



FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER : SM-G903F

FCC ID: A3LSMG903F

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Prepared for

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ACCREDITED

TL-637

Revision History

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac, ANT+ and NFC
MODEL NUMBER: SM-G903F
SERIAL NUMBER: R38G60CA7KK (RADIATED); R38G60C9R5L(CONDUCTED)
DATE TESTED: JUN 15 - JUL 01, 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
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, 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	
<input checked="" type="checkbox"/>	Chamber 1
<input type="checkbox"/>	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 Phone+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	Power Mode	Output Power [dBm]	Output Power [mW]
2402 - 2480	Basic GFSK	Average	8.41	6.94
		Peak	8.58	7.20
	Enhanced Pi/4-DPSK	Average	4.30	2.69
		Peak	6.70	4.68
	Enhanced 8PSK	Average	4.39	2.75
		Peak	7.00	5.01

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 an FPCB antenna, with a maximum gain of -1.89 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-TA20EWE	N/A	N/A
Data Cable	SAMSUNG	EP-DN915UWE	N/A	N/A
Earphone	SAMSUNG	EHS64AVFWE	N/A	N/A

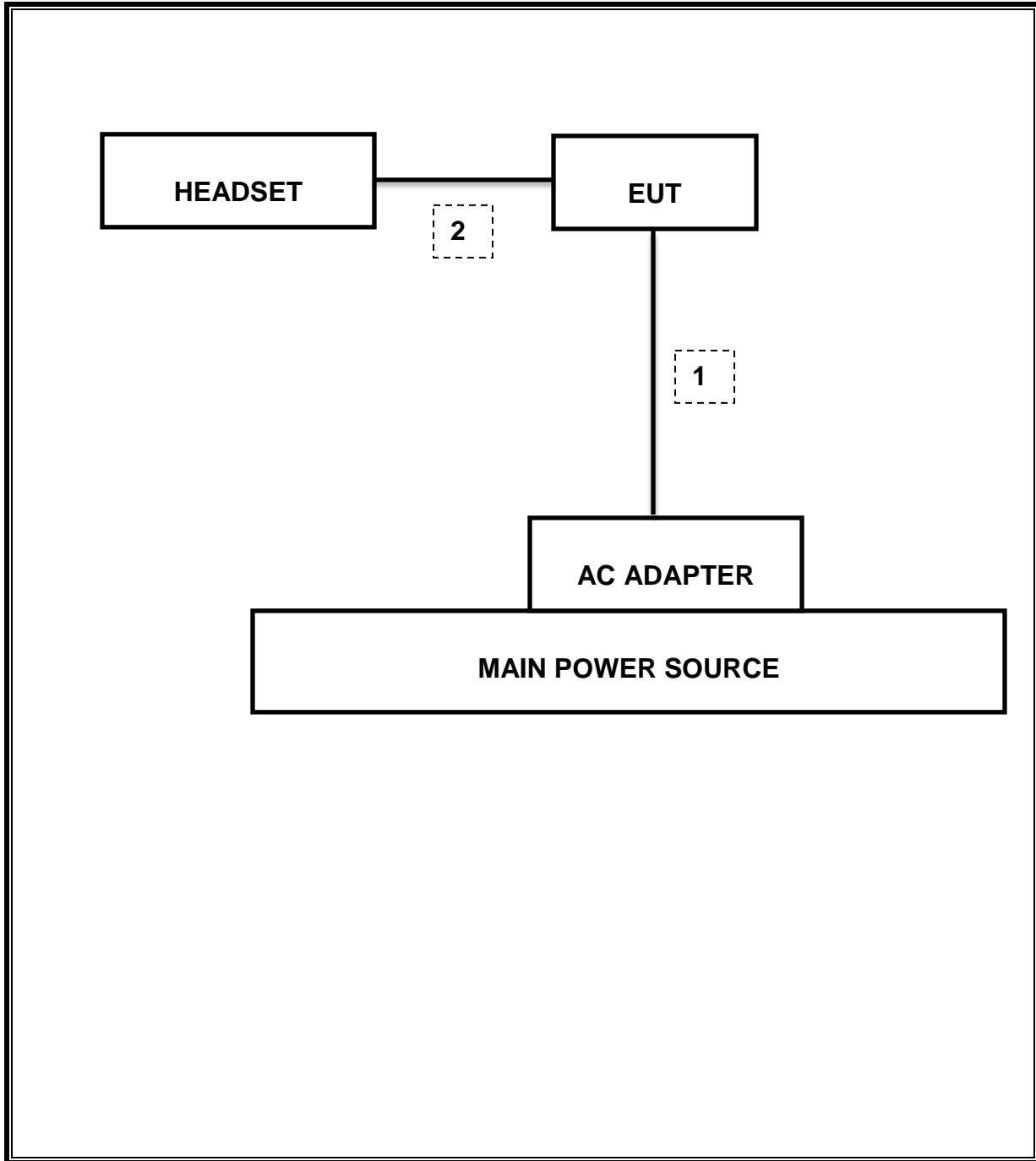
I/O CABLES

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	1.240 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-48.819 dBm
15.247 (b)(1)	TX conducted output power	<21dBm		Pass	8.58 dBm (Peak)
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	0.375 sec
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	48.6 dBuV (QP)
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	38.49 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	1.056	0.965
Mid	2441	1.030	0.938
High	2480	1.027	0.932
Worst		1.056	0.965

8.1.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

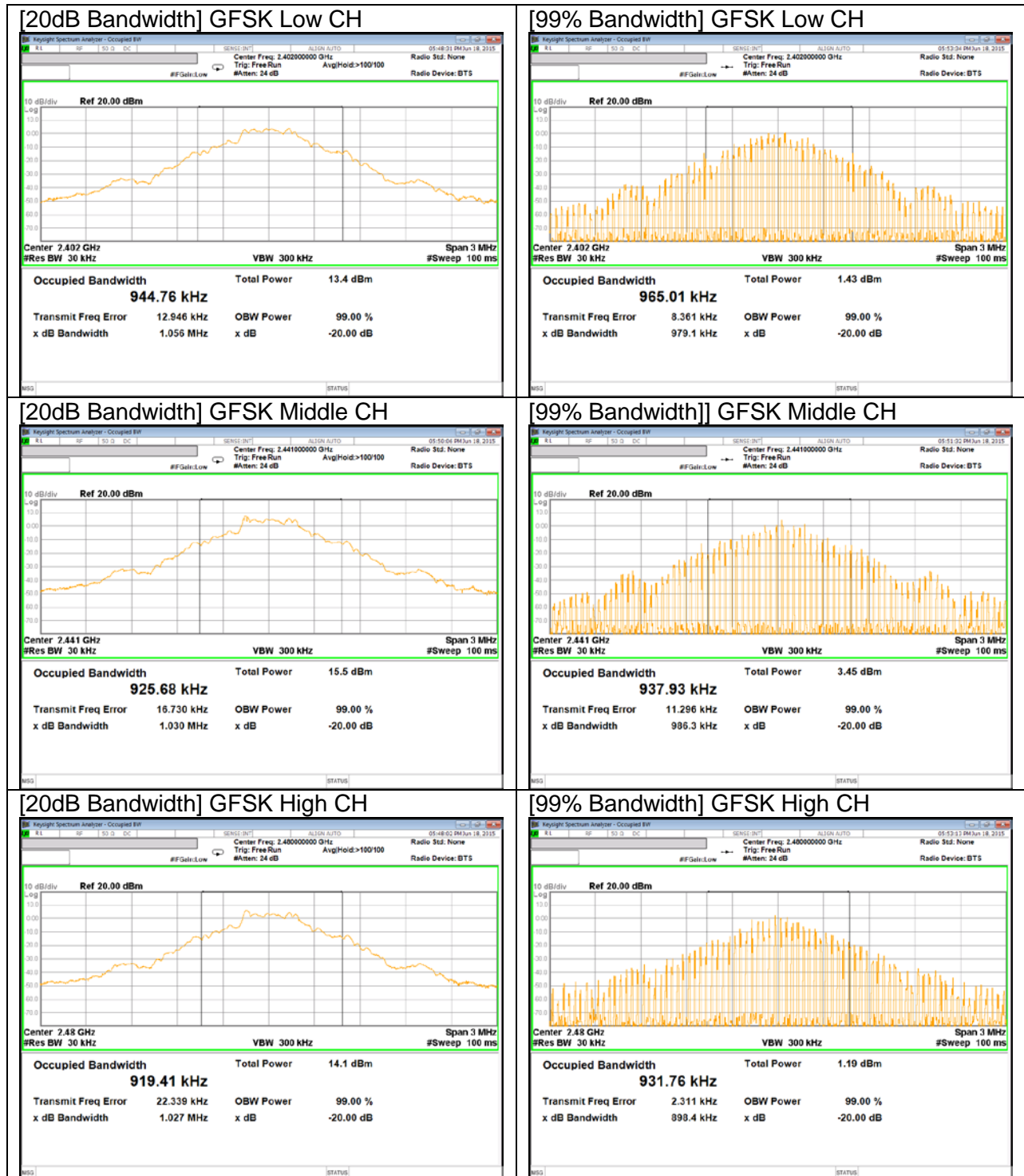
Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.306	1.240
Mid	2441	1.298	1.203
High	2480	1.301	1.201
Worst		1.306	1.240

8.1.3. ENHANCED DATA RATE 8PSK MODULATION

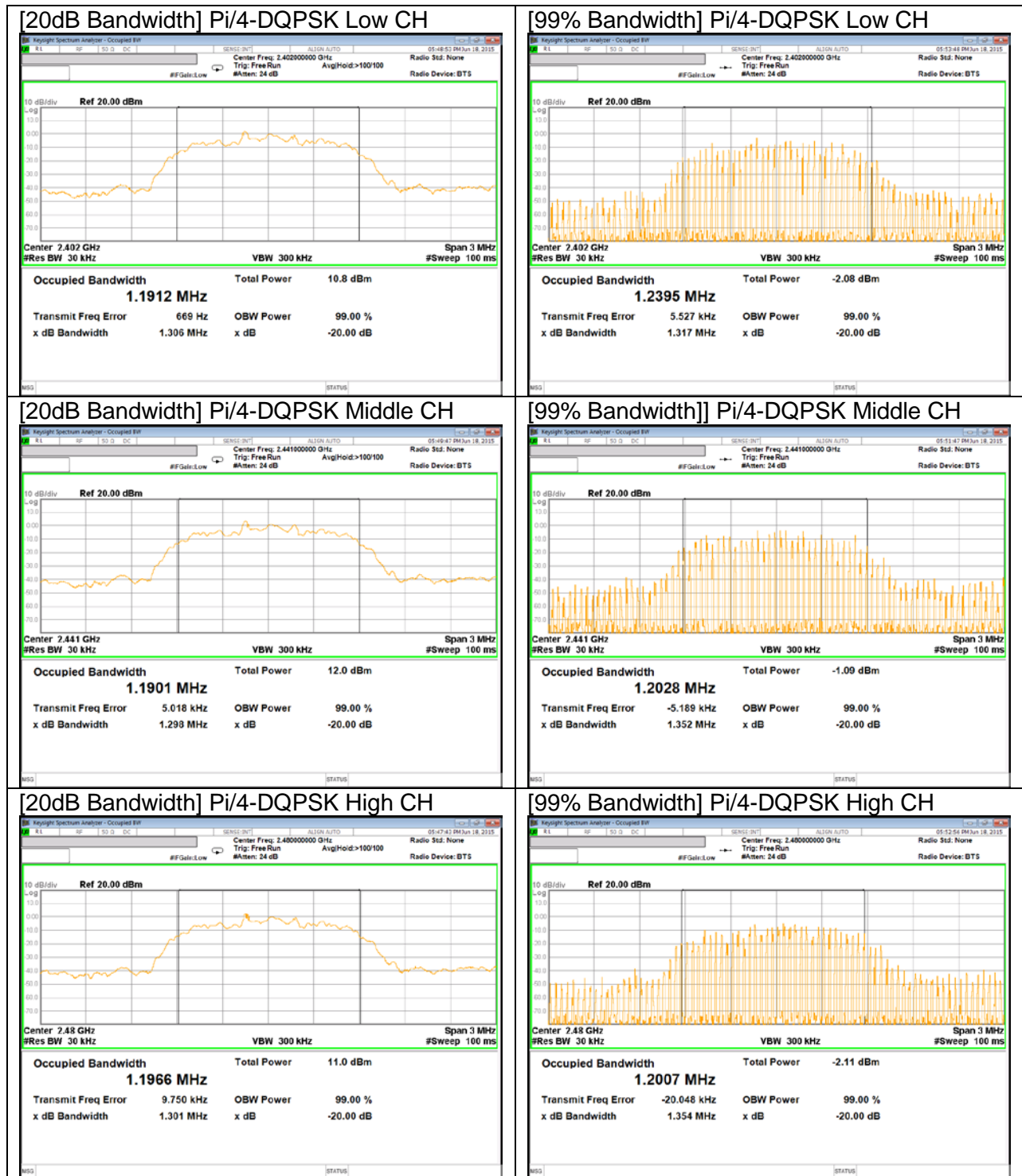
Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.322	1.199
Mid	2441	1.324	1.192
High	2480	1.324	1.206
Worst		1.324	1.206

8.1.4. 20 dB AND 99% BANDWIDTH PLOTS

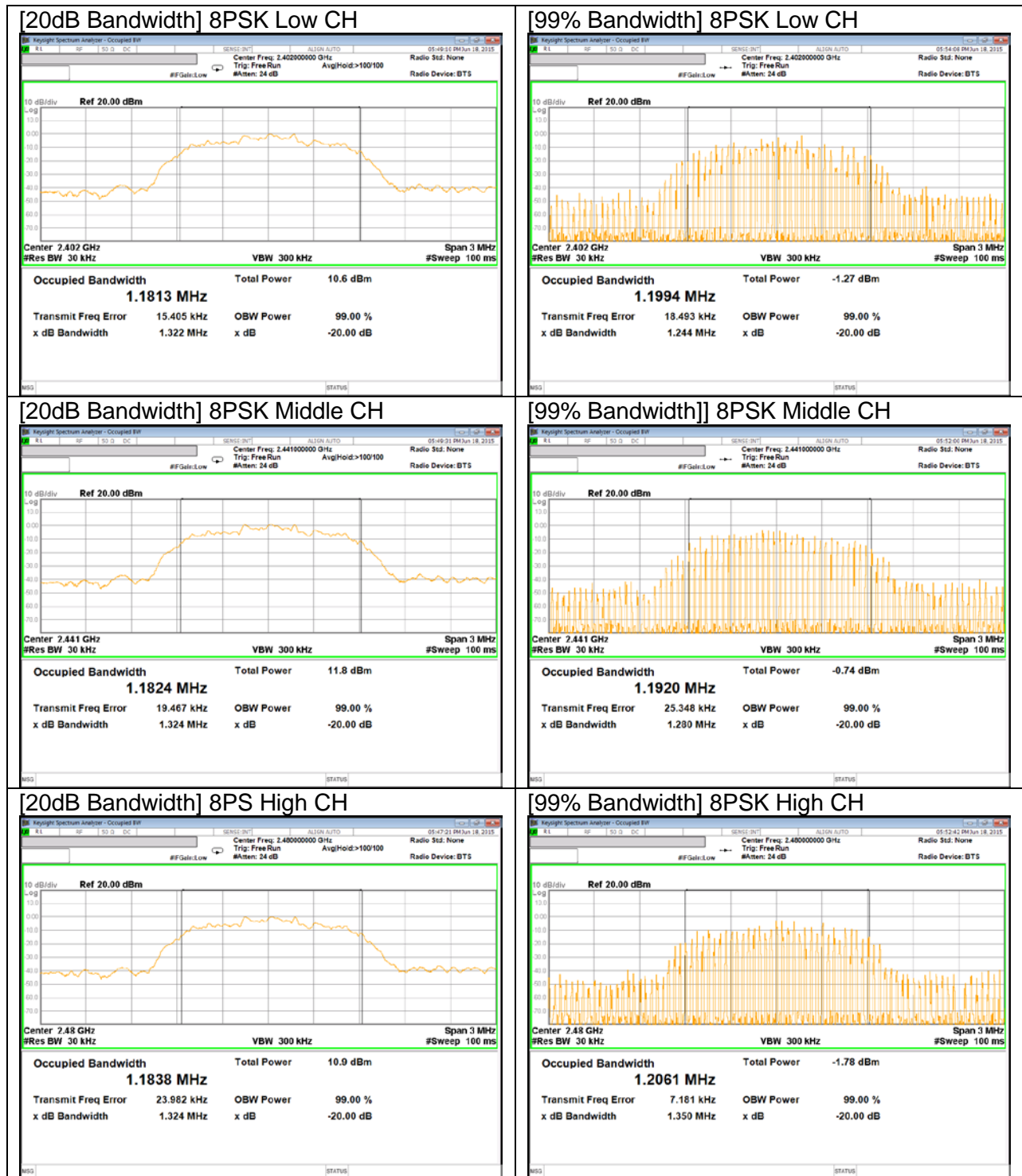
GFSK BANDWIDTH



Pi/4-DQPSK BANDWIDTH



8PSK BANDWIDTH



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.

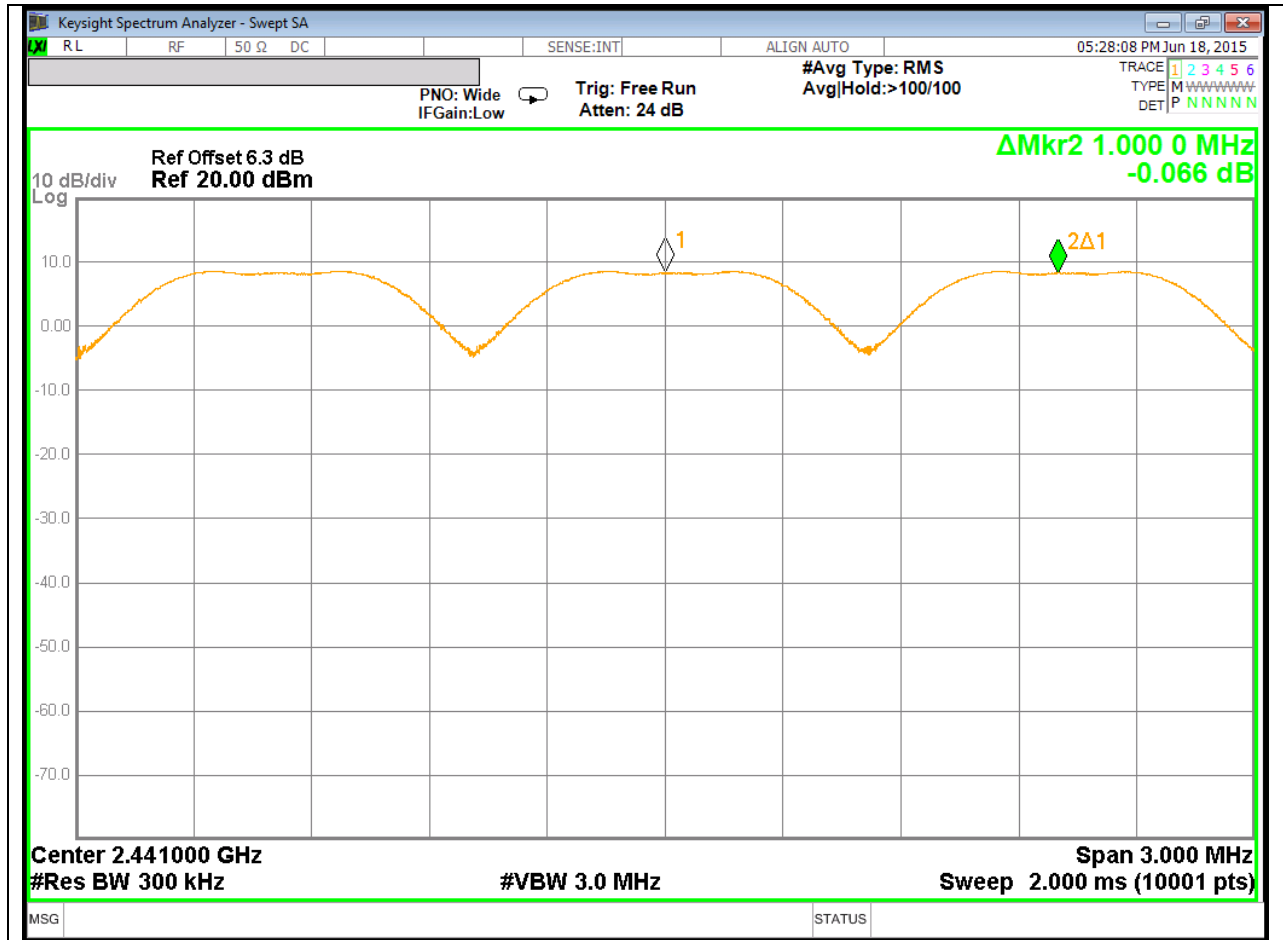
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

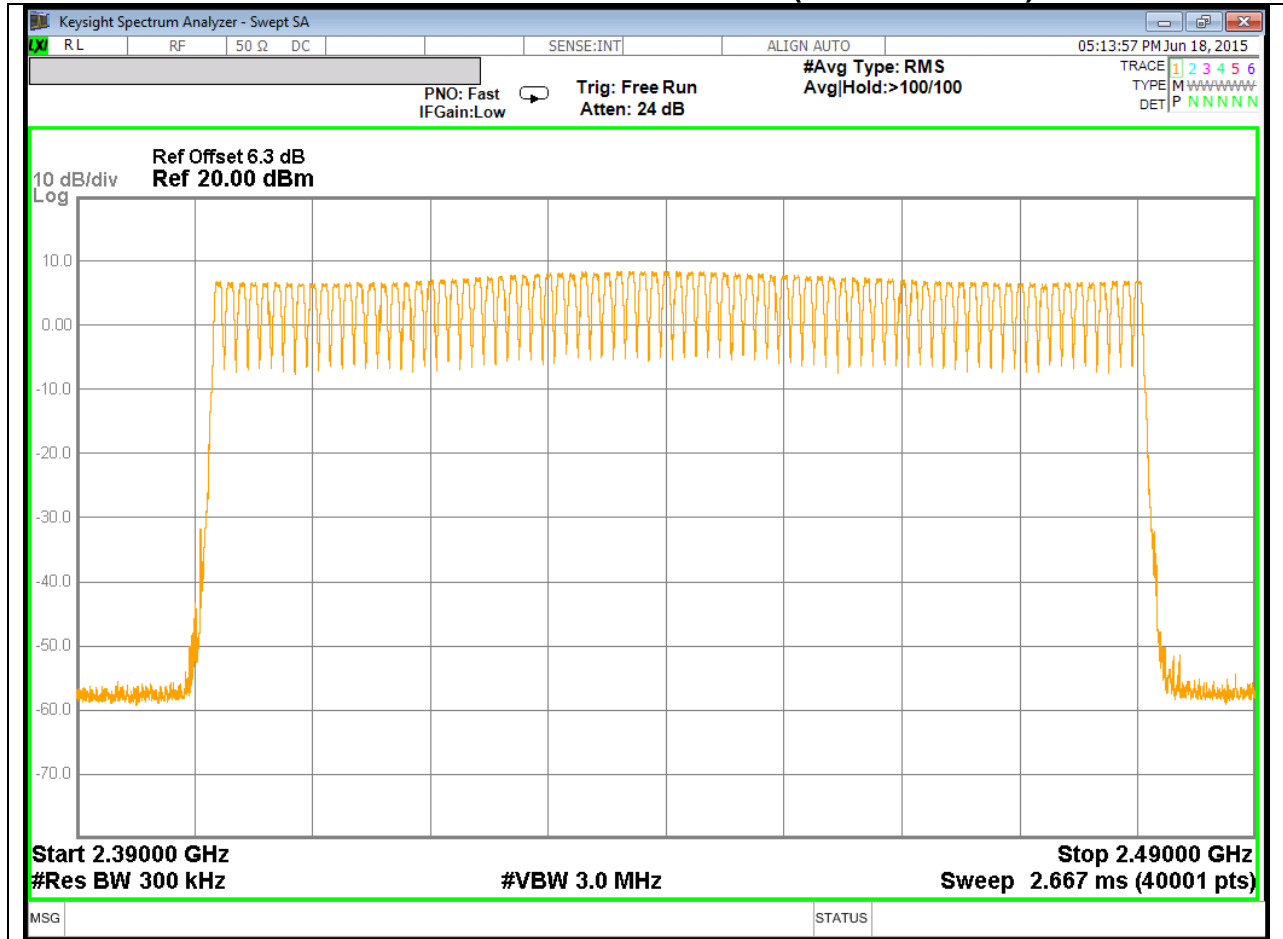
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

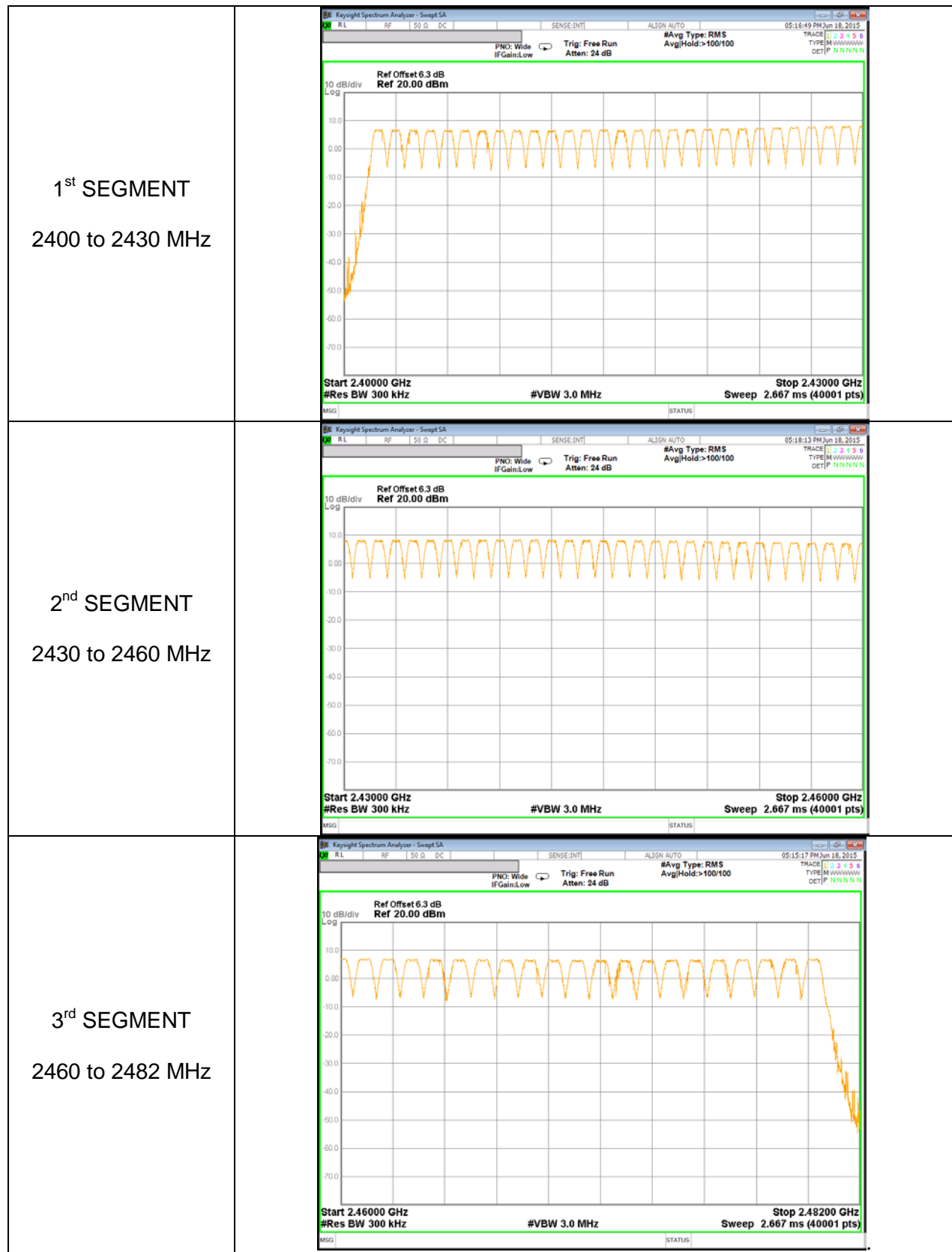
RESULTS

Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS PLOTS

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)





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.

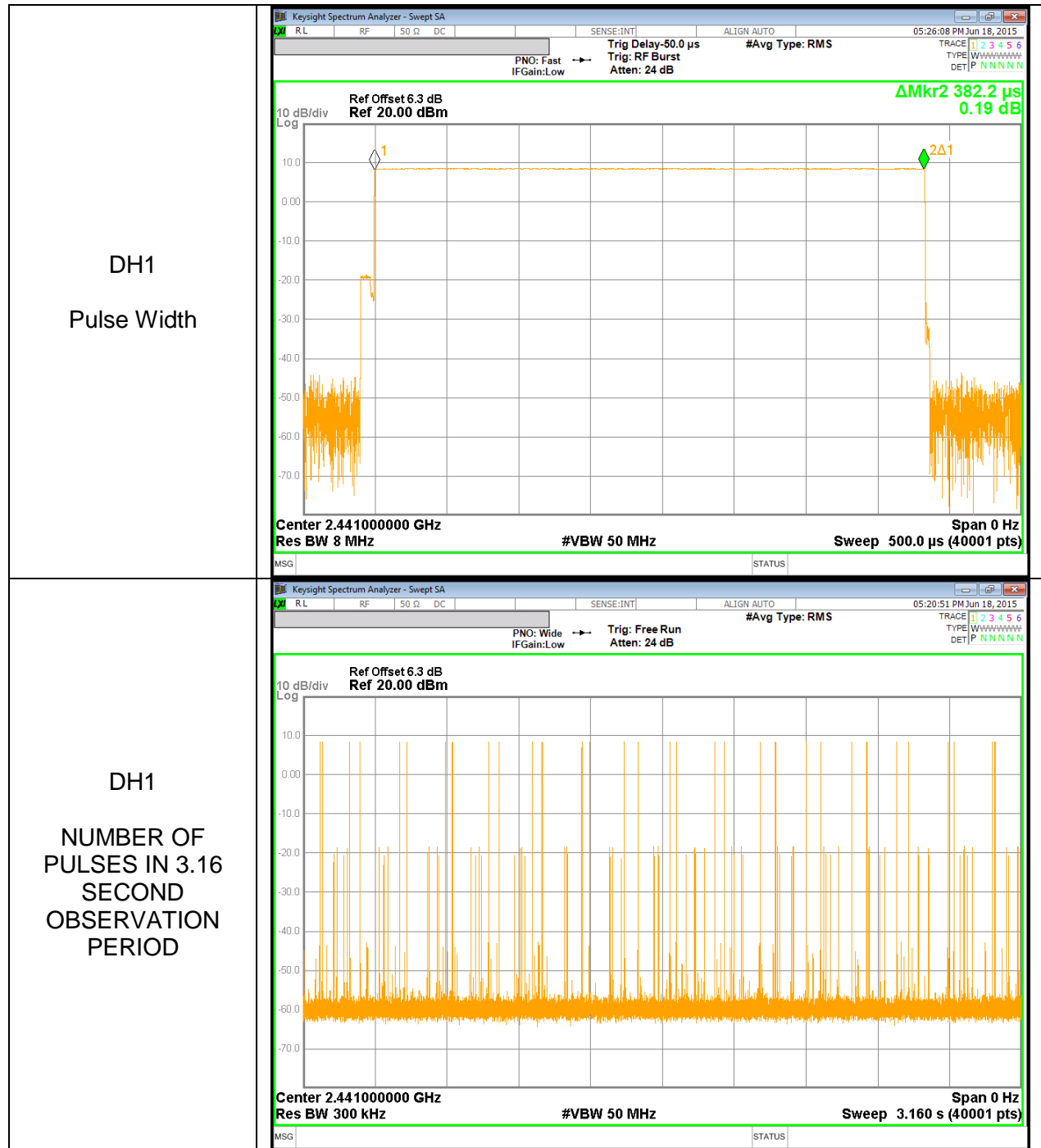
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$.

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

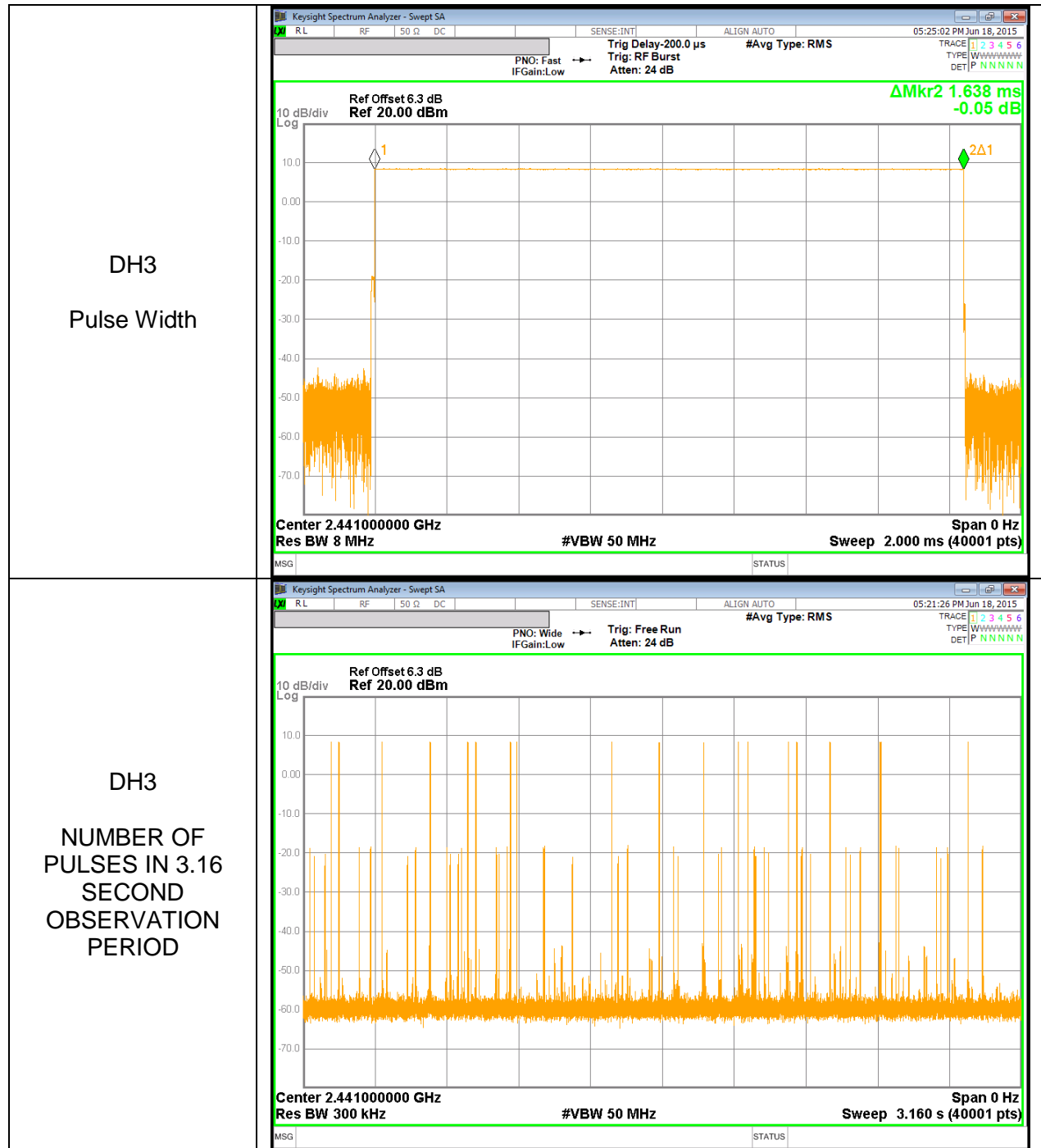
RESULTS

DH Packet	Pulse Width [msec]	Number of Pulses in 3.16 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK Normal					
DH1	0.382	32	0.122304	0.4	-0.2777
DH3	1.638	18	0.294840	0.4	-0.1052
DH5	2.886	13	0.375180	0.4	-0.0248
GFSK AFH					
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
DH1	0.382	8	0.030576	0.4	-0.3694
DH3	1.638	4.5	0.073710	0.4	-0.3263
DH5	2.886	3.25	0.093795	0.4	-0.3062

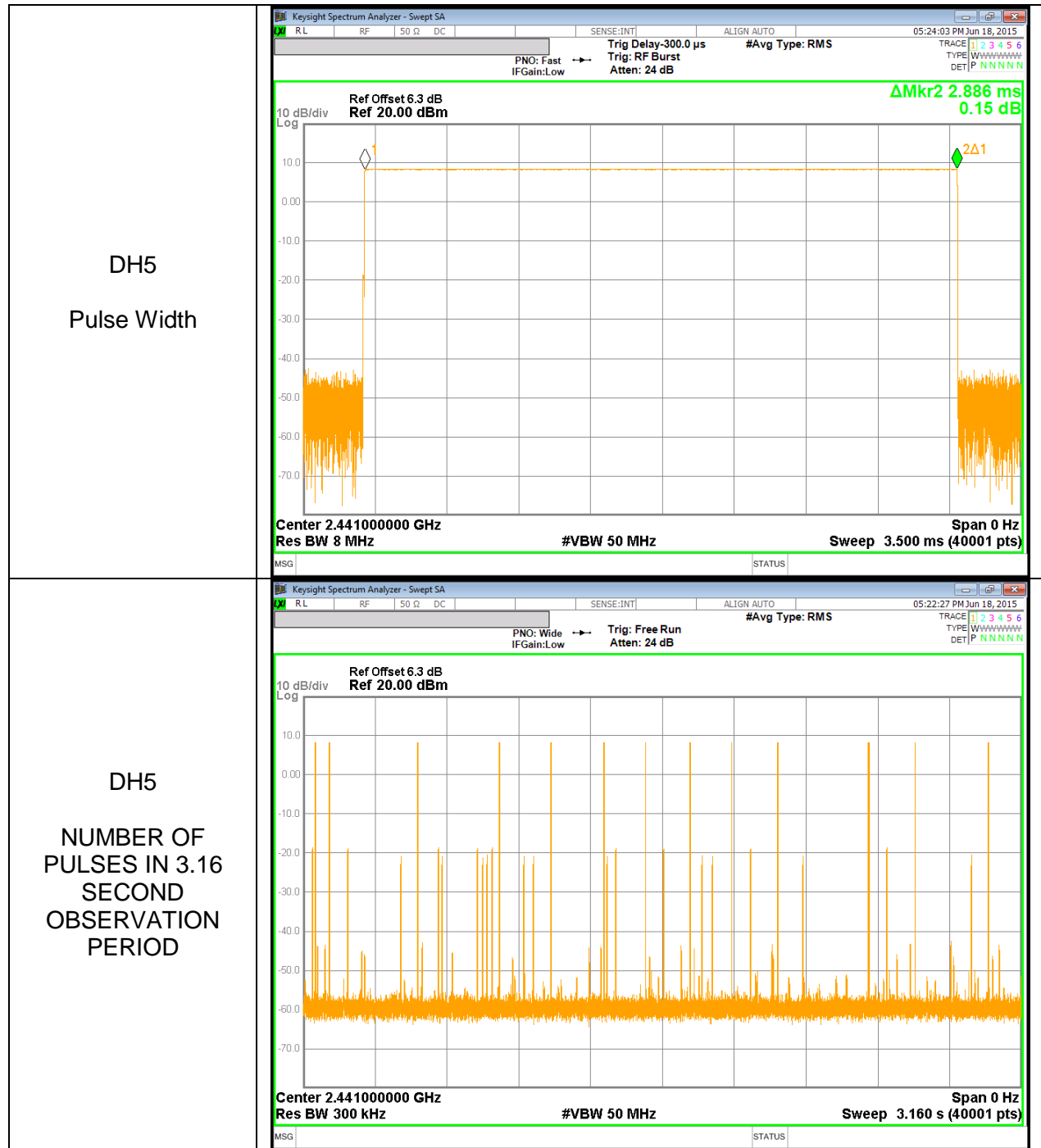
DH1



DH3



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	6.875	21	-14.125
Middle	2441	8.575	21	-12.425
High	2480	7.131	21	-13.869
Worst		8.575	21	-12.425

8.5.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

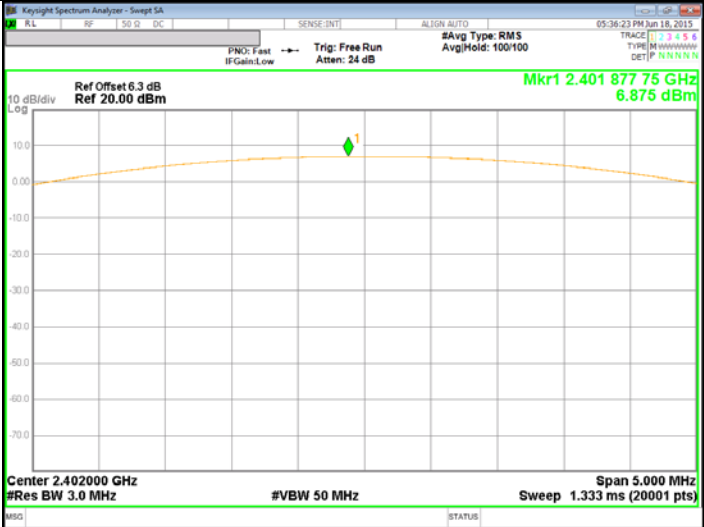
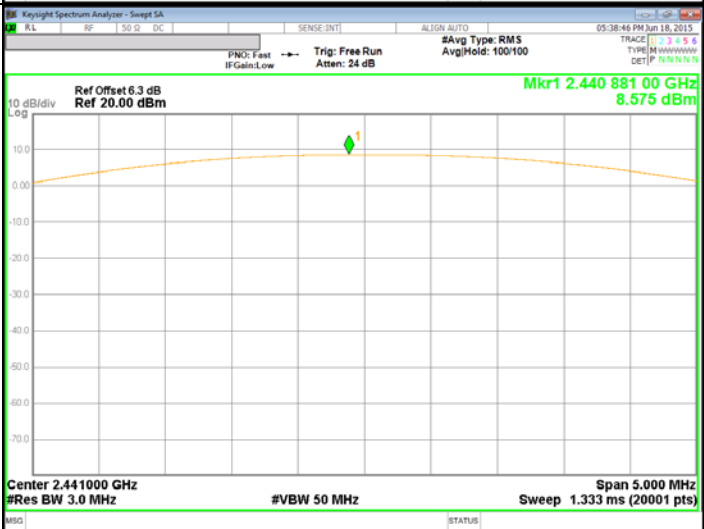
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	5.403	21	-15.597
Middle	2441	6.701	21	-14.299
High	2480	5.734	21	-15.266
Worst		6.701	21	-14.299

8.5.3. ENHANCED DATA RATE 8PSK MODULATION

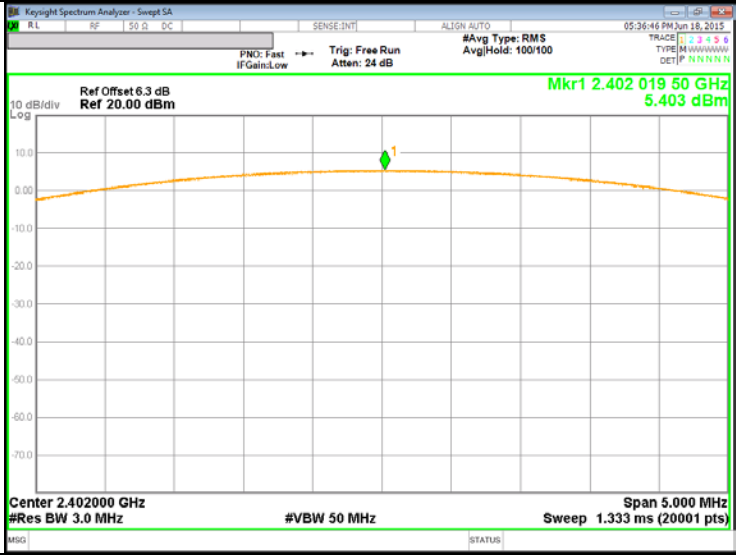
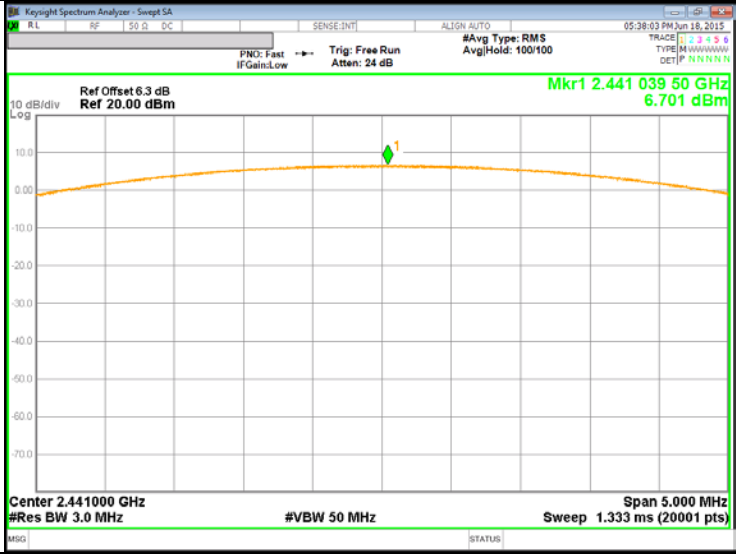
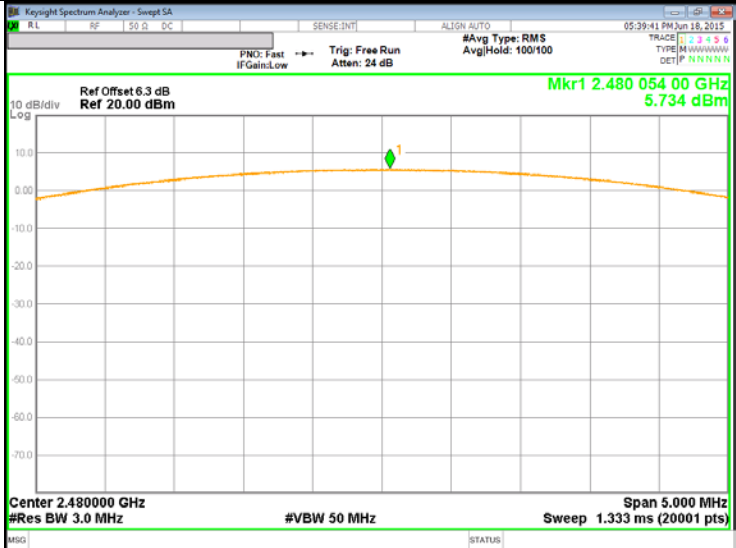
Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	5.403	21	-15.597
Middle	2441	6.997	21	-14.003
High	2480	6.016	21	-14.984
Worst		6.997	21	-14.003

8.5.4. OUTPUT POWER PLOTS

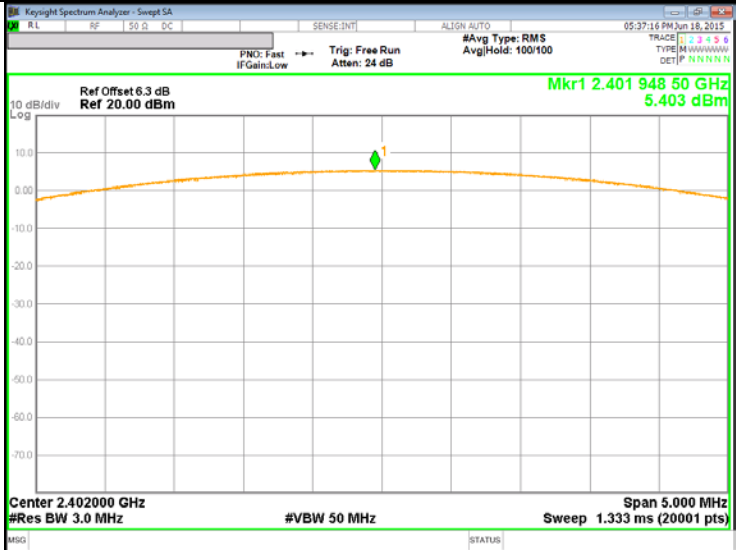
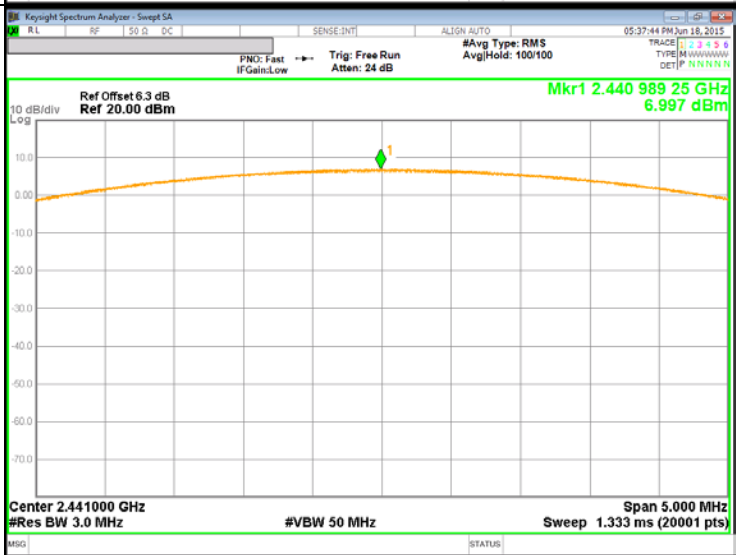
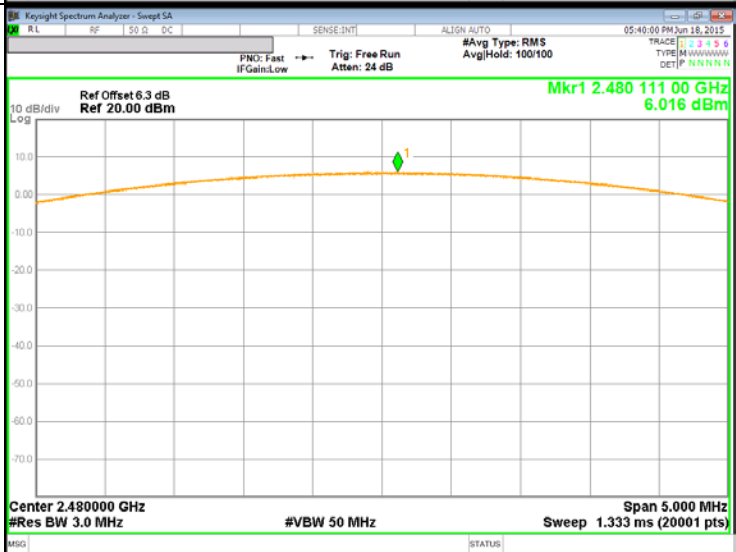
GFSK OUTPUT POWER

<p>GFSK Low CH</p>	
<p>GFSK Middle CH</p>	
<p>GFSK High CH</p>	

Pi/4-DPSK OUTPUT POWER

<p>Pi/4-DPSK Low CH</p>	 <p>Center 2.402019 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 1.333 ms (20001 pts)</p>
<p>Pi/4-DPSK Middle CH</p>	 <p>Center 2.441039 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 1.333 ms (20001 pts)</p>
<p>Pi/4-DPSK High CH</p>	 <p>Center 2.480054 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 1.333 ms (20001 pts)</p>

8PSK OUTPUT POWER

<p>8PSK Low CH</p>	 <p>KeySight Spectrum Analyzer - Swept SA Ref Offset 6.3 dB Ref 20.00 dBm Mkr1 2.401 948 50 GHz 5.403 dBm Center 2.402000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 1.333 ms (20001 pts)</p>
<p>8PSK Middle CH</p>	 <p>KeySight Spectrum Analyzer - Swept SA Ref Offset 6.3 dB Ref 20.00 dBm Mkr1 2.440 989 25 GHz 6.997 dBm Center 2.441000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 1.333 ms (20001 pts)</p>
<p>8PSK High CH</p>	 <p>KeySight Spectrum Analyzer - Swept SA Ref Offset 6.3 dB Ref 20.00 dBm Mkr1 2.480 111 00 GHz 6.016 dBm Center 2.480000 GHz #Res BW 3.0 MHz #VBW 50 MHz Span 5.000 MHz Sweep 1.333 ms (20001 pts)</p>

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	6.81	4.80
Middle	2441	8.41	6.94
High	2480	6.95	4.96

8.6.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	3.09	2.04
Middle	2441	4.30	2.69
High	2480	3.42	2.20

8.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	3.15	2.07
Middle	2441	4.39	2.75
High	2480	3.50	2.24

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.

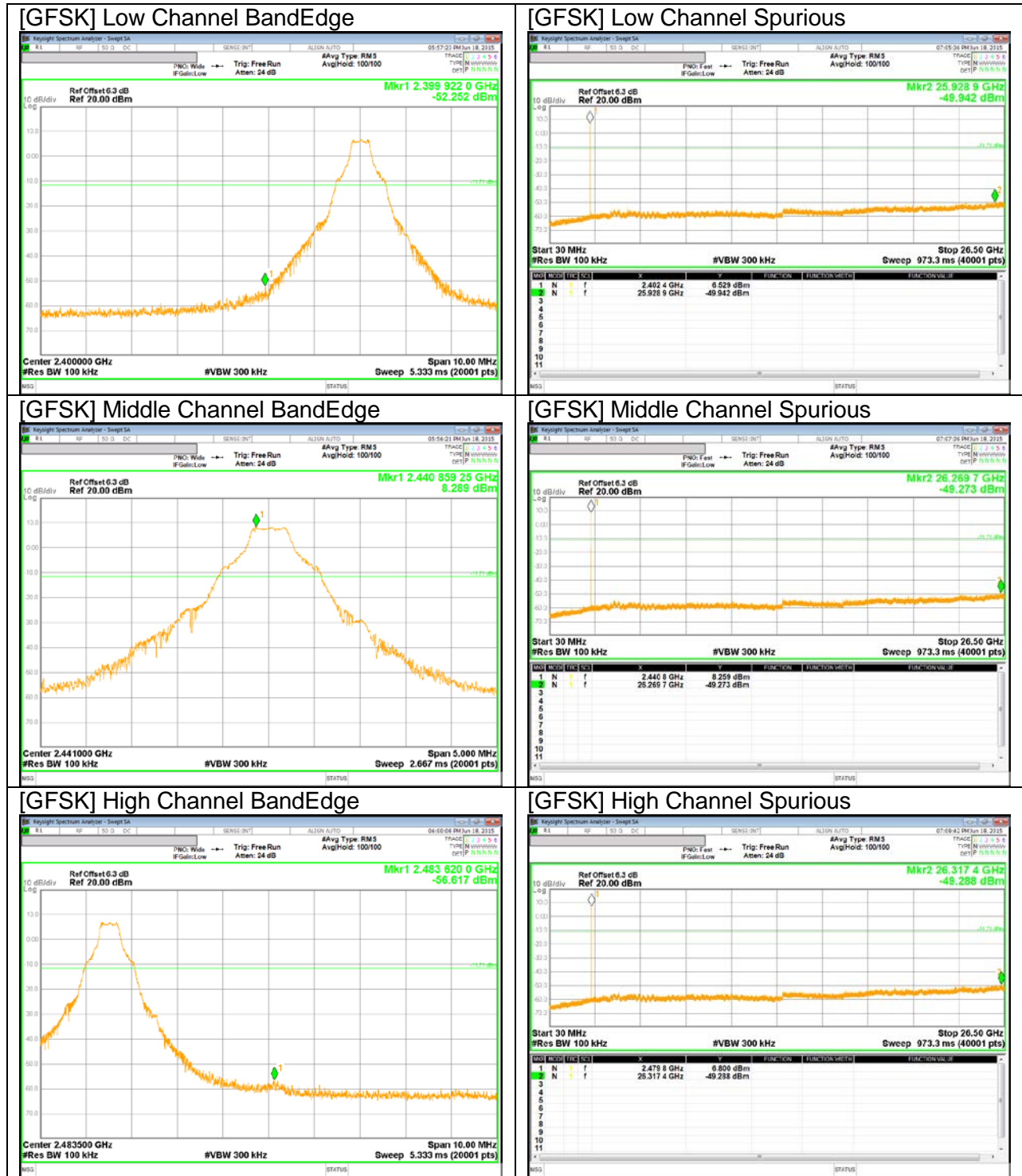
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

RESULTS

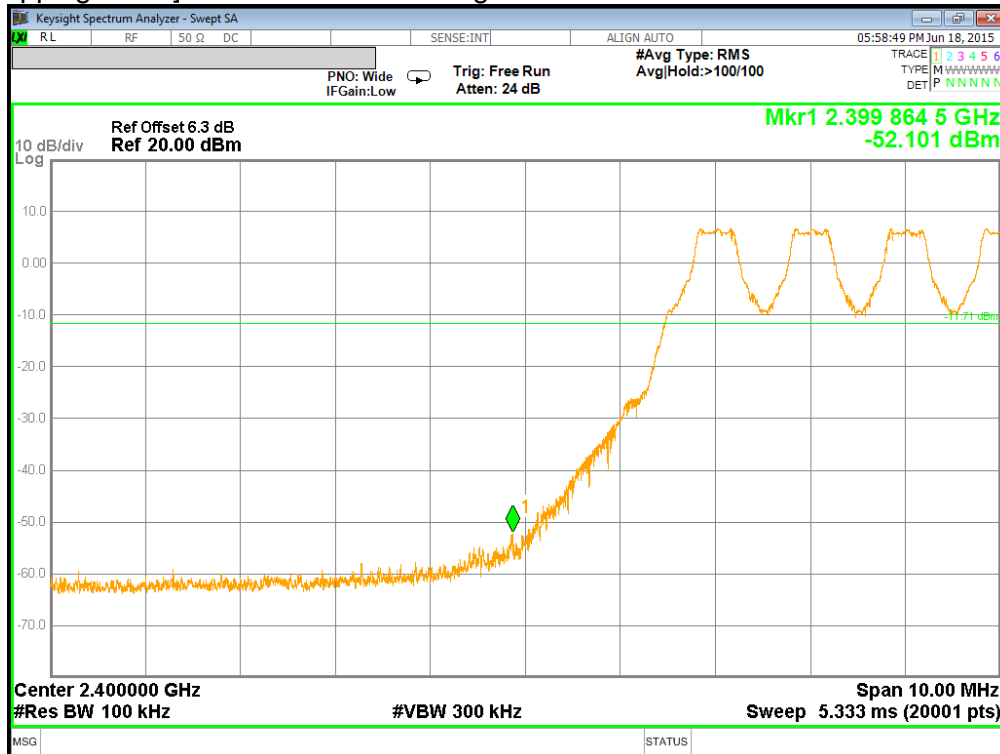
8.7.1. BASIC DATA RATE GFSK MODULATION

GFSK Mode

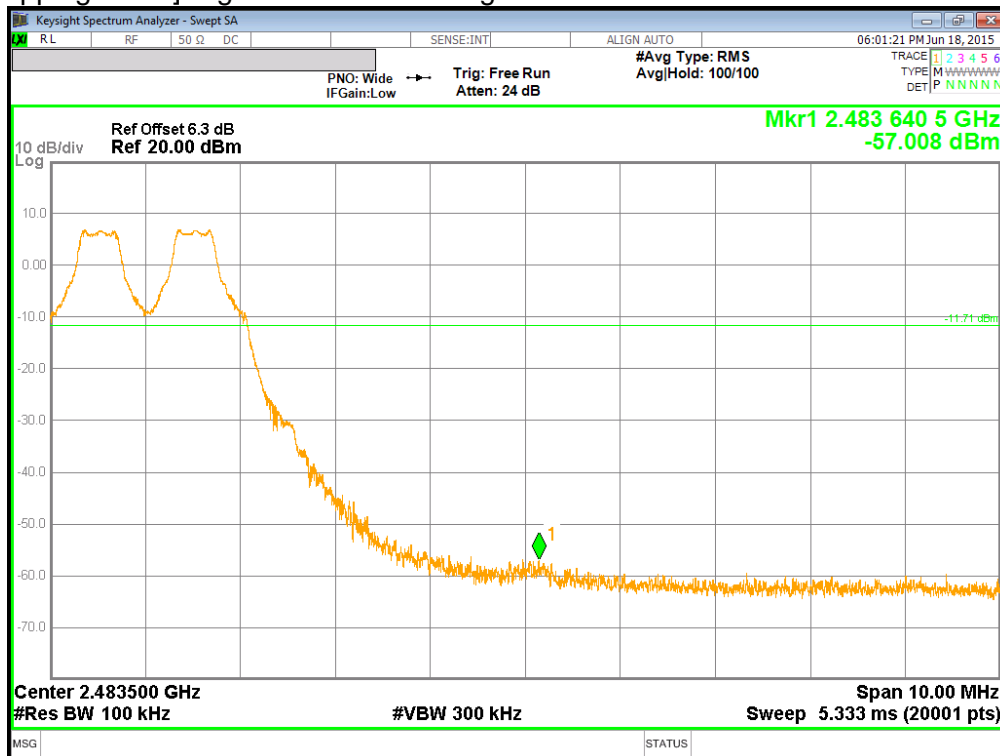


BandEdge Emission at GFSK Hopping Mode

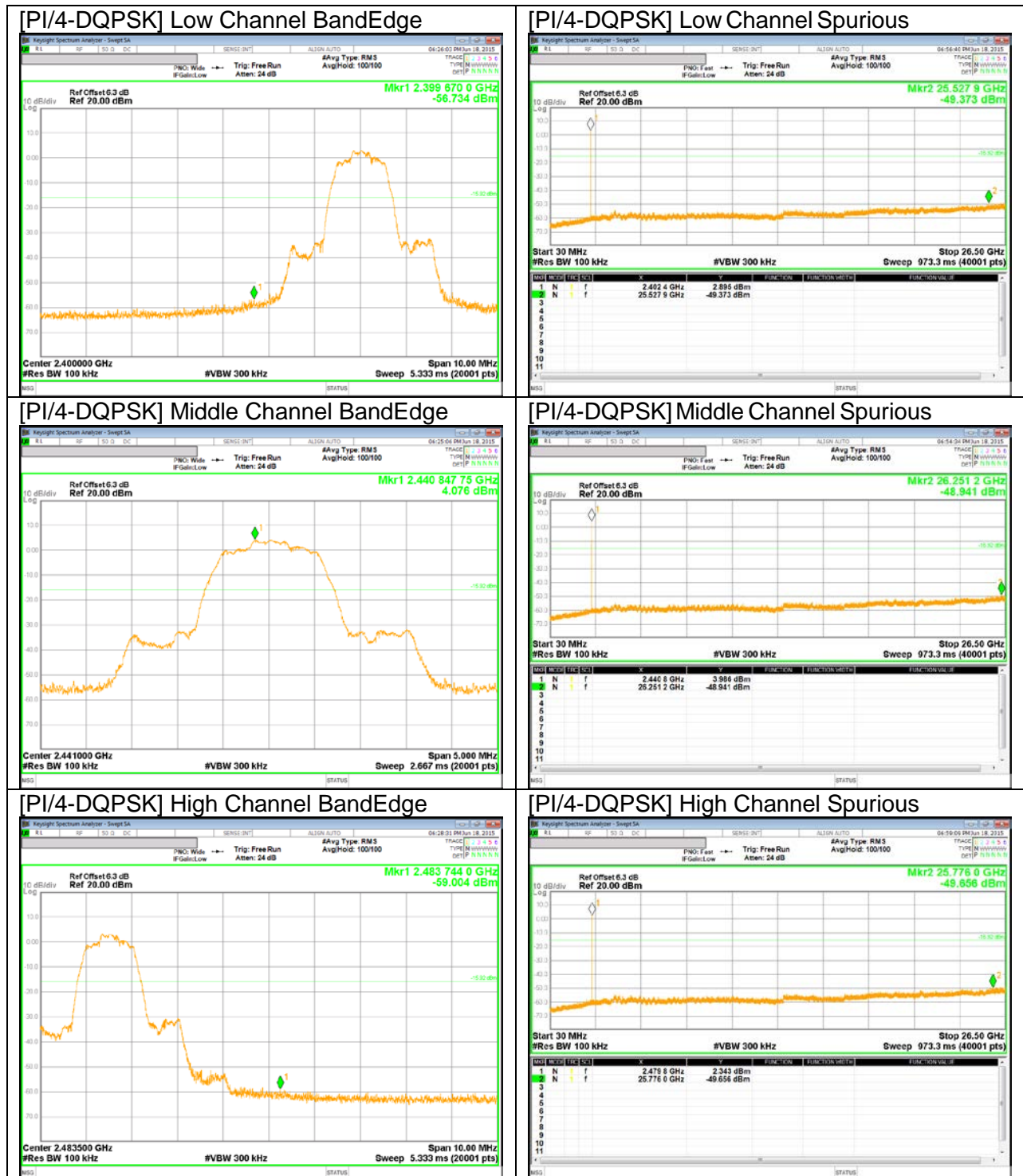
[GFSK Hopping Mode] Low Channel BandEdge



[GFSK Hopping Mode] High Channel BandEdge

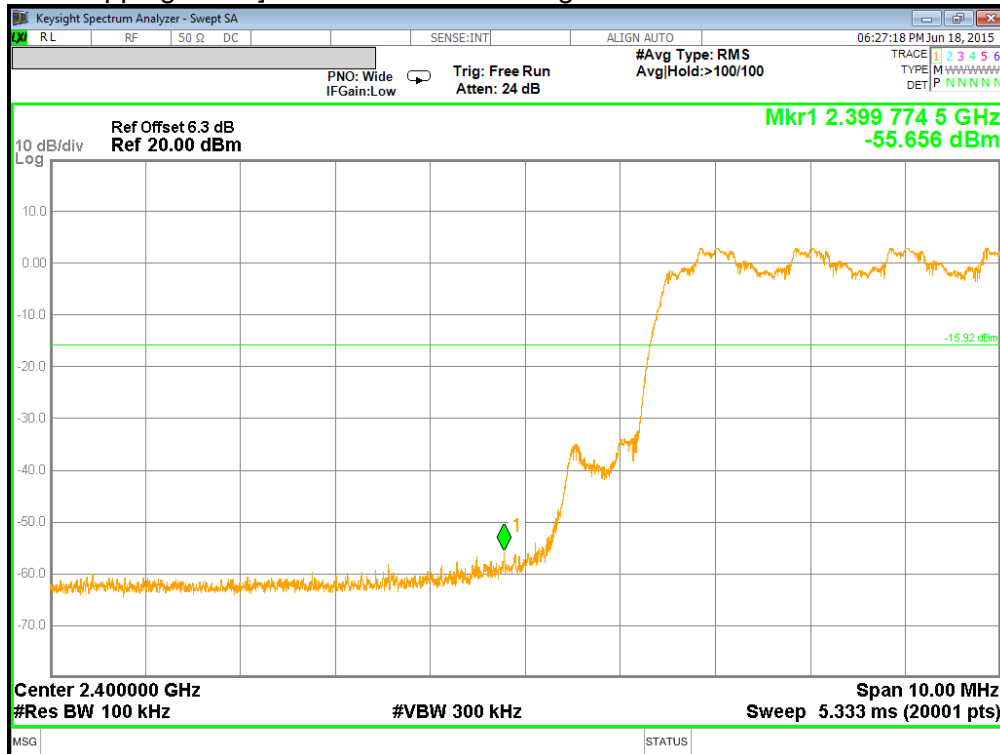


PI/4-DQPSK Mode

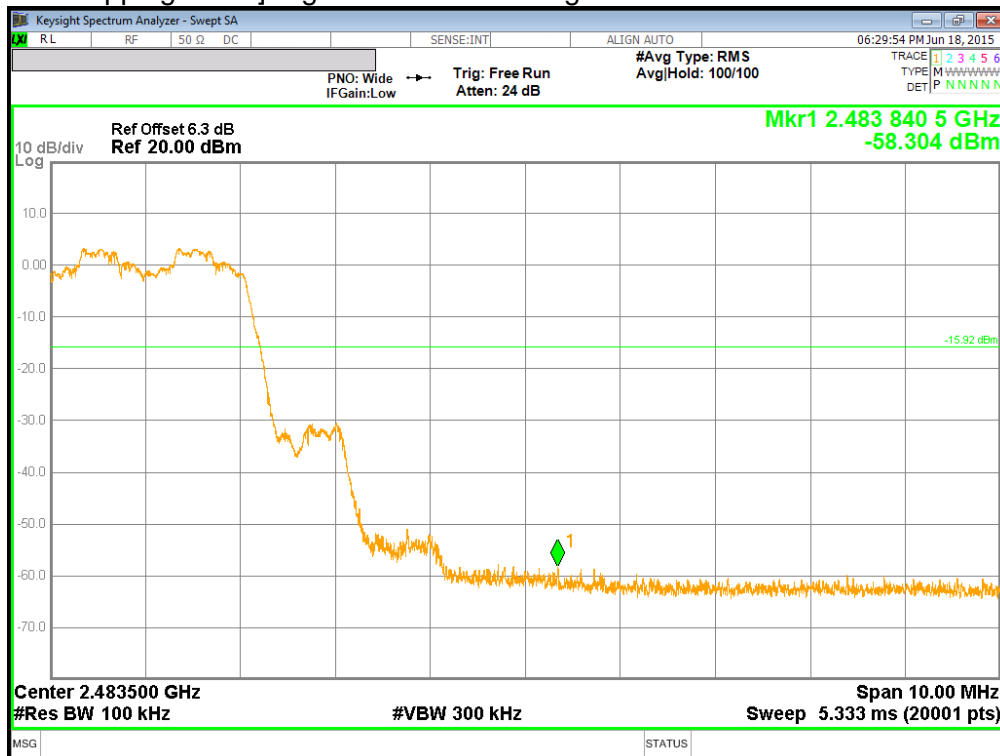


BandEdge Emission at PI/4-DQPSK Hopping Mode

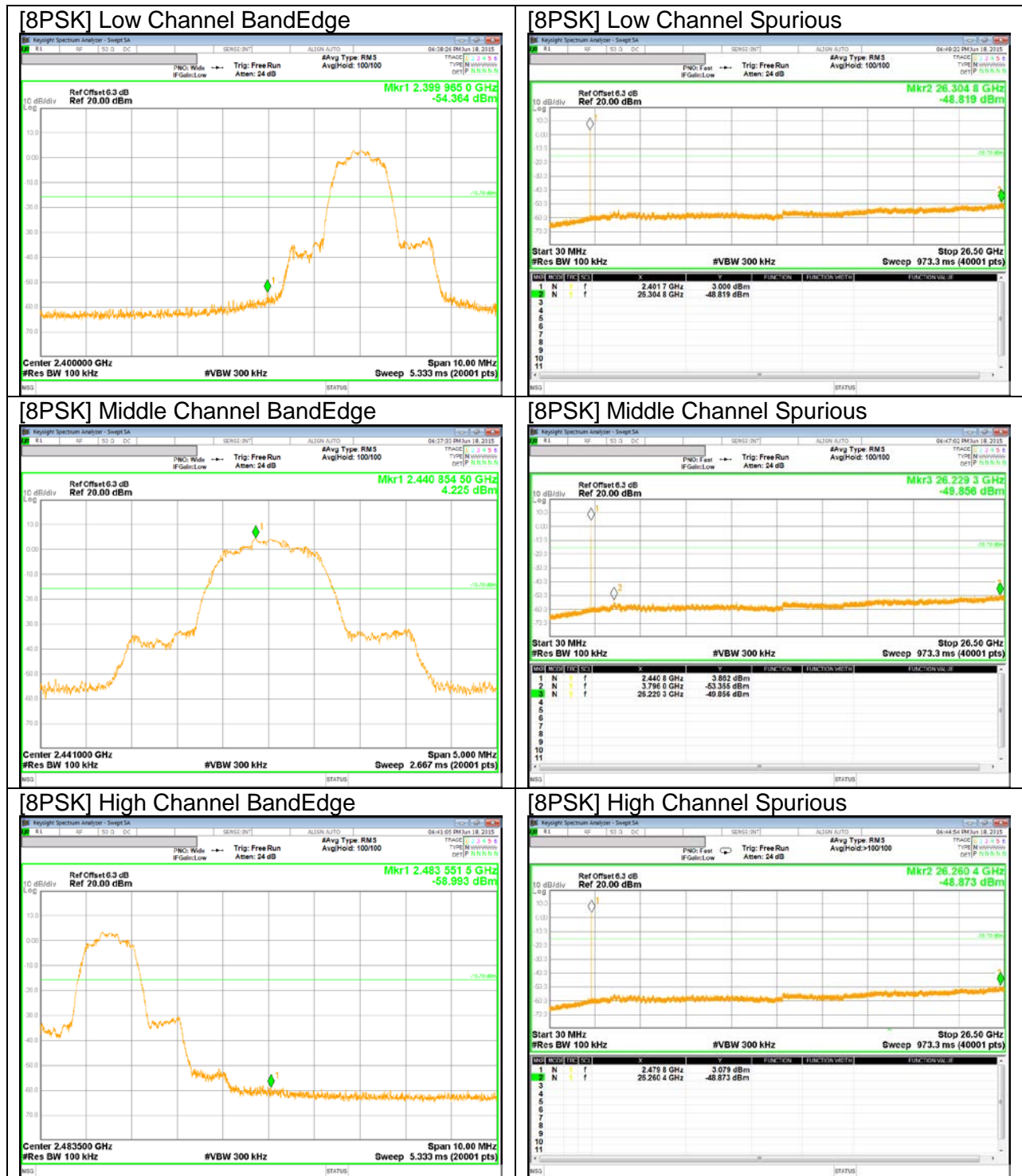
[PI/4-DQPSK Hopping Mode] Low Channel BandEdge



[PI/4-DQPSK Hopping Mode] High Channel BandEdge

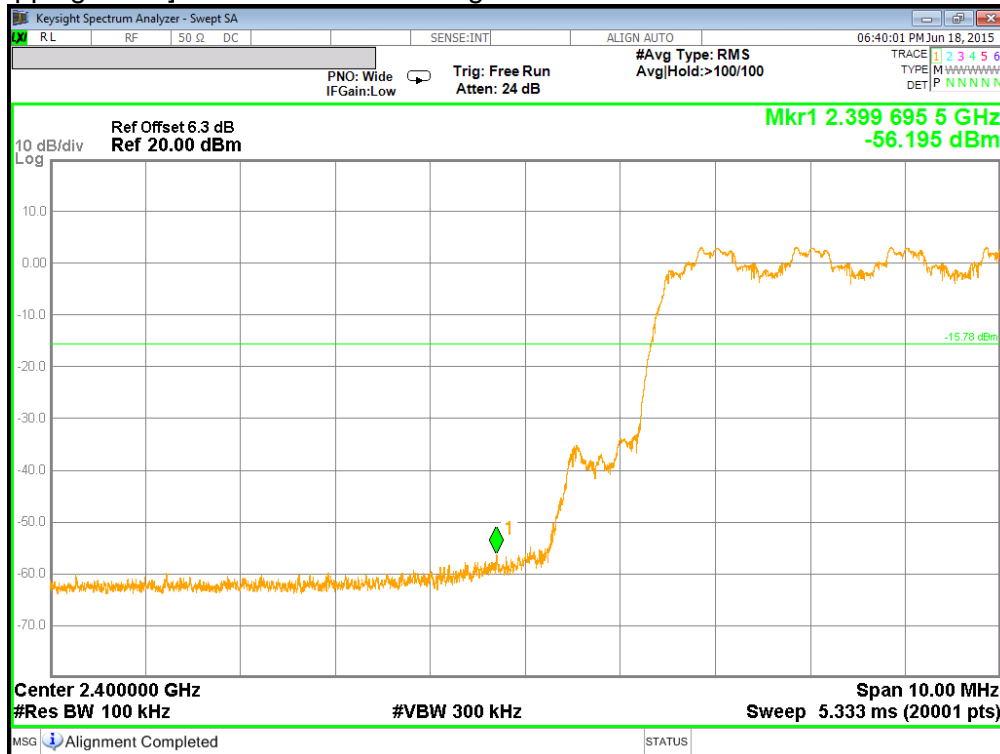


8PSK Mode

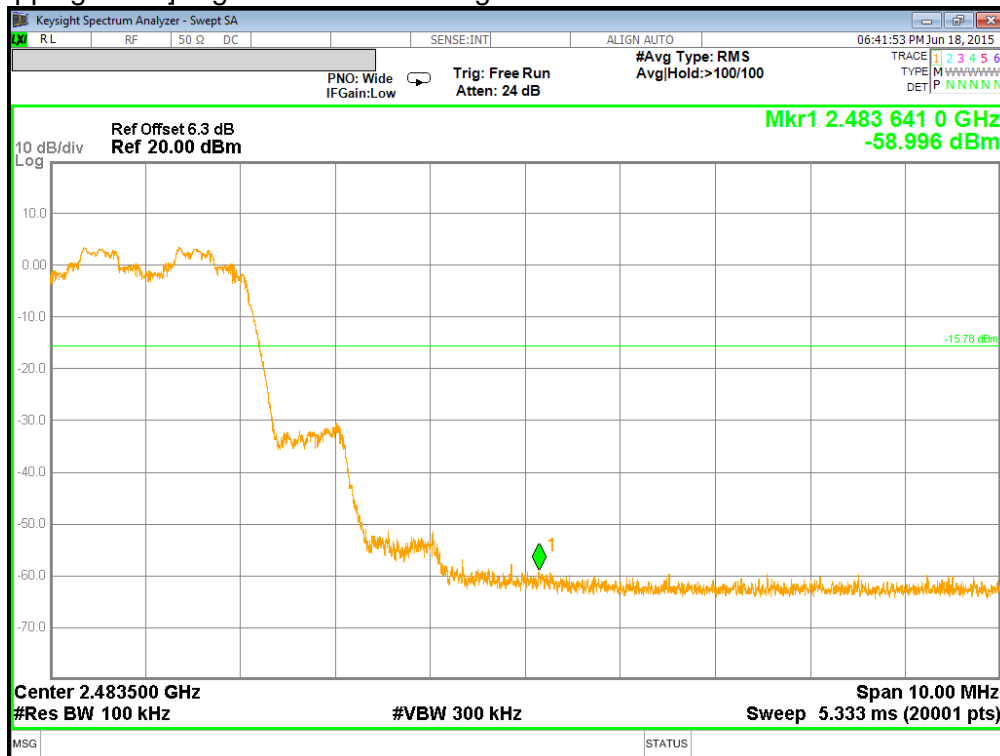


BandEdge Emission at 8PSK Hopping Mode

[8PSK Hopping Mode] Low Channel BandEdge



[8PSK Hopping Mode] High Channel BandEdge



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.

$$\text{GFSK} = 1/T = 1 / 0.0029\text{S} = 350\text{Hz}.$$

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.

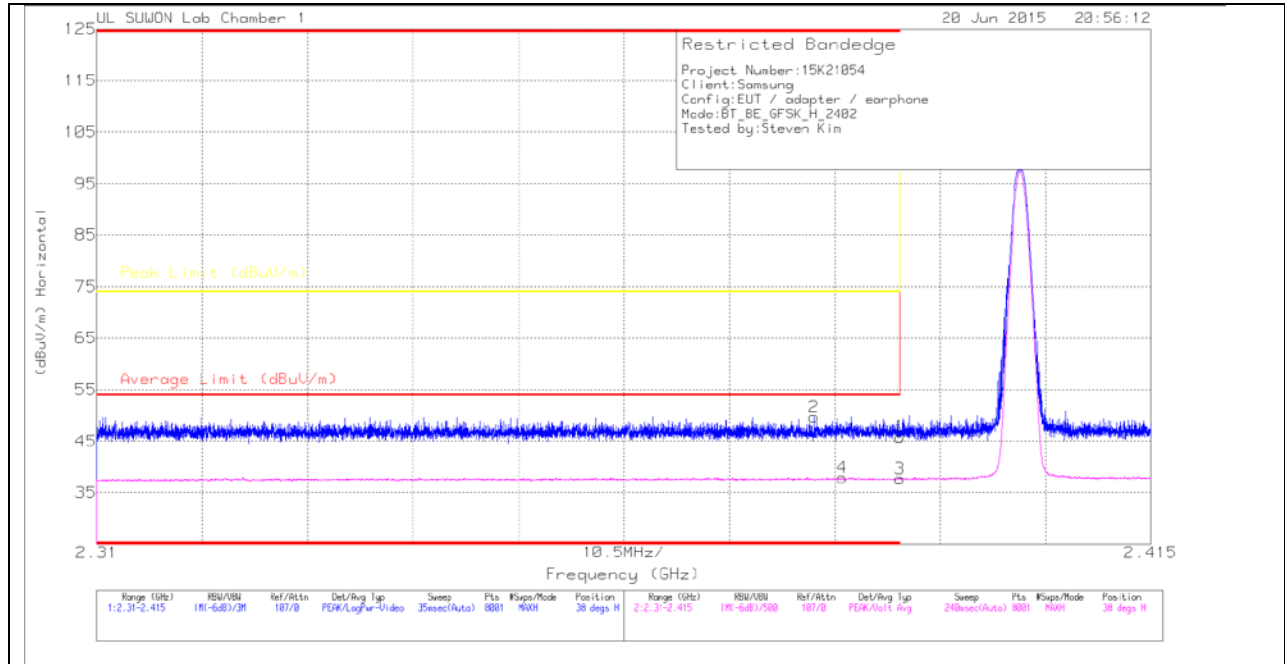
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

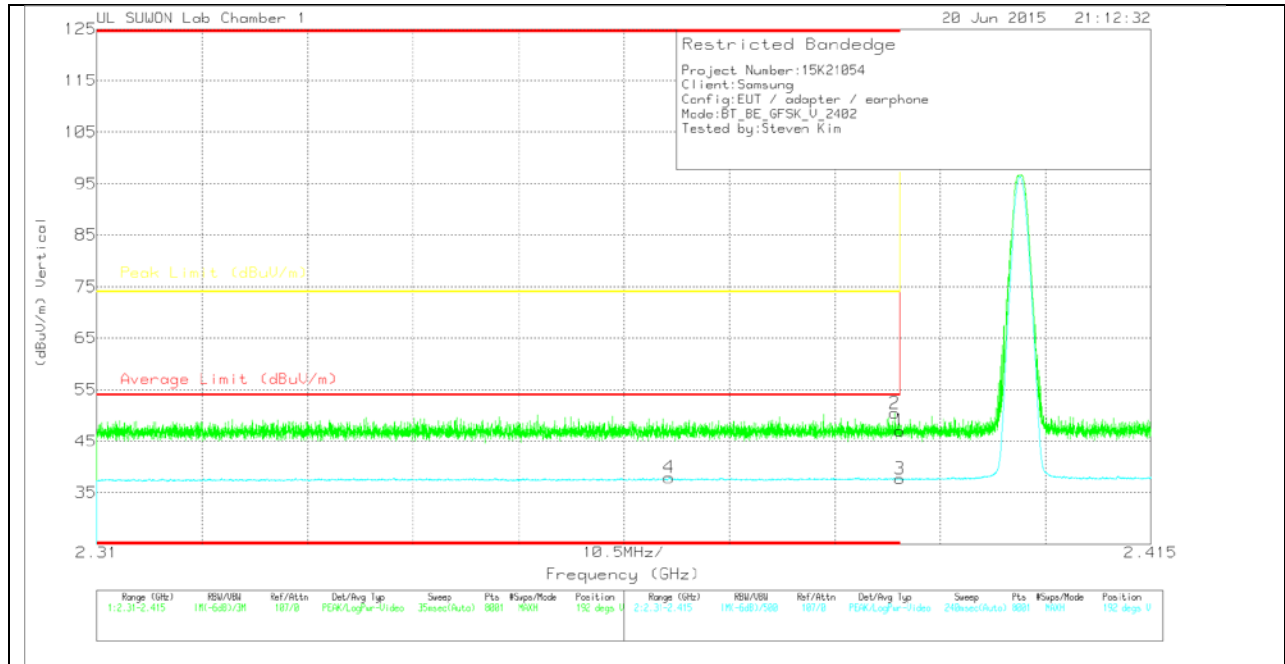
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2_10 dB	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	36.82	Pk	31.8	-22.8	45.82	-	-	74	-28.18	38	253	H
2	* 2.381	40.7	Pk	31.8	-22.8	49.7	-	-	74	-24.3	38	253	H
3	* 2.39	28.69	VB1T	31.8	-22.8	37.69	54	-16.31	-	-	38	253	H
4	* 2.384	28.96	VB1T	31.8	-22.8	37.96	54	-16.04	-	-	38	253	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

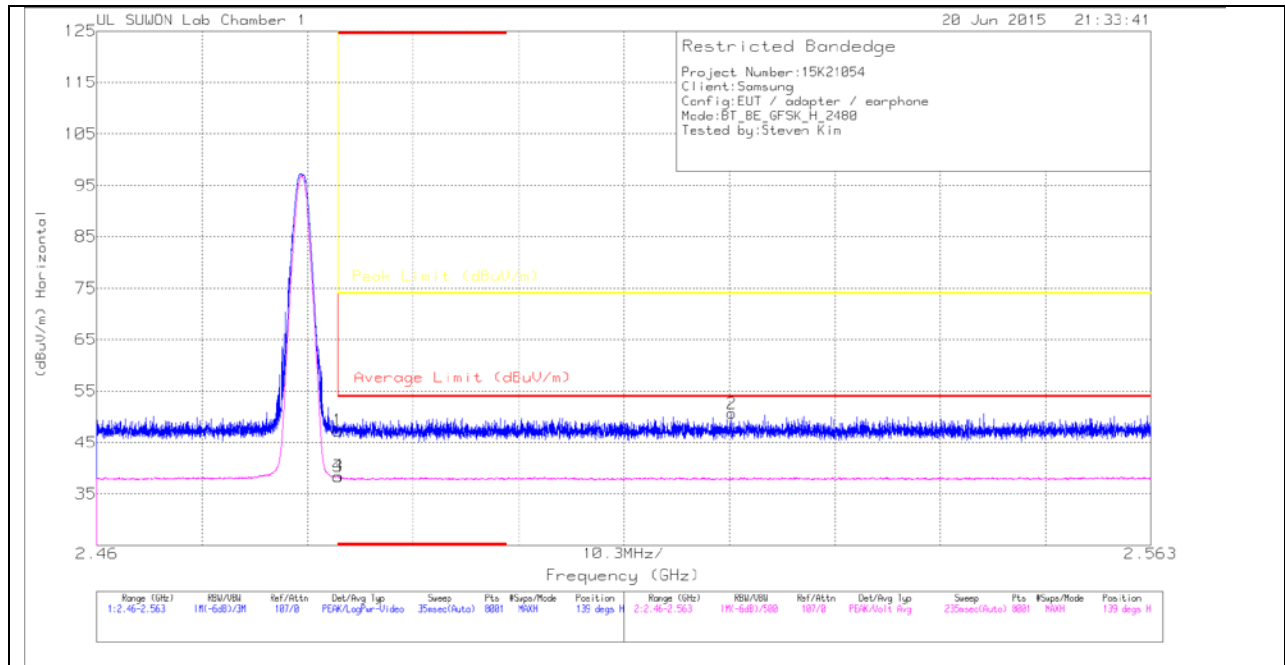
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2_10 dB	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity		
1	* 2.39	38.05	Pk			31.8	-22.8	47.05	-	-	74	-26.95	192	101	V
2	* 2.389	41.45	Pk			31.8	-22.8	50.45	-	-	74	-23.55	192	101	V
3	* 2.39	28.74	VB1T			31.8	-22.8	37.74	54	-16.26	-	-	192	101	V
4	* 2.367	28.99	VB1T			31.8	-22.8	37.99	54	-16.01	-	-	192	101	V

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

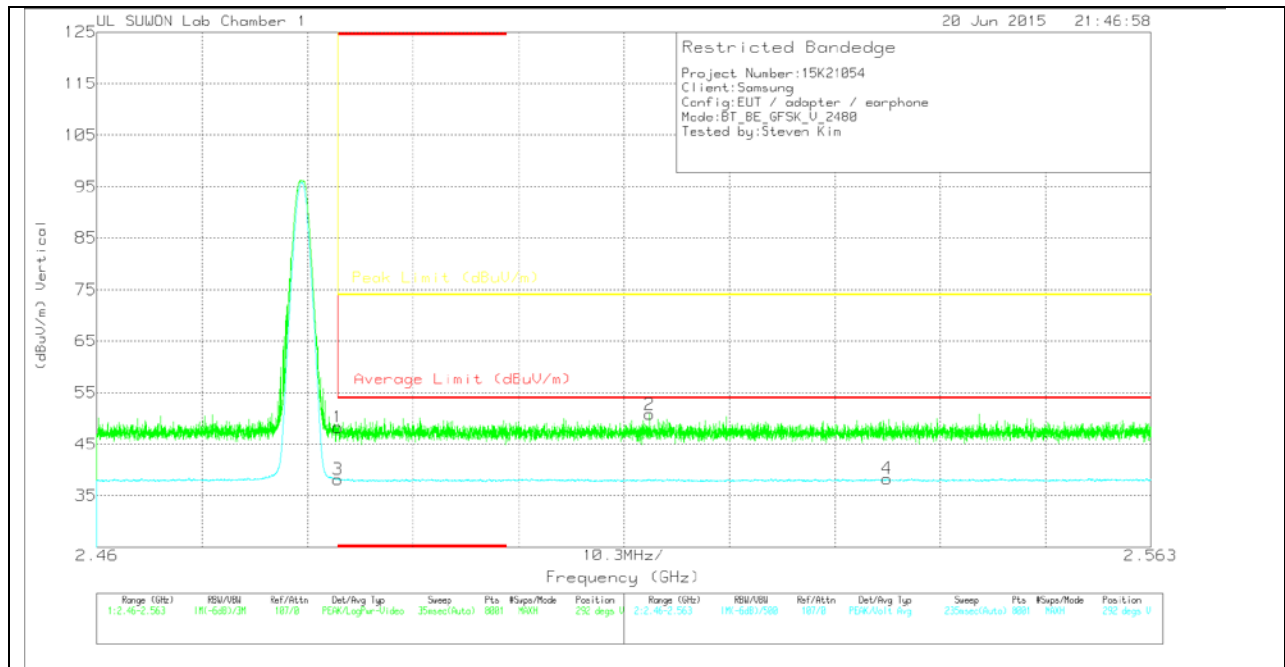
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2_10 dB	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	37.89	Pk	32	-22.6	47.29	-	-	74	-26.71	139	195	H
2	2.522	41.28	Pk	32	-22.6	50.68	-	-	74	-23.32	139	195	H
3	* 2.484	29.06	VB1T	32	-22.6	38.46	54	-15.54	-	-	139	195	H
4	* 2.484	29.09	VB1T	32	-22.6	38.49	54	-15.51	-	-	139	195	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	3117(0016 8717)_150 619	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	38.88	Pk	32	-22.6	48.28	-	-	74	-25.72	292	321	V
2	2.514	41.35	VB	32	-22.6	50.75	-	-	74	-23.25	292	321	V
3	* 2.484	28.77	VB1T	32	-22.6	38.17	54	-15.83	-	-	292	321	V
4	2.537	28.95	VB1T	32	-22.6	38.35	54	-15.65	-	-	292	321	V

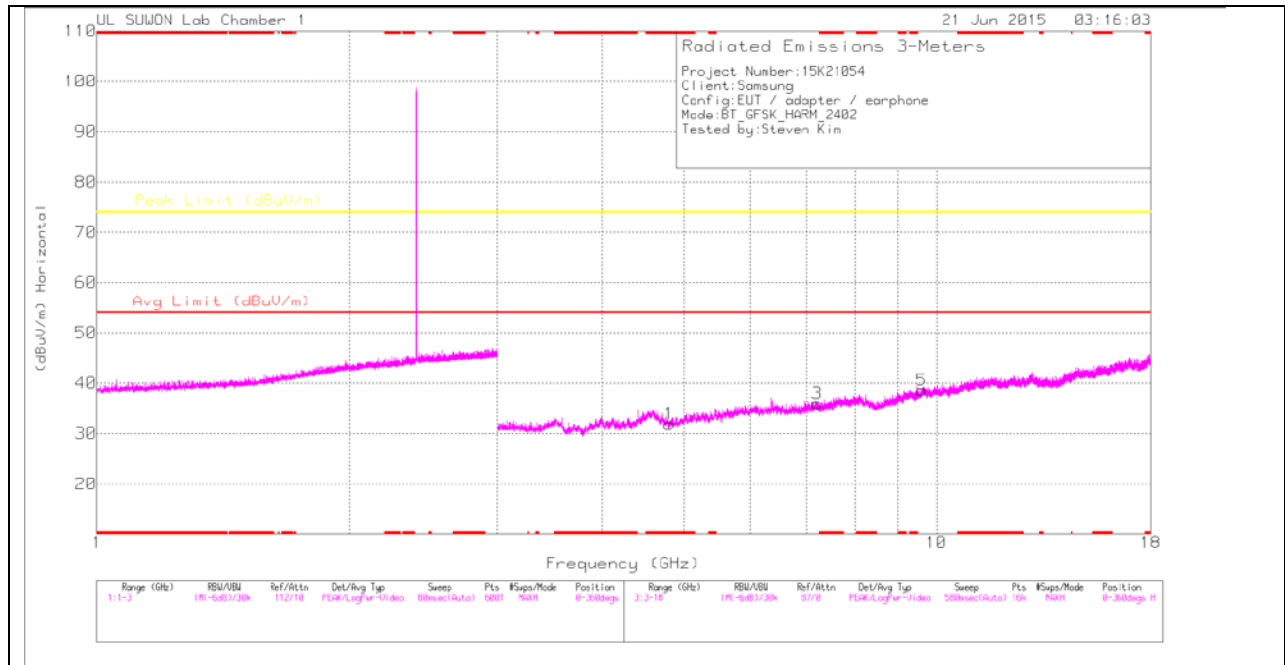
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

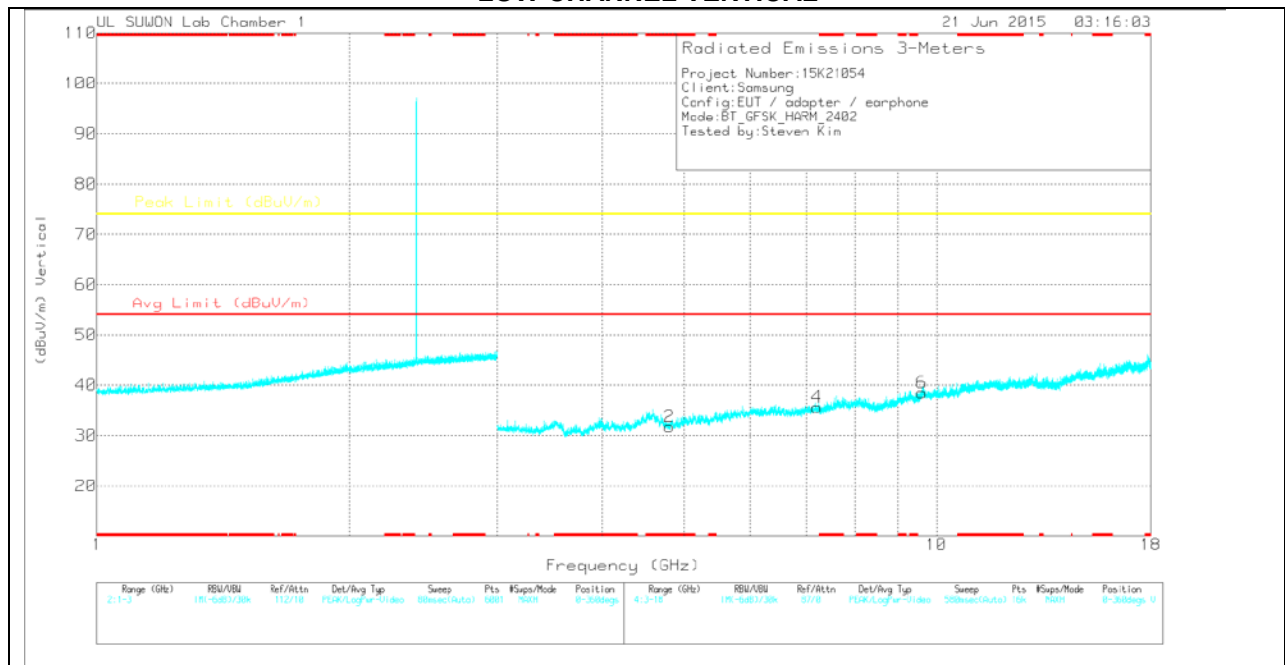
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

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

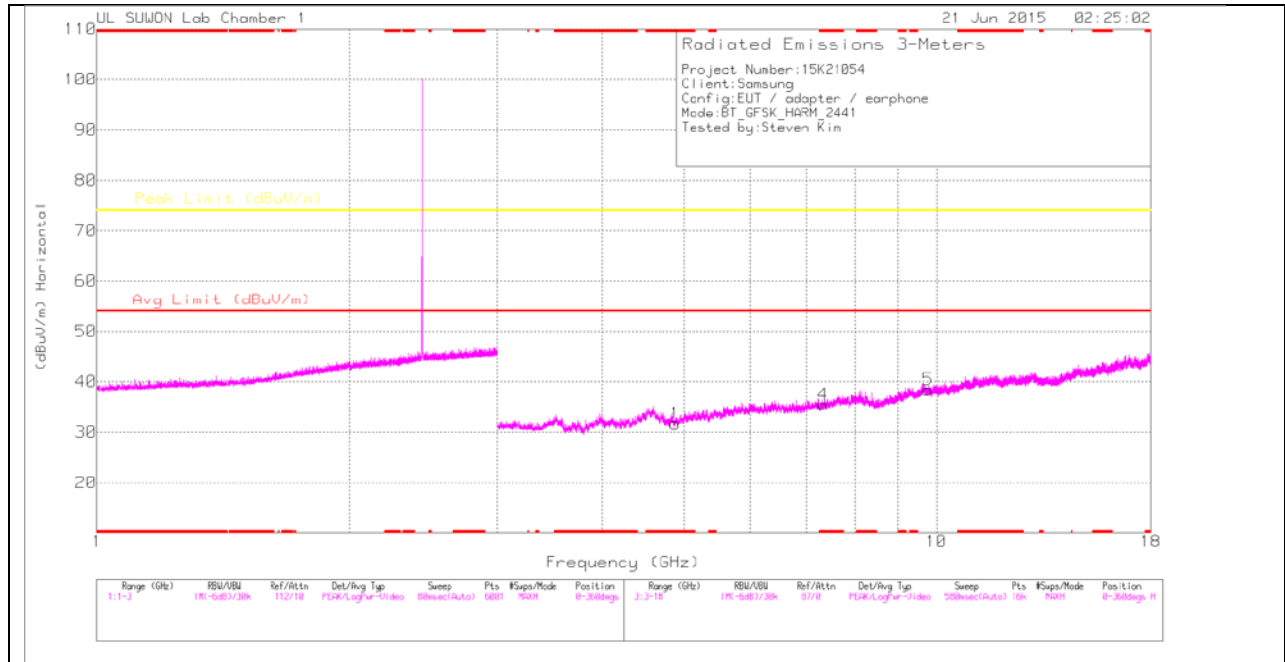
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17_150619)	Path_3_3GHP	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.805	27.73	PK	34	-29.8	31.93	-	-	74	-42.07	0-360	100	H
3	7.206	25.67	PK	35.7	-25.4	35.97	-	-	-	-	0-360	200	H
5	9.607	22.63	PK	37	-21	38.63	-	-	-	-	0-360	100	H
2	* 4.806	27.58	PK	34	-29.8	31.78	-	-	74	-42.22	0-360	100	V
4	7.206	25.36	PK	35.7	-25.4	35.66	-	-	-	-	0-360	200	V
6	9.609	22.51	PK	37	-21	38.51	-	-	-	-	0-360	200	V

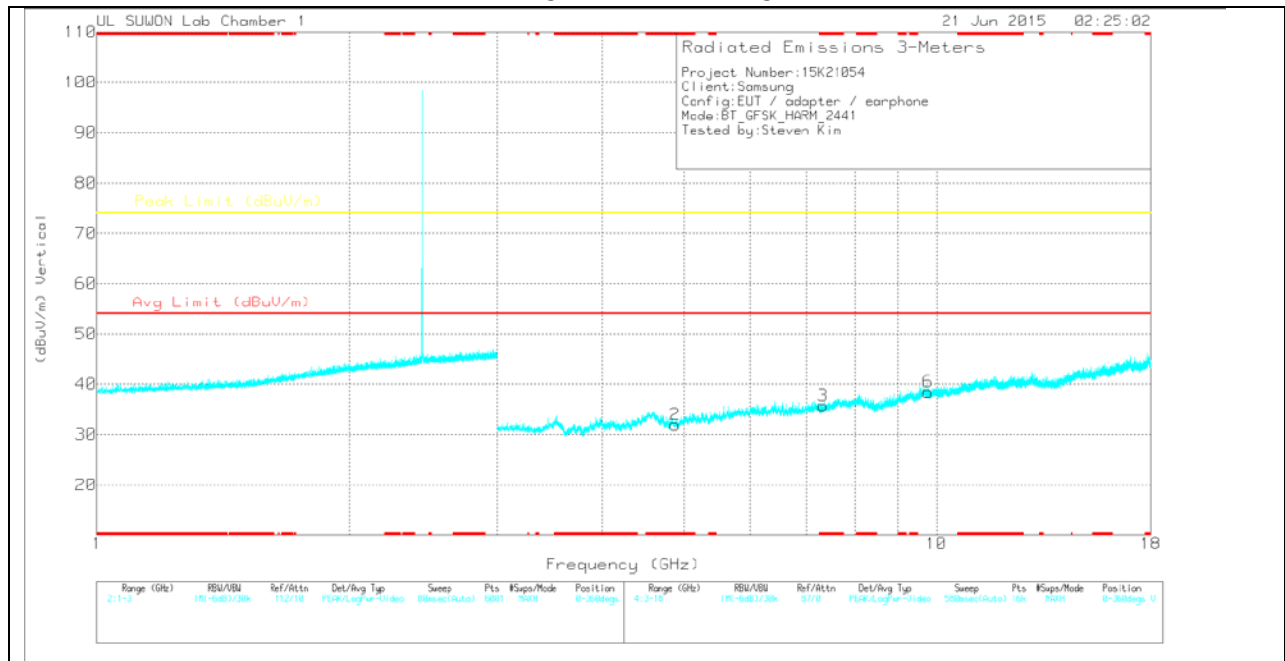
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

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

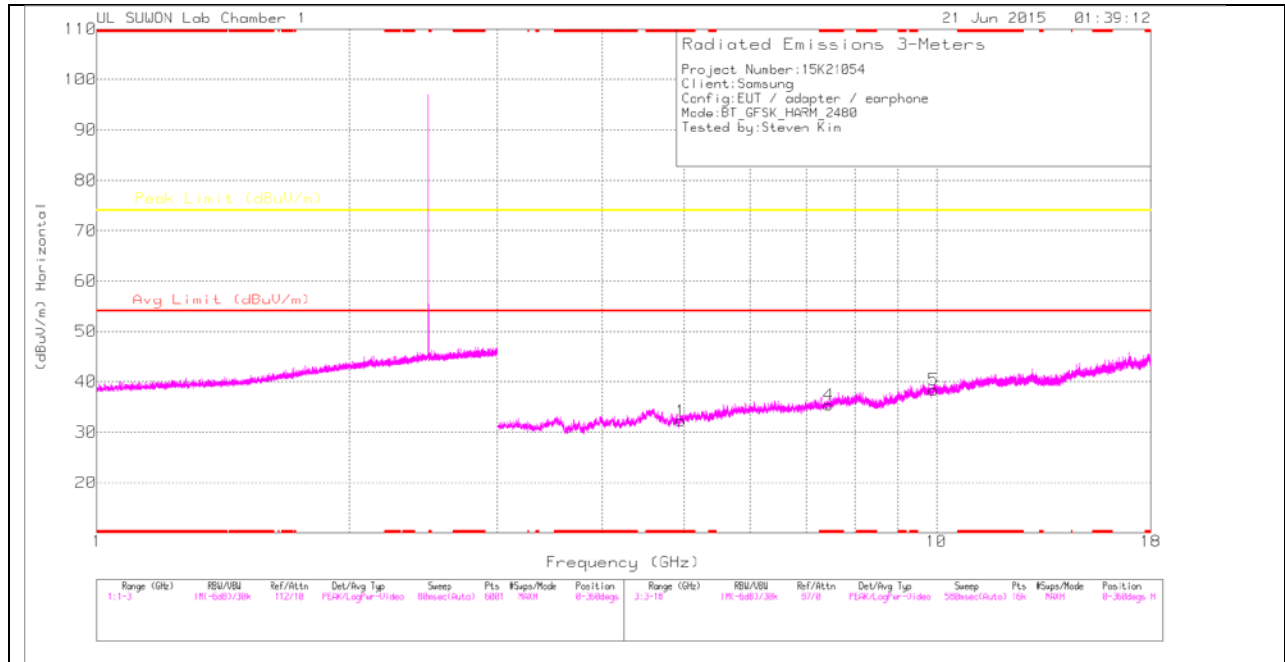
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17_150619)	Path_3_3GHP	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.882	26.8	PK	34	-29.1	31.7	-	-	74	-42.3	0-360	100	H
4	* 7.323	25.31	PK	35.8	-25.6	35.51	-	-	74	-38.49	0-360	200	H
5	9.765	23.22	PK	37.2	-22	38.42	-	-	-	-	0-360	100	H
2	* 4.882	27.05	PK	34	-29.1	31.95	-	-	74	-42.05	0-360	200	V
3	* 7.323	25.53	PK	35.8	-25.6	35.73	-	-	74	-38.27	0-360	100	V
6	9.766	23.35	PK	37.2	-22.1	38.45	-	-	-	-	0-360	100	V

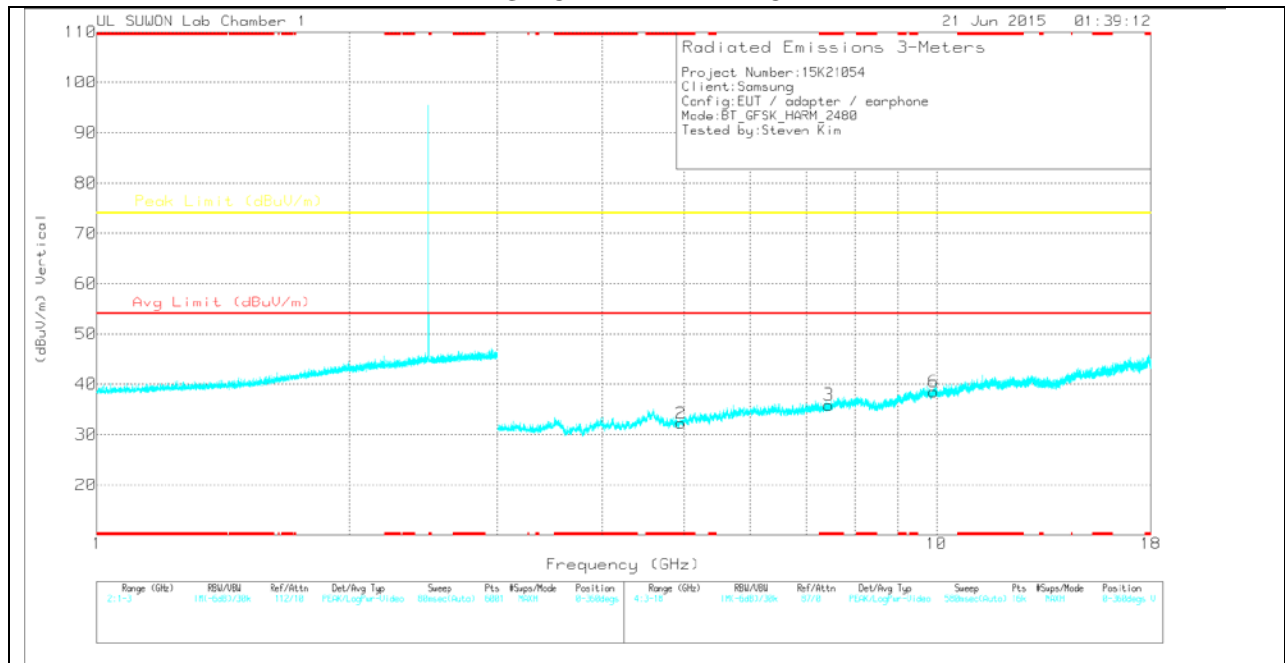
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

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

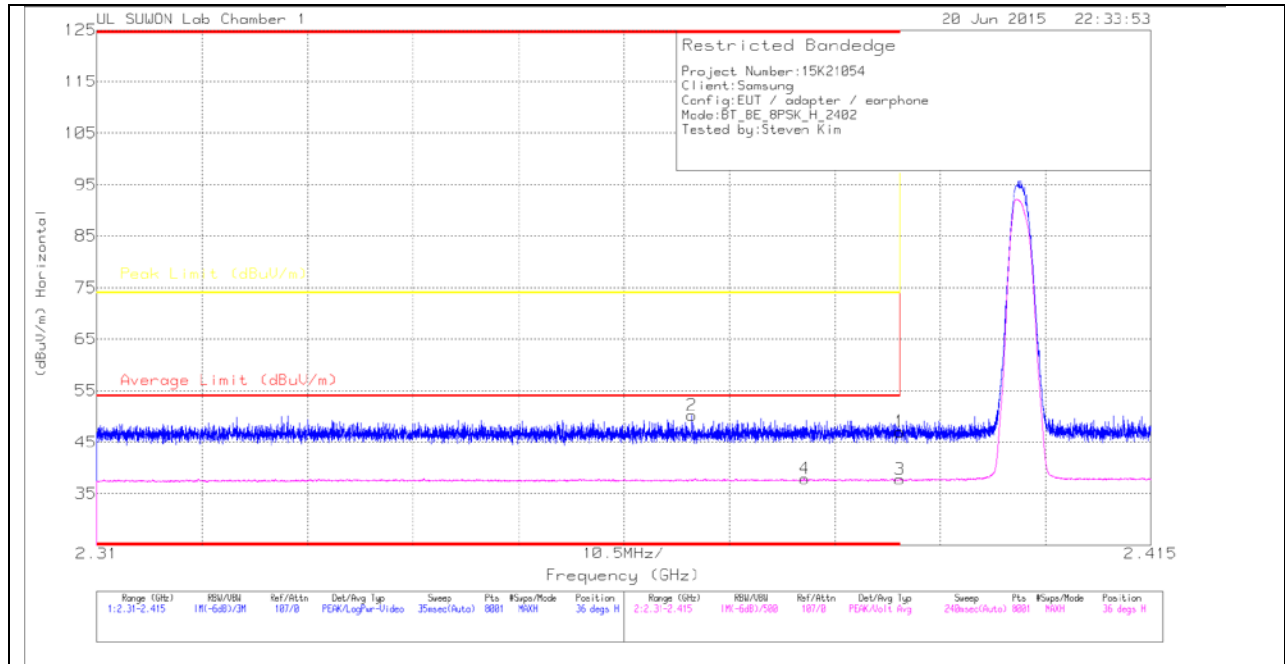
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17_150619)	Path_3_3GHP	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.959	27.16	PK	34	-28.9	32.26	-	-	74	-41.74	0-360	100	H
4	* 7.44	24.37	PK	35.8	-24.8	35.37	-	-	74	-38.63	0-360	100	H
5	9.92	21.38	PK	37.4	-20.4	38.38	-	-	-	-	0-360	100	H
2	* 4.959	27.16	PK	34	-28.9	32.26	-	-	74	-41.74	0-360	200	V
3	* 7.44	24.91	PK	35.8	-24.8	35.91	-	-	74	-38.09	0-360	200	V
6	9.918	21.49	PK	37.4	-20.4	38.49	-	-	-	-	0-360	200	V

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

PK – Peak detector

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



HORIZONTAL DATA

Trace Markers

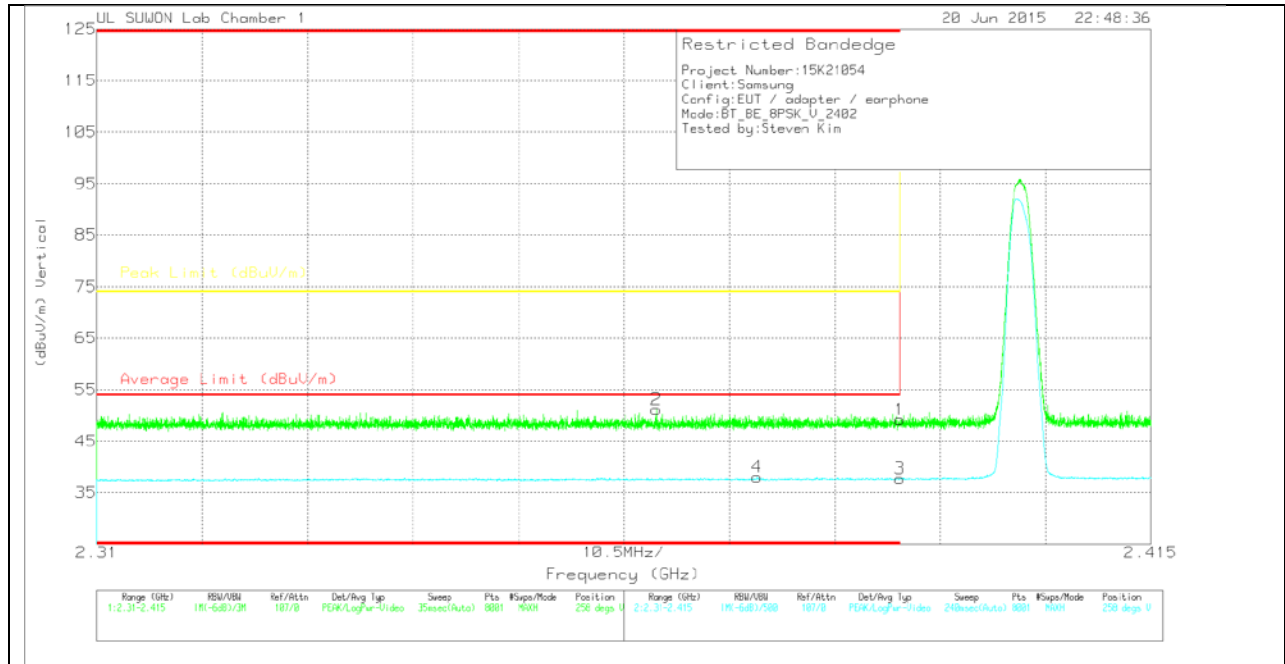
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2_10 dB	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.02	Pk	31.8	-22.8	47.02	-	-	74	-26.98	36	254	H
2	* 2.369	41.21	Pk	31.8	-22.8	50.21	-	-	74	-23.79	36	254	H
3	* 2.39	28.82	VB1T	31.8	-22.8	37.82	54	-16.18	-	-	36	254	H
4	* 2.38	28.95	VB1T	31.8	-22.8	37.95	54	-16.05	-	-	36	254	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	3117(0016 8717)_150 619	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	40.18	Pk	31.8	-22.8	49.18	-	-	74	-24.82	258	347	V
2	* 2.366	42.18	Pk	31.8	-22.8	51.18	-	-	74	-22.82	258	347	V
3	* 2.39	28.75	VB1T	31.8	-22.8	37.75	54	-16.25	-	-	258	347	V
4	* 2.376	29.05	VB1T	31.8	-22.8	38.05	54	-15.95	-	-	258	347	V

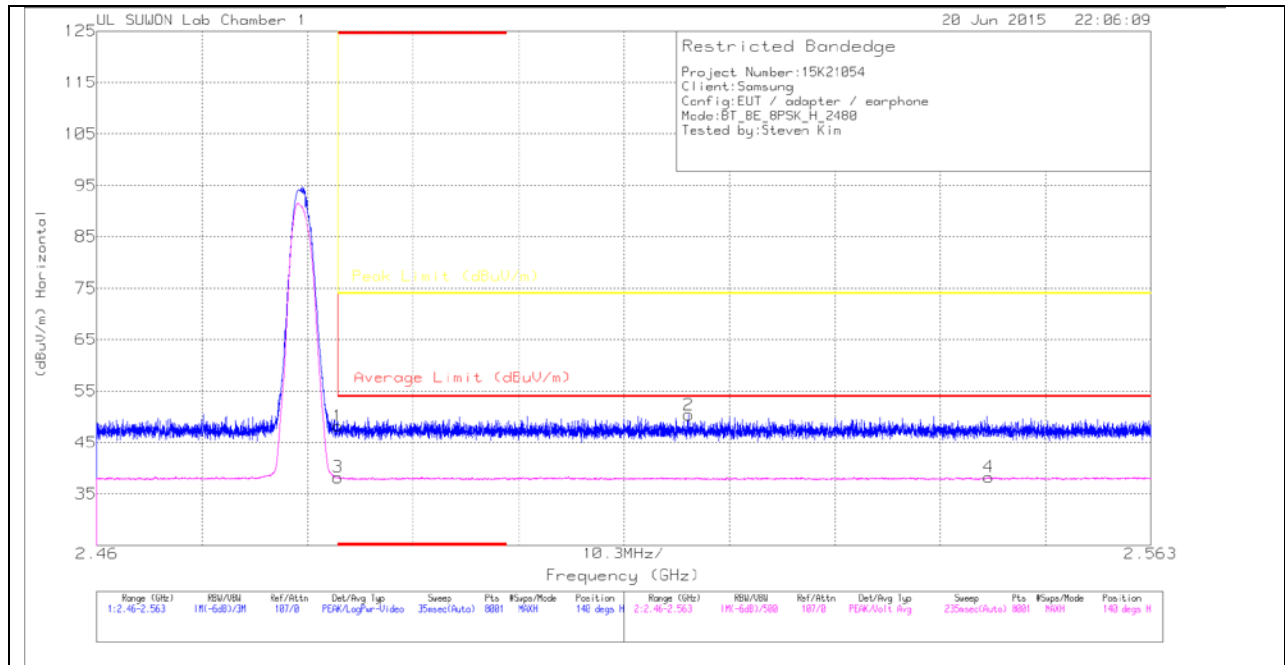
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

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

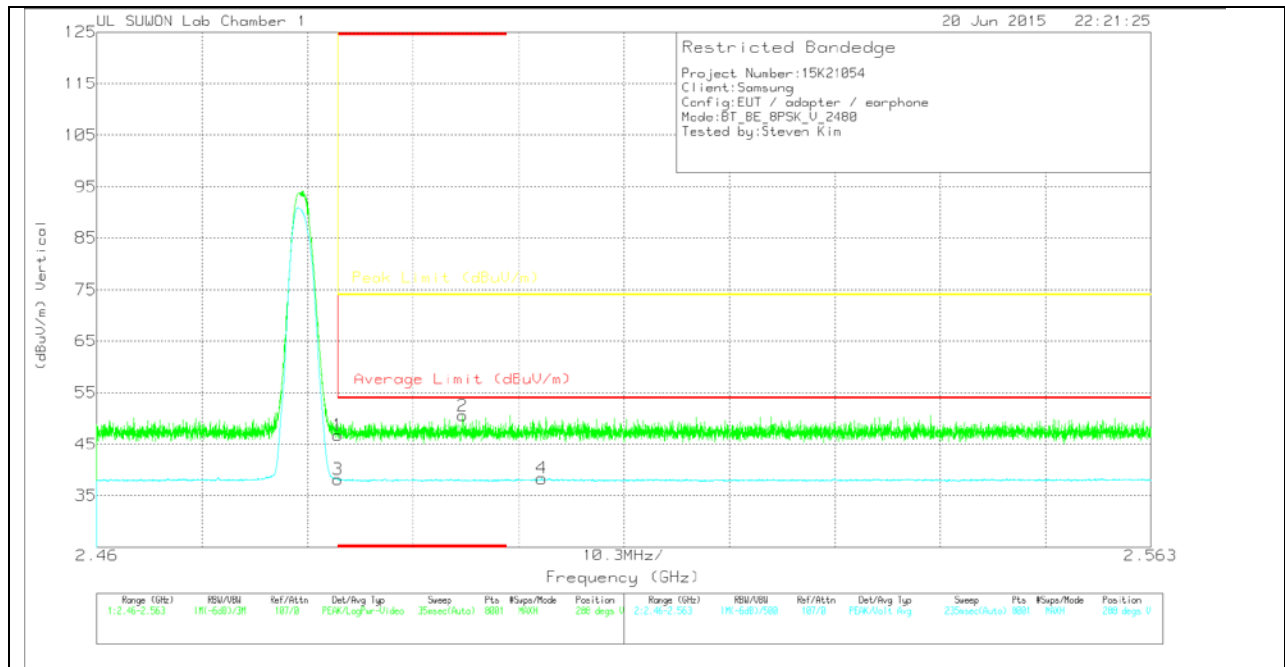
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	Path_2_10 dB	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	38.8	Pk	32	-22.6	48.2	-	-	74	-25.8	140	194	H
2	2.518	40.96	Pk	32	-22.6	50.36	-	-	74	-23.64	140	194	H
3	* 2.484	28.86	VB1T	32	-22.6	38.26	54	-15.74	-	-	140	194	H
4	2.547	28.91	VB1T	32	-22.6	38.31	54	-15.69	-	-	140	194	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	3117(0016 8717)_150 619	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	37.31	Pk	32	-22.6	46.71	-	-	74	-27.29	288	323	V
2	* 2.496	41.15	Pk	32	-22.6	50.55	-	-	74	-23.45	288	323	V
3	* 2.484	28.78	VB1T	32	-22.6	38.18	54	-15.82	-	-	288	323	V
4	2.503	28.99	VB1T	32	-22.6	38.39	54	-15.61	-	-	288	323	V

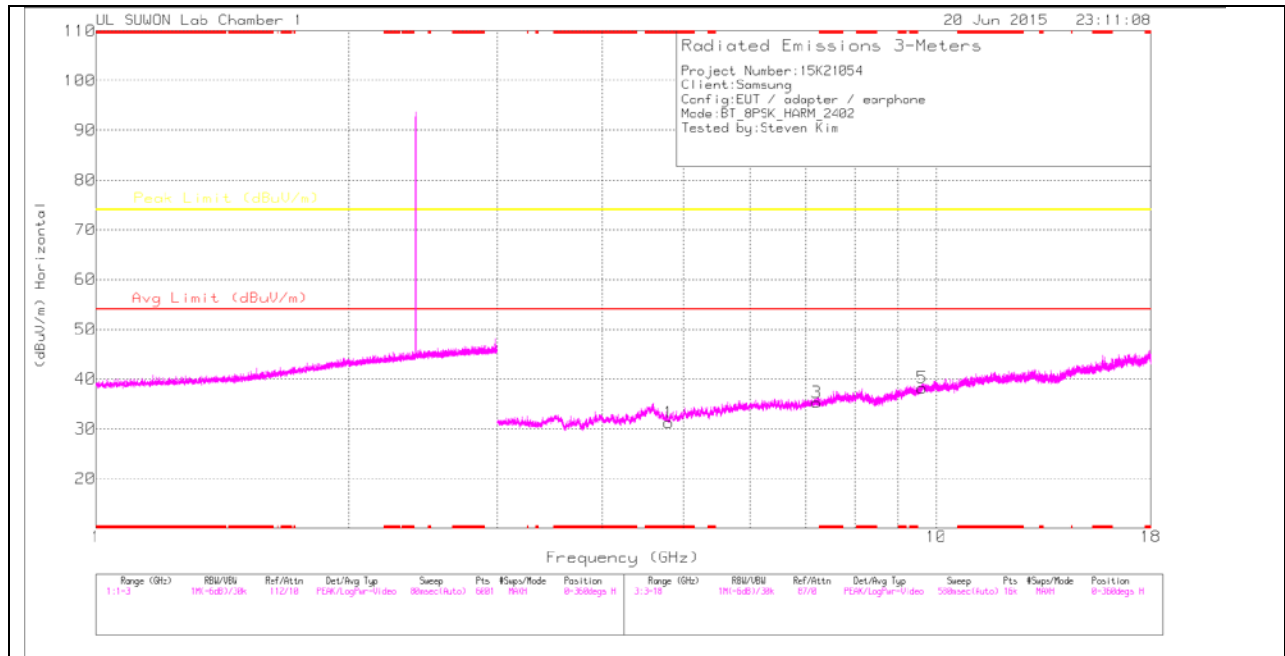
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

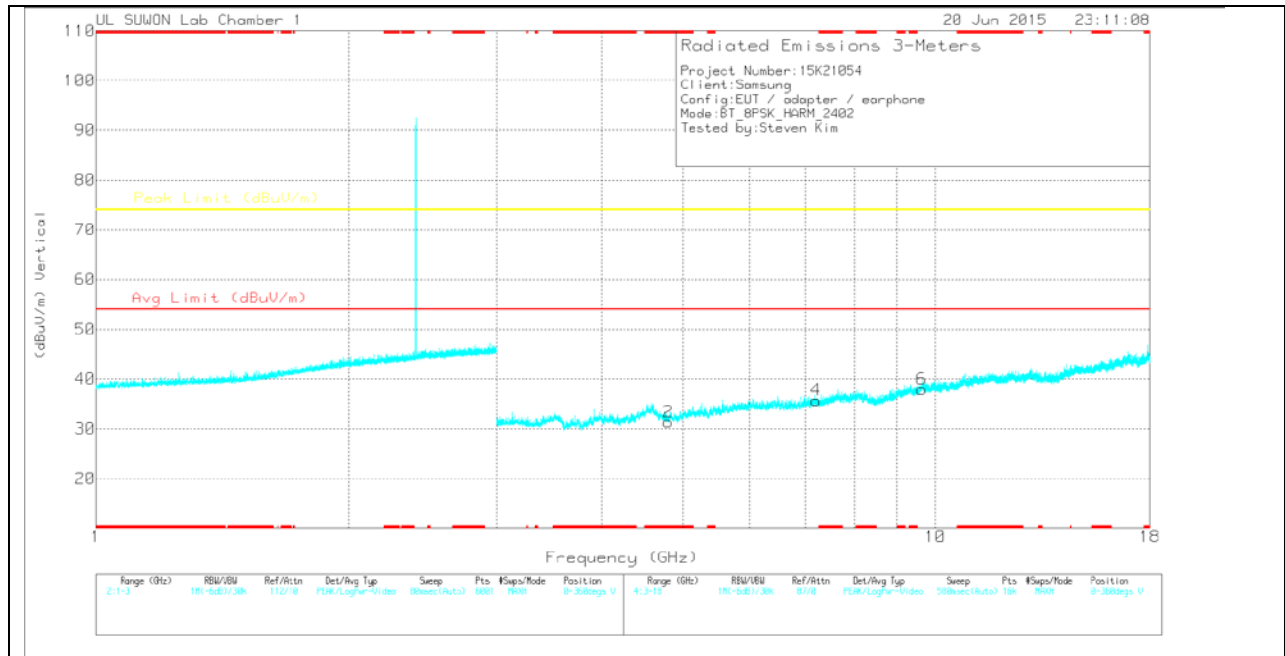
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

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

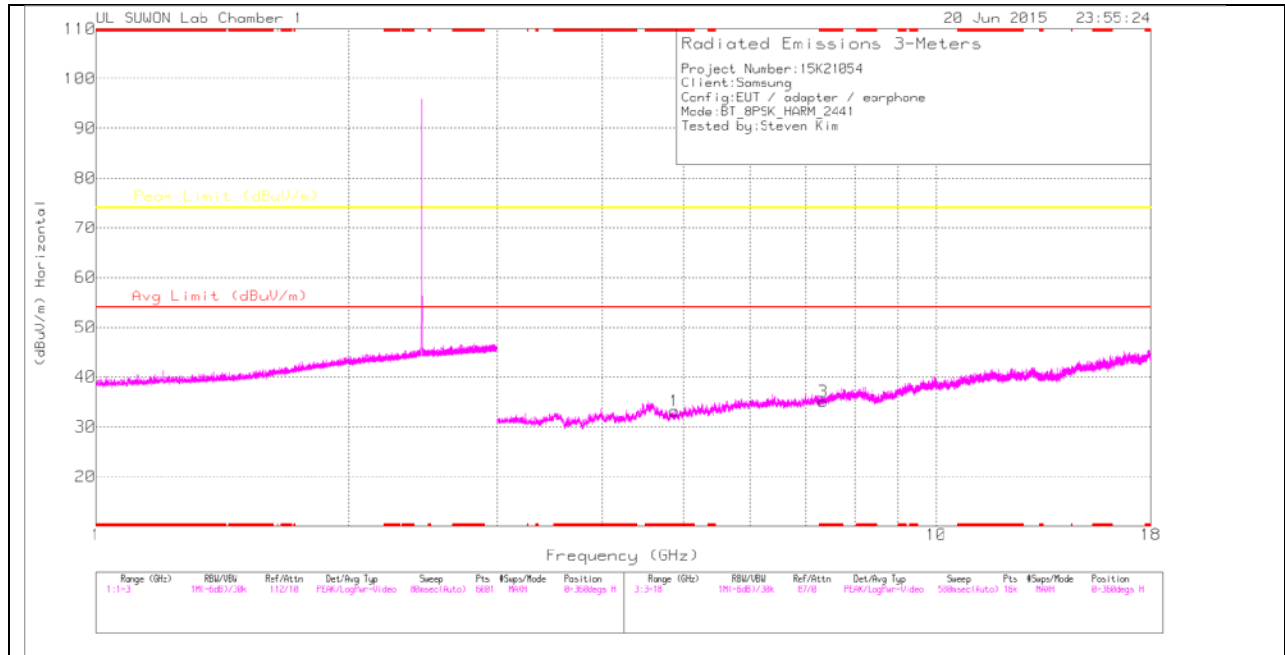
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17_150619)	Path_3_3GHP	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.805	27.07	PK	34	-29.8	31.27	-	-	74	-42.73	0-360	200	H
3	7.206	25.04	PK	35.7	-25.4	35.34	-	-	-	-	0-360	100	H
5	9.616	22.19	PK	37	-21	38.19	-	-	-	-	0-360	100	H
2	* 4.804	27.16	PK	34	-29.8	31.36	-	-	74	-42.64	0-360	200	V
4	7.206	25.45	PK	35.7	-25.4	35.75	-	-	-	-	0-360	200	V
6	9.616	22.01	PK	37	-21	38.01	-	-	-	-	0-360	200	V

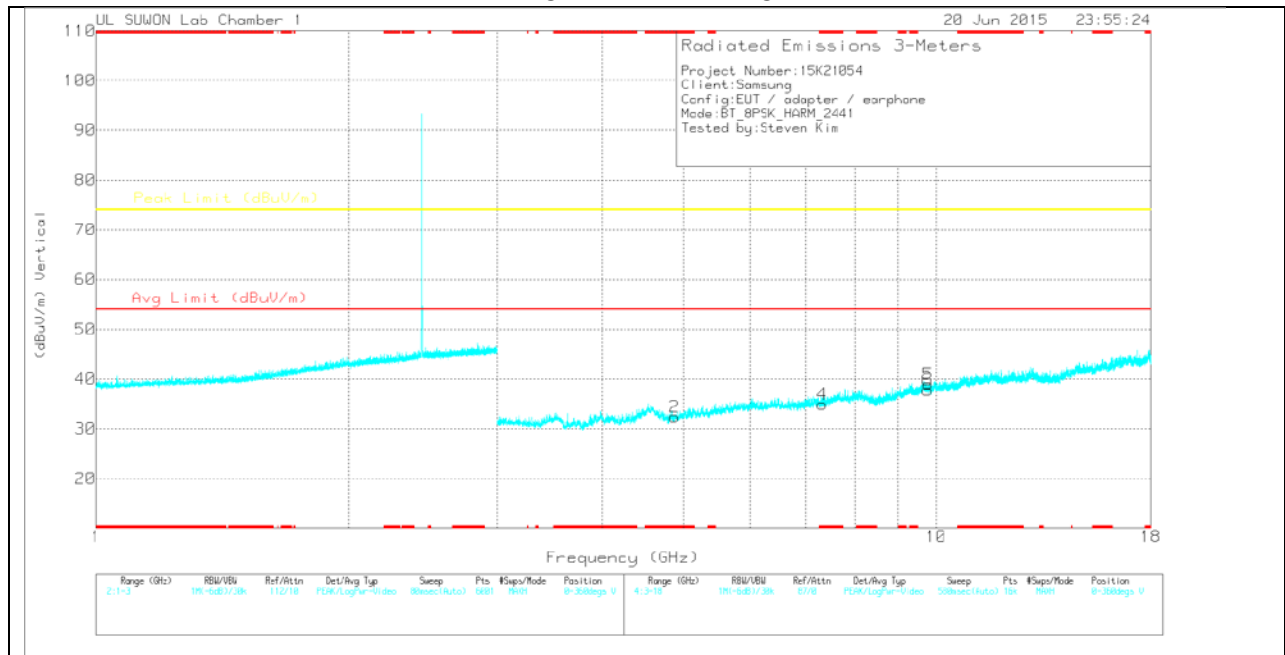
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

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

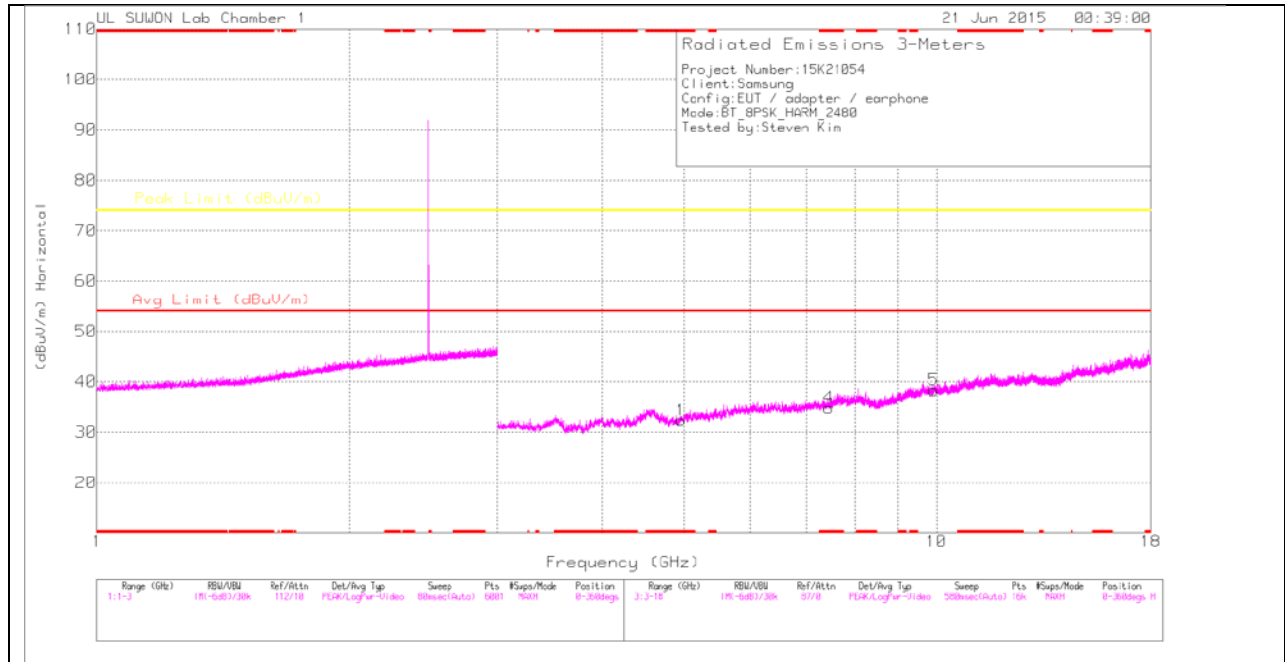
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(001687 17_150619)	Path_3_3GHP	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.882	28.28	PK	34	-29.1	33.18	-	-	74	-40.82	0-360	100	H
3	* 7.323	24.8	PK	35.8	-25.6	35	-	-	74	-39	0-360	100	H
2	* 4.881	27.46	PK	34	-29.1	32.36	-	-	74	-41.64	0-360	100	V
4	* 7.323	24.72	PK	35.8	-25.6	34.92	-	-	74	-39.08	0-360	200	V
5	9.766	23.84	PK	37.2	-22.1	38.94	-	-	-	-	0-360	200	V
6	9.765	22.66	PK	37.2	-22	37.86	-	-	-	-	0-360	200	V

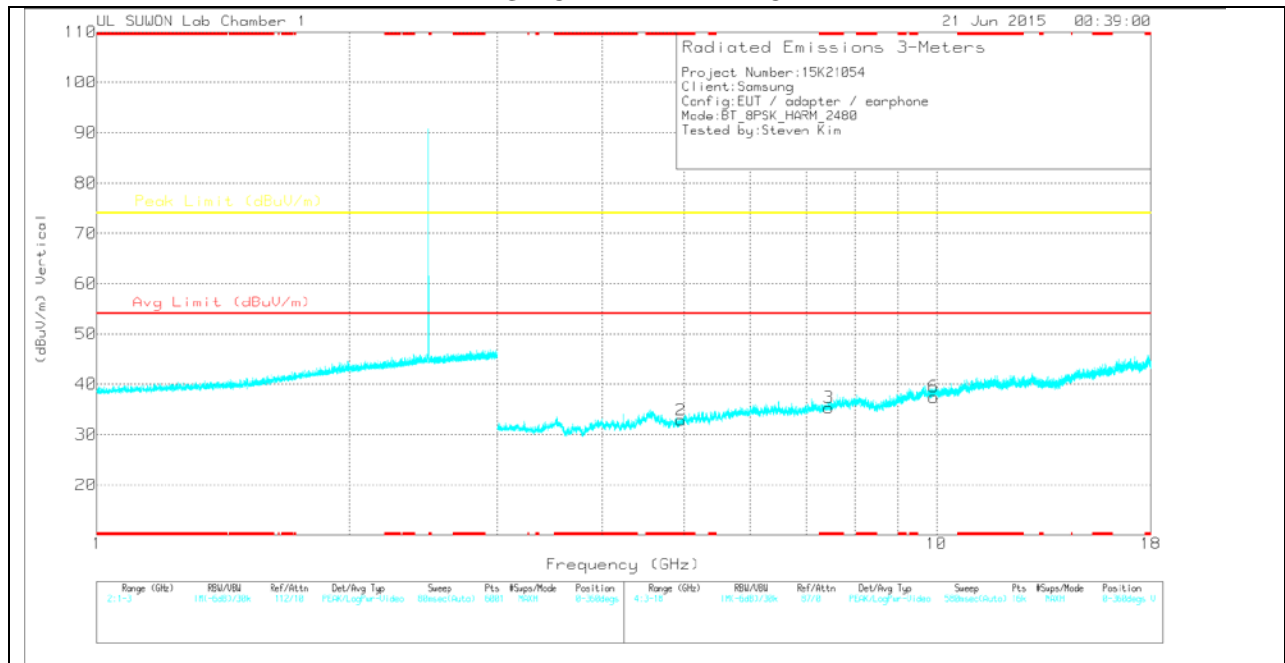
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

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	3117(001687 17_150619)	Path_3_3GHP	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.96	27.25	PK	34	-28.9	32.35	-	-	74	-41.65	0-360	100	H
4	* 7.441	23.83	PK	35.8	-24.8	34.83	-	-	74	-39.17	0-360	100	H
5	9.92	21.33	PK	37.4	-20.4	38.33	-	-	-	-	0-360	100	H
2	* 4.96	27.74	PK	34	-28.9	32.84	-	-	74	-41.16	0-360	200	V
3	* 7.441	24.33	PK	35.8	-24.8	35.33	-	-	74	-38.67	0-360	200	V
6	9.918	20.45	PK	37.4	-20.4	37.45	-	-	-	-	0-360	100	V

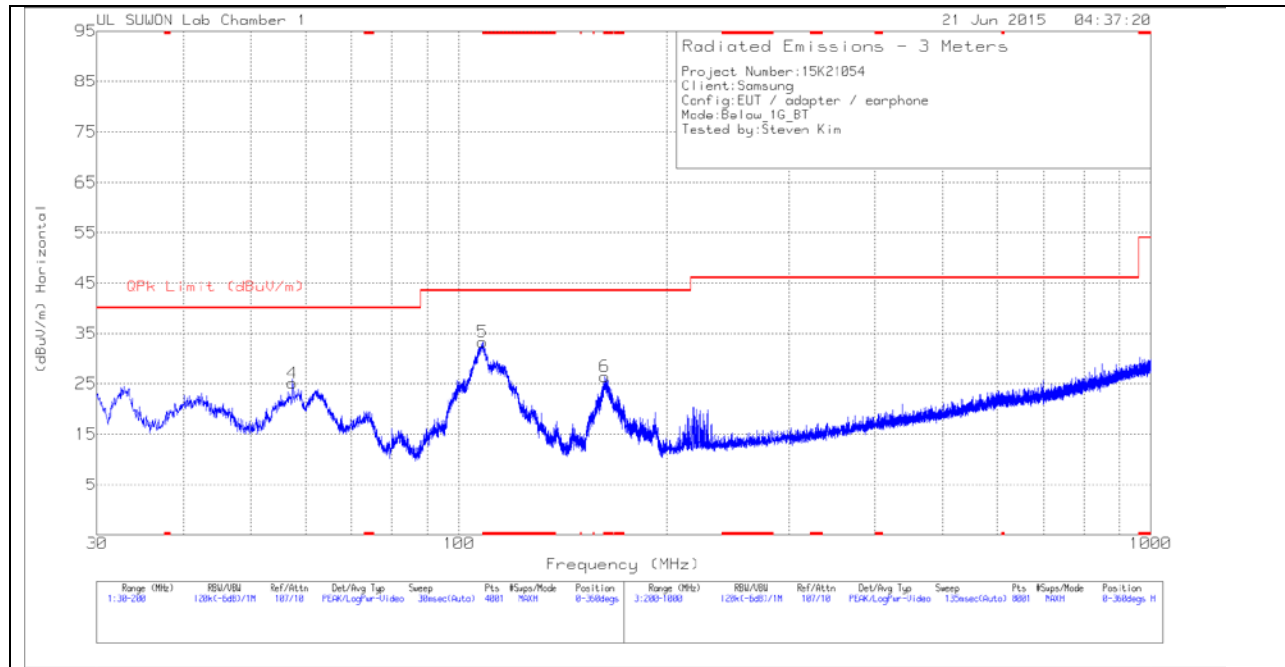
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak detector

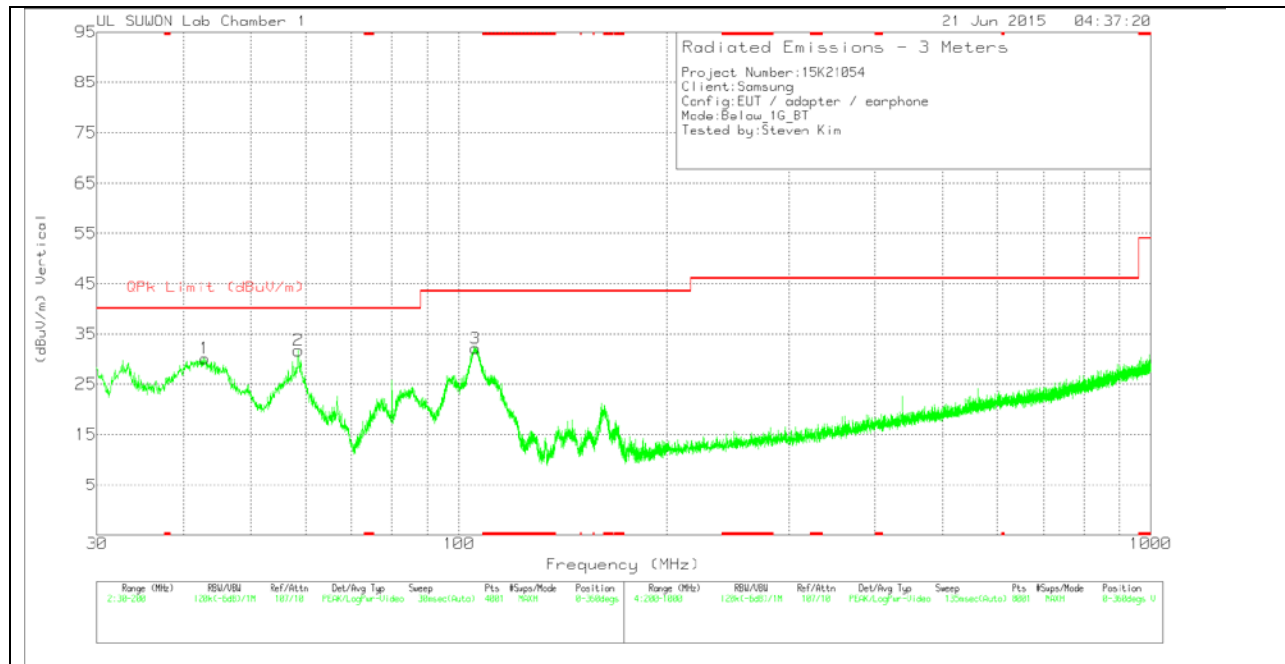
9.3. WORST-CASE BELOW 1 GHz

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
4	57.4975	42.1	Pk	13	-30	25.1	40	-14.9	0-360	400	H
5	* 108.2	51.6	Pk	10.9	-29.2	33.3	43.52	-10.22	0-360	300	H
6	* 162.6425	46.33	Pk	8.6	-28.5	26.43	43.52	-17.09	0-360	200	H
1	42.9625	47.19	Pk	13.1	-30.2	30.09	40	-9.91	0-360	100	V
2	58.6025	48.9	Pk	12.8	-30	31.7	40	-8.3	0-360	100	V
3	105.6075	50.22	Pk	11.1	-29.2	32.12	43.52	-11.4	0-360	100	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.

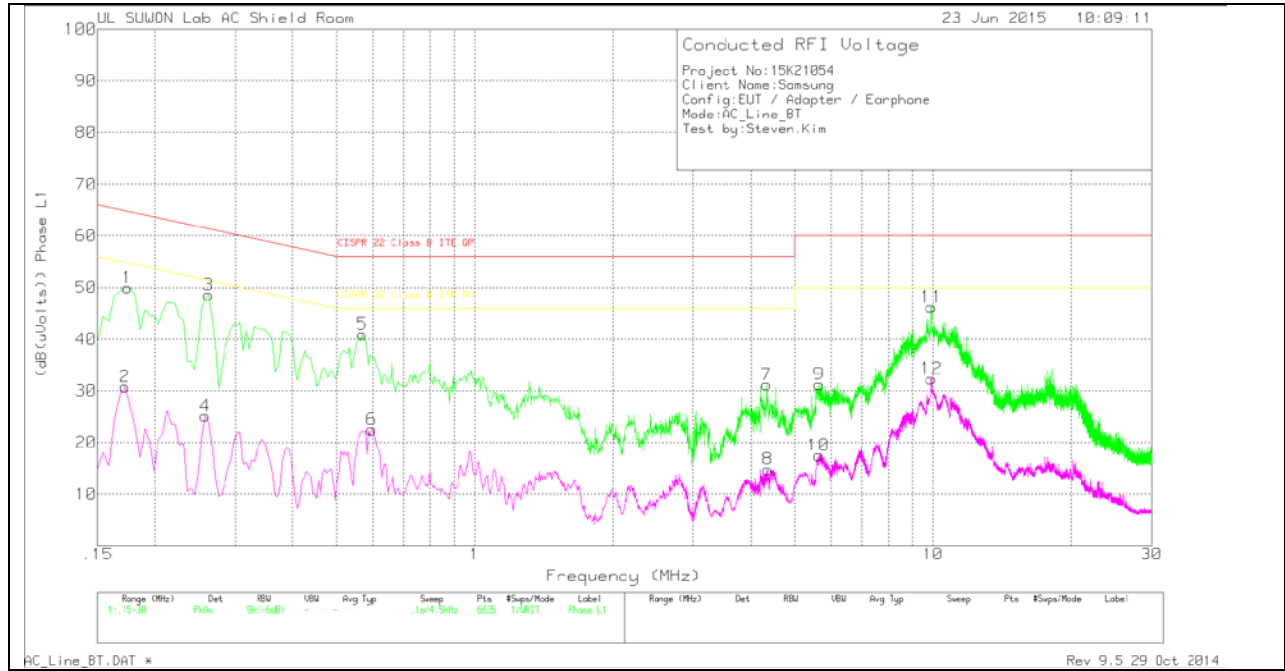
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

6 WORST EMISSIONS

LINE 1 PLOT



LINE 1 RESULTS

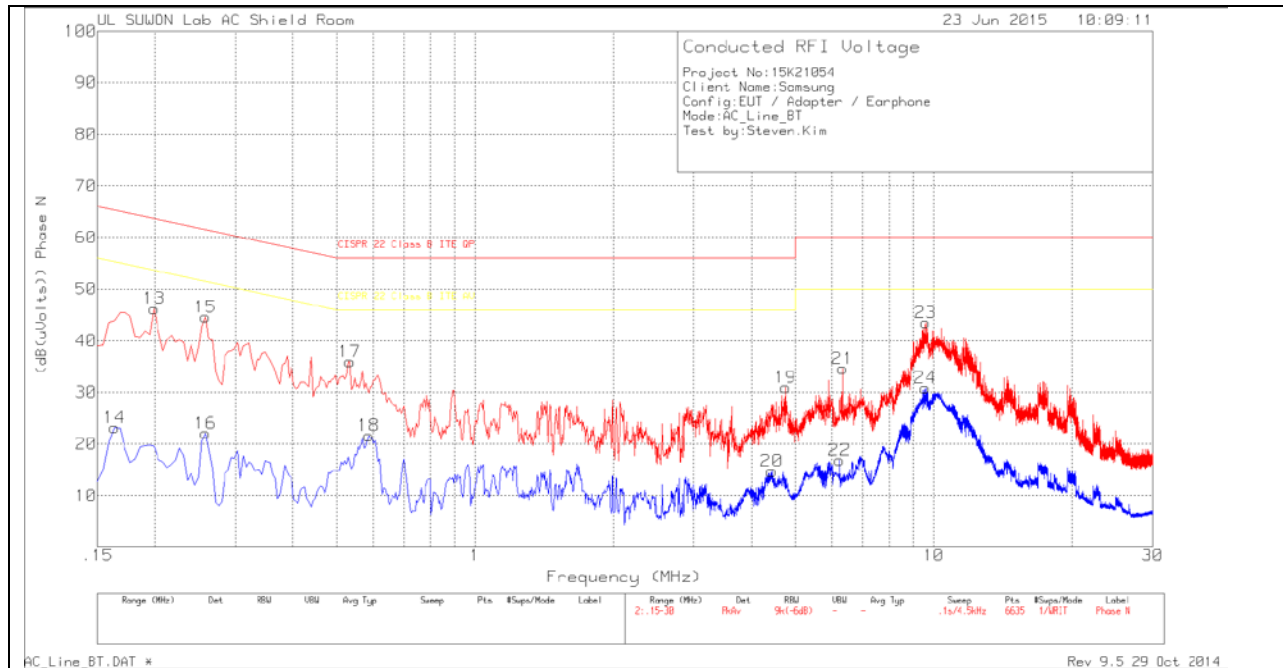
Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_w ith ex-cord_L1	CE Shield Room	Corrected Reading (dBuV)	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.17475	39.74	Pk	10.2	0	49.94	64.73	-14.79	-	-
2	.1725	20.5	Av	10.3	0	30.8	-	-	54.84	-24.04
3	.2625	38.9	Pk	9.7	0	48.6	61.35	-12.75	-	-
4	.258	15.45	Av	9.7	0	25.15	-	-	51.5	-26.35
5	.5685	30.88	Pk	10.1	0	40.98	56	-15.02	-	-
6	.5955	12.41	Av	10.1	0	22.51	-	-	46	-23.49
7	4.3395	21.27	Pk	9.8	.1	31.17	56	-24.83	-	-
8	4.3575	4.93	Av	9.8	.1	14.83	-	-	46	-31.17
9	5.64	21.36	Pk	9.8	.1	31.26	60	-28.74	-	-
10	5.6265	7.62	Av	9.8	.1	17.52	-	-	50	-32.48
11	9.924	36.11	Pk	9.9	.2	46.21	60	-13.79	-	-
12	9.924	22.26	Av	9.9	.2	32.36	-	-	50	-17.64

Pk - Peak detector

Av - Average detection

LINE 2 PLOT



LINE 2 RESULTS

Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_w ith ex-cord_N	CE Shield Room	Corrected Reading (dBuV)	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
13	.1995	36.34	Pk	9.9	0	46.24	63.63	-17.39	-	-
14	.1635	13.04	Av	10.1	0	23.14	-	-	55.28	-32.14
15	.258	34.89	Pk	9.7	0	44.59	61.5	-16.91	-	-
16	.258	12.36	Av	9.7	0	22.06	-	-	51.5	-29.44
17	.5325	25.83	Pk	10.1	0	35.93	56	-20.07	-	-
18	.5865	11.52	Av	10.1	0	21.62	-	-	46	-24.38
19	4.749	21.06	Pk	9.8	.1	30.96	56	-25.04	-	-
20	4.4385	4.83	Av	9.8	.1	14.73	-	-	46	-31.27
21	6.3285	24.58	Pk	9.9	.1	34.58	60	-25.42	-	-
22	6.2385	6.95	Av	9.8	.1	16.85	-	-	50	-33.15
23	9.6	33.27	Pk	10	.2	43.47	60	-16.53	-	-
24	9.5865	20.67	Av	10	.2	30.87	-	-	50	-19.13

Pk - Peak detector

Av - Average detection