



CERTIFICATION TEST REPORT

Report Number : 16U23555-E4V3

Applicant : Google Inc.
1600 Amphitheatre Parkway
Mountain View, CA 94043 U.S.A

Model : NC2-6A5-D

FCC ID : A4RNC2-6A5-D

IC ID : 10395A-NC26A5D

EUT Description : Internet Video Streaming Device

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 1

Date of Issue:

Tuesday, August 16, 2016

Prepared by:

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NVLAP LAB CODE 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	7/25/2016	Initial Issue	---
V2	7/28/2016	Revision to EUT Description	Grace Rincand
V3	8/16/2016	Updated sections 4.2, 4.8 and 5.1	Francisco de Anda

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Google Inc.
1600 Amphitheatre Parkway
Mountain View, CA 94043 U.S.A

EUT DESCRIPTION: Internet Video Streaming Device

MODEL: NC2-6A5-D

SERIAL NUMBER: 6520CZZAXW (Radiated); 6520CZZAYG (Conducted)

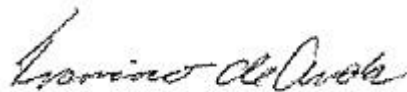
DATE TESTED: JULY 1ST 2016 – AUGUST 16TH 2016

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 ISSUE 1	Pass
INDUSTRY CANADA RSS-GEN ISSUE 4	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.

Approved & Released For
UL Verification Services Inc. By:



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2. SUMMARY OF TESTING

2.1. 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(IC: 2324B-1)	☐ Chamber D(IC: 2324B-4)
☒ Chamber B(IC: 2324B-2)	☐ Chamber E(IC: 2324B-5)
☐ Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 2324B-6)
	☐ Chamber G(IC: 2324B-7)
	☐ Chamber H(IC: 2324B-8)

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>.

2.2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-247 Issue 1.

2.3. CALIBRATION AND UNCERTAINTY

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.

SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

2.4. 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	ID Num	Cal Due
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	T130	09/01/16
Antenna, Horn, 1-18GHz	ETS Lindgren	3117	T345	03/07/17
Antenna, Horn, 18-26 GHz	ARA	MWH-1826/B	T449	05/26/17
RF Preamplifier, 10kHz - 1GHz	HP	8447D	T10	02/01/17
RF Preamplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	T493	03/09/17
RF Preamplifier, 1 - 8GHz	Miteq	AMF-4D-01000800-30-29P	T1156	03/09/17
RF Preamplifier, 1 - 26GHz	Agilent	8449B	T404	07/05/17
Spectrum Analyzer, 44 GHz	Keysight	N9030A	T907	01/06/17
Spectrum Analyzer, 44 GHz	Keysight	E440A	T198	12/12/16
Spectrum Analyzer, 40 GHz	HP	8564E	T106	08/14/16
EMI Test Receiver, 9 kHz to 7 GHz	Rohde & Schwarz	ESR	T1436	12/19/16
Power Meter	Keysight	N1911A	T229	07/30/16
Power Sensor	Keysight	N1921A	T1223	02/28/17
LISN, 30 MHz	FCC	FCC-LISN-50/250-25-2-01	T1310	06/08/17
Low Pass Filter 3GHz	Micro-Tronics	HPM17543	T485	3/9/2017
Spectrum Analyzer, 44 GHz	Agilent	N9030A	T339	9/14/2016

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, June 24, 2015
Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015
CLT Software	UL	UL RF	Ver 1.0, Feb 2, 2015
Antenna Port Software	UL	UL RF	Ver 3.9, Dec 16, 2015

3. EQUIPMENT UNDER TEST

3.1. 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	5.65	3.67
2402 - 2480	Enhanced DQPSK	5.63	3.66
2402 - 2480	Enhanced 8PSK	5.65	3.67

Note: GFSK, DQPSK, 8PSK average and peak power are all investigated, The GFSK & 8PSK power are the worst case. Testing is based on these modes to showing compliance. For average power data refer to section 4.7.

3.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB antenna, with a maximum gain of 4.9 dBi.

3.3. 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.

Worst-case data rates as provided by the client were:

GFSK mode: 1-DH5

8PSK mode: 3-DH5

DQPSK has been verified to have the lowest power.

3.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	HP	HSTNN-LA40	WDUV0B3U8HK1Y	DoC
Laptop	HP	11-d001ax	5CD51643JG	DoC

I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	Micro USB	unshielded	2	
2	USB	1	Micro USB	unshielded	0.2	Y-cable
3	USB	1	USB	unshielded	2.5	USB serial cable
4	DC	1	Barrel	unshielded	1.7	
5	AC	1	3 prong	unshielded	1	

TEST SETUP

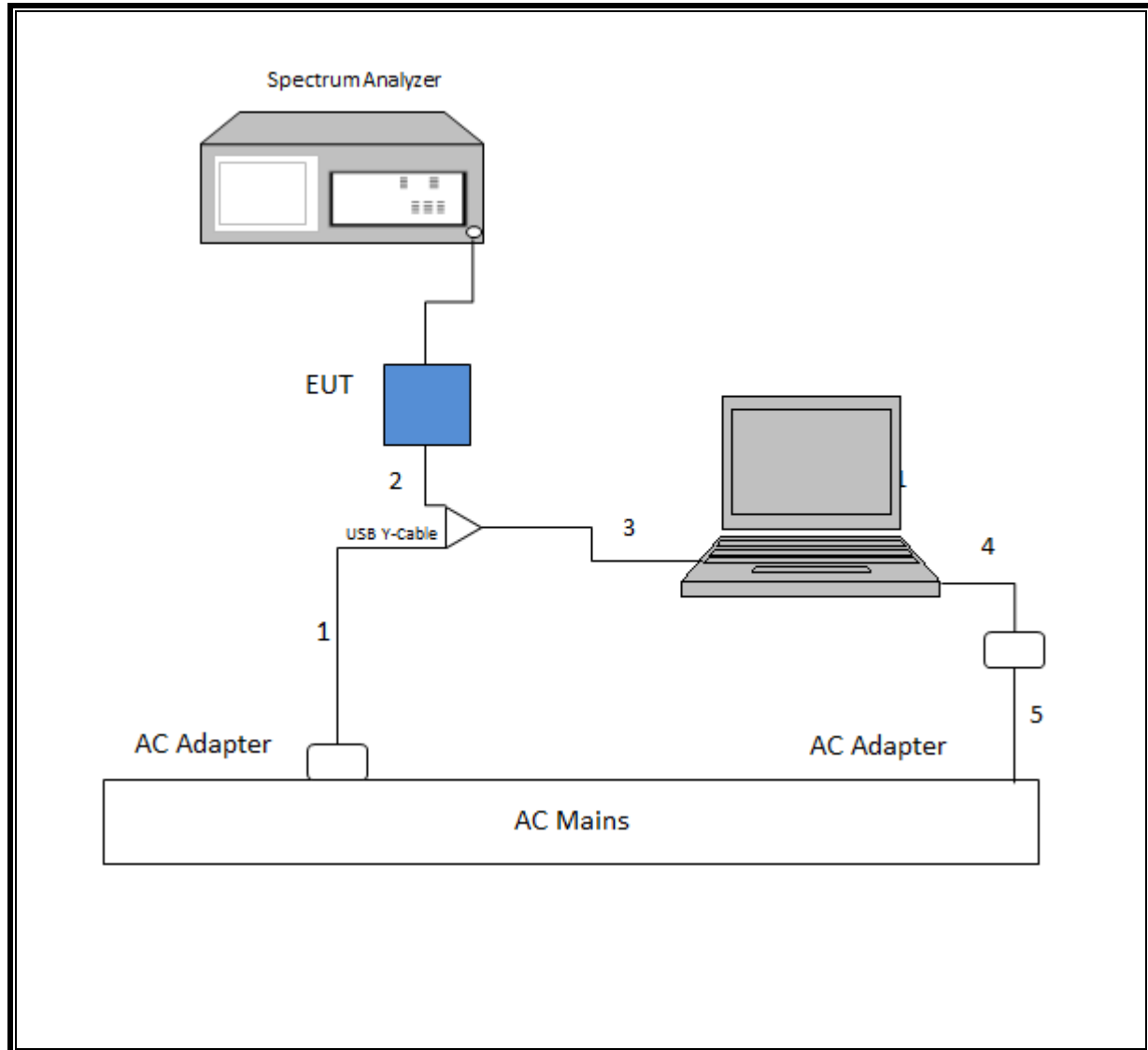
The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

SOFTWARE AND FIRMWARE

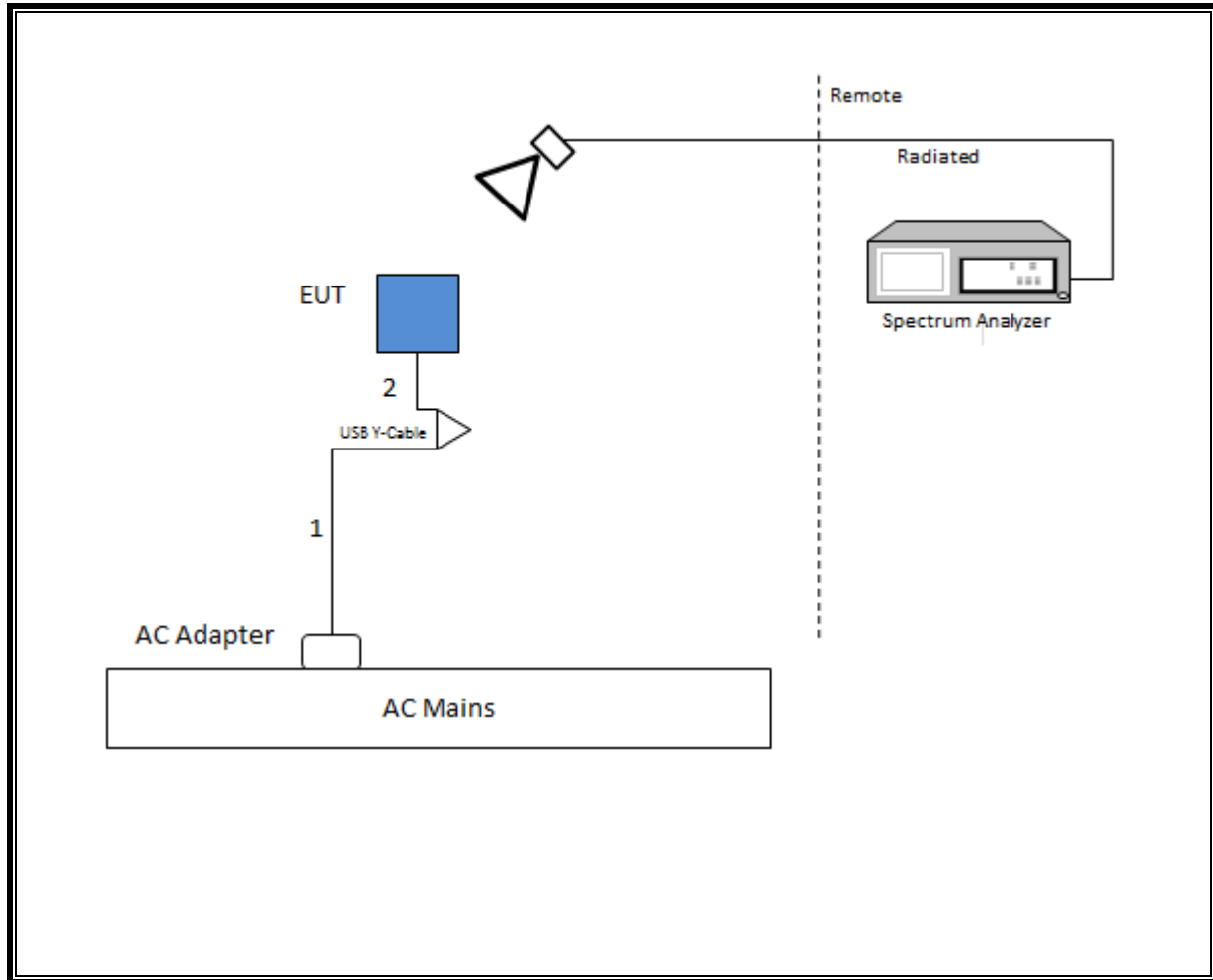
The firmware installed in the EUT during testing was 16.80.205.82

The test utility software used during testing was Labtool ver. 1.0.0.82.

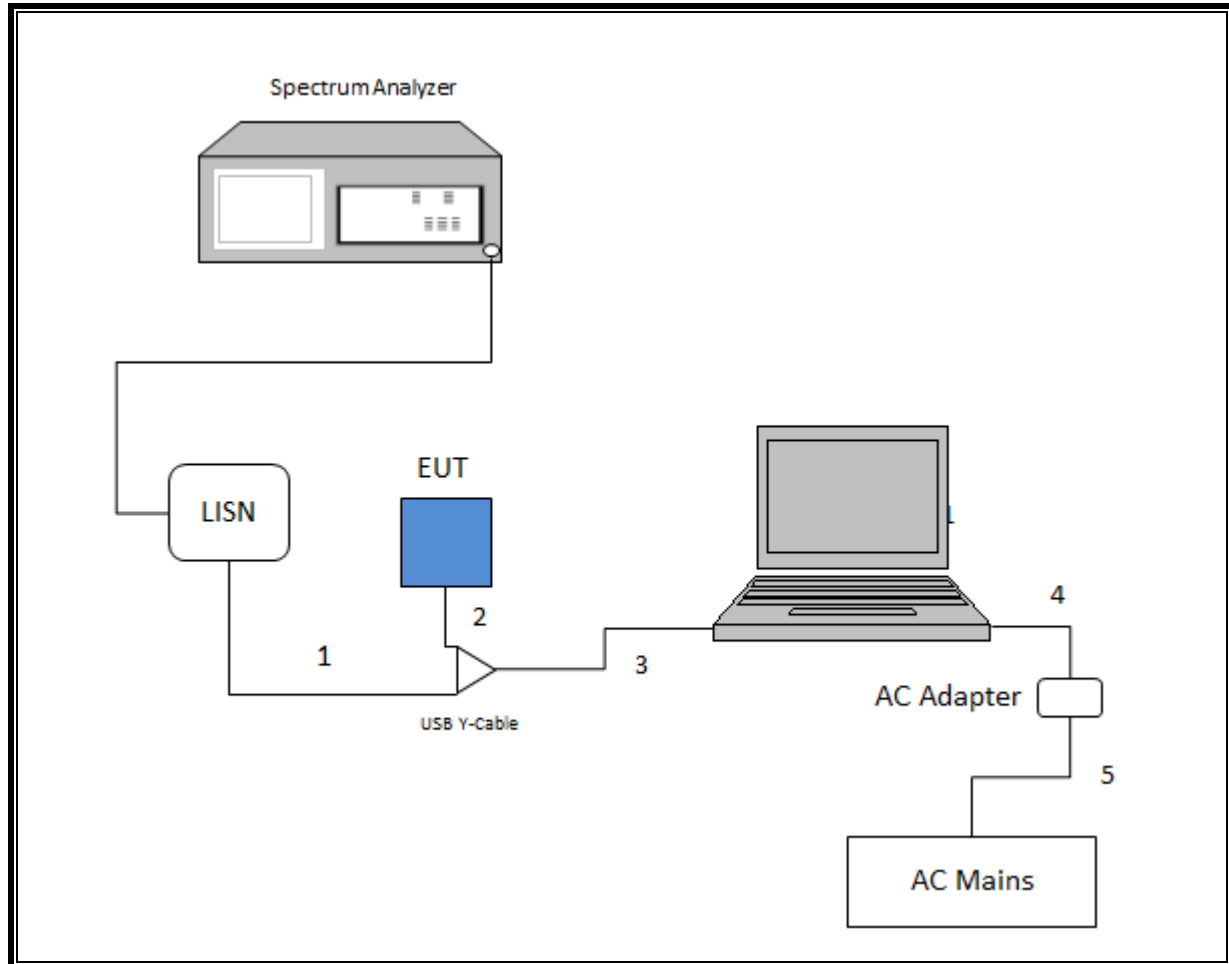
SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS



SETUP DIAGRAM FOR LINE CONDUCTED TEST



4. ANTENNA PORT TEST RESULTS

4.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Tested by: 39316 CX
Date: 7/1/2016- 7/2/2016

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
Bluetooth GFSK	2.88	3.75	0.769	76.9%	1.14	0.347
Bluetooth 8PSK	2.88	3.75	0.769	76.9%	1.14	0.347

DUTY CYCLE PLOTS



4.2. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

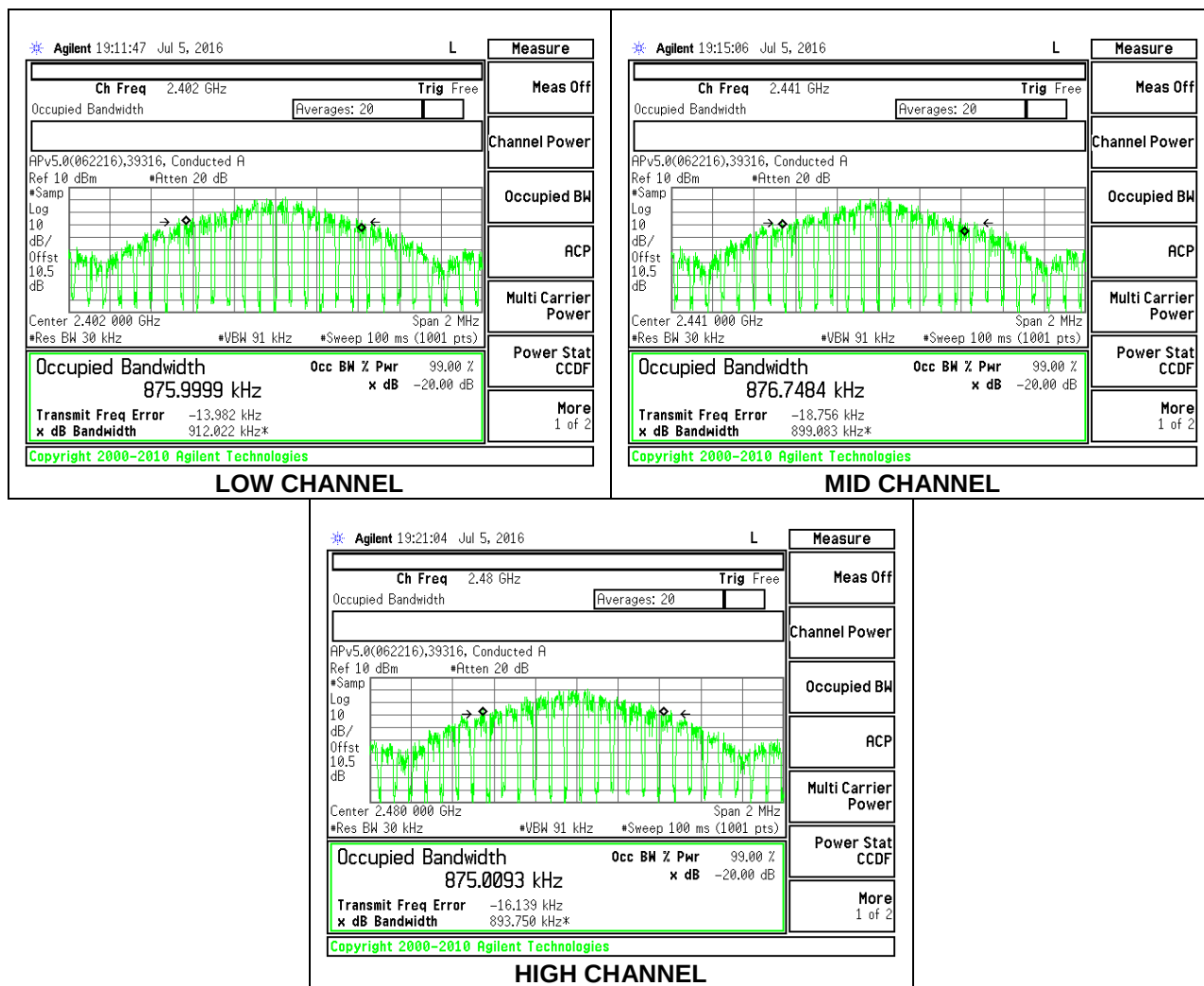
TEST PROCEDURE

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

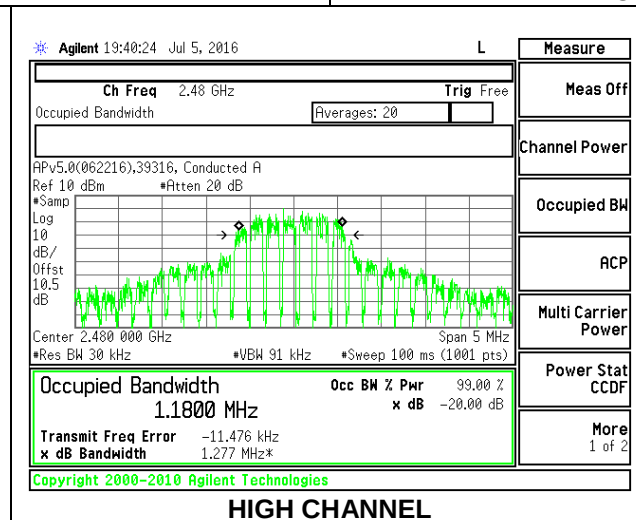
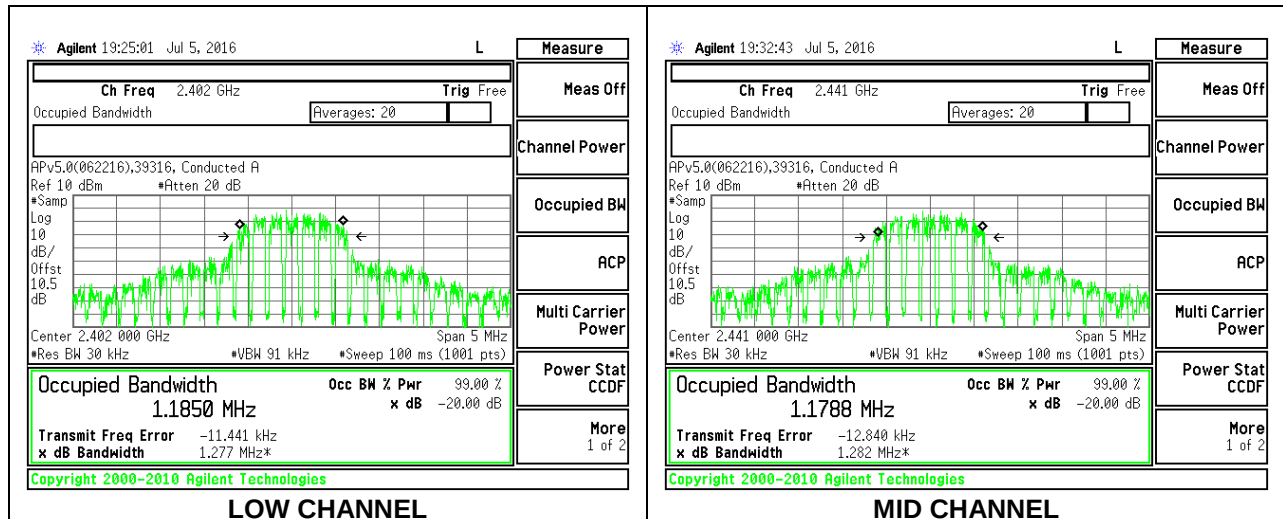
4.2.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20 dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low	2402	912.022	875.9999
Mid	2441	899.083	876.7484
High	2480	893.75	875.0093



4.2.2. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.277	1.185
Mid	2441	1.282	1.178
High	2480	1.277	1.18



4.3. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 5.1.2

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.

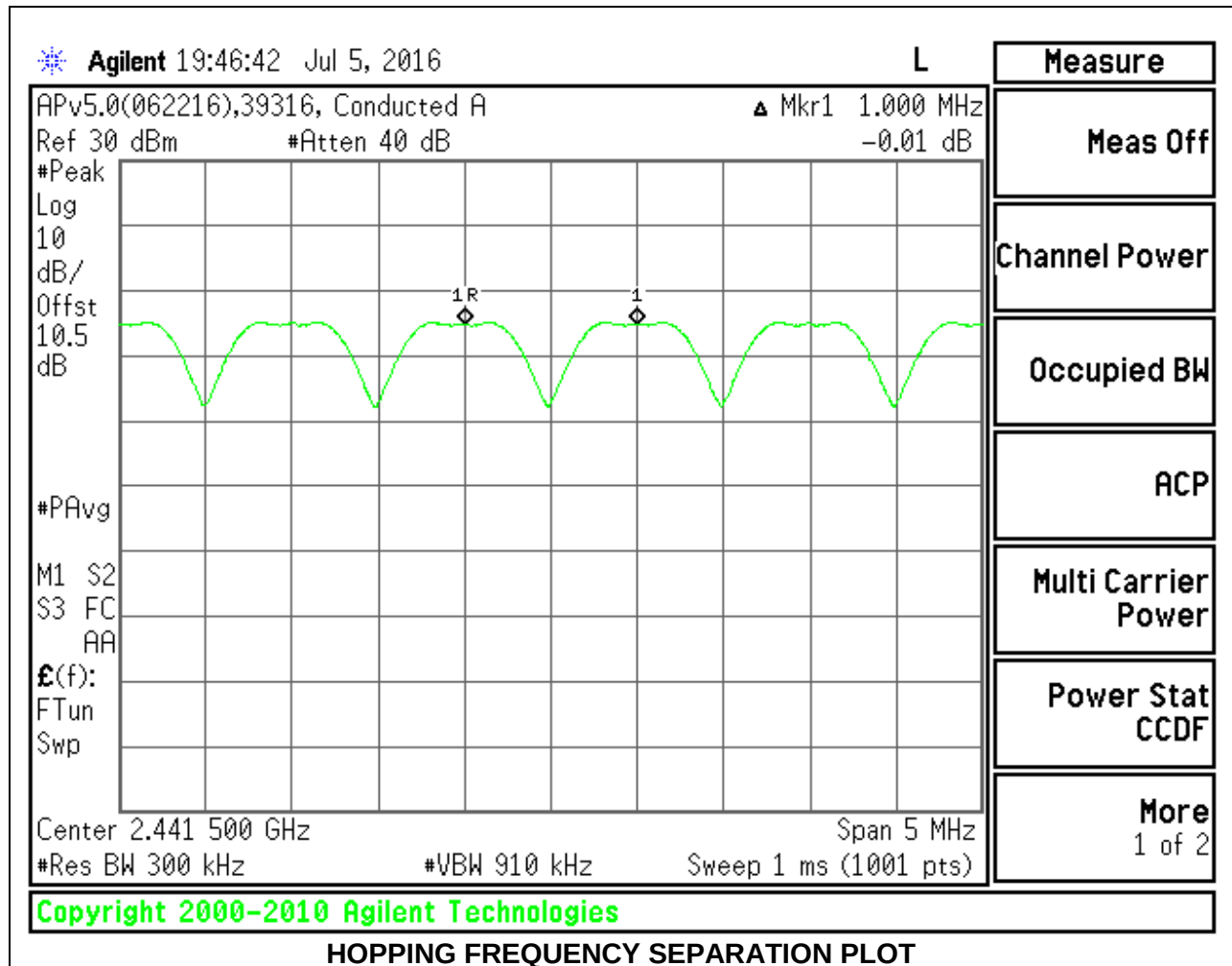
TEST PROCEDURE

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.

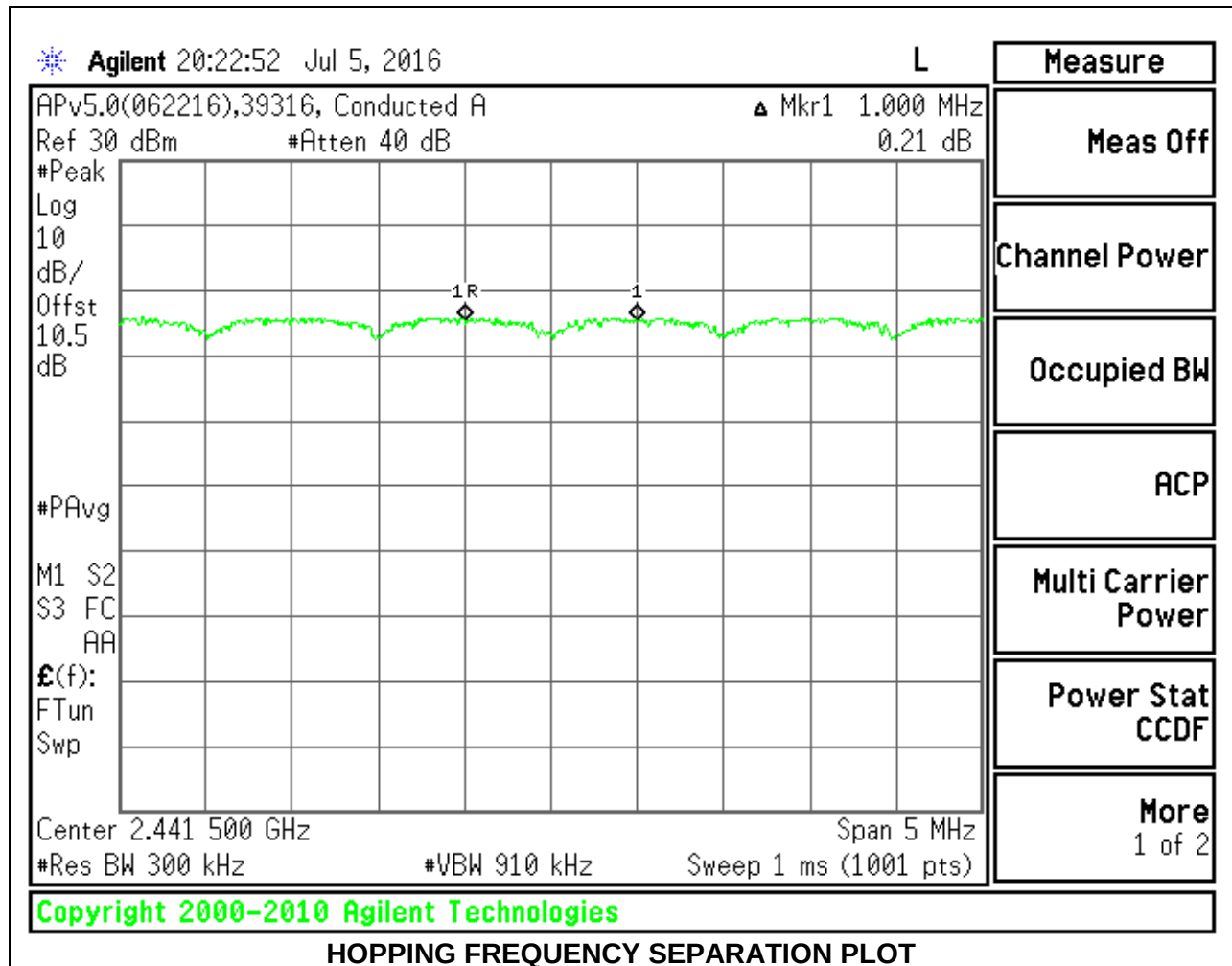
RESULTS

The EUT's channel separation (1MHz) is greater than the 20 dB BW.

4.3.1. BASIC DATA RATE GFSK MODULATION



4.3.2. ENHANCED DATA RATE 8PSK MODULATION



4.4. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 5.1.4

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

TEST PROCEDURE

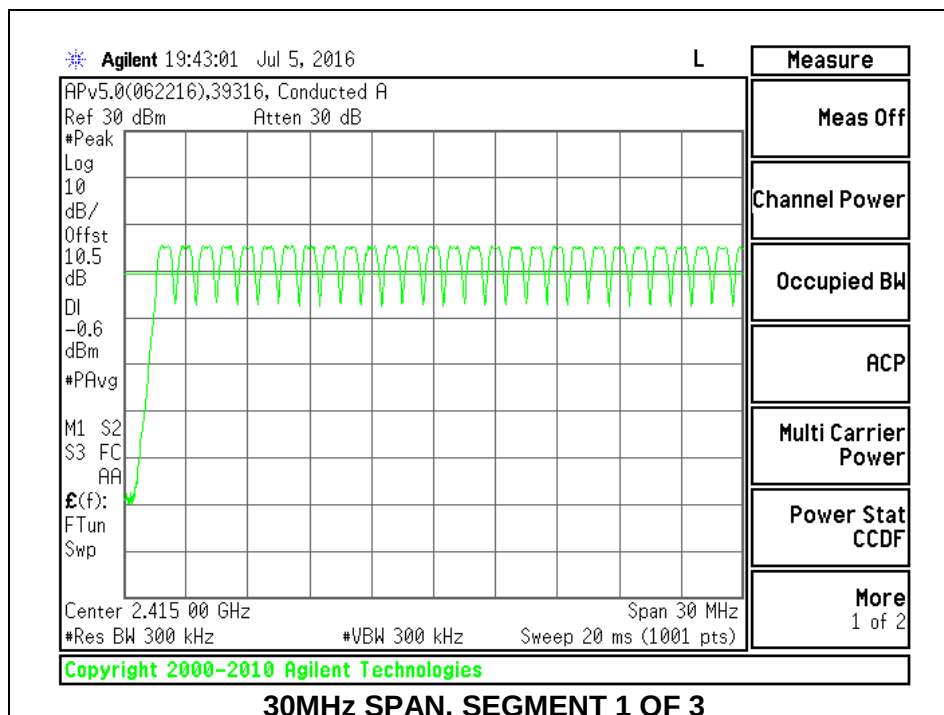
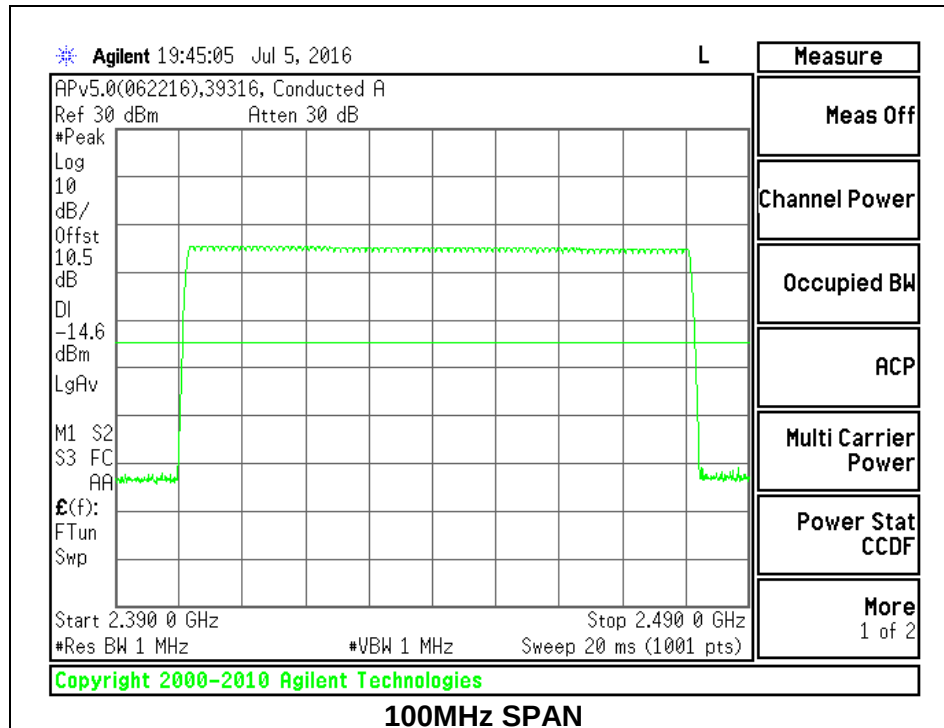
DA 00-705: The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

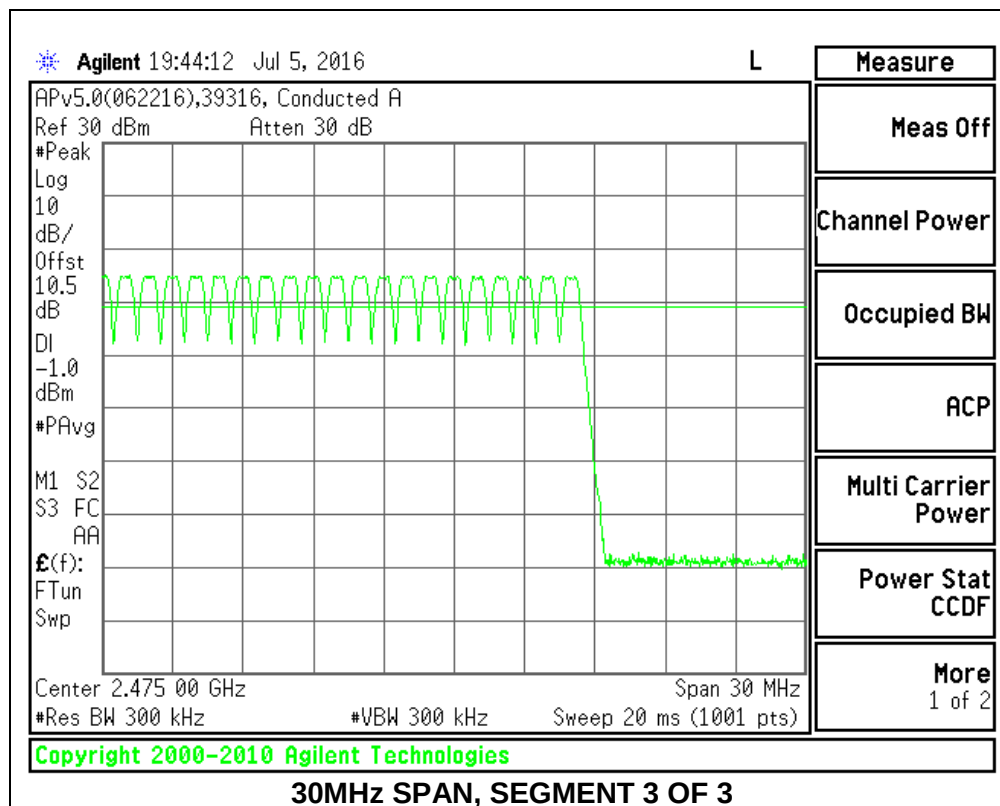
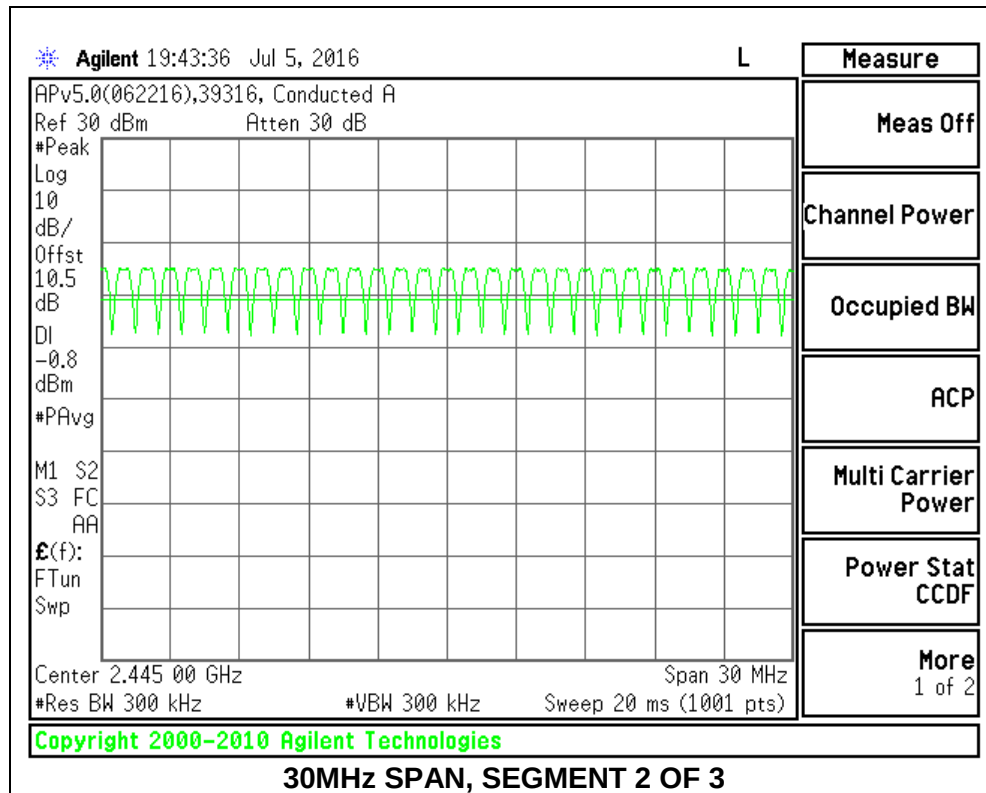
RESULTS

Normal Mode: 79 Channels observed.

4.4.1. BASIC DATA RATE GFSK MODULATION

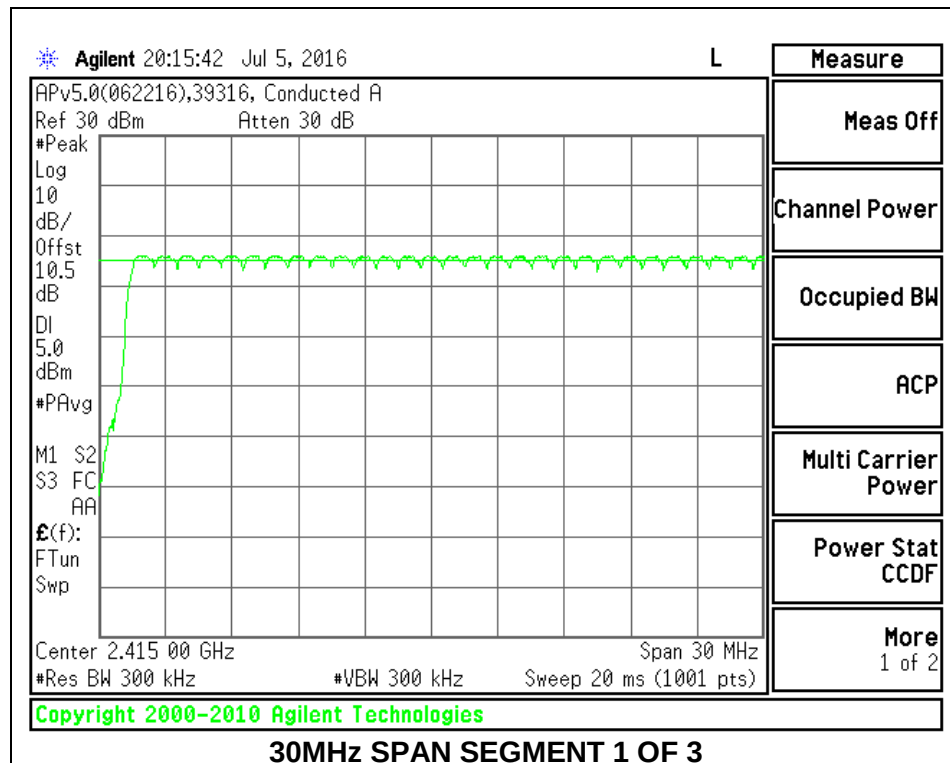
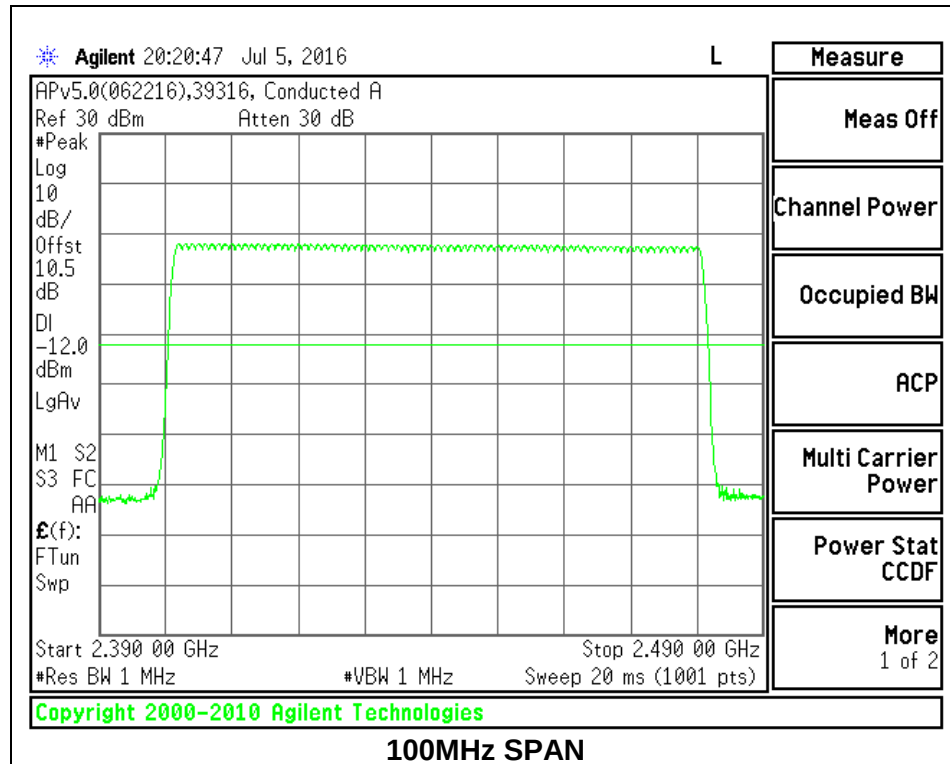
NUMBER OF HOPPING CHANNELS

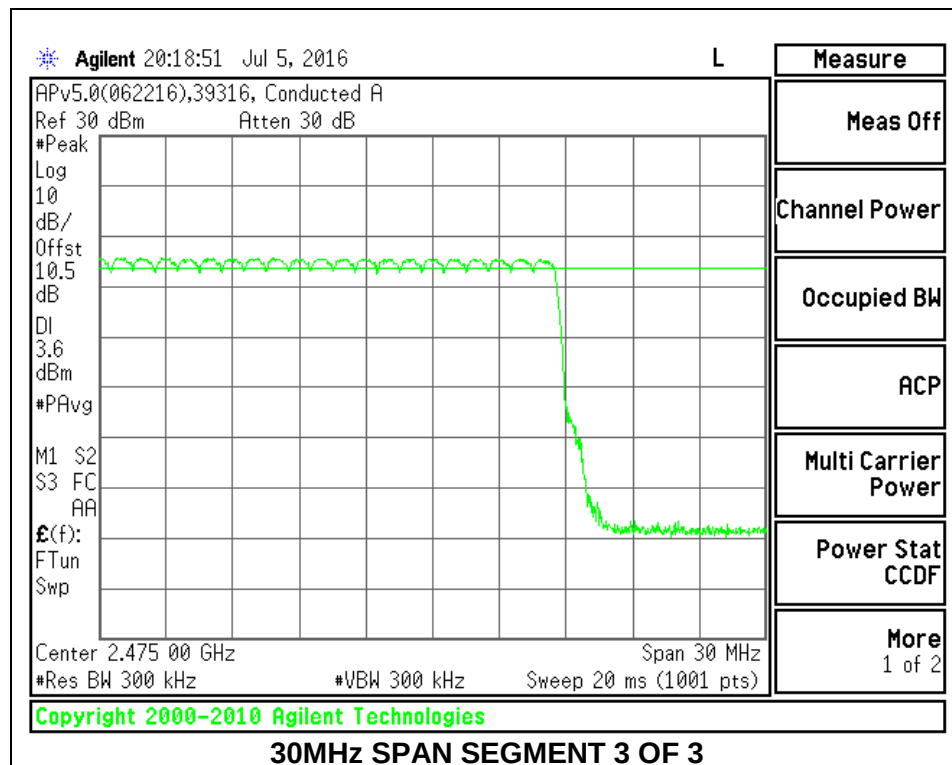
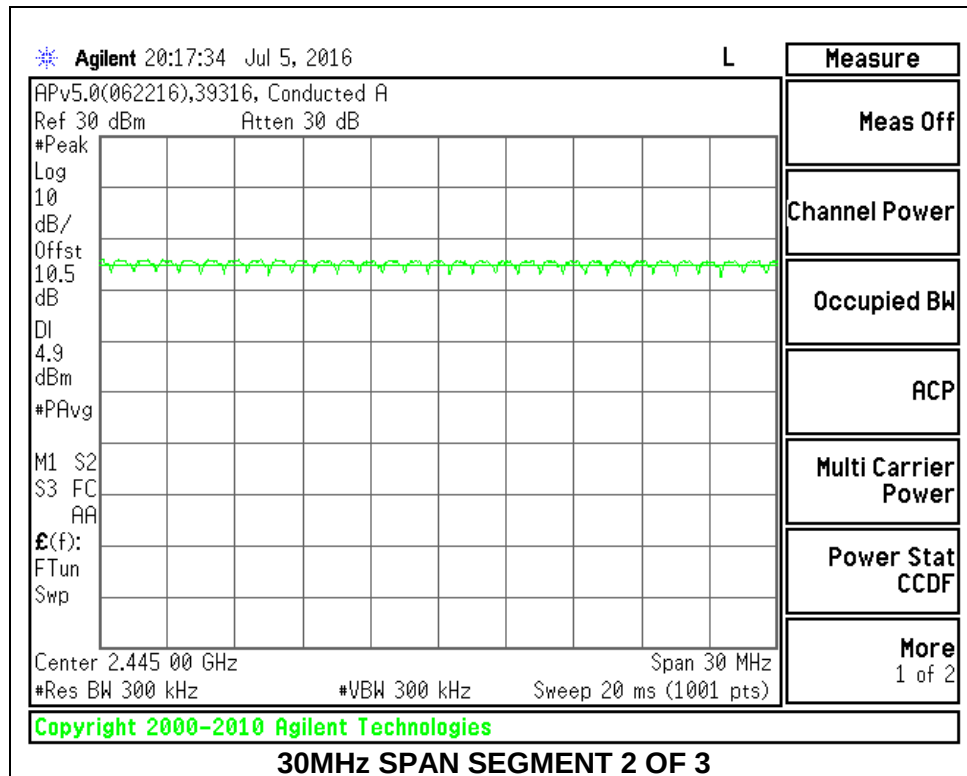




4.4.2. ENHANCED DATA RATE 8PSK MODULATION

NUMBER OF HOPPING CHANNELS





4.5. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 5.1.4

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 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

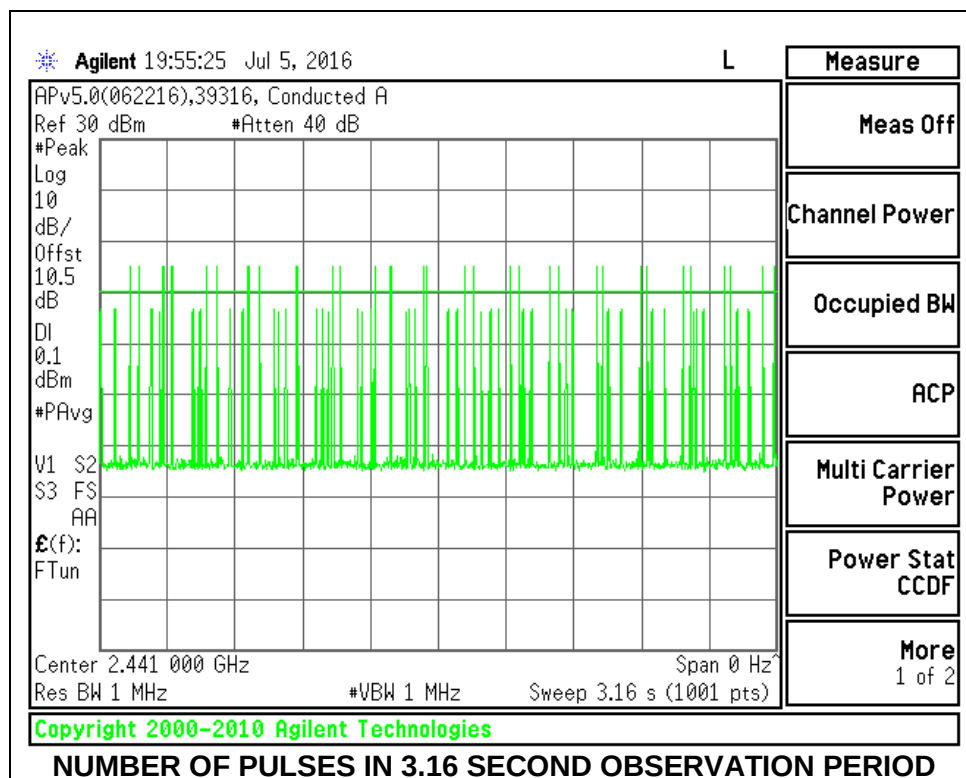
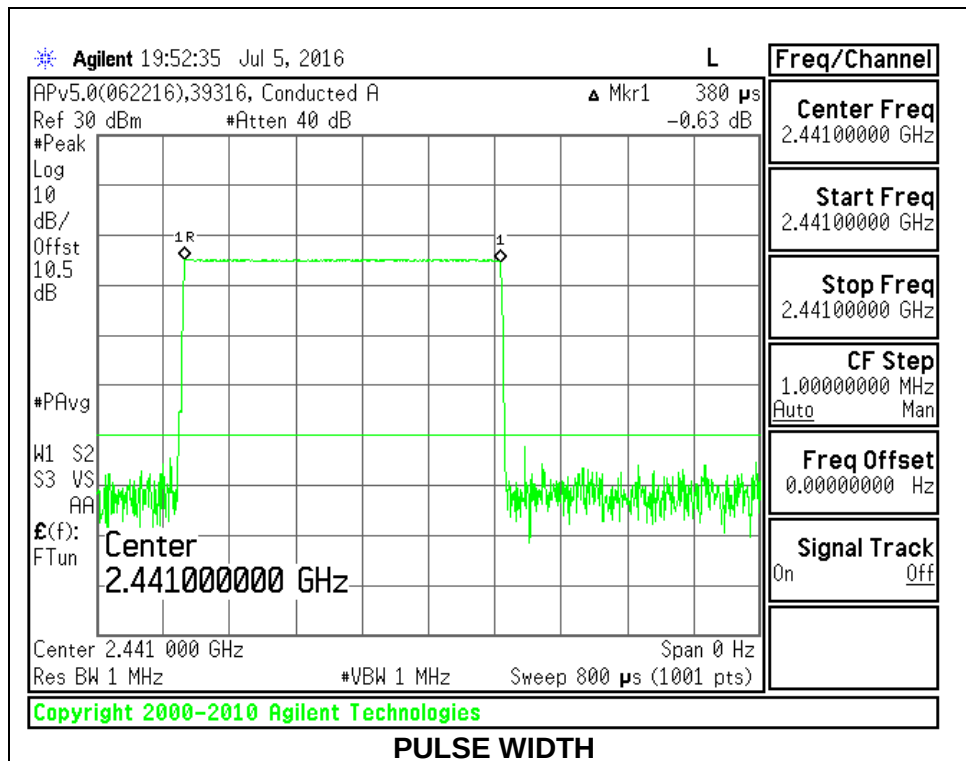
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{pulse width}$.

RESULTS

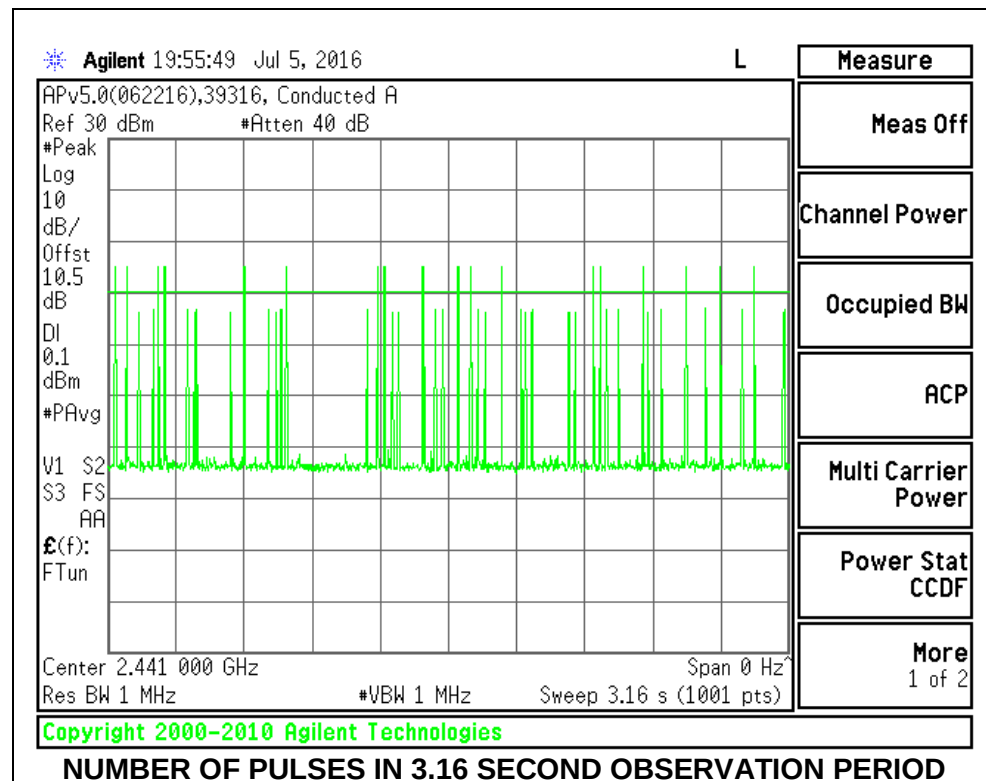
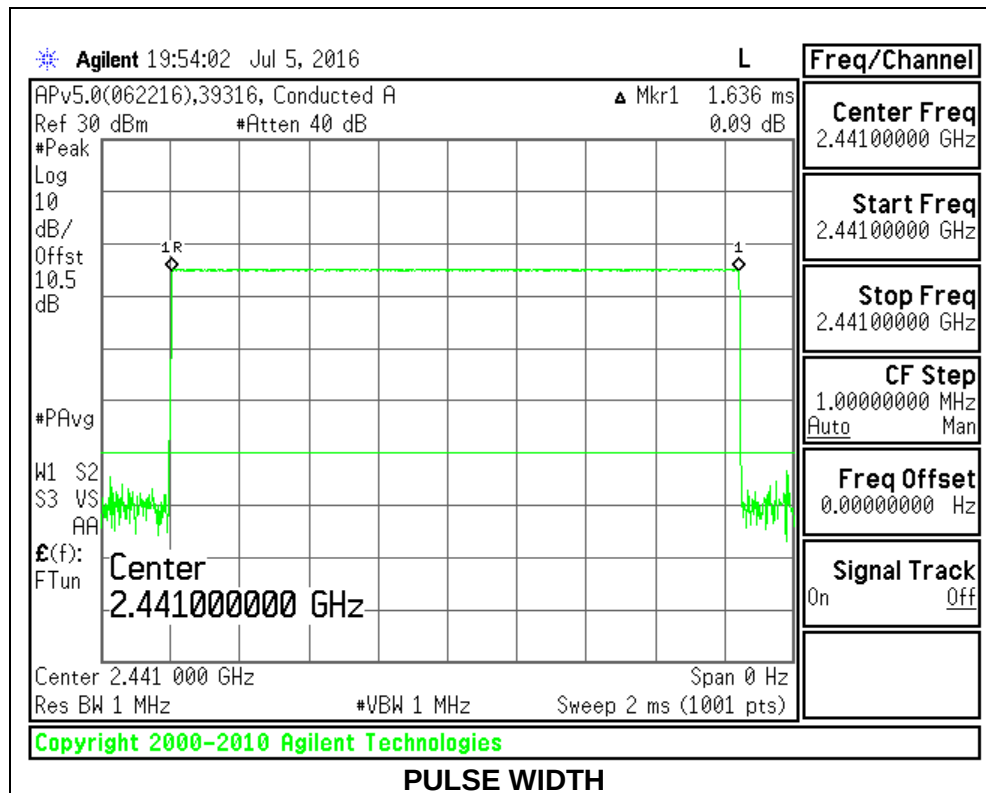
4.5.1. BASIC DATA RATE GFSK MODULATION

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	0.38	32	0.1216	0.4	-0.2784
DH3	1.636	19	0.3108	0.4	-0.0892
DH5	2.884	13	0.3749	0.4	-0.0251
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.38	8	0.03040	0.4	-0.3696
DH3	1.636	4.75	0.07771	0.4	-0.3223
DH5	2.884	3.25	0.09373	0.4	-0.3063

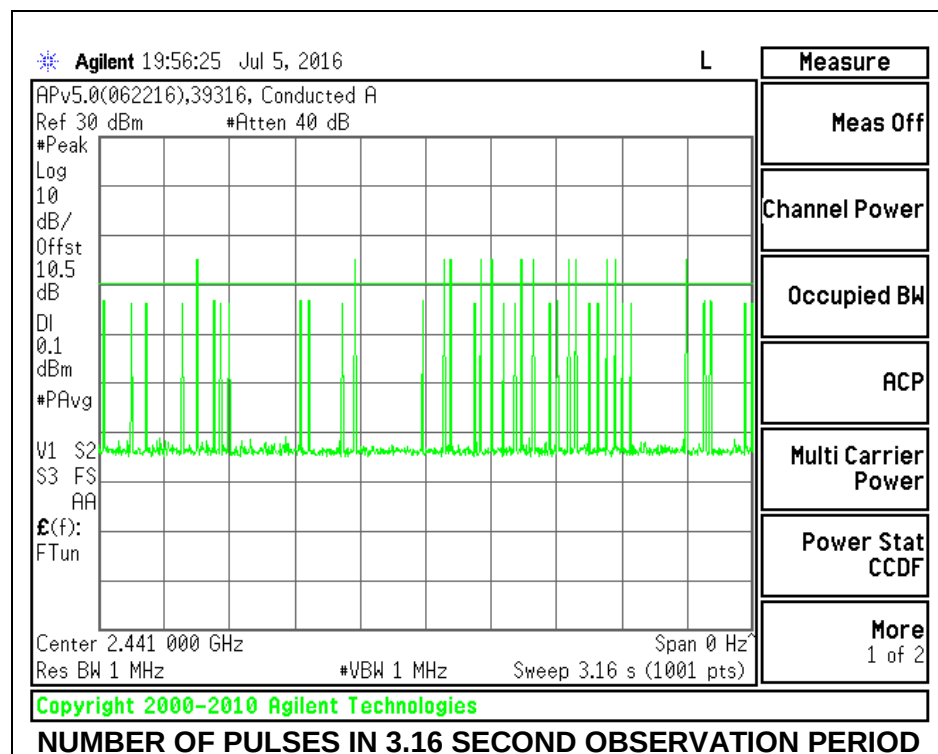
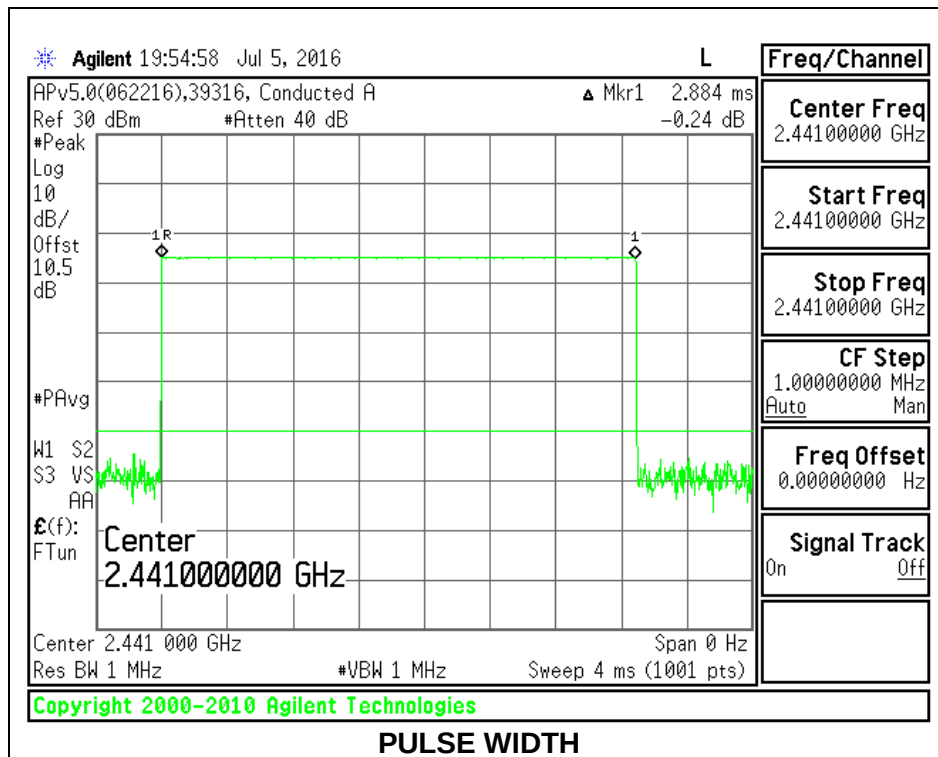
DH1 PLOTS



DH3 PLOTS



DH5 PLOTS

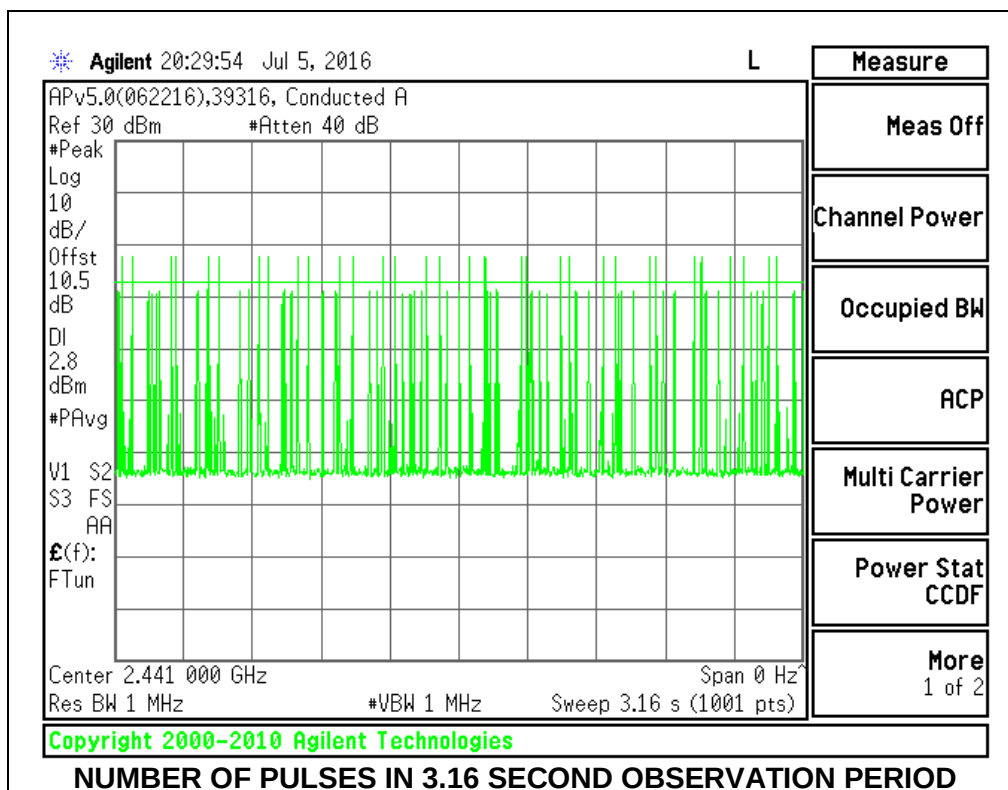
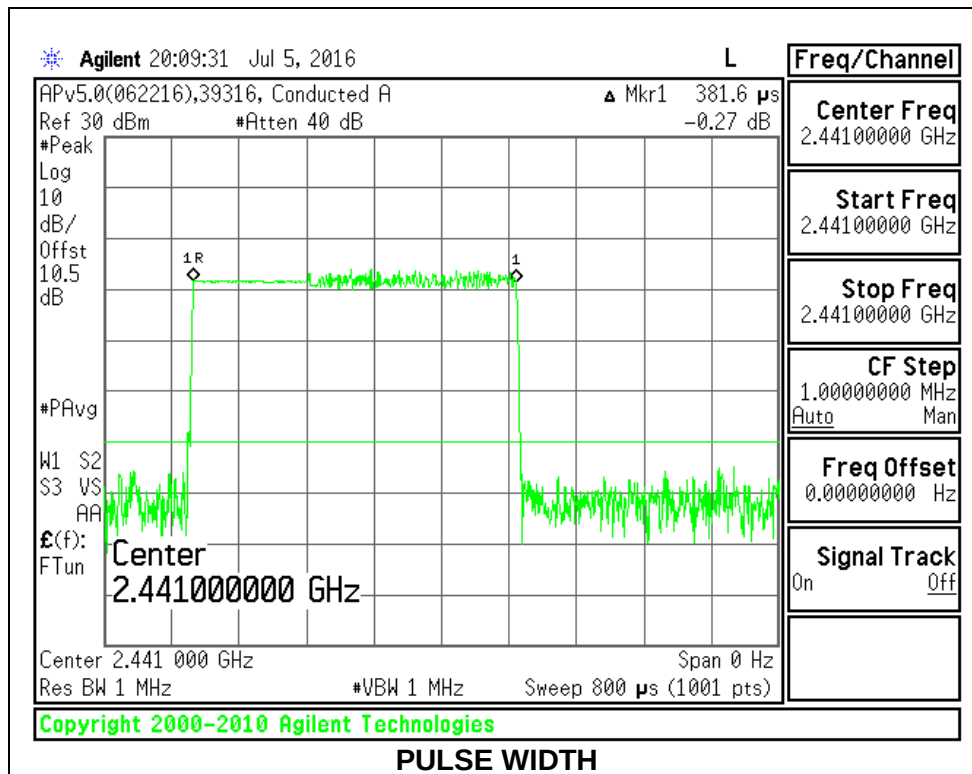


4.5.2. ENHANCED DATA RATE 8PSK MODULATION

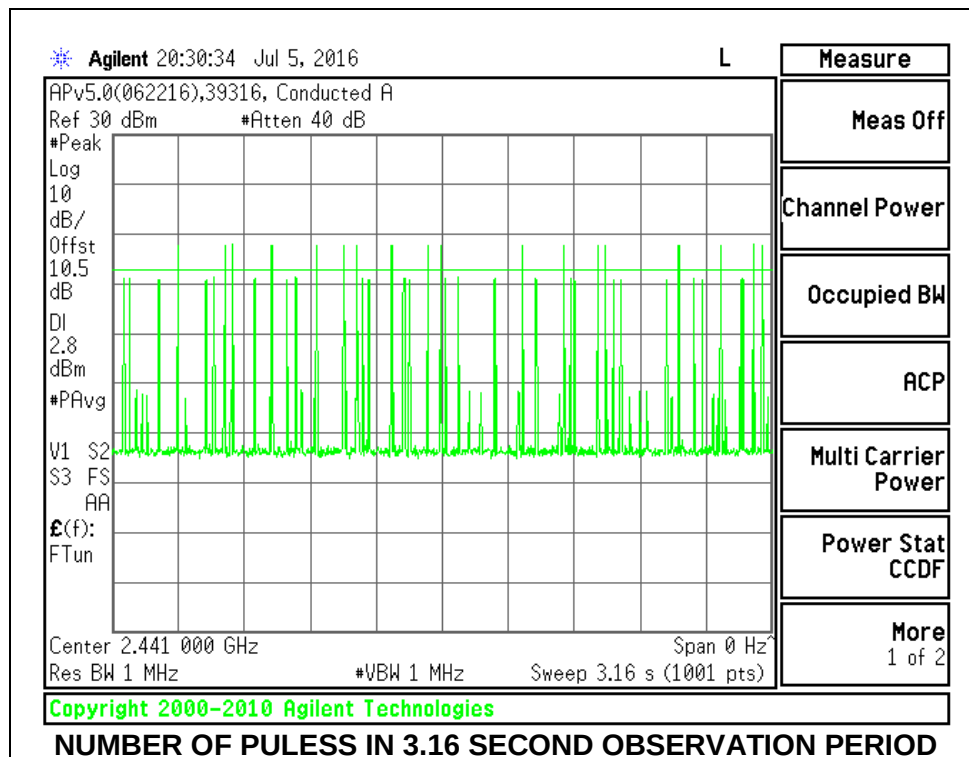
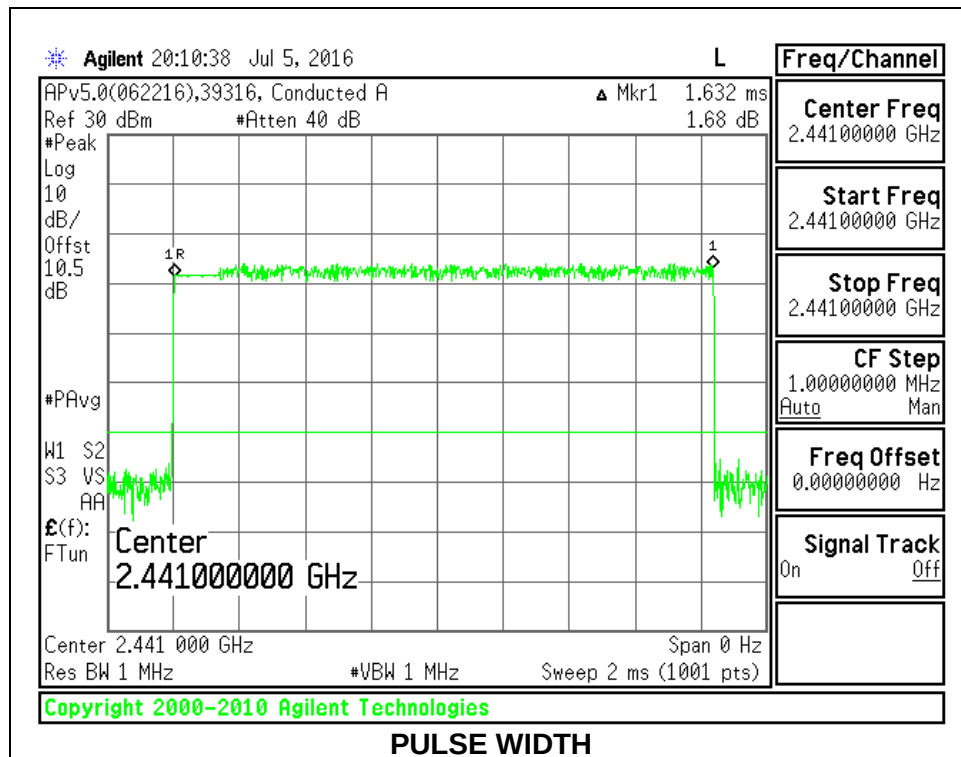
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
DH1	0.3816	32	0.122112	0.4	-0.27789
DH3	1.632	18	0.29376	0.4	-0.10624
DH5	2.88	10	0.288	0.4	-0.112

Note: for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 4.5.1 demonstrates compliance with channel occupancy when AFH is employed.

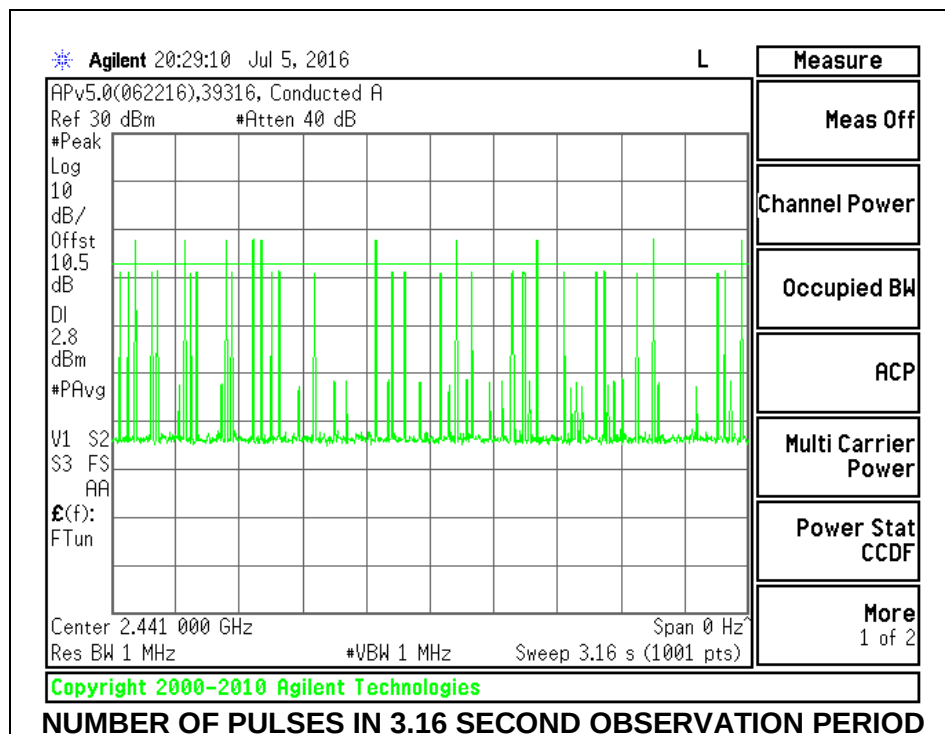
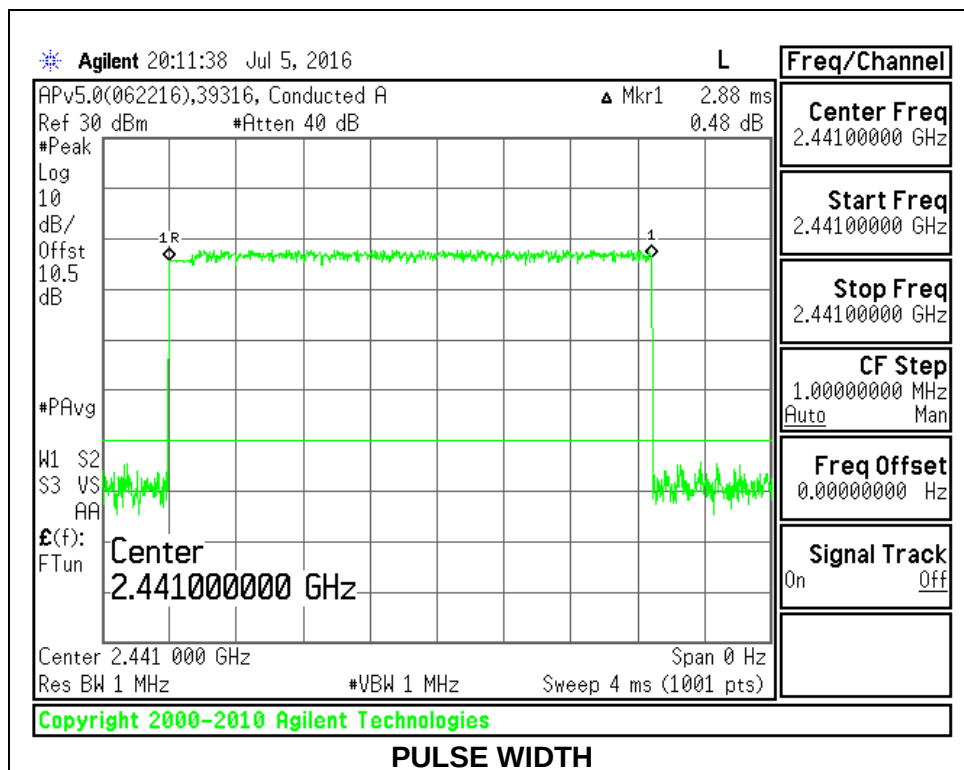
DH1 PLOTS



DH3 PLOTS



DH5 PLOTS



4.6. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-247 5.4.2

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 wideband peak power meter

RESULTS

Tested by:	37699 CS
Date:	7/7/2016

Mode	Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
GFSK	Low	2402	5.65	21	-15.35
	Middle	2441	5.37	21	-15.63
	High	2480	5.1	21	-15.9
DQPSK	Low	2402	5.24	21	-15.76
	Middle	2441	4.99	21	-16.01
	High	2480	5.63	21	-15.37
8PSK	Low	2402	5.33	21	-15.67
	Middle	2441	5.03	21	-15.97
	High	2480	5.65	21	-15.35

4.7. 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 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Tested By:	39316 CX
Date:	7/1/2016

Mode	Channel	Frequency (MHz)	Average Power (dBm)
GFSK	Low	2402	5.6
	Middle	2441	5.33
	High	2480	5.01
DQPSK	Low	2402	5.21
	Middle	2441	4.94
	High	2480	5.6
8PSK	Low	2402	5.26
	Middle	2441	4.97
	High	2480	5.62

4.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 5.5

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.

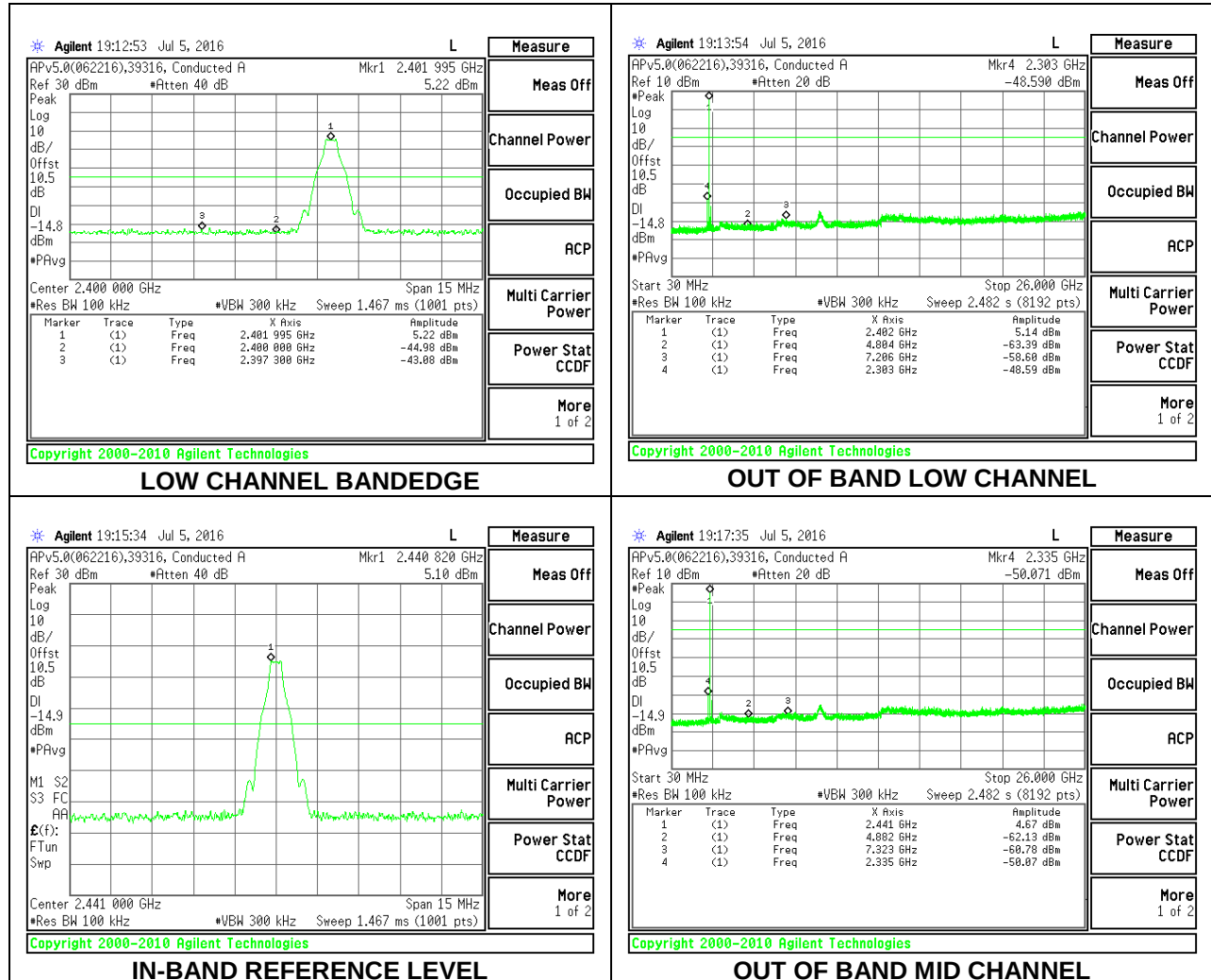
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

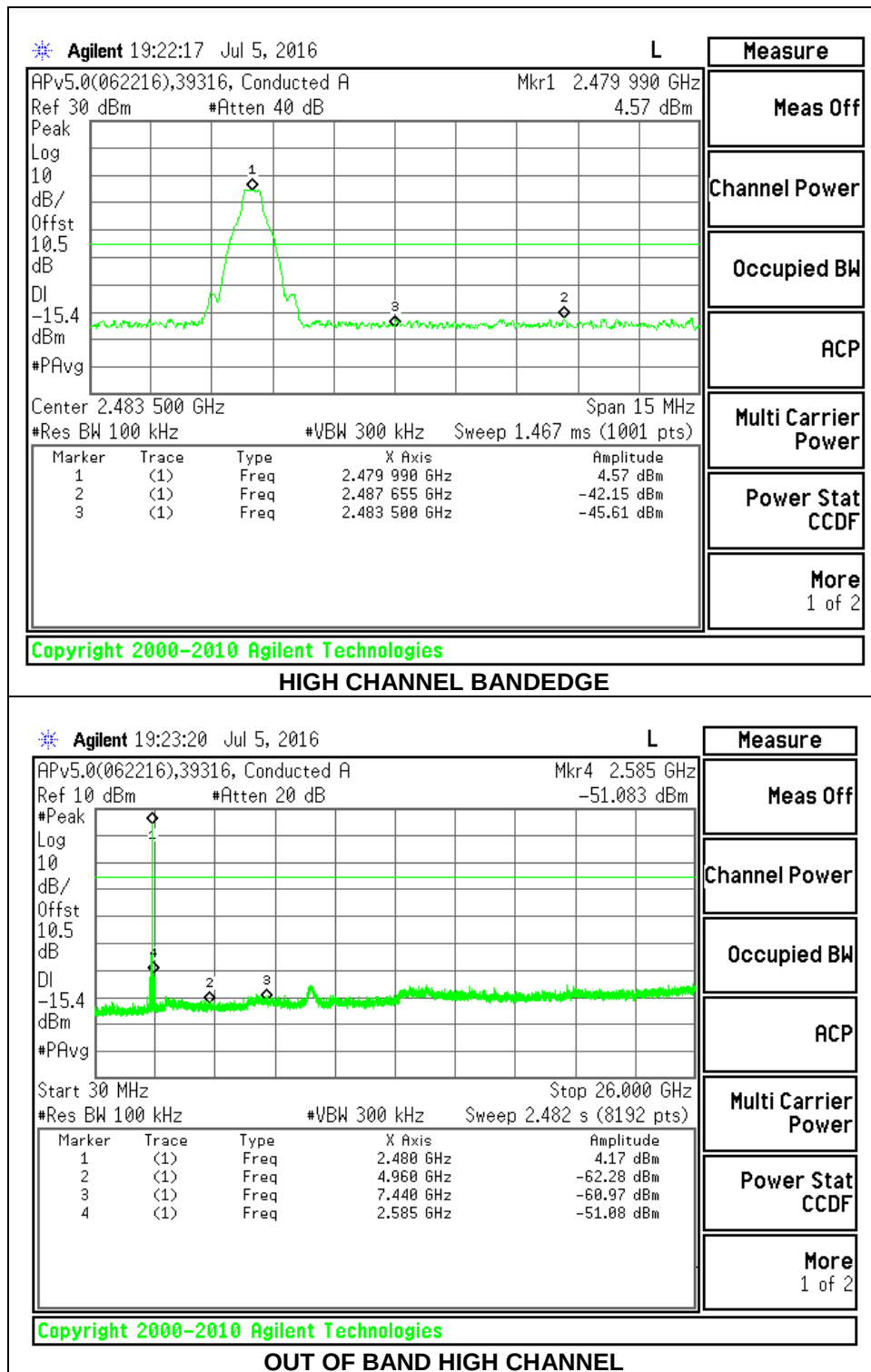
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

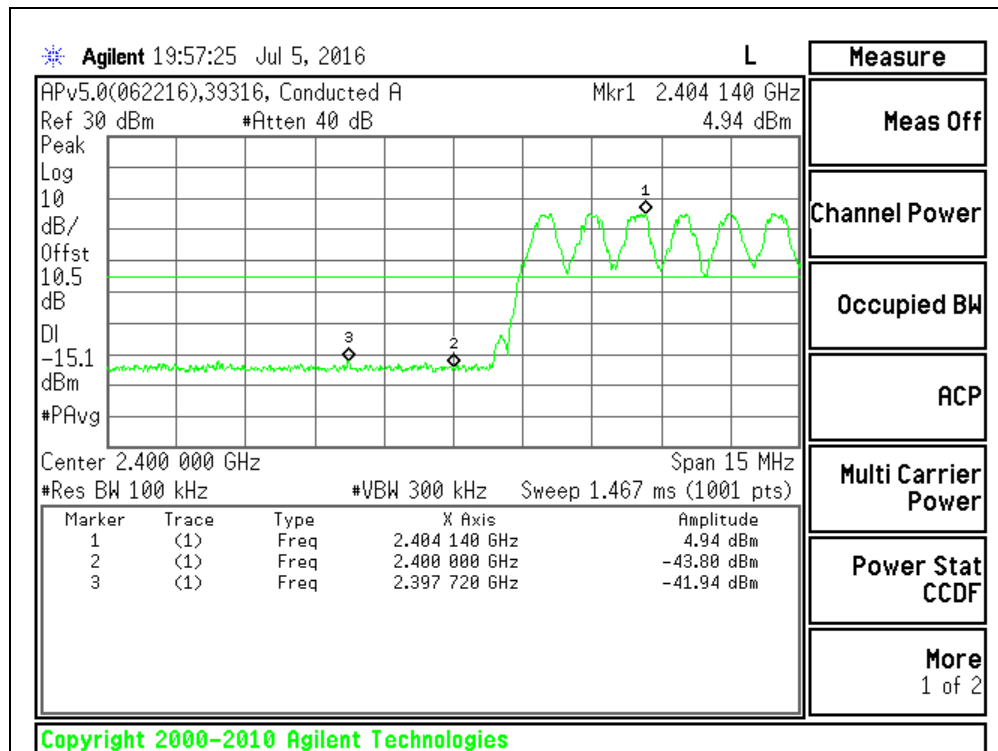
4.8.1. BASIC DATA RATE GFSK MODULATION

SPURIOUS EMISSIONS, NON HOPPING

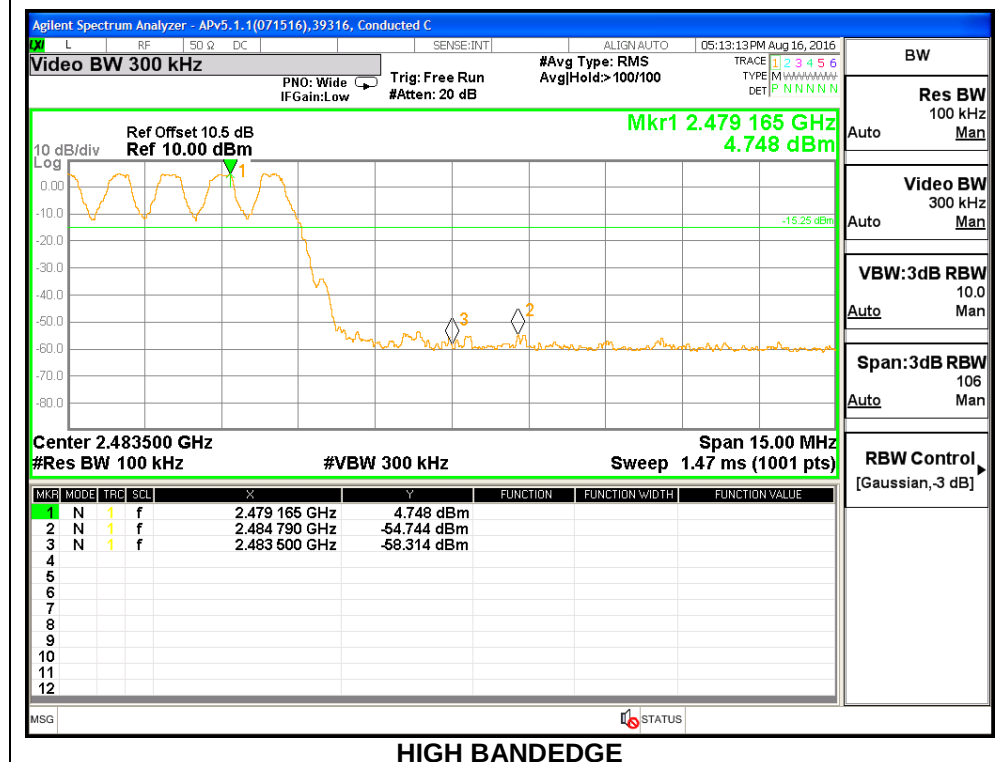




SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



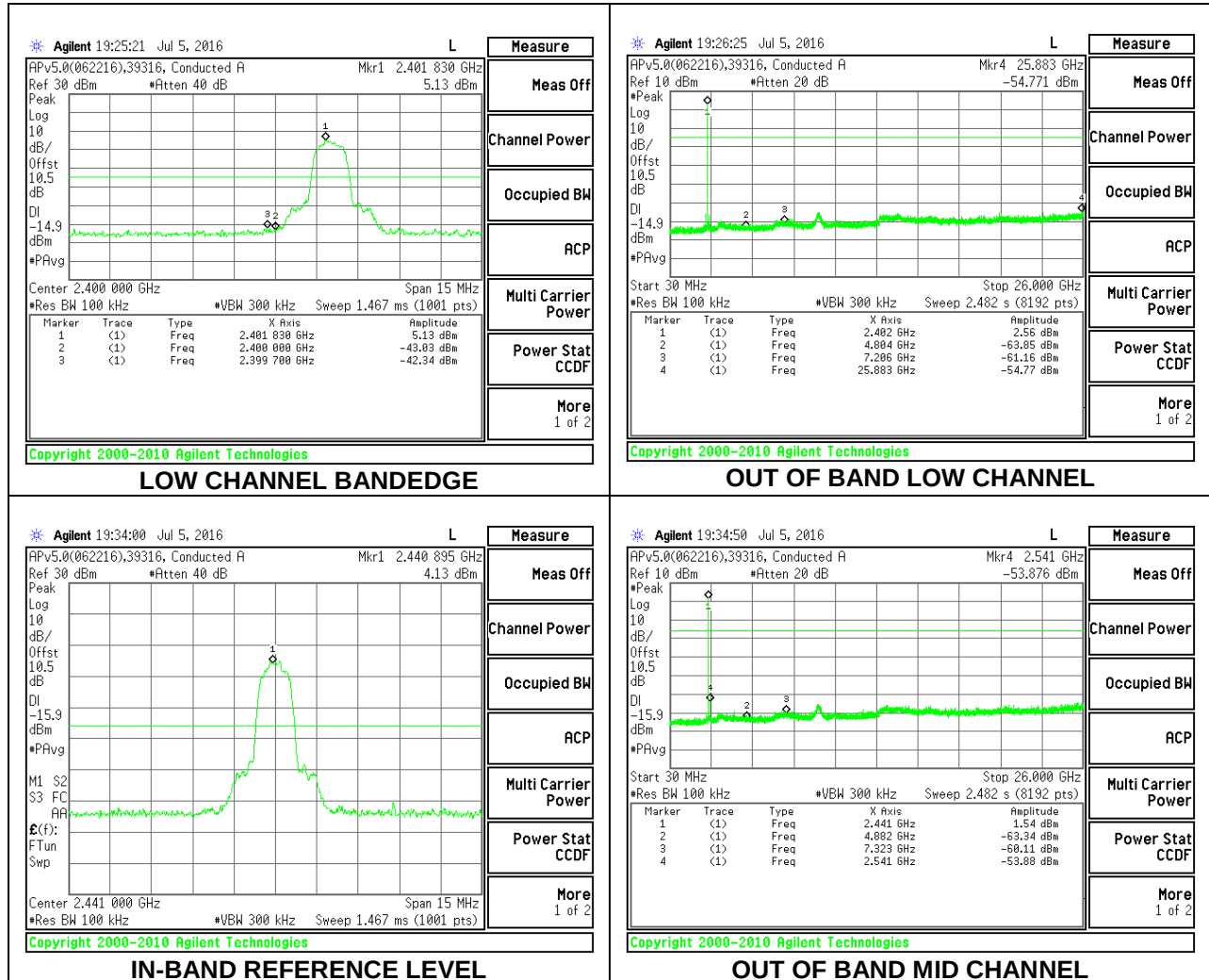
LOW BANDEDGE

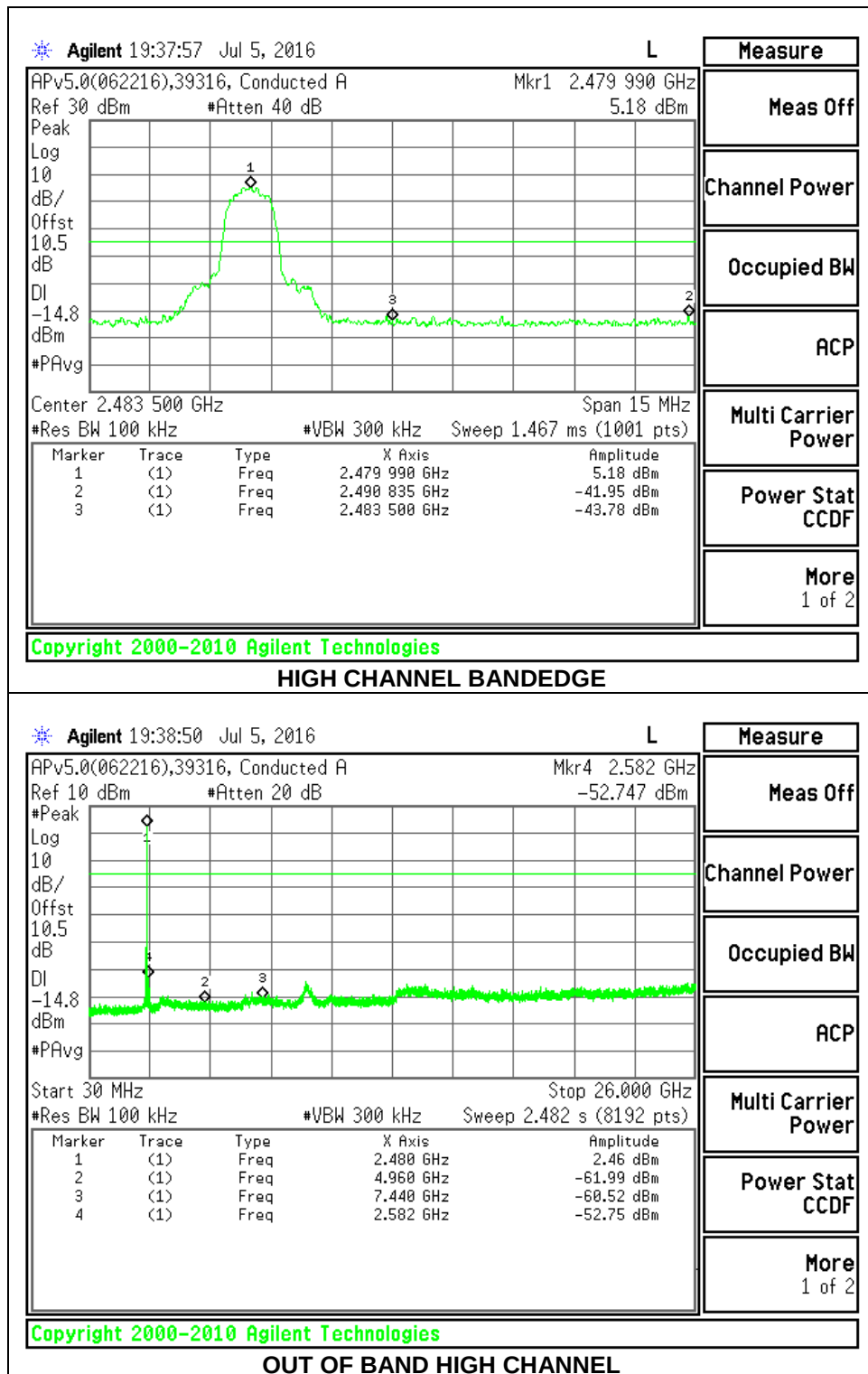


HIGH BANDEDGE

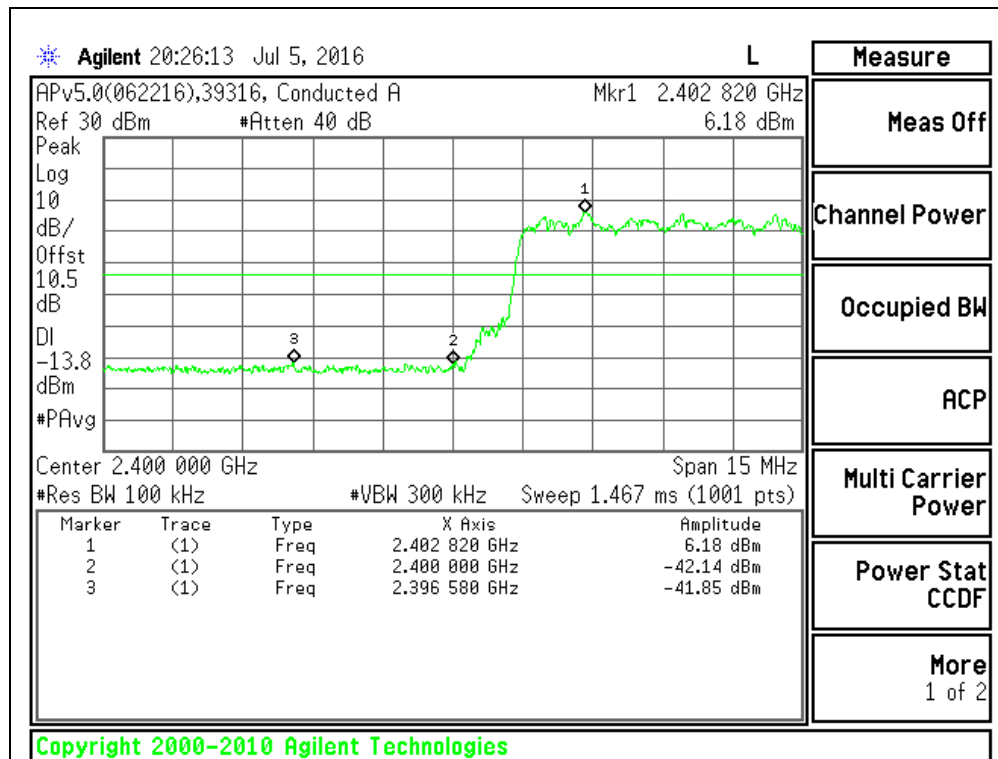
4.8.2. ENHANCED DATA RATE 8PSK MODULATION

SPURIOUS EMISSIONS, NON HOPPING

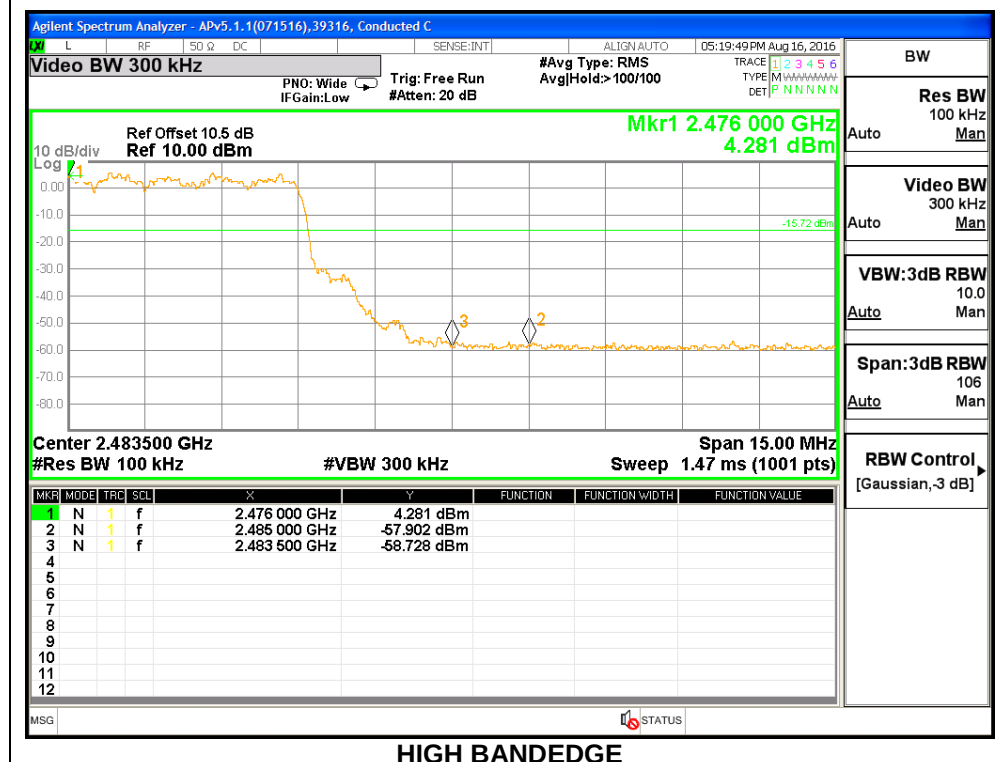




SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



LOW BANDEDGE



5. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN Clause 8.9 (Transmitter)

IC RSS-GEN Clause 7 (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 for below 1GHz and 150cm for above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. 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 measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T (360 Hz) video bandwidth with peak detector for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

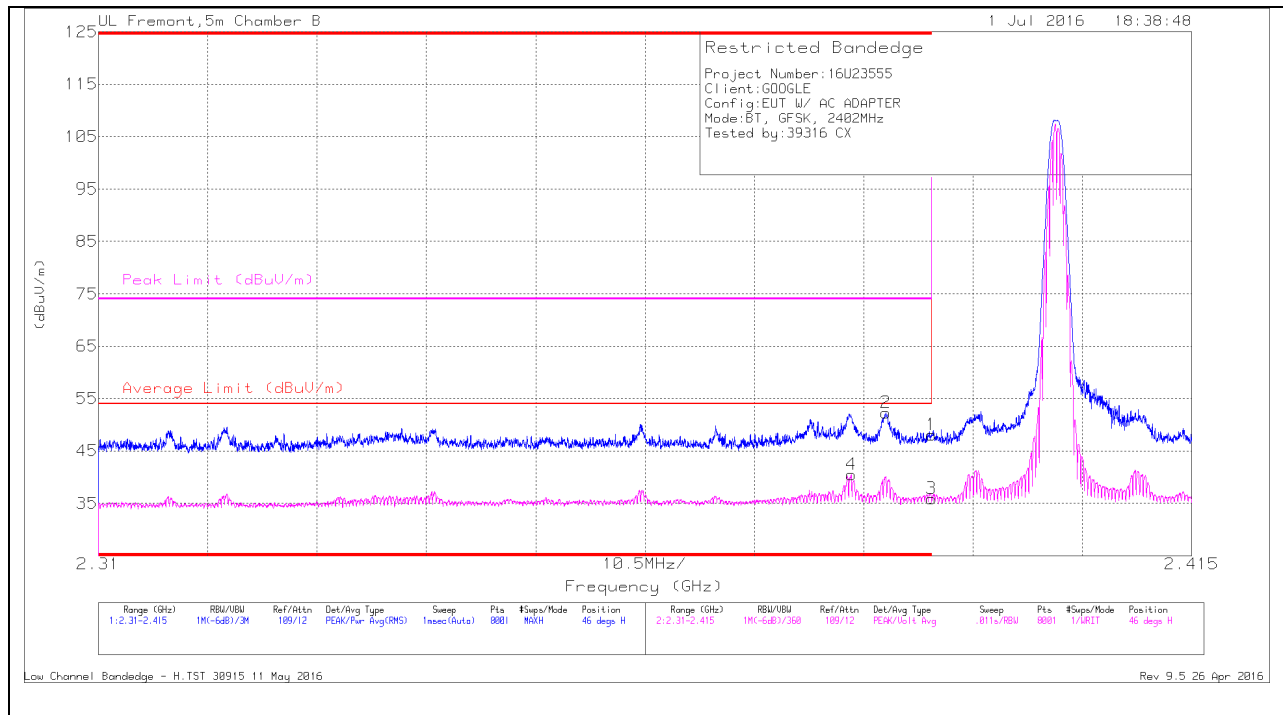
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

5.1. TRANSMITTER ABOVE 1 GHz

5.1.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULTS



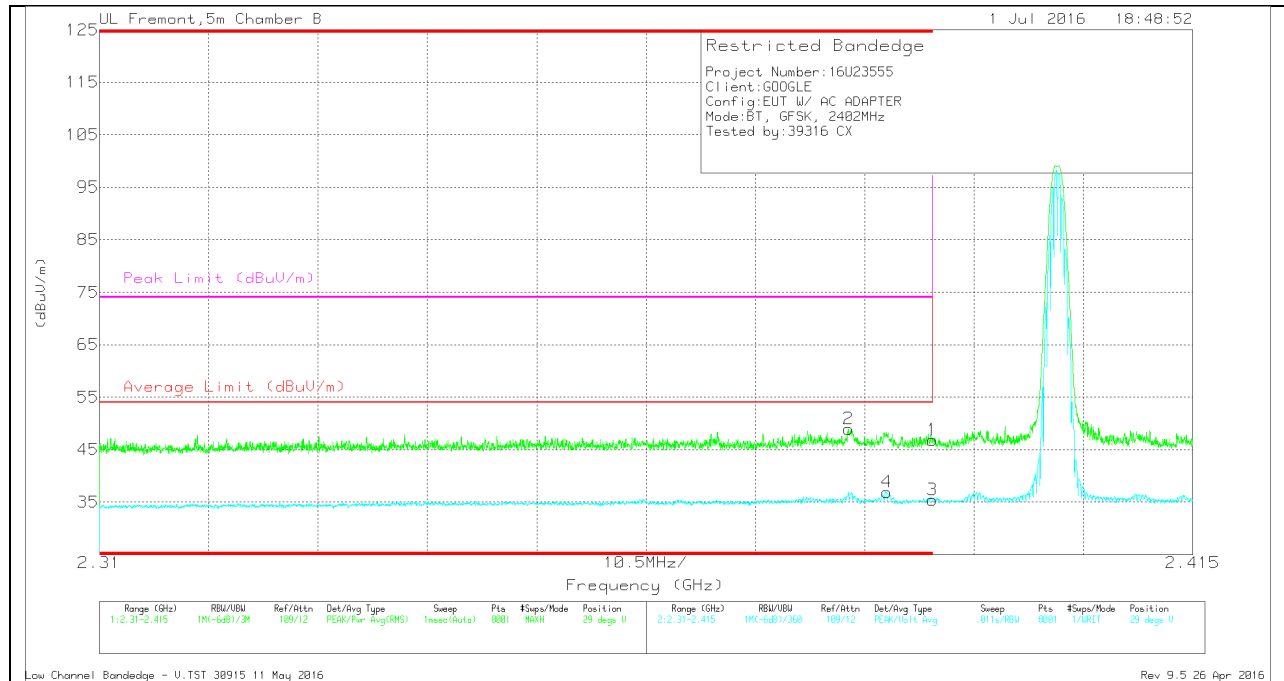
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.2	Pk	32.1	-22.3	48	-	-	74	-26	46	103	H
2	* 2.386	42.48	Pk	32.1	-22.3	52.28	-	-	74	-21.72	46	103	H
3	* 2.39	26.04	VA1T	32.1	-22.3	35.84	54	-18.16	-	-	46	103	H
4	* 2.382	30.78	VA1T	32.1	-22.4	40.48	54	-13.52	-	-	46	103	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

VERTICAL RESULTS



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
2	* 2.382	39.23	Pk	32.1	-22.4	48.93	-	-	74	-25.07	29	339	V
4	* 2.386	27.1	VA1T	32.1	-22.3	36.9	54	-17.1	-	-	29	339	V
1	* 2.39	36.98	Pk	32.1	-22.3	46.78	-	-	74	-27.22	29	339	V
3	* 2.39	25.57	VA1T	32.1	-22.3	35.37	54	-18.63	-	-	29	339	V

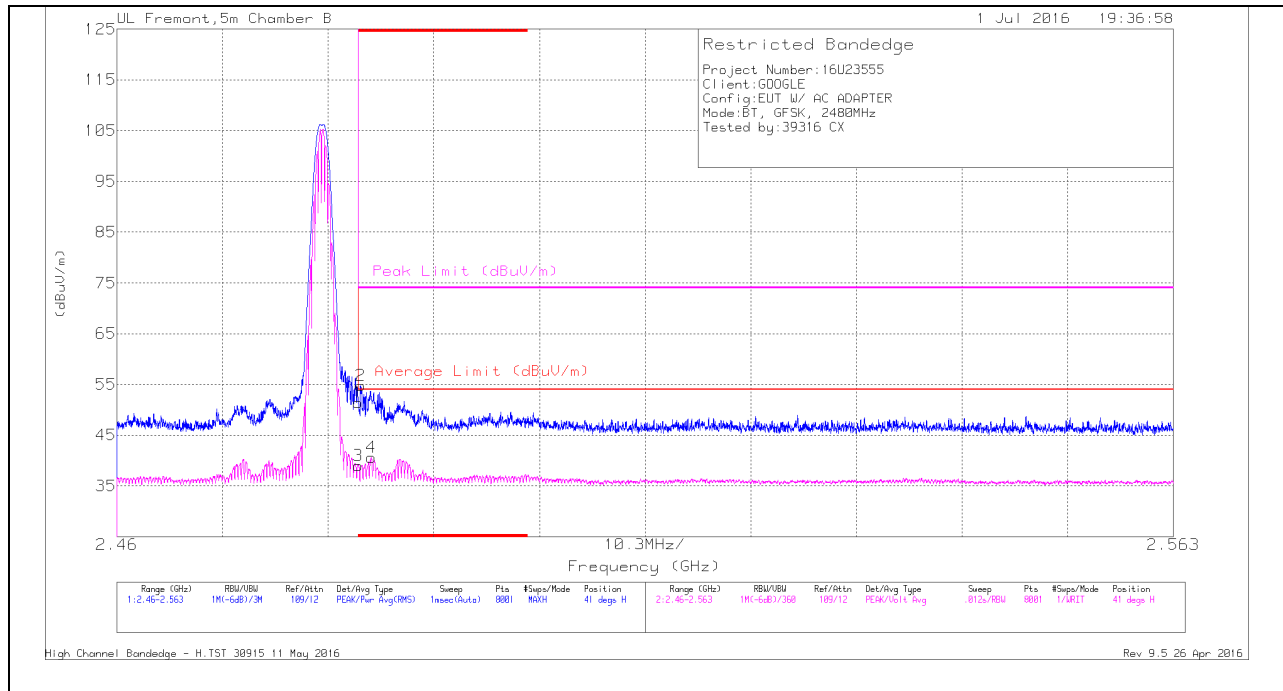
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

AUTHORIZED BANDEGE (HIGH CHANNEL)

HORIZONTAL RESULTS



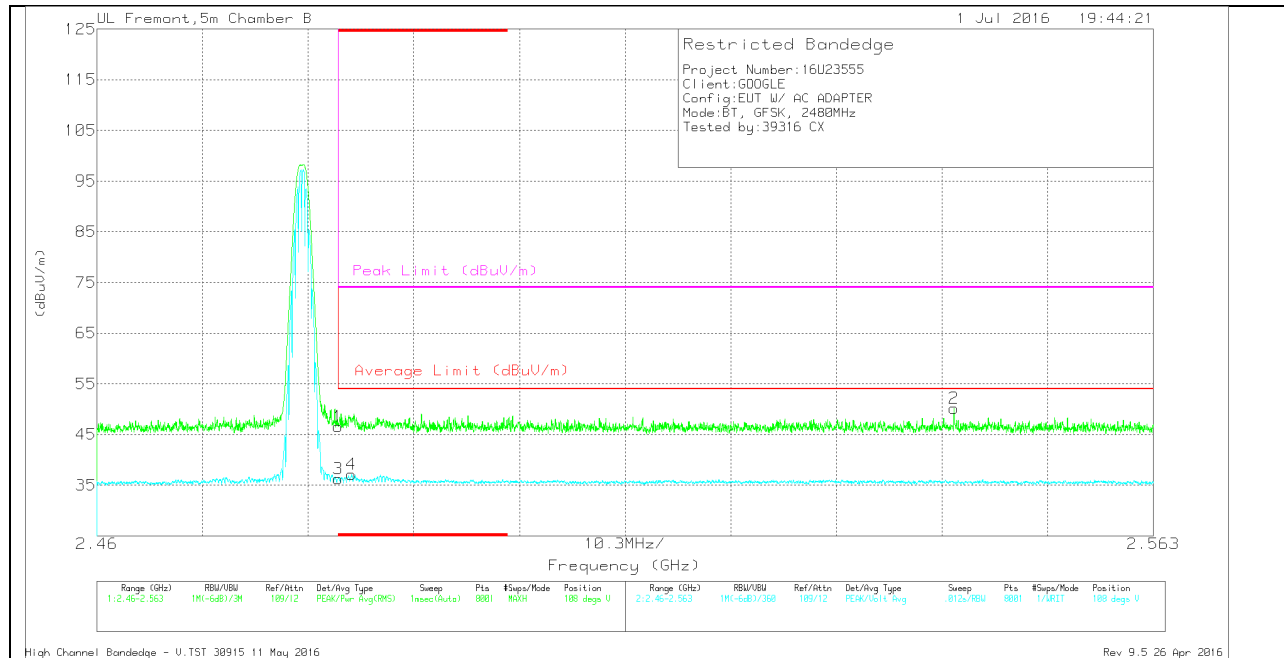
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Ampl/Cbl/Ftr/P ad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.43	Pk	32.3	-22.3	51.43	-	-	74	-22.57	41	308	H
2	* 2.484	44.76	Pk	32.3	-22.3	54.76	-	-	74	-19.24	41	308	H
3	* 2.484	29.02	VA1T	32.3	-22.3	39.02	54	-14.98	-	-	41	308	H
4	* 2.485	30.53	VA1T	32.3	-22.2	40.63	54	-13.37	-	-	41	308	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

VERTICAL RESULTS



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Ftrl/P ad (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	36.57	Pk	32.3	-22.3	46.57	-	-	74	-27.43	108	311	V
3	* 2.484	26.3	VA1T	32.3	-22.3	36.3	54	-17.7	-	-	108	310	V
4	* 2.485	27.04	VA1T	32.3	-22.2	37.14	54	-16.86	-	-	108	310	V
2	2.544	40.03	Pk	32.3	-22.2	50.13	-	-	74	-23.87	108	311	V

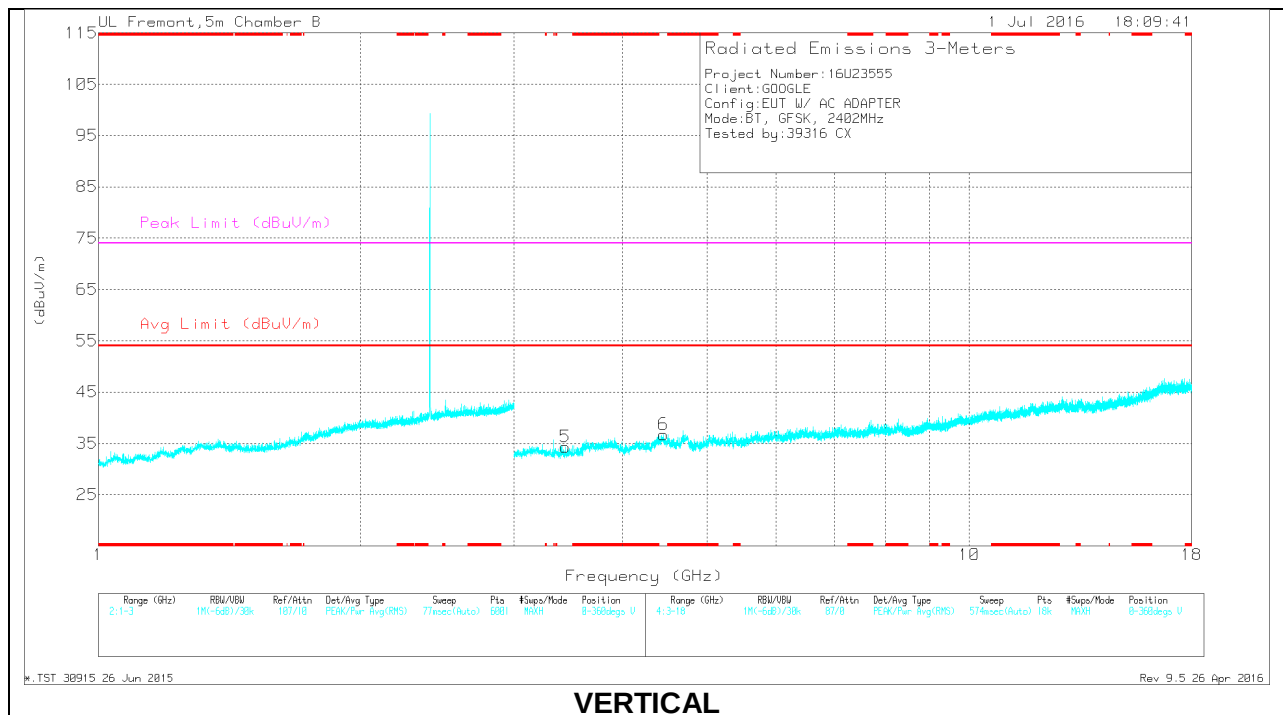
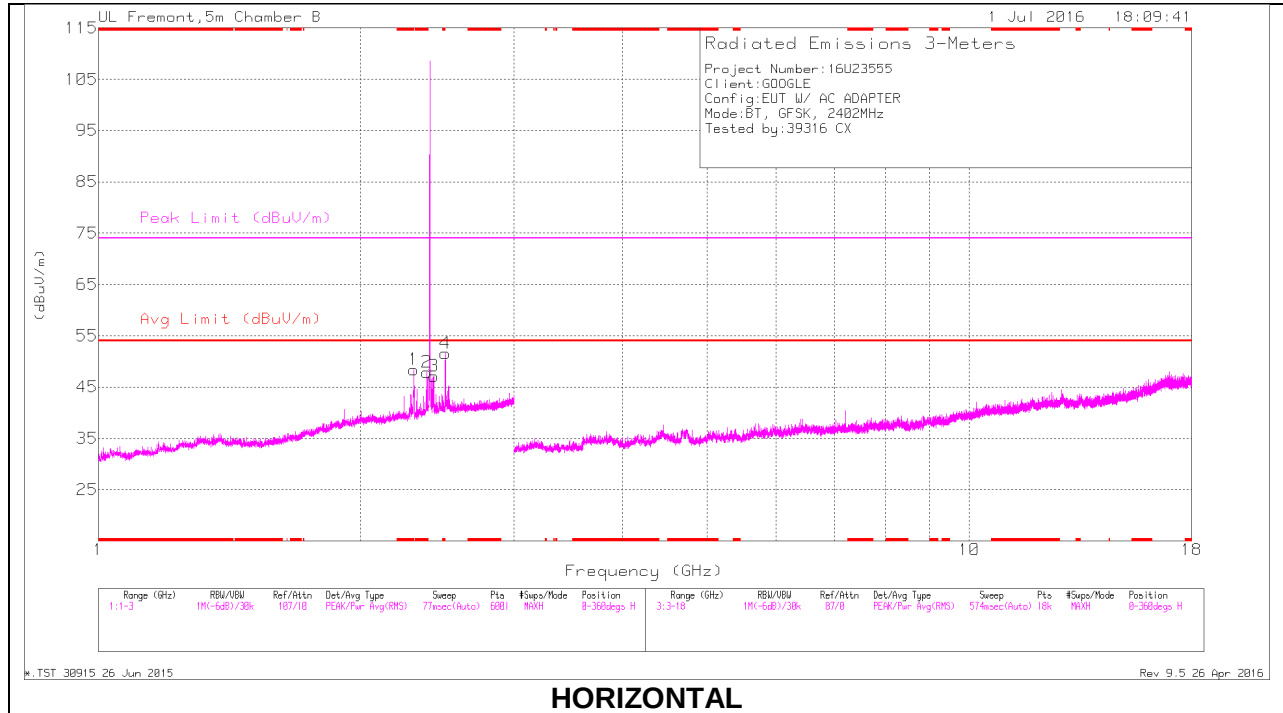
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



LOW CHANNEL DATA

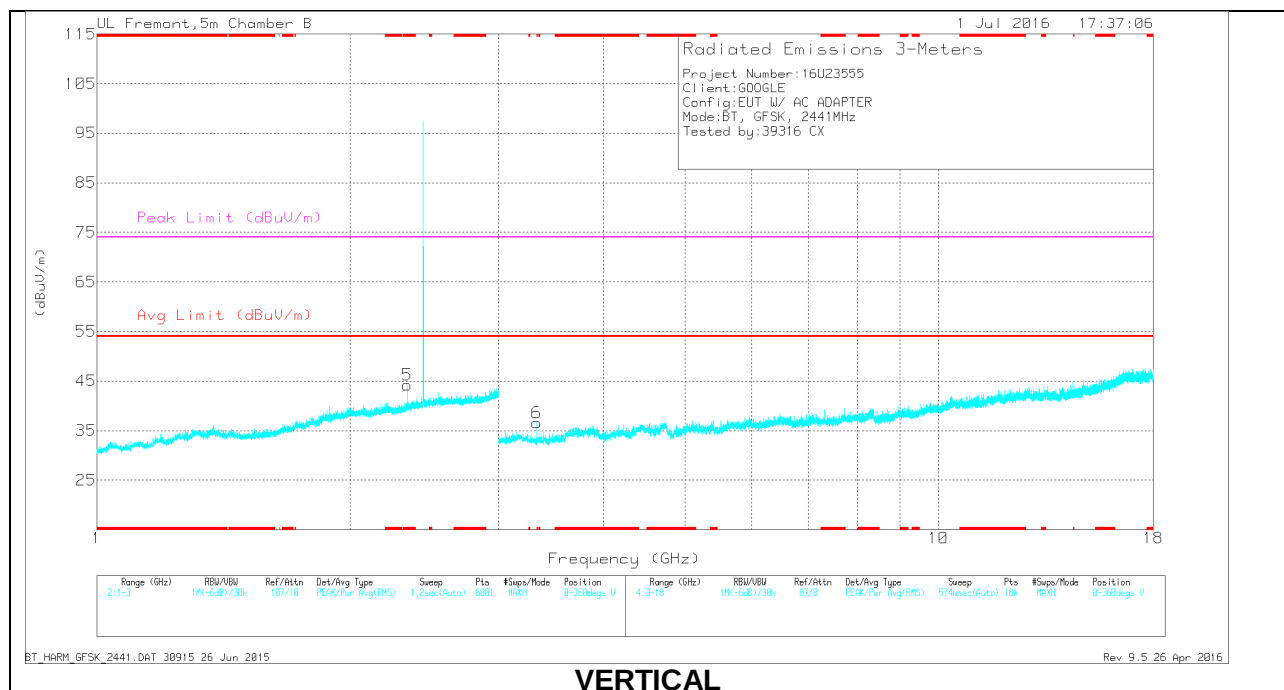
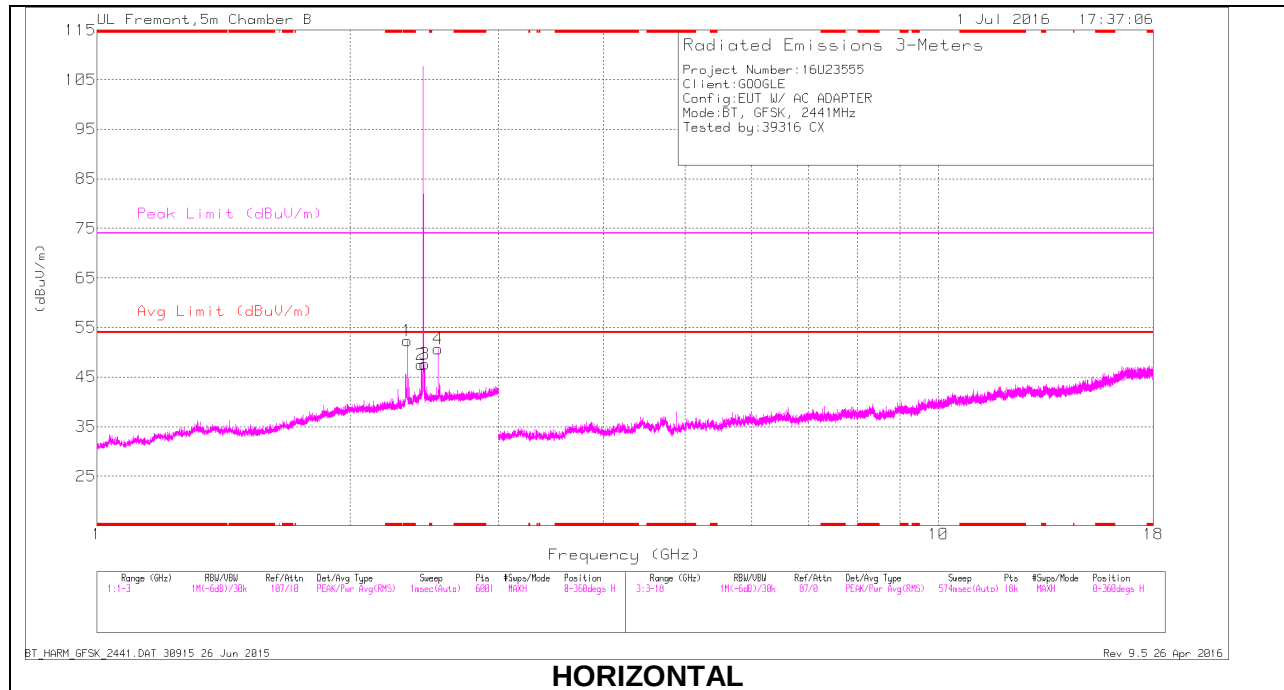
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.386	40.55	PKFH	32.1	-22.3	50.35	-	-	74	-23.65	37	161	H
	* 2.386	29.07	VA1T	32.1	-22.3	38.87	54	-15.13	-	-	37	161	H
1	2.301	39.21	Pk	31.5	-22.3	48.41	-	-	-	-	0-360	101	H
3	2.426	37.25	Pk	32.2	-22.3	47.15	-	-	-	-	0-360	199	H
4	2.502	41.58	Pk	32.3	-22.3	51.58	-	-	-	-	0-360	101	H
5	3.437	34.71	Pk	32.8	-33.2	34.31	-	-	-	-	0-360	101	V
6	4.453	33.58	Pk	34	-30.9	36.68	-	-	-	-	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

MID CHANNEL RESULTS



MID CHANNEL DATA

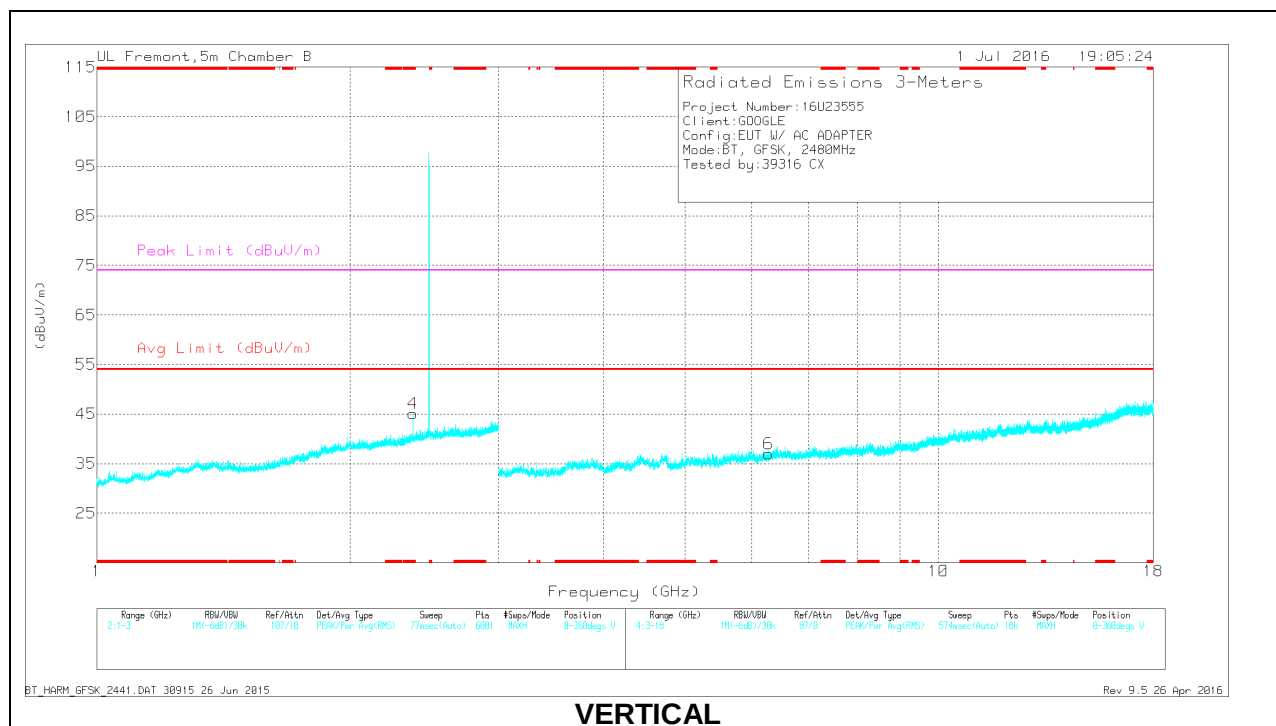
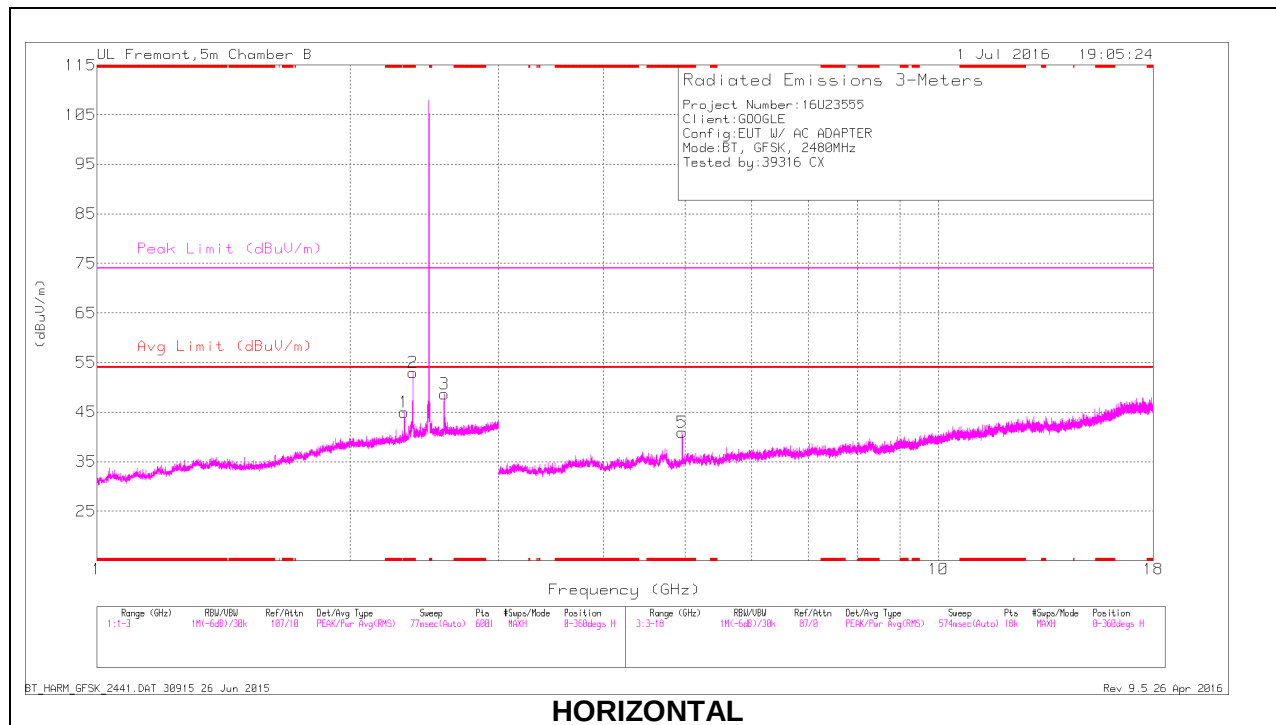
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.339	45.03	PKFH	31.8	-22.3	54.53	-	-	74	-19.47	37	176	H
	* 2.337	34.14	VA1T	31.7	-22.4	43.44	54	-10.56	-	-	37	176	H
5	* 2.339	41.4	PKFH	31.8	-22.3	50.9	-	-	74	-23.1	357	345	V
	* 2.339	29.79	VA1T	31.8	-22.3	39.29	54	-14.71	-	-	357	345	V
6	* 3.333	41.9	PKFH	32.6	-32.8	41.7	-	-	74	-32.3	154	297	V
	* 3.333	32.69	VA1T	32.6	-32.8	32.49	54	-21.51	-	-	154	297	V
2	2.428	37.67	Pk	32.2	-22.4	47.47	-	-	-	-	0-360	225	H
3	2.454	37.77	Pk	32.2	-22.3	47.67	-	-	-	-	0-360	225	H
4	2.544	40.61	Pk	32.3	-22.2	50.71	-	-	-	-	0-360	101	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HIGH CHANNEL RESULTS



HIGH CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Fitr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.32	40.77	PKFH	31.6	-22.4	49.97	-	-	74	-24.03	41	140	H
	* 2.32	24.04	VA1T	31.6	-22.4	33.24	54	-20.76	-	-	41	140	H
2	* 2.375	45.6	PKFH	32	-22.3	55.3	-	-	74	-18.7	39	136	H
	* 2.374	36.19	VA1T	32	-22.2	45.99	54	-8.01	-	-	39	136	H
4	* 2.374	41.09	PKFH	32	-22.2	50.89	-	-	74	-23.11	0	344	V
	* 2.374	30	VA1T	32	-22.2	39.8	54	-14.2	-	-	0	344	V
5	* 4.96	44.42	PKFH	34	-32.2	46.22	-	-	74	-27.78	116	115	H
	* 4.96	38.13	VA1T	34	-32.2	39.93	54	-14.07	-	-	116	115	H
3	2.586	38.6	Pk	32.2	-22.2	48.6	-	-	-	-	0-360	101	H
6	6.278	32.46	Pk	35.5	-31	36.96	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

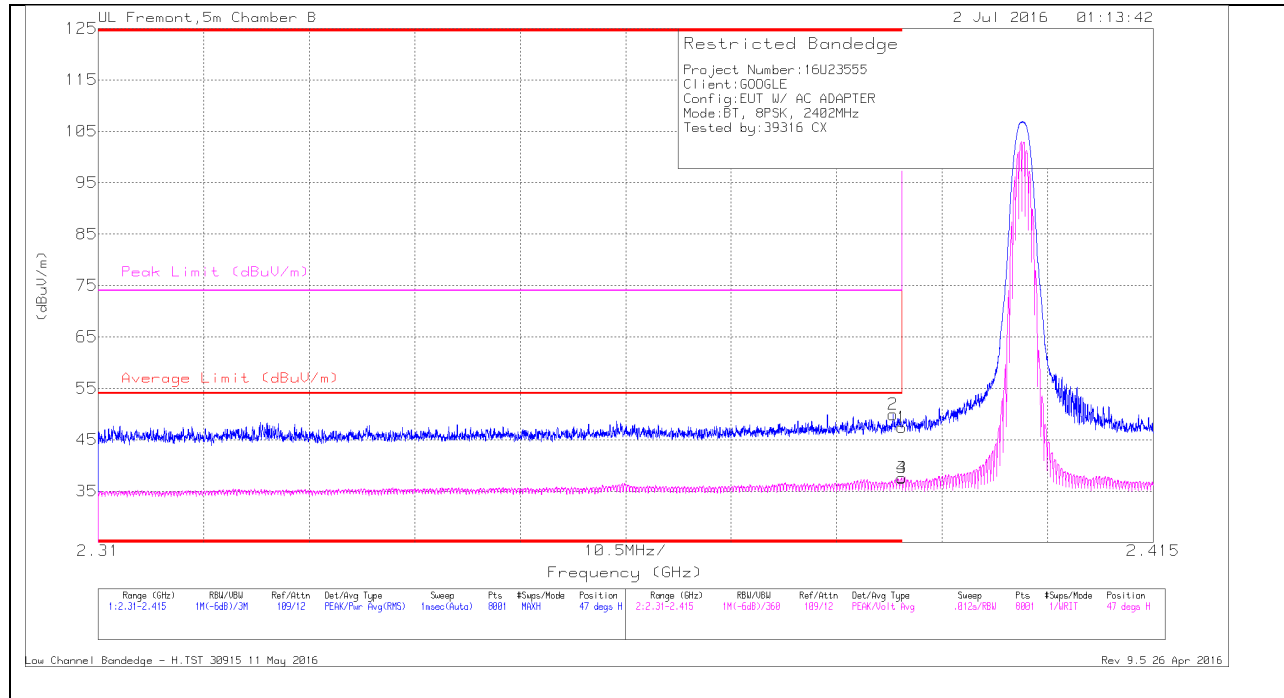
PKFH - FHSS: RB=1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

5.1.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULTS



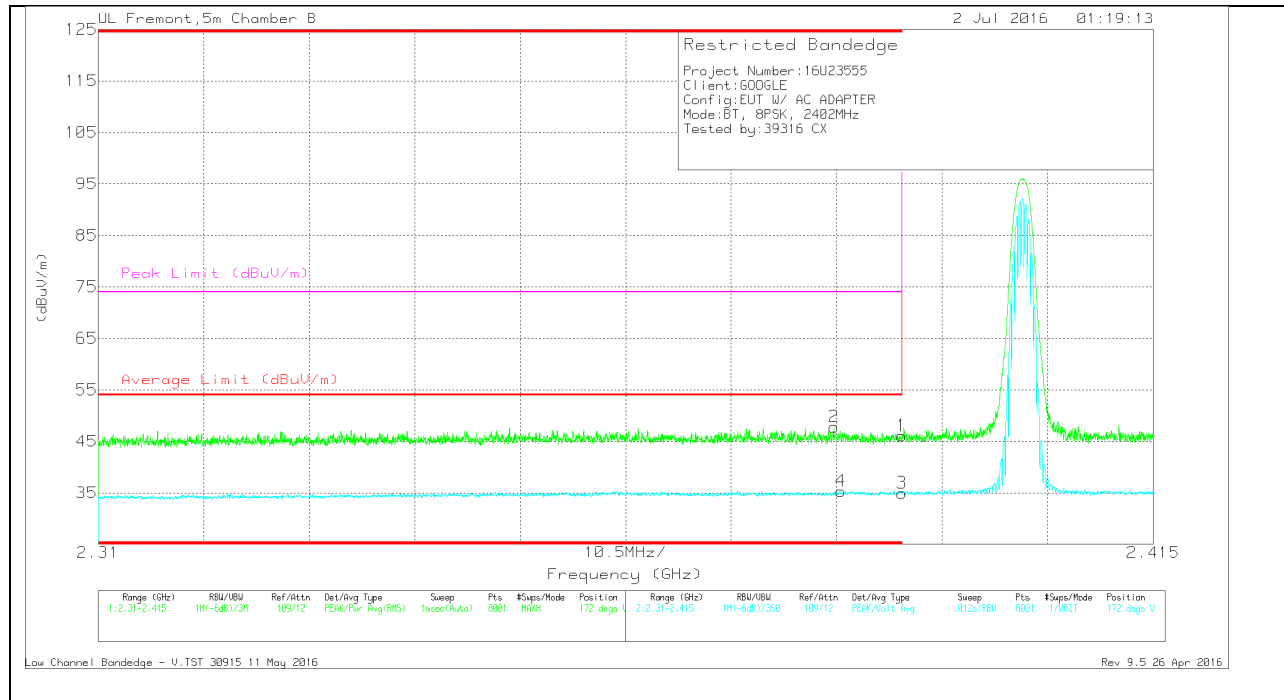
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dBm)	Amp/Cbl/Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	37.57	Pk	32.1	-22.3	47.37	-	-	74	-26.63	47	264	H
2	* 2.389	40.12	Pk	32.1	-22.3	49.92	-	-	74	-24.08	47	264	H
3	* 2.39	27.78	VA1T	32.1	-22.3	37.58	54	-16.42	-	-	47	264	H
4	* 2.39	27.82	VA1T	32.1	-22.3	37.62	54	-16.38	-	-	47	264	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

VERTICAL RESULTS



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dBm)	Amp/Cbl/Ftr/P ad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	36.29	Pk	32.1	-22.3	46.09	-	-	74	-27.91	172	309	V
2	* 2.383	38.13	Pk	32.1	-22.4	47.83	-	-	74	-26.17	172	309	V
3	* 2.39	25.17	VA1T	32.1	-22.3	34.97	54	-19.03	-	-	172	309	V
4	* 2.384	25.54	VA1T	32.1	-22.3	35.34	54	-18.66	-	-	172	309	V

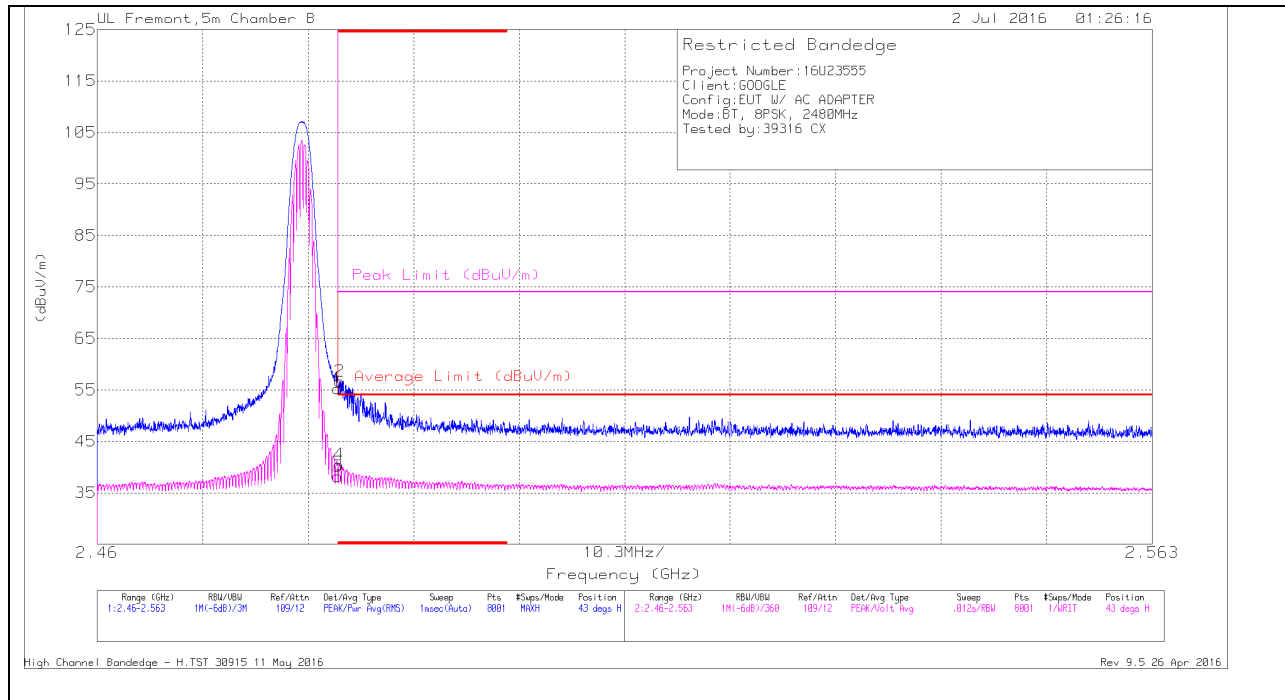
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULTS



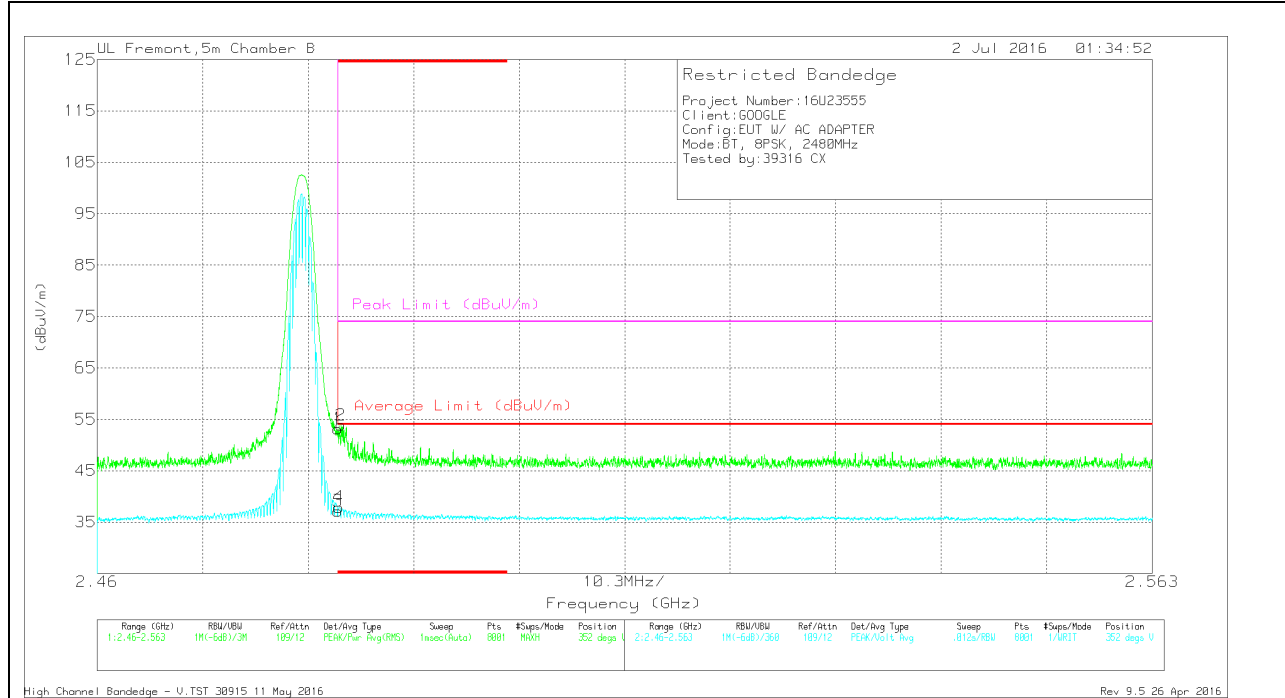
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dBm)	Ampl/Cbll/Filt/P ad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	45.27	Pk	32.3	-22.3	55.27	-	-	74	-18.73	43	311	H
2	* 2.484	46.69	Pk	32.3	-22.3	56.69	-	-	74	-17.31	43	311	H
3	* 2.484	28.18	VA1T	32.3	-22.3	38.18	54	-15.82	-	-	43	311	H
4	* 2.484	30.46	VA1T	32.3	-22.3	40.46	54	-13.54	-	-	43	311	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

VERTICAL RESULTS



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Ftr/P ad (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	43.18	Pk	32.3	-22.3	53.18	-	-	74	-20.82	352	391	V
2	* 2.484	43.85	Pk	32.3	-22.3	53.85	-	-	74	-20.15	352	391	V
3	* 2.484	27.17	VA1T	32.3	-22.3	37.17	54	-16.83	-	-	352	391	V
4	* 2.484	27.9	VA1T	32.3	-22.3	37.9	54	-16.1	-	-	352	391	V

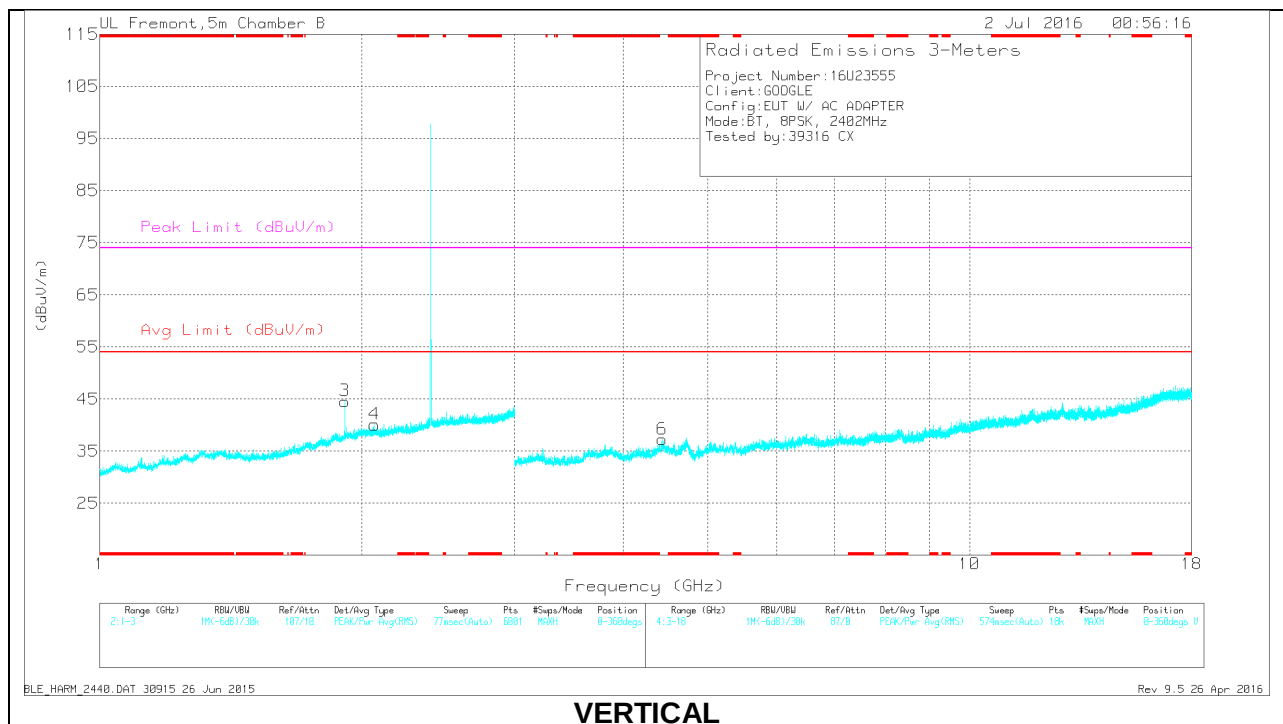
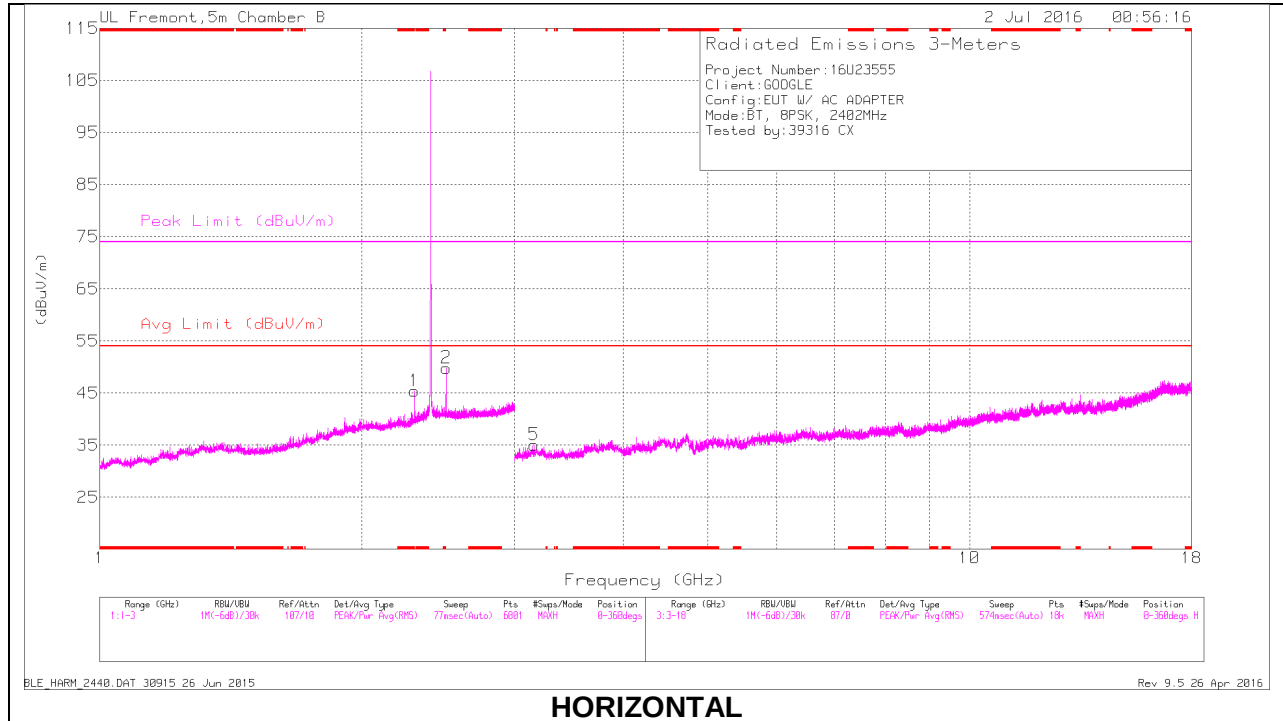
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B = 1/T_{on}$ where: T_{on} is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS

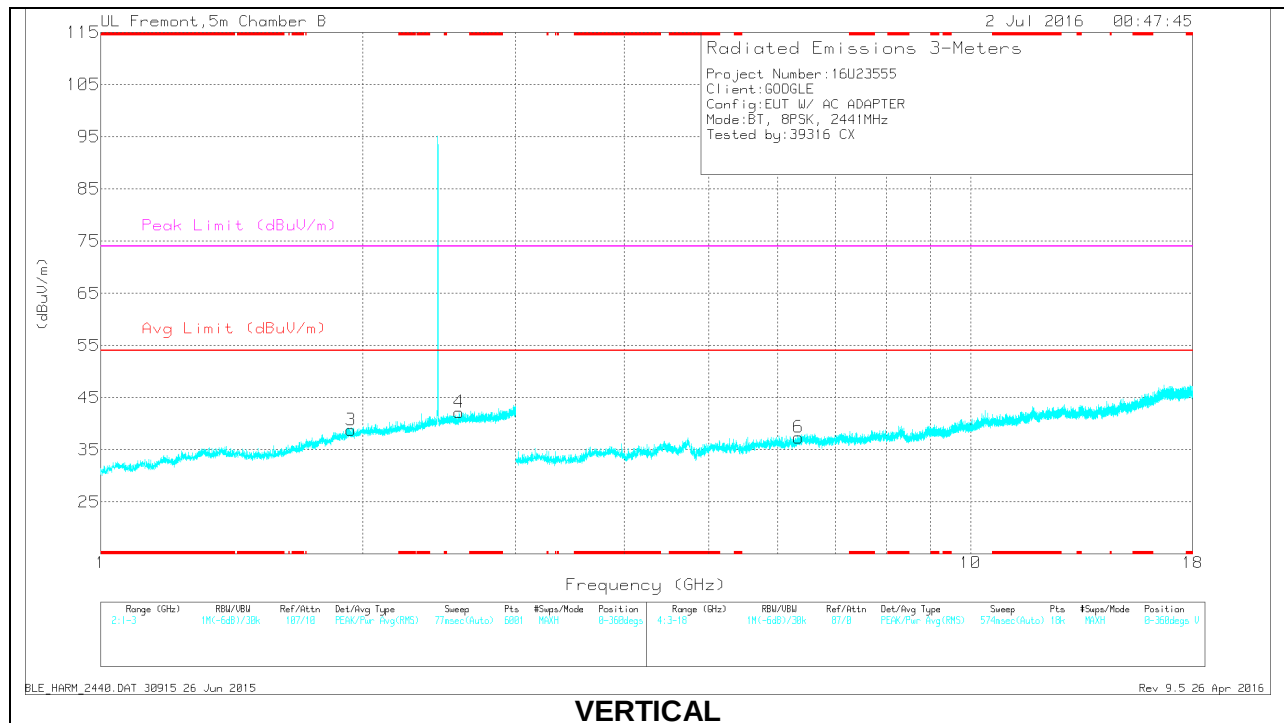
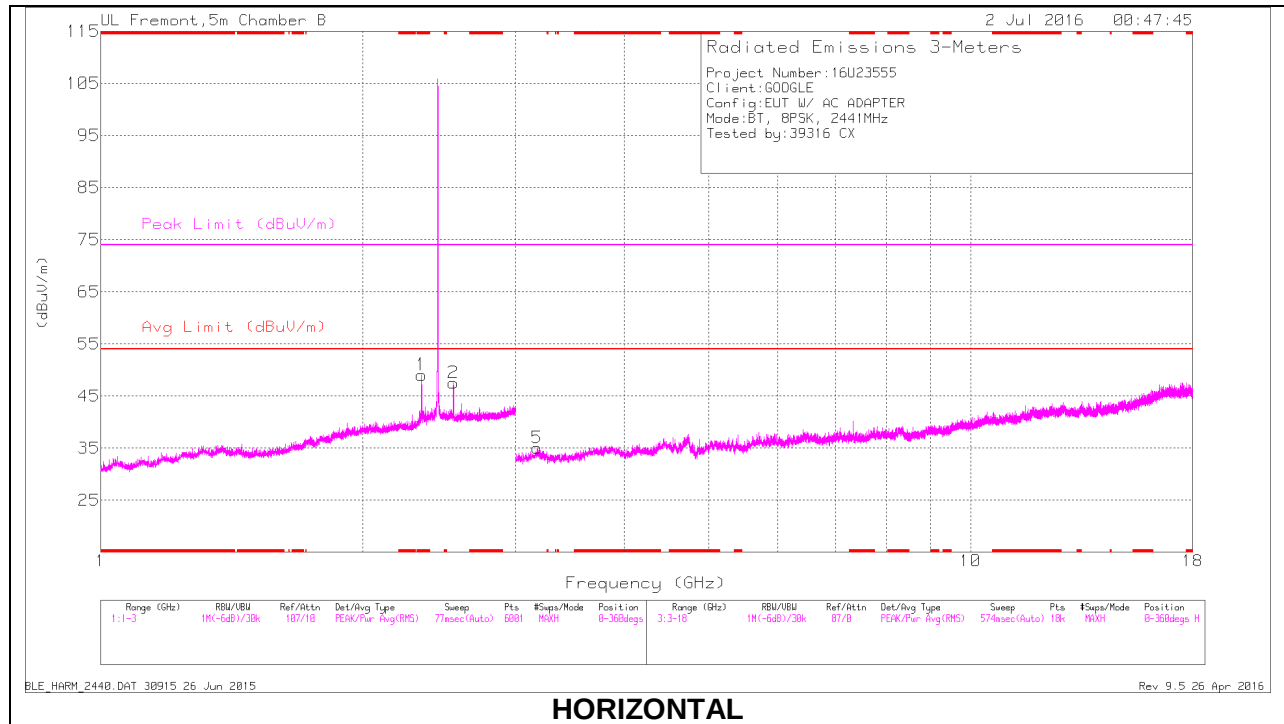


LOW CHANNEL DATA

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
3	1.914	35.79	Pk	30.9	-22.1	44.59	-	-	-	-	0-360	199	V
4	2.07	31.1	Pk	31.3	-22.3	40.1	-	-	-	-	0-360	199	V
1	2.301	36.2	Pk	31.5	-22.3	45.4	-	-	-	-	0-360	199	H
2	2.503	39.8	Pk	32.3	-22.3	49.8	-	-	-	-	0-360	199	H
5	3.157	34.47	Pk	32.9	-32.3	35.07	-	-	-	-	0-360	199	H
6	4.436	33.97	Pk	34.1	-30.8	37.27	-	-	-	-	0-360	199	V

Pk - Peak detector

MID CHANNEL RESULTS



MID CHANNEL DATA

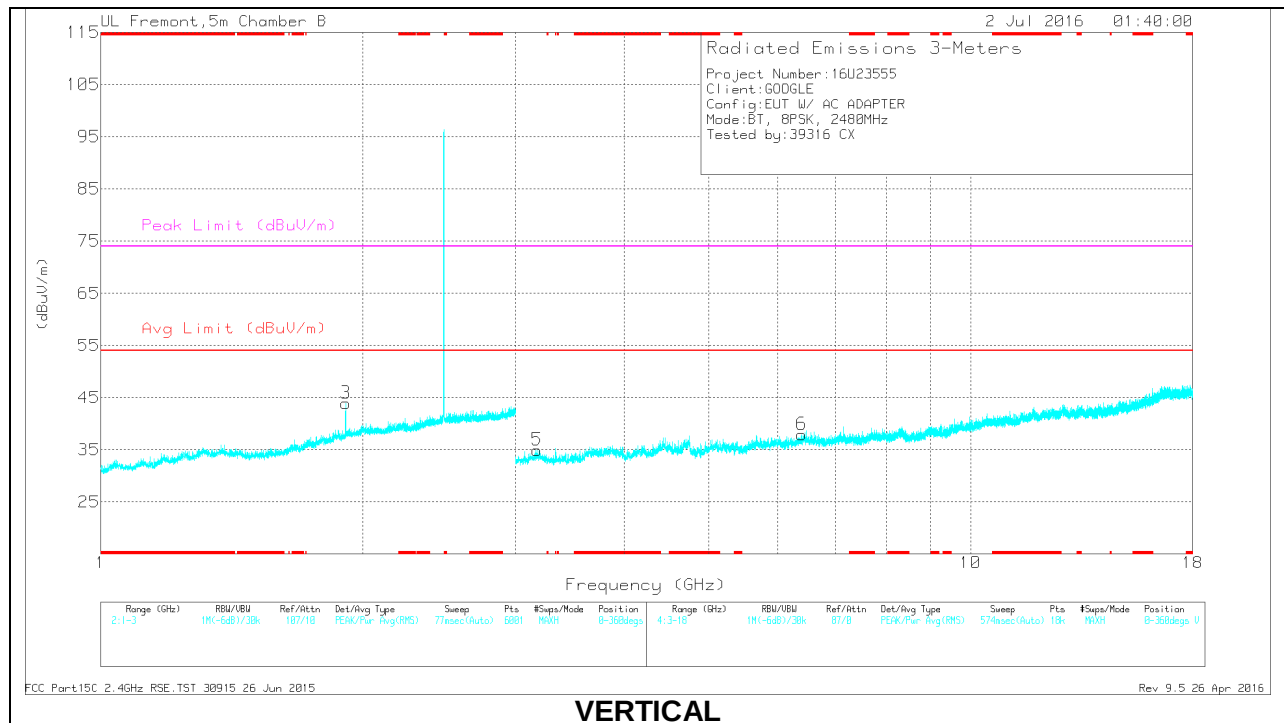
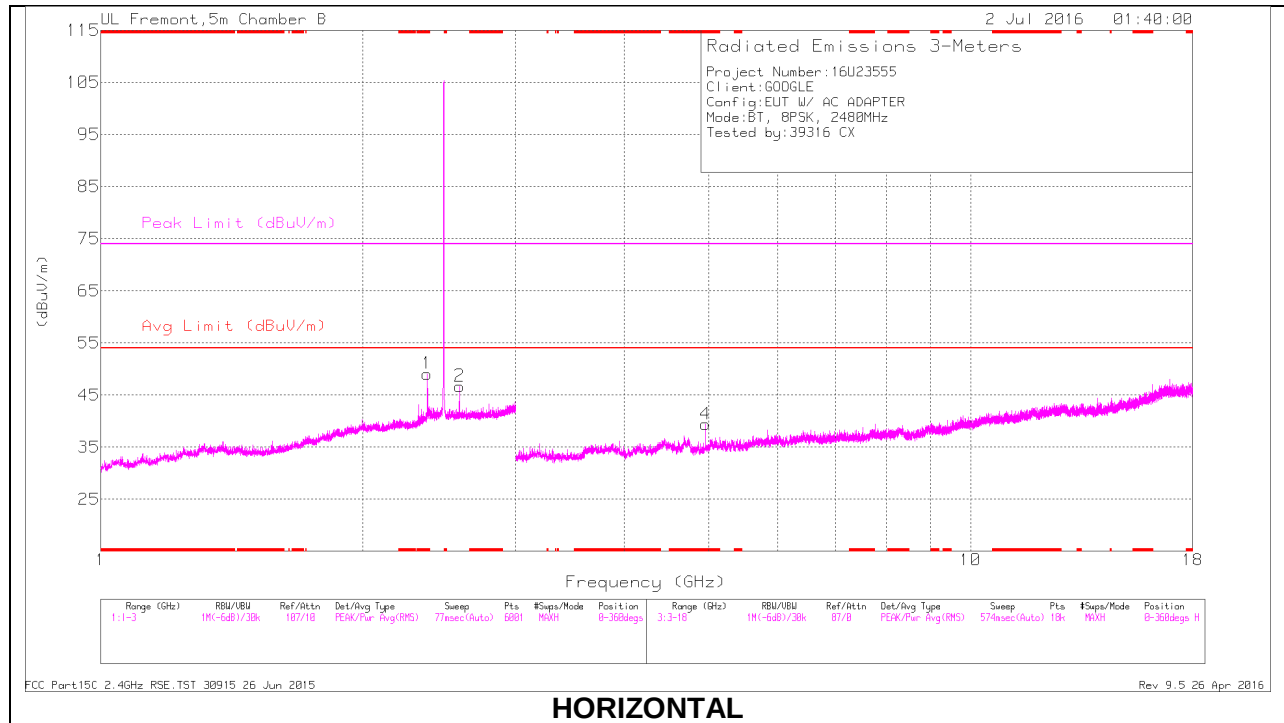
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Ampl/Cbl/Filtr/Pa d (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.338	43.19	PKFH	31.7	-22.4	52.49	-	-	74	-21.51	40	134	H
	* 2.338	28.72	VA1T	31.7	-22.4	38.02	54	-15.98	-	-	40	134	H
3	1.94	29.55	Pk	31.1	-21.9	38.75	-	-	-	-	0-360	199	V
2	2.544	37.39	Pk	32.3	-22.2	47.49	-	-	-	-	0-360	101	H
4	2.584	32.08	Pk	32.2	-22.1	42.18	-	-	-	-	0-360	199	V
5	3.177	34.32	Pk	32.9	-32.2	35.02	-	-	-	-	0-360	101	H
6	6.338	33.16	Pk	35.5	-31.3	37.36	-	-	-	-	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HIGH CHANNEL RESULTS



HIGH 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	* 2.373	45.64	PKFH	32	-22.3	55.34	-	-	74	-18.66	47	235	H
	* 2.374	29.13	VA1T	32	-22.2	38.93	54	-15.07	-	-	47	235	H
4	* 4.959	43.29	PKFH	34	-32.2	45.09	-	-	74	-28.91	117	139	H
	* 4.96	35.52	VA1T	34	-32.2	37.32	54	-16.68	-	-	117	139	H
3	1.914	35.13	Pk	30.9	-22.1	43.93	-	-	-	-	0-360	101	V
2	2.587	36.69	Pk	32.2	-22.2	46.69	-	-	-	-	0-360	290	H
5	3.175	34.26	Pk	32.9	-32.2	34.96	-	-	-	-	0-360	199	V
6	6.392	33.96	Pk	35.6	-31.6	37.96	-	-	-	-	0-360	101	V

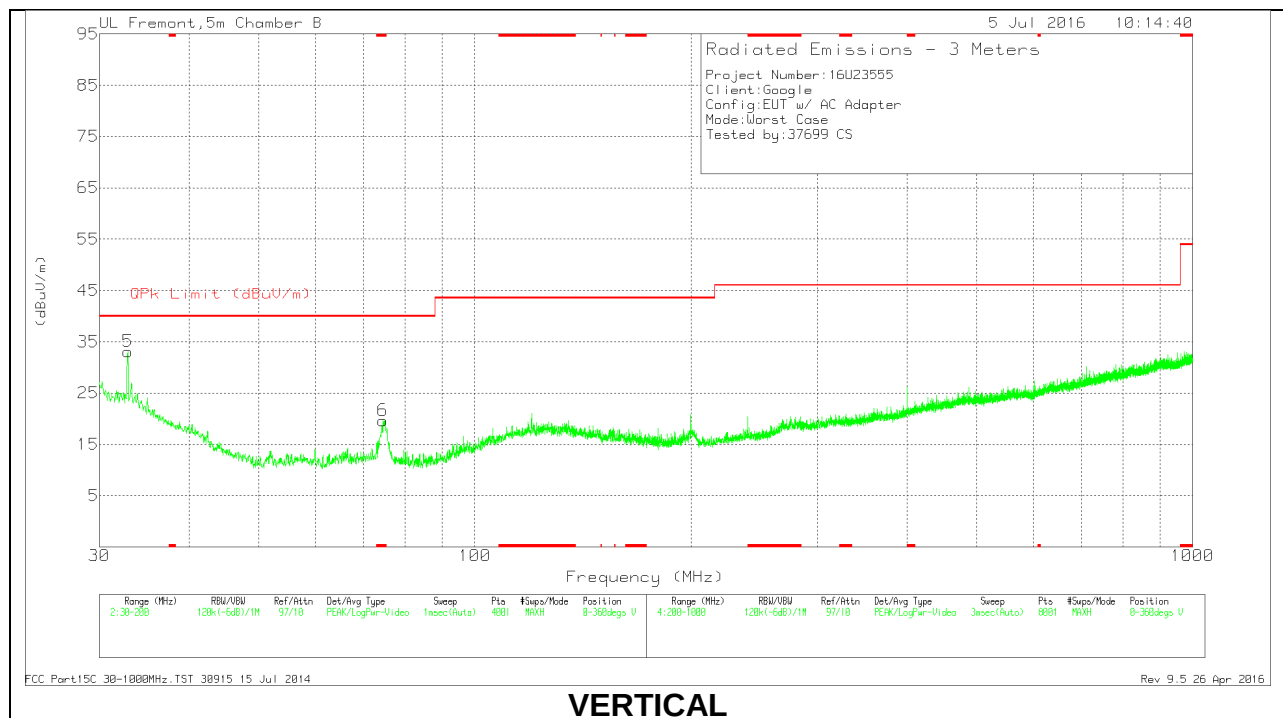
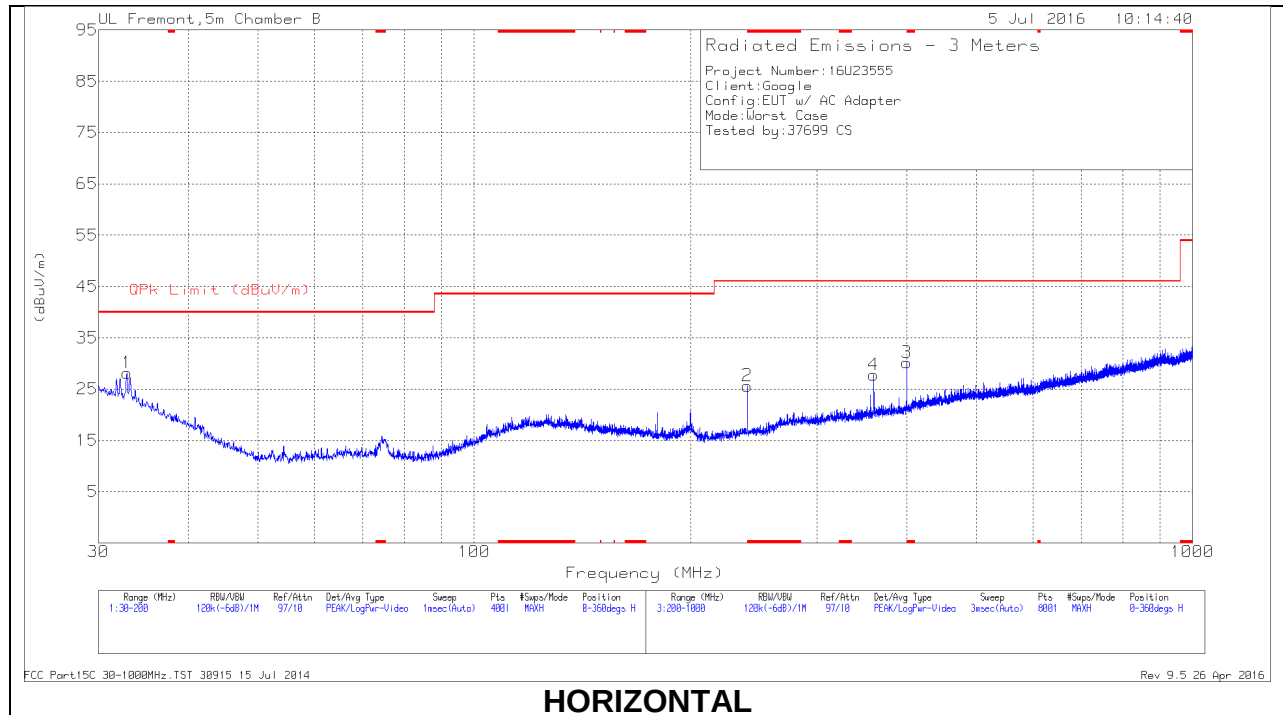
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

5.2. WORST-CASE BELOW 1 GHz

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



Data

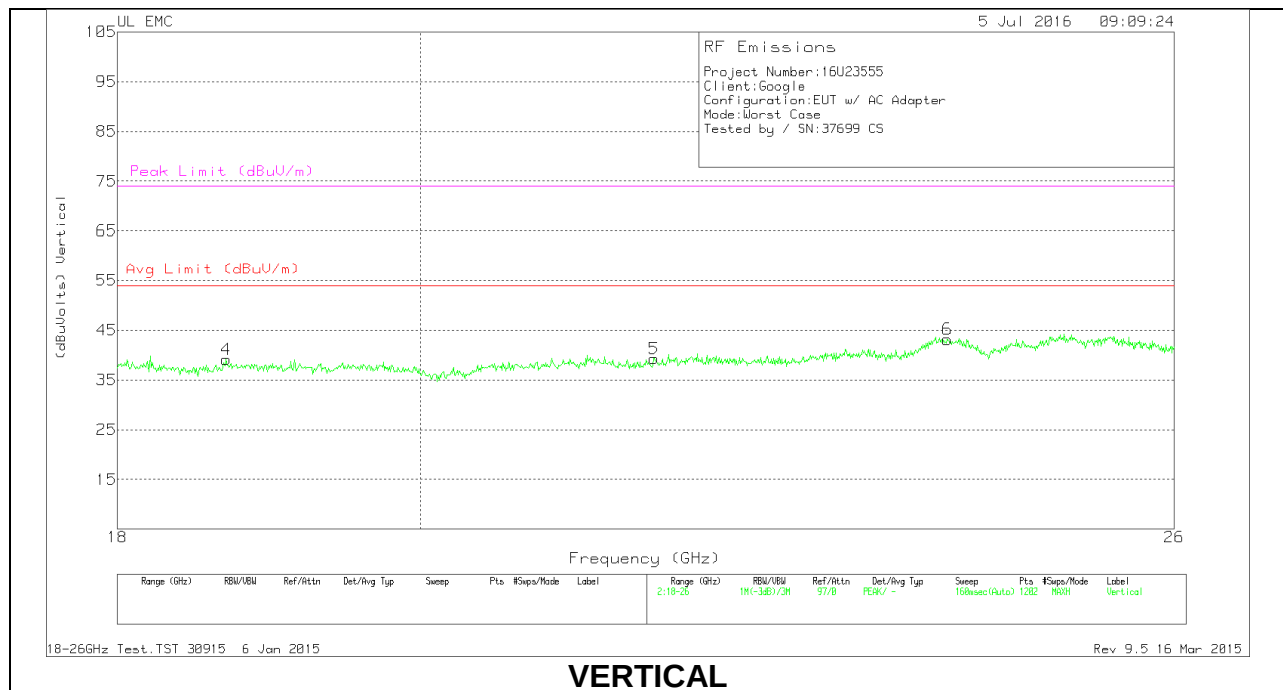
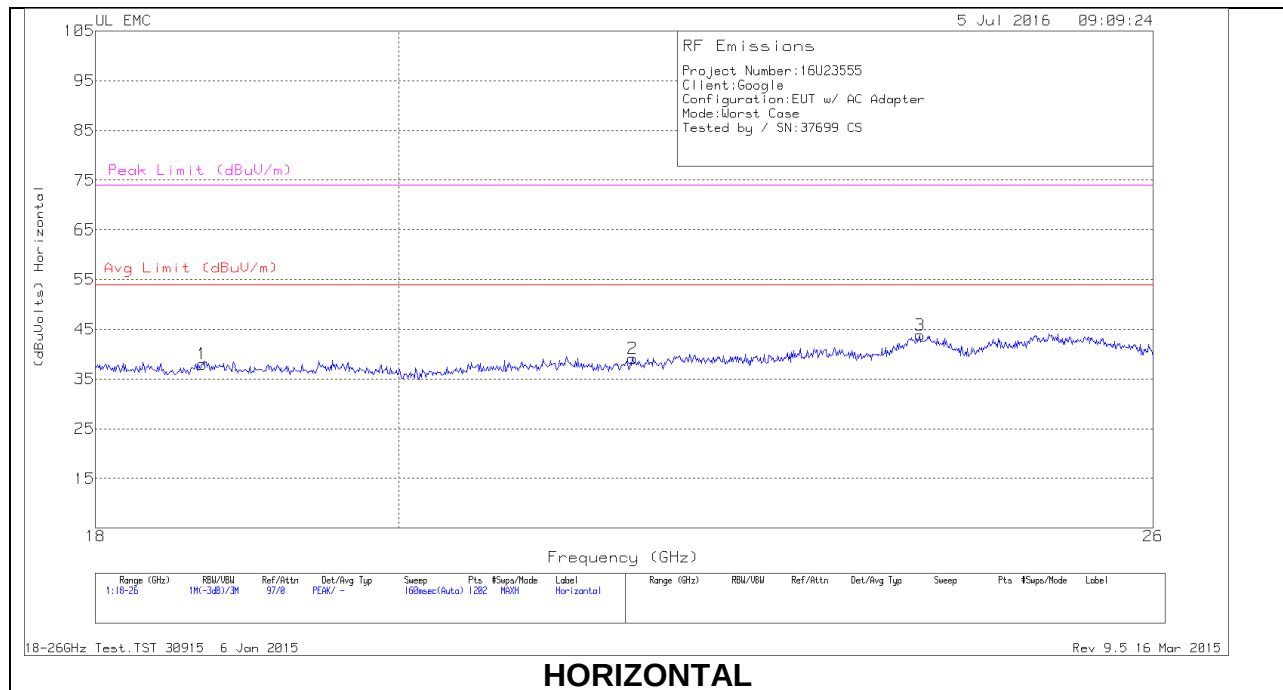
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	* 74.54	36.18	Pk	11.9	-28.4	19.68	40	-20.32	0-360	100	V
3	* 400	37	Pk	19.5	-26.3	30.2	46.02	-15.82	0-360	100	H
1	32.8475	33.77	Pk	23.2	-28.8	28.17	40	-11.83	0-360	100	H
5	32.8475	38.67	Pk	23.2	-28.8	33.07	40	-6.93	0-360	100	V
2	240	36.86	Pk	15.5	-26.7	25.66	46.02	-20.36	0-360	100	H
4	360	35.13	Pk	18.7	-26.1	27.73	46.02	-18.29	0-360	100	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

5.3. WORST-CASE 18 GHz – 26 GHz

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T449 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	18.679	39.7	Pk	32.4	-24.6	-9.5	38	54	-16	74	-36
2	21.697	40.07	Pk	33.2	-24.6	-9.5	39.17	54	-14.83	74	-34.83
3	23.975	43.53	Pk	34	-24.2	-9.5	43.83	54	-10.17	74	-30.17
4	18.693	40.47	Pk	32.4	-24.2	-9.5	39.17	54	-14.83	74	-34.83
5	21.694	40.23	Pk	33.2	-24.6	-9.5	39.33	54	-14.67	74	-34.67
6	24.025	42.77	Pk	34	-24.1	-9.5	43.17	54	-10.83	74	-30.83

Pk - Peak detector

6. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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 C63.10-2013.

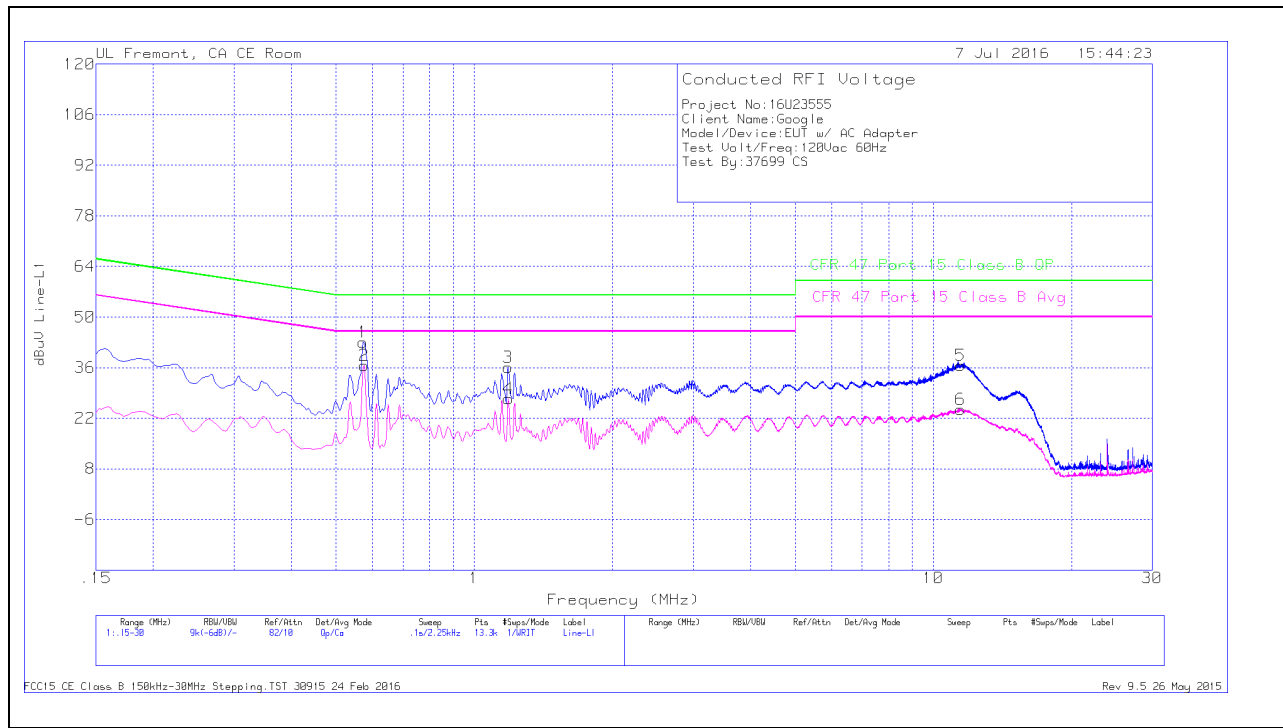
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

WORST EMISSIONS

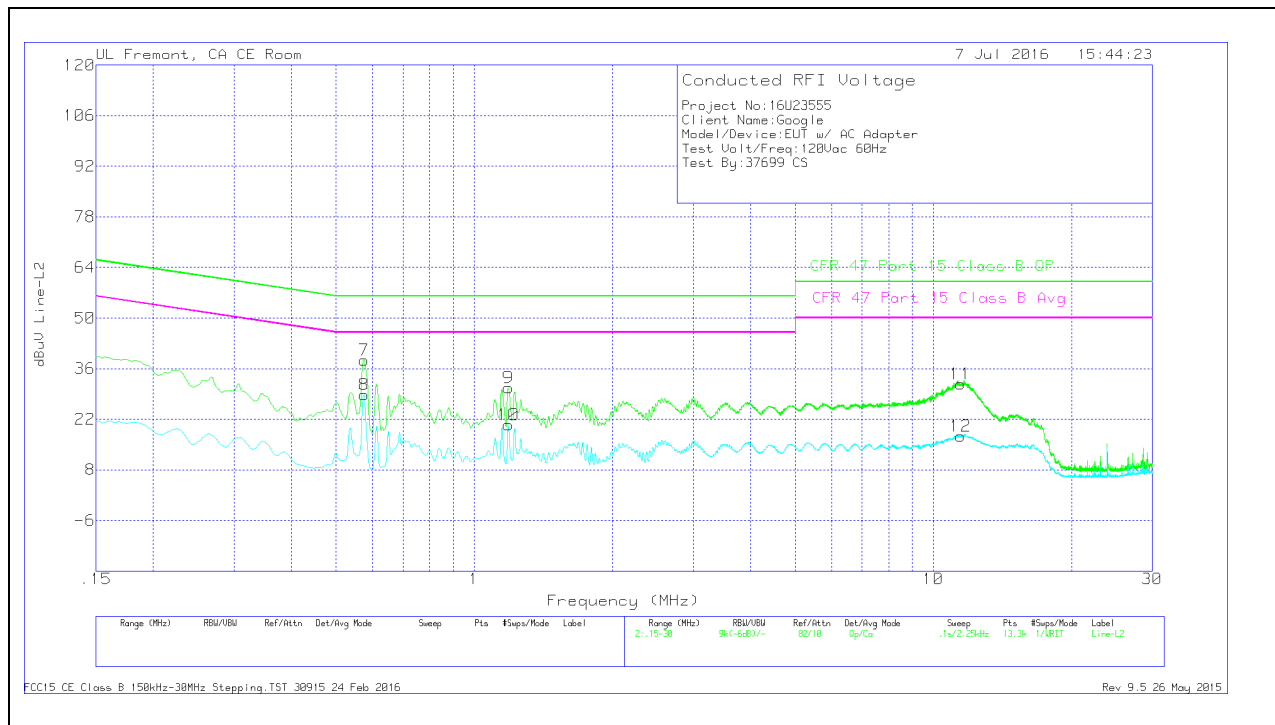
LINE 1 RESULTS



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables 1&3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.573	32.94	Qp	0	0	10.1	43.04	56	-12.96	-	-
2	.57525	26.59	Ca	0	0	10.1	36.69	-	-	46	-9.31
3	1.185	25.85	Qp	0	.1	10.1	36.05	56	-19.95	-	-
4	1.18725	17.24	Ca	0	.1	10.1	27.44	-	-	46	-18.56
5	11.463	26.27	Qp	0	.2	10.2	36.67	60	-23.33	-	-
6	11.4585	13.99	Ca	0	.2	10.2	24.39	-	-	50	-25.61

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables 2&3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
7	57525	28.18	Qp	0	0	10.1	38.28	56	-17.72	-	-
8	57525	18.71	Ca	0	0	10.1	28.81	-	-	46	-17.19
9	1.18725	20.46	Qp	0	.1	10.1	30.66	56	-25.34	-	-
10	1.18725	10.27	Ca	0	.1	10.1	20.47	-	-	46	-25.53
11	11.46975	21.4	Qp	0	.2	10.2	31.8	60	-28.2	-	-
12	11.4675	6.93	Ca	0	.2	10.2	17.33	-	-	50	-32.67

Qp - Quasi-Peak detector
Ca - CISPR average detection