FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT
FOR
GSM 1900 Phone + Bluetooth

MODEL NUMBER: SM-B510S, SM-B510K

FCC ID: A3LSMB510

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	3/12/14	Initial Issue	P. Kim
A	3/17/14	Updated max peak antenna, KDB 558074 removed from page 45, worst case TX conducted corrected on page 11	P. Kim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: GSM 1900 Phone + Bluetooth

MODEL: SM-B510S, SM-510K

SERIAL NUMBER: FL-087-D (Conducted), FL-087-A (Radiated)

DATE TESTED: MARCH 6-12, 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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LAB TECHNICIAN
UL Verification Services Inc.

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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.ccsemc.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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM 1900 Phone + Bluetooth.

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	9.03	8.00
2402 - 2480	Enhanced 8PSK	7.84	6.07

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 peak gain of -1.97 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.

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter	SAMSUNG	ETA0U18KWK	N/Z	N/A
Earphone	SAMSUNG	N/A	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.

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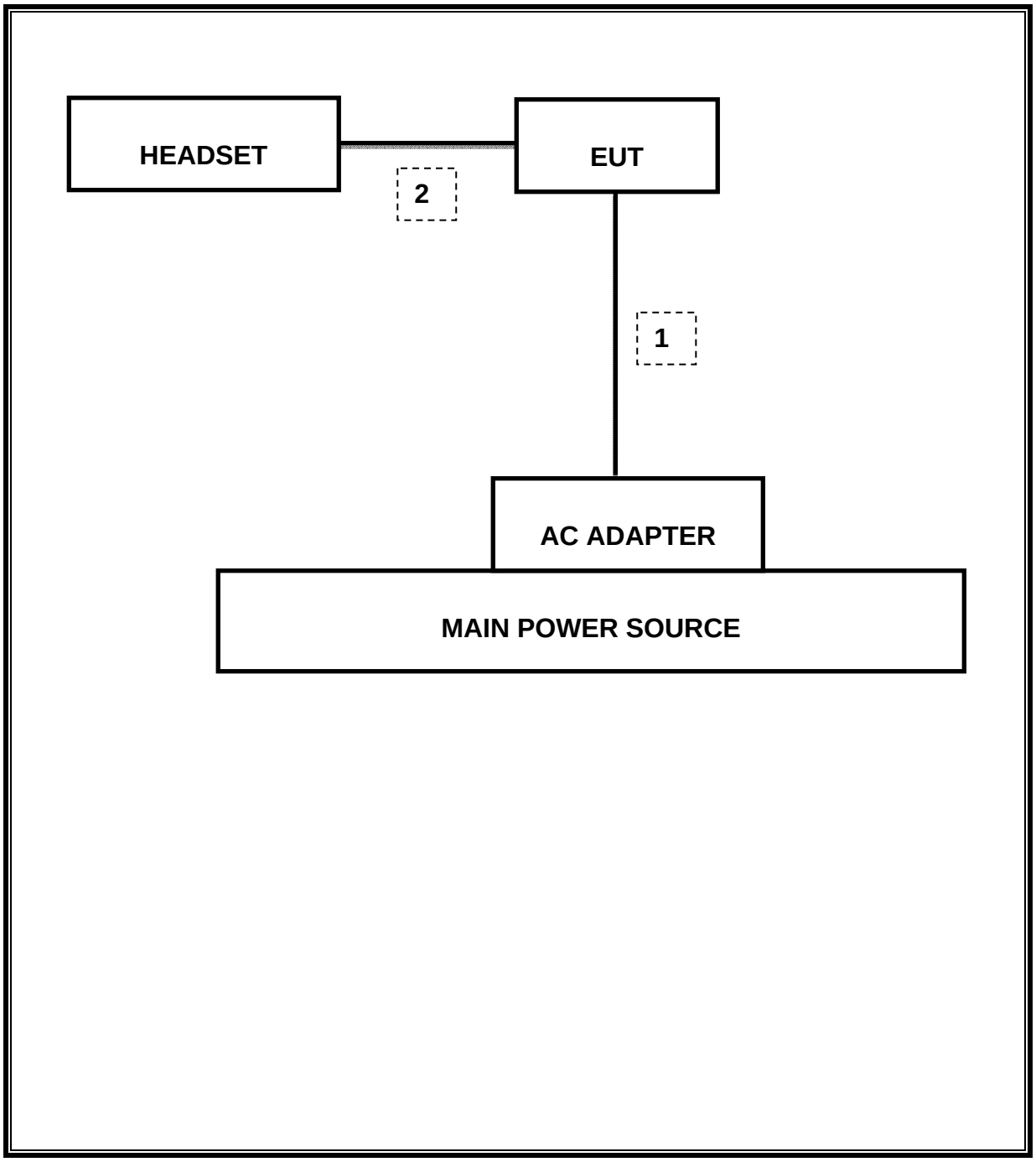
SETUP DIAGRAM FOR TESTS



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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	12/13/2014
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/2014

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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	1.22MHz
2.1051, 15.247 (d)	RSS-210 A8.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-40.79dBm
15.247 (b)(1)	RSS-210 A8.4	TX conducted output power	<21dBm		Pass	9.03dBm
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	0.288sec
15.207 (a)	RSS-GEN 7.2.2	AC Power Line conducted emissions	Section 10	Radiated	Pass	48.97dBuV/m
15.205, 15.209	RSS-210 Clause 2.6, RSS-210 Clause 6	Radiated Spurious Emission	< 54dBuV/m		Pass	44.54dBuV/m

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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 ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ 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	0.926	0.858
Middle	2441	0.926	0.824
High	2480	0.926	0.862
Worst		0.926	0.862

8.1.1. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.299	1.211
Middle	2441	1.299	1.22
High	2480	1.299	1.218
Worst		1.299	1.22

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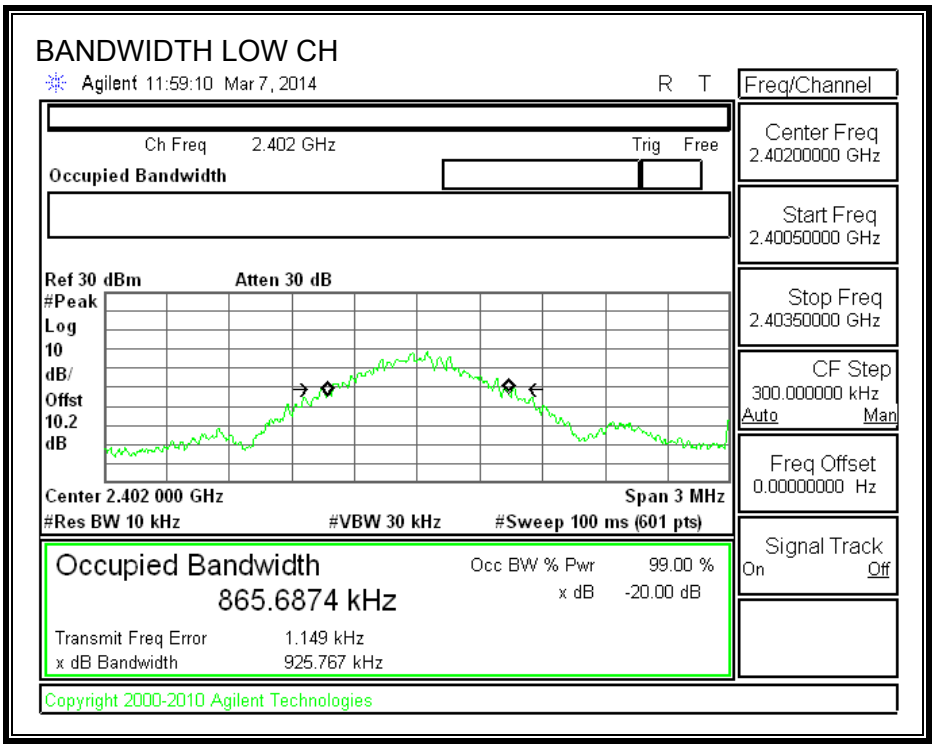
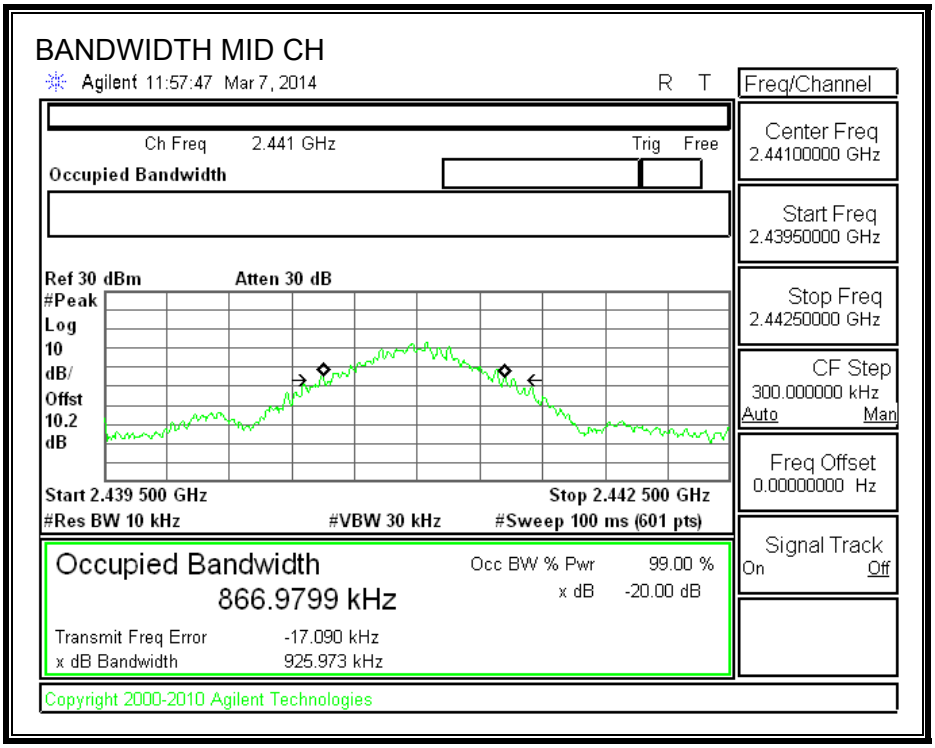
GFSK 20 dB BANDWIDTH





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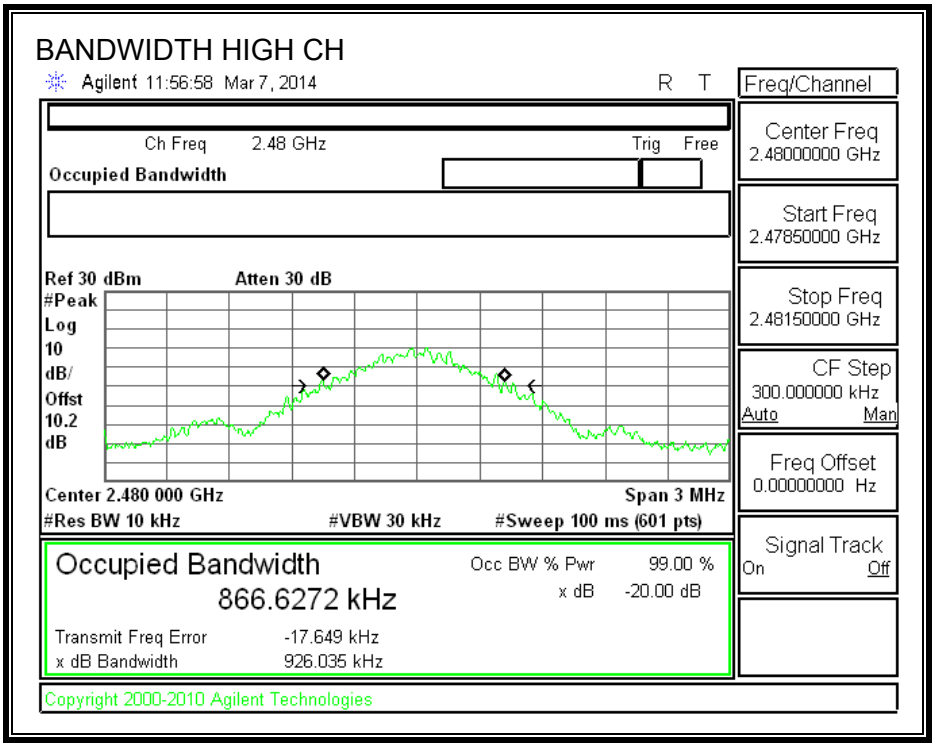

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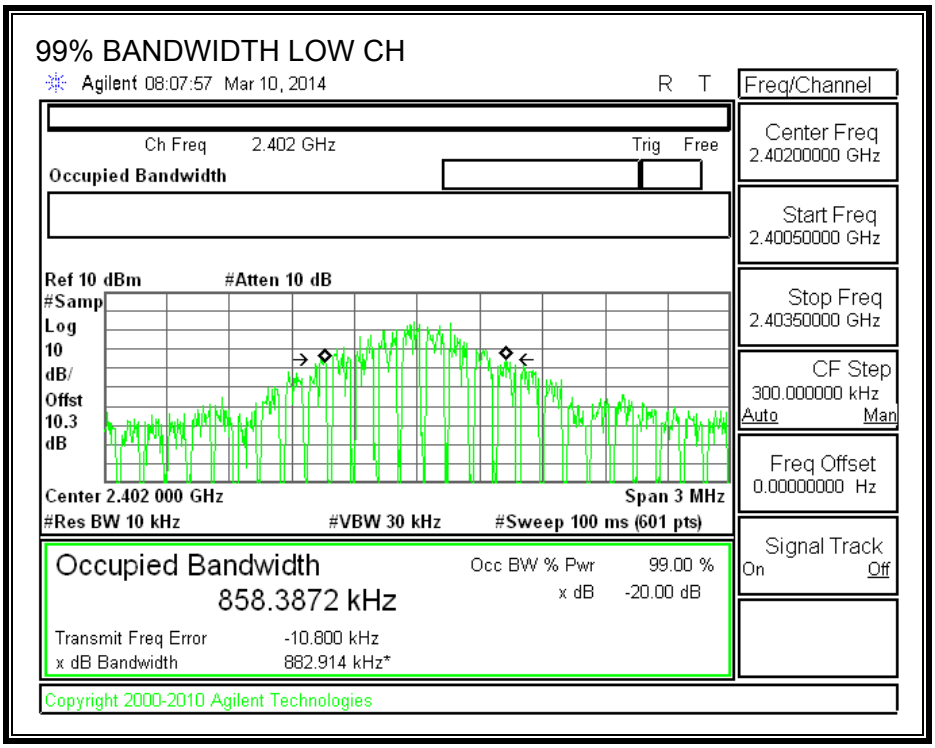
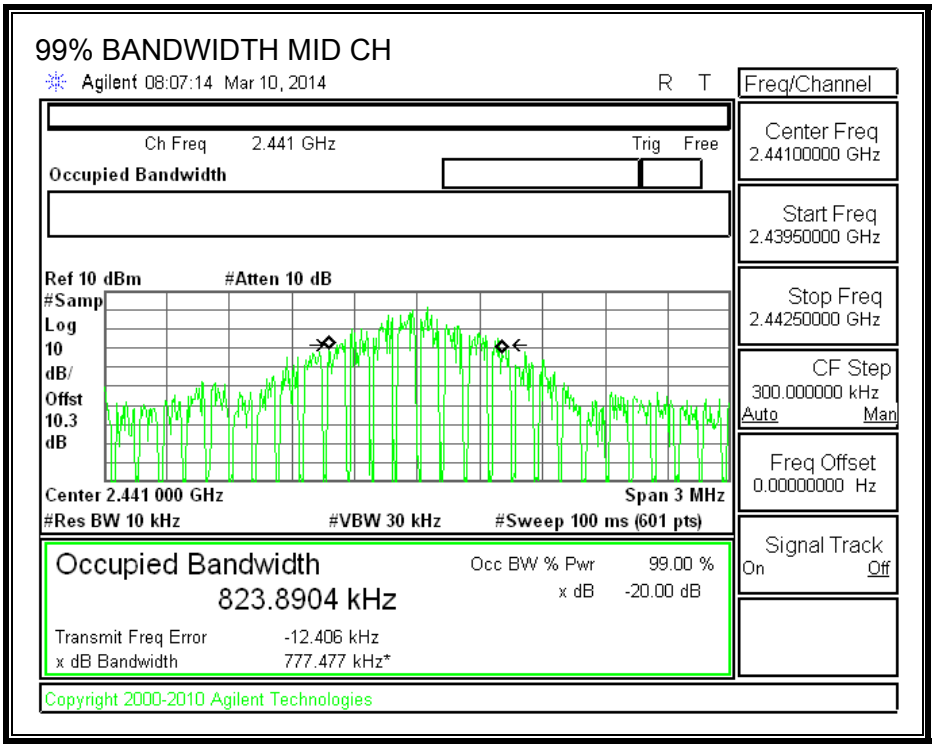
GFSK 99% BANDWIDTH





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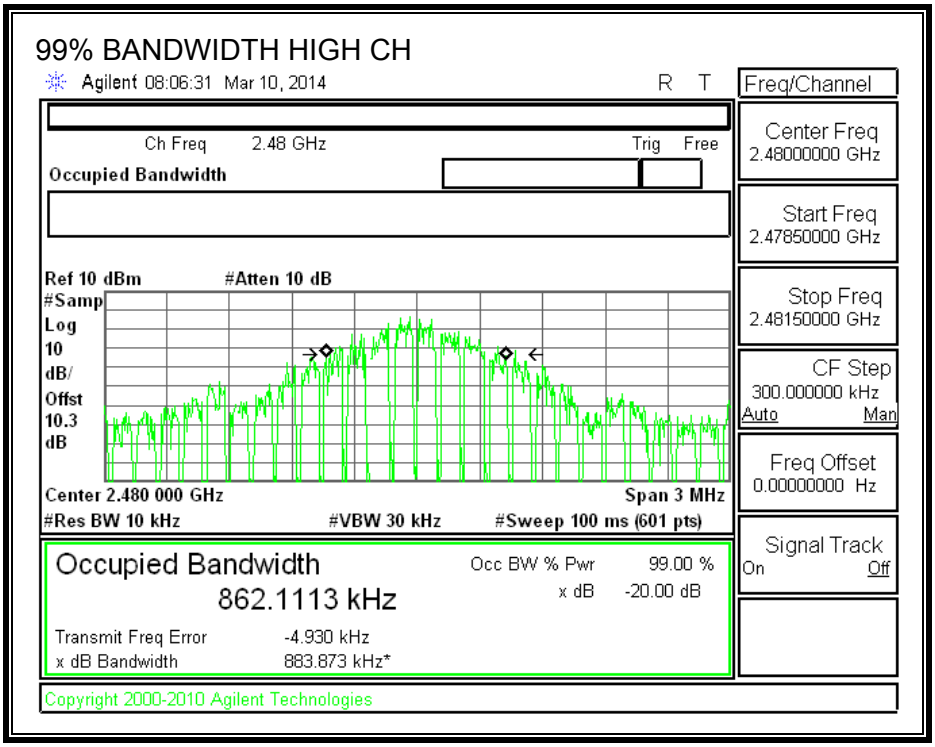

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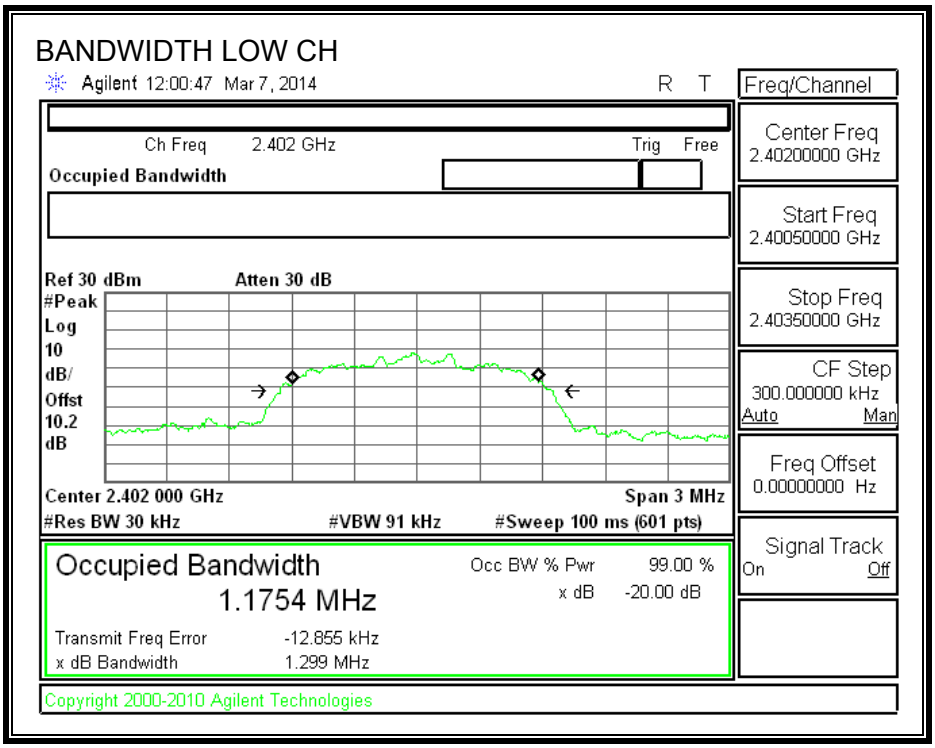
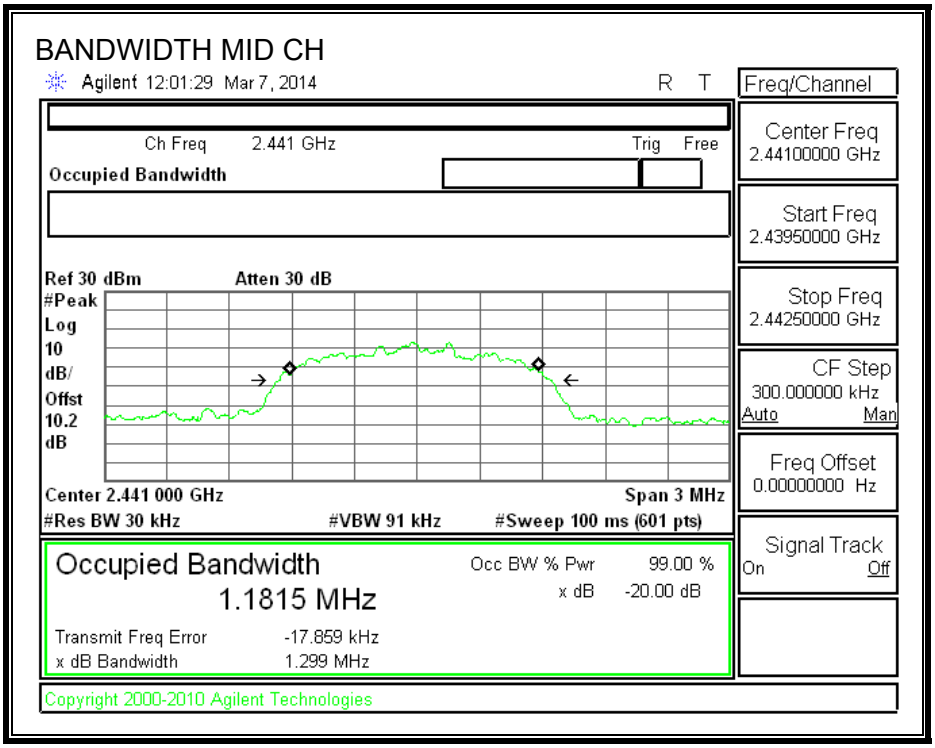
8PSK 20 dB BANDWIDTH





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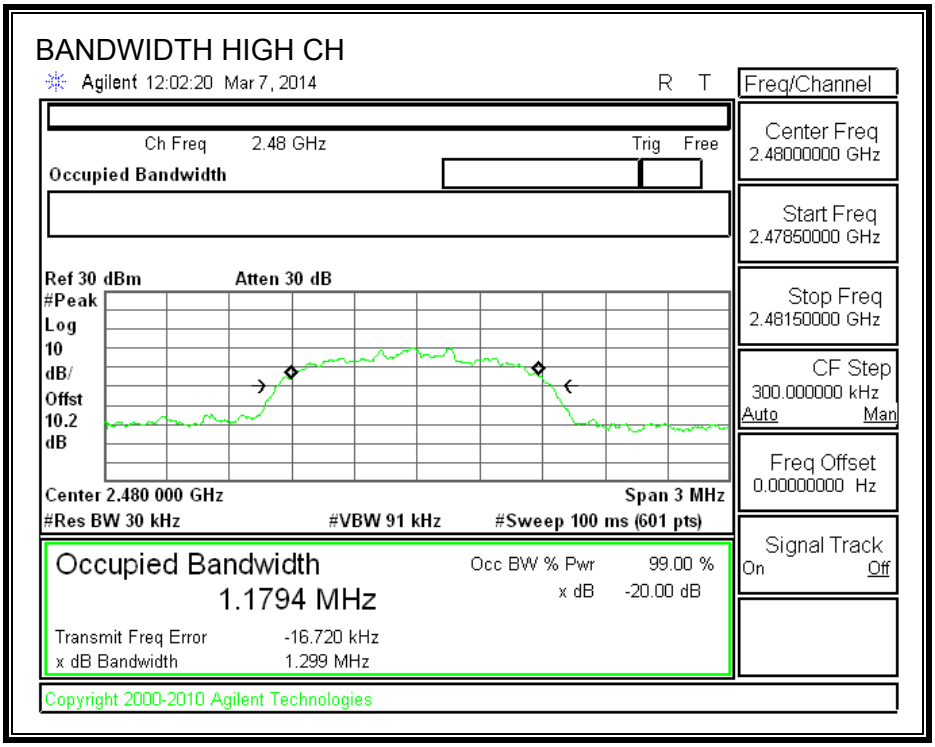

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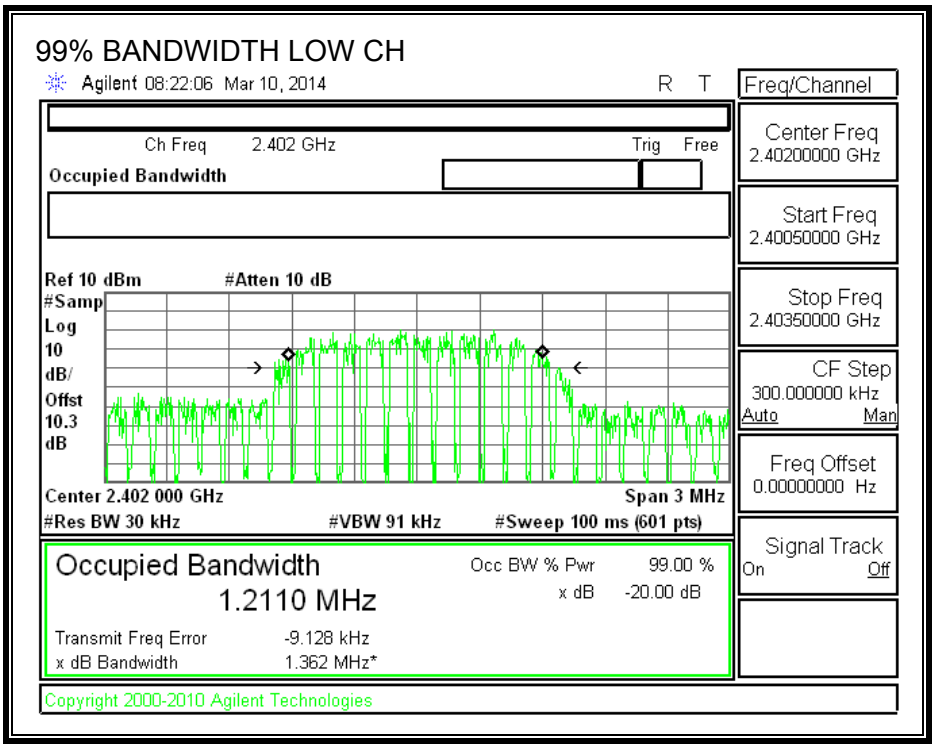
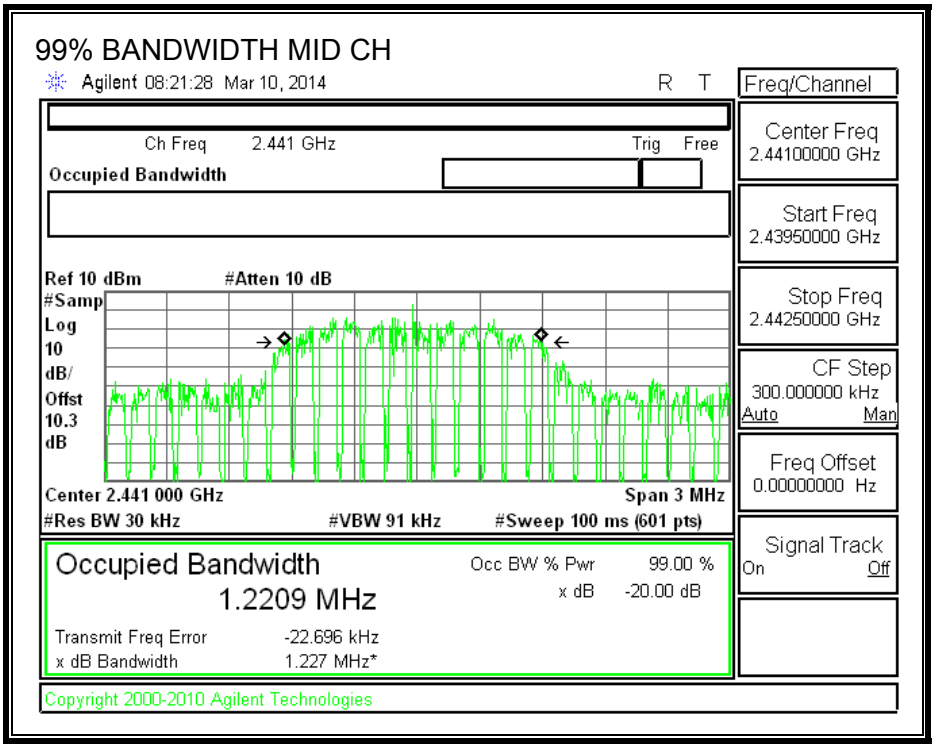
8PSK 99% BANDWIDTH





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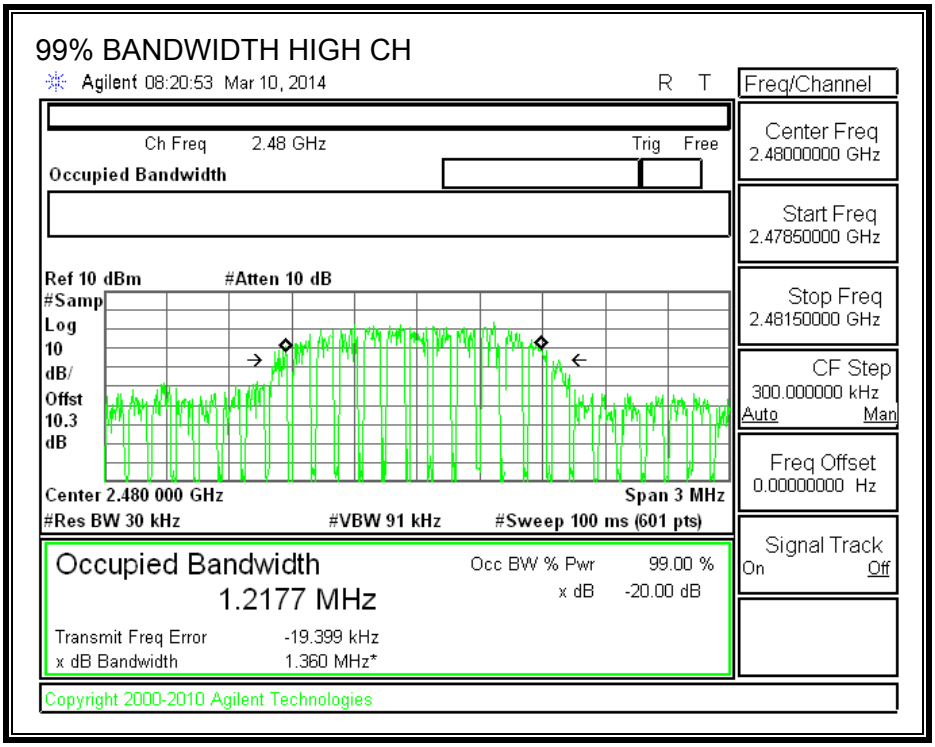

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8.2. HOPPING FREQUENCY SEPARATION

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 hoping 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

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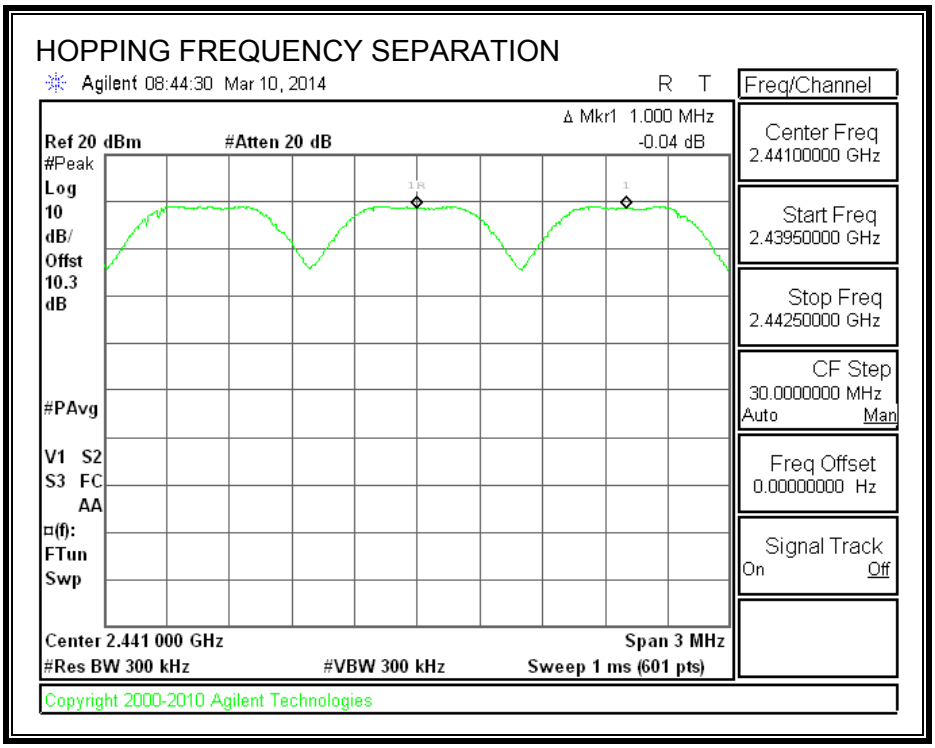
HOPPING FREQUENCY SEPARATION



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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.

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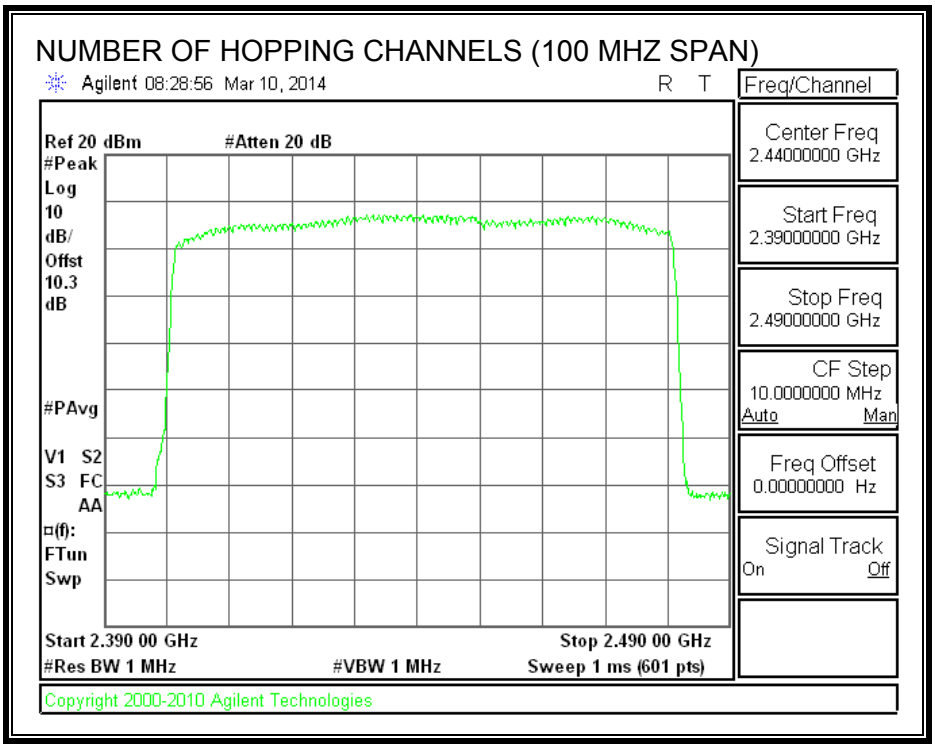
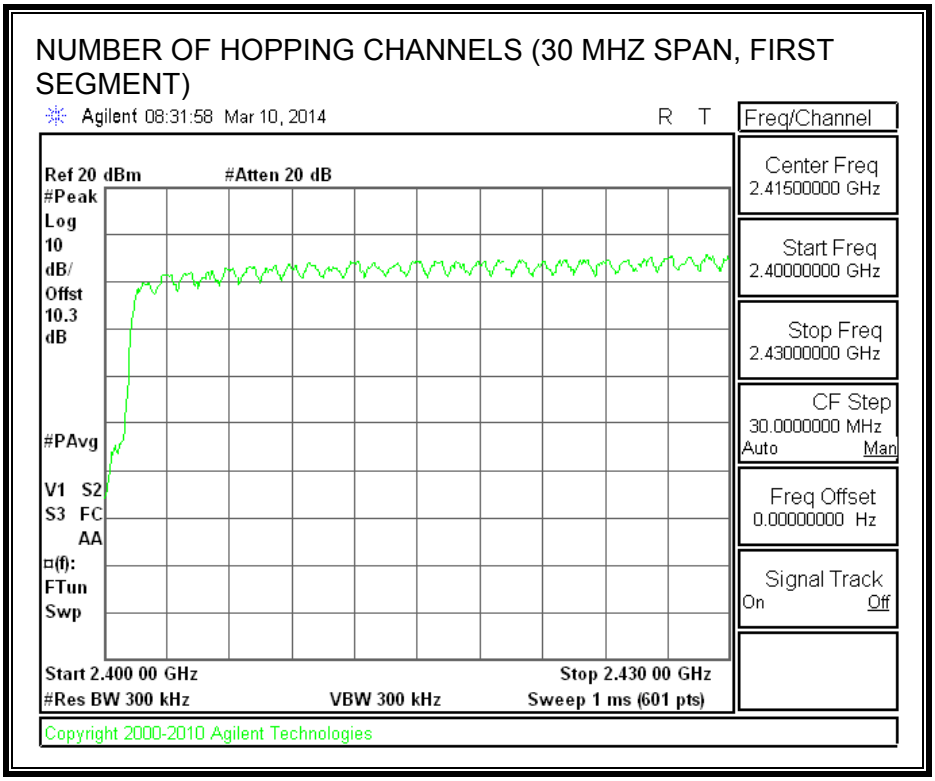
NUMBER OF HOPPING CHANNELS





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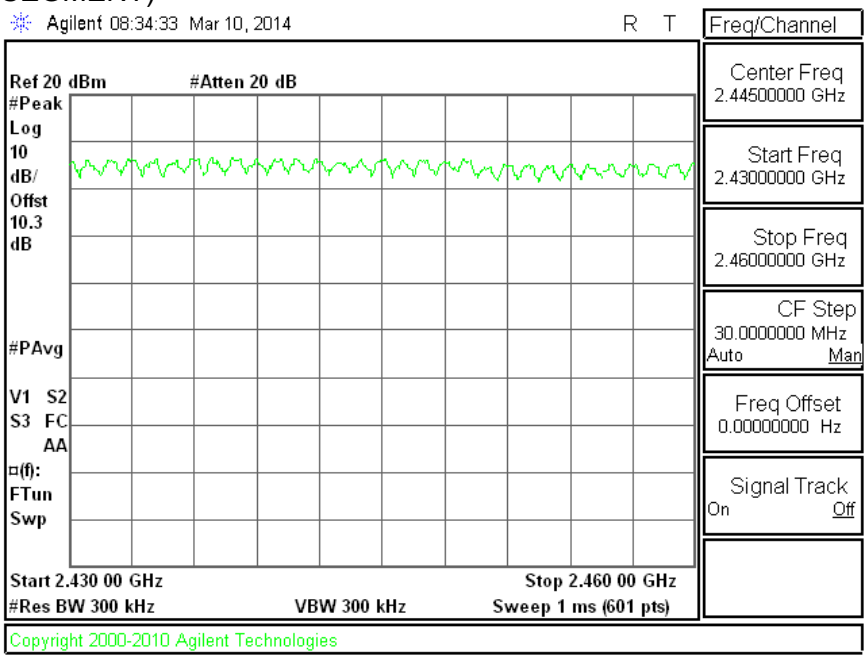
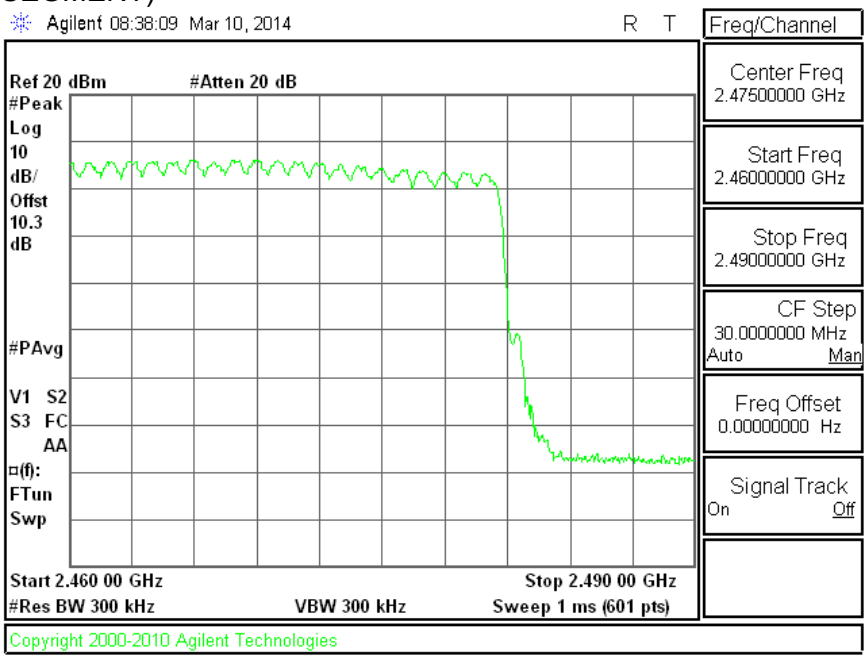
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



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



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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 * (# of pulses in 3.16 s) * pulse width.

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

RESULTS

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.3783	32	0.121	0.4	-0.279
DH3	1.632	16	0.261	0.4	-0.139
DH5	2.88	10	0.288	0.4	-0.112
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	8	0.000	0.4	-0.400
DH3	0.3783	4	0.015	0.4	-0.385
DH5	1.632	3	0.049	0.4	-0.351

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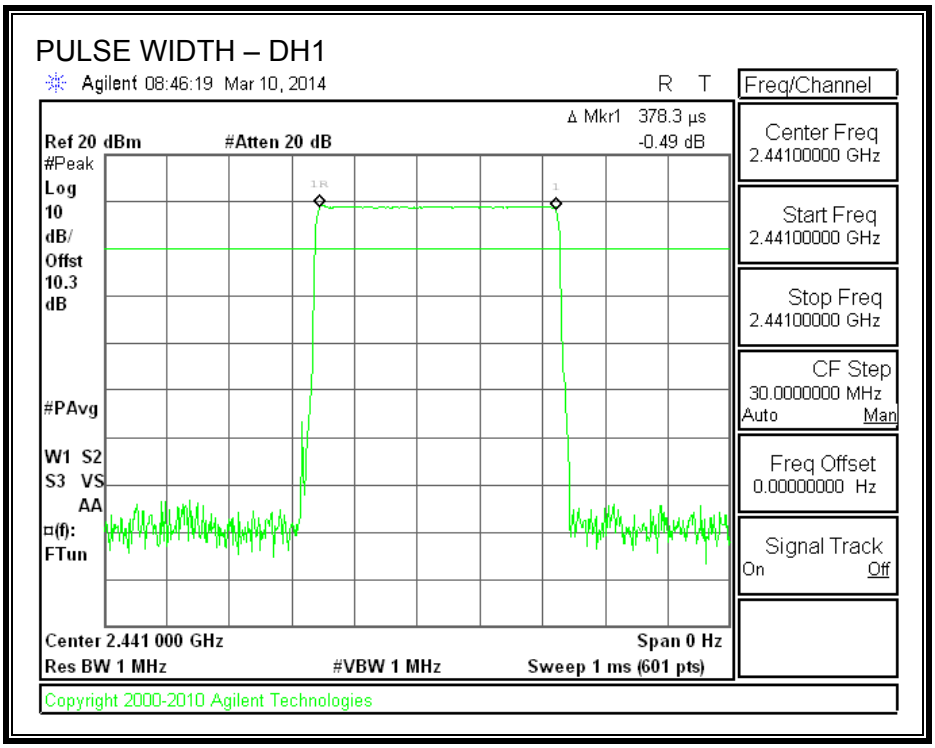
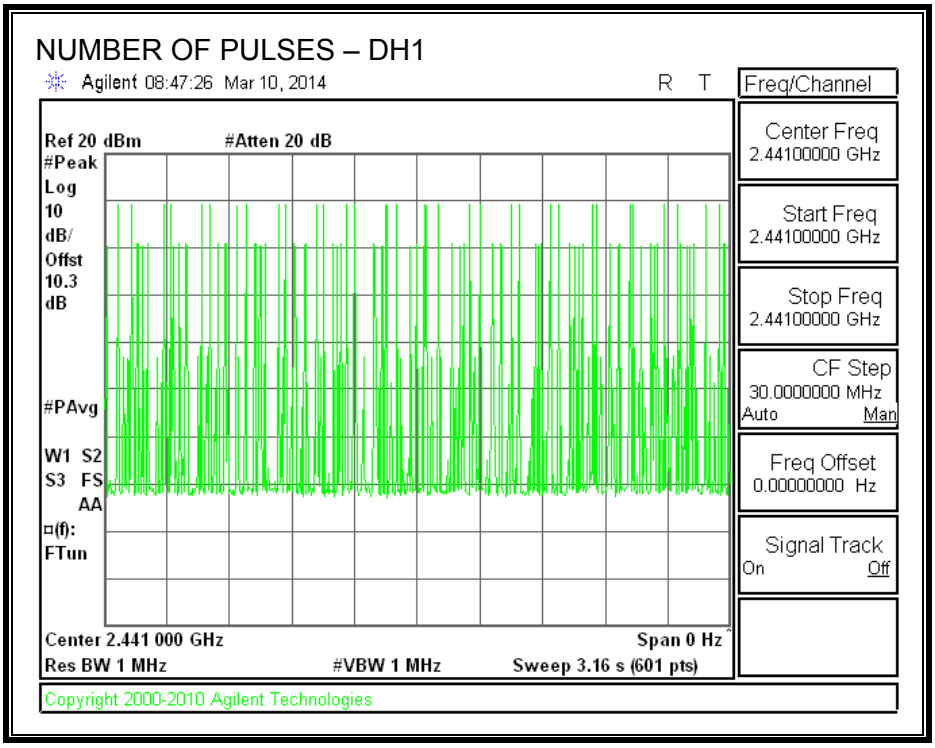
PULSE WIDTH - DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



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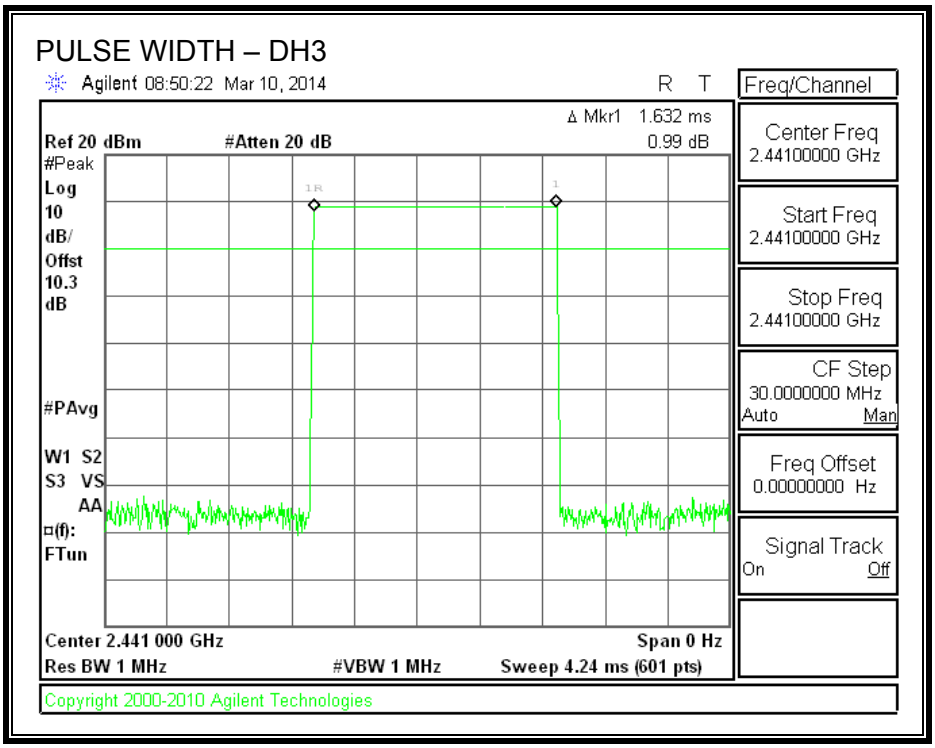
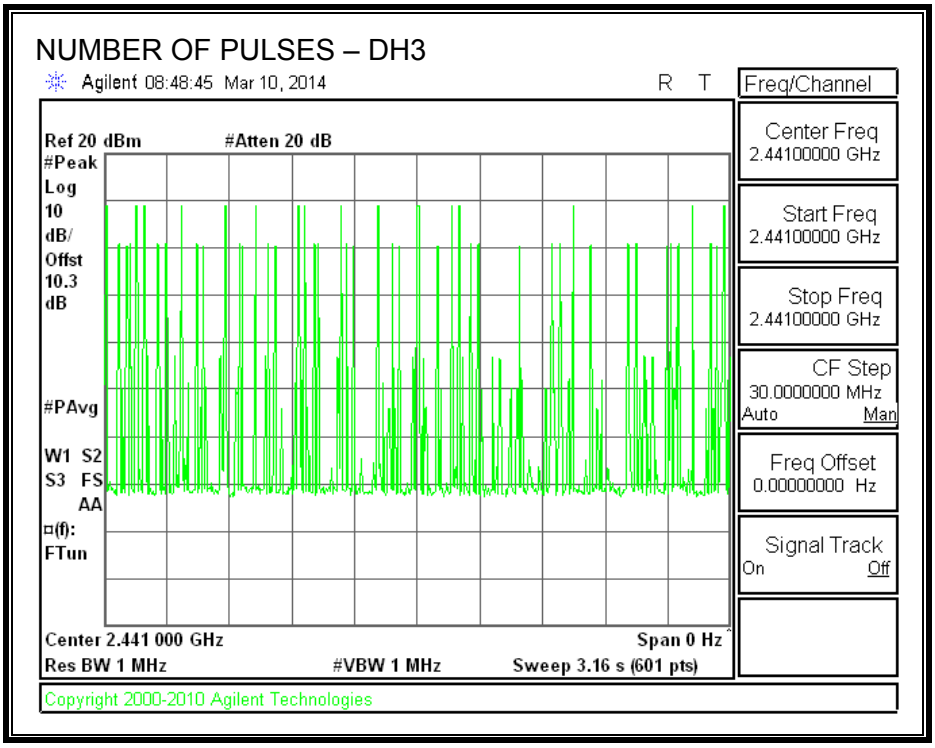
PULSE WIDTH – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



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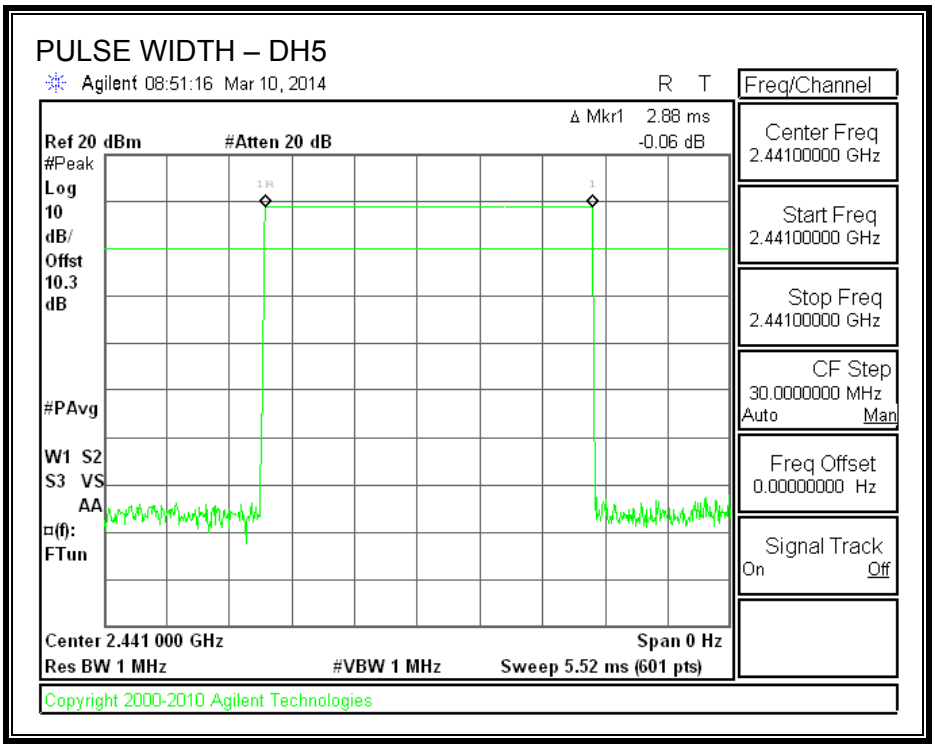
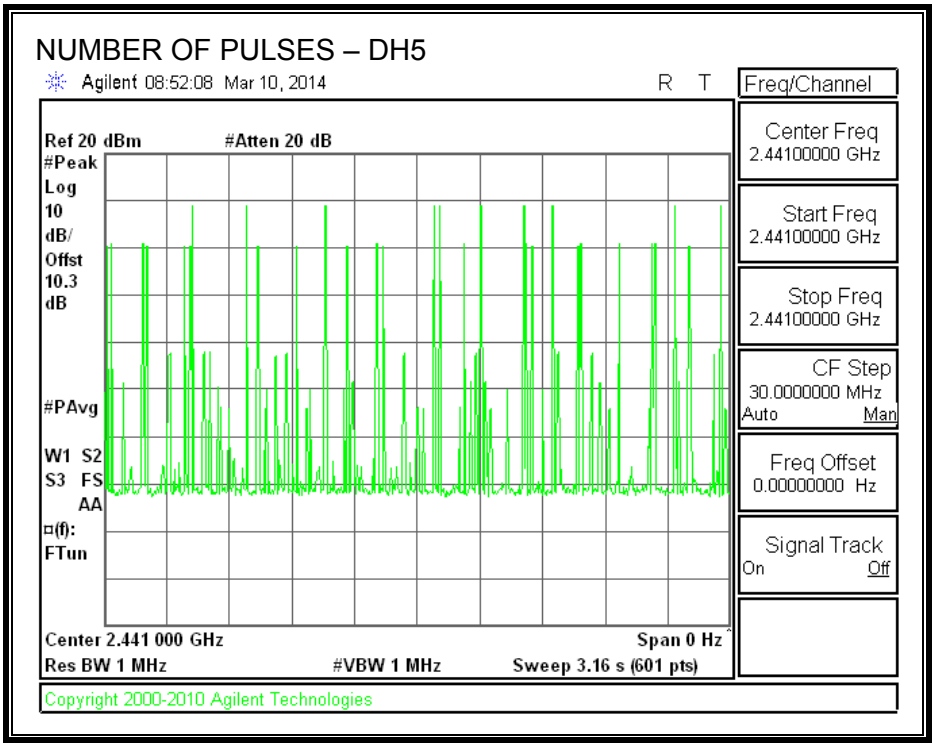
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



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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	3.84	21	-17.16
Middle	2441	9.03	21	-11.97
High	2480	6.29	21	-14.71
Worst		9.03		-11.97

8.5.2. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.25	21	-18.76
Middle	2441	7.84	21	-13.17
High	2480	5.04	21	-15.97
Worst		7.84		-13.17

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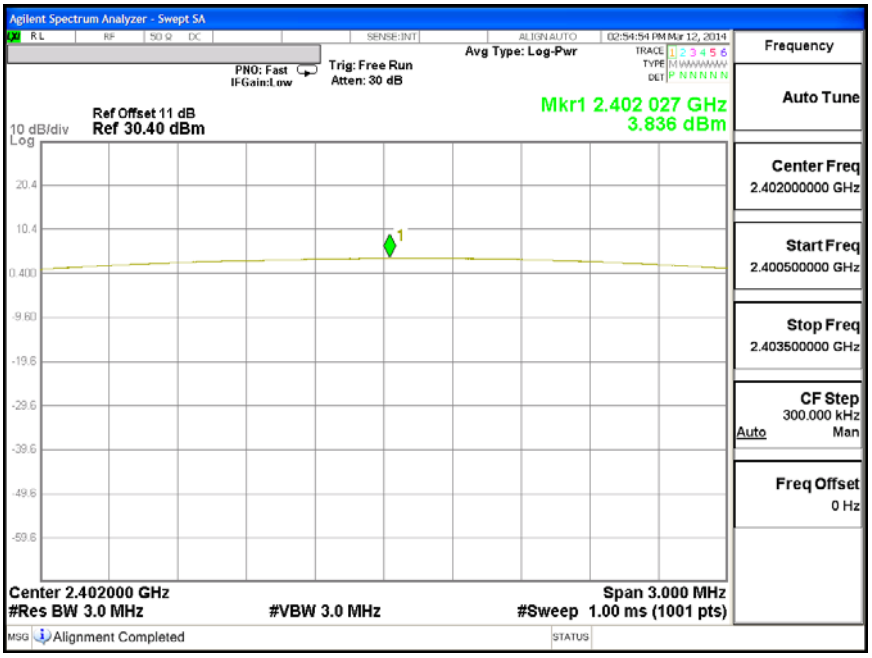
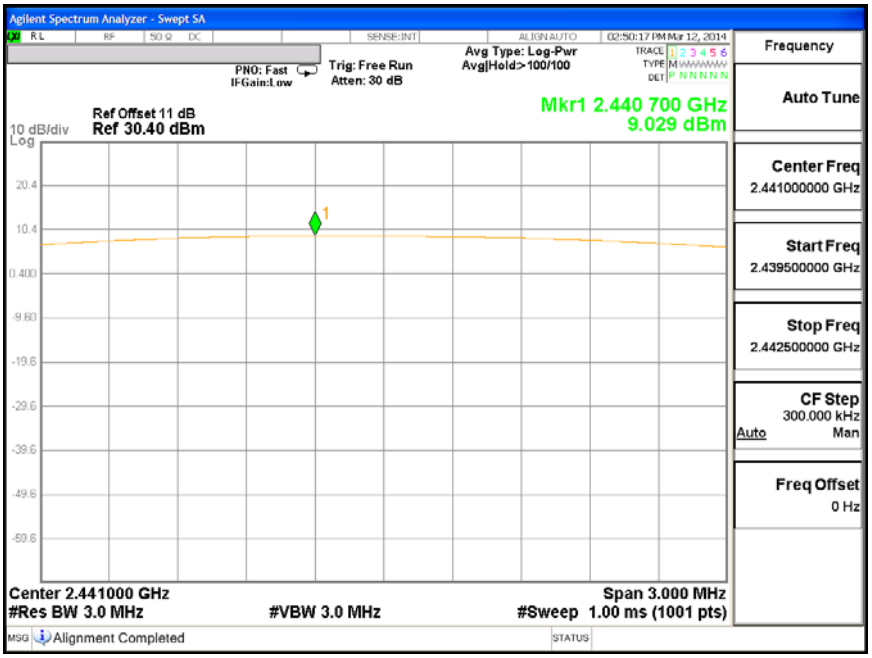
GFSK OUTPUT POWER

PEAK POWER LOW CH



PEAK POWER MID CH



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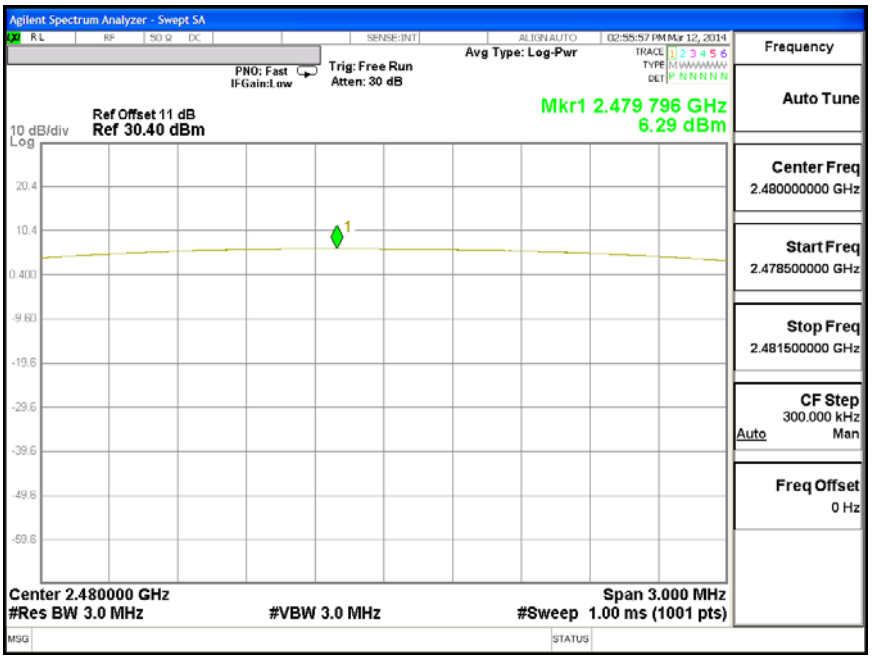
PEAK POWER HIGH CH



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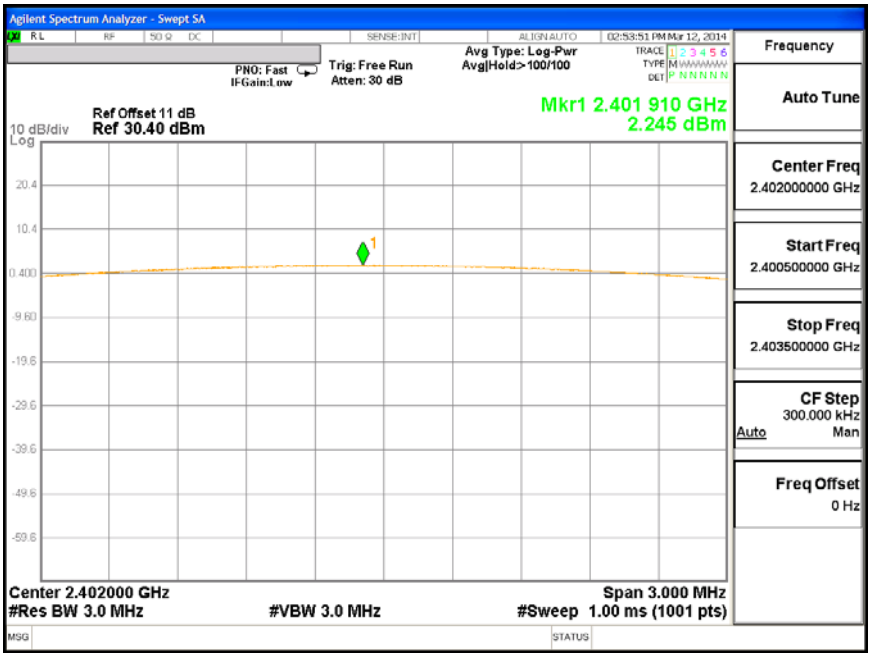
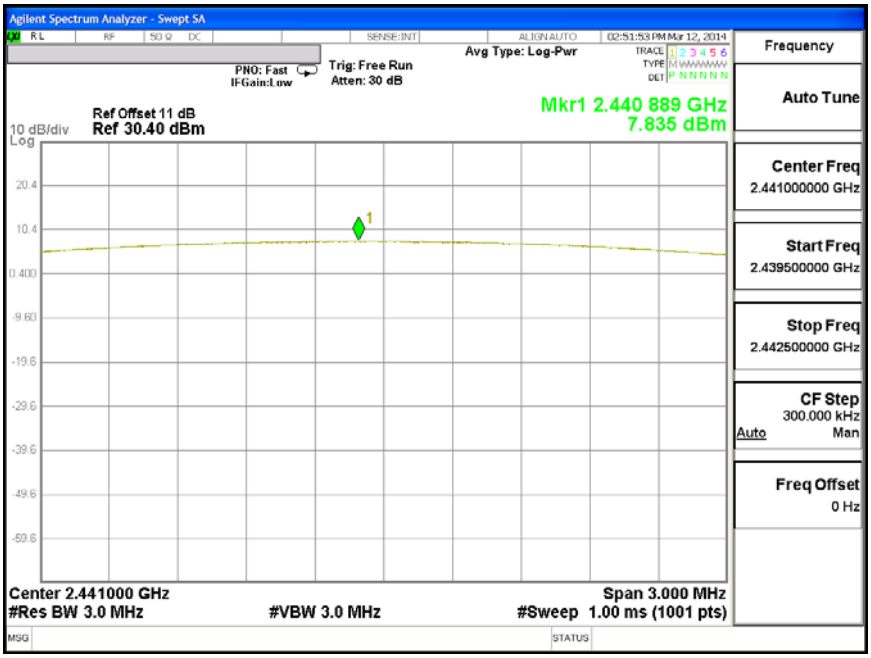
8PSK OUTPUT POWER

PEAK POWER LOW CH



PEAK POWER MID CH



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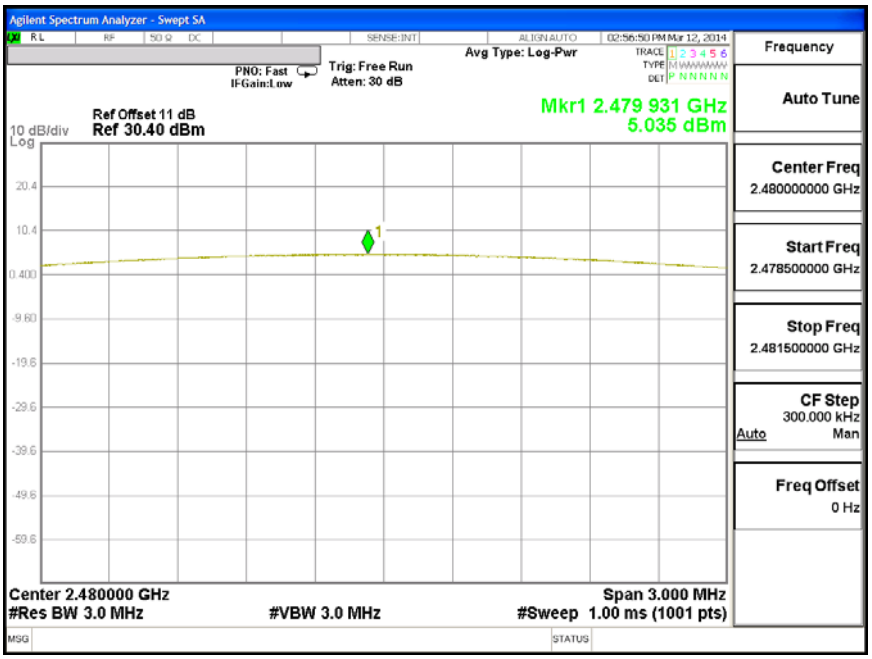
PEAK POWER HIGH CH



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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	3.10
Middle	2441	8.80
High	2480	5.50
Worst		8.80

8.6.2. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	-0.70
Middle	2441	6.30
High	2480	2.00
Worst		6.30

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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

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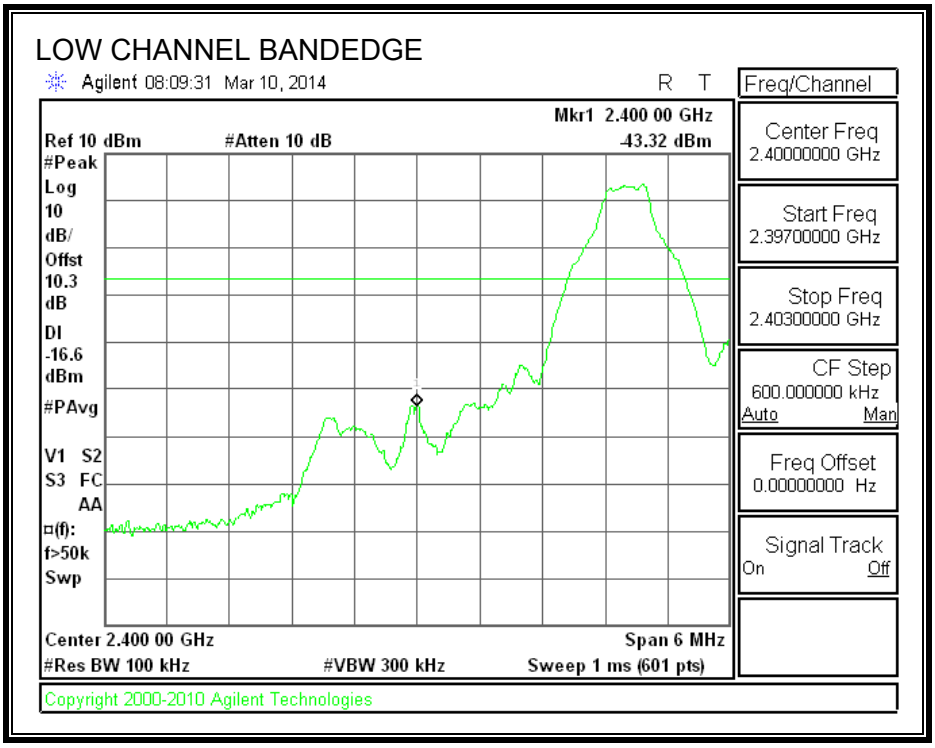
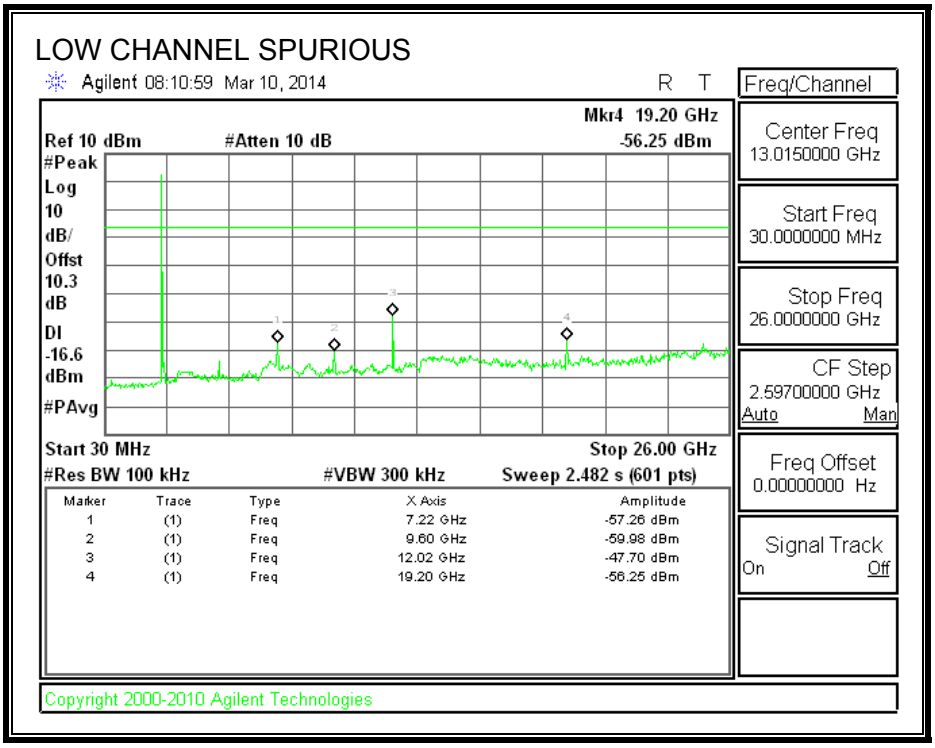
8.7.1. BASIC DATA RATE GFSK MODULATION

SPURIOUS EMISSIONS, LOW CHANNEL





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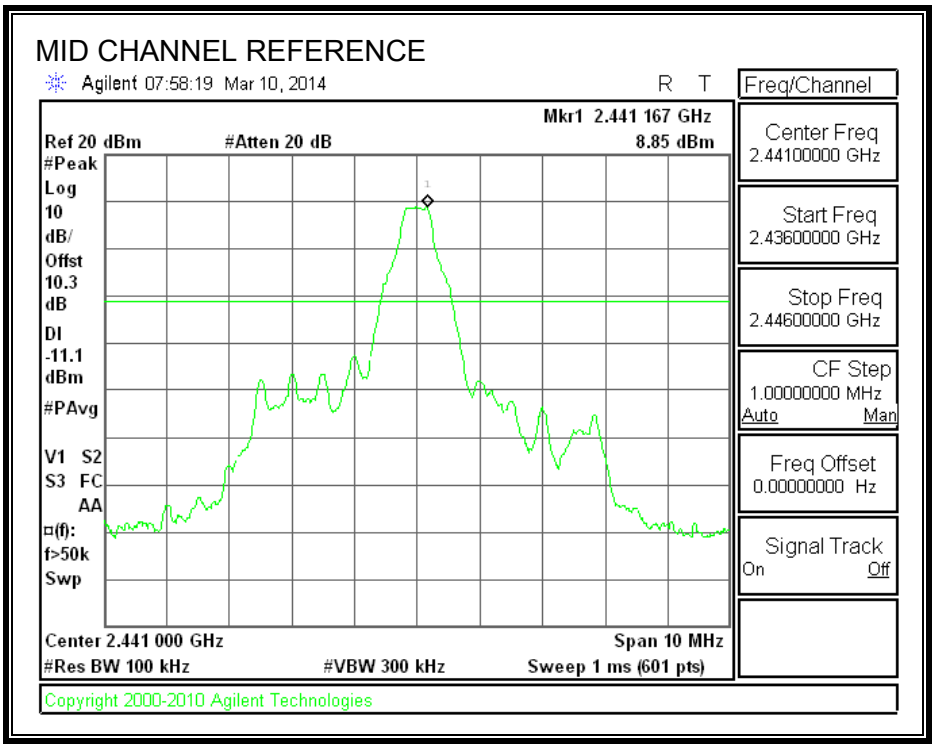
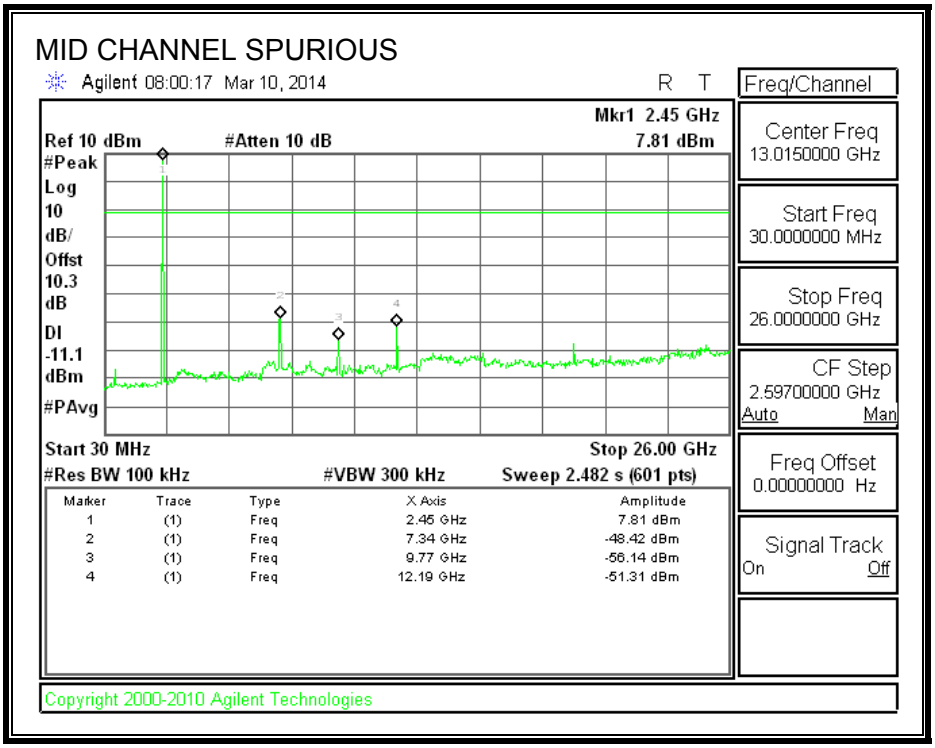
SPURIOUS EMISSIONS, MID CHANNEL





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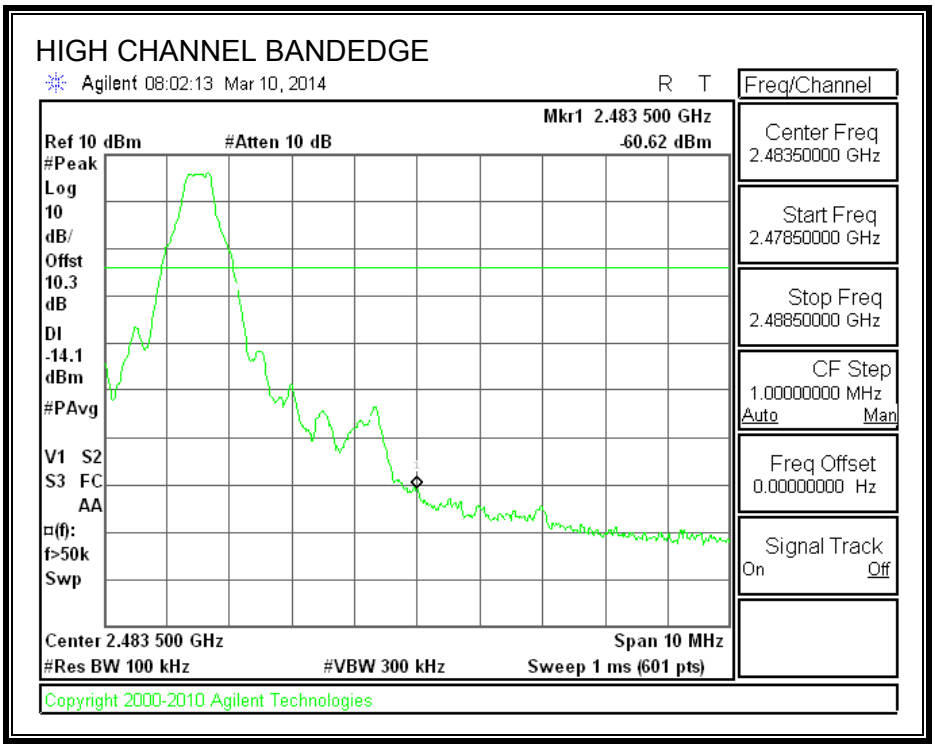
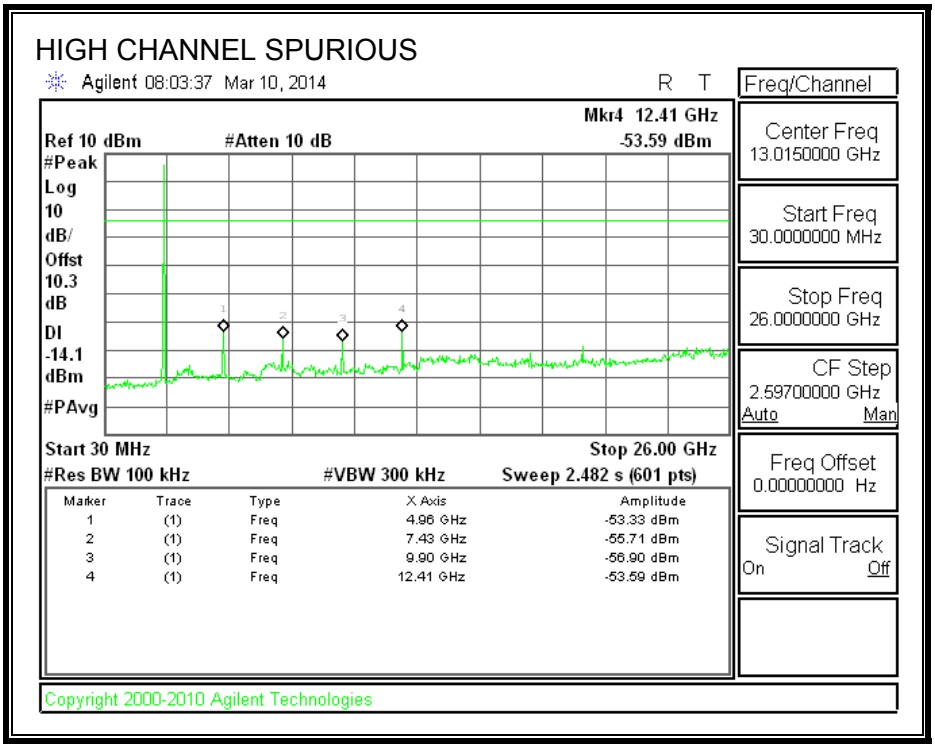
SPURIOUS EMISSIONS, HIGH CHANNEL





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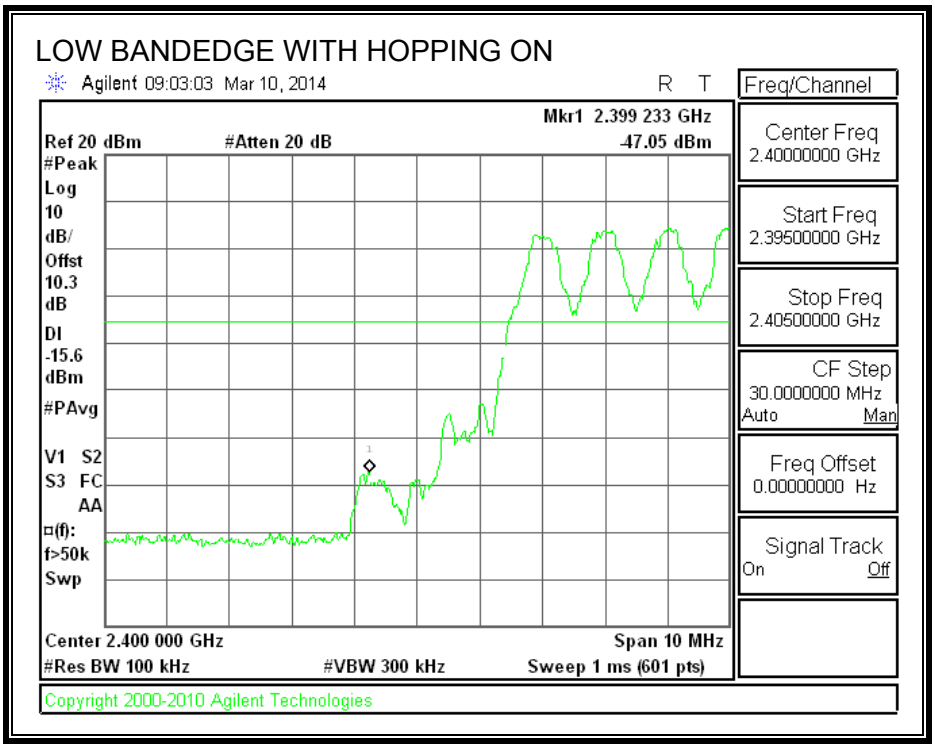
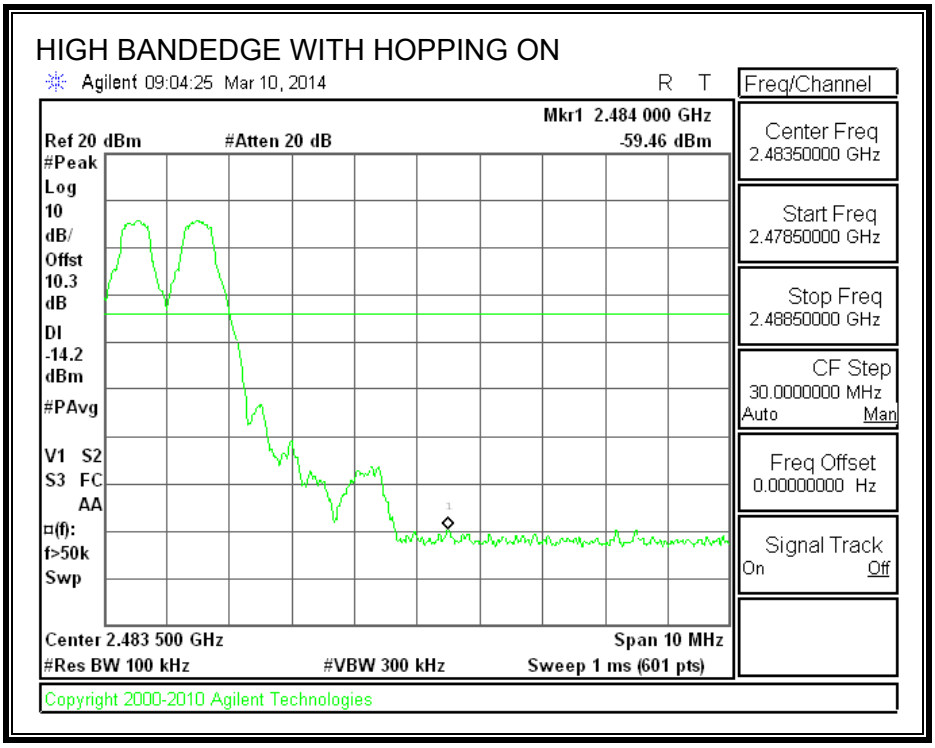
SPURIOUS BANDEDGE EMISSIONS WITH GFSK HOPPING ON





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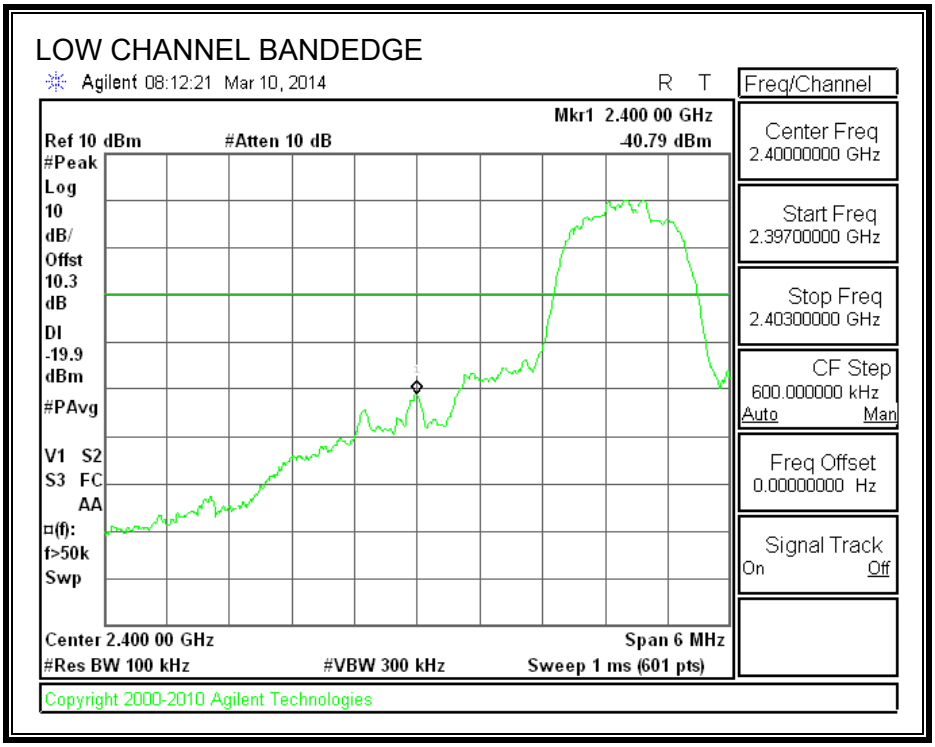
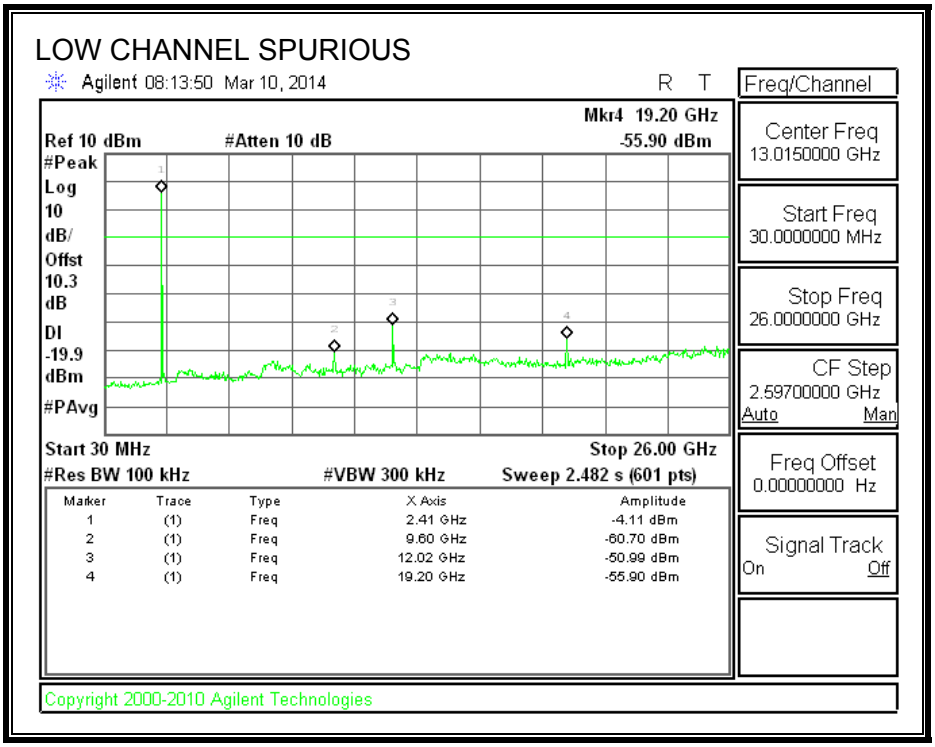
8.7.1. ENHANCED DATA RATE 8PSK MODULATION

SPURIOUS EMISSIONS, LOW CHANNEL





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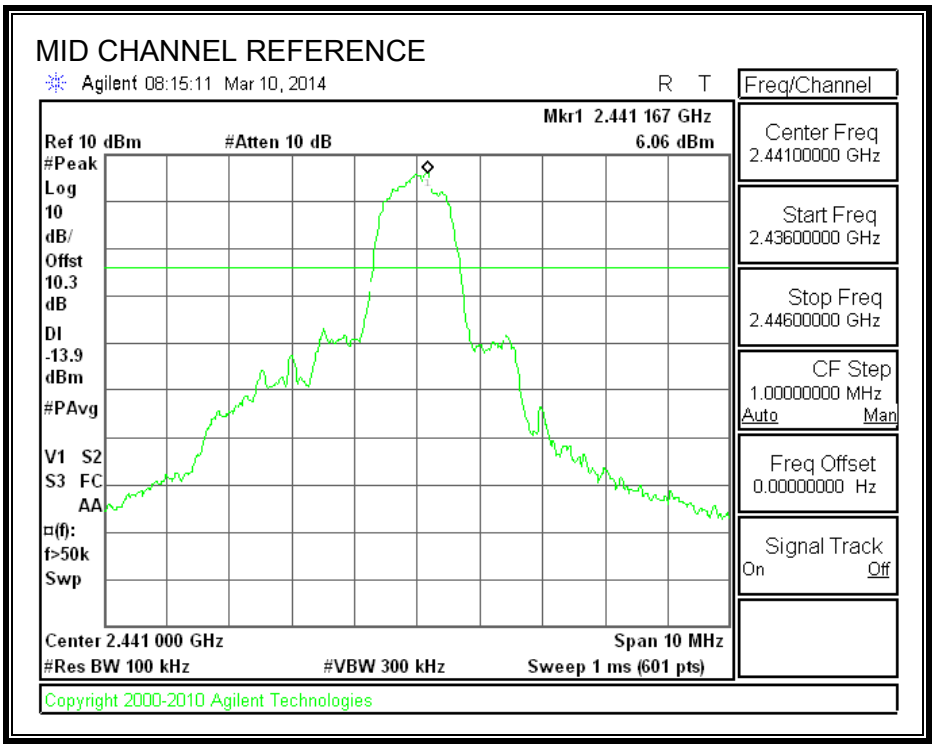
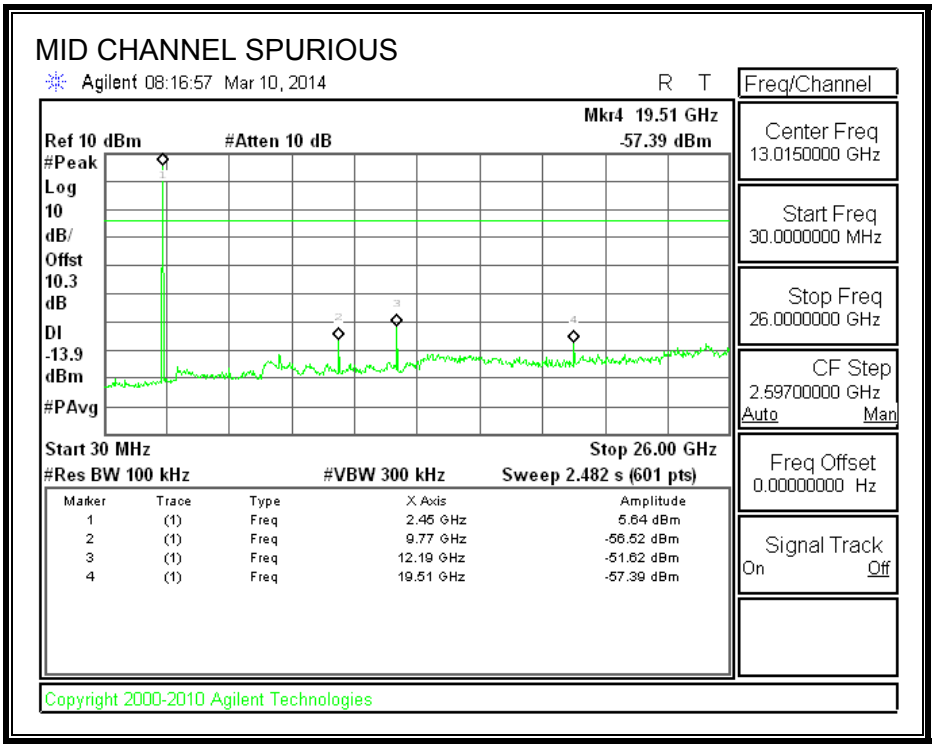
SPURIOUS EMISSIONS, MID CHANNEL





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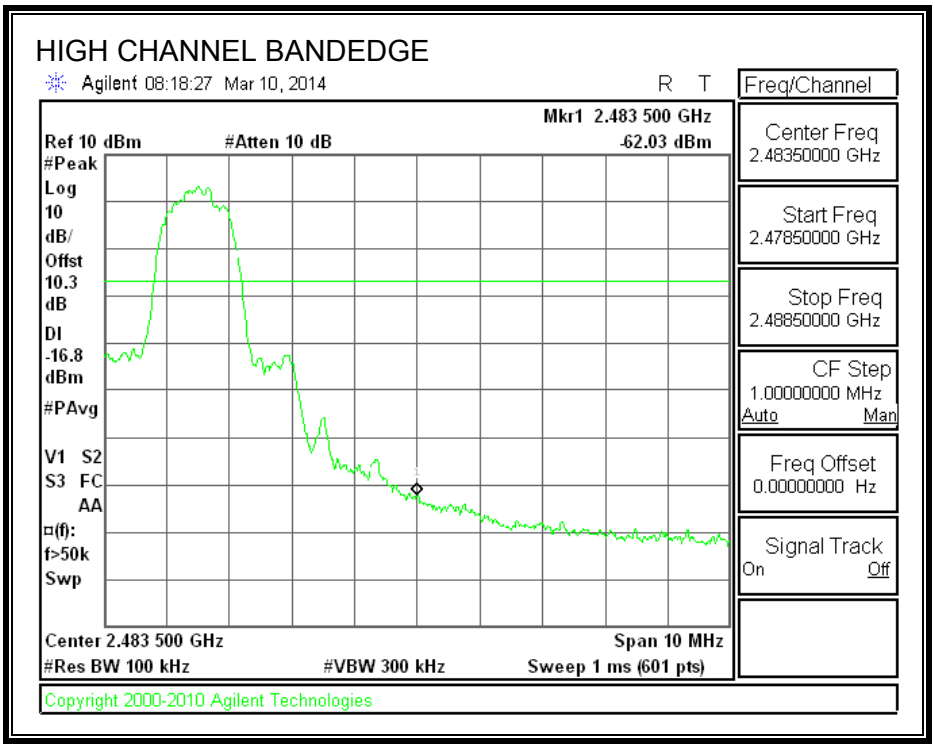
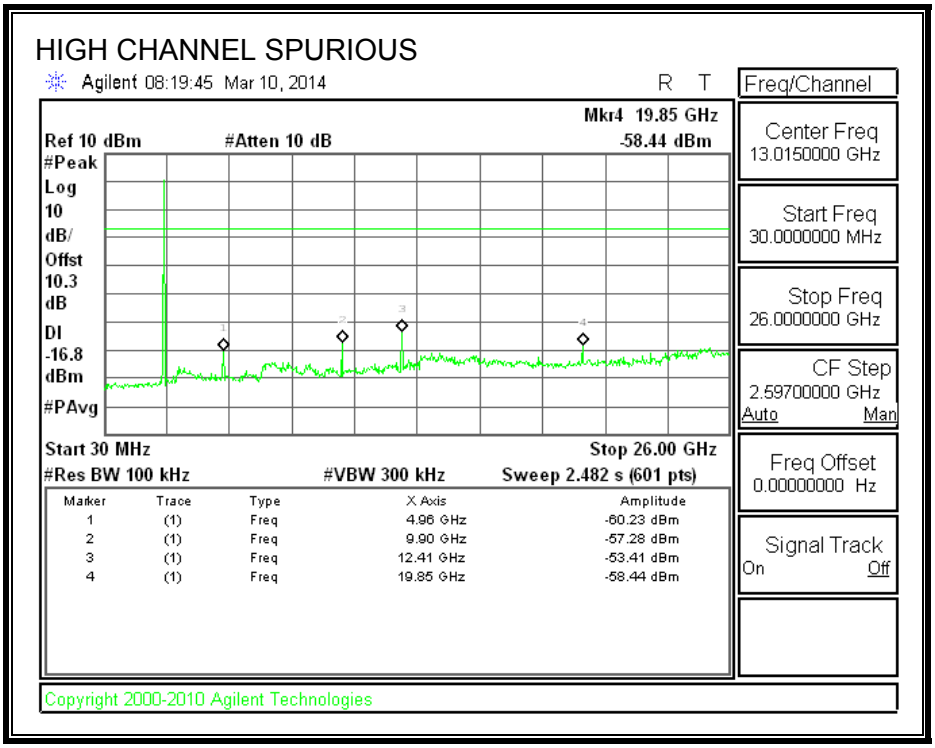
SPURIOUS EMISSIONS, HIGH CHANNEL





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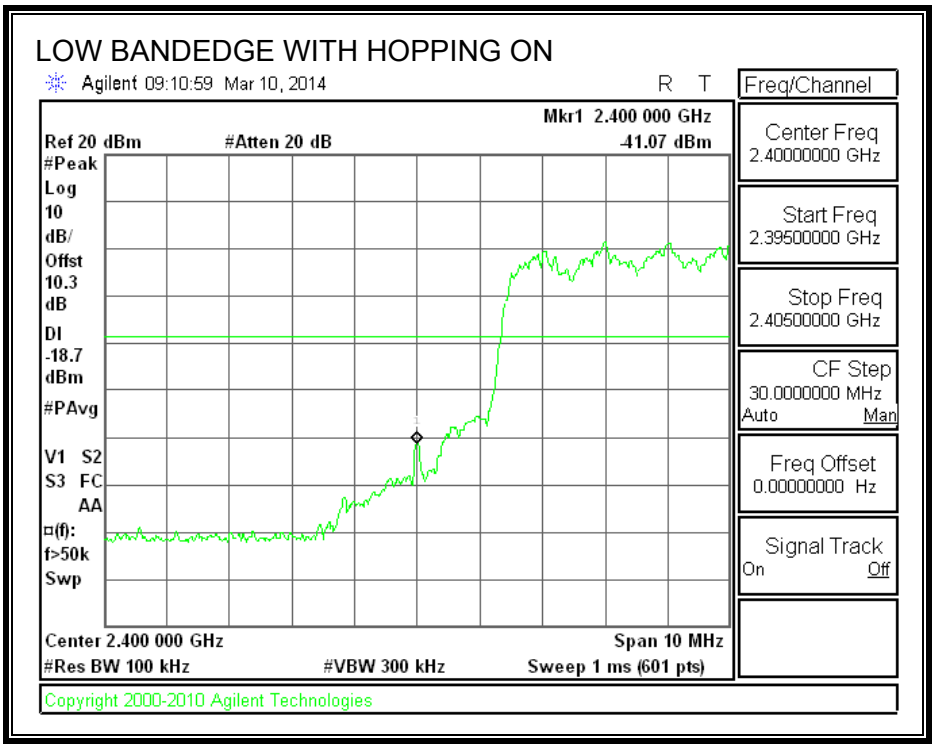
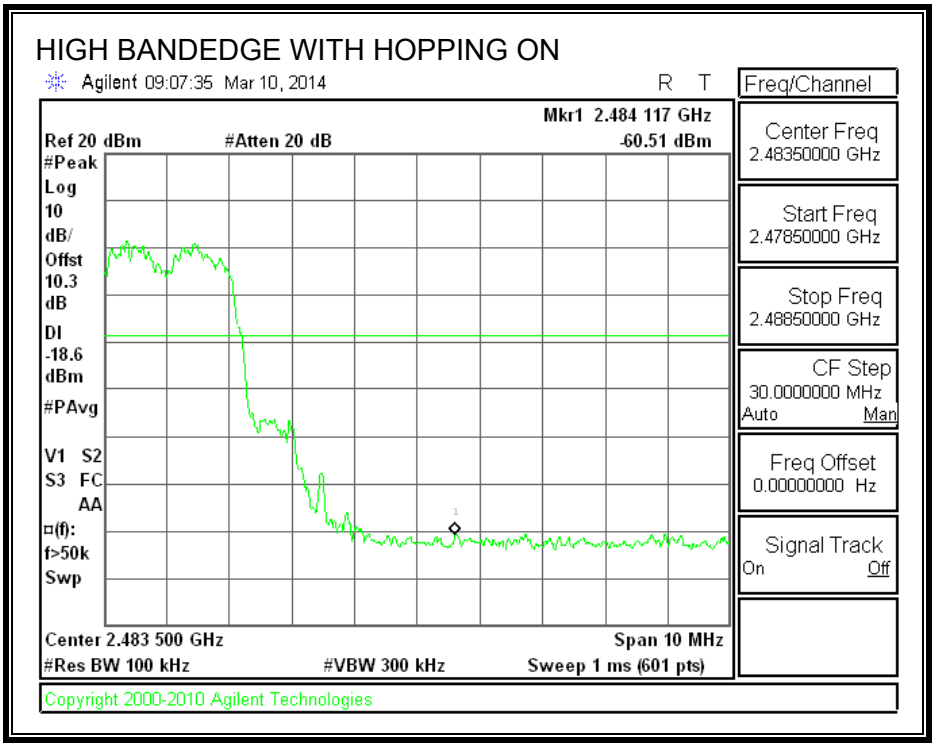
SPURIOUS BANDEDGE EMISSIONS WITH 8PSK HOPPING ON





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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 = 350Hz.

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

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

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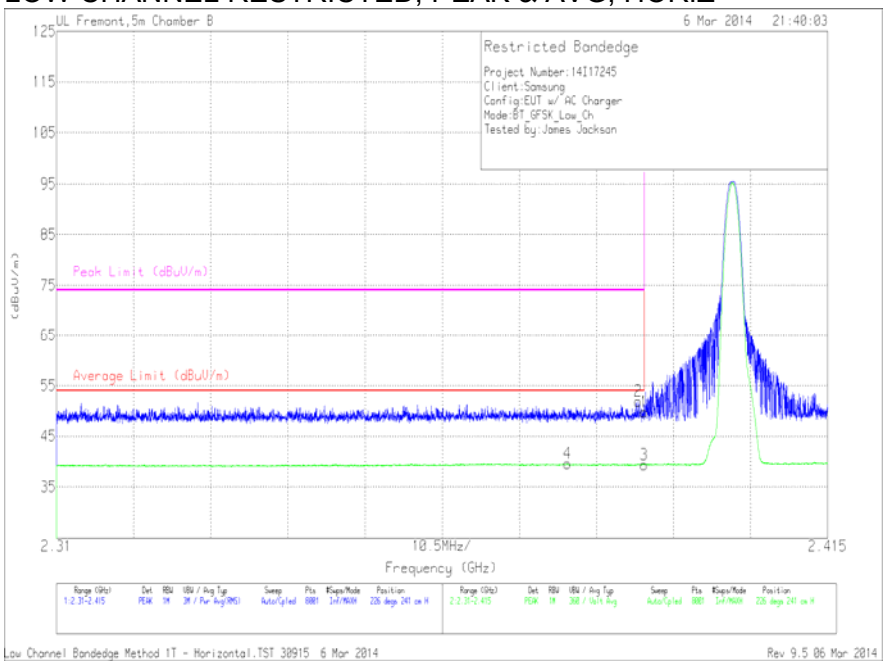
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK & AVG, HORIZ



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/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	2.38	30.4	VB1T	32.1	-22.9	39.6	54	-14.4	-	-	226	241	H
2	2.389	42.65	PK	32.1	-22.9	51.85	-	-	74	-22.15	226	241	H
1	2.39	40.58	PK	32.1	-22.9	49.78	-	-	74	-24.22	226	241	H
3	2.39	30.19	VB1T	32.1	-22.9	39.39	54	-14.61	-	-	226	241	H

PK - Peak detector

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

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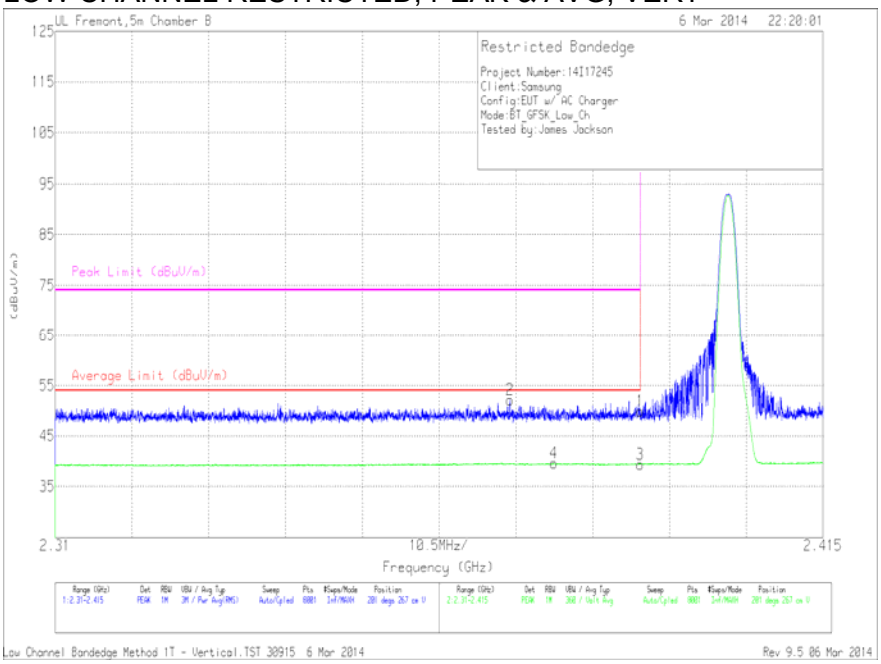
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK & AVG, VERT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/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	2.372	42.82	PK	32.1	-22.8	52.12	-	-	74	-21.88	201	267	V
4	2.378	30.4	VB1T	32.1	-22.9	39.6	54	-14.4	-	-	201	267	V
1	2.39	40.75	PK	32.1	-22.9	49.95	-	-	74	-24.05	201	267	V
3	2.39	30.21	VB1T	32.1	-22.9	39.41	54	-14.59	-	-	201	267	V

PK - Peak detector

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

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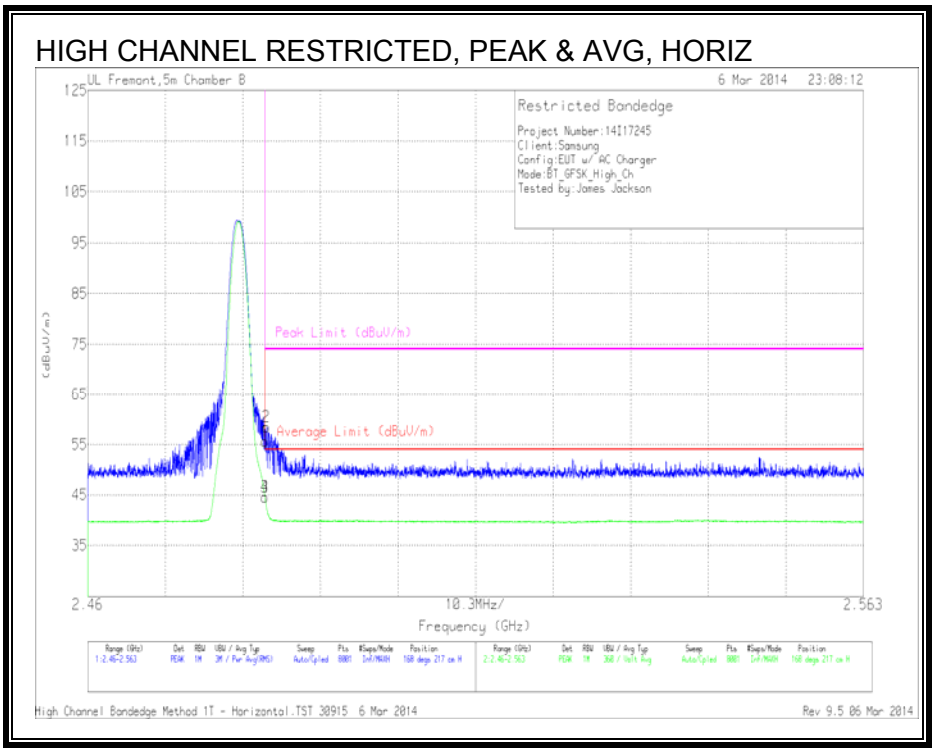
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/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	45.94	PK	32.3	-22.6	55.64	-	-	74	-18.36	168	217	H
2	2.484	48.81	PK	32.3	-22.6	58.51	-	-	74	-15.49	168	217	H
3	2.484	34.84	VB1T	32.3	-22.6	44.54	54	-9.46	-	-	168	217	H
4	2.484	34.84	VB1T	32.3	-22.6	44.54	54	-9.46	-	-	168	217	H

PK - Peak detector

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

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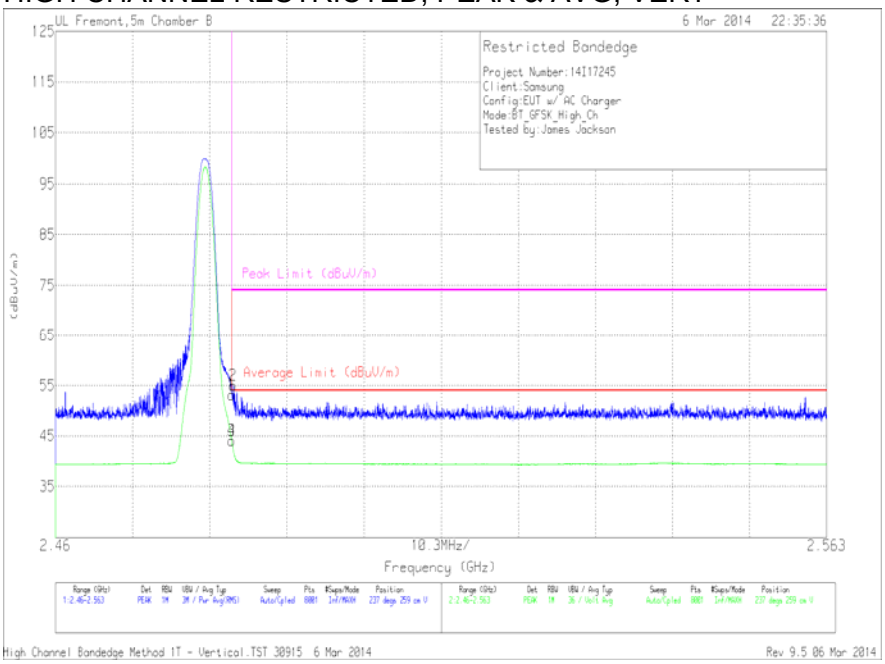
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK & AVG, VERT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/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	43.42	PK	32.3	-22.6	53.12	-	-	74	-20.88	237	259	V
2	2.484	45.27	PK	32.3	-22.6	54.97	-	-	74	-19.03	237	259	V
3	2.484	34.34	VB1T	32.3	-22.6	44.04	54	-9.96	-	-	237	259	V
4	2.484	34.34	VB1T	32.3	-22.6	44.04	54	-9.96	-	-	237	259	V

PK - Peak detector

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

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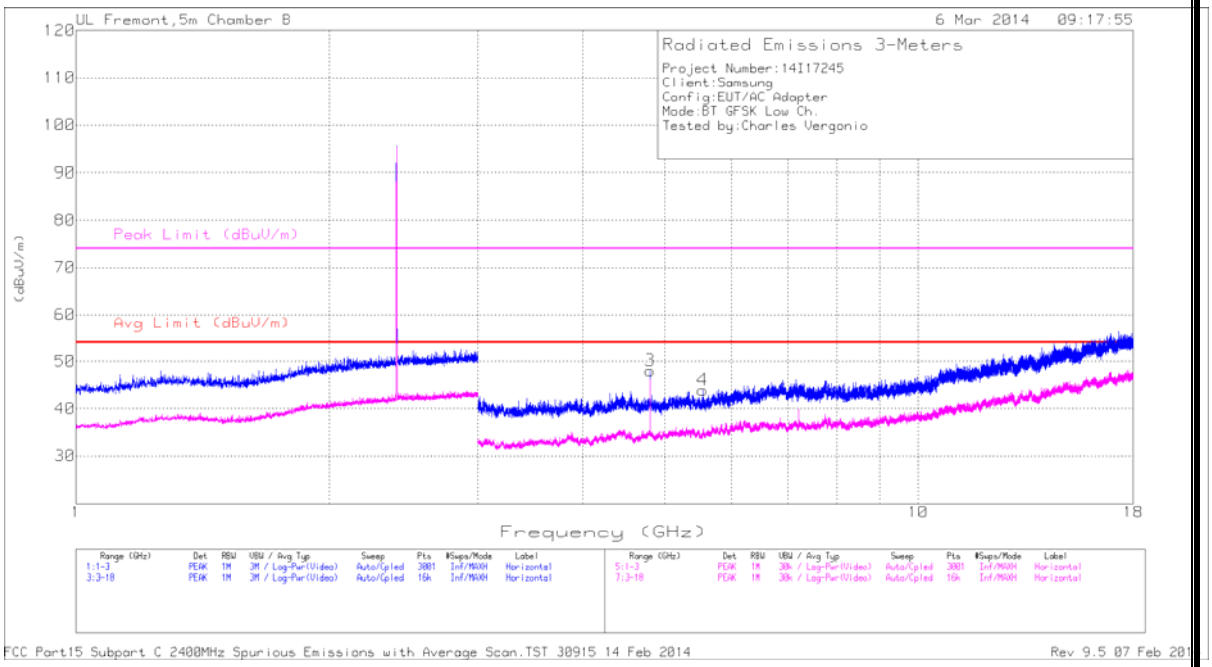
HARMONICS AND SPURIOUS EMISSIONS

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.

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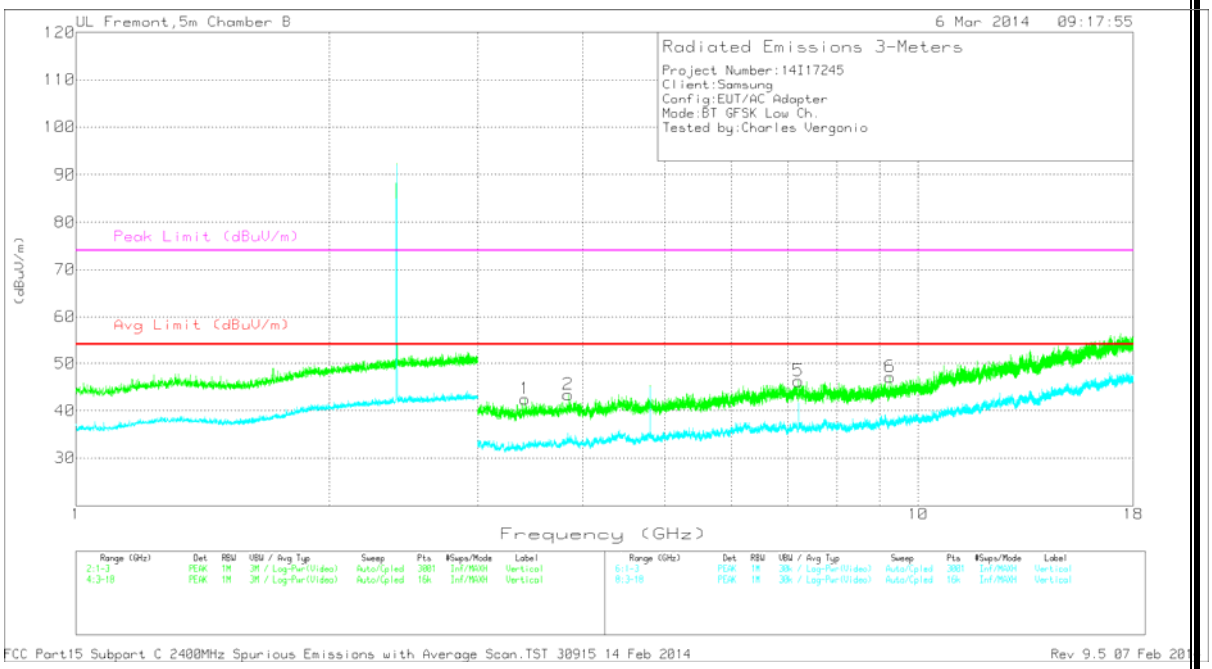
VERTICAL



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

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LOW CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/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	* 4.804	42.63	PK	34.2	-28.8	48.03	54	-5.97	74	-25.97	0-360	99	H
2	* 3.841	40.22	PK	33.4	-30.2	43.42	54	-10.58	74	-30.58	0-360	202	V
1	3.412	40.77	PK	32.8	-31.1	42.47	54	-11.53	74	-31.53	0-360	99	V
4	5.549	39.19	PK	34.5	-29.8	43.89	54	-10.11	74	-30.11	0-360	99	H
5	7.206	37.46	PK	35.7	-26.9	46.26	54	-7.74	74	-27.74	0-360	99	V
6	9.257	35.43	PK	36.4	-24.7	47.13	54	-6.87	74	-26.87	0-360	99	V

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

PK - Peak detector

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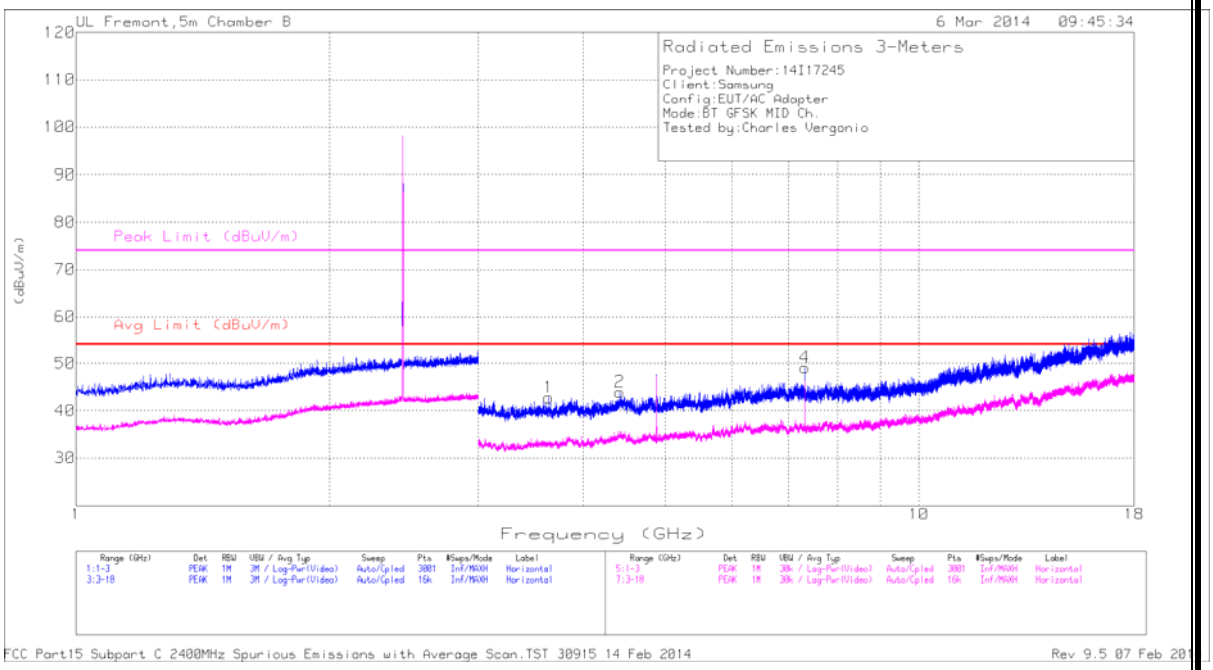
MID CHANNEL
HORIZONTAL



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

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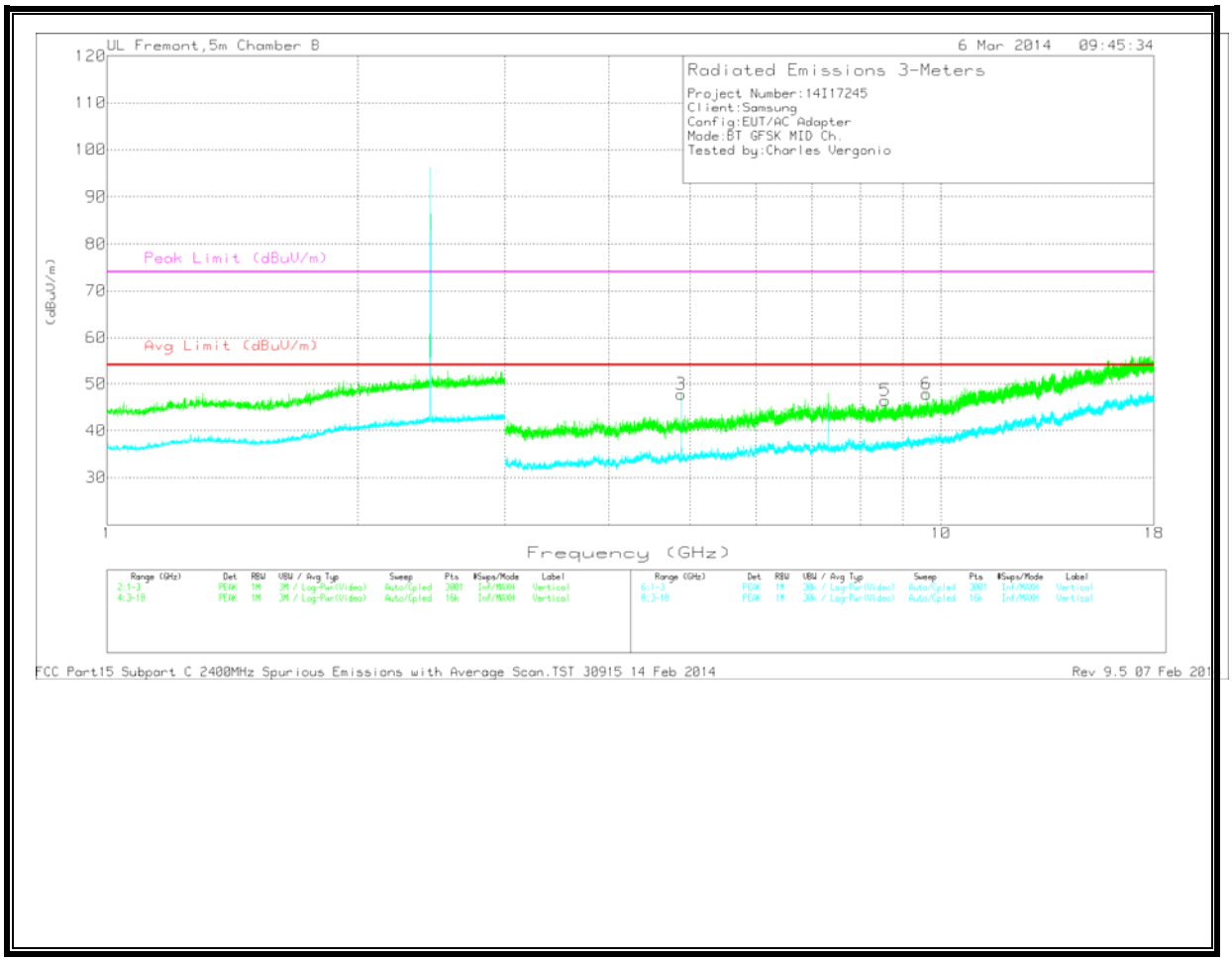
VERTICAL



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

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MID CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/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	* 3.637	40.47	PK	33.4	-31.1	42.77	54	-11.23	74	-31.23	0-360	99	H
4	* 7.323	41.17	PK	35.7	-27.8	49.07	54	-4.93	74	-24.93	0-360	202	H
3	* 4.881	44.15	PK	34.2	-30.6	47.75	54	-6.25	74	-26.25	0-360	99	V
2	4.416	39.52	PK	33.9	-29.5	43.92	54	-10.08	74	-30.08	0-360	202	H
5	8.57	36.82	PK	35.9	-26.3	46.42	54	-7.58	74	-27.58	0-360	202	V
6	9.609	35.22	PK	36.7	-24.1	47.82	54	-6.18	74	-26.18	0-360	202	V

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

PK - Peak detector

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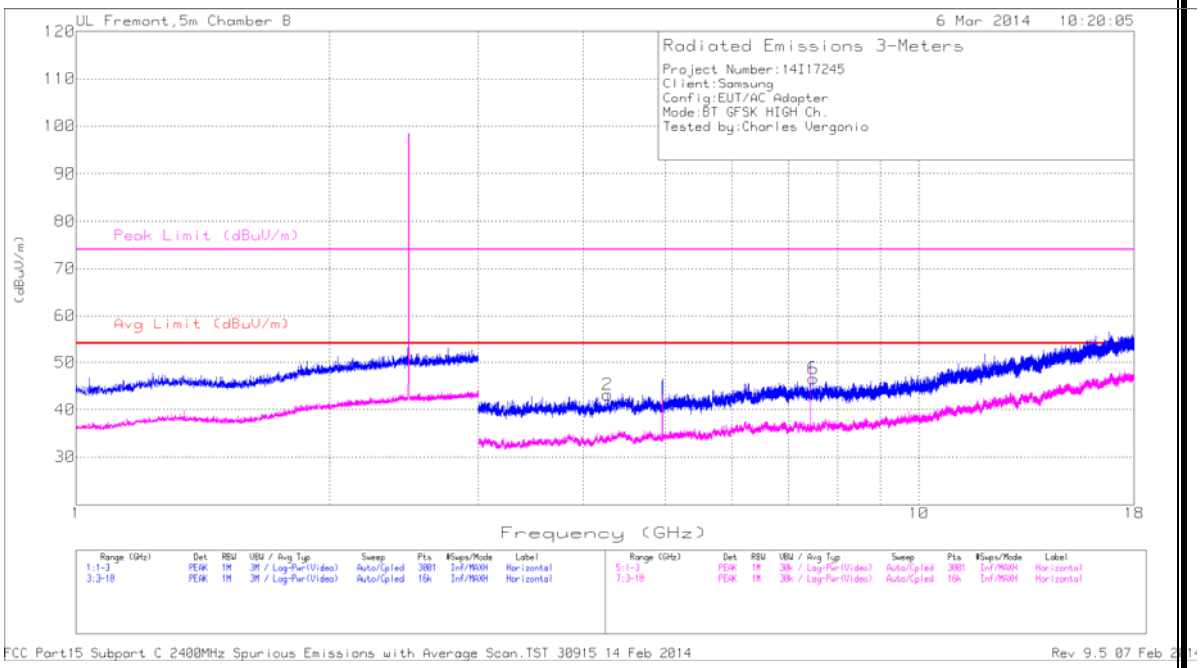
HIGH CHANNEL
HORIZONTAL



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

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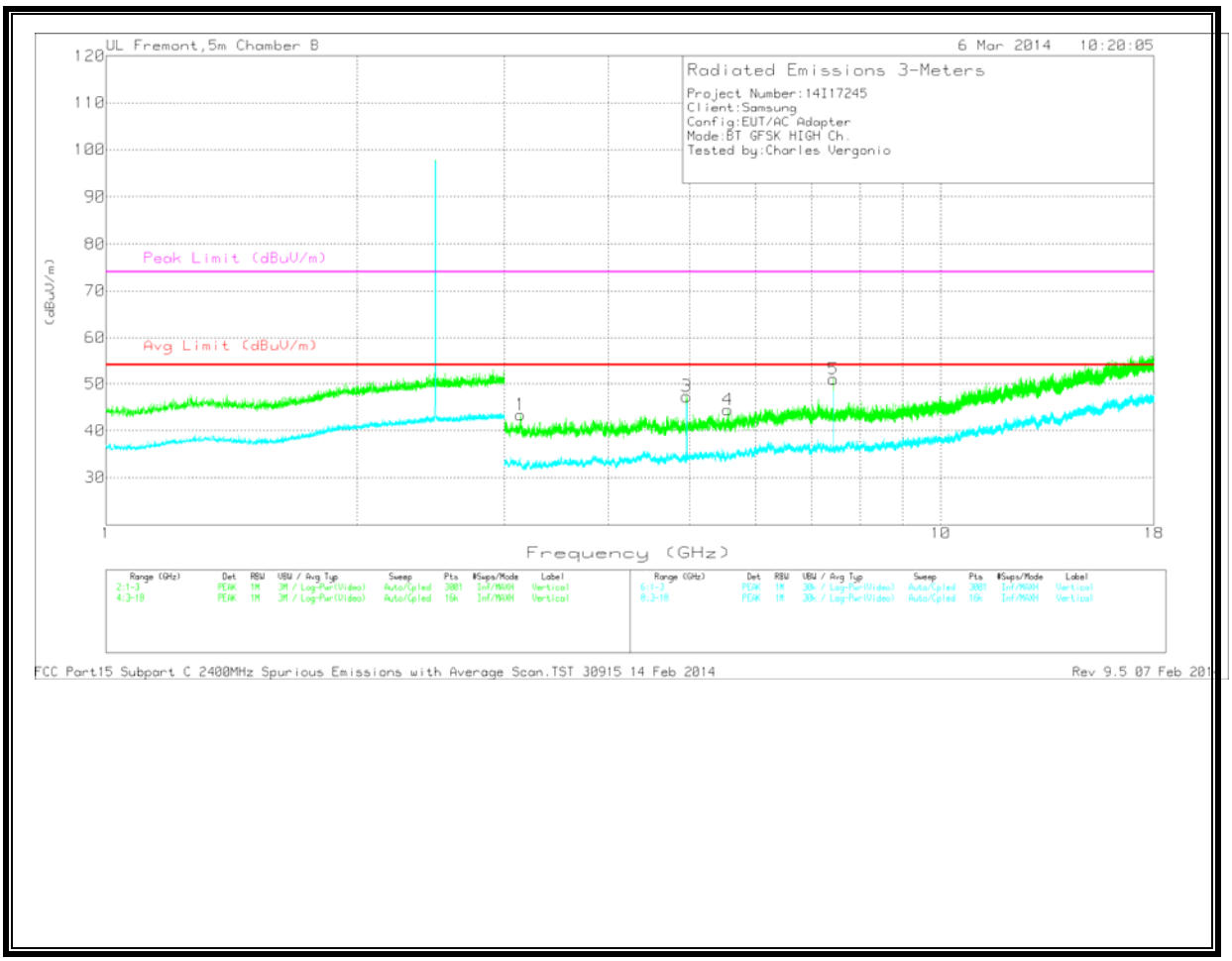
VERTICAL



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

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HIGH CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/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	* 4.273	40.47	PK	33.7	-31	43.17	54	-10.83	74	-30.83	0-360	99	H
6	* 7.492	37.33	PK	35.6	-26.4	46.53	54	-7.47	74	-27.47	0-360	99	H
3	* 4.959	43.31	PK	34.2	-30.2	47.31	54	-6.69	74	-26.69	0-360	202	V
5	* 7.439	42.11	PK	35.6	-26.7	51.01	54	-2.99	74	-22.99	0-360	99	V
1	3.136	41.99	PK	32.8	-31.4	43.39	54	-10.61	74	-30.61	0-360	202	V
4	5.556	39.43	PK	34.5	-29.5	44.43	54	-9.57	74	-29.57	0-360	202	V

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

PK - Peak detector

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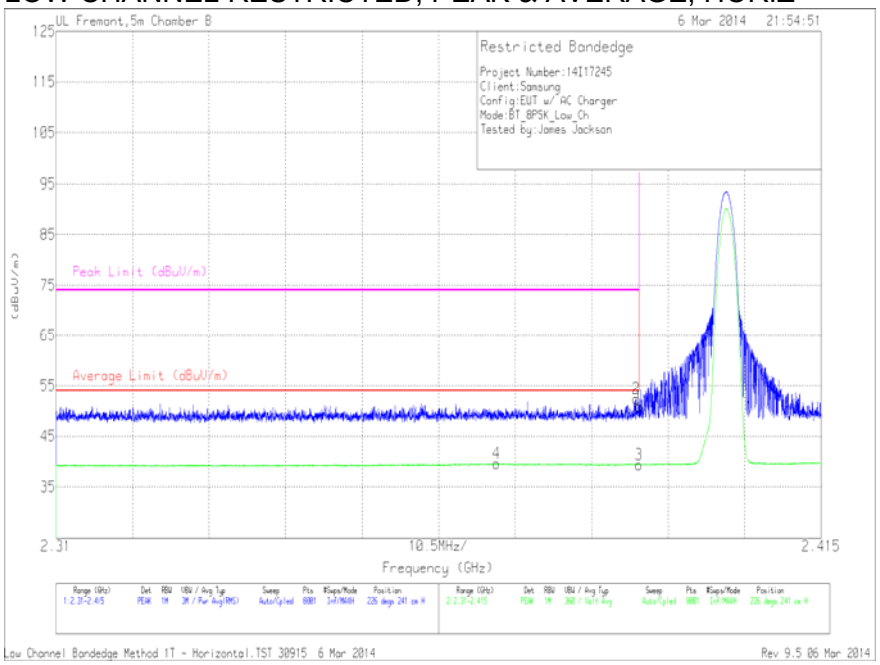
9.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK & AVERAGE, HORIZ



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/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	2.37	30.31	VB1T	32.1	-22.8	39.61	54	-14.39	-	-	226	241	H
1	2.39	41.67	PK	32.1	-22.9	50.87	-	-	74	-23.13	226	241	H
2	2.39	43.23	PK	32.1	-22.9	52.43	-	-	74	-21.57	226	241	H
3	2.39	30.19	VB1T	32.1	-22.9	39.39	54	-14.61	-	-	226	241	H

PK - Peak detector

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

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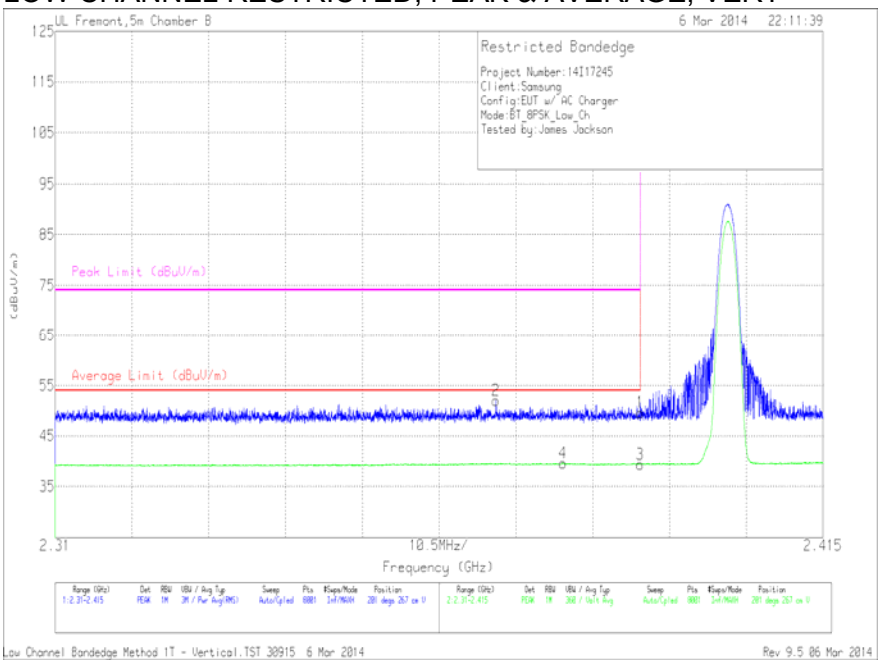
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK & AVERAGE, VERT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/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	2.37	42.77	PK	32.1	-22.8	52.07	-	-	74	-21.93	201	267	V
4	2.379	30.45	VB1T	32.1	-22.9	39.65	54	-14.35	-	-	201	267	V
1	2.39	40.41	PK	32.1	-22.9	49.61	-	-	74	-24.39	201	267	V
3	2.39	30.2	VB1T	32.1	-22.9	39.4	54	-14.6	-	-	201	267	V

PK - Peak detector

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

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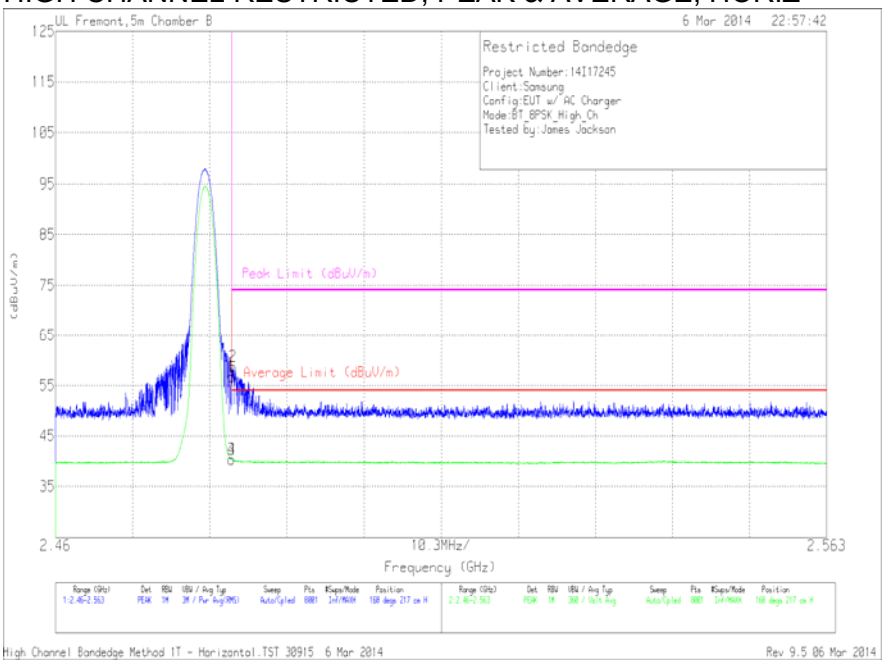
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK & AVERAGE, HORIZ



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/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	47.06	PK	32.3	-22.6	56.76	-	-	74	-17.24	168	217	H
2	2.484	49.01	PK	32.3	-22.6	58.71	-	-	74	-15.29	168	217	H
3	2.484	30.67	VB1T	32.3	-22.6	40.37	54	-13.63	-	-	168	217	H
4	2.484	30.67	VB1T	32.3	-22.6	40.37	54	-13.63	-	-	168	217	H

PK - Peak detector

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

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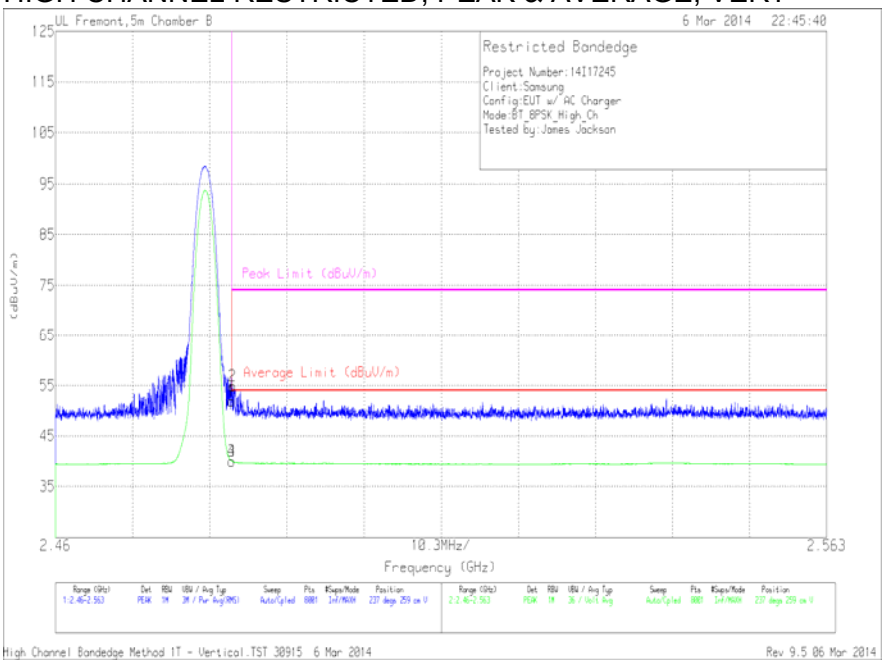
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK & AVERAGE, VERT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/ Fltr/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	42.26	PK	32.3	-22.6	51.96	-	-	74	-22.04	237	259	V
2	2.484	45.21	PK	32.3	-22.6	54.91	-	-	74	-19.09	237	259	V
3	2.484	30.33	VB1T	32.3	-22.6	40.03	54	-13.97	-	-	237	259	V
4	2.484	30.33	VB1T	32.3	-22.6	40.03	54	-13.97	-	-	237	259	V

PK - Peak detector

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

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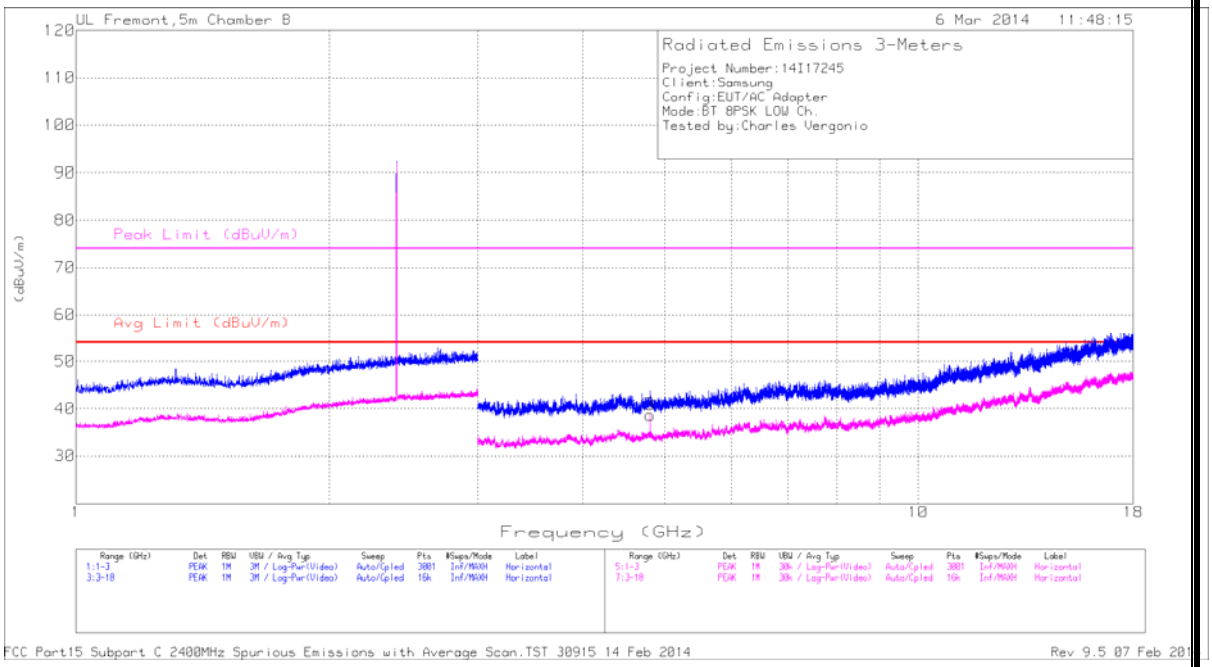
HARMONICS AND SPURIOUS EMISSIONS

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.

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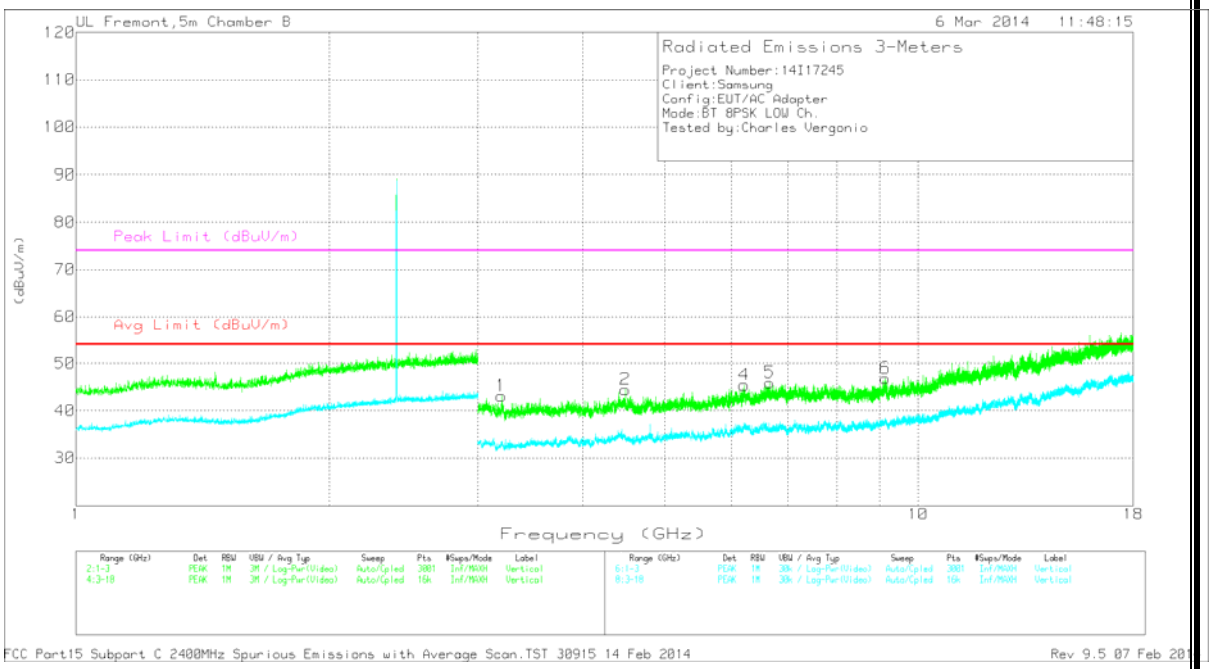
VERTICAL



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

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LOW CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	* 9.139	35.43	PK	36.3	-24.9	46.83	54	-7.17	74	-27.17	0-360	99	V
3	* 4.805	33.26	Avg	34.2	-28.8	38.66	54	-15.34	74	-35.34	0-360	202	H
1	3.2	41.61	PK	32.7	-31.2	43.11	54	-10.89	74	-30.89	0-360	203	V
2	4.49	39.86	PK	33.9	-29.3	44.46	54	-9.54	74	-29.54	0-360	99	V
4	6.214	37.72	PK	35.5	-27.8	45.42	54	-8.58	74	-28.58	0-360	203	V
5	6.664	39.21	PK	35.6	-28.9	45.91	54	-8.09	74	-28.09	0-360	99	V

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

PK - Peak detector

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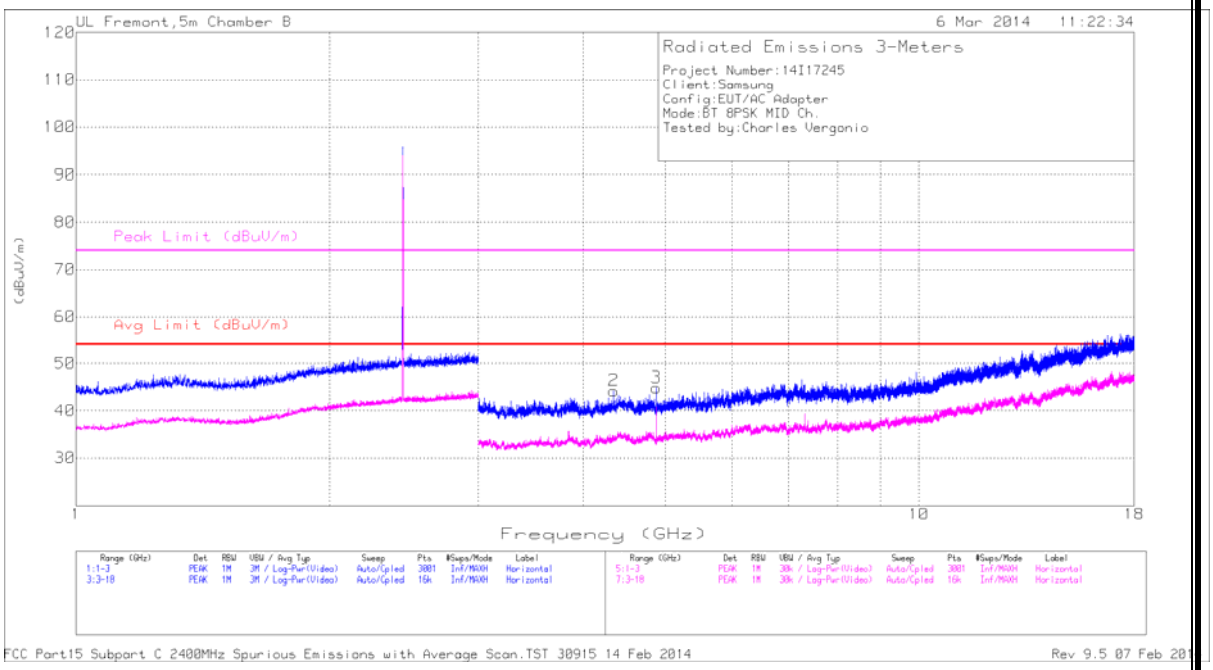
MID CHANNEL
HORIZONTAL



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

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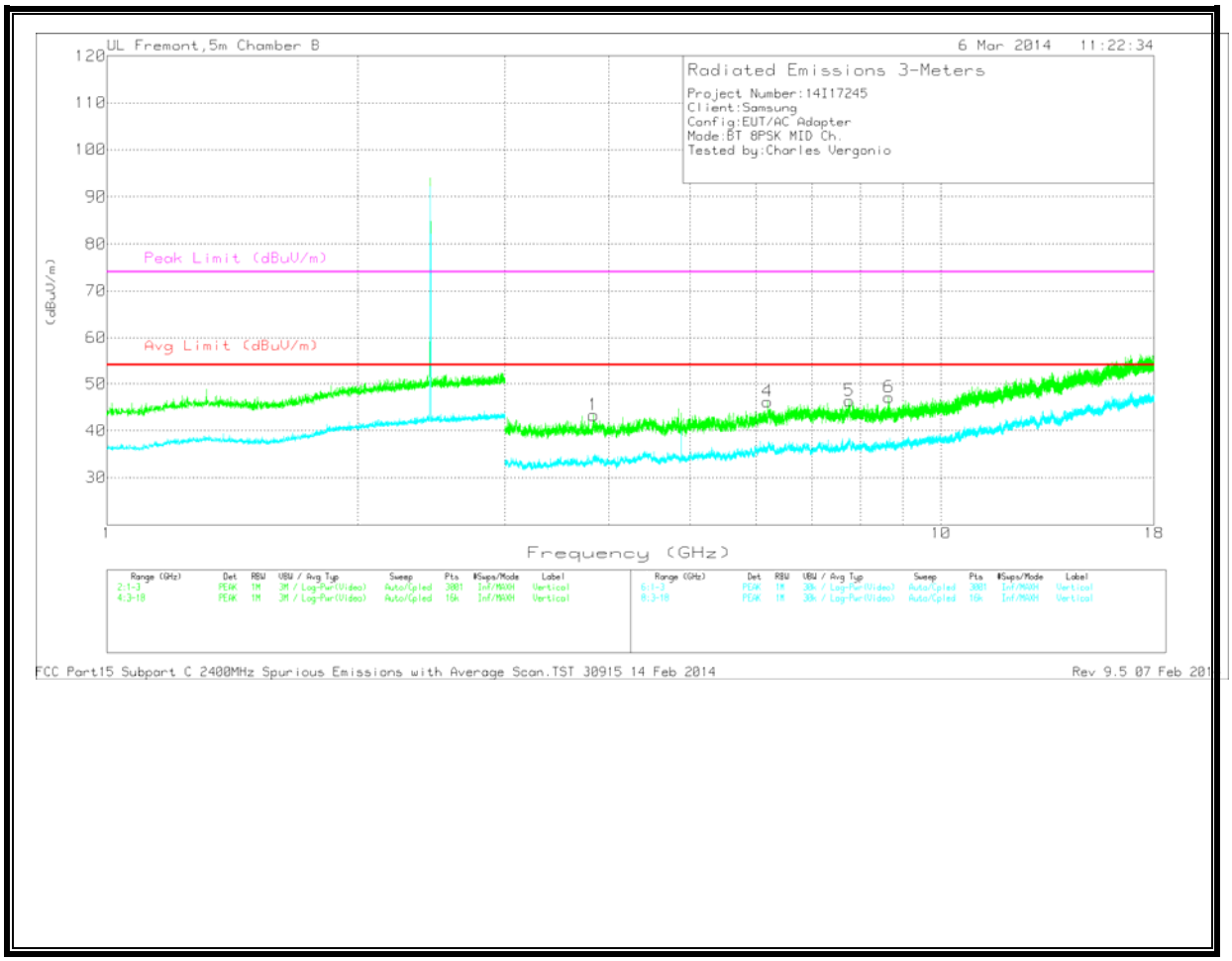
VERTICAL



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

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MID CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/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	* 4.344	41.41	PK	33.8	-31	44.21	54	-9.79	74	-29.79	0-360	202	H
3	* 4.882	41.21	PK	34.2	-30.6	44.81	54	-9.19	74	-29.19	0-360	202	H
1	* 3.832	40.22	PK	33.4	-30.3	43.32	54	-10.68	74	-30.68	0-360	202	V
4	6.194	38.91	PK	35.5	-28.2	46.21	54	-7.79	74	-27.79	0-360	202	V
5	7.763	36.59	PK	35.8	-26	46.39	54	-7.61	74	-27.61	0-360	99	V
6	8.657	37.04	PK	36	-25.9	47.14	54	-6.86	74	-26.86	0-360	202	V

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

PK - Peak detector

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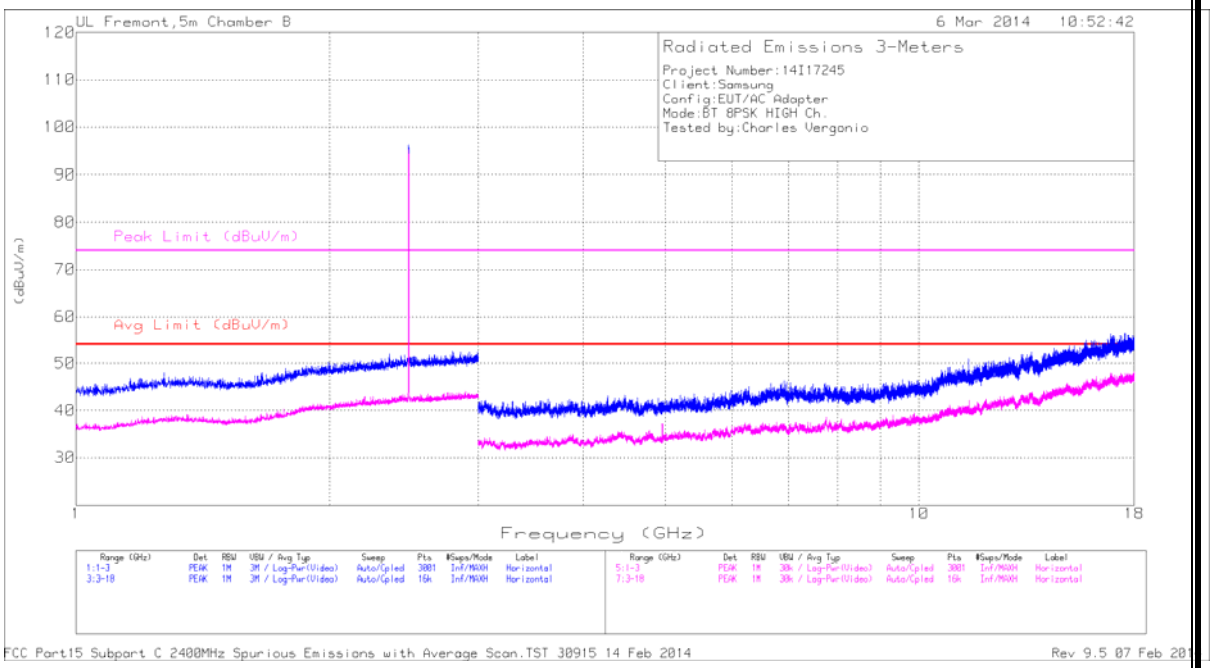
HIGH CHANNEL
HORIZONTAL



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

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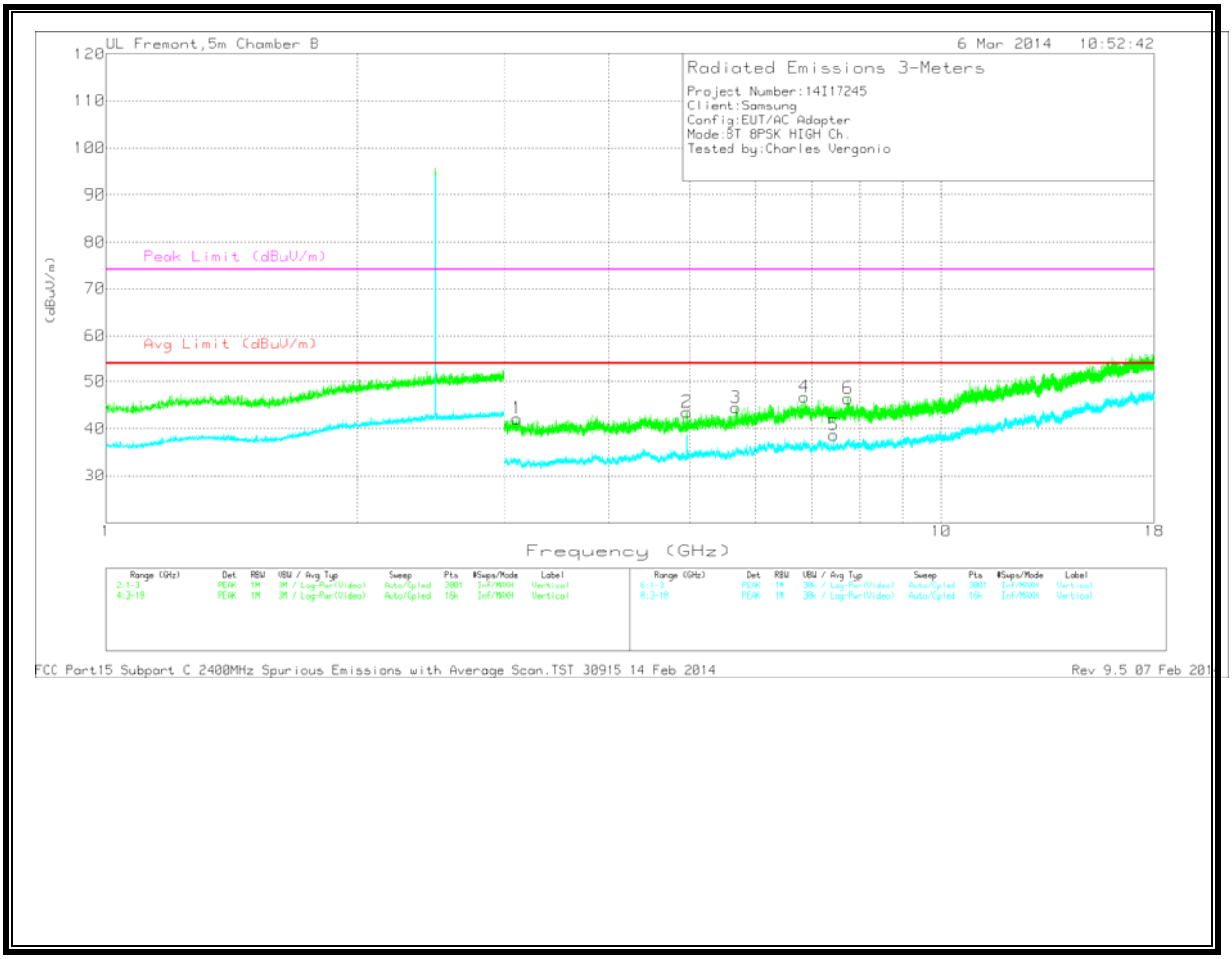
VERTICAL



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

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HIGH CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/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	* 4.96	39.51	PK	34.2	-30.2	43.51	54	-10.49	74	-30.49	0-360	202	V
6	* 7.748	36.59	PK	35.8	-26	46.39	54	-7.61	74	-27.61	0-360	202	V
5	* 7.44	29.87	Avg	35.6	-26.8	38.67	54	-15.33	-	-	0-360	202	V
1	3.112	40.94	PK	32.8	-31.6	42.14	54	-11.86	74	-31.86	0-360	99	V
3	5.69	38.65	PK	34.7	-28.9	44.45	54	-9.55	74	-29.55	0-360	99	V
4	6.86	38.59	PK	35.5	-27.4	46.69	54	-7.31	74	-27.31	0-360	202	V

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

PK - Peak detector

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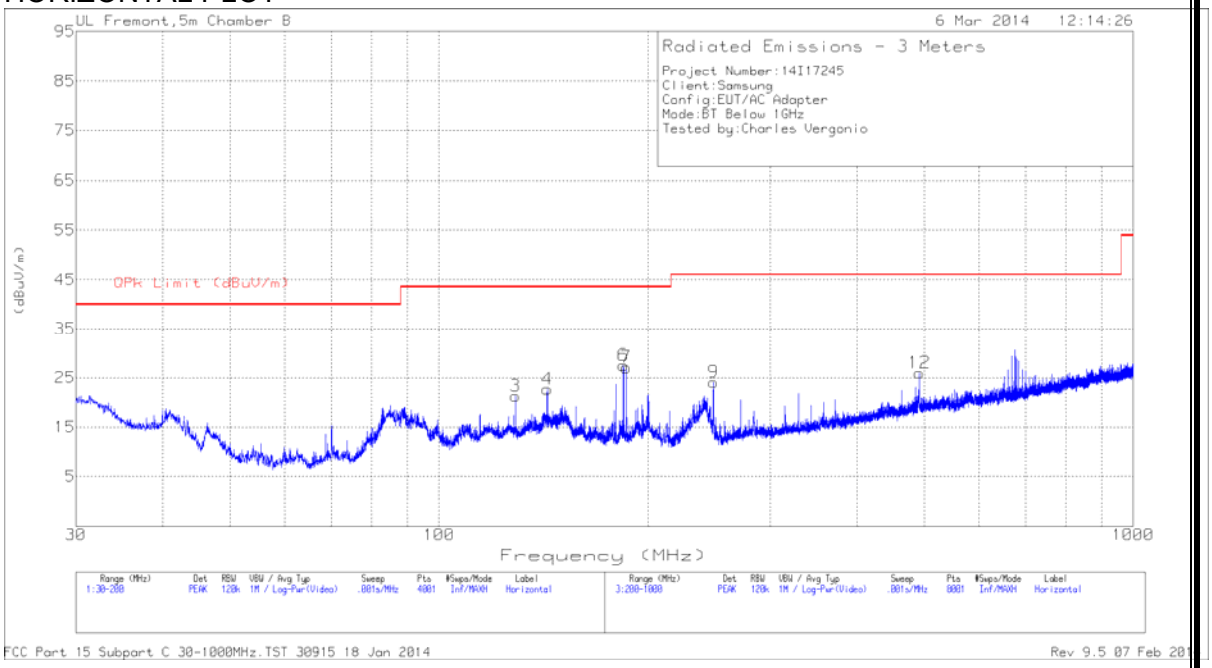
9.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



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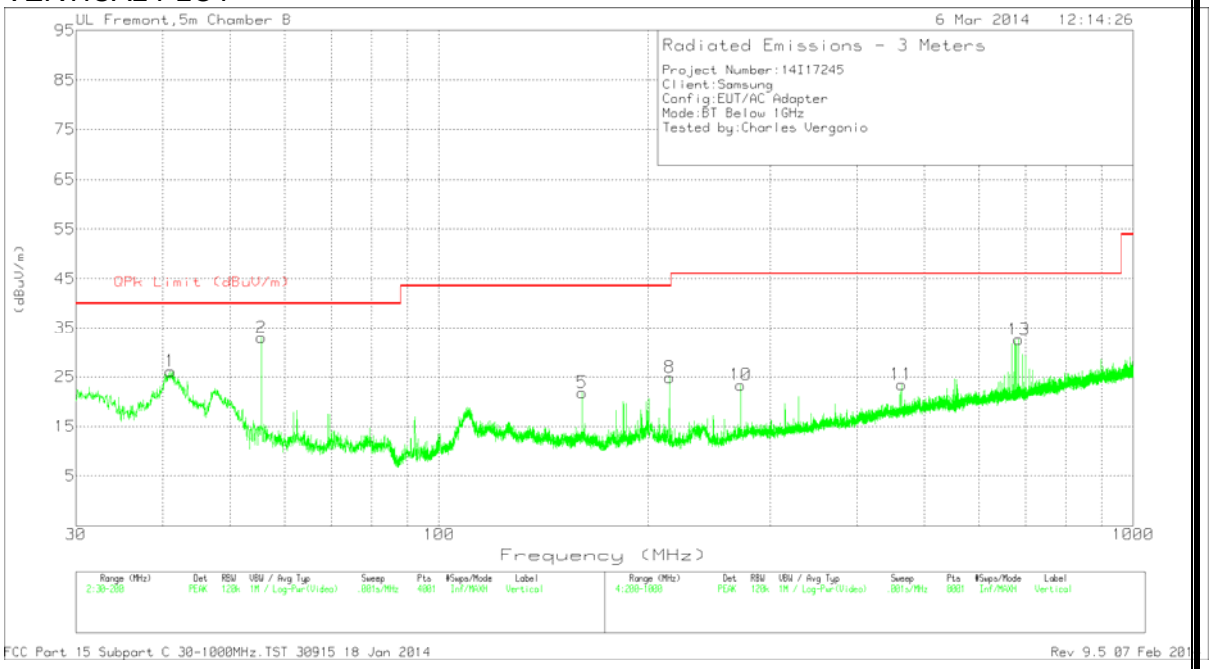
VERTICAL PLOT



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DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 128.855	35.48	PK	13.6	-27.8	21.28	43.5	-22.22	0-360	200	H
9	* 248.6	39.19	PK	11.4	-26.5	24.09	46.5	-22.41	0-360	101	H
10	* 272	36.66	PK	13	-26.3	23.36	46.5	-23.14	0-360	200	V
1	41.05	42.01	PK	12.8	-28.7	26.11	40	-13.89	0-360	101	V
2	55.5	54.6	PK	7	-28.6	33	40	-7.0	0-360	101	V
4	143.22	37.67	PK	12.6	-27.6	22.67	43.5	-20.83	0-360	200	H
5	160.73	36.87	PK	12.2	-27.3	21.77	43.5	-21.73	0-360	101	V
6	184.3175	43.3	PK	11.3	-27.1	27.5	43.5	-16.0	0-360	200	H
7	186.145	42.87	PK	11.3	-27.1	27.07	43.5	-16.43	0-360	101	H
8	214.8	41.23	PK	10.4	-26.8	24.83	43.5	-18.67	0-360	200	V
11	463.8	32.45	PK	16.9	-25.9	23.45	46.5	-23.05	0-360	101	V
12	492	34.2	PK	17.6	-25.8	26	46.5	-20.5	0-360	101	H
13	684	37.87	PK	19.6	-24.9	32.57	46.5	-13.93	0-360	101	V

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

PK - Peak detector

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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

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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 dB(uVolts)	CFR 47 Part 15 Class B QP	Margin to Limit (dB)	CFR 47 Part 15 Class B Avg	Margin to Limit (dB)
1	.3885	40.46	PK	.4	0	40.86	58.1	-17.24	-	-
2	.3885	24.47	Av	.4	0	24.87	-	-	48.1	-23.23
9	1.0815	41.45	PK	.2	0	41.65	56	-14.35	-	-
10	1.0815	23.79	Av	.2	0	23.99	-	-	46	-22.01
7	1.8375	43.1	PK	.2	.1	43.4	56	-12.6	-	-
8	1.8375	27.08	Av	.2	.1	27.38	-	-	46	-18.62
3	16.872	40.26	PK	.3	.2	40.76	60	-19.24	-	-
4	16.872	23.28	Av	.3	.2	23.78	-	-	50	-26.22
5	22.7085	33.11	PK	.3	.2	33.61	60	-26.39	-	-
6	22.7085	18.73	Av	.3	.2	19.23	-	-	50	-30.77

Line-L2 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dB(uVolts)	CFR 47 Part 15 Class B QP	Margin to Limit (dB)	CFR 47 Part 15 Class B Avg	Margin to Limit (dB)
11	.2085	41.22	PK	1	0	42.22	63.3	-21.08	-	-
12	.2085	17.47	Av	1	0	18.47	-	-	53.3	-34.83
13	1.0635	36.72	PK	.3	0	37.02	56	-18.98	-	-
14	1.0635	19.78	Av	.3	0	20.08	-	-	46	-25.92
15	2.706	39.94	PK	.2	.1	40.24	56	-15.76	-	-
16	2.706	21.3	Av	.2	.1	21.6	-	-	46	-24.4
17	16.9755	44.83	PK	.3	.2	45.33	60	-14.67	-	-
18	17.475	48.47	PK	.3	.2	48.97	60	-11.03	-	-
19	17.475	28.05	Av	.3	.2	28.55	-	-	50	-21.45
20	23.595	35.48	PK	.3	.2	35.98	60	-24.02	-	-
21	23.595	19.83	Av	.3	.2	20.33	-	-	50	-29.67

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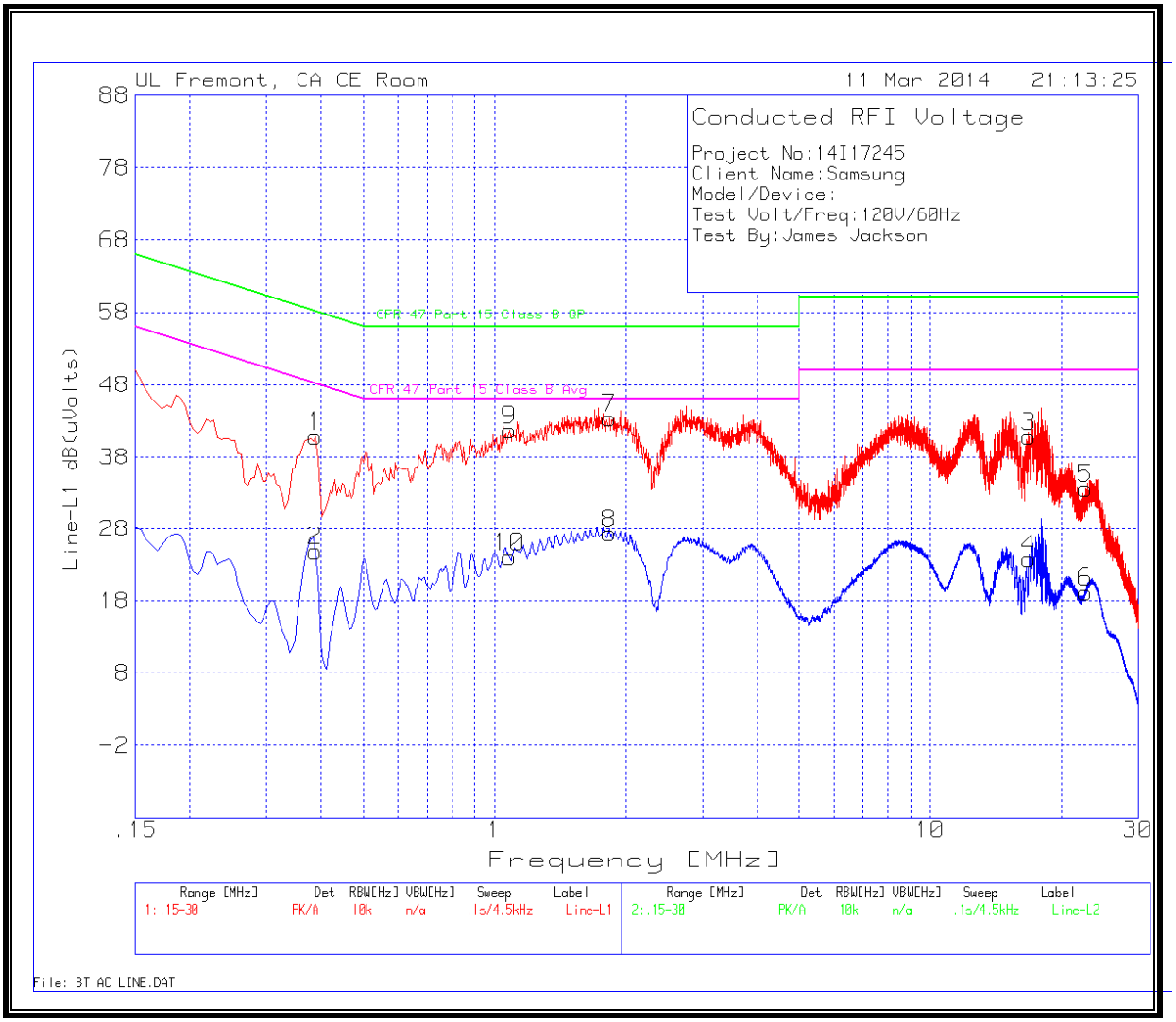
LINE 1 RESULTS



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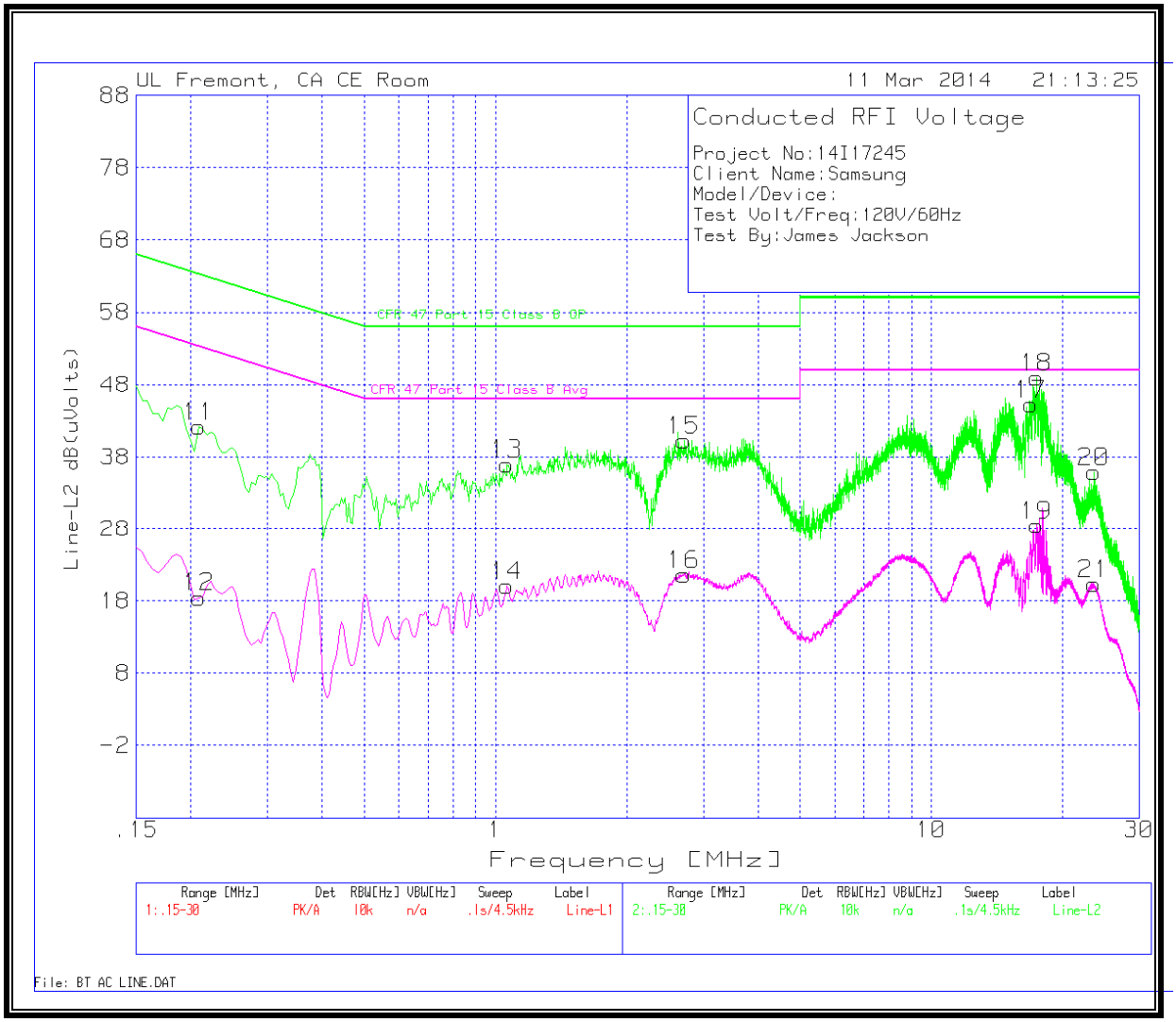
LINE 2 RESULTS



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