FCC/IC Test Report

FOR:

Manufacturer: Intel Corporation

Model Number: CZ120
Product Description: HSPA+ Smartphone

FCC ID: O2Z-CZ120
IC ID: 1000W-CZ120

47 CFR Part 15.247 (DSS)

IC RSS-210 Issue 8, Annex 8

TEST REPORT #: EMC_INTEL-032-13001_DSS
DATE: 2013-08-28

ACCREDITED TESTING LABORATORY Certificate #2135.01

CTIA Authorized Test Lab LAB CODE 20020328-00

FCC: Accredited

IC recognized # 3462B-1

***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: 2905571

TABLE OF CONTENTS

1 Assessment

The following equipment (and as identified in Ch.3 of this test report) was evaluated against the applicable criteria specified in FCC CFR47 Part 15.247, 15.207, 15.209 and Industry Canada Radio Standard Specification RSS-210 Issue 8, Annex 8.
No deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Intel Corporation	HSPA+ Smartphone	CZ120

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2013-08-28	Compliance	Tunji Yusuf (Test Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
2013-08-28	Compliance	Zack Gray (EMC Engineer)	2013.08.28 22:14:13 -07'00'

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 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 Manager:	Tunji Yusuf
Responsible Project Leader:	Zack Gray

2.2 Identification of the Client

Applicant's Name:	Intel Corporation
Street Address:	2200 Mission College MS:SC1-20
City/Zip Code	Santa Clara, CA 94085
Country	USA
Contact Person:	Christine Ryan
Phone No.	+1 (408) 300-2167
e-mail:	Christine.m.ryan@intel.com

2.3 Identification of the Manufacturer

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

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Model Number:	CZ120
FCC-ID :	O2Z-CZ120
IC ID:	1000W-CZ120
Product Description:	Smartphone with multiband GSM/GPRS/EDGE/UMTS/HSPA+, WLAN 802.11 a/b/g/n, Bluetooth, NFC and GPS
Technology / Type(s) of Modulation:	Bluetooth v2.1+EDR, using FHSS with GFSK or π/4 DQPSK or 8DPSK modulation
Operating Frequency Ranges (MHz) / Channels:	Nominal band: 2400 – 2483.5; Center to center: 2402(ch 1) – 2480(ch 79), 79 channels
Antenna info:	Internal Monopole Documented max antenna gain(2.4GHz) = -0.7dBi
Max. Output Powers:	**Measured Conducted output power:** GFSK: 9.07 dBm/ 8.1 mW; π/4DQPSK: 8.77 dBm/ 7.5 mW; 8DPSK: 8.54 dBm/ 7.1 mW **Calculated Radiated output power:** GFSK: 8.37 dBm/ 6.9 mW; π/4DQPSK: 8.07 dBm/ 6.4 mW; 8DPSK: 7.84 dBm/ 6.1 mW
Rated Operating Voltage Range:	Vmin: 3.6V/ Vnom: 3.8V/ Vmax: 4.2V
Rated Operating Temperature Range:	Tmin: -10°C/ Tmax: 55°C
Test Sample Status:	Prototype
Other Radios included:	1. Intel XMM 6360 Radio Module • GSM 850 / 900 / 1800 / 1900 GPRS / EDGE Multislot Class 12 operation • WCDMA / HSPA+ 850 / 900 / 1800 / 2100 2. WLAN 802.11 a/b/g/n Texas Instruments WL 1283 chipset 2.4 and 5.0 GHz bands of operation 3. GPS 1575.42 MHz 4. NFC (13.56 MHz)

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	Sample	HW/SW Version
1	RHBEC2244302235	Radiated	PR2.0 / RHB JB r42-85
2	RHBMB309100061	Radiated	PR2.0 / RHB JB r42-85
3	RHBEC244302204	Conducted	PR2.0 / RHB JB r42-85

3.3 Identification of Support Test Equipment

STE #	Type	Manufacturer	Model	Serial Number
1	AC/DC Adapter	Solcomp	SC1402	12374000330319

3.4 Environmental conditions during Test:

Ambient Temperature: 20-25°C
Relative humidity: 40-60%

3.5 Dates of Testing:

05/10/2013 – 07/15/2013

3.6 Other Testing Notes:

1. The EUT was set in BT Test mode using a development version of the SW available on the device. In this mode, the unit can be connected to a Bluetooth Tester (R&S CBT) to control different modulation schemes, channels etc., as required for testing.
2. The EUT was tested on low, mid and high channels in GFSK, π/4DQPSK and 8DPSK modes.

4 Subject of Investigation

The objective of the measurements applied by CETECOM Inc. was to establish compliance of the EUT as described under Ch. 3 of this Test Report, with the applicable criteria specified in

- FCC CFR47 Parts 15.247, 15.207, 15.209 and
- Industry Canada Radio Standard Specifications RSS-210 Issue 8, RSS-Gen Issue 3

This test report is to support a request for new equipment authorization under the FCC ID**: O2Z-CZX20** and IC ID**: 1000W-CZ120**.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(e) RSS-210 A8.2(b)	Power Spectral Density	Nominal	-	☐	☐	■	☐	Note 1
§15.247(a)(1) RSS-210 A8.1(b)	Carrier Frequency Separation	Nominal	Hopping	■	☐	☐	☐	Complies
§15.247(a)(1)(i) RSS-210 A8.1(d)	Number of Hopping Channels	Nominal	Hopping	■	☐	☐	☐	Complies
§15.247(a)(1)(iii) RSS-210 A8.3(1)	Time of occupancy (Dwell Time)	Nominal	Hopping	■	☐	☐	☐	Complies
§15.247(a)(1) RSS-210 A8.1(a)	Channel Bandwidth	Nominal	GFSK π/4DQPSK 8DPSK	NA	NA	☐	☐	Complies
§15.247(b)(1) RSS-210 A8.4(2)	Maximum Peak Output Power	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(d) RSS-210 A8.5	Band edge compliance-Conducted	Nominal	GFSK π/4DQPSK 8DPSK	☐	☐	☐	■	Note 2
§15.247(d) RSS-210 A8.5	Band edge compliance-Radiated	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(d) RSS-210 A8.5	TX Spurious emissions-Conducted	Nominal	GFSK π/4DQPSK 8DPSK	■	☐	☐	☐	Complies
§15.247(d) RSS-210 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) RSS Gen	Conducted Emissions <30MHz	Nominal	GFSK	■	☐	☐	☐	Complies

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

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

6 Measurements

6.1 Measurement Method:

Ref: FCC Public Notice DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems|

6.2 Radiated Measurement Procedure

ANSI C63.4 (2009) 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 (2009) 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.
Radiated Measurement Uncertainty: ±3dB

6.3 Sample Calculations for Radiated Measurements

6.3.1.1 Field Strength Measurements:

Measurements from the Spectrum Analyzer/ Receiver is used to calculate the Field Strength, taking into account the following parameters:

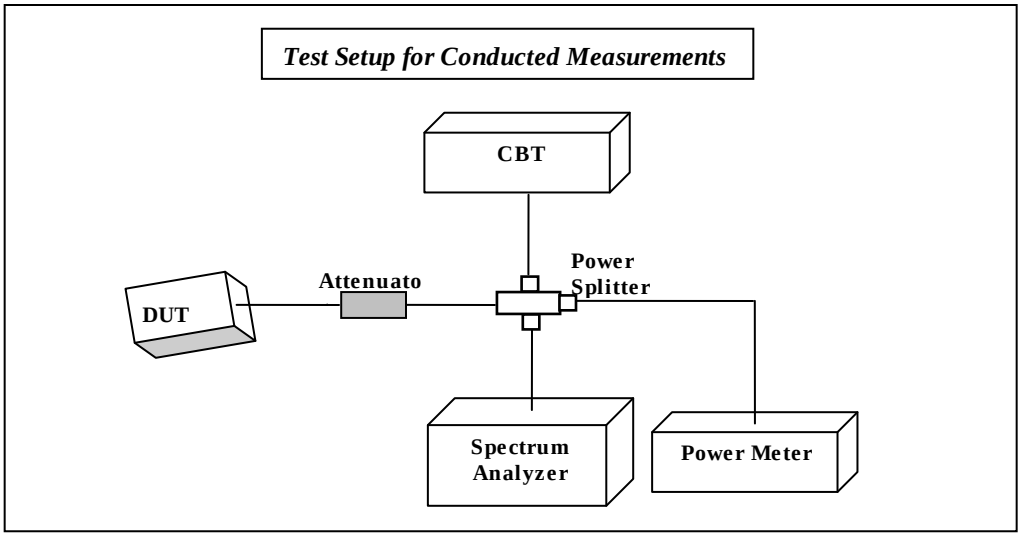
1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

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

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the above equation.

6.4 Conducted Measurement Procedure



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the CBT (Rohde-Schwarz Bluetooth Tester) to connect the EUT at the required mode of test.
3. Measurements are to be performed with the EUT set to the low, middle and high channels and for GFSK, π/4DQPSK and 8DPSK modulation schemes.

Measurement uncertainty for all conducted measurements: +/-0.5dB

6.5 Maximum Peak Output Power

6.5.1 Limits:

6.5.1.1 §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.

6.5.1.2 RSS-210- A8.4(2)

Nominal Peak Output Power < 30 dBm (1W)

6.5.2 Test Conditions:

Tnom: 20ºC; Vnom: 3.8 V
Hopping OFF

6.5.3 Test Procedure:

Measurement according to DA 00-705

Measurement Settings:

Conducted output power measured using a CBT (Bluetooth Tester).
Radiated EIRP calculated using the formula= Conducted Power+ Antenna Gain.
Rated max. Antenna Gain (dBi): -0.7 dBi

6.5.4 Test Result:

Measured Max Peak Output Power- Conducted (dBm)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	7.85	8.68	9.07
π/4 DQPSK	7.52	8.4	8.77
8-DPSK	7.3	8.15	8.54

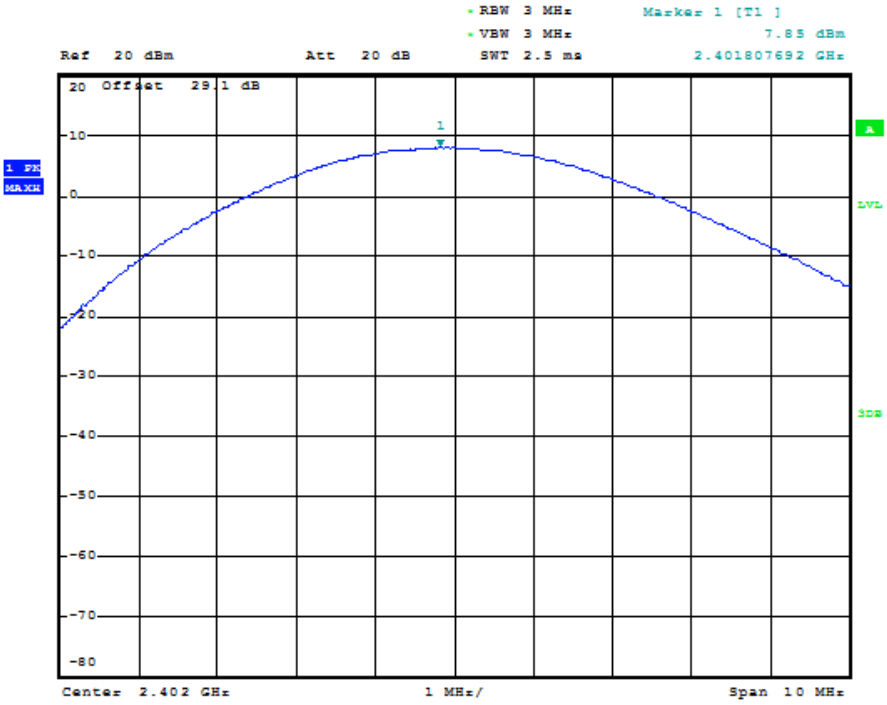
Calculated Max Peak Output Power- Radiated EIRP (dBm)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	7.15	7.18	8.37
π/4 DQPSK	6.82	6.7	8.07
8-DPSK	6.7	7.45	7.84

Note: EIRP = ***Conducted Measurement Result + Antenna Gain (dBi)***

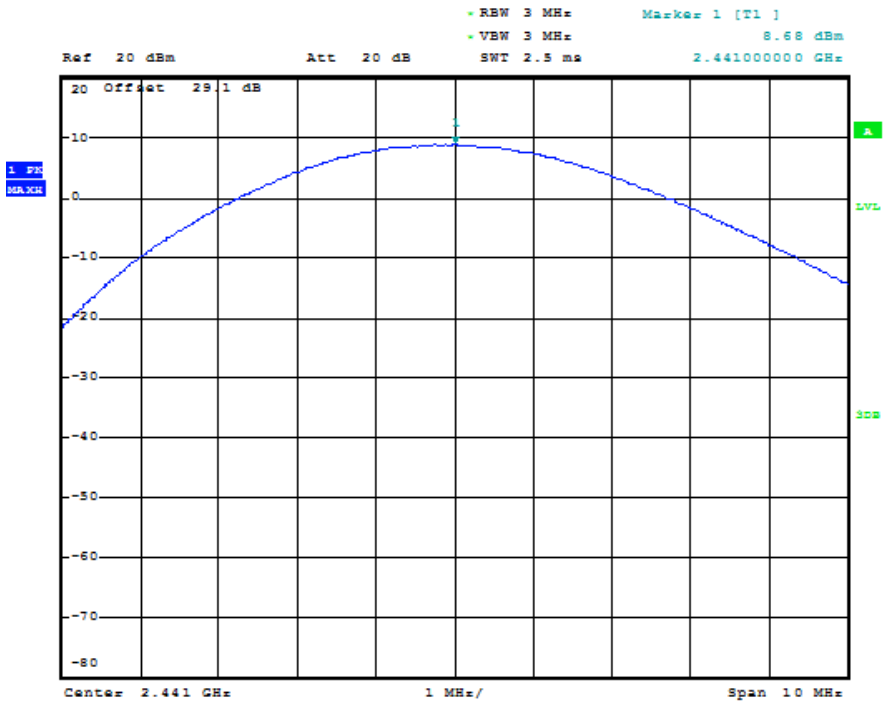
6.5.4.1 Measurement Verdict:
Pass.

6.5.5 Test Data/plots:

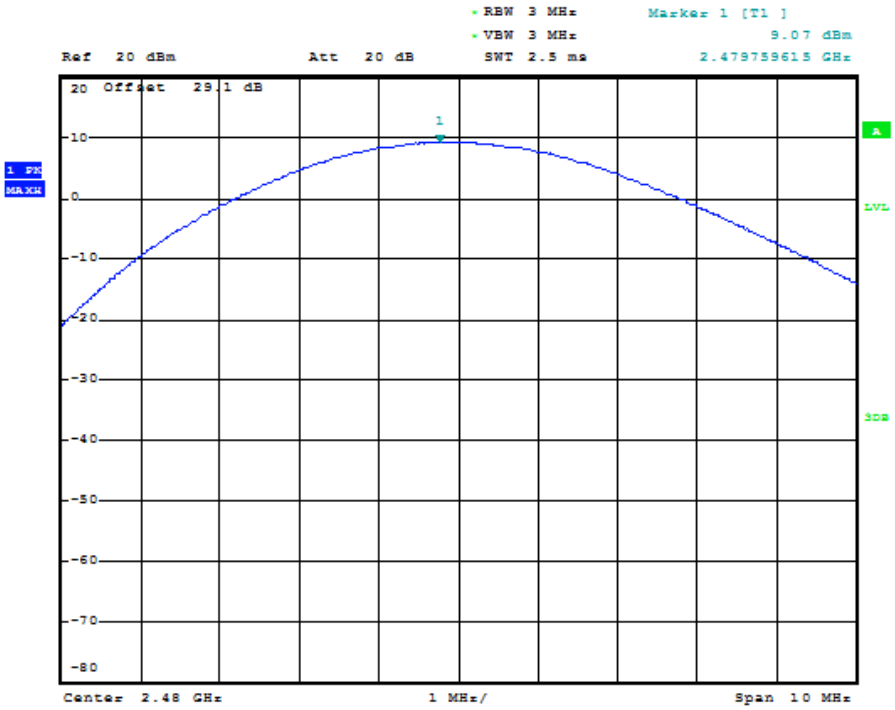
Conducted Peak Power GFSK 2402 MHz



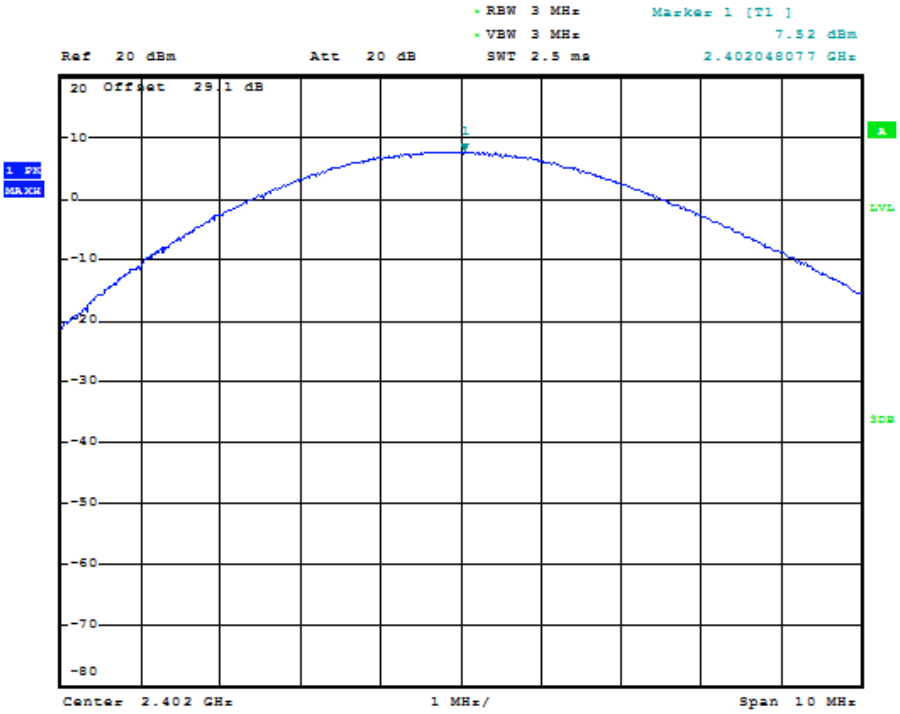
Conducted Peak Power GFSK 2441 MHz



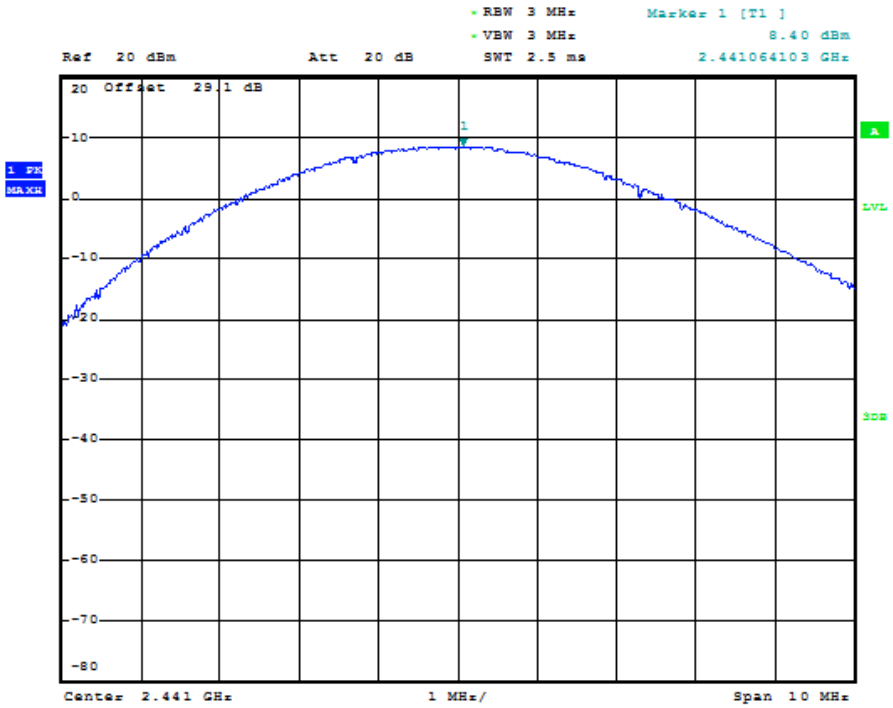
Conducted Peak Power GFSK 2480 MHz



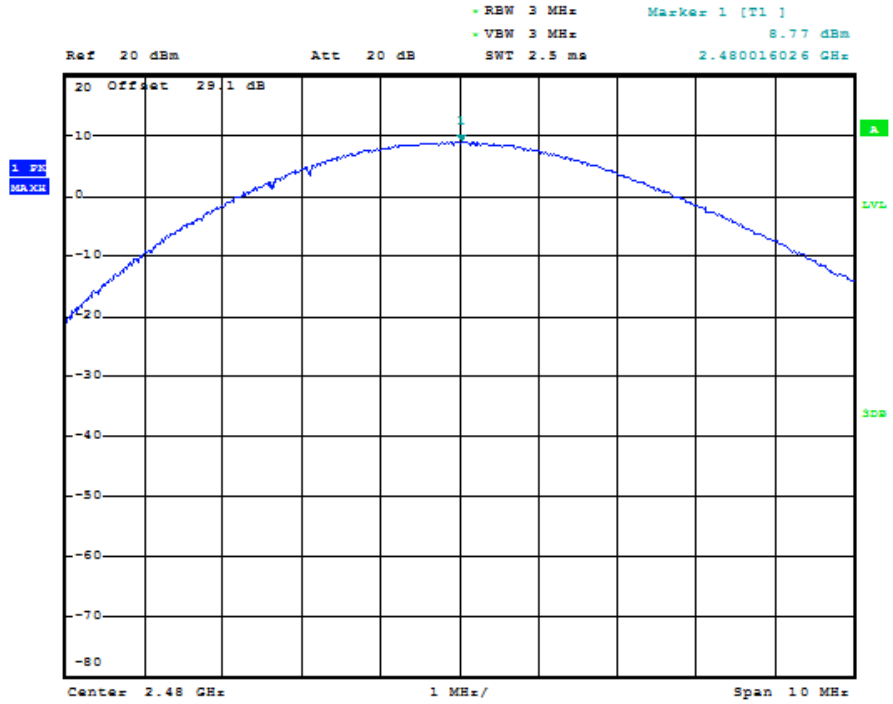
Conducted Peak Power π / 4 DQPSK 2402 MHz



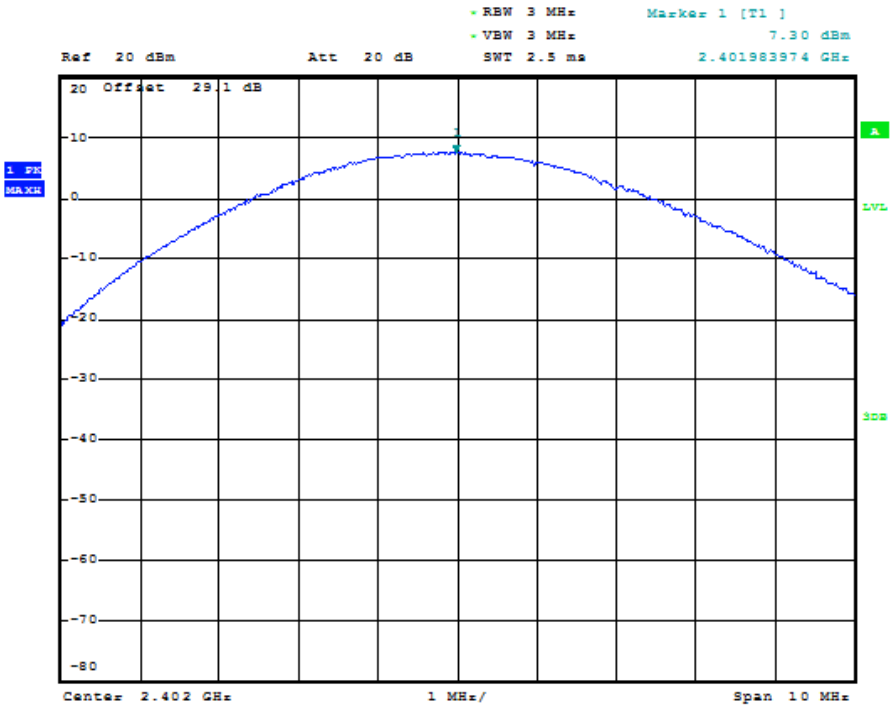
Conducted Peak Power π / 4 DQPSK 2441 MHz



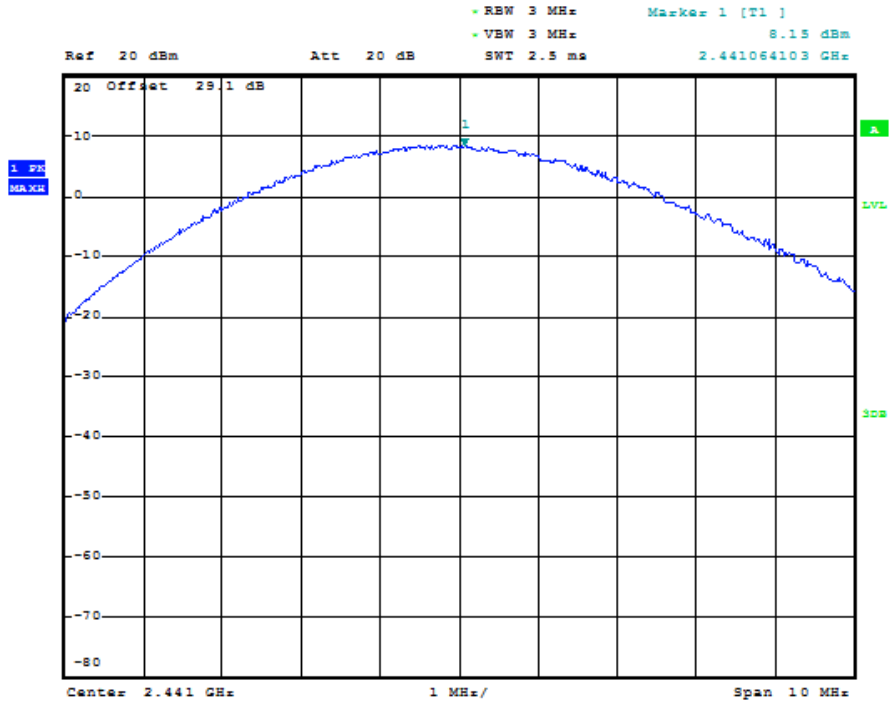
Conducted Peak Power π / 4 DQPSK 2480 MHz



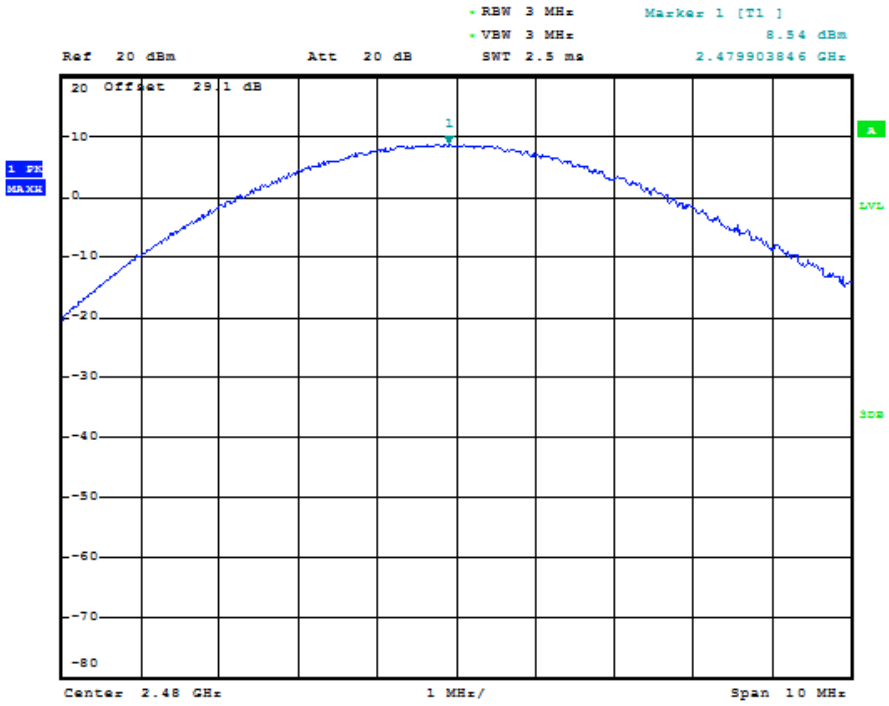
Conducted Peak Power 8DPSK 2402 MHz



Conducted Peak Power 8DPSK 2441 MHz



Conducted Peak Power 8DPSK 2480 MHz



6.6 Channel Bandwidth/ 20dB Bandwidth

20 dB Channel Bandwidth is measured to determine minimum carrier frequency separation distance.

6.6.1 Test Conditions:

Tnom: 20ºC; Vnom: 3.8V
Hopping OFF

6.6.2 Test Procedure:

Measurement according to DA 00-705
Spectrum Analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Measurements taken at 20dB below peak.

6.6.3 Test Result:

20dB Bandwidth (MHz)			
Modulation	**Frequency (MHz)**		
	2402	**2441**	**2480**
GFSK	1.04	1.04	1.04
π/4 DQPSK	1.14	1.15	1.17
8-DPSK	1.21	1.20	1.21
Measurement Uncertainty: ±10 kHz			

6.6.3.1 Measurement Verdict:

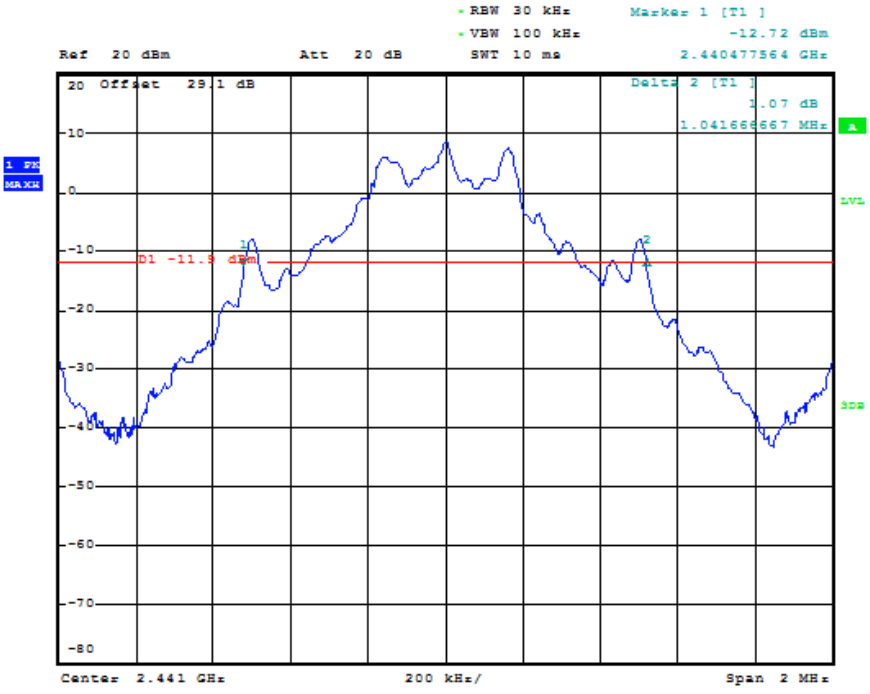
Since 2/3 of each of the above measured 20 dB channel bandwidth values of the 2.4 GHz hopping system at hand are greater than 25kHz and since also the output power is lower than 125 mW (see section 6.5), the minimum channel carrier frequency separation distance should be 2/3 of the maximum values listed above. (FCC part 15.247 (a)(1) and RSS-210 annex 8.1(b).

Channel Carrier minimum frequency separation distances are thus:
GFSK: 693 kHz
π/4 DQPSK: 780 kHz
8-DPSK: 806.7 kHz

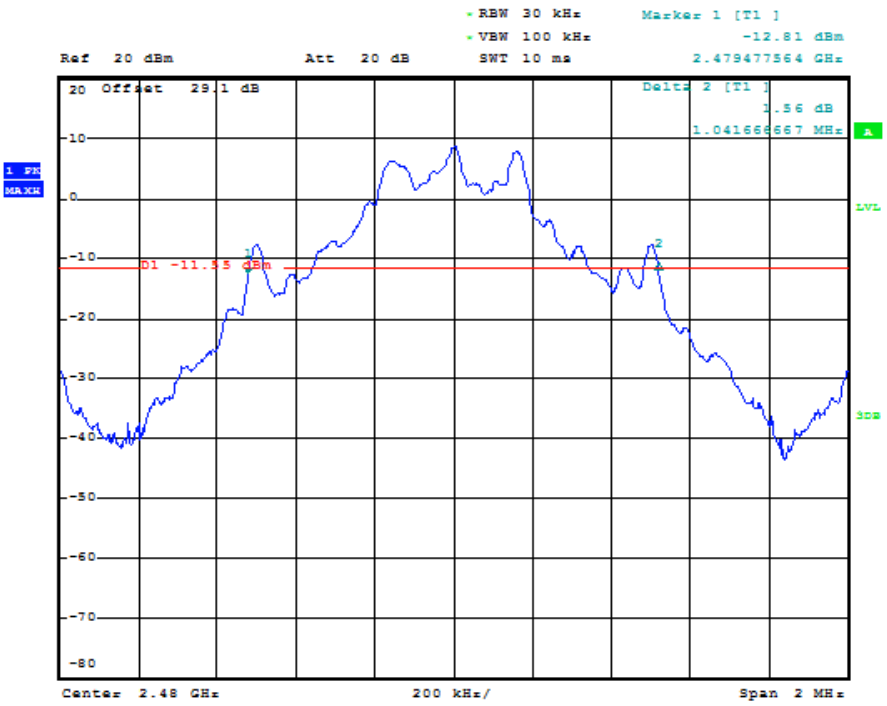
6.6.4 Test Data/plots:

20dB Bandwidth GFSK 2402MHz

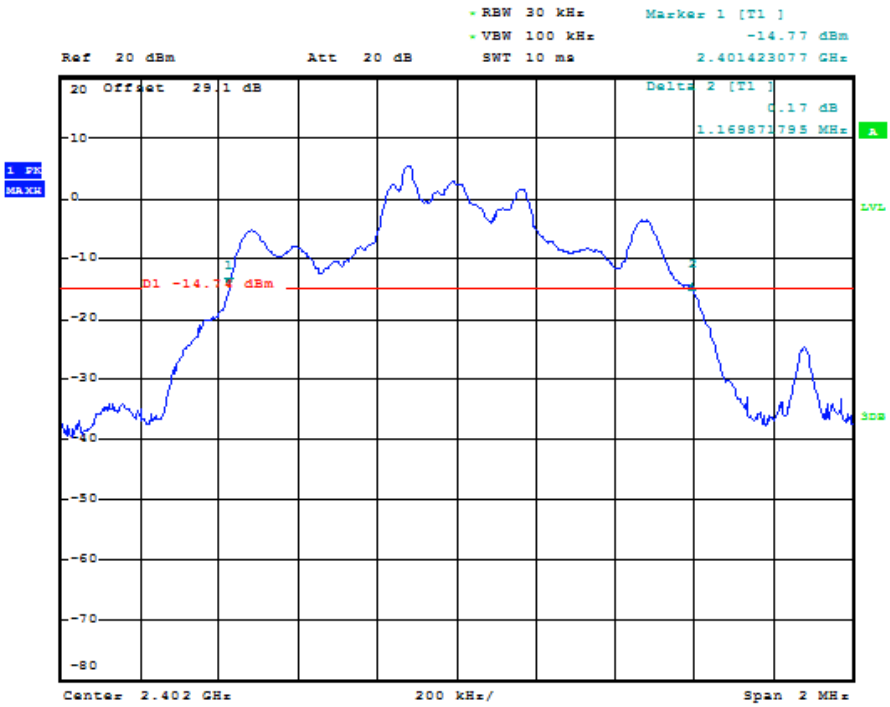
20dB Bandwidth GFSK 2441MHz



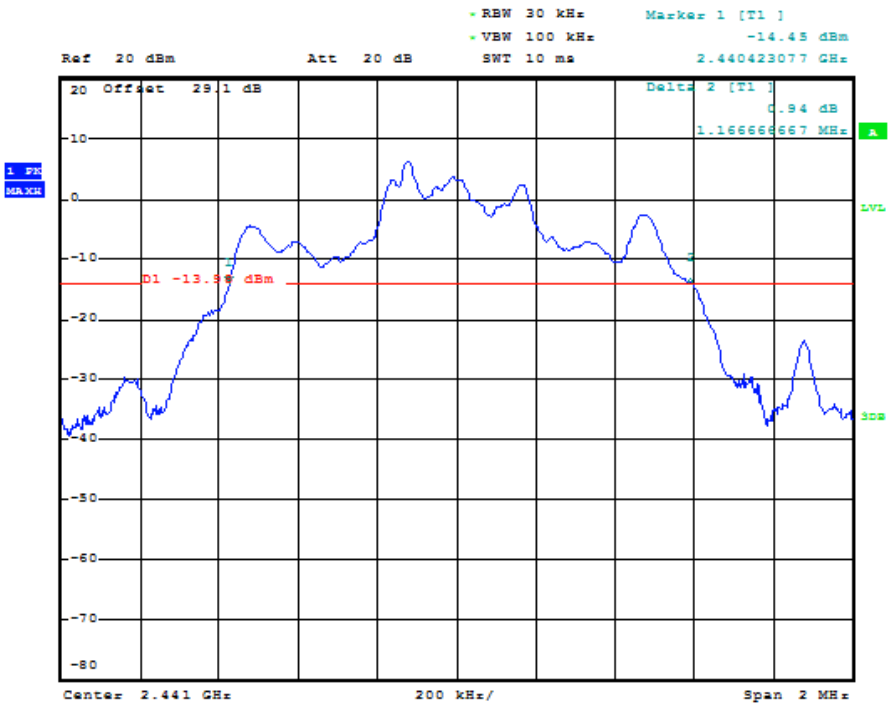
20dB Bandwidth GFSK 2480MHz



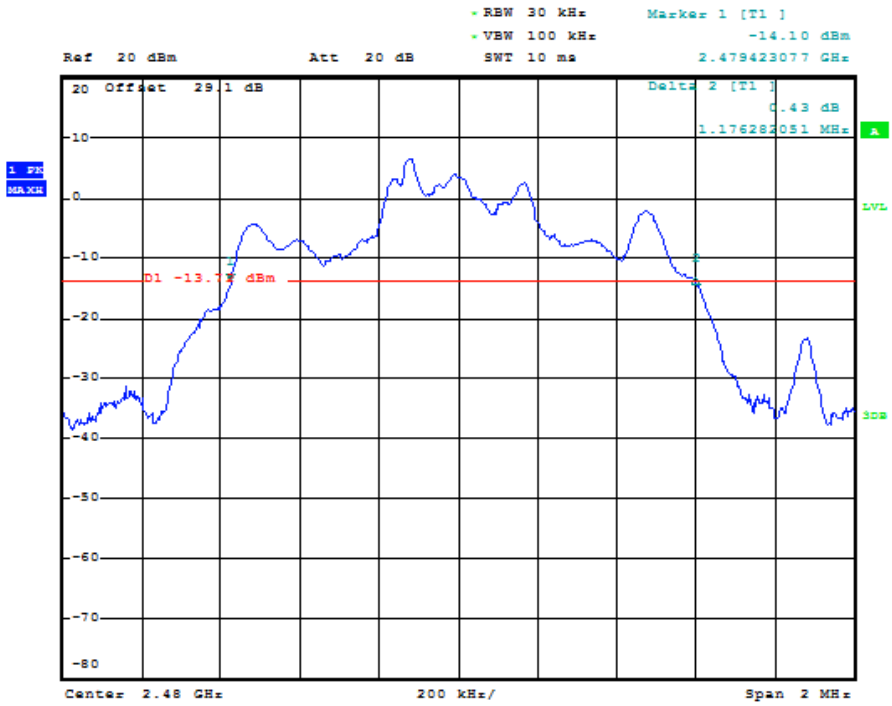
20dB Bandwidth π / 4 DQPSK 2402MHz



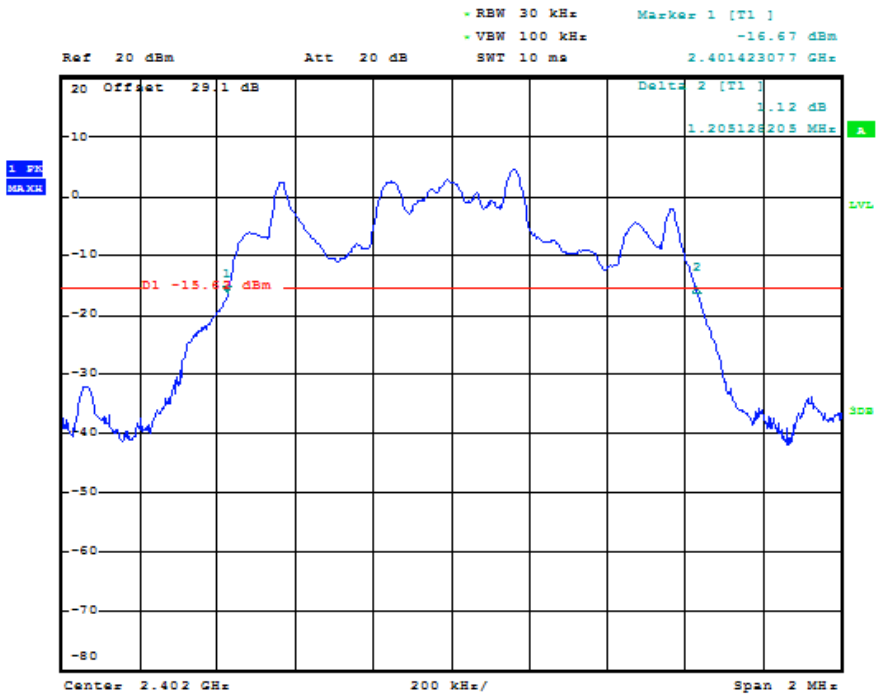
20dB Bandwidth π / 4 DQPSK 2441MHz



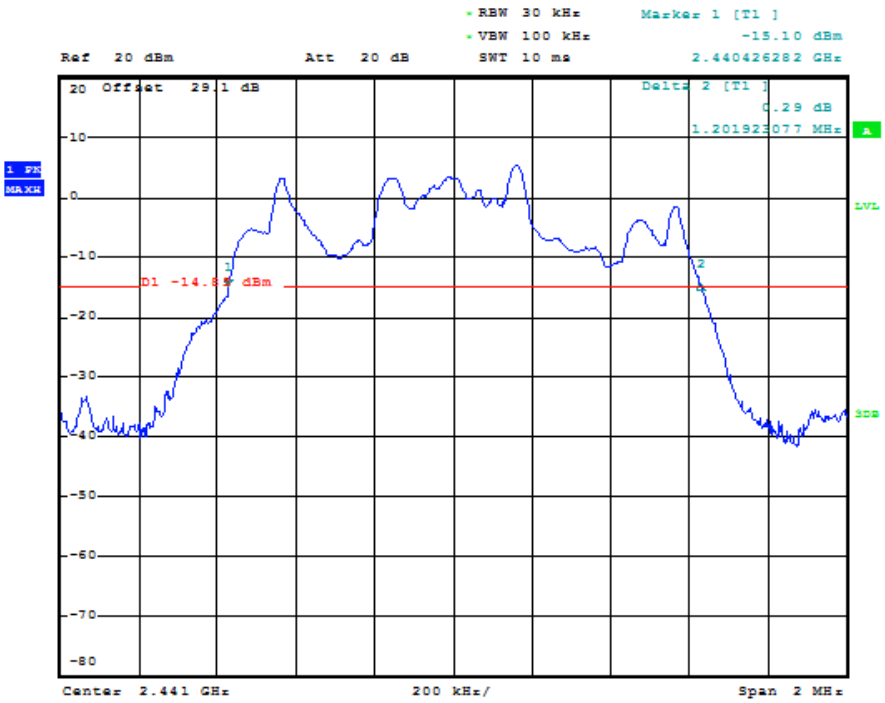
20dB Bandwidth π / 4 DQPSK 2480MHz



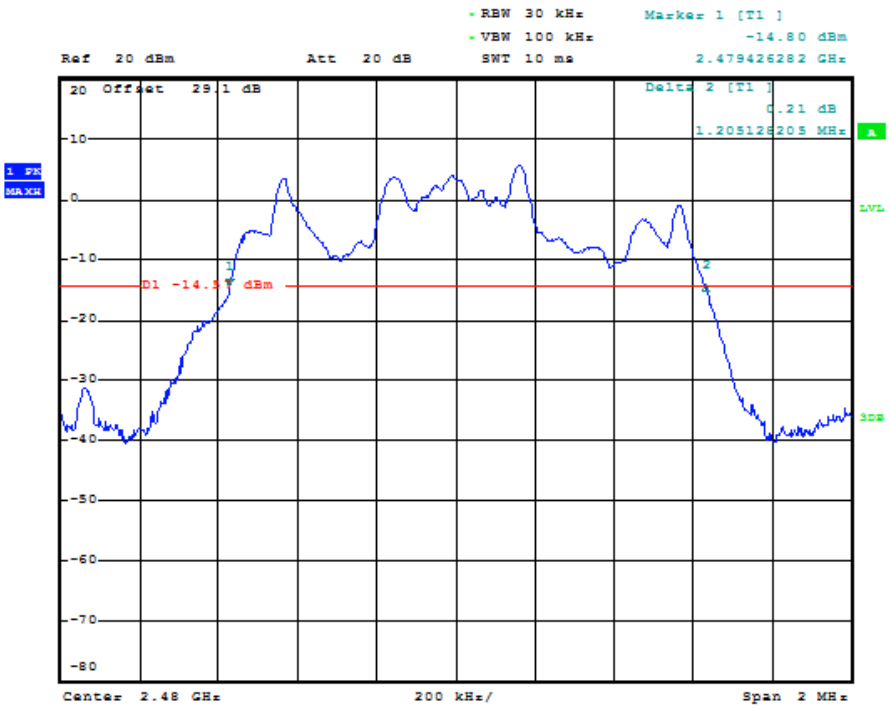
20dB Bandwidth 8DPSK 2402MHz



20dB Bandwidth 8DPSK 2441MHz



20dB Bandwidth 8DPSK 2480MHz



6.7 Carrier Frequency Separation

6.7.1 Limits:

§ 15.247 (a) (1)
RSS-210- A8.1(b)
For the 2.4GHz hopping system at hand, having less than 125 mW output power: 2/3 of the 20dB channel bandwidth as measured and listed under section 6.6 above.

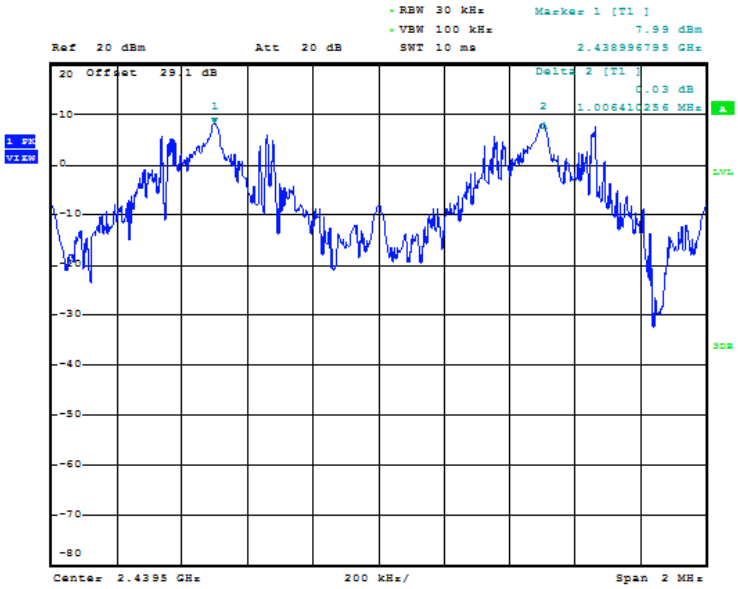
6.7.2 Test Conditions:

Tnom: 20 C; Vnom: 3.8
Hopping ON

6.7.3 Test Procedure:

Measurement according to DA 00-705
Spectrum Analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
Video (or Average) Bandwidth (VBW) ≥ RBW
Sweep = auto; Detector function = peak; Trace = max hold

6.7.4 Test Data/plot:



6.7.5 Test Result:

Modulation: GFSK
Channel Separation: 1.0 MHz

6.7.5.1 Measurement Verdict:

Pass. The measurement exceeds the minimum limits set in section 6.6.3.1.

6.8 Number of Hopping Channels

6.8.1 Limits:

§ 15.247 (a) (1)

RSS-210- A8.1(d)

Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

6.8.2 Test Conditions:

Tnom: 20ºC; Vnom: 3.8 V

Hopping ON

6.8.3 Test Procedure:

Measurement according to DA 00-705

Spectrum Analyzer settings:

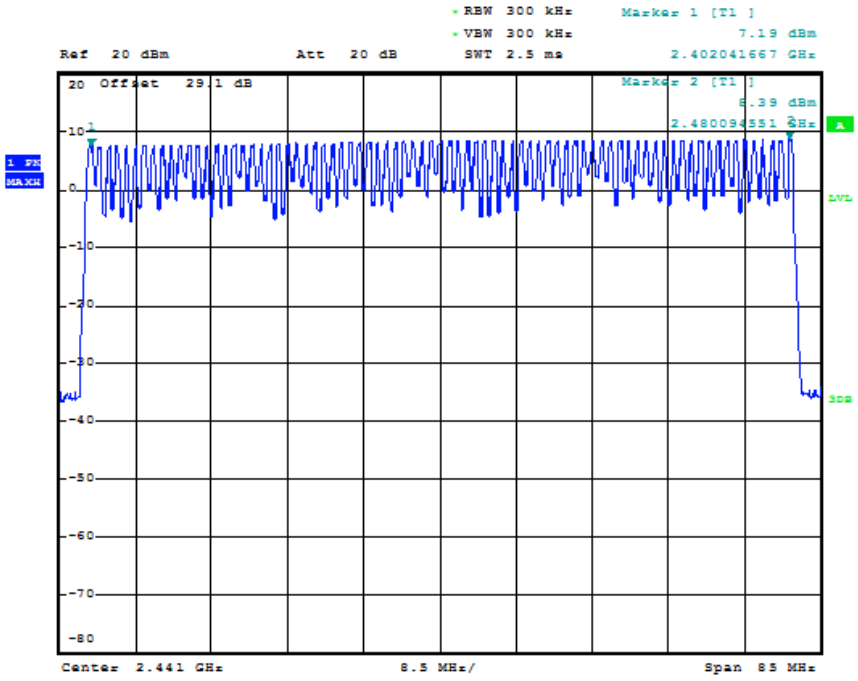
Span = the frequency band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto; Detector function = peak; Trace = max hold

6.8.4 Test Data/plot:



6.8.5 Test Result:

Modulation: GFSK

Number of hopping channels: 79

6.8.5.1 Measurement Verdict:

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 Conditions:

Tnom: 20ºC; Vnom: 3.8 V
Hopping ON

6.9.3 Test Procedure:

Measurement according to DA 00-705
Spectrum Analyzer settings:
Span = zero span, centered on a hopping channel
RBW = 1 MHz
VBW ≥ RBW
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold

6.9.4 Test Result:

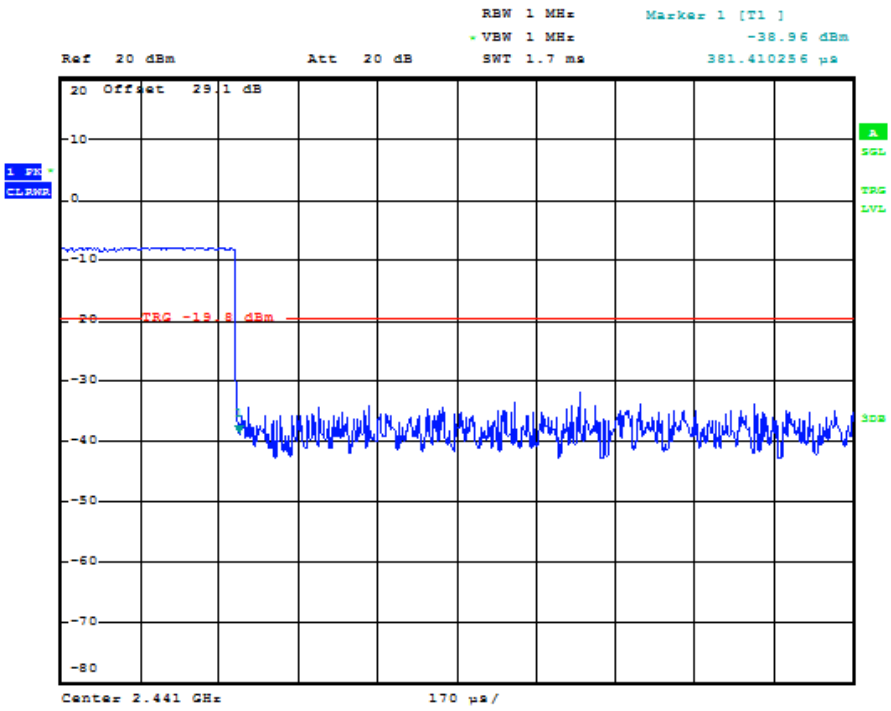
Packet Type	Tx-on Time (ms)	max. number of transmissions per channel in 31.6 sec assuming even distributions over 79 channels	Dwell Time (ms)= (Pulse width * Number of transmissions)	Limit (ms)
DH-1	0.381	(1600 hopping slots per second*31.6 seconds) / (2 slots used per hop * 79 channels) = **320**	121.92	400
DH-3	1.65	(1600 hopping slots per second*31.6 seconds) / (4 slots used per hop * 79 channels) = **160**	264	400
DH-5	2.90	(1600 hopping slots per second*31.6 seconds) / (6 slots used per hop * 79 channels) = **106.67**	309.34	400

6.9.4.1 Measurement Verdict

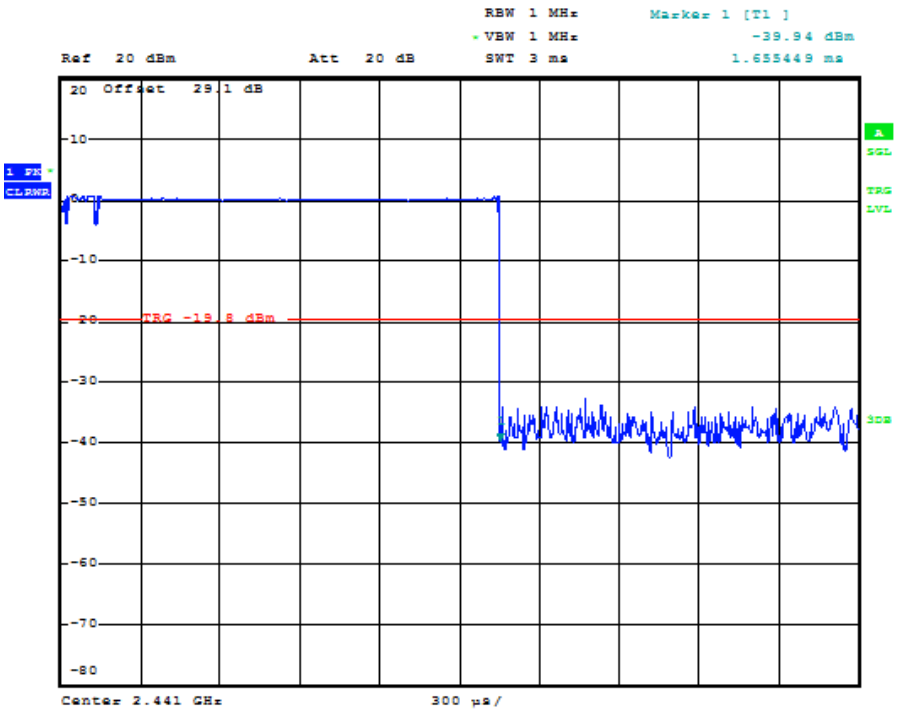
Pass.

6.9.5 Test Dat/plots:

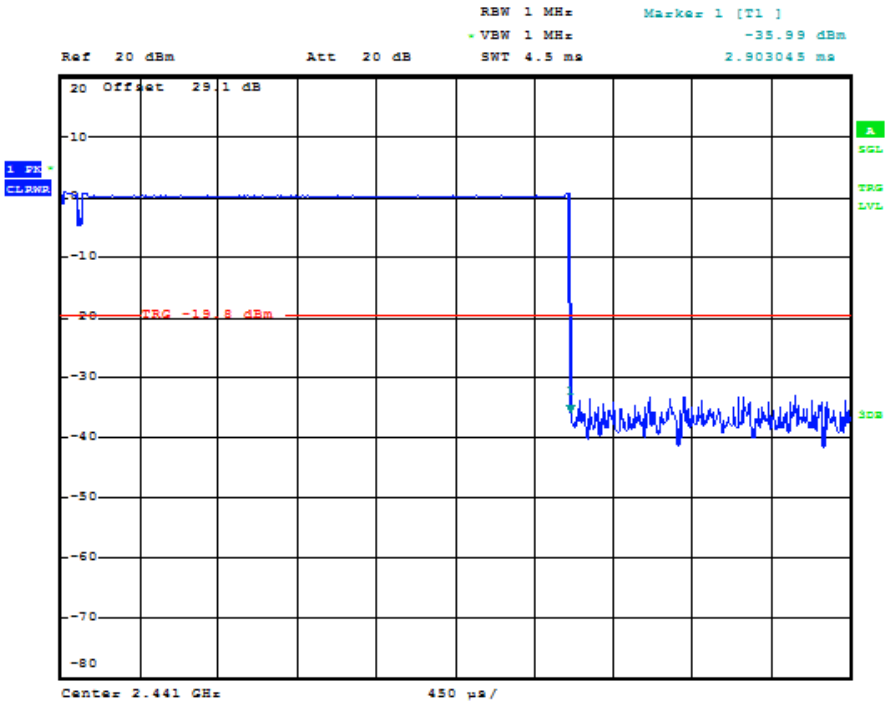
DH1



DH3



DH5


RBW 1 MHz
VBW 1 MHz
SWT 4.5 ms
Marker 1 [T1]
-35.99 dBm
2.903045 ms
Ref 20 dBm
Att 20 dB
Offset 29.1 dB
TRG -15.8 dBm
Center 2.441 GHz
450 µs/

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

6.11.2 Test Conditions:

Tnom: 20ºC; Vnom: 3.8 V
Hopping OFF

6.11.3 Test Procedure:

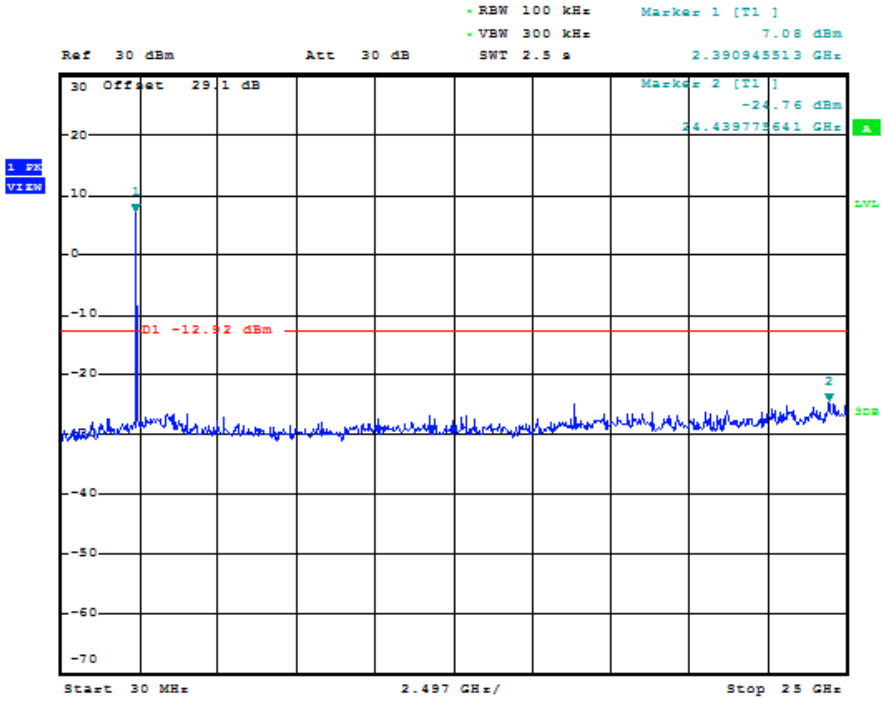
Measurement according to DA 00-705
Spectrum Analyzer settings:
Span = Full
RBW = 100 kHz; VBW ≥ RBW
Sweep = auto
Detector function = peak; Trace = max hold

6.11.4 Test Result:

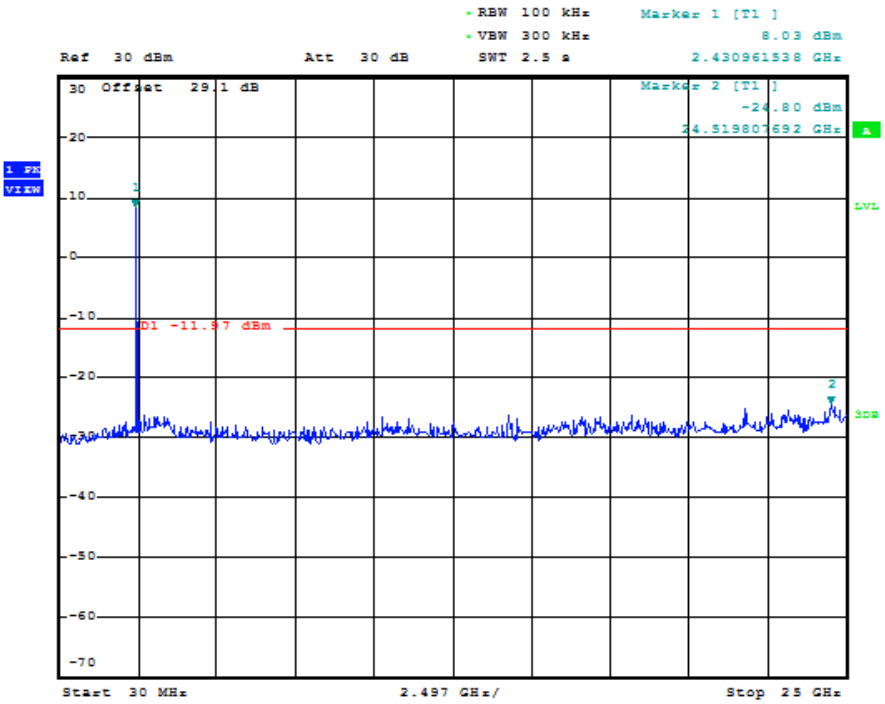
Conducted Spurious Emissions					
Channel	**Frequency (MHz)**	**Amplitude (dBm)**			**Limits**
		GFSK	**π/4DQPSK**	**8DPSK**	
Low	**2402**	7.08	5.27	2.21	
	Spurious	All other peaks >20dB below limit			-20dBc
Mid	**2441**	8.03	6.12	3.1	
	Spurious	All other peaks >20dB below limit			-20dBc
High	**2480**	8.38	6.39	3.43	
	Spurious	All other peaks >20dB below limit			-20dBc
Measurement Uncertainty: ±1.0 dB					

6.11.5 Test data/ plots:

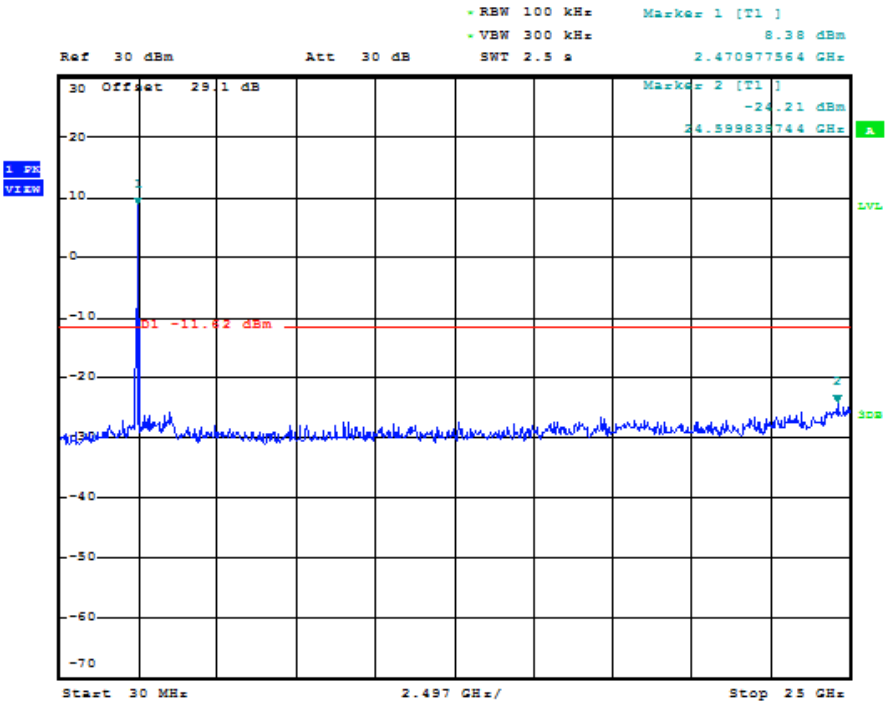
Conducted Spurious Emissions GFSK 2402MHz



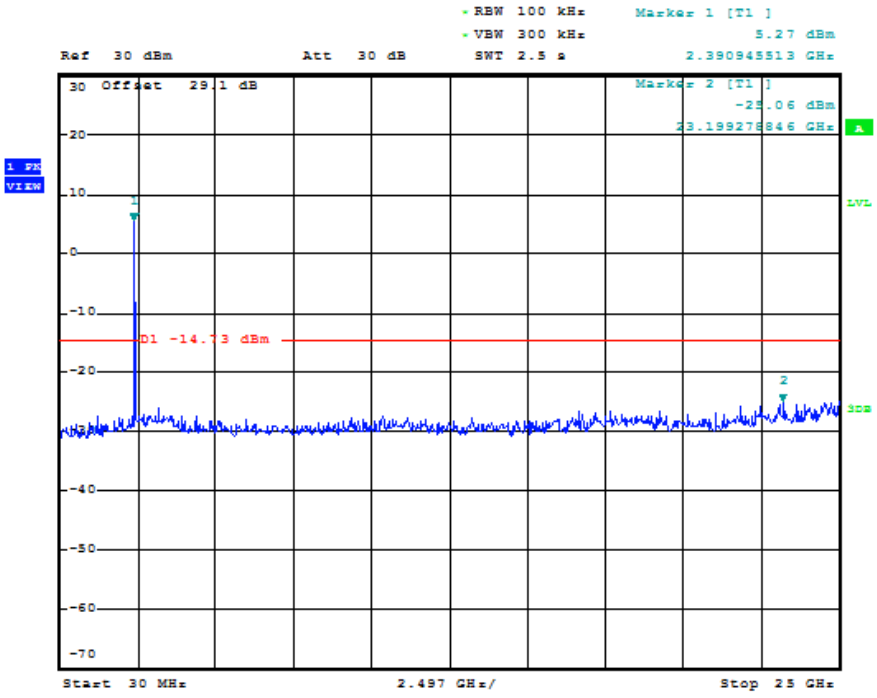
Conducted Spurious Emissions GFSK 2441MHz



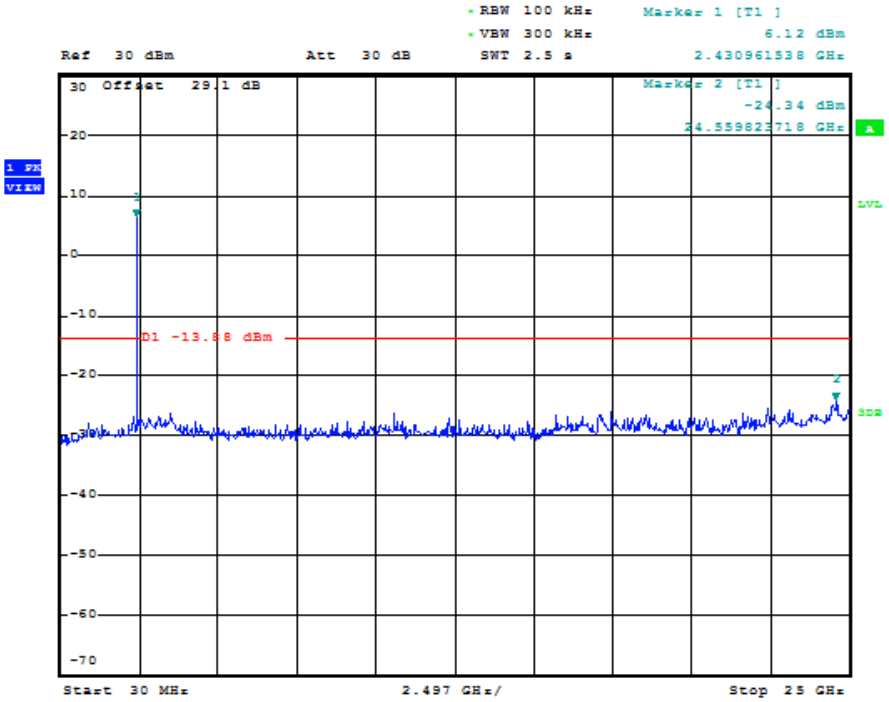
Conducted Spurious Emissions GFSK 2480MHz



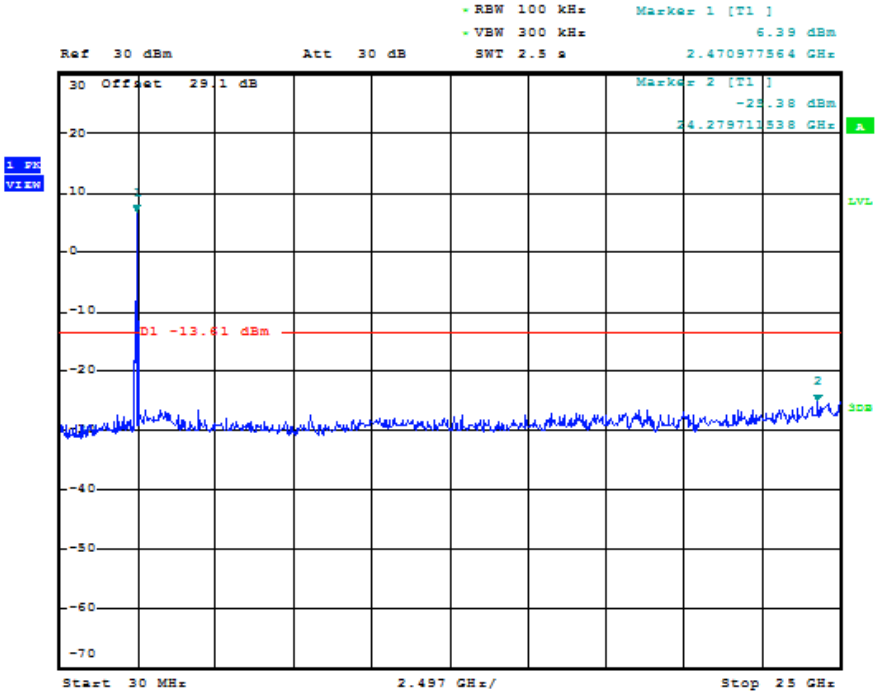
Conducted Spurious Emissions π / 4 DQPSK 2402MHz



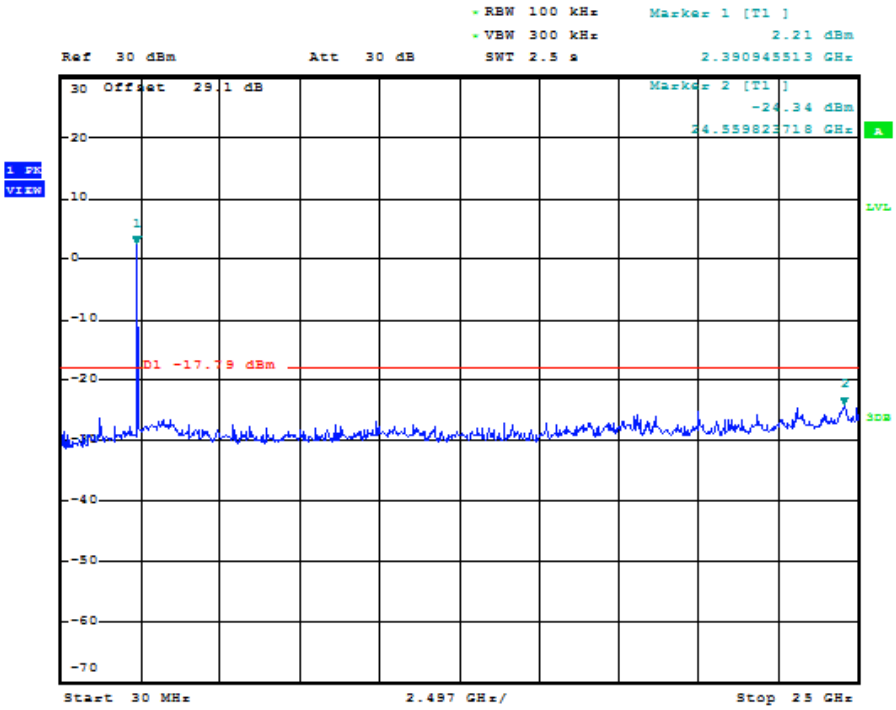
Conducted Spurious Emissions π / 4 DQPSK 2441MHz



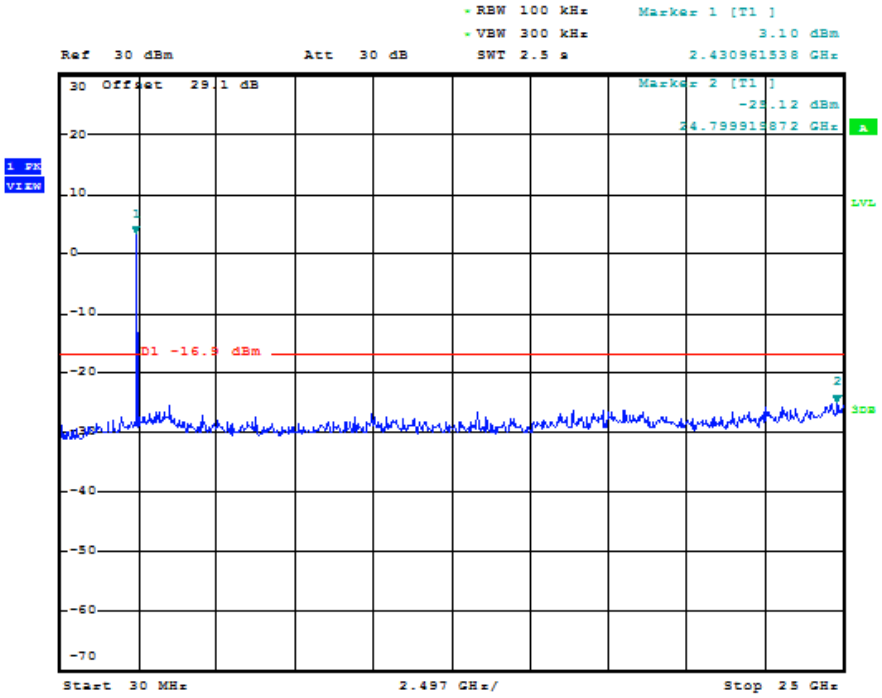
Conducted Spurious Emissions π / 4 DQPSK 2480MHz



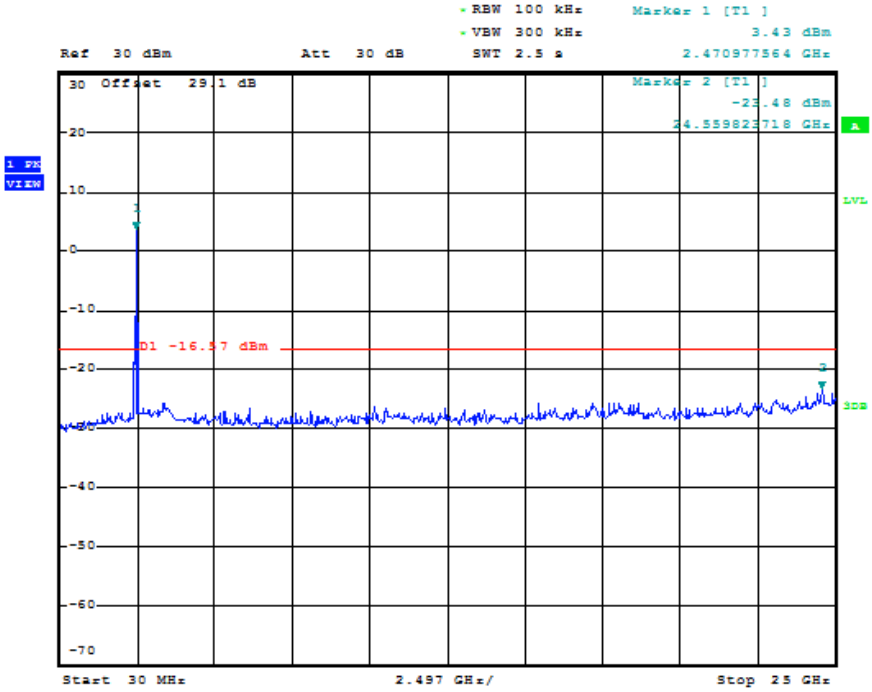
Conducted Spurious Emissions 8DPSK 2402MHz



Conducted Spurious Emissions 8DPSK 2441MHz



Conducted Spurious Emissions 8DPSK 2480MHz



6.11.5.1 Measurement Verdict:

Pass.

6.12 Restricted Band Edge Compliance

6.12.1 Reference and Limits: §15.247/15.205/15.209; 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			

15.209 (a) Emission Limits:

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30 (29.5 dBµV/m)	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:

Tnom: 20ºC; Vnom: 3.8V
Hopping OFF

6.12.3 Measurement Procedure:

Peak measurements are made using a peak detector and RBW=1MHz.
*PEAK LIMIT= 74dBµV/m

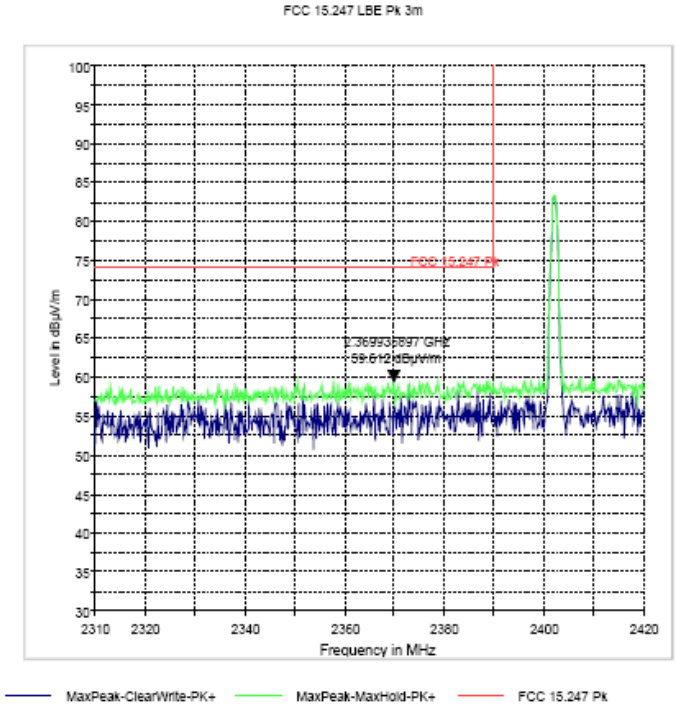
Average measurements performed using a peak detector and according to video averaging procedure with RBW=1MHz and VBW=10Hz.
*AVG. LIMIT= 54dBµV/m

6.12.3.1 Measurement Verdict

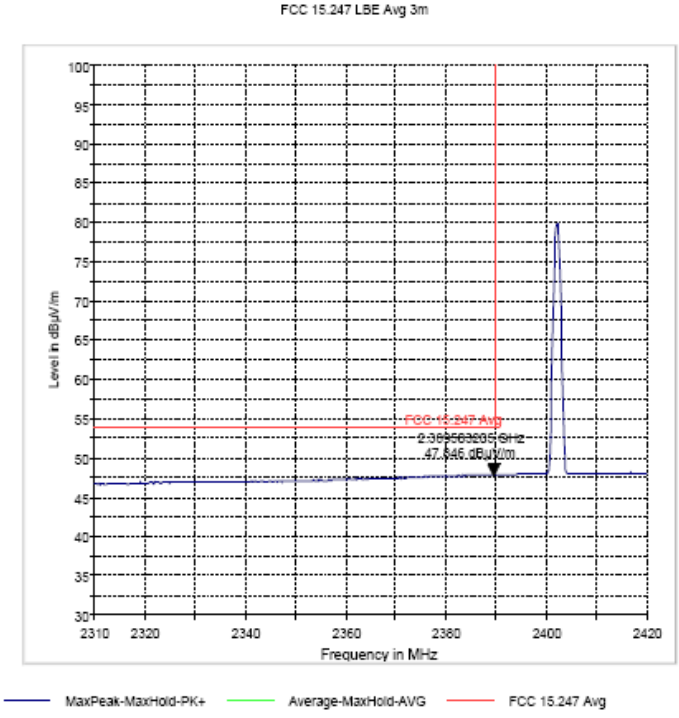
Pass.

6.12.4 Test Data/plots:

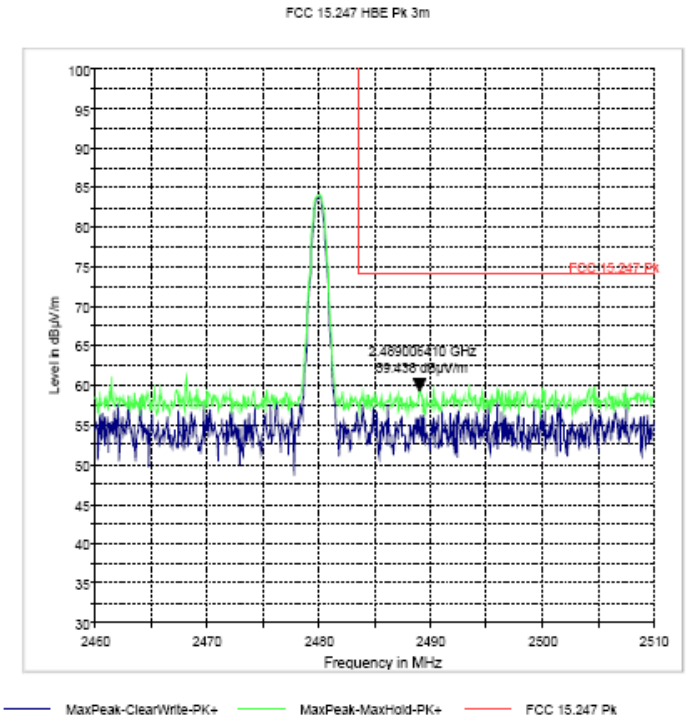
Lower band edge peak -GFSK modulation



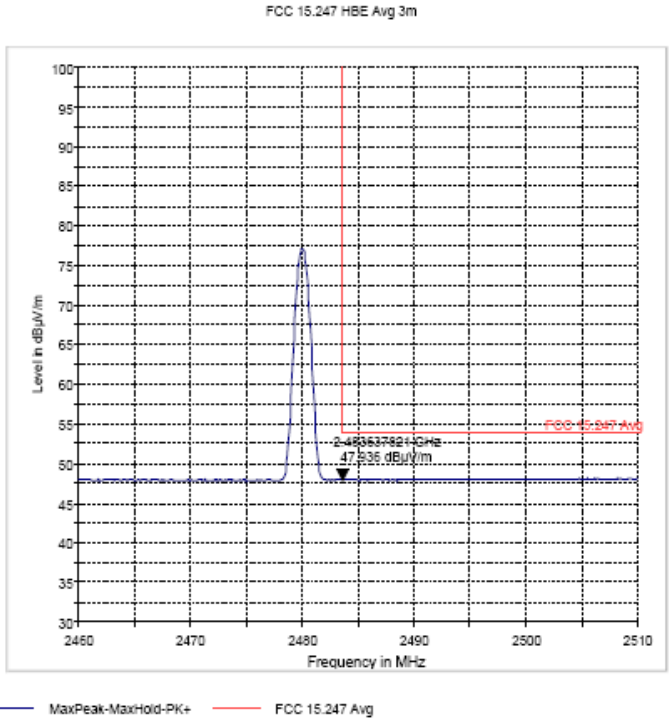
Lower band edge average -GFSK modulation



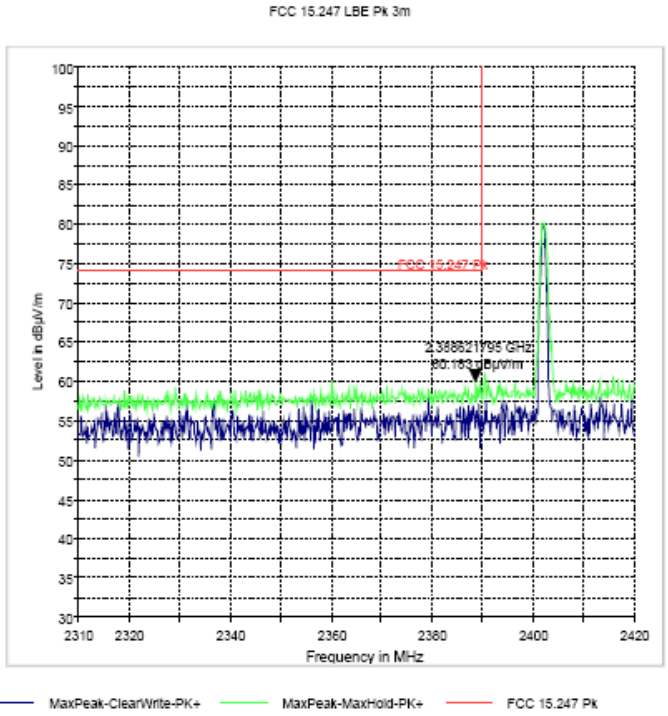
Higher band edge peak -GFSK modulation



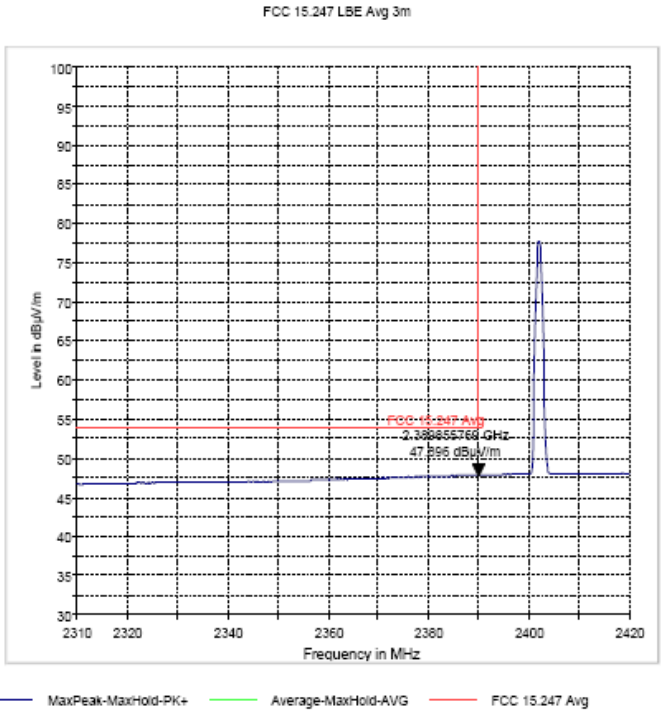
Higher band edge average-GFSK modulation



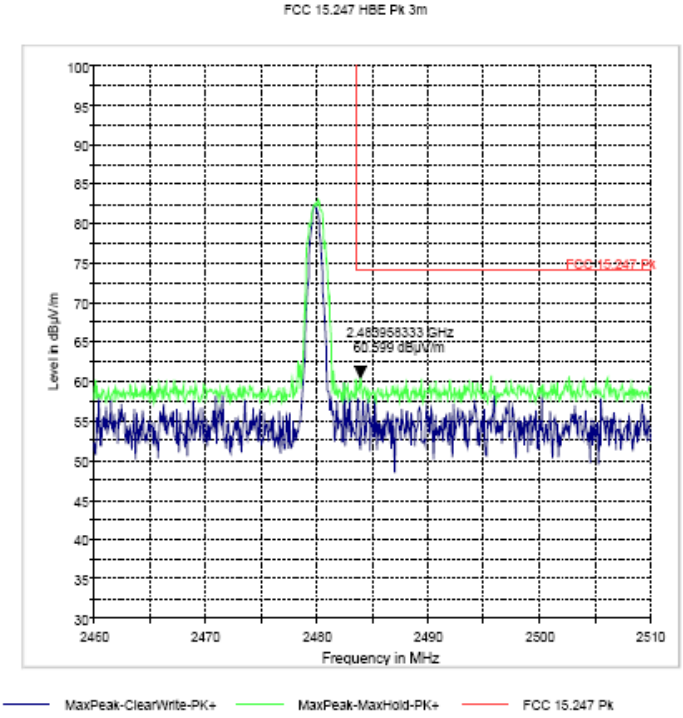
Lower band edge peak - π/4 DQPSK modulation



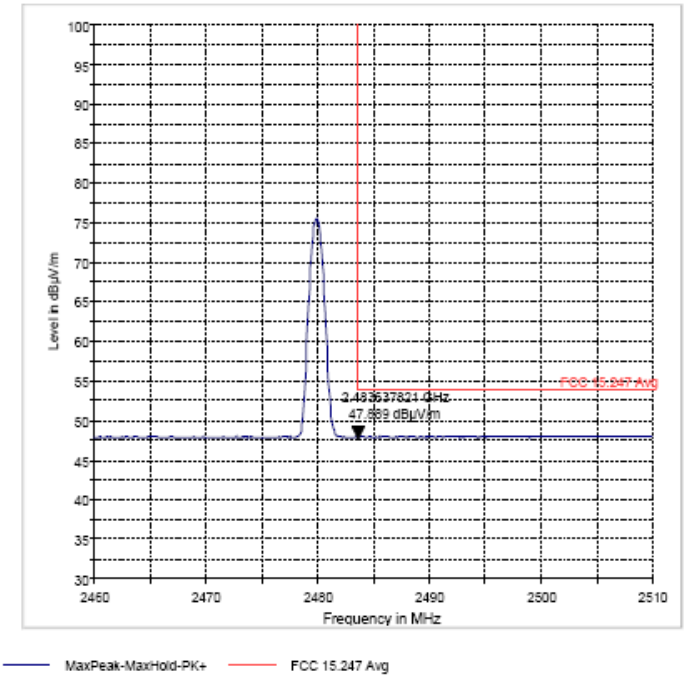
Lower band edge average -π/4 DQPSK modulation



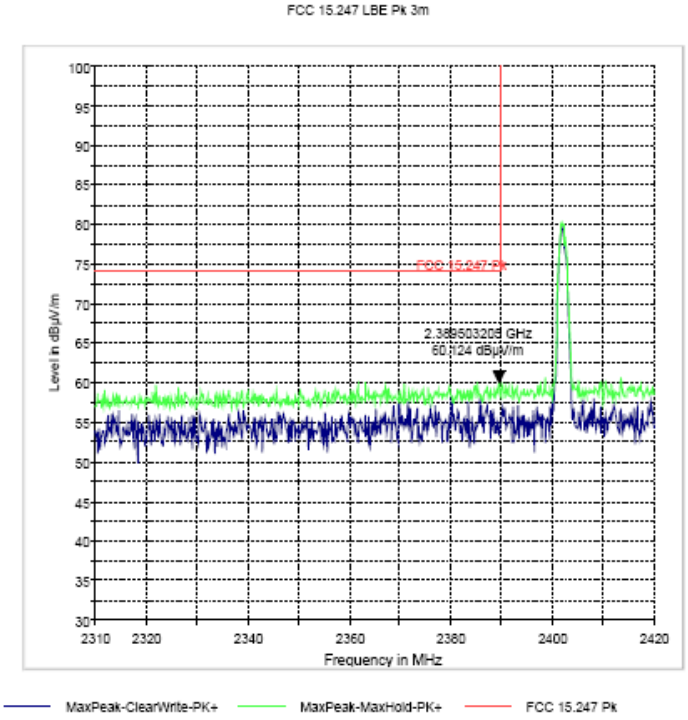
Higher band edge peak -π/4 DQPSK modulation



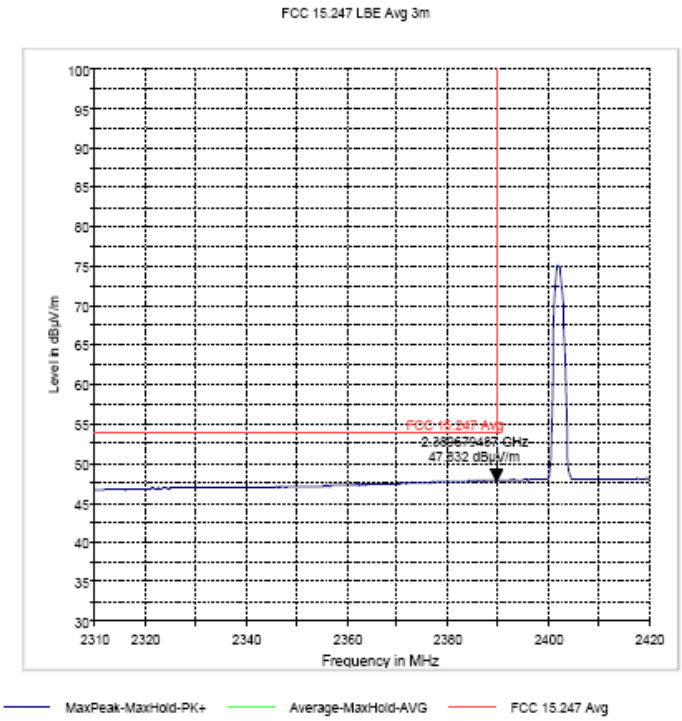
Higher band edge average- π/4 DQPSK modulation



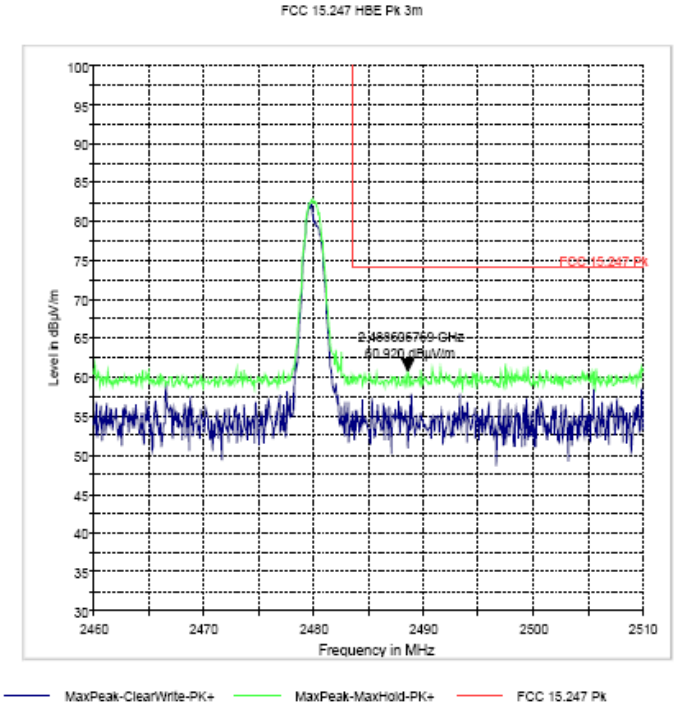
Lower band edge peak - 8DPSK modulation



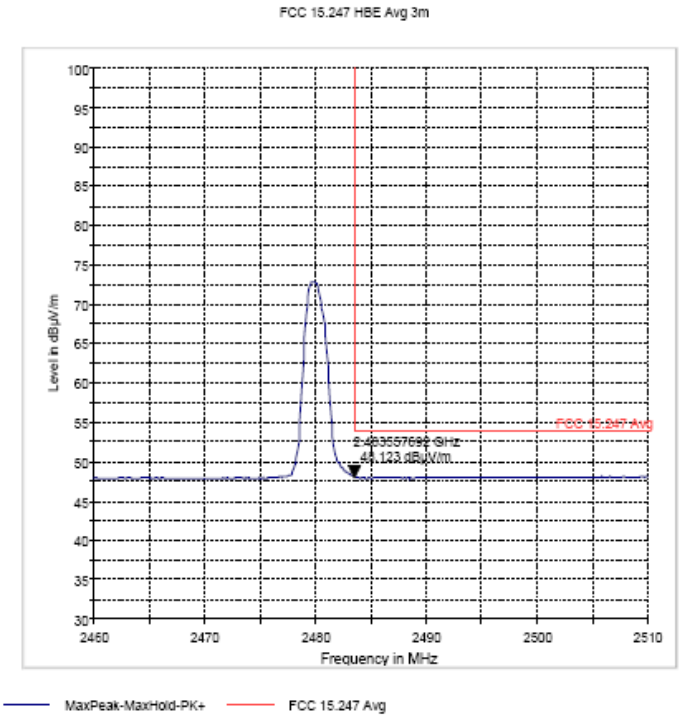
Lower band edge average -8DPSK modulation



Higher band edge peak - 8DPSK modulation



Higher band edge average-8DPSK modulation



6.13 Transmitter Spurious Emissions- Radiated

6.13.1 Reference and Limits:

§15.247/15.205/15.209;
RSS-Gen Section 4.9; RSS-210-A8.5

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30 (29.5 dBµV/m)	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

6.13.2 Test Result:

The device was set to operate in GFSK test mode (highest conducted output power) and measurement results as reported here, represents the worst case radiated spurious emissions.
Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.
For radiated measurements, all data in this report shows the worst case emissions data between H/V antenna polarizations and for all 3 orthogonal orientations of the EUT.

6.13.3 Test Conditions:

Tnom: 20ºC; Vnom: 3.8 V
Hopping OFF

6.13.4 Measurement Procedure:

Peak measurements are made using a peak detector and RBW=120kHz (<1GHz) and RBW= 1MHz (>1GHz)

6.13.5 Testing Notes:

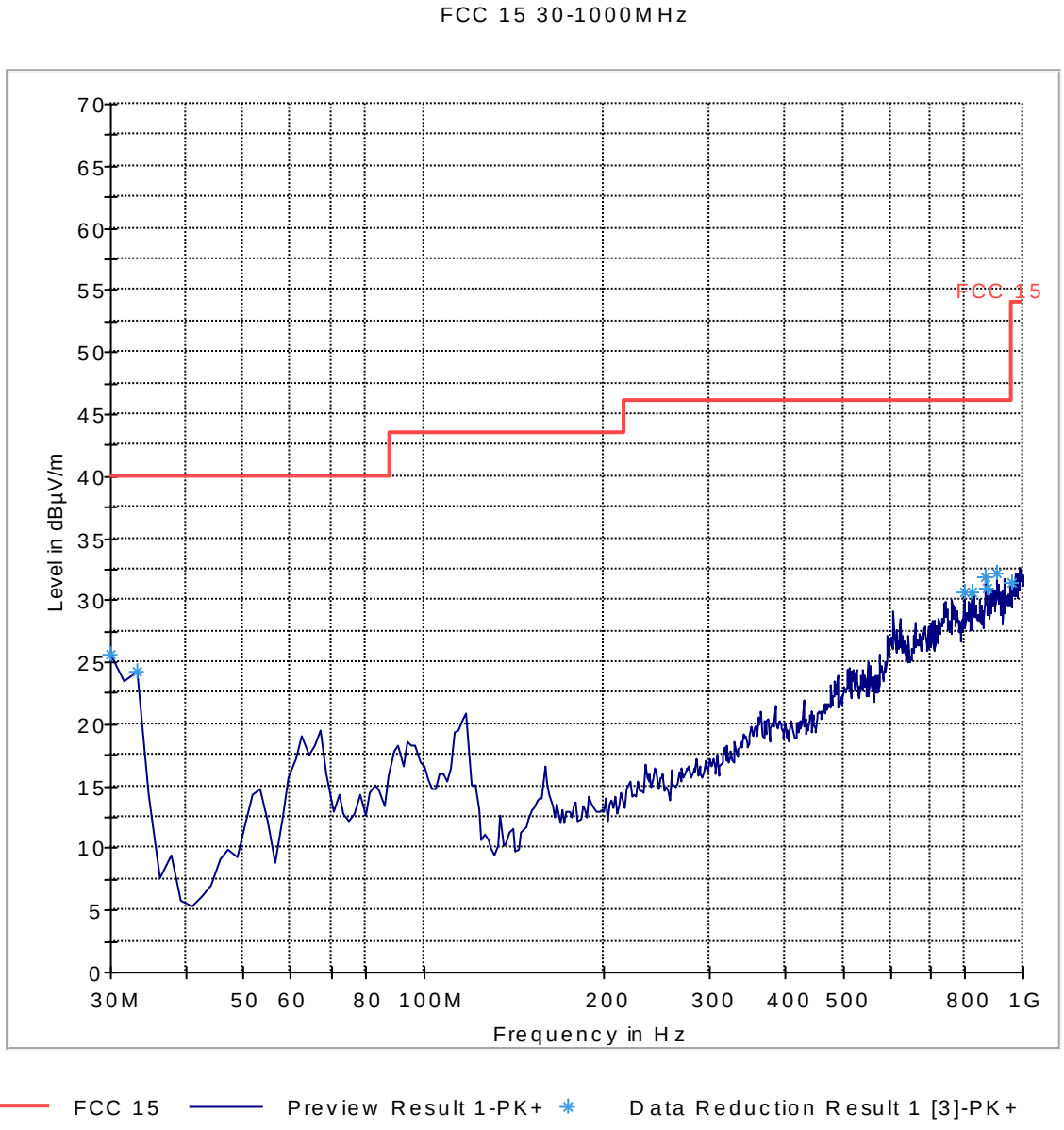
The following plots show the worst case per frequency range out of all tested modes of operation.
For the measurement range up to 30 MHz in the following plots the field strength results from 3m distance measurement are extrapolated to 300m and 30m distance respectively, by 40dB/decade, according to part 15.31(f)(2), per antenna factor scaling.
The red limit line shows the 300 m limit up to 490 kHz, the 30m limit up to 30 MHz and 3m limit above 30MHz.

6.13.5.1 Measurements Verdict

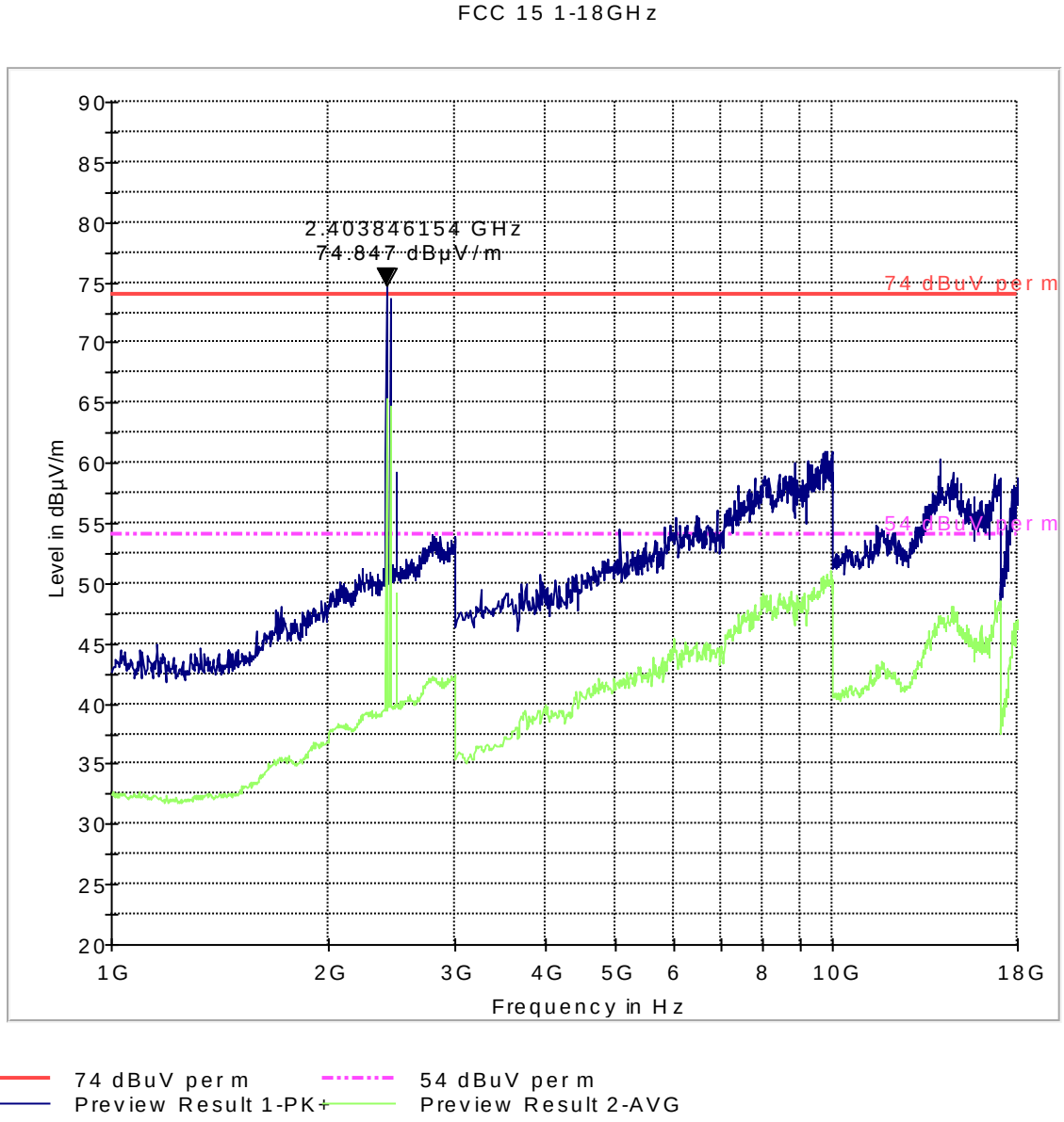
Pass.

6.13.6 Test data/ plots:

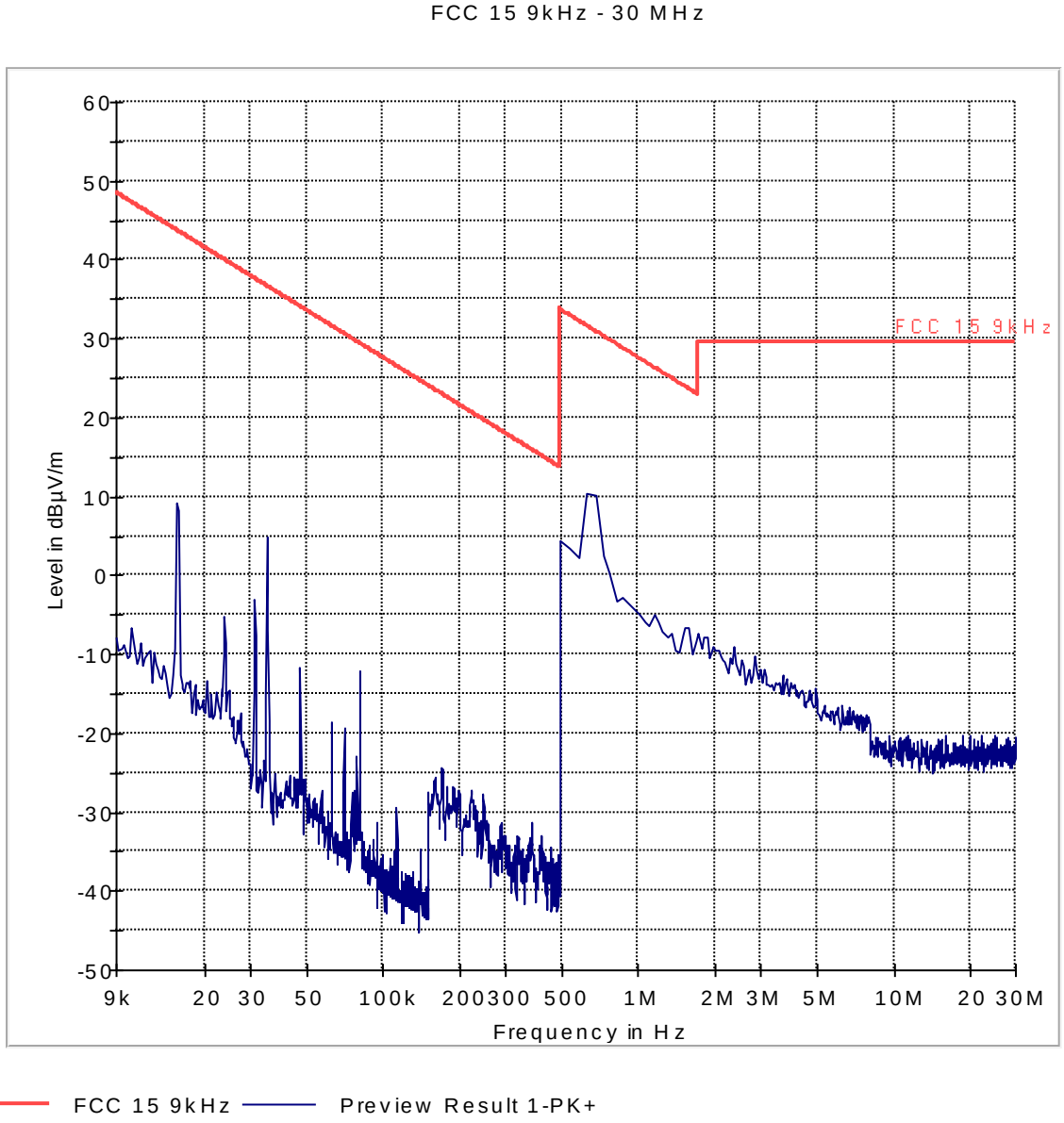
Transmitter Radiated Spurious Emission- Ch0- 30MHz-1GHz



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

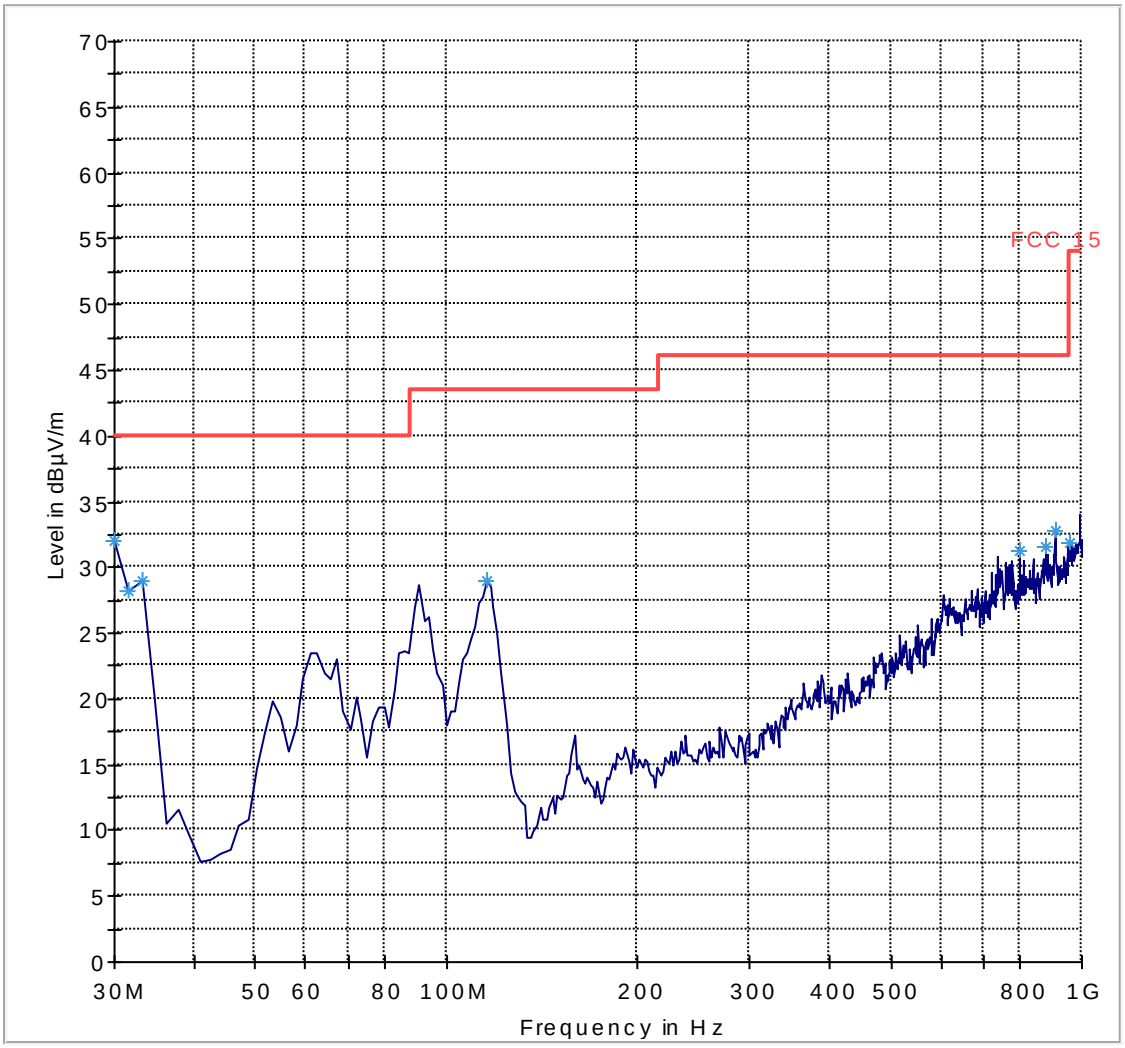


Transmitter Radiated Spurious Emission: Ch39- 9kHz-30MHz

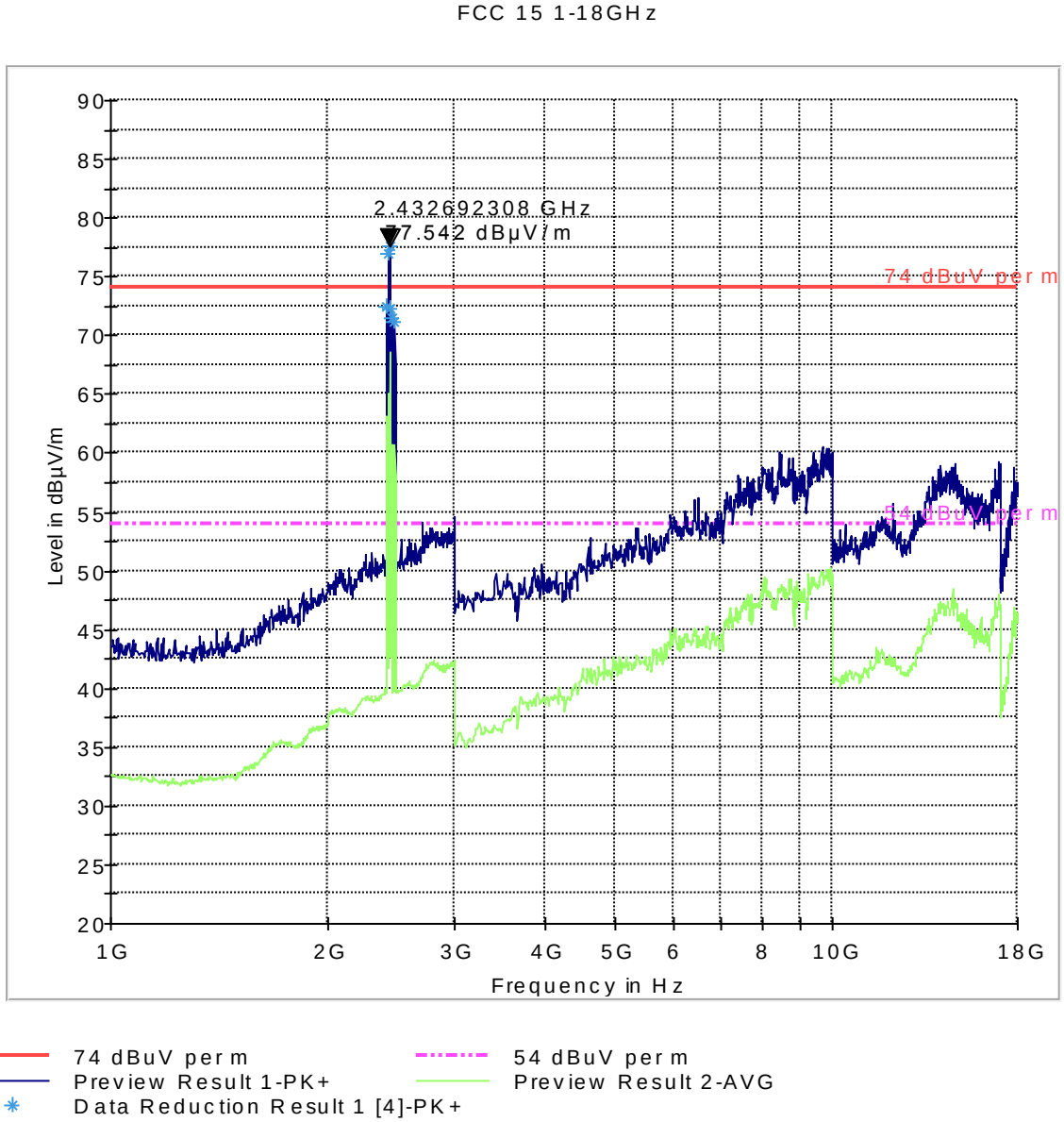


Transmitter Radiated Spurious Emission- Ch39- 30MHz-1GHz

FCC 15 30-1000MHz

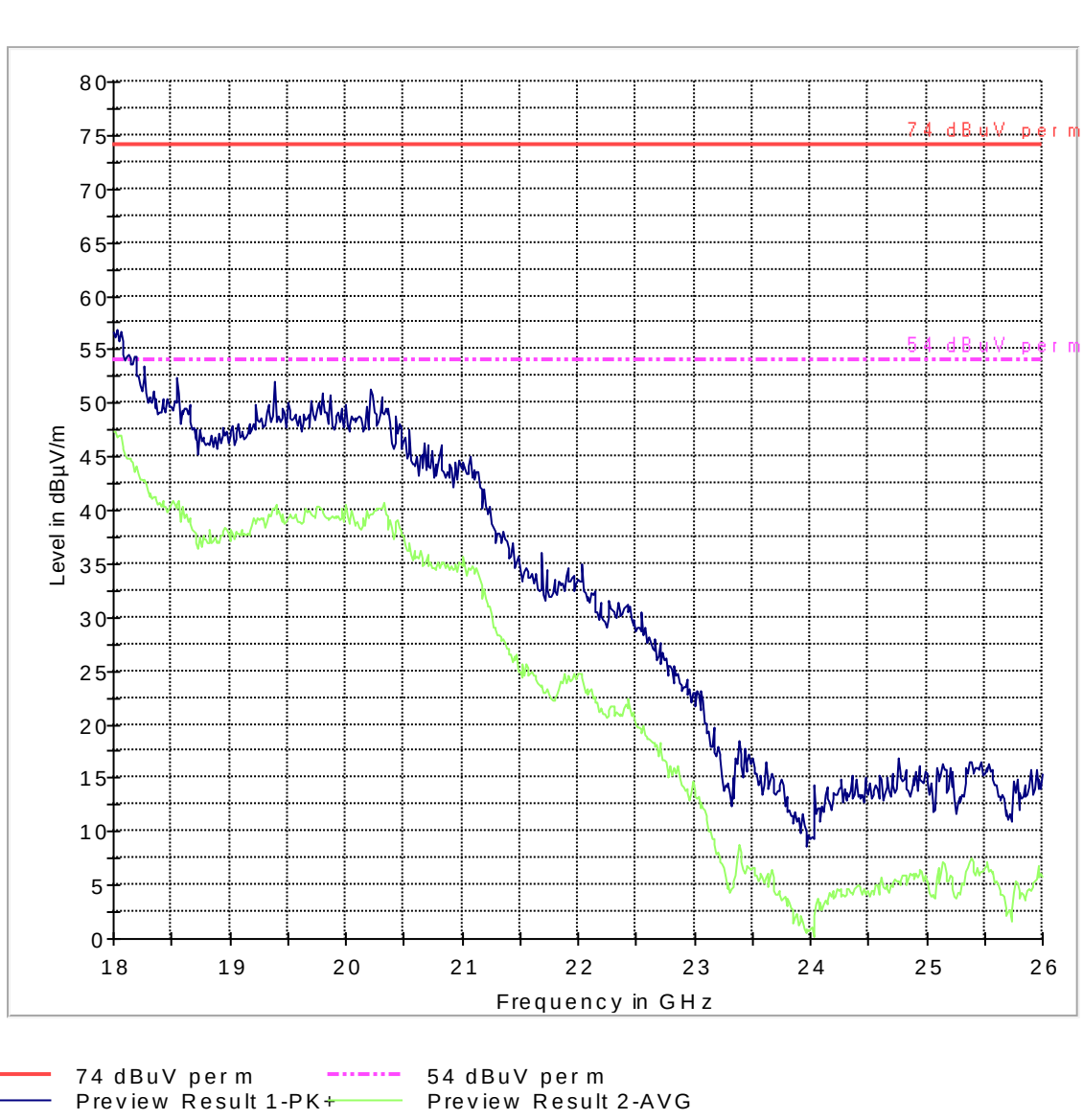


Transmitter Radiated Spurious Emission- Ch39- 1GHz-18GHz

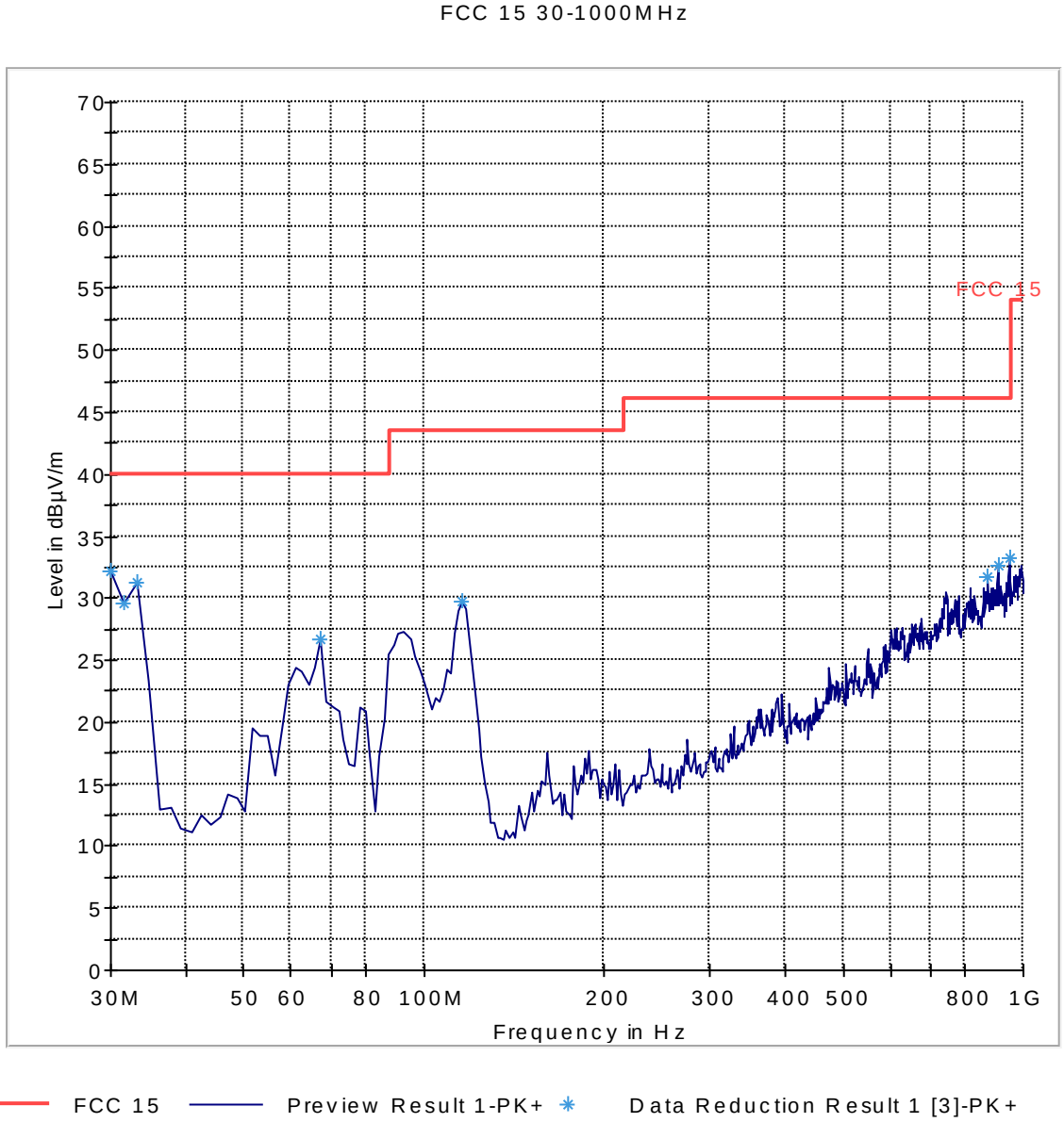


Transmitter Radiated Spurious Emission- Ch39- 18GHz-26GHz

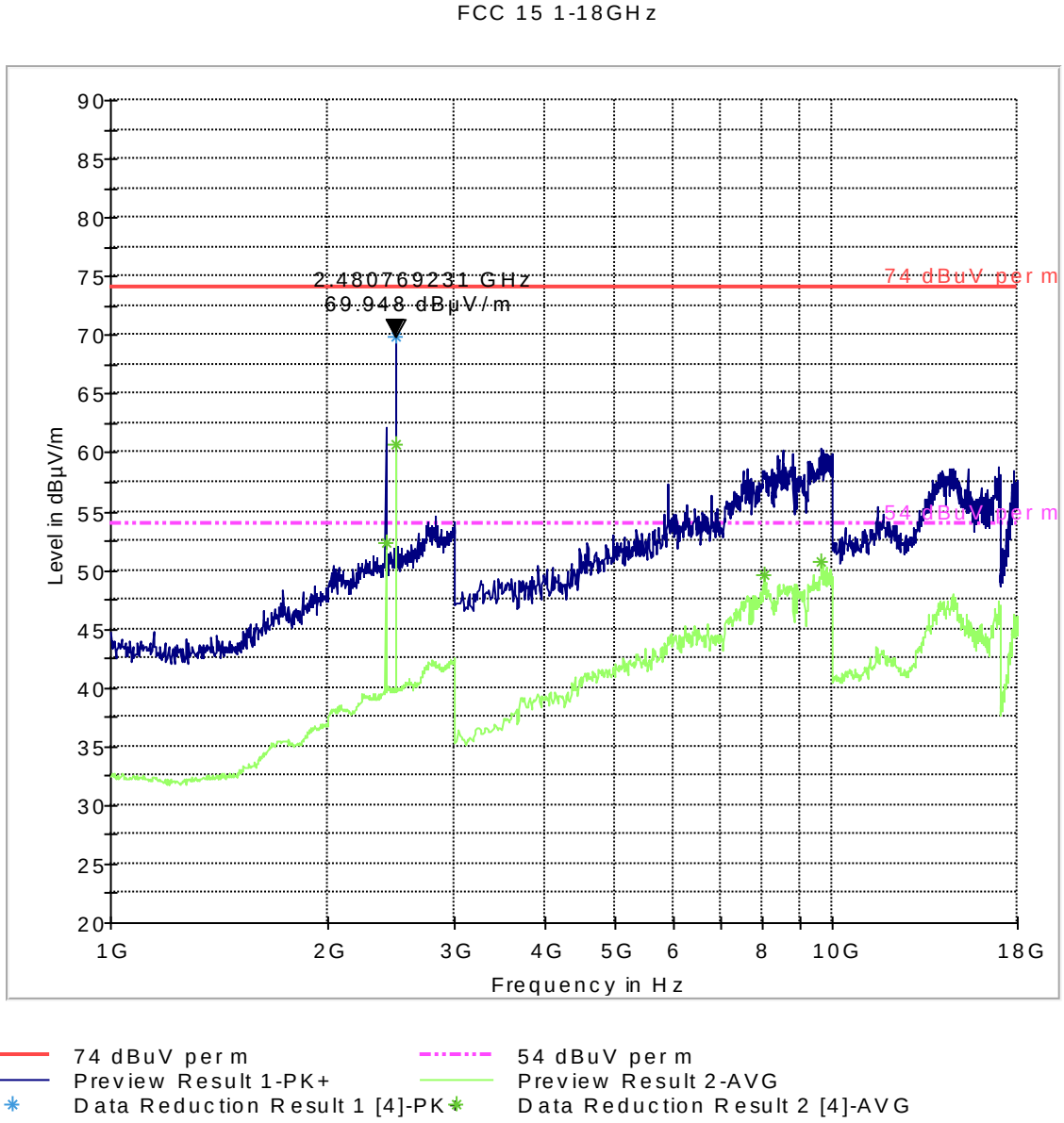
NOTE: Worst case representation for all modes of operation in this range of test.



Transmitter Radiated Spurious Emission: Ch78- 30-1GHz



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



6.14 AC Power Line Conducted Emissions

6.14.1 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.

6.14.2 Limits:

6.14.2.1 §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.

6.14.2.2 RSS-Gen 7.2.2

Except when the requirements applicable to a given device state otherwise, for any license-exempt radio communication 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.

6.14.3 Test Conditions:

Modulation: GFSK- Transmit modes of operation
Measurement Uncertainty: ±3.0dB

6.14.4 Results

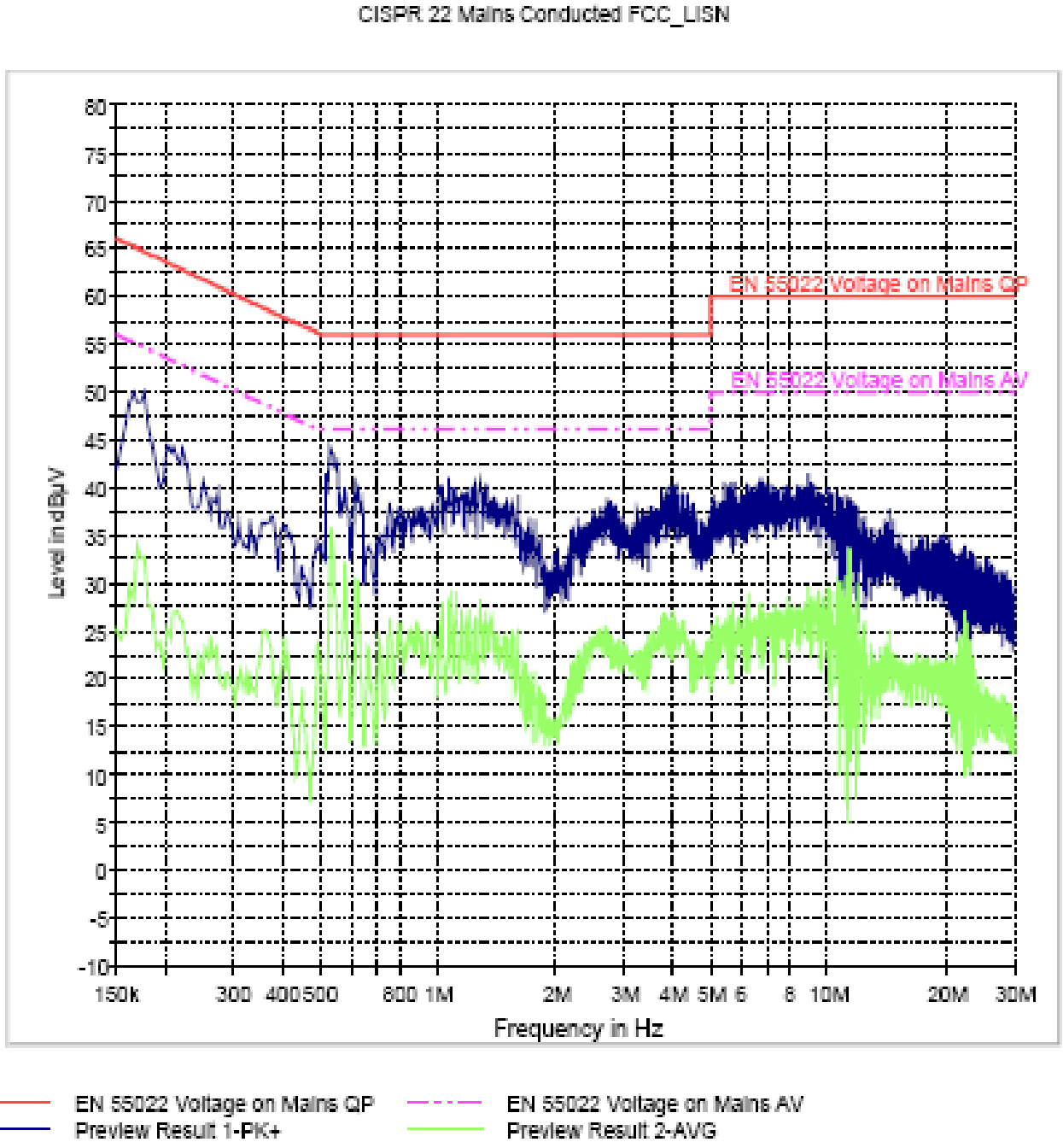
Plots shown here represent the combined worse case emissions for power lines, phases and neutral line.

6.14.4.1 Measurement Result

Pass.

6.14.5 Test Results:

BT TX Mode:

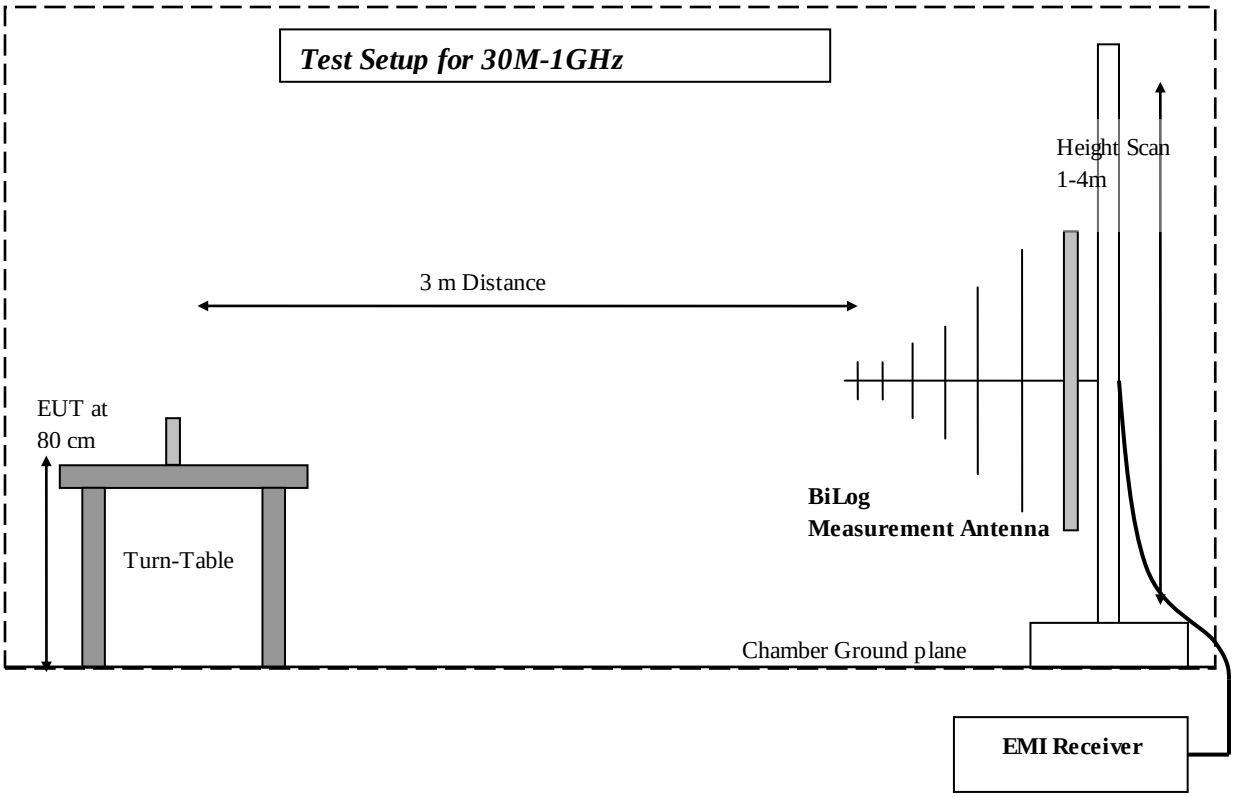


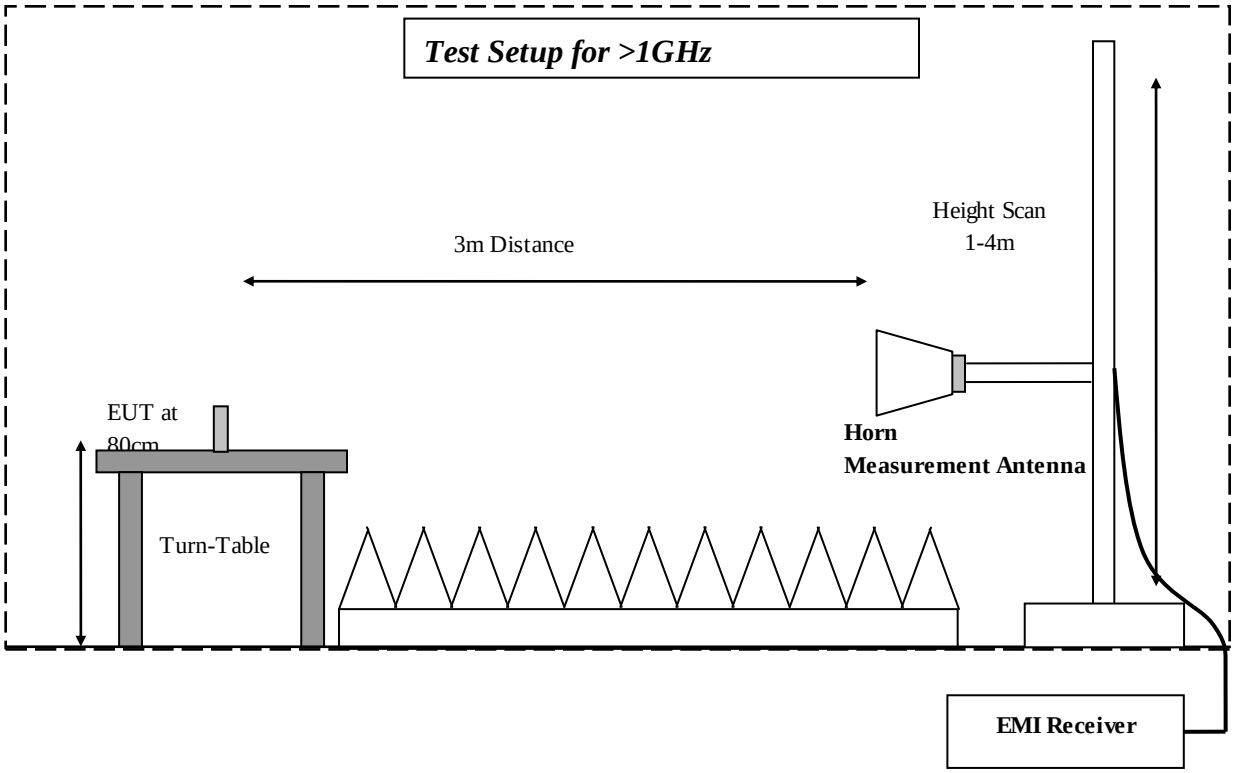
7 Test Equipment and Ancillaries used for tests

No.	Equipment Name	Manufacturer	Type/model	Serial No.	Cal Date	Cal Interval
3m Semi- Anechoic Chamber:						
	Turntable	EMCO	2075	N/A	N/A	N/A
	MAPS Position Controller	ETS Lindgren	2092	0004-1510	N/A	N/A
	Antenna Mast	EMCO	2075	N/A	N/A	N/A
	Relay Switch Unit	Rohde&Schwarz	RSU	338964/001	N/A	N/A
	EMI Receiver/Analyzer	Rohde&Schwarz	ESU 40	100251	Aug 2012	1 Year
	Spectrum Analyzer	Agilent	E4440A	MY46186445	Dec 2012	1 Year
	1500MHz HP Filter	Filtek	HP12/1700	14c48	N/A	N/A
	2800 MHZ HP Filter	Filtek	HP12/2800	14C47	N/A	N/A
	Pre-Amplifier	Miteq	JS40010260	340125	N/A	N/A
	Binconilog Antenna	EMCO	3141	0005-1186	Apr 2012	3 Years
	Binconilog Antenna	ETS	3149	J000123908	Feb 2012	3 years
	Horn Antenna	EMCO	3115	35114	Mar 2012	3 Years
Ancillary equipment						
	Multimeter	Klein Tools	MM200	001	Apr 2011	2 Years
	Humidity Temperature Logger	Dickson	TM320	03280063	Mar 2012	1 Year
	Digital Barometer	VWR	35519-055	91119547	Nov 2011	2 Years
	Climatic Chamber	Votsch	VT4004	G1115	N/A	N/A
	DC Power Supply	HP	E3610A	KR83023316	N/A	N/A
	DC Power Supply	Protek	3003B	H012771	N/A	N/A
	Communication Antenna	IBP5-900/1940	Kathrein	N/A	N/A	N/A

Calibration status valid at the time of testing.
Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
Calibration due dates, unless defined specifically, falls on the last day of the month.
Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

8 Test Setup Info:





9 Revision History

Date	Report Name	Changes to report	Report prepared by
2013-08-28	EMC_INTEL-032-13001_DSS	First Version	Z. Gray