



FCC 47 CFR PART 15 SUBPART C

**CERTIFICATION TEST REPORT
FOR**

GSM/WCDMA/LTE Phone + Bluetooth & DTS/UNII a/b/g/n + NFC

MODEL NUMBER: LG-D631, D631, LGD631

FCC ID: ZNFD631

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Prepared for

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: LG ELECTRONICS MOBILECOMM U.S.A., INC
EUT DESCRIPTION: GSM/WCDMA/LTE Phone + Bluetooth & DTS/UNII a/b/g/n + NFC.
MODEL: LG-D631, D631, LGD631
SERIAL NUMBER: 403KPDT000322 (Conducted), 403KPMZ000323 (Radiated)
DATE TESTED: APRIL 1-7, 2014

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, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsenc.com>.

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	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 GSM/WCDMA/LTE Phone + Bluetooth & DTS/UNII a/b/g/n + NFC.

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	11.22	13.23
2402 - 2480	Enhanced 8PSK	9.73	9.39

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 -8.45 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,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	LG ELECTRONICS	MCS-01WD	DB390078751	N/A
Earphone	LG ELECTRONICS	LG-D631	N/A	N/A

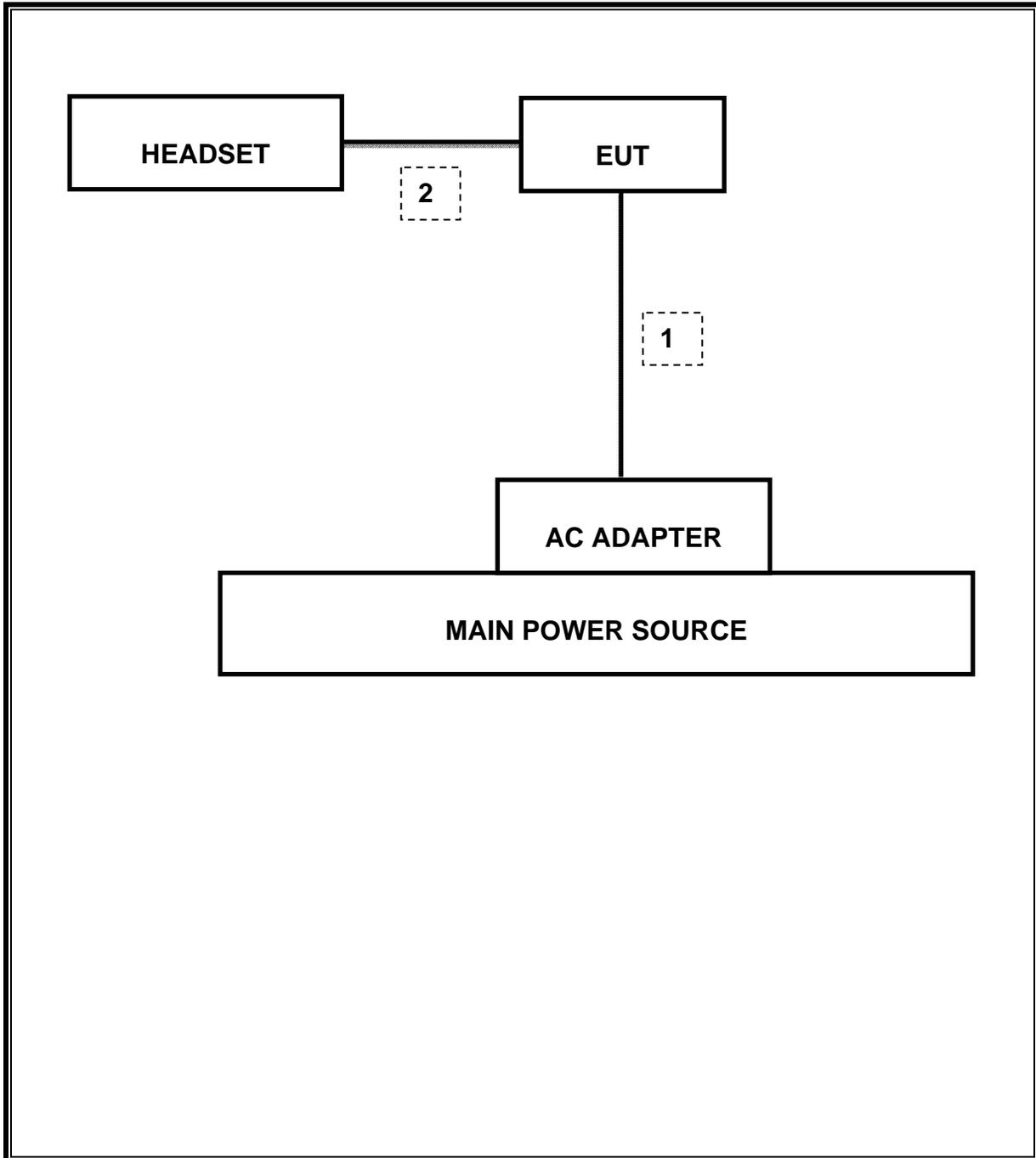
I/O CABLES

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	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	Asset	Cal Due
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	C01171	02/13/15
Antenna, Horn, 18GHz	EMCO	3115	C00783	10/25/14
Antenna, Horn, 25.5 GHz	ARA	MWH-1826/B	C00980	11/14/14
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/28/15
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	10/22/14
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/20/14
CBT Bluetooth Tester	R & S	CBT	None	07/12/14
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/14
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/14
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/15
Reject Filter, 2.4GHz	Micro-Tronics	BRM50702	N02684	CNR
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/14
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/14

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	1.242MHz
2.1051, 15.247 (d)	RSS-210 A8.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-30.459dBm
15.247 (b)(1)	RSS-210 A8.4	TX conducted output power	<21dBm		Pass	11.22dBm
15.247 (a)(1)	RSS-210 A8.1(b)	Hopping frequency separation	> 25KHz		Pass	1MHz
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	0.228sec
15.207 (a)	RSS-GEN 7.2.2	AC Power Line conducted emissions	Section 10	Radiated	Pass	43.72dBuV
15.205, 15.209	RSS-210 Clause 2.6, RSS-210 Clause 6	Radiated Spurious Emission	< 54dBuV/m		Pass	40.88dBuV/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

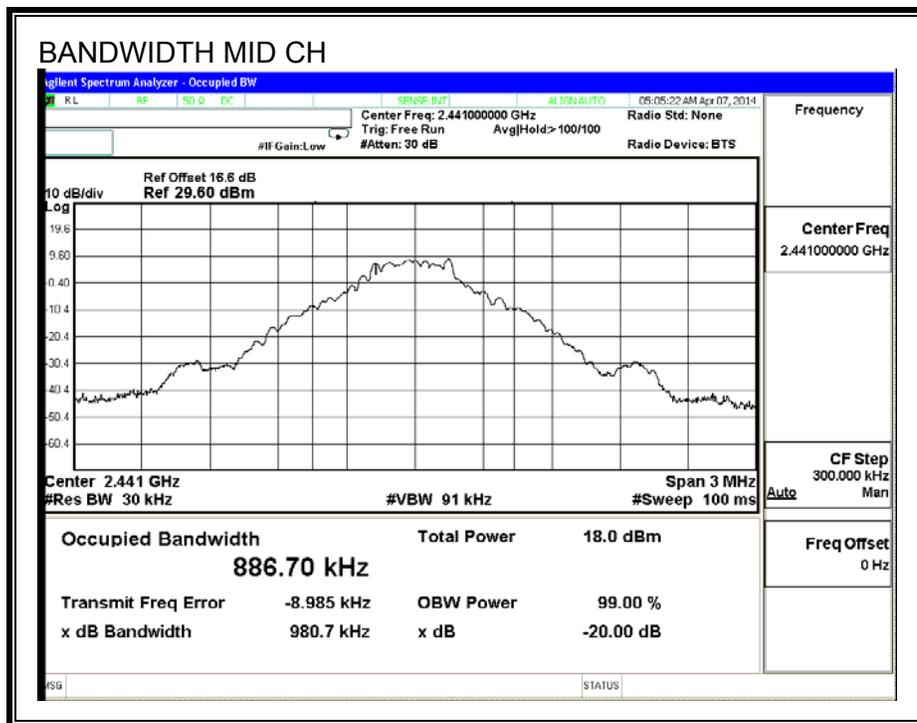
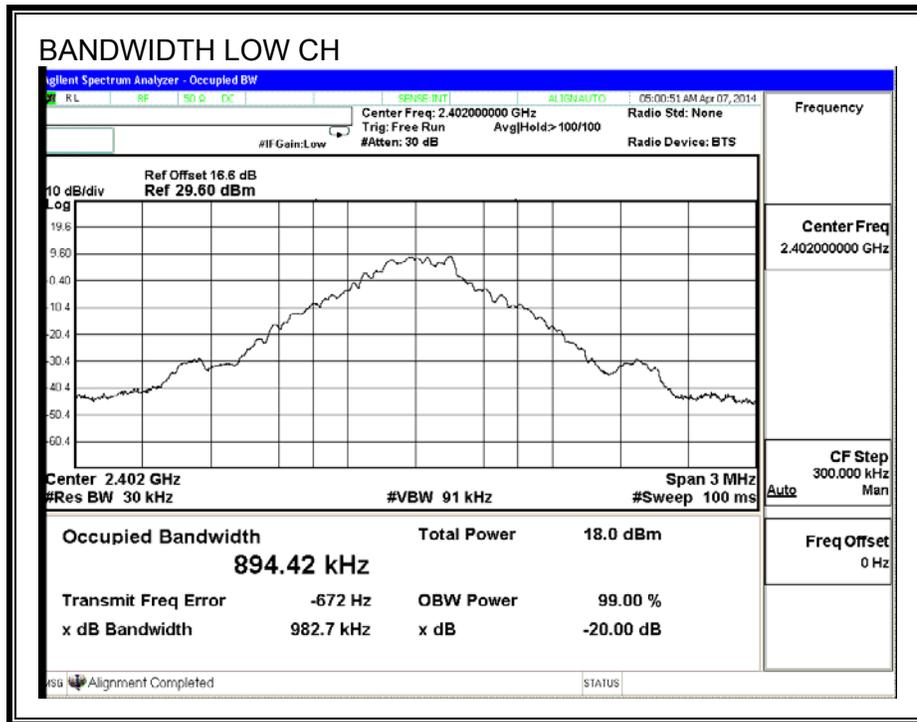
8.1.1. BASIC DATA RATE GFSK MODULATION

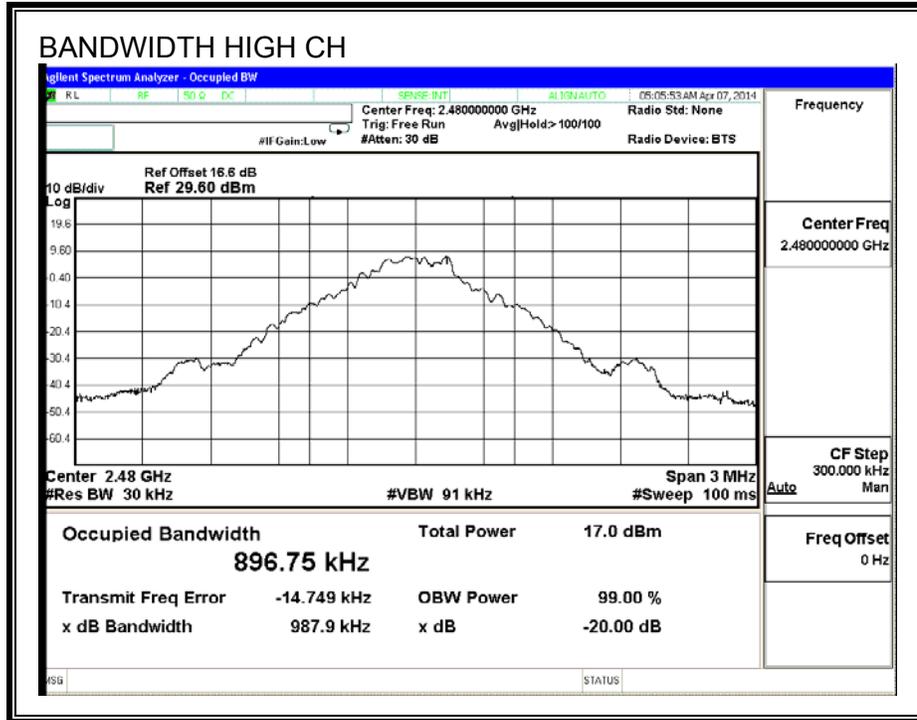
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.983	0.9064
Middle	2441	0.981	0.9136
High	2480	0.988	0.9434
Worst		0.988	0.9434

8.1.1. ENHANCED DATA RATE 8PSK MODULATION

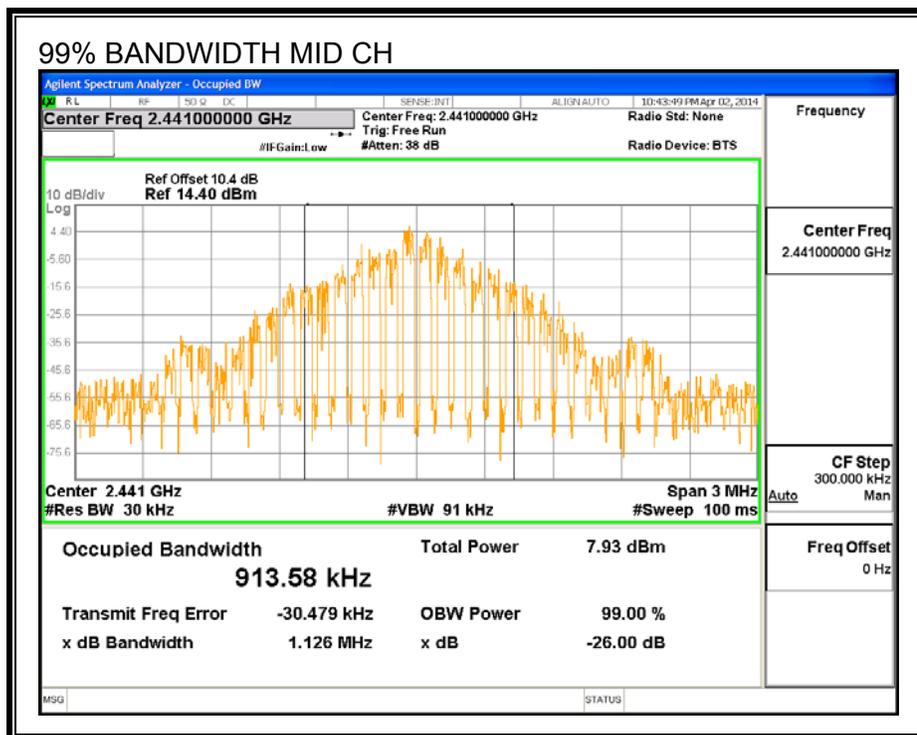
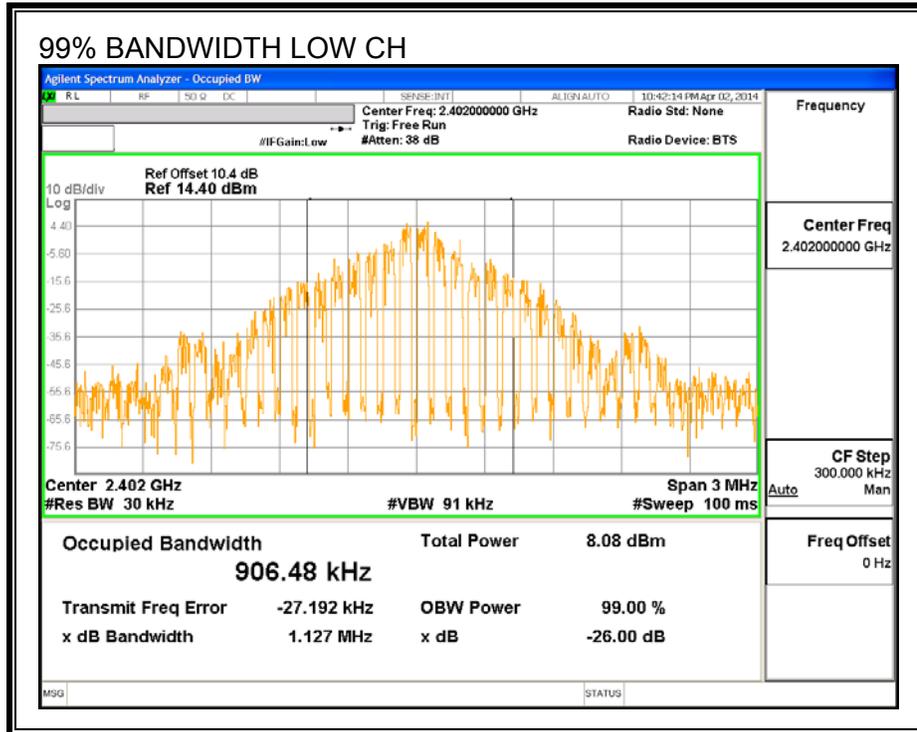
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.333	1.242
Middle	2441	1.335	1.2109
High	2480	1.332	1.2144
Worst		1.335	1.242

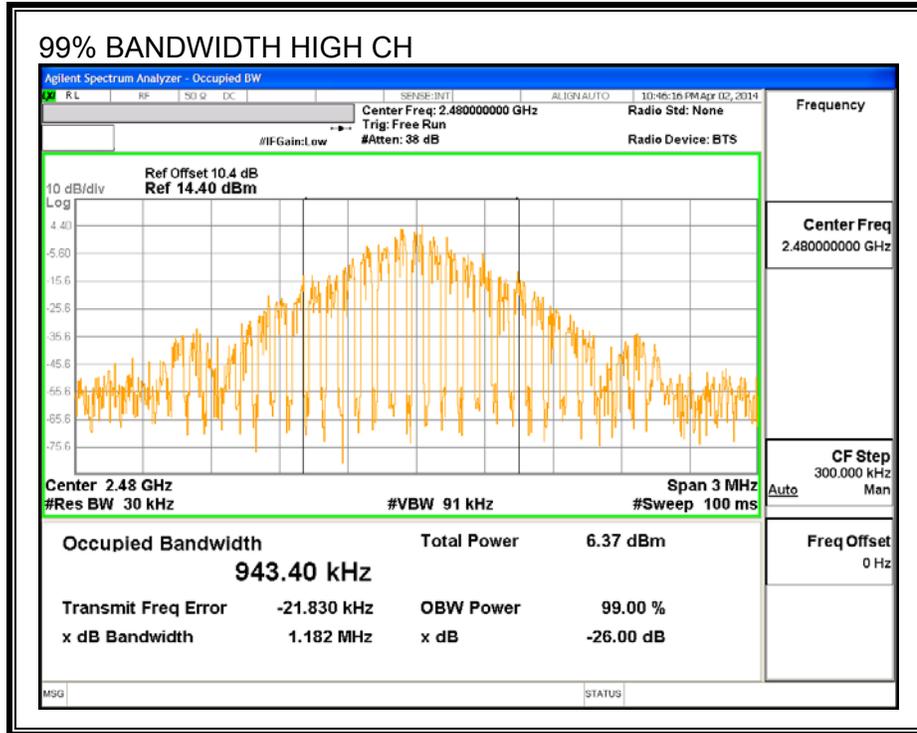
GFSK 20 dB BANDWIDTH



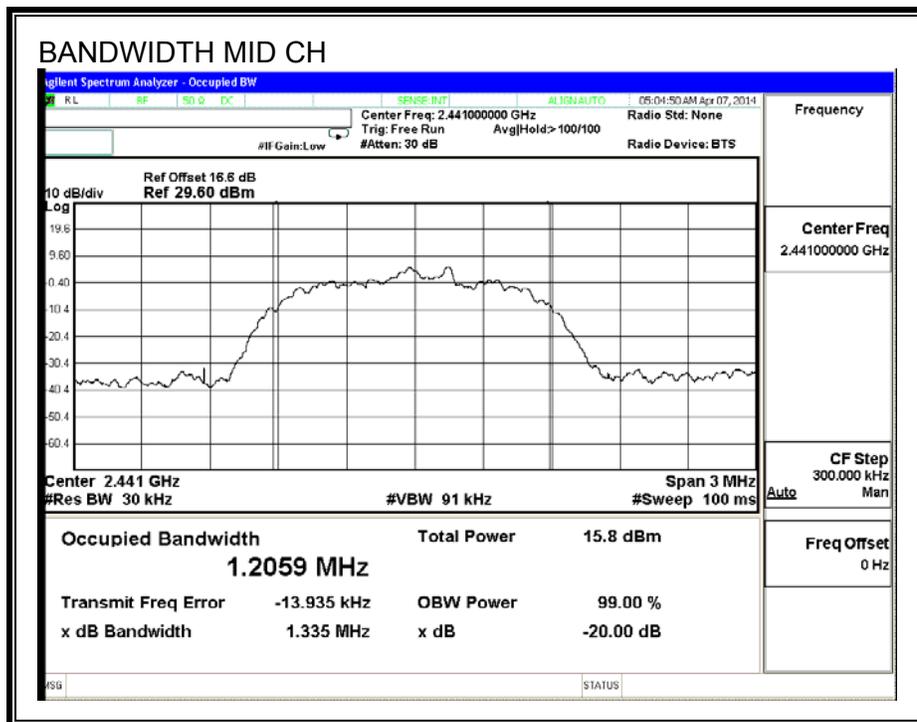
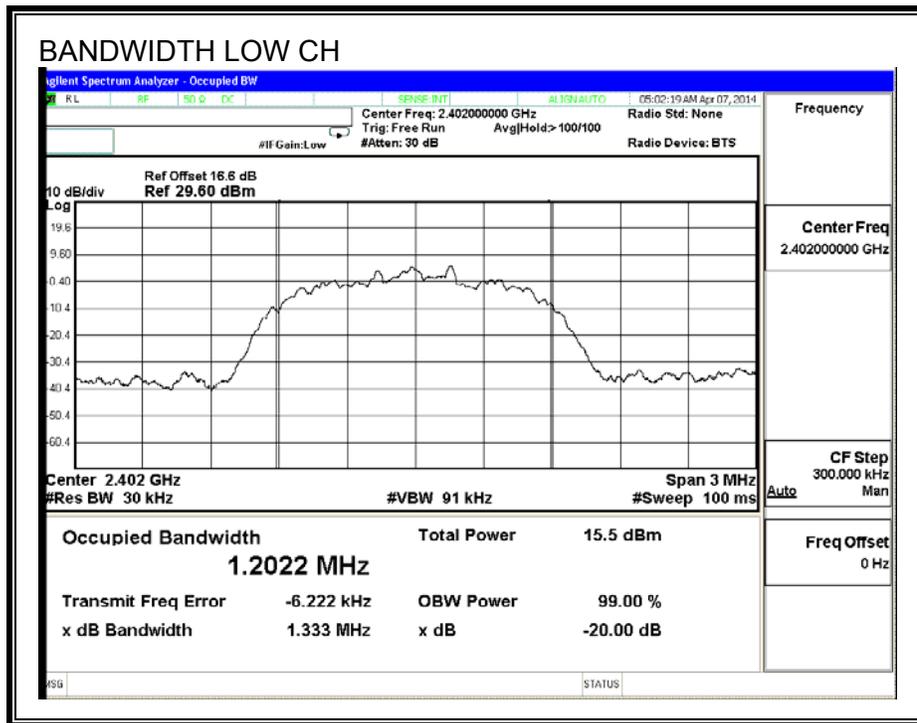


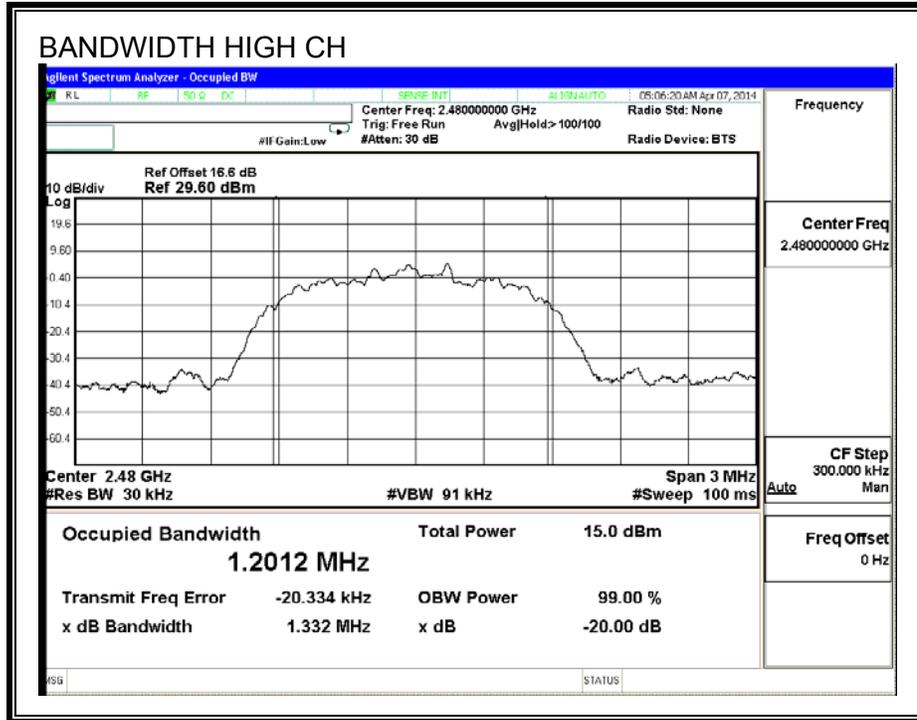
GFSK 99% BANDWIDTH



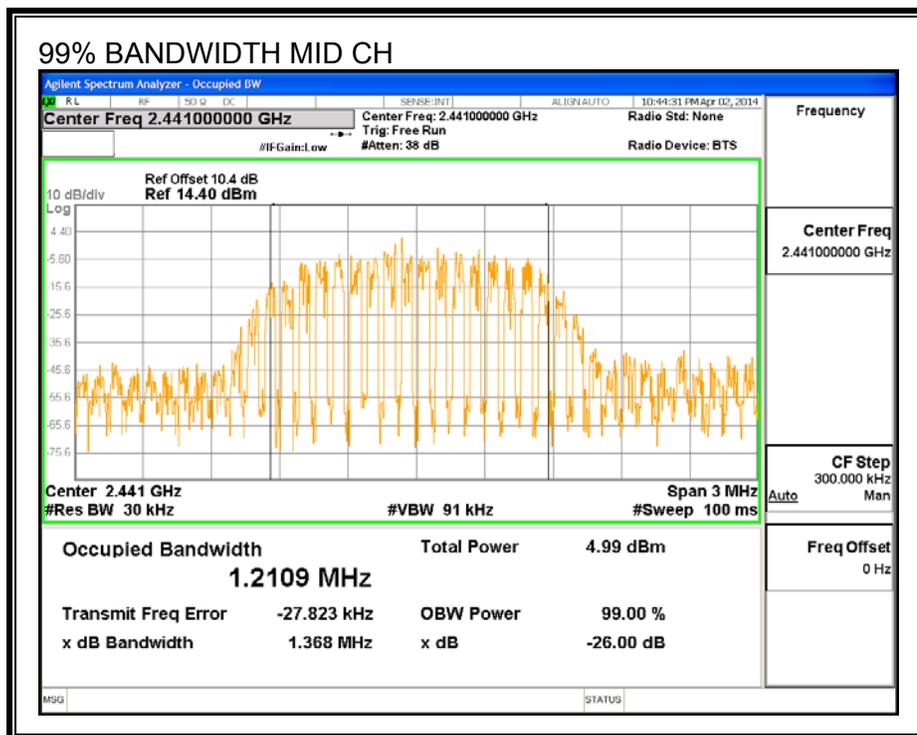
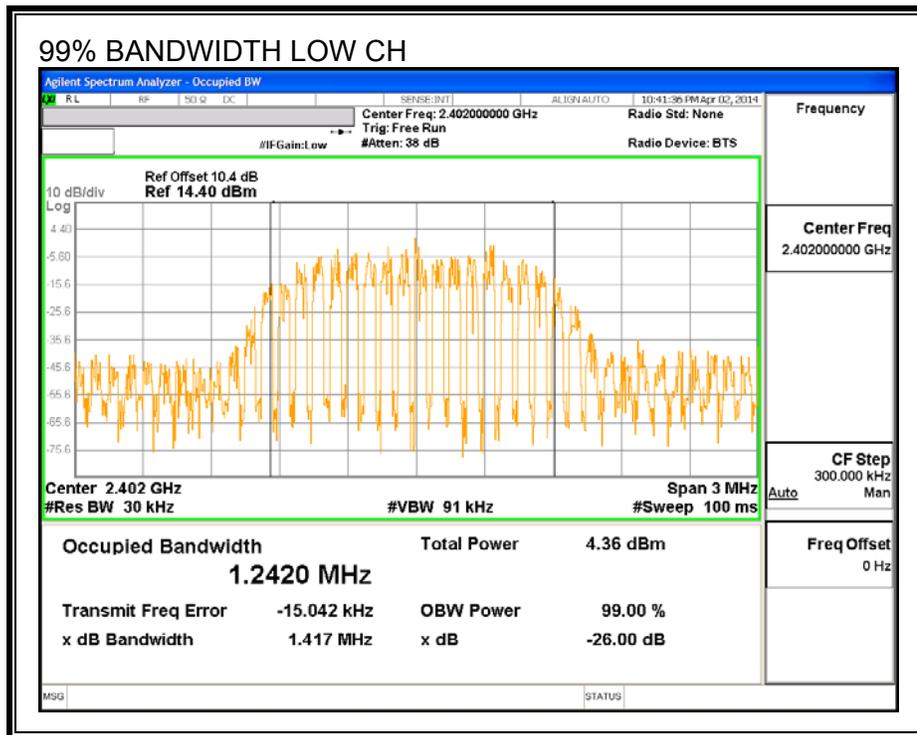


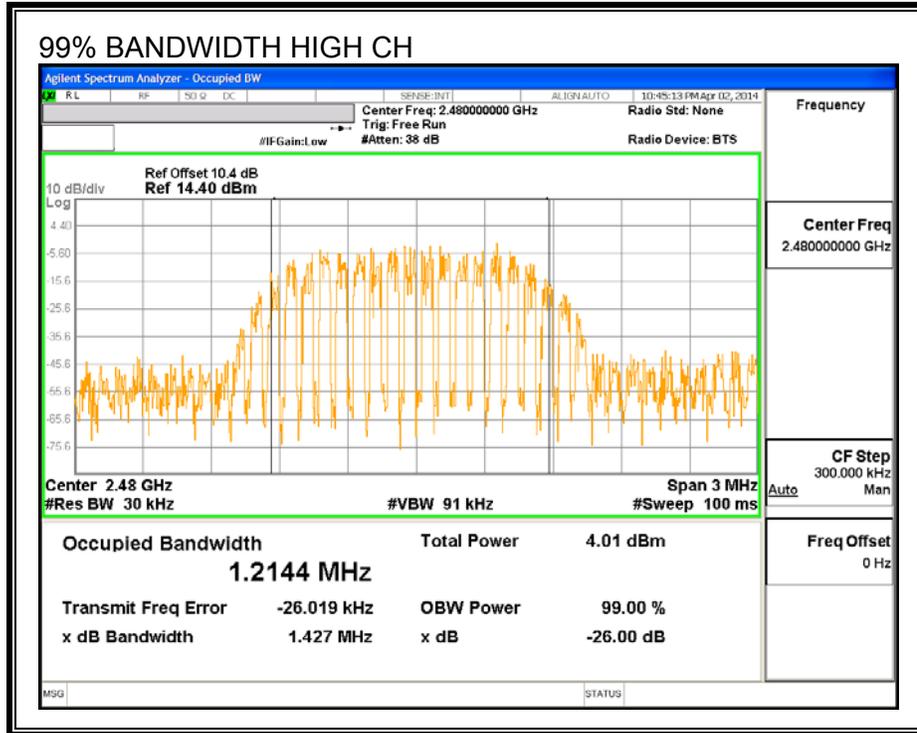
8PSK 20 dB BANDWIDTH





8PSK 99% BANDWIDTH





8.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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)

IC RSS-210 A8.1 (d)

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

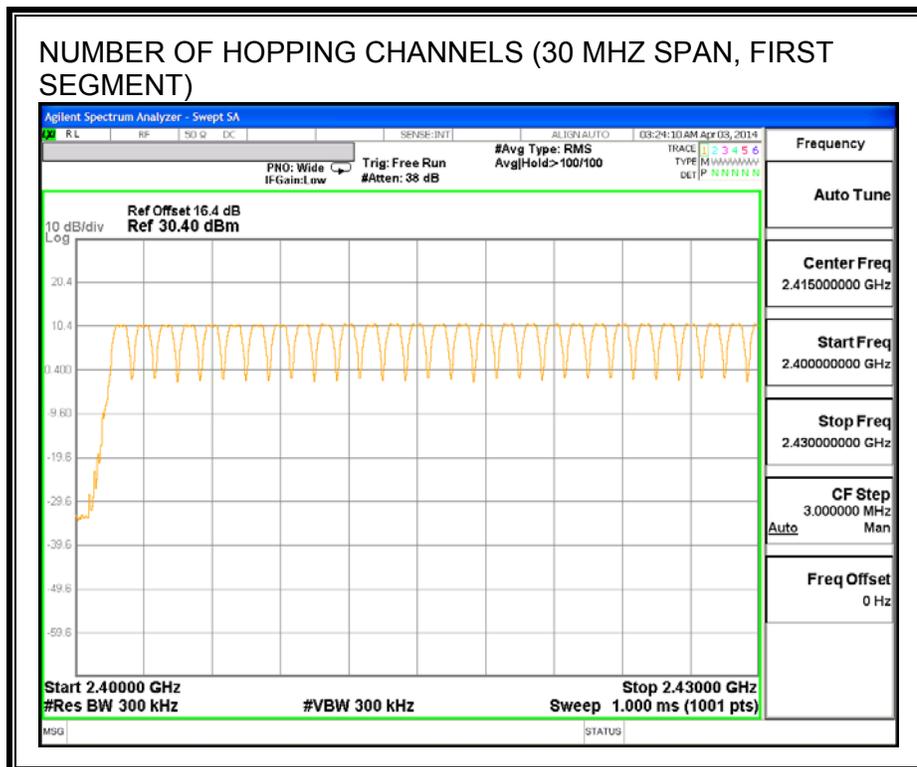
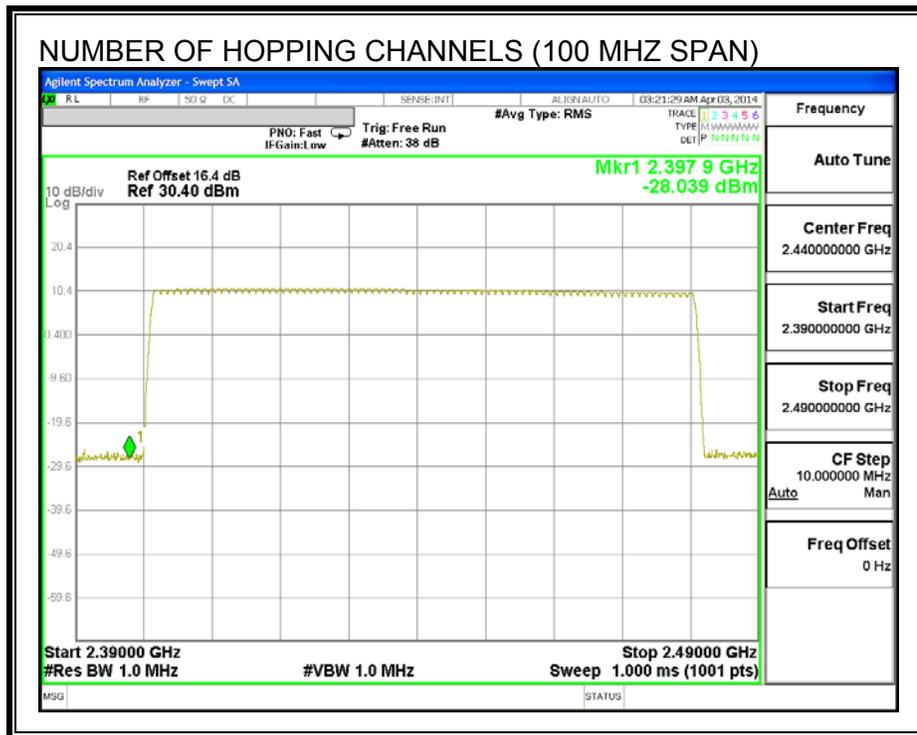
TEST PROCEDURE

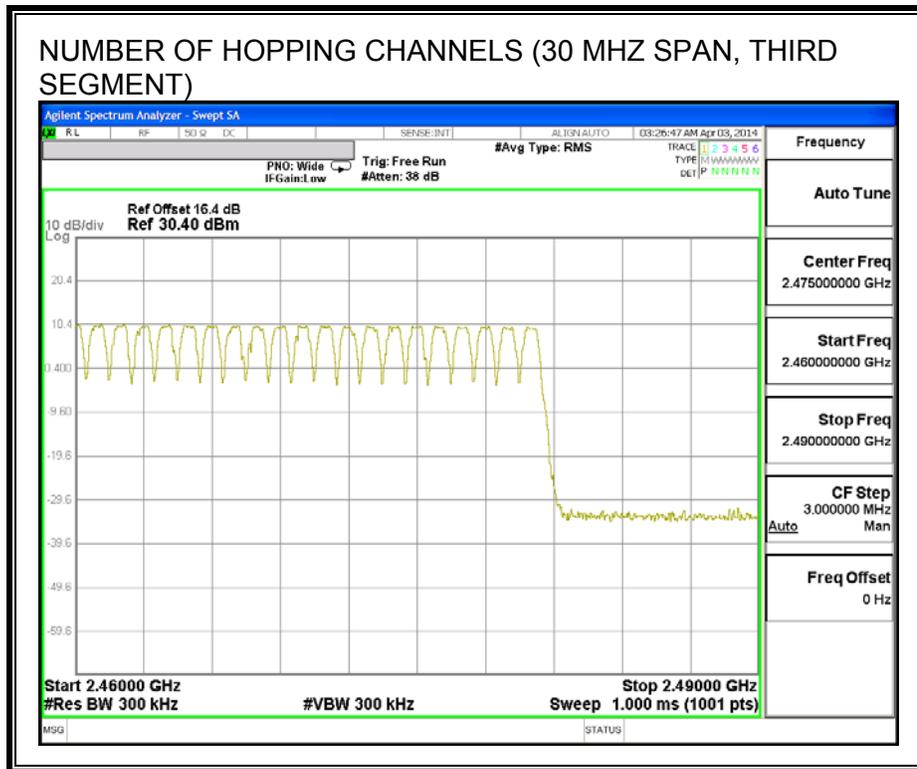
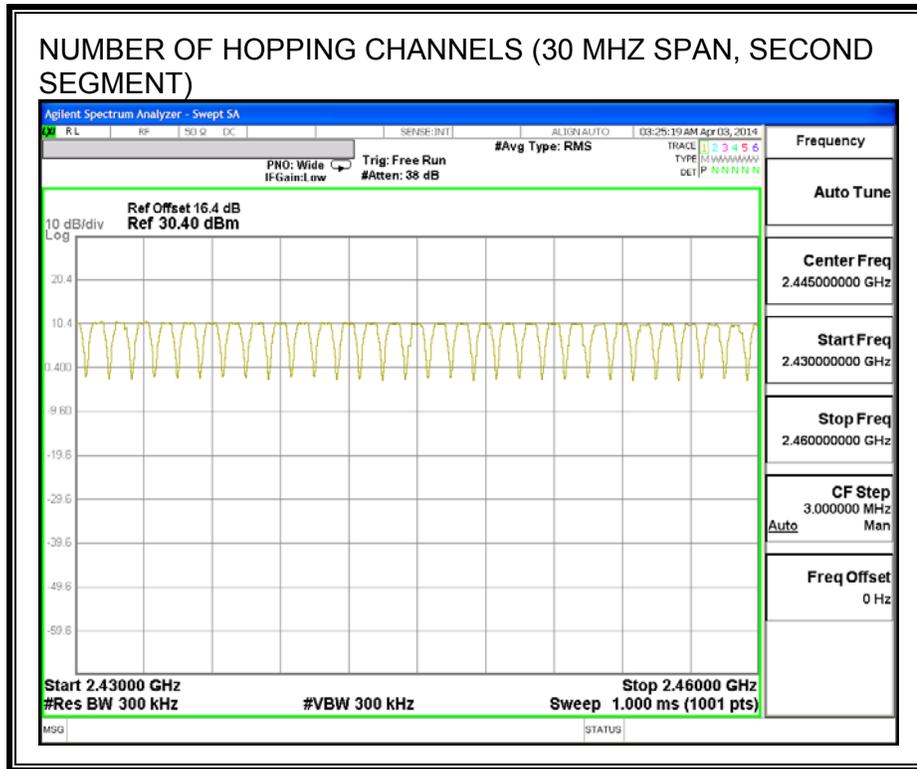
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS





8.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

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 $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{ pulse width}$.

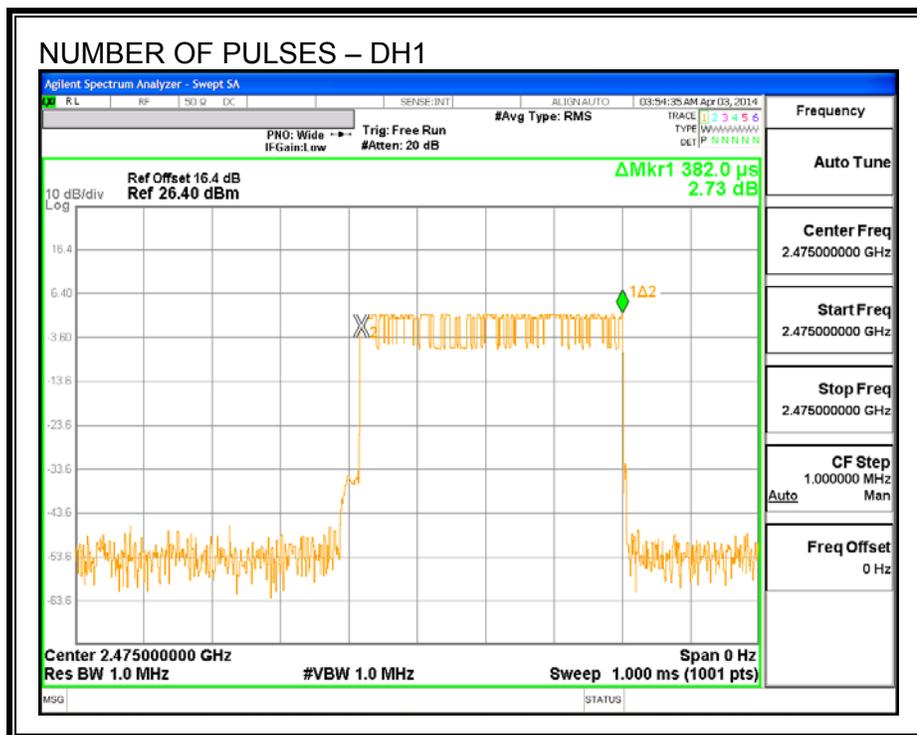
RESULTS

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.382	32	0.122	0.4	-0.278
DH3	1.632	14	0.228	0.4	-0.172
DH5	2.875	7	0.201	0.4	-0.199
GFSK AFH Mode					
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	0.031	0.4	-0.369
DH3	1.632	4	0.065	0.4	-0.335
DH5	2.875	2	0.058	0.4	-0.343

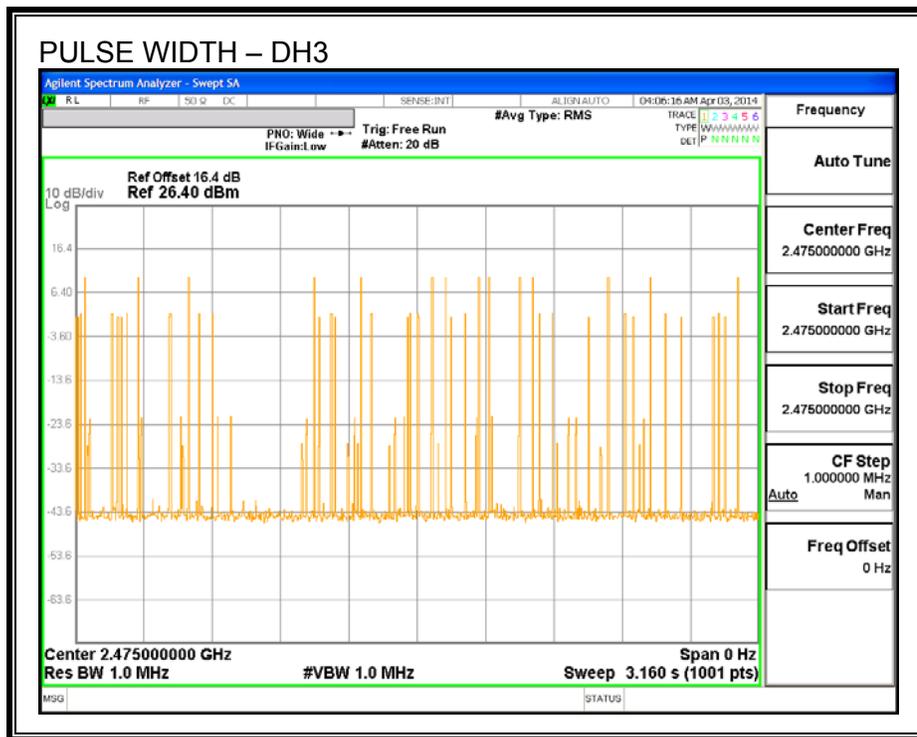
PULSE WIDTH - DH1



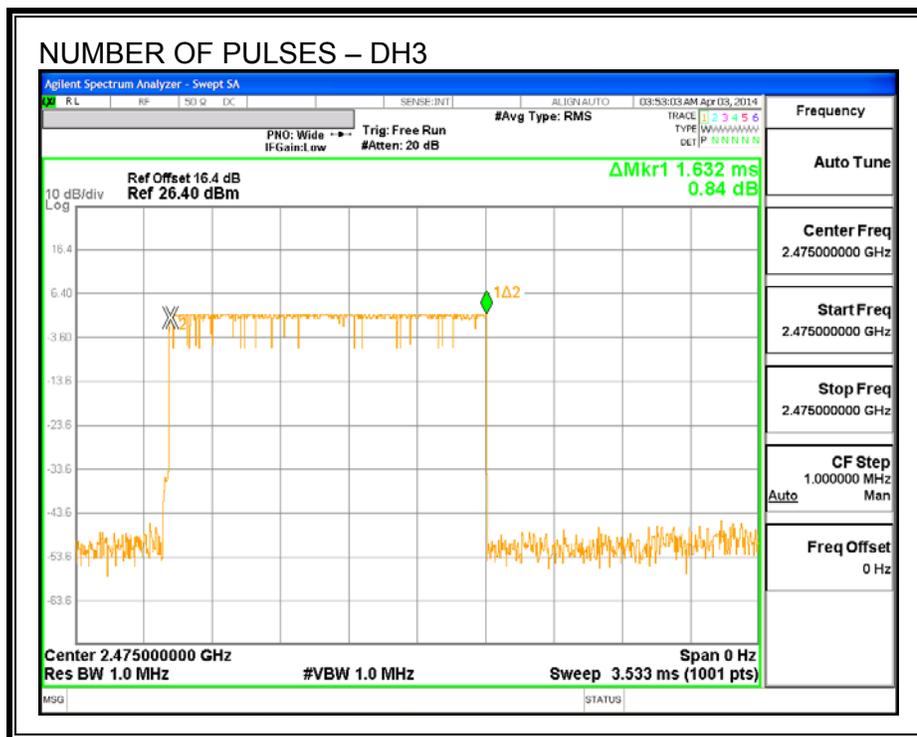
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1



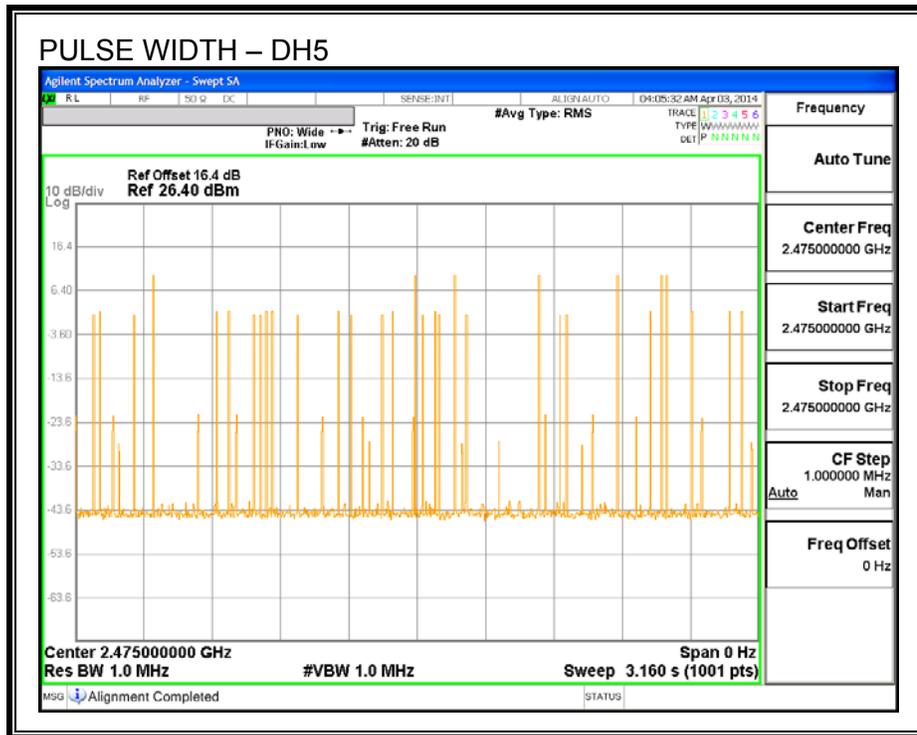
PULSE WIDTH – DH3



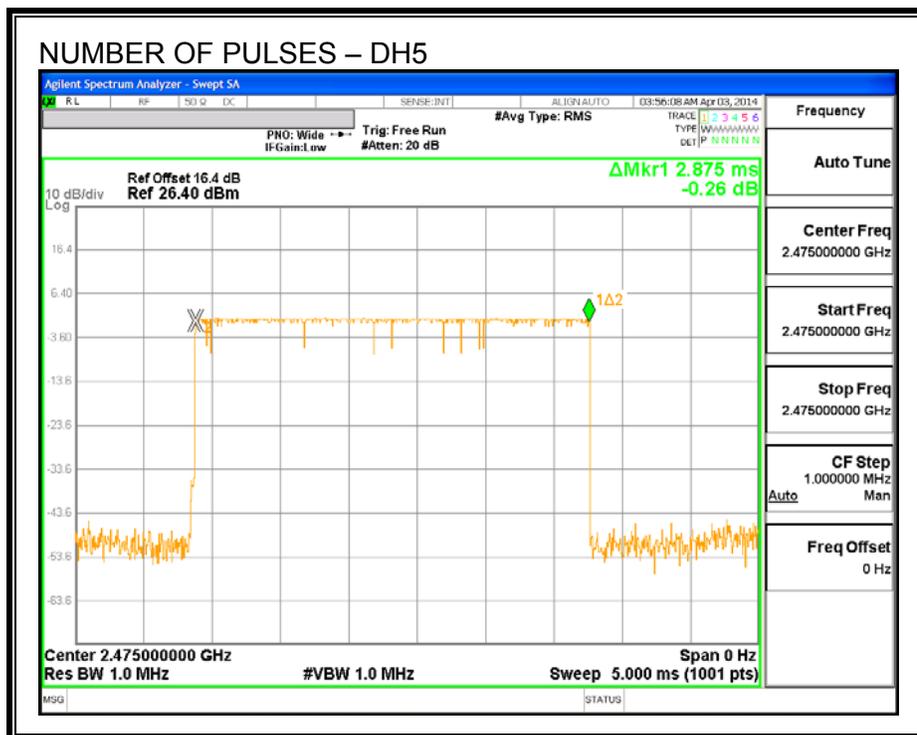
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

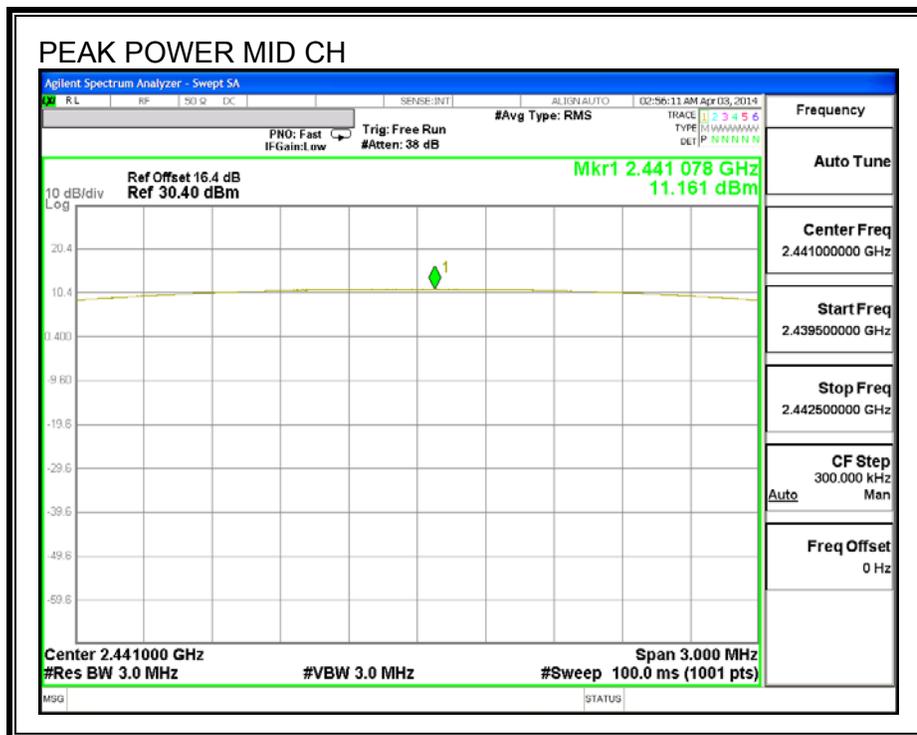
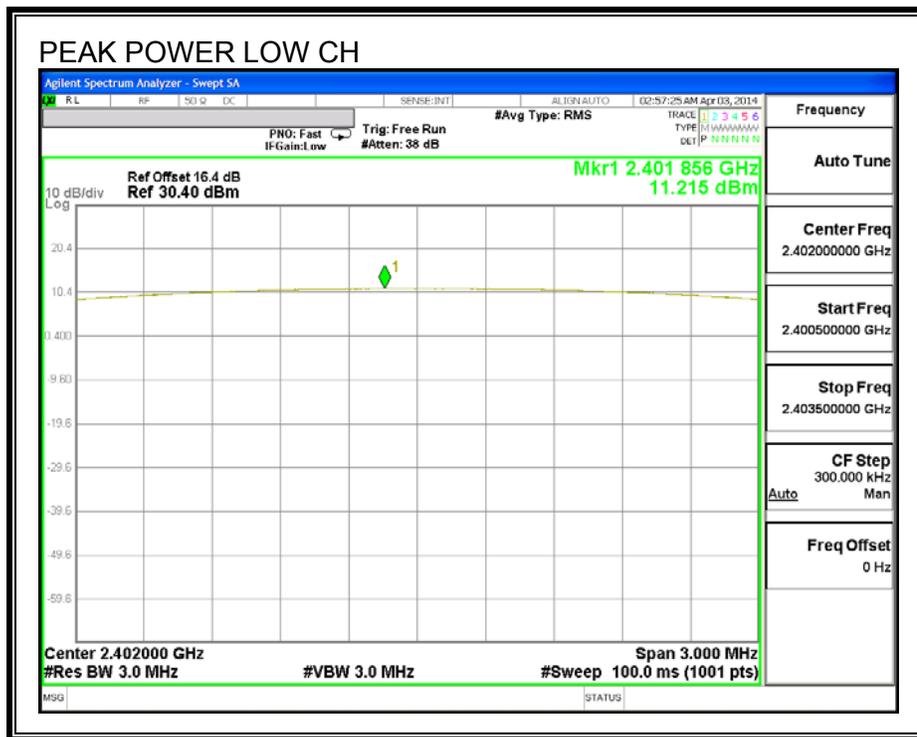
8.5.1. BASIC DATA RATE GFSK MODULATION

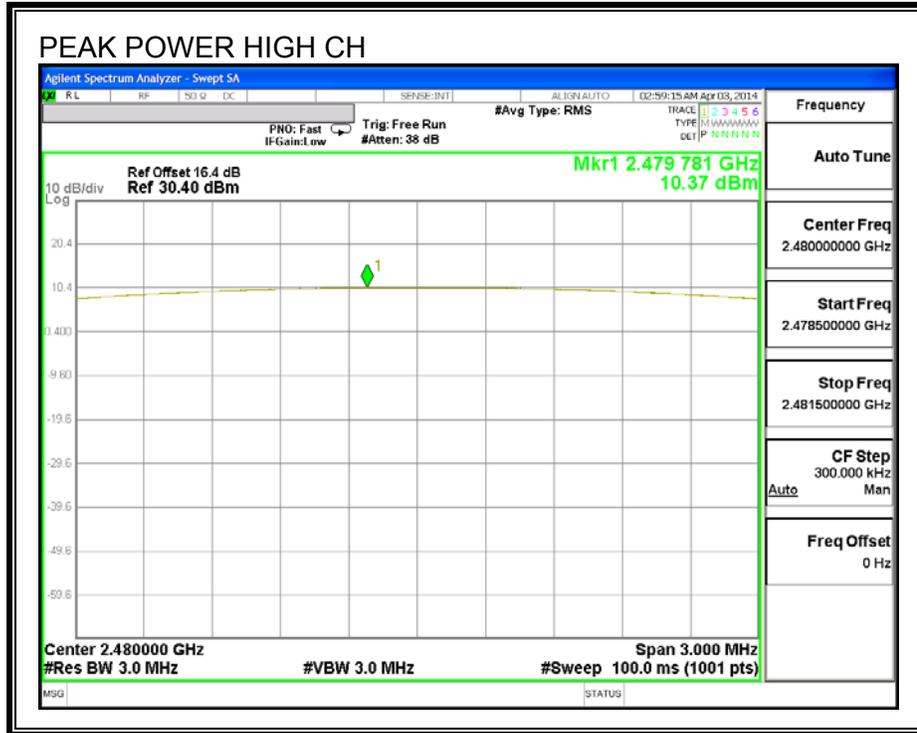
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.22	21	-9.79
Middle	2441	11.16	21	-9.84
High	2480	10.37	21	-10.63
Worst		11.22		-9.79

8.5.2. ENHANCED DATA RATE 8PSK MODULATION

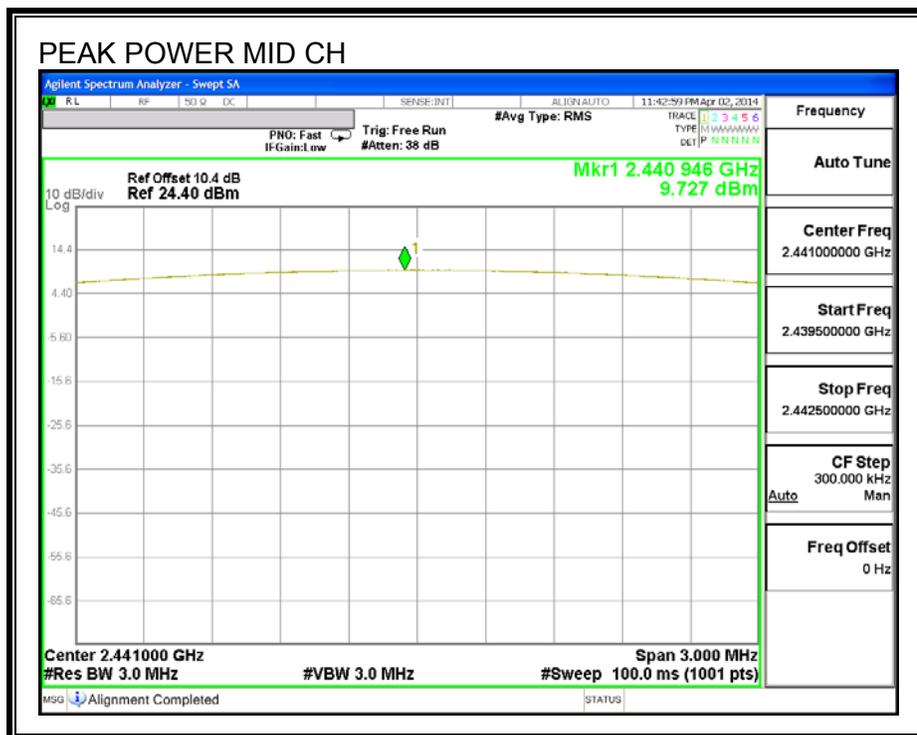
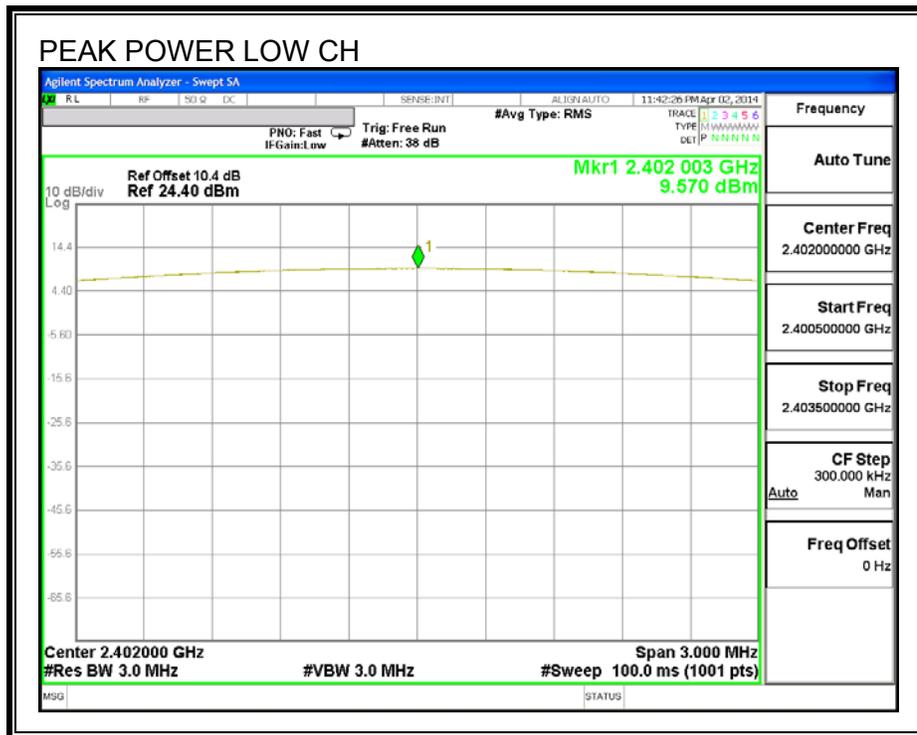
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.57	21	-11.43
Middle	2441	9.73	21	-11.27
High	2480	8.80	21	-12.20
Worst		9.73		-11.27

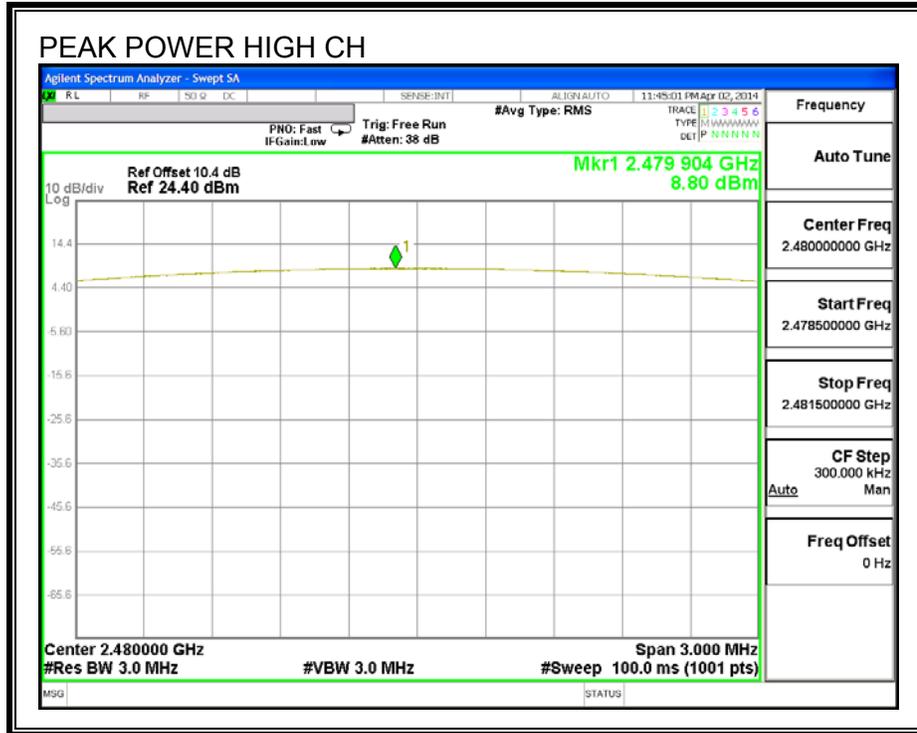
GFSK OUTPUT POWER





8PSK OUTPUT POWER





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 0.7 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)	Average Power (dBm)
Low	2402	10.90
Middle	2441	11.00
High	2480	9.90
Worst		11.00

8.6.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.60
Middle	2441	8.00
High	2480	7.00
Worst		8.00

8.6.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.60
Middle	2441	8.10
High	2480	7.10
Worst		8.10

8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

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.

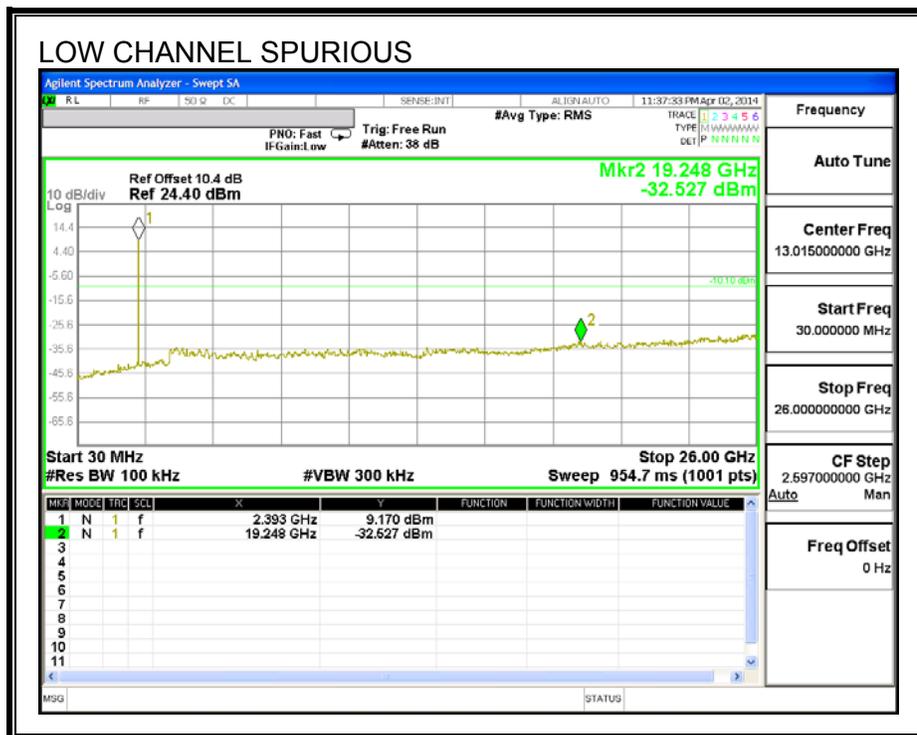
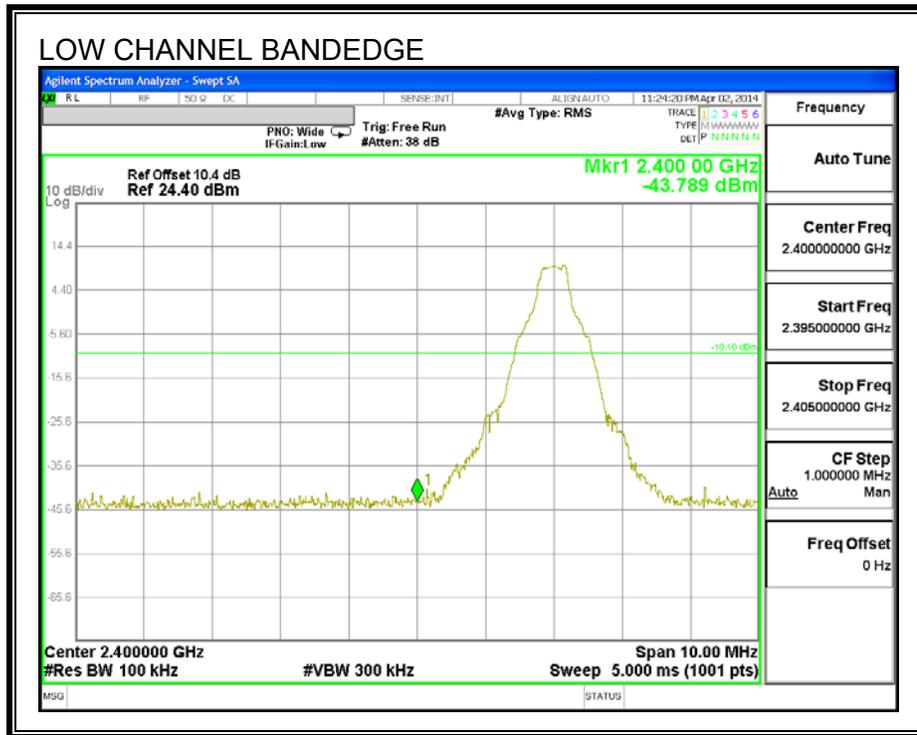
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

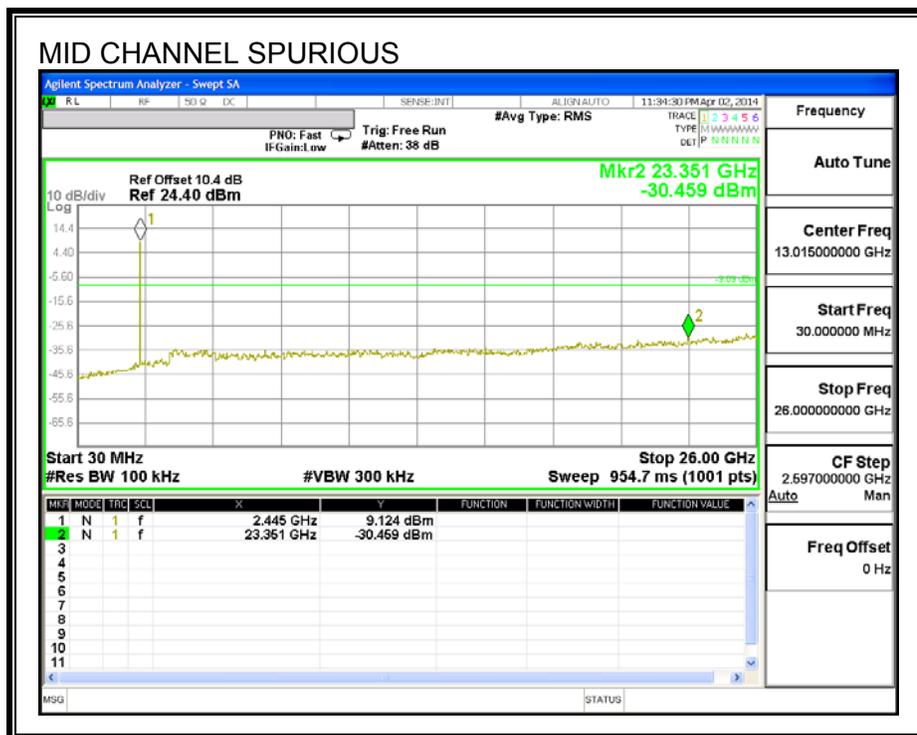
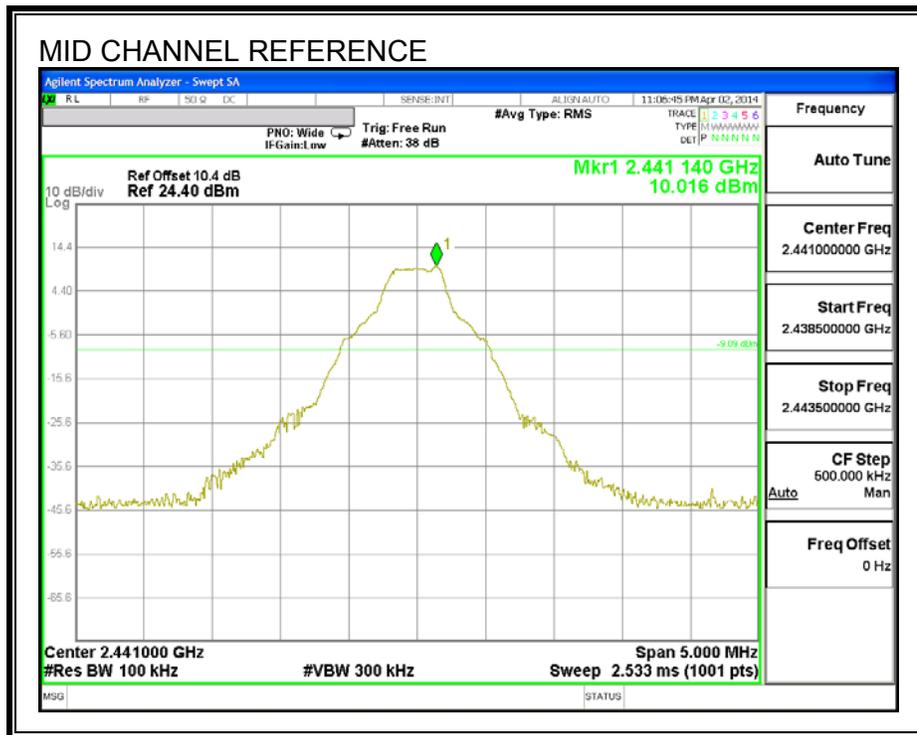
RESULTS

8.7.1. BASIC DATA RATE GFSK MODULATION

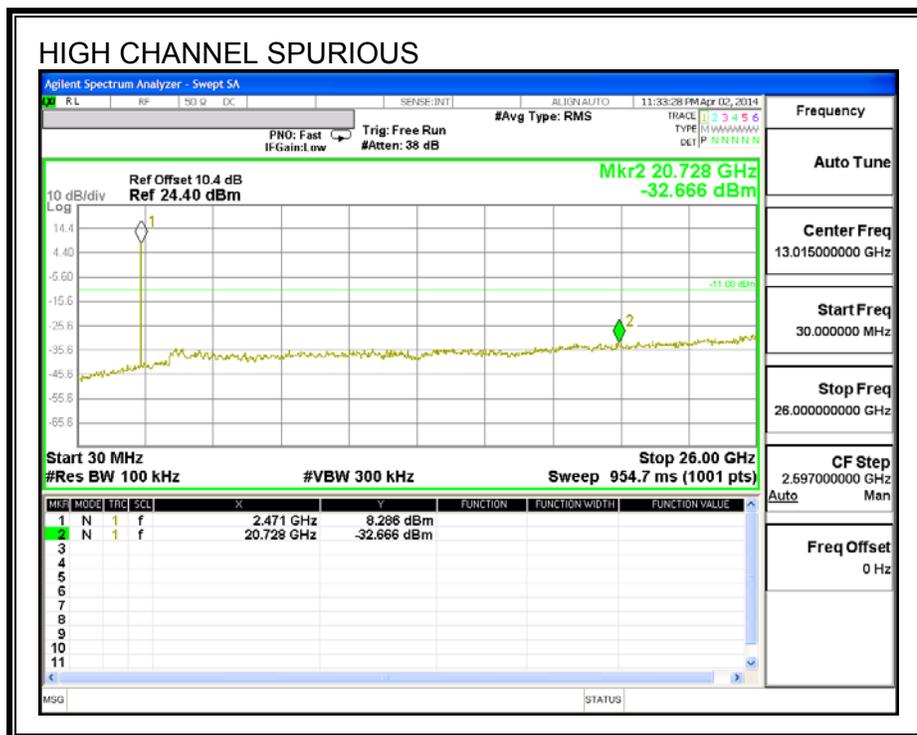
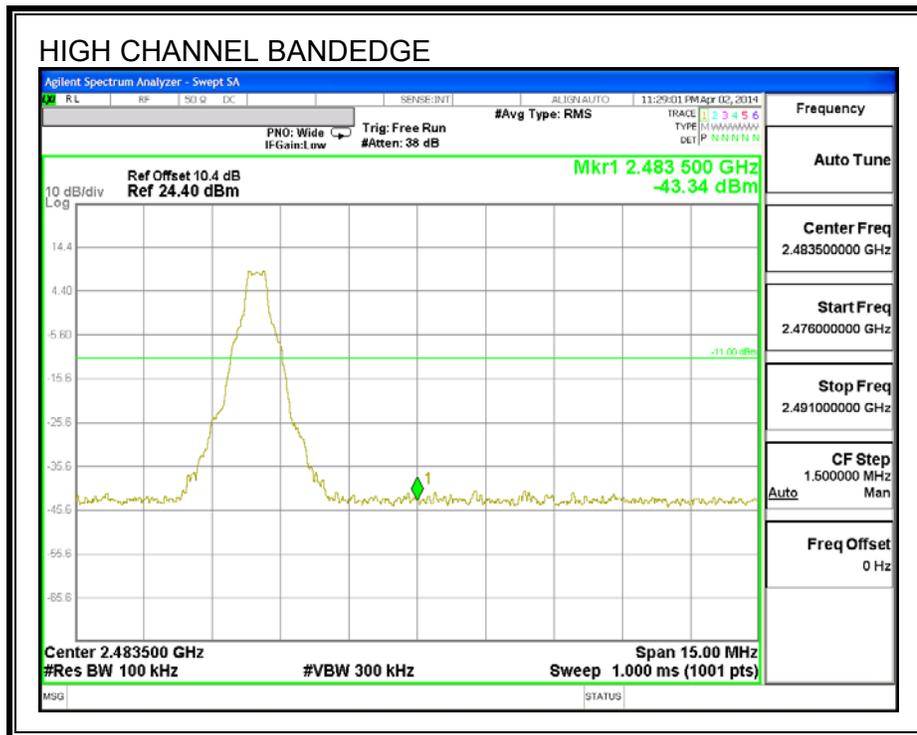
SPURIOUS EMISSIONS, LOW CHANNEL



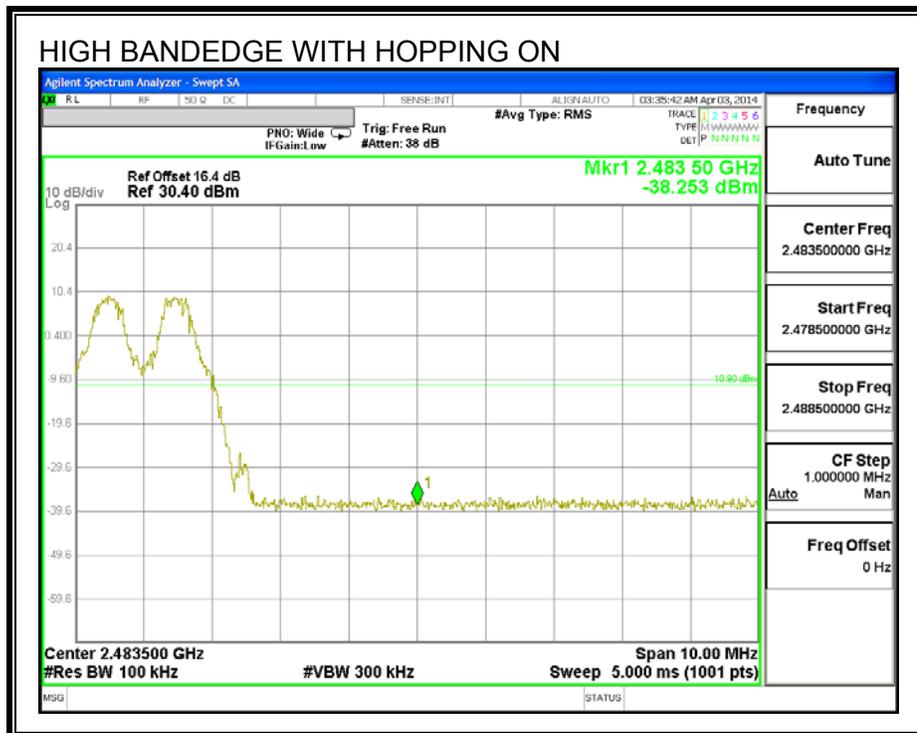
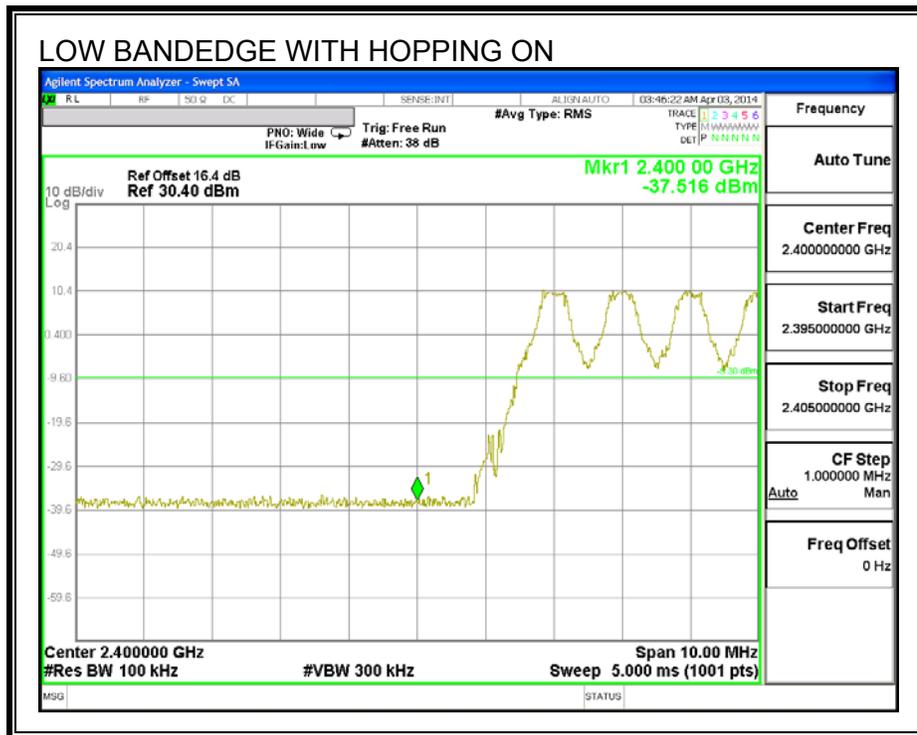
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL

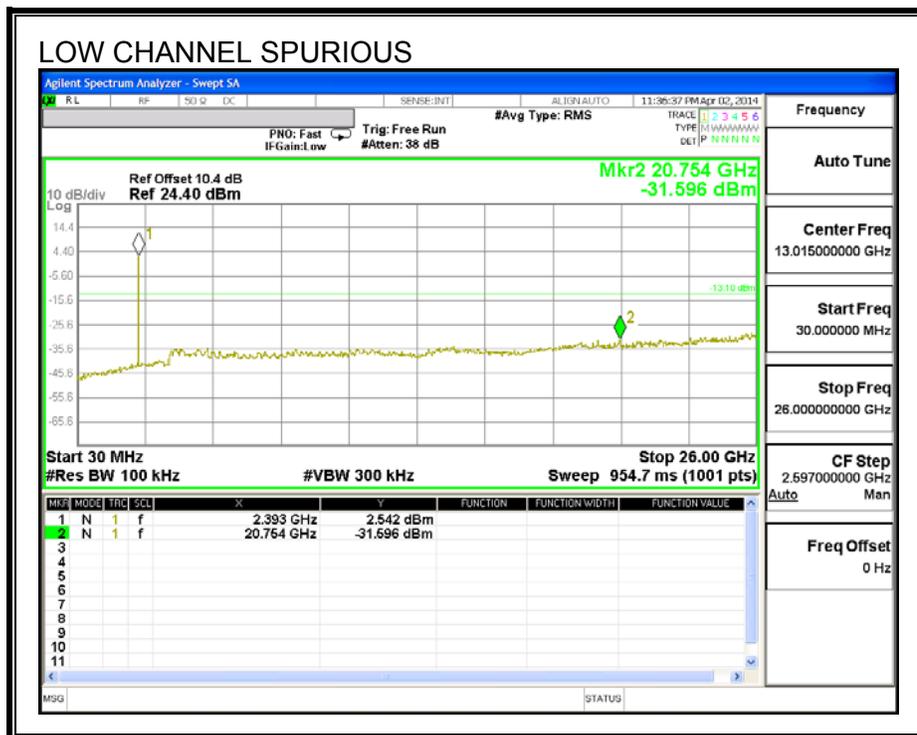
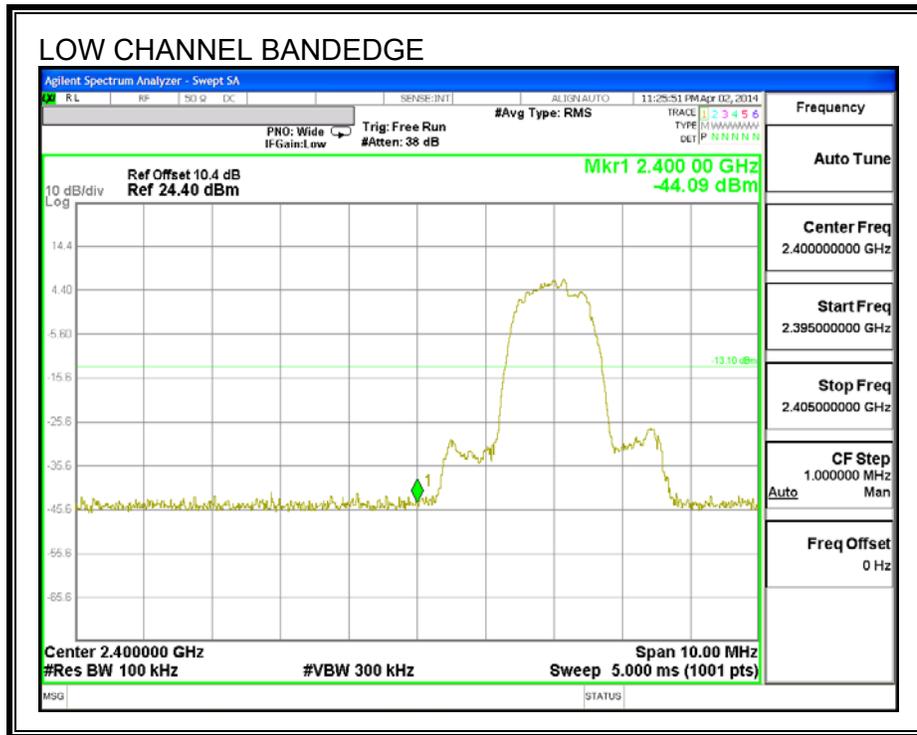


SPURIOUS BANDEDGE EMISSIONS WITH GFSK HOPPING ON

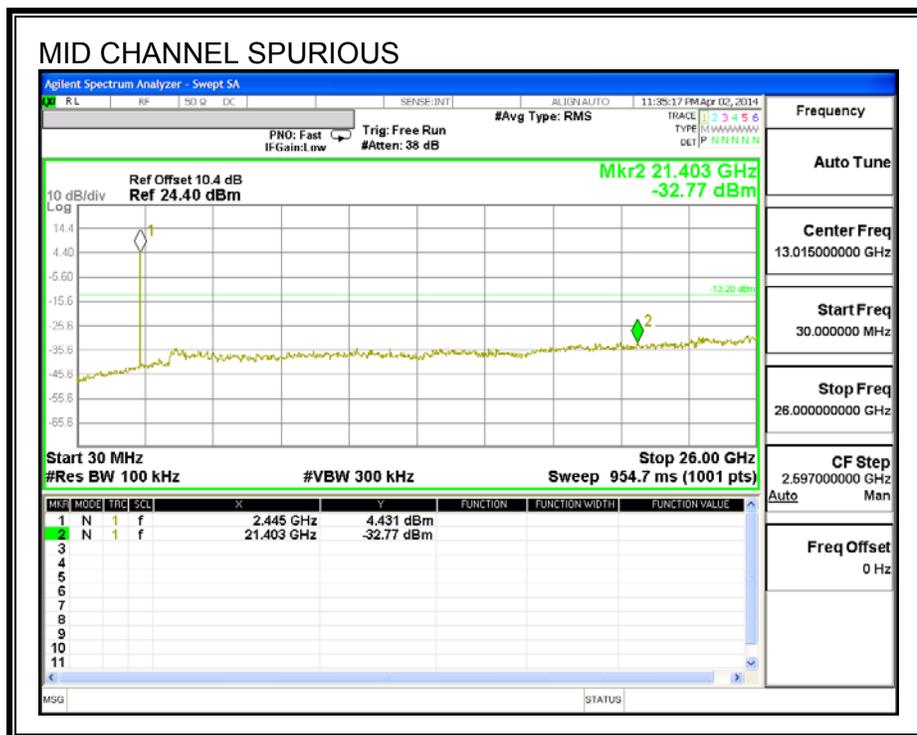
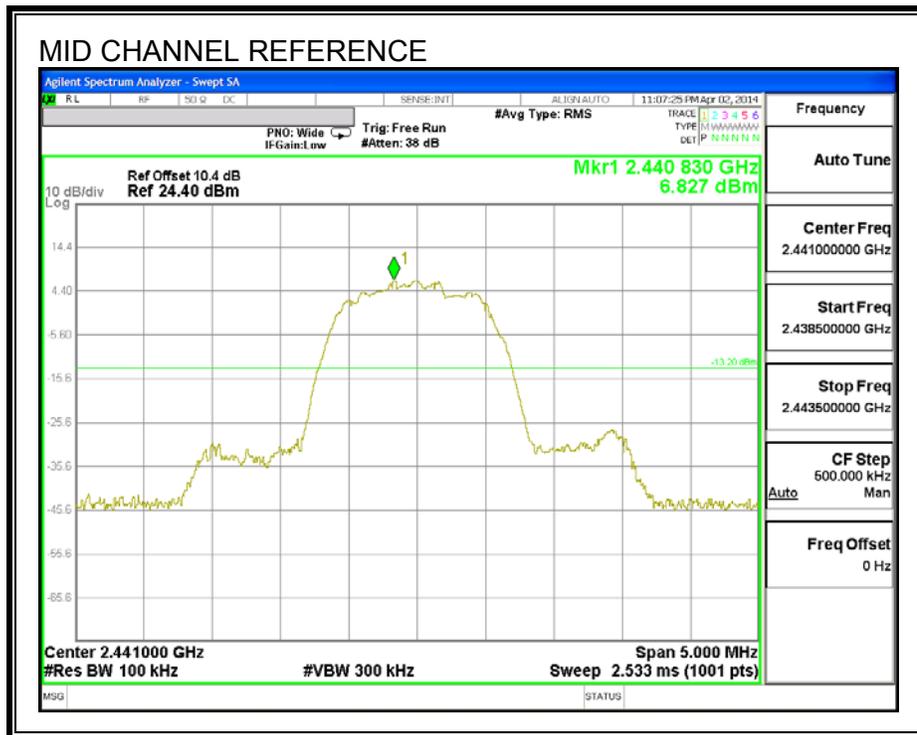


8.7.1. ENHANCED DATA RATE 8PSK MODULATION

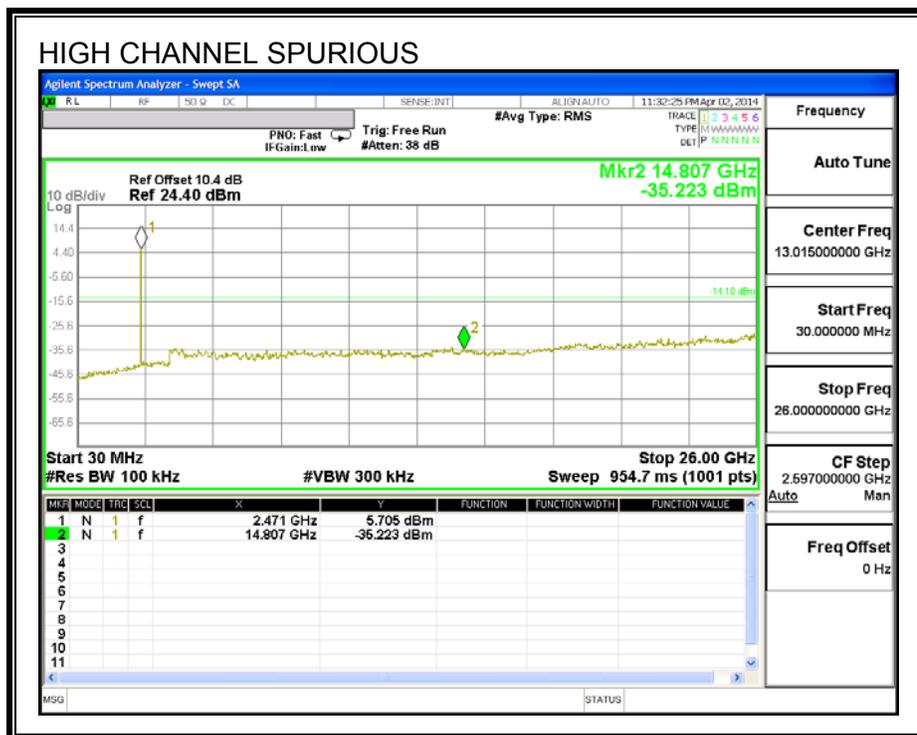
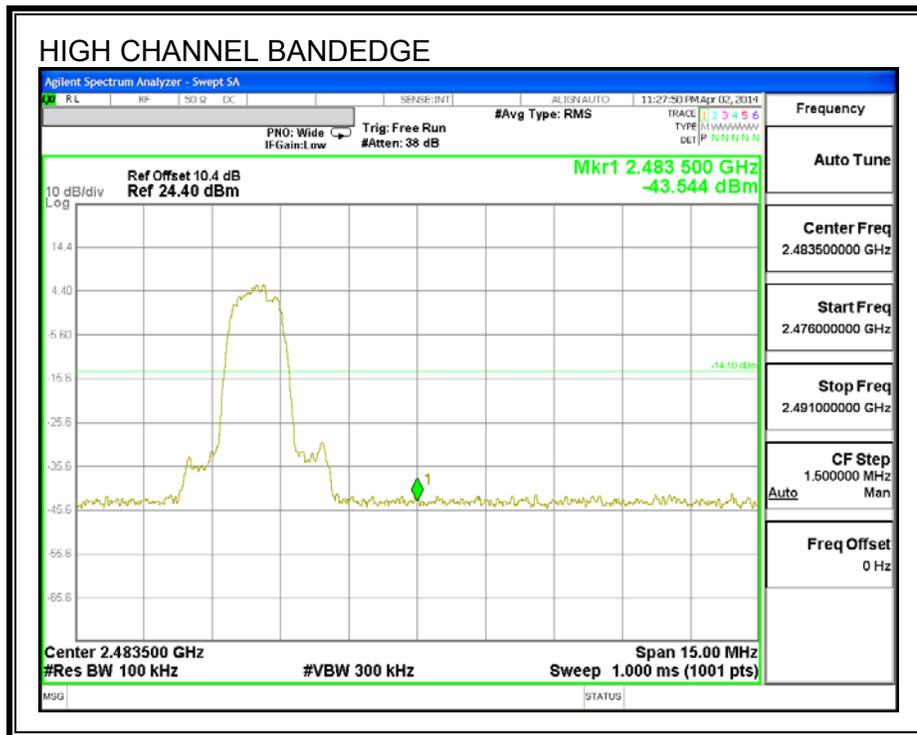
SPURIOUS EMISSIONS, LOW CHANNEL



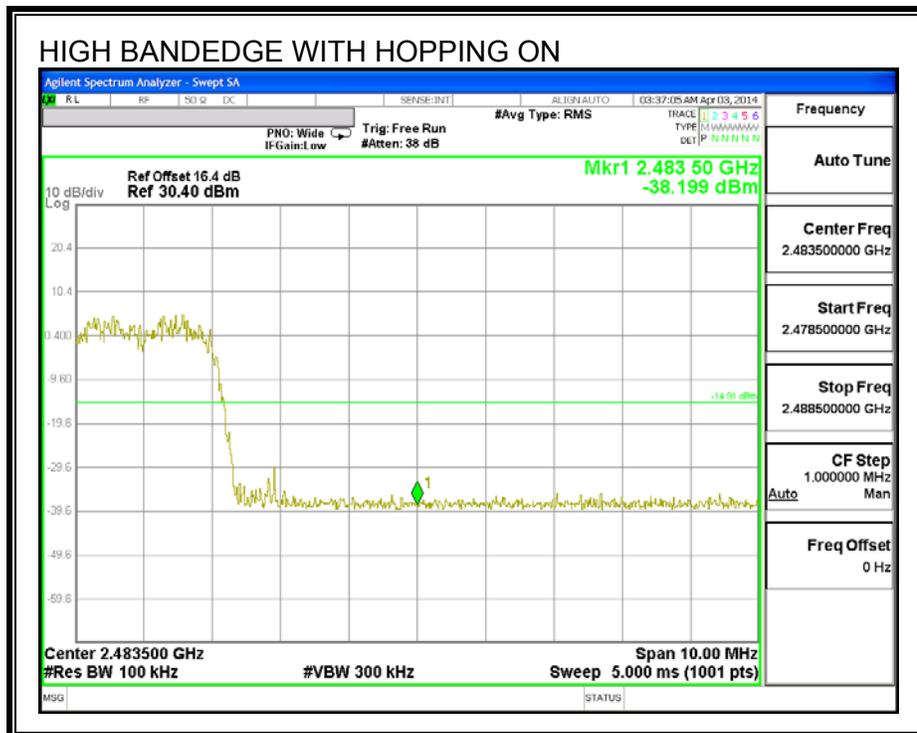
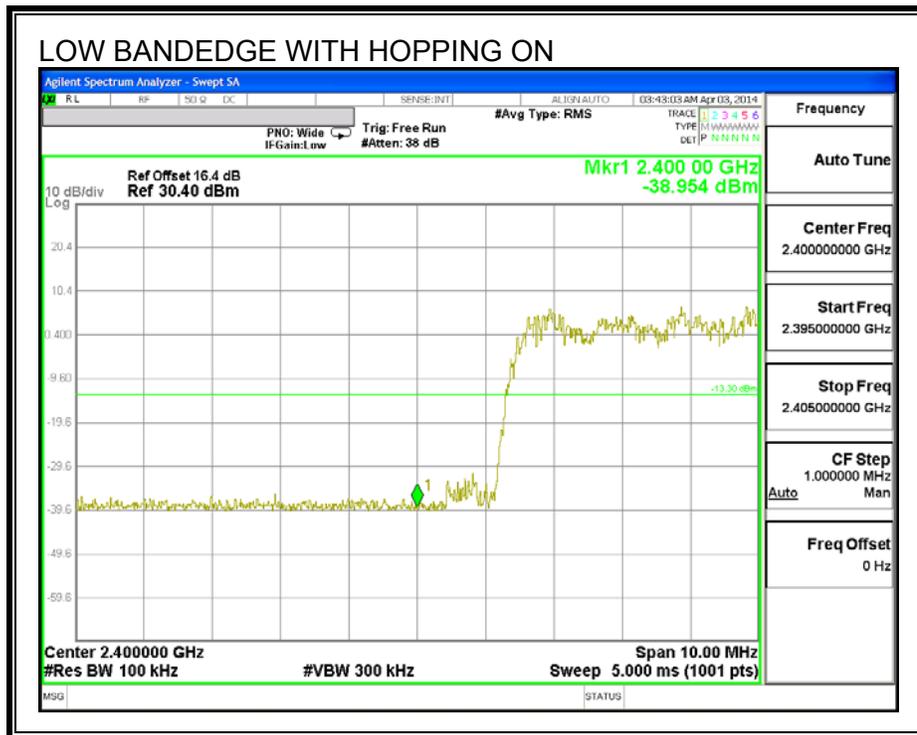
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



SPURIOUS BANDEDGE EMISSIONS WITH 8PSK HOPPING ON



9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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. $GFSK = 1/T = 1 / 0.0038S = 260Hz$.

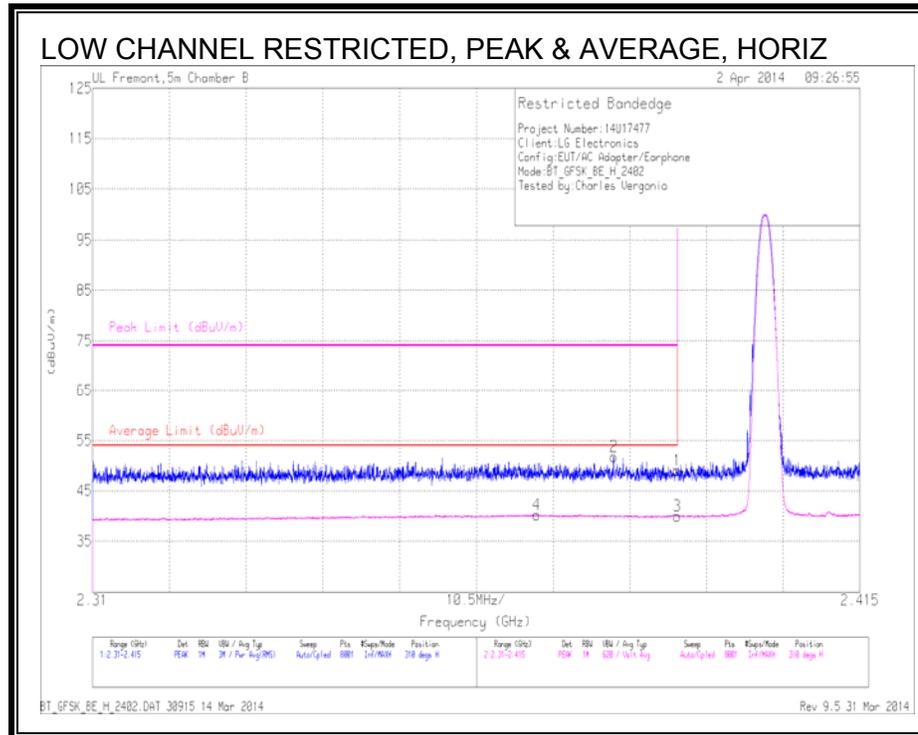
The spectrum from 1GHzHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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)



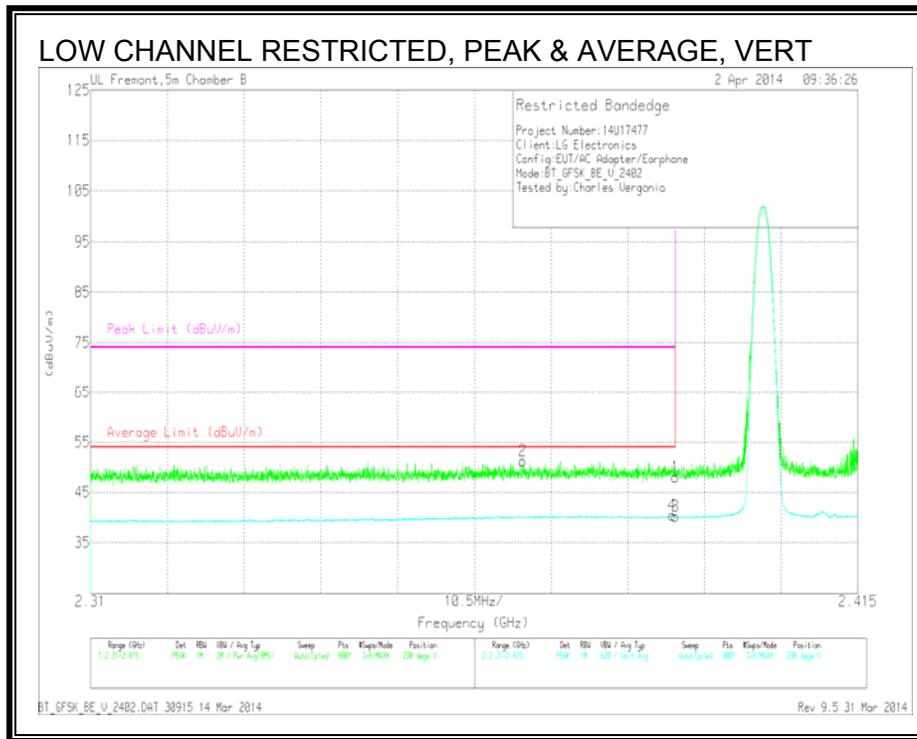
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/ Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 2.371	31.07	VB1T	32	-22.8	40.27	54	-13.73	-	-	310	308	H
2	* 2.381	42.7	PK	32	-22.9	51.8	-	-	74	-22.2	310	308	H
1	* 2.39	39.82	PK	32.1	-22.9	49.02	-	-	74	-24.98	310	308	H
3	* 2.39	30.83	VB1T	32.1	-22.9	40.03	54	-13.97	-	-	310	308	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

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



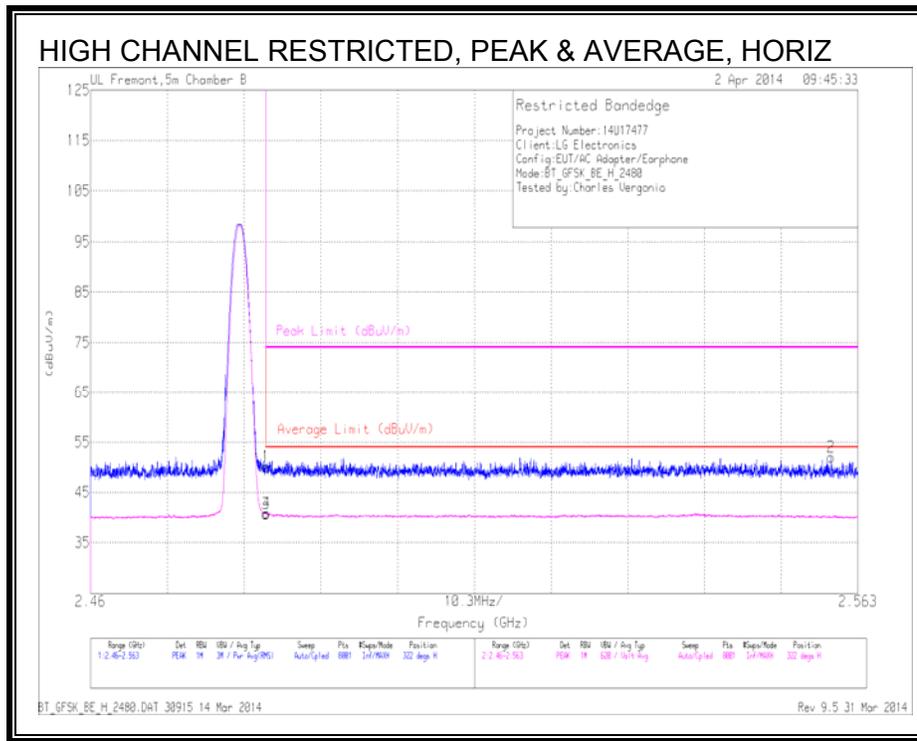
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.369	42.04	PK	32	-22.8	51.24	-	-	74	-22.76	238	376	V
1	* 2.39	38.85	PK	32.1	-22.9	48.05	-	-	74	-25.95	238	376	V
3	* 2.39	31.04	VB1T	32.1	-22.9	40.24	54	-13.76	-	-	238	376	V
4	* 2.39	31.27	VB1T	32.1	-22.9	40.47	54	-13.53	-	-	238	376	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

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



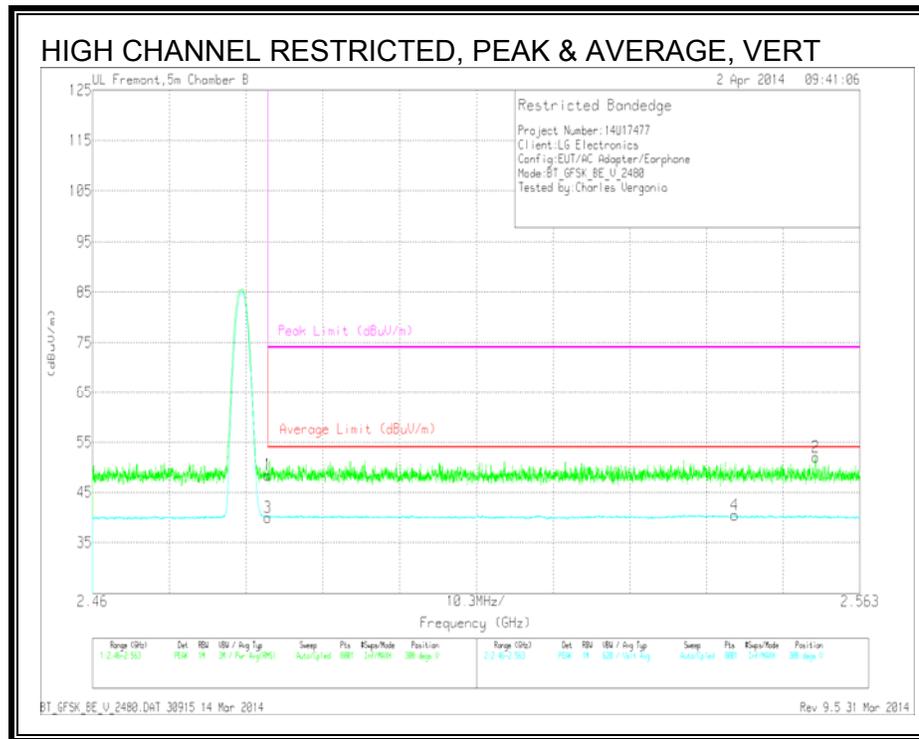
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.36	PK	32.4	-22.6	50.16	-	-	74	-23.84	322	174	H
3	* 2.484	30.9	VB1T	32.4	-22.6	40.7	54	-13.3	-	-	322	174	H
4	* 2.484	31.08	VB1T	32.4	-22.6	40.88	54	-13.12	-	-	322	174	H
2	2.559	42.35	PK	32.5	-22.8	52.05	-	-	74	-21.95	322	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

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/ 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	38.69	PK	32.4	-22.6	48.49	-	-	74	-25.51	308	182	V
3	* 2.484	30.19	VB1T	32.4	-22.6	39.99	54	-14.01	-	-	308	182	V
4	2.546	30.6	VB1T	32.5	-22.6	40.5	54	-13.5	-	-	308	182	V
2	2.557	42.27	PK	32.5	-22.7	52.07	-	-	74	-21.93	308	182	V

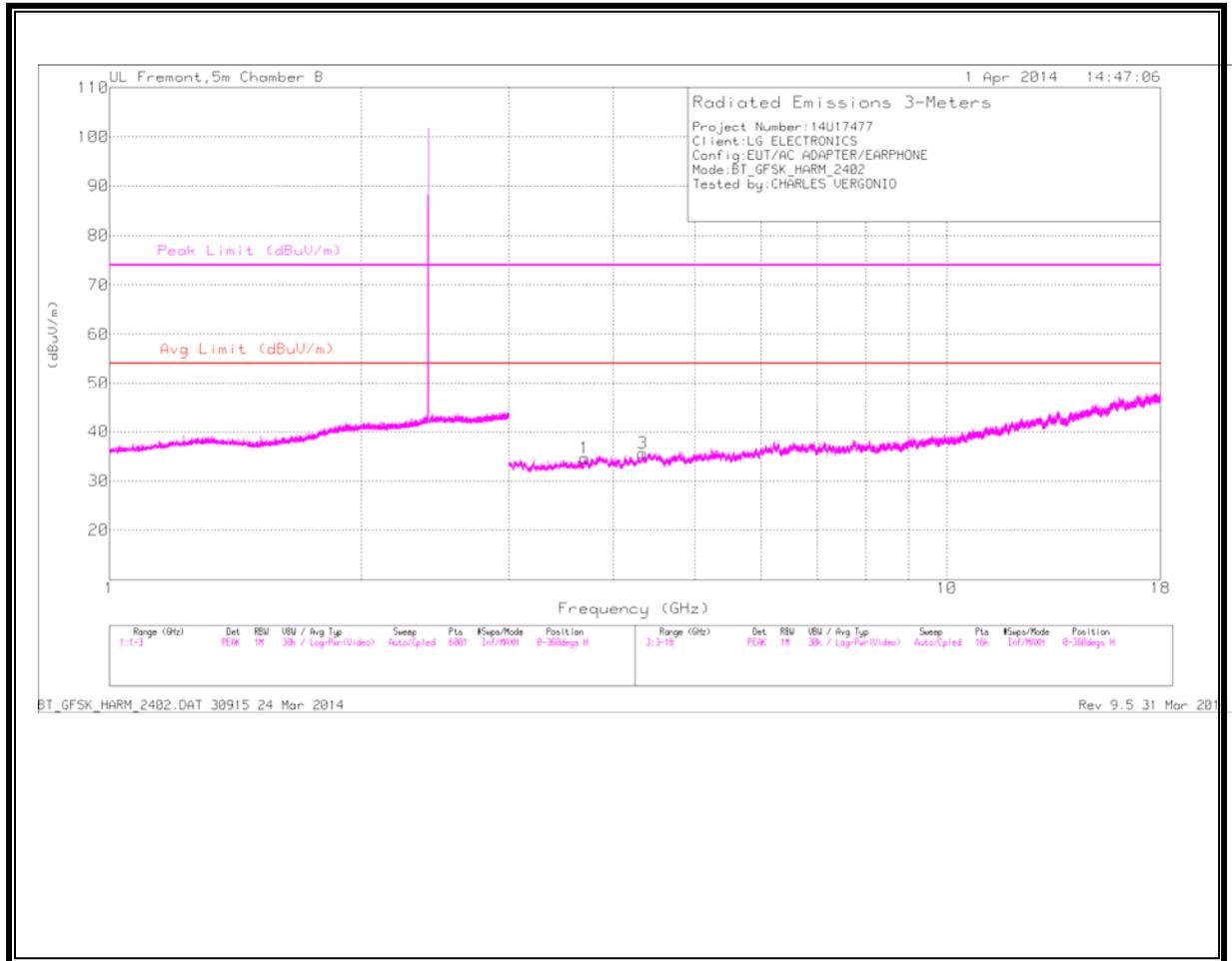
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

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

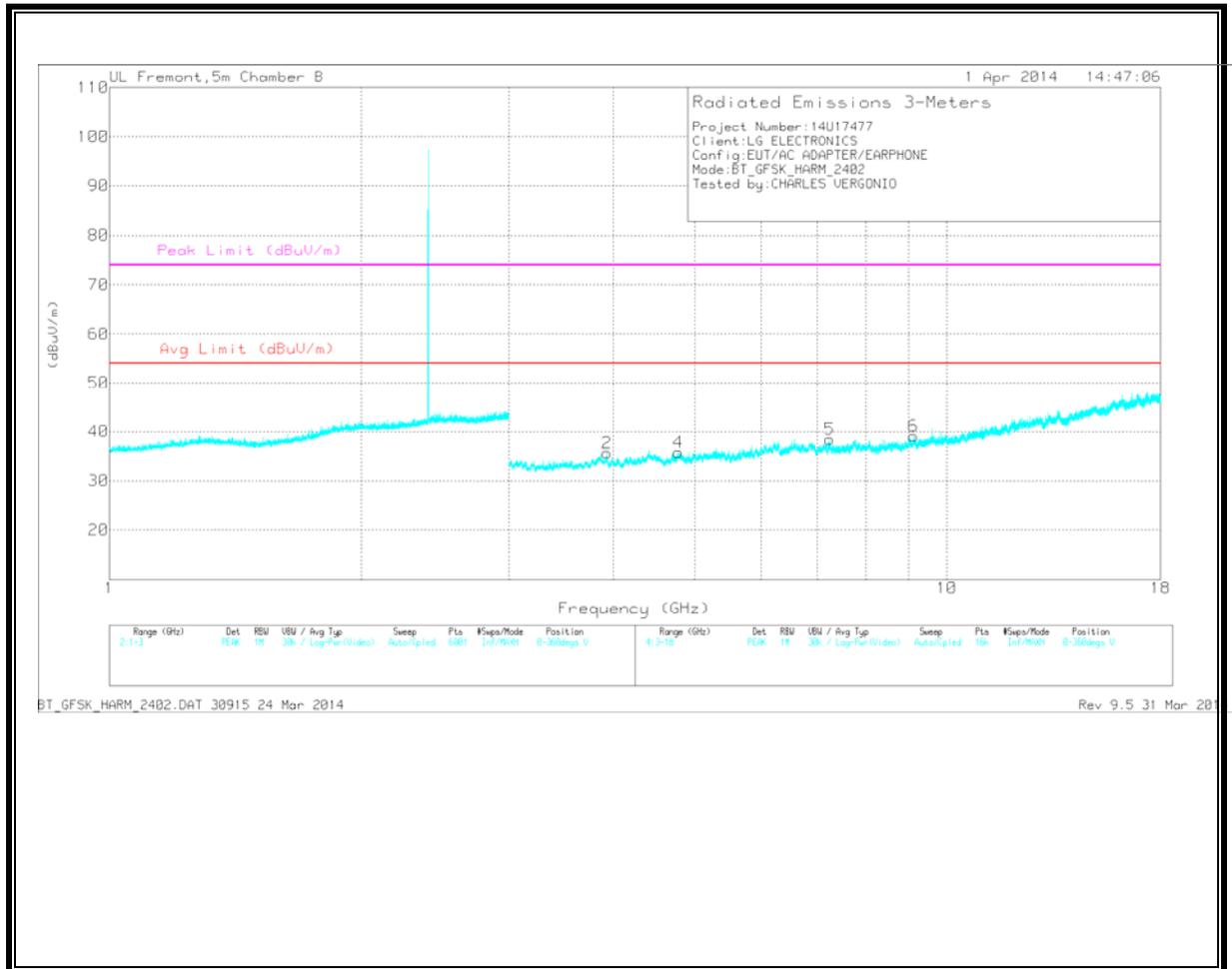
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL
HORIZONTAL



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

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.

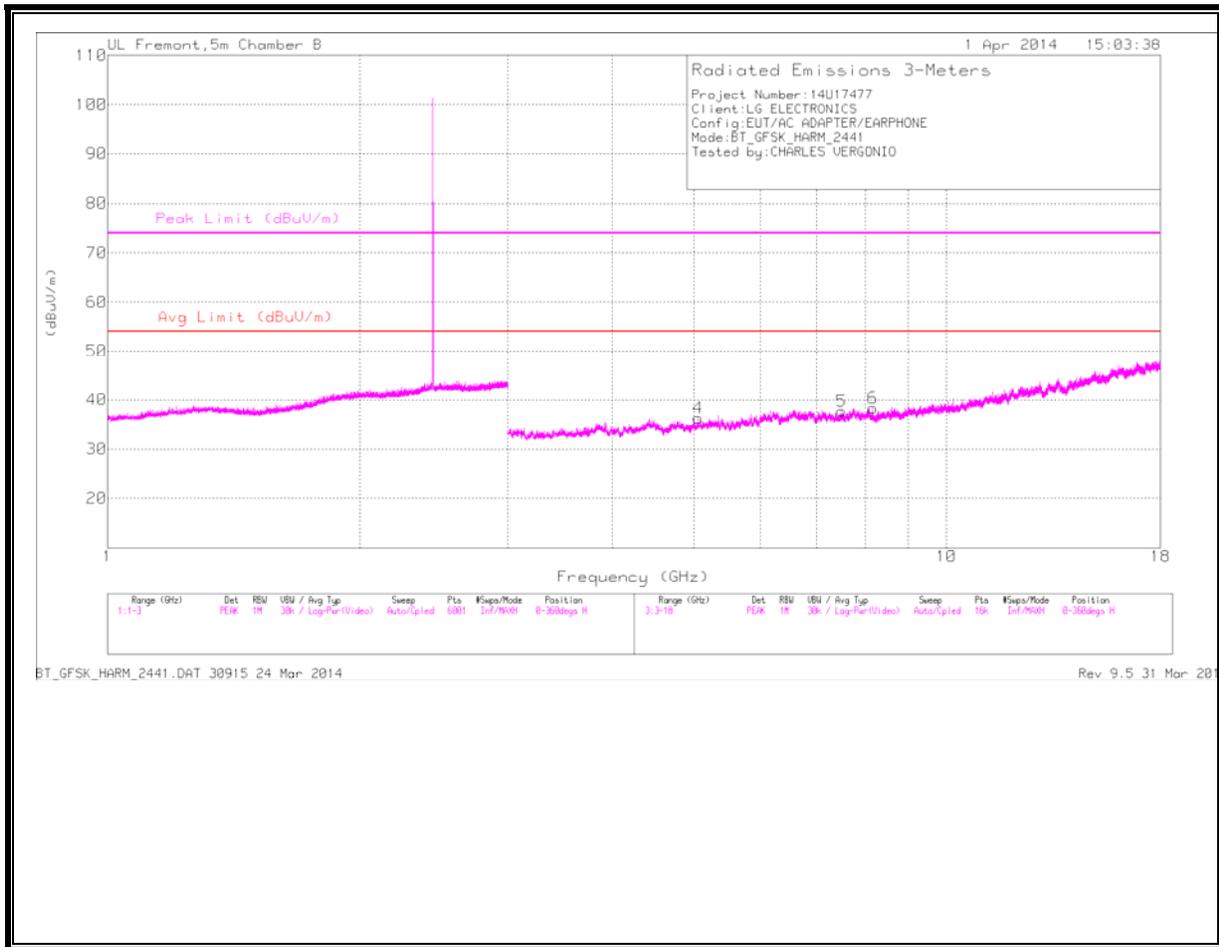
LOW CHANNEL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/F ltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 3.696	41.75	PK3	33.3	-31.2	43.85	54	-10.15	74	-30.15	1	100	H
* 4.331	41.15	PK3	33.7	-31	43.85	54	-10.15	74	-30.15	1	100	H
* 3.928	40.5	PK3	33.7	-30.5	43.7	54	-10.3	74	-30.3	1	100	V
* 4.783	39.75	PK3	34.2	-29	44.95	54	-9.05	74	-29.05	1	100	V
* 9.132	36.05	PK3	36.3	-24.9	47.45	54	-6.55	74	-26.55	1	100	V
7.24	38.33	PK3	35.6	-27.4	46.53	54	-7.47	74	-27.47	1	100	V

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

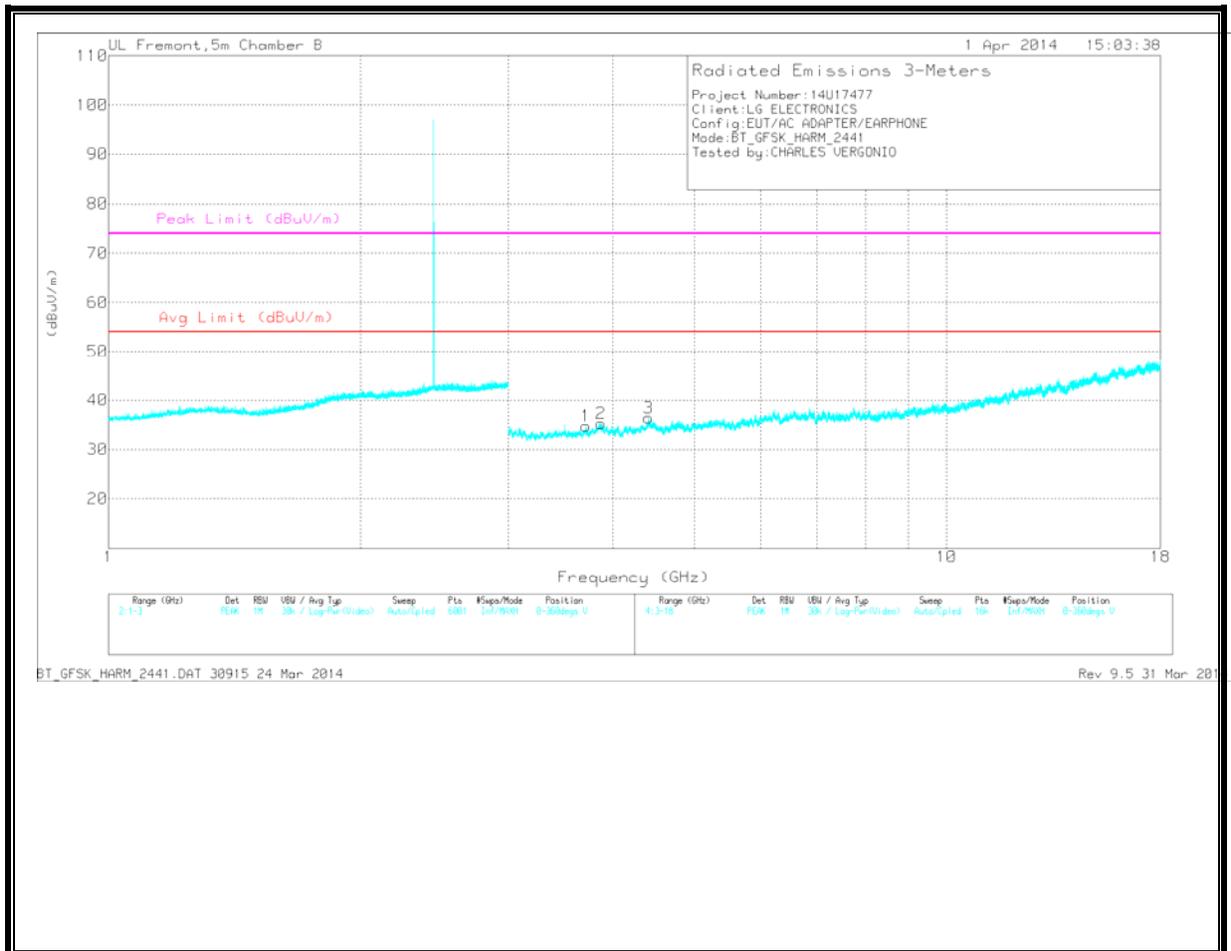
PK3 - FHSS Method: Maximum Peak

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.

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.

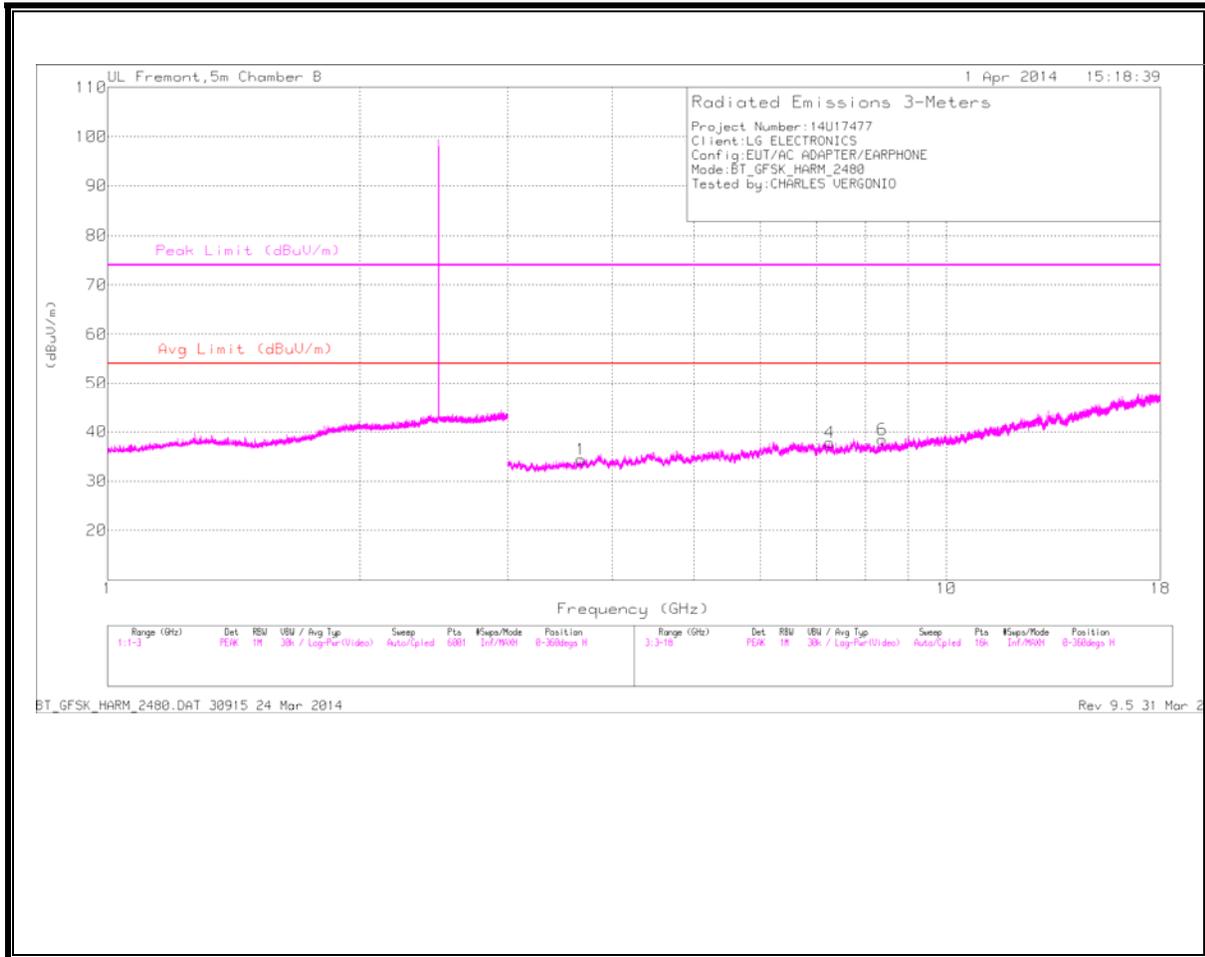
MID CHANNEL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/F Itr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 5.058	39.1	PK3	34.2	-28.9	44.4	54	-9.6	74	-29.6	1	100	H
* 7.5	37.11	PK3	35.6	-26.6	46.11	54	-7.89	74	-27.89	1	100	H
* 8.172	37.09	PK3	35.7	-26.8	45.99	54	-8.01	74	-28.01	1	100	H
* 3.711	41.56	PK3	33.4	-31.1	43.86	54	-10.14	74	-30.14	1	100	V
* 3.869	39.91	PK3	33.7	-30.2	43.41	54	-10.59	74	-30.59	1	100	V
4.408	40.42	PK3	33.8	-29.7	44.52	54	-9.48	74	-29.48	1	100	V

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

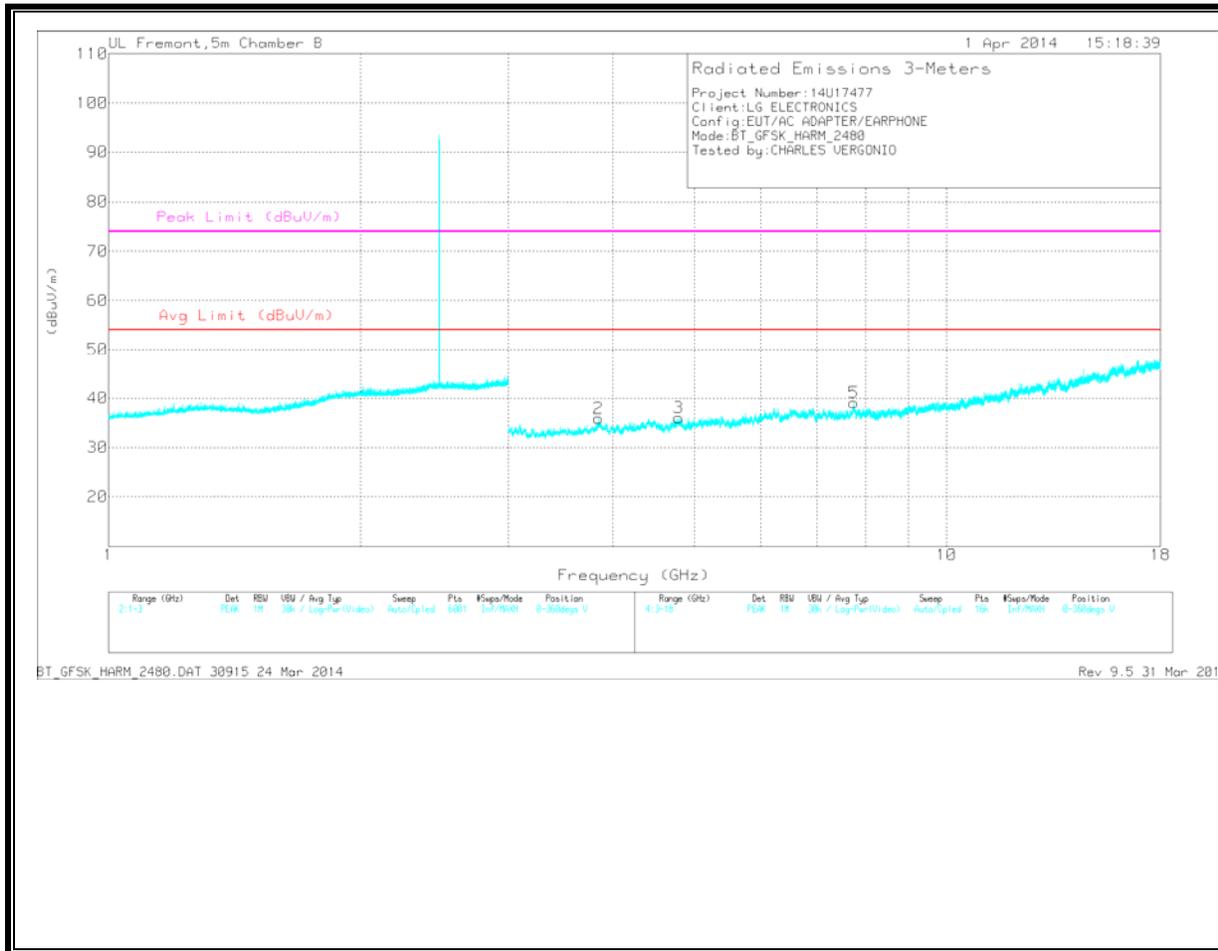
PK3 - FHSS Method: Maximum Peak

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.

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

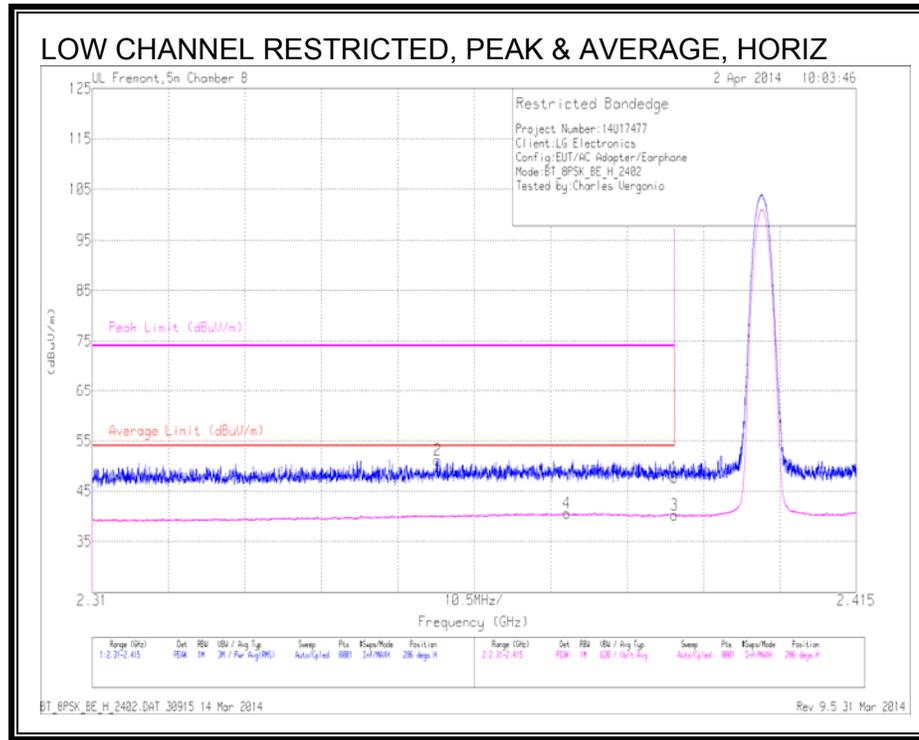
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/F Itr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 3.667	40.1	PK3	33.3	-31	42.4	54	-11.6	74	-31.6	1	100	H
* 7.255	38.07	PK3	35.6	-27.3	46.37	54	-7.63	74	-27.63	1	100	H
* 8.39	36.1	PK3	35.7	-25.5	46.3	54	-7.7	74	-27.7	1	100	H
* 3.844	40.68	PK3	33.7	-30.2	44.18	54	-9.82	74	-29.82	1	100	V
* 4.786	39.39	PK3	34.2	-28.9	44.69	54	-9.31	74	-29.31	1	100	V
* 7.745	37.89	PK3	35.7	-26	47.59	54	-6.41	74	-26.41	1	100	V

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

PK3 - FHSS Method: Maximum Peak

9.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



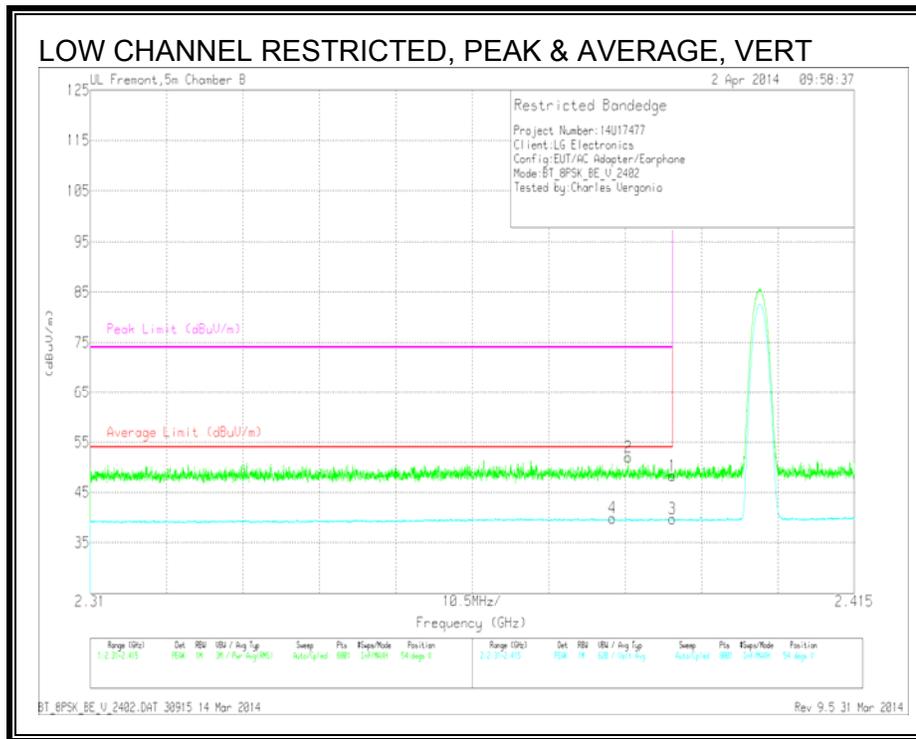
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.53	PK	32.1	-22.9	47.73	-	-	74	-26.27	286	301	H
2	* 2.357	42.21	PK	31.9	-22.9	51.21	-	-	74	-22.79	286	301	H
3	* 2.39	31.01	VB1T	32.1	-22.9	40.21	54	-13.79	-	-	286	301	H
4	* 2.375	31.44	VB1T	32	-22.8	40.64	54	-13.36	-	-	286	301	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

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



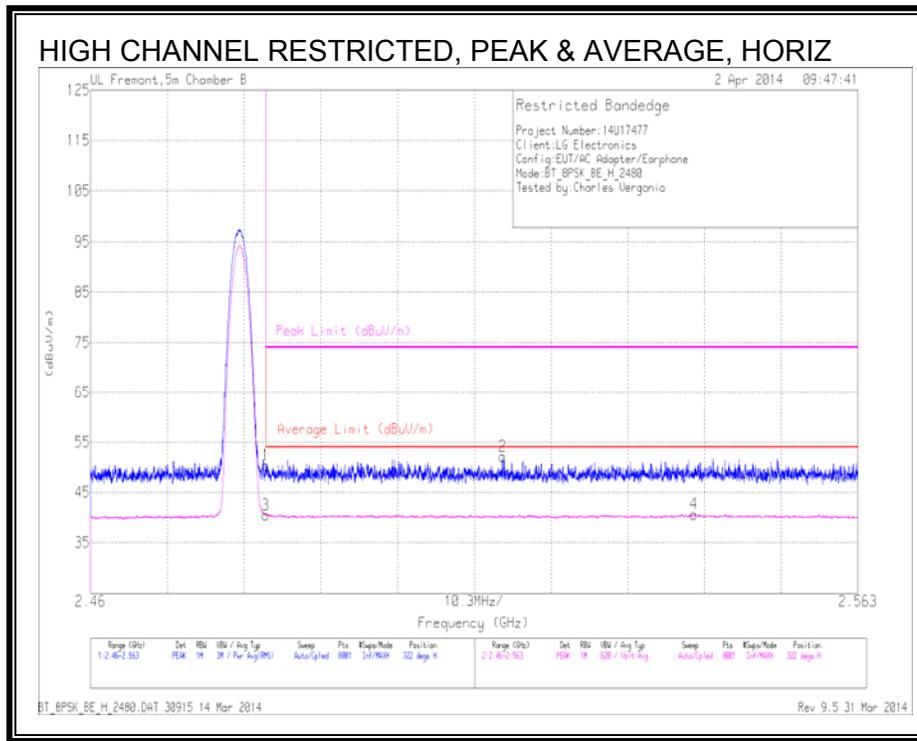
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/ Fitr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 2.382	30.82	VB1T	32	-22.9	39.92	54	-14.08	-	-	54	253	V
2	* 2.384	42.84	PK	32.1	-22.9	52.04	-	-	74	-21.96	54	253	V
1	* 2.39	39.12	PK	32.1	-22.9	48.32	-	-	74	-25.68	54	253	V
3	* 2.39	30.51	VB1T	32.1	-22.9	39.71	54	-14.29	-	-	54	253	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

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



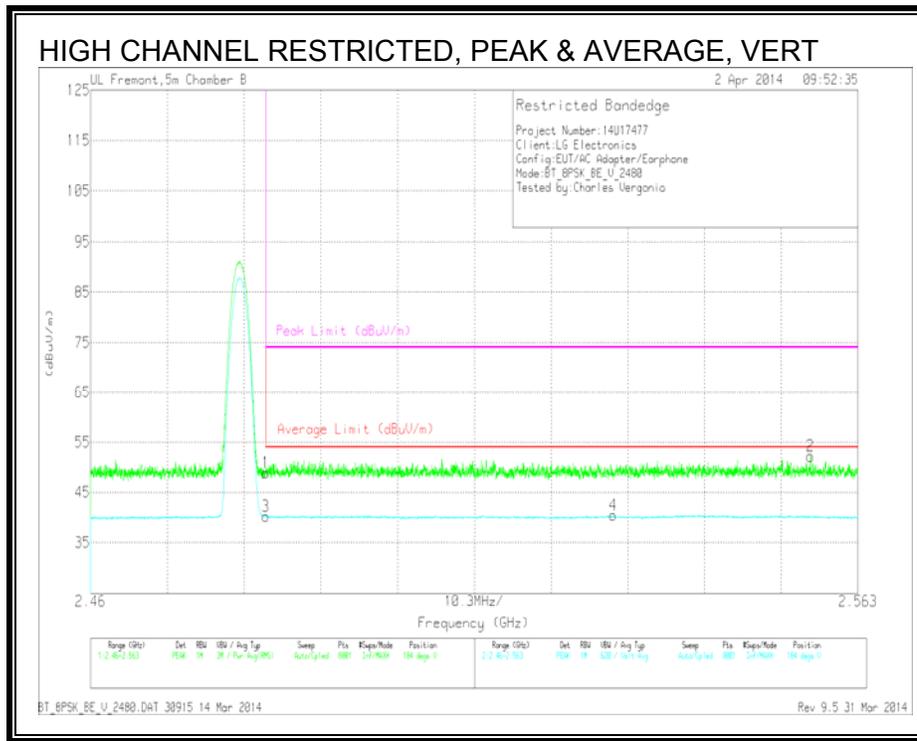
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/ Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.56	PK	32.4	-22.6	50.36	-	-	74	-23.64	322	174	H
3	* 2.484	30.7	VB1T	32.4	-22.6	40.5	54	-13.5	-	-	322	174	H
2	2.515	42.44	PK	32.5	-22.8	52.14	-	-	74	-21.86	322	174	H
4	2.541	30.67	VB1T	32.5	-22.5	40.67	54	-13.33	-	-	322	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

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (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	* 2.484	39.17	PK	32.4	-22.6	48.97	-	-	74	-25.03	184	346	V
3	* 2.484	30.44	VB1T	32.4	-22.6	40.24	54	-13.76	-	-	184	346	V
4	2.53	30.63	VB1T	32.5	-22.7	40.43	54	-13.57	-	-	184	346	V
2	2.557	42.42	PK	32.5	-22.7	52.22	-	-	74	-21.78	184	346	V

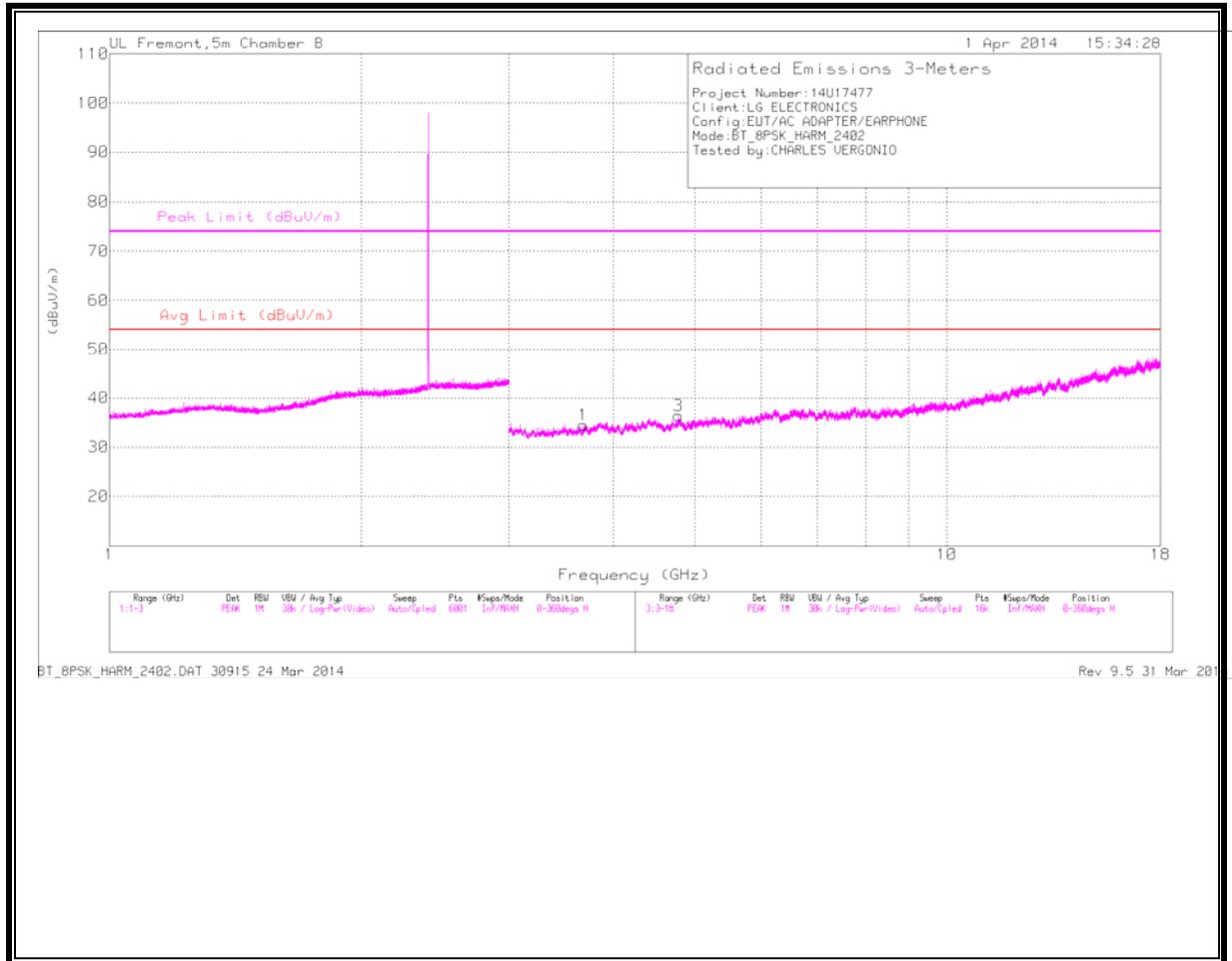
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

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

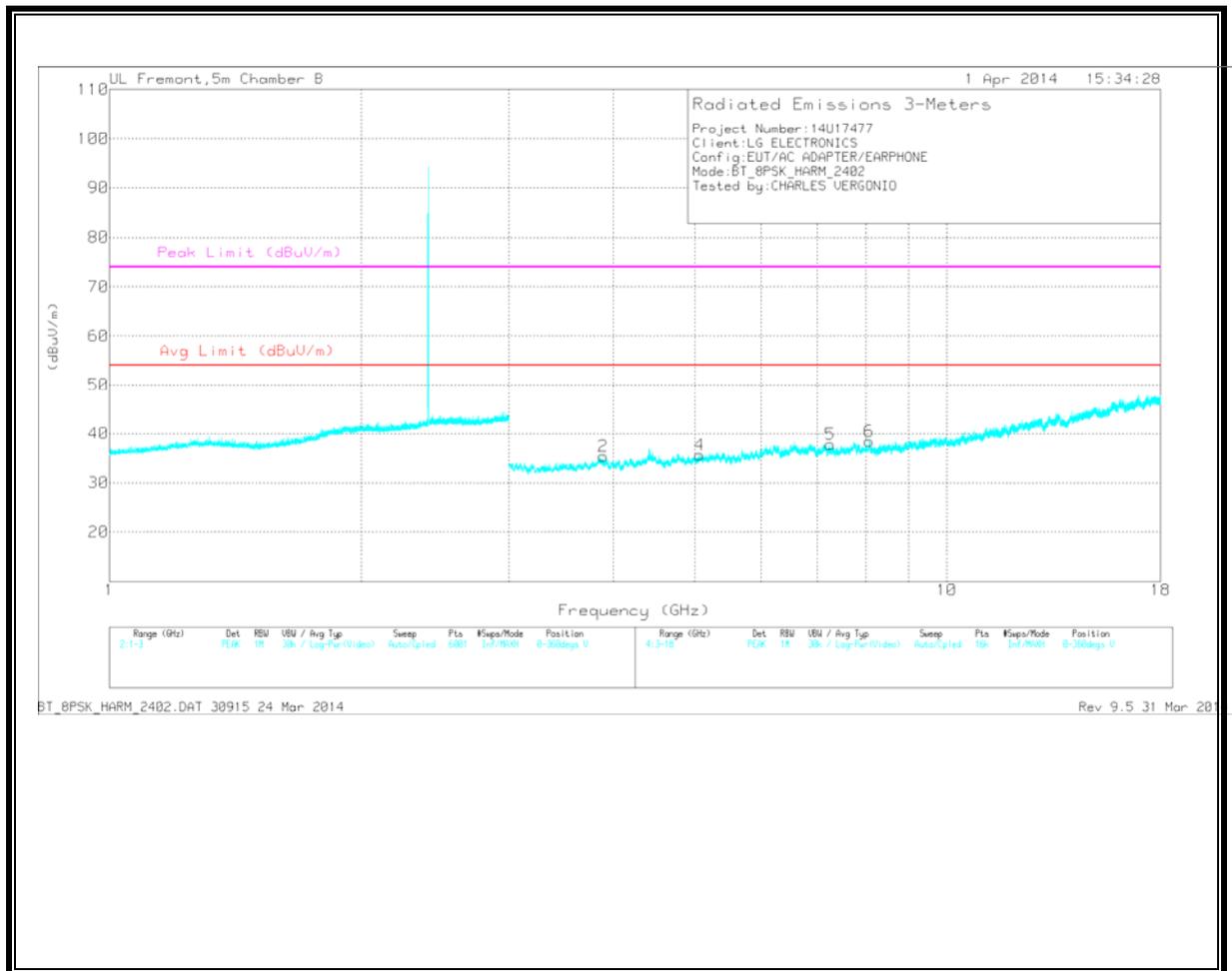
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL
HORIZONTAL



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

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.

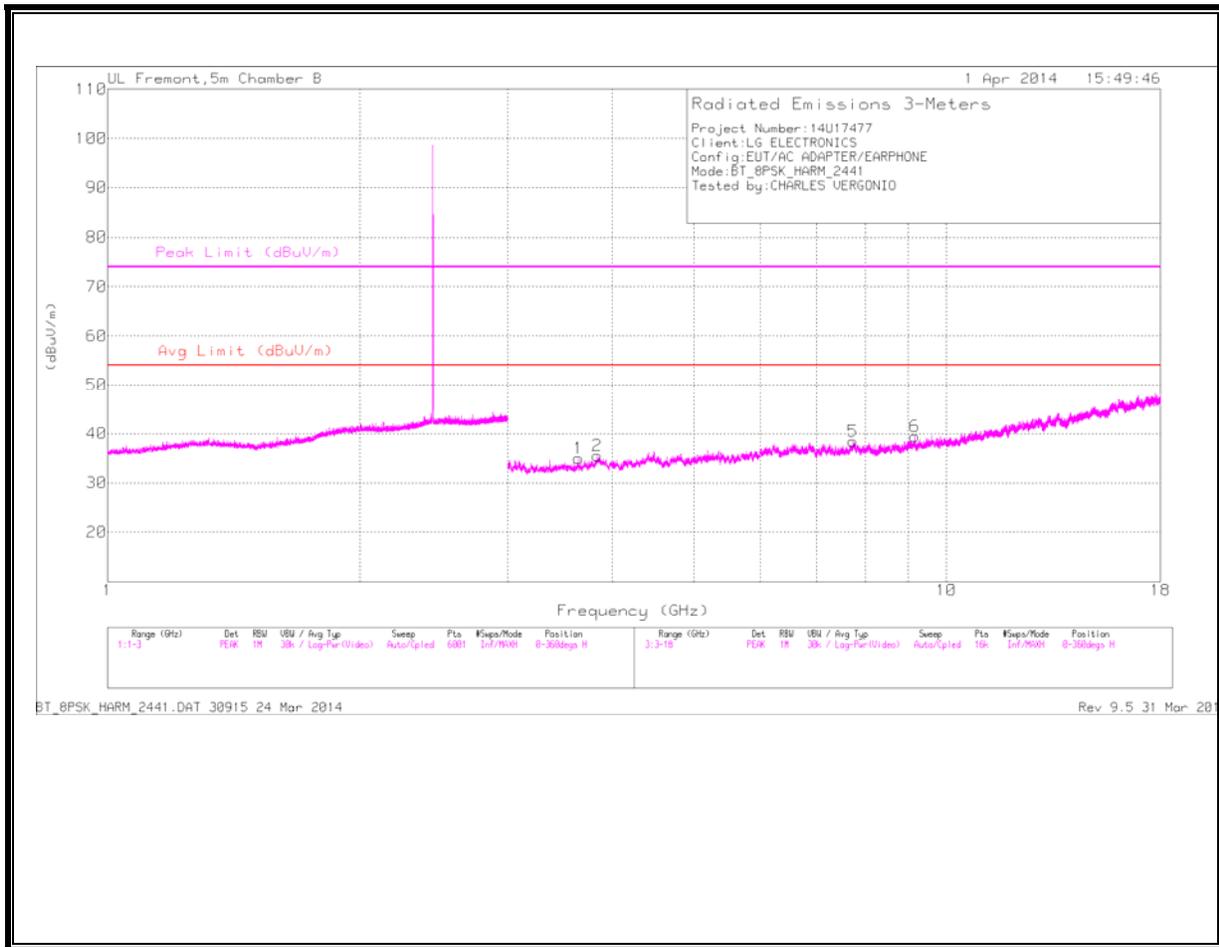
LOW CHANNEL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/F Itr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 3.678	40.59	PK3	33.3	-31.2	42.69	54	-11.31	74	-31.31	1	100	H
* 4.779	40.24	PK3	34.2	-29.1	45.34	54	-8.66	74	-28.66	1	100	H
* 3.889	40.45	PK3	33.8	-30.4	43.85	54	-10.15	74	-30.15	1	100	V
* 5.07	39.34	PK3	34.2	-28.8	44.74	54	-9.26	74	-29.26	1	100	V
* 7.258	38.29	PK3	35.6	-27.3	46.59	54	-7.41	74	-27.41	1	100	V
* 8.072	36.86	PK3	35.7	-26.1	46.46	54	-7.54	74	-27.54	1	100	V

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

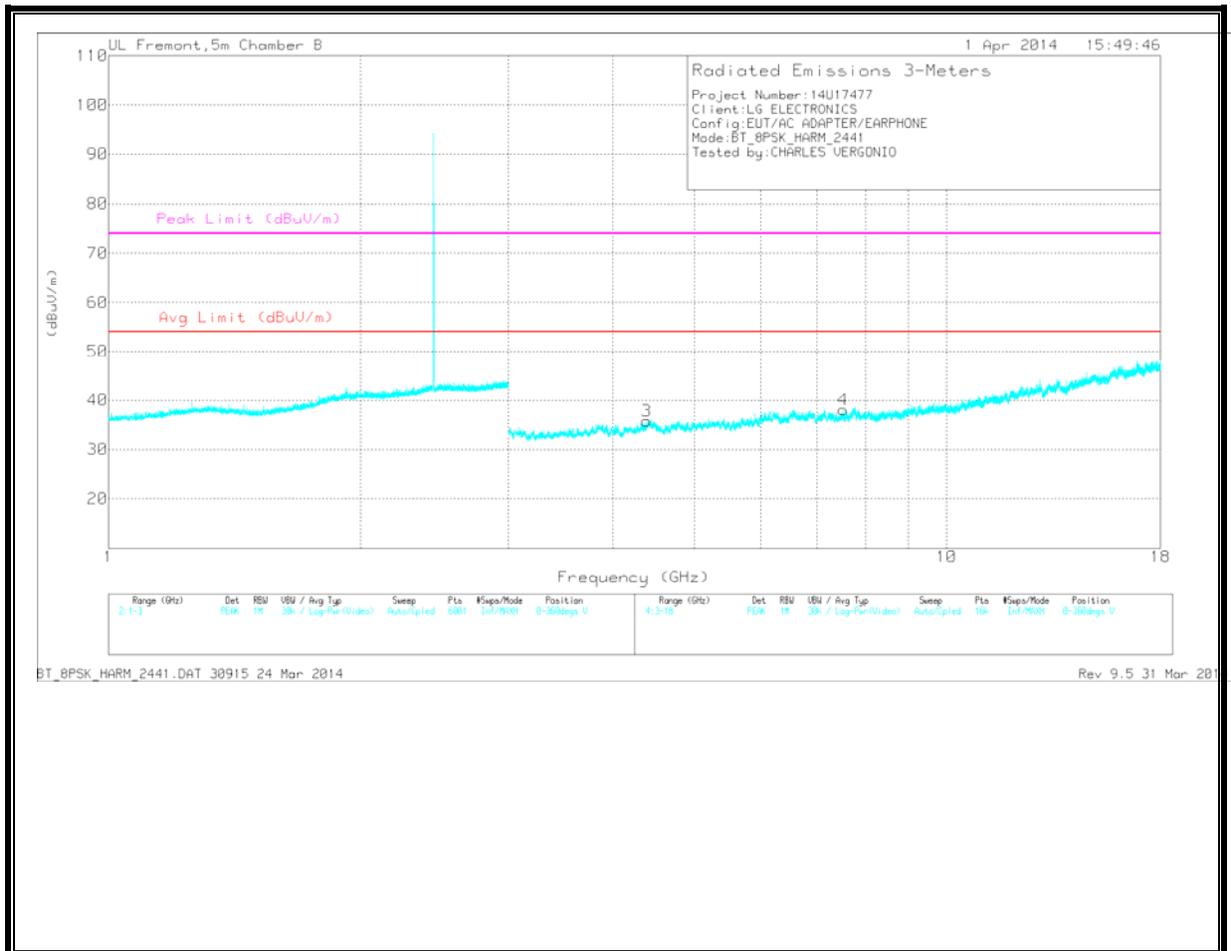
PK3 - FHSS Method: Maximum Peak

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.

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.

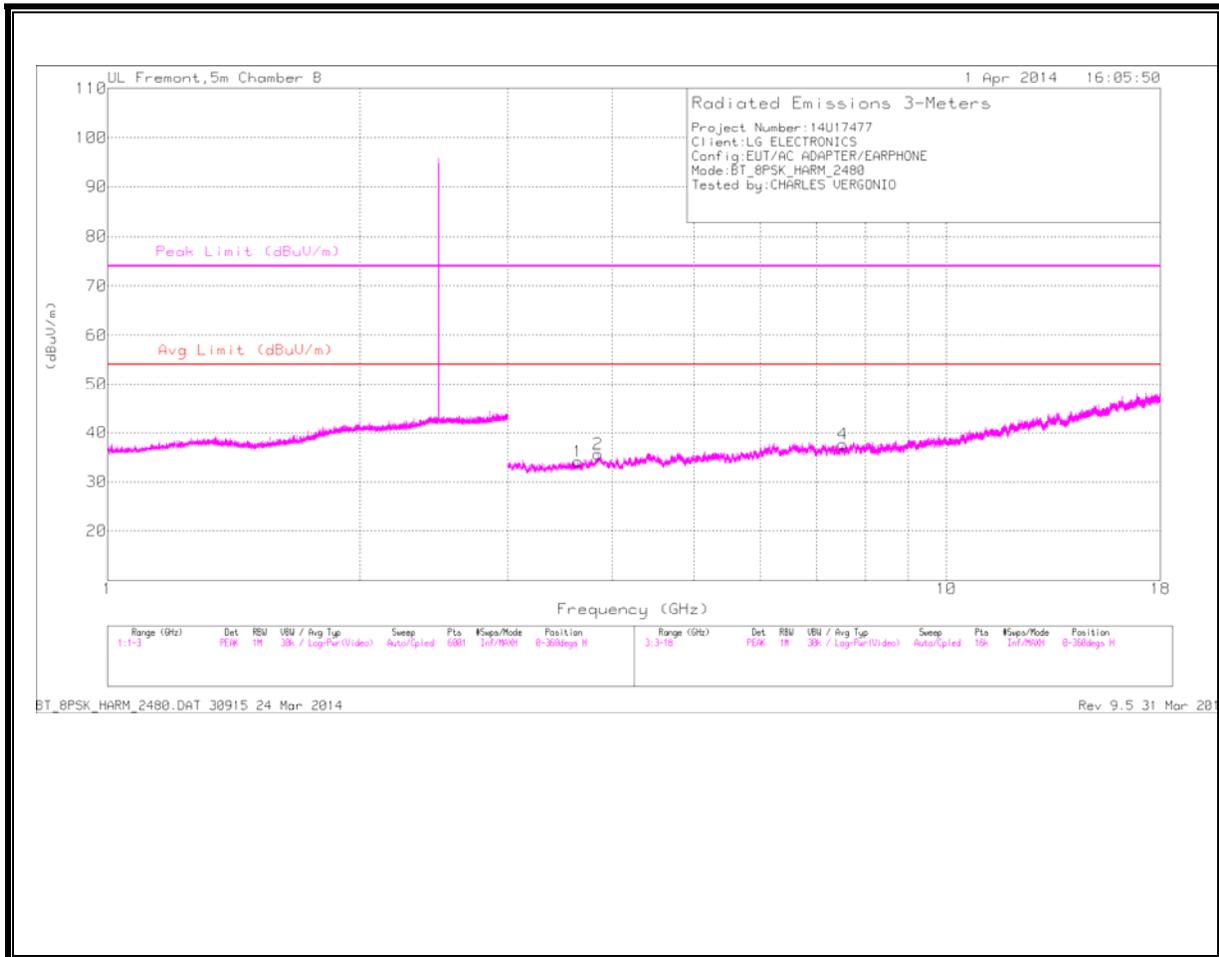
MID CHANNEL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/F Itr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 3.642	41	PK3	33.2	-31	43.2	54	-10.8	74	-30.8	1	100	H
* 3.838	40.04	PK3	33.7	-30.2	43.54	54	-10.46	74	-30.46	1	100	H
* 7.739	37.17	PK3	35.7	-26	46.87	54	-7.13	74	-27.13	1	100	H
* 9.167	36.09	PK3	36.3	-25.4	46.99	54	-7.01	74	-27.01	1	100	H
* 4.387	40.99	PK3	33.8	-30.3	44.49	54	-9.51	74	-29.51	1	100	V
* 7.523	37.44	PK3	35.6	-27	46.04	54	-7.96	74	-27.96	1	100	V

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

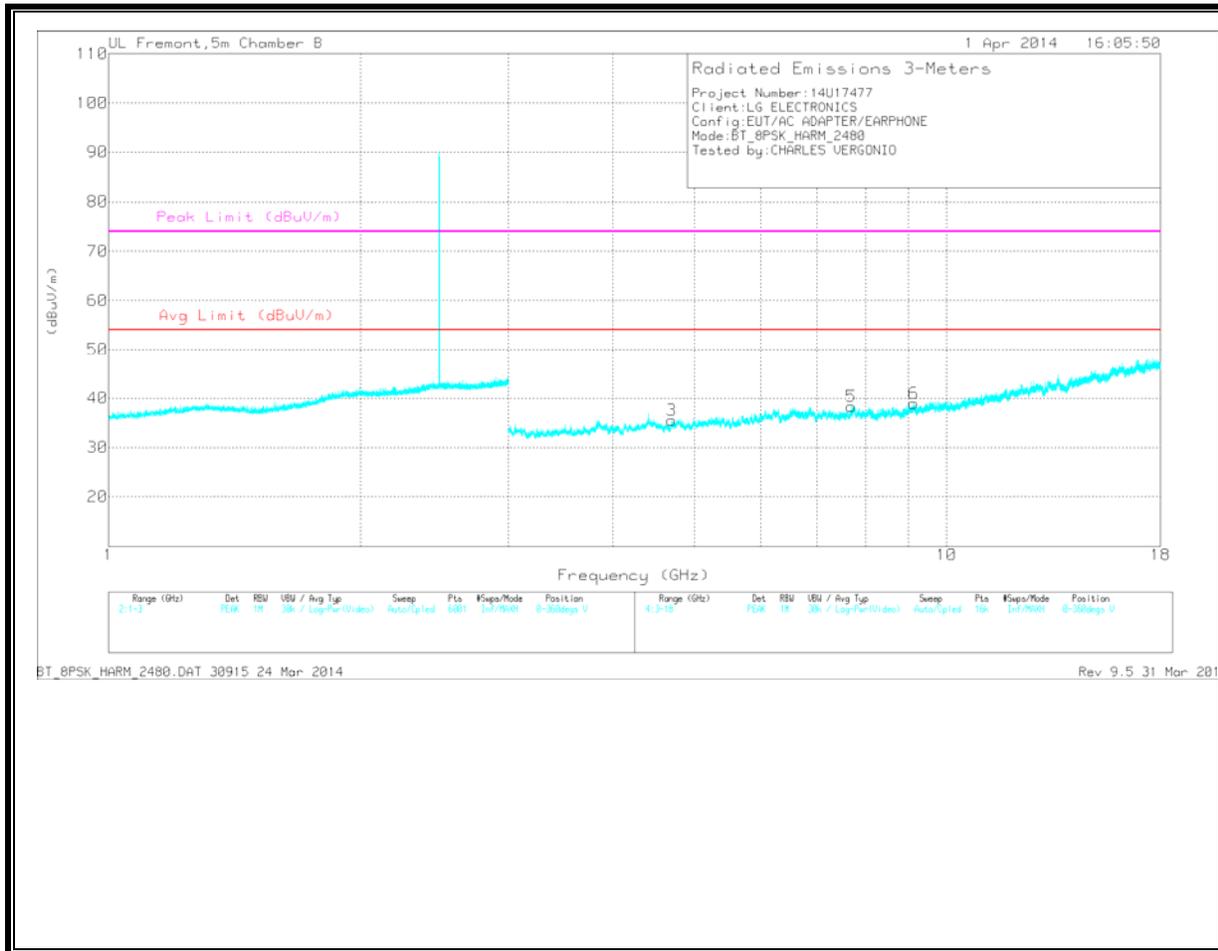
PK3 - FHSS Method: Maximum Peak

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.

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

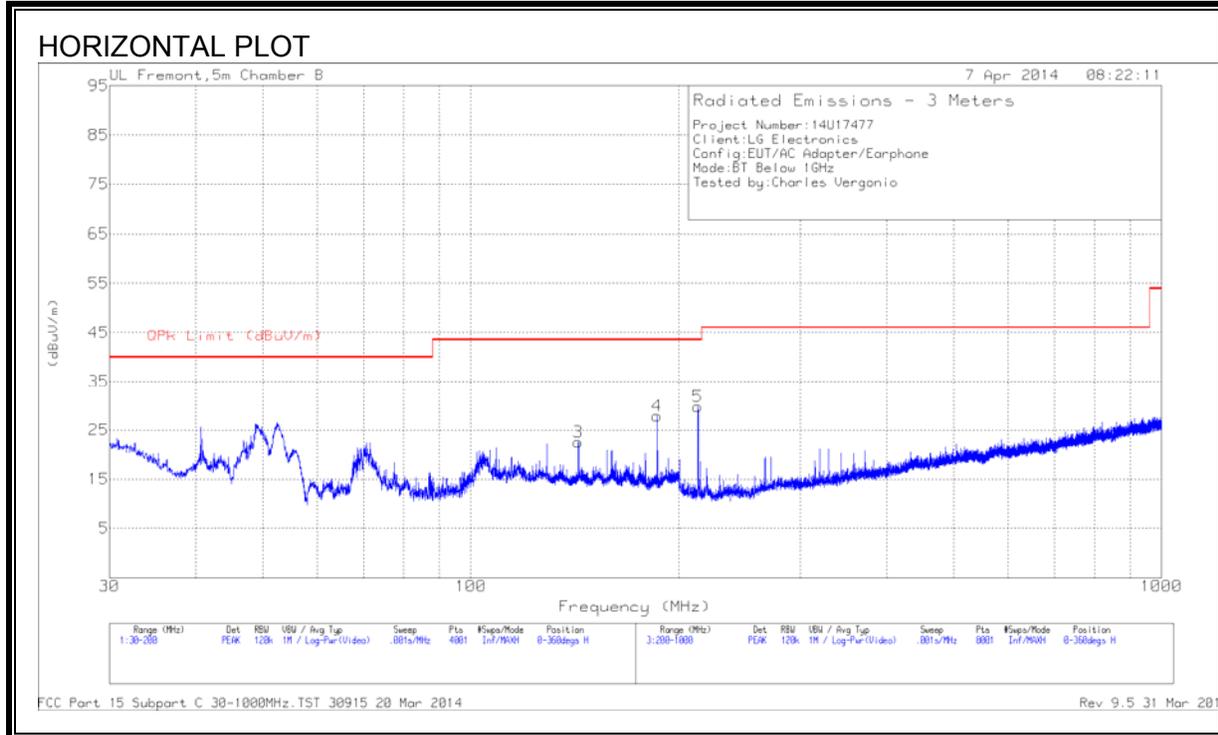
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/F Itr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 3.636	40.81	PK3	33.2	-31.1	42.91	54	-11.06	74	-31.09	1	100	H
* 3.842	40.3	PK3	33.7	-30.2	43.8	54	-10.2	74	-30.2	1	100	H
* 7.521	37.14	PK3	35.6	-27	45.74	54	-8.26	74	-28.26	1	100	H
* 4.7	40.3	PK3	34.2	-29.8	44.7	54	-9.3	74	-29.3	1	100	V
* 7.702	38.15	PK3	35.7	-26.7	47.15	54	-6.85	74	-26.85	1	100	V
* 9.139	36.1	PK3	36.3	-24.9	47.5	54	-6.5	74	-26.5	1	100	V

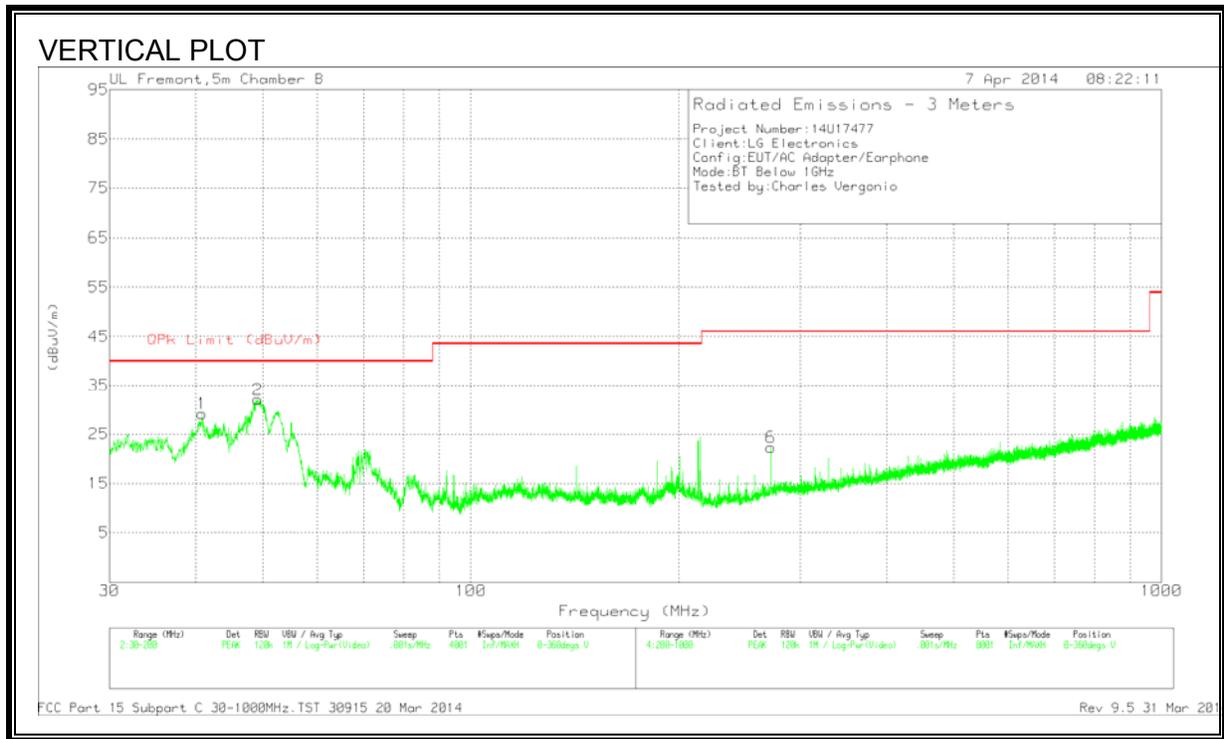
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

9.3. WORST-CASE BELOW 1 GHz

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





DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AFT477 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	* 272	35.57	PK	13	-26.3	22.27	46.02	-23.75	0-360	101	V
1	40.88	44.91	PK	12.9	-28.7	29.11	40	-10.89	0-360	101	V
2	49.1675	52.52	PK	8.1	-28.6	32.02	40	-7.98	0-360	101	V
3	143.1775	37.59	PK	12.6	-27.6	22.59	43.52	-20.93	0-360	200	H
4	186.145	43.63	PK	11.3	-27.1	27.83	43.52	-15.69	0-360	100	H
5	213.3	46.33	PK	10.4	-26.9	29.83	43.52	-13.69	0-360	200	H

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

PK - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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-L1 .15 - 30MHz

Trace Markers

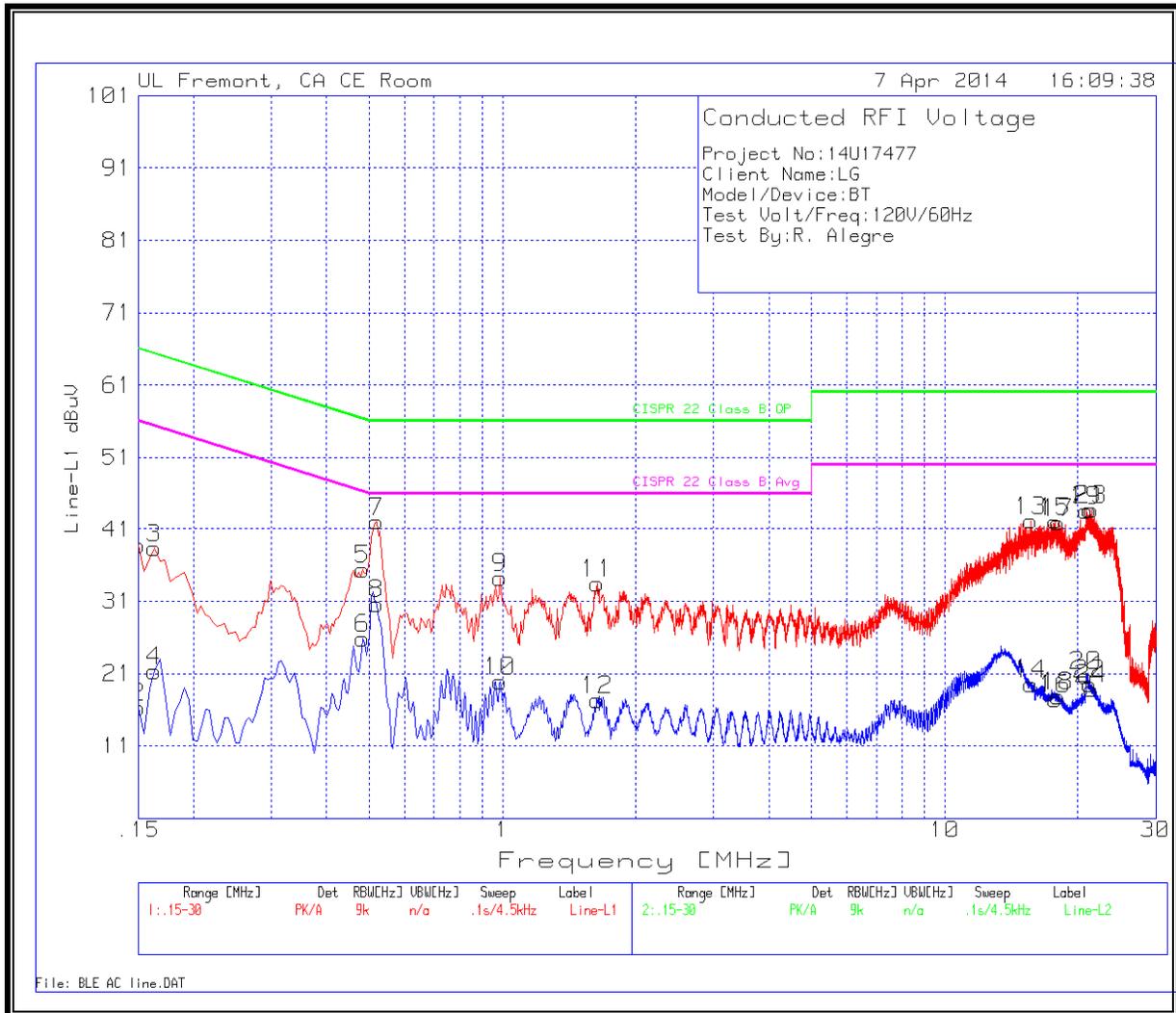
Marker	Frequency (MHz)	Meter Reading (dBUV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dBUV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
1	.15	37.27	PK	1.4	0	38.67	66	-27.33	-	-
2	.15	14.91	Av	1.4	0	16.31	-	-	56	-39.69
3	.1635	37.18	PK	1.2	0	38.38	65.3	-26.92	-	-
4	.1635	20.13	Av	1.2	0	21.33	-	-	55.3	-33.97
5	.483	34.93	PK	.4	0	35.33	56.3	-20.97	-	-
6	.483	25.46	Av	.4	0	25.86	-	-	46.3	-20.44
7	.519	41.78	PK	.3	0	42.08	56	-13.92	-	-
8	.519	30.27	Av	.3	0	30.57	-	-	46	-15.43
9	.987	33.87	PK	.3	0	34.17	56	-21.83	-	-
10	.987	19.65	Av	.3	0	19.95	-	-	46	-26.05
11	1.635	33.09	PK	.2	.1	33.39	56	-22.61	-	-
12	1.635	16.99	Av	.2	.1	17.29	-	-	46	-28.71
13	15.6885	41.66	PK	.3	.2	42.16	60	-17.84	-	-
14	15.6885	19.02	Av	.3	.2	19.52	-	-	50	-30.48
15	17.7495	41.64	PK	.3	.2	42.14	60	-17.86	-	-
16	17.7495	16.93	Av	.3	.2	17.43	-	-	50	-32.57
17	18.0105	41.41	PK	.3	.2	41.91	60	-18.09	-	-
18	18.0105	17.34	Av	.3	.2	17.84	-	-	50	-32.16
19	20.886	43.13	PK	.3	.2	43.63	60	-16.37	-	-
20	20.886	20.13	Av	.3	.2	20.63	-	-	50	-29.37
21	21.2235	43.21	PK	.3	.2	43.71	60	-16.29	-	-
22	21.2235	18.99	Av	.3	.2	19.49	-	-	50	-30.51
23	21.462	43.22	PK	.3	.2	43.72	60	-16.28	-	-
24	21.462	18.4	Av	.3	.2	18.9	-	-	50	-31.1

Line-L2 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
25	.1545	38.09	PK	1.4	0	39.49	65.8	-26.31	-	-
26	.1545	16.08	Av	1.4	0	17.48	-	-	55.8	-38.32
27	.33	35.2	PK	.5	0	35.7	59.5	-23.8	-	-
28	.33	20.12	Av	.5	0	20.62	-	-	49.5	-28.88
29	.474	36.99	PK	.4	0	37.39	56.4	-19.01	-	-
30	.474	21.76	Av	.4	0	22.16	-	-	46.4	-24.24
31	.5235	40.25	PK	.4	0	40.65	56	-15.35	-	-
32	.5235	26.61	Av	.4	0	27.01	-	-	46	-18.99
33	.762	32.97	PK	.3	0	33.27	56	-22.73	-	-
34	.762	19.21	Av	.3	0	19.51	-	-	46	-26.49
35	.897	32.25	PK	.3	0	32.55	56	-23.45	-	-
36	.897	15.37	Av	.3	0	15.67	-	-	46	-30.33
39	12.8355	35.53	PK	.3	.2	36.03	60	-23.97	-	-
40	12.8355	18.89	Av	.3	.2	19.39	-	-	50	-30.61
37	13.3845	37.33	PK	.3	.2	37.83	60	-22.17	-	-
38	13.3845	20.51	Av	.3	.2	21.01	-	-	50	-28.99
41	13.56	36.39	PK	.3	.2	36.89	60	-23.11	-	-
42	13.56	20.65	Av	.3	.2	21.15	-	-	50	-28.85
43	17.5965	33.4	PK	.3	.2	33.9	60	-26.1	-	-
44	17.5965	13.47	Av	.3	.2	13.97	-	-	50	-36.03

LINE 1 RESULTS



LINE 2 RESULTS

