



FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Tablet + Bluetooth/BLE and DTS/UNII a/b/g/n/ac and ANT+

MODEL NUMBER : SM-T815

FCC ID: A3LSMT815

REPORT NUMBER: 15K20540-E3

ISSUE DATE: MAY 05, 2015

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	05/05/15	Initial issue	CY Choi

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	6
4.1. MEASURING INSTRUMENT CALIBRATION	6
4.2. SAMPLE CALCULATION	6
4.3. MEASUREMENT UNCERTAINTY.....	6
5. EQUIPMENT UNDER TEST	7
5.1. DESCRIPTION OF EUT	7
5.2. MAXIMUM OUTPUT POWER.....	7
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	7
5.4. WORST-CASE CONFIGURATION AND MODE	7
5.5. DESCRIPTION OF TEST SETUP.....	8
6. TEST AND MEASUREMENT EQUIPMENT	10
7. SUMMARY TABLE	11
8. ANTENNA PORT TEST RESULTS	12
8.1. 20 dB AND 99% BANDWIDTH	12
8.1.1. BASIC DATA RATE GFSK MODULATION	12
8.1.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION.....	12
8.1.3. ENHANCED DATA RATE 8PSK MODULATION	12
8.1.4. 20 dB AND 99% BANDWIDTH PLOTS.....	13
8.2. HOPPING FREQUENCY SEPARATION	31
8.3. NUMBER OF HOPPING CHANNELS.....	33
8.4. AVERAGE TIME OF OCCUPANCY.....	38
8.5. OUTPUT POWER.....	45
8.5.1. BASIC DATA RATE GFSK MODULATION	45
8.5.2. ENHANCED DATA RATE PI/4-DPSK MODULATION	45
8.5.3. ENHANCED DATA RATE 8PSK MODULATION	45
8.5.4. OUTPUT POWER PLOTS.....	46
8.6. AVERAGE POWER	55
8.6.1. BASIC DATA RATE GFSK MODULATION	55
8.6.2. DATA RATE PI/4-DQPSK MODULATION	55
8.6.3. ENHANCED DATA RATE 8PSK MODULATION	55
8.7. CONDUCTED SPURIOUS EMISSIONS.....	56
8.7.1. BASIC DATA RATE GFSK MODULATION	57

8.7.2.	ENHANCED DATA RATE Pi/4-DPSK MODULATION	65
8.7.3.	ENHANCED DATA RATE 8DPSK MODULATION.....	73
9.	RADIATED TEST RESULTS.....	81
9.1.	LIMITS AND PROCEDURE	81
9.2.	TRANSMITTER ABOVE 1 GHz	82
9.2.1.	BASIC DATA RATE GFSK MODULATION	82
9.2.2.	ENHANCED DATA RATE Pi/4-DPSK MODULATION	92
9.3.	WORST-CASE BELOW 1 GHz.....	102
10.	AC POWER LINE CONDUCTED EMISSIONS	104
11.	SETUP PHOTOS	107

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: GSM/WCDMA/LTE Tablet+Bluetooth/BLE, DTS/UNII a/b/g/n/ac and ANT+
MODEL NUMBER: SM-T815
SERIAL NUMBER: R32G300M6CW (RADIATED); R32G300N6DL (CONDUCTED)
DATE TESTED: APRIL 06 - MAY 04, 2015

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

UL Korea, Ltd. 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 Korea, Ltd. 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 Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

Tested By:



Ji Ho Choi
Suwon Lab Manager
UL Korea, Ltd.

CY Choi
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

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

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-823, Korea. Line conducted emissions are measured only at the 218 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.

218 Maeyeong-ro	
☒	Chamber 1
☐	Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

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:

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

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	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Tablet + Bluetooth/BLE, DTS/UNII a/b/g/n/ac and ANT+. This test report addresses the DSS (BT) operational mode.

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	9.92	9.82
2402 - 2480	Enhanced Pi/4-DPSK	5.82	3.82
2402 - 2480	Enhanced 8PSK	5.74	3.75

Note: GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & Pi/4-DPSK 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 an FPCB antenna, with a maximum gain of -0.34 dBi.

5.4. 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 and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA12EWE	N/A	N/A
Data Cable	SAMSUNG	ECB-DG925UWE	N/A	N/A
Earphone	SAMSUNG	GH59-11129H	N/A	N/A

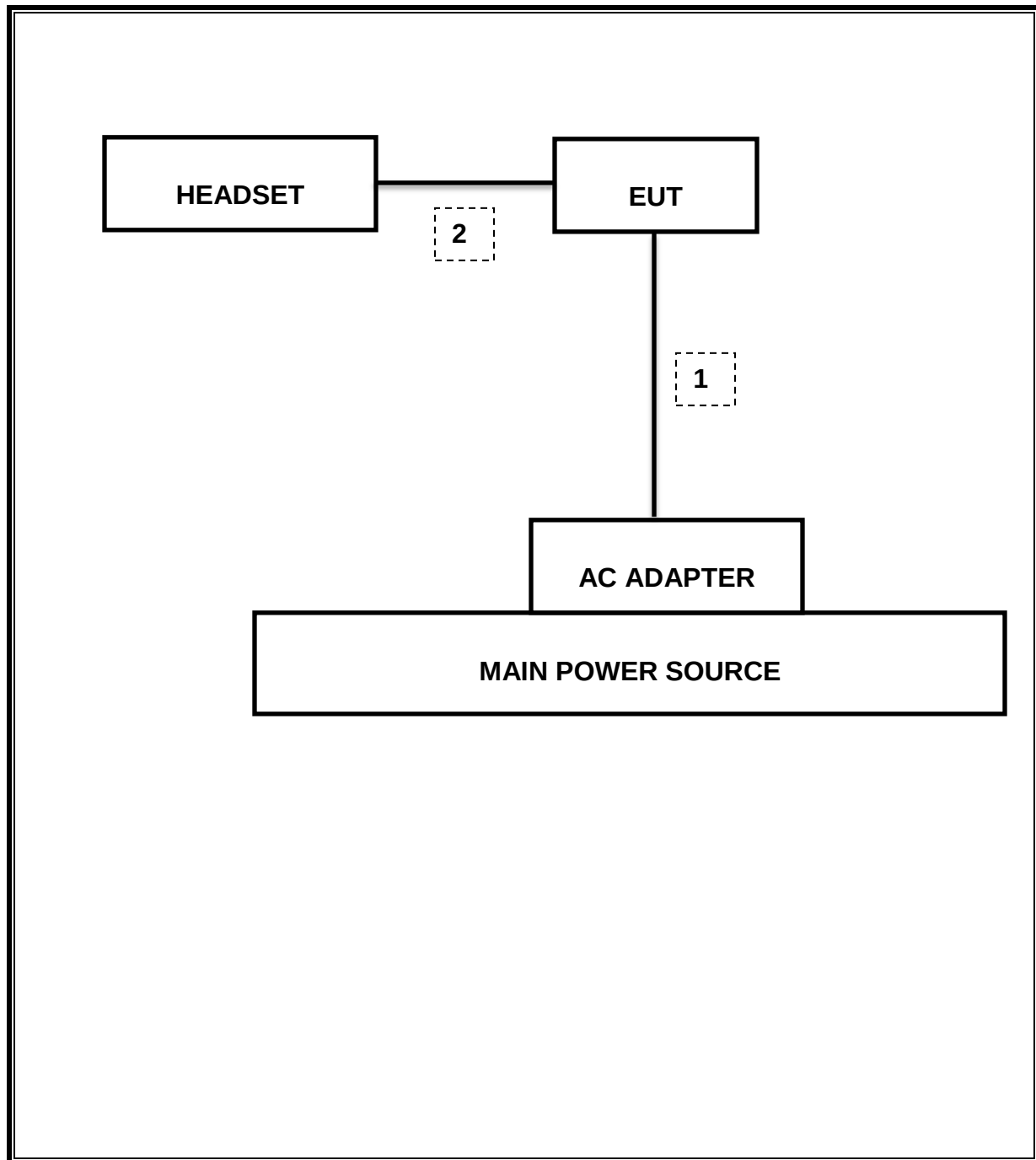
I/O CABLES

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	0.8m	N/A
2	Audio	1	Mini-Jack	Unshielded	1.0m	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	S/N	Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	950	11-17-15
Antenna, Horn, 18 GHz	ETS	3115	00167211	09-20-15
Antenna, Horn, 40 GHz	ETS	3116C	00166255	09-23-15
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	09-29-15
Preamplifier, 1000 MHz	Sonoma	310N	341282	11-17-15
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	11-18-15
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	09-23-15
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	11-17-15
Average Power Sensor	R&S	NRZ-Z91	102681	11-17-15
Average Power Sensor	Agilent / HP	U2000	MY54270007	09-23-15
EMI Test Receive, 40 GHz	R&S	ESU40	100439	11-17-15
EMI Test Receive, 3 GHz	R&S	ESR3	101832	11-17-15
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
Low Pass Filter 3GHz	Micro-Tronics	LPS17541	009	11-17-15
High Pass Filter 5GHz	Micro-Tronics	HPS17542	009	11-17-15
High Pass Filter 6GHz	Micro-Tronics	HPM17543	010	11-17-15
LISN	R&S	ENV-216	101836	04-09-16
LISN	R&S	ENV-216	101837	04-09-16

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass	1.199 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-38.940 dBm
15.247 (b)(1)	TX conducted output power	<21dBm		Pass	9.92 dBm (AV)
15.247 (a)(1)	Hopping frequency separation	> 25KHz		Pass	1 MHz
15.247 (a)(1)(iii)	Number of Hopping channels	More than 15 non-overlapping channels		Pass	79
15.247 (a)(1)(iii)	Avg Time of Occupancy	< 0.4sec		Pass	0.317 sec
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	56.68 dBuV (QP)
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	34.62 dBuV/m (AV)

8. ANTENNA PORT TEST RESULTS

8.1. 20 dB AND 99% BANDWIDTH

LIMITS

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	0.925	0.899
Mid	2440	0.936	0.900
High	2480	0.932	0.900
Worst		0.936	0.900

8.1.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.194	1.166
Mid	2440	1.195	1.199
High	2480	1.195	1.199
Worst		1.195	1.199

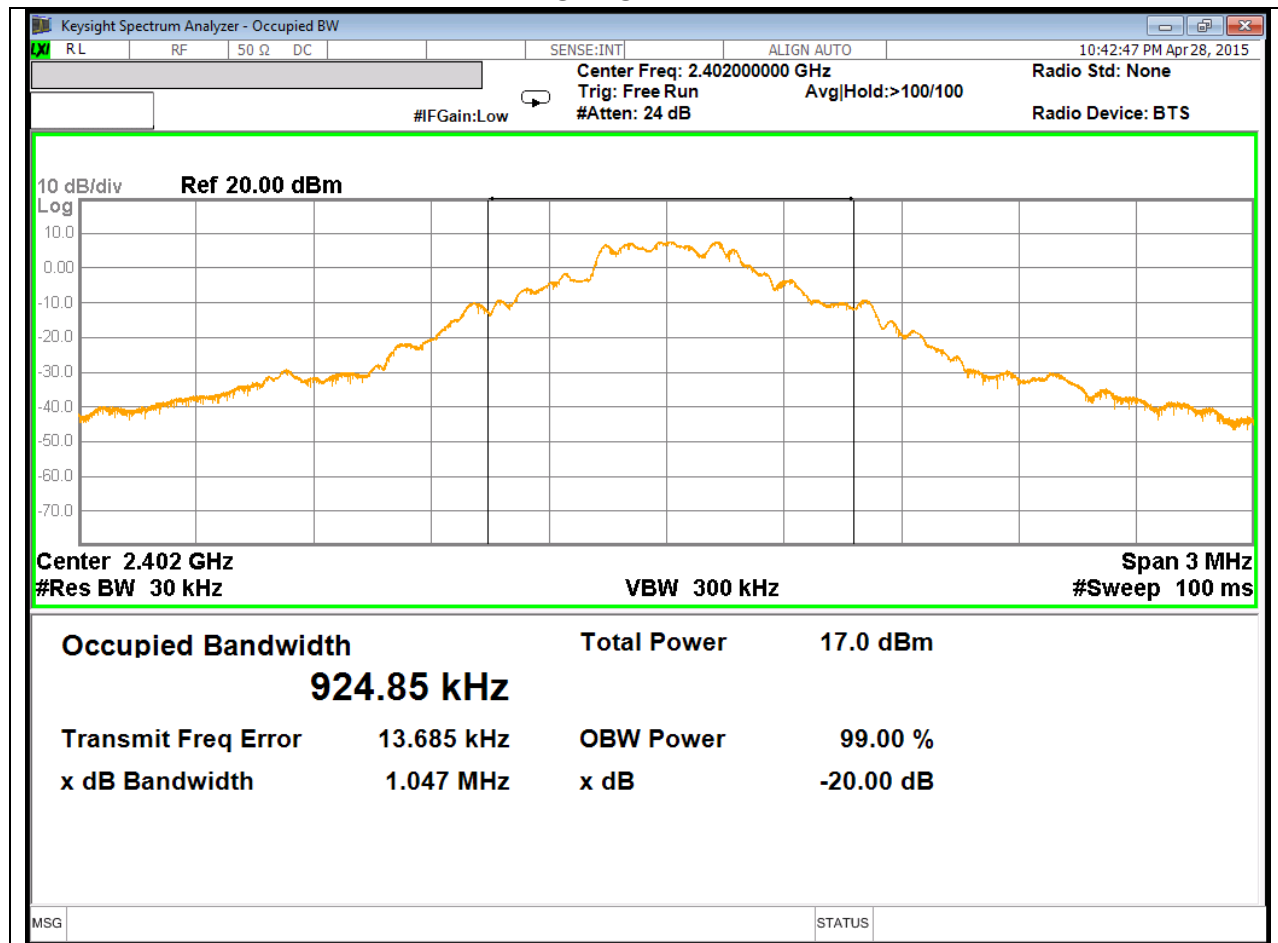
8.1.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.177	1.195
Mid	2440	1.177	1.196
High	2480	1.177	1.195
Worst		1.177	1.196

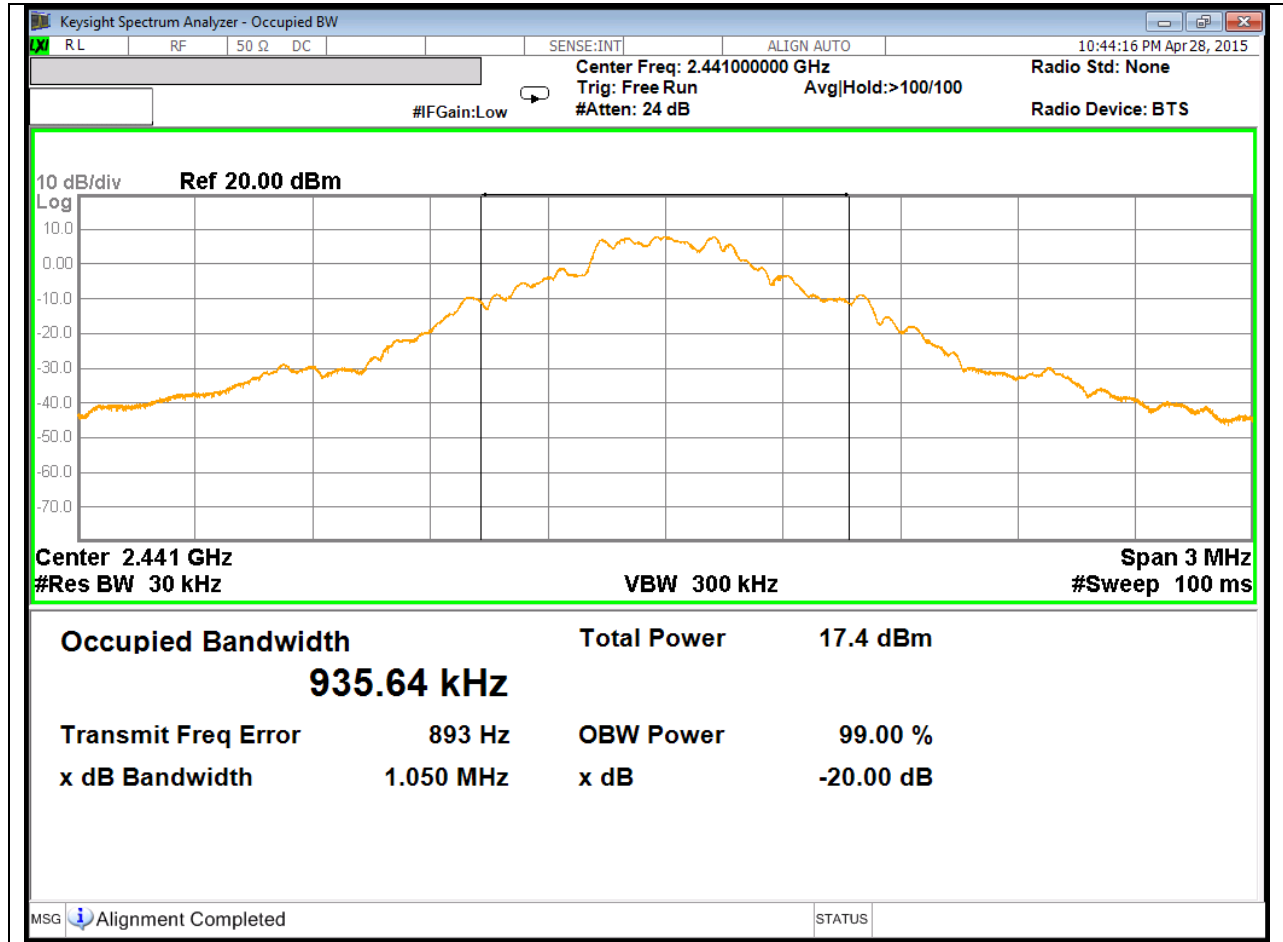
8.1.4. 20 dB AND 99% BANDWIDTH PLOTS

GFSK 20 dB BANDWIDTH

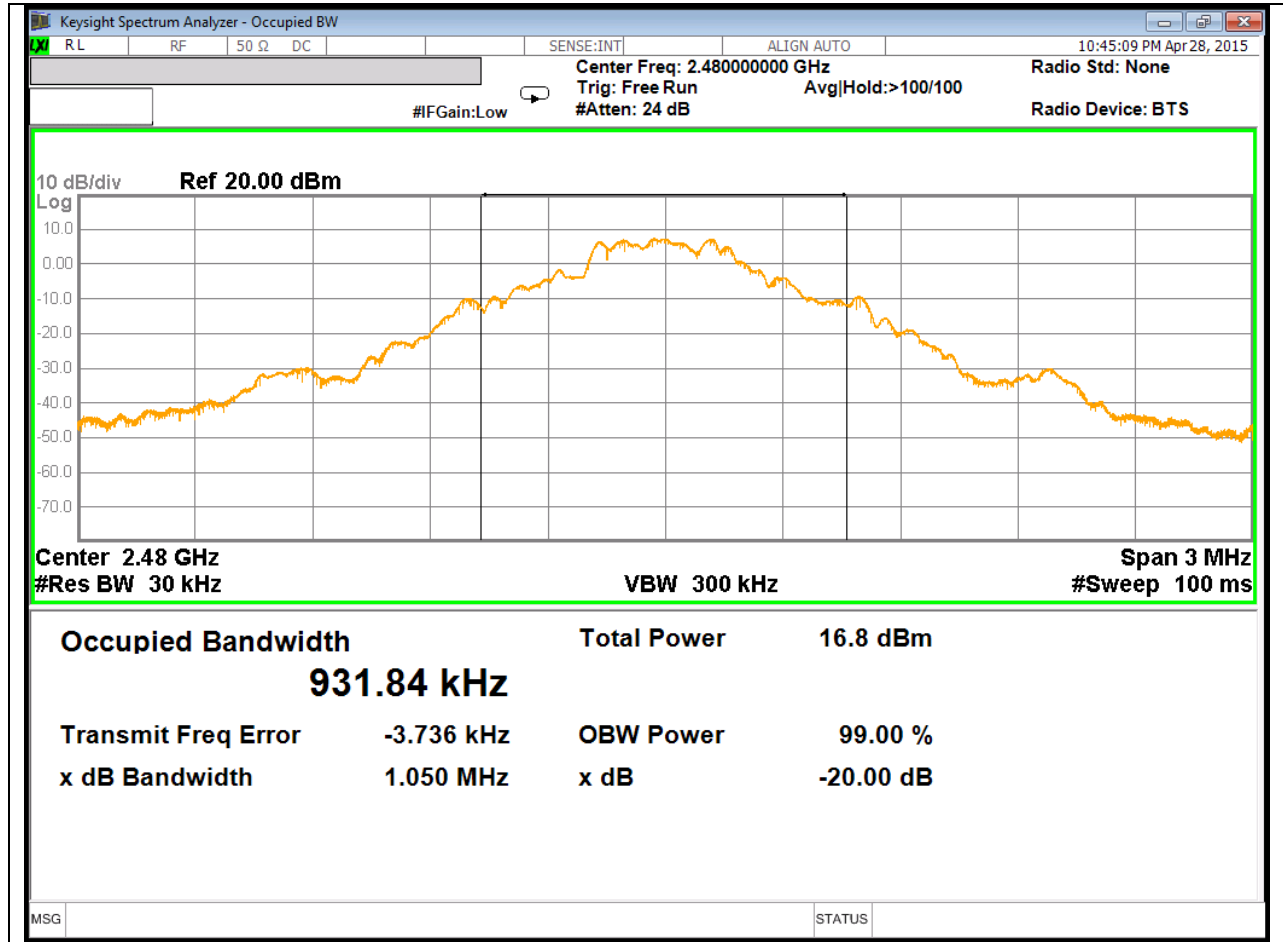
LOW CHANNEL



MID CHANNEL

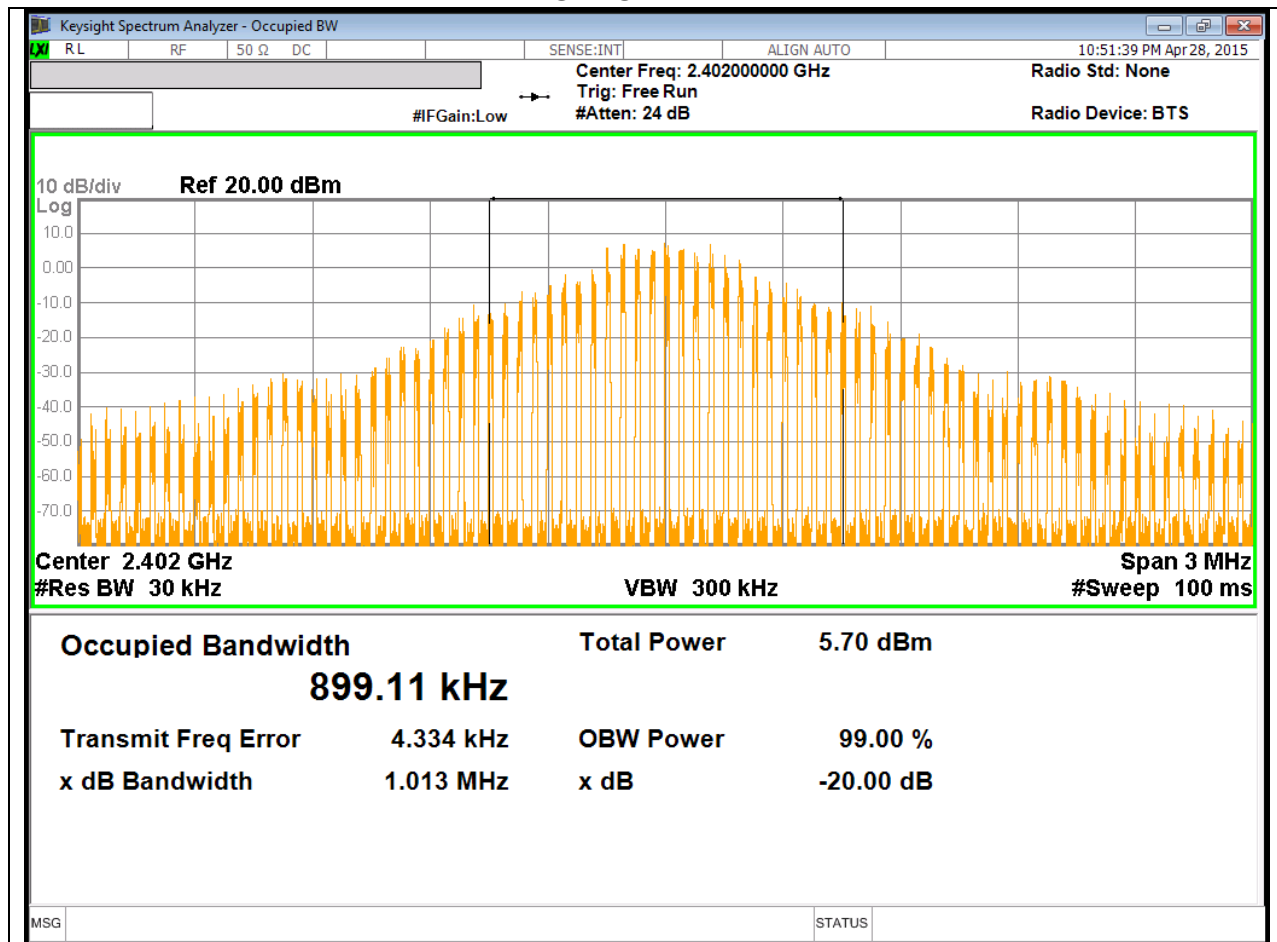


HIGH CHANNEL

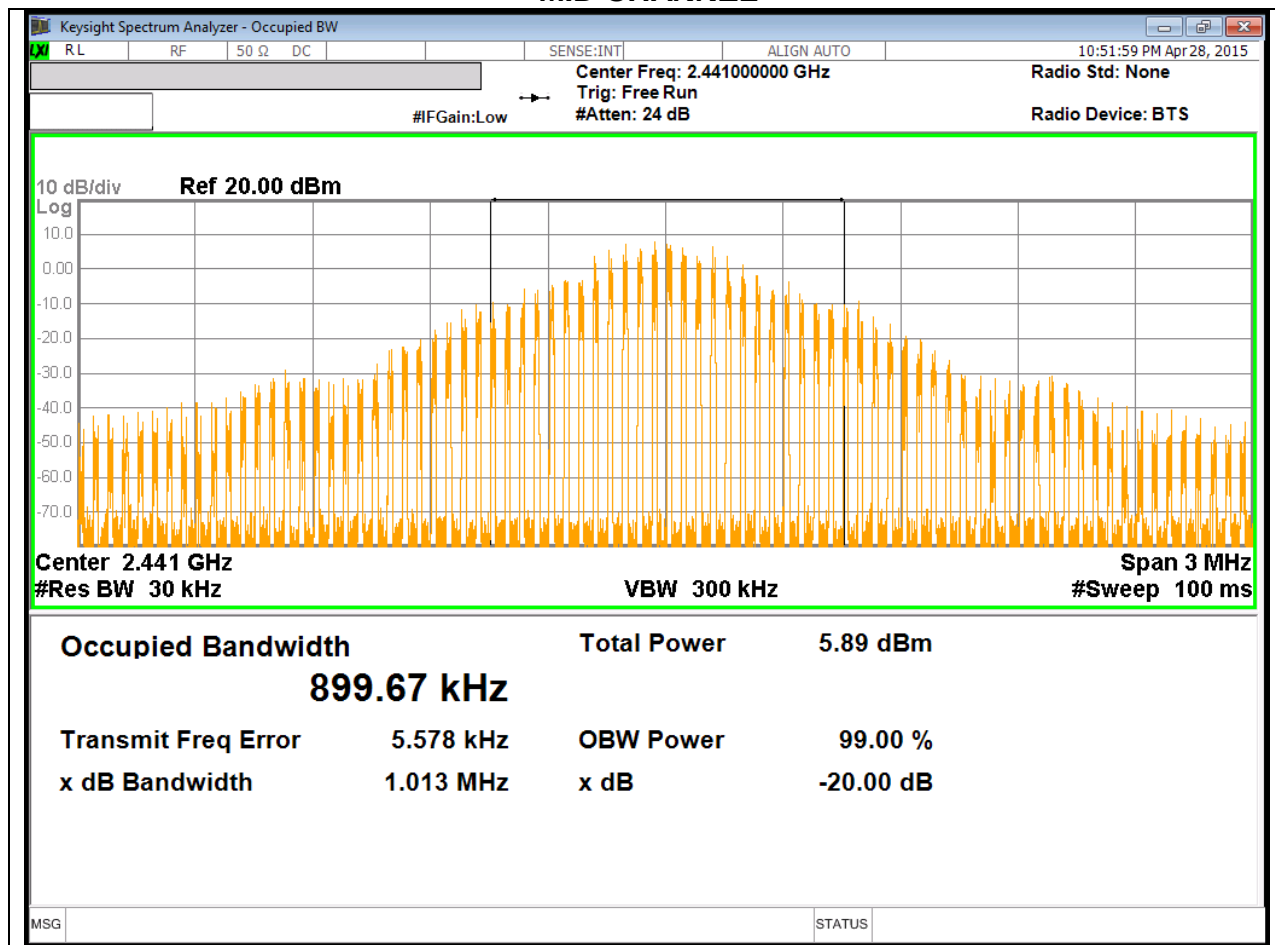


GFSK 99% BANDWIDTH

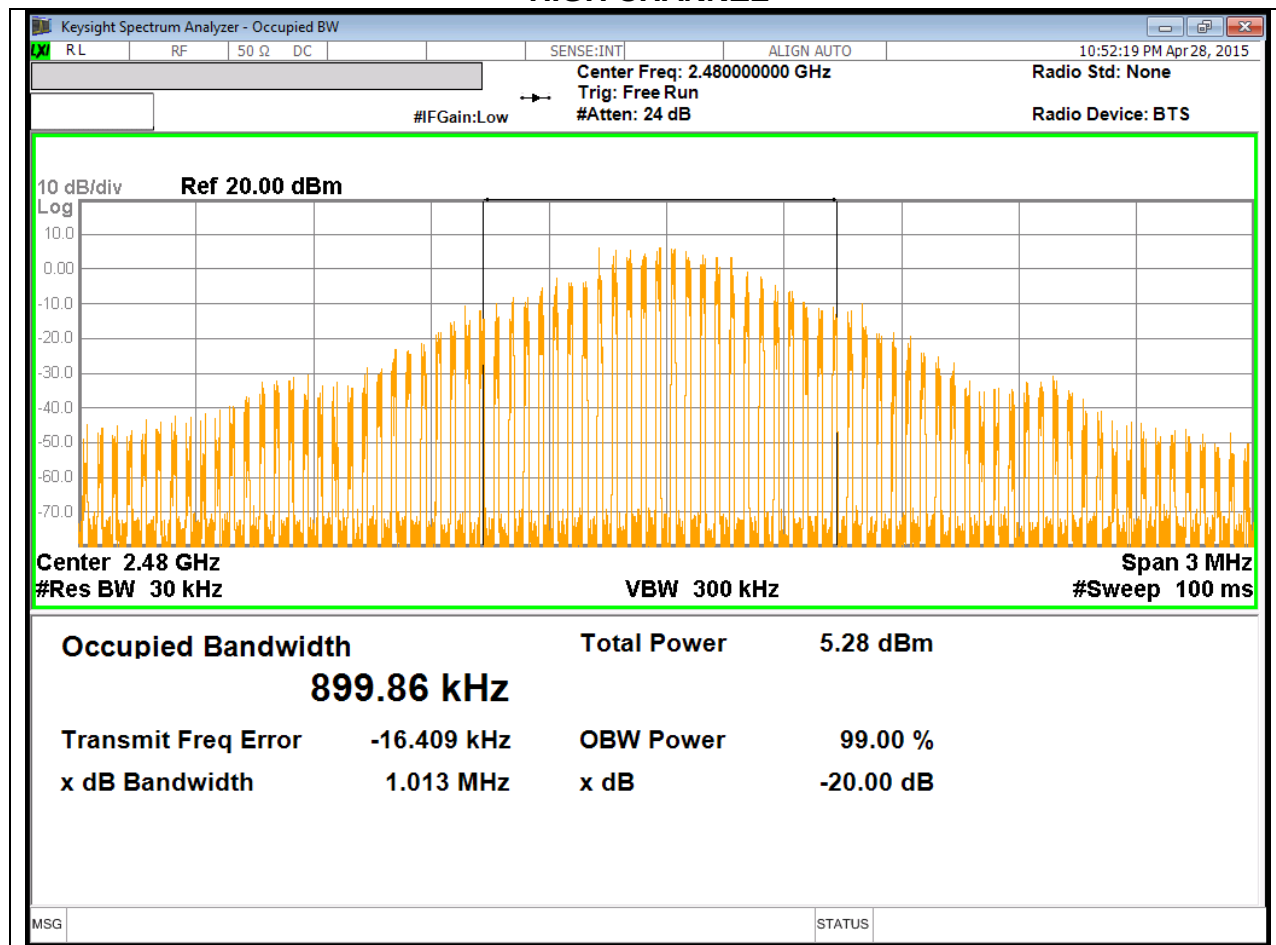
LOW CHANNEL



MID CHANNEL

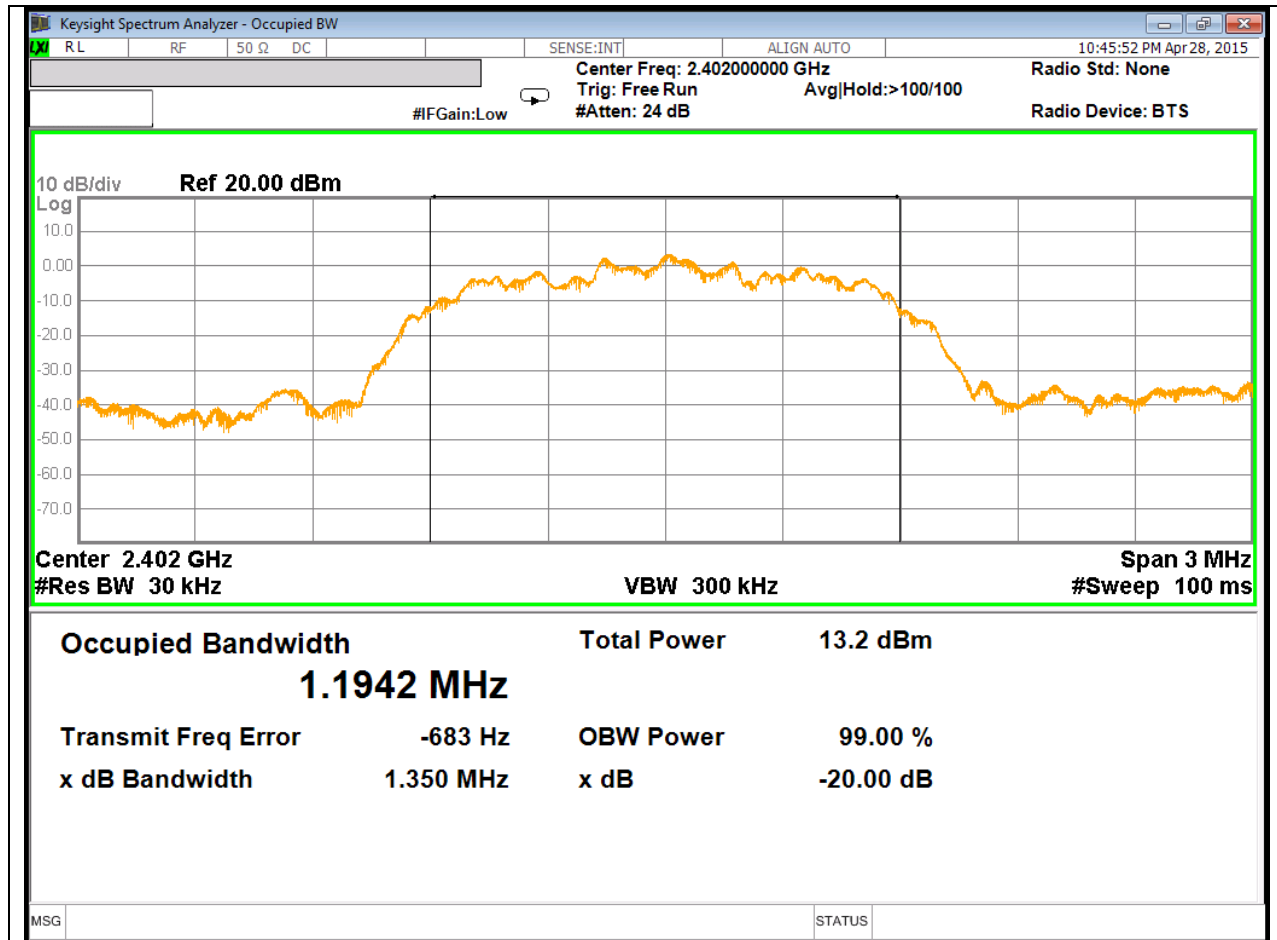


HIGH CHANNEL

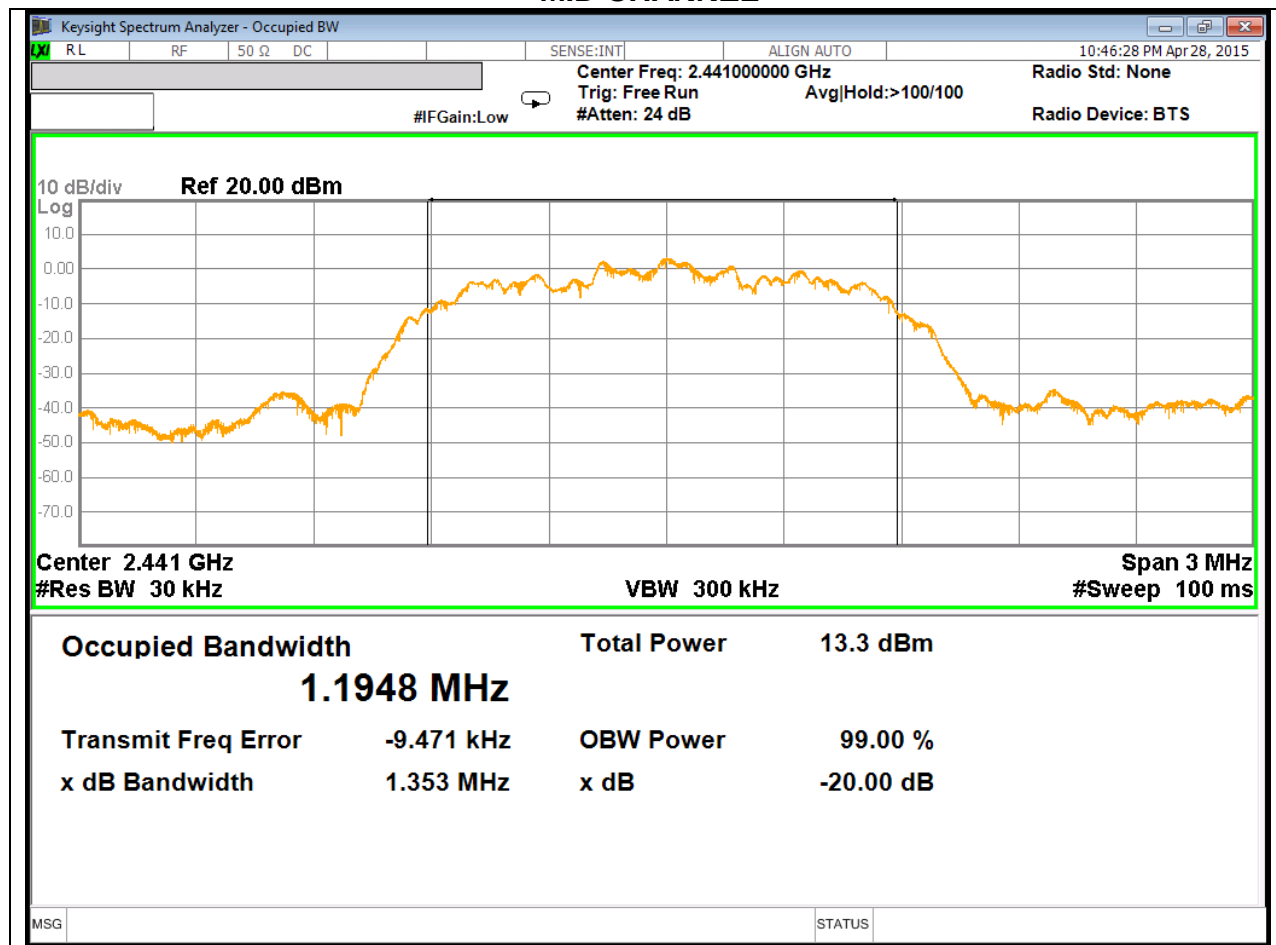


Pi/4-DQPSK 20 dB BANDWIDTH

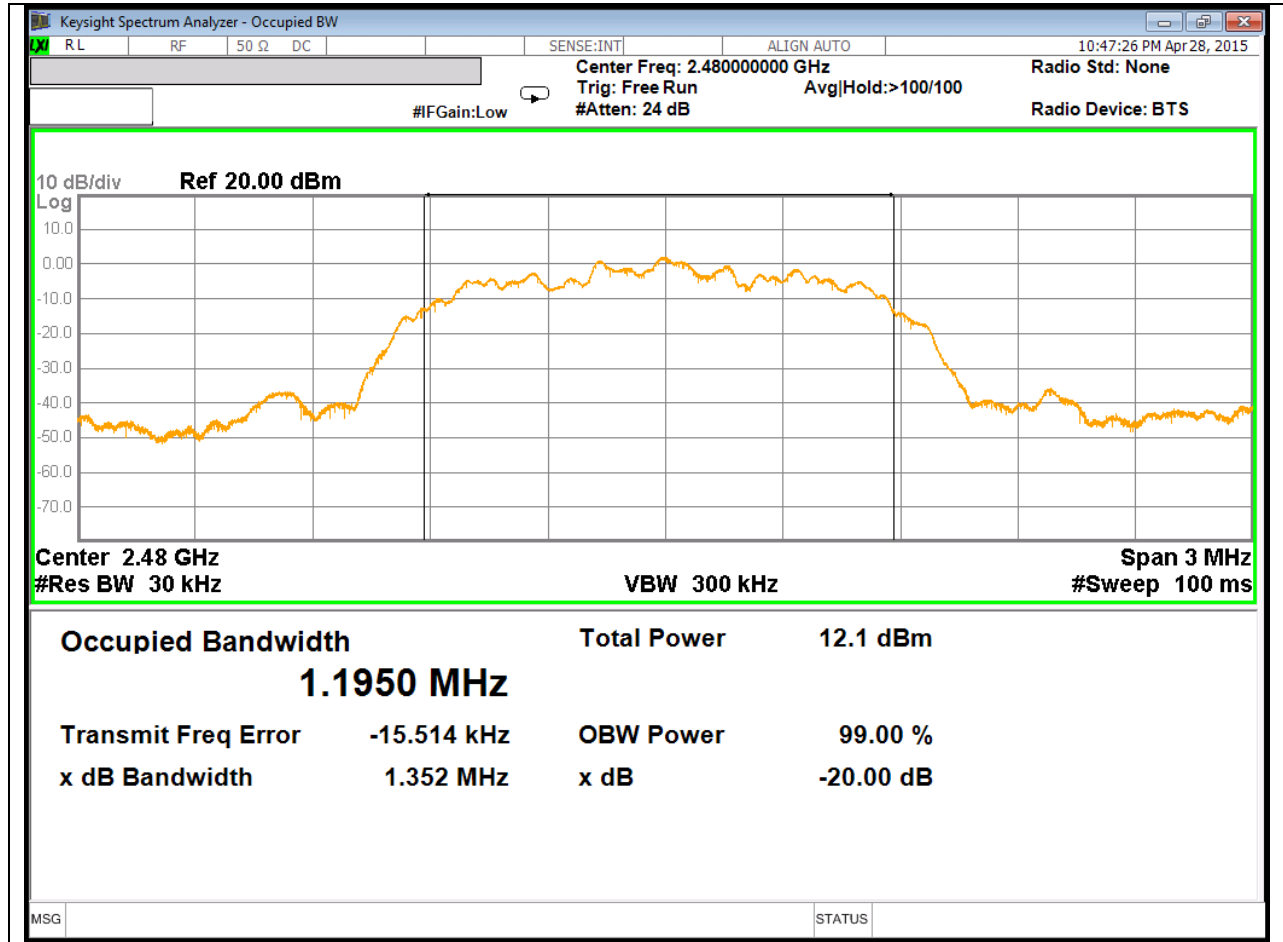
LOW CHANNEL



MID CHANNEL

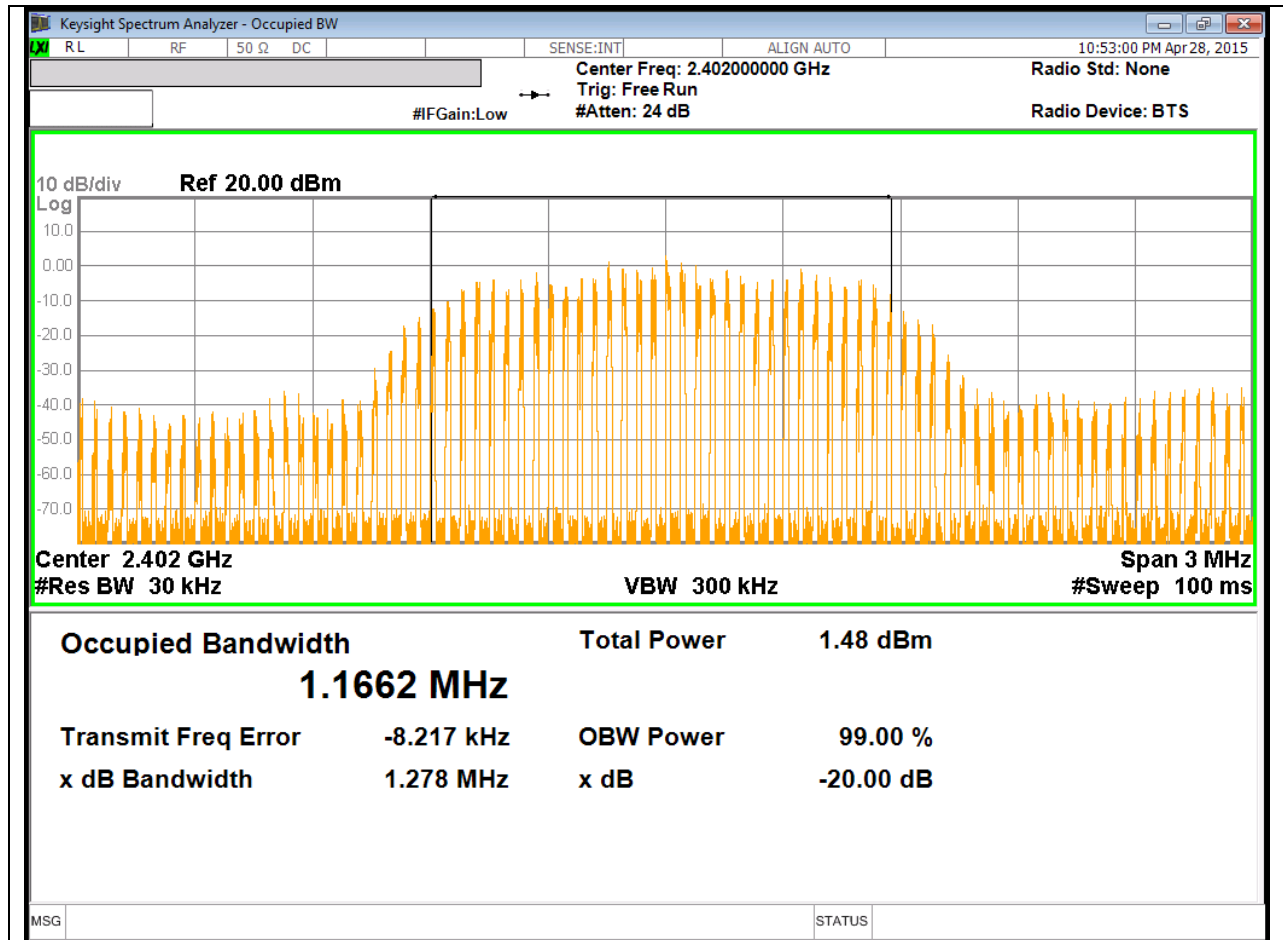


HIGH CHANNEL

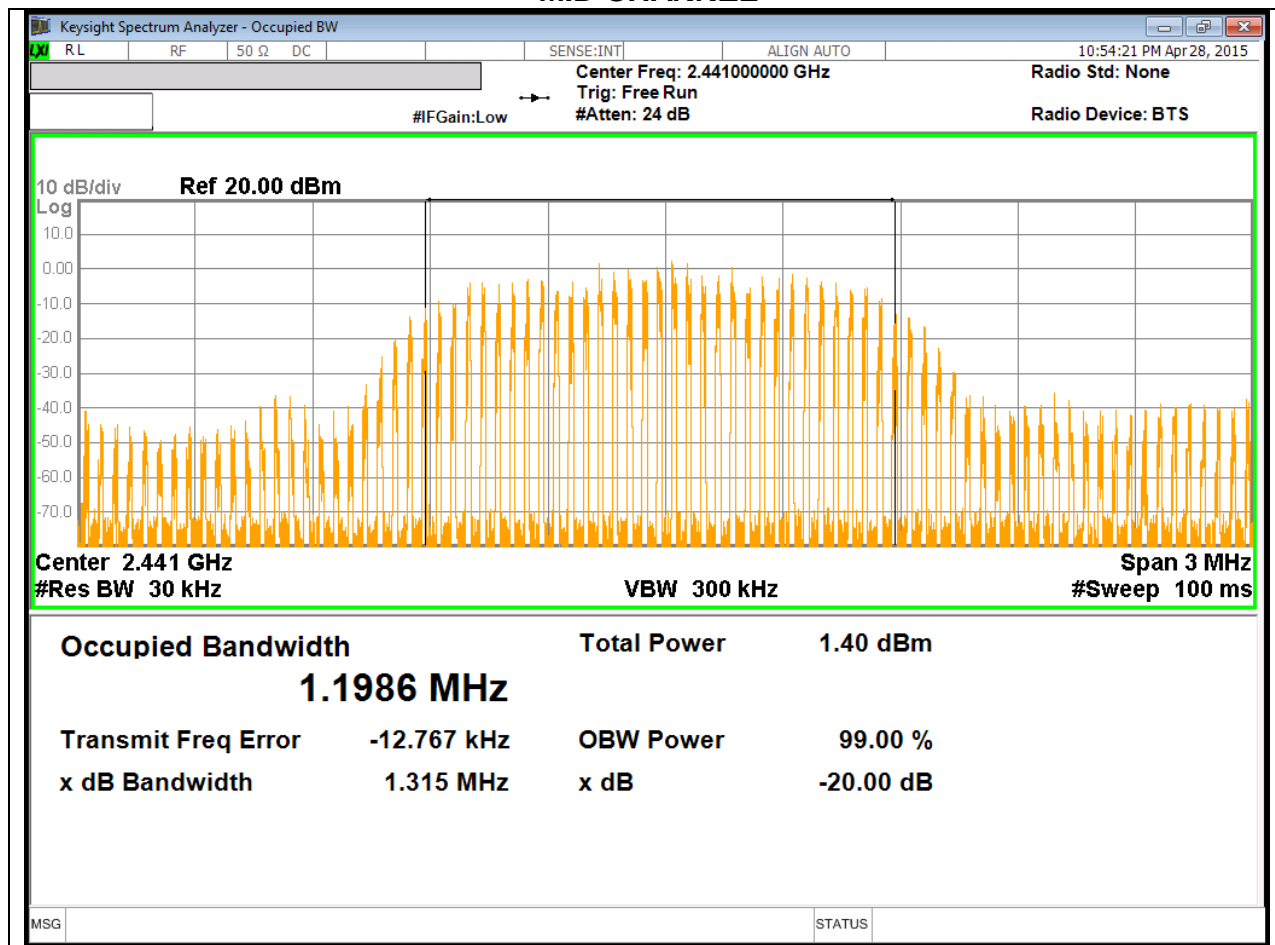


Pi/4-DQPSK 99% BANDWIDTH

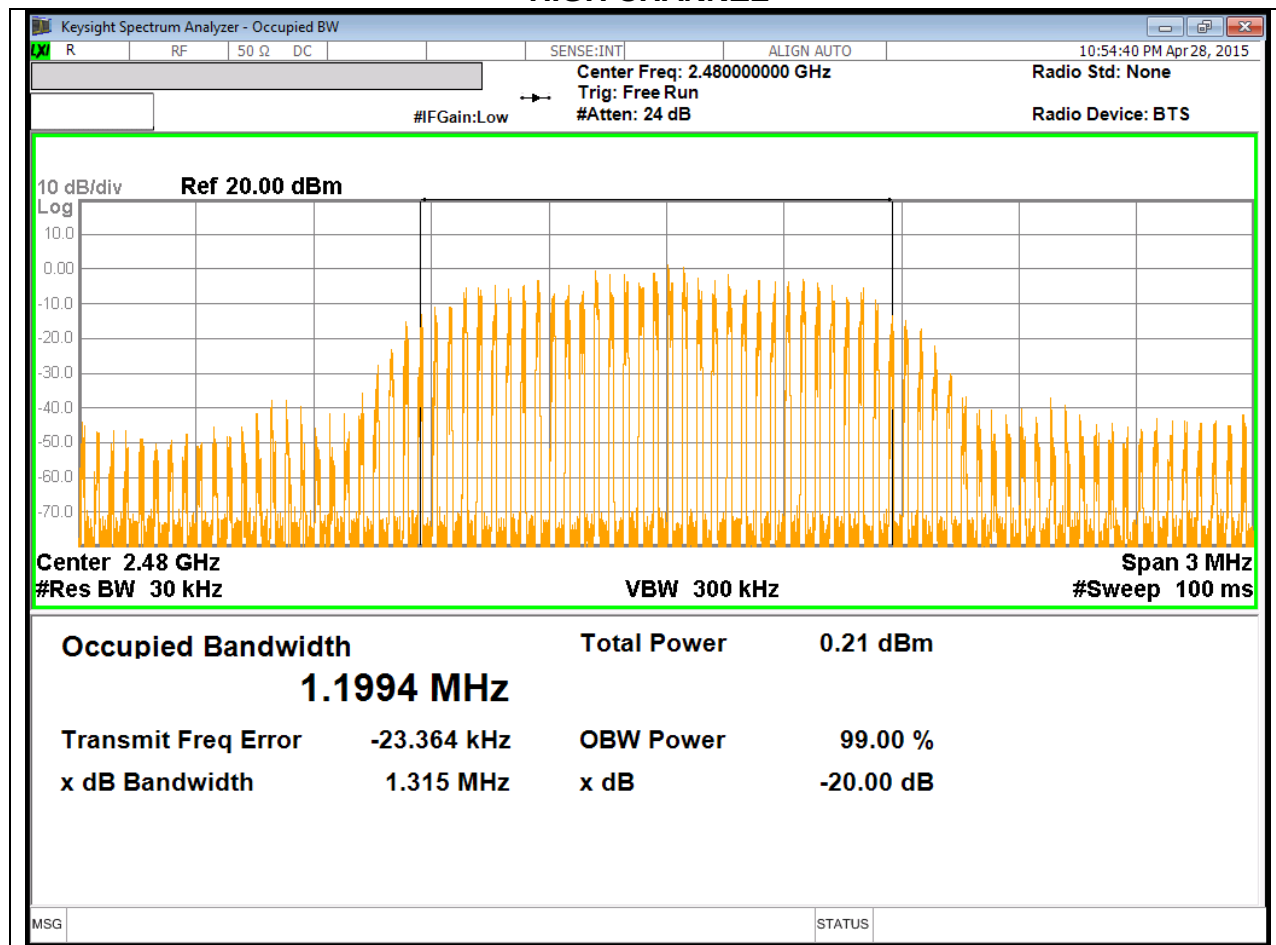
LOW CHANNEL



MID CHANNEL

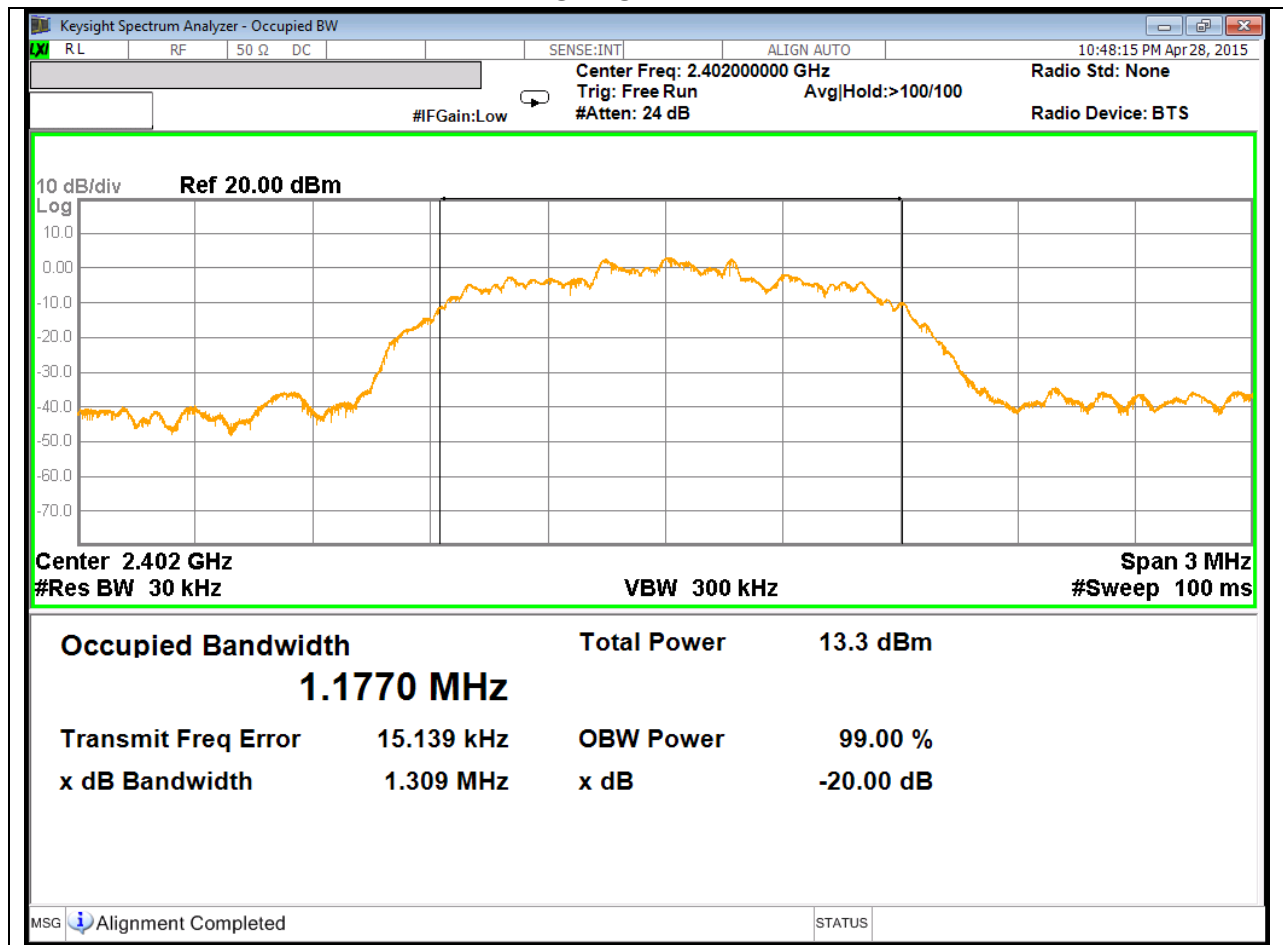


HIGH CHANNEL

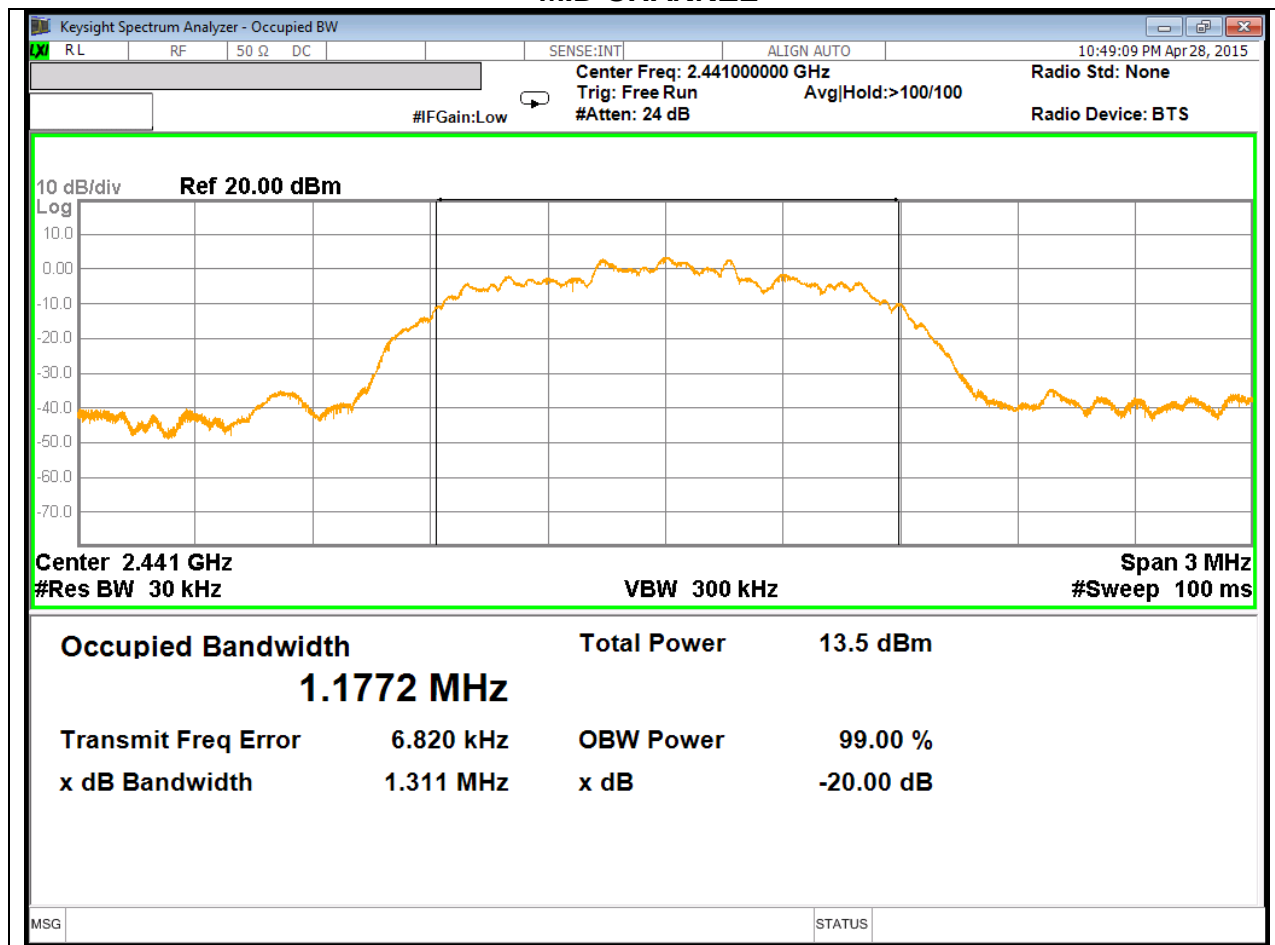


8PSK 20 dB BANDWIDTH

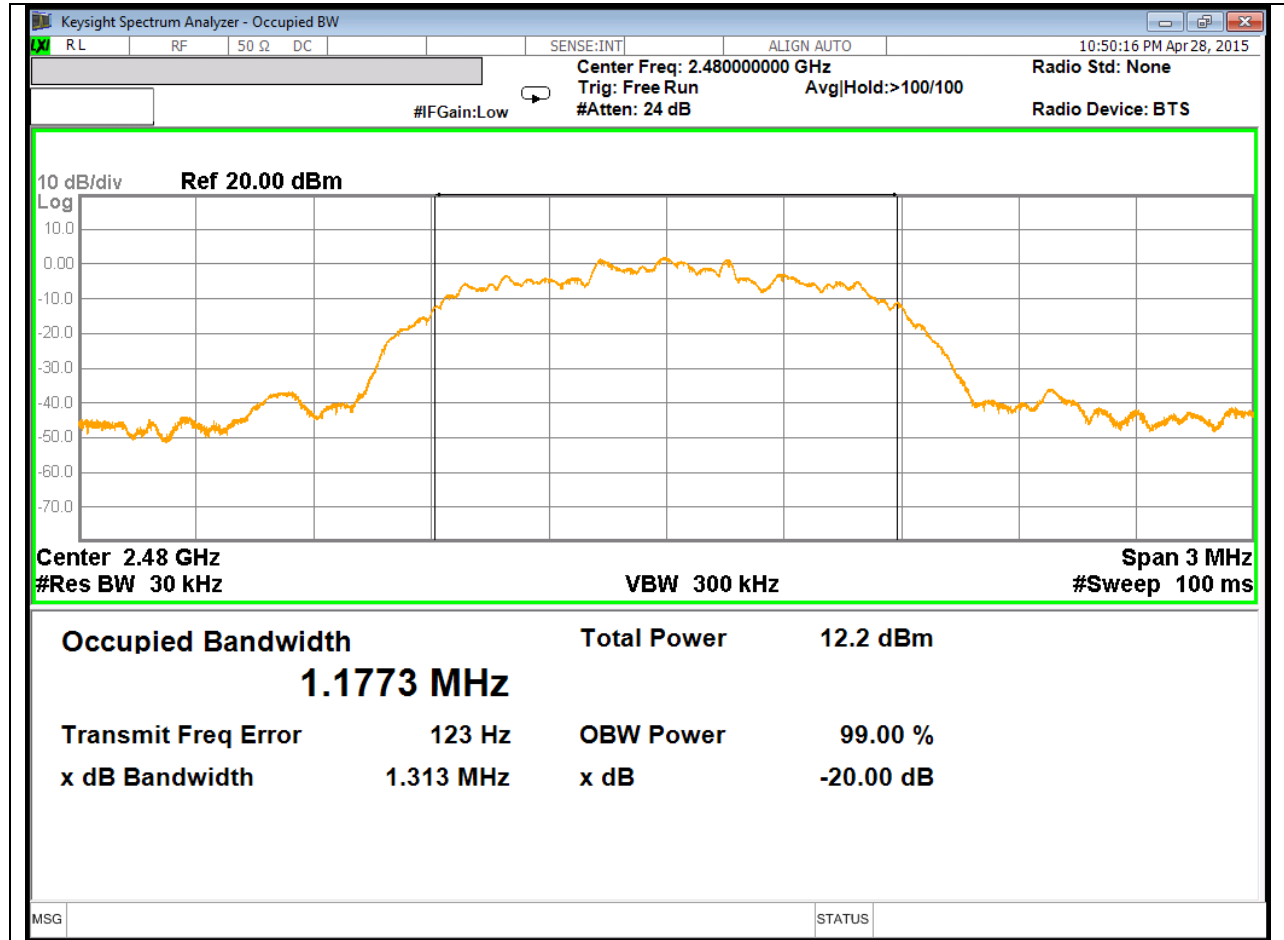
LOW CHANNEL



MID CHANNEL

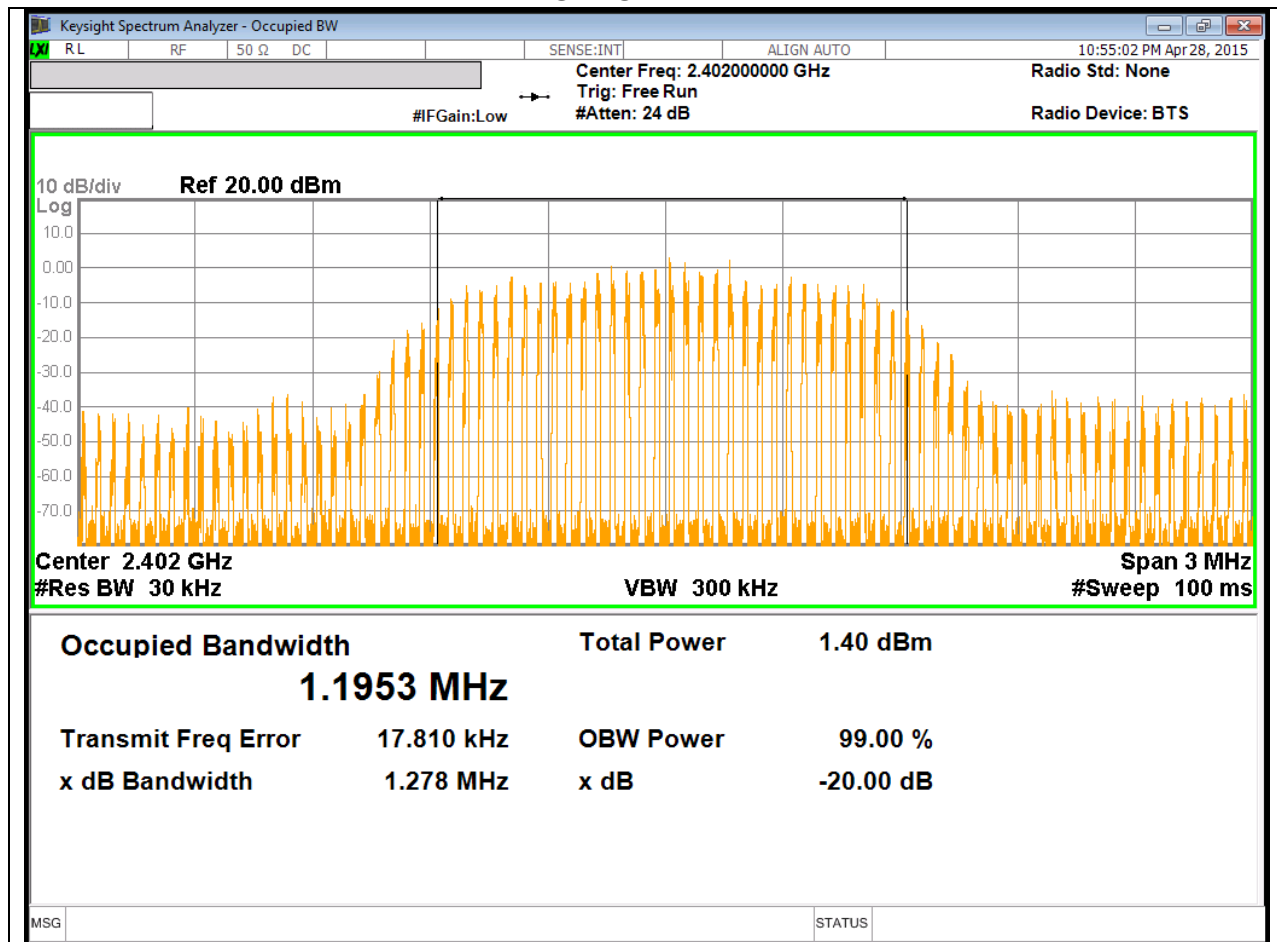


HIGH CHANNEL

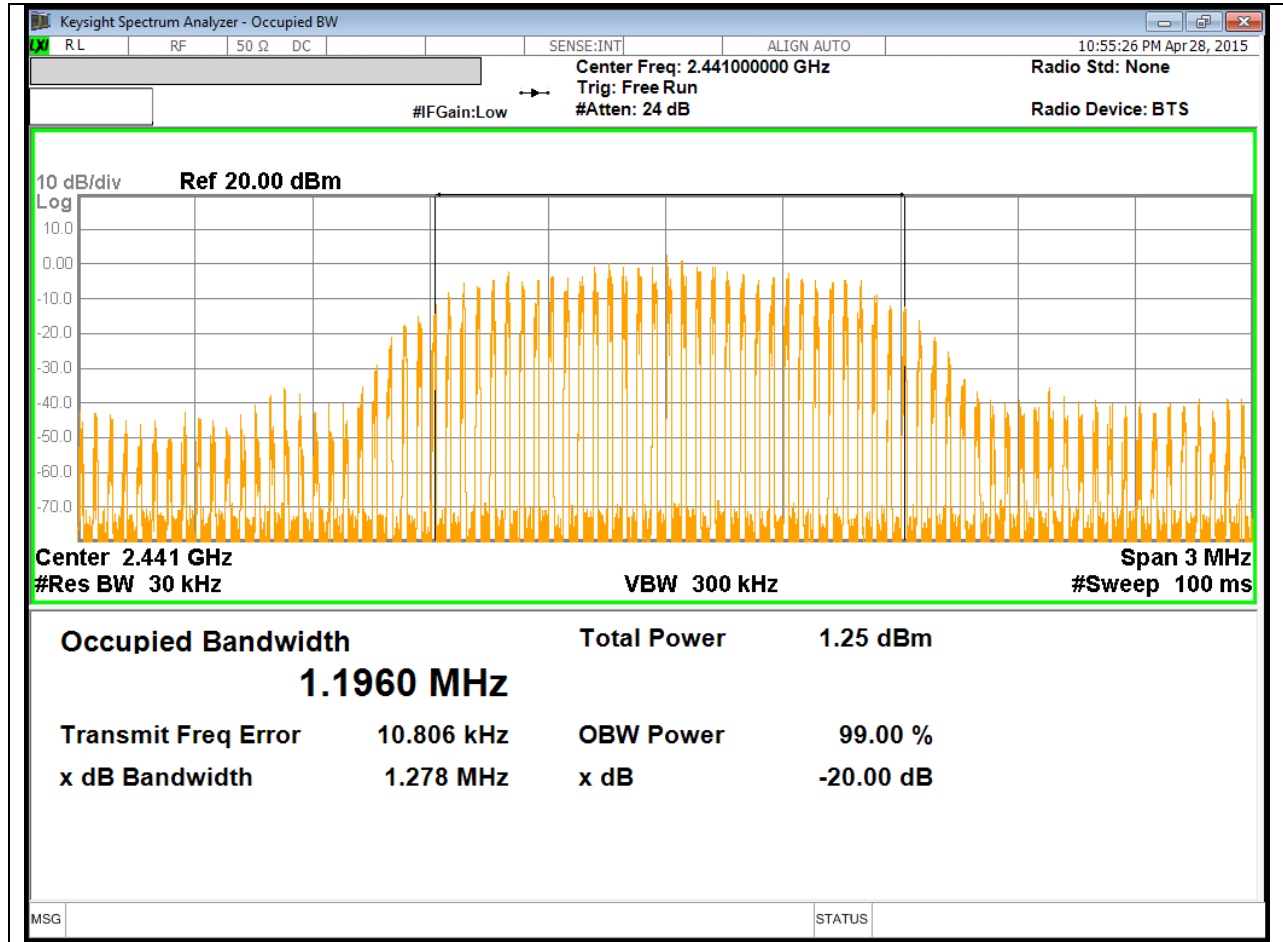


8PSK 99% BANDWIDTH

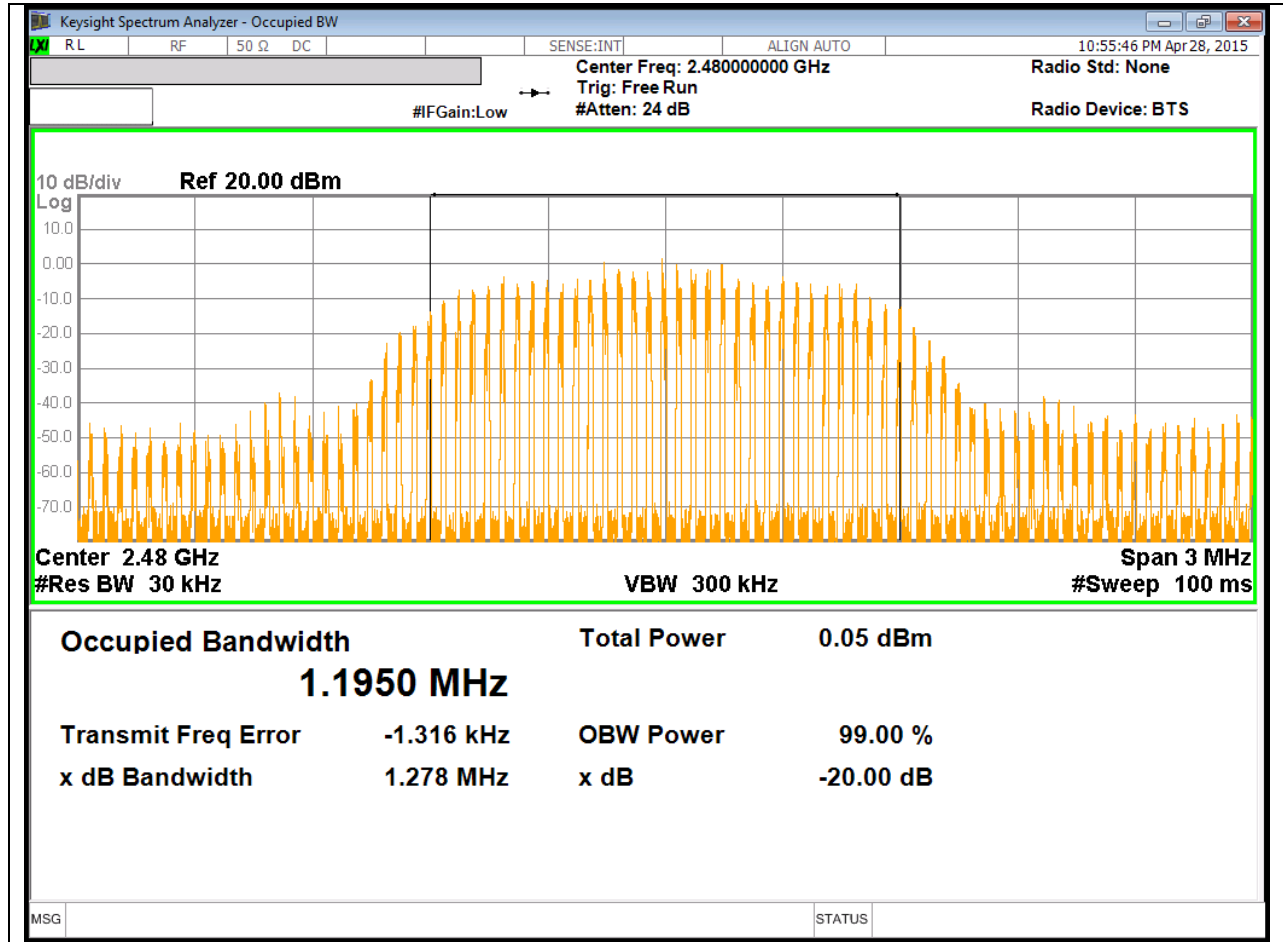
LOW CHANNEL



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.

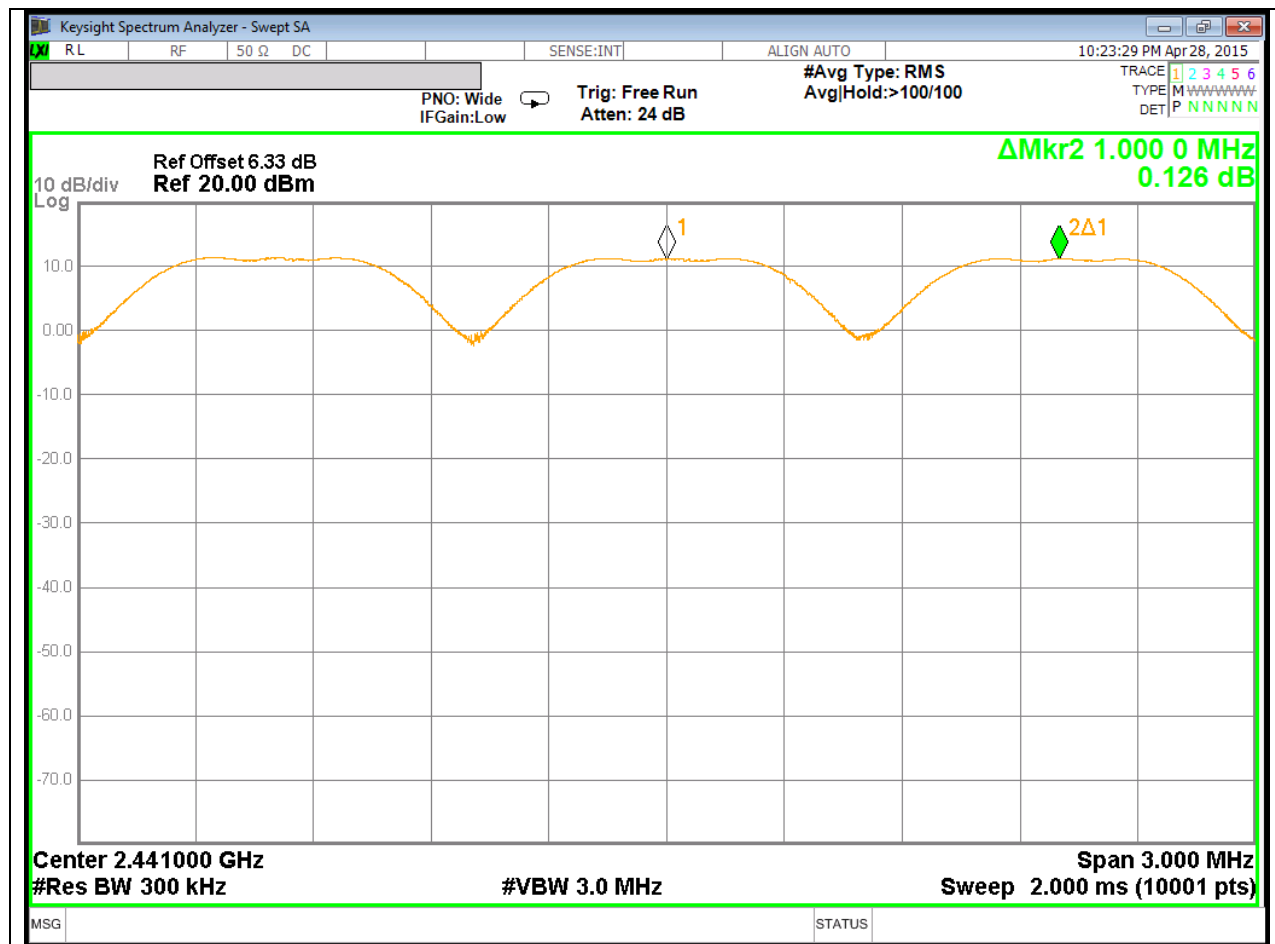
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 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

HOPPING FREQUENCY SEPARATION PLOT



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

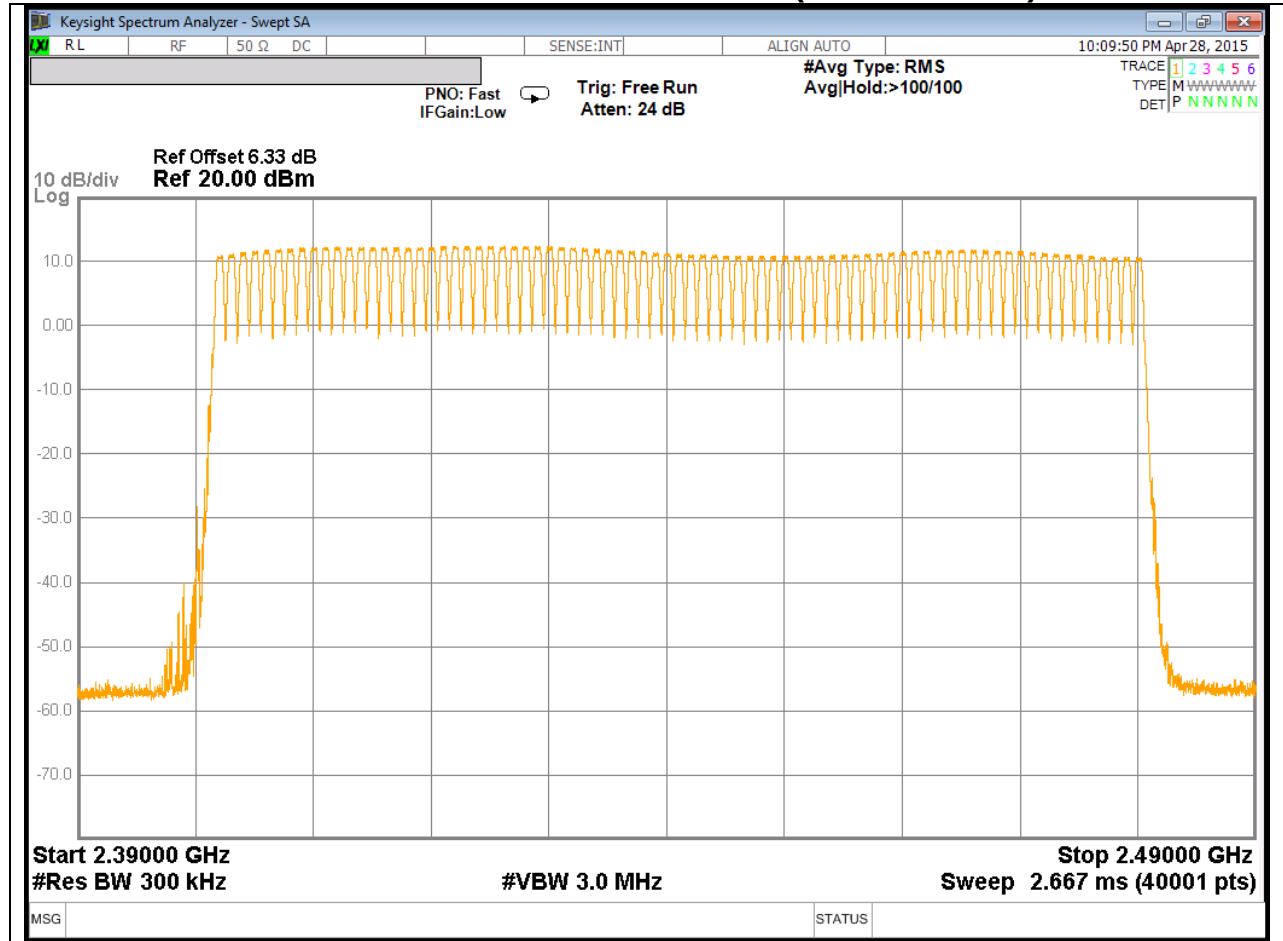
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

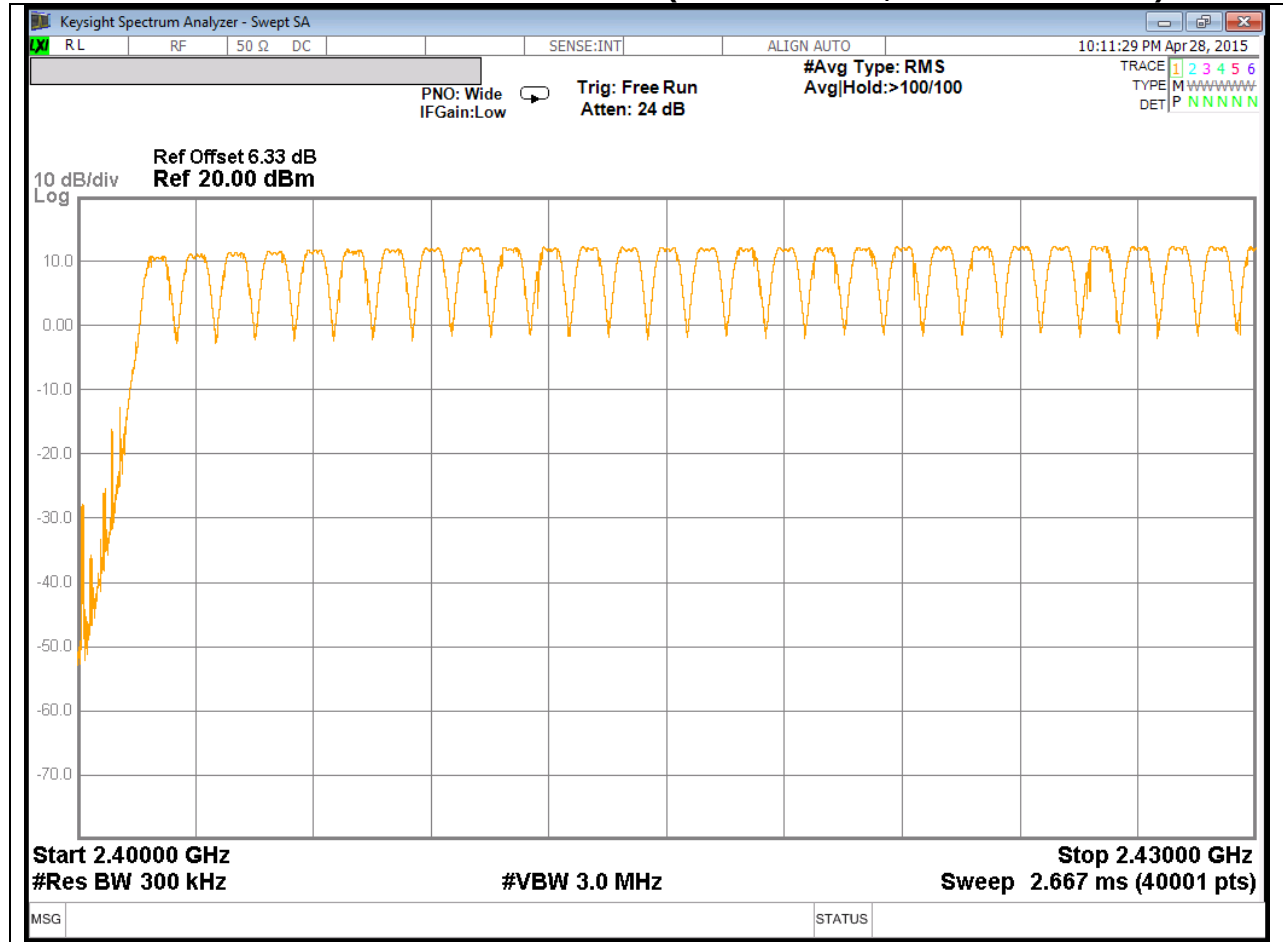
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS PLOTS

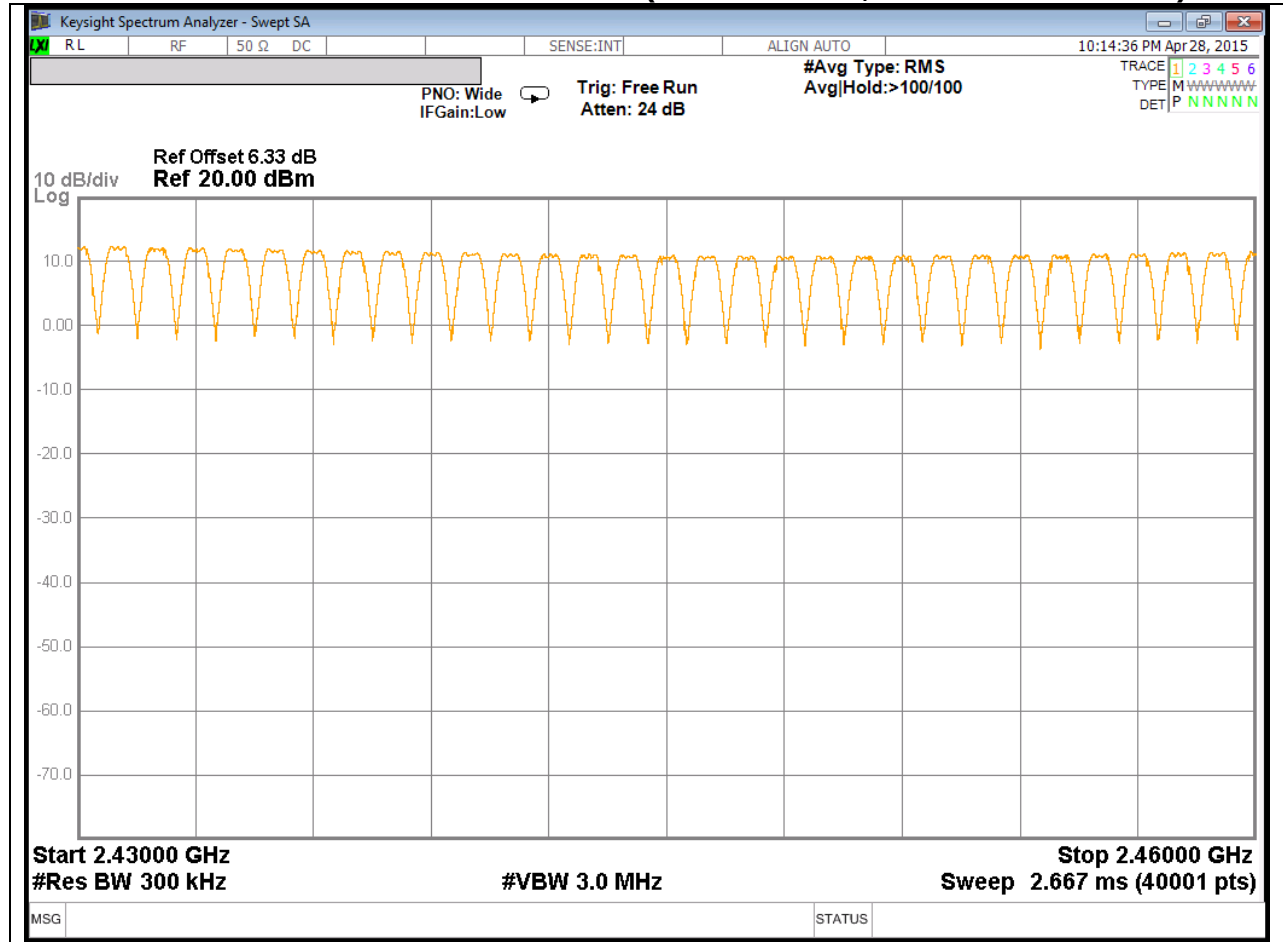
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



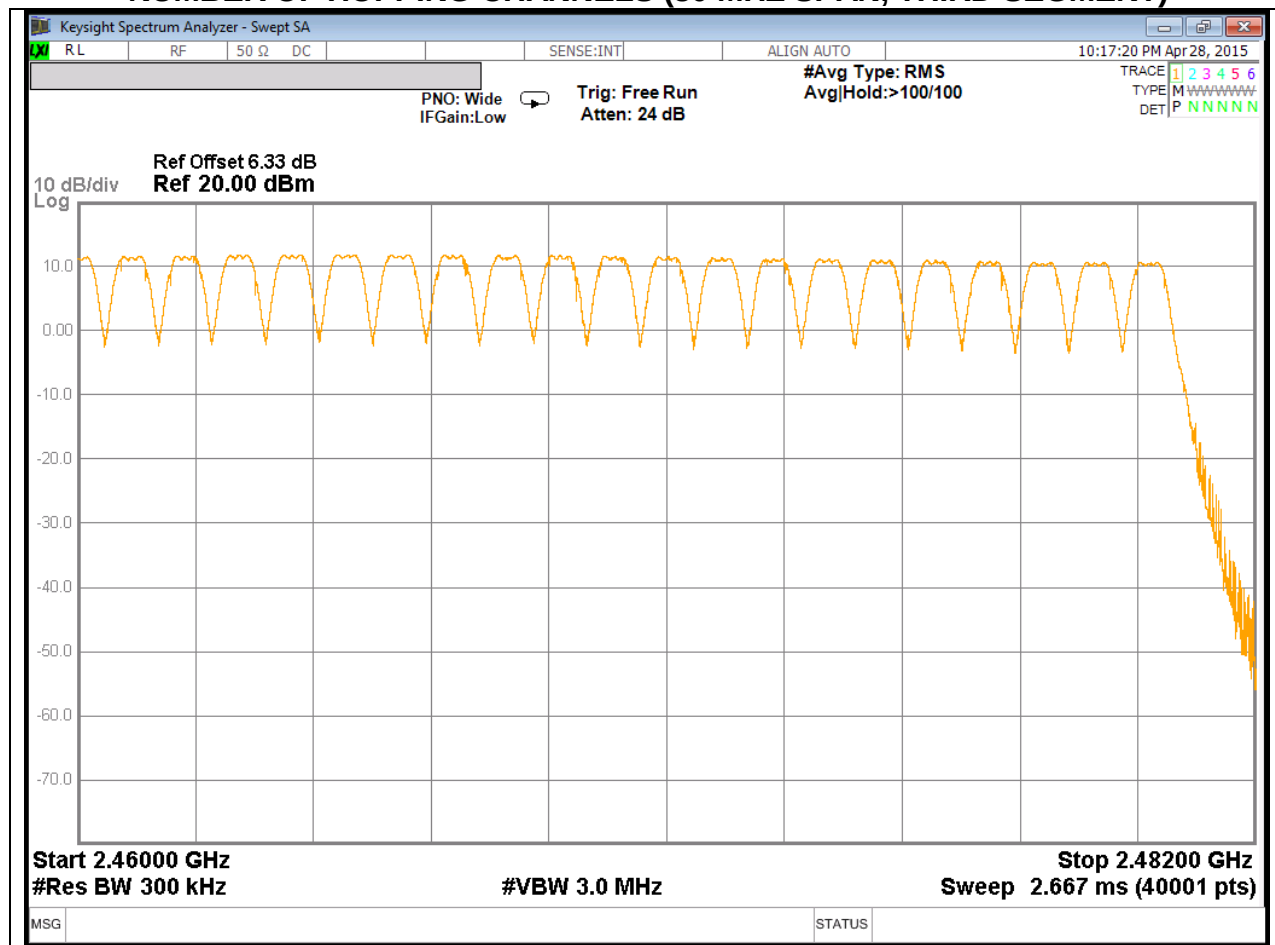
NUMBER OF HOPPING CHANNELS (30 MHz SPAN, FIRST SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHz SPAN, THIRD SEGMENT)



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.

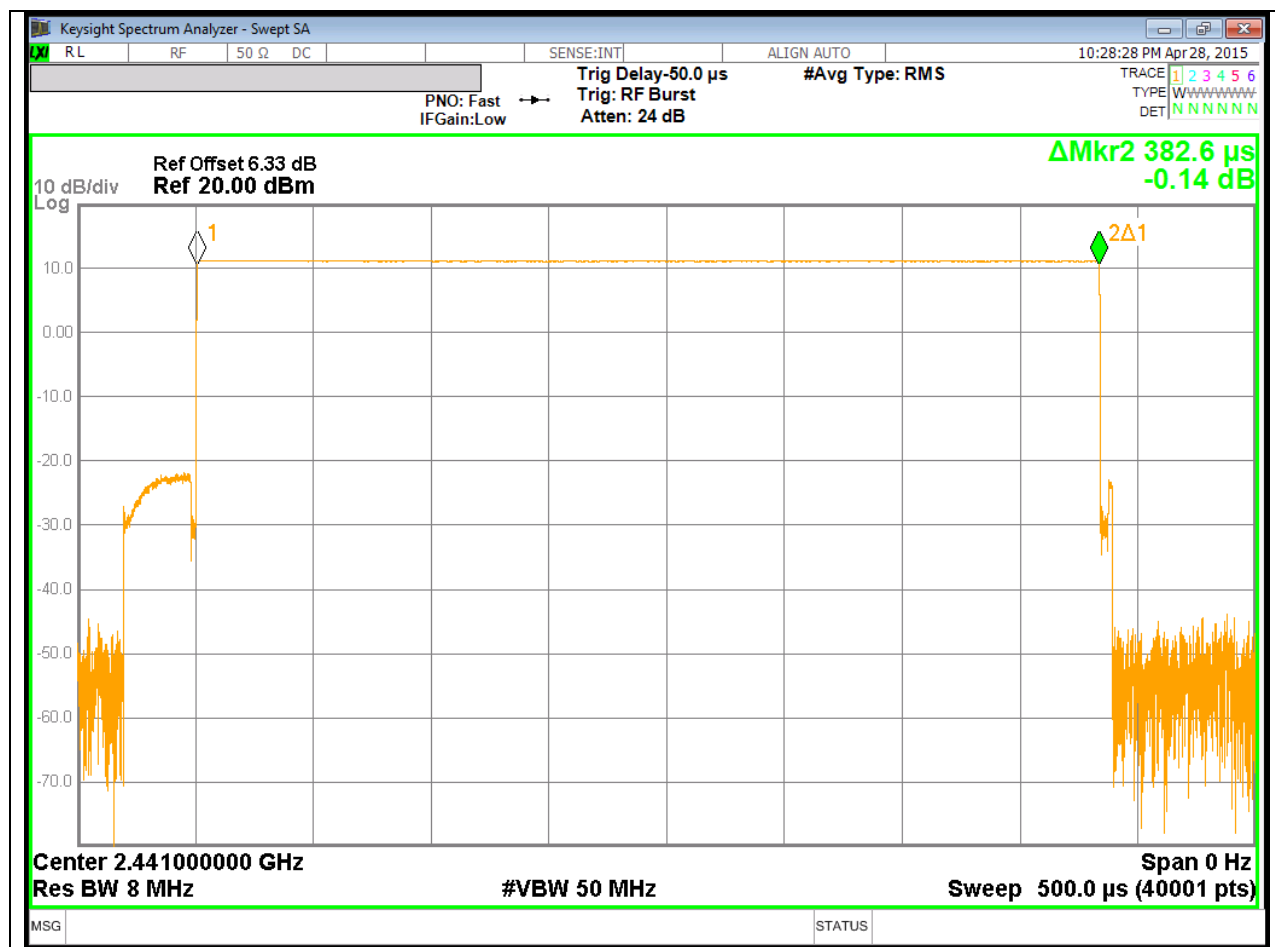
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

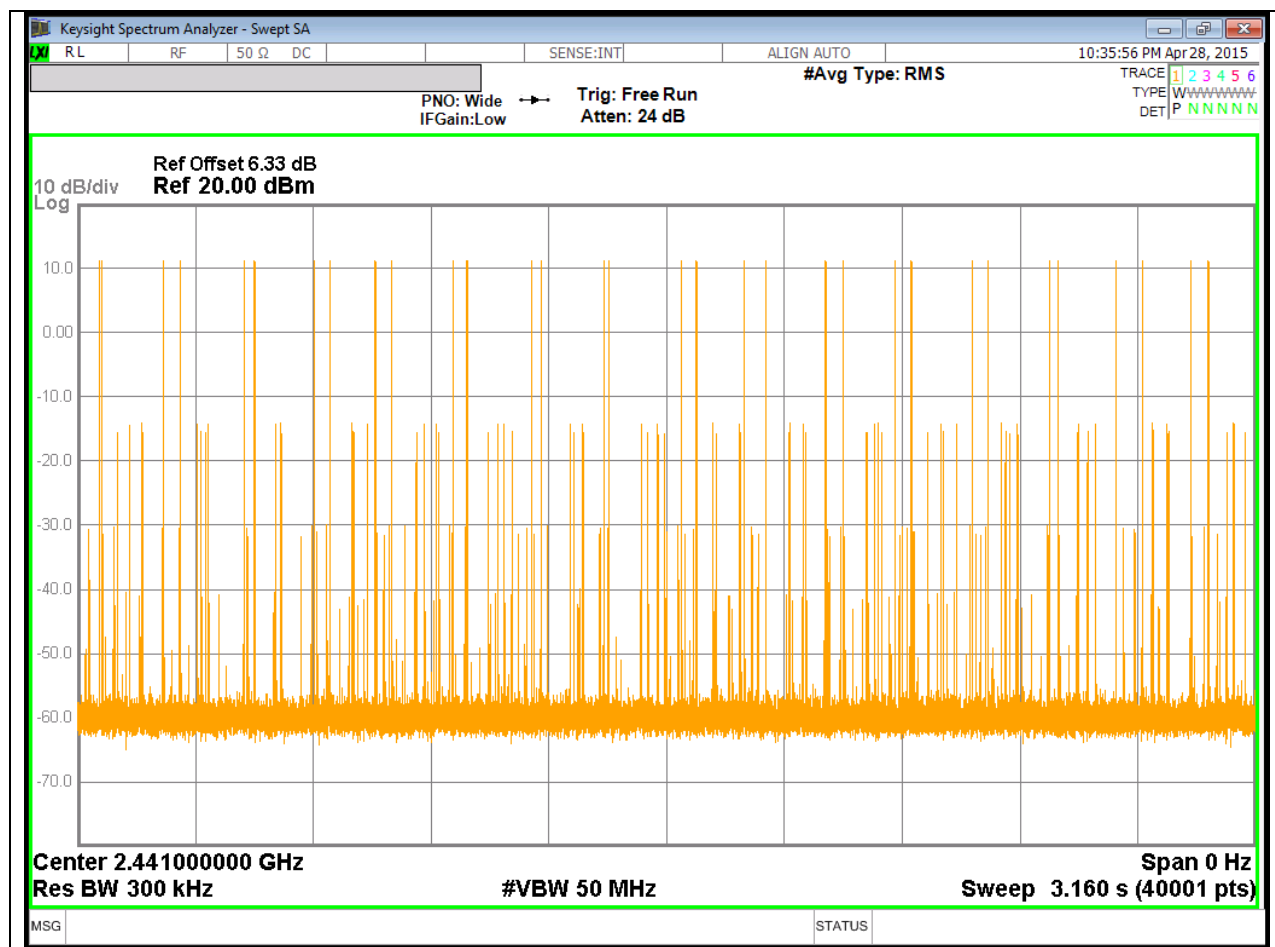
RESULTS

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Normal					
DH1	0.383	32	0.122432	0.4	-0.2776
DH3	1.639	17	0.27863	0.4	-0.1214
DH5	2.886	11	0.31746	0.4	-0.0825
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK AFH					
DH1	0.383	8	0.030608	0.4	-0.3694
DH3	1.639	4.25	0.0696575	0.4	-0.3303
DH5	2.886	2.75	0.079365	0.4	-0.3206

PULSE WIDTH - DH1



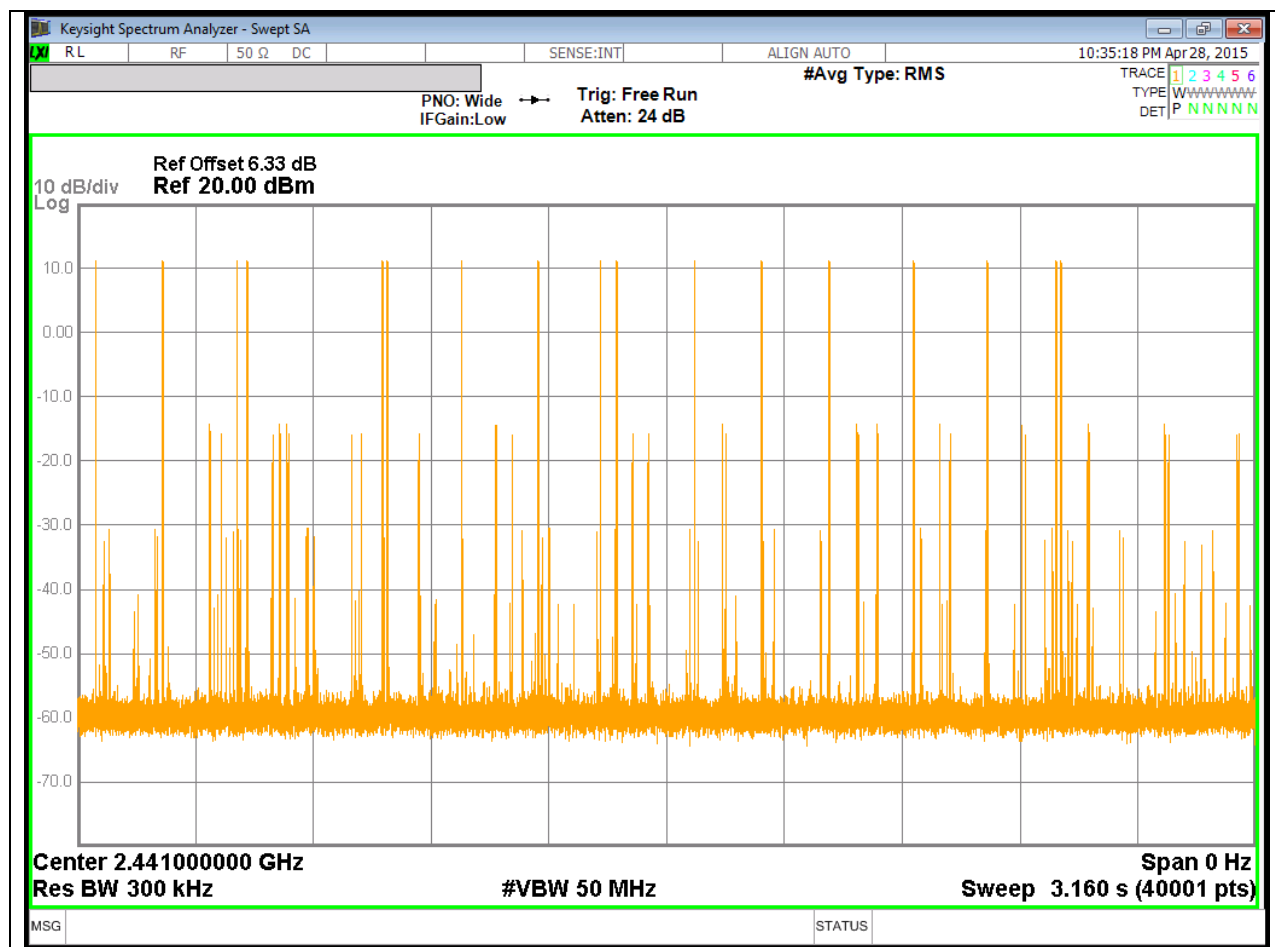
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1



PULSE WIDTH - DH3



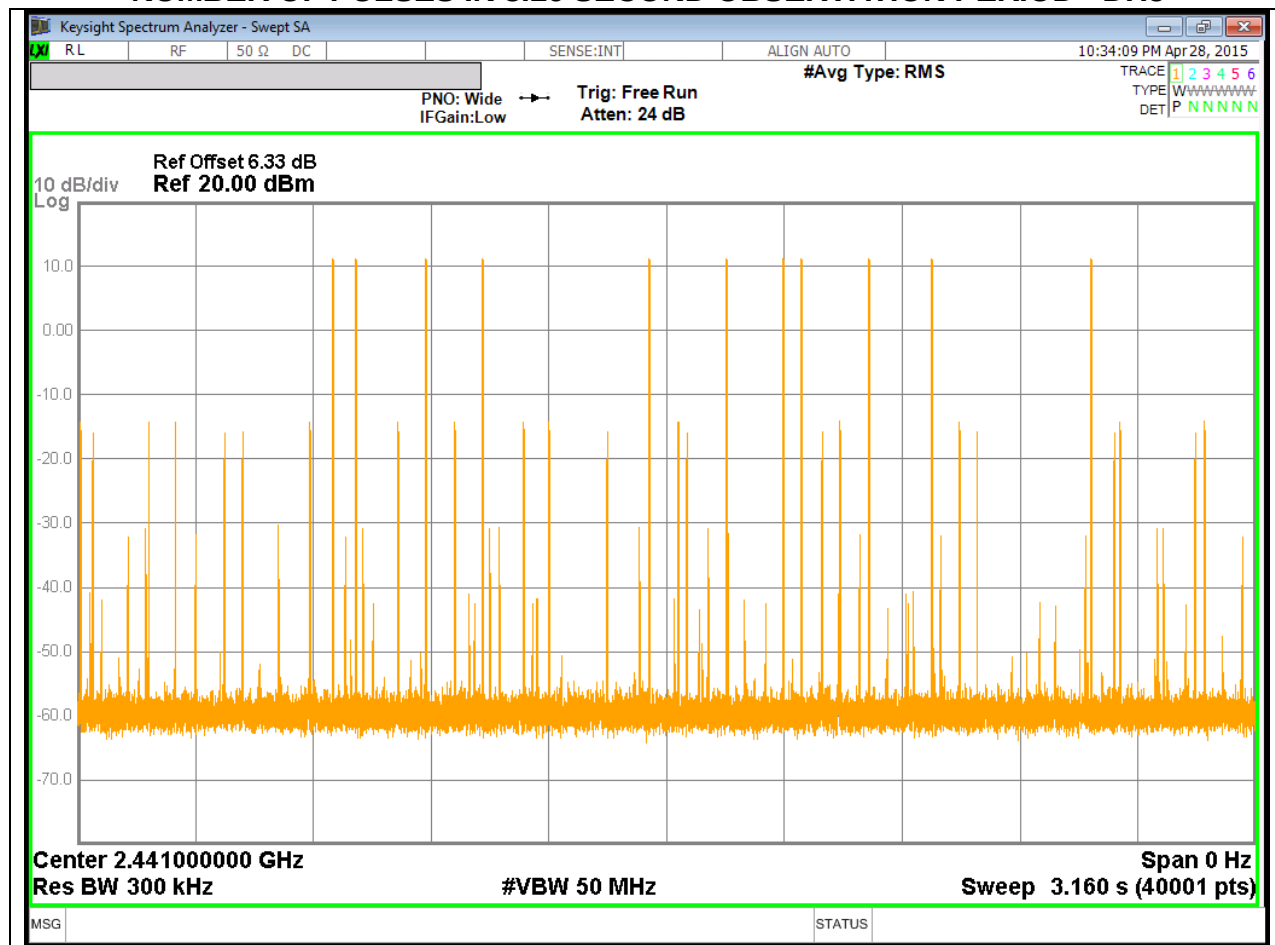
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH3



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	9.193	21	-11.807
Middle	2441	10.038	21	-10.962
High	2480	9.301	21	-11.699
Worst		10.038		-10.962

8.5.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	7.630	21	-13.370
Middle	2441	8.198	21	-12.802
High	2480	7.160	21	-13.840
Worst		8.198		-12.802

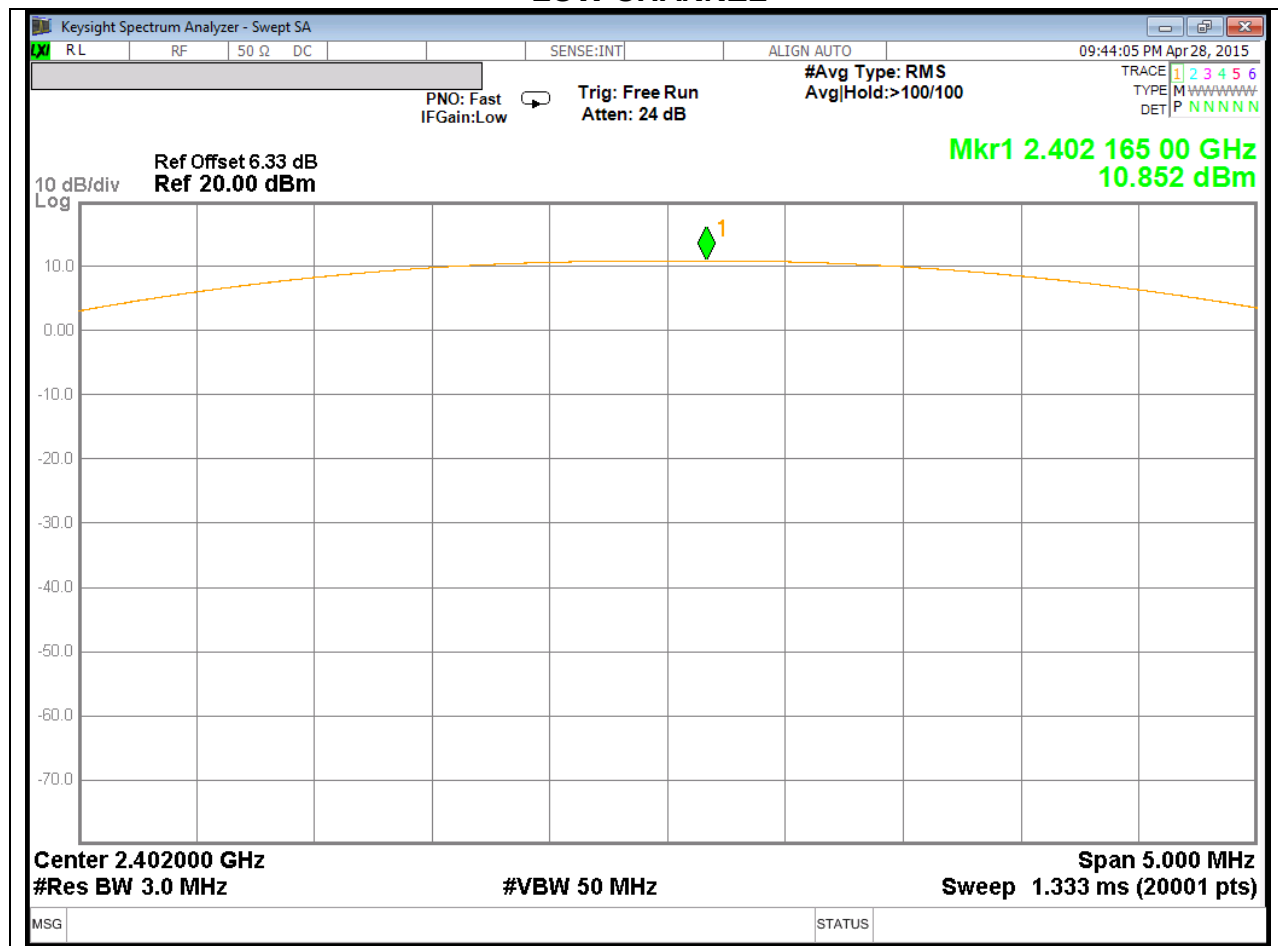
8.5.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	7.650	21	-13.350
Middle	2441	8.175	21	-12.825
High	2480	7.145	21	-13.855
Worst		8.175		-12.825

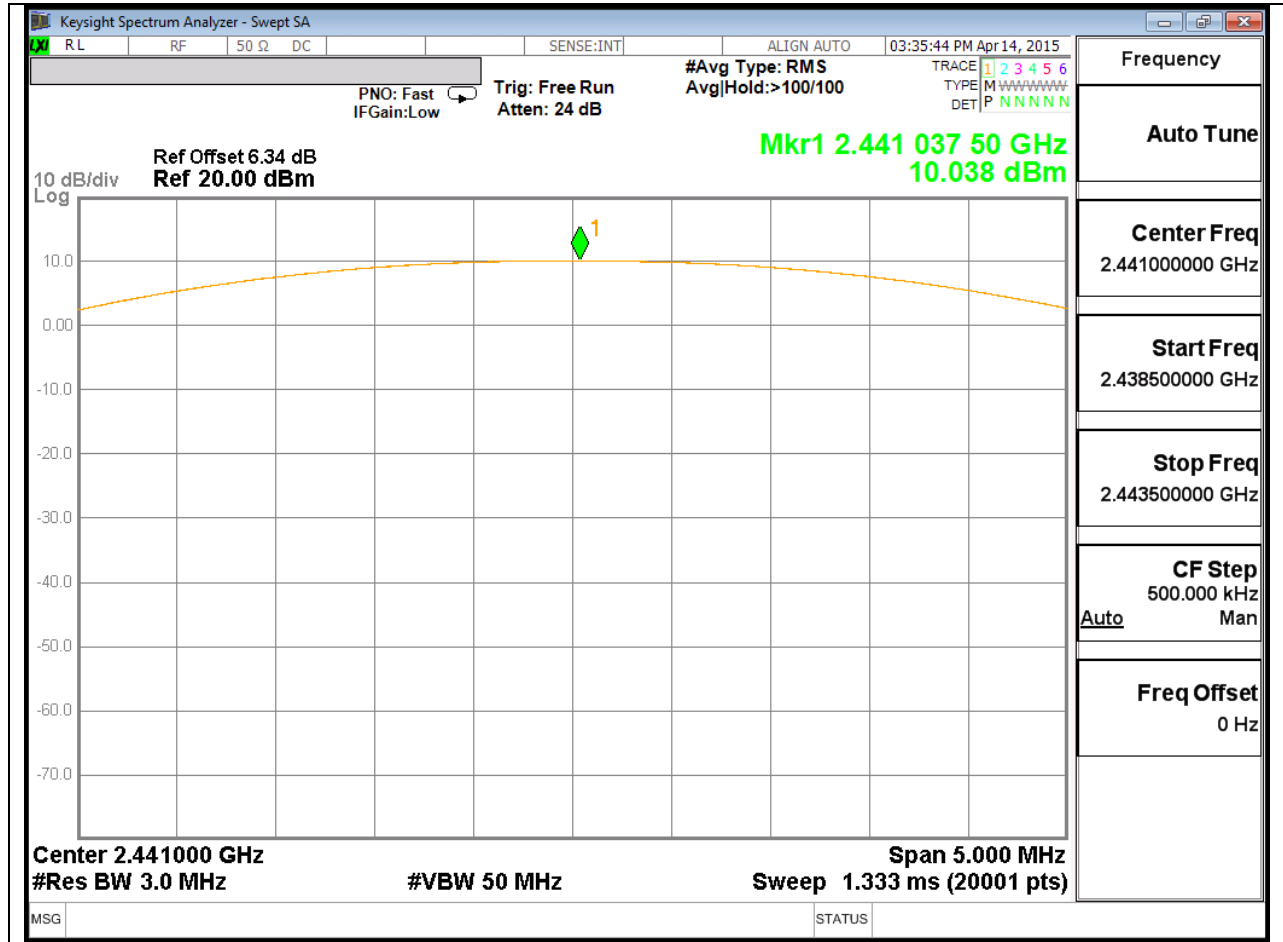
8.5.4. OUTPUT POWER PLOTS

GFSK OUTPUT POWER

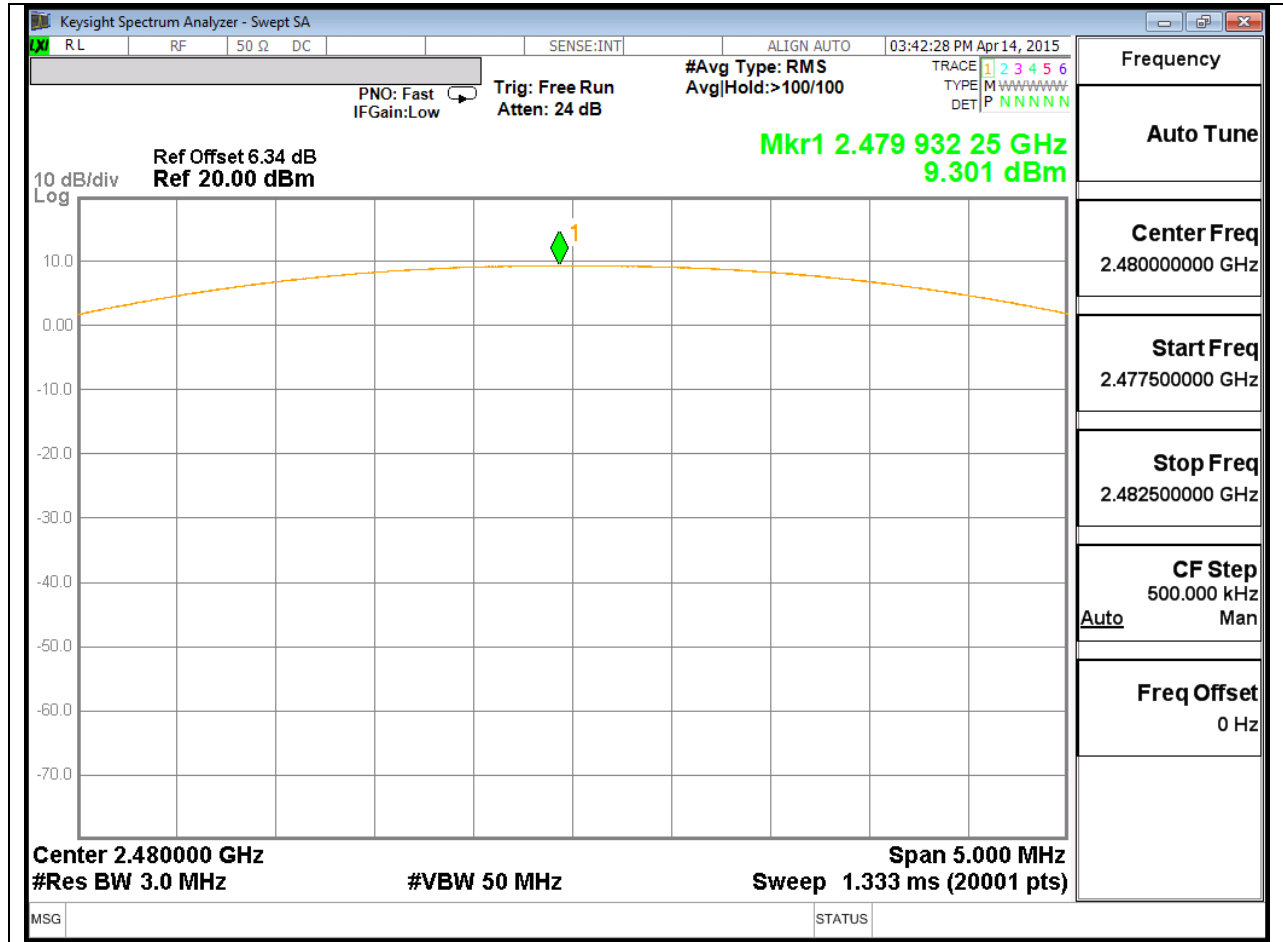
LOW CHANNEL



MID CHANNEL

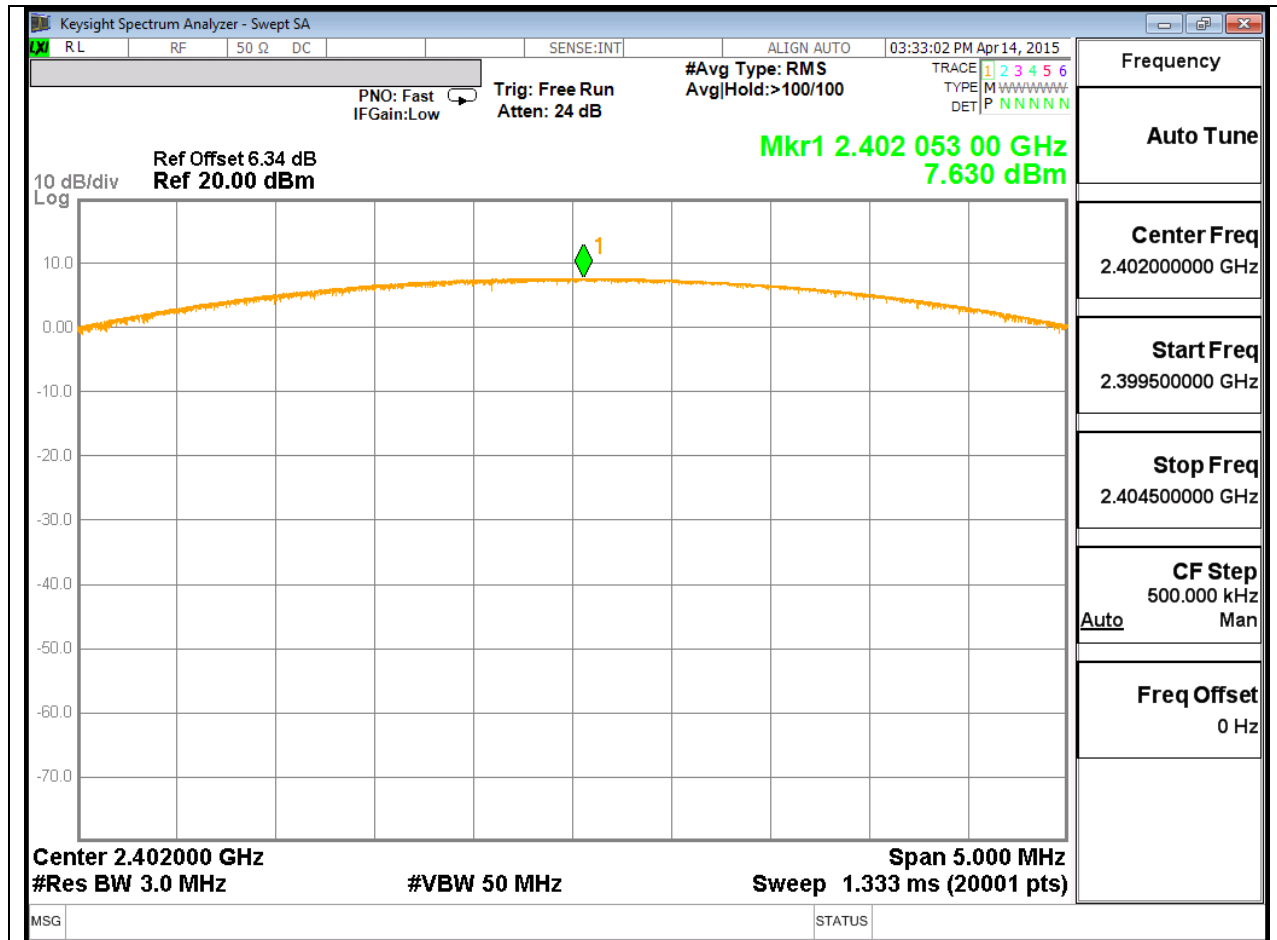


HIGH CHANNEL

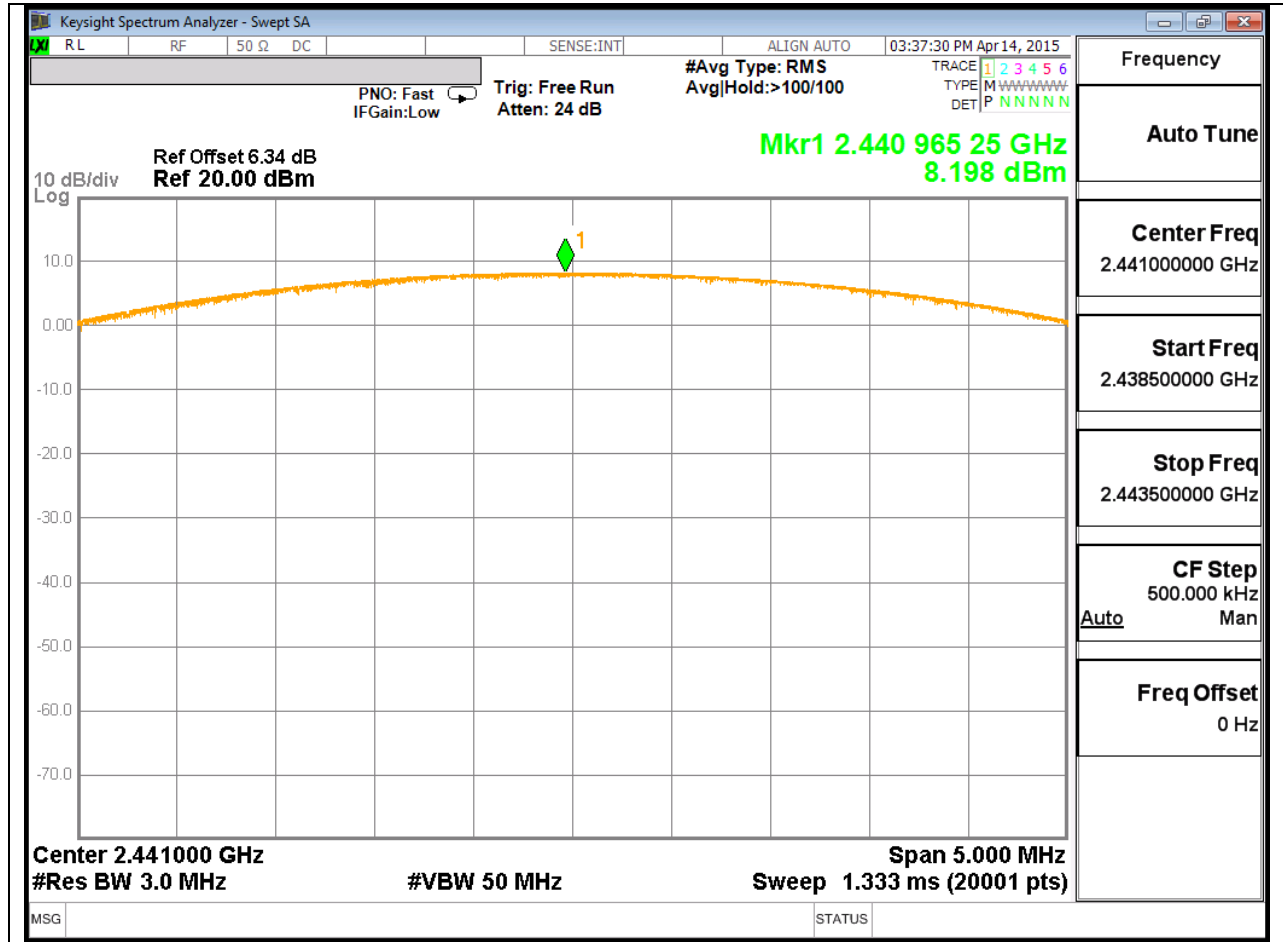


Pi/4-DPSK OUTPUT POWER

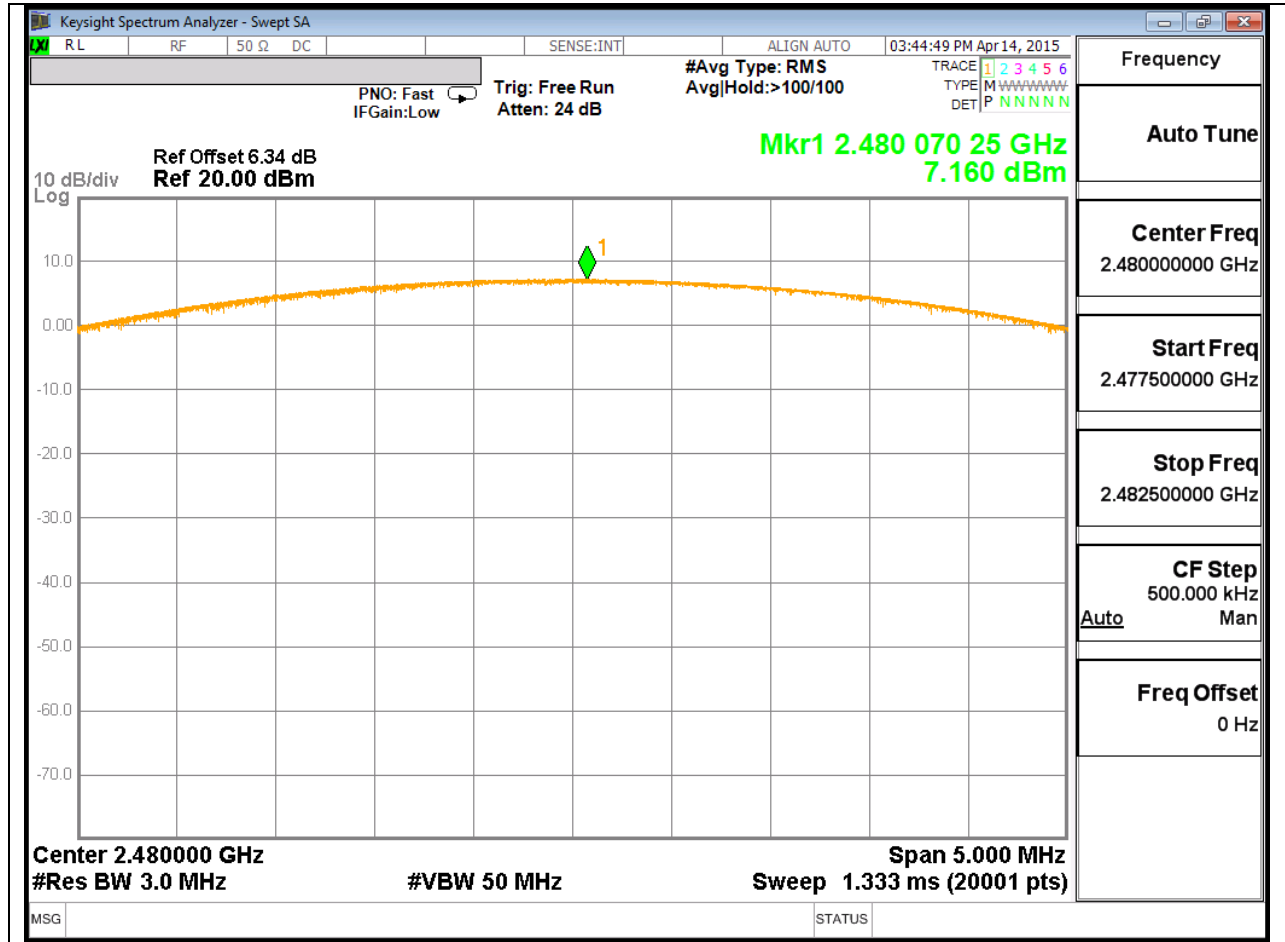
LOW CHANNEL



MID CHANNEL

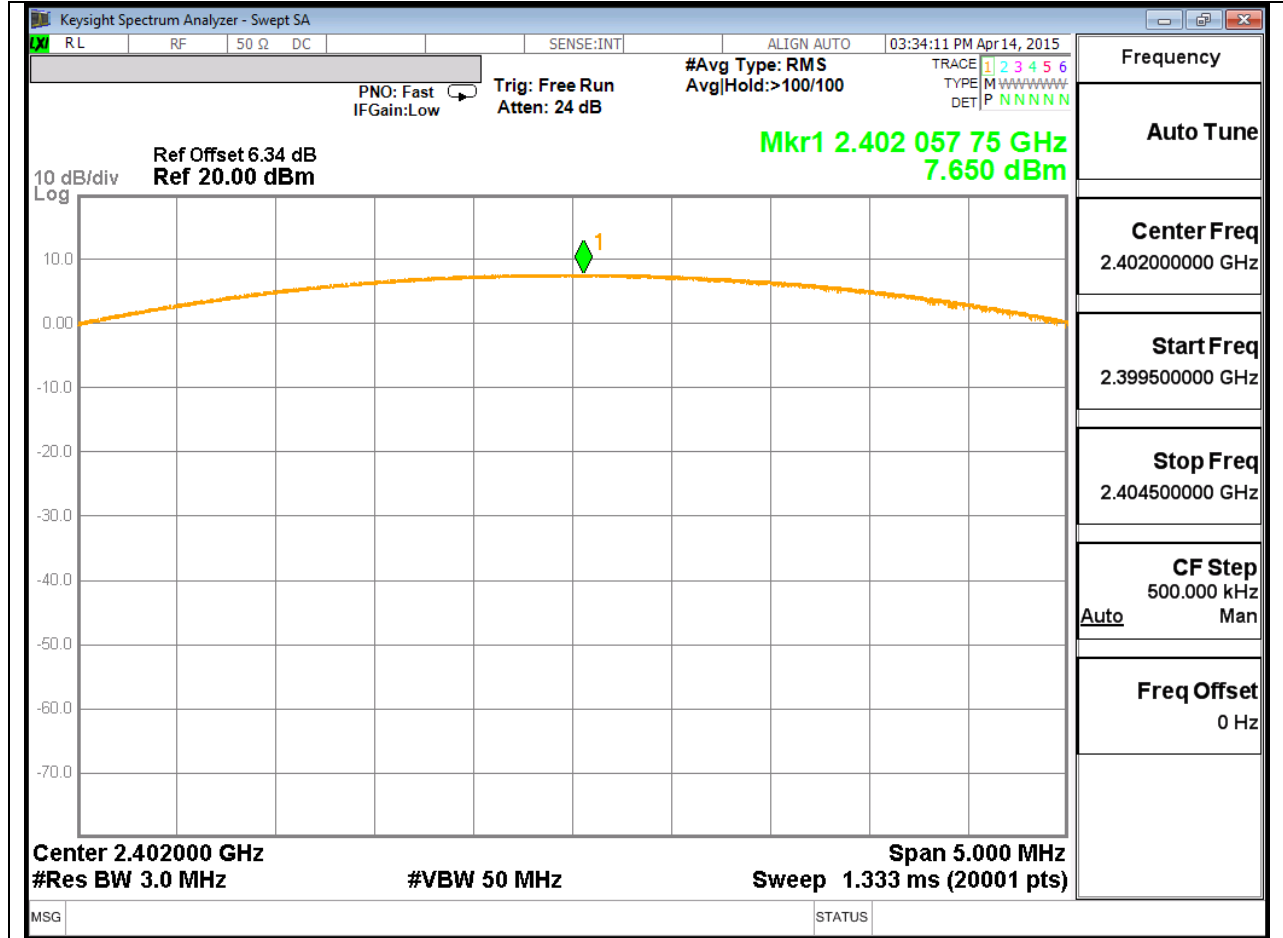


HIGH CHANNEL

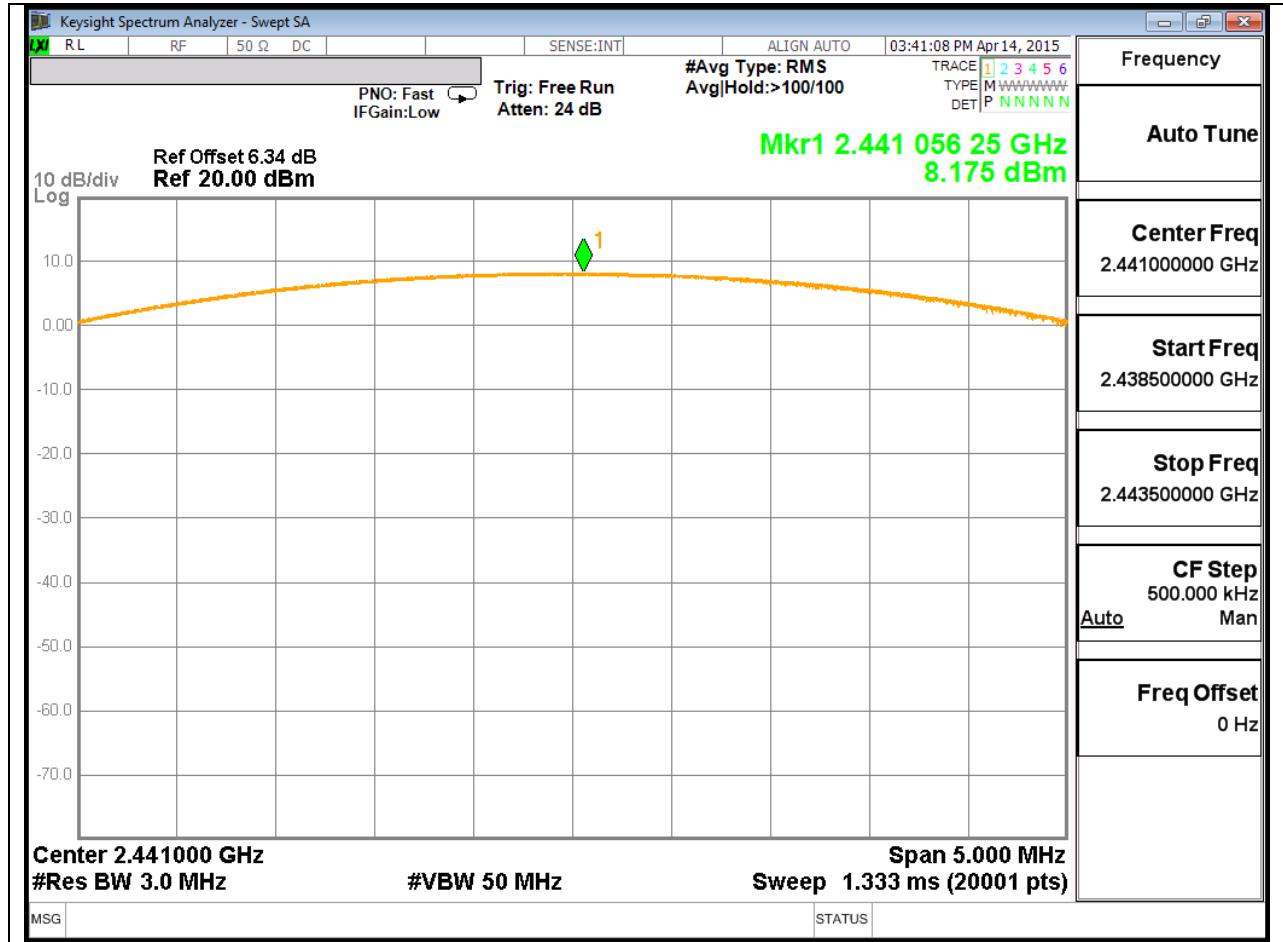


8PSK OUTPUT POWER

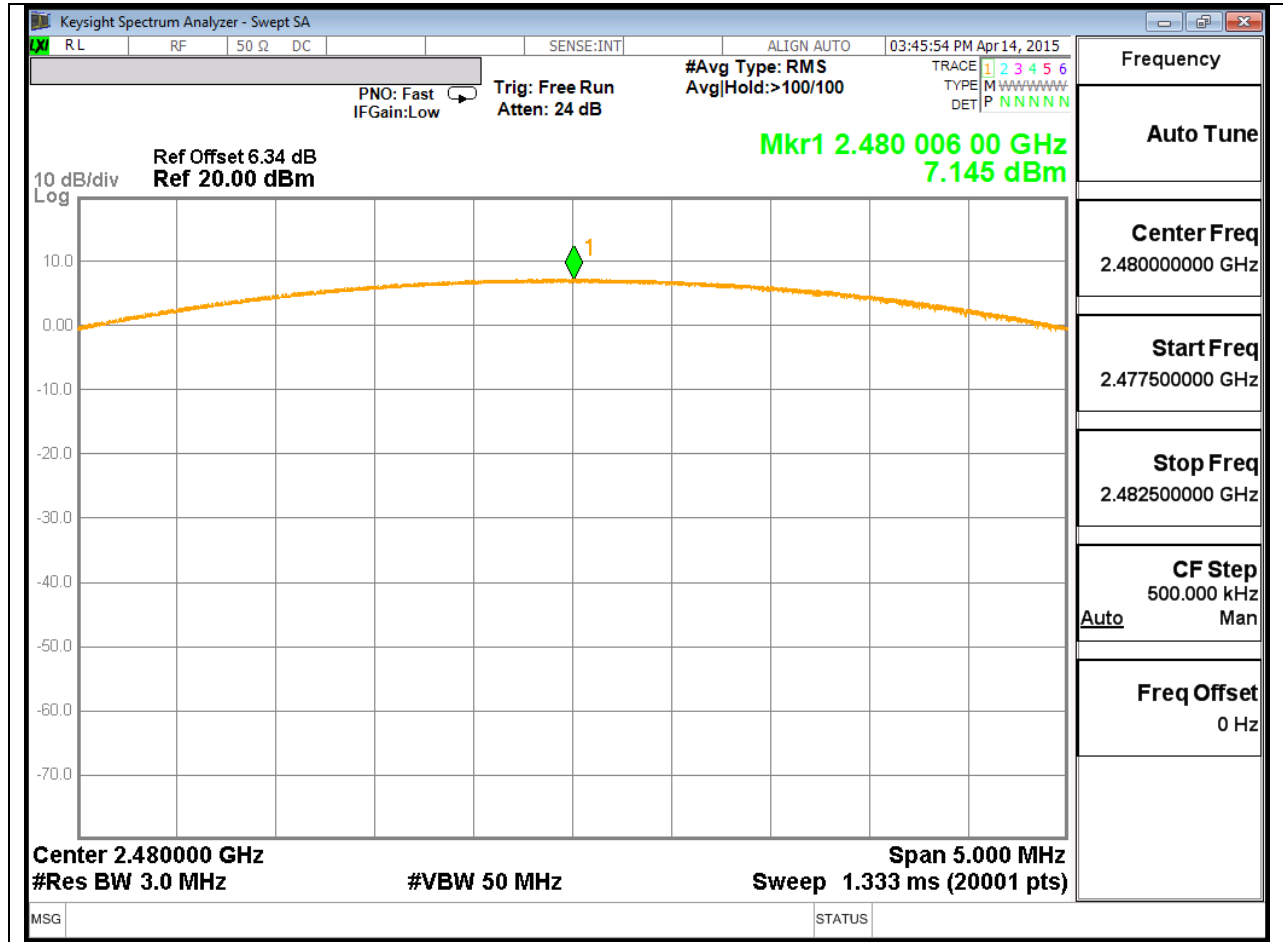
LOW CHANNEL



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.

RESULTS

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 0.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

8.6.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	9.09	8.12
Middle	2441	9.92	9.82
High	2480	9.03	8.00

8.6.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	5.44	3.50
Middle	2441	5.82	3.82
High	2480	4.61	2.89

8.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	5.18	3.29
Middle	2441	5.74	3.75
High	2480	4.56	2.86

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.

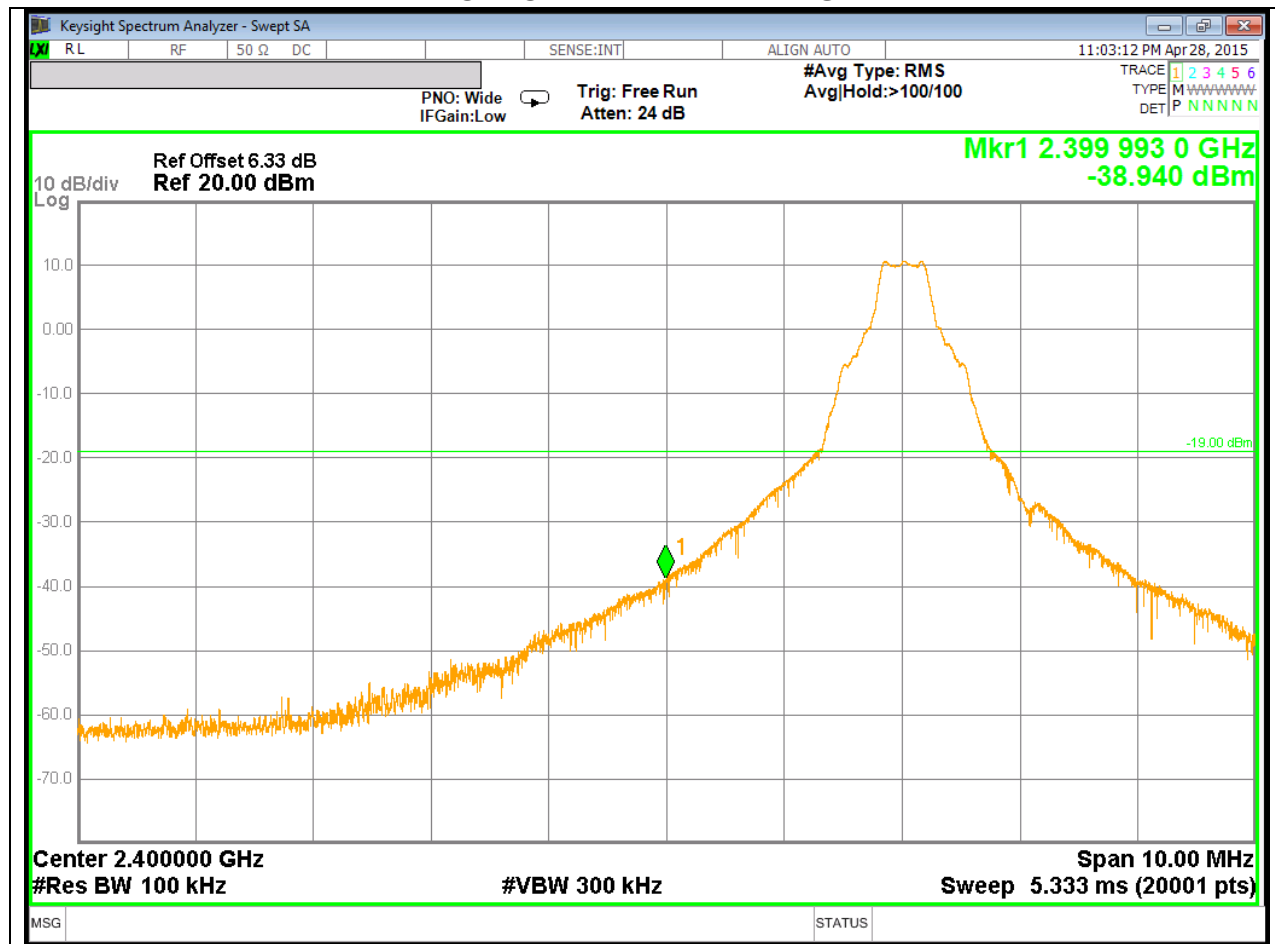
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

8.7.1. BASIC DATA RATE GFSK MODULATION

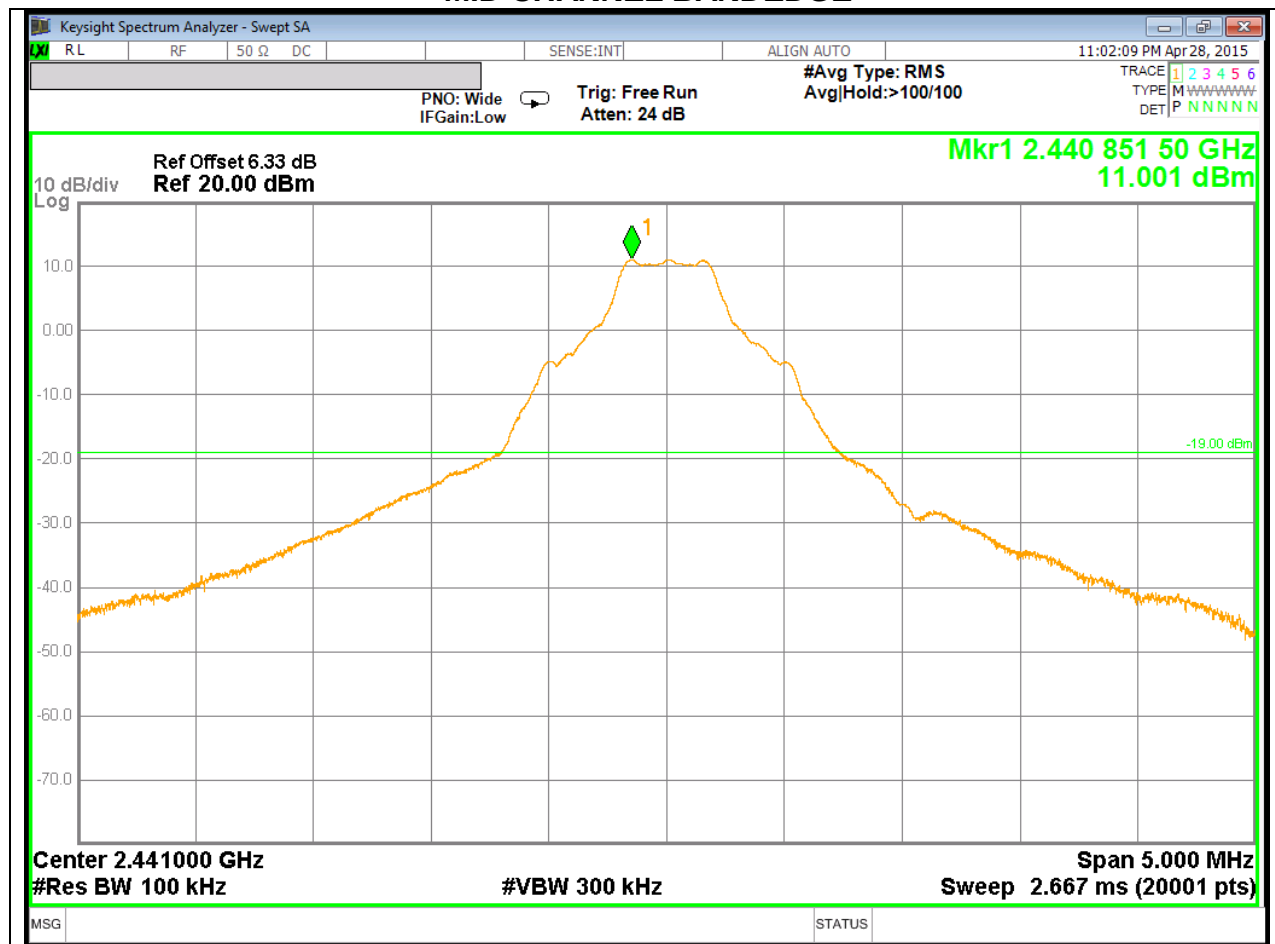
SPURIOUS EMISSIONS, LOW CHANNEL

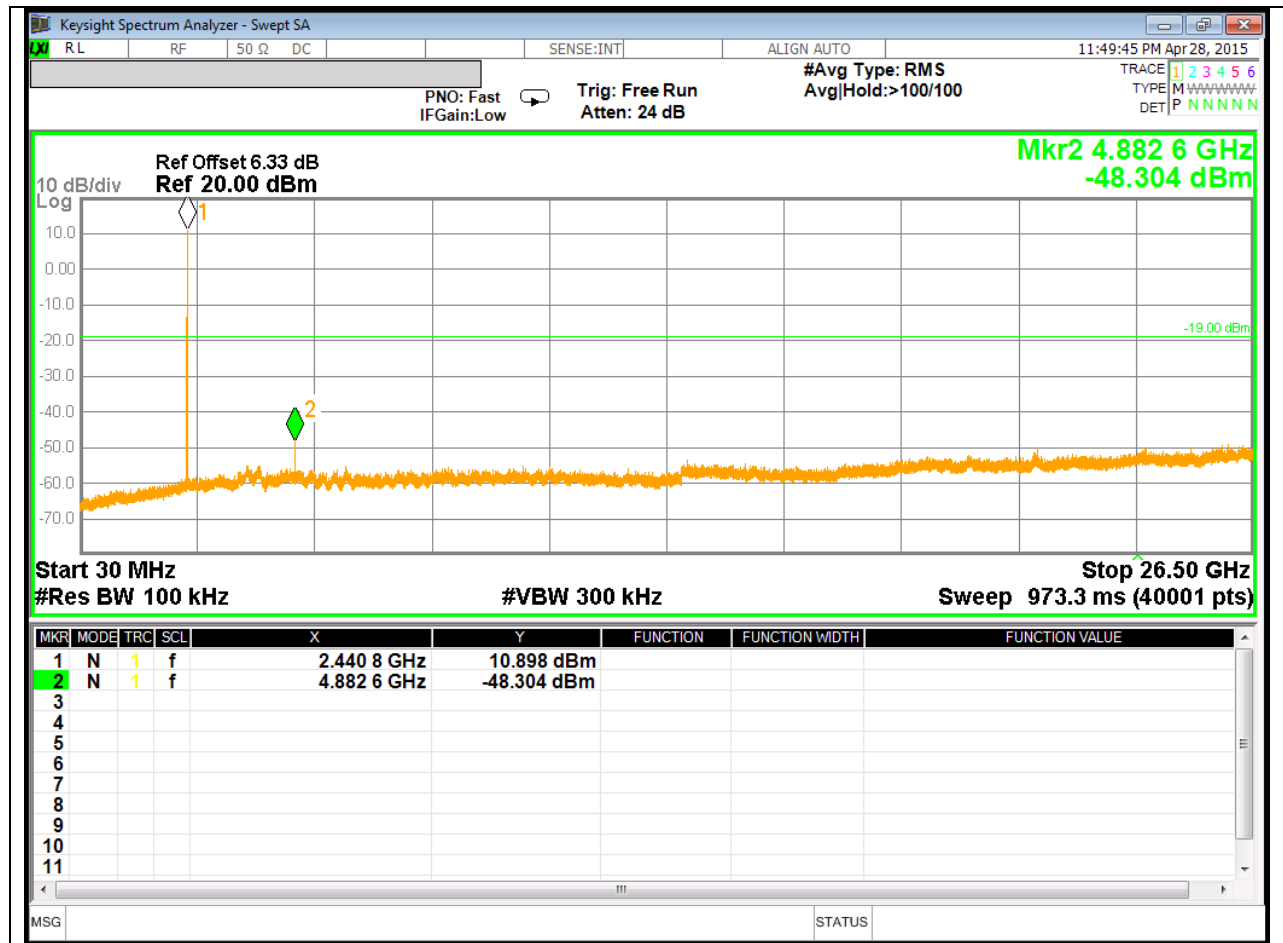
LOW CHANNEL BANDEDGE



SPURIOUS EMISSIONS, MID CHANNEL

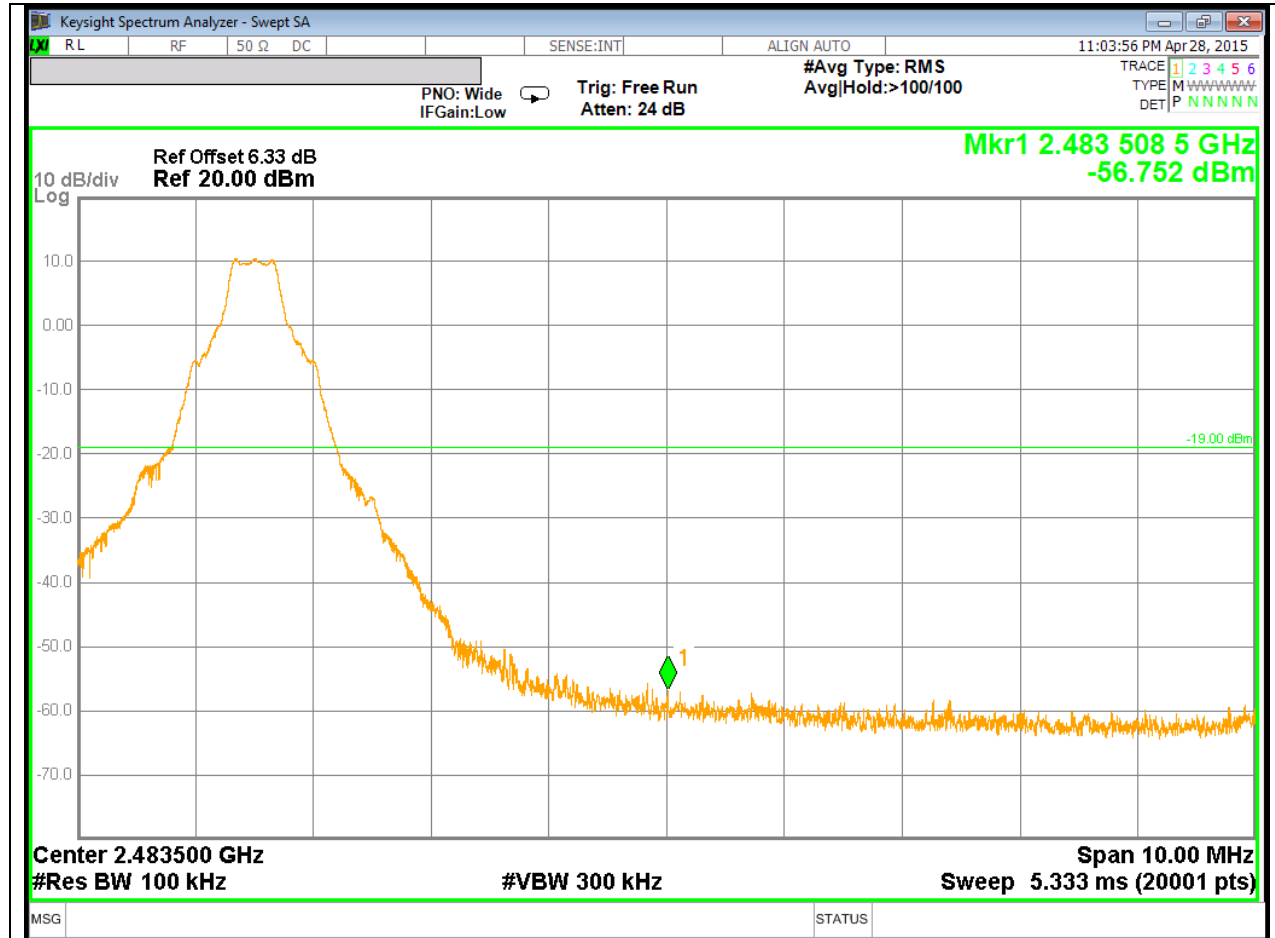
MID CHANNEL BANDEDGE

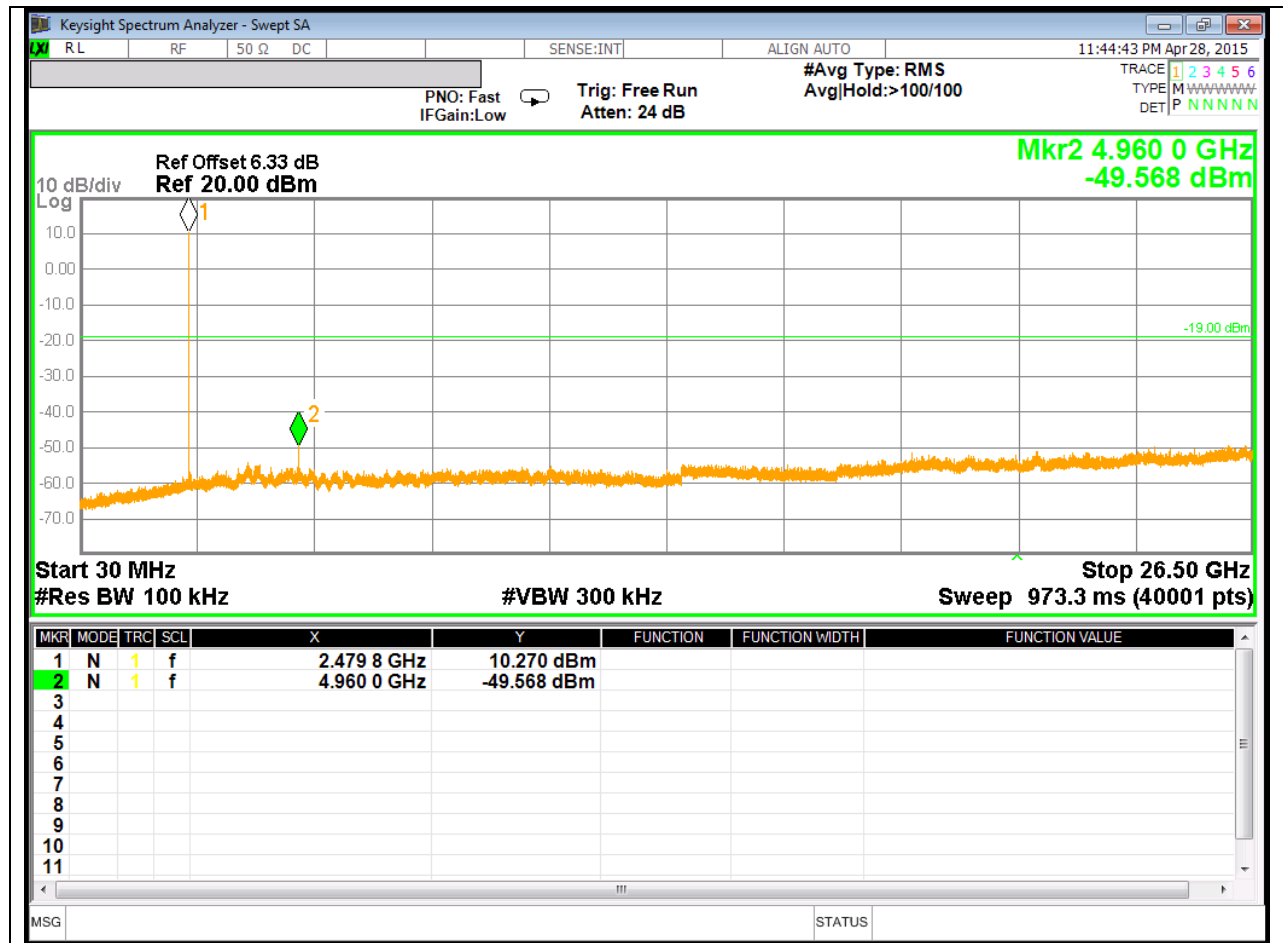




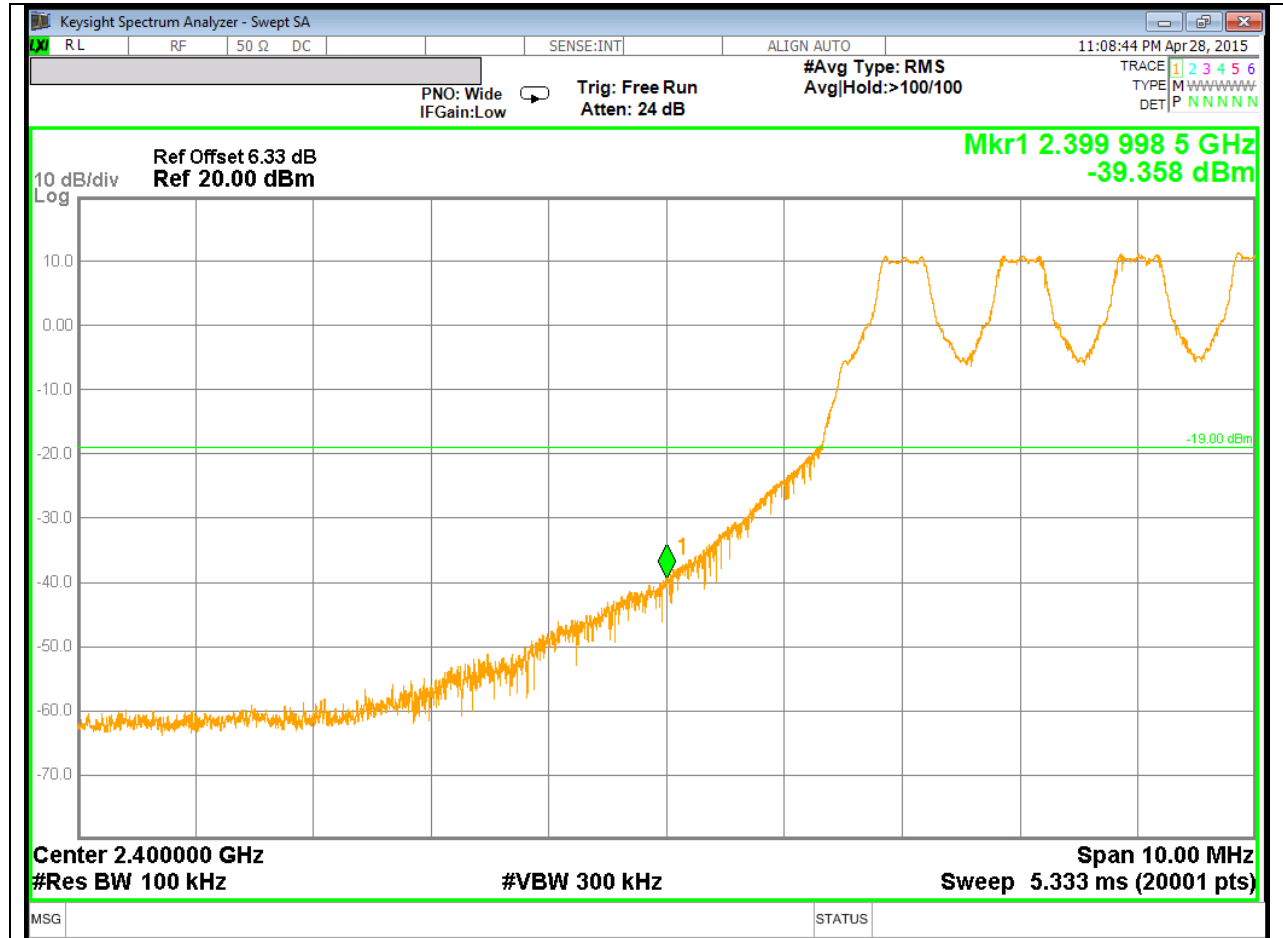
SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

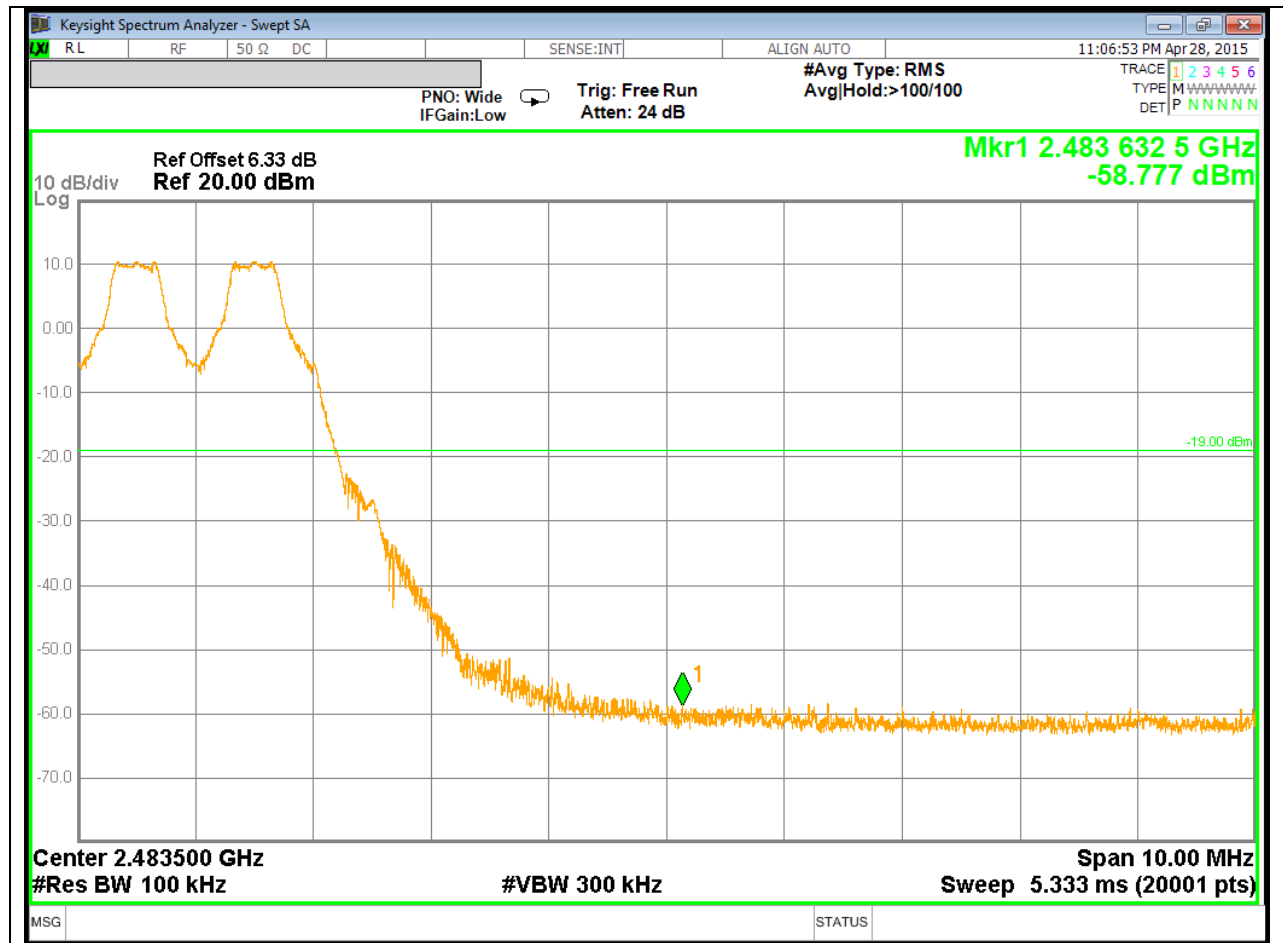




LOW BANDEDGE WITH HOPPING ON



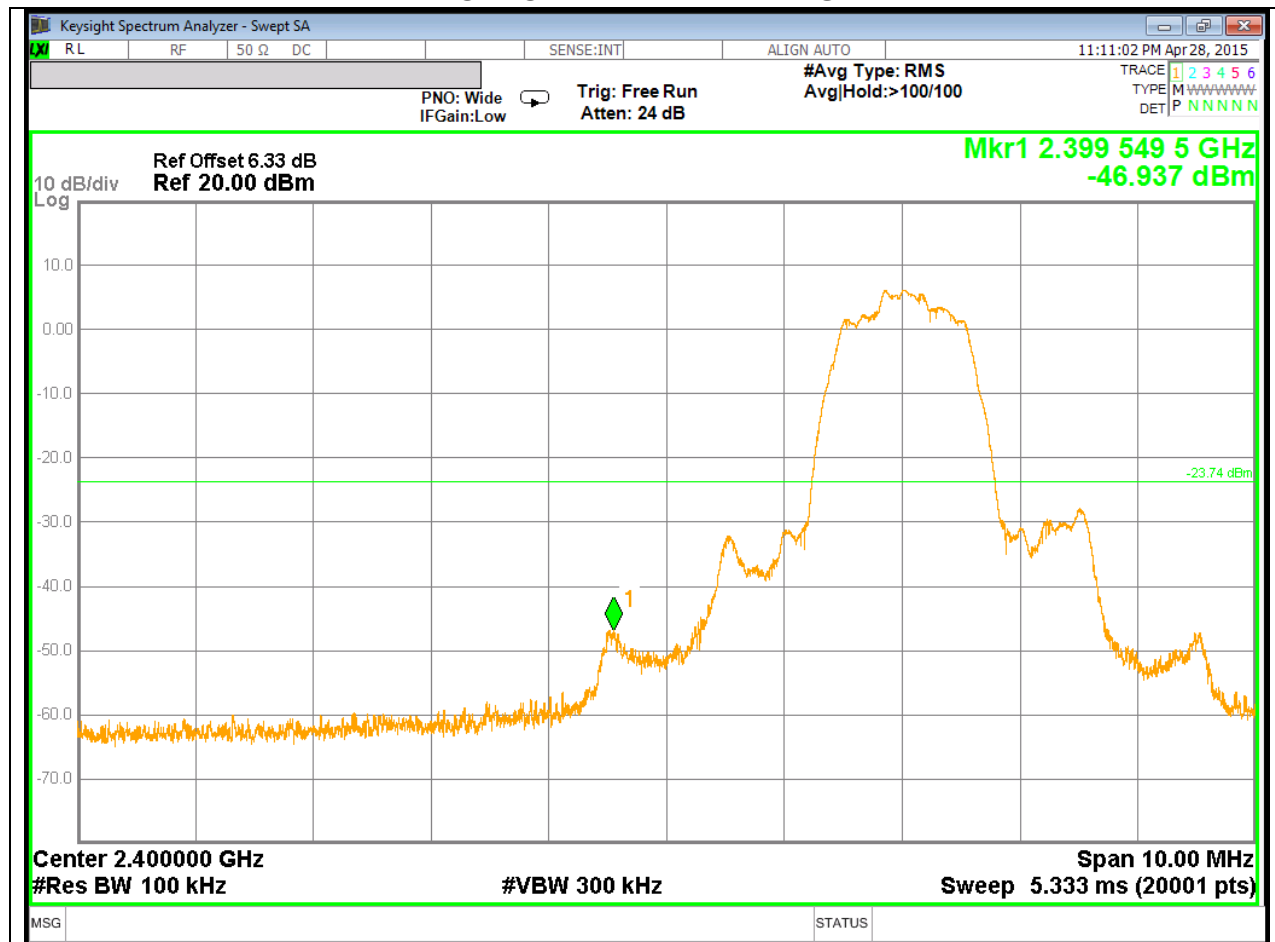
HIGH BANDEGE WITH HOPPING ON



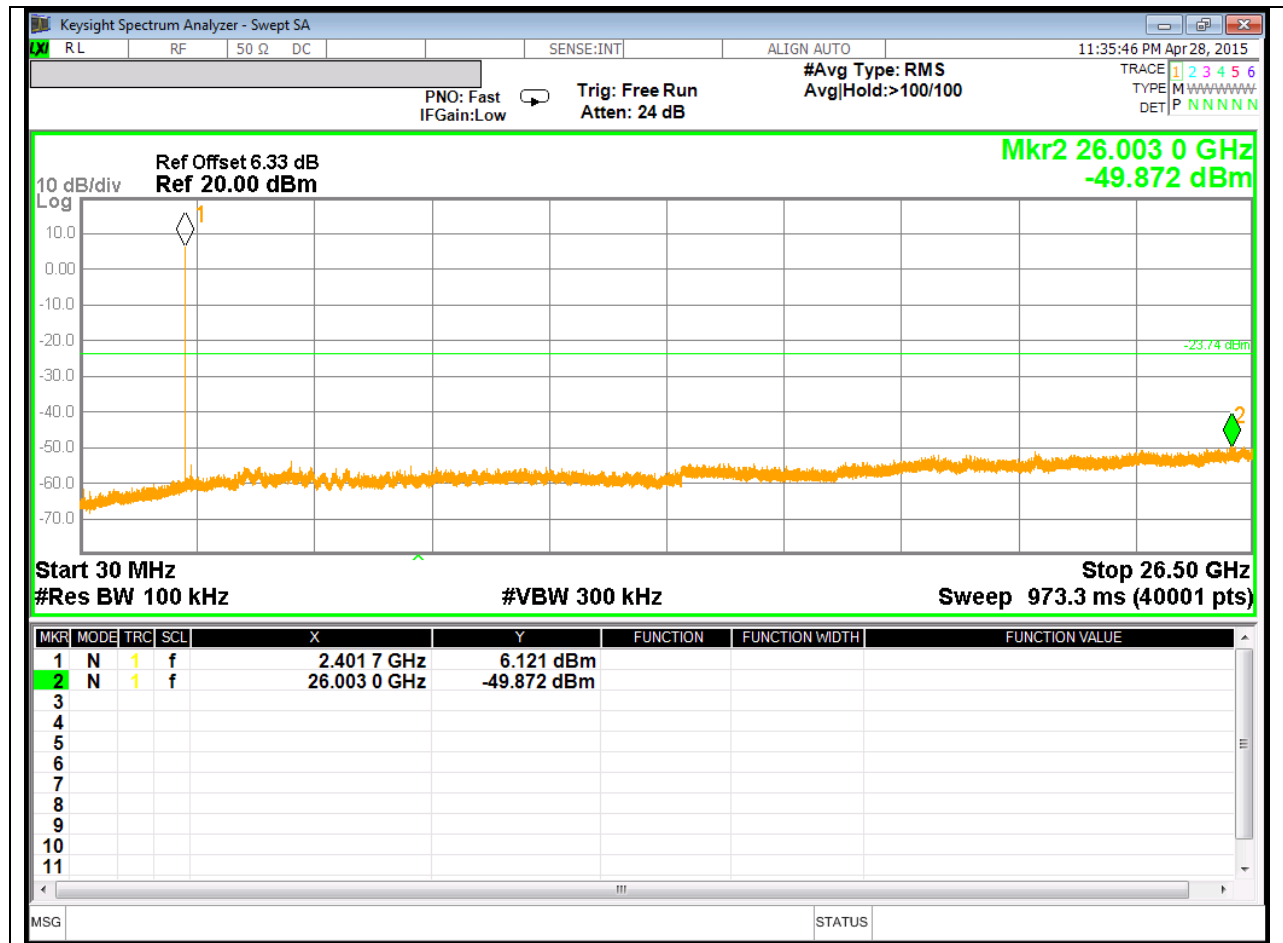
8.7.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

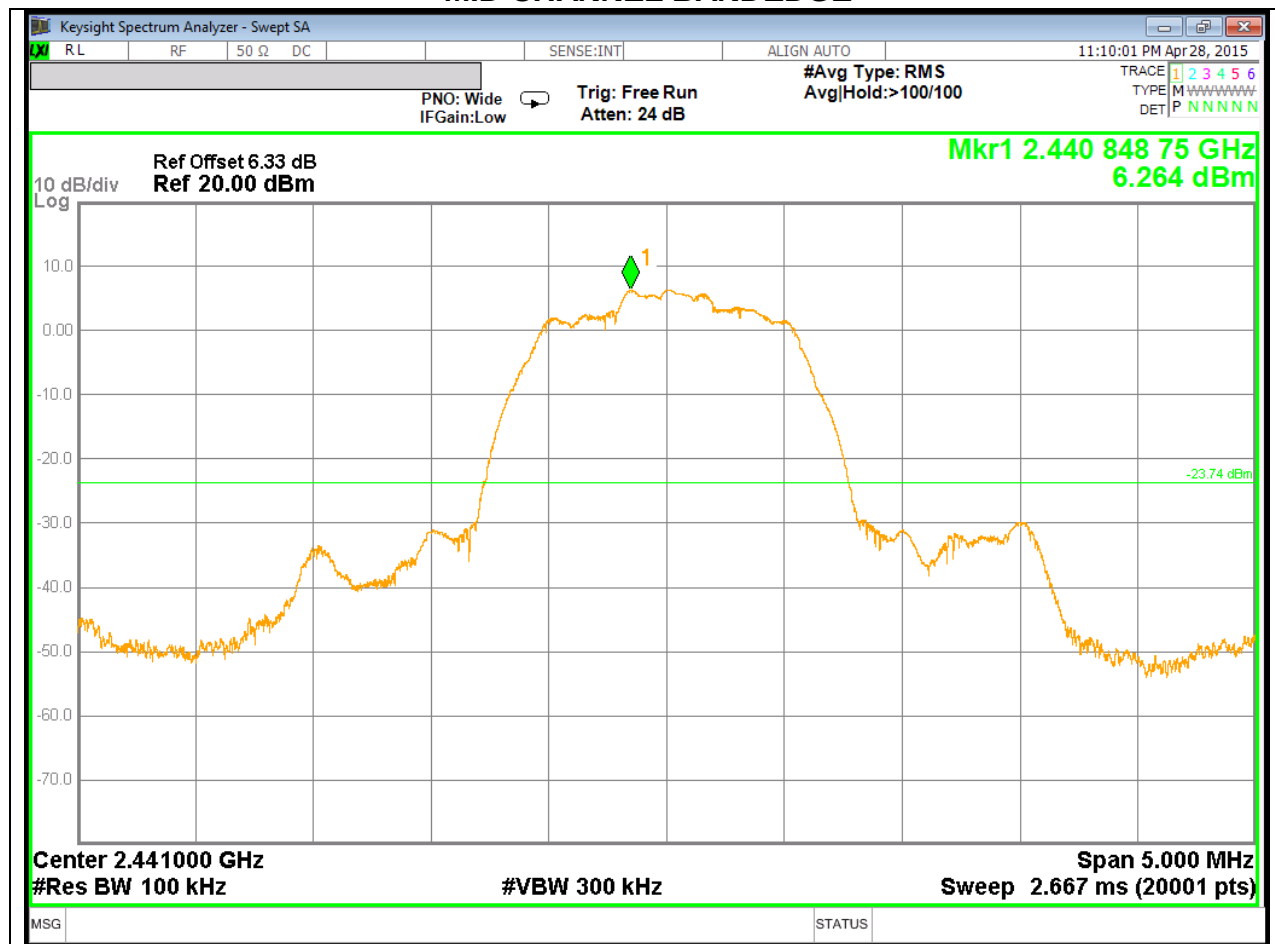


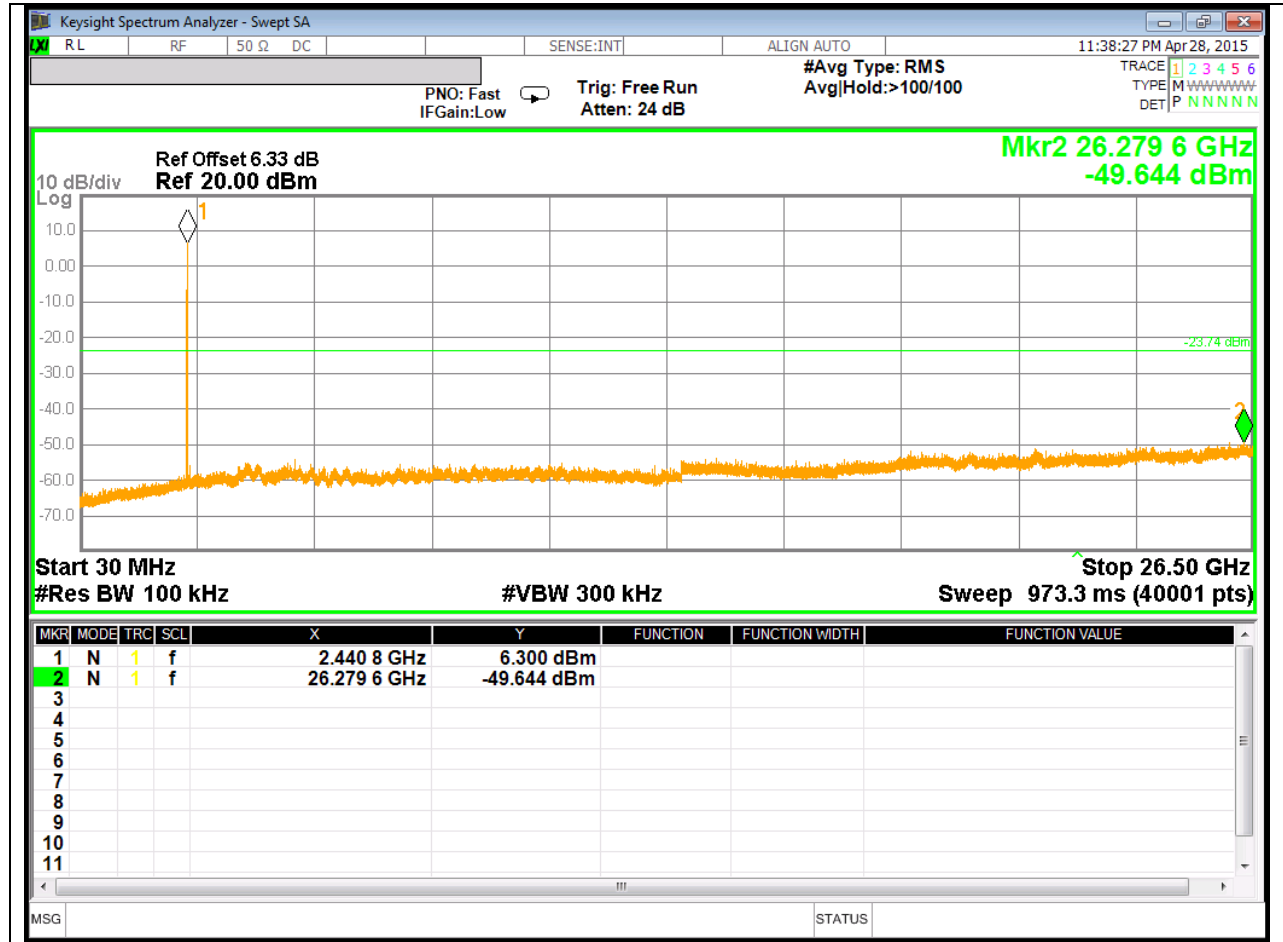
LOW CHANNEL SPURIOUS

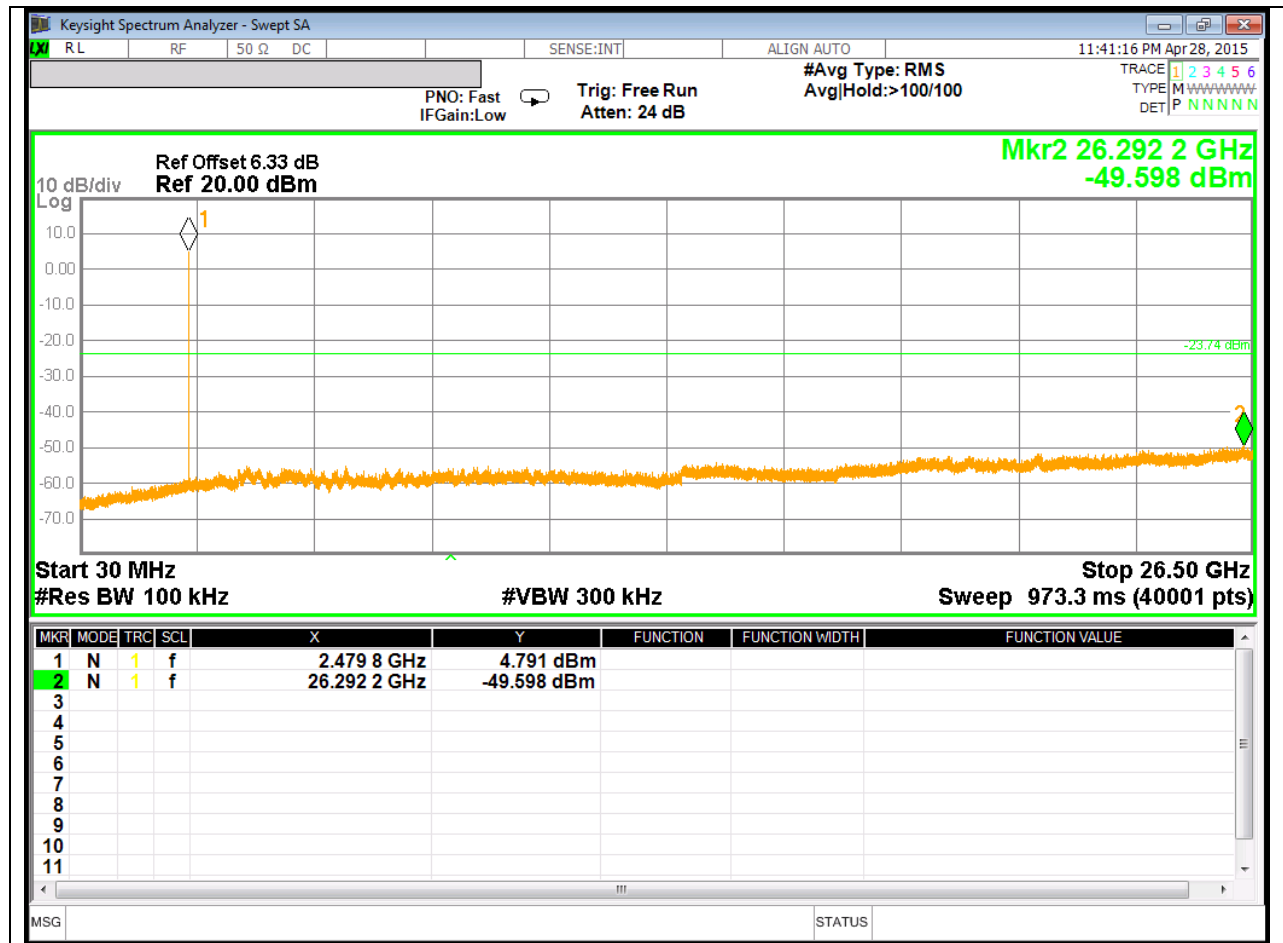


SPURIOUS EMISSIONS, MID CHANNEL

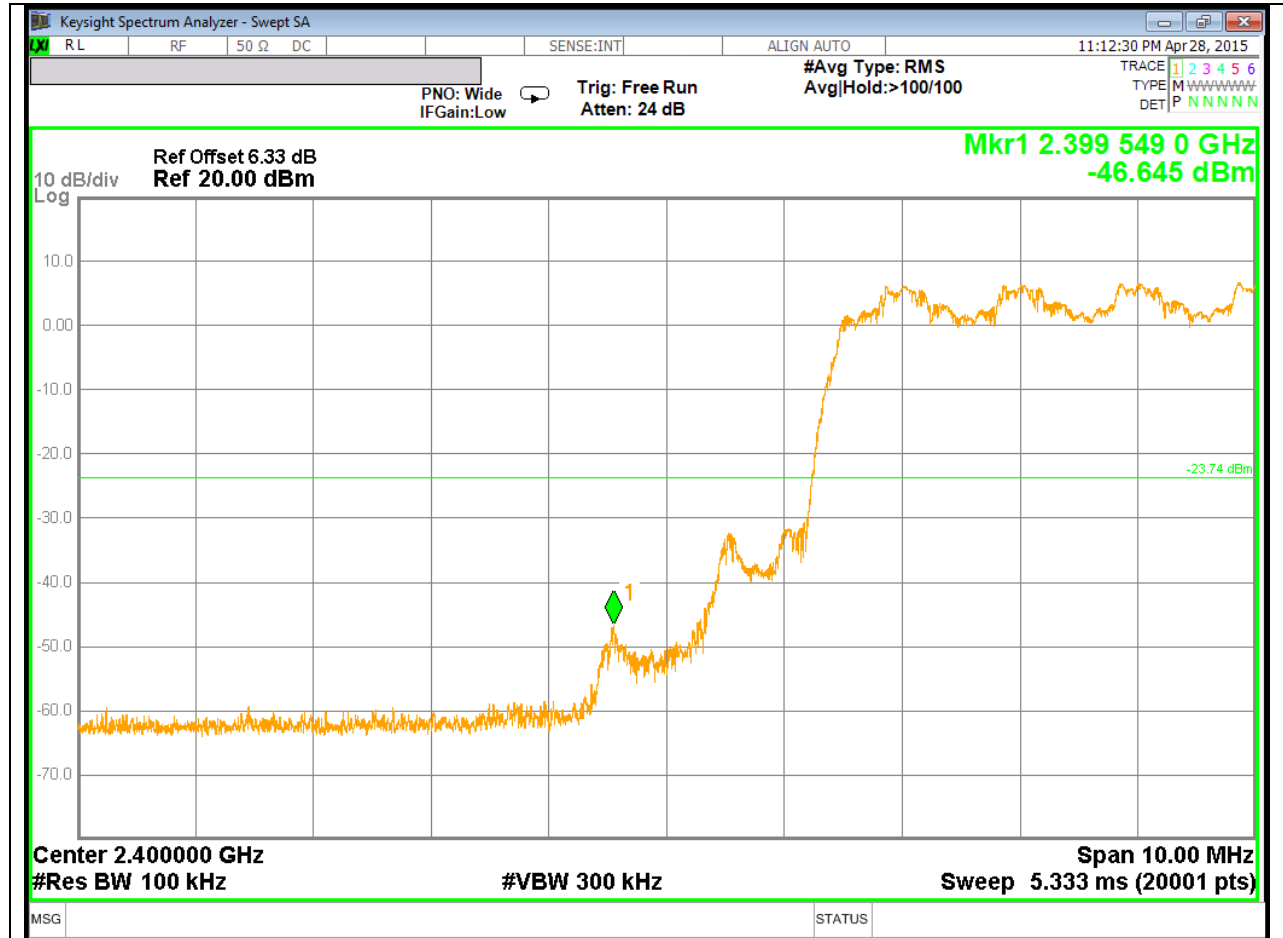
MID CHANNEL BANDEDGE



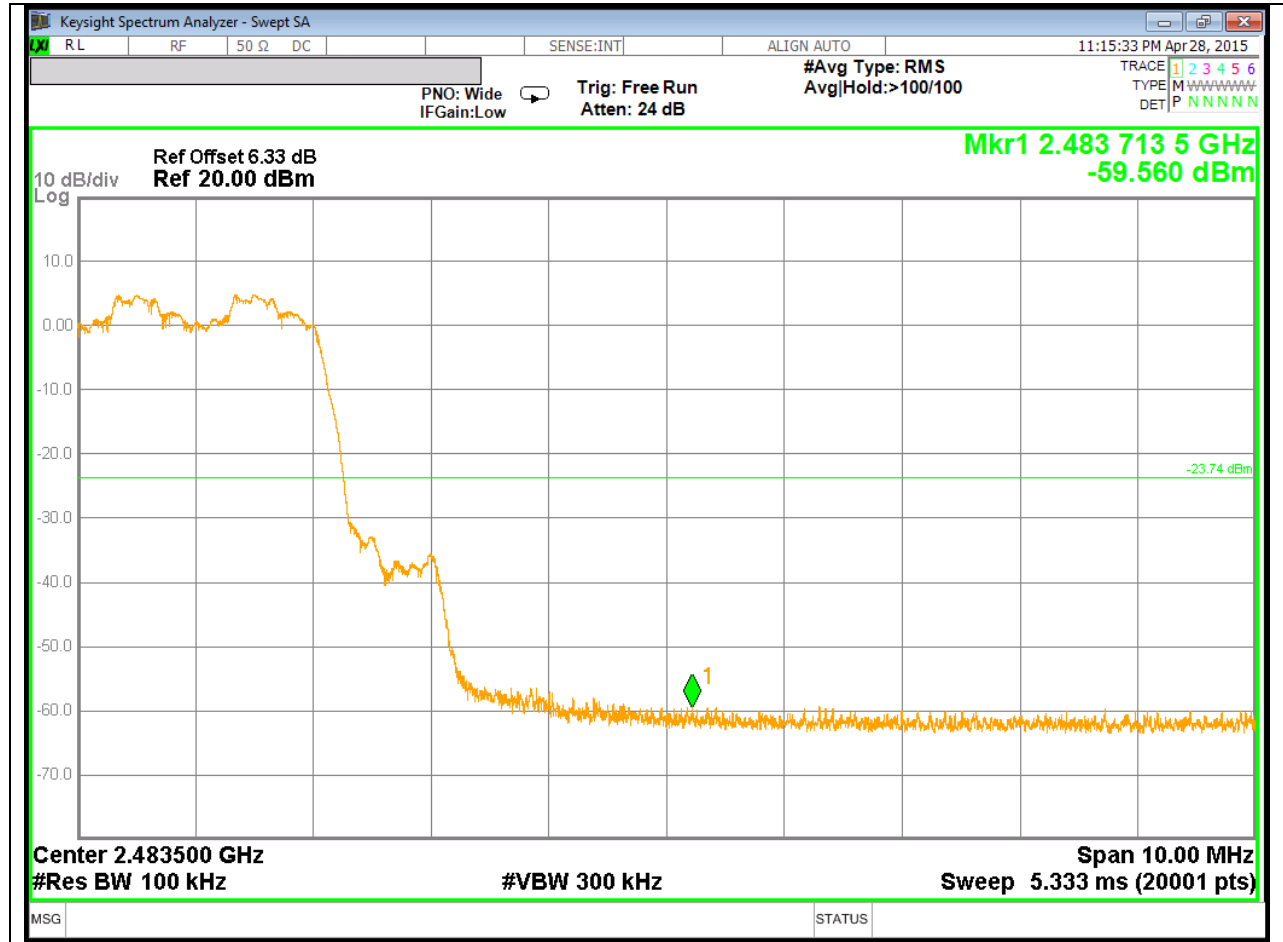




LOW BANDEDGE WITH HOPPING ON



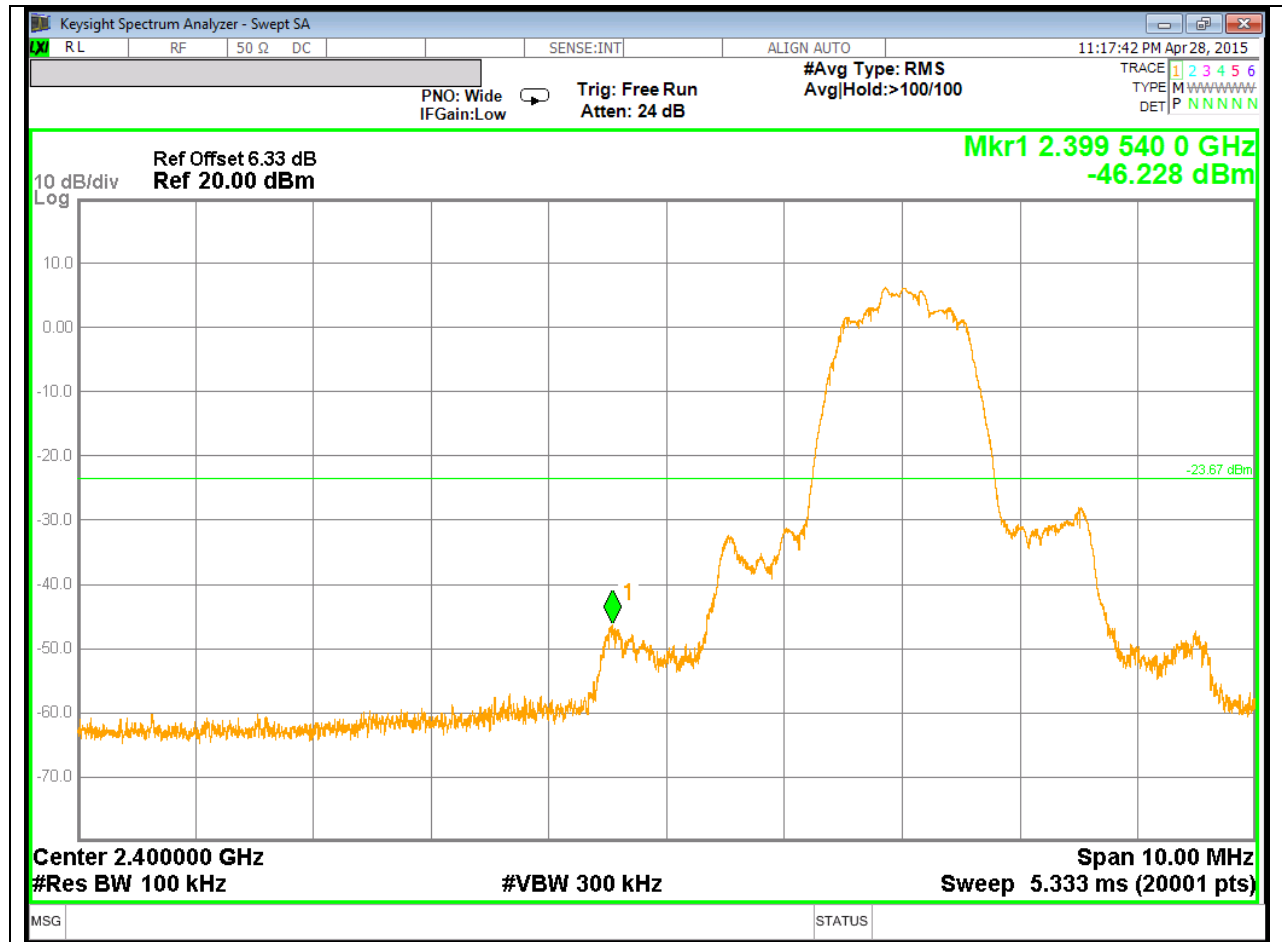
HIGH BANDEDGE WITH HOPPING ON



8.7.3. ENHANCED DATA RATE 8DPSK MODULATION

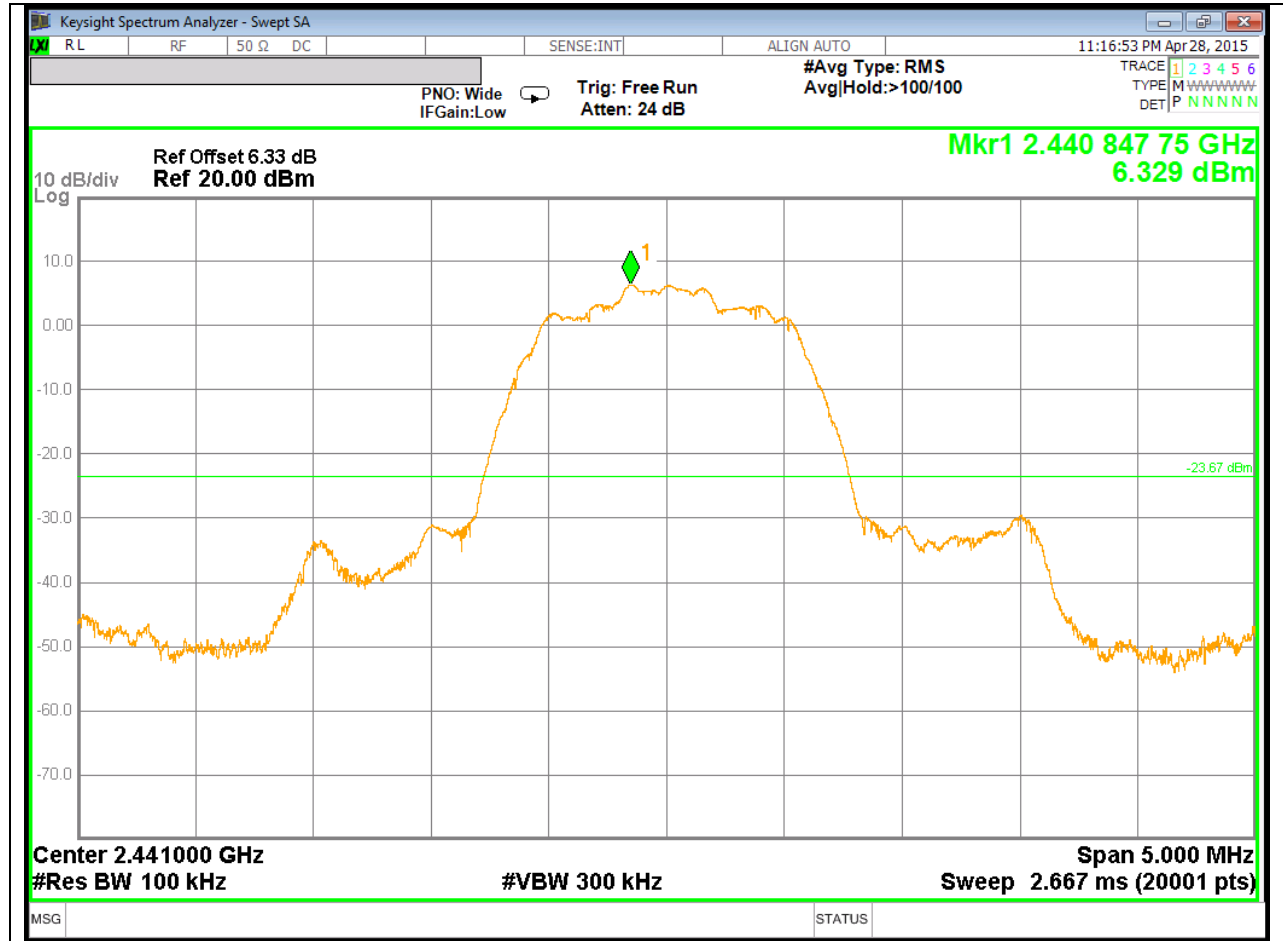
SPURIOUS EMISSIONS, LOW CHANNEL

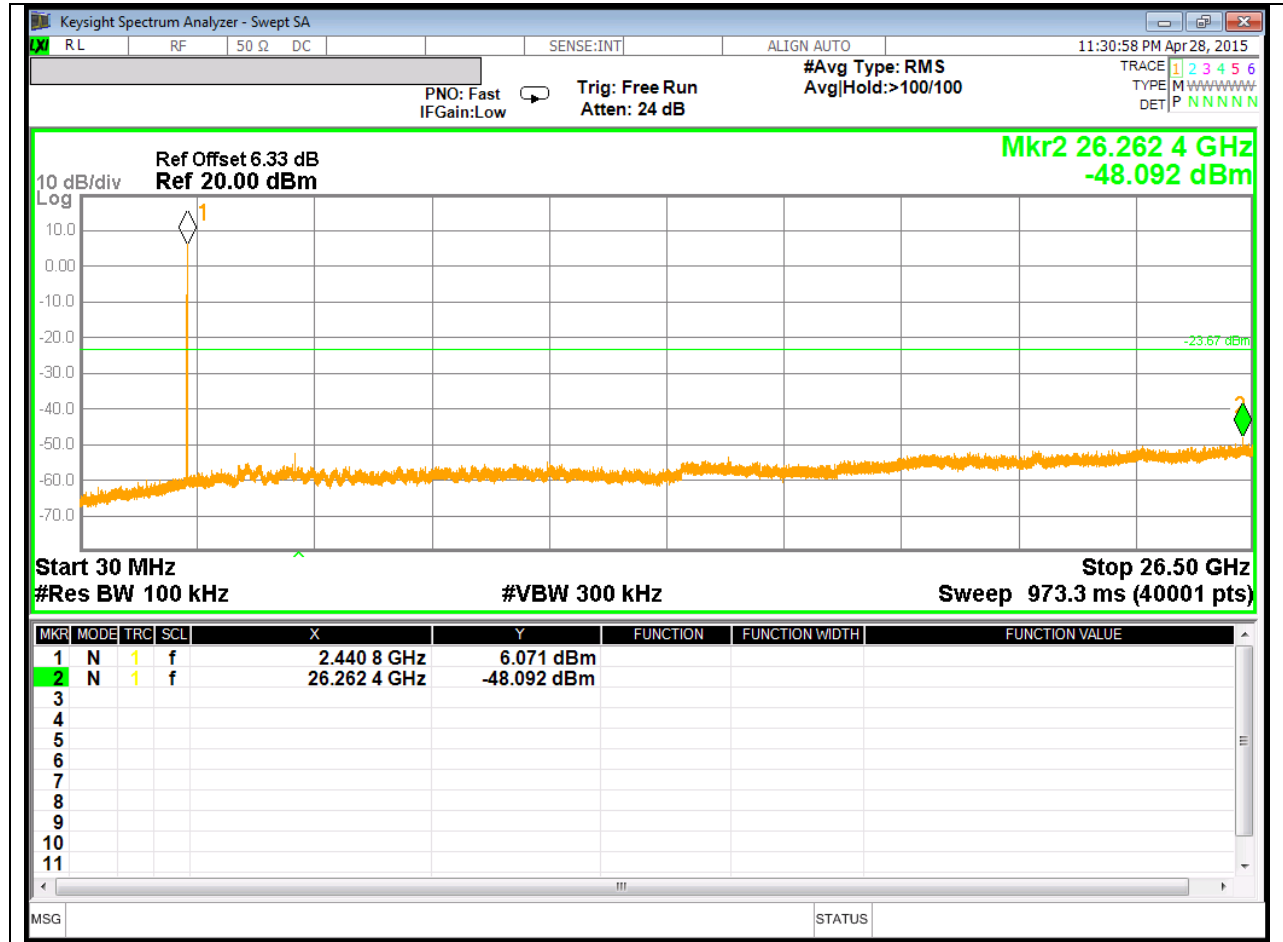
LOW CHANNEL BANDEDGE



SPURIOUS EMISSIONS, MID CHANNEL

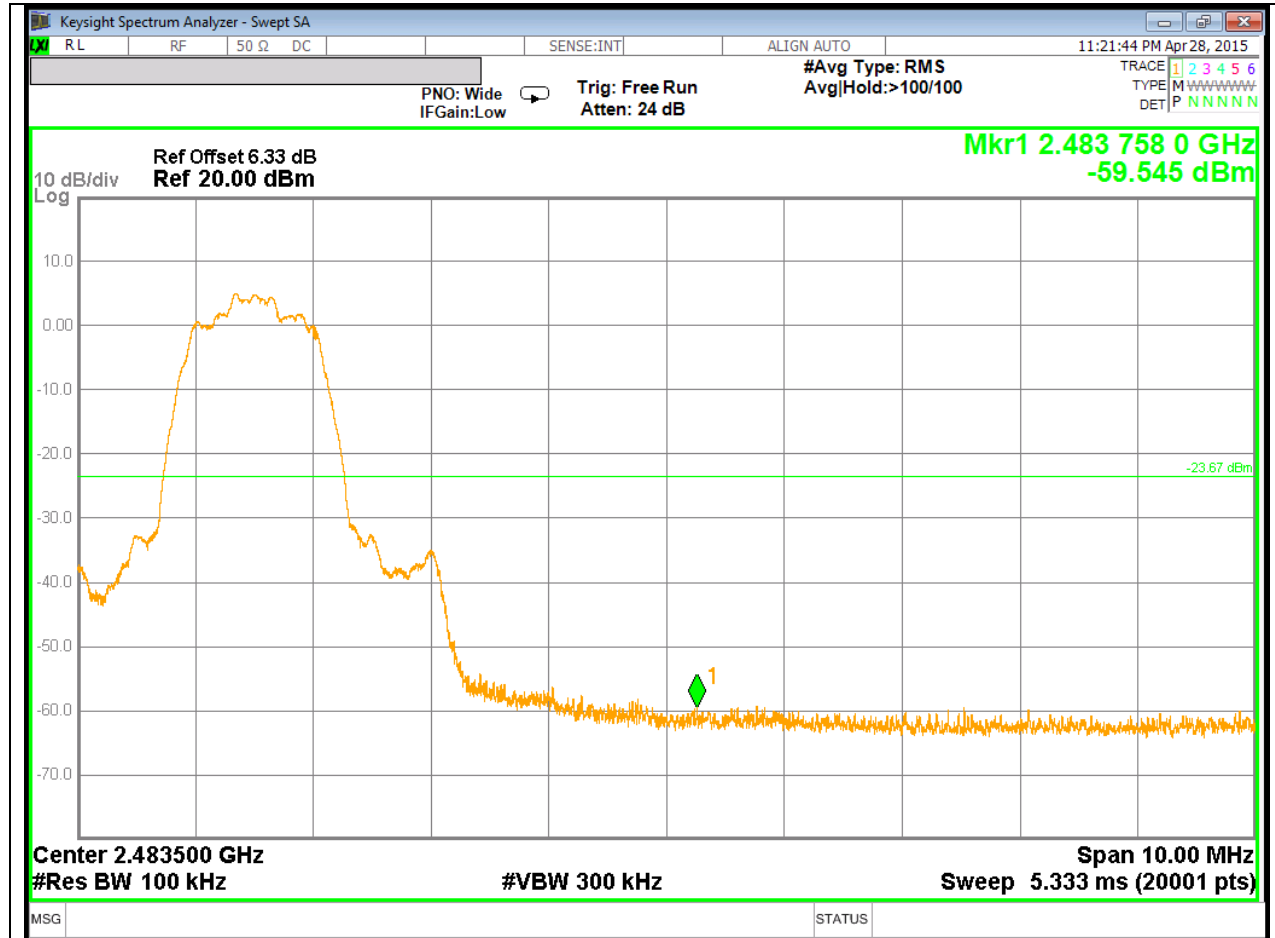
MID CHANNEL BANDEDGE

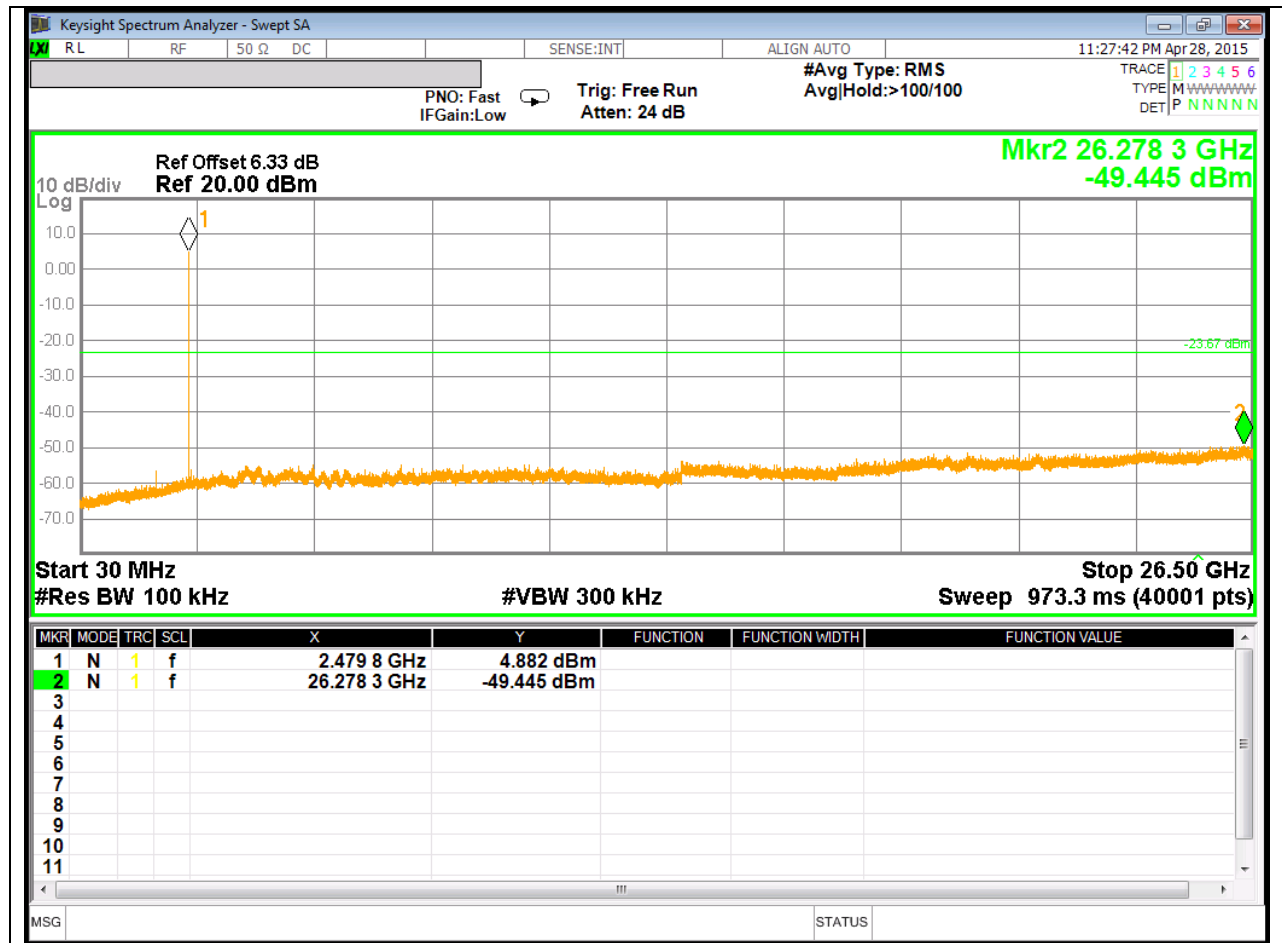




SPURIOUS EMISSIONS, HIGH CHANNEL

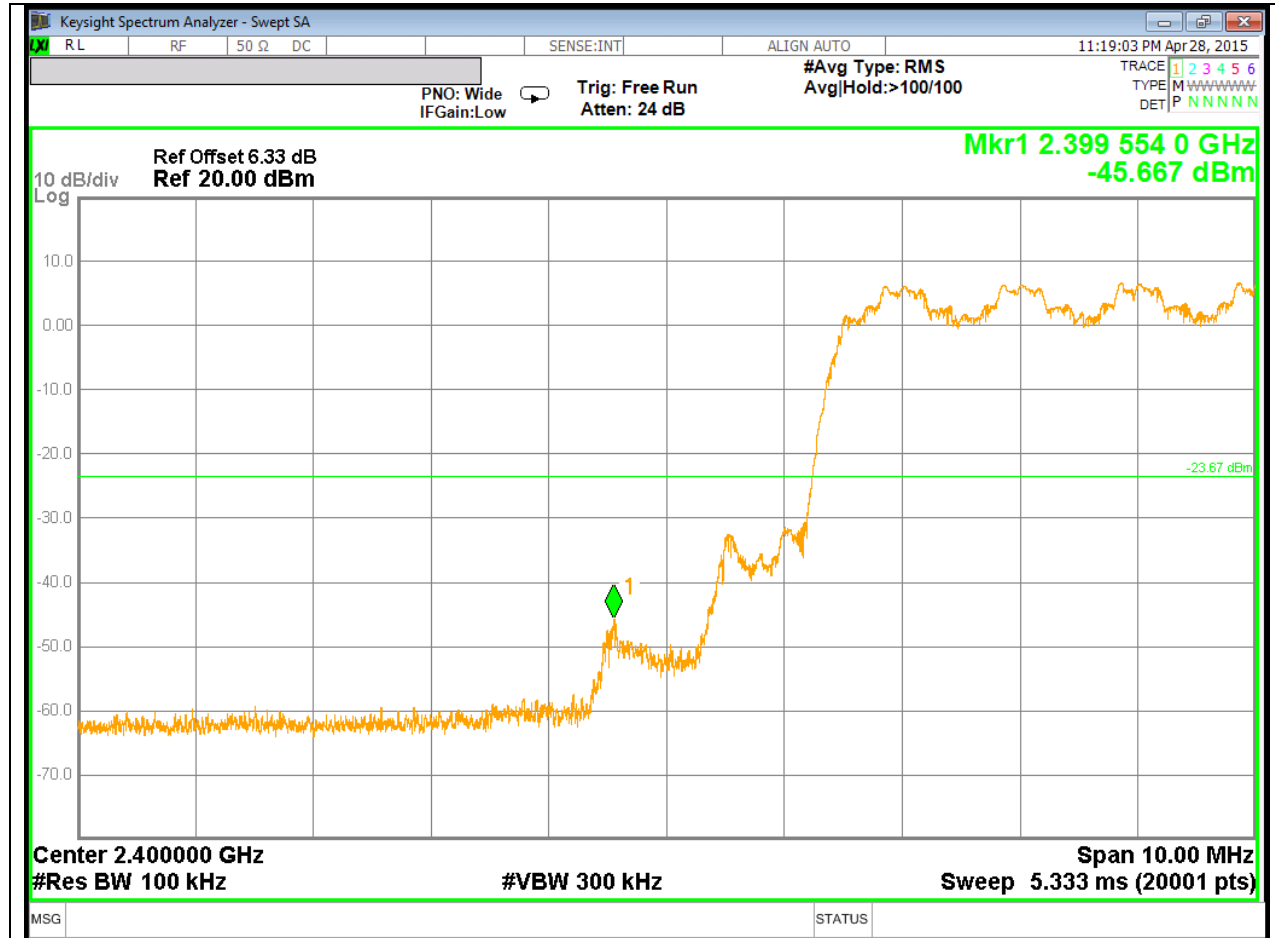
HIGH CHANNEL BANDEDGE



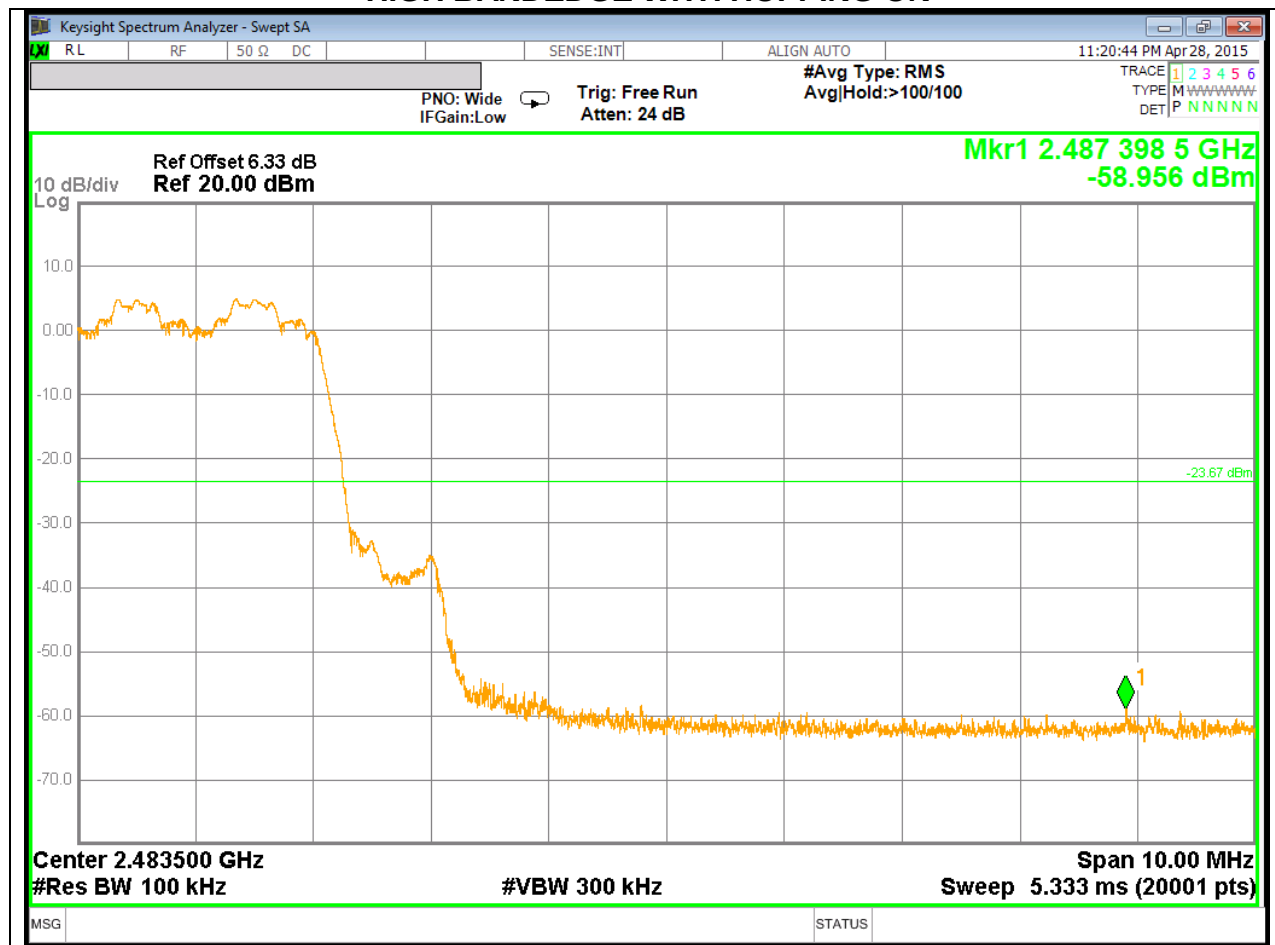


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE 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.

$$GFSK = 1/T = 1 / 0.0029S = 350Hz.$$

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.

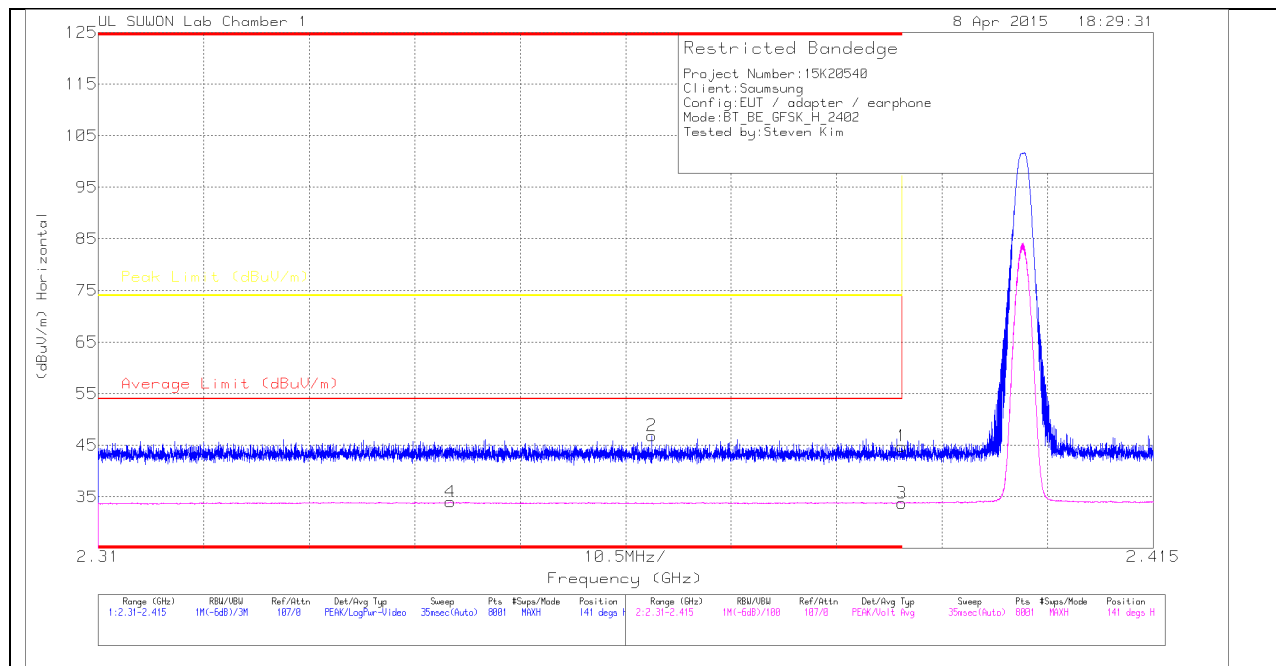
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

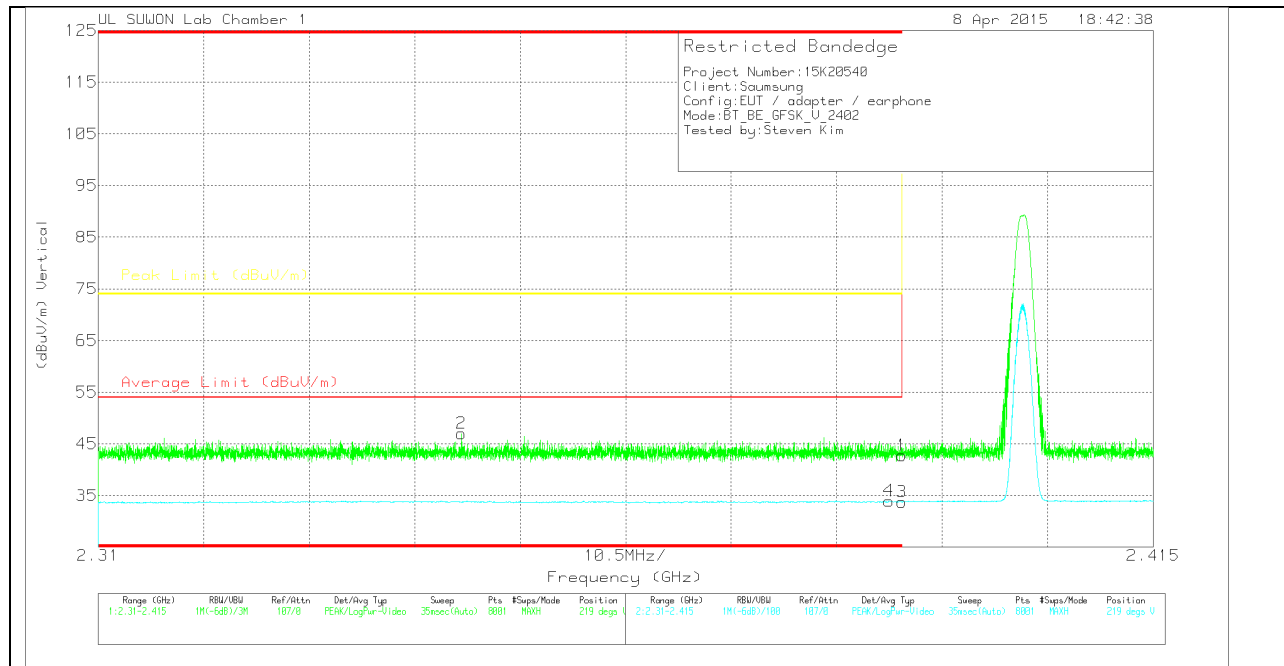
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 dB	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.72	Pk	27.9	-22.8	44.82	-	-	74	-29.18	141	143	H
2	* 2.365	41.86	Pk	27.8	-22.8	46.86	-	-	74	-27.14	141	143	H
3	* 2.39	28.67	VB1T	27.9	-22.8	33.77	54	-20.23	-	-	141	143	H
4	* 2.345	29.12	VB1T	27.8	-22.9	34.02	54	-19.98	-	-	141	143	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 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	37.68	Pk	27.9	-22.8	42.78	-	-	74	-31.22	219	173	V
2	* 2.346	42.12	Pk	27.8	-22.9	47.02	-	-	74	-26.98	219	173	V
3	* 2.39	28.67	VB1T	27.9	-22.8	33.77	54	-20.23	-	-	219	173	V
4	* 2.389	28.87	VB1T	27.9	-22.8	33.97	54	-20.03	-	-	219	173	V

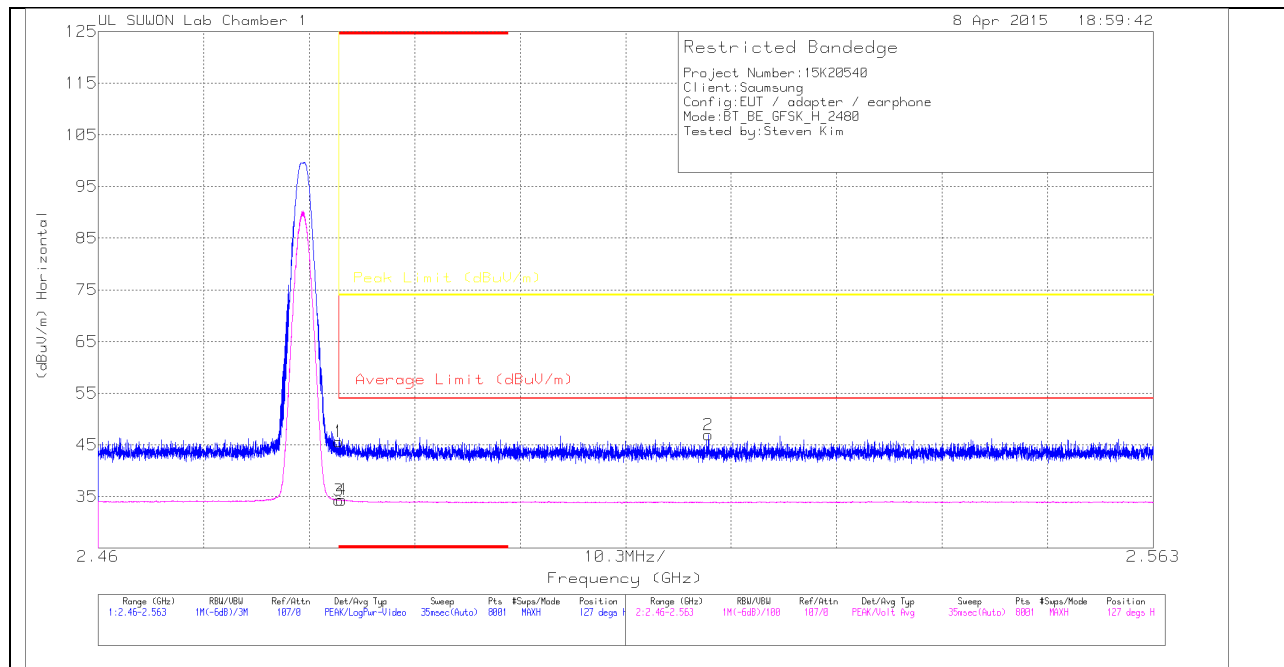
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

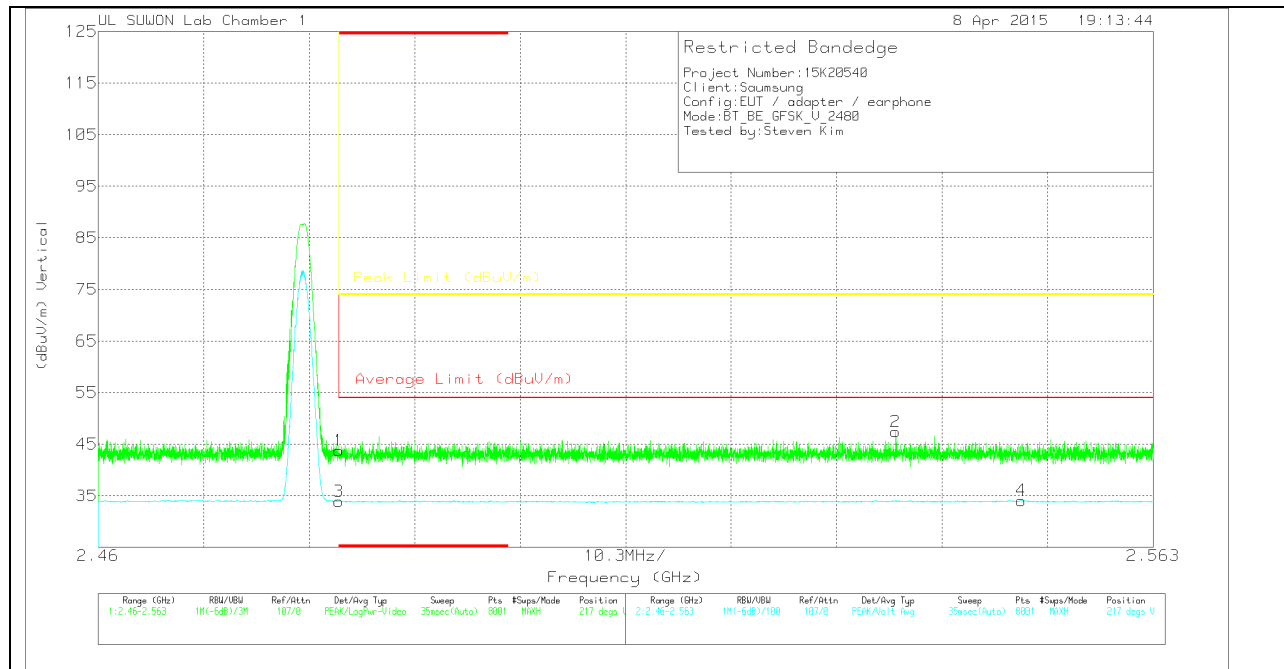
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 dB	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.33	Pk	27.9	-22.6	45.63	-	-	74	-28.37	127	175	H
2	2.52	41.66	Pk	27.9	-22.6	46.96	-	-	74	-27.04	127	175	H
3	* 2.484	28.98	VB1T	27.9	-22.6	34.28	54	-19.72	-	-	127	175	H
4	* 2.484	29.07	VB1T	27.9	-22.6	34.37	54	-19.63	-	-	127	175	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 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	38.48	Pk	27.9	-22.6	43.78	-	-	74	-30.22	217	162	V
2	2.538	42.14	Pk	27.9	-22.6	47.44	-	-	74	-26.56	217	162	V
3	* 2.484	28.64	VB1T	27.9	-22.6	33.94	54	-20.06	-	-	217	162	V
4	2.55	28.78	VB1T	27.9	-22.6	34.08	54	-19.92	-	-	217	162	V

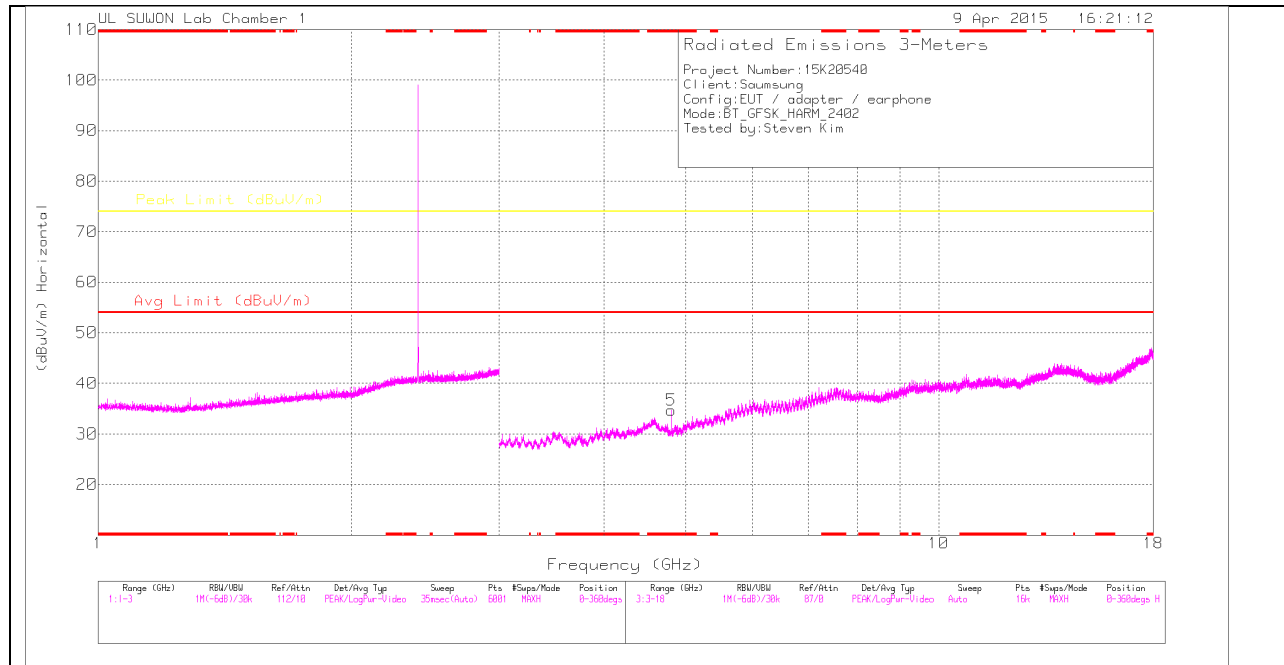
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

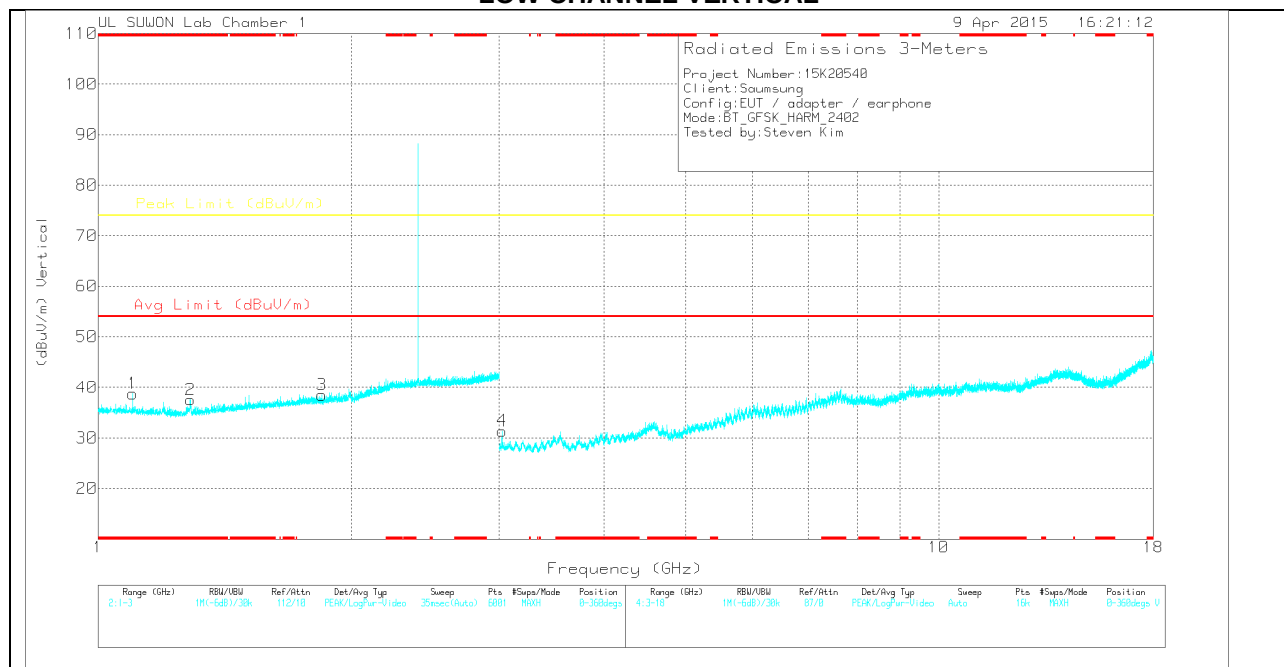
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



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

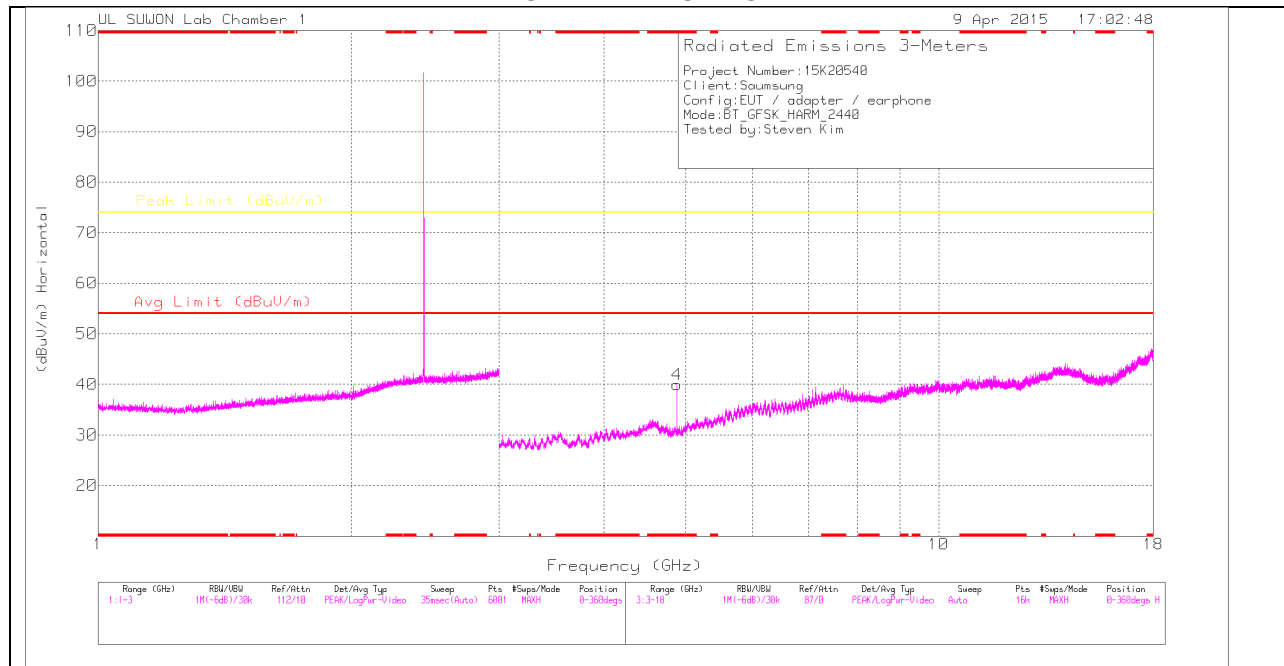
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 dB	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.1	39.56	PK	24.3	-25.1	38.76	-	-	74	-35.24	0-360	200	V
2	* 1.289	38.45	PK	23.8	-24.7	37.55	-	-	74	-36.45	0-360	100	V
3	1.846	36.8	PK	25.3	-23.6	38.5	-	-	-	-	0-360	200	V
5	* 4.804	32.56	PK	31.9	-29.8	34.66	-	-	74	-39.34	0-360	100	H
4	3.023	33.68	PK	28.8	-31.1	31.38	-	-	-	-	0-360	200	V

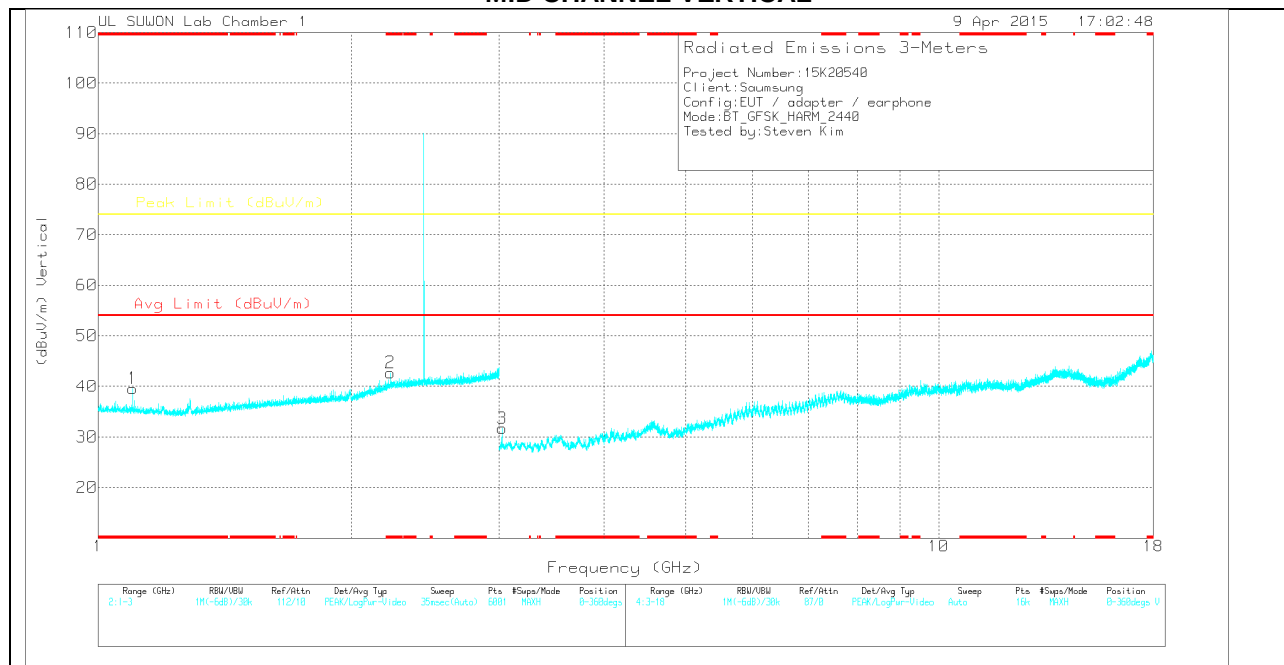
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

MID CHANNEL HORIZONTAL



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	3115D Factor	Path_2_10 dB	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.1	40.38	PK	24.3	-25.1	39.58	-	-	74	-34.42	0-360	200	V
2	* 2.228	38.11	PK	27.6	-23	42.71	-	-	74	-31.29	0-360	200	V
4	* 4.88	37.03	PK	32	-29.1	39.93	-	-	74	-34.07	0-360	100	H
3	3.023	34.02	PK	28.8	-31.1	31.72	-	-	-	-	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

Radiated Emissions

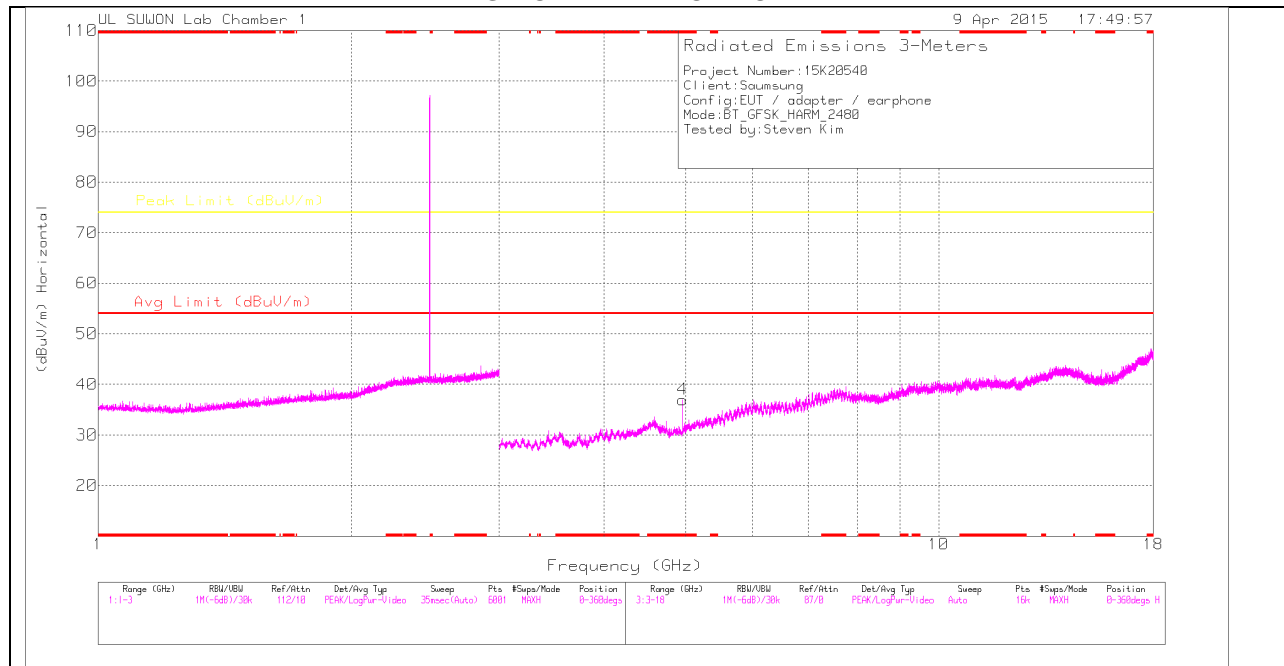
Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_3_3G HP	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.88	42.9	PK3	32	-29.1	45.8	-	-	74	-28.2	120	100	H
* 4.88	29.38	VB1T	32	-29.1	32.28	54	-21.72	-	-	120	100	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

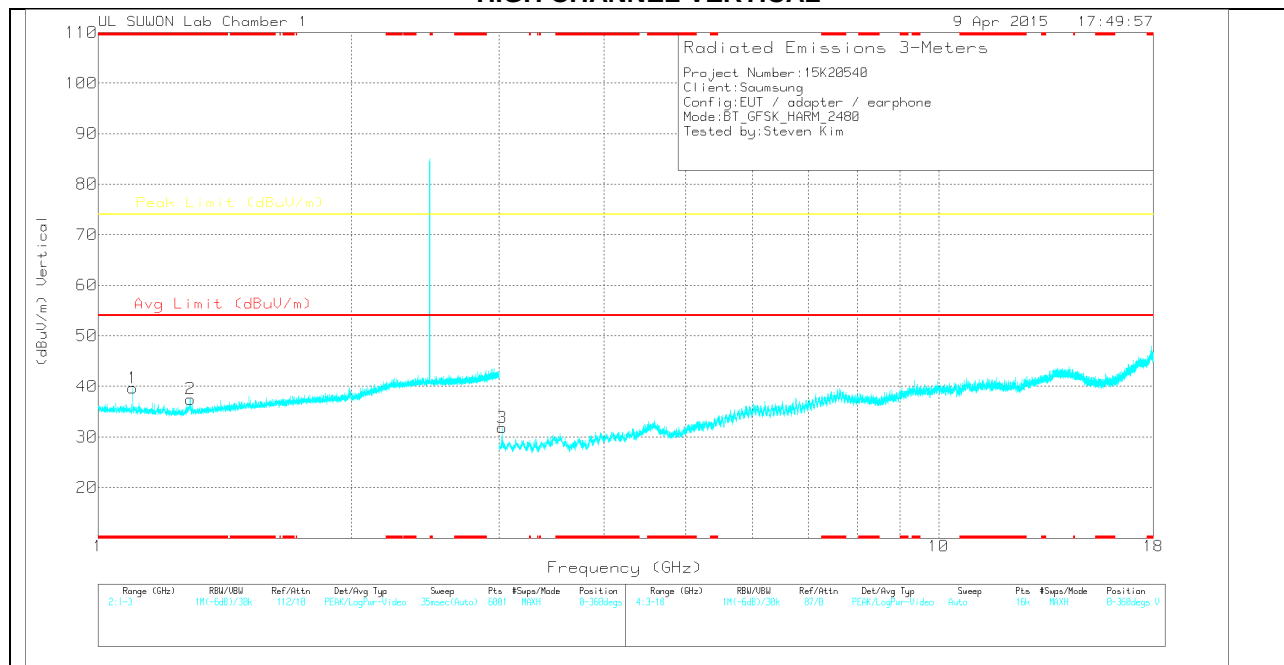
PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HIGH CHANNEL HORIZONTAL



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	3115D Factor	Path_2_10 dB	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.1	40.48	PK	24.3	-25.1	39.68	-	-	74	-34.32	0-360	200	V
2	* 1.288	38.39	PK	23.8	-24.7	37.49	-	-	74	-36.51	0-360	100	V
4	* 4.96	33.79	PK	32.1	-28.9	36.99	-	-	74	-37.01	0-360	100	H
3	3.023	34.1	PK	28.8	-31.1	31.8	-	-	-	-	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

Radiated Emissions

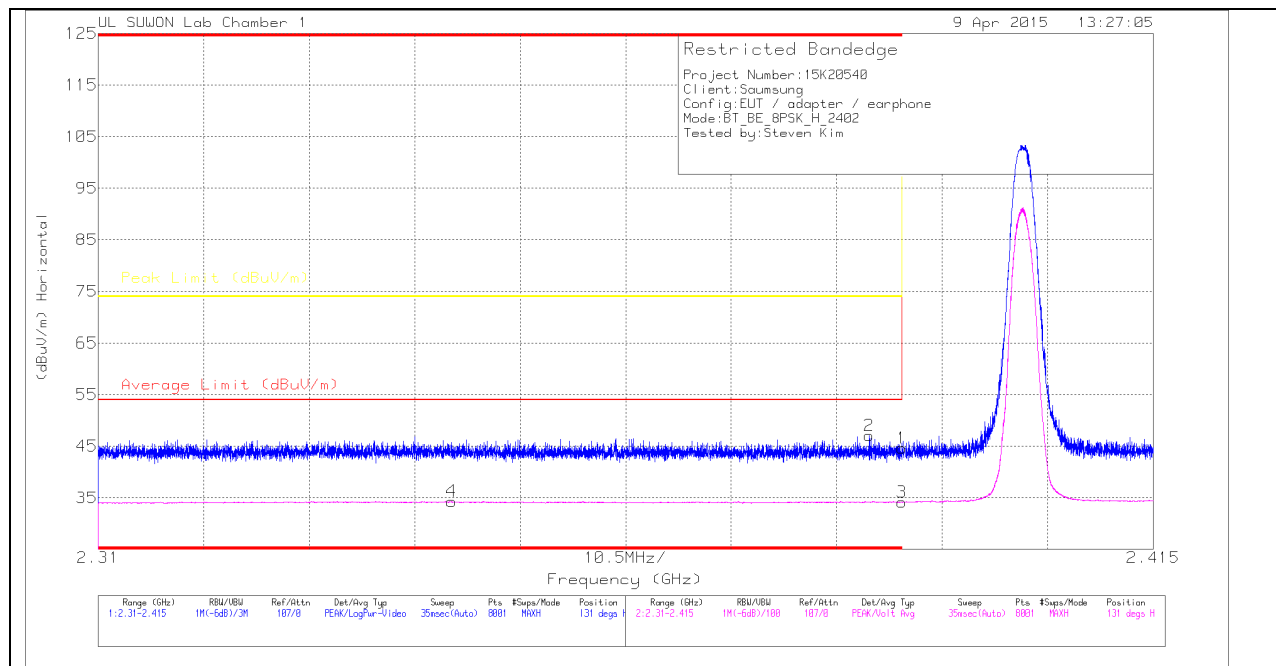
Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_3_3G HP	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.88	42.9	PK3	32	-29.1	45.8	-	-	74	-28.2	120	100	H
* 4.88	29.38	VB1T	32	-29.1	32.28	54	-21.72	-	-	120	100	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

9.2.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION RESTRICTED BANDEDGE (LOW CHANNEL)



HORIZONTAL DATA

Trace Markers

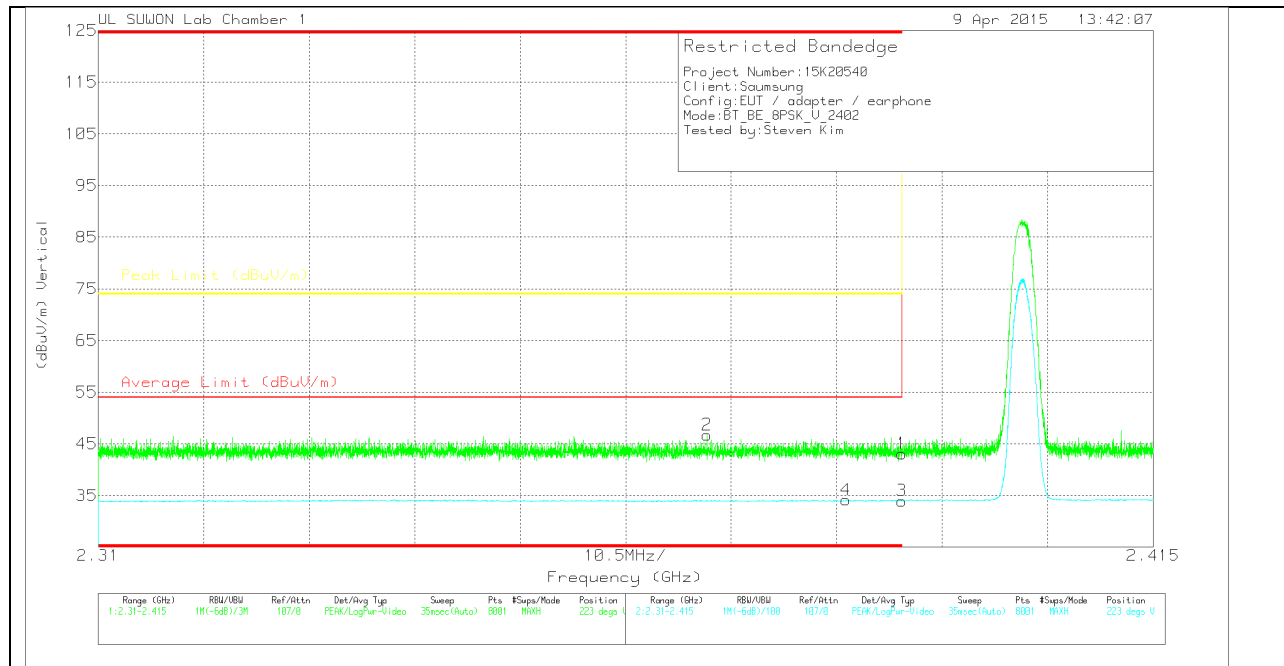
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 dB	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.53	Pk	27.9	-22.8	44.63	-	-	74	-29.37	131	151	H
2	* 2.387	41.97	Pk	27.9	-22.8	47.07	-	-	74	-26.93	131	151	H
3	* 2.39	29.07	VB1T	27.9	-22.8	34.17	54	-19.83	-	-	131	151	H
4	* 2.345	29.43	VB1T	27.8	-22.9	34.33	54	-19.67	-	-	131	151	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 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	38.02	Pk	27.9	-22.8	43.12	-	-	74	-30.88	223	131	V
2	* 2.371	41.74	Pk	27.8	-22.8	46.74	-	-	74	-27.26	223	131	V
3	* 2.39	28.89	VB1T	27.9	-22.8	33.99	54	-20.01	-	-	223	131	V
4	* 2.384	29.07	VB1T	27.9	-22.8	34.17	54	-19.83	-	-	223	131	V

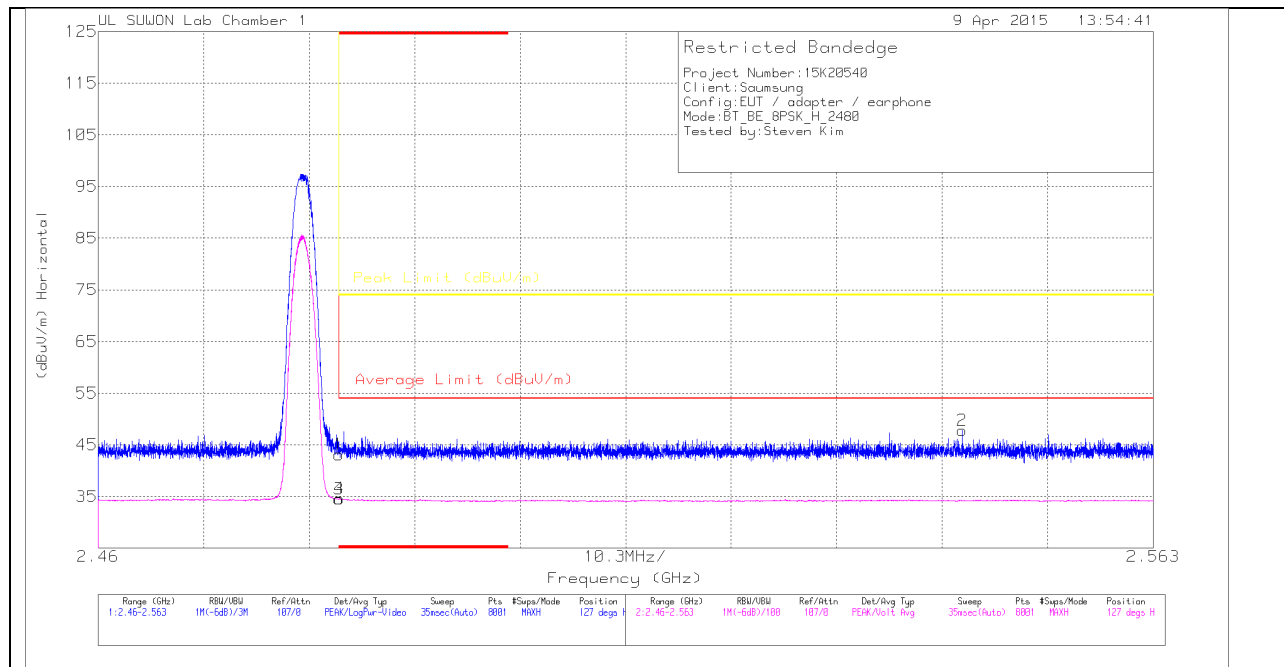
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

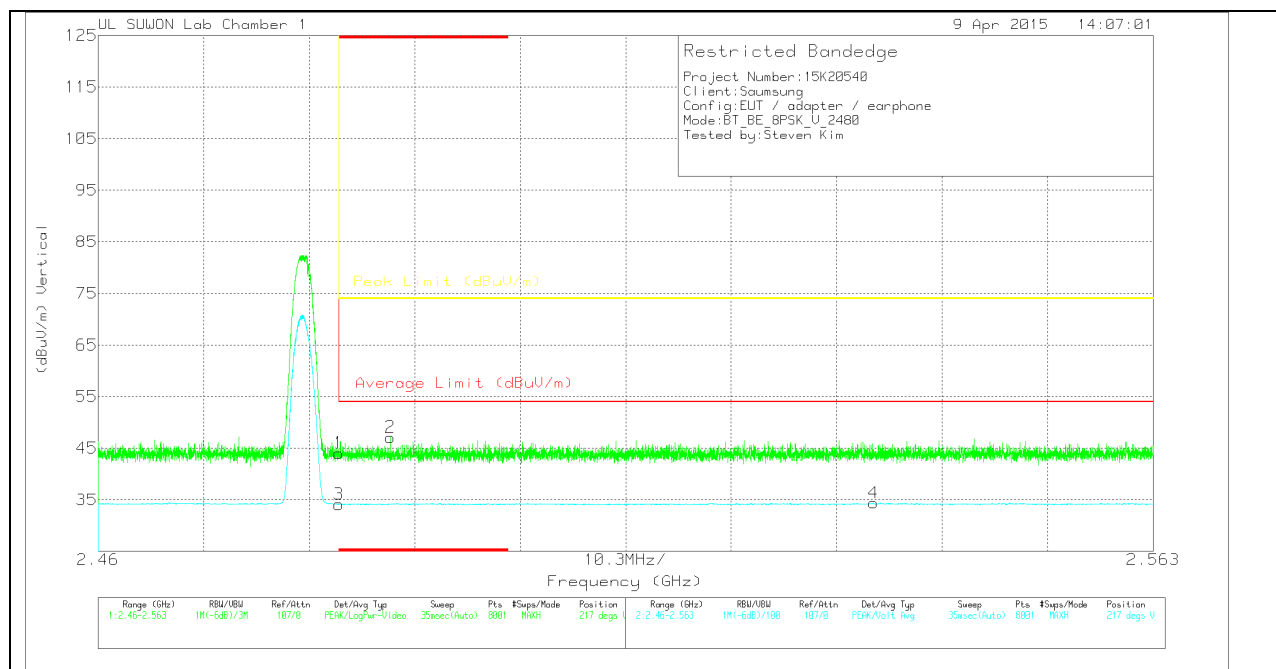
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 dB	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	37.84	Pk	27.9	-22.6	43.14	-	-	74	-30.86	127	174	H
2	2.544	42.49	Pk	27.9	-22.6	47.79	-	-	74	-26.21	127	174	H
3	* 2.484	29.23	VB1T	27.9	-22.6	34.53	54	-19.47	-	-	127	174	H
4	* 2.484	29.32	VB1T	27.9	-22.6	34.62	54	-19.38	-	-	127	174	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 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	38.78	Pk	27.9	-22.6	44.08	-	-	74	-29.92	217	137	V
2	* 2.484	41.81	Pk	27.9	-22.6	47.11	-	-	74	-26.89	217	137	V
3	* 2.484	28.83	VB1T	27.9	-22.6	34.13	54	-19.87	-	-	217	137	V
4	2.536	29.09	VB1T	27.9	-22.6	34.39	54	-19.61	-	-	217	137	V

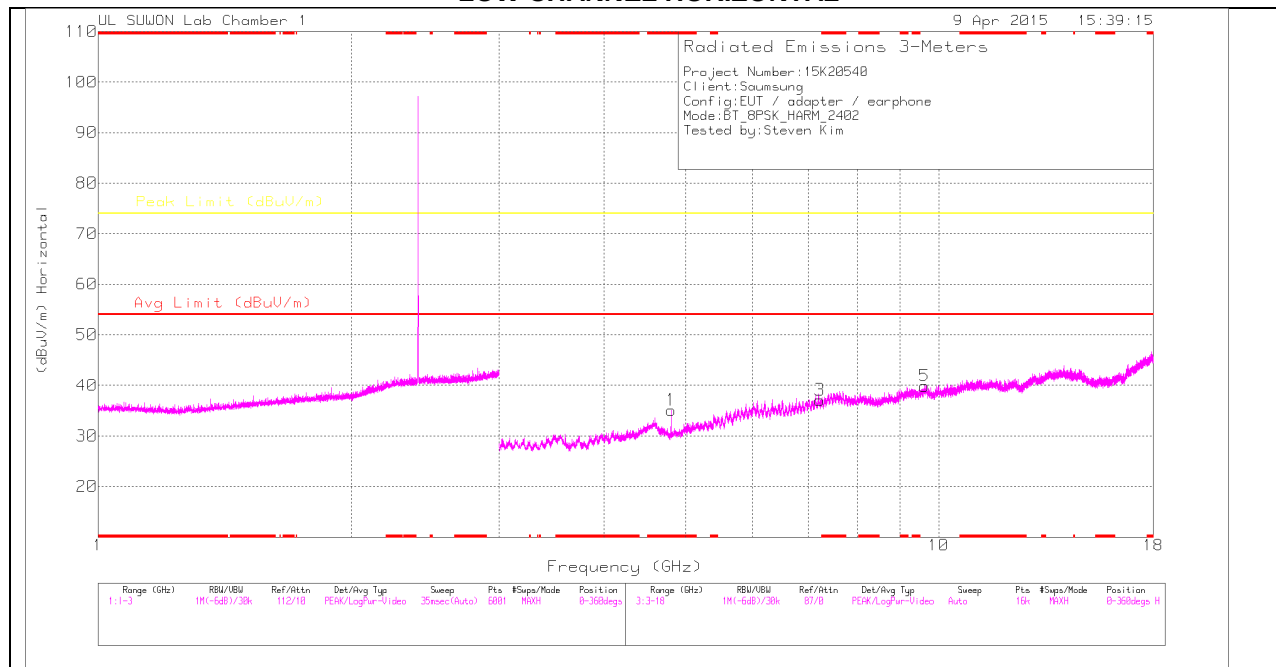
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

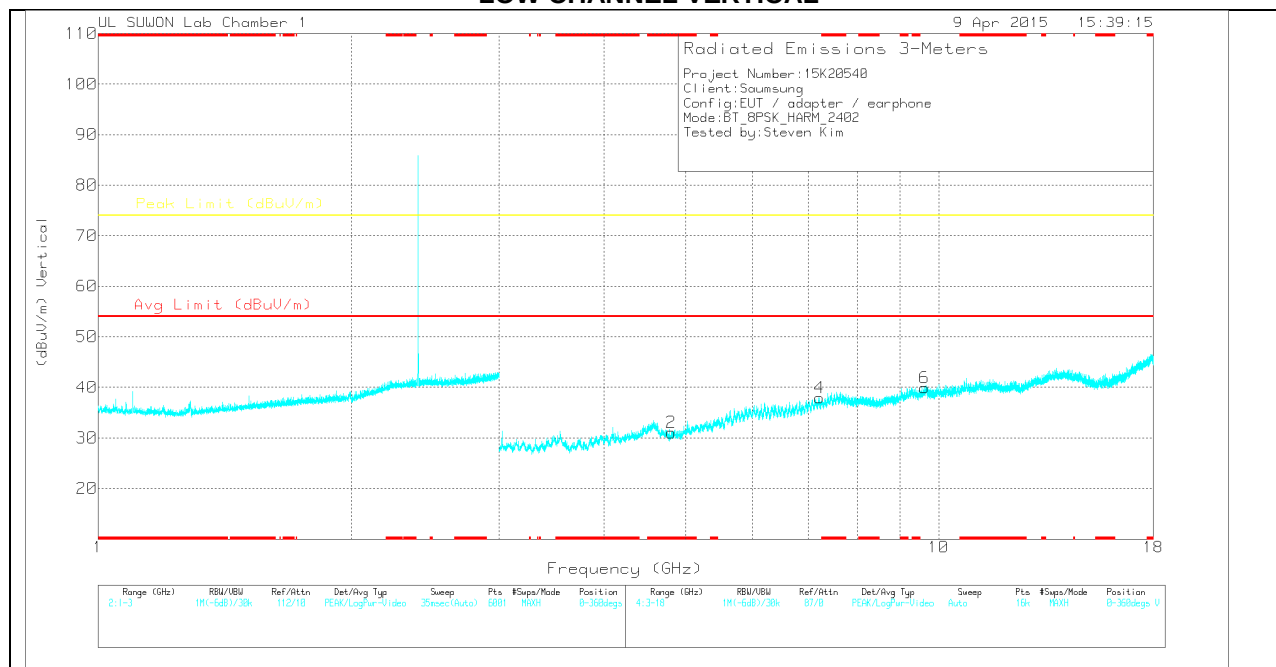
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



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

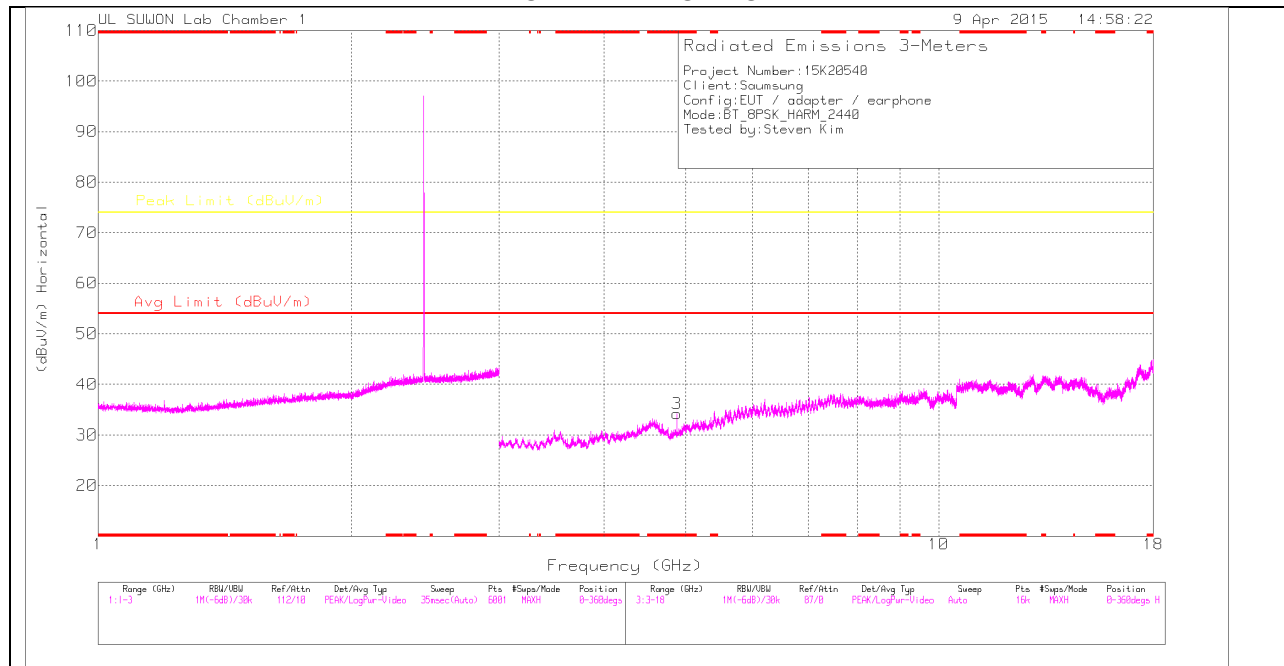
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_3_3G HP	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.804	32.99	PK	31.9	-29.8	35.09	-	-	74	-38.91	0-360	100	H
3	7.221	25.58	PK	37	-25.5	37.08	-	-	-	-	0-360	200	H
5	9.614	23.18	PK	37.7	-21	39.88	-	-	-	-	0-360	200	H
2	* 4.804	28.95	PK	31.9	-29.8	31.05	-	-	74	-42.95	0-360	100	V
4	7.219	26.41	PK	37	-25.5	37.91	-	-	-	-	0-360	100	V
6	9.615	23.21	PK	37.7	-21	39.91	-	-	-	-	0-360	200	V

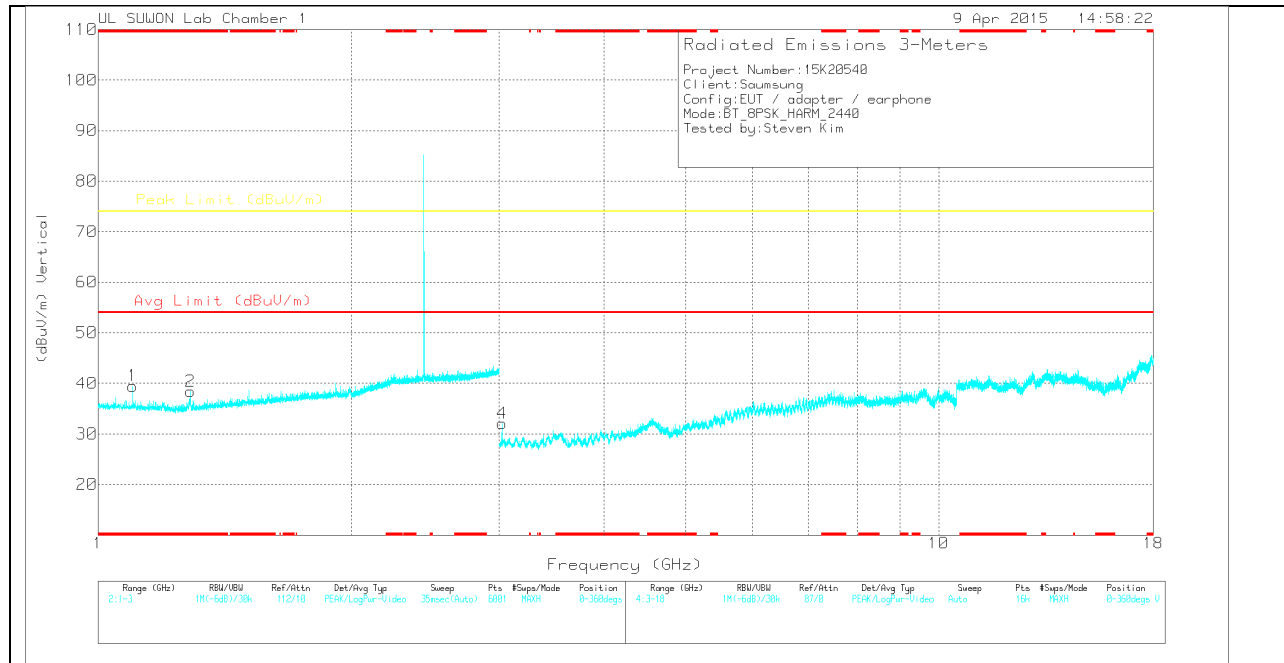
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

MID CHANNEL HORIZONTAL



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

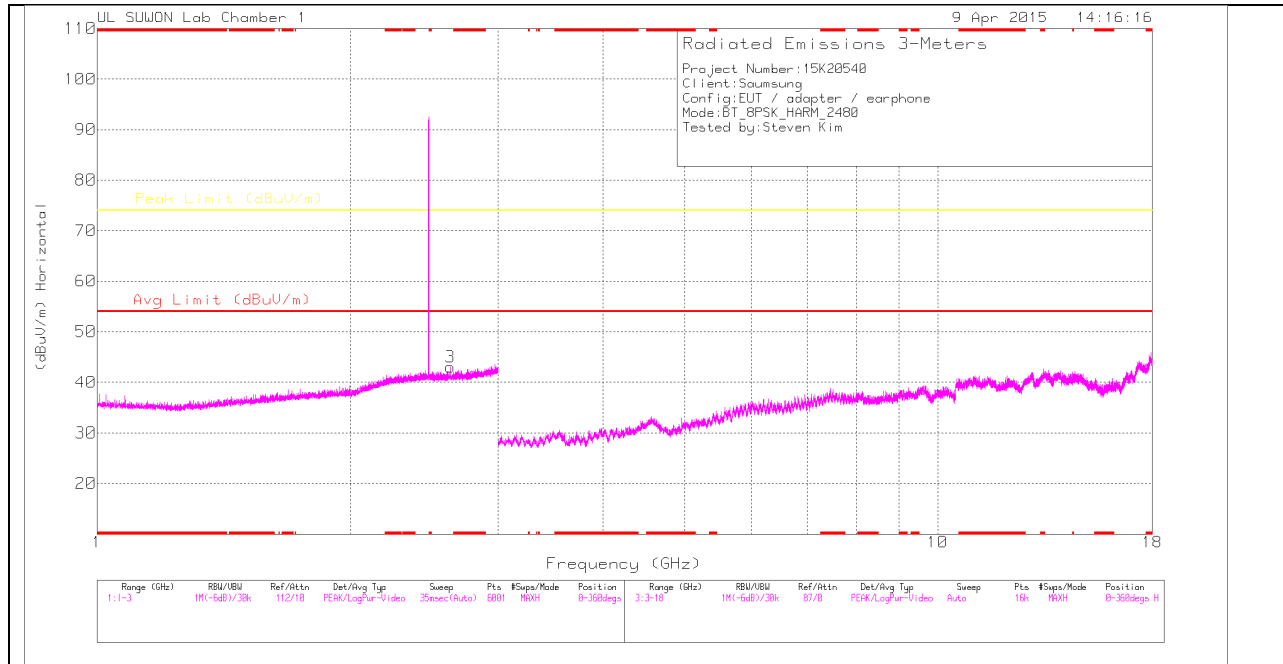
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3115D Factor	Path_2_10 dB	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.1	40.29	PK	24.3	-25.1	39.49	-	-	74	-34.51	0-360	200	V
2	* 1.288	39.34	PK	23.8	-24.7	38.44	-	-	74	-35.56	0-360	100	V
3	* 4.88	31.29	PK	32	-29.1	34.19	-	-	74	-39.81	0-360	100	H
4	3.023	34.37	PK	28.8	-31.1	32.07	-	-	-	-	0-360	200	V

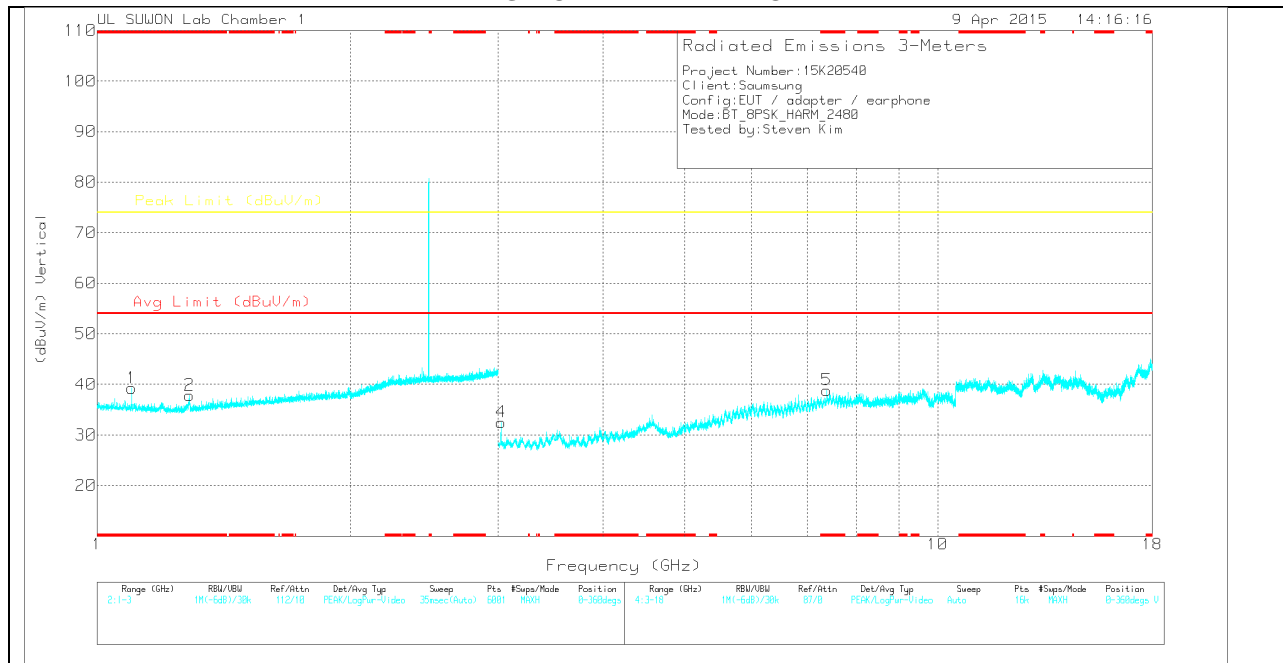
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

HIGH CHANNEL HORIZONTAL



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	3115D Factor	Path_2_10 dB	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	2.631	37.53	PK	27.9	-22.4	43.03	-	-	-	-	0-360	200	H
1	* 1.1	40.06	PK	24.3	-25.1	39.26	-	-	74	-34.74	0-360	100	V
2	* 1.289	38.75	PK	23.8	-24.7	37.85	-	-	74	-36.15	0-360	100	V
4	3.023	34.82	PK	28.8	-31.1	32.52	-	-	-	-	0-360	200	V
5	* 7.383	26.76	PK	37.2	-25.1	38.86	-	-	74	-35.14	0-360	100	V

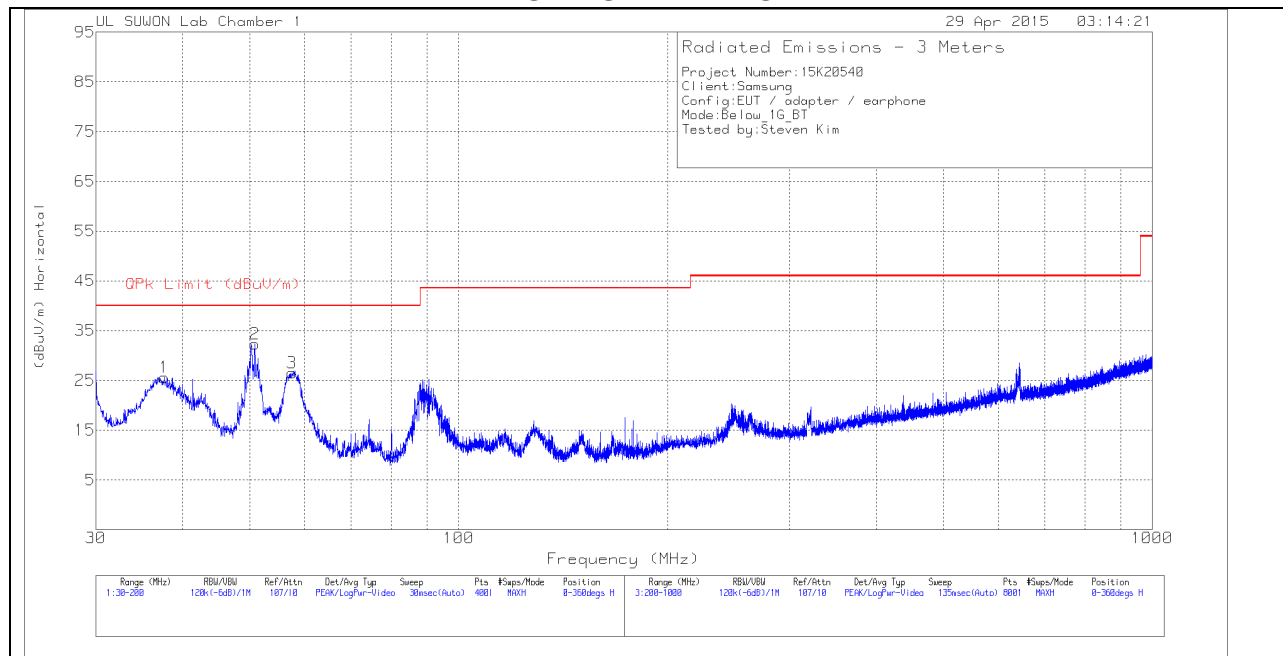
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

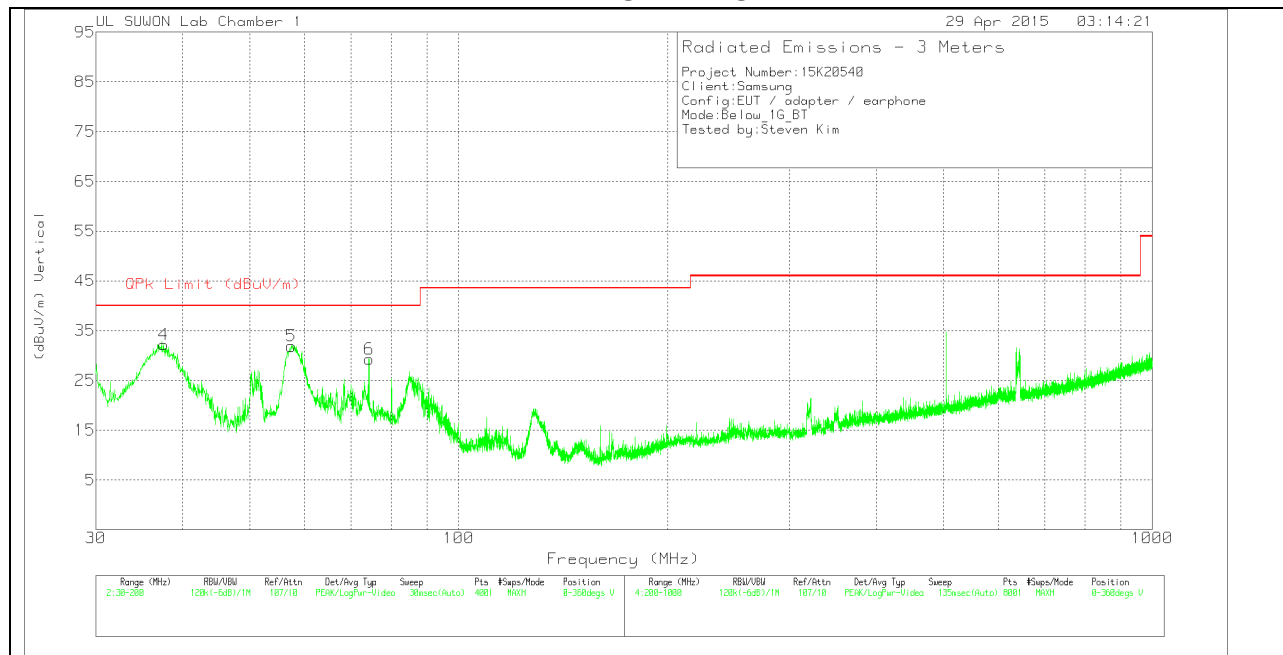
9.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-750	Bi-Log	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	37.65	44.51	Pk	11.5	-30.4	25.61	40	-14.39	0-360	300	H
2	50.825	48.65	Pk	13.8	-30.1	32.35	40	-7.65	0-360	400	H
3	57.455	43.54	Pk	13	-30	26.54	40	-13.46	0-360	400	H
4	37.565	51.09	Pk	11.5	-30.4	32.19	40	-7.81	0-360	100	V
5	57.37	48.88	Pk	13	-30	31.88	40	-8.12	0-360	100	V
6	74.2425	50.53	Pk	8.5	-29.7	29.33	40	-10.67	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

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

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.

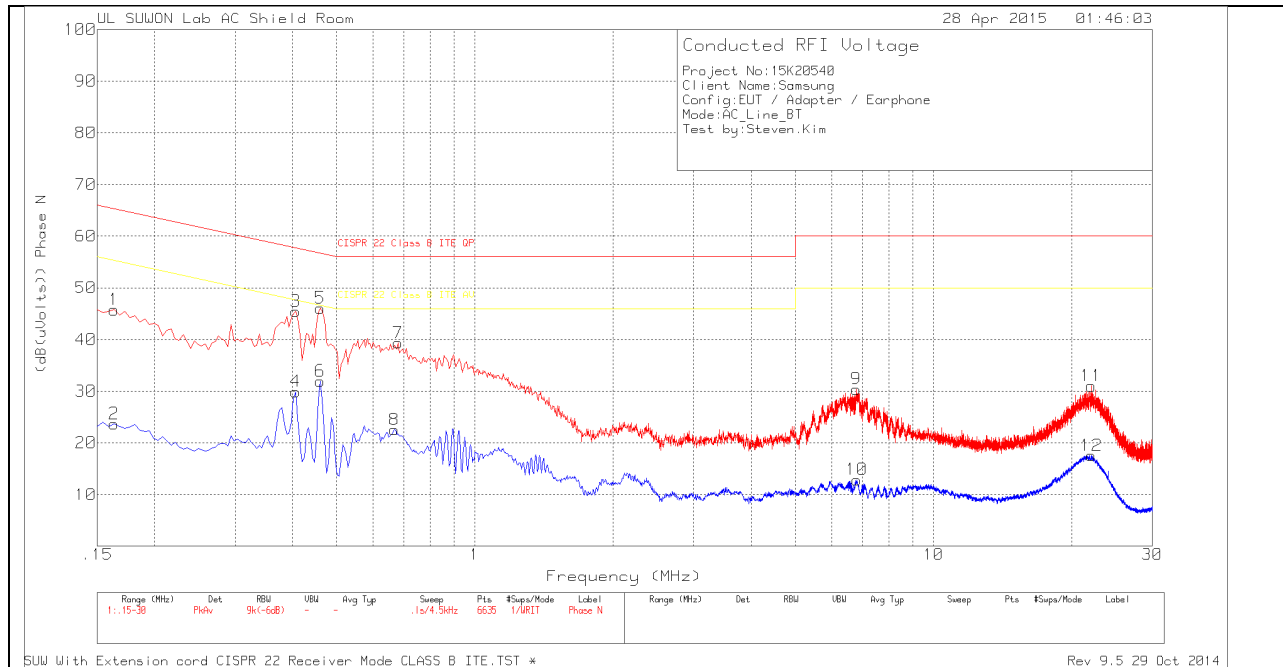
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

6 WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

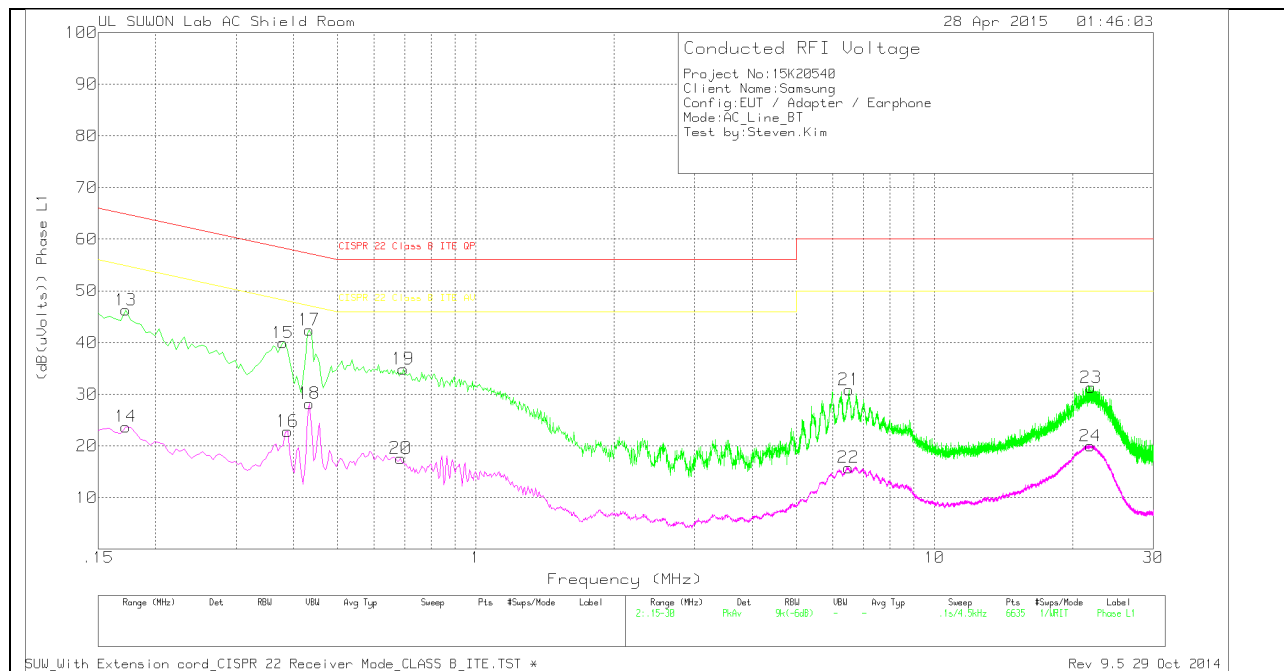
Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN HPF ON and Extension cord	CE Shield Room	Corrected Reading (dBuV)	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.1635	35.66	Pk	10.1	0	45.76	65.28	-19.52	-	-
2	.1635	13.58	Av	10.1	0	23.68	-	-	55.28	-31.6
3	.4065	35.37	Pk	10.1	0	45.47	57.72	-12.25	-	-
4	.4065	19.82	Av	10.1	0	29.92	-	-	47.72	-17.8
5	.4605	35.97	Pk	10.1	0	46.07	56.68	-10.61	-	-
6	.4605	21.86	Av	10.1	0	31.96	-	-	46.68	-14.72
7	.681	29.33	Pk	10	0	39.33	56	-16.67	-	-
8	.6675	12.53	Av	10	0	22.53	-	-	46	-23.47
9	6.7875	20.41	Pk	9.9	.1	30.41	60	-29.59	-	-
10	6.801	2.88	Av	9.9	.1	12.88	-	-	50	-37.12
11	22.101	20.14	Pk	10.7	.2	31.04	60	-28.96	-	-
12	22.11	6.66	Av	10.7	.2	17.56	-	-	50	-32.44

Pk - Peak detector

Av - Average detection

LINE 2 PLOT



LINE 2 RESULTS

Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_w ith extension cord_L1	CE Shield Room	Corrected Reading (dBuV)	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
13	.1725	35.98	Pk	10.3	0	46.28	64.84	-18.56	-	-
14	.1725	13.41	Av	10.3	0	23.71	-	-	54.84	-31.13
15	.3795	29.86	Pk	10.1	0	39.96	58.29	-18.33	-	-
16	.3885	12.73	Av	10.1	0	22.83	-	-	48.1	-25.27
17	.4335	32.33	Pk	10.1	0	42.43	57.19	-14.76	-	-
18	.4335	18.11	Av	10.1	0	28.21	-	-	47.19	-18.98
19	.6945	24.79	Pk	10.1	0	34.89	56	-21.11	-	-
20	.6855	7.5	Av	10.1	0	17.6	-	-	46	-28.4
21	6.5175	20.98	Pk	9.8	.1	30.88	60	-29.12	-	-
22	6.495	5.91	Av	9.8	.1	15.81	-	-	50	-34.19
23	21.9435	20.71	Pk	10.4	.2	31.31	60	-28.69	-	-
24	21.8895	9.41	Av	10.4	.2	20.01	-	-	50	-29.99

Pk - Peak detector

Av - Average detection