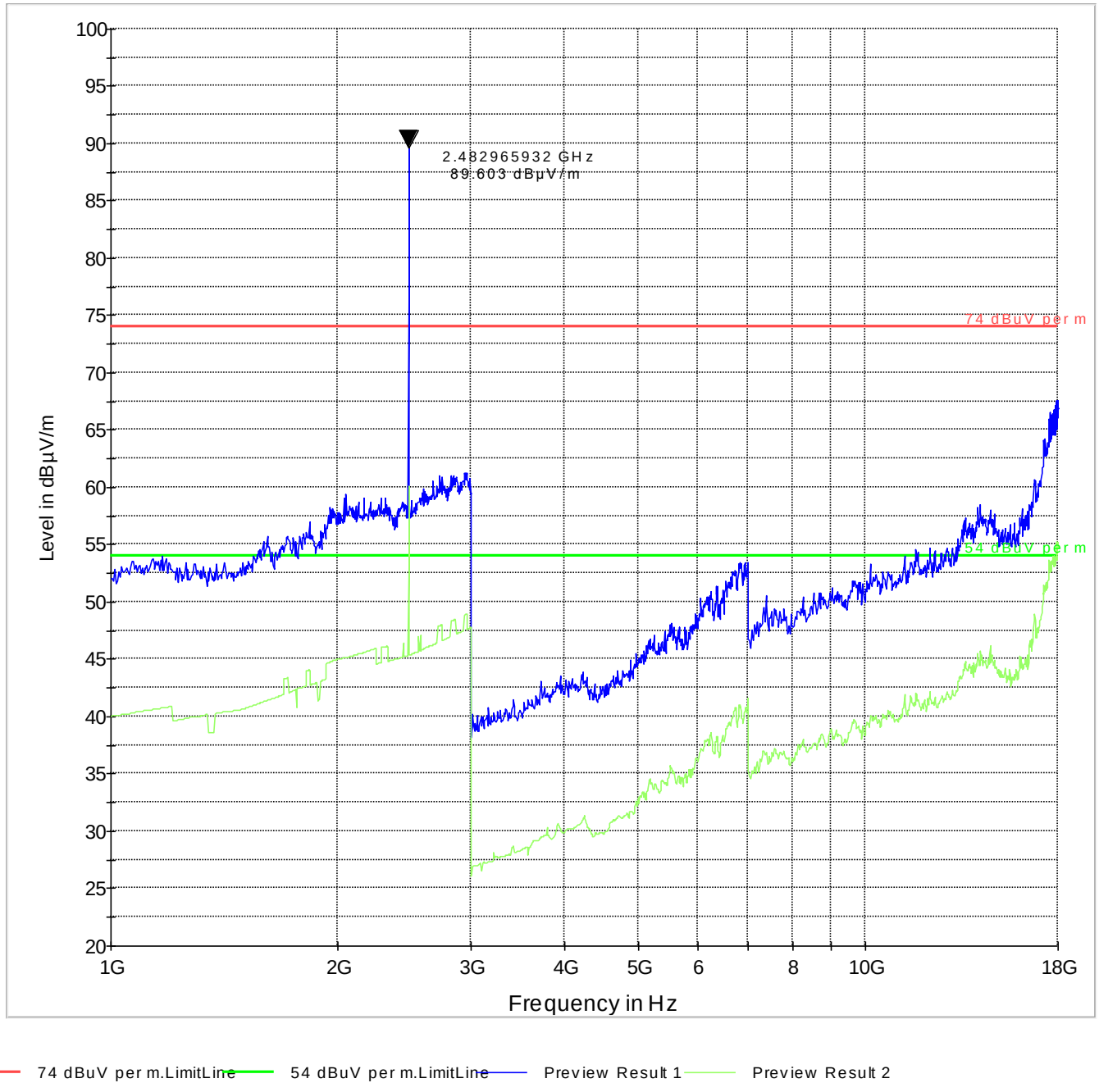
Transmitter Radiated Spurious Emission- Ch39- 1G-18GHz



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



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



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 - Transmit mode of operation
Measurement Uncertainty: ±3.0dB

6.13.4 Results

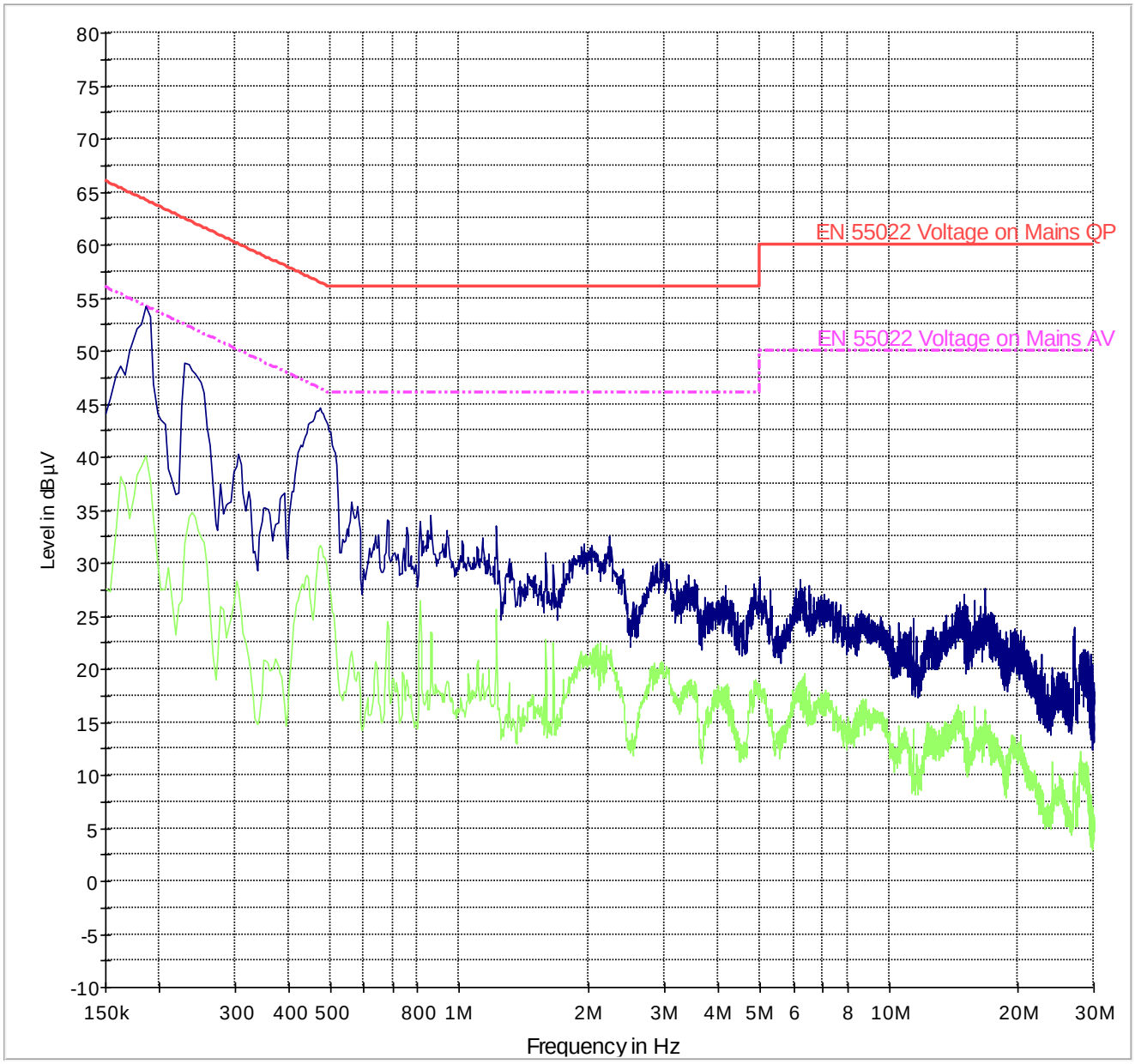
Plots shown here represent the combined worse case emissions for power lines, phases and neutral line.

6.13.4.1 Measurement Result

Pass.

6.13.5 Test Results:

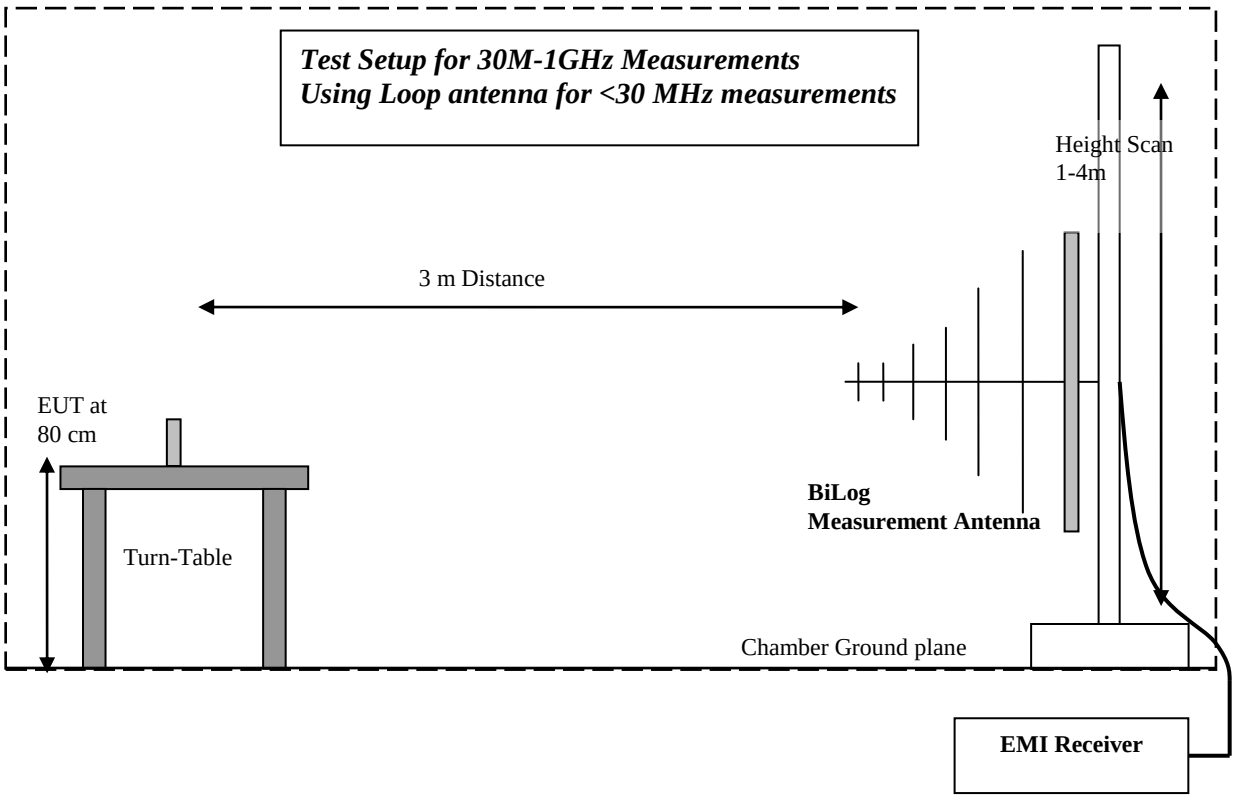
BT TX Mode:

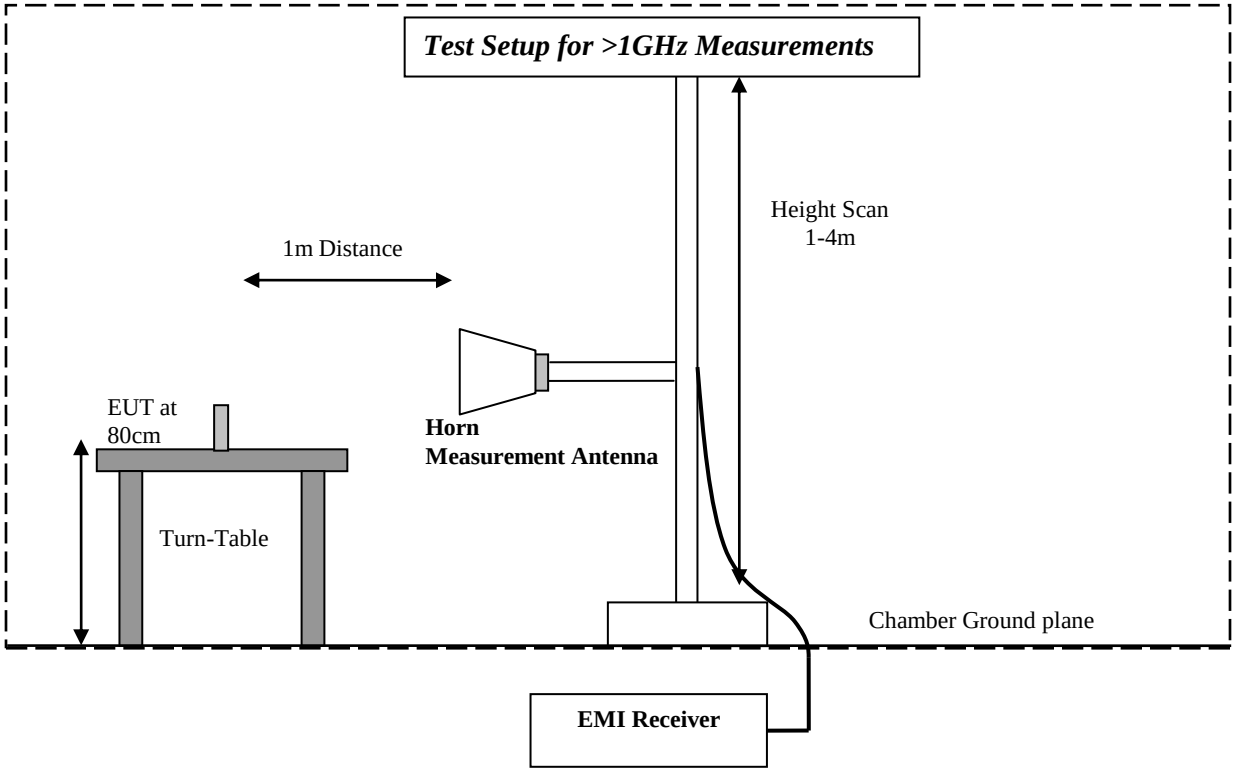


7 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
Bluetooth Tester	CBT	Rohde & Schwarz	100212	May 2011	2 Years
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2011	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	May 2011	2 Years
Loop Antenna	6512	EMCO	00049838	Aug 2011	3 years
Biconilog Antenna	3141	EMCO	0005-1186	June 2009	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035114	Mar 2009	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Aug 2011	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	
LISN	50-25-2-08	FCC	08014	Jan 2012	1 year
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
Power Smart Sensor	R&S	NRP-Z81	100161	May 2011	2 Years
DC Power Supply	E3610A	Hewlett Packard	KR83021224	n/a	n/a
Multimeter	MM200	Klein	N/A	Apr 2011	2 Years
Temp Hum Logger	TM320	Dickson	03280063	Feb 2012	1 Year
Temp Hum Logger	TM325	Dickson	5285354	Feb 2012	1 Year

8 Test Setup Info:





9 Revision History

Date	Report Name	Changes to report	Report prepared by
2012-03-30	EMC_TRIMB_083_11001_FCC_IC_FHSS	First Version	Tunji Yusuf