



FCC 47 CFR PART 15 SUBPART C

**CERTIFICATION TEST REPORT
FOR**

GSM/WCDMA Phone + Bluetooth & WLAN 2.4GHz b/g/n

MODEL NUMBER: SM-G313M

FCC ID: A3LSMG313M

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	6/13/14	Initial Issue	P. Zhang
A	6/25/14	Updated antenna info	P. Zhang

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: GSM/WCDMA Phone + Bluetooth & WLAN 2.4GHz b/g/n
MODEL: SM-G313M
SERIAL NUMBER: FL-206-A, FL-206-B, FL-206-C (Radiated), FL-206-D (Conducted)
DATE TESTED: JUNE 1 - 13, 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 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☐ Chamber A	☐ Chamber D
☒ Chamber B	☐ Chamber E
☐ Chamber C	☐ Chamber F

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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 Phone + Bluetooth & WLAN 2.4GHz b/g/n unit.

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	9.59	9.10
2402 - 2480	Enhanced 8PSK	8.03	6.35

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 -0.6 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	Samsung	SM-G313M	N/A	N/A
Earphone	Samsung	SM-G313M	N/A	N/A

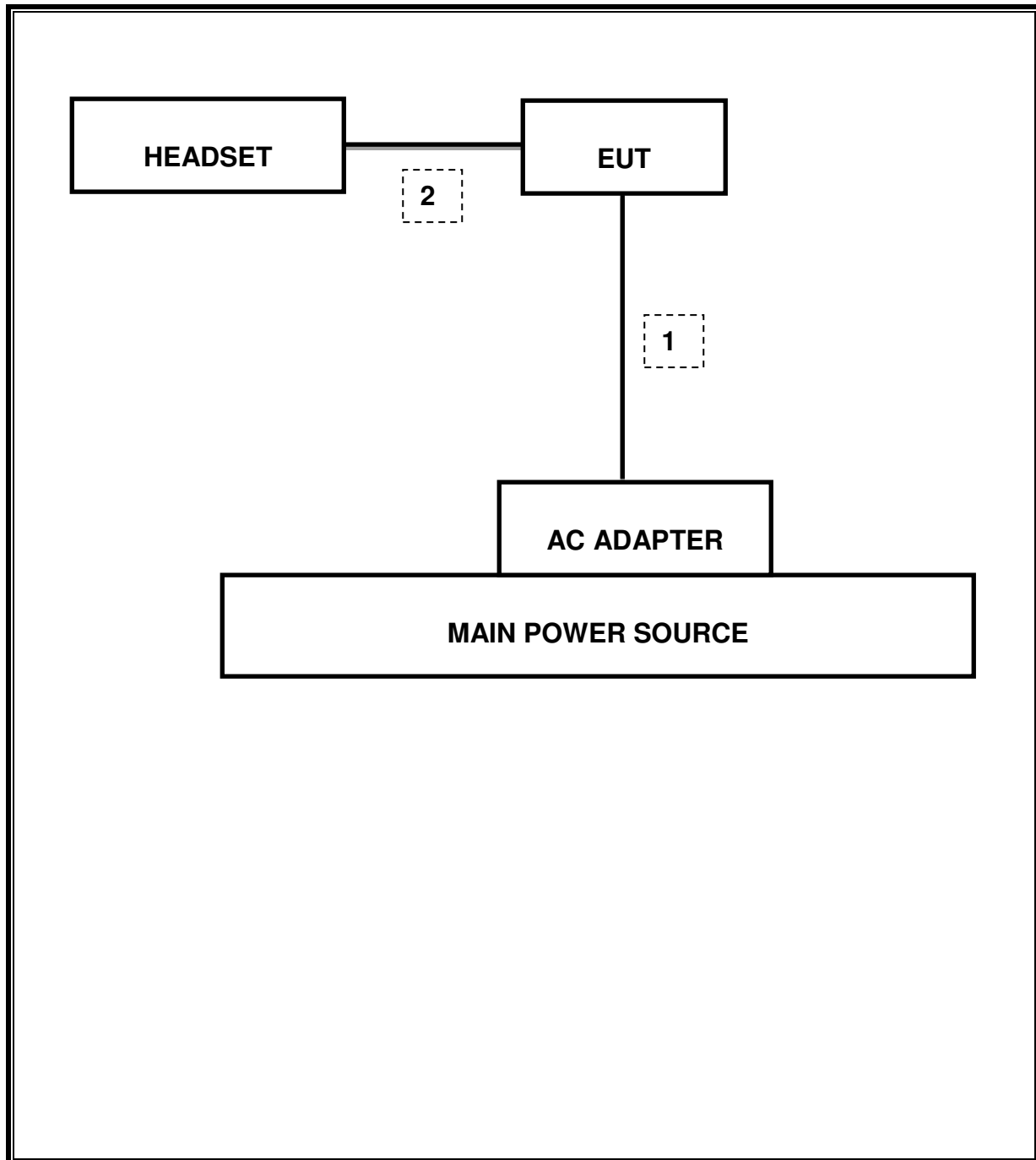
I/O CABLES

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, 26.5 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	1.061 MHz
2.1051, 15.247 (d)	RSS-210 A8.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-50.62 dBm
15.247 (b)(1)	RSS-210 A8.4	TX conducted output power	<21dBm		Pass	9.59 dBm
15.247 (a)(1)	RSS-210 A8.1(b)	Hopping frequency separation	> 25KHz		Pass	1 MHz
15.247 (a)(1)(iii)	RSS-210 A8.1(d)	Number of Hopping channels	More than 15 non-overlapping channels		Pass	79 ch
15.247 (a)(1)(iii)	RSS-210 A8.1(d)	Avg Time of Occupancy	< 0.4sec		Pass	0.349 s
15.207 (a)	RSS-GEN 7.2.2	AC Power Line conducted emissions	Section 10	Radiated	Pass	48.32 dBuV
15.205, 15.209	RSS-210 Clause 2.6, RSS-210 Clause 6	Radiated Spurious Emission	< 54dBuV/m		Pass	44.03 dBuV/m

8. ANTENNA PORT TEST RESULTS

8.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

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

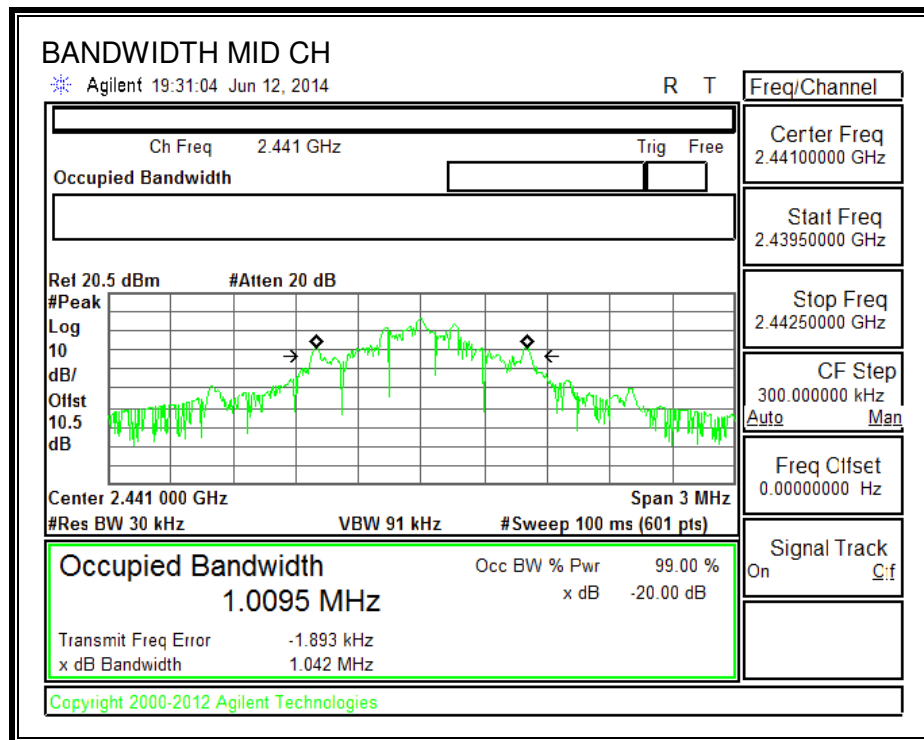
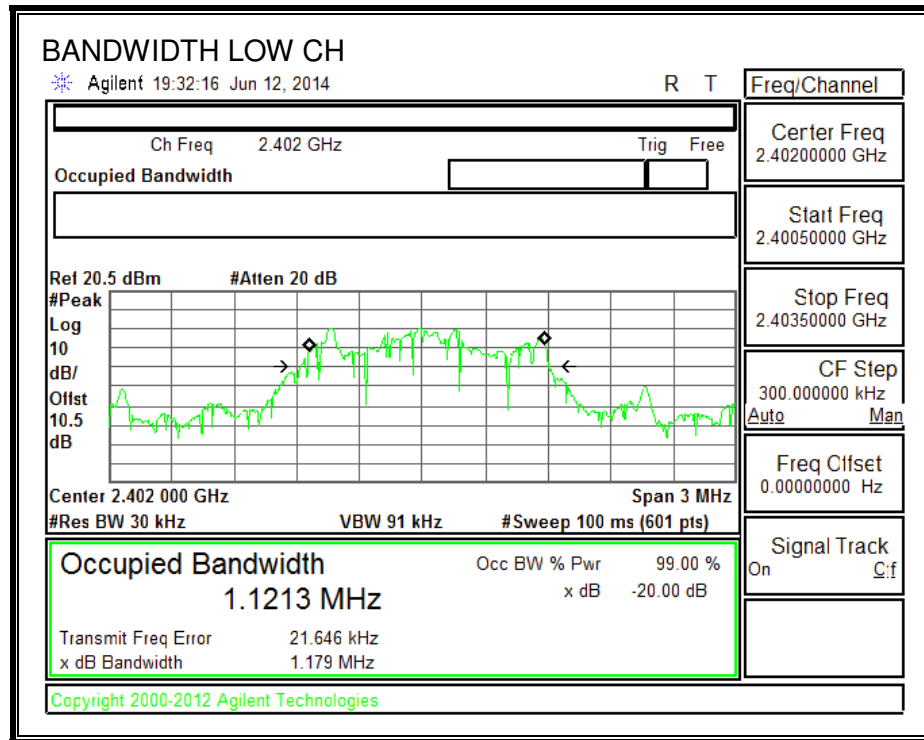
RESULTS

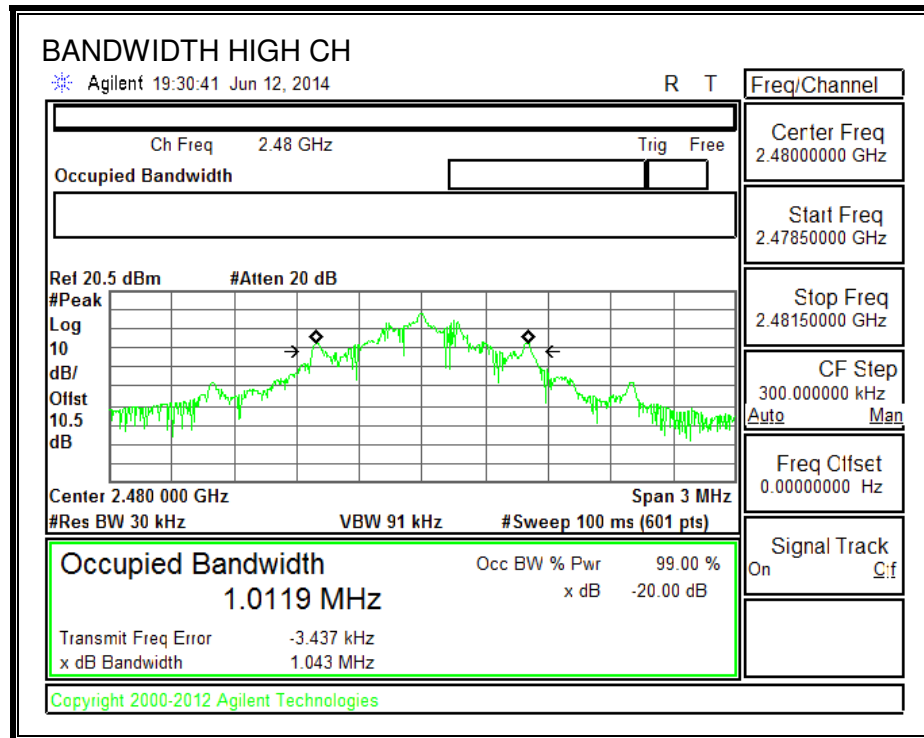
8.1.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.179	1.0194
Middle	2441	1.042	1.0132
High	2480	1.043	1.0128
Worst		1.179	1.0194

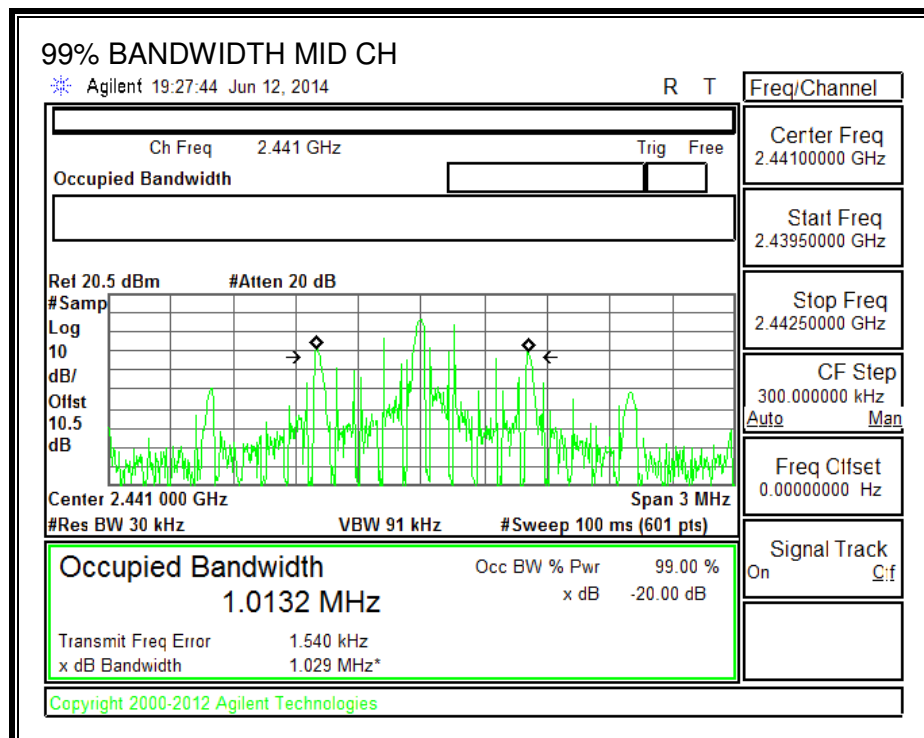
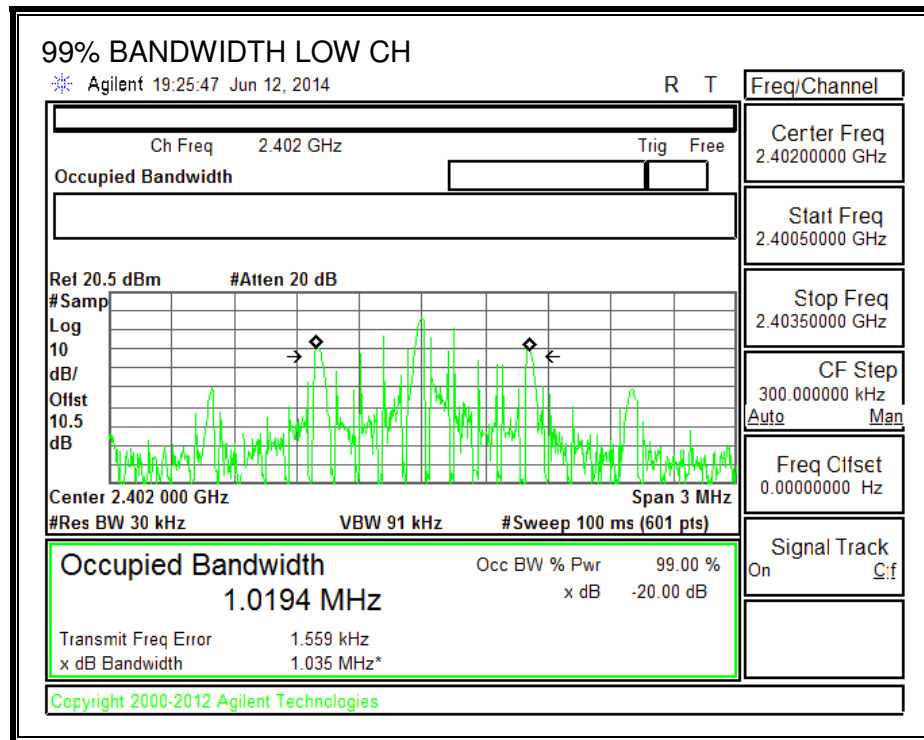
8.1.1. ENHANCED DATA RATE 8PSK MODULATION

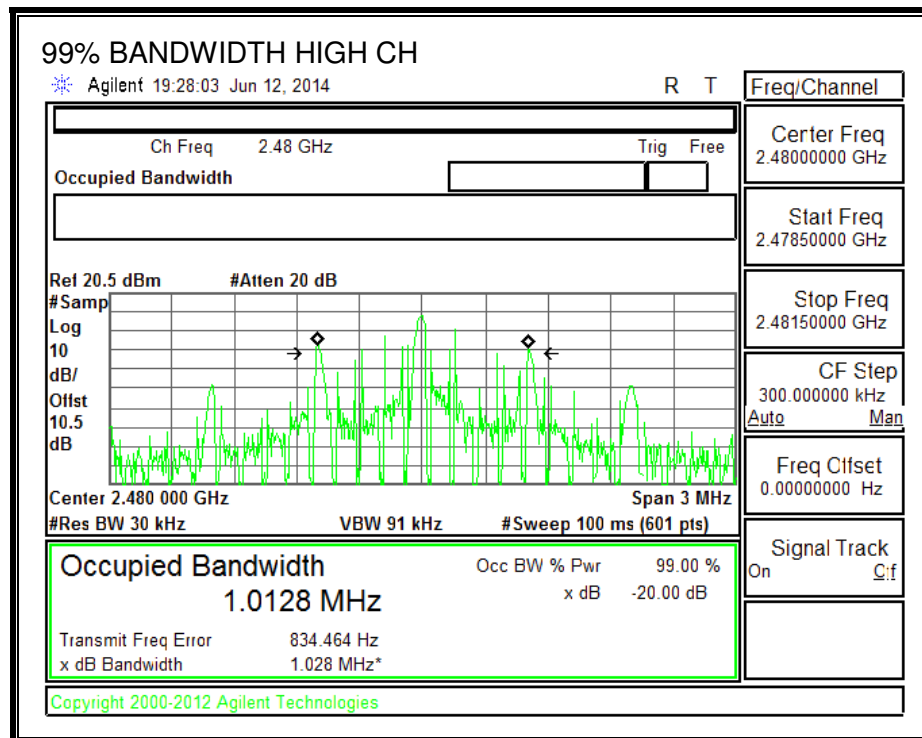
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.179	1.0565
Middle	2441	1.169	1.0609
High	2480	1.17	1.043
Worst		1.179	1.0609



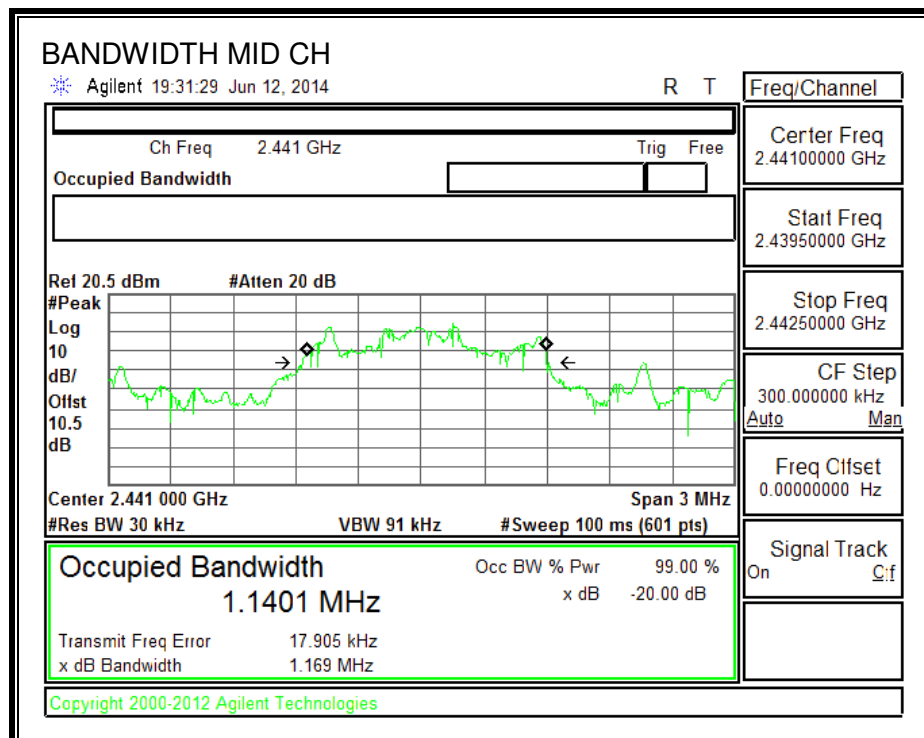
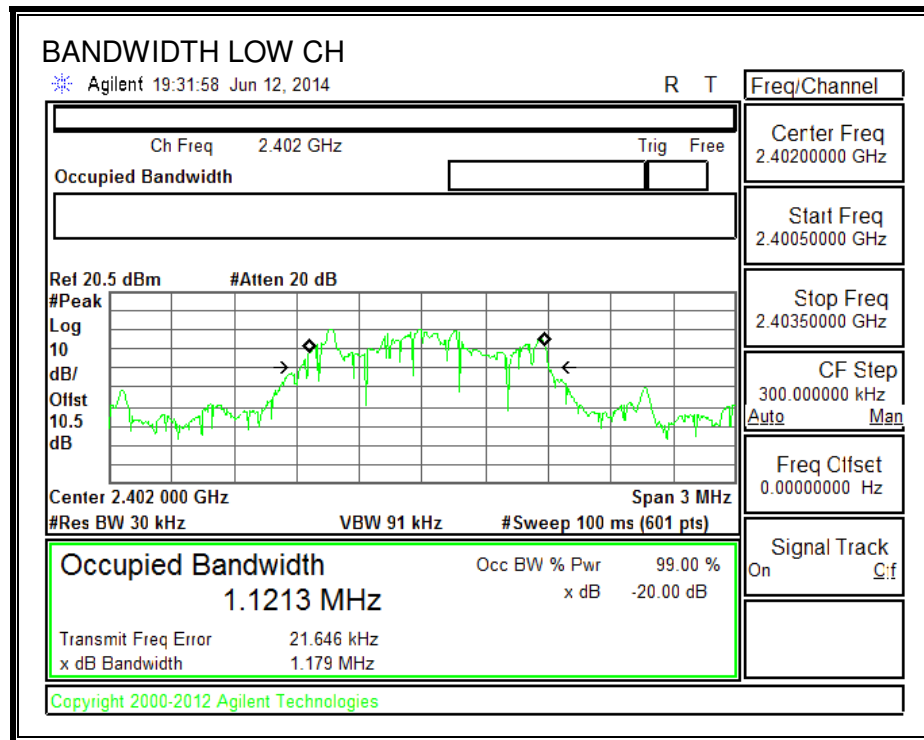


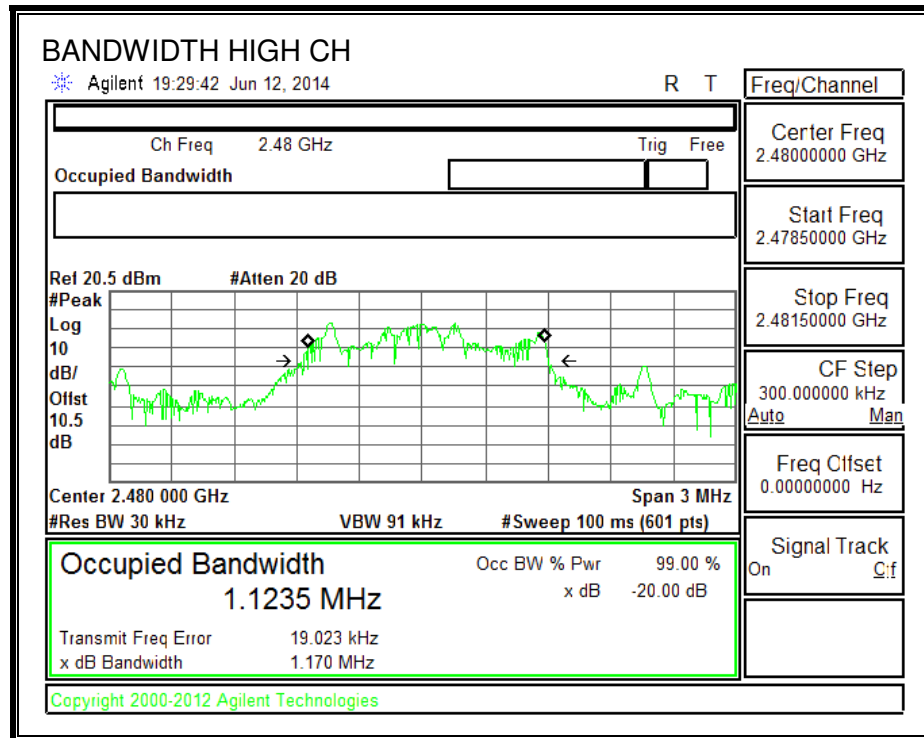
GFSK 99% BANDWIDTH



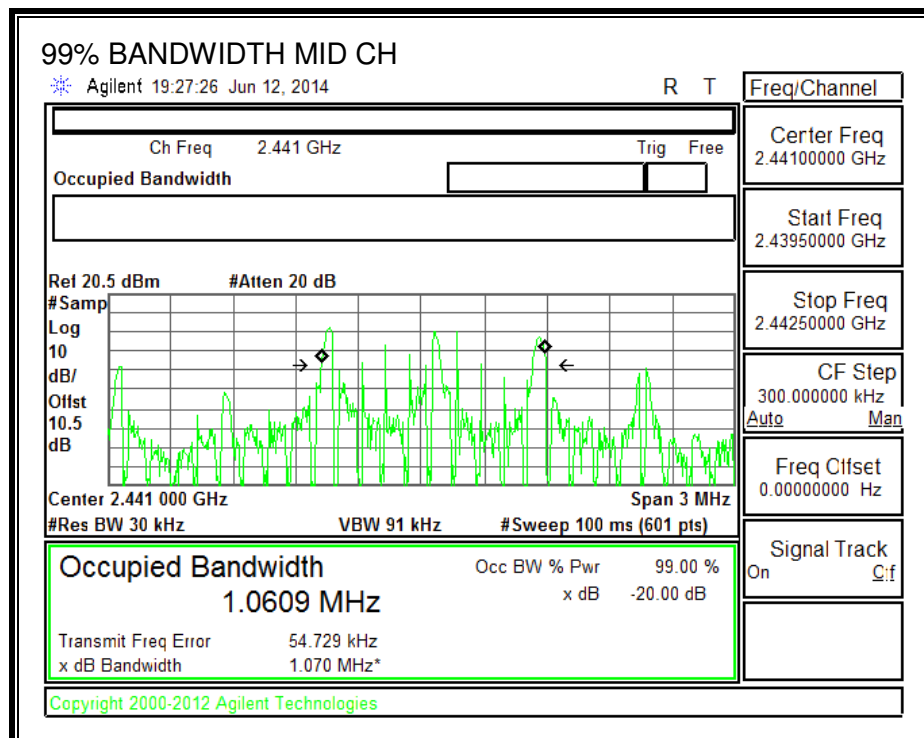
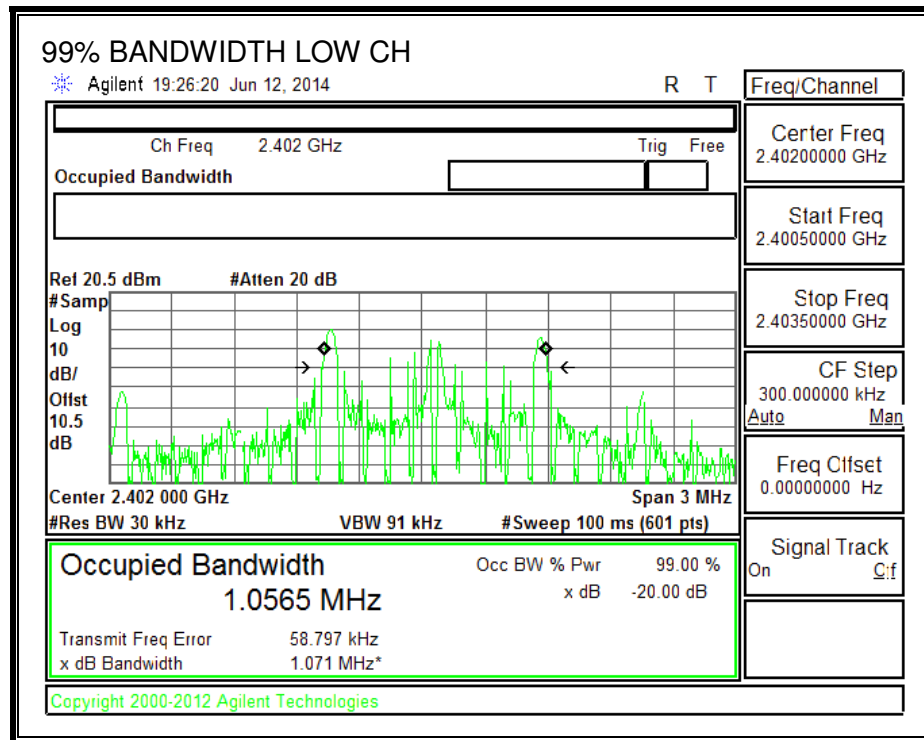


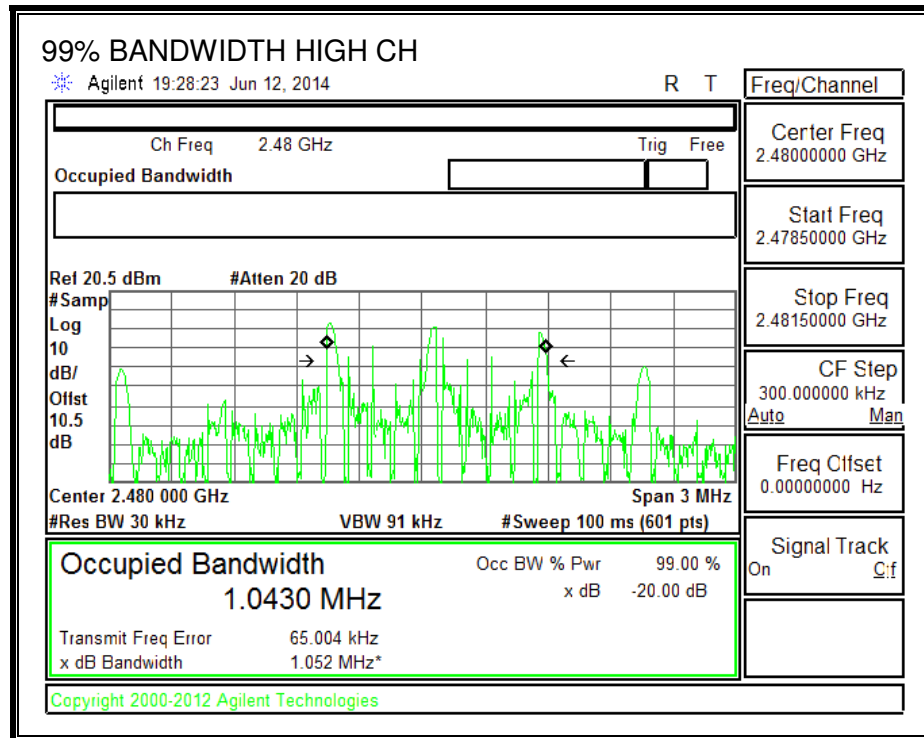
8PSK 20 dB BANDWIDTH





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.

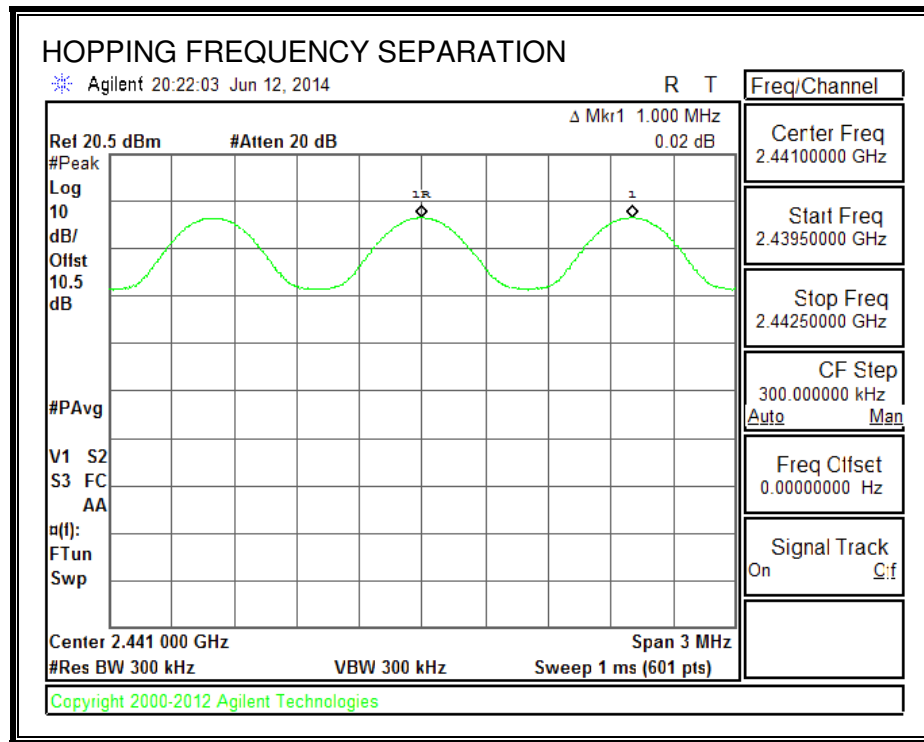
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

HOPPING FREQUENCY SEPARATION



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.

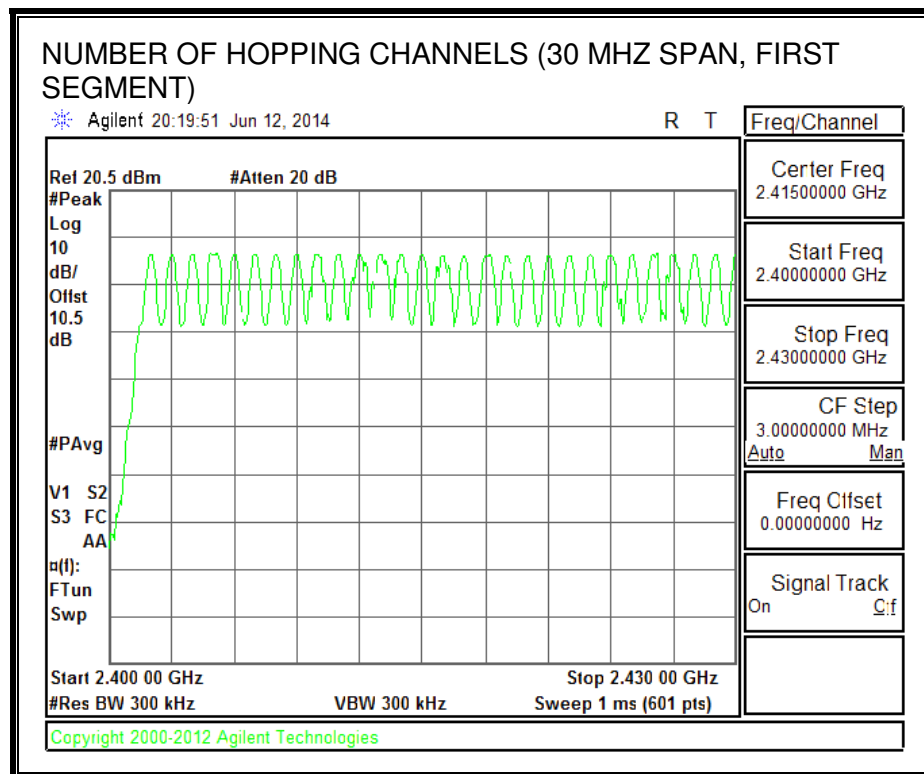
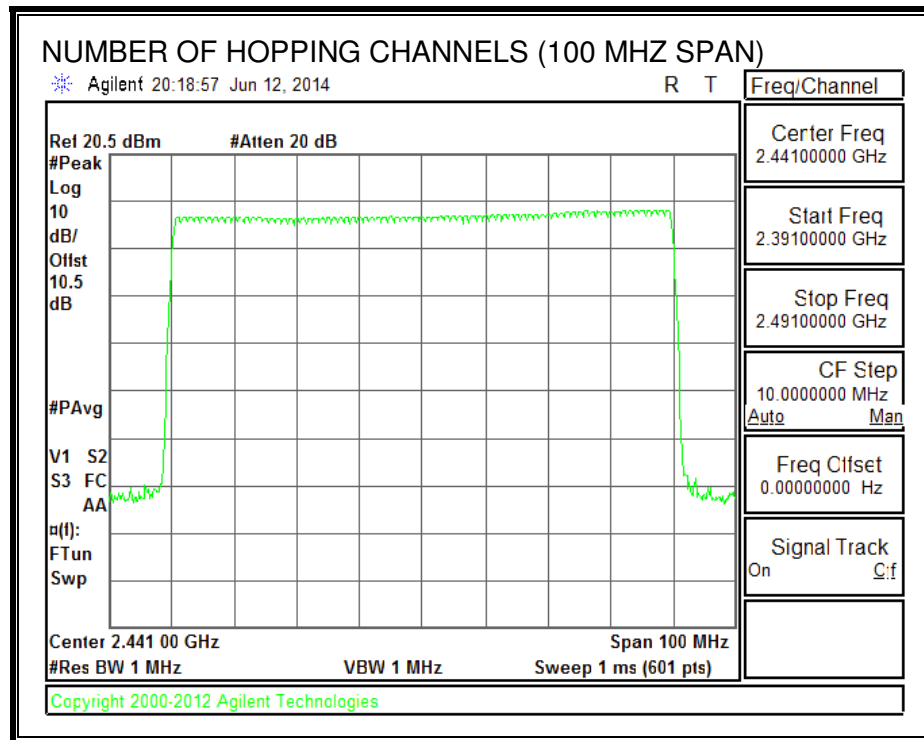
TEST PROCEDURE

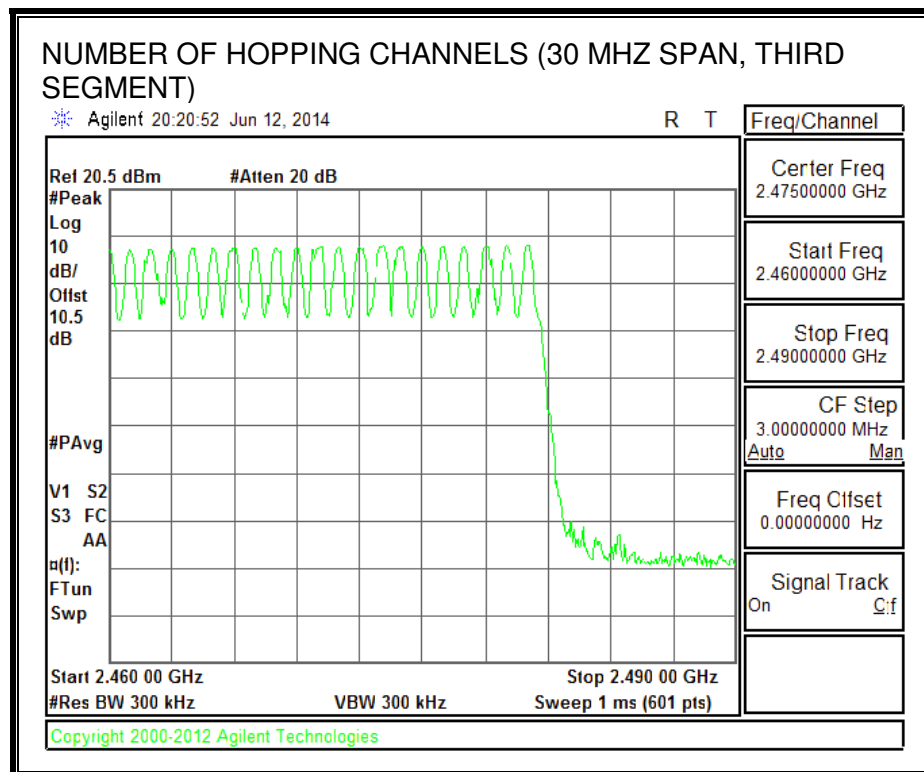
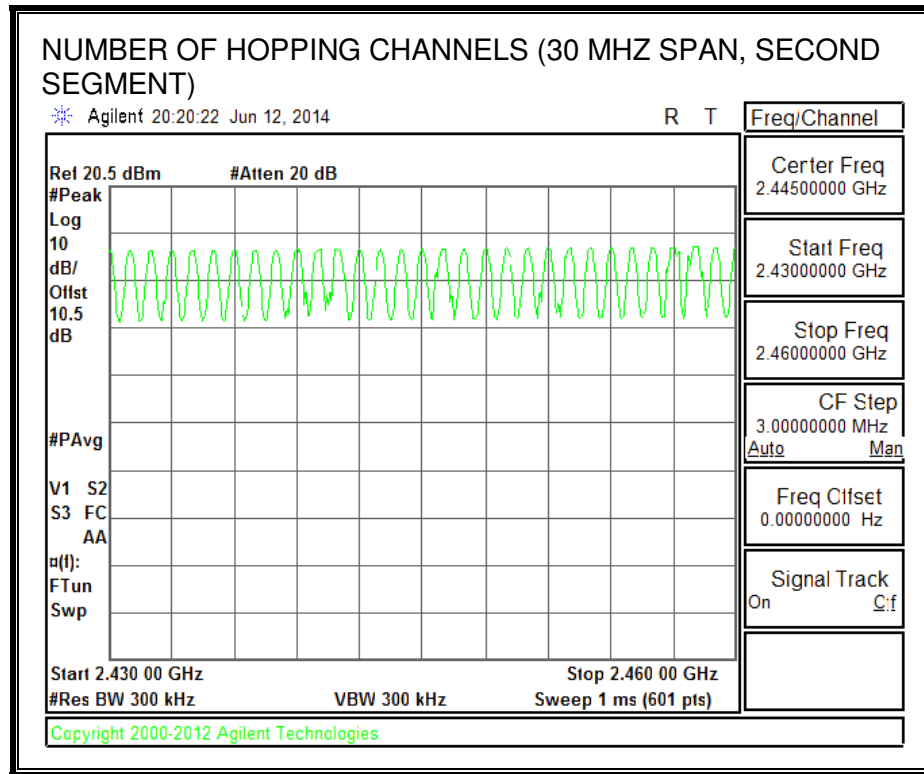
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

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.

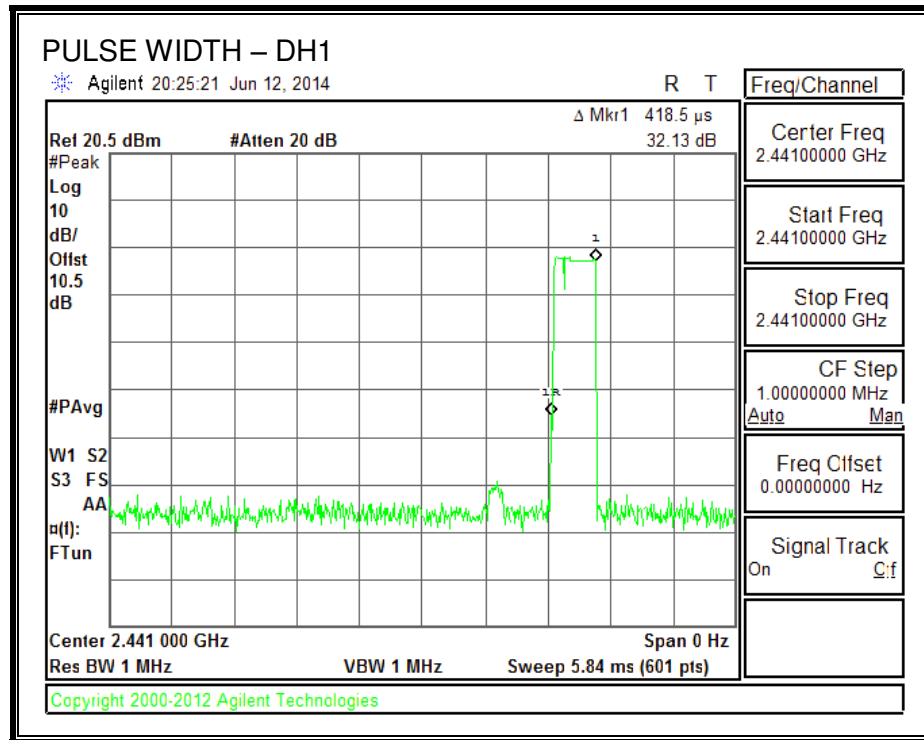
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

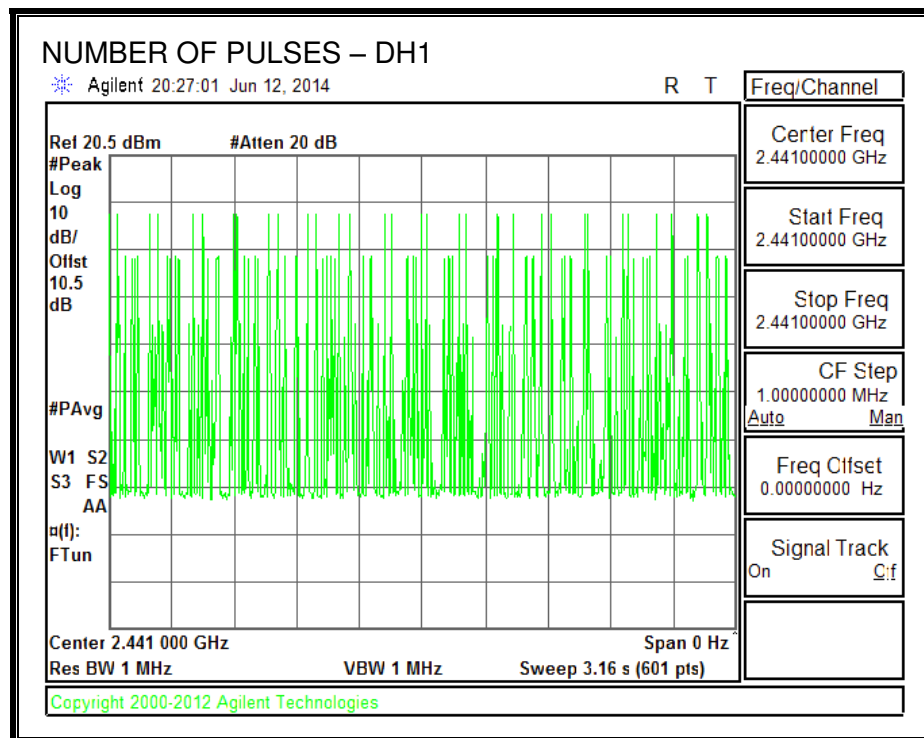
RESULTS

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	0.4185	28	0.117	0.4	-0.283
DH3	1.674	18	0.301	0.4	-0.099
DH5	2.91	12	0.349	0.4	-0.051
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.4185	7	0.029	0.4	-0.371
DH3	1.674	5	0.084	0.4	-0.316
DH5	2.91	3	0.087	0.4	-0.313

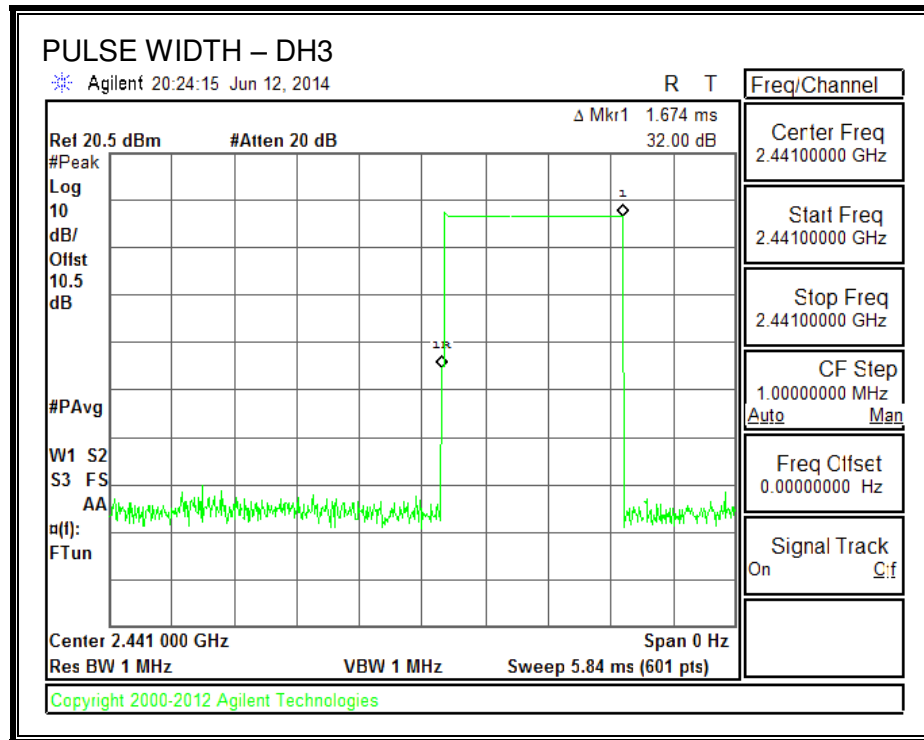
PULSE WIDTH - DH1



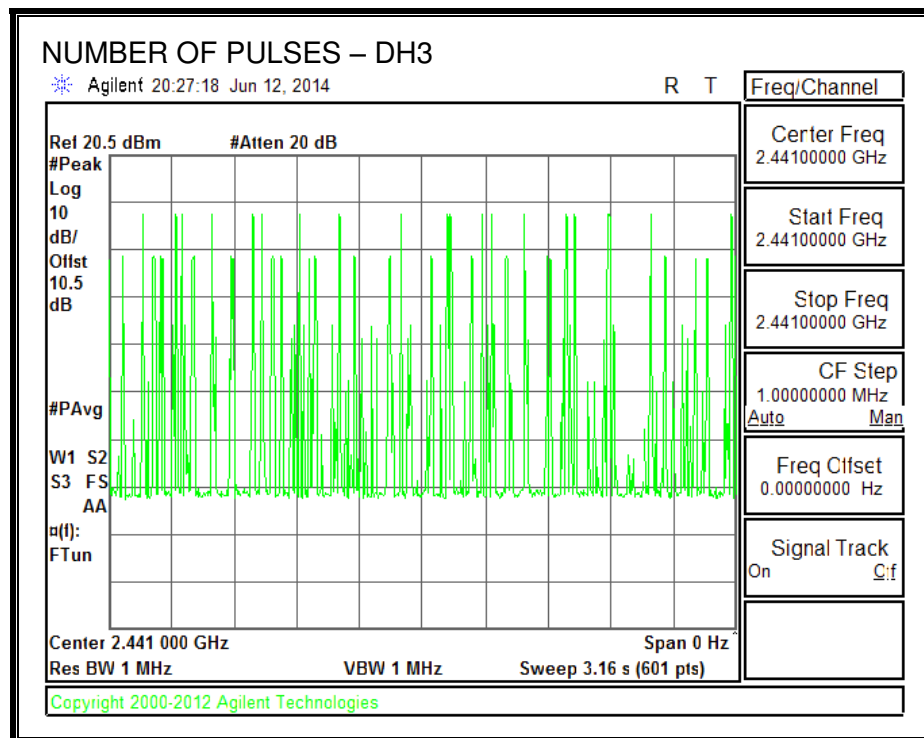
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1



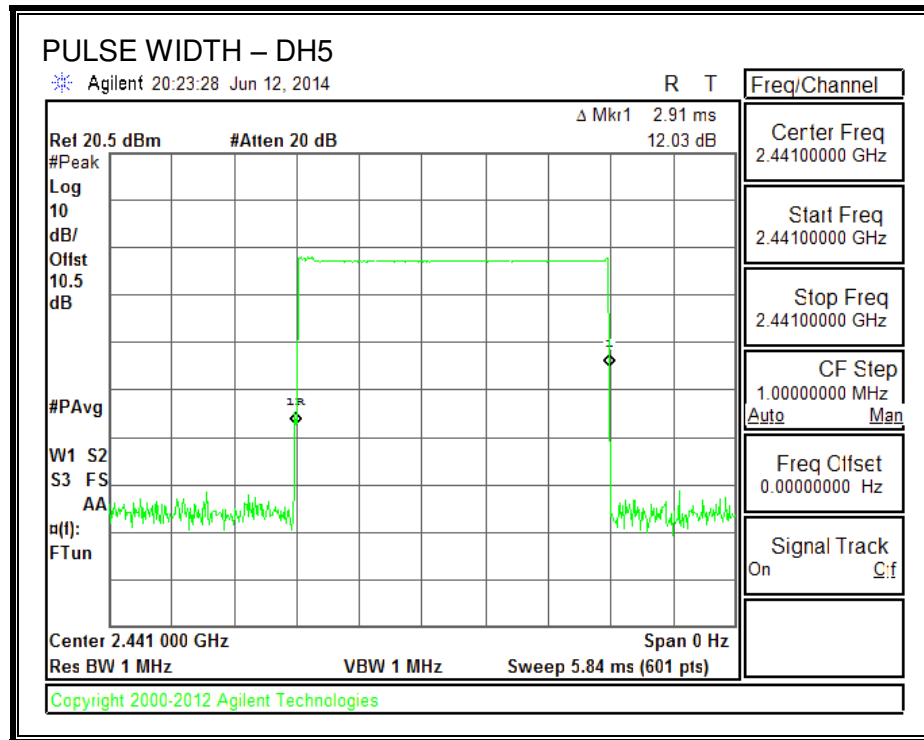
PULSE WIDTH – DH3



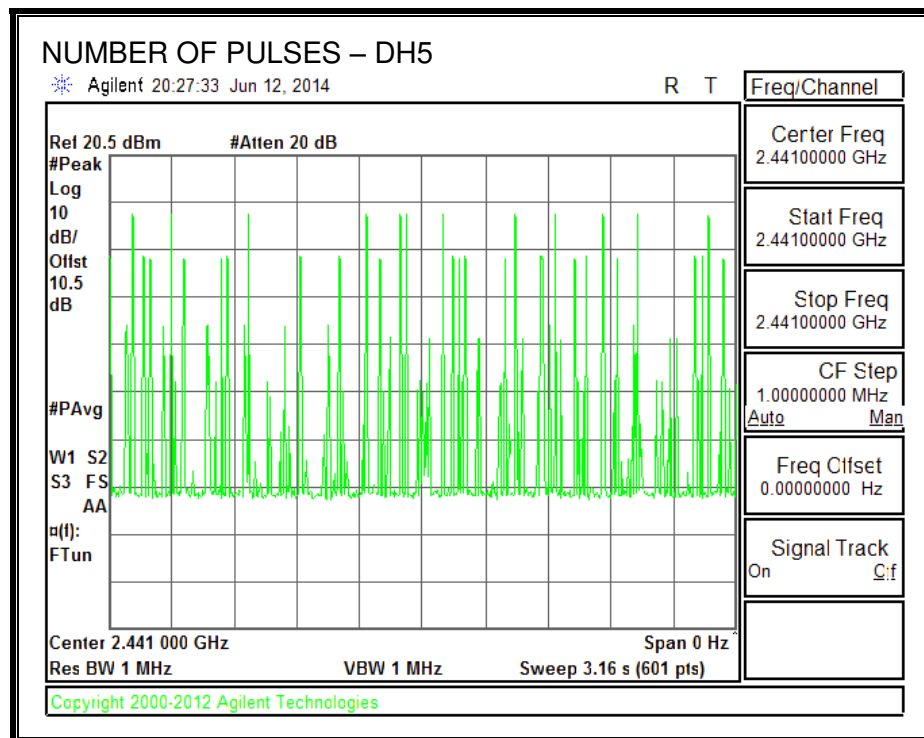
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



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.

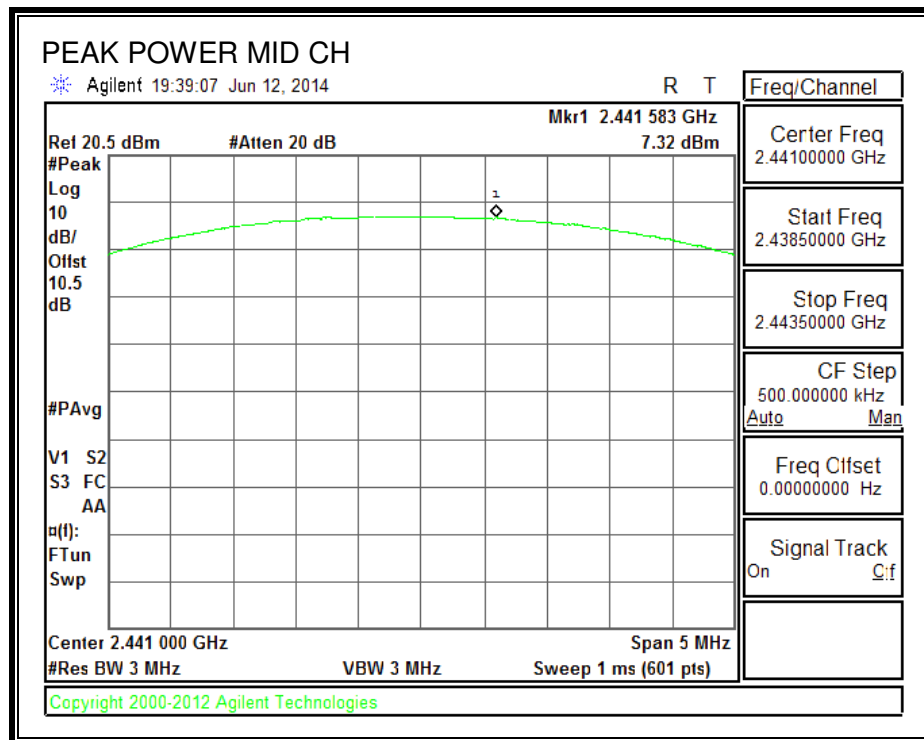
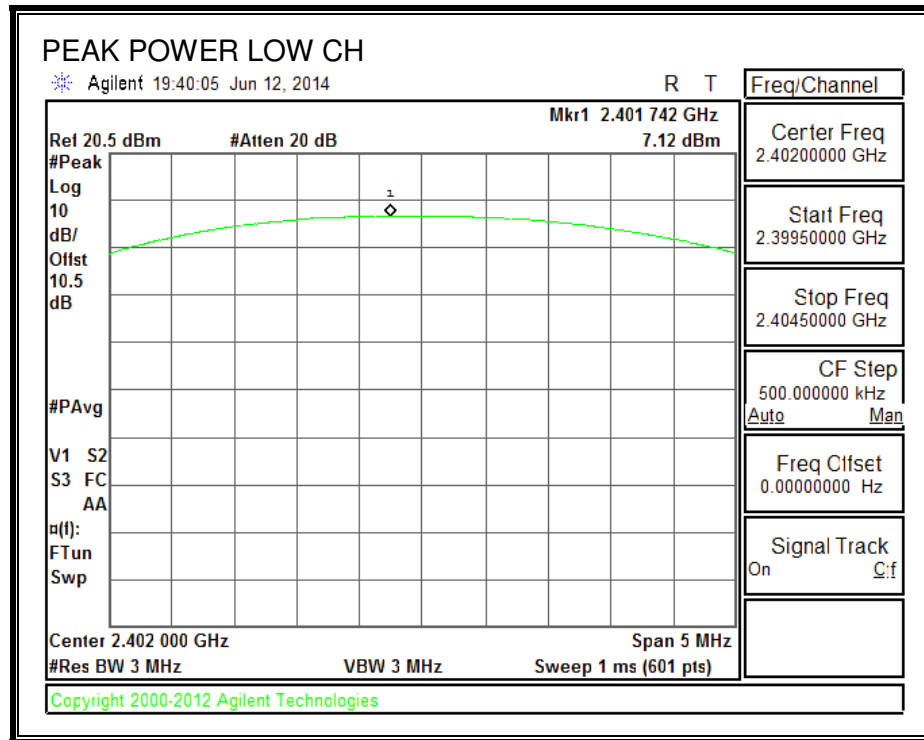
RESULTS

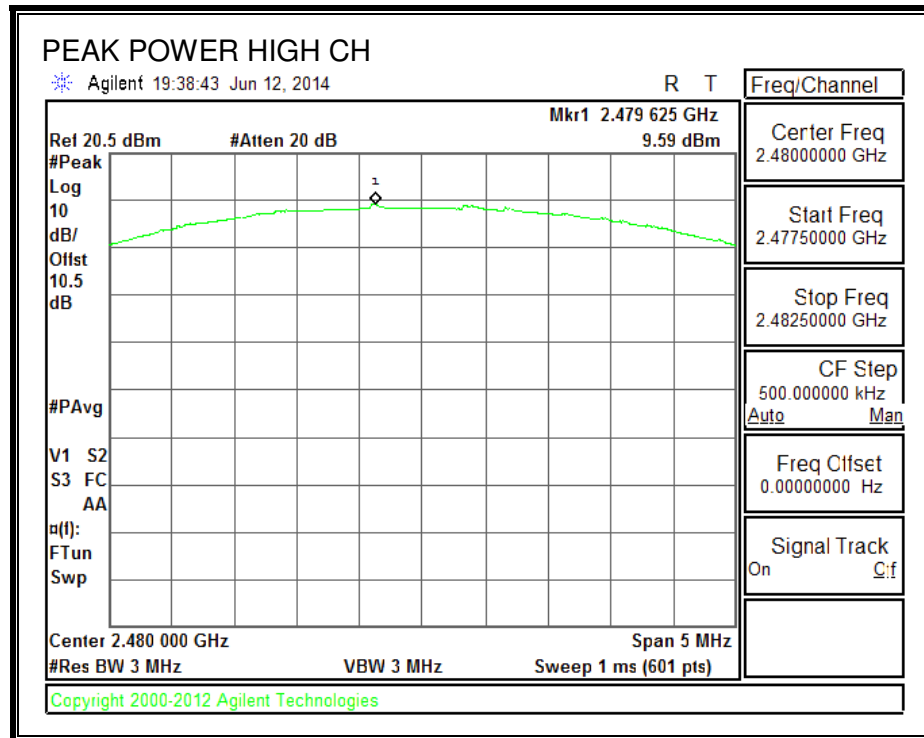
8.5.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.12	21	-13.88
Middle	2441	7.32	21	-13.68
High	2480	9.59	21	-11.41
Worst		9.59		-11.41

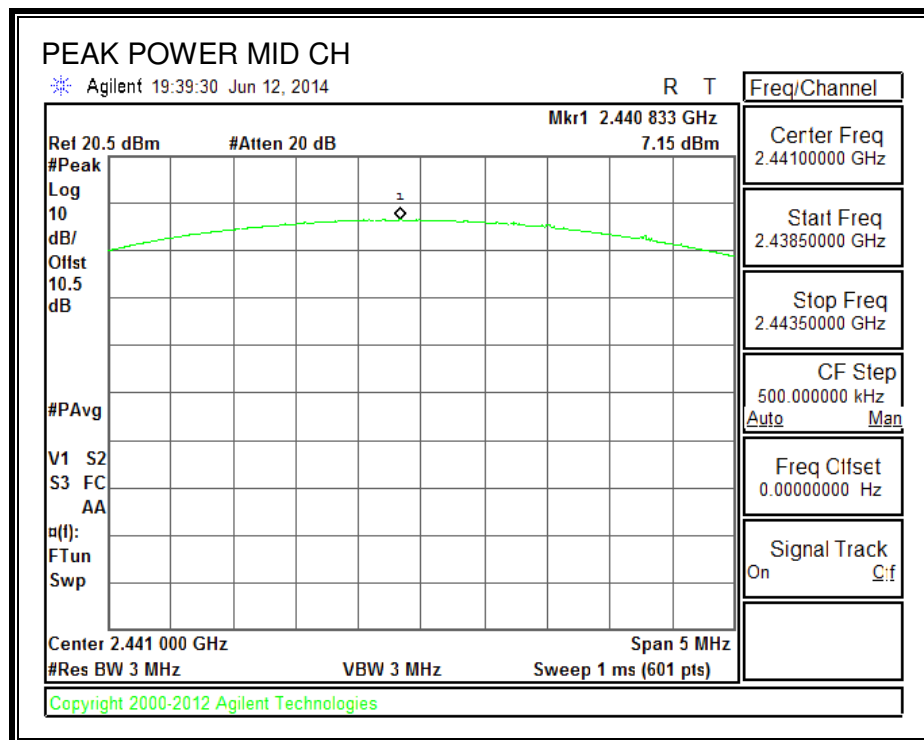
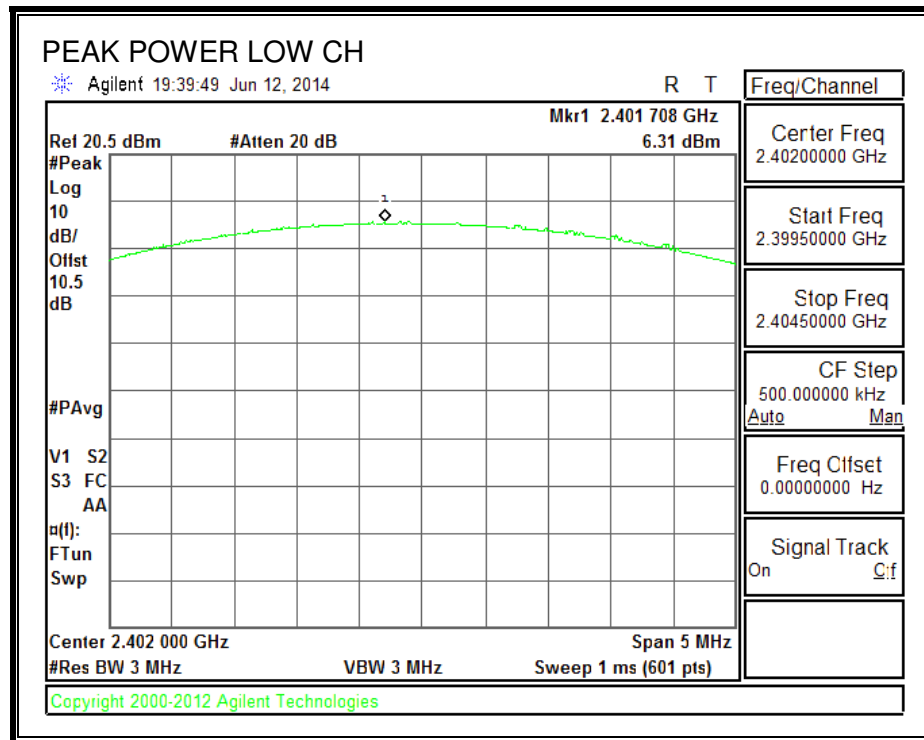
8.5.2. ENHANCED DATA RATE 8PSK MODULATION

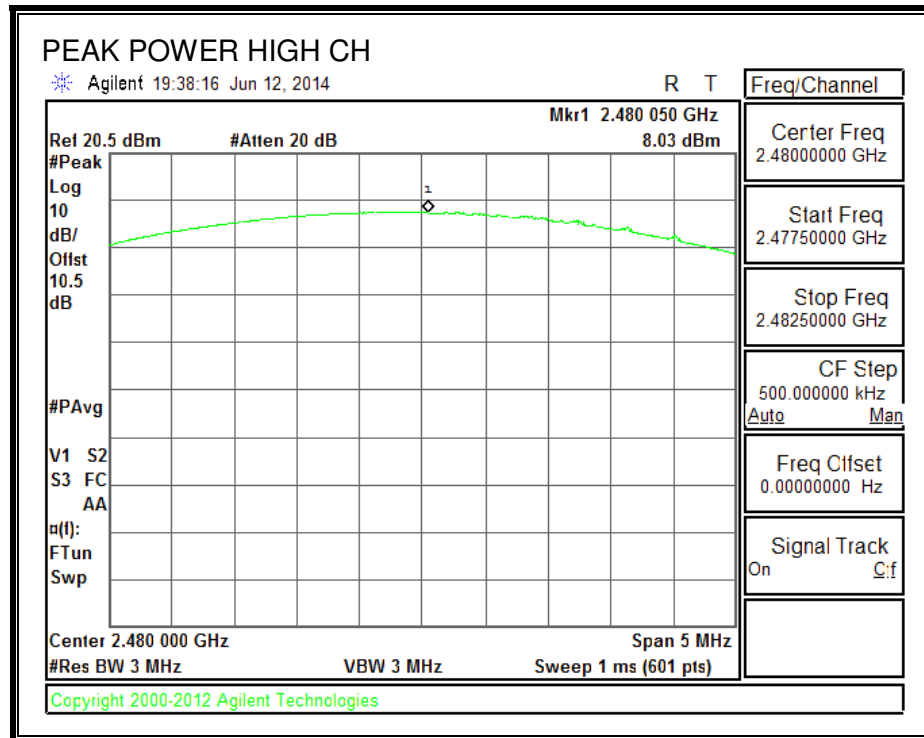
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.31	21	-14.69
Middle	2441	7.15	21	-13.85
High	2480	8.03	21	-12.97
Worst		8.03		-12.97

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	7.00
Middle	2441	7.30
High	2480	8.10
Worst		8.10

8.6.2. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	4.50
Middle	2441	5.90
High	2480	6.30
Worst		6.30

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.

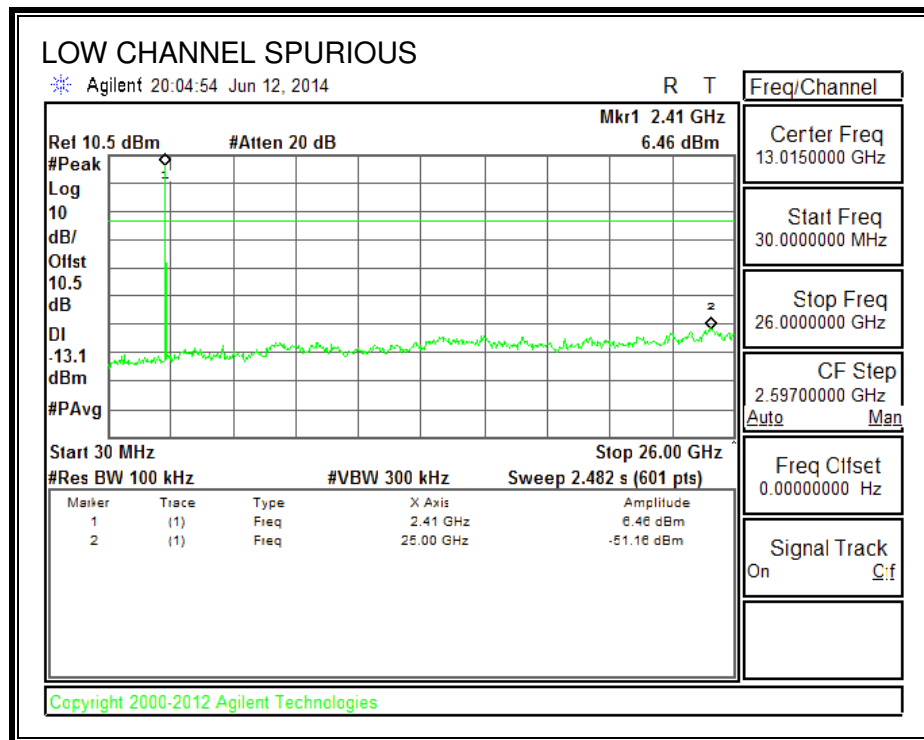
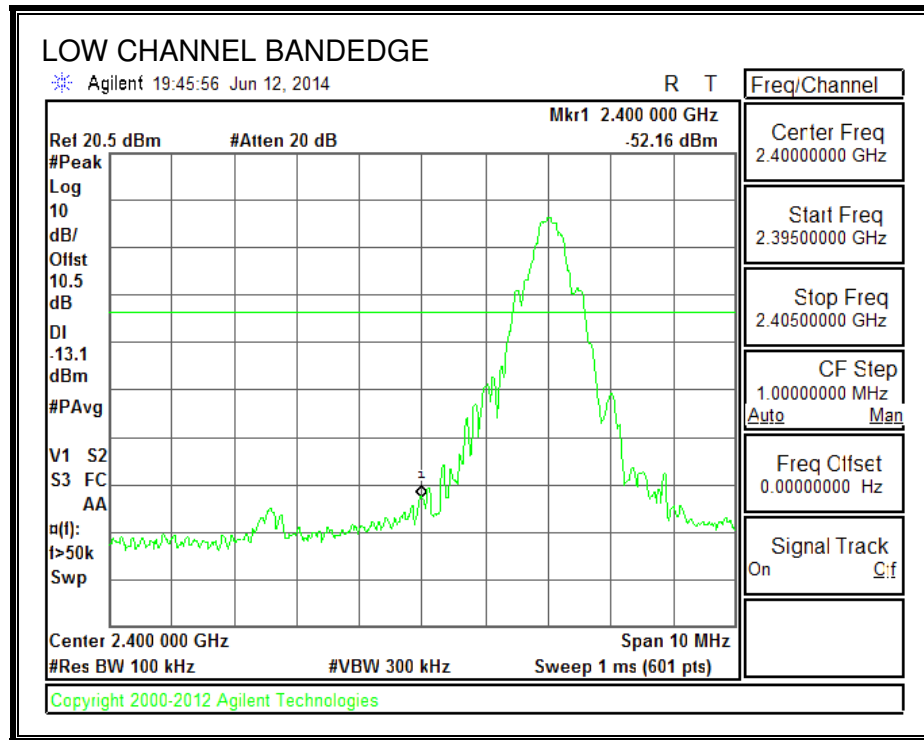
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

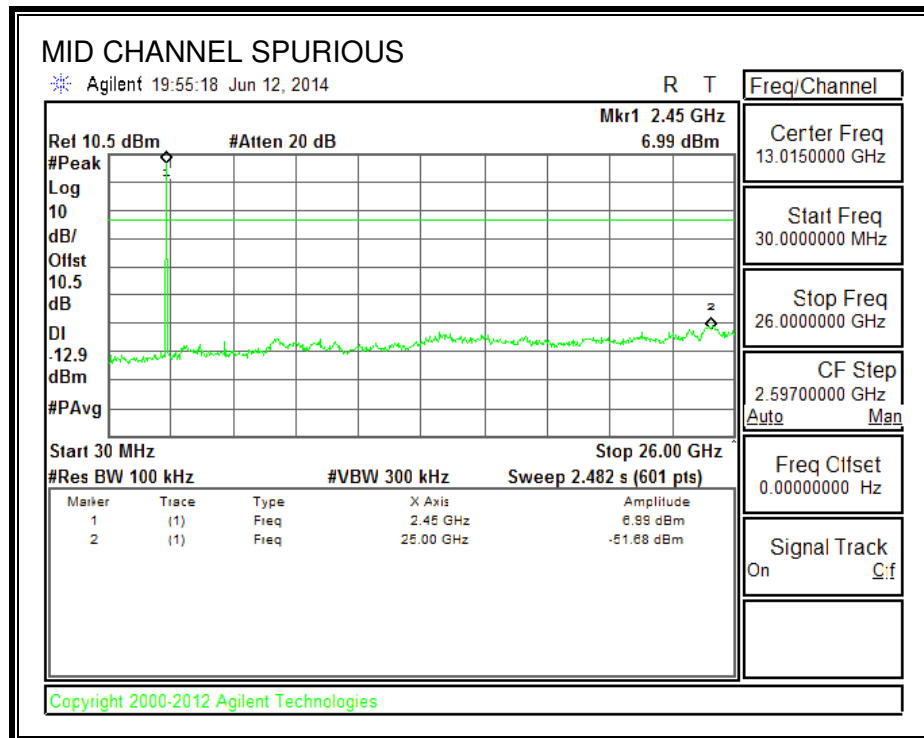
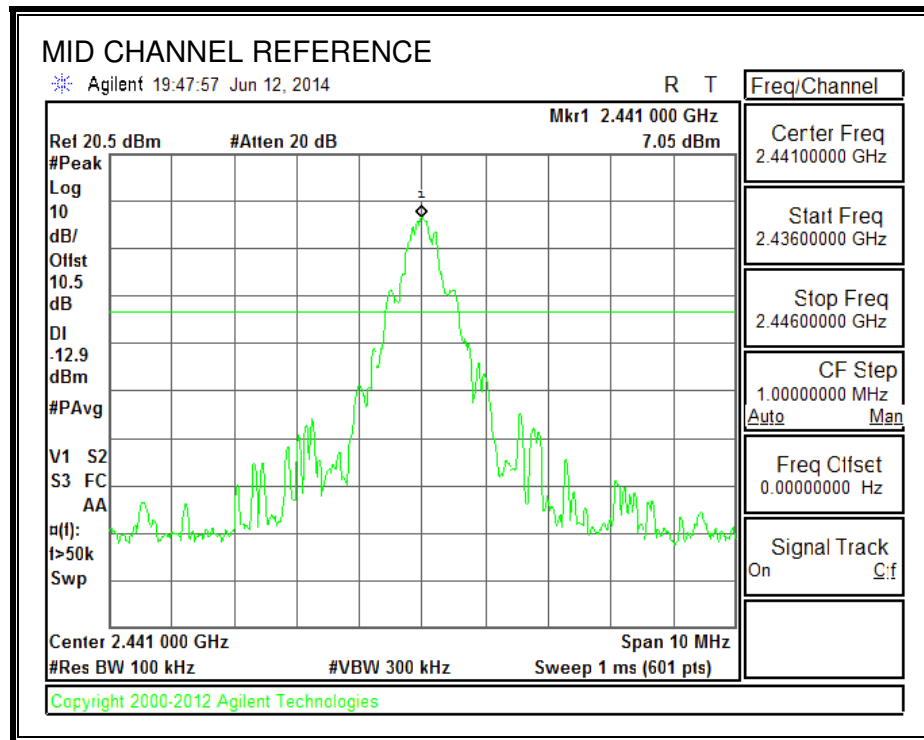
RESULTS

8.7.1. BASIC DATA RATE GFSK MODULATION

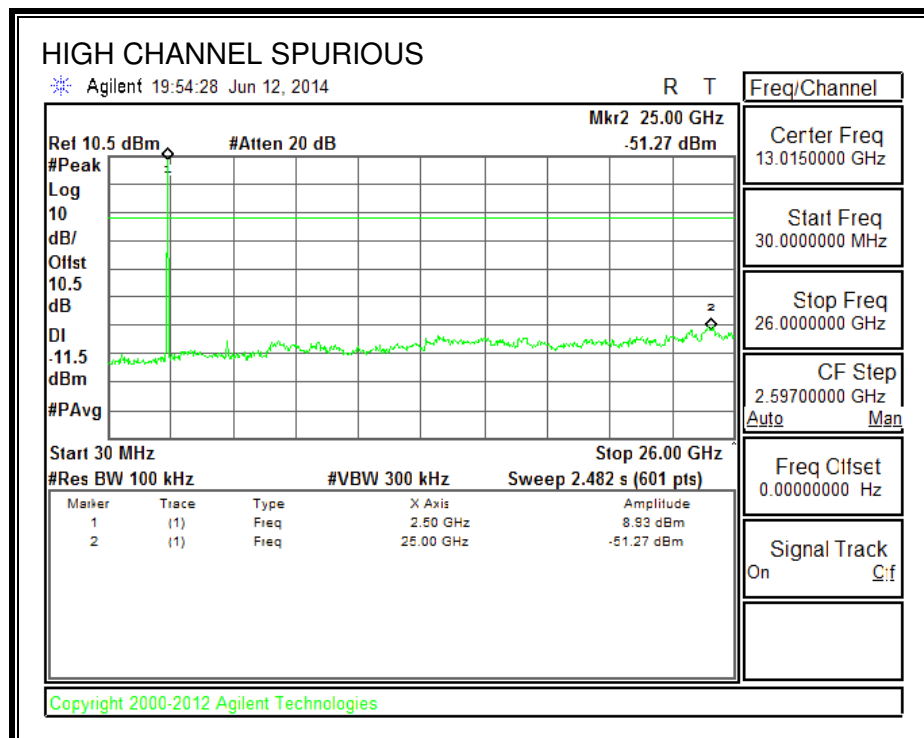
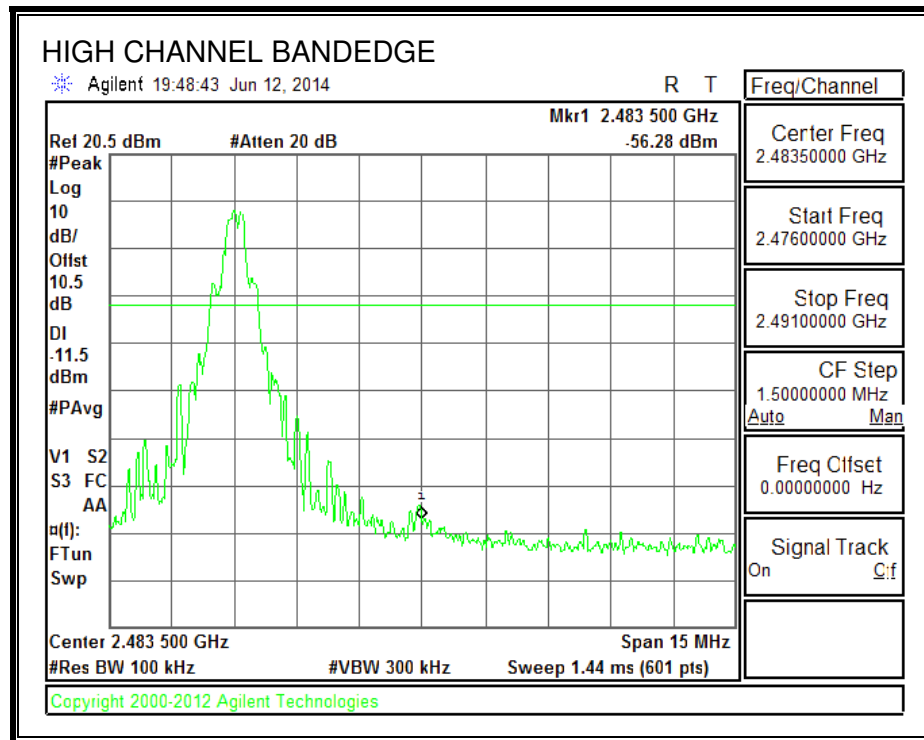
SPURIOUS EMISSIONS, LOW CHANNEL



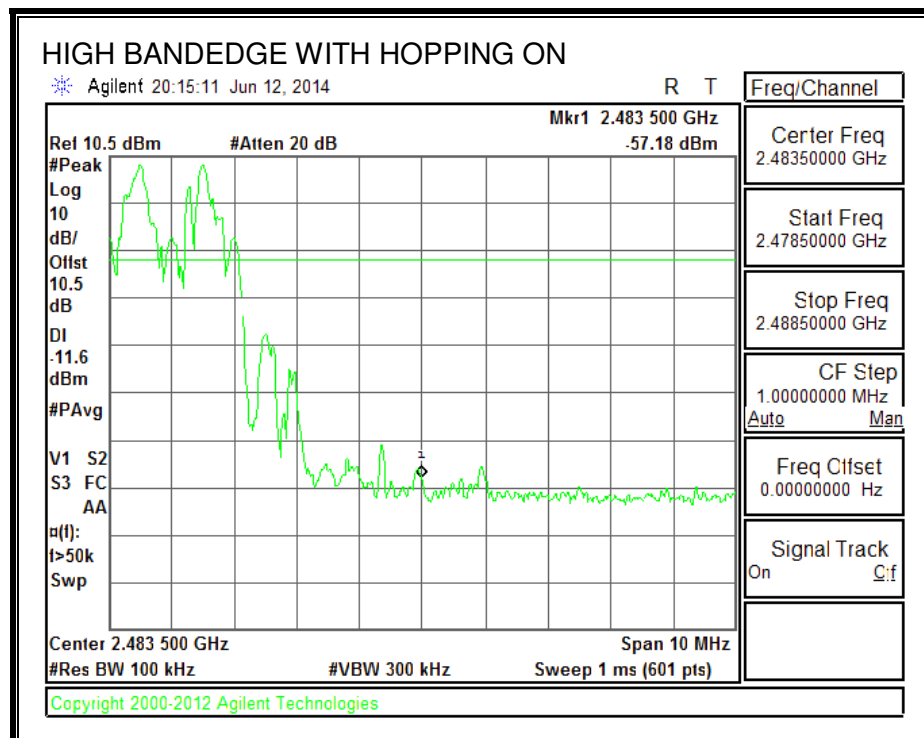
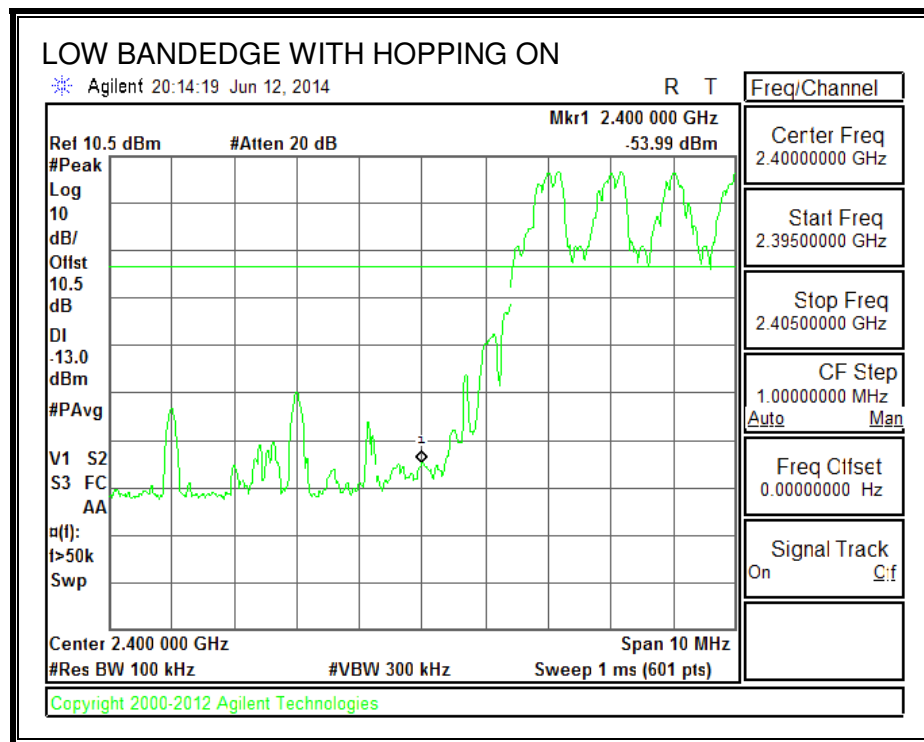
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL

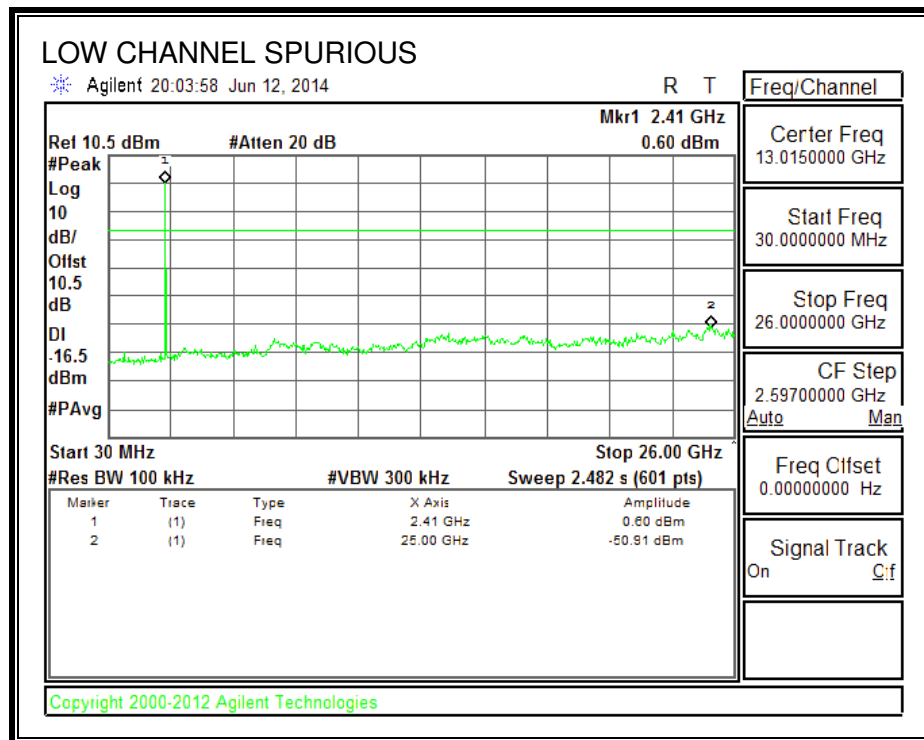
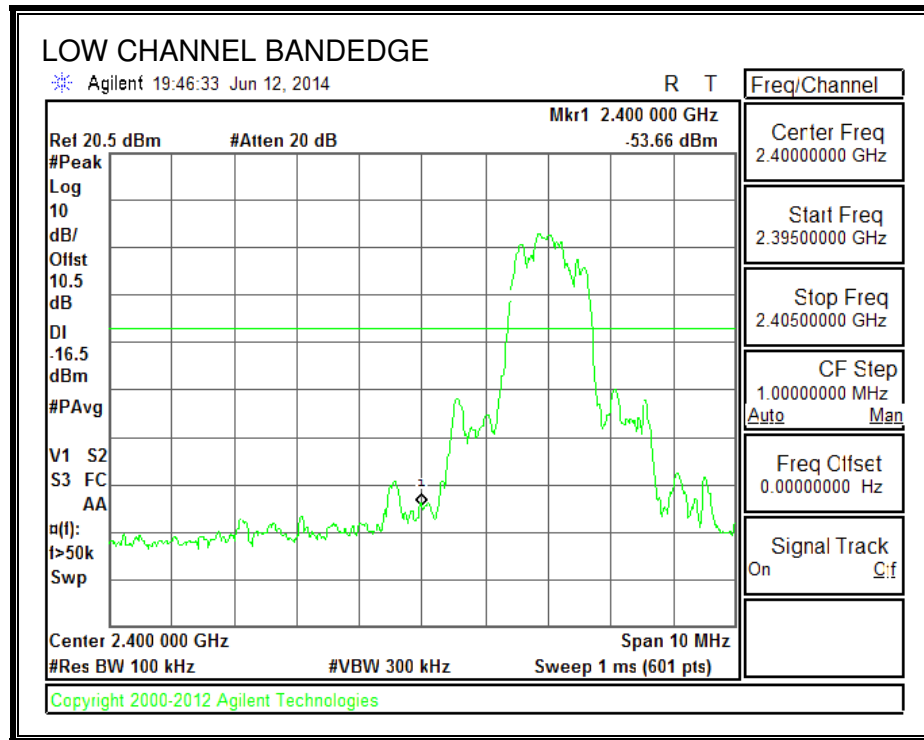


SPURIOUS BANDEDGE EMISSIONS WITH GFSK HOPPING ON

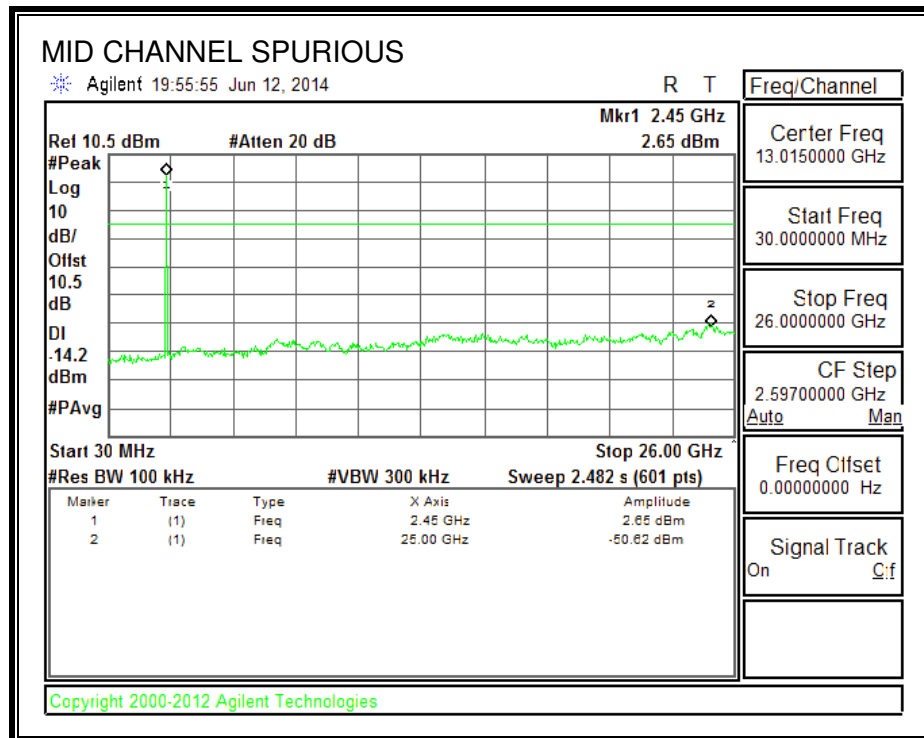
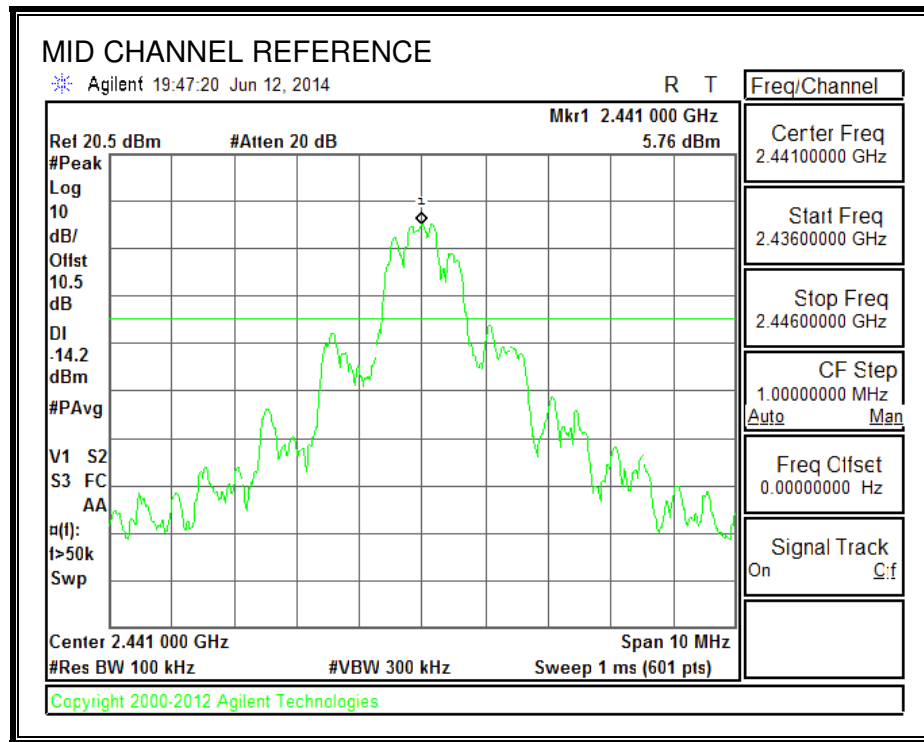


8.7.1. ENHANCED DATA RATE 8PSK MODULATION

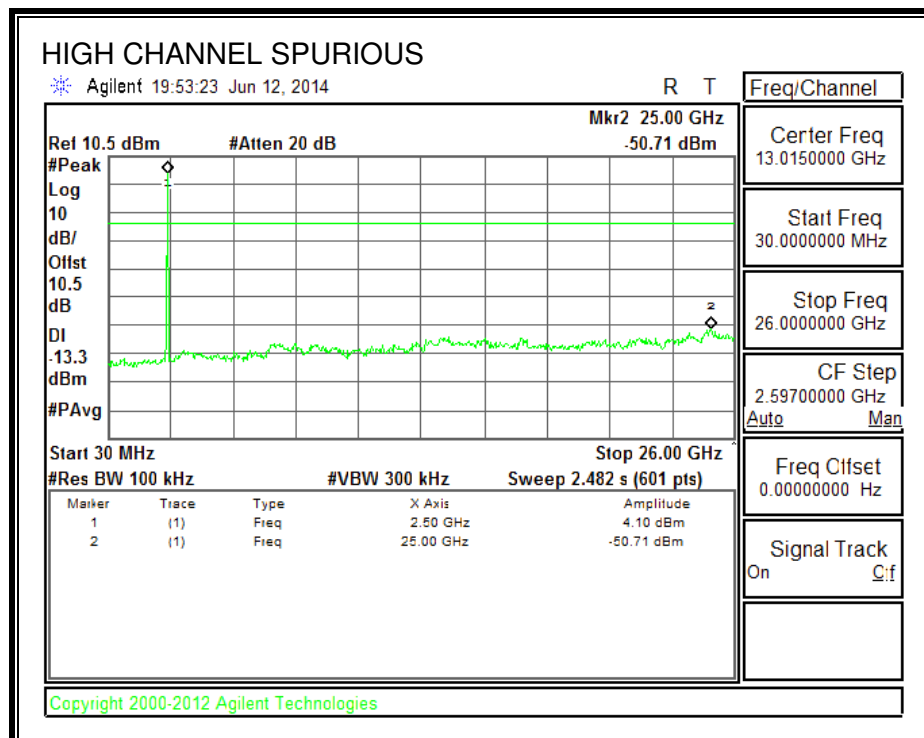
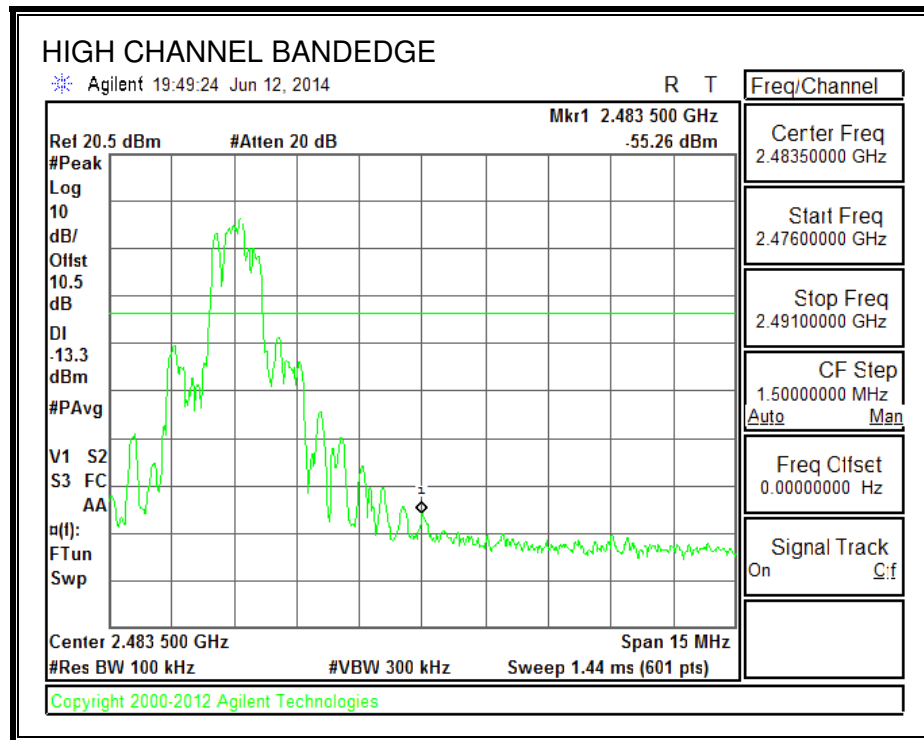
SPURIOUS EMISSIONS, LOW CHANNEL



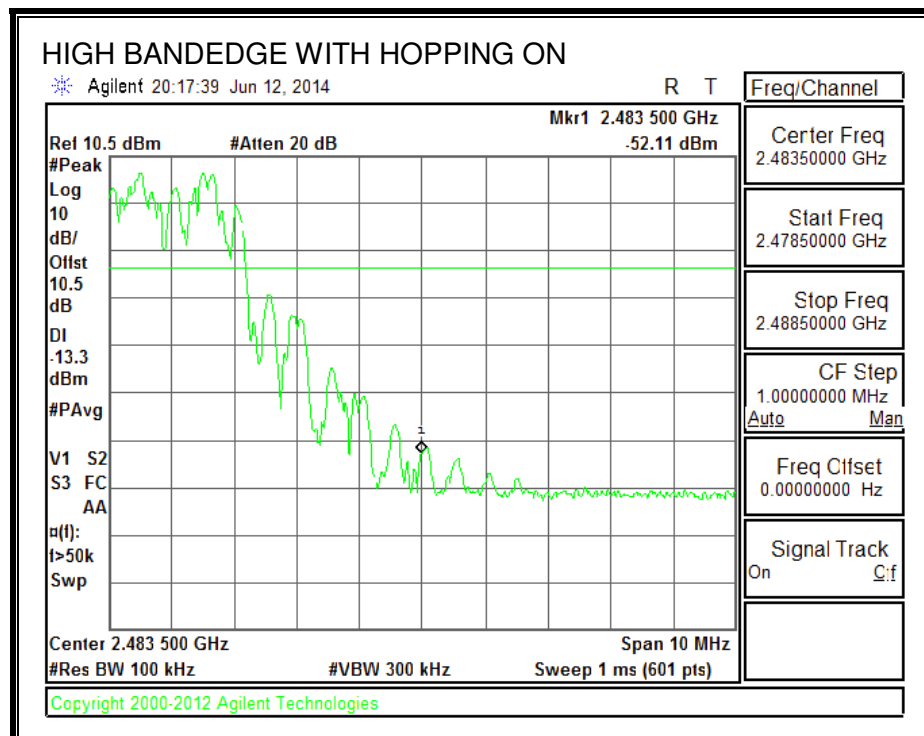
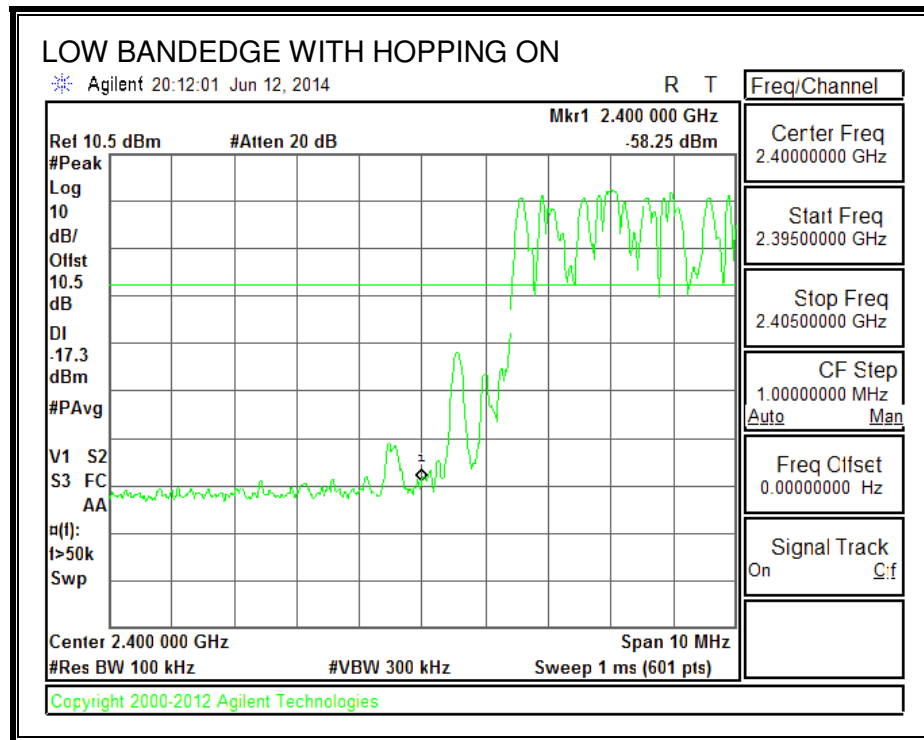
SPURIOUS EMISSIONS, MID CHANNEL



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. $GFSK = 1/T = 1 / 0.0028S = 360Hz$.

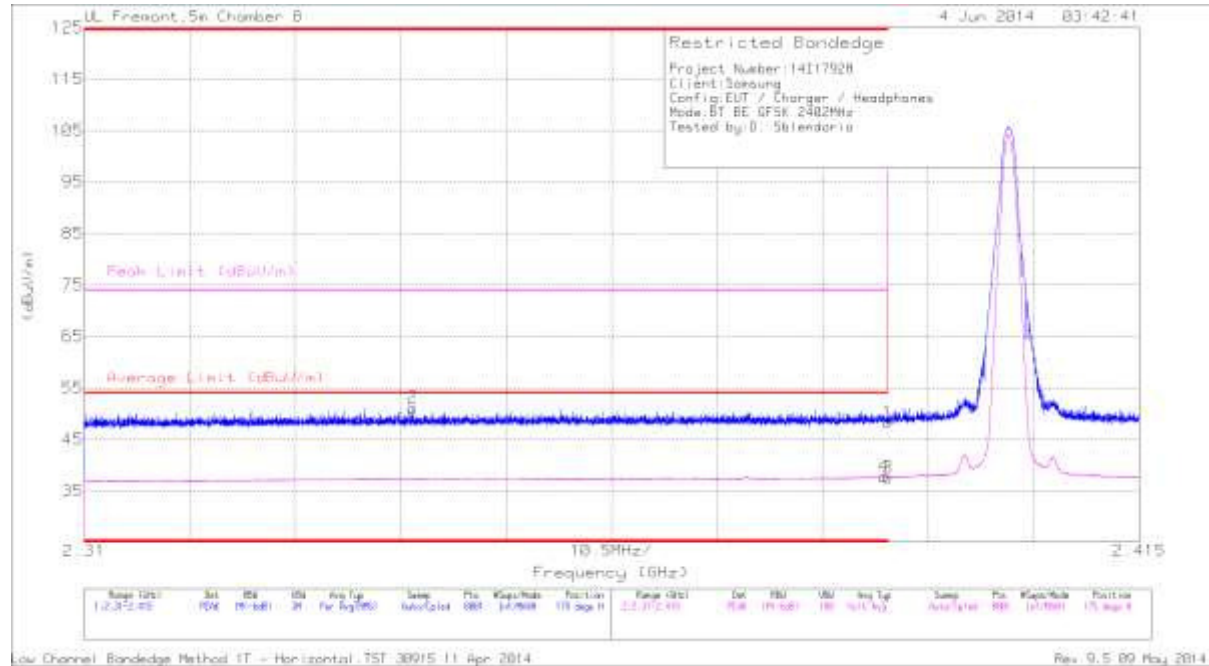
The spectrum from 1GHzHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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)



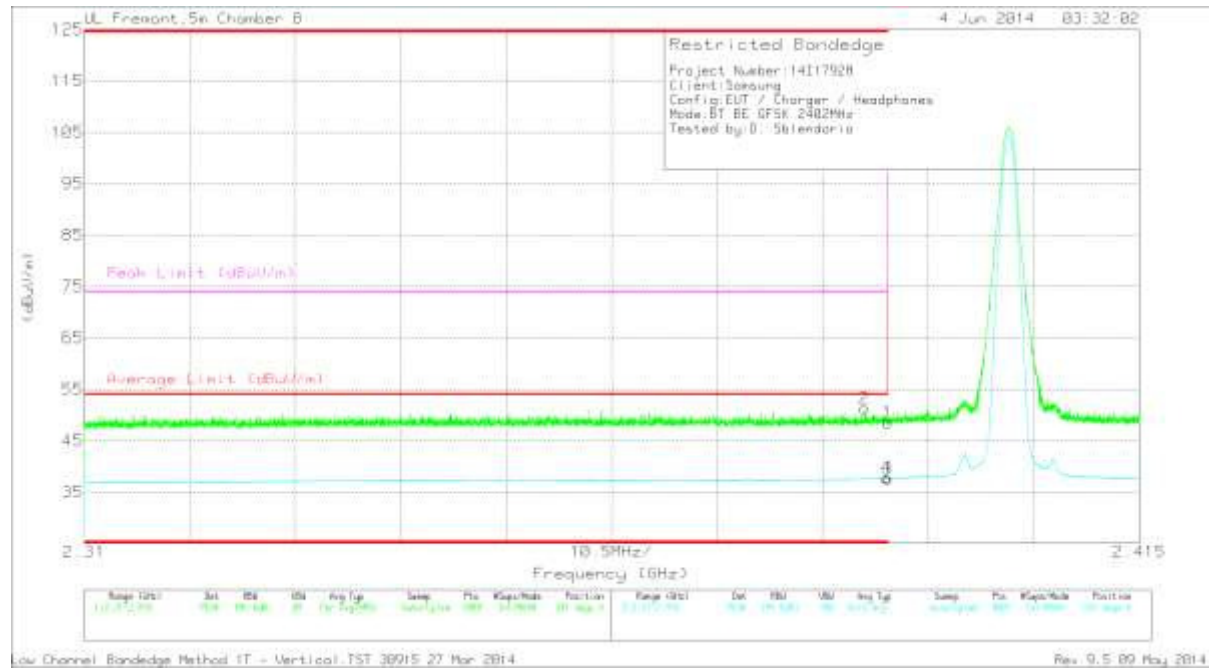
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Filt/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.06	PK	32.1	-22.8	48.36	-	-	74	-25.64	175	187	H
2	* 2.343	42.12	PK	31.9	-22.9	51.12	-	-	74	-22.88	175	187	H
3	* 2.39	28.34	VB1T	32.1	-22.8	37.64	54	-16.36	-	-	175	187	H
4	* 2.39	28.42	VB1T	32.1	-22.8	37.72	54	-16.28	-	-	175	187	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)



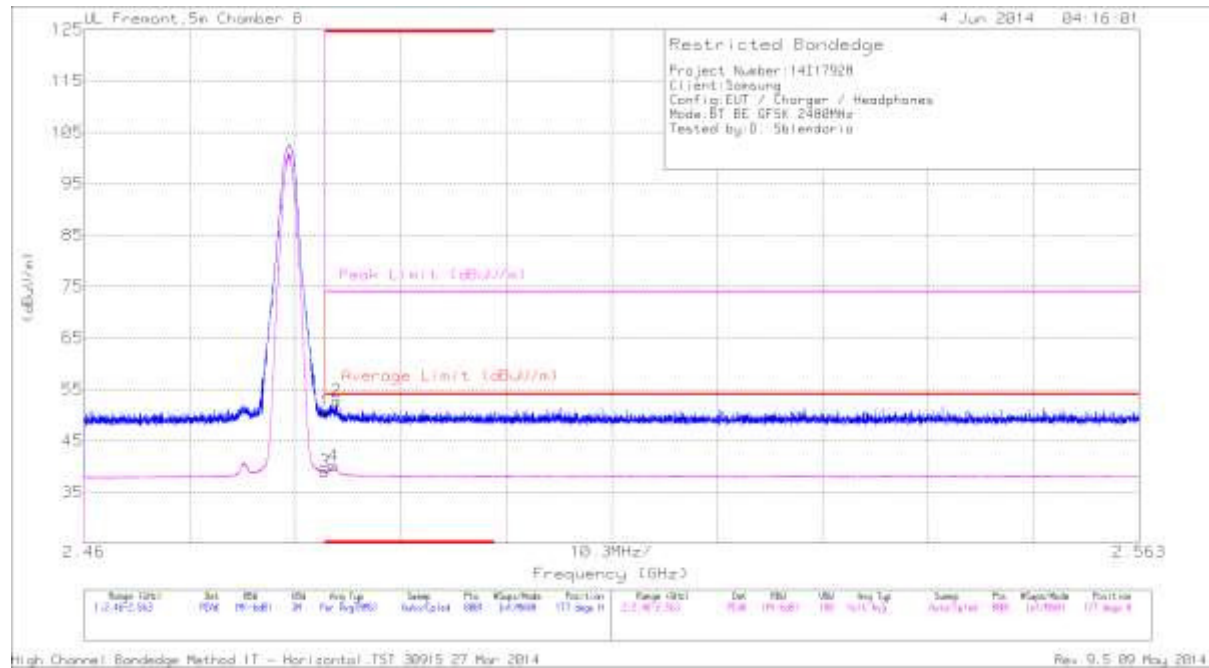
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.27	PK	32.1	-22.8	48.57	-	-	74	-25.43	241	355	V
2	* 2.388	42.01	PK	32.1	-22.8	51.31	-	-	74	-22.69	241	355	V
3	* 2.39	28.31	VB1T	32.1	-22.8	37.61	54	-16.39	-	-	241	355	V
4	* 2.39	28.44	VB1T	32.1	-22.8	37.74	54	-16.26	-	-	241	355	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)



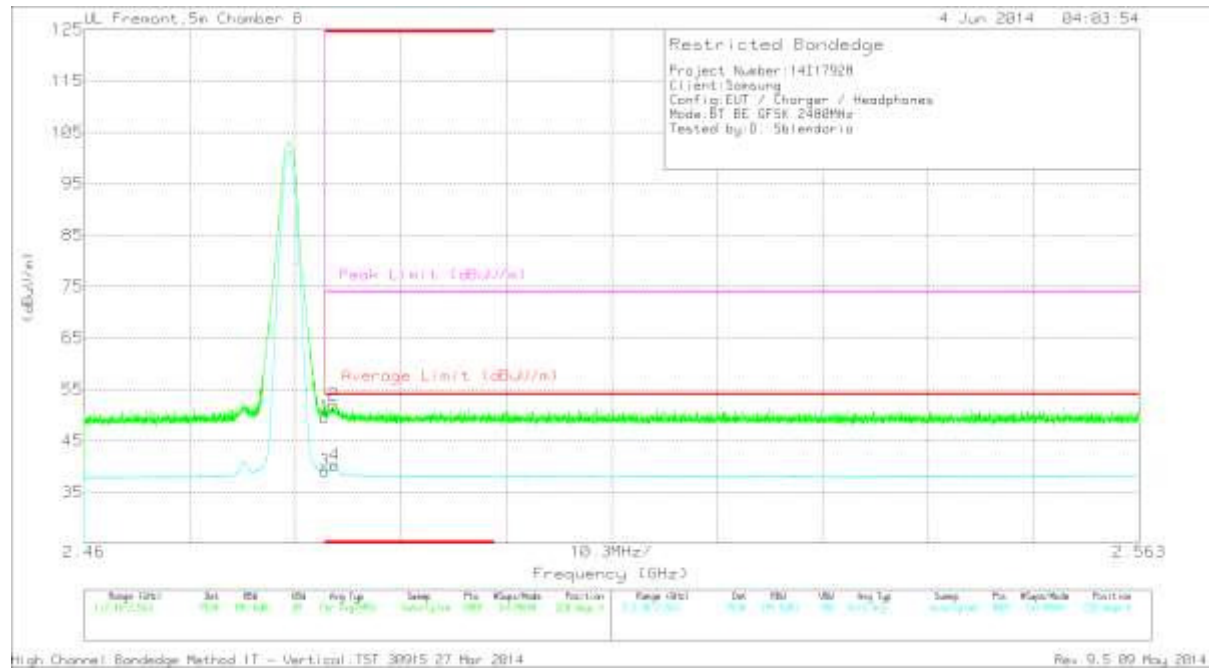
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Filt/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.96	PK	32.4	-22.7	50.66	-	-	74	-23.34	177	331	H
2	* 2.485	42.98	PK	32.4	-22.7	52.68	-	-	74	-21.32	177	331	H
3	* 2.484	29.29	VB1T	32.4	-22.7	38.99	54	-15.01	-	-	177	331	H
4	* 2.484	30.38	VB1T	32.4	-22.7	40.08	54	-13.92	-	-	177	331	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/Cbl/ Filt/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	39.97	PK	32.4	-22.7	49.67	-	-	74	-24.33	220	329	V
2	* 2.484	42.34	PK	32.4	-22.7	52.04	-	-	74	-21.96	220	329	V
3	* 2.484	29.47	VB1T	32.4	-22.7	39.17	54	-14.83	-	-	220	329	V
4	* 2.484	30.58	VB1T	32.4	-22.7	40.28	54	-13.72	-	-	220	329	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.



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

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.098	36.85	PK	27.4	-24.7	0	39.55	-	-	74	-34.45	0-360	101	H
2	* 1.049	37.12	PK	27.2	-24.8	0	39.52	-	-	74	-34.48	0-360	100	V
3	* 4.122	34.25	PK	33.6	-30	0	37.85	-	-	74	-36.15	0-360	201	H
5	* 9.045	28.08	PK	36.2	-23.5	0	40.78	-	-	74	-33.22	0-360	201	H
4	* 4.107	34.62	PK	33.6	-30.4	0	37.82	-	-	74	-36.18	0-360	101	V
6	* 9.043	28.61	PK	36.2	-23.5	0	41.31	-	-	74	-32.69	0-360	101	V

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

PK - Peak detector

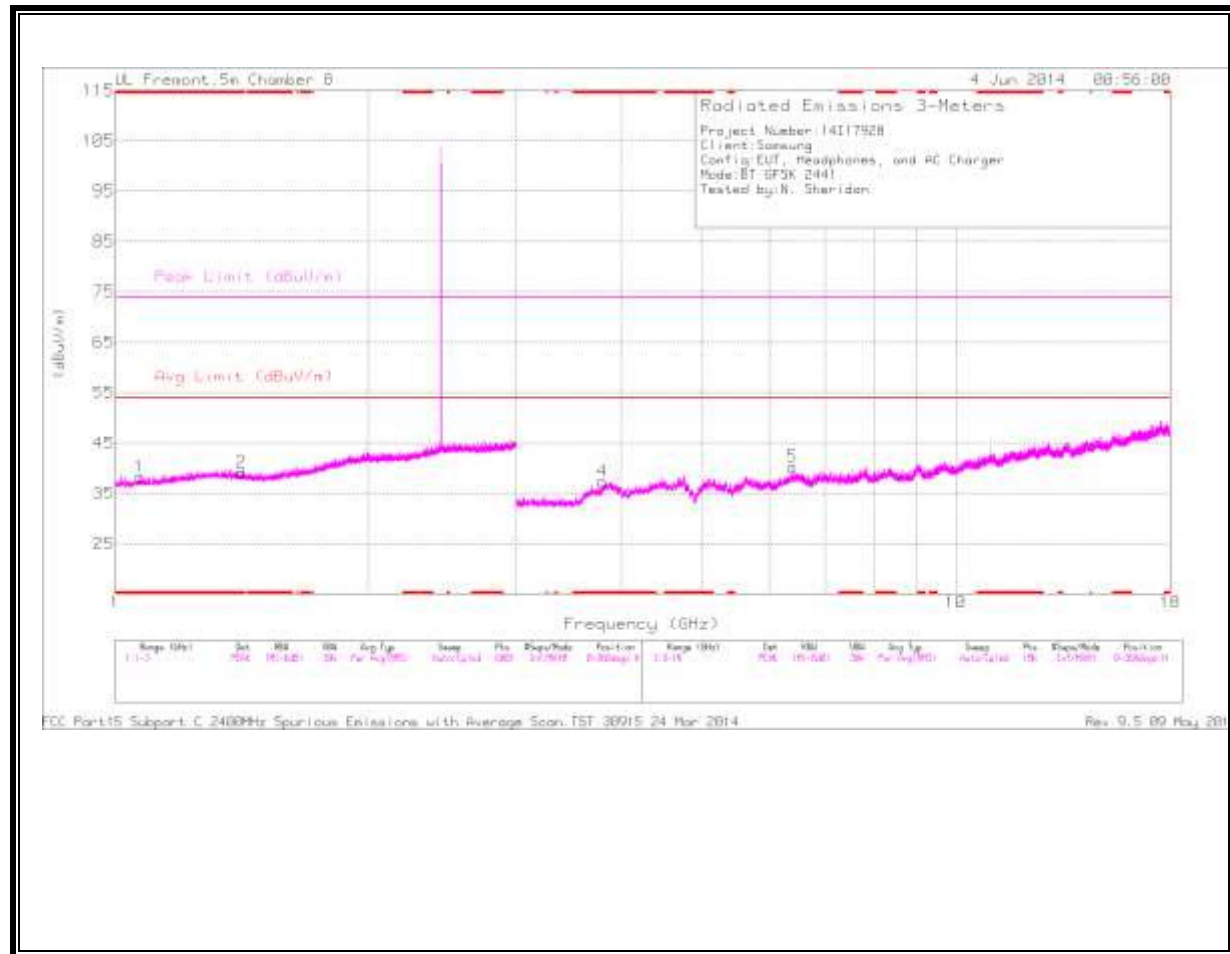
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr /Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.096	44	PK3	27.4	-24.7	46.7	-	-	74	-27.3	134	102	H
* 1.049	43.25	PK3	27.2	-24.8	45.65	-	-	74	-28.35	0	400	V
* 1.051	30.86	VB1T	27.2	-24.8	34.36	54	-19.64	-	-	0	400	V
* 4.123	41.28	PK3	33.6	-30	44.88	-	-	74	-29.12	219	191	H
* 4.122	28.63	VB1T	33.6	-30	33.33	54	-20.67	-	-	219	191	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

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.



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

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.07	35.7	PK	27.3	-24.7	0	38.3	-	-	74	-35.7	0-360	201	H
2	* 1.413	35.16	PK	28.4	-24.4	0	39.16	-	-	74	-34.84	0-360	201	H
4	* 3.802	34.55	PK	33.6	-30.8	0	37.35	-	-	74	-36.65	0-360	100	H
6	* 9.073	28.04	PK	36.3	-24.3	0	40.04	-	-	74	-33.96	0-360	100	V
3	1.99	34.55	PK	31.3	-23.4	0	42.45	-	-	-	-	0-360	201	V
5	6.395	33.68	PK	35.6	-29	0	40.28	-	-	-	-	0-360	201	H

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

PK - Peak detector

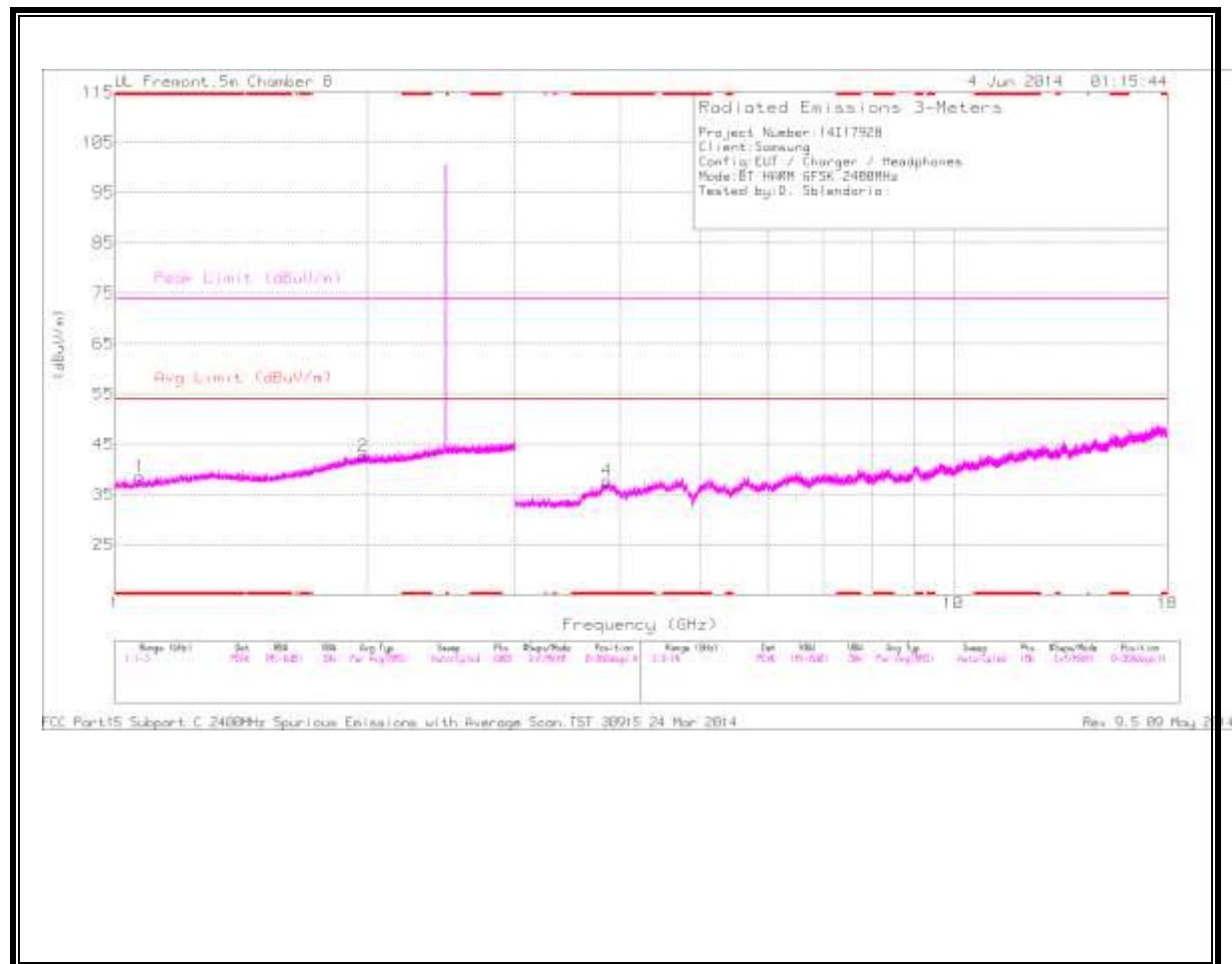
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr /Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.069	44.02	PK3	27.3	-24.7	46.62	-	-	74	-27.38	0	202	H
* 1.071	30.99	VB1T	27.3	-24.7	34.79	54	-19.21	-	-	0	202	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



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



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

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/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
1	* 1.072	35.91	PK	27.3	-24.7	38.51	-	-	74	-35.49	0-360	202	H
3	* 1.169	36.7	PK	27.9	-24.6	40	-	-	74	-34	0-360	201	V
4	* 3.862	34.4	PK	33.7	-30.4	37.7	-	-	74	-36.3	0-360	100	H
6	* 9.019	28.99	PK	36.2	-24	41.19	-	-	74	-32.81	0-360	100	V
2	1.976	34.63	PK	31.3	-23.3	42.63	-	-	-	-	0-360	202	H
5	6.528	31.24	PK	35.7	-27.9	39.04	-	-	-	-	0-360	201	V

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

PK - Peak detector

Radiated Emissions

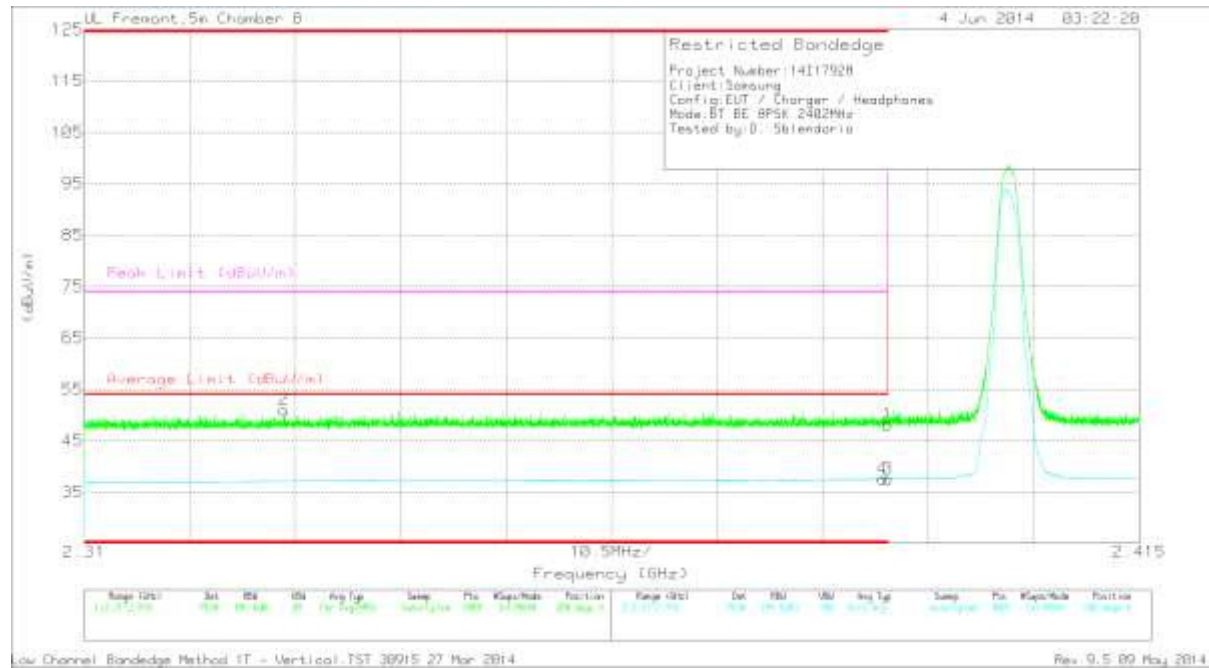
Frequency (GHz)	Meter Reading (dBuV)	Det	AFT345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.17	44.09	PK3	28	-24.6	47.49	-	-	74	-26.51	1	202	V
* 1.171	30.91	VB1T	28	-24.6	34.31	54	-19.69	-	-	1	202	V

* - 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

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



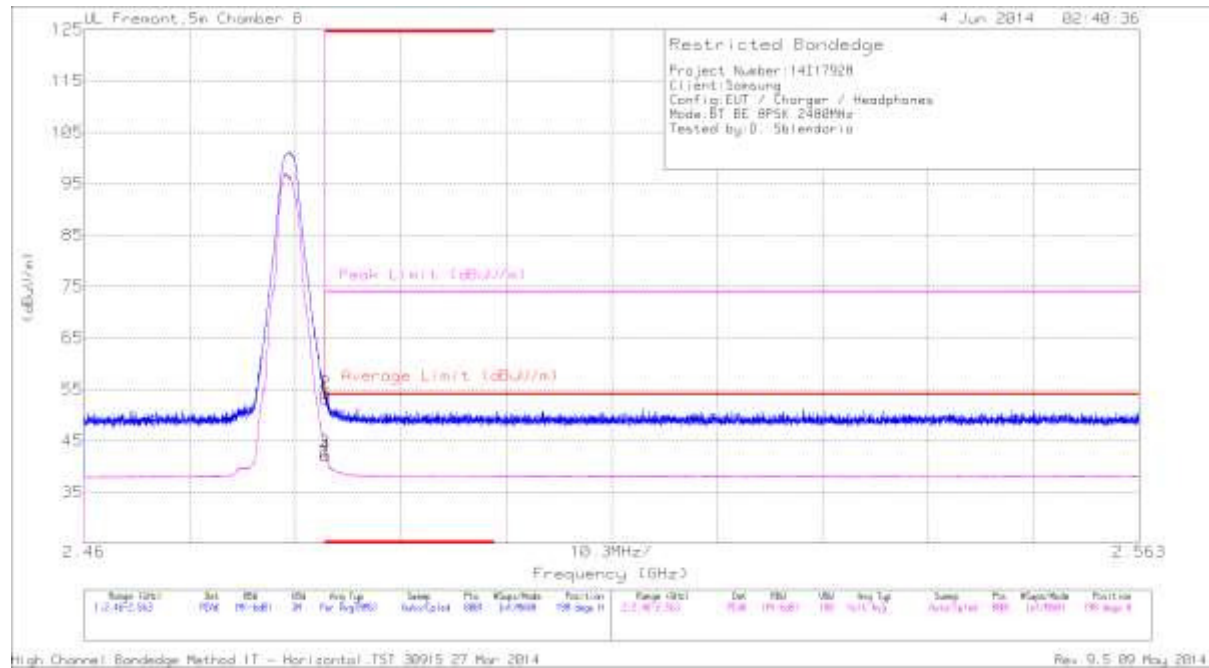
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Filt/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.9	PK	32.1	-22.8	48.2	-	-	74	-25.8	200	367	V
2	* 2.33	42.09	PK	31.8	-22.9	50.99	-	-	74	-23.01	200	367	V
3	* 2.39	28.27	VB1T	32.1	-22.8	37.57	54	-16.43	-	-	200	367	V
4	* 2.389	28.33	VB1T	32.1	-22.8	37.63	54	-16.37	-	-	200	367	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)



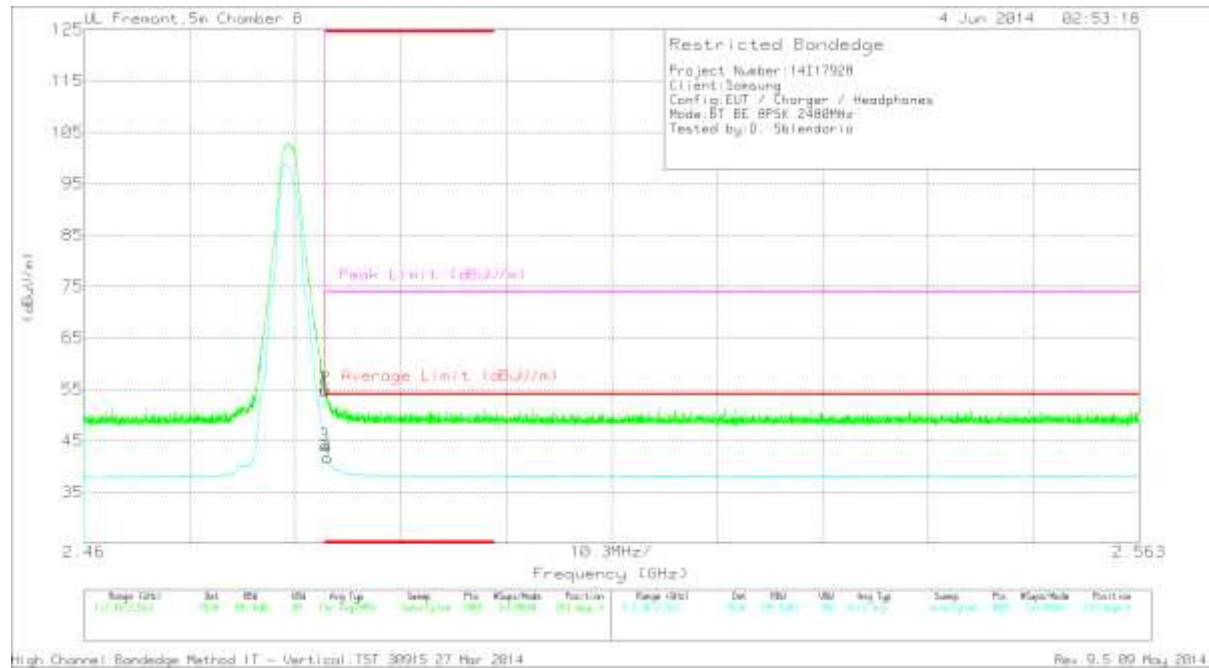
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Filt/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	43.44	PK	32.4	-22.7	53.14	-	-	74	-20.86	198	341	H
2	* 2.484	44.63	PK	32.4	-22.7	54.33	-	-	74	-19.67	198	341	H
3	* 2.484	33.13	VB1T	32.4	-22.7	42.83	54	-11.17	-	-	198	341	H
4	* 2.484	32.34	VB1T	32.4	-22.7	42.04	54	-11.96	-	-	198	341	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/Cbl/ Filt/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	45.08	PK	32.4	-22.7	54.78	-	-	74	-19.22	243	327	V
2	* 2.484	45.49	PK	32.4	-22.7	55.19	-	-	74	-18.81	243	327	V
3	* 2.484	34.33	VB1T	32.4	-22.7	44.03	54	-9.97	-	-	243	327	V
4	* 2.484	31.93	VB1T	32.4	-22.7	41.63	54	-12.37	-	-	243	327	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

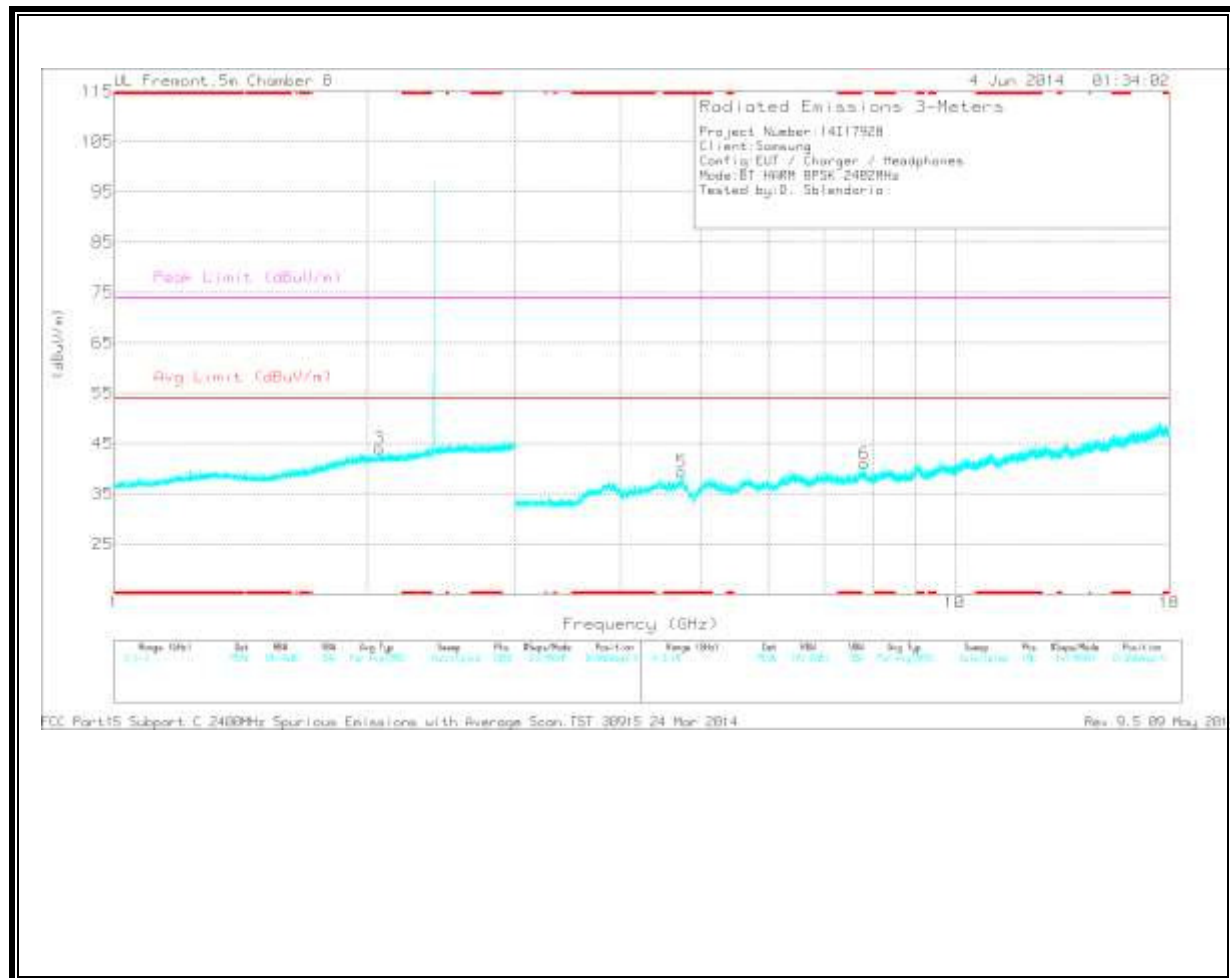
HARMONICS AND SPURIOUS EMISSIONS

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

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.323	36.65	PK	28.8	-24.5	40.95	-	-	74	-33.05	0-360	202	H
2	* 1.678	36.4	PK	28.9	-23.7	41.6	-	-	74	-32.4	0-360	202	H
4	* 3.868	35.06	PK	33.7	-30.3	38.46	-	-	74	-35.54	0-360	201	H
5	* 4.733	34.51	PK	34.2	-29.4	39.31	-	-	74	-34.69	0-360	100	V
3	2.068	36.17	PK	31.3	-23.4	44.07	-	-	-	-	0-360	201	V
6	7.814	31.04	PK	35.7	-25.7	41.04	-	-	-	-	0-360	202	V

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

PK - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 3.87	42.11	PK3	33.7	-30.3	45.51	-	-	74	-28.49	232	202	H
* 3.87	29.39	VB1T	33.7	-30.3	32.79	54	-21.21	-	-	232	202	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



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



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MID CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/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
1	* 1.515	36.25	PK	28	-24.1	40.15	-	-	74	-33.85	0-360	202	H
2	* 1.168	39.88	PK	27.9	-24.7	43.08	-	-	74	-30.92	0-360	201	V
5	* 4.736	33.96	PK	34.2	-29.4	38.76	-	-	74	-35.24	0-360	201	V
6	* 9.445	29.52	PK	36.5	-24.5	41.52	-	-	74	-32.48	0-360	201	V
3	4.492	33.68	PK	34	-29.2	38.48	-	-	-	-	0-360	201	H
4	6.497	33.23	PK	35.7	-28.6	40.33	-	-	-	-	0-360	201	H

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

PK - Peak detector

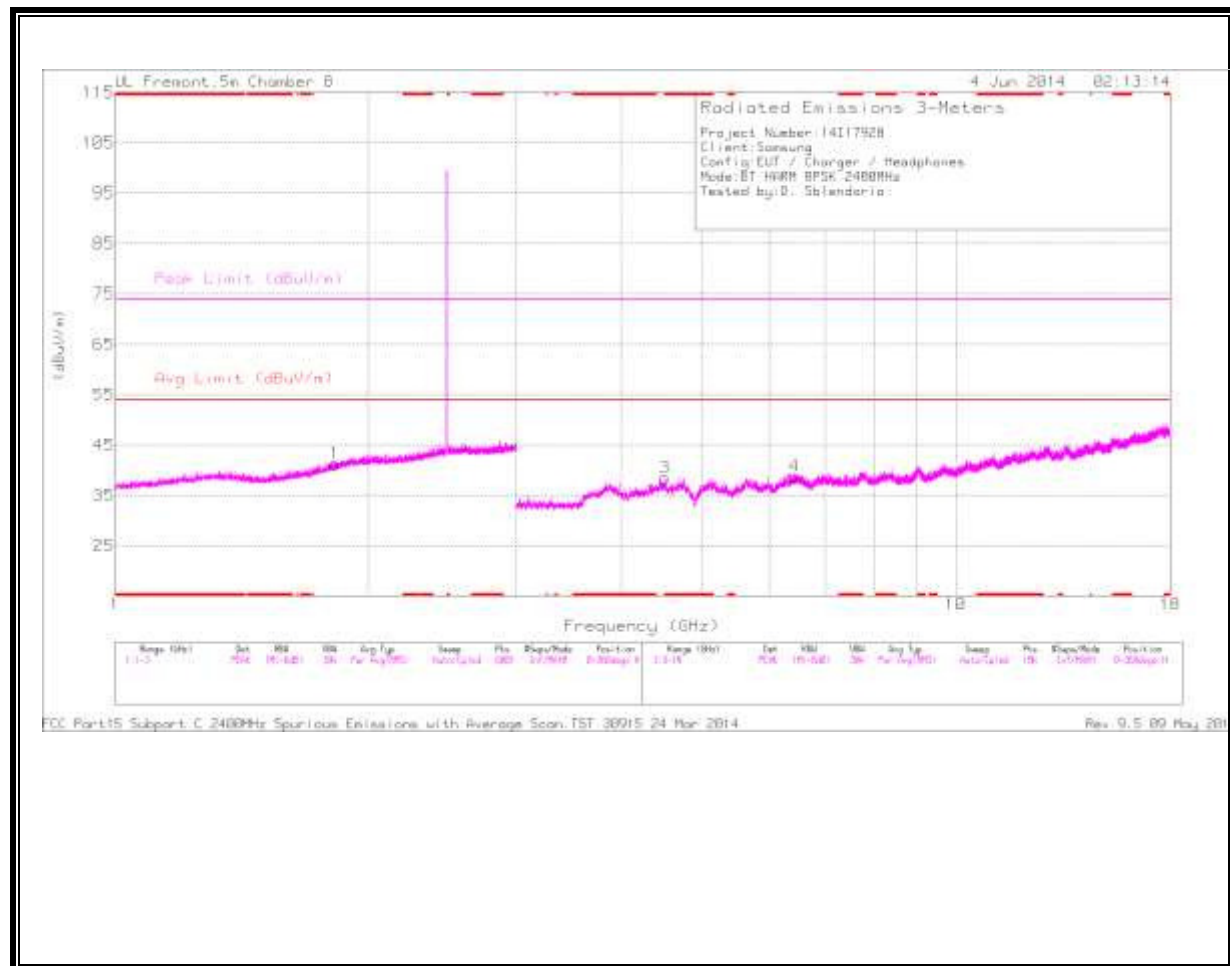
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/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
* 1.169	44.13	PK3	27.9	-24.6	47.43	-	-	74	-26.57	359	202	V
* 1.169	30.87	VB1T	27.9	-24.6	34.17	54	-19.83	-	-	359	202	V
* 1.167	43.38	PK3	27.9	-24.7	46.58	-	-	74	-27.42	359	202	V
* 1.168	30.92	VB1T	27.9	-24.6	34.22	54	-19.78	-	-	359	202	V

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

PK3 - FHSS Method: Maximum Peak

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Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/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
2	* 1.071	36.63	PK	27.3	-24.7	39.23	-	-	74	-34.77	0-360	100	V
3	* 4.508	33.99	PK	34	-29.5	38.49	-	-	74	-35.51	0-360	101	H
5	* 3.867	34.04	PK	33.7	-30.4	37.34	-	-	74	-36.66	0-360	101	V
1	1.826	34.43	PK	30.4	-23.6	41.23	-	-	-	-	0-360	100	H
4	6.426	32.24	PK	35.6	-29	38.84	-	-	-	-	0-360	101	H
6	8.999	29.13	PK	36.2	-24.1	41.23	-	-	-	-	0-360	201	V

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

PK - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AFT345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.071	43.62	PK3	27.3	-24.7	46.22	-	-	74	-27.78	359	100	V
* 1.071	31.06	VB1T	27.3	-24.7	33.66	54	-20.34	-	-	359	100	V

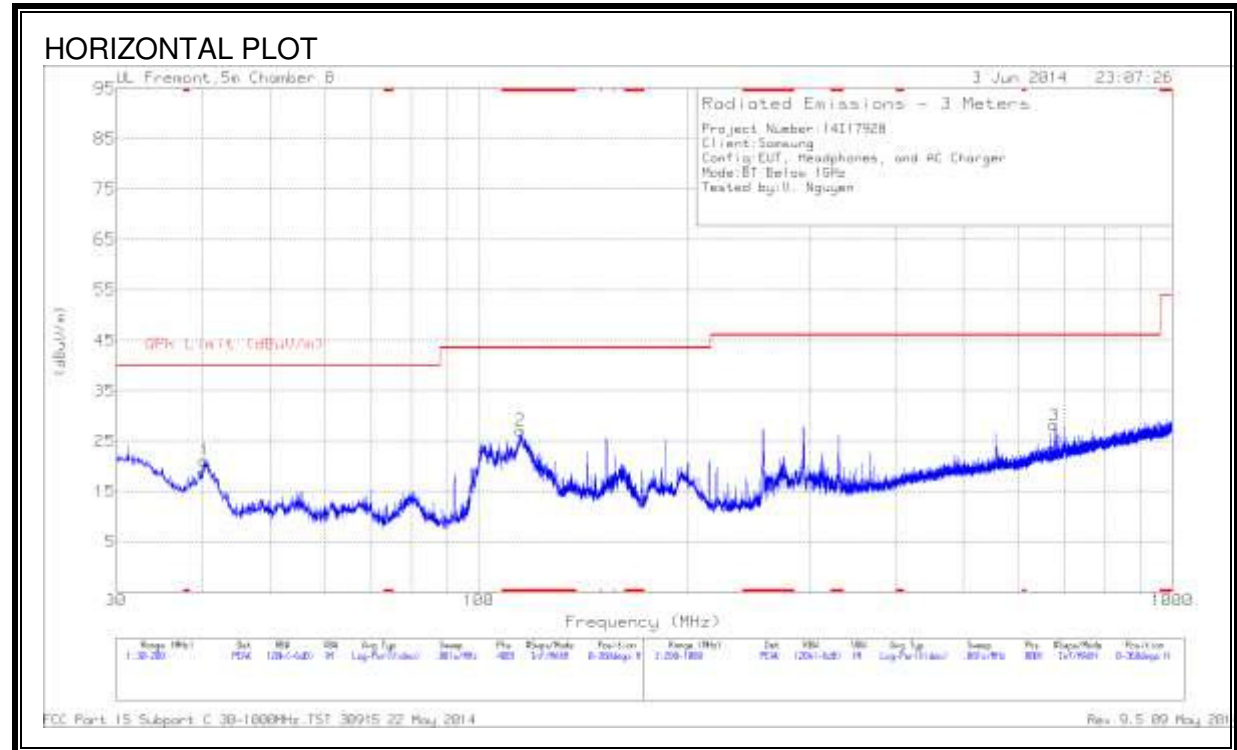
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

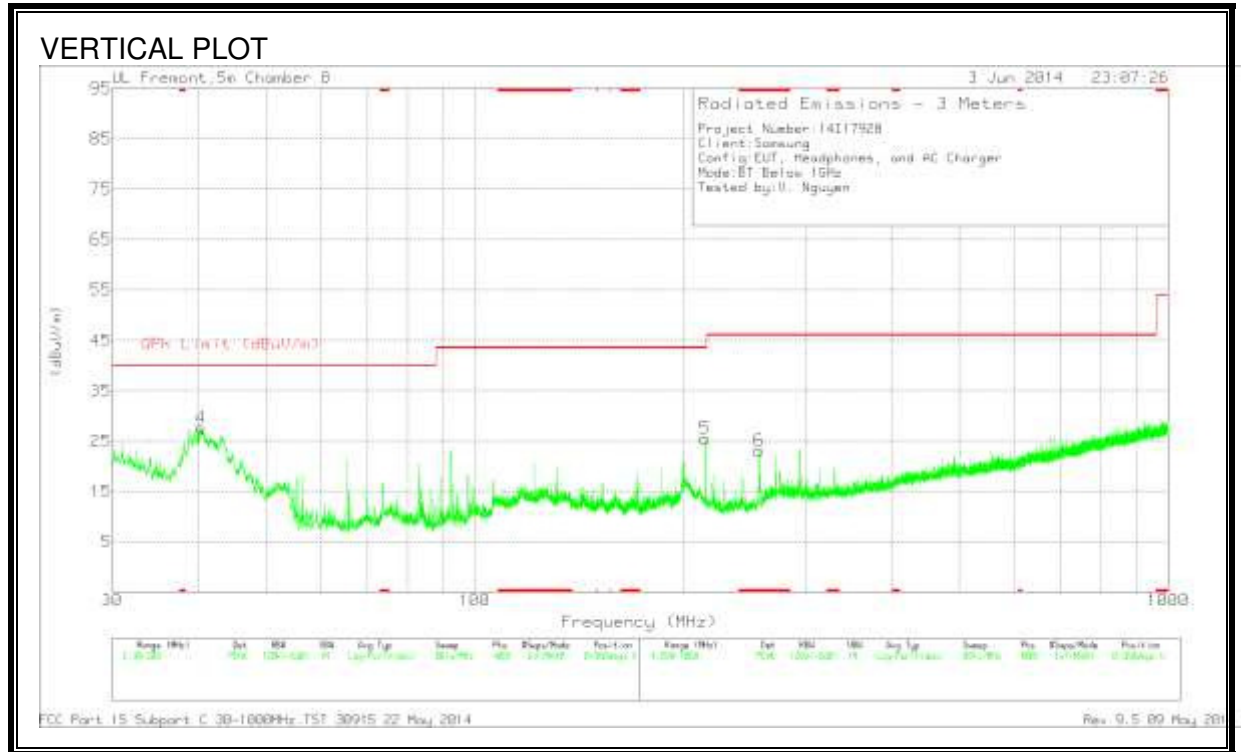
PK3 - FHSS Method: Maximum Peak

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

9.3. WORST-CASE BELOW 1 GHz

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





DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T243 (dB/m)	Amp/Cbl (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 114.9575	41.56	PK	13.4	-27.9	0	27.06	43.52	-16.46	0-360	300	H
6	* 257	37.6	PK	11.8	-26.3	0	23.1	46.02	-22.92	0-360	200	V
1	40.2425	36.11	PK	13.7	-28.7	0	21.11	40	-18.89	0-360	200	H
4	40.285	42.68	PK	13.7	-28.7	0	27.68	40	-12.32	0-360	101	V
5	214.8	41.75	PK	10.6	-26.8	0	25.55	43.52	-17.97	0-360	200	V
3	676	33.36	PK	19.6	-24.8	0	28.16	46.02	-17.86	0-360	400	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	.339	47.82	PK	.5	0	48.32	59.2	-10.88	-	-
2	.339	41.29	Av	.5	0	41.79	-	-	49.2	-7.41
3	3.48	41	PK	.2	.1	41.3	56	-14.7	-	-
4	3.48	25.37	Av	.2	.1	25.67	-	-	46	-20.33
5	11.121	33.16	PK	.2	.2	33.56	60	-26.44	-	-
6	11.121	15.83	Av	.2	.2	16.23	-	-	50	-33.77

Line-L2 .15 - 30MHz

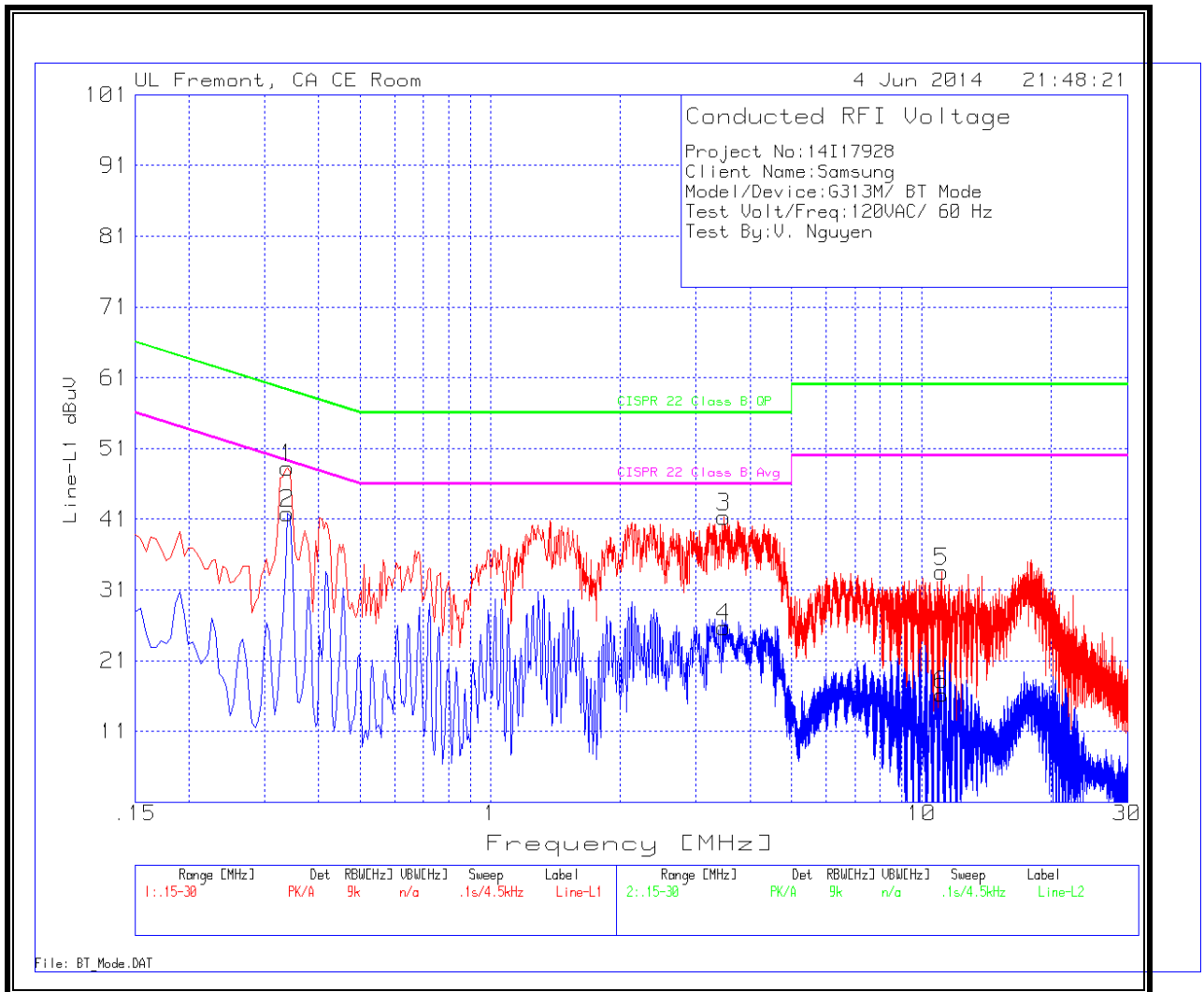
Trace Markers

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)
7	.3435	44.32	PK	.5	0	44.82	59.1	-14.28	-	-
8	.3435	34.89	Av	.5	0	35.39	-	-	49.1	-13.71
9	2.166	37.84	PK	.2	.1	38.14	56	-17.86	-	-
10	2.166	19.53	Av	.2	.1	19.83	-	-	46	-26.17
11	18.429	37.9	PK	.3	.2	38.4	60	-21.6	-	-
12	18.429	13.59	Av	.3	.2	14.09	-	-	50	-35.91

PK - Peak detector

Av - average detection

LINE 1 RESULTS



LINE 2 RESULTS

