



**FCC 47 CFR PART 15 SUBPART C**

**CERTIFICATION TEST REPORT**

**FOR**

**CDMA/LTE Phone + Bluetooth and DTS WLAN b/g/n**

**MODEL NUMBER: LG-LS665, LGLS665, LS665**

**FCC ID: ZNFLS665**

**REPORT NUMBER: 15I20413-E2**

**ISSUE DATE: APRIL 27, 2015**

*Prepared for*

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**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	04/27/15	Initial Issue	D. Corona

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>5</b>
<b>2. TEST METHODOLOGY .....</b>	<b>6</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>6</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>6</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION .....</i>	<i>6</i>
4.2. <i>SAMPLE CALCULATION .....</i>	<i>6</i>
4.3. <i>MEASUREMENT UNCERTAINTY.....</i>	<i>7</i>
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>8</b>
5.1. <i>DESCRIPTION OF EUT .....</i>	<i>8</i>
5.2. <i>MAXIMUM OUTPUT POWER.....</i>	<i>8</i>
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS .....</i>	<i>8</i>
5.1. <i>WORST-CASE CONFIGURATION AND MODE.....</i>	<i>8</i>
5.2. <i>DESCRIPTION OF TEST SETUP.....</i>	<i>9</i>
<b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>11</b>
<b>7. SUMMARY TABLE .....</b>	<b>12</b>
<b>8. ANTENNA PORT TEST RESULTS .....</b>	<b>13</b>
8.1. <i>20 dB AND 99% BANDWIDTH .....</i>	<i>13</i>
8.1.1. <i>BASIC DATA RATE GFSK MODULATION .....</i>	<i>14</i>
8.1.2. <i>ENHANCED DATA RATE 8PSK MODULATION .....</i>	<i>14</i>
8.1.3. <i>20 dB AND 99% BANDWIDTH PLOTS.....</i>	<i>15</i>
8.2. <i>HOPPING FREQUENCY SEPARATION .....</i>	<i>27</i>
8.3. <i>NUMBER OF HOPPING CHANNELS.....</i>	<i>29</i>
8.4. <i>AVERAGE TIME OF OCCUPANCY.....</i>	<i>34</i>
8.5. <i>OUTPUT POWER.....</i>	<i>41</i>
8.5.1. <i>BASIC DATA RATE GFSK MODULATION .....</i>	<i>41</i>
8.5.2. <i>ENHANCED DATA RATE 8PSK MODULATION .....</i>	<i>41</i>
8.5.3. <i>OUTPUT POWER PLOTS.....</i>	<i>42</i>
8.6. <i>AVERAGE POWER.....</i>	<i>48</i>
8.6.1. <i>BASIC DATA RATE GFSK MODULATION .....</i>	<i>49</i>
8.6.2. <i>DATA RATE PI/4-DQPSK MODULATION .....</i>	<i>49</i>
8.6.3. <i>ENHANCED DATA RATE 8PSK MODULATION .....</i>	<i>49</i>
8.7. <i>CONDUCTED SPURIOUS EMISSIONS.....</i>	<i>50</i>
8.7.1. <i>BASIC DATA RATE GFSK MODULATION .....</i>	<i>51</i>

8.7.2. ENHANCED DATA RATE 8PSK MODULATION .....59

**9. RADIATED TEST RESULTS.....67**

9.1. LIMITS AND PROCEDURE.....67

9.2. TRANSMITTER ABOVE 1 GHz.....68

9.2.1. BASIC DATA RATE GFSK MODULATION.....68

9.2.2. ENHANCED DATA RATE 8PSK MODULATION .....81

9.3. WORST-CASE BELOW 1 GHz.....94

**10. AC POWER LINE CONDUCTED EMISSIONS .....96**

**11. SETUP PHOTOS .....99**

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** LG ELECTRONICS MOBILECOMM U.S.A., INC  
**EUT DESCRIPTION:** CDMA/LTE PHONE + BLUETOOTH and DTS WLAN b/g/n  
**MODEL:** LG-LS665, LGLS665, LS665  
**SERIAL NUMBER:** 80CB9D62 (Radiated), 8065FB39 (Conducted)  
**DATE TESTED:** MARCH 26-27 – APRIL 8-17, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

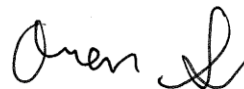
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, FCC CFR 47 Part 2, and FCC CFR 47 Part 15C.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A(IC: 2324B-1)	<input type="checkbox"/> Chamber D(IC: 2324B-4)
<input checked="" type="checkbox"/> Chamber B(IC: 2324B-2)	<input type="checkbox"/> Chamber E(IC: 2324B-5)
<input checked="" type="checkbox"/> Chamber C(IC: 2324B-3)	<input type="checkbox"/> Chamber F(IC: 2324B-6)
	<input type="checkbox"/> Chamber G(IC: 2324B-7)
	<input type="checkbox"/> Chamber H(IC: 2324B-8)

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable} \\ &\text{Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 18000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a CDMA/LTE PHONE + BLUETOOTH and DTS WLAN b/g/n

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	8.08	6.43
2402 - 2480	Enhanced 8PSK	8.13	6.50

Note: GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on this mode to showing compliance. For average power data please refer to section 8.6.

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of 0.46dBi.

### 5.1. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.



## 5.2. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	LG	MCS-04WD2	EAY62991904	N/A
Earphone	LG	NA	NA	N/A

### I/O CABLES

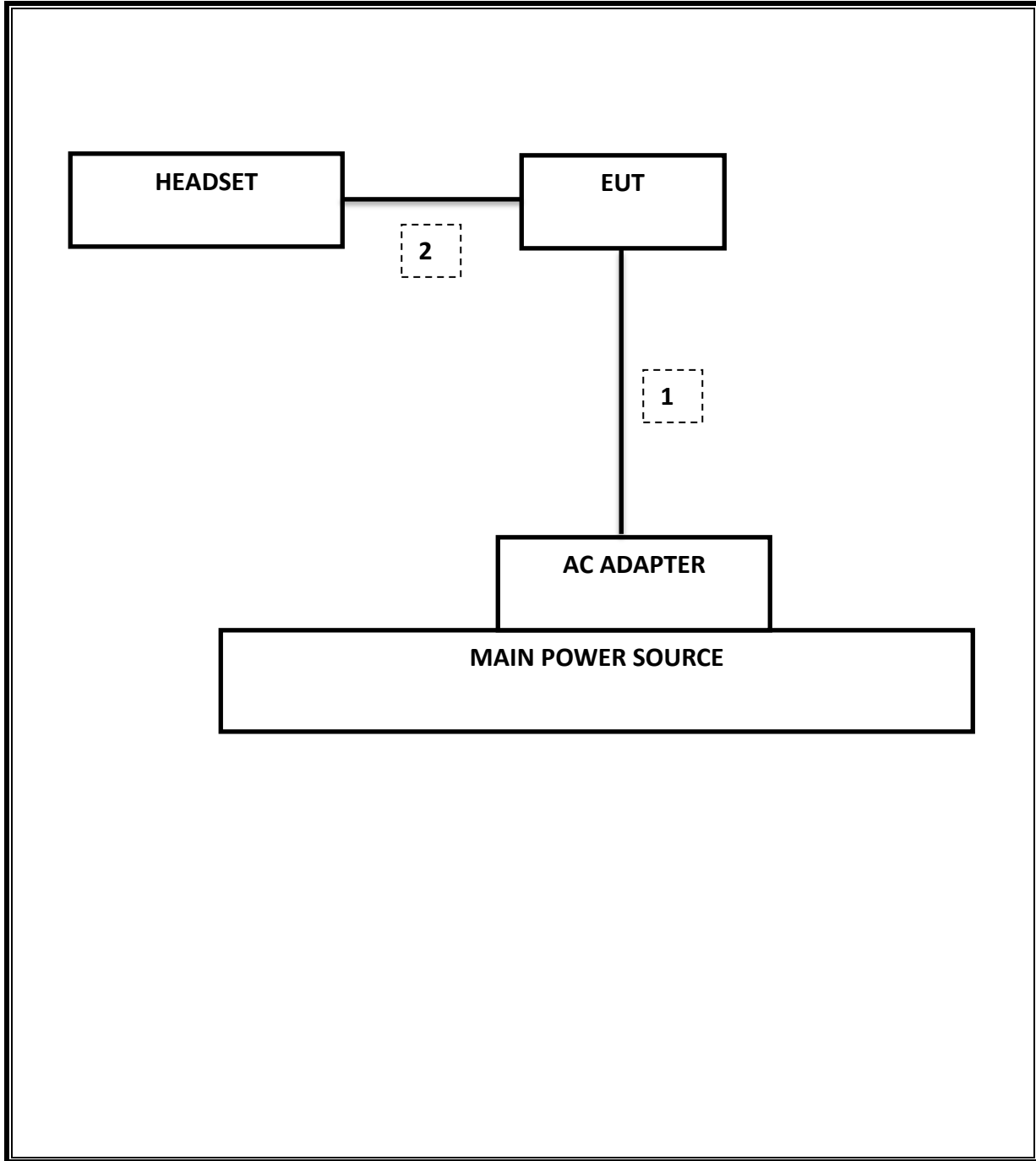
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Mini-USB	Shielded	1.2m	N/A
2	Audio	1	Mini-Jack	Unshielded	1m	N/A

### TEST SETUP

The EUT is continuously communicating to the Bluetooth tester during the tests.

EUT was set in the Hidden menu mode to enable BT communications.

**SETUP DIAGRAM FOR TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	Tnumber	Cal Due
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	122	02/13/16
Antenna, Horn, 18GHz	EMCO	3115	60	10/25/16
Antenna, Horn, 26.5 GHz	ARA	MWH-1826	89	11/14/15
RF Preamplifier, 100KHz -> 1300MHz	HP	TBD	C00825	06/01/15
RF Preamplifier, 1GHz - 18GHz	Miteq	AFS42-00101800-25-S-42	740	01/26/16
RF Preamplifier, 1GHz - 26.5GHz	HP	8449B	F00351	06/27/15
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	123	10/28/15
CBT Bluetooth Tester	R & S	CBT	258	07/08/15
Peak Power Meter	Agilent / HP	E4416A	84	01/26/16
Peak / Average Power Sensor	Agilent / HP	8481A	224	12/10/15
LISN, 30 MHz	FCC	50/250-25-2	24	01/16/16
Reject Filter, 2.4GHz	Micro-Tronics	BRM50702	N02684	CNR
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014	
Conducted Software	UL	UL EMC	Ver 9.5, May 17 2012	
CLT Software	UL	UL RF	Ver 1.0, Feb 2 2015	
Antenna Port Software	UL	UL RF	Ver 2.1.1.1, Jan 20 2015	

## 7. SUMMARY TABLE

FCC Part Section	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Worst Case
2.1049	RSS-GEN 4.6	Occupied Band width (99%)	N/A	Conducted	Pass	1.219 MHz
2.1051, 15.247 (d)	RSS-210 A8.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-48.824 dBm
15.247 (b)(1)	RSS-210 A8.4	TX conducted output power	<21dBm		Pass	8.132 dBm
15.247 (a)(1)	RSS-210 A8.1(b)	Hopping frequency separation	> 25KHz		Pass	1 MHz
15.247 (a)(1)(iii)	RSS-210 A8.1(d)	Number of Hopping channels	More than 15 non-overlapping channels		Pass	79
15.247 (a)(1)(iii)	RSS-210 A8.1(d)	Avg Time of Occupancy	< 0.4sec		Pass	0.317 S
15.207 (a)	RSS-GEN 7.2.2	AC Power Line conducted emissions	Section 10	Radiated	Pass	52.81 dBuV
15.205, 15.209	RSS-210 Clause 2.6, RSS-210 Clause 6	Radiated Spurious Emission	< 54dBuV/m		Pass	46.5 dBuV/m

## **8. ANTENNA PORT TEST RESULTS**

### **8.1. 20 dB AND 99% BANDWIDTH**

#### **LIMIT**

None; for reporting purposes only.

#### **TEST PROCEDURE**

DA 00-705: The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

#### **RESULTS**

### 8.1.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.922	0.85376
Middle	2441	0.922	0.89136
High	2480	0.922	0.90651
Worst		0.922	0.90651

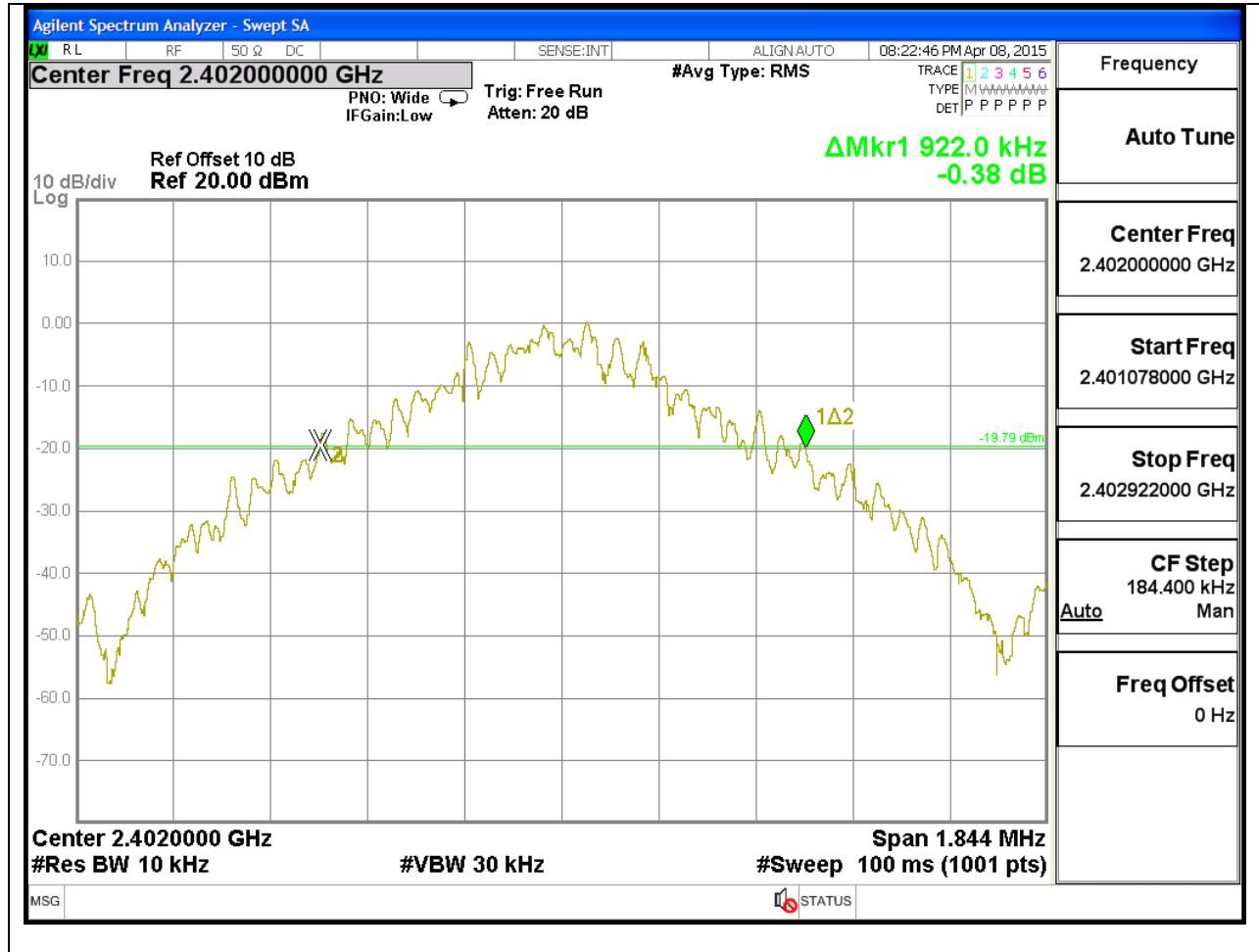
### 8.1.2. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.2615	1.1606
Middle	2441	1.2544	1.1874
High	2480	1.2600	1.2190
Worst		1.2615	1.2190

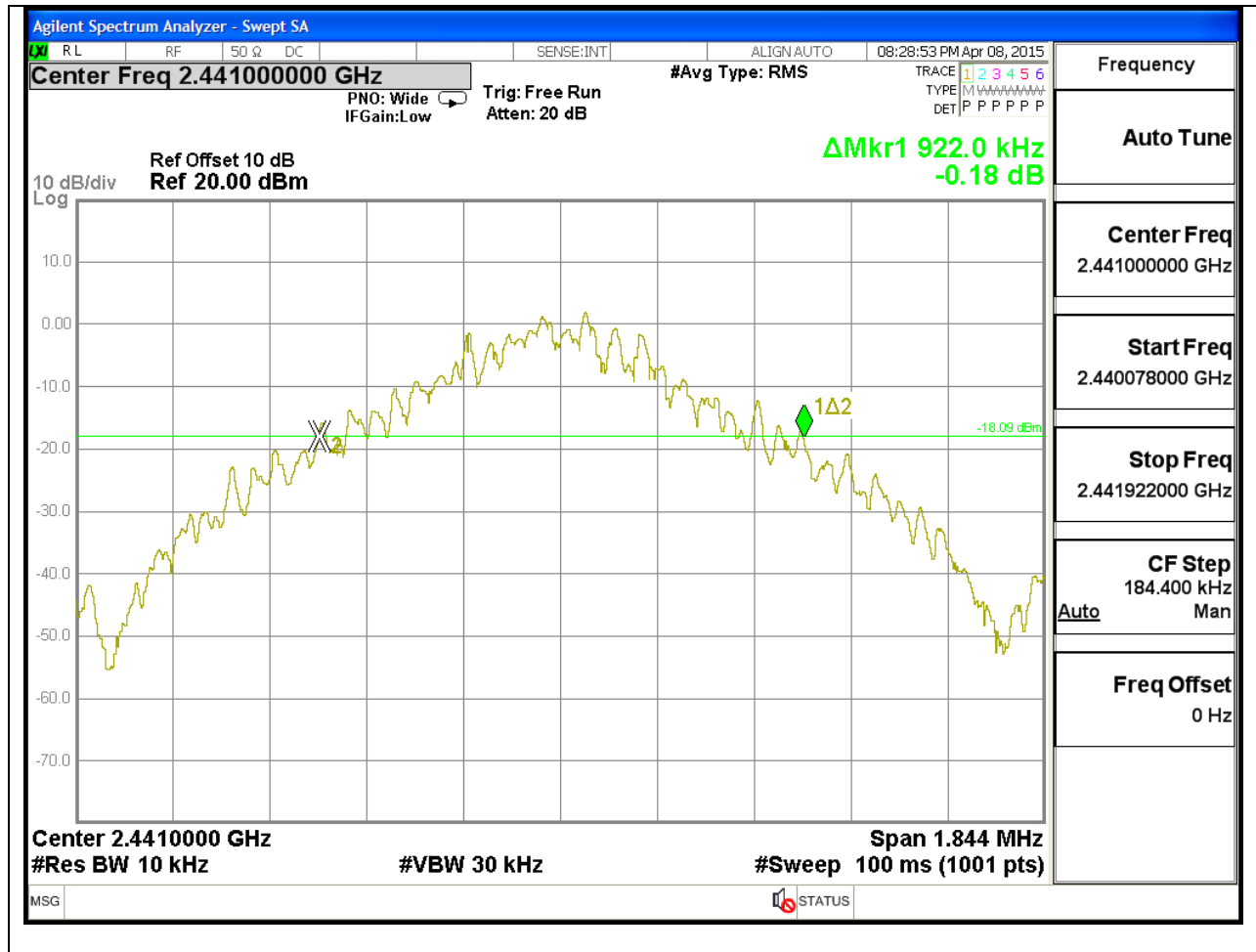
### 8.1.3. 20 dB AND 99% BANDWIDTH PLOTS

#### GFSK 20 dB BANDWIDTH

#### LOW CHANNEL

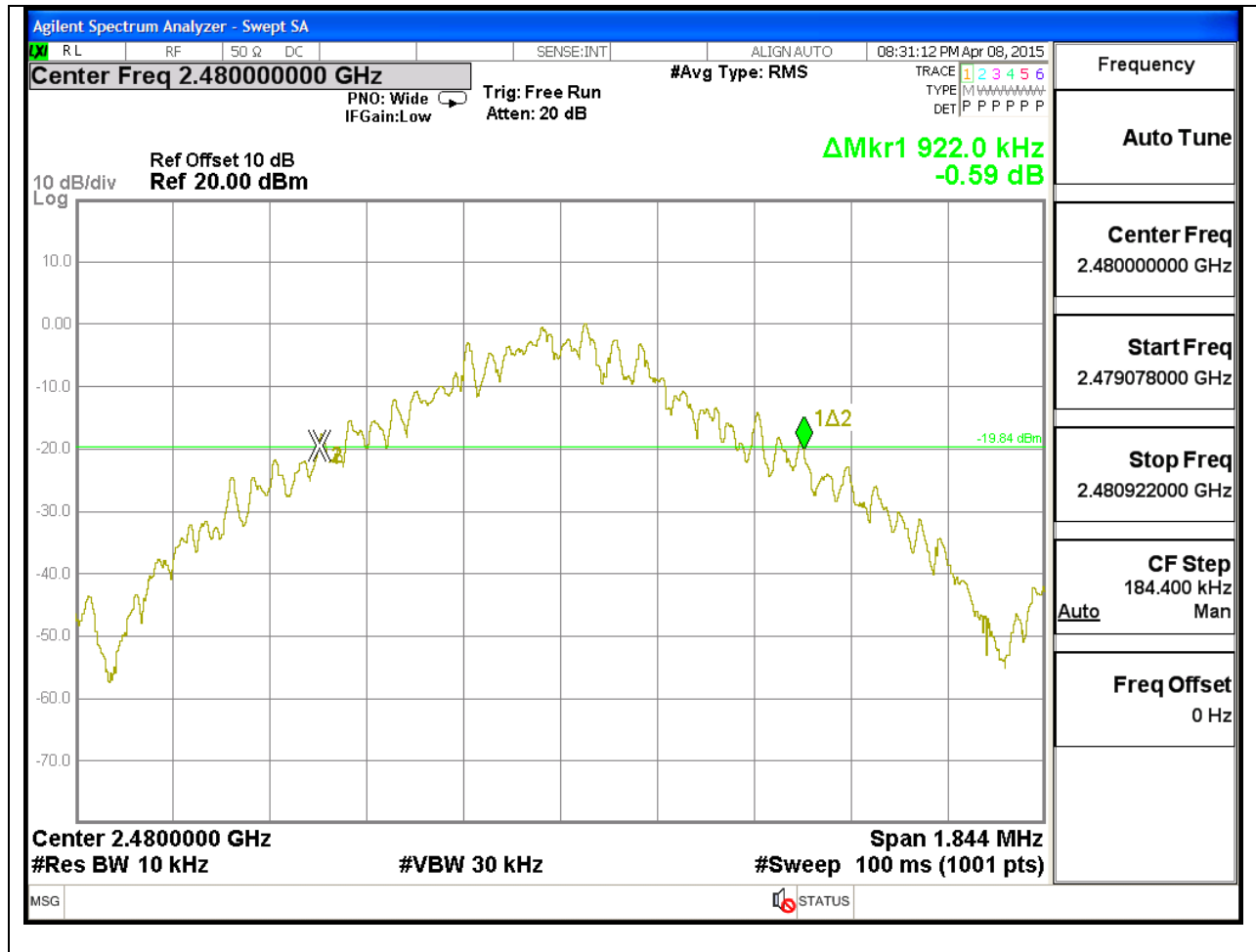


MID CHANNEL



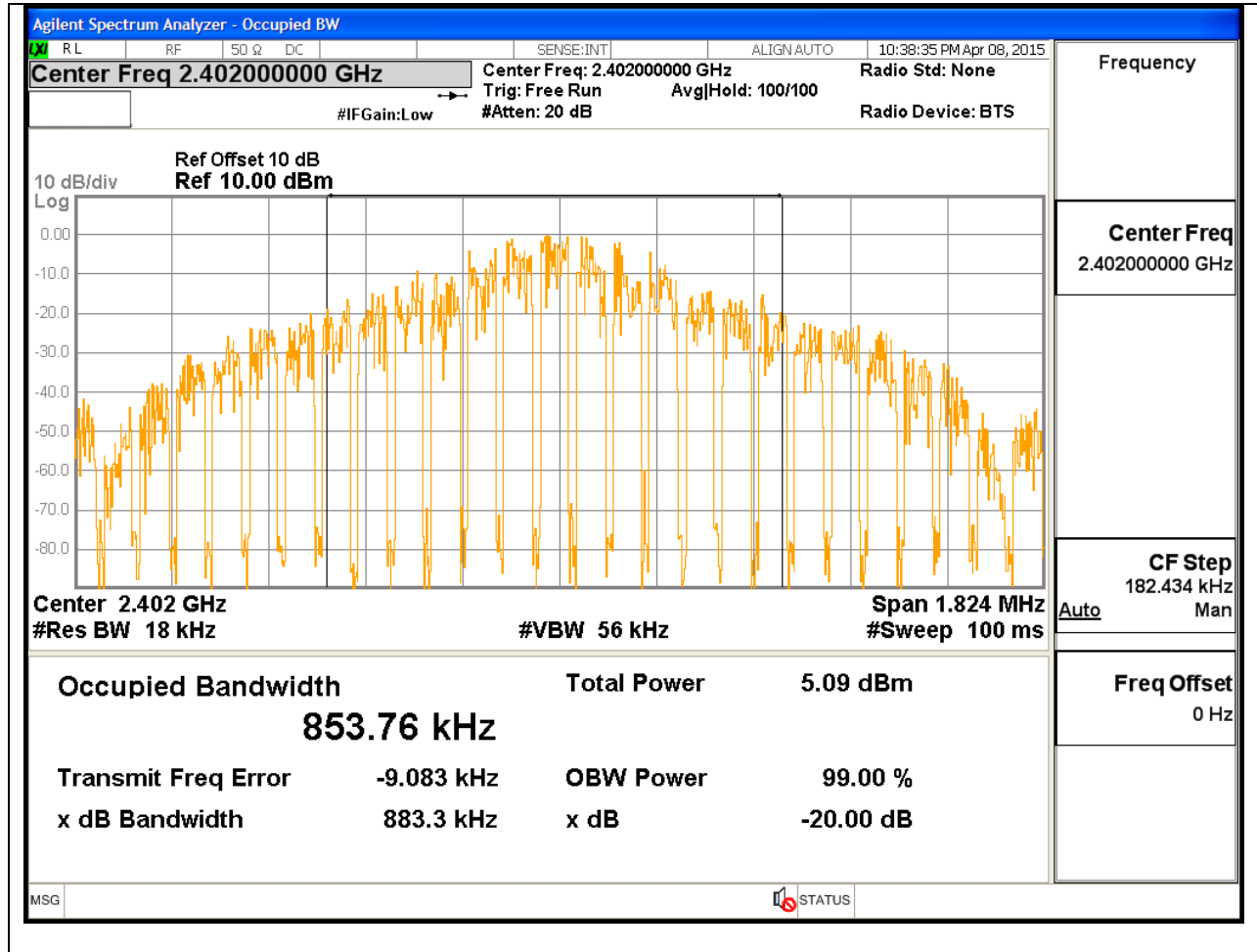


### HIGH CHANNEL

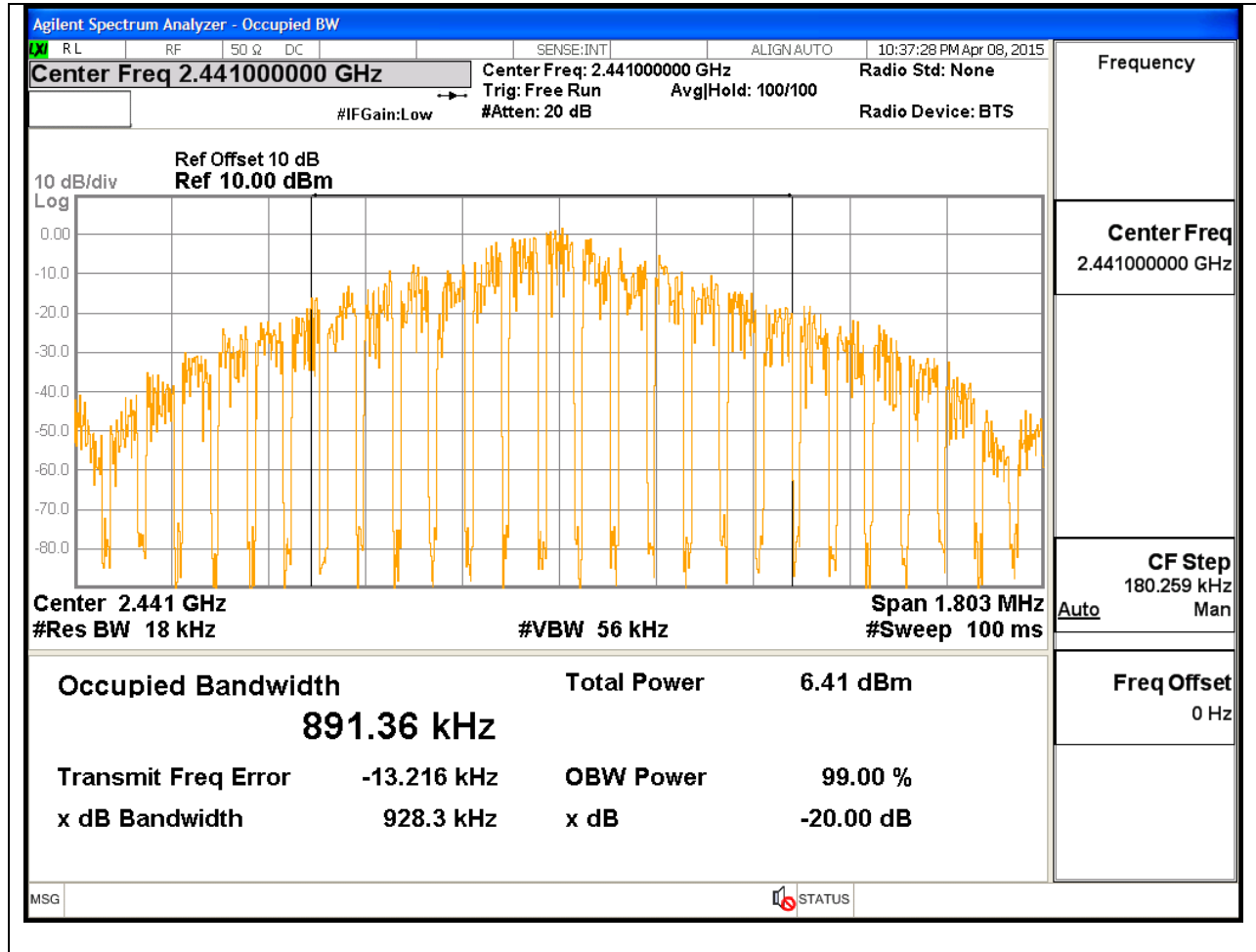


**GFSK 99% BANDWIDTH**

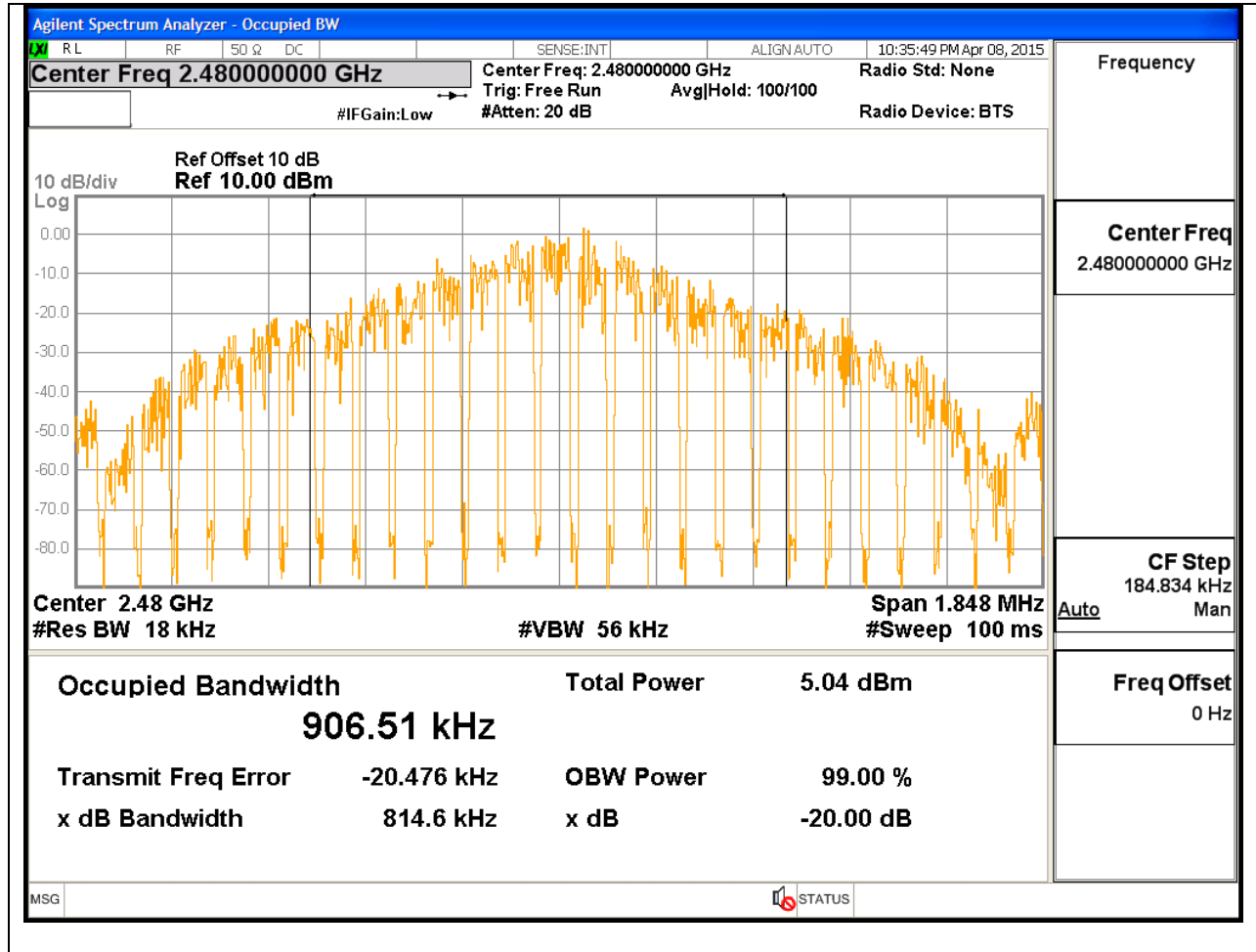
**LOW CHANNEL**



MID CHANNEL

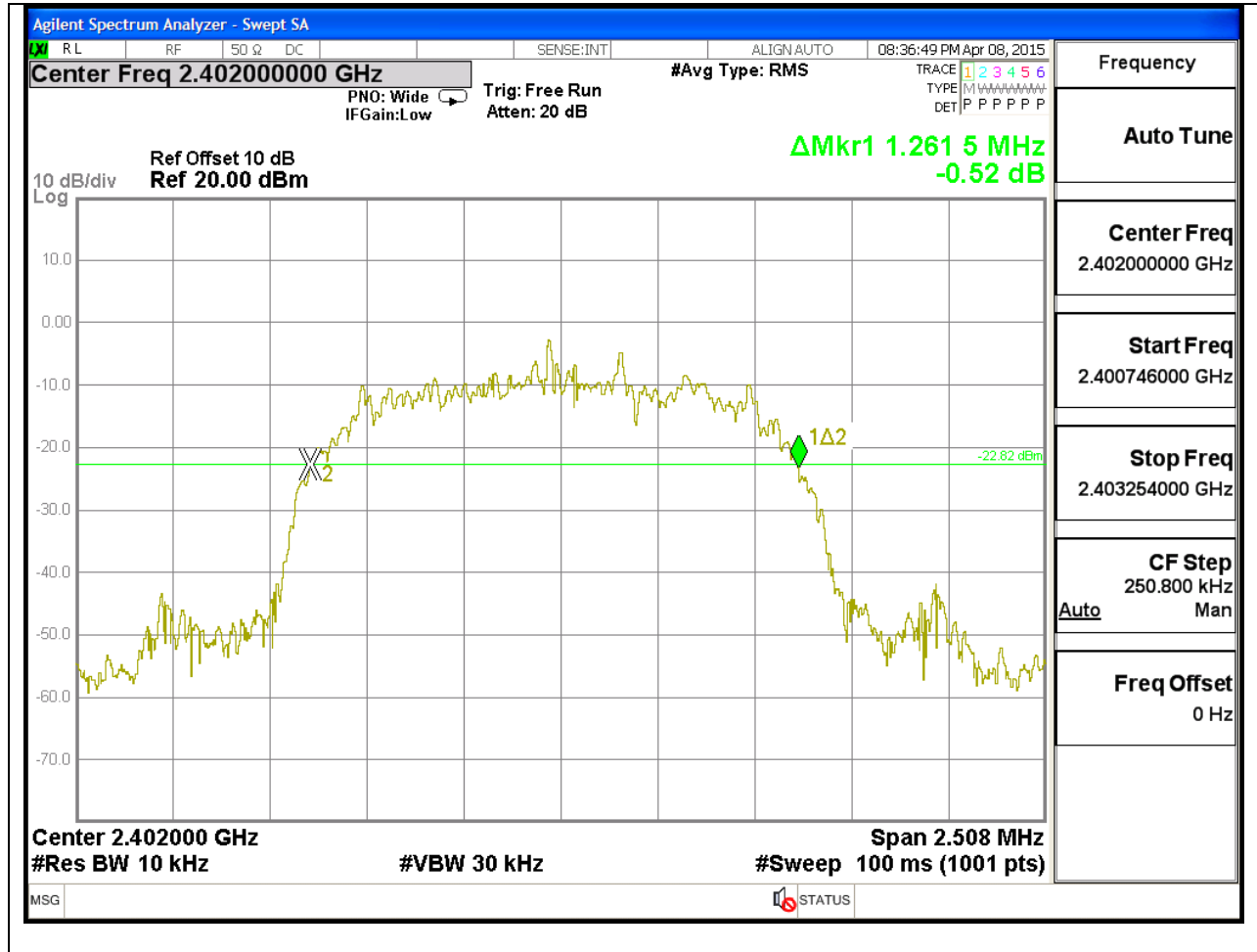


**HIGH CHANNEL**

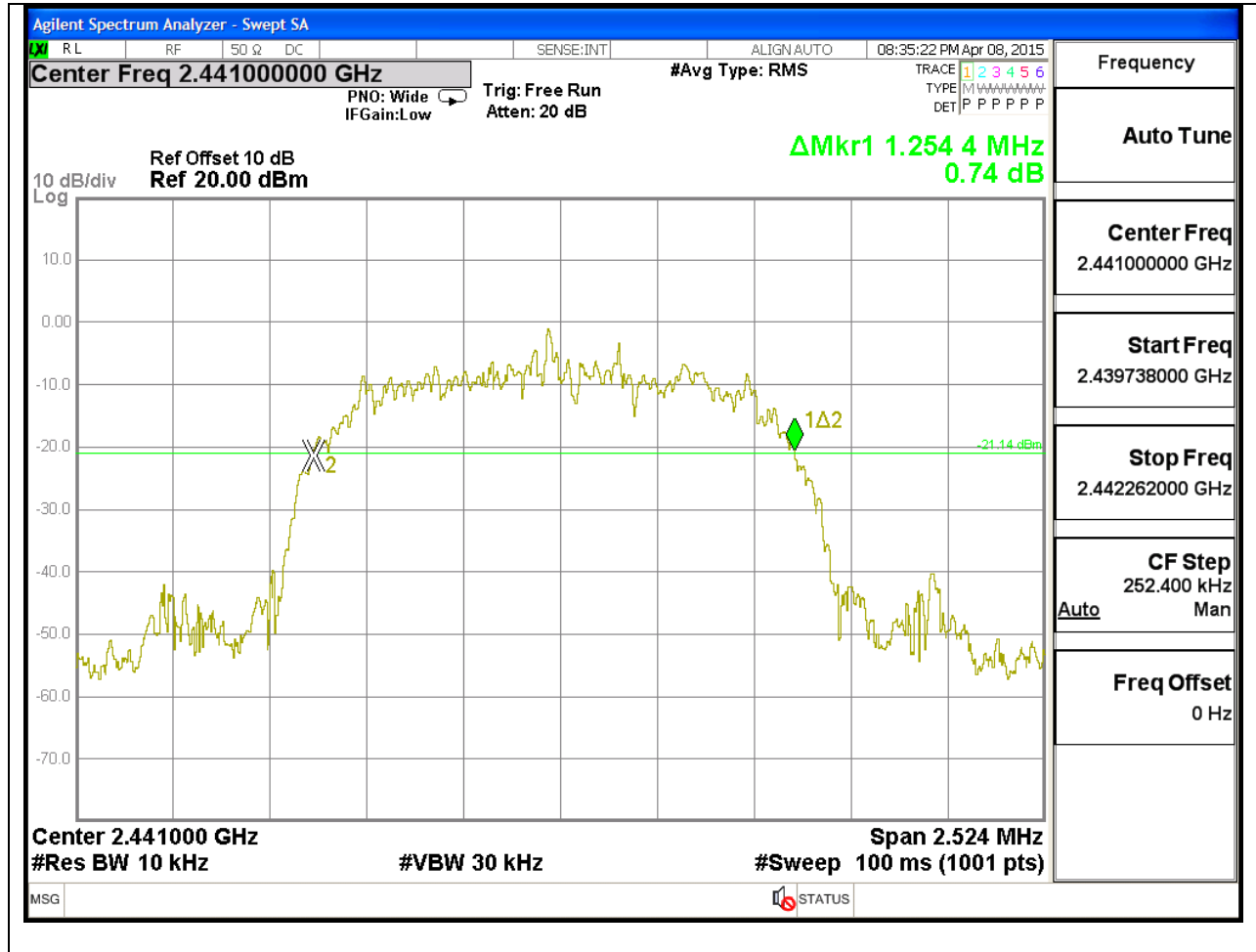


**8PSK 20 dB BANDWIDTH**

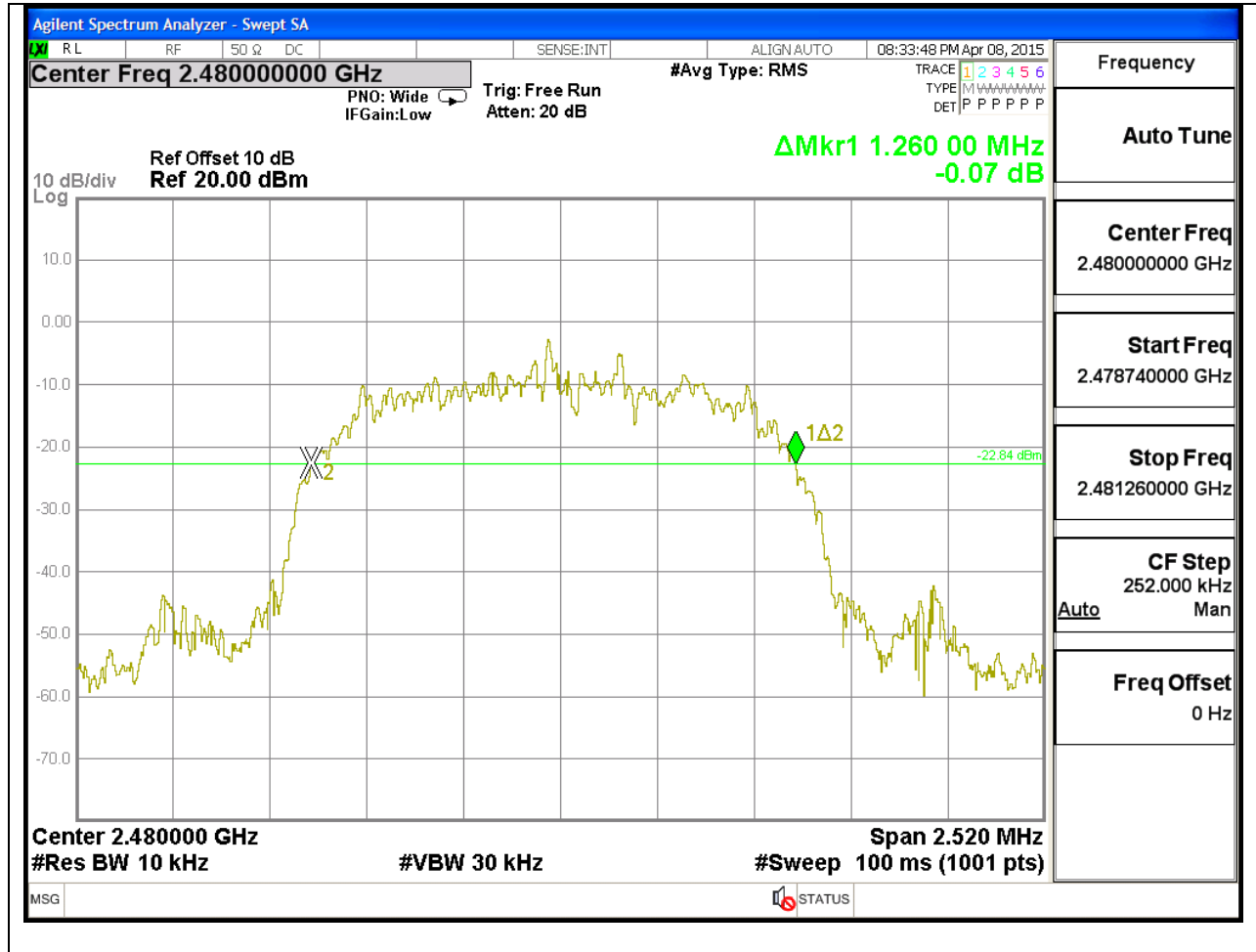
**LOW CHANNEL**



**MID CHANNEL**

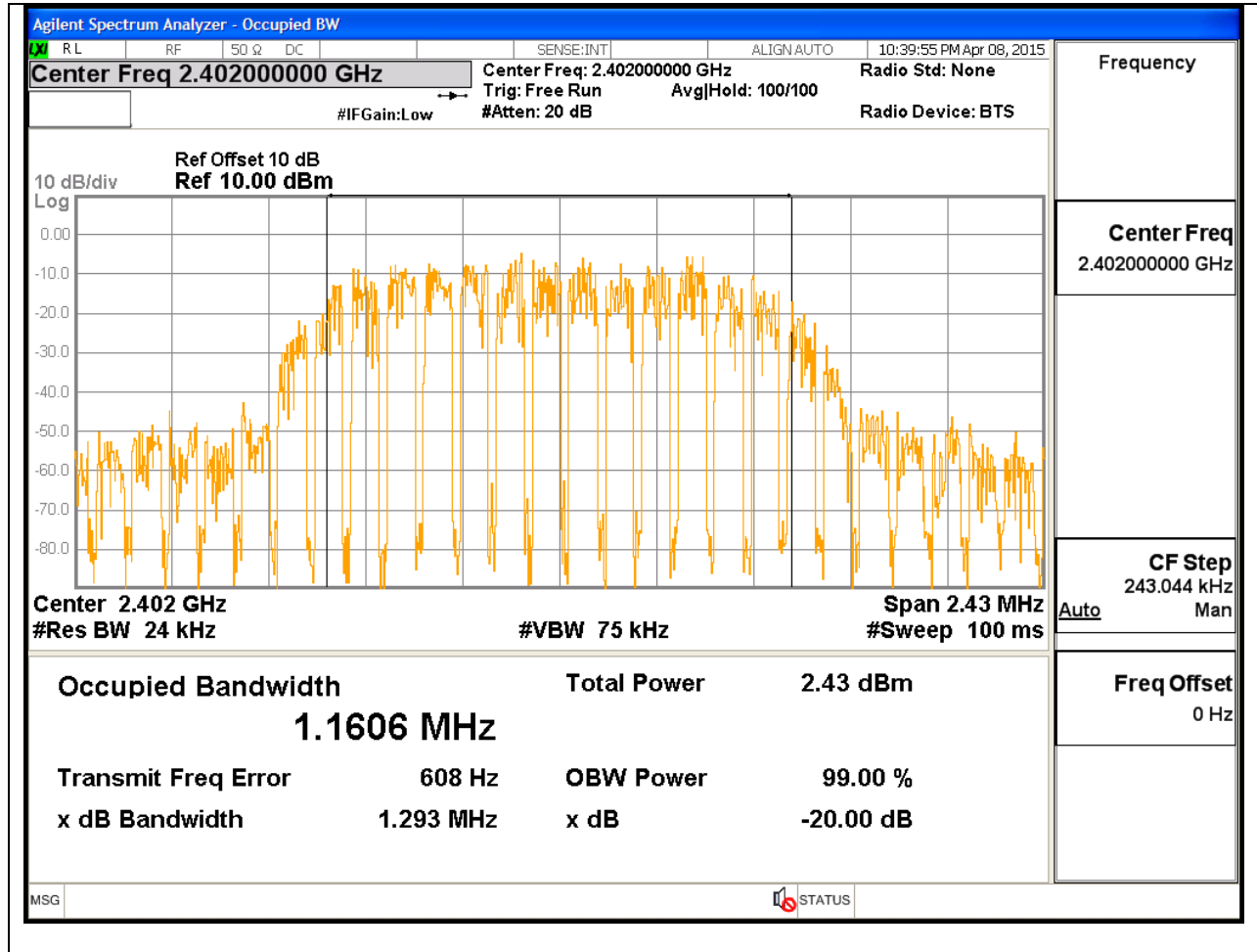


**HIGH CHANNEL**



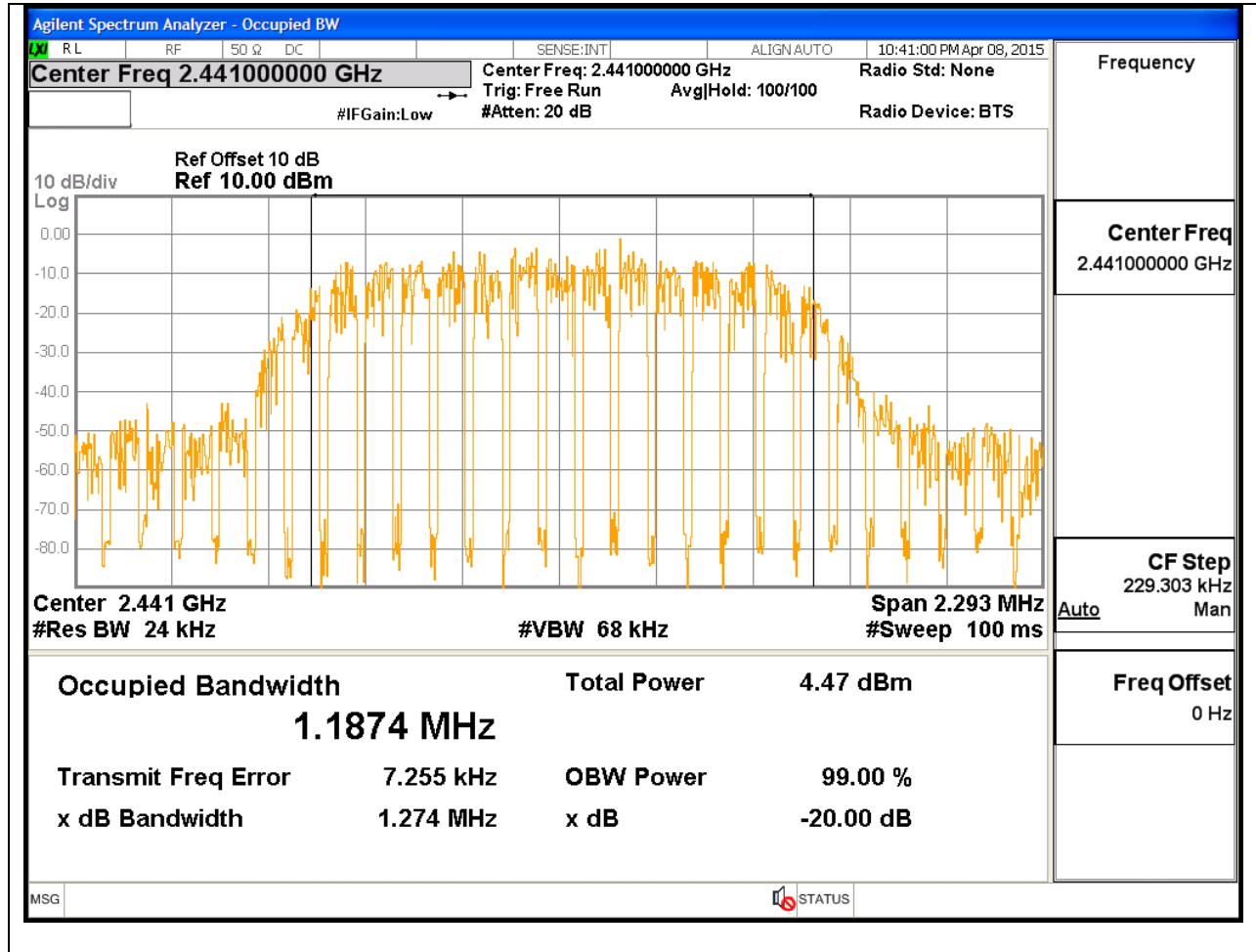
**8PSK 99% BANDWIDTH**

**LOW CHANNEL**

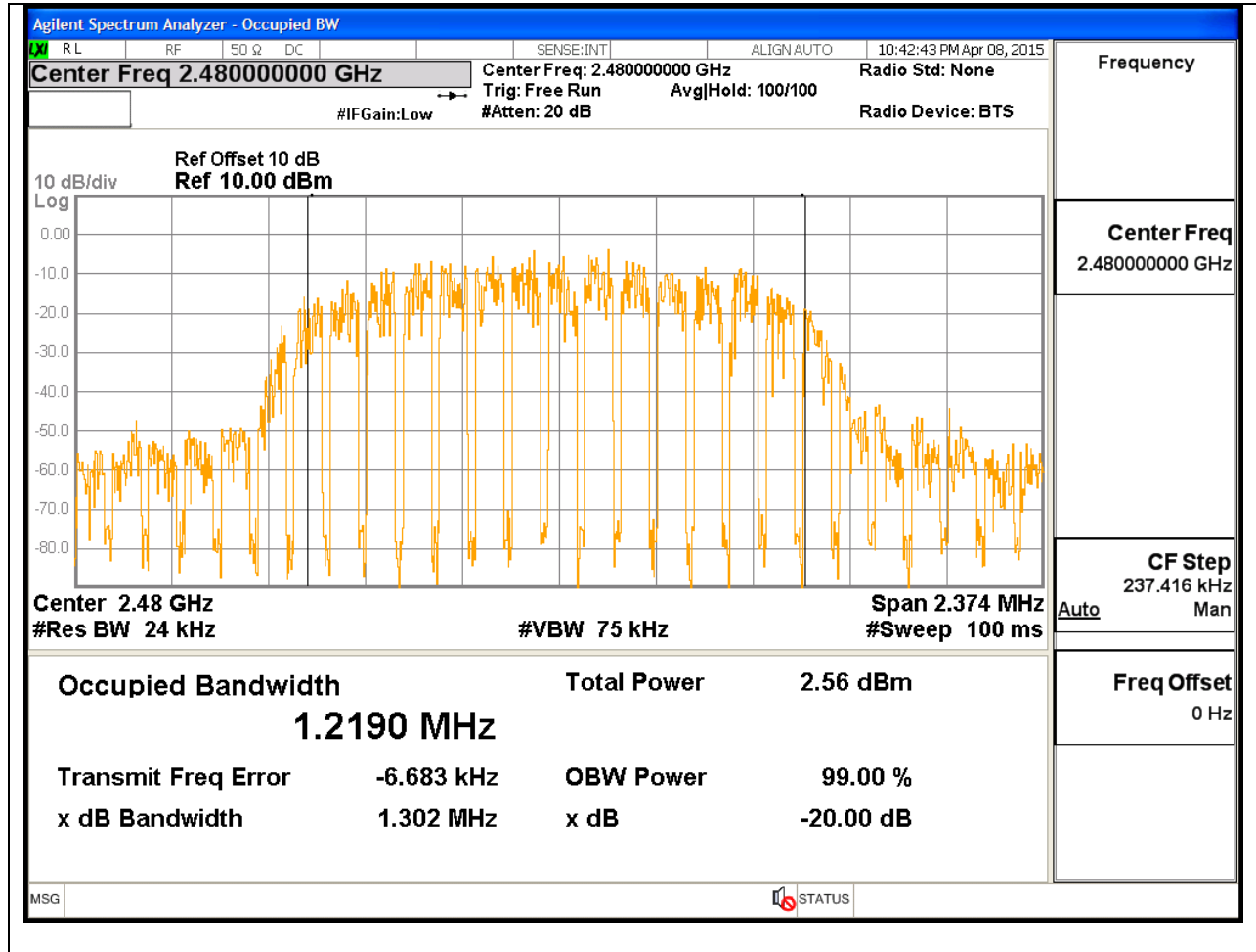




**MID CHANNEL**



**HIGH CHANNEL**



## **8.2. HOPPING FREQUENCY SEPARATION**

### **LIMIT**

FCC §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, 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.

### **TEST PROCEDURE**

DA 00-705: The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

### **RESULTS**



### **8.3. NUMBER OF HOPPING CHANNELS LIMIT**

FCC §15.247 (a) (1) (iii)

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

### **TEST PROCEDURE**

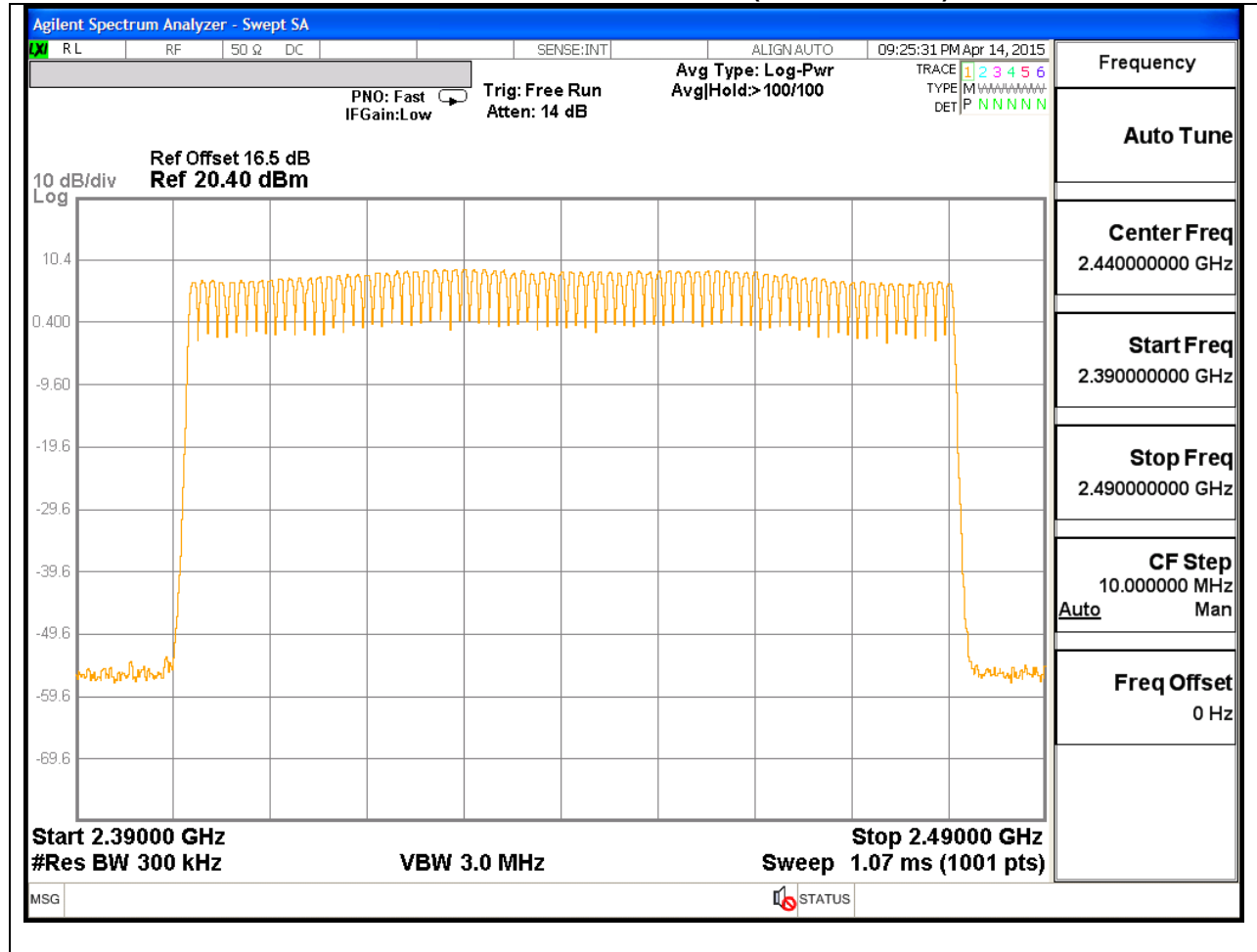
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

### **RESULTS**

Normal Mode: 79 Channels observed.

**NUMBER OF HOPPING CHANNELS PLOTS**

**NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)**











**8.4. AVERAGE TIME OF OCCUPANCY  
 LIMIT**

FCC §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.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

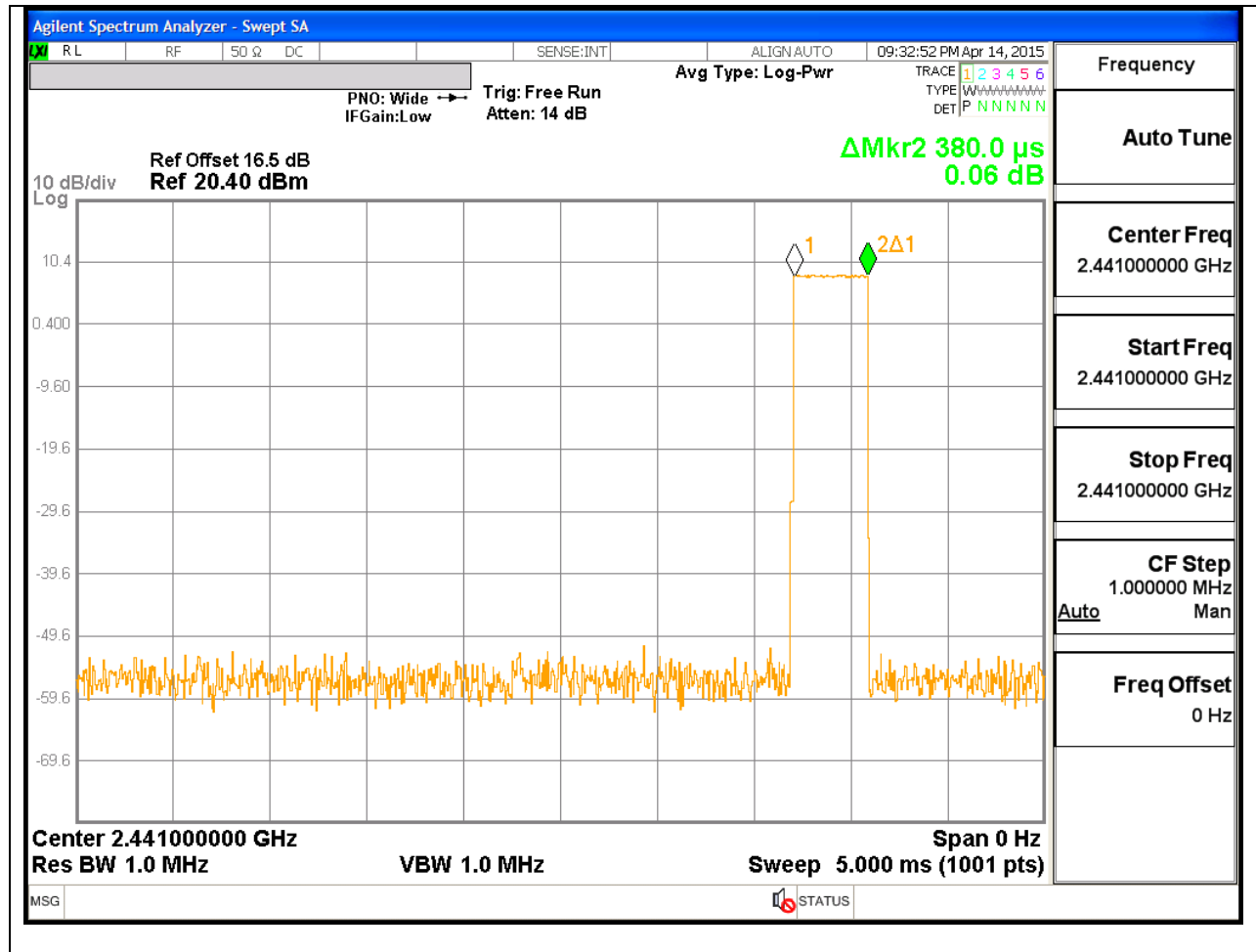
The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to 10 \* (# of pulses in 3.16 s) \* pulse width.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels \* 0.4 seconds) is equal to 10 \* (# of pulses in 0.8 s) \* pulse width.

**RESULTS**

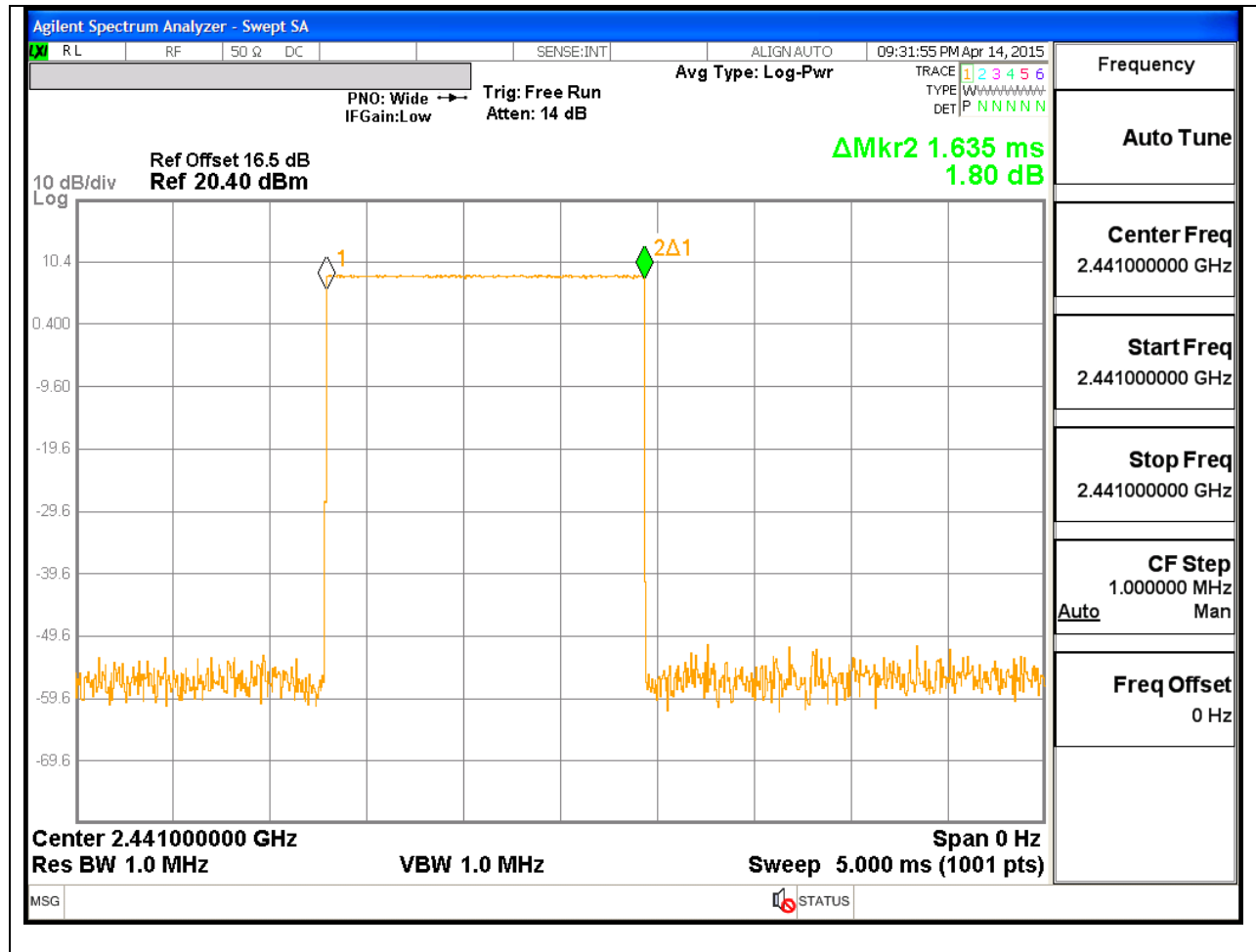
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
<b>GFSK Normal Mode</b>					
DH1	0.38	32	0.1216	0.4	-0.2784
DH3	1.635	18	0.2943	0.4	-0.1057
DH5	2.885	11	0.31735	0.4	-0.08265
<b>GFSK AFH Mode</b>					
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.38	8	0.0304	0.4	-0.3696
DH3	1.635	4.5	0.073575	0.4	-0.32643
DH5	2.885	2.75	0.0793375	0.4	-0.32066

**PULSE WIDTH - DH1**

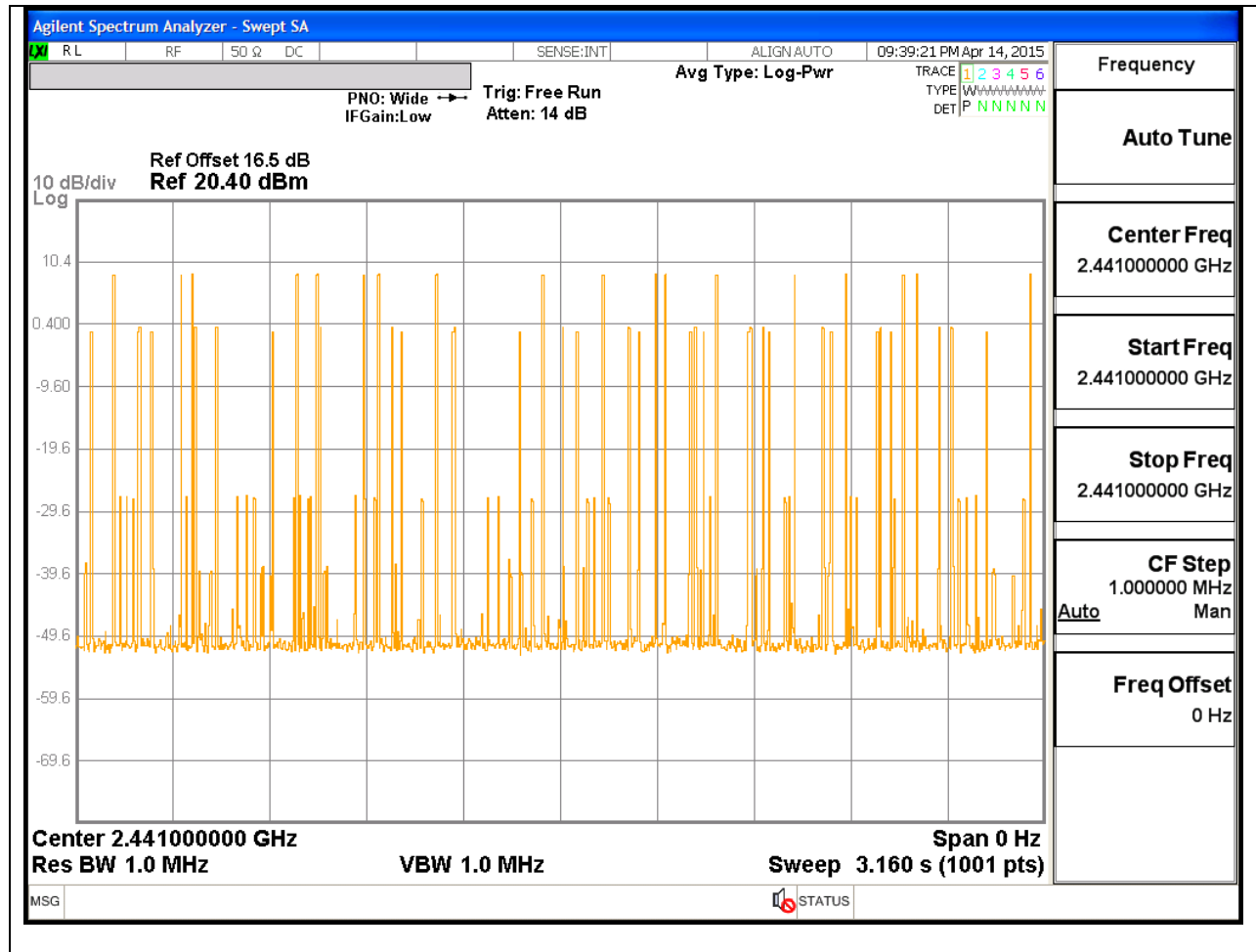




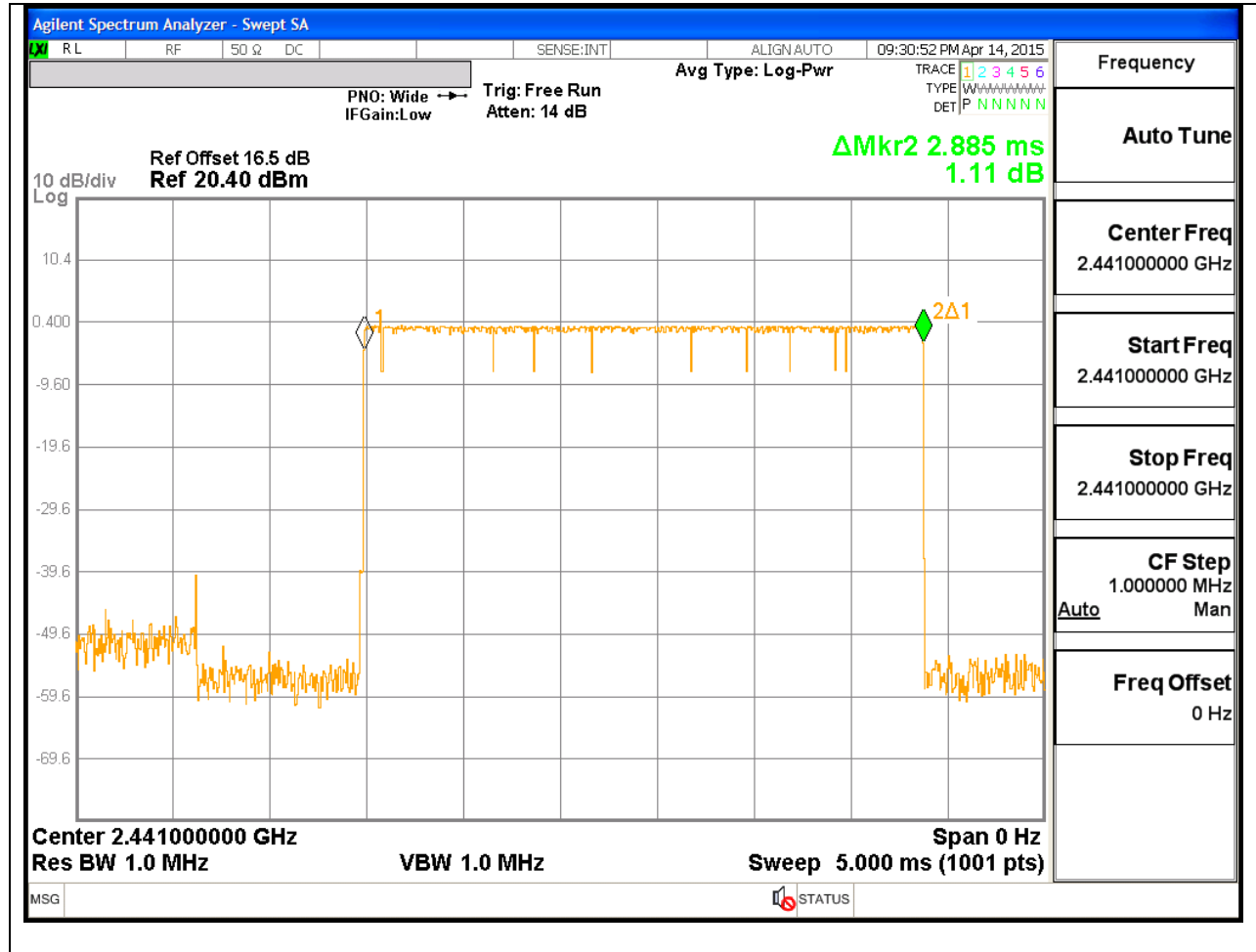
**PULSE WIDTH - DH3**



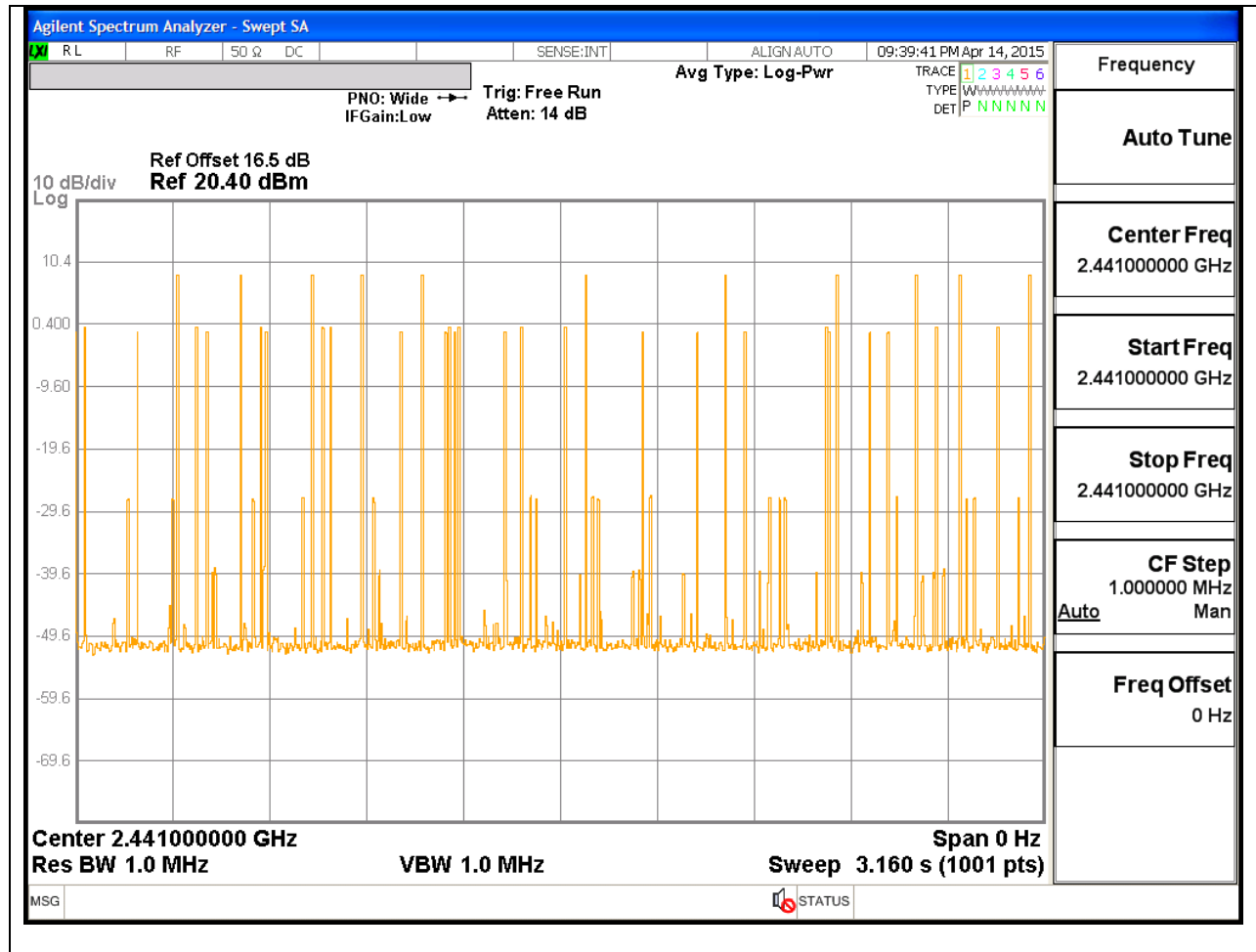
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH3**



**PULSE WIDTH - DH5**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH5**





## **8.5. OUTPUT POWER LIMIT**

§15.247 (b) (1)

The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

### **TEST PROCEDURE**

DA 00-705: The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

### **RESULTS**

#### **8.5.1. BASIC DATA RATE GFSK MODULATION**

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.394	21	-14.606
Middle	2441	8.080	21	-12.920
High	2480	6.428	21	-14.572
Worst		8.080		-12.920

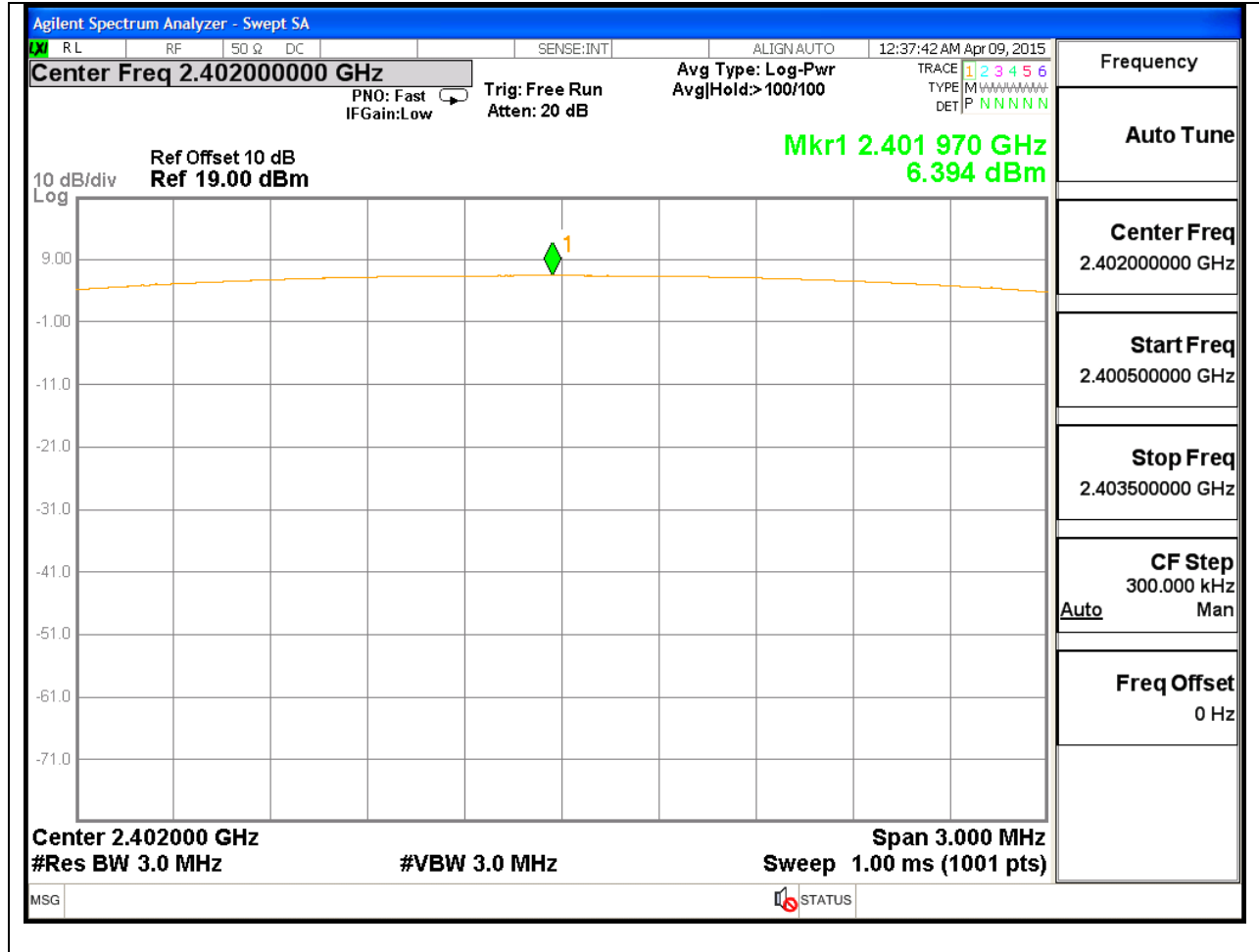
#### **8.5.2. ENHANCED DATA RATE 8PSK MODULATION**

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.498	21	-14.502
Middle	2441	8.132	21	-12.868
High	2480	6.455	21	-14.545
Worst		8.132		-12.868

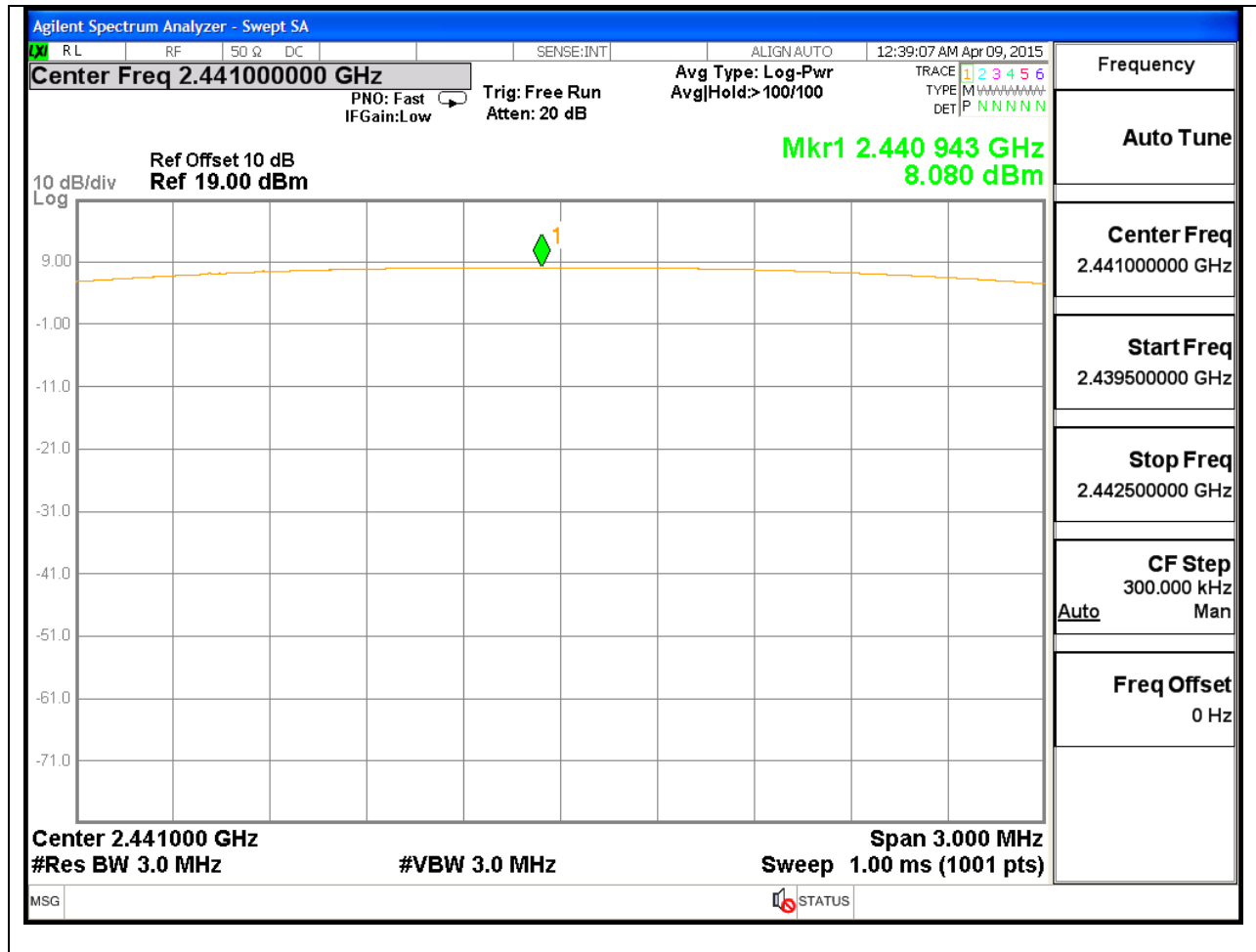
### 8.5.3. OUTPUT POWER PLOTS

#### GFSK OUTPUT POWER

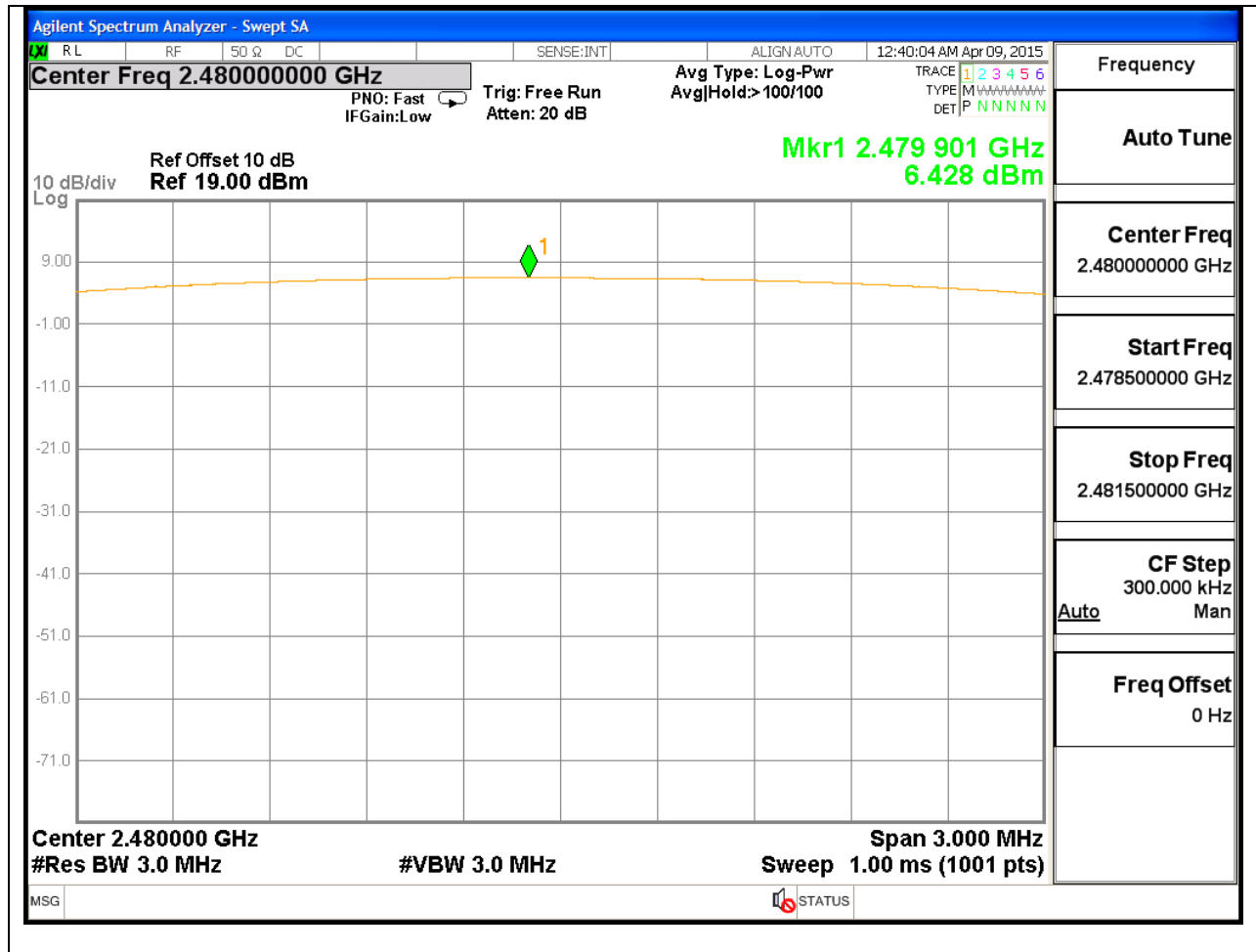
#### LOW CHANNEL



MID CHANNEL

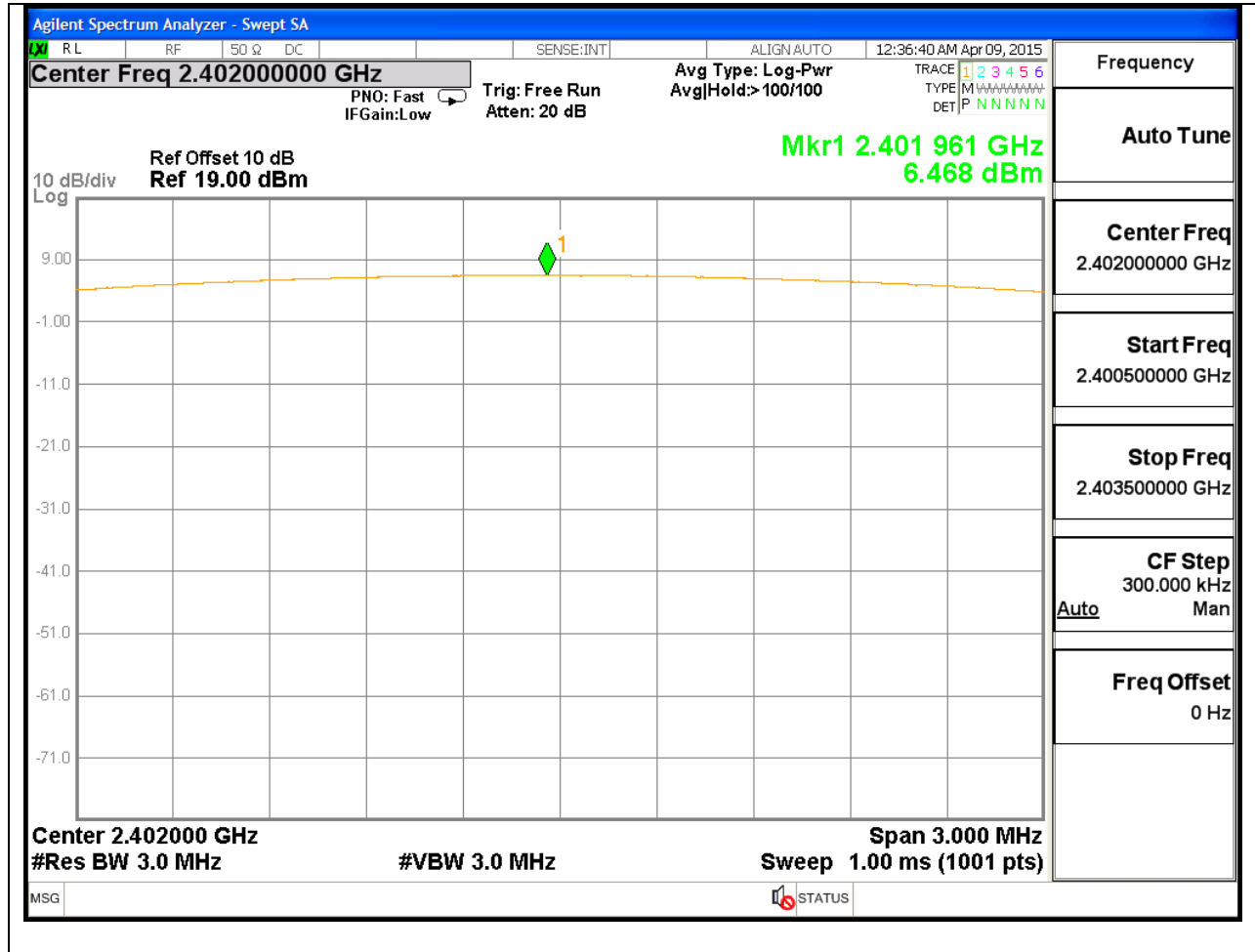


**HIGH CHANNEL**

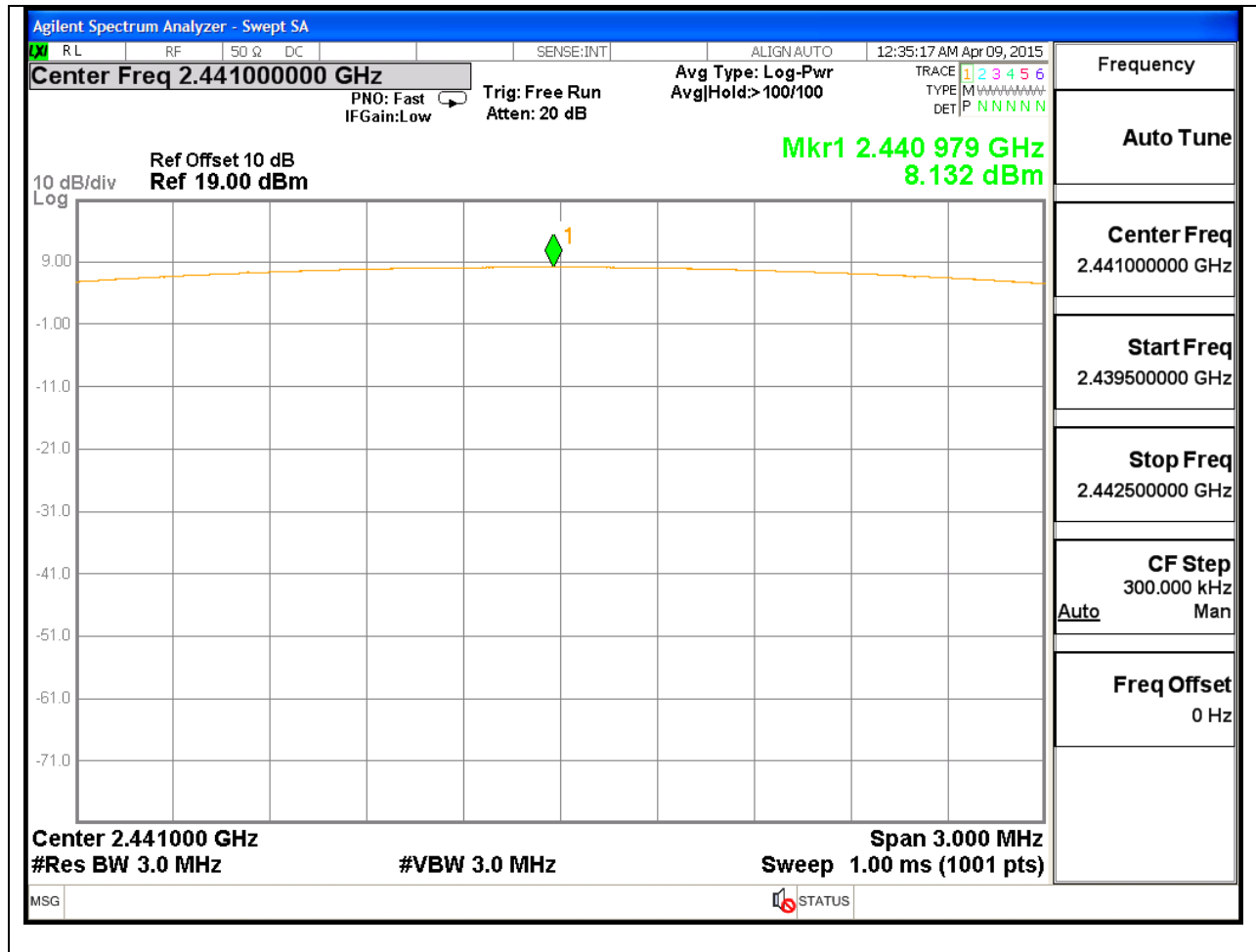


**8PSK OUTPUT POWER**

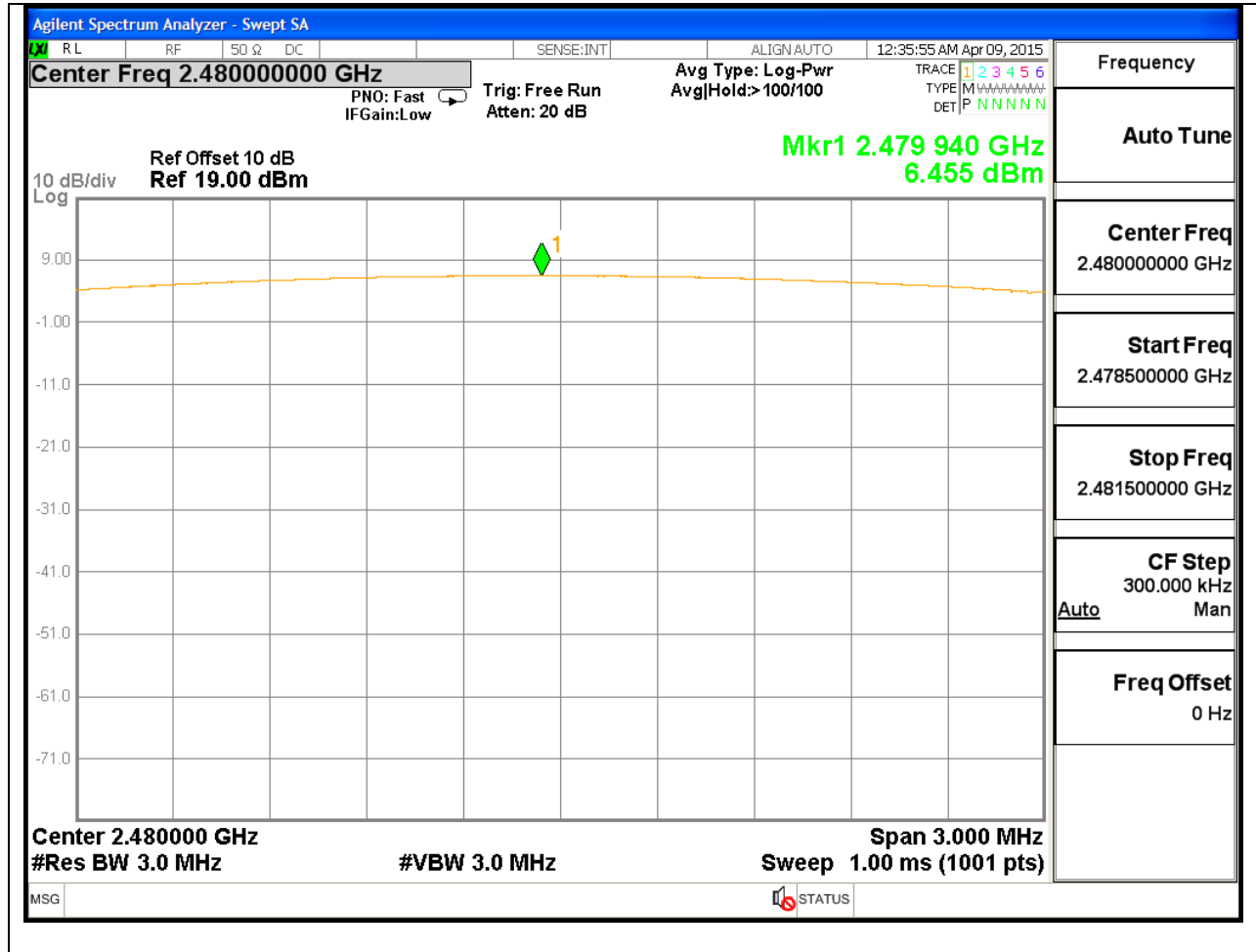
**LOW CHANNEL**



MID CHANNEL



**HIGH CHANNEL**



## **8.6. AVERAGE POWER**

### **LIMIT**

None; for reporting purposes only.

### **TEST PROCEDURE**

DA 00-705: The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 0.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

### **RESULTS**



### 8.6.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	5.8
Middle	2441	7.7
High	2480	5.9
Worst		7.7

### 8.6.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.00
Middle	2441	5.90
High	2480	4.30
Worst		6.00

### 8.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.3
Middle	2441	5.2
High	2480	3.4
Worst		5.2

## **8.7. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.247 (d)

Limit = -20 dBc

### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

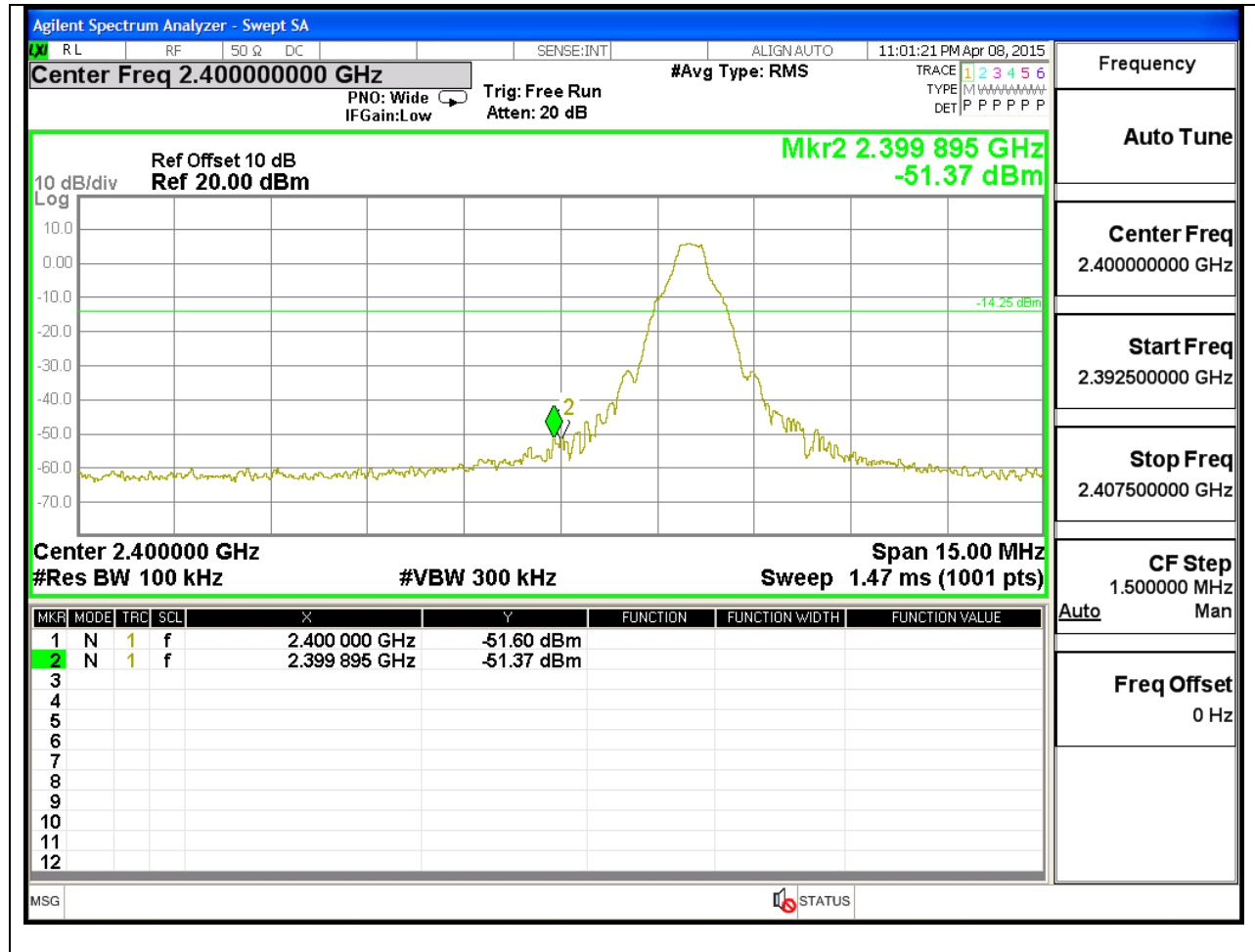
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

### **RESULTS**

**8.7.1. BASIC DATA RATE GFSK MODULATION**  
**SPURIOUS EMISSIONS, LOW CHANNEL**

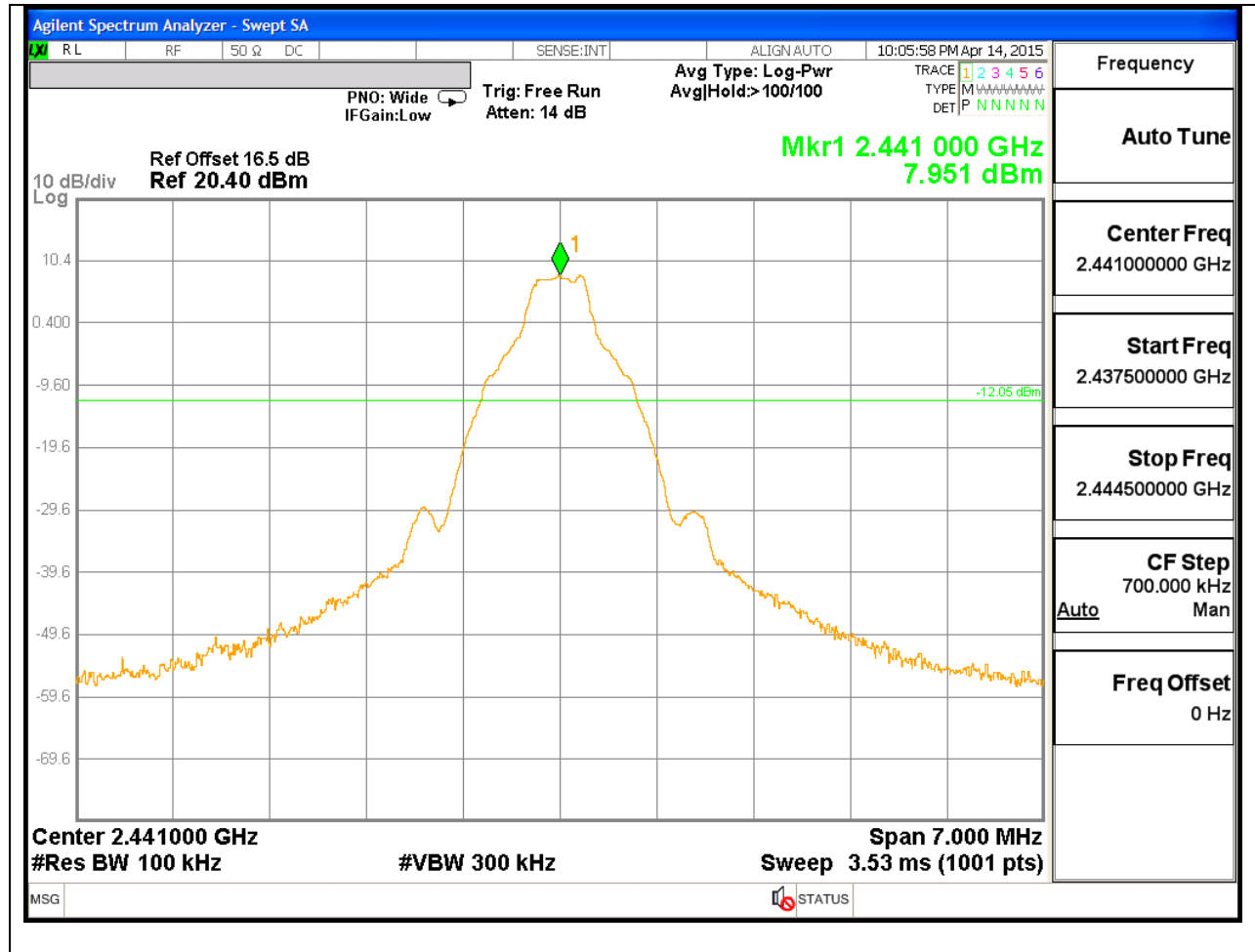
**LOW CHANNEL BANDEDGE**



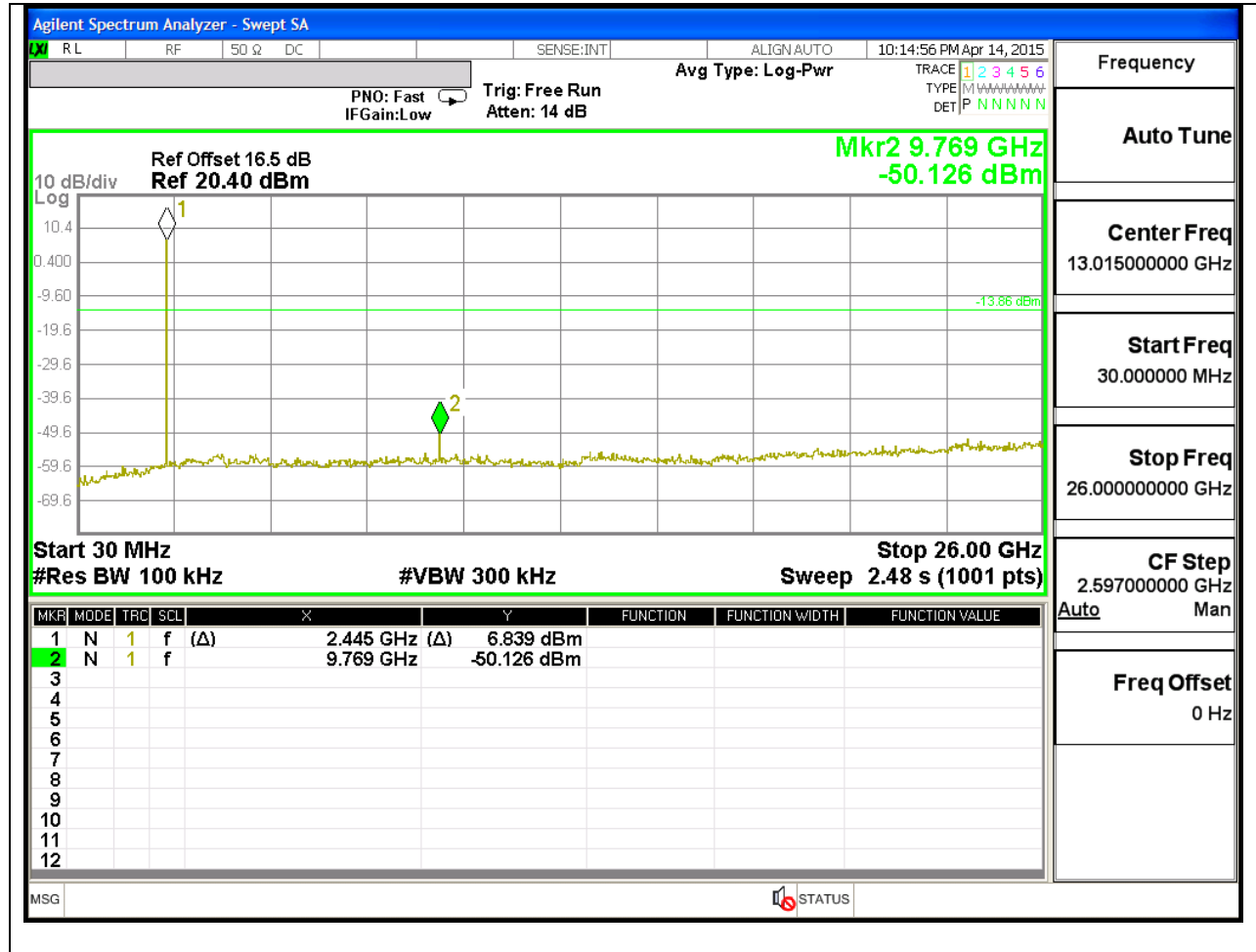


**SPURIOUS EMISSIONS, MID CHANNEL**

**MID CHANNEL BANDEDGE**

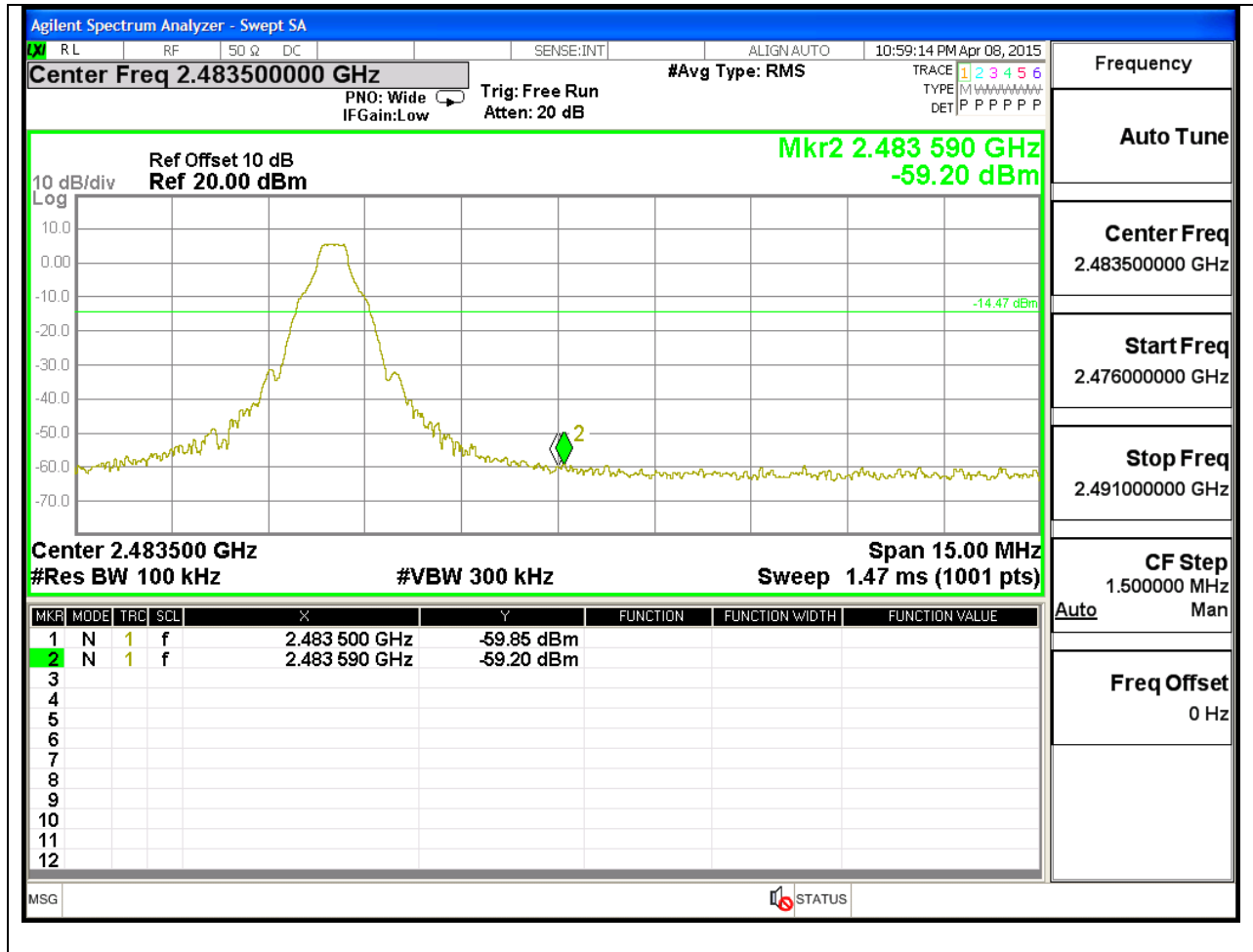


MID CHANNEL SPURIOUS

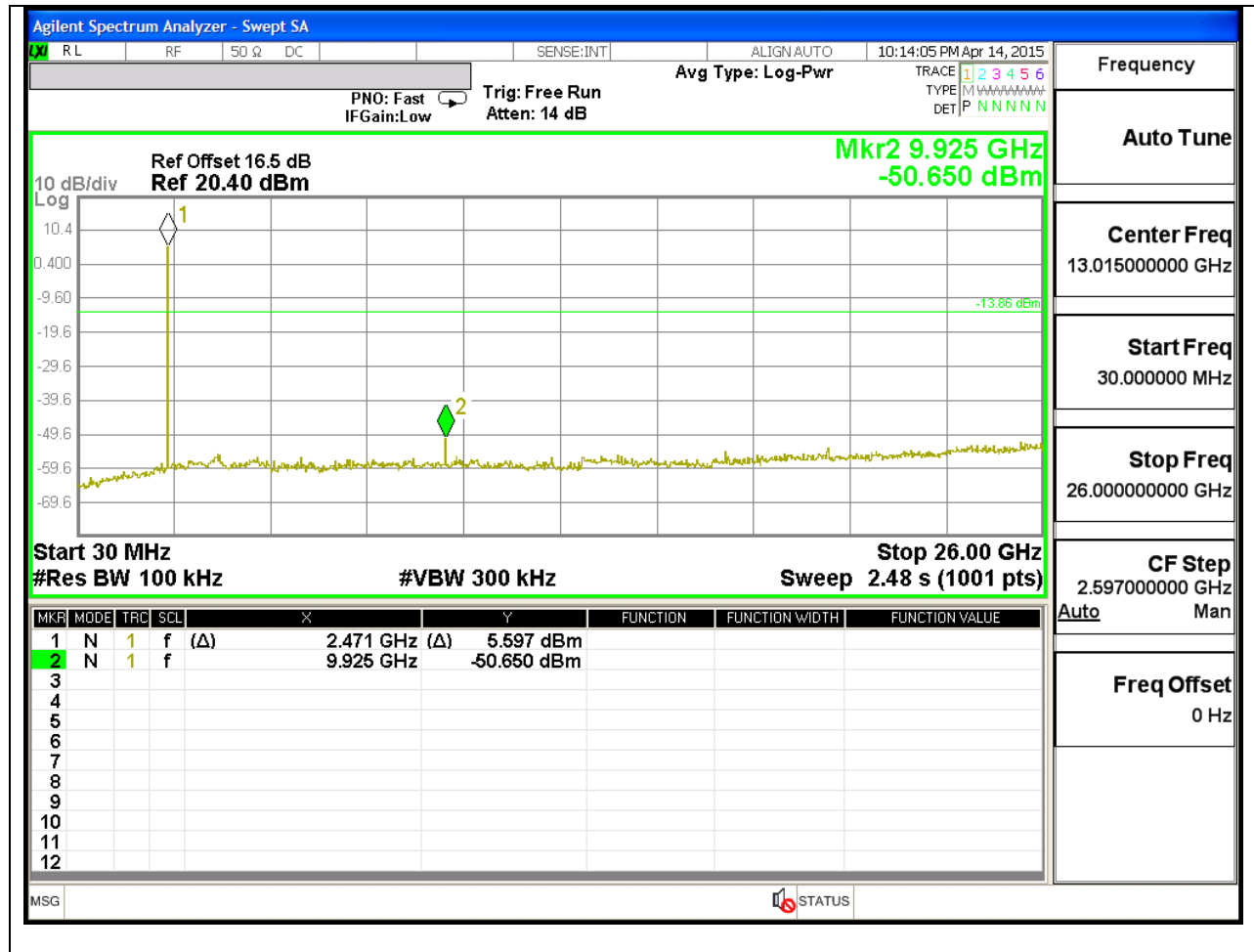


**SPURIOUS EMISSIONS, HIGH CHANNEL**

**HIGH CHANNEL BANDEDGE**



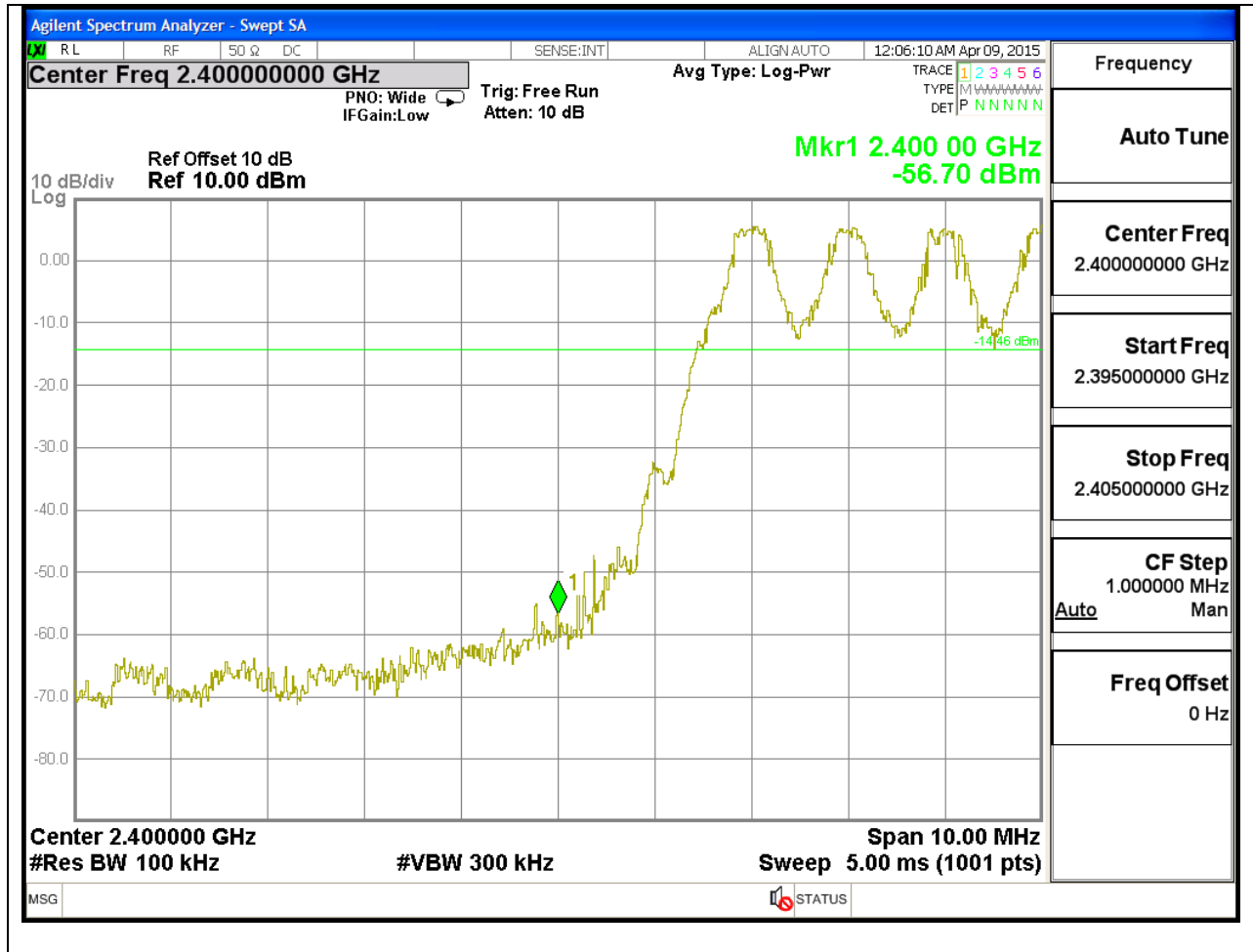
**HIGH CHANNEL SPURIOUS**



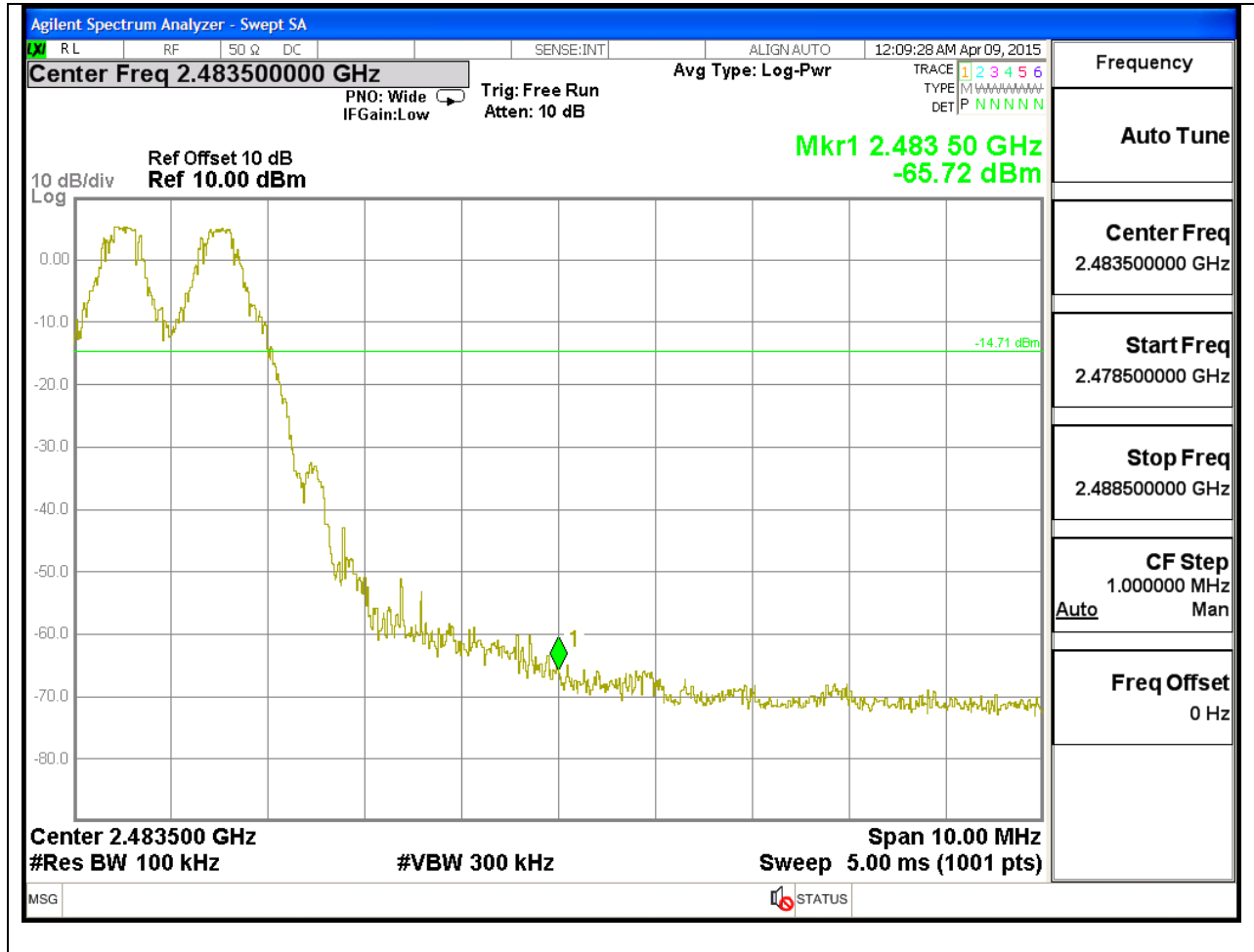


**SPURIOUS BANDEGE EMISSIONS WITH HOPPING ON**

**LOW BANDEGE WITH HOPPING ON**



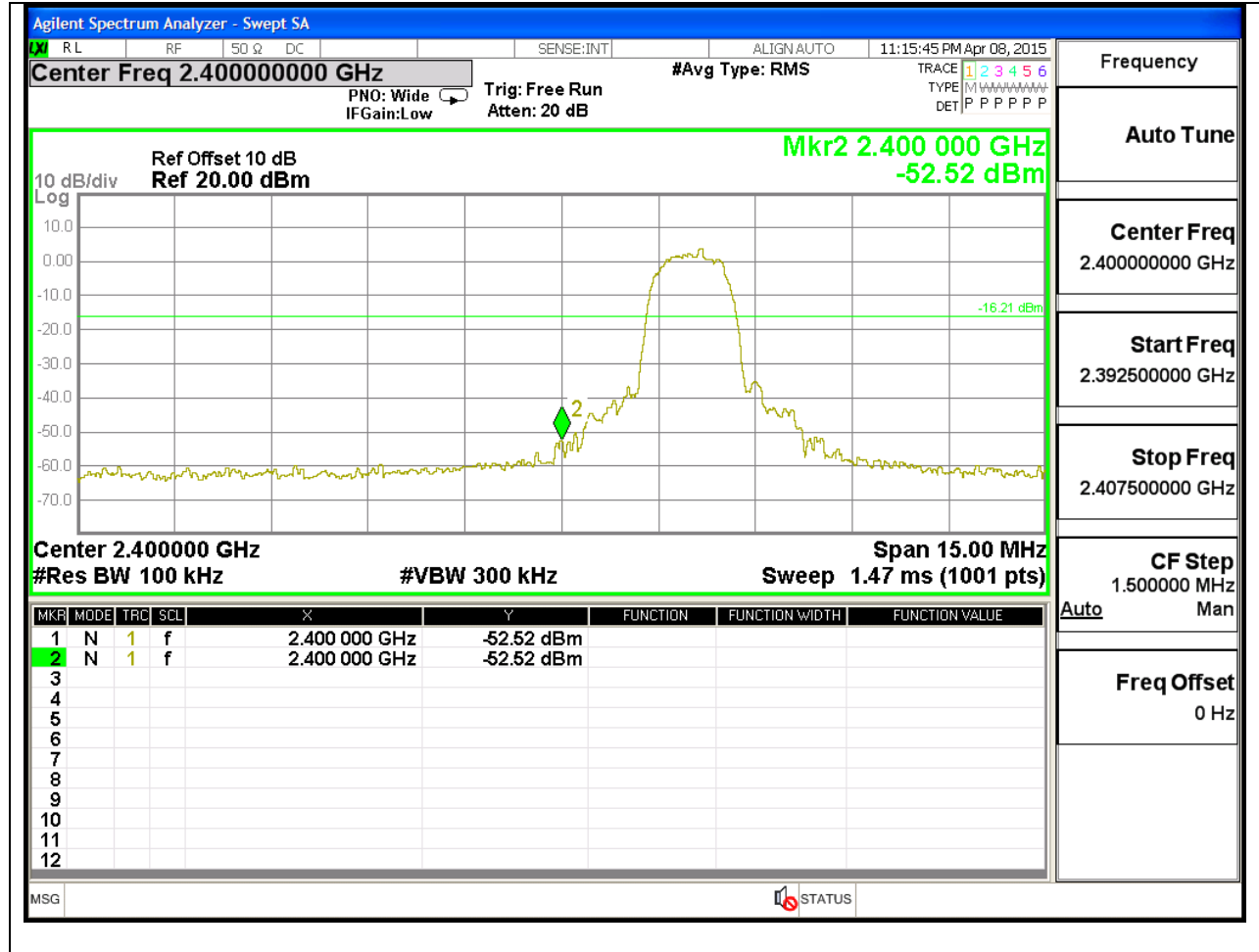
**HIGH BANDEDGE WITH HOPPING ON**



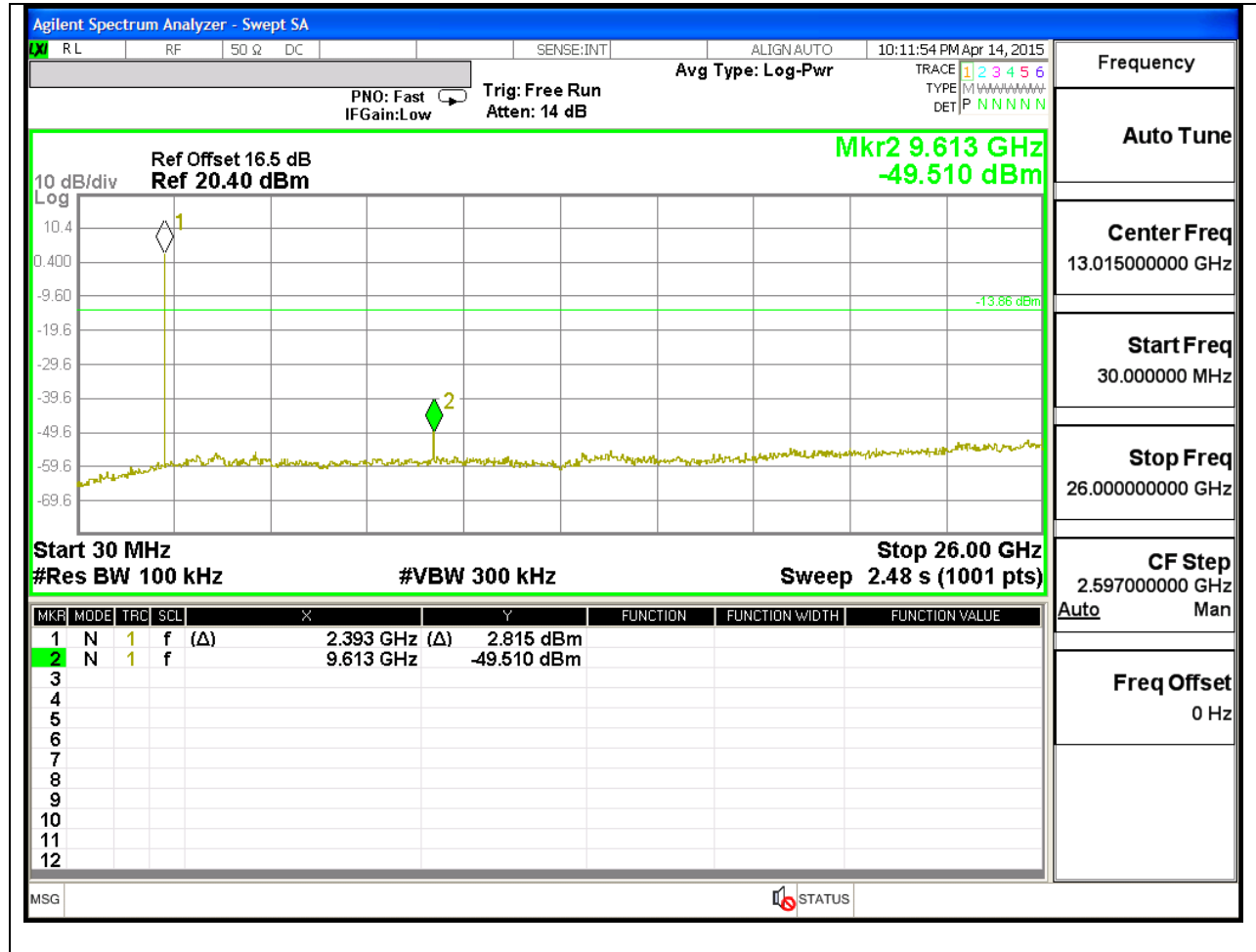
### 8.7.2. ENHANCED DATA RATE 8PSK MODULATION

#### SPURIOUS EMISSIONS, LOW CHANNEL

#### LOW CHANNEL BANDEDGE

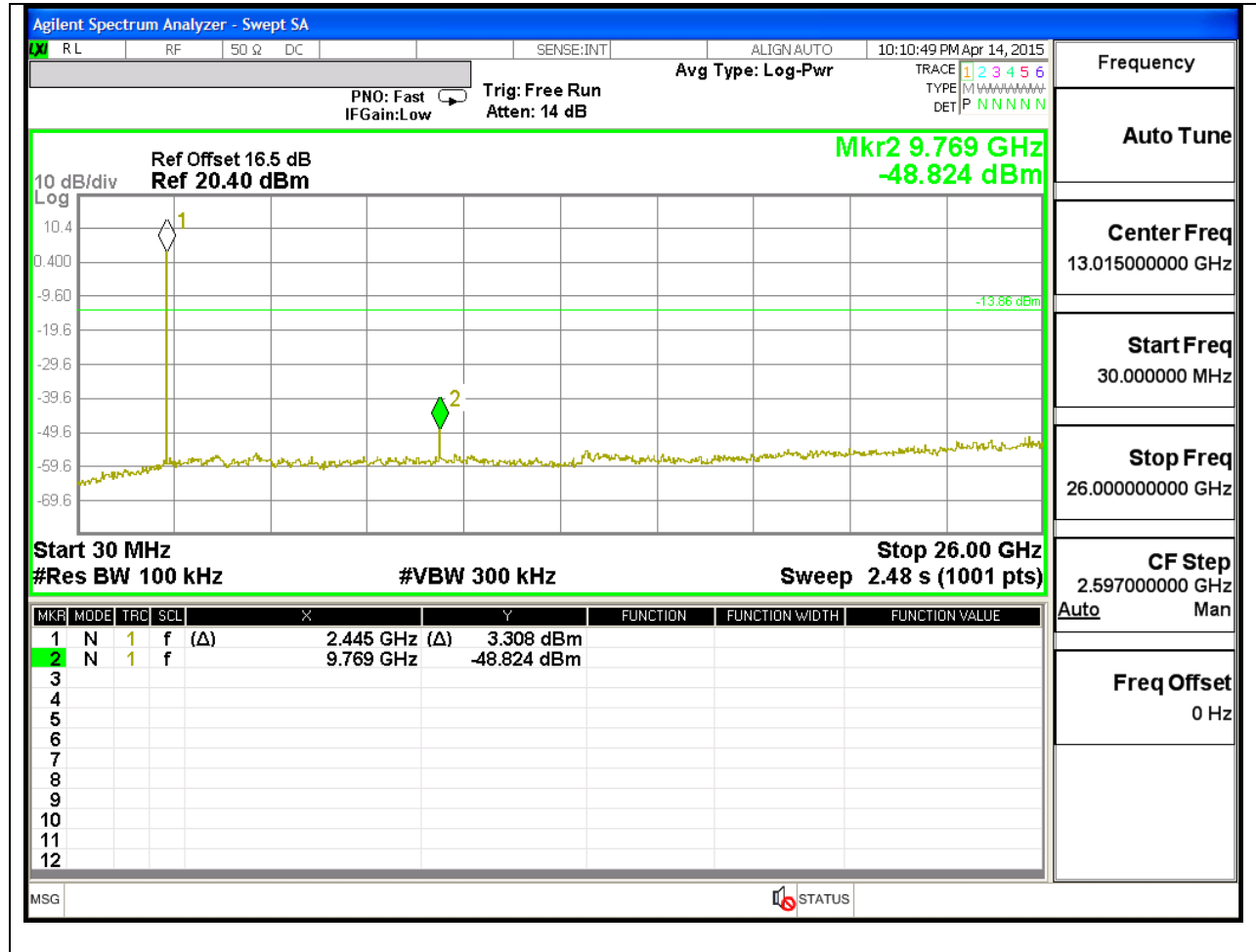


LOW CHANNEL SPURIOUS



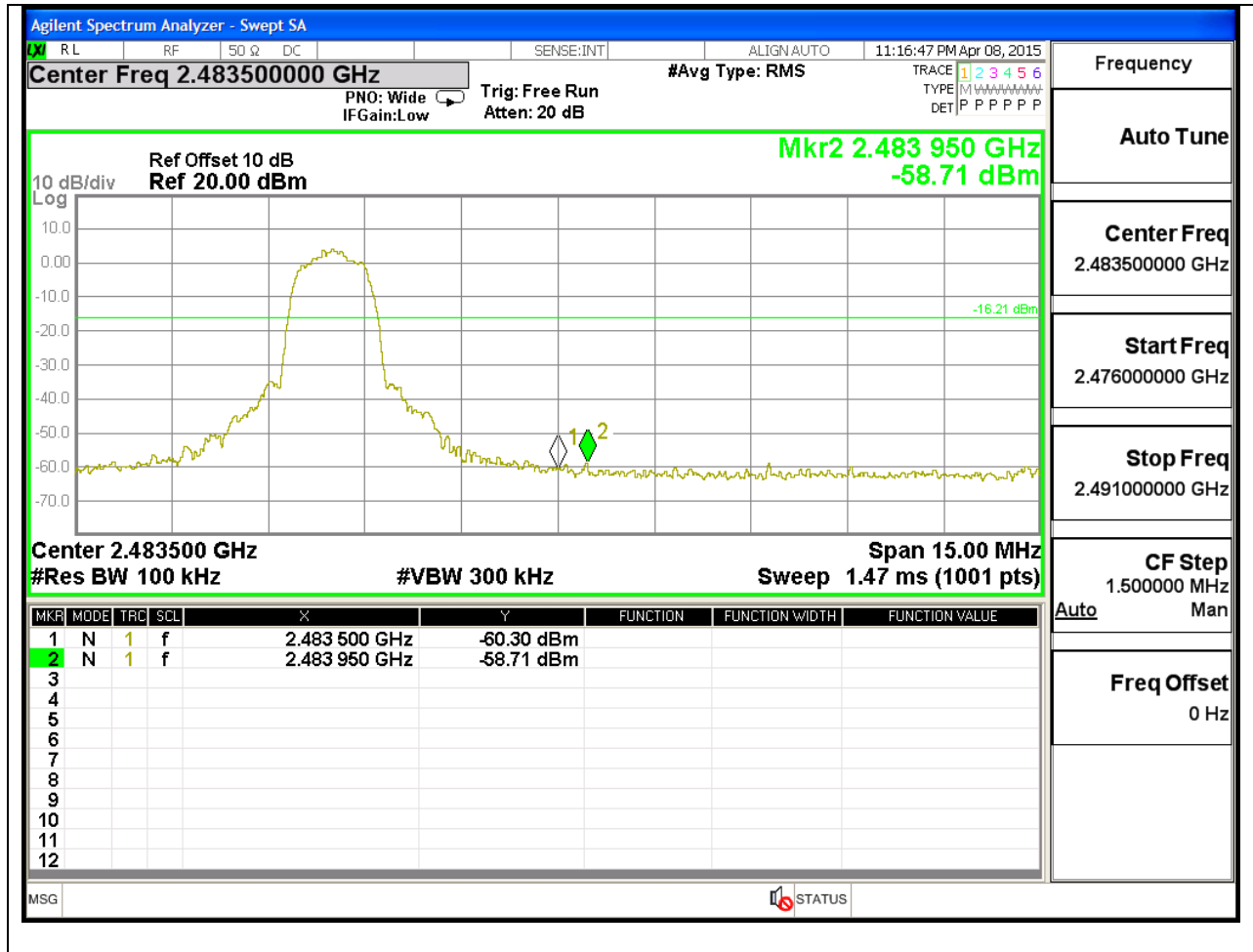


**MID CHANNEL SPURIOUS**

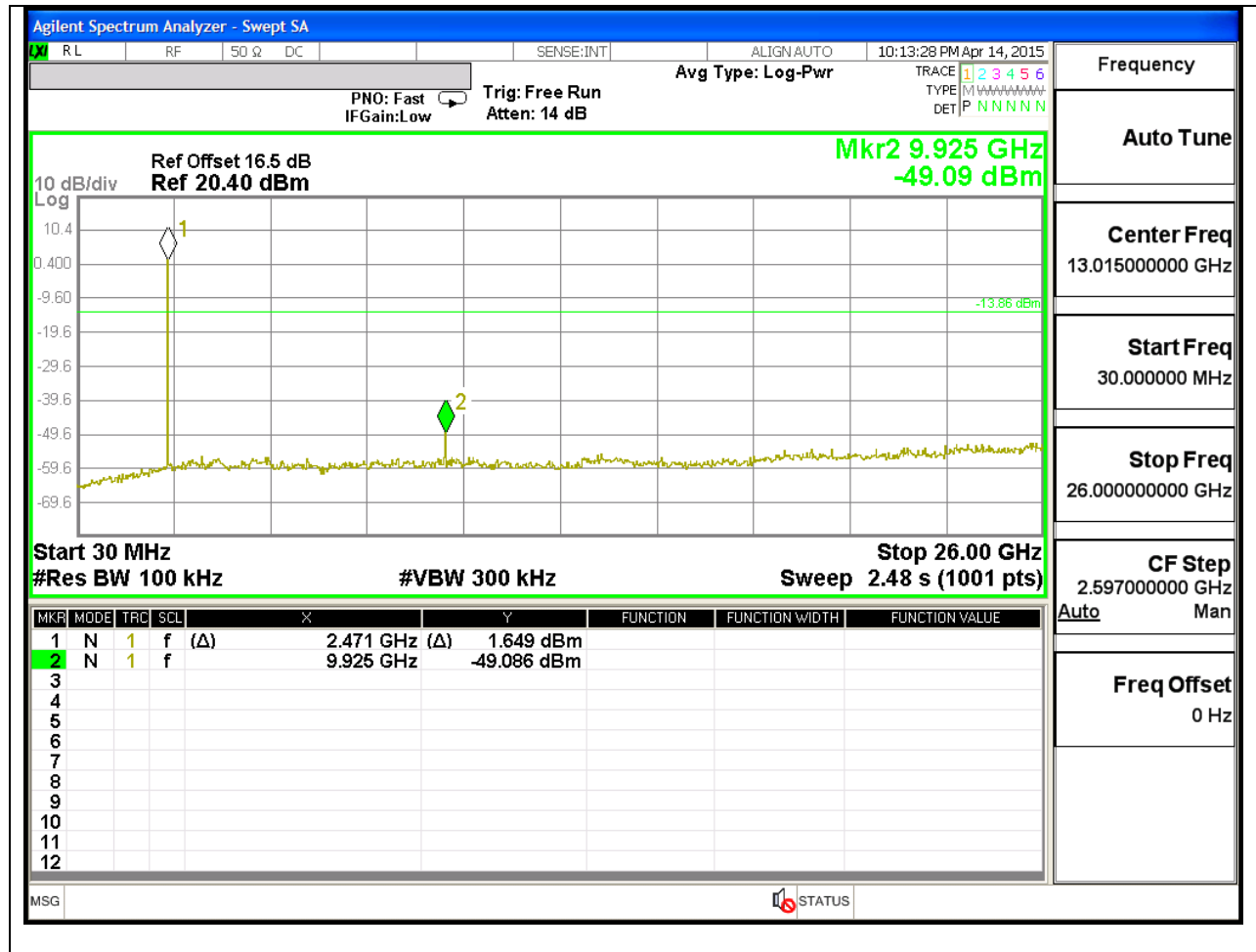


**SPURIOUS EMISSIONS, HIGH CHANNEL**

**HIGH CHANNEL BANDEDGE**



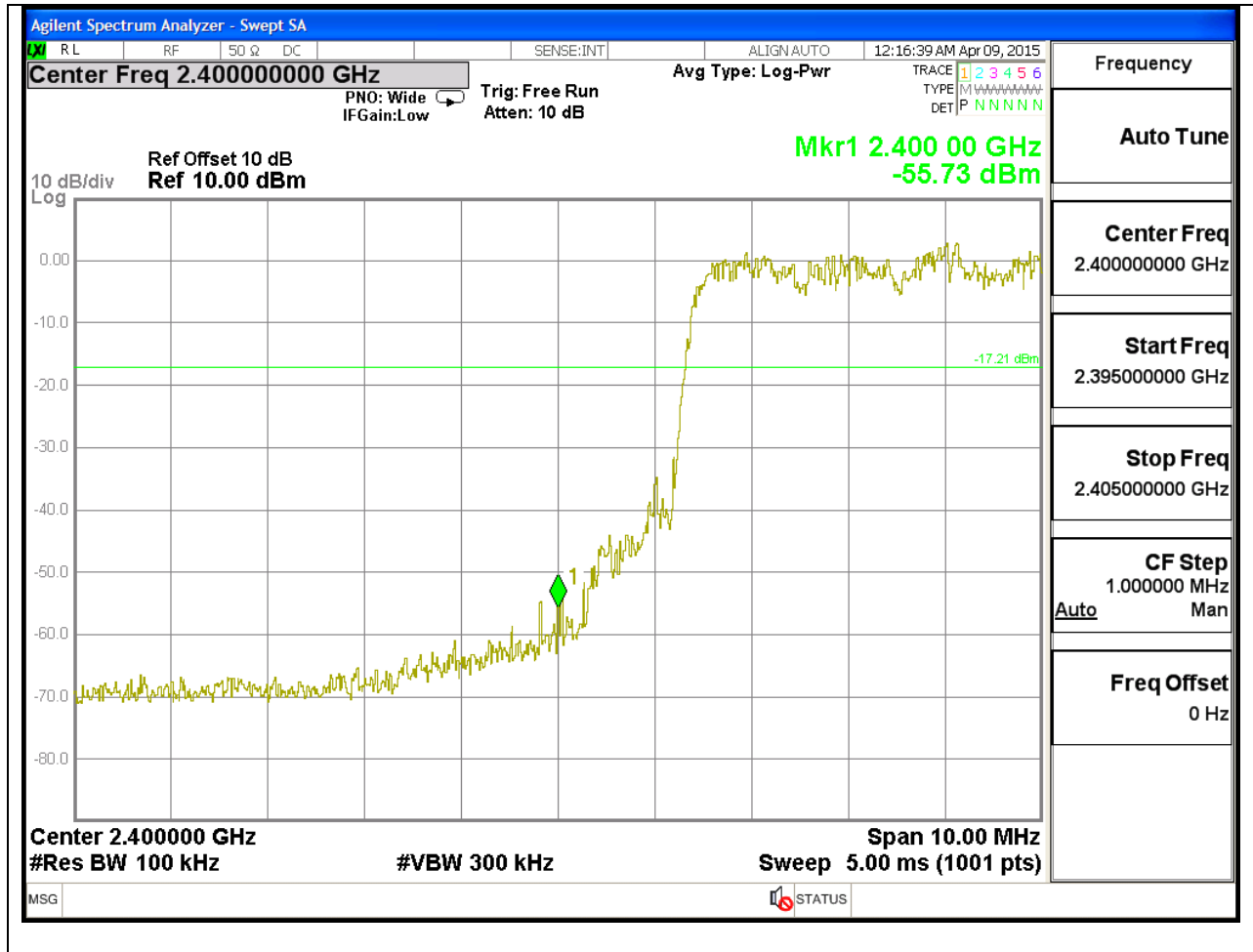
### HIGH CHANNEL SPURIOUS



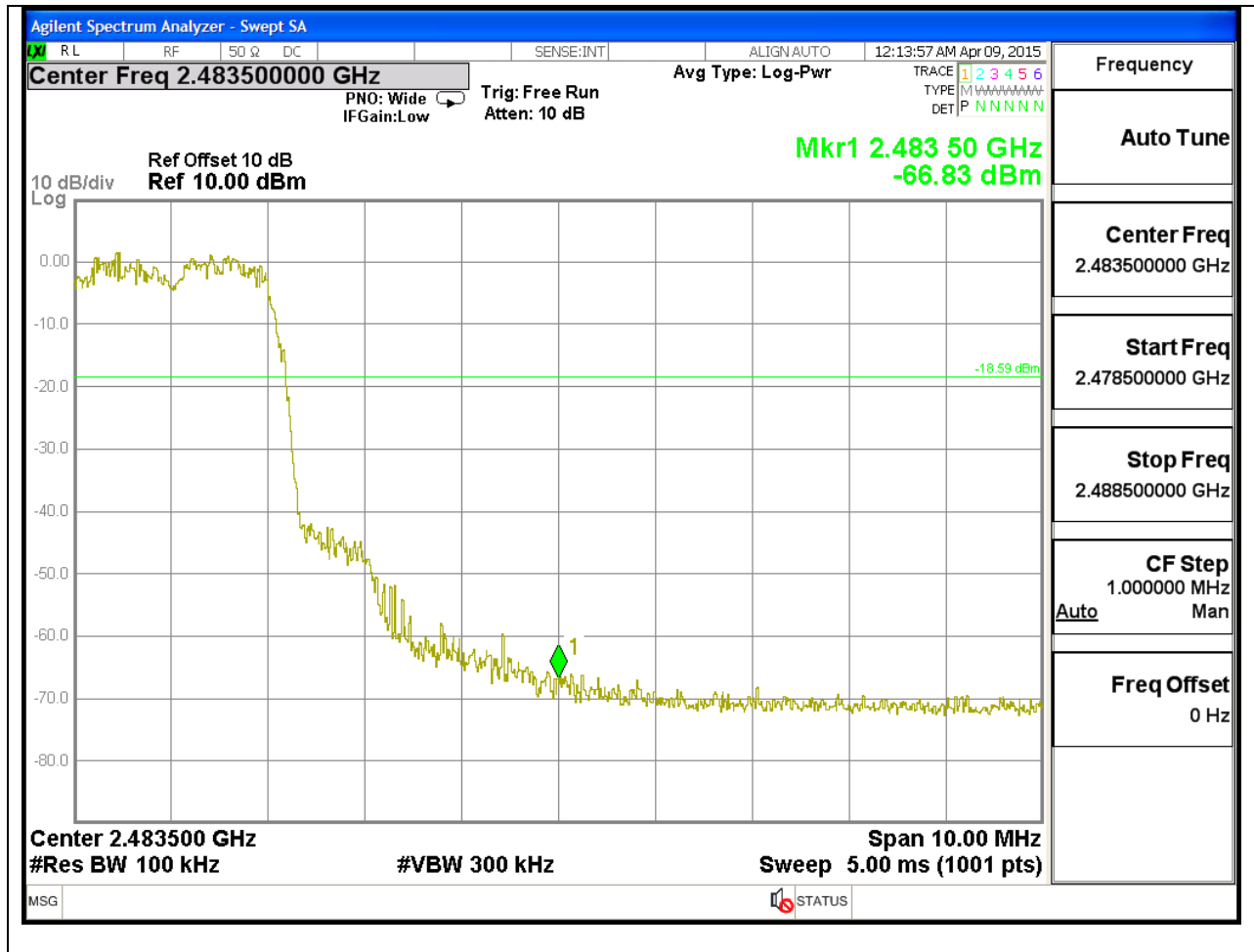


**SPURIOUS BANDEGE EMISSIONS WITH HOPPING ON**

**LOW BANDEGE WITH HOPPING ON**



**HIGH BANDEDGE WITH HOPPING ON**



## 9. RADIATED TEST RESULTS

### 9.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For band edge measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 1/T (on time) for average measurement.  $GFSK = 1/T = 1 / 0.0038S = 260Hz$ .

The spectrum from 1GHzHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

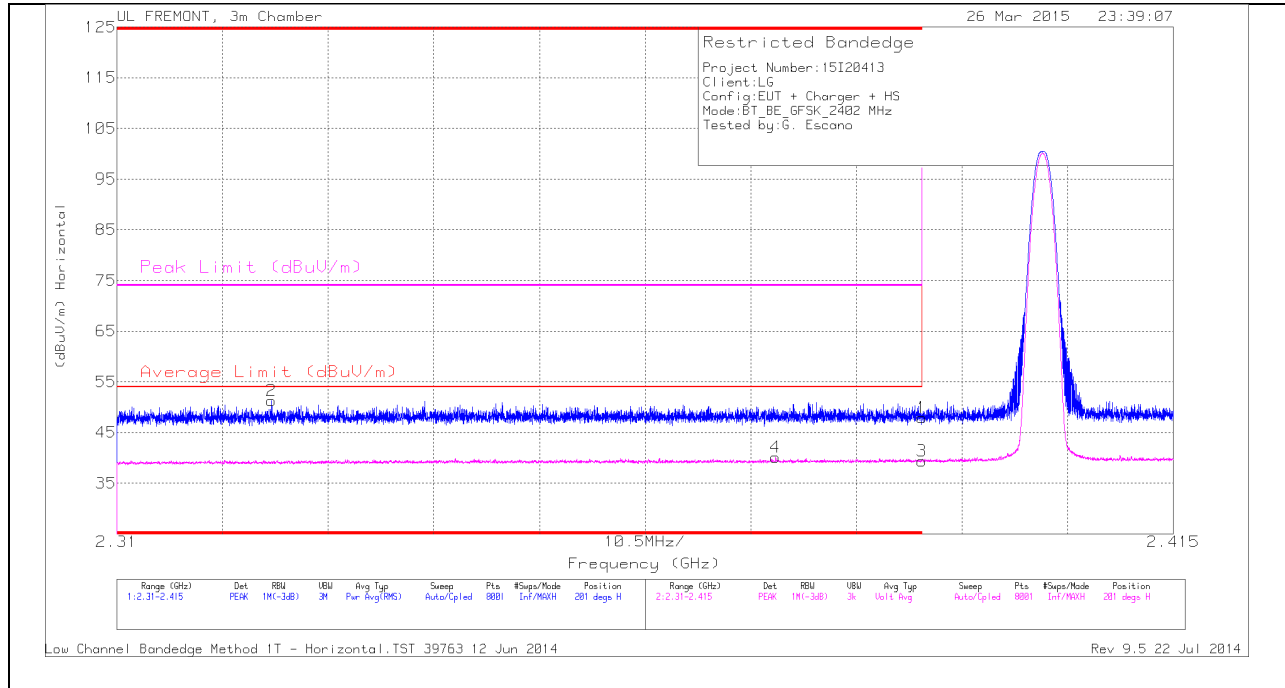
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

## 9.2. TRANSMITTER ABOVE 1 GHz

### 9.2.1. BASIC DATA RATE GFSK MODULATION

#### RESTRICTED BANDEDGE (LOW CHANNEL)

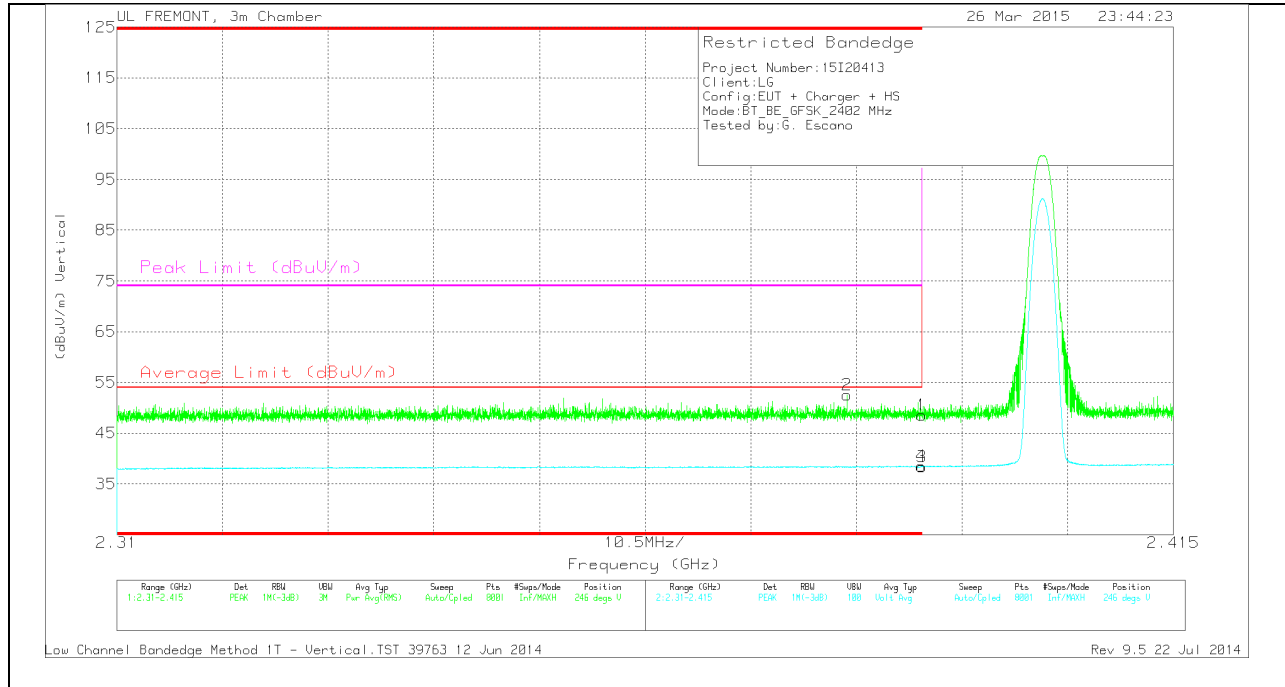
##### HORIZONTAL PEAK AND AVERAGE PLOT



#### HORIZONTAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/ Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.07	PK	32	-23.1	47.97	-	-	74	-26.03	201	308	H
2	* 2.325	42.7	PK	31.7	-23.1	51.3	-	-	74	-22.7	201	308	H
3	* 2.39	30.44	VB1T	32	-23.1	39.34	54	-14.66	-	-	201	308	H
4	* 2.375	31.31	VB1T	31.9	-23.1	40.11	54	-13.89	-	-	201	308	H

**VERTICAL PEAK AND AVERAGE PLOT**

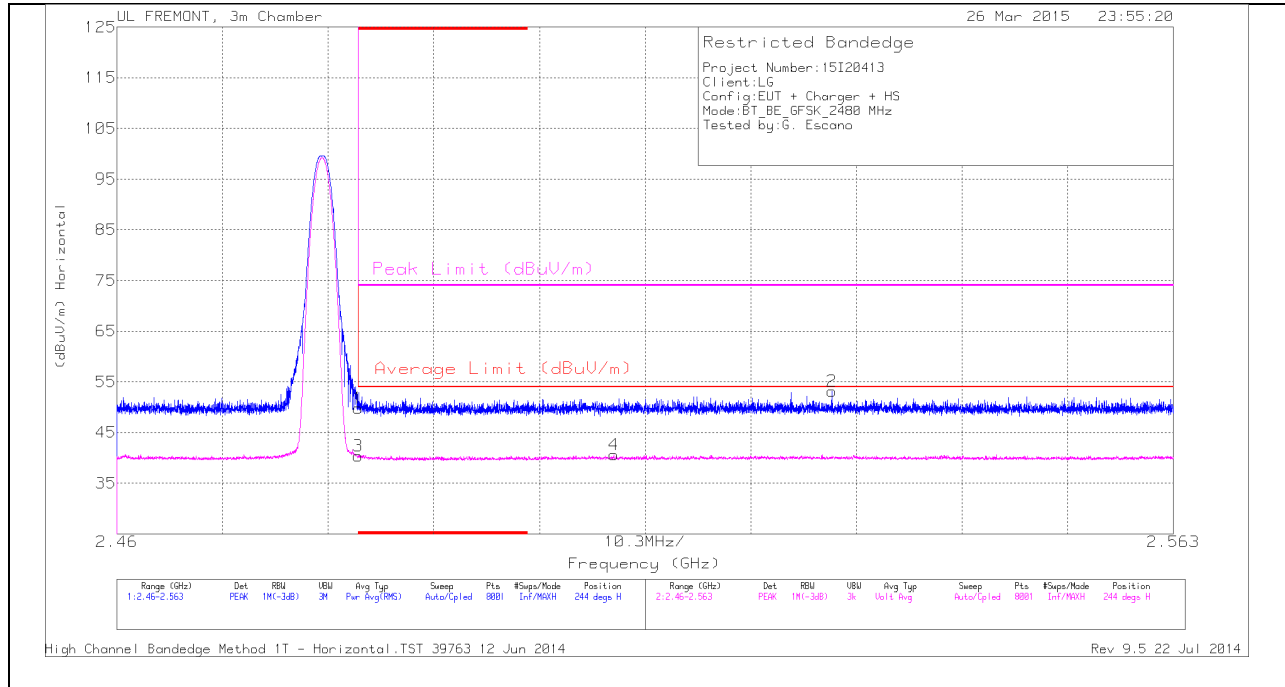


**VERTICAL DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/ Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.383	43.61	PK	32	-23.1	52.51	-	-	74	-21.49	246	313	V
1	* 2.39	39.71	PK	32	-23.1	48.61	-	-	74	-25.39	246	313	V
3	* 2.39	29.51	VB1T	32	-23.1	38.41	54	-15.59	-	-	246	313	V
4	* 2.39	29.61	VB1T	32	-23.1	38.51	54	-15.49	-	-	246	313	V

**AUTHORIZED BANDEDGE (HIGH CHANNEL)**

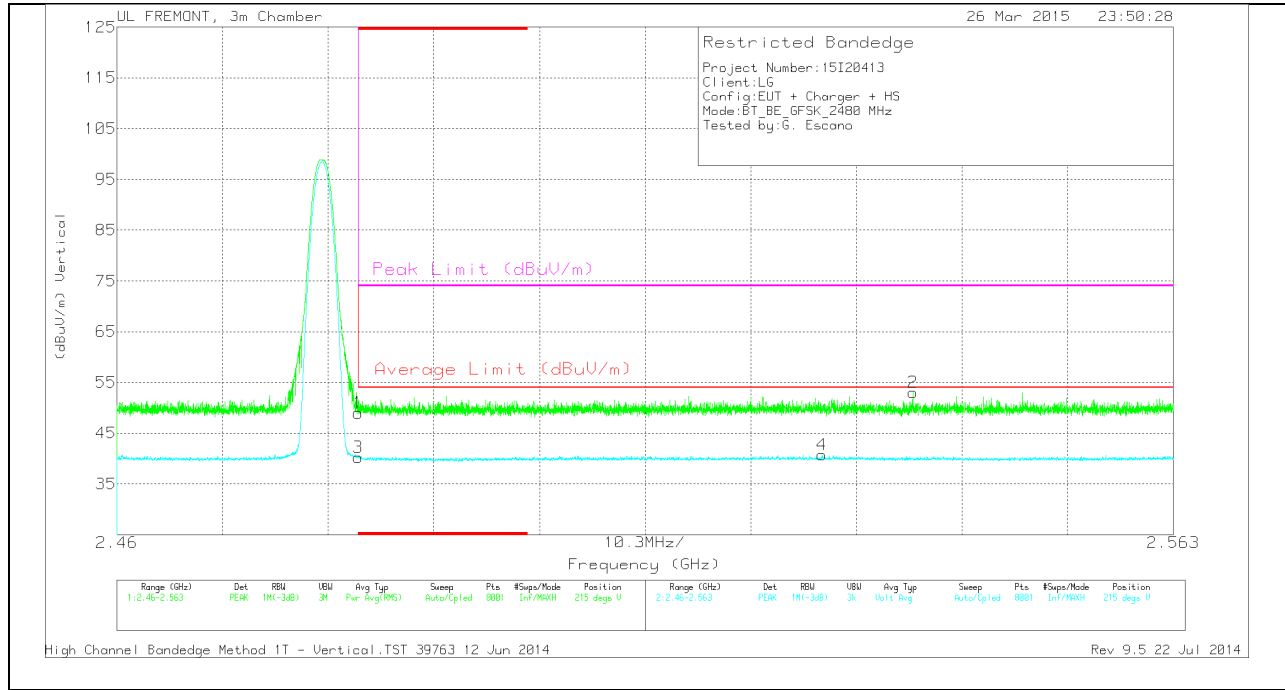
**HORIZONTAL PEAK AND AVERAGE PLOT**



**HORIZONTAL DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/ Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.32	PK	32.3	-22.8	49.82	-	-	74	-24.18	244	304	H
3	* 2.484	30.87	VB1T	32.3	-22.8	40.37	54	-13.63	-	-	244	304	H
4	2.508	31.1	VB1T	32.3	-22.8	40.6	54	-13.4	-	-	244	304	H
2	2.53	43.32	PK	32.4	-22.6	53.12	-	-	74	-20.88	244	304	H

**VERTICAL PEAK AND AVERAGE PLOT**

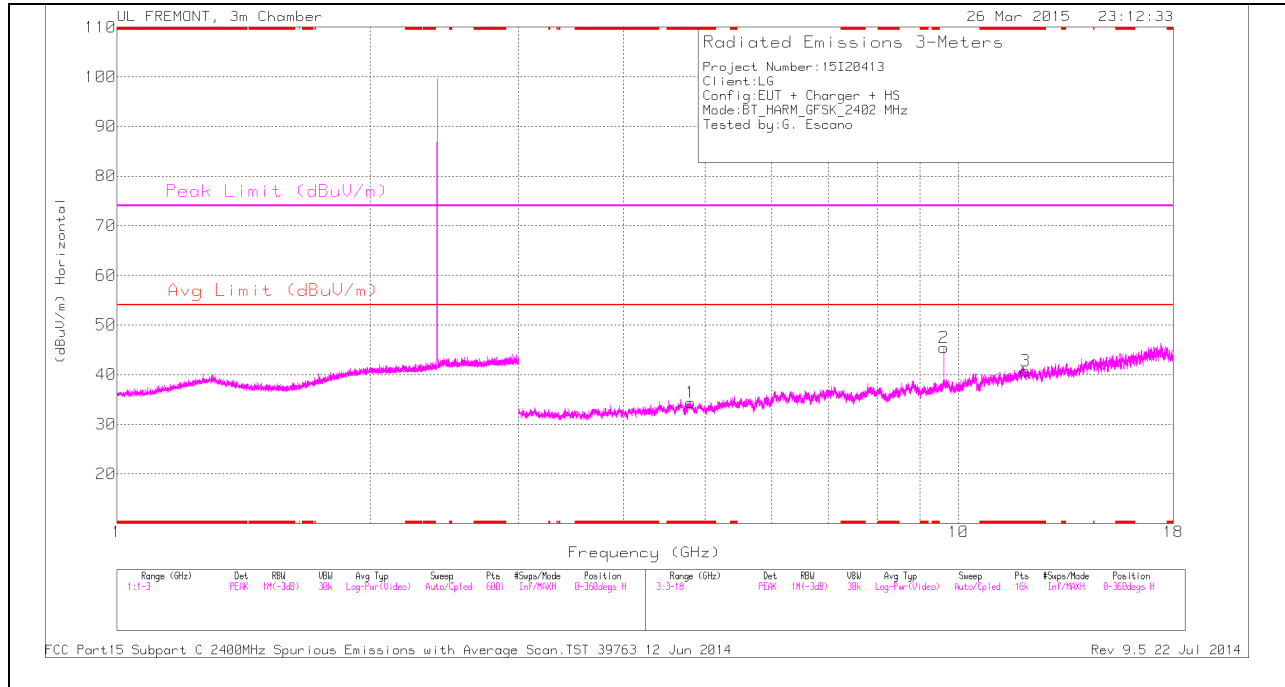


**VERTICAL DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/ Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	39.49	PK	32.3	-22.8	48.99	-	-	74	-25.01	215	303	V
3	* 2.484	30.68	VB1T	32.3	-22.8	40.18	54	-13.82	-	-	215	303	V
4	2.529	30.98	VB1T	32.4	-22.6	40.78	54	-13.22	-	-	215	303	V
2	2.538	43.3	PK	32.4	-22.7	53	-	-	74	-21	215	303	V

### HARMONICS AND SPURIOUS EMISSIONS

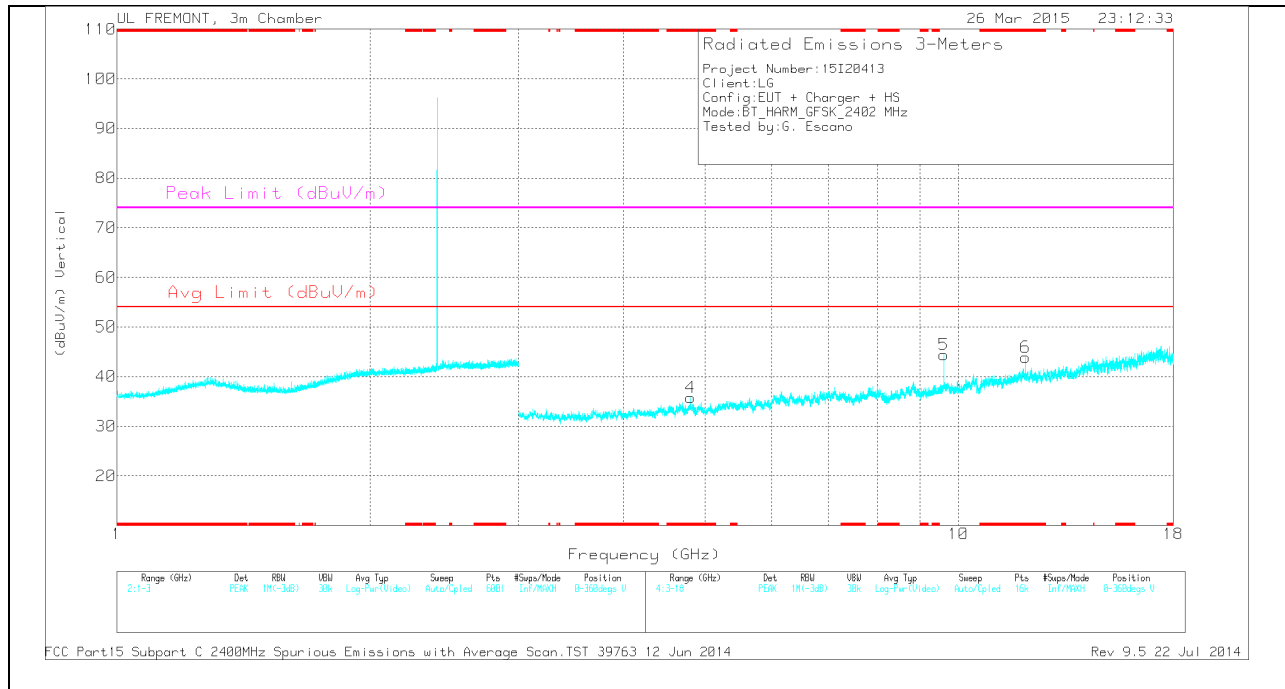
#### LOW CHANNEL HORIZONTAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.



**LOW CHANNEL VERTICAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

**LOW CHANNEL DATA**

*TRACE MARKERS*

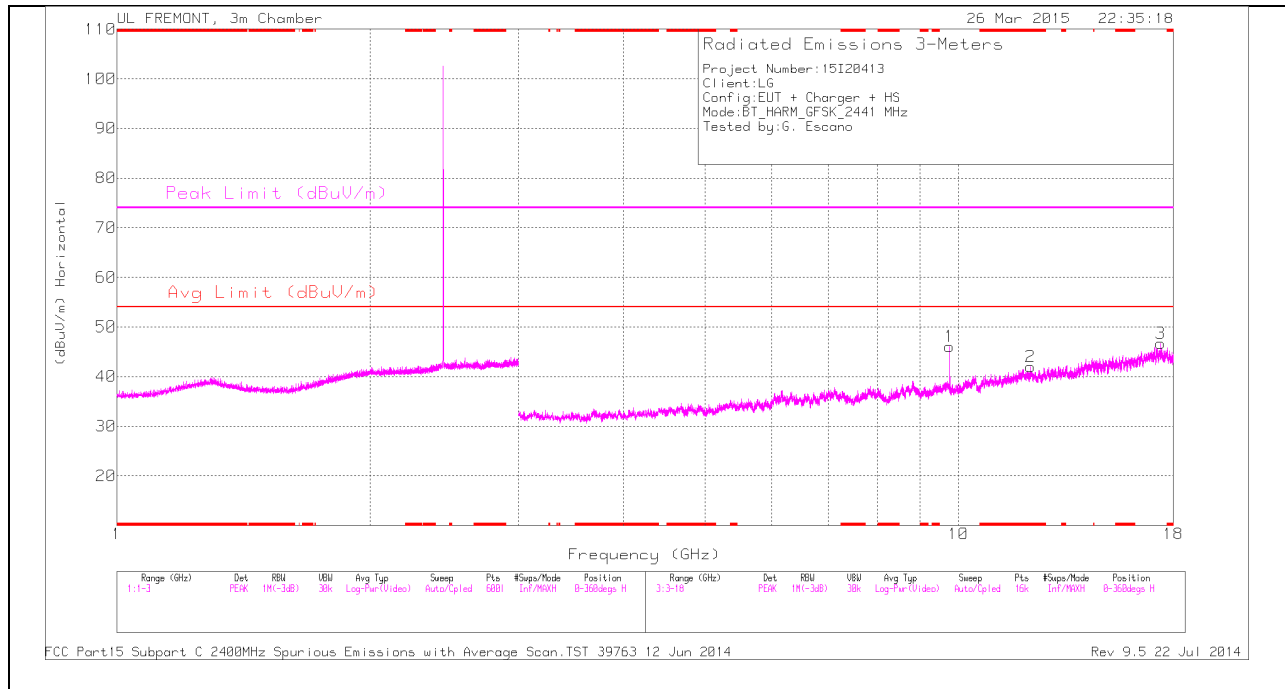
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.805	30.64	PK	34	-30.3	34.34	-	-	74	-39.66	0-360	100	H
3	* 12.011	27.52	PK	39.1	-25.9	40.72	-	-	74	-33.28	0-360	200	H
4	* 4.804	32.02	PK	34	-30.3	35.72	-	-	74	-38.28	0-360	200	V
6	* 12.011	30.65	PK	39.1	-25.9	43.85	-	-	74	-30.15	0-360	200	V
2	9.608	33.99	PK	36.7	-25.3	45.39	-	-	-	-	0-360	200	H
5	9.608	33.06	PK	36.7	-25.3	44.46	-	-	-	-	0-360	100	V

PK - Peak detector

*RADIATED EMISSIONS*

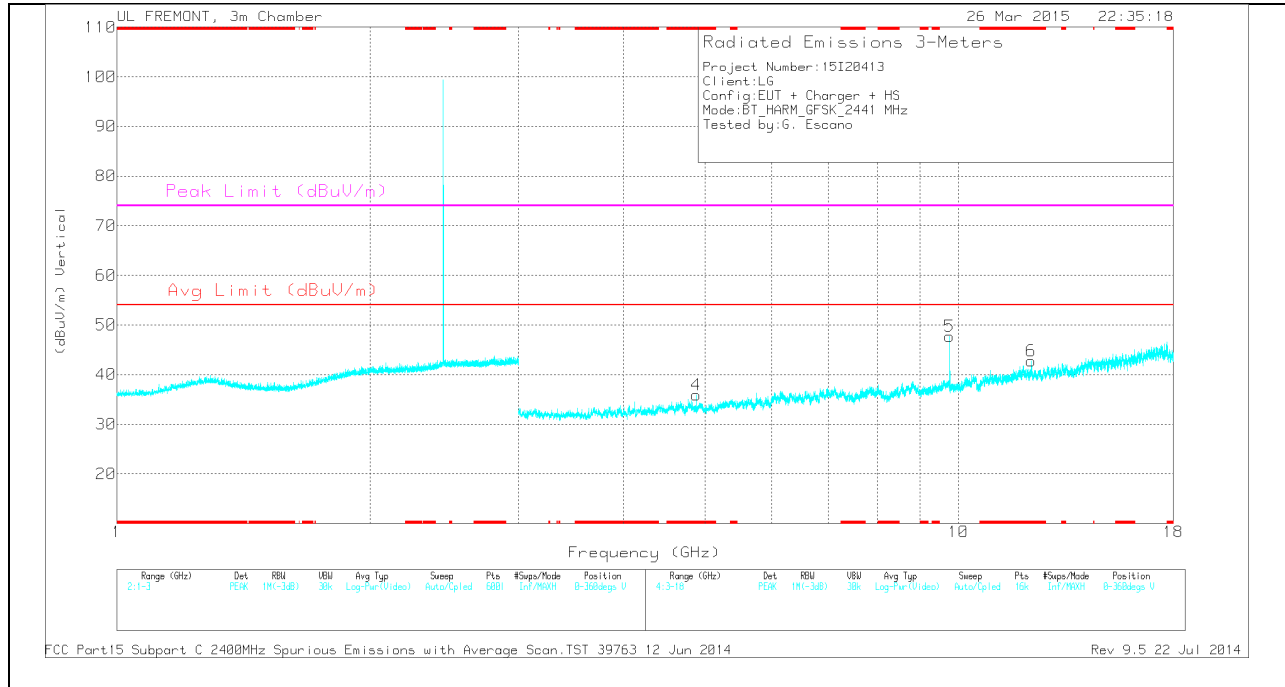
Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.804	41.04	PK3	34	-30.3	44.74	-	-	74	-29.26	166	125	H
* 4.804	29.73	VB1T	34	-30.3	33.43	54	-20.57	-	-	166	125	H
* 12.01	38.03	PK3	39.1	-25.9	51.23	-	-	74	-22.77	83	165	H
* 12.01	28.91	VB1T	39.1	-25.9	42.11	54	-11.89	-	-	83	165	H
* 4.804	43.61	PK3	34	-30.3	47.31	-	-	74	-26.69	359	379	V
* 4.804	33.43	VB1T	34	-30.3	37.13	54	-16.87	-	-	359	379	V
* 12.01	39.82	PK3	39.1	-25.9	53.02	-	-	74	-20.98	94	141	V
* 12.01	33.3	VB1T	39.1	-25.9	46.5	54	-7.5	-	-	94	141	V
9.608	39.26	PK3	36.7	-25.3	50.66	-	-	-	-	117	174	H
9.608	32.5	VB1T	36.7	-25.3	43.9	-	-	-	-	117	174	H
9.608	39.51	PK3	36.7	-25.3	50.91	-	-	-	-	225	154	V
9.608	33.41	VB1T	36.7	-25.3	44.81	-	-	-	-	225	154	V

**MID CHANNEL HORIZONTAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

**MID CHANNEL VERTICAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

**MID CHANNEL DATA**

*TRACE MARKERS*

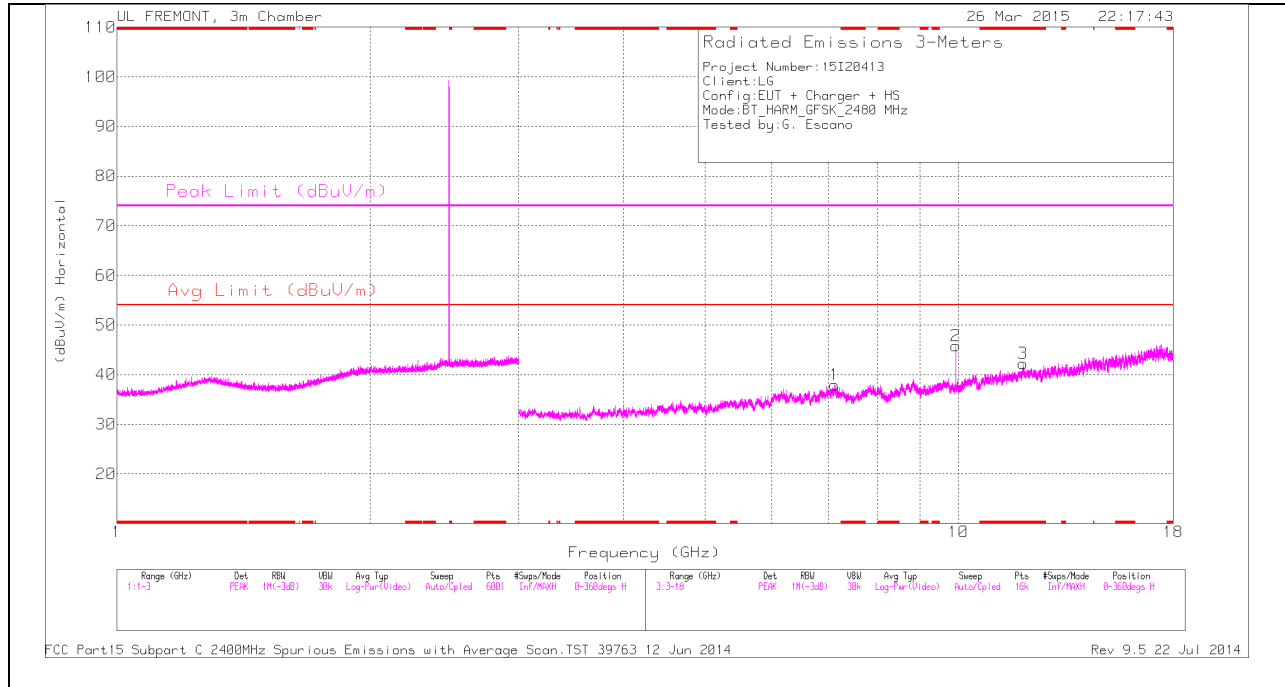
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 12.179	29.34	PK	39	-26.4	41.94	-	-	74	-32.06	0-360	200	H
4	* 4.882	32.05	PK	34	-30.1	35.95	-	-	74	-38.05	0-360	100	V
6	* 12.205	30.11	PK	39	-26.4	42.71	-	-	74	-31.29	0-360	200	V
1	9.764	35.13	PK	36.9	-26	46.03	-	-	-	-	0-360	200	H
5	9.764	36.77	PK	36.9	-26	47.67	-	-	-	-	0-360	100	V
3	17.4	27.74	PK	41.4	-22.4	46.74	-	-	-	-	0-360	100	H

PK - Peak detector

*RADIATED EMISSIONS*

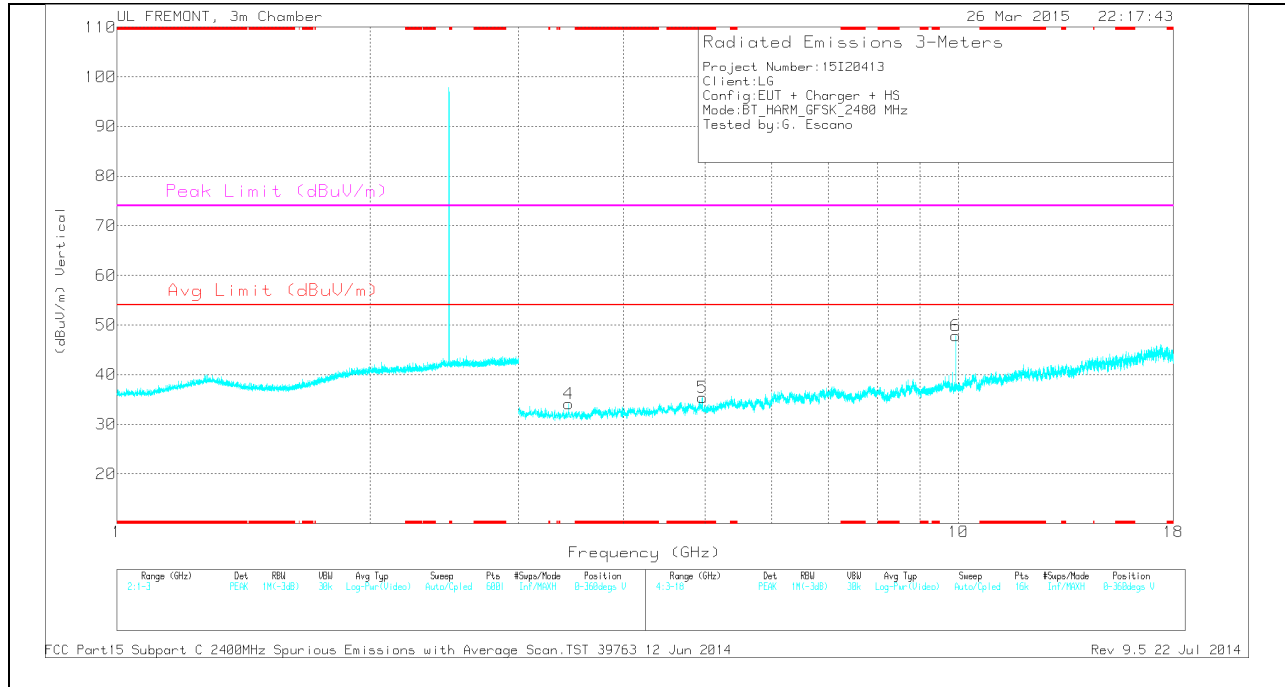
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 12.184	37.91	PK3	39	-26.4	50.51	-	-	74	-23.49	247	335	H
* 12.183	26.28	VB1T	39	-26.4	38.88	54	-15.12	-	-	247	335	H
* 4.882	42.04	PK3	34	-30.1	45.94	-	-	74	-28.06	11	240	V
* 4.882	32.93	VB1T	34	-30.1	36.83	54	-17.17	-	-	11	240	V
* 12.205	39.37	PK3	39	-26.4	51.97	-	-	74	-22.03	90	306	V
* 12.205	30.46	VB1T	39	-26.4	43.06	54	-10.94	-	-	90	306	V
9.764	42.18	PK3	36.9	-26	53.08	-	-	-	-	221	160	V
9.764	37.49	VB1T	36.9	-26	48.39	-	-	-	-	221	160	V

**HIGH CHANNEL HORIZONTAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

**HIGH CHANNEL VERTICAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

**HIGH CHANNEL DATA**

*TRACE MARKERS*

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 11.938	29.3	PK	39.1	-26.1	42.3	-	-	74	-31.7	0-360	200	H
5	* 4.96	32.42	PK	34	-31	35.42	-	-	74	-38.58	0-360	100	V
4	3.442	32.93	PK	32.7	-31.5	34.13	-	-	-	-	0-360	200	V
1	7.127	30.45	PK	35.6	-28.1	37.95	-	-	-	-	0-360	200	H
2	9.919	34.46	PK	36.9	-25.6	45.76	-	-	-	-	0-360	100	H
6	9.919	36.57	PK	36.9	-25.6	47.87	-	-	-	-	0-360	100	V

PK - Peak detector

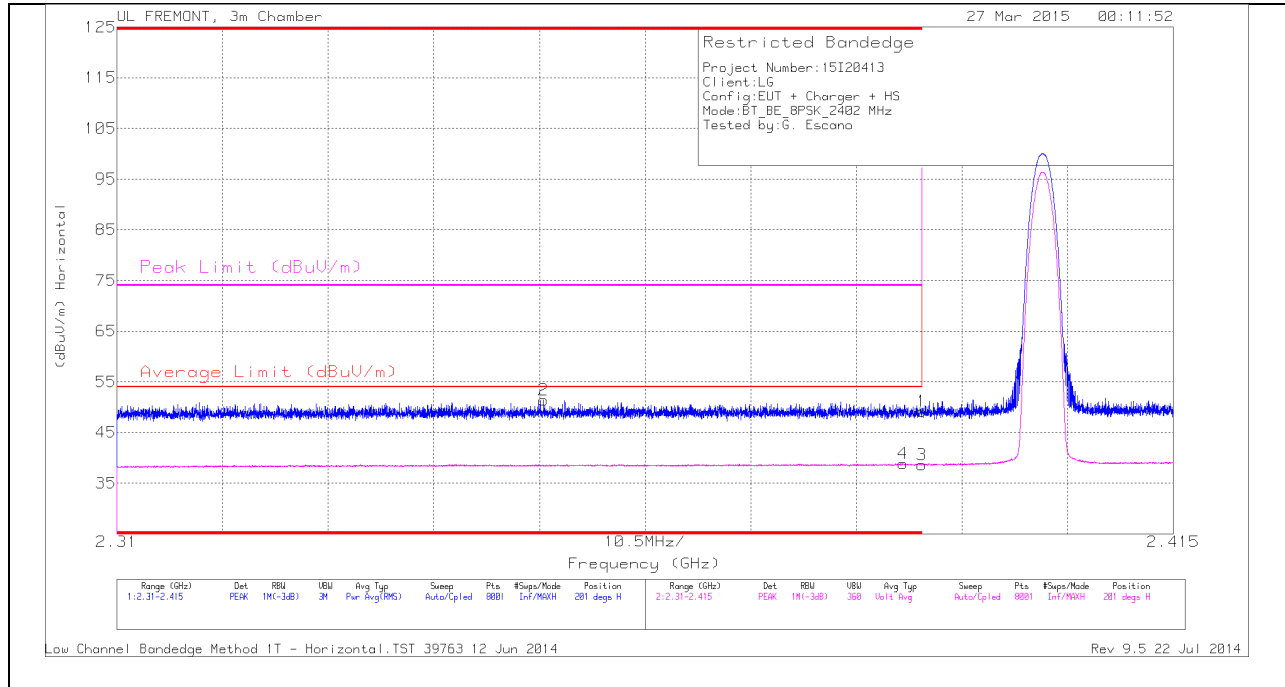
*RADIATED EMISSIONS*

Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.96	42.77	PK3	34	-31	45.77	-	-	74	-28.23	18	103	V
* 4.96	33.93	VB1T	34	-31	36.93	54	-17.07	-	-	18	103	V
9.92	43.25	PK3	36.9	-25.6	54.55	-	-	-	-	233	352	V
9.92	38.38	VB1T	36.9	-25.6	49.68	-	-	-	-	233	352	V



## 9.2.2. ENHANCED DATA RATE 8PSK MODULATION RESTRICTED BANDEDGE (LOW CHANNEL)

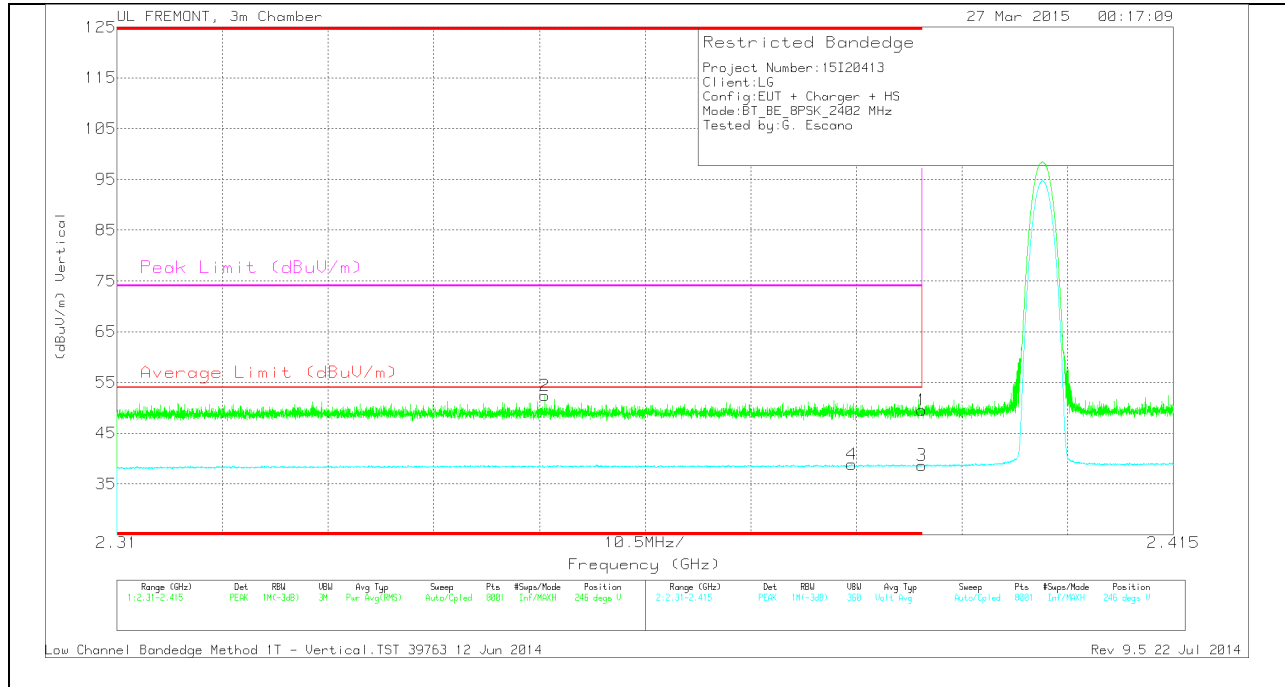
**HORIZONTAL PEAK AND AVERAGE PLOT**



### HORIZONTAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.352	42.69	PK	31.8	-23.1	51.39	-	-	74	-22.61	201	310	H
4	* 2.388	30.01	VB1T	32	-23.1	38.91	54	-15.09	-	-	201	310	H
1	* 2.39	40.33	PK	32	-23.1	49.23	-	-	74	-24.77	201	310	H
3	* 2.39	29.74	VB1T	32	-23.1	38.64	54	-15.36	-	-	201	310	H

**VERTICAL PEAK AND AVERAGE PLOT**

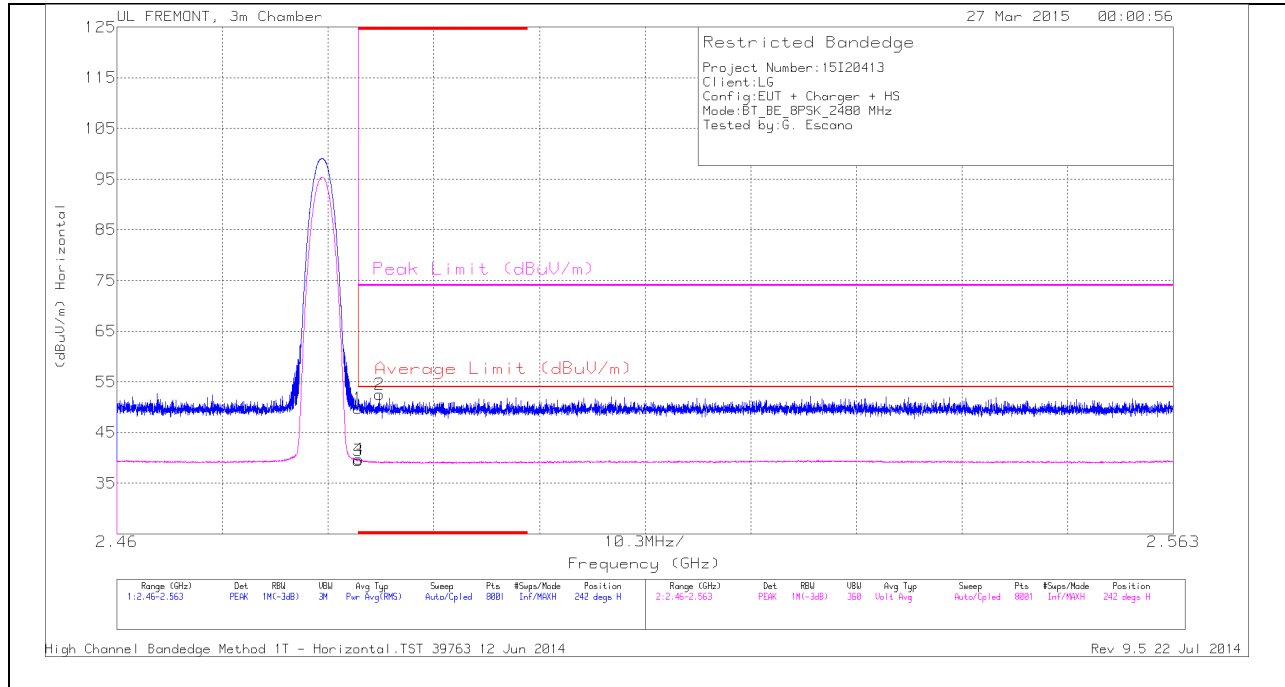


**VERTICAL DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/ Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.353	43.74	PK	31.8	-23.1	52.44	-	-	74	-21.56	246	393	V
4	* 2.383	29.97	VB1T	32	-23.1	38.87	54	-15.13	-	-	246	393	V
1	* 2.39	40.7	PK	32	-23.1	49.6	-	-	74	-24.4	246	393	V
3	* 2.39	29.78	VB1T	32	-23.1	38.68	54	-15.32	-	-	246	393	V

**AUTHORIZED BANDEDGE (HIGH CHANNEL)**

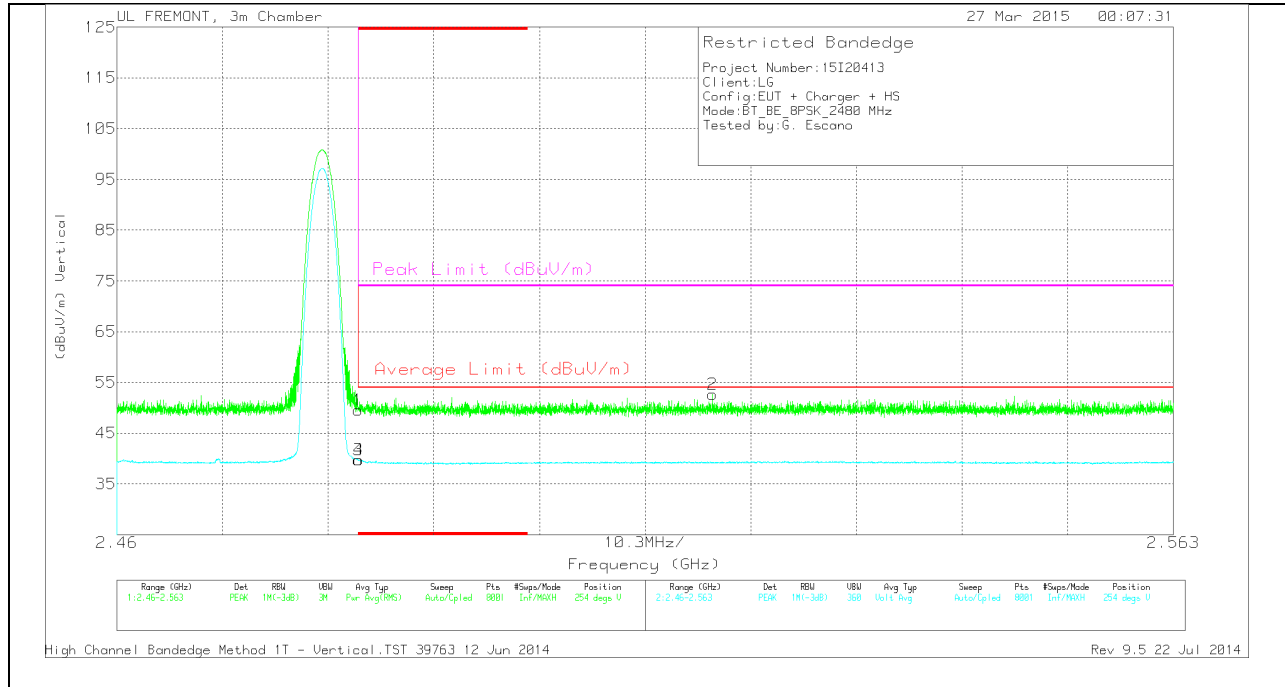
**HORIZONTAL PEAK AND AVERAGE PLOT**



**HORIZONTAL DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/ Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.3	PK	32.3	-22.8	49.8	-	-	74	-24.2	242	367	H
3	* 2.484	29.94	VB1T	32.3	-22.8	39.44	54	-14.56	-	-	242	367	H
4	* 2.484	30.27	VB1T	32.3	-22.8	39.77	54	-14.23	-	-	242	367	H
2	* 2.486	43.04	PK	32.3	-22.8	52.54	-	-	74	-21.46	242	367	H

**VERTICAL PEAK AND AVERAGE PLOT**

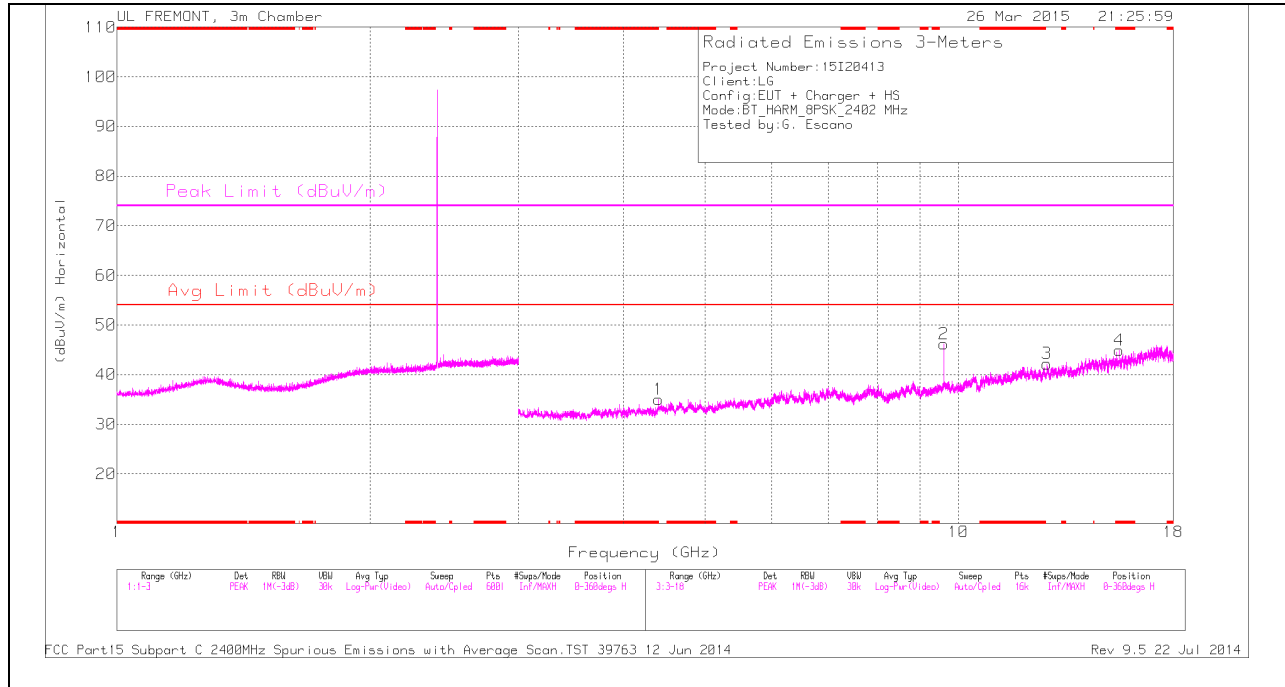


**VERTICAL DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/ Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40	PK	32.3	-22.8	49.5	-	-	74	-24.5	254	296	V
3	* 2.484	30.22	VB1T	32.3	-22.8	39.72	54	-14.28	-	-	254	296	V
4	* 2.484	30.26	VB1T	32.3	-22.8	39.76	54	-14.24	-	-	254	296	V
2	2.518	43.1	PK	32.3	-22.8	52.6	-	-	74	-21.4	254	296	V

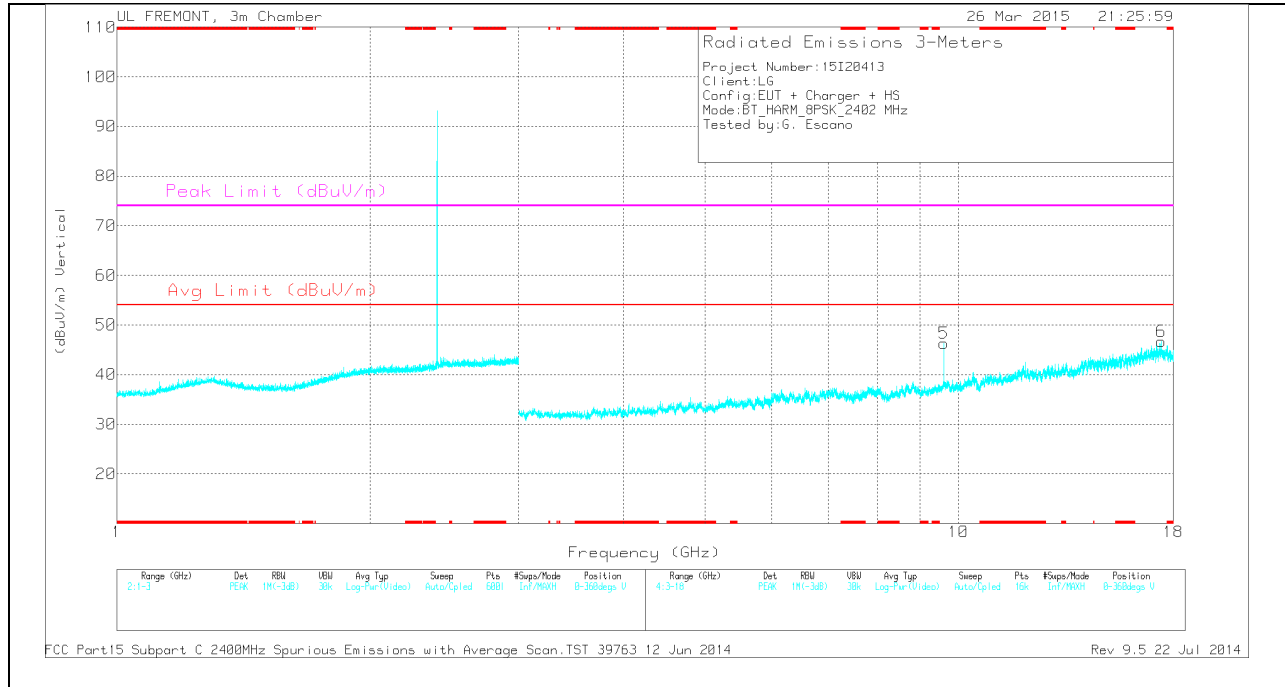
### HARMONICS AND SPURIOUS EMISSIONS

#### LOW CHANNEL HORIZONTAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

**LOW CHANNEL VERTICAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

**LOW CHANNEL DATA**

*TRACE MARKERS*

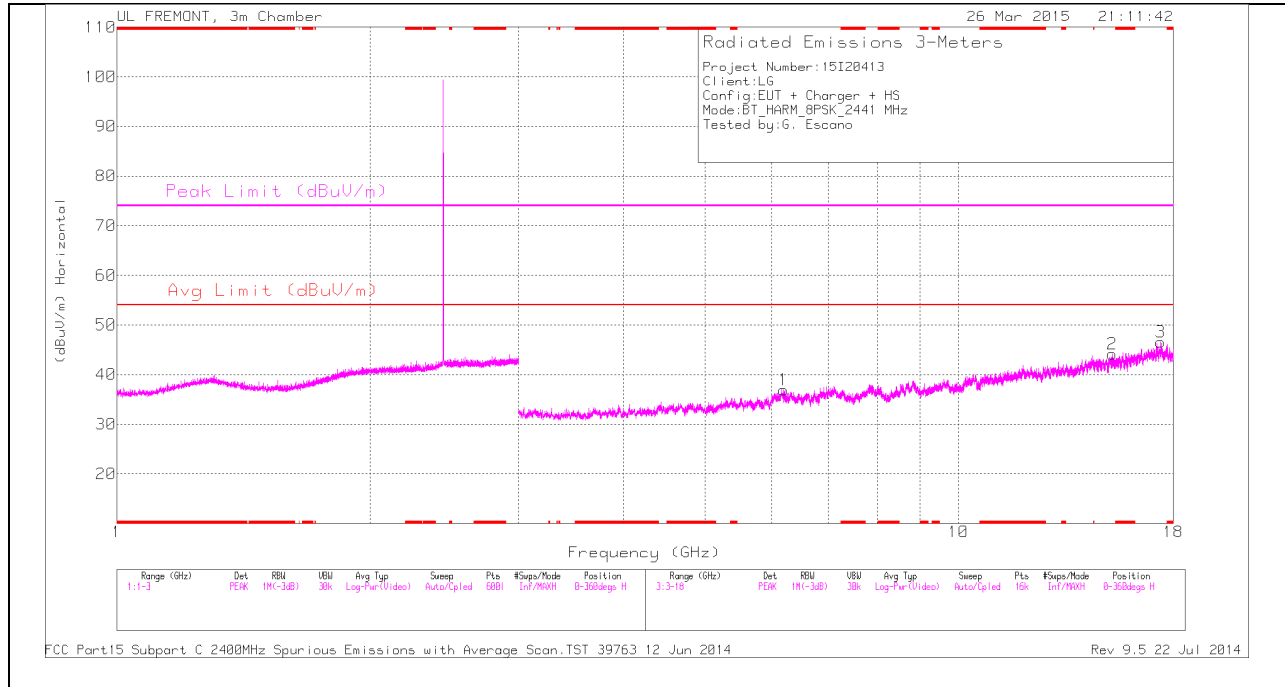
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 15.531	31.36	PK	40.2	-26.7	44.86	-	-	74	-29.14	0-360	100	H
1	* 4.4	31.27	PK	33.6	-29.9	34.97	-	-	74	-39.03	0-360	200	H
3	12.74	29.59	PK	39.1	-26.5	42.19	-	-	-	-	0-360	100	H
6	17.417	27.34	PK	41.4	-22.1	46.64	-	-	-	-	0-360	100	V
2	9.608	34.74	PK	36.7	-25.3	46.14	-	-	-	-	0-360	100	H
5	9.608	34.9	PK	36.7	-25.3	46.3	-	-	-	-	0-360	200	V

PK - Peak detector

*RADIATED EMISSIONS*

Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.399	39.81	PK3	33.6	-29.9	43.51	-	-	74	-30.49	5	133	H
* 4.4	27.1	VB1T	33.6	-29.9	30.8	54	-23.2	-	-	5	133	H
* 15.53	40.17	PK3	40.2	-26.7	53.67	-	-	74	-20.33	204	129	H
* 15.531	27.07	VB1T	40.2	-26.7	40.57	54	-13.43	-	-	204	129	H
9.608	40.54	PK3	36.7	-25.3	51.94	-	-	-	-	105	184	H
9.608	34.25	VB1T	36.7	-25.3	45.65	-	-	-	-	105	184	H
9.608	41.49	PK3	36.7	-25.3	52.89	-	-	-	-	78	286	V
9.608	36.5	VB1T	36.7	-25.3	47.9	-	-	-	-	78	286	V

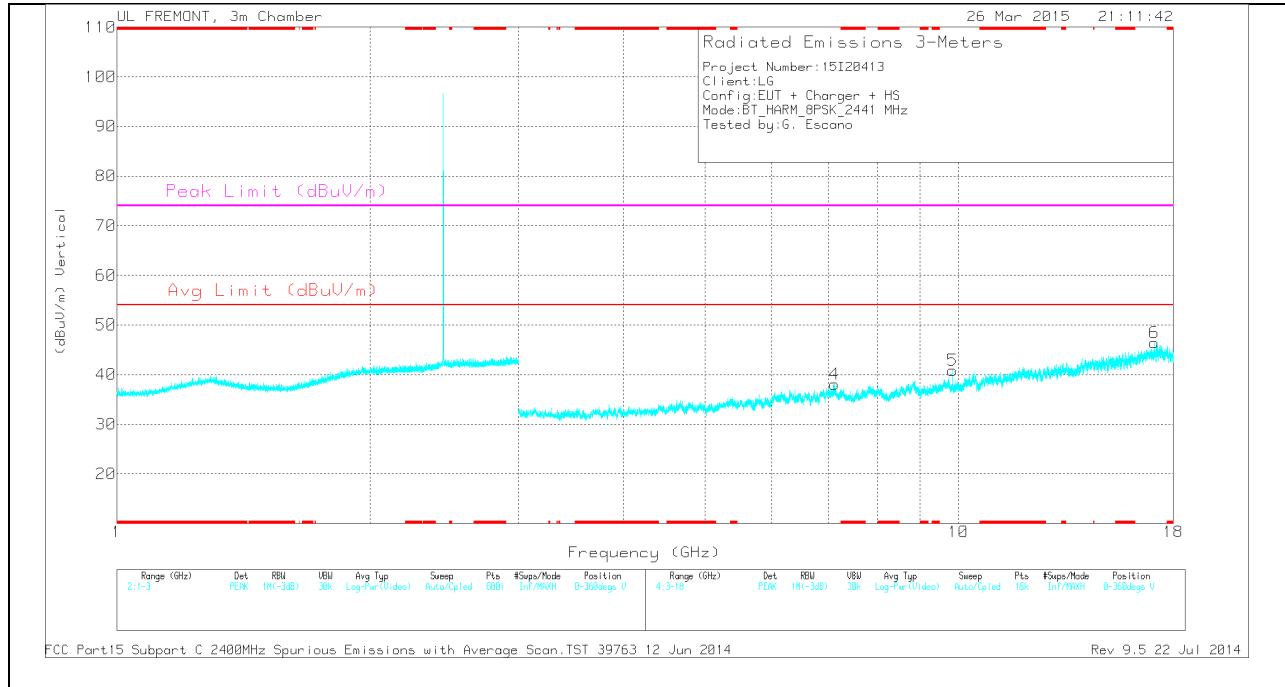
**MID CHANNEL HORIZONTAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.



**MID CHANNEL VERTICAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

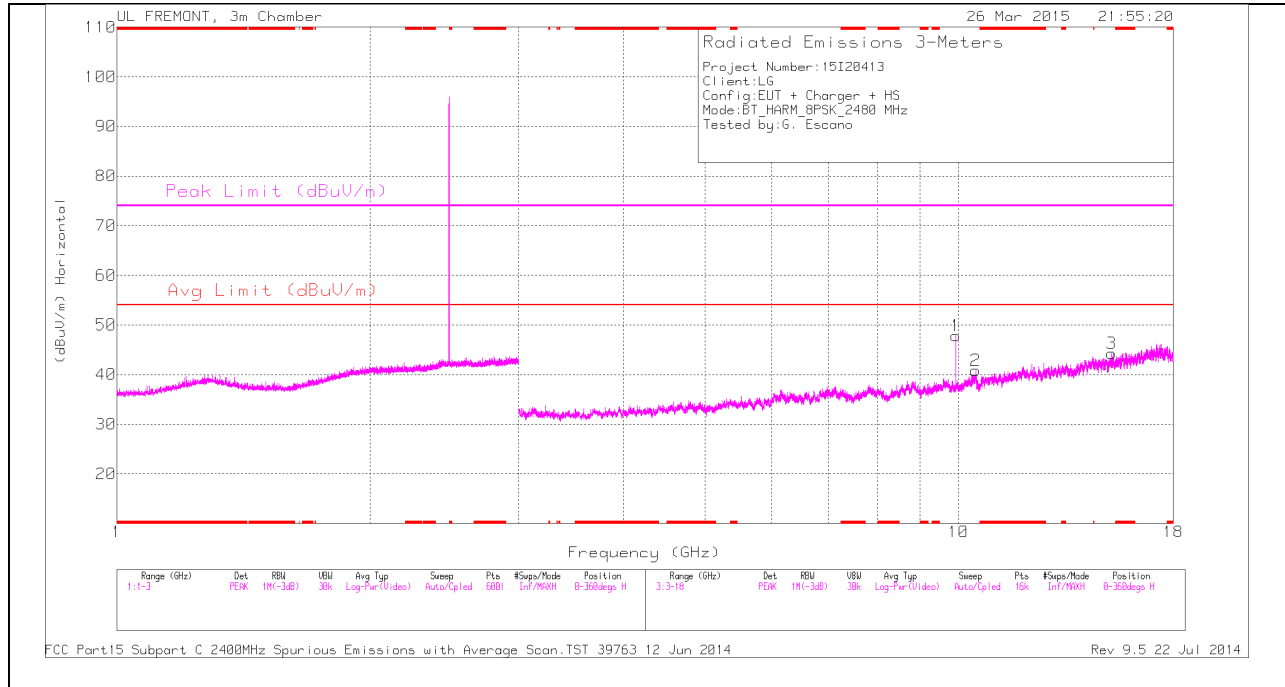
**MID CHANNEL DATA**

*TRACE MARKERS*

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	6.194	31.85	PK	35.3	-30.2	36.95	-	-	-	-	0-360	100	H
4	7.122	30.42	PK	35.6	-28	38.02	-	-	-	-	0-360	200	V
5	9.848	29.81	PK	36.9	-25.9	40.81	-	-	-	-	0-360	200	V
2	15.241	30.76	PK	39.9	-26.5	44.16	-	-	-	-	0-360	100	H
6	17.077	29.54	PK	41.4	-24.5	46.44	-	-	-	-	0-360	100	V
3	17.391	27.61	PK	41.4	-22.5	46.51	-	-	-	-	0-360	200	H

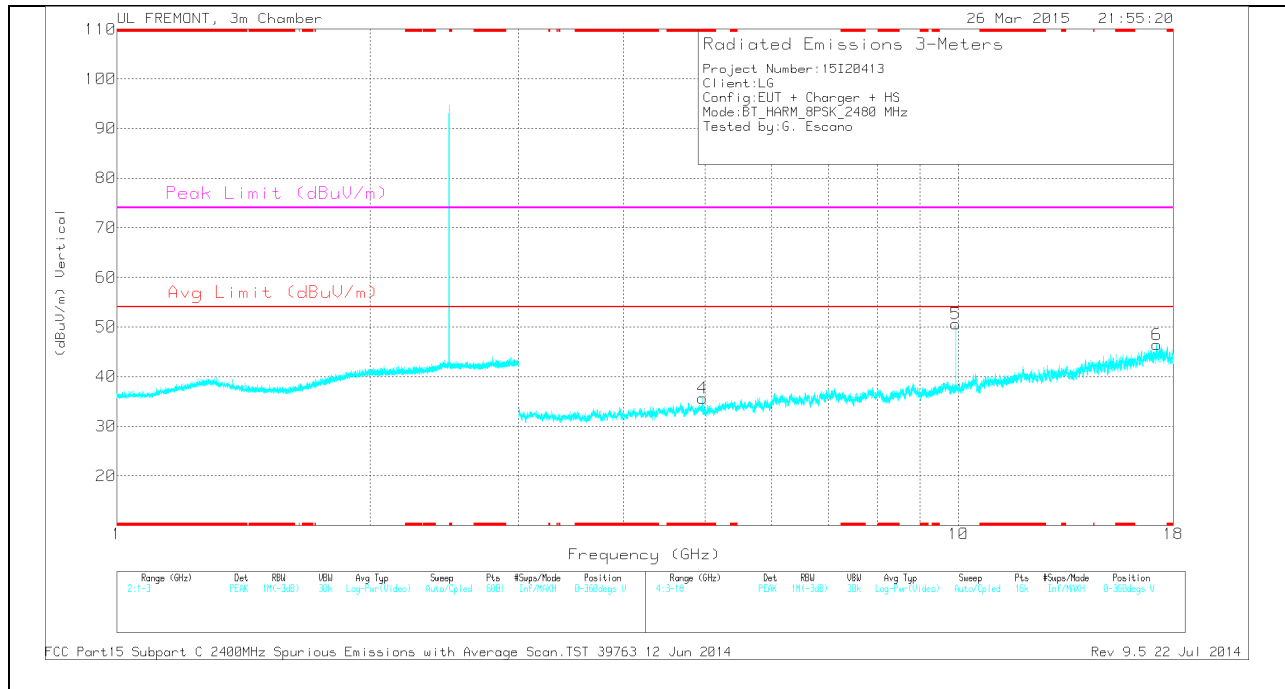
PK - Peak detector

**HIGH CHANNEL HORIZONTAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

**HIGH CHANNEL VERTICAL**



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

**HIGH CHANNEL DATA**

*TRACE MARKERS*

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 4.962	32.7	PK	34	-31	35.7	-	-	74	-38.3	0-360	100	V
1	9.924	36.59	PK	36.9	-25.6	47.89	-	-	-	-	0-360	200	H
5	9.924	39.34	PK	36.9	-25.6	50.64	-	-	-	-	0-360	200	V
2	10.479	28.63	PK	37.4	-25.2	40.83	-	-	-	-	0-360	100	H
3	15.205	31.08	PK	39.9	-26.7	44.28	-	-	-	-	0-360	100	H
6	17.196	28.31	PK	41.3	-23.2	46.41	-	-	-	-	0-360	100	V

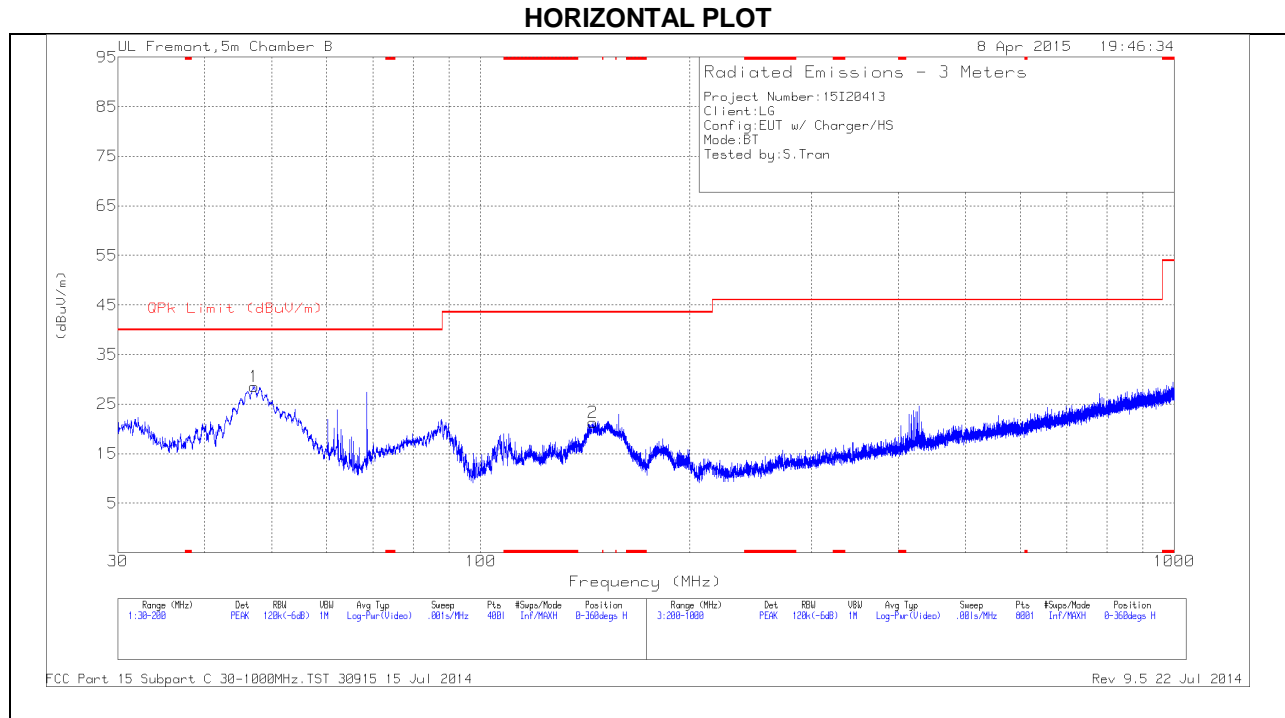
PK - Peak detector

*RADIATED EMISSIONS*

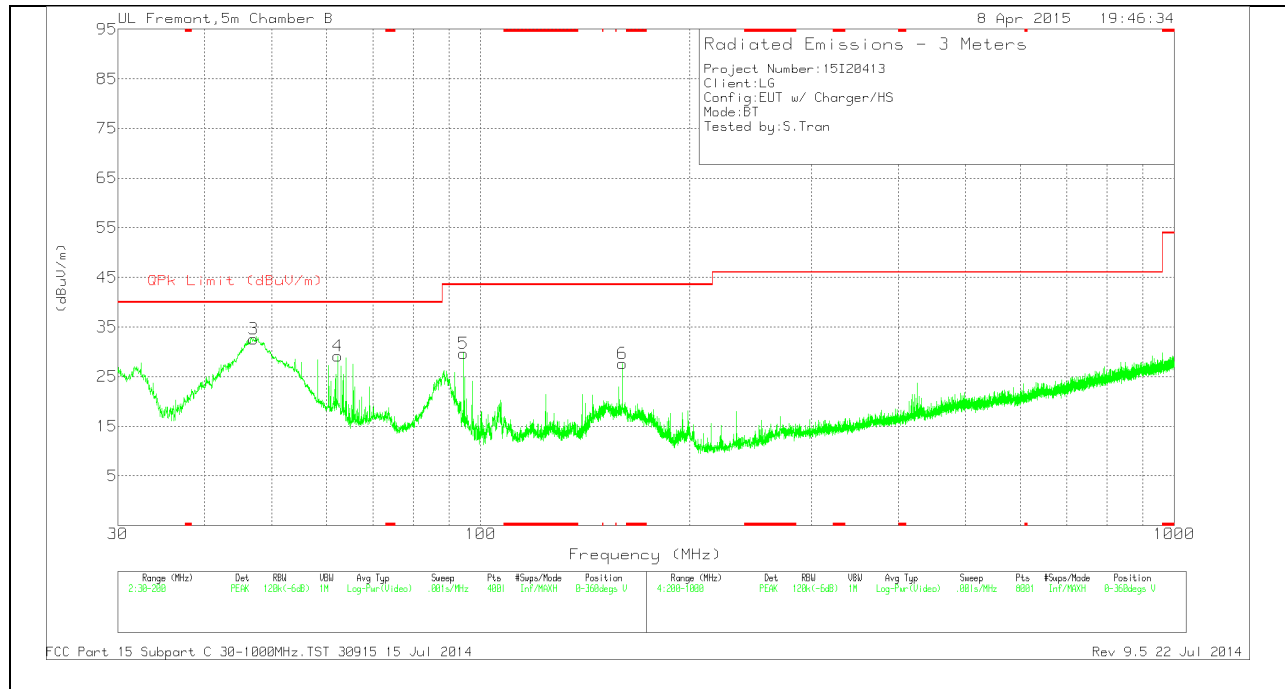
Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.962	42.71	PK3	34	-31	45.71	-	-	74	-28.29	17	104	V
* 4.962	33.03	VB1T	34	-31	36.03	54	-17.97	-	-	17	104	V
9.924	44.44	PK3	36.9	-25.6	55.74	-	-	-	-	226	171	V
9.924	40.47	VB1T	36.9	-25.6	51.77	-	-	-	-	226	171	V

### 9.3. WORST-CASE BELOW 1 GHz

#### GFSK SPOURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



**VERTICAL PLOT**



**BELOW 1 GHz TABLE**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T243 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	47.085	51.9	PK	9.4	-28.7	32.6	40	-7.4	0-360	101	V
1	47.17	47.83	PK	9.4	-28.7	28.53	40	-11.47	0-360	300	H
4	62.2575	49.98	PK	7.7	-28.5	29.18	40	-10.82	0-360	101	V
5	94.4725	49.06	PK	8.7	-28.1	29.66	43.52	-13.86	0-360	101	V
2	145.0475	36.16	PK	12.7	-27.6	21.26	43.52	-22.26	0-360	300	H
6	160.05	42.73	PK	12.2	-27.3	27.63	43.52	-15.89	0-360	101	V

PK - Peak detector

## 10. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	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.

### TEST PROCEDURE

#### **ANSI C63.4 – 2009**

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

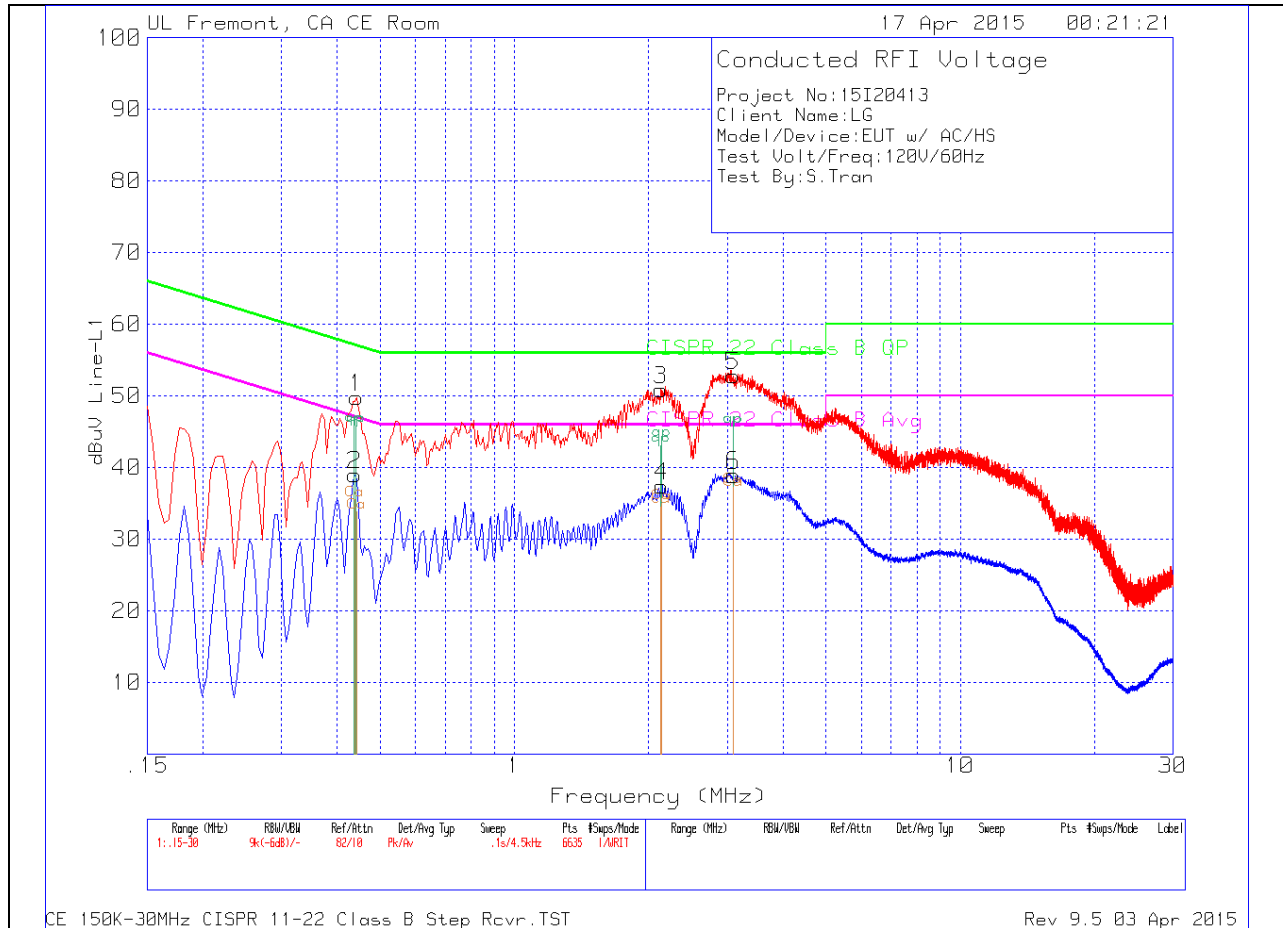
Line conducted data is recorded for both NEUTRAL and HOT lines.

### RESULTS



**6 WORST EMISSIONS**

**LINE 1 PLOT**



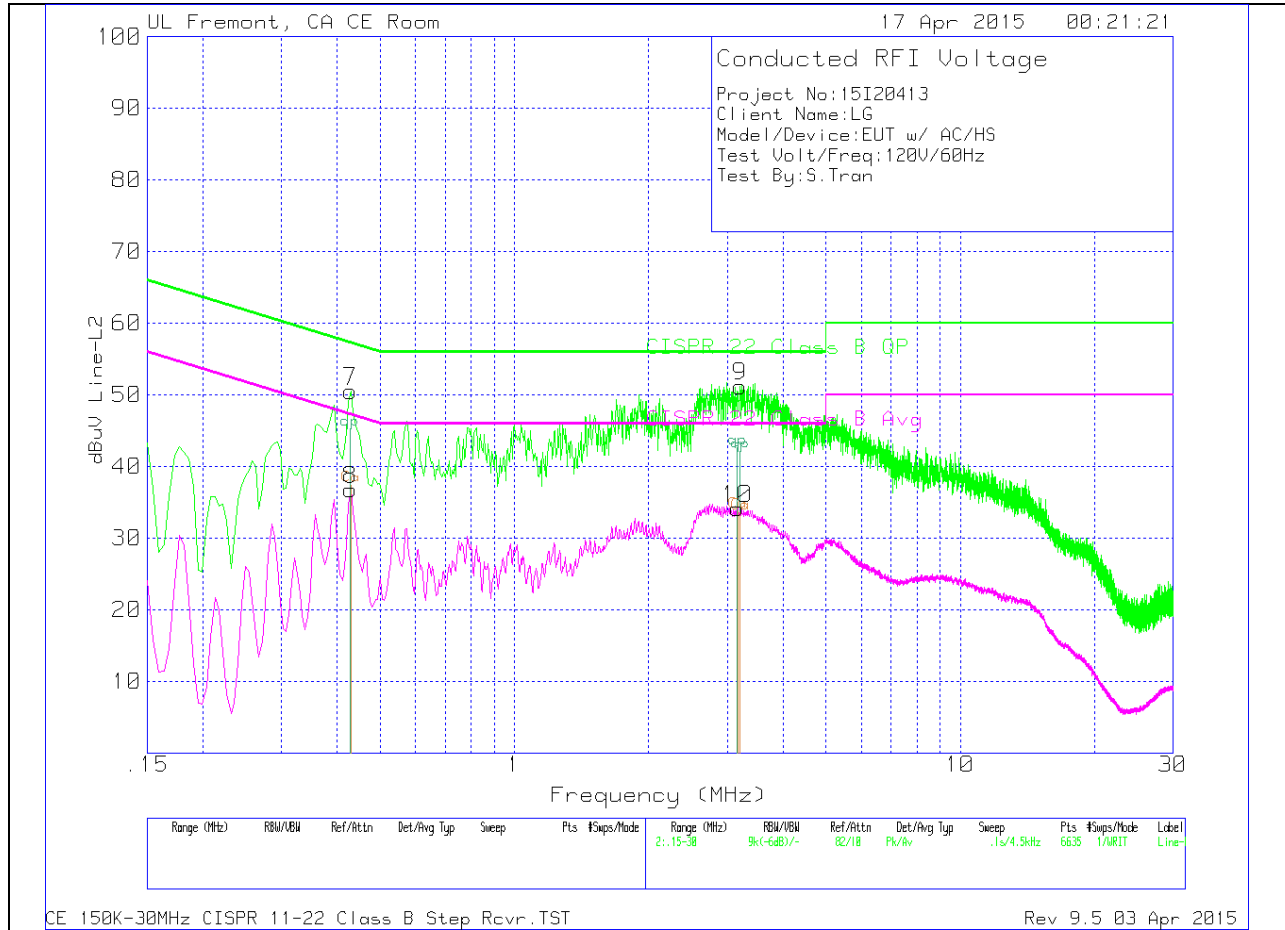
**LINE 1 RESULTS**

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.4425	49.4	Pk	.4	0	49.8	57.01	-7.21	--	--
2	.438	38.59	Av	.4	0	38.99	--	--	47.1	-8.11
3	2.13	50.58	Pk	.2	.1	50.88	56	-5.12	--	--
4	2.139	37.12	Av	.2	.1	37.42	--	--	46	-8.58
5	3.093	52.51	Pk	.2	.1	52.81	56	-3.19	--	--
6	3.0975	38.65	Av	.2	.1	38.95	--	--	46	-7.05

Pk - Peak detector  
 Av - Average detection

**LINE 2 PLOT**



**LINE 2 RESULTS**

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
7	.429	50.13	Pk	.4	0	50.53	57.27	-6.74	--	--
8	.429	36.4	Av	.4	0	36.8	--	--	47.27	-10.47
9	3.21	50.91	Pk	.2	.1	51.21	56	-4.79	--	--
10	3.165	33.86	Av	.2	.1	34.16	--	--	46	-11.84

Pk - Peak detector  
 Av - Average detection