FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone with BT, BLE, DTS/UNII a/b/g/n/ac & NFC

FCC ID: PY7-29752M

REPORT NUMBER: 16J23633A-E2V3

ISSUE DATE: 2016-08-18

Prepared for
SONY MOBILE COMMUNICATIONS, INC.
4-12-3 HIGASHI-SHINAGAWA,
SHINAGAWA -KU,TOKYO, 140-0002, JAPAN

Prepared by
UL LLC
12 LABORATORY DR.
RESEARCH TRIANGLE PARK, NC 27709 USA
TEL: (919) 549-1400

NVLAP Lab code: 200246-0

Revision History

Ver.	Issue Date	Revisions	Revised By
1	8/3/16	Initial Issue	Brian Kiewra
2	2016-08-15	Corrected maximum output power in section 5.2 Corrected 20dB BW data to agree with unit in section 7.1.1 Identified measurement procedure in section 2 Corrected standard reference in section 9 Corrected average measurement procedure in section 8.1 Update 1/B in table in section 7.1	Brian Kiewra
3	2016-08-18	Included clarifying calculation for 1/Ton in Radiated procedure and throughout Radiated results.	Brian Kiewra

This report shall not be reproduced except in full, without the written approval of UL LLC.

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS 5

2. TEST METHODOLOGY 6

3. FACILITIES AND ACCREDITATION 6

4. CALIBRATION AND UNCERTAINTY 6

4.1. MEASURING INSTRUMENT CALIBRATION 6

4.2. SAMPLE CALCULATION 6

4.3. MEASUREMENT UNCERTAINTY 7

5. EQUIPMENT UNDER TEST 8

5.1. DESCRIPTION OF EUT 8

5.2. MAXIMUM OUTPUT POWER 8

5.3. DESCRIPTION OF AVAILABLE ANTENNAS 8

5.4. SOFTWARE AND FIRMWARE 8

5.5. WORST-CASE CONFIGURATION AND MODE 9

5.6. DESCRIPTION OF TEST SETUP 10

6. TEST AND MEASUREMENT EQUIPMENT 13

7. ANTENNA PORT TEST RESULTS 16

7.1. ON TIME AND DUTY CYCLE 16

7.1. BASIC DATA RATE GFSK MODULATION 19

7.1.1. 20 dB BANDWIDTH 19

7.1.2. HOPPING FREQUENCY SEPARATION 22

7.1.3. NUMBER OF HOPPING CHANNELS 23

7.1.4. AVERAGE TIME OF OCCUPANCY 26

7.1.5. OUTPUT POWER 30

7.1.6. AVERAGE POWER 31

7.1.7. CONDUCTED SPURIOUS EMISSIONS 32

7.2. ENHANCED DATA RATE QPSK MODULATION 41

7.2.1. 20 dB AND 99% BANDWIDTH 41

7.2.2. HOPPING FREQUENCY SEPARATION 44

7.2.3. NUMBER OF HOPPING CHANNELS 45

This report shall not be reproduced except in full, without the written approval of UL LLC.

7.2.4. AVERAGE TIME OF OCCUPANCY 48
7.2.5. OUTPUT POWER 52
7.2.6. AVERAGE POWER 53
7.2.7. CONDUCTED SPURIOUS EMISSIONS 54
7.3. ENHANCED DATA RATE 8PSK MODULATION 59
7.3.1. 20 dB AND 99% BANDWIDTH 59
7.3.2. HOPPING FREQUENCY SEPARATION 62
7.3.3. NUMBER OF HOPPING CHANNELS 64
7.3.4. AVERAGE TIME OF OCCUPANCY 67
7.3.5. OUTPUT POWER 71
7.3.6. AVERAGE POWER 72
7.3.7. CONDUCTED SPURIOUS EMISSIONS 73
8. RADIATED TEST RESULTS 82
8.1. LIMITS AND PROCEDURE 82
8.2. TRANSMITTER ABOVE 1 GHz 83
8.2.1. BASIC DATA RATE GFSK MODULATION 83
8.2.2. ENHANCED DATA RATE 8PSK MODULATION 90
8.3. WORST-CASE BELOW 1 GHz 97
8.4. WORST-CASE ABOVE 18GHz 99
9. AC POWER LINE CONDUCTED EMISSIONS 100
10. SETUP PHOTOS 103

This report shall not be reproduced except in full, without the written approval of UL LLC.

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SONY MOBILE COMMUNICATIONS, INC.
4-12-3 HIGASHI-SHINAGAWA,
SHINAGAWA -KU,TOKYO, 140-0002, JAPAN

EUT DESCRIPTION: GSM/WCDMA/LTE Phone with BT, BLE, DTS/UNII a/b/g/n/ac & NFC

SERIAL NUMBER: Conducted: CB512AP7SV, CB512AP7UK
Radiated: CB512AP7SN

DATE TESTED: 2016-07-13 to 2016-08-02

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass

UL LLC 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 LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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 LLC By:

Jeff Moser
EMC Program Manager
UL – Consumer Technology Division

Prepared By:

Brian T. Kiewra
EMC Engineer
UL – Consumer Technology Division

This report shall not be reproduced except in full, without the written approval of UL LLC.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Suite B, Perimeter Park Drive, Morrisville, NC 27560.

12 Laboratory Dr., RTP, NC 27709
☐ Chamber A
☐ Chamber C

2800 Suite B Perimeter Park Dr., Morrisville, NC 27560
☐ Chamber NORTH
☒ Chamber SOUTH

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap/

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

This report shall not be reproduced except in full, without the written approval of UL LLC.

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, 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%.

This report shall not be reproduced except in full, without the written approval of UL LLC.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone with BT, BLE, DTS/UNII a/b/g/n/ac & NFC

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	10.80	12.02
2402 - 2480	DQPSK	9.40	8.71
2402 - 2480	Enhanced 8PSK	9.70	9.33

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two integrated antennas, with the following maximum gains:

Frequency Range (MHz)	Antenna Gain (dBi)
	Ant 0 (Main)
2402 – 2480	-6.2

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was SONY, s_atp_1_600_7_9
The test utility software used during testing was Tera Term ver 4.89 (SVN# 6182).

This report shall not be reproduced except in full, without the written approval of UL LLC.

5.5. 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-Axis orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X-Axis orientation.

This report shall not be reproduced except in full, without the written approval of UL LLC.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Desktop	Lenovo	ThinkCentre	MG00ADEN	NA
Laptop	Lenovo	T450	RTP0116PC0A2UQT	NA
Headphones	Sony	MH410x	12271A100010396	NA
PowerSupply	Sony	1300-7146.1B	5816W02400051	NA

I/O CABLES

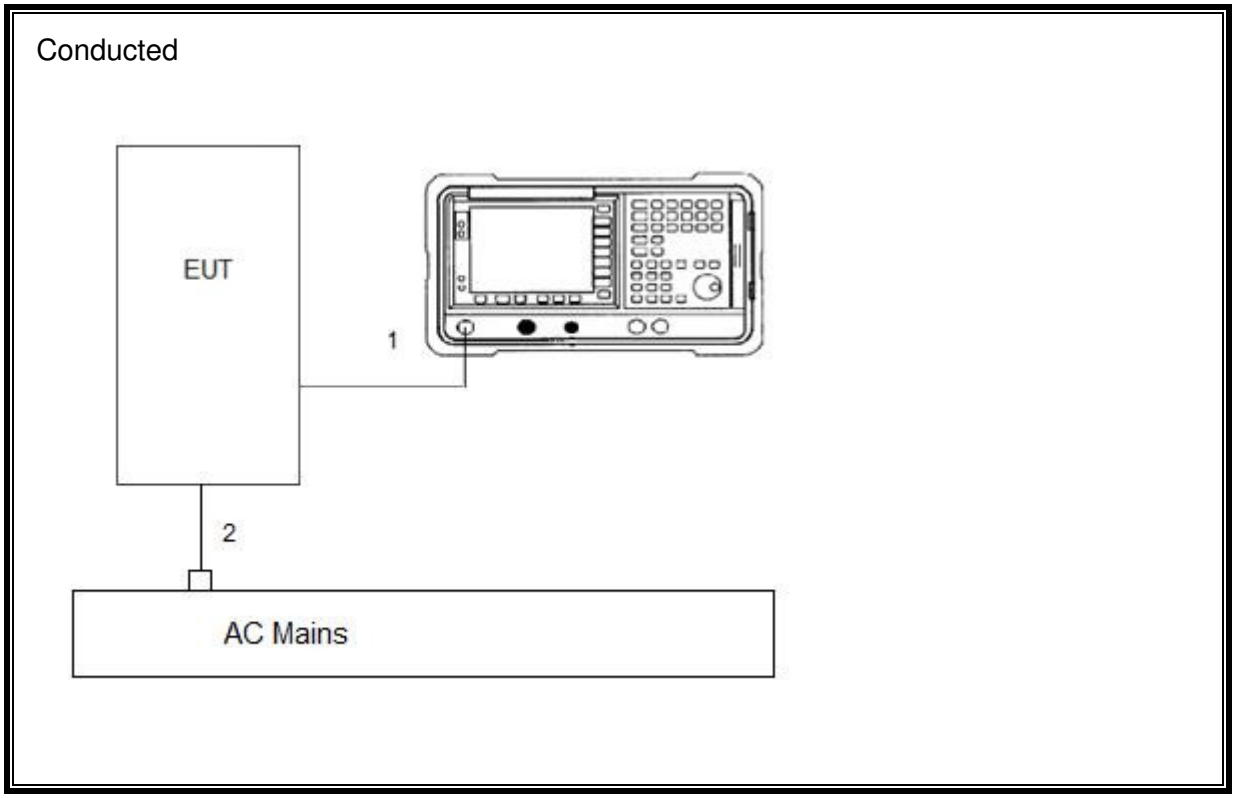
I/O Cable List					
Cable No	**Port**	**# of Identical ports**	**Connector Type**	**Cable Length (m)**	**Remarks**
1	Antenna Port	1	RF	<1m	NA
2	DC Mains	1	Mini-USB	>1m	NA
3	Audio	1	3.5mm	>1m	Headphone

TEST SETUP

The EUT is setup as a standalone device. Test software exercised the radio card.

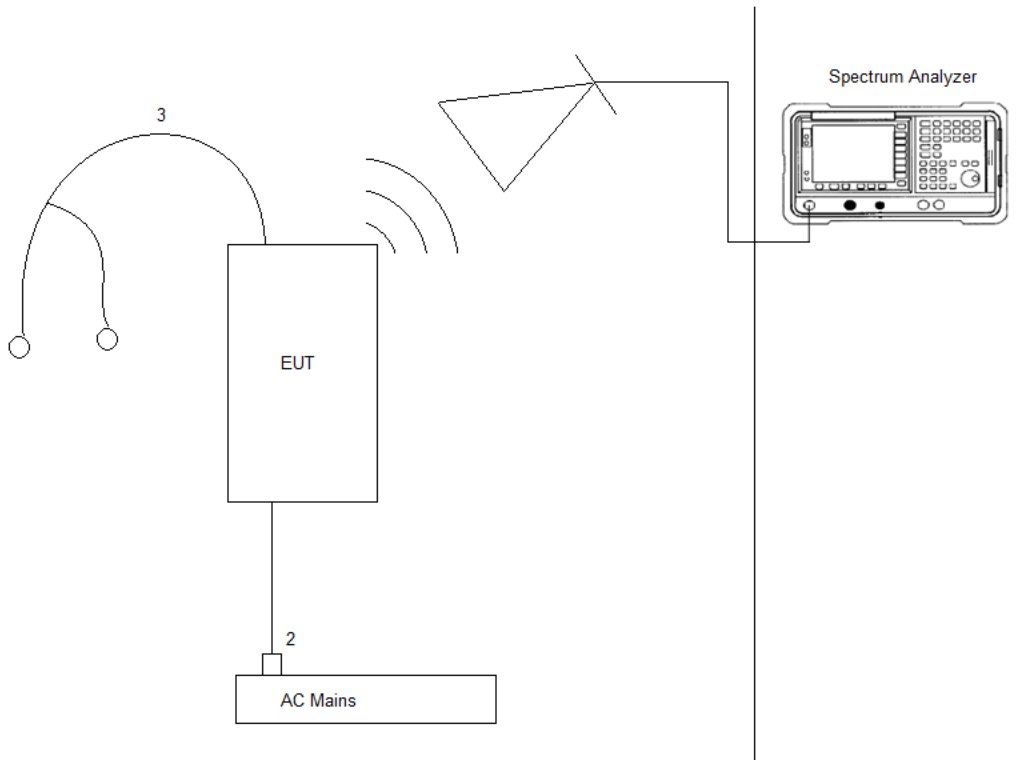
This report shall not be reproduced except in full, without the written approval of UL LLC.

SETUP DIAGRAM FOR TESTS



This report shall not be reproduced except in full, without the written approval of UL LLC.

Radiated



This report shall not be reproduced except in full, without the written approval of UL LLC.

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2015-12-08	2016-12-31
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2016-06-07	2017-06-30
	1-18 GHz				
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2016-03-07	2017-03-31
	18-40 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2015-08-27	2016-08-31
AT0077	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2015-08-27	2016-08-31
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2015-10-07	2016-10-31
S-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2016-06-26	2017-06-30
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2015-08-22	2016-08-31
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2016-02-29	2017-02-28
	Receiver & Software				
SA0025	Spectrum Analyzer	Agilent	N9030A	2016-03-17	2017-03-31
SA0026 (18-40GHz RSE)	Spectrum Analyzer	Agilent	N9030A	2016-02-24	2017-02-28
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0078	Temp/Humid/Pressure Meter	Springfield Precision	PreciseTemp	2016-06-13	2017-06-13

This report shall not be reproduced except in full, without the written approval of UL LLC.

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 1				
72822	Spectrum Analyzer	Agilent Technologies	E4446A	2015-09-02	2016-09-30
PWM004	RF Power Meter	Keysight Technologies	N1911A	2016-06-22	2017-06-22
PWS004	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2016-06-22	2017-06-22
HI0078	Temp/Humid/Pressure Meter	Springfield Precision	PreciseTemp	2016-06-13	2017-06-13
MM0167	True RMS Multimeter	Agilent	U1232A	2015-08-17	2016-08-31
76022	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	N/A	N/A

This report shall not be reproduced except in full, without the written approval of UL LLC.

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL077	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3476-240	2016-06-15	2017-06-30
HI0078	Temp/Humid/Pressure Meter	Springfield Precision	PreciseTemp	2016-06-13	2017-06-13
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2015-08-24	2016-08-31
LISN008	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	2015-09-03	2016-09-30
MM0167	Multi-meter	Agilent	U1232A	2015-08-17	2016-08-31
PRE0101521 (75141)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2015-08-26	2016-08-31
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2016-06-09	2017-06-30
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Miscellaneous (if needed)				
ATA220	ISN for Unshielded Balanced Pairs	Teseq, Inc.	ISN T8	2015-08-24	2016-08-31
TN0129	ISN for Shielded Balanced Pairs	Teseq, Inc.	ISN ST08	2015-08-24	2016-08-31
TN0145	ISN for Cat-6 Unshielded Balanced Pairs	Teseq, Inc.	ISN T8-Cat6	2015-08-25	2016-08-31
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2016-06-04	2017-06-30

This report shall not be reproduced except in full, without the written approval of UL LLC.

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

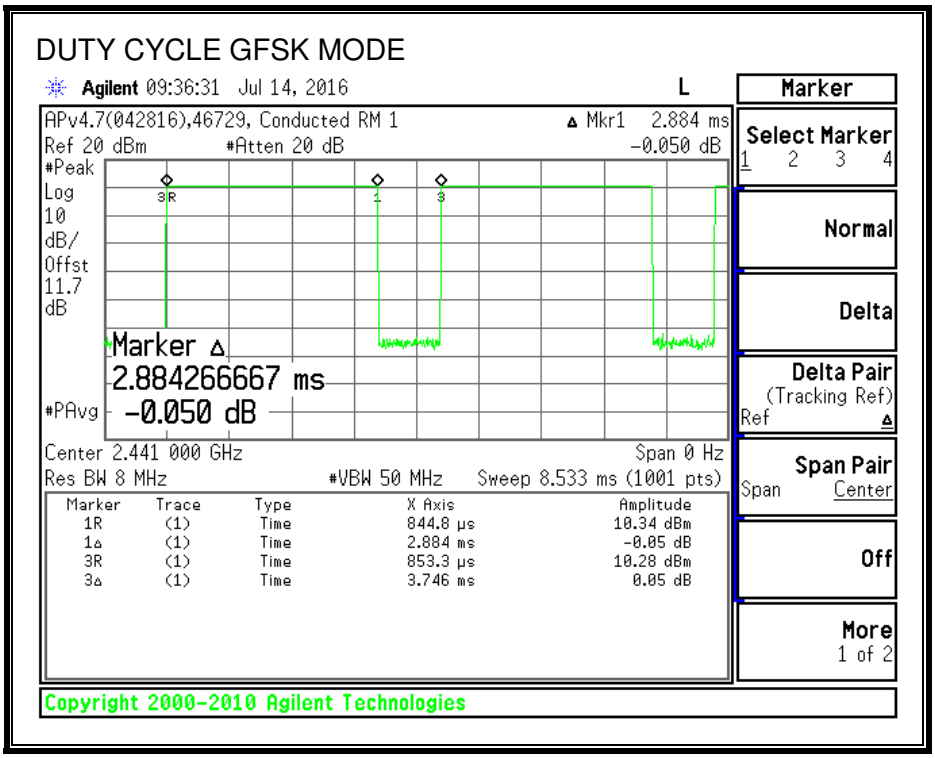
TEST INFORMATION
Date: 2016-07-14
Tester: Ron Reichard

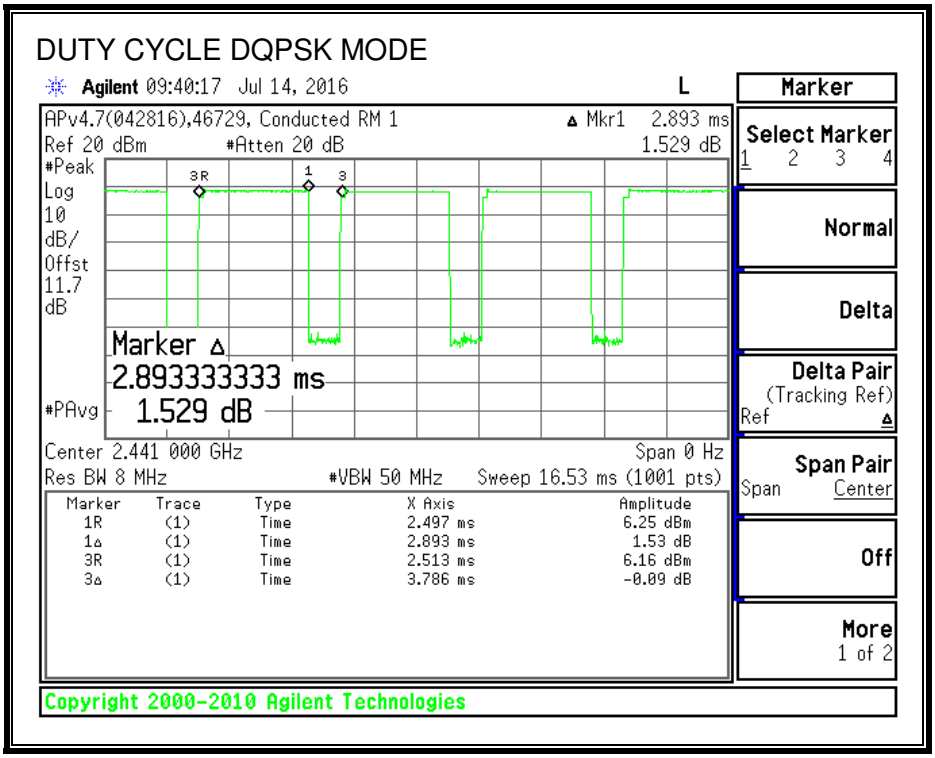
ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4 GHz band (Hopping OFF)						
Bluetooth GFSK	2.884	3.746	0.770	76.99%	2.27	0.347
Bluetooth DQPSK	2.893	3.786	0.764	76.41%	2.34	0.346
Bluetooth 8PSK	2.877	3.745	0.768	76.82%	2.29	0.348

This report shall not be reproduced except in full, without the written approval of UL LLC.

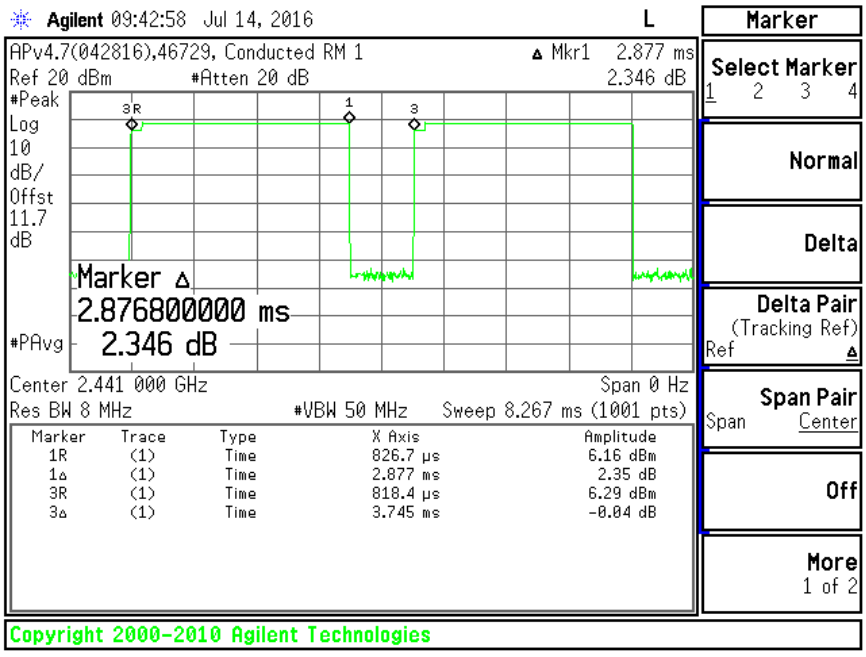
DUTY CYCLE PLOTS
HOPPING OFF





This report shall not be reproduced except in full, without the written approval of UL LLC.

DUTY CYCLE 8PSK MODE



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.1. BASIC DATA RATE GFSK MODULATION

7.1.1. 20 dB BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

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.

Test Information

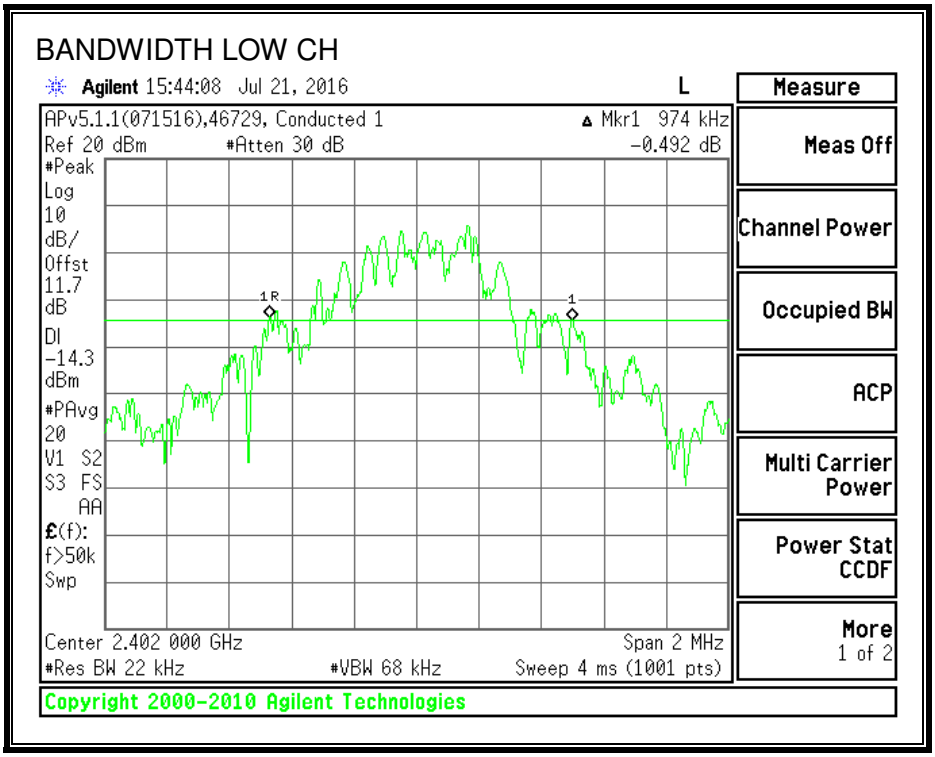
Date: 2016-07-21
Tester: Ron Reichard

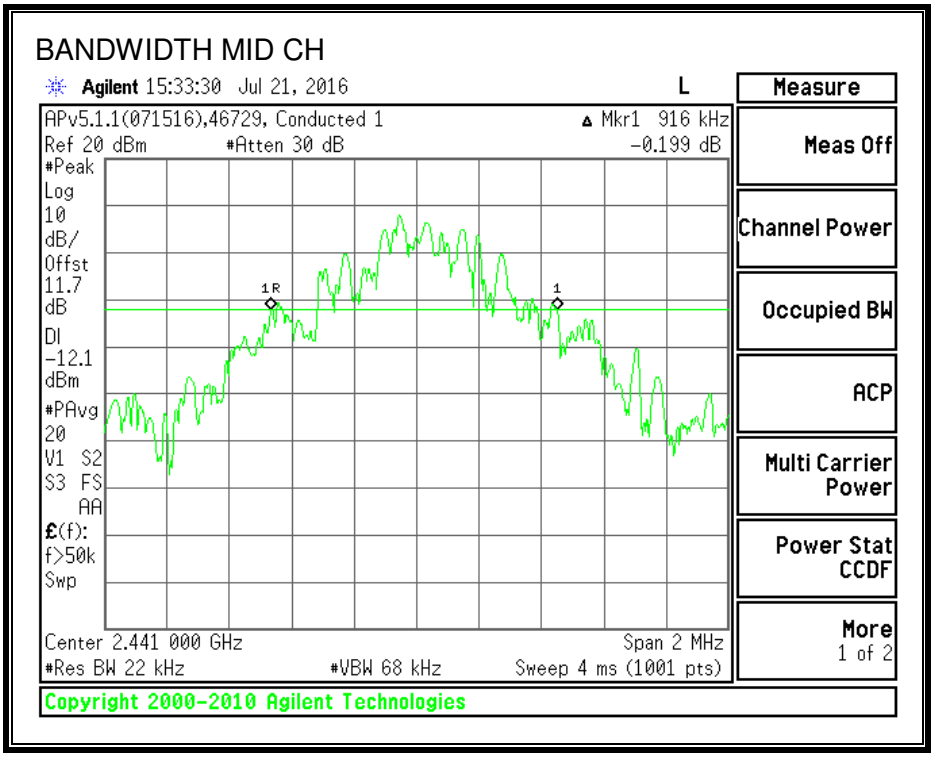
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	974
Middle	2441	916
High	2480	928

This report shall not be reproduced except in full, without the written approval of UL LLC.

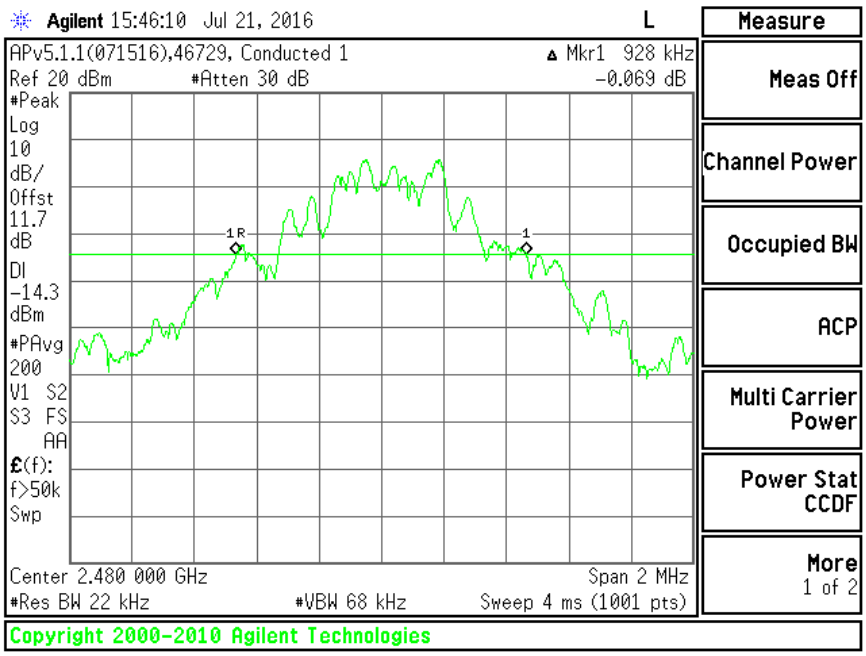
20 dB BANDWIDTH





This report shall not be reproduced except in full, without the written approval of UL LLC.

BANDWIDTH HIGH CH



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.1.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the 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.

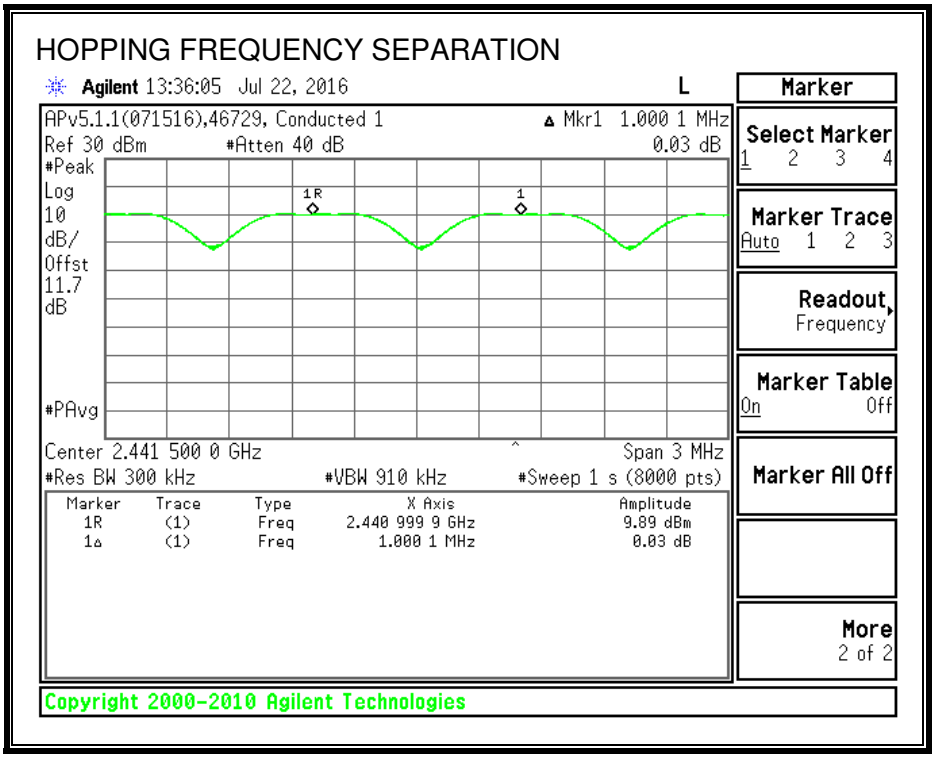
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

Test Information

Date: 2016-07-22
Tester: Ron Reichard

RESULTS
HOPPING FREQUENCY SEPARATION



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.1.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

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

TEST PROCEDURE

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.

Test Information

Date: 2016-07-22
Tester: Ron Reichard

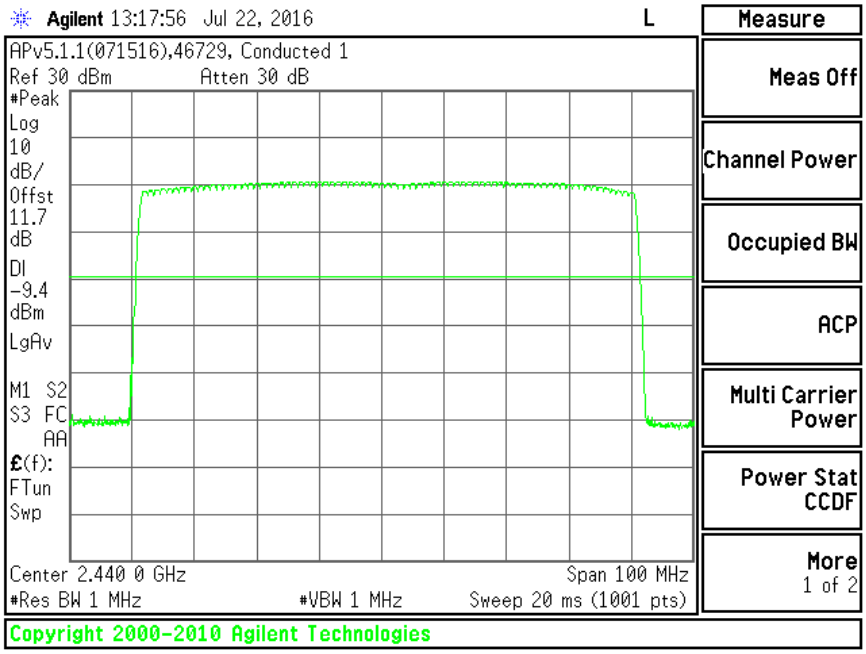
RESULTS

Normal Mode: 79 Channels observed.

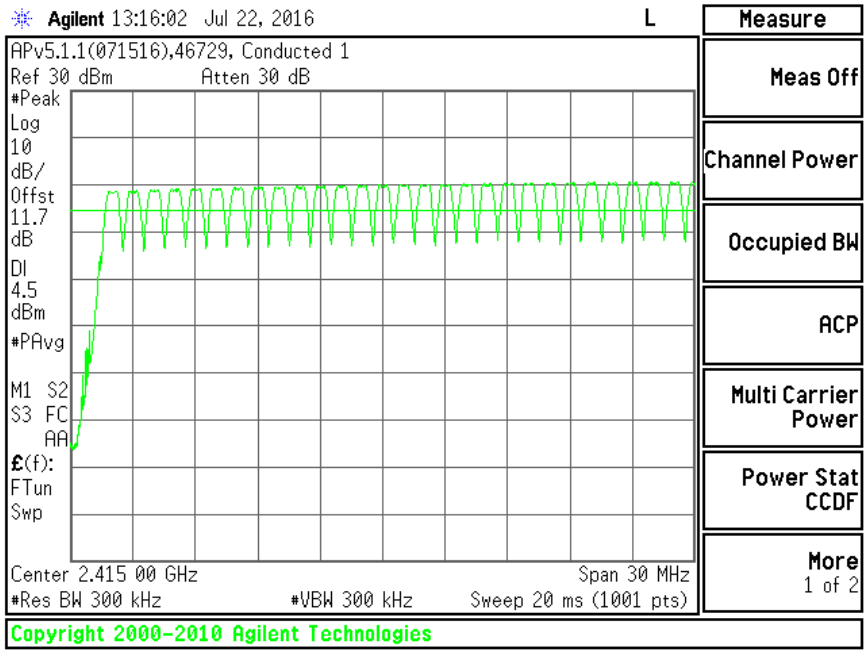
This report shall not be reproduced except in full, without the written approval of UL LLC.

NUMBER OF HOPPING CHANNELS

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)

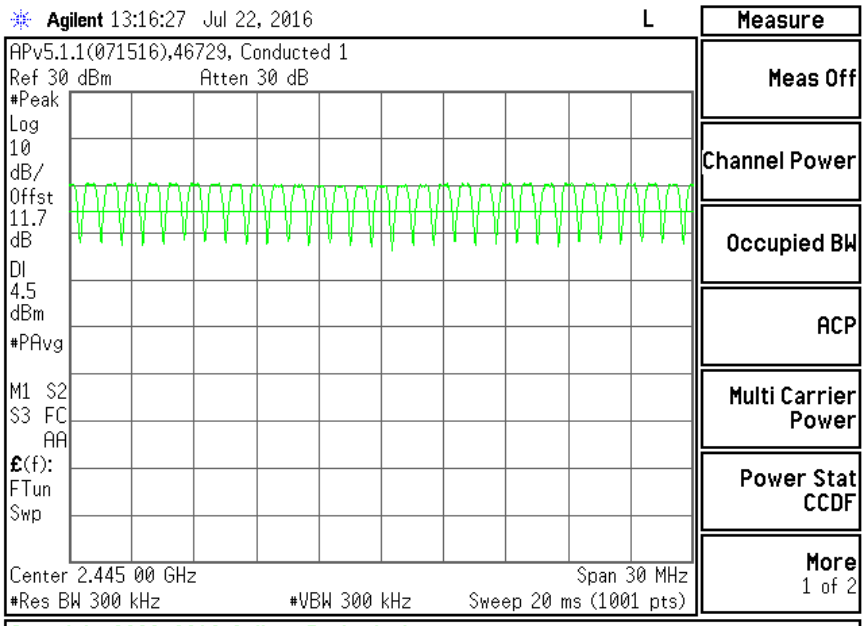


NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)

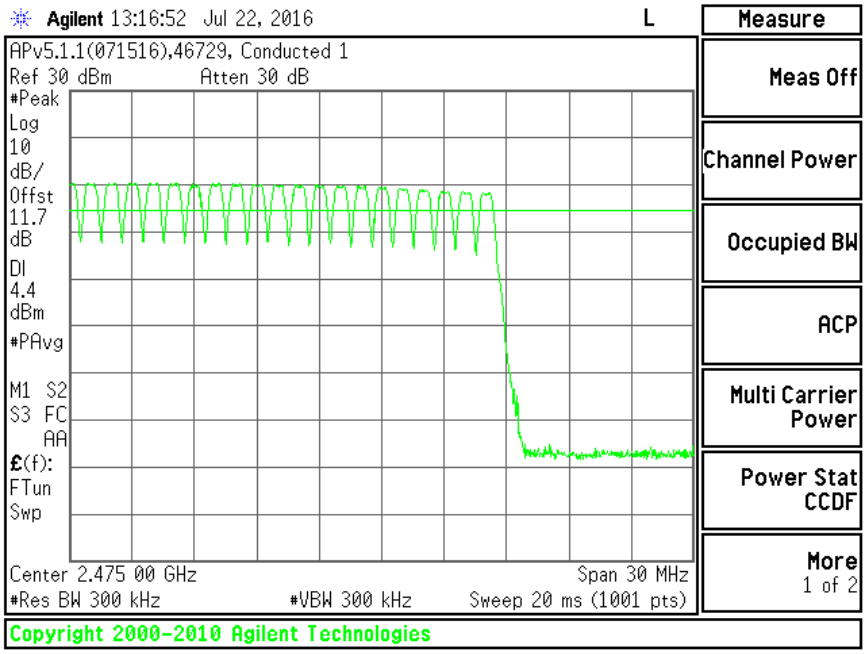


This report shall not be reproduced except in full, without the written approval of UL LLC.

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



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



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.1.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# 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.

Test Information

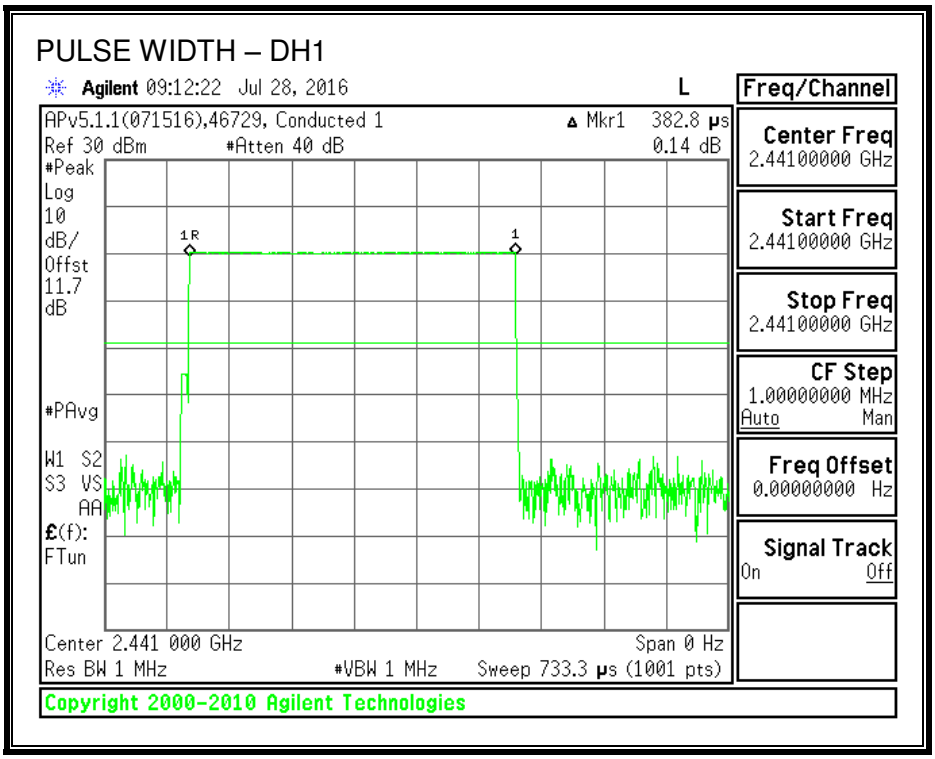
Date: 2016-07-28
Tester: Ron Reichard

RESULTS

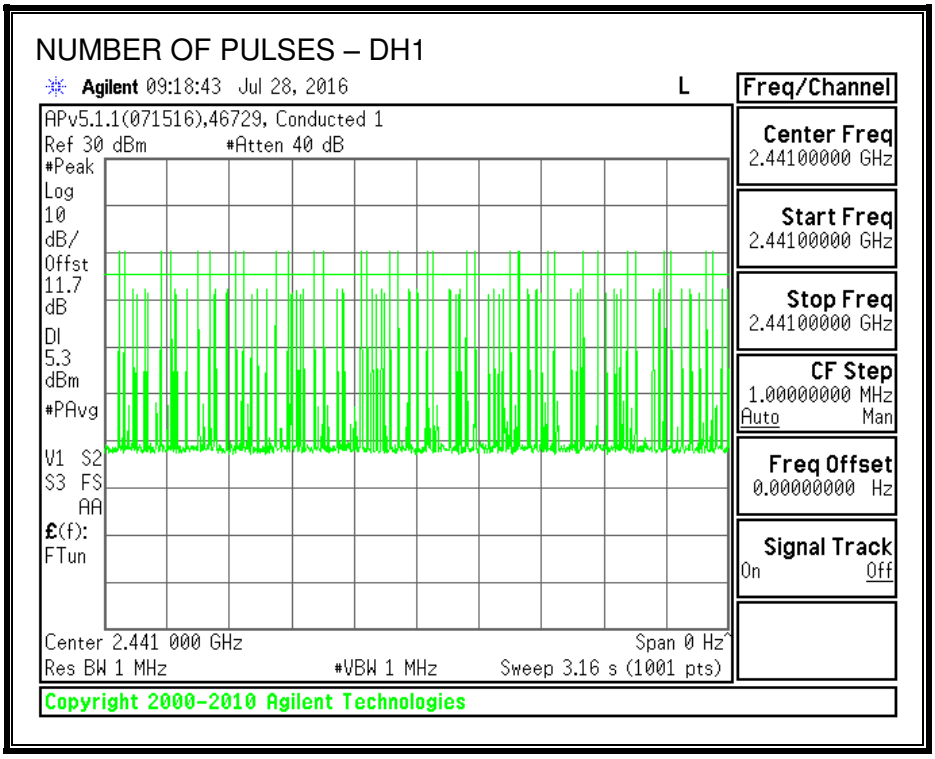
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.3828	32	0.122	0.4	-0.278
DH3	1.638	14	0.229	0.4	-0.171
DH5	2.888	13	0.375	0.4	-0.025

This report shall not be reproduced except in full, without the written approval of UL LLC.

PULSE WIDTH - DH1

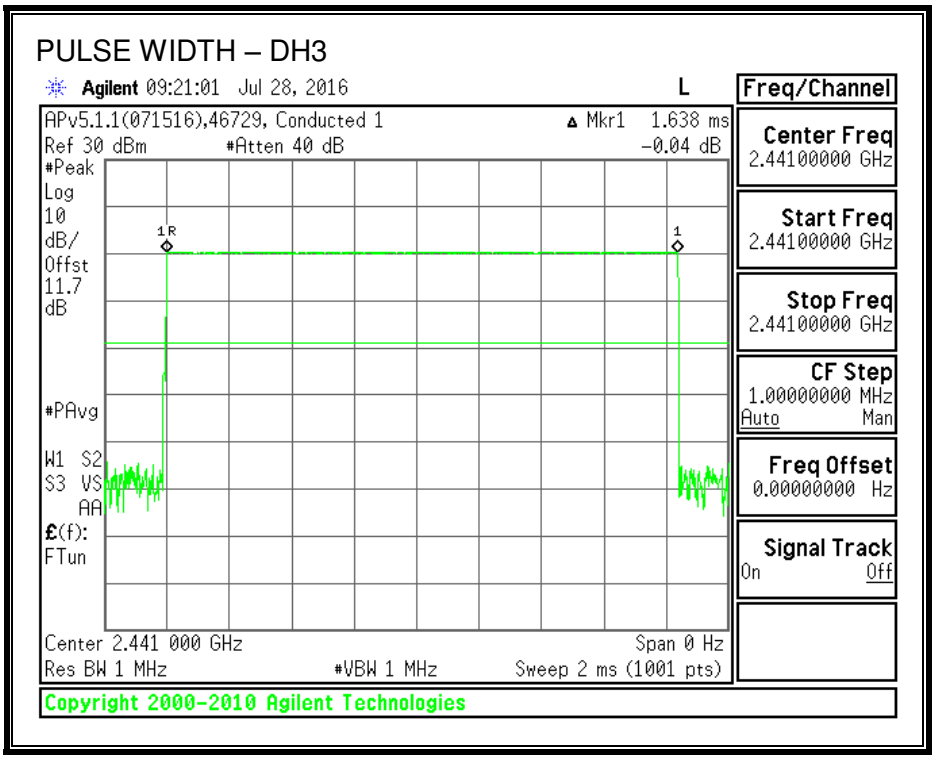


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

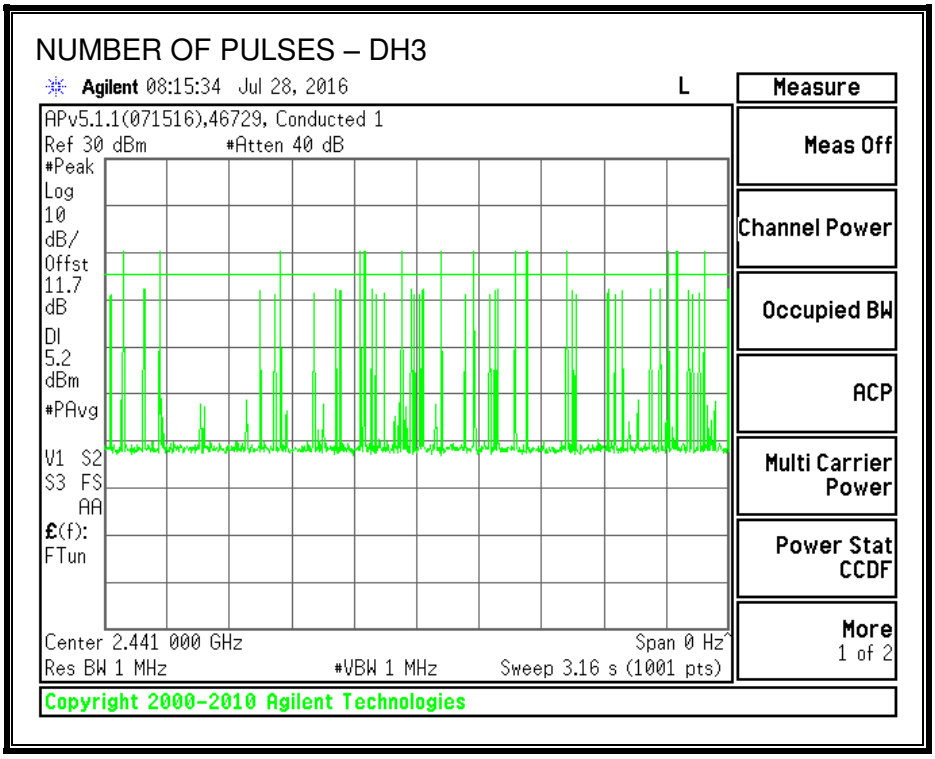


This report shall not be reproduced except in full, without the written approval of UL LLC.

PULSE WIDTH – DH3

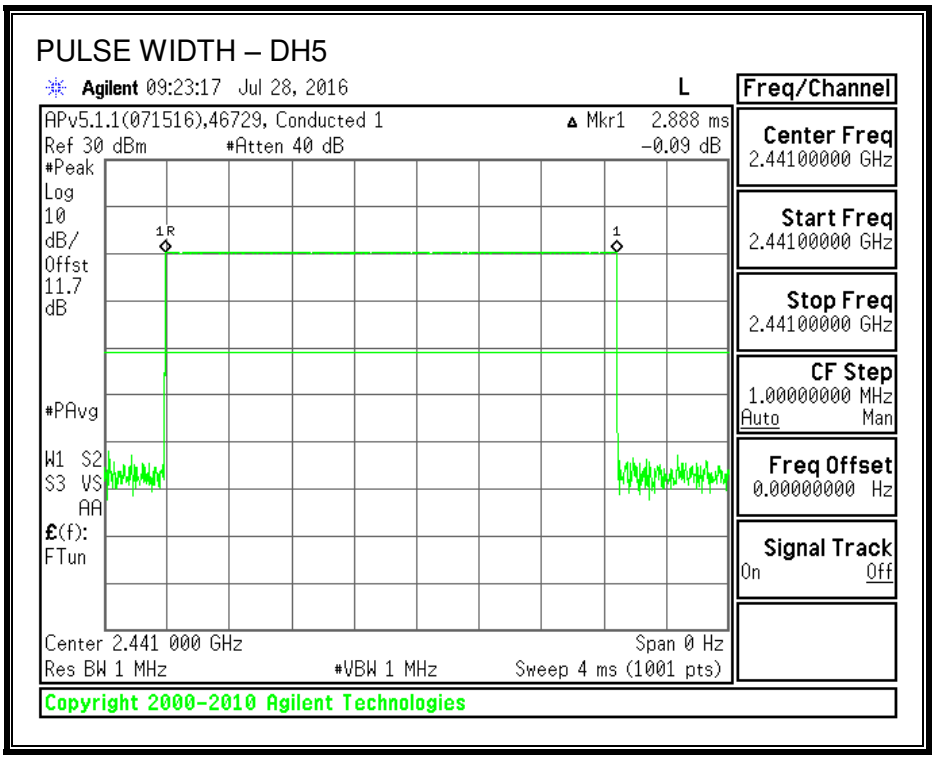


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

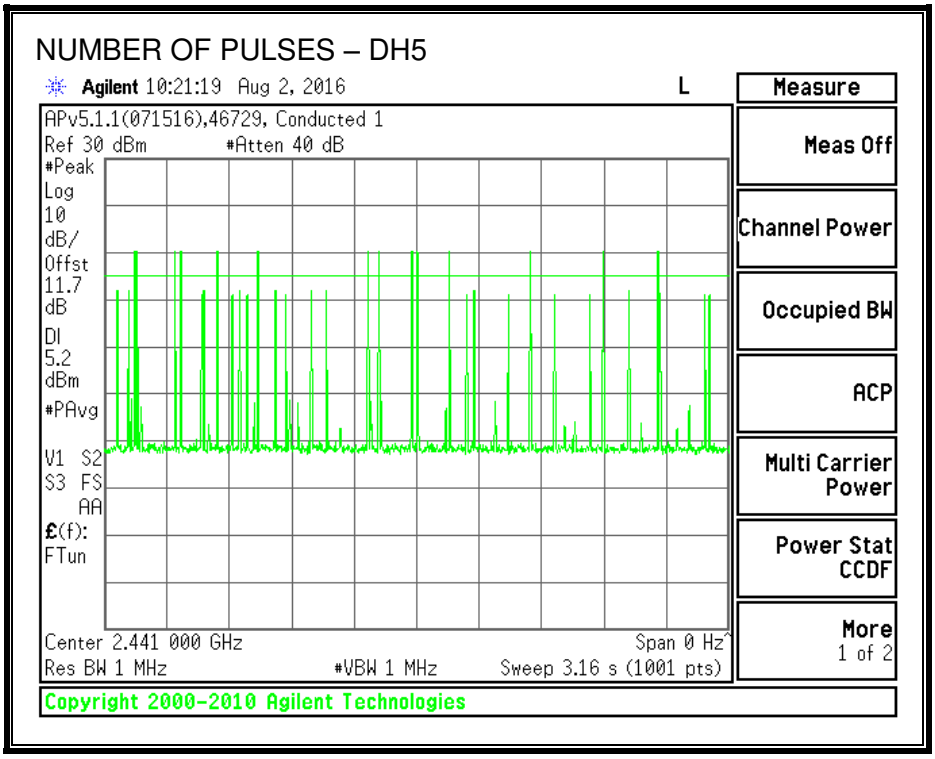


This report shall not be reproduced except in full, without the written approval of UL LLC.

PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.1.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

TEST PROCEDURE

The transmitter output is connected to a power meter.

TEST INFORMATION

Date: 2016-07-29
Tester: Ron Reichard

RESULTS

The cable assembly insertion loss of 11.7 dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	9.00	-6.20	21	-12.00
Middle	2441	10.80	-6.20	21	-10.20
High	2480	8.70	-6.20	21	-12.30

This report shall not be reproduced except in full, without the written approval of UL LLC.

7.1.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

TEST INFORMATION

Date: 2016-07-29
Tester: Ron Reichard

RESULTS

The cable assembly insertion loss of 11.7 dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	8.90
Middle	2441	10.60
High	2480	8.60

This report shall not be reproduced except in full, without the written approval of UL LLC.

7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

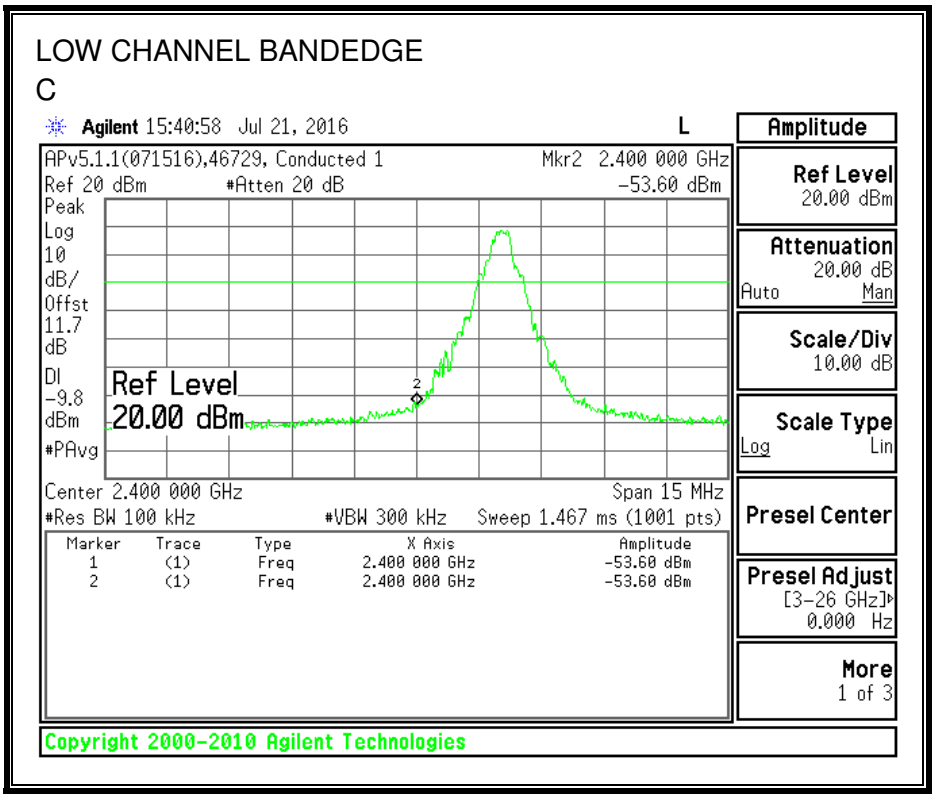
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

Test Information

Date: 2016-07-21
Tester: Ron Reichard

This report shall not be reproduced except in full, without the written approval of UL LLC.

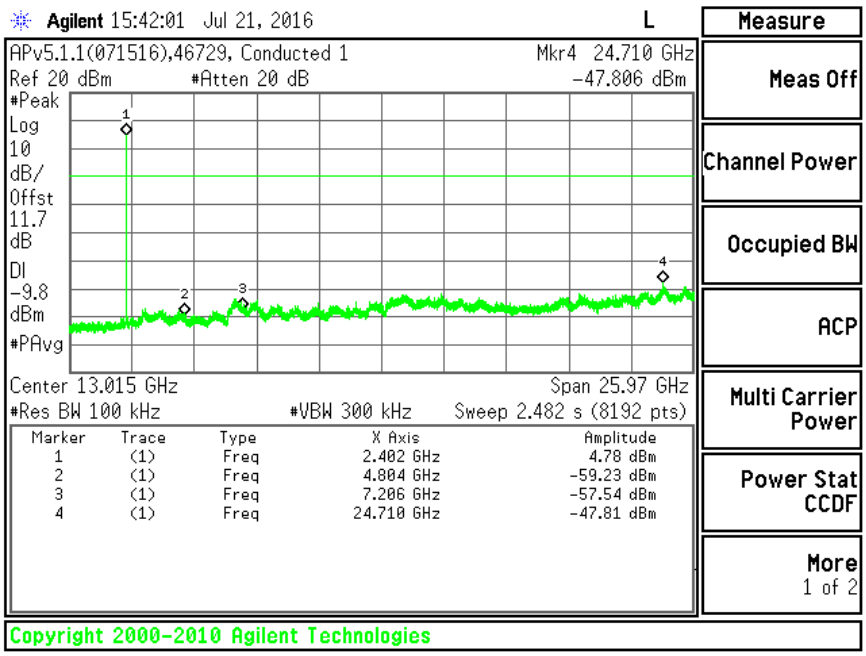
RESULTS
SPURIOUS EMISSIONS, LOW CHANNEL



Note: Limit line should be -10.37 dBm, however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

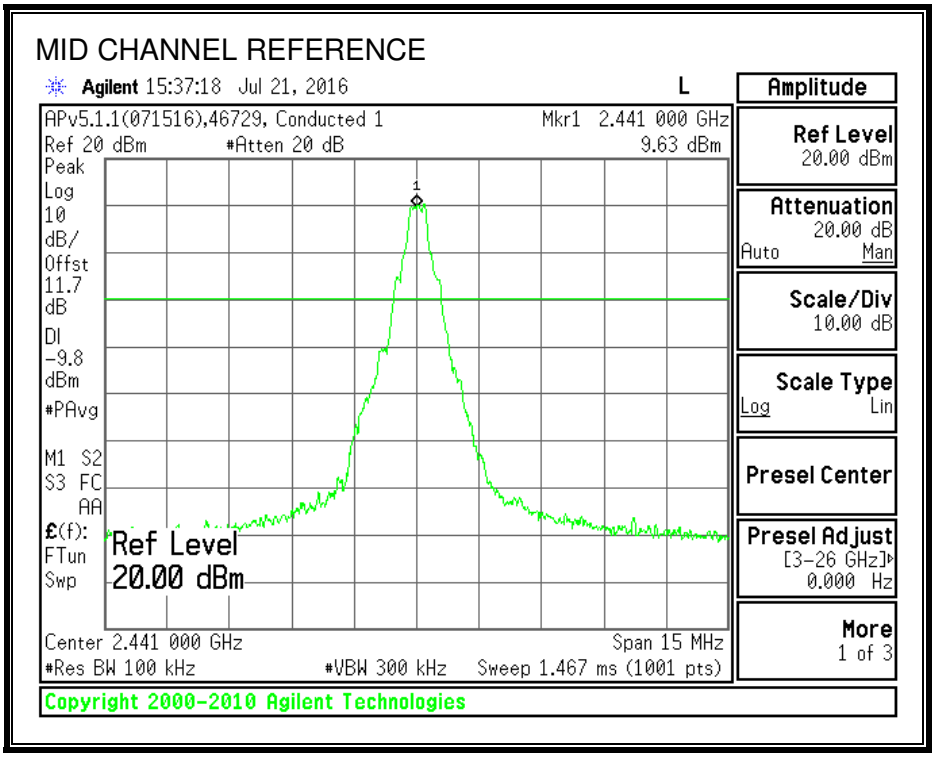
LOW CHANNEL SPURIOUS



Note: Limit line should be -10.37 dBm, however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

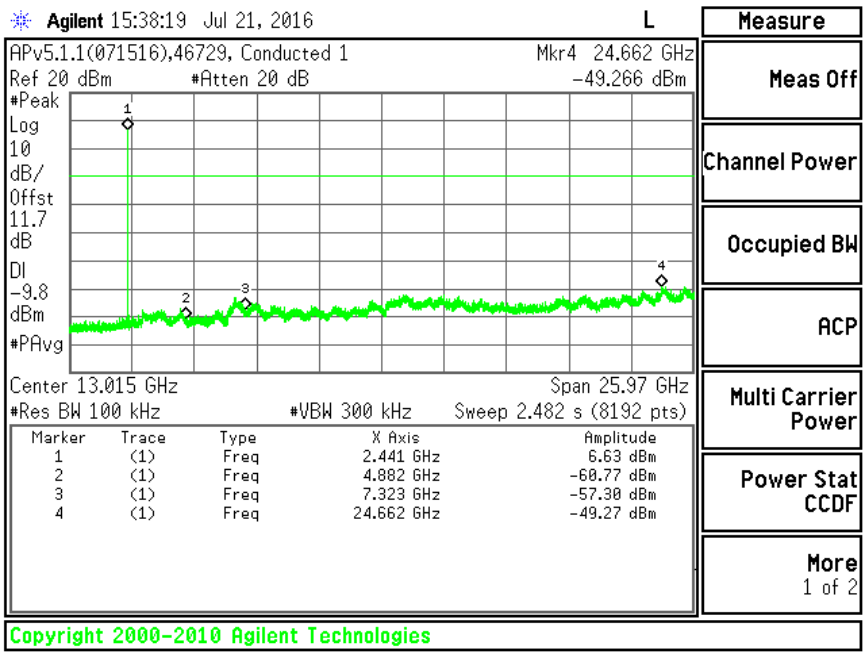
SPURIOUS EMISSIONS, MID CHANNEL



Note: Limit line should be -10.37dBm

This report shall not be reproduced except in full, without the written approval of UL LLC.

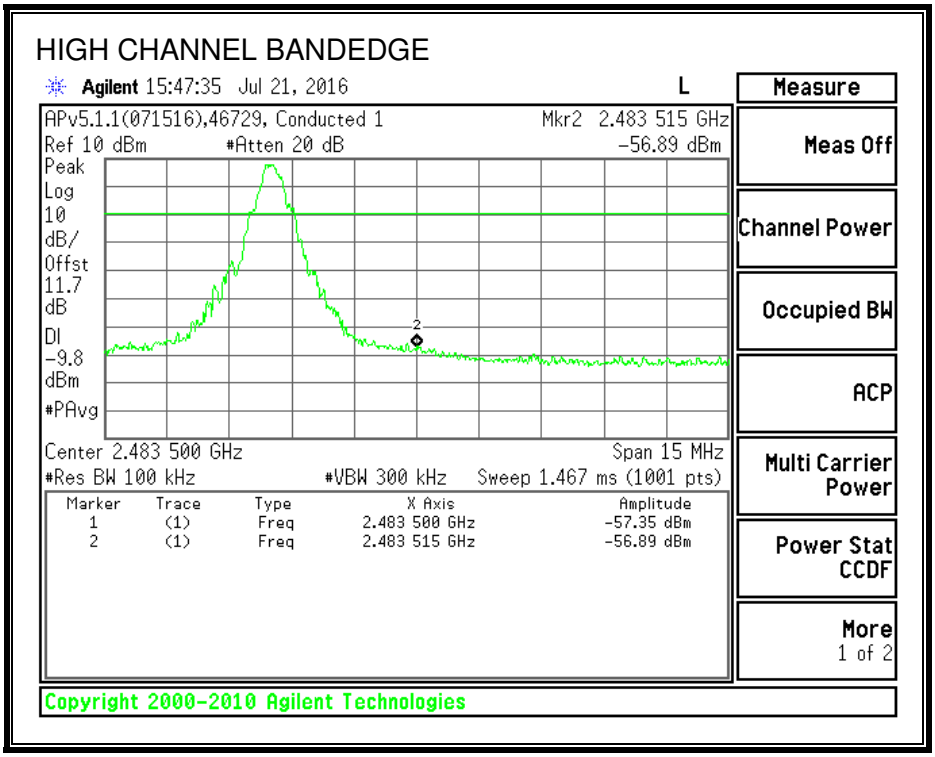
MID CHANNEL SPURIOUS



Note: Limit line should be -10.37 dBm, however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

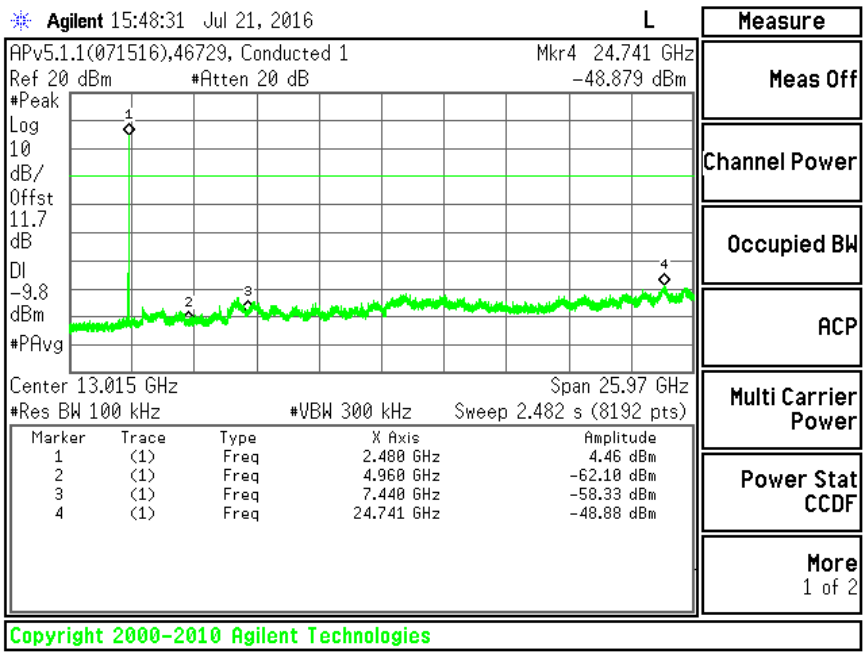
SPURIOUS EMISSIONS, HIGH CHANNEL



Note: Limit line should be -10.37 dBm, however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

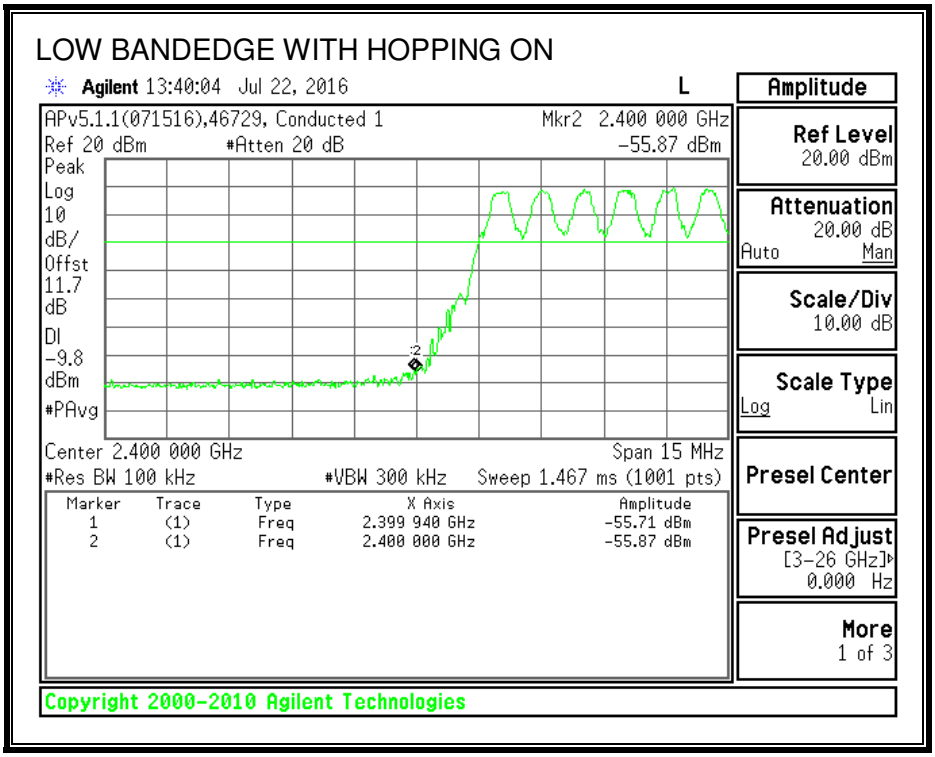
HIGH CHANNEL SPURIOUS



Note: Limit line should be -10.37 dBm, however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

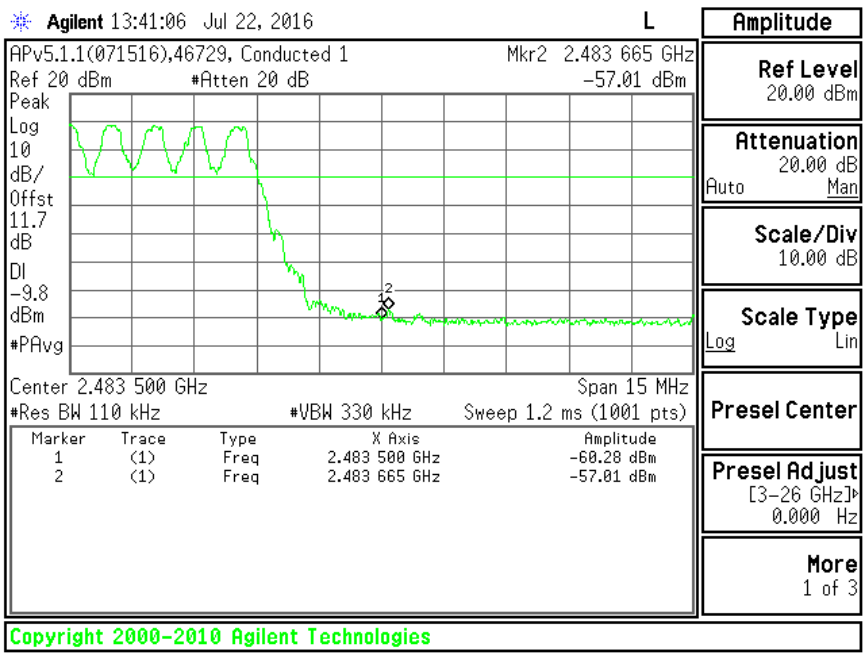
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



Note: Limit line should be -10.37 dBm, however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

HIGH BANDEDGE WITH HOPPING ON



Note: Limit line should be -10.37 dBm, however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

7.2. ENHANCED DATA RATE QPSK MODULATION

7.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

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.

Test Information

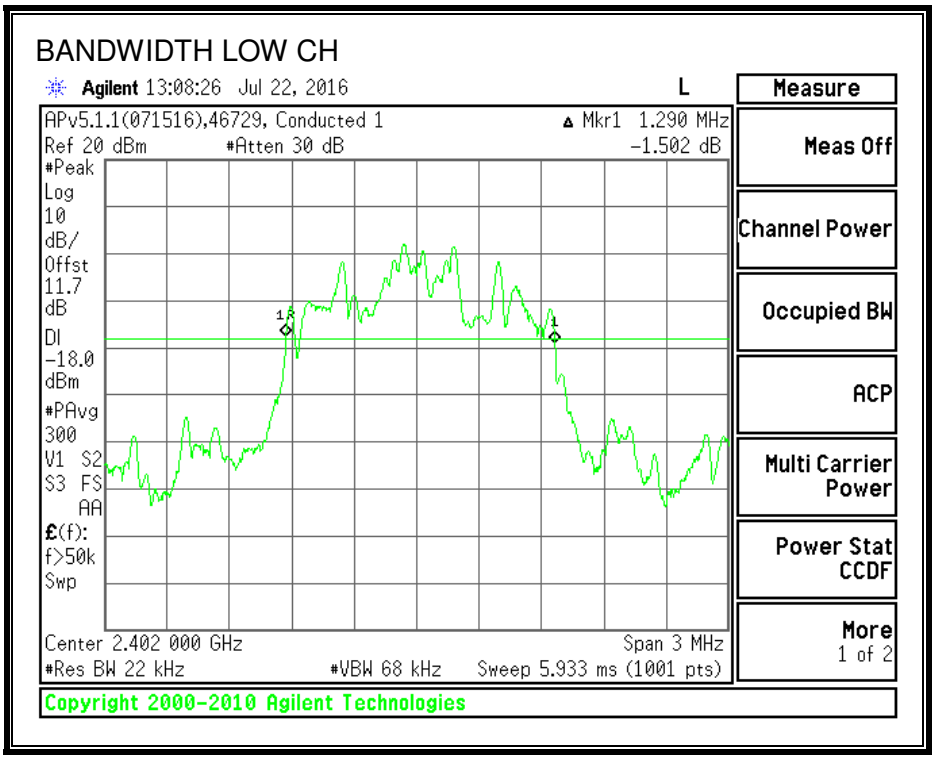
Date: 2016-07-22
Tester: Ron Reichard

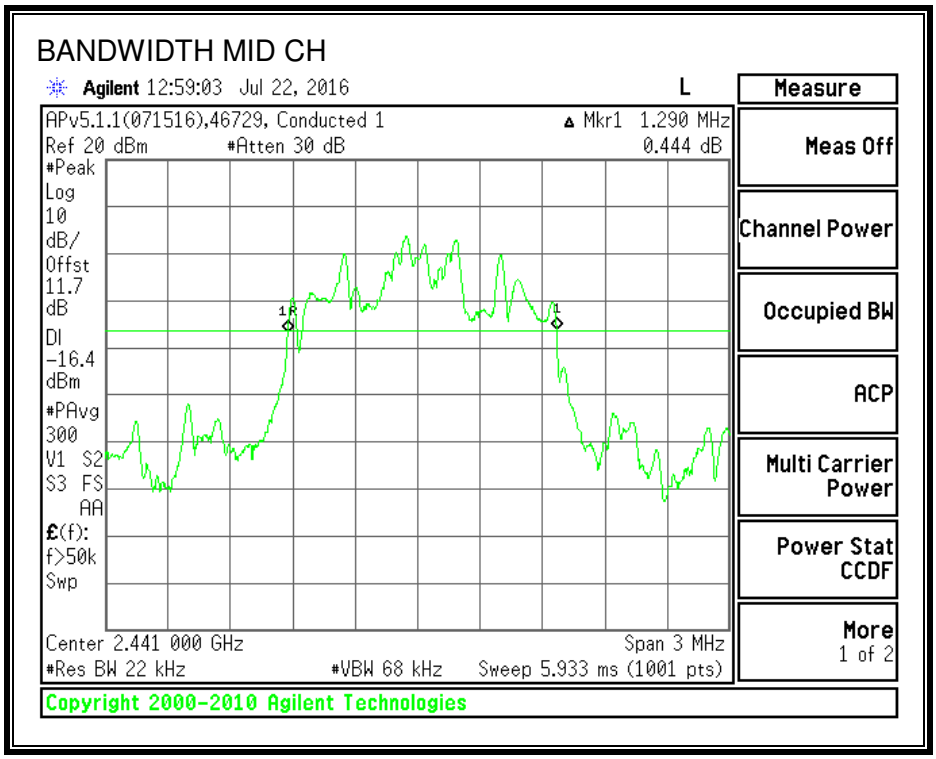
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	1290
Middle	2441	1290
High	2480	1290

This report shall not be reproduced except in full, without the written approval of UL LLC.

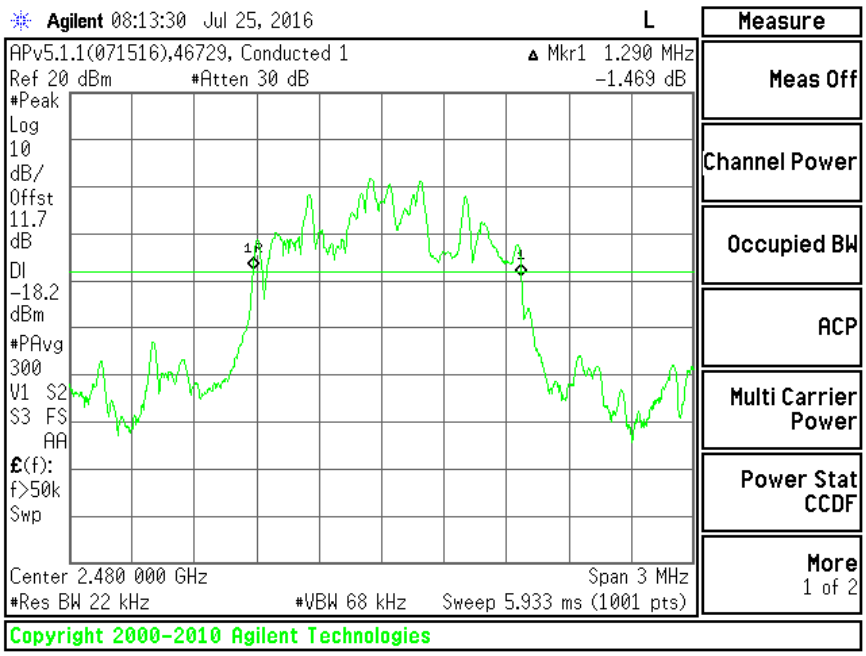
20 dB BANDWIDTH





This report shall not be reproduced except in full, without the written approval of UL LLC.

BANDWIDTH HIGH CH



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

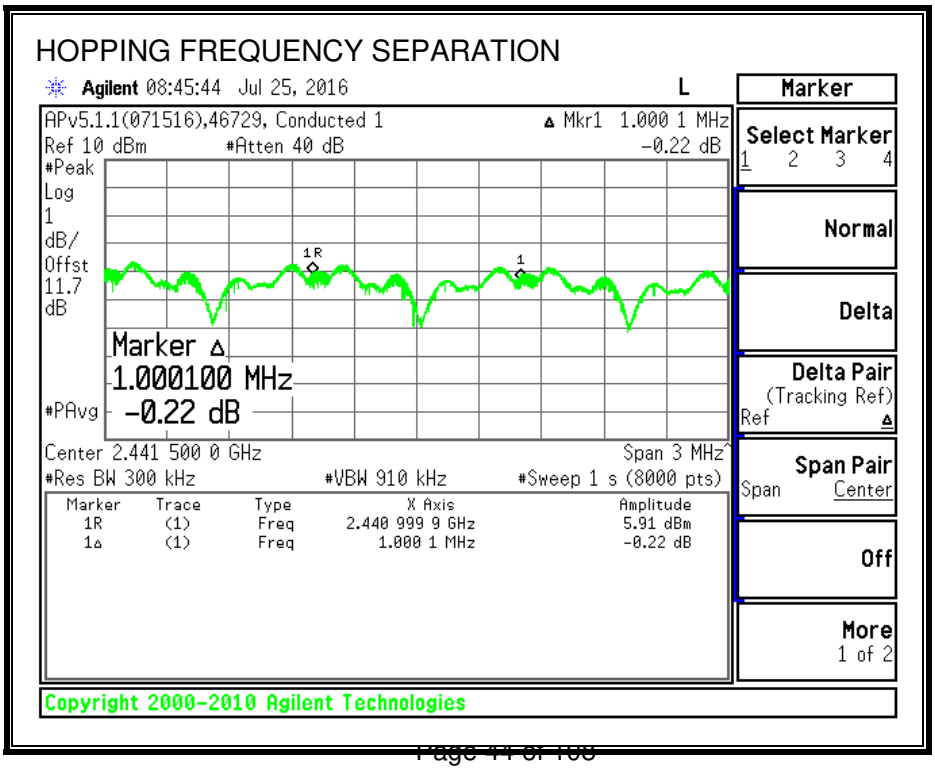
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

Test Information
Date: 2016-07-25
Tester: Ron Reichard

RESULTS
HOPPING FREQUENCY SEPARATION



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.2.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

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

TEST PROCEDURE

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.

Test Information

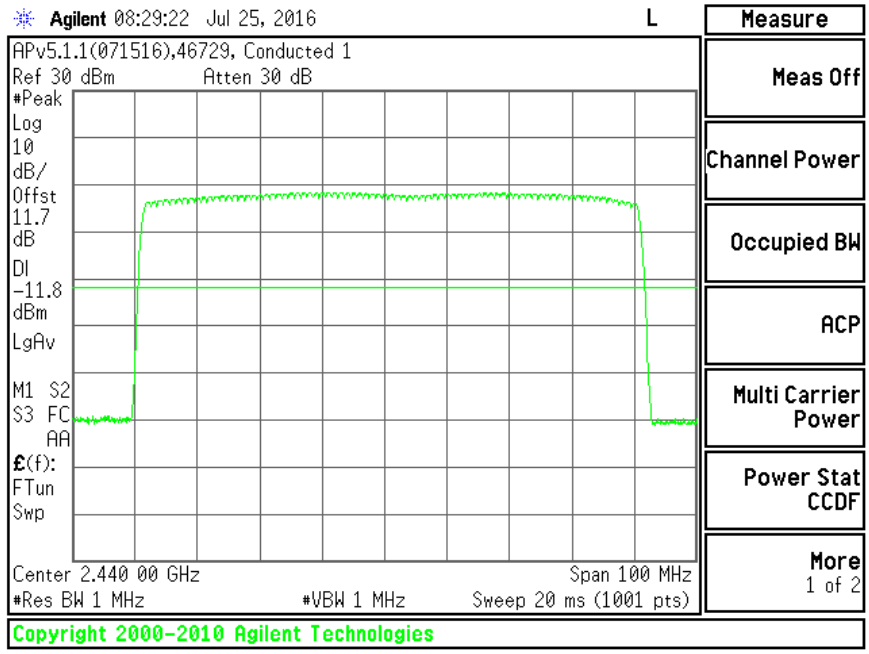
Date: 2016-07-25
Tester: Ron Reichard

RESULTS

Normal Mode: 79 Channels observed.

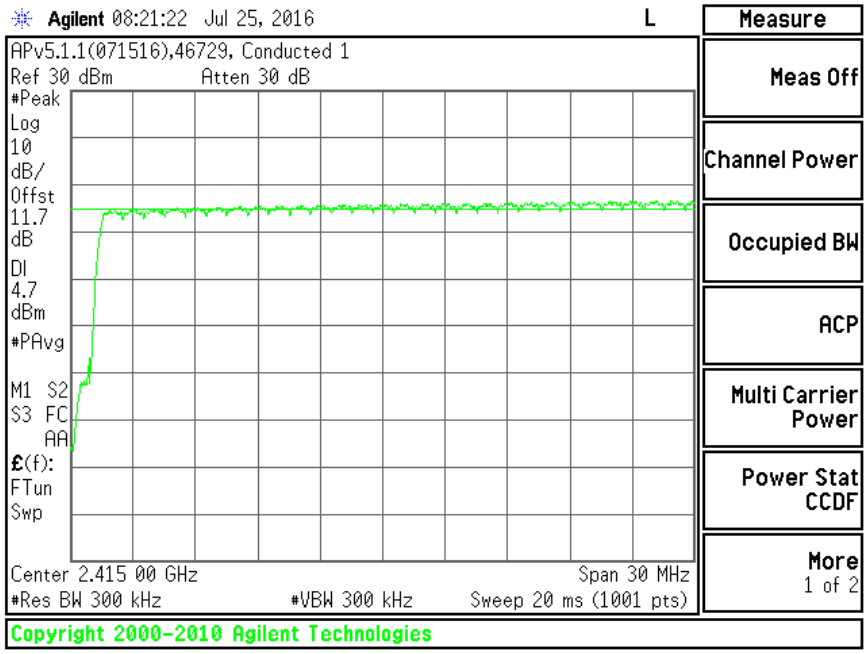
NUMBER OF HOPPING CHANNELS

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)

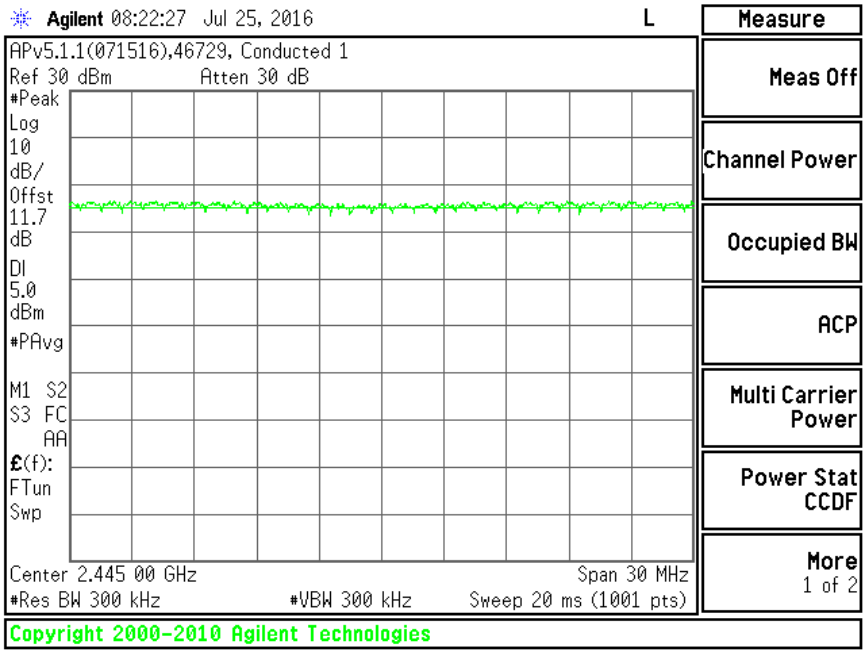


This report shall not be reproduced except in full, without the written approval of UL LLC.

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

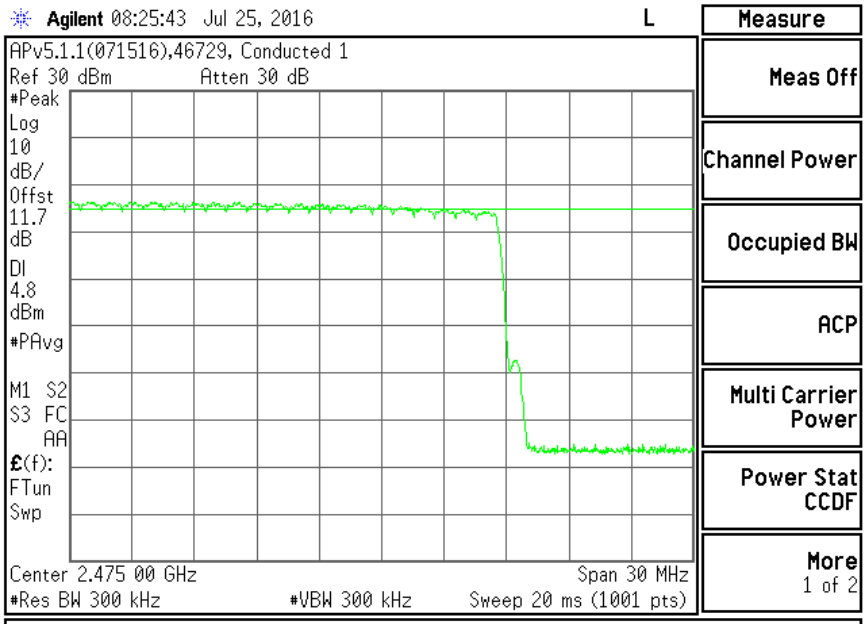


NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



This report shall not be reproduced except in full, without the written approval of UL LLC.

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



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

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

Test Information

Date: 2016-07-28
Tester: Ron Reichard

RESULTS

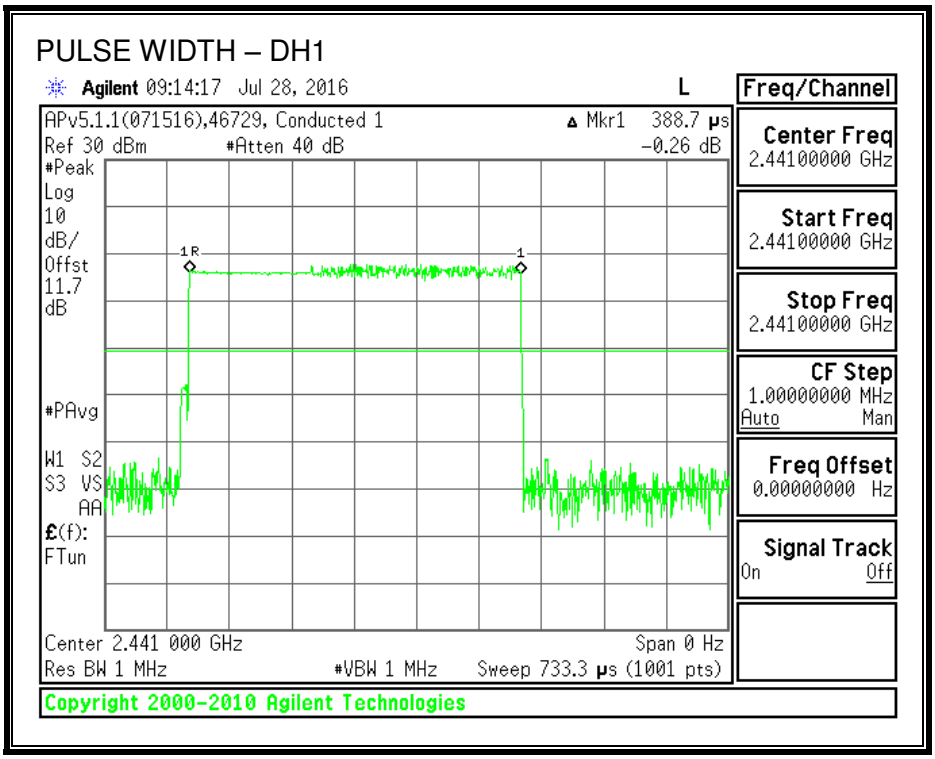
Time Of Occupancy = 10 * xx pulses * yy msec = zz msec

DQPSK Mode

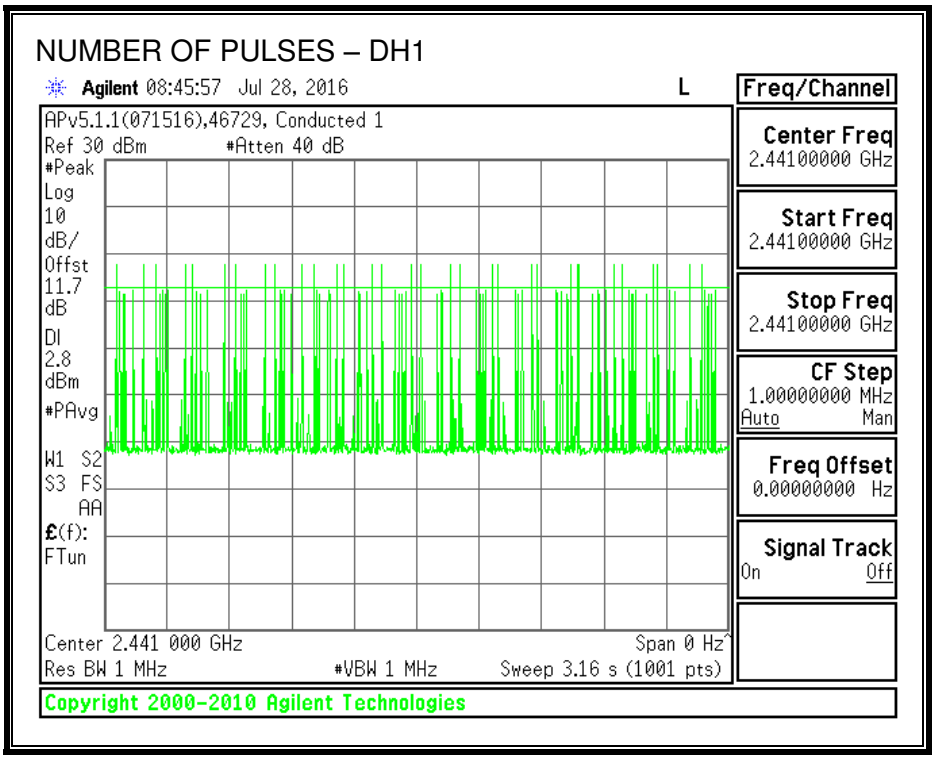
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.3887	31	0.120	0.4	-0.280
DH3	1.642	14	0.230	0.4	-0.170
DH5	2.888	9	0.260	0.4	-0.140

This report shall not be reproduced except in full, without the written approval of UL LLC.

PULSE WIDTH - DH1

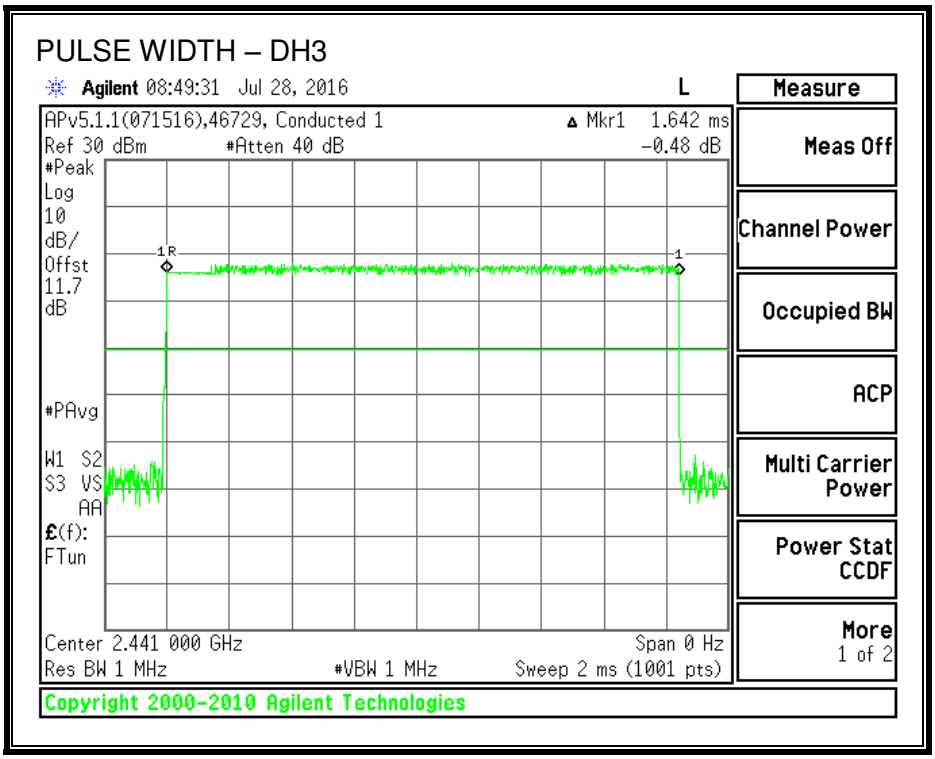


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

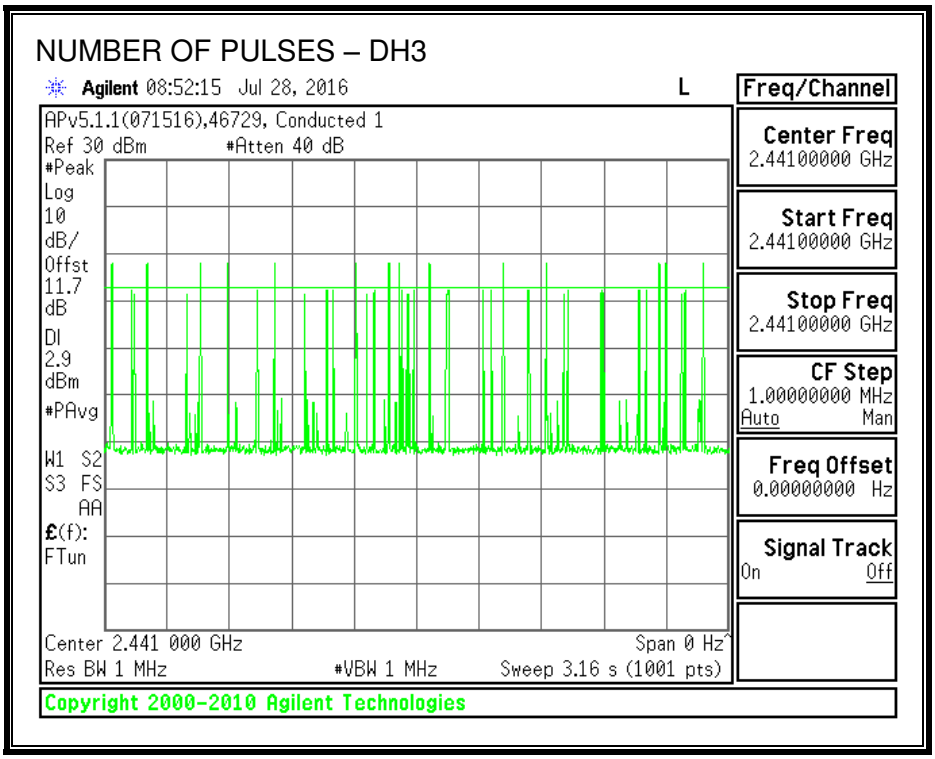


This report shall not be reproduced except in full, without the written approval of UL LLC.

PULSE WIDTH – DH3

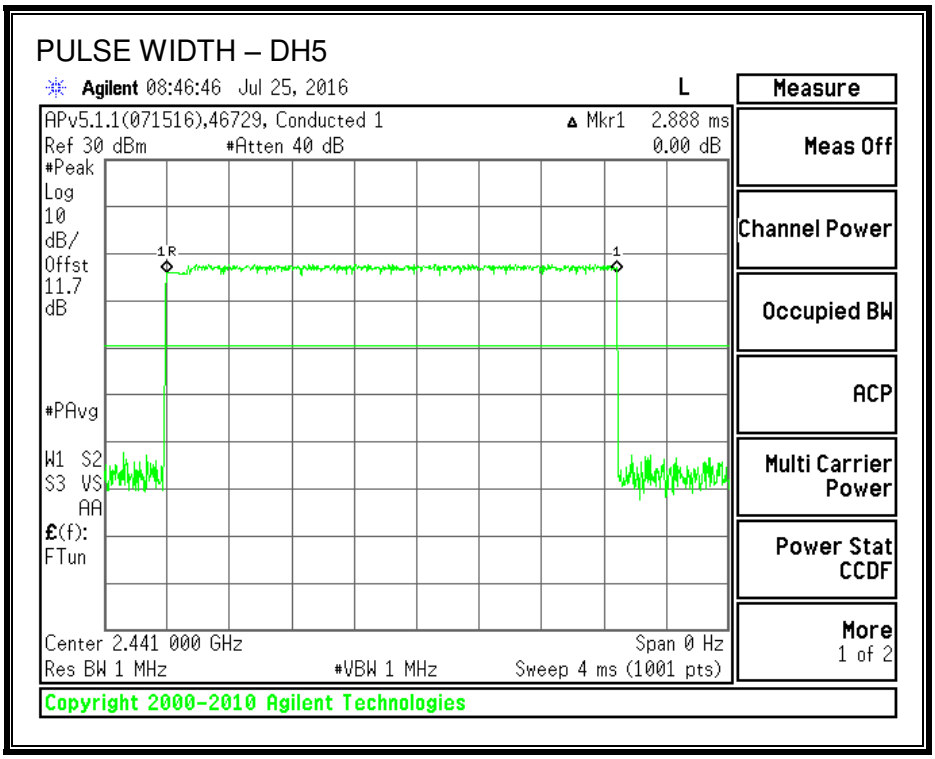


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

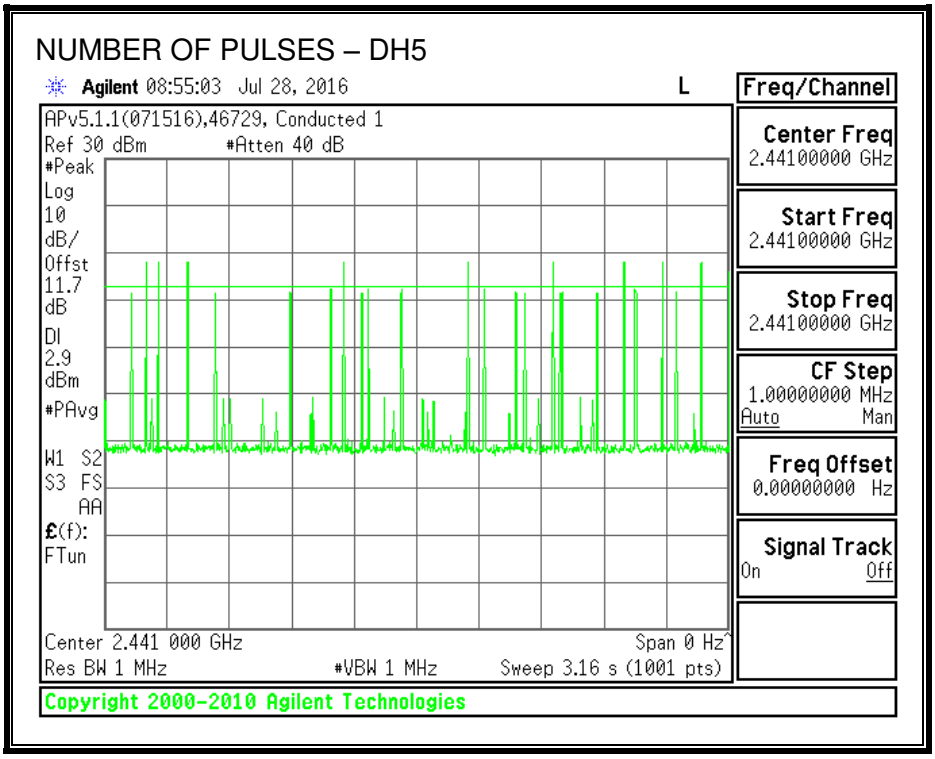


This report shall not be reproduced except in full, without the written approval of UL LLC.

PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.2.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

TEST PROCEDURE

The transmitter output is connected to a power meter.

TEST INFORMATION

Date: 2016-07-29
Tester: Ron Reichard

RESULTS

The cable assembly insertion loss of 11.7 dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	7.80	-6.20	21	-13.20
Middle	2441	9.40	-6.20	21	-11.60
High	2480	7.40	-6.20	21	-13.60

This report shall not be reproduced except in full, without the written approval of UL LLC.

7.2.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

TEST INFORMATION

Date: 2016-07-29
Tester: Ron Reichard

RESULTS

The cable assembly insertion loss of 11.7 dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	5.10
Middle	2441	6.80
High	2480	4.90

This report shall not be reproduced except in full, without the written approval of UL LLC.

7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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.

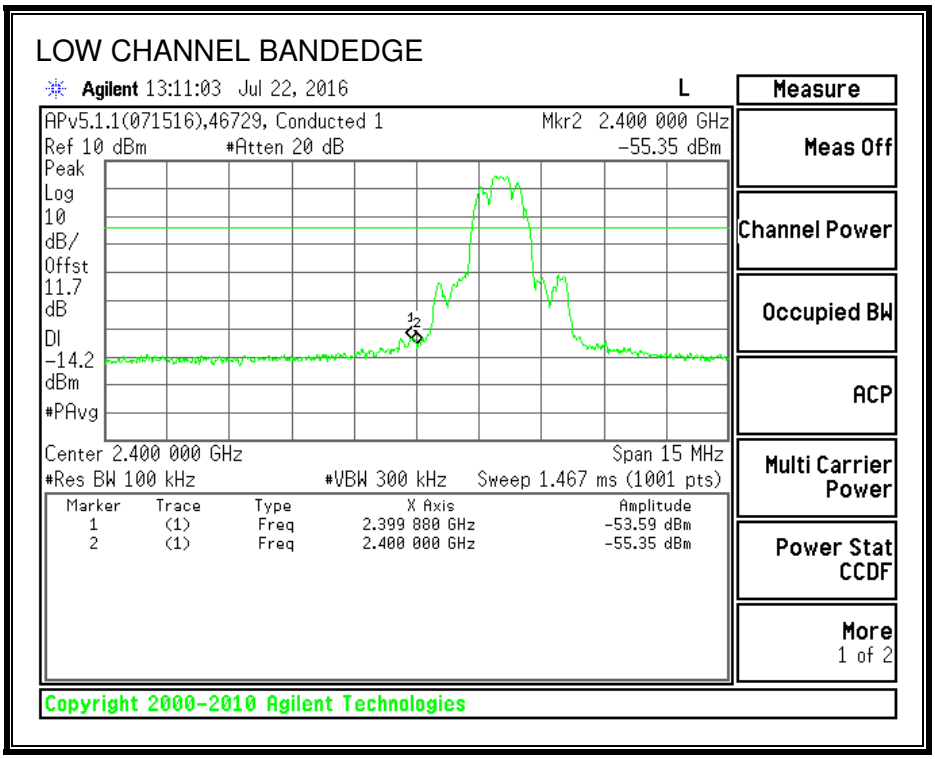
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

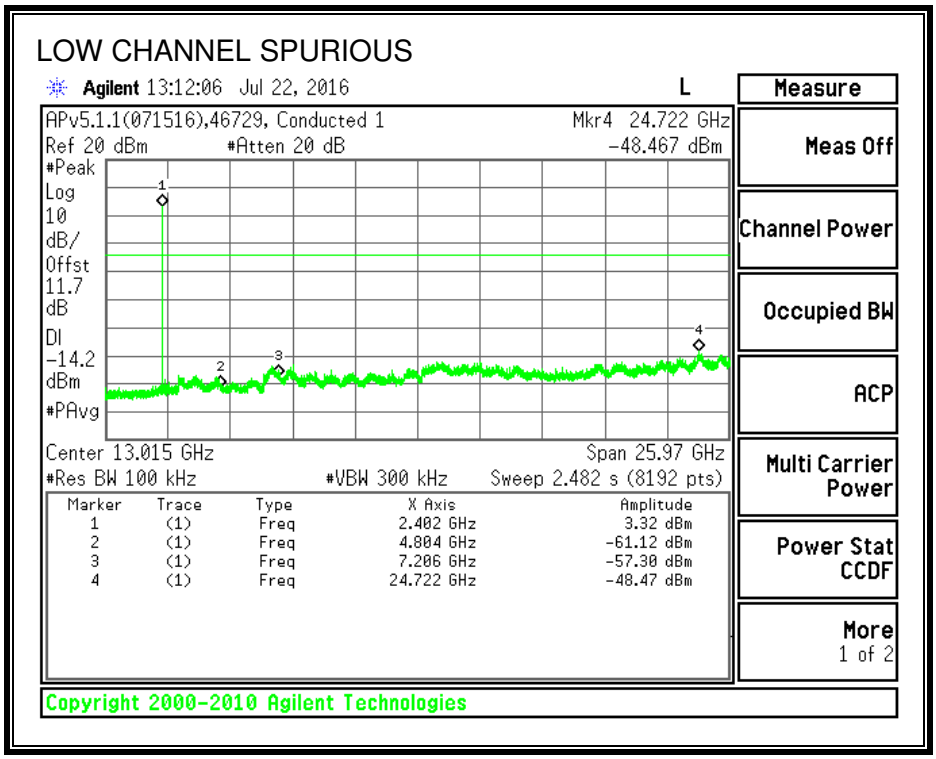
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

Test Information
Date: 2016-07-22
Tester: Ron Reichard

This report shall not be reproduced except in full, without the written approval of UL LLC.

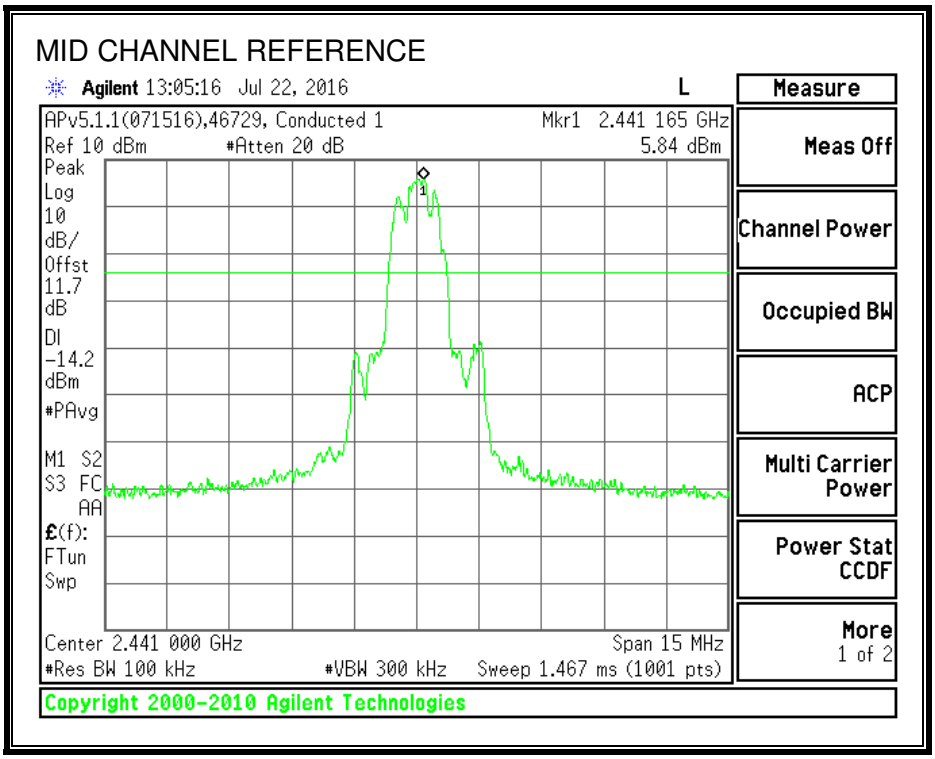
RESULTS
SPURIOUS EMISSIONS, LOW CHANNEL

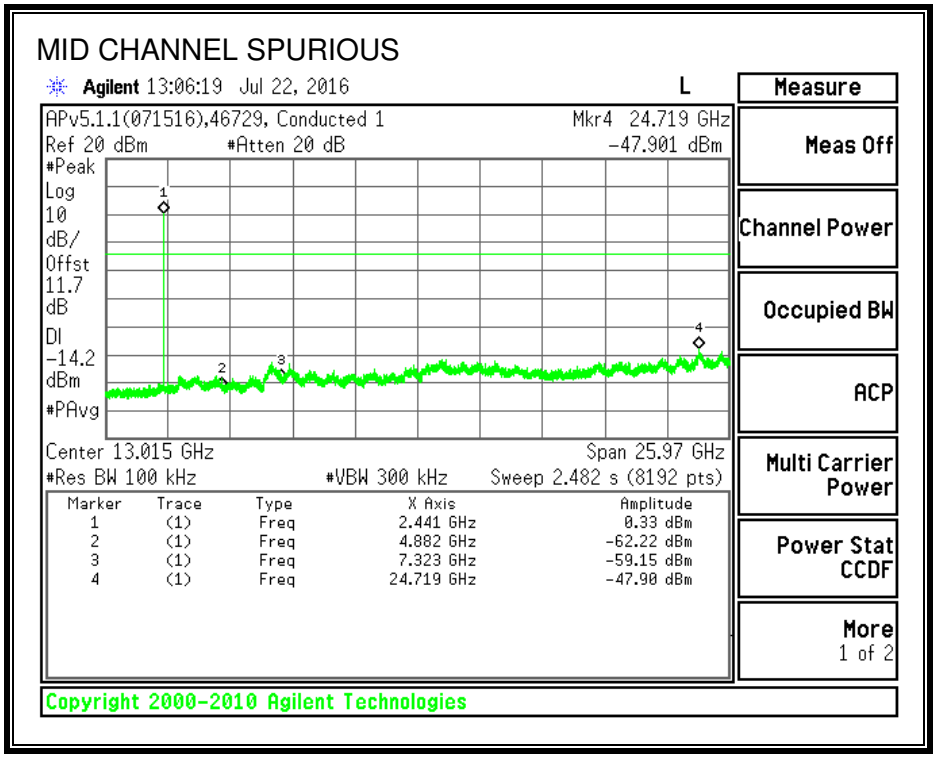




This report shall not be reproduced except in full, without the written approval of UL LLC.

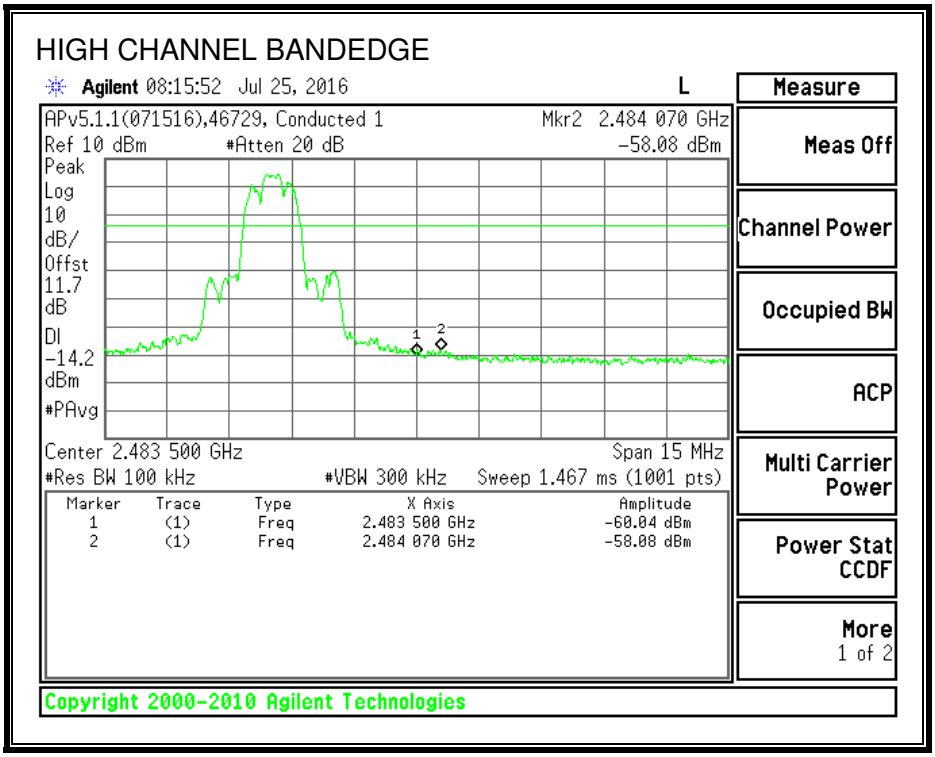
SPURIOUS EMISSIONS, MID CHANNEL

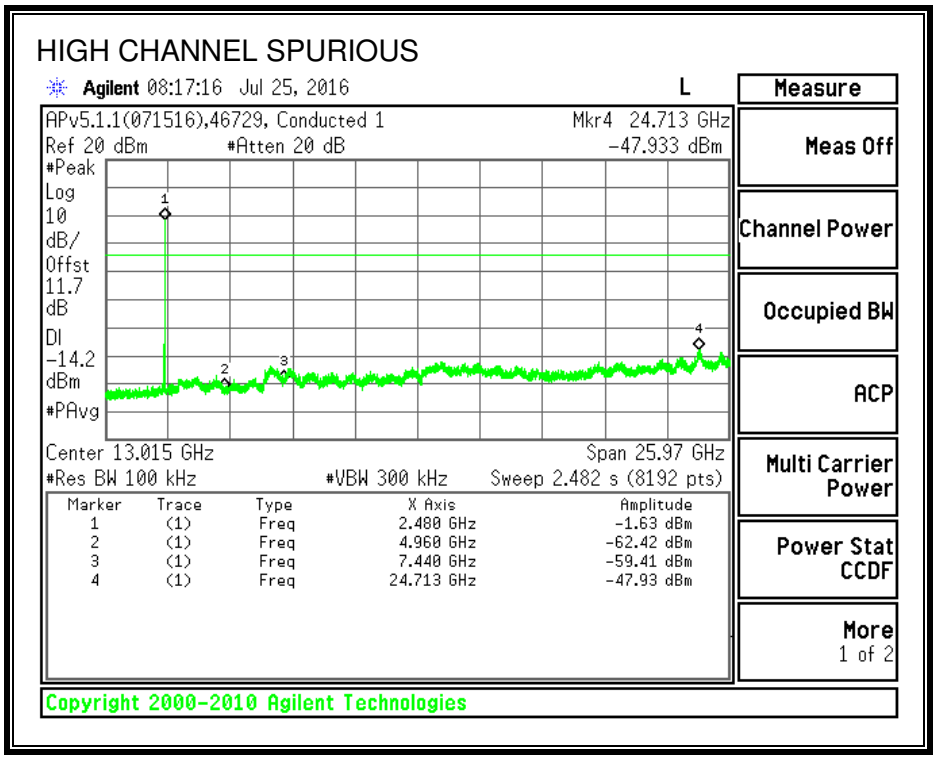




This report shall not be reproduced except in full, without the written approval of UL LLC.

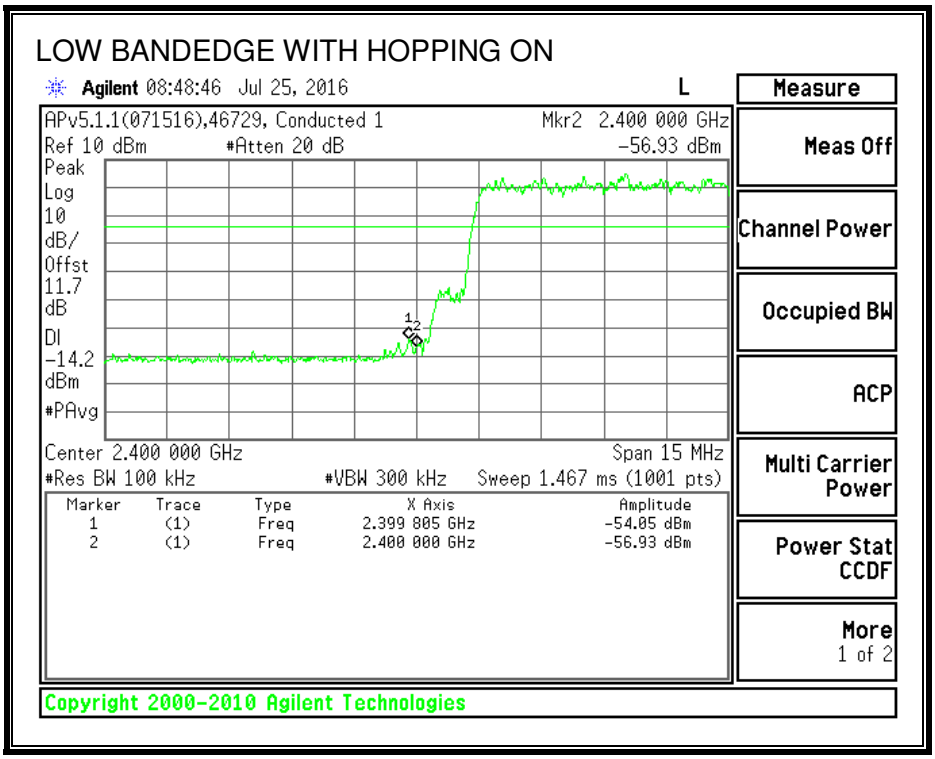
SPURIOUS EMISSIONS, HIGH CHANNEL

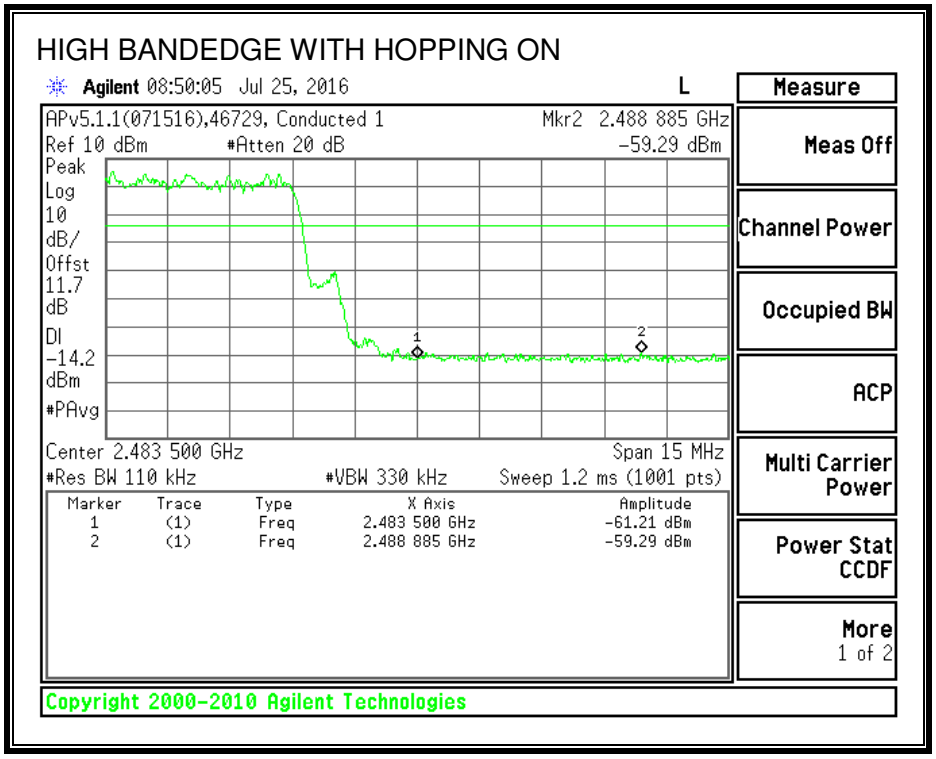




This report shall not be reproduced except in full, without the written approval of UL LLC.

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





This report shall not be reproduced except in full, without the written approval of UL LLC.

7.3. ENHANCED DATA RATE 8PSK MODULATION

7.3.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

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.

Test Information

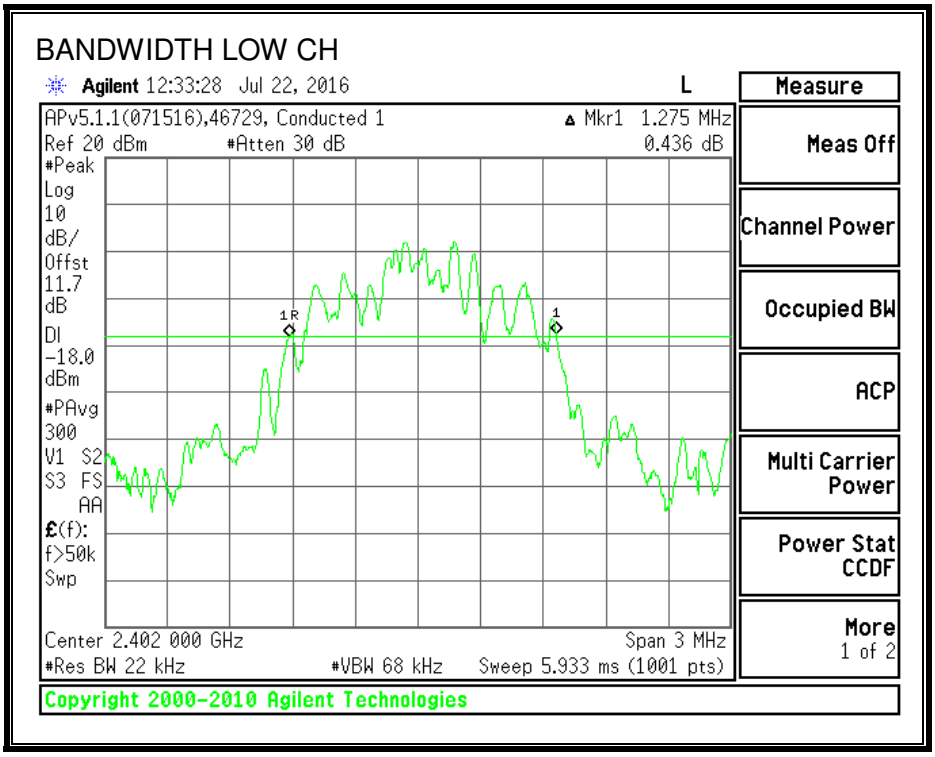
Date: 2016-07-22
Tester: Ron Reichard

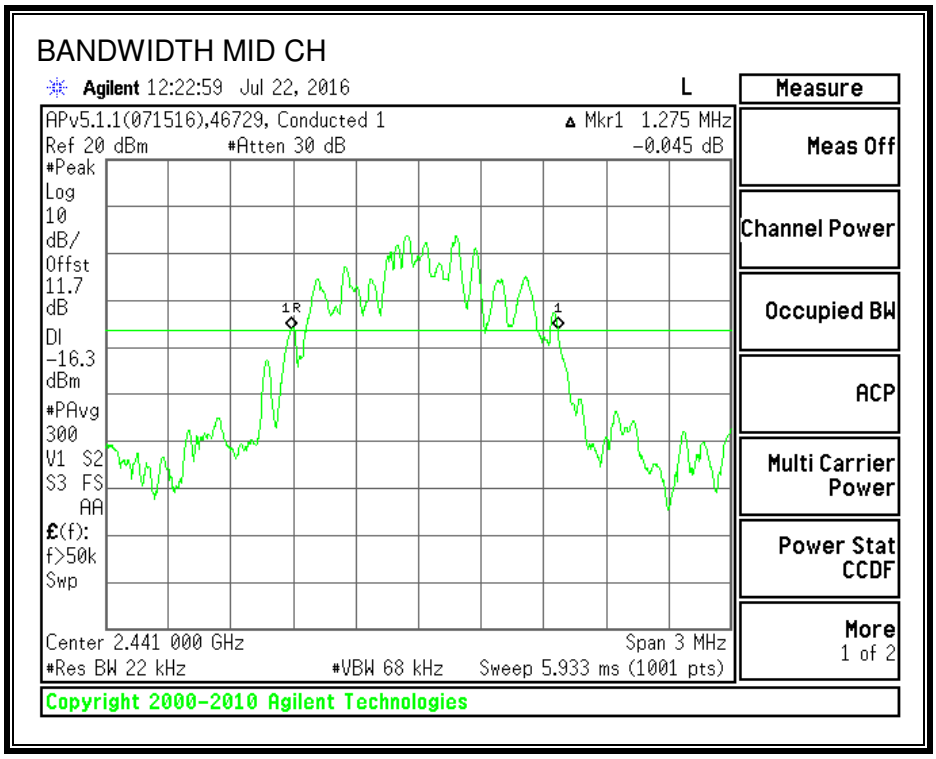
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	1275
Middle	2441	1275
High	2480	1278

This report shall not be reproduced except in full, without the written approval of UL LLC.

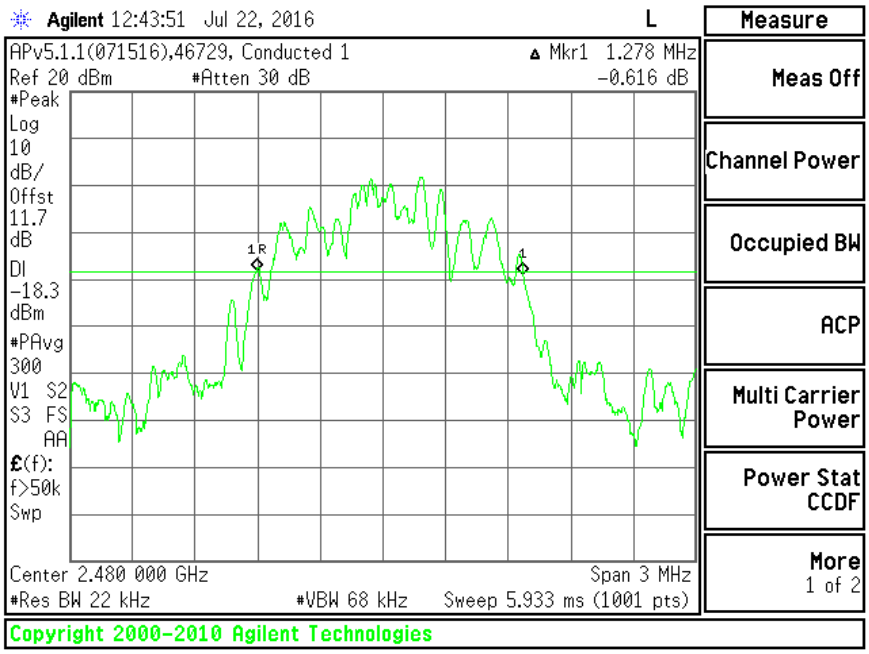
20 dB AND 99% BANDWIDTH





This report shall not be reproduced except in full, without the written approval of UL LLC.

BANDWIDTH HIGH CH



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.3.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the 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

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

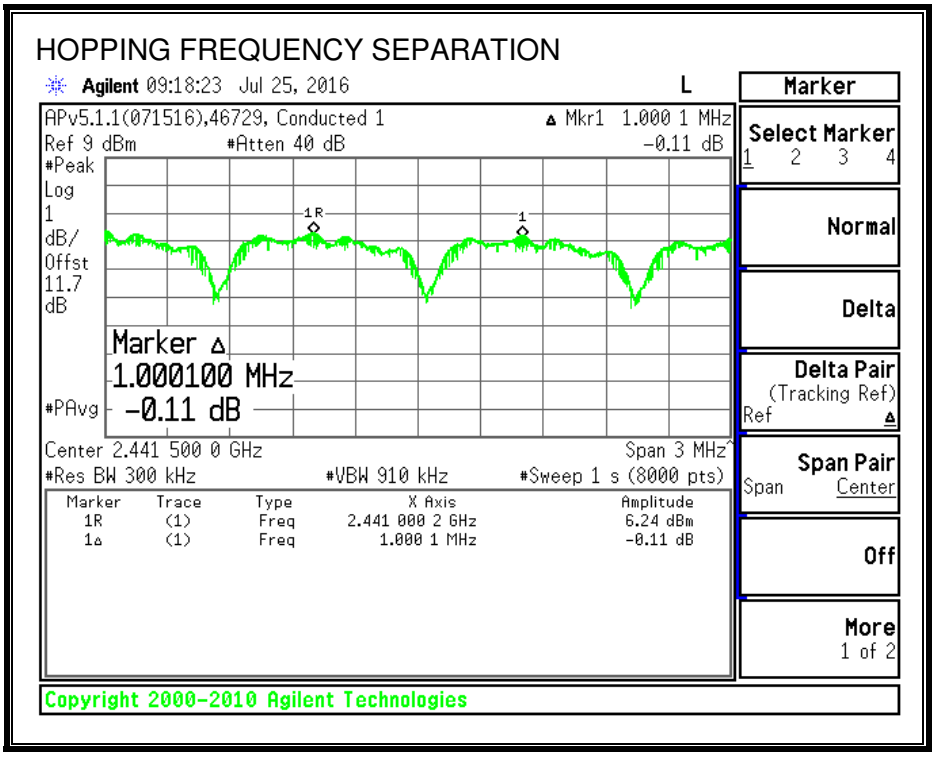
Test Information

Date: 2016-07-25
Tester: Ron Reichard

RESULTS

This report shall not be reproduced except in full, without the written approval of UL LLC.

HOPPING FREQUENCY SEPARATION



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.3.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

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

TEST PROCEDURE

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.

Test Information

Date: 2016-07-25
Tester: Ron Reichard

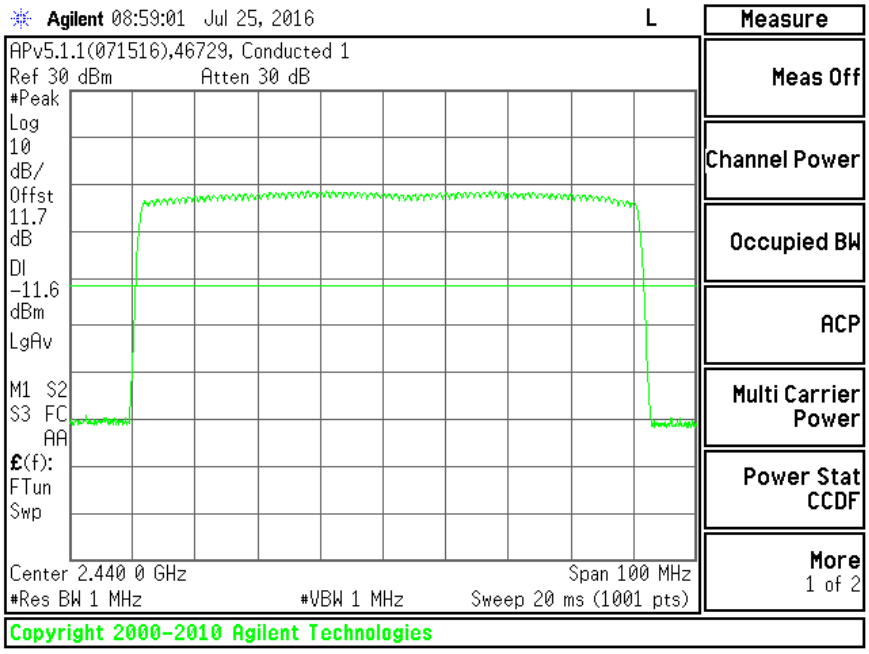
RESULTS

Normal Mode: 79 Channels observed.

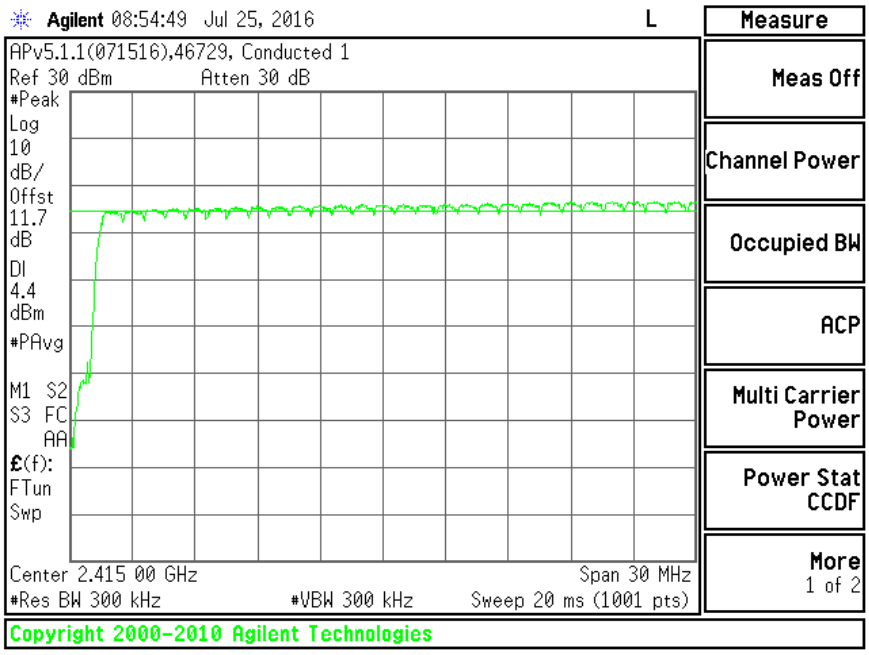
This report shall not be reproduced except in full, without the written approval of UL LLC.

NUMBER OF HOPPING CHANNELS

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)

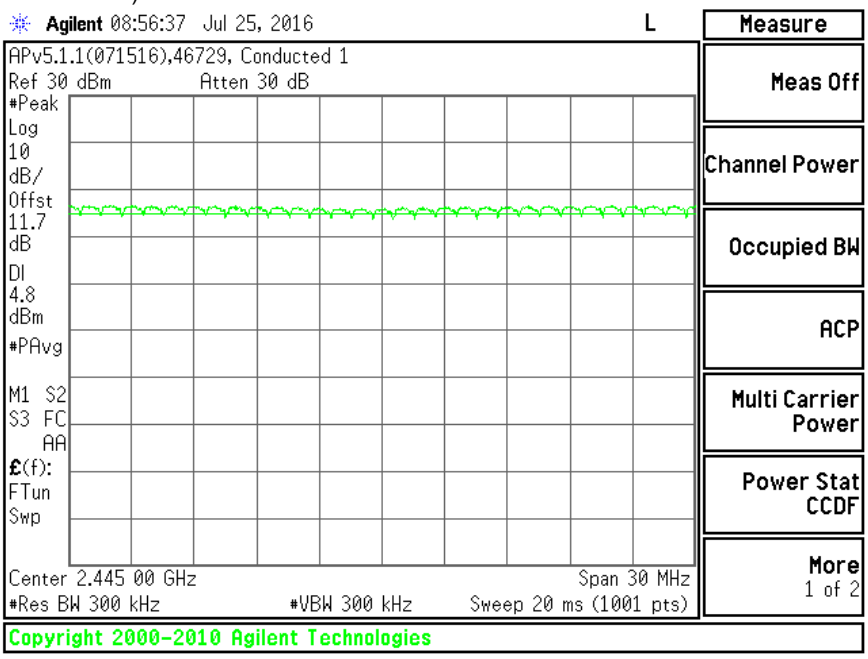


NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)

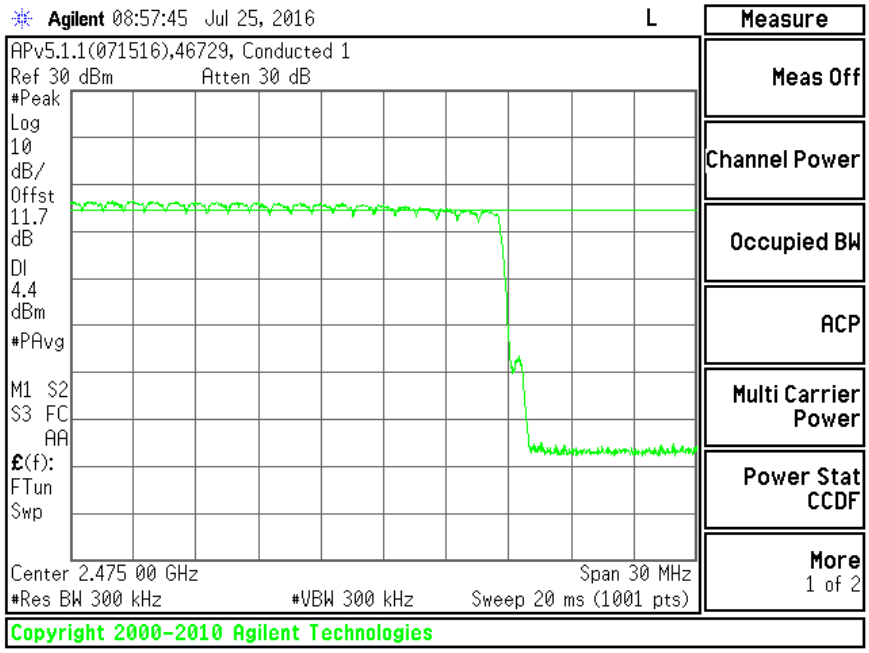


This report shall not be reproduced except in full, without the written approval of UL LLC.

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



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



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.3.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

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

Test Information

Date: 2016-07-25
Tester: Ron Reichard

RESULTS

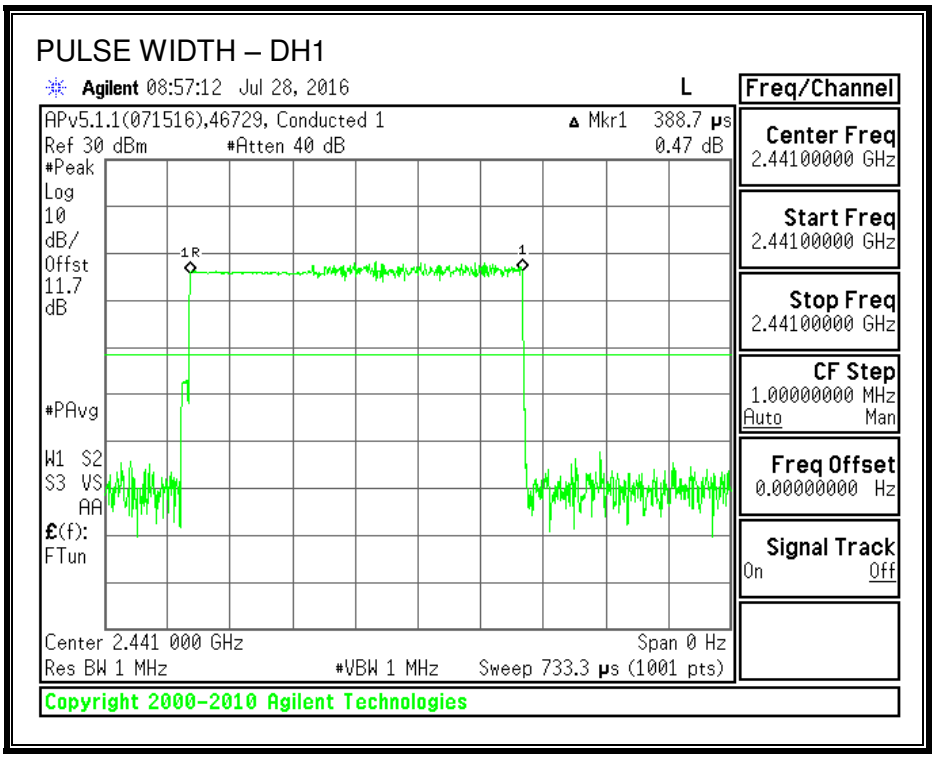
Time Of Occupancy = 10 * xx pulses * yy msec = zz msec

8PSK (EDR) Mode

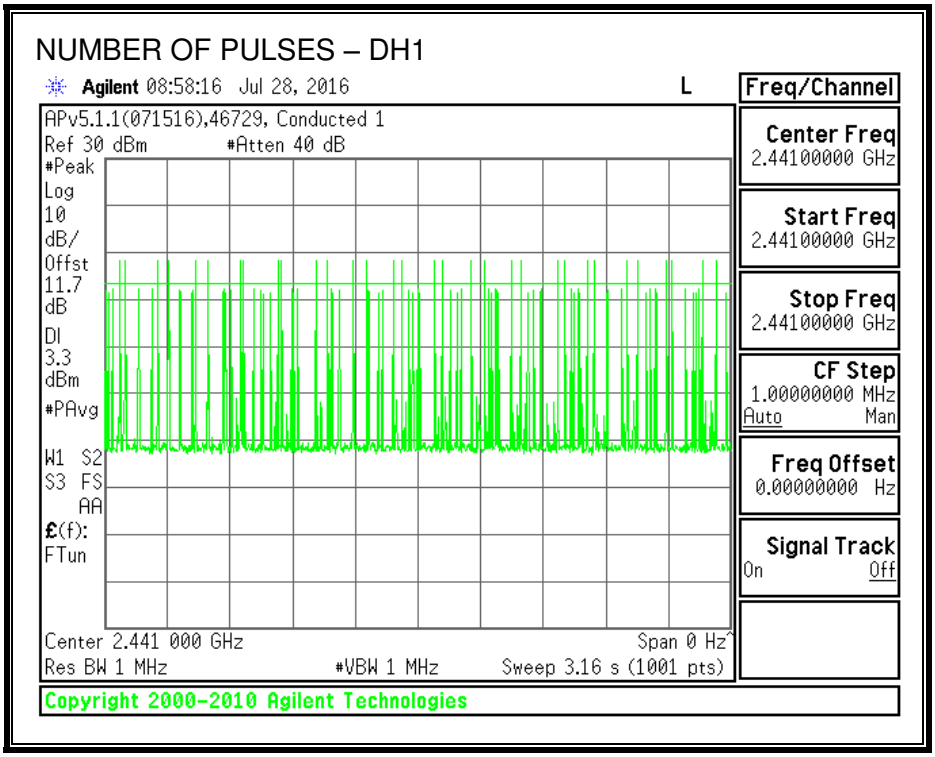
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.3887	32	0.124	0.4	-0.276
DH3	1.638	17	0.278	0.4	-0.122
DH5	2.892	9	0.260	0.4	-0.140

This report shall not be reproduced except in full, without the written approval of UL LLC.

PULSE WIDTH - DH1

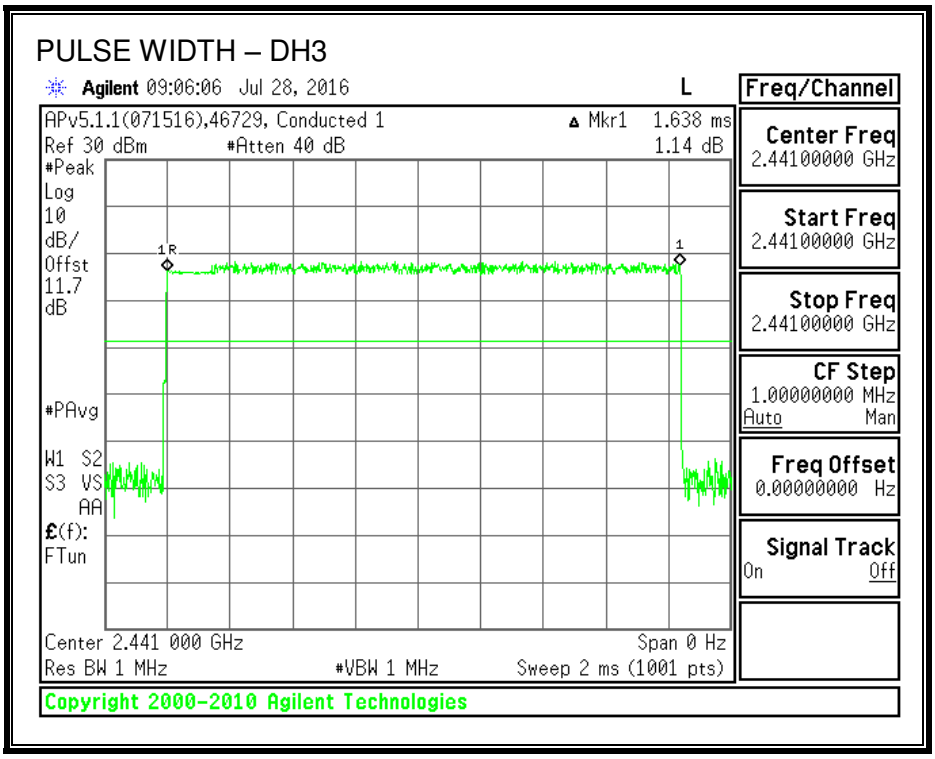


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

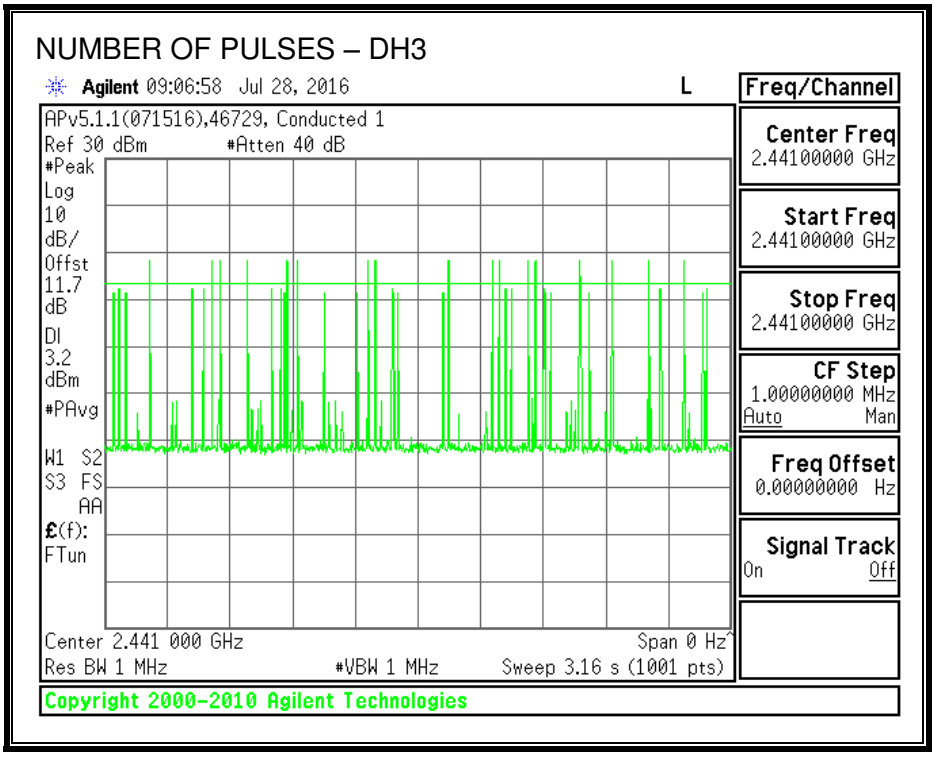


This report shall not be reproduced except in full, without the written approval of UL LLC.

PULSE WIDTH – DH3

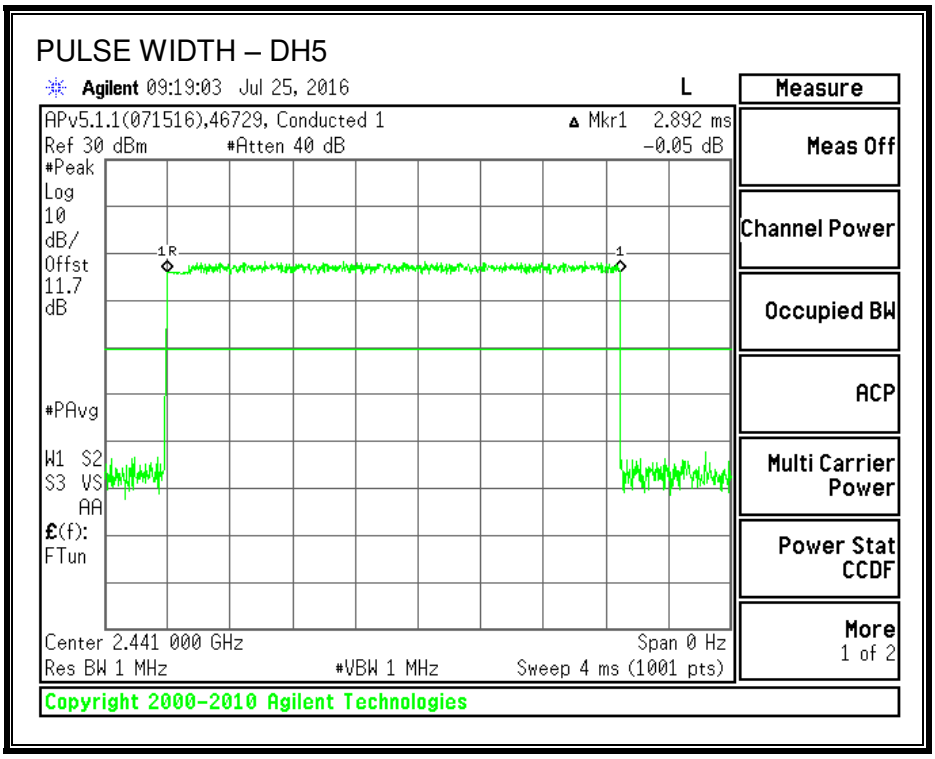


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

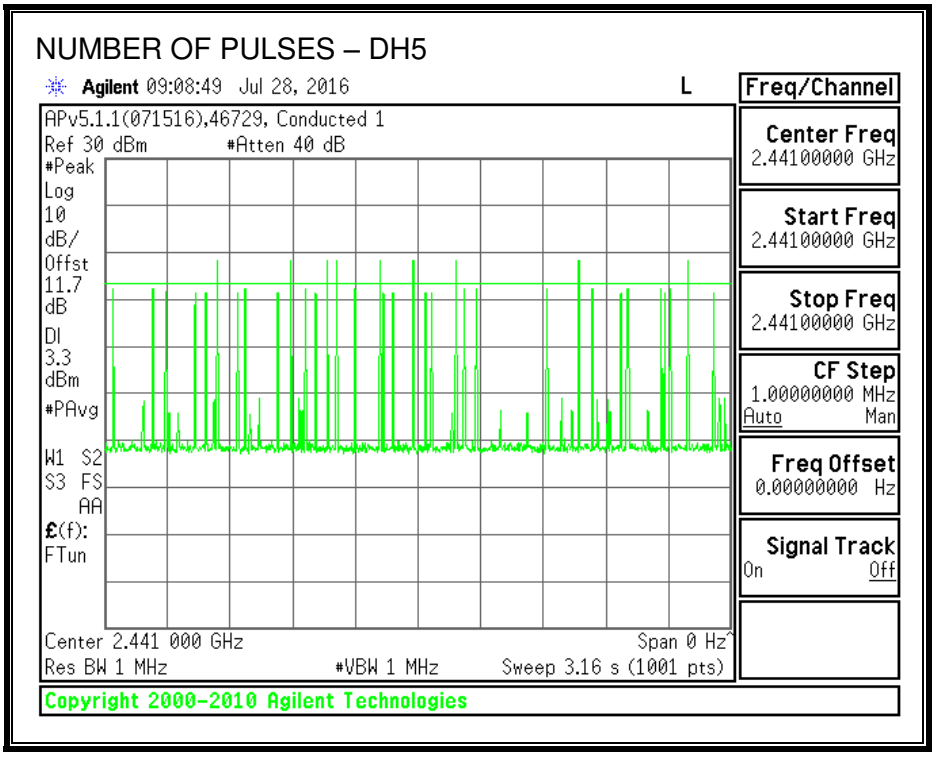


This report shall not be reproduced except in full, without the written approval of UL LLC.

PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



This report shall not be reproduced except in full, without the written approval of UL LLC.

7.3.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

TEST PROCEDURE

The transmitter output is connected to a power meter.

TEST INFORMATION

Date: 2016-07-29
Tester: Ron Reichard

RESULTS

The cable assembly insertion loss of 11.7 dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	7.80	-6.20	21	-13.20
Middle	2441	9.70	-6.20	21	-11.30
High	2480	7.60	-6.20	21	-13.40

This report shall not be reproduced except in full, without the written approval of UL LLC.

7.3.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

TEST INFORMATION

Date: 2016-07-29
Tester: Ron Reichard

RESULTS

The cable assembly insertion loss of 11.7 dB (including 10 dB pad and 1.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	5.10
Middle	2441	6.70
High	2480	4.80

This report shall not be reproduced except in full, without the written approval of UL LLC.

7.3.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

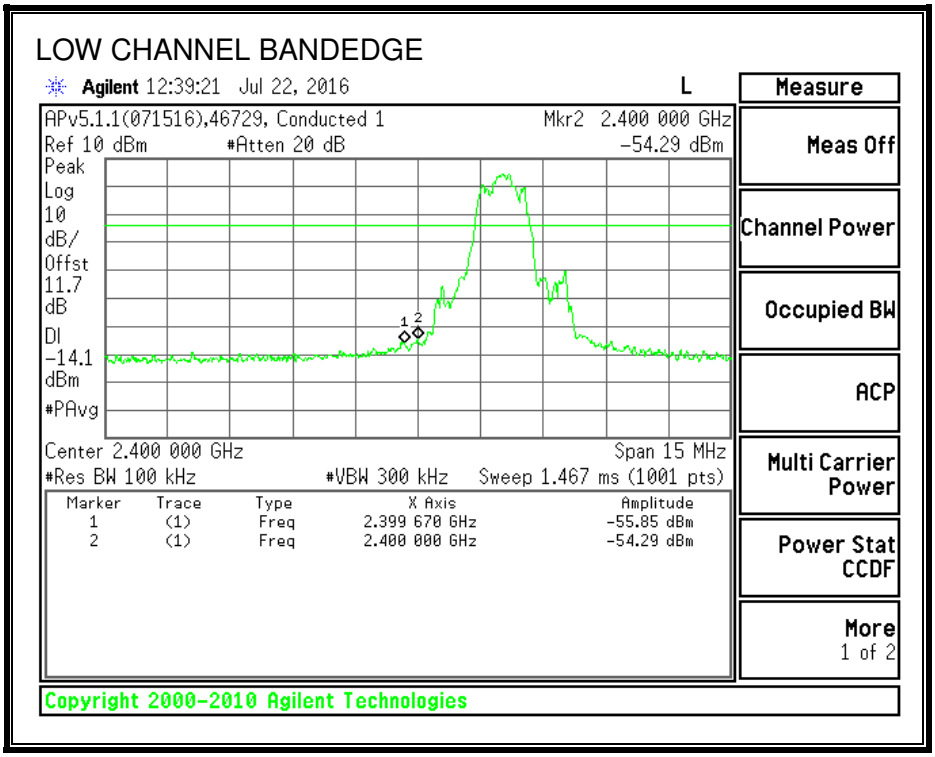
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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.

This report shall not be reproduced except in full, without the written approval of UL LLC.

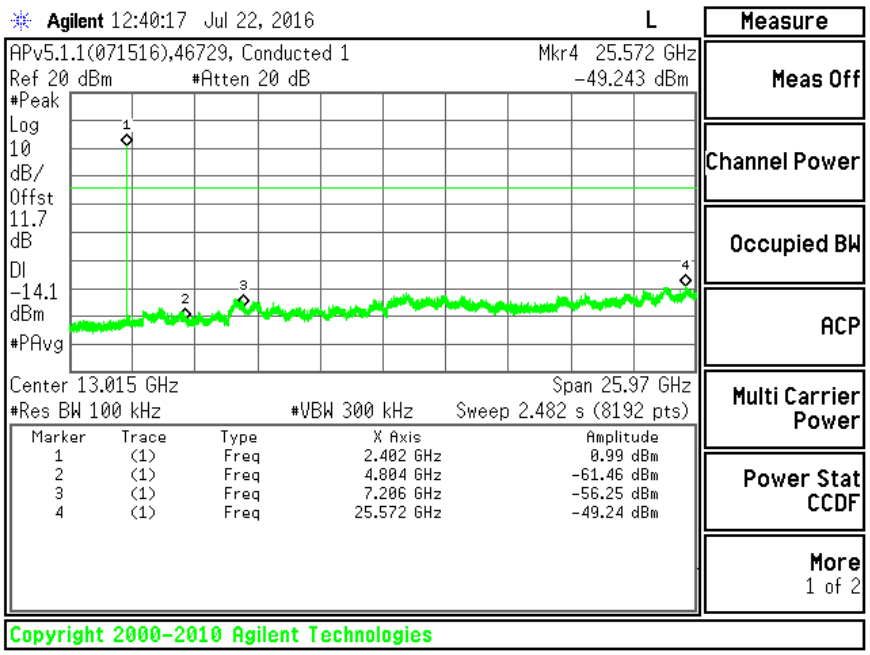
RESULTS
SPURIOUS EMISSIONS, LOW CHANNEL



Note: Limit line should be -14.62 dBm , however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

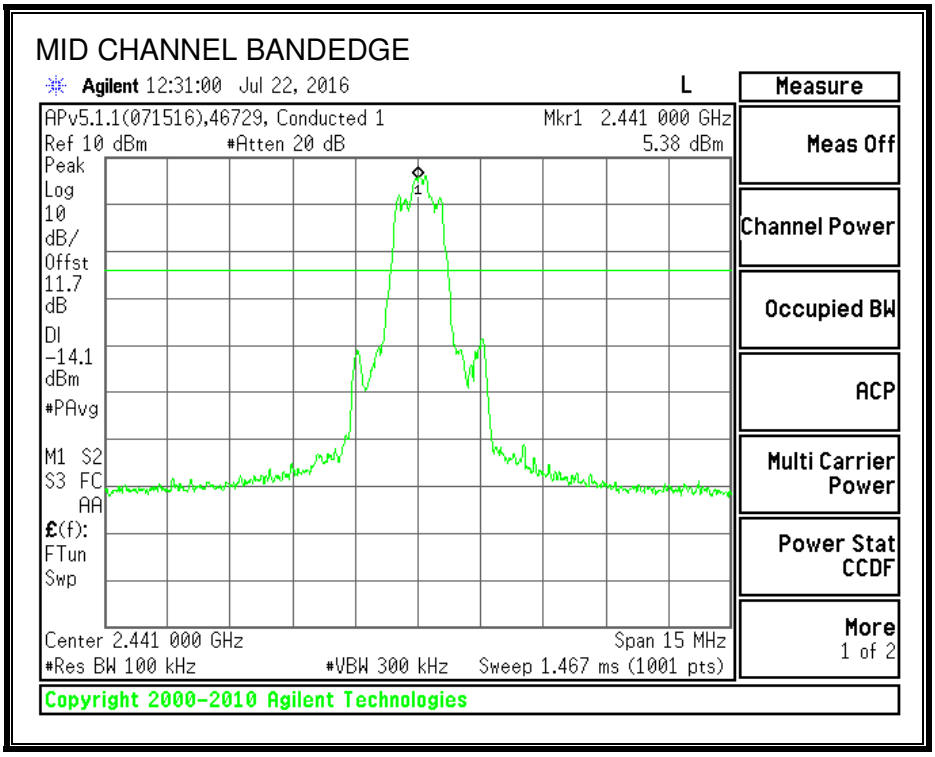
LOW CHANNEL SPURIOUS



Note: Limit line should be -14.62 dBm , however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

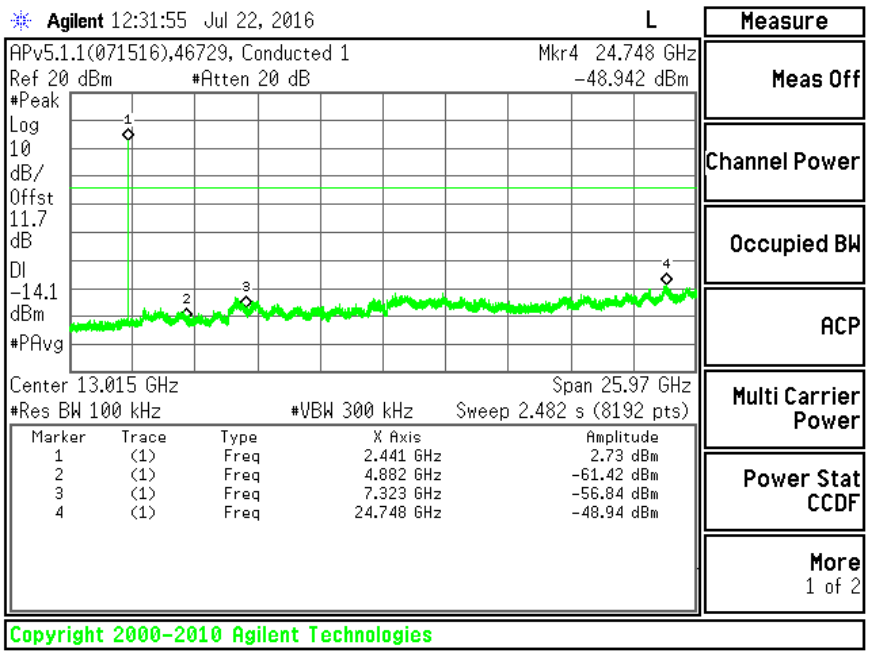
SPURIOUS EMISSIONS, MID CHANNEL



Note: Limit line should be -14.62 dBm

This report shall not be reproduced except in full, without the written approval of UL LLC.

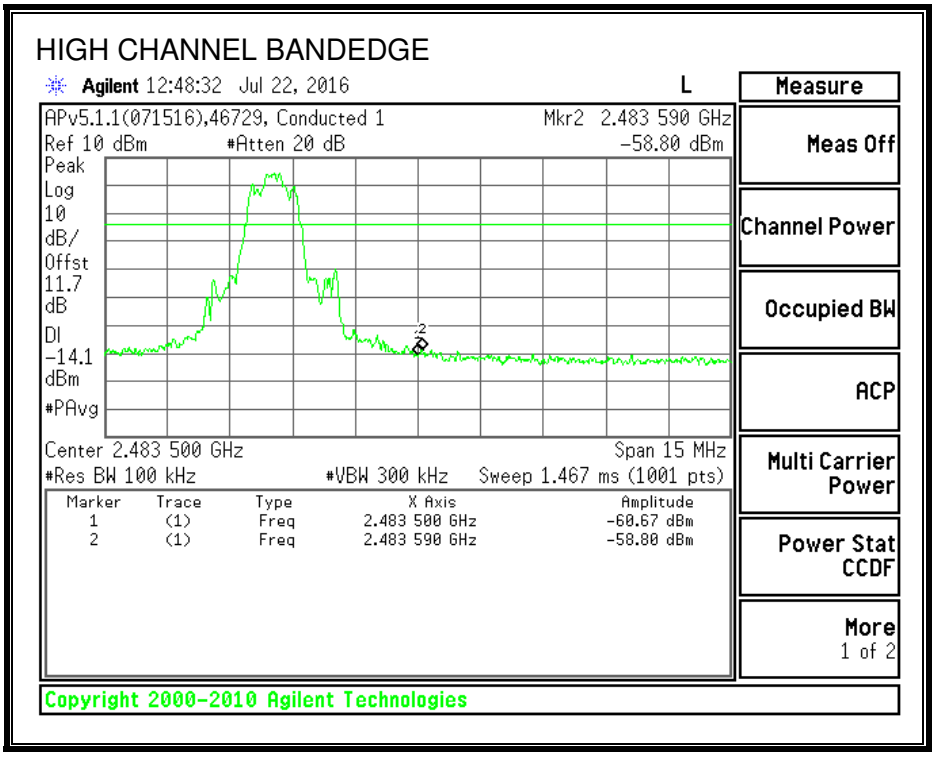
MID CHANNEL SPURIOUS



Note: Limit line should be -14.62 dBm , however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

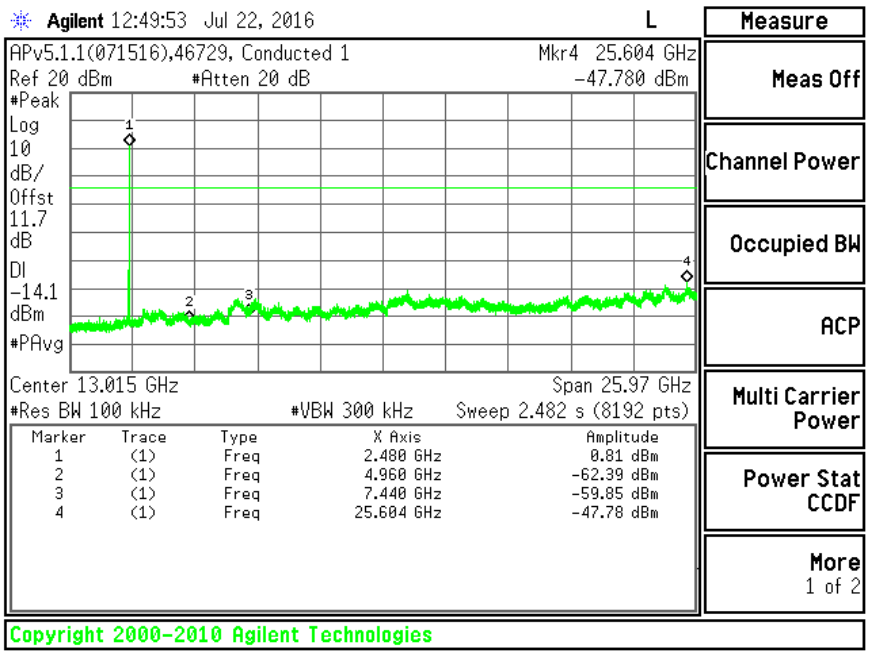
SPURIOUS EMISSIONS, HIGH CHANNEL



Note: Limit line should be -14.62 dBm , however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

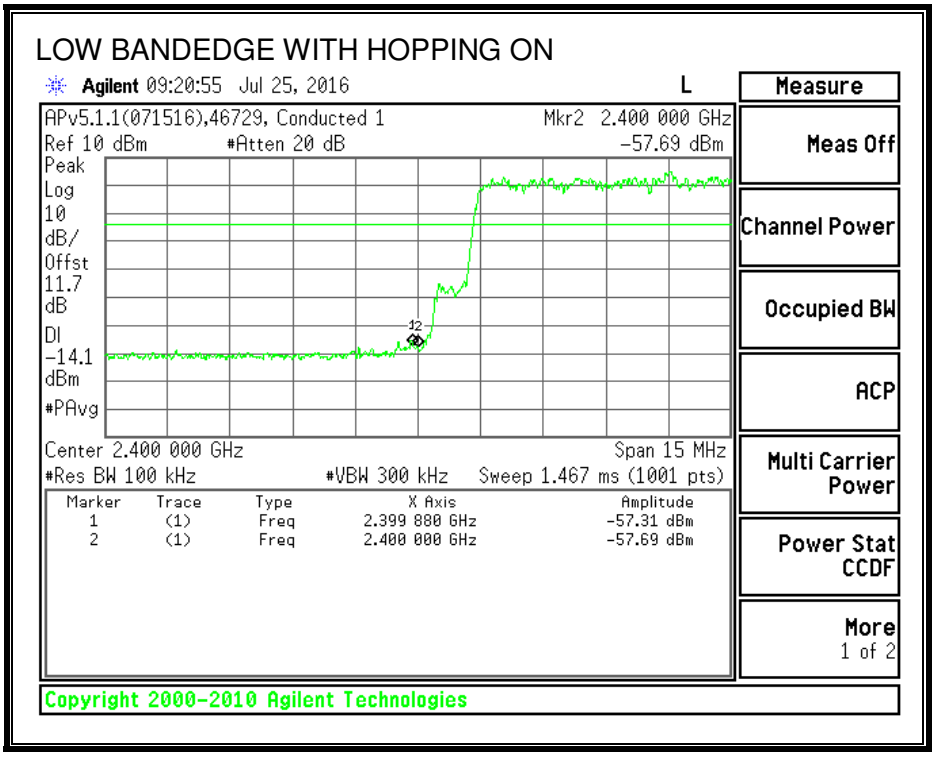
HIGH CHANNEL SPURIOUS



Note: Limit line should be -14.62 dBm , however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

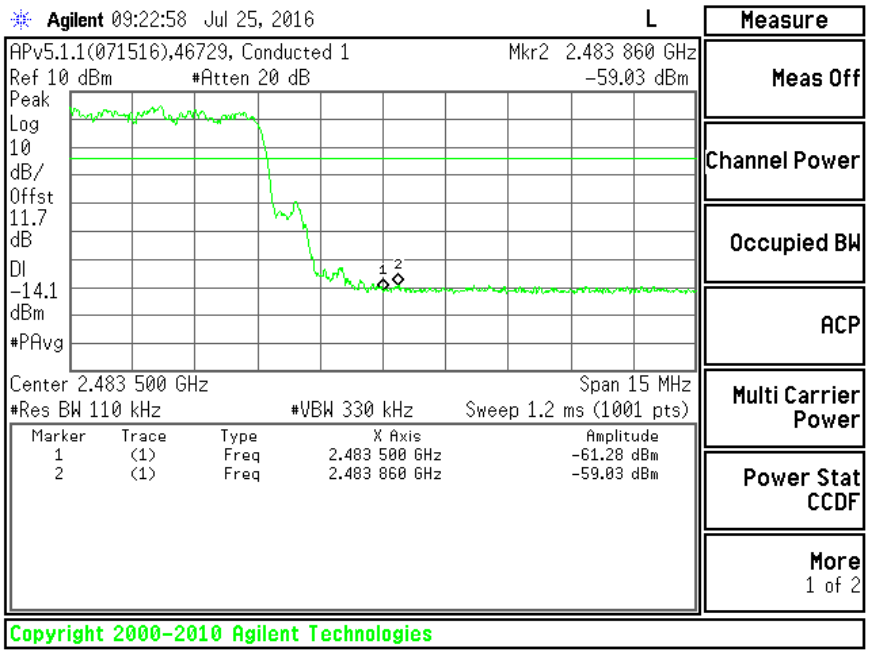
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



Note: Limit line should be -14.62 dBm , however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

HIGH BANDEDGE WITH HOPPING ON



Note: Limit line should be -14.62 dBm , however margin is sufficient to be compliant.

This report shall not be reproduced except in full, without the written approval of UL LLC.

8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
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 measurements and 1.5 m above the ground plane for above 1GHz measurements. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For peak measurements above 1 GHz, the resolution bandwidth is set to 1 MHz and the video bandwidth is set to 3 MHz. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. The particular averaging method used for this test program was by measuring using a Peak detector with the resolution bandwidth set to 1MHz and a reduced video bandwidth, based on $1/T_{on}$ where T_{on} is the transmit on time (calculated to approx. 2.9 ms).

The spectrum from 9 kHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

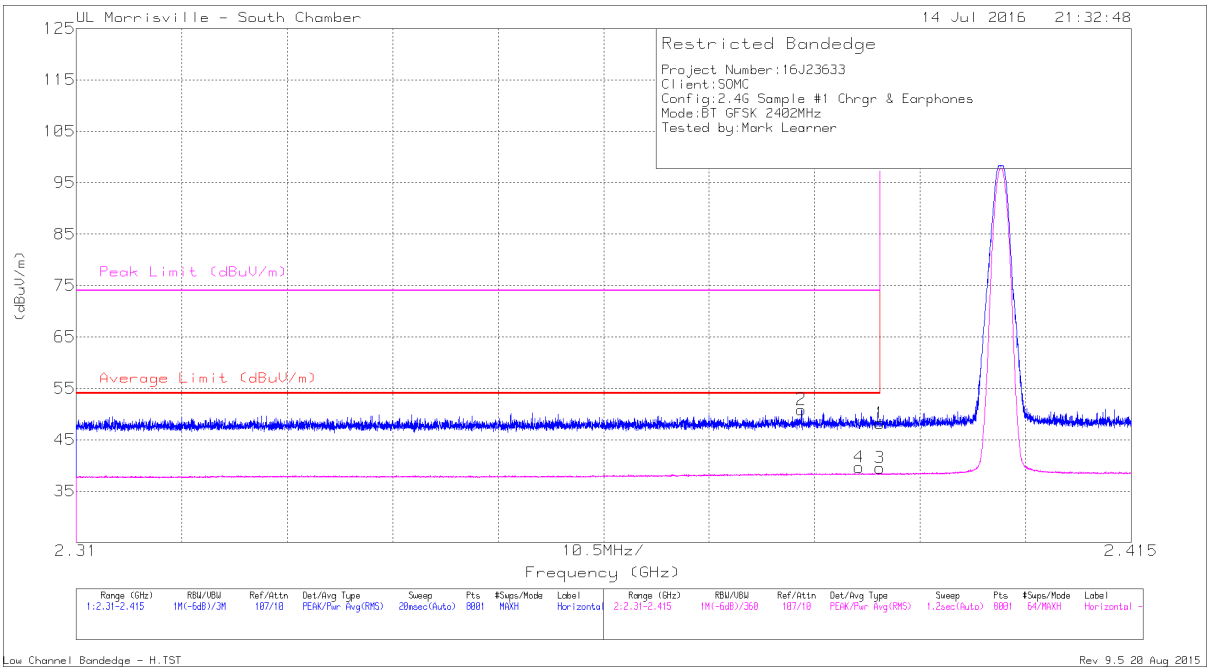
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

This report shall not be reproduced except in full, without the written approval of UL LLC.

8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

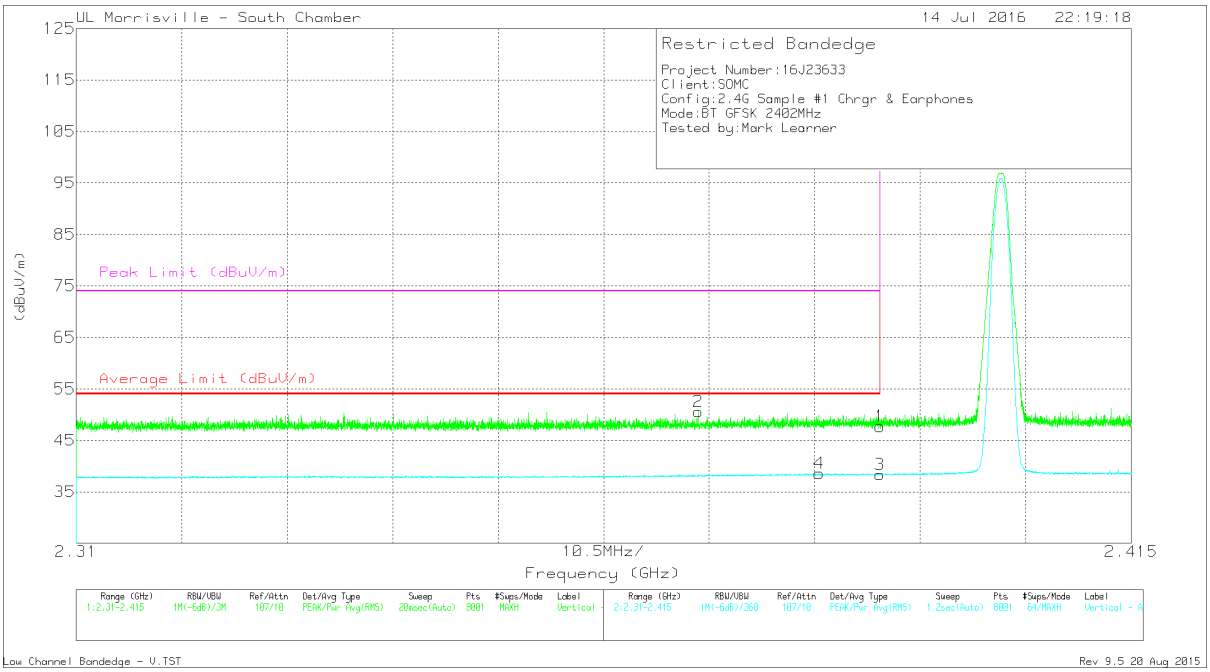


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.81	Pk	32.2	-24.8	48.21	-	-	74	-25.79	346	375	H
2	* 2.382	43.45	Pk	32.1	-24.7	50.85	-	-	74	-23.15	346	375	H
3	* 2.39	30.98	V1TR	32.2	-24.8	38.38	54	-15.62	-	-	346	375	H
4	* 2.388	31.11	V1TR	32.2	-24.8	38.51	54	-15.49	-	-	346	375	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

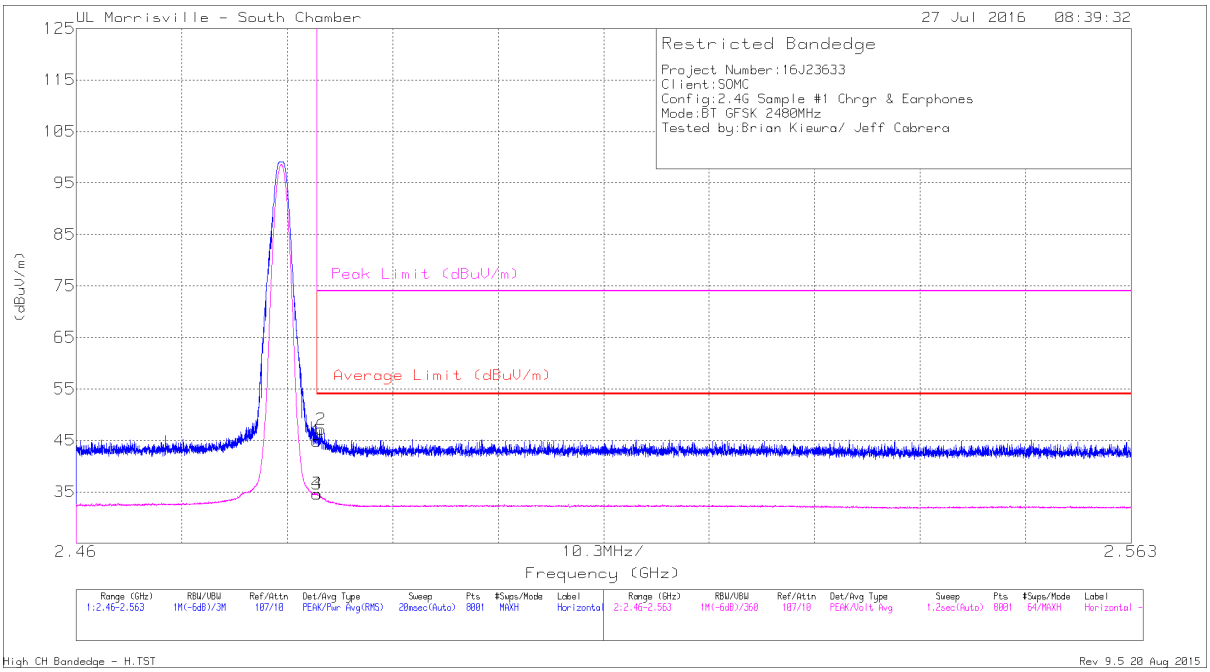


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.32	Pk	32.2	-24.8	47.72	-	-	74	-26.28	121	300	V
2	* 2.372	43.38	Pk	32	-24.8	50.58	-	-	74	-23.42	121	300	V
3	* 2.39	30.95	V1TR	32.2	-24.8	38.35	54	-15.65	-	-	121	300	V
4	* 2.384	31.19	V1TR	32.1	-24.7	38.59	54	-15.41	-	-	121	300	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

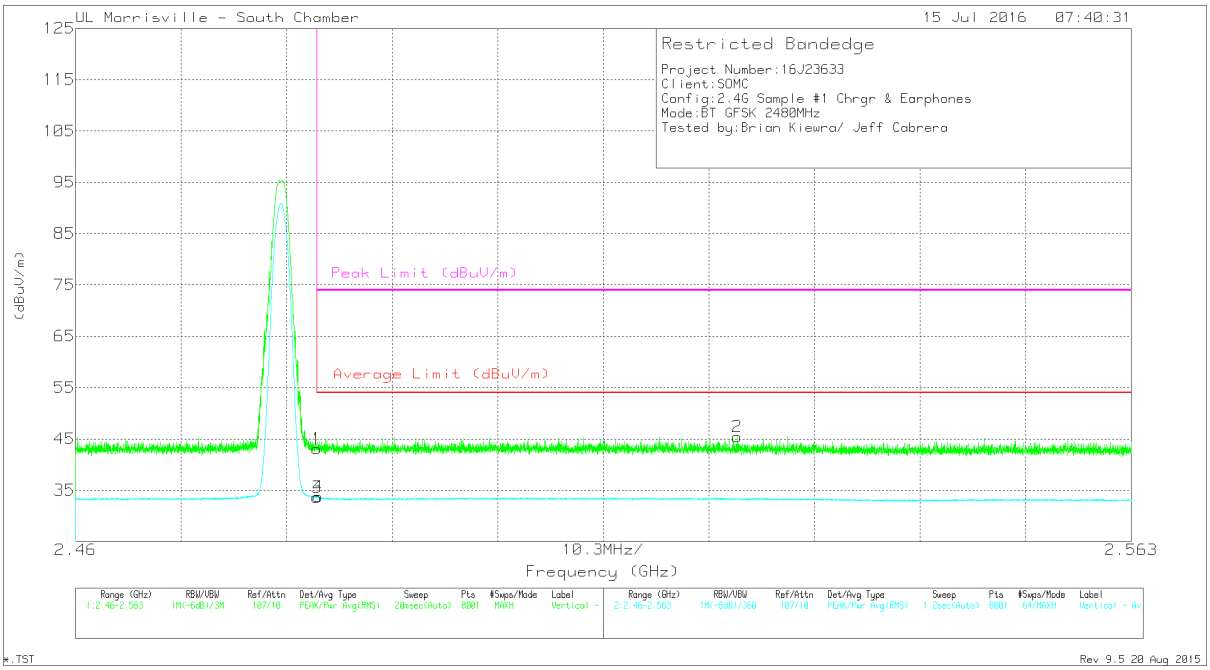


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	37.2	Pk	32.4	-24.7	44.9	-	-	74	-29.1	346	278	H
2	* 2.484	39.43	Pk	32.4	-24.7	47.13	-	-	74	-26.87	346	278	H
3	* 2.484	26.9	V1TR	32.4	-24.7	34.6	54	-19.4	-	-	346	278	H
4	* 2.484	26.92	V1TR	32.4	-24.7	34.62	54	-19.38	-	-	346	278	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

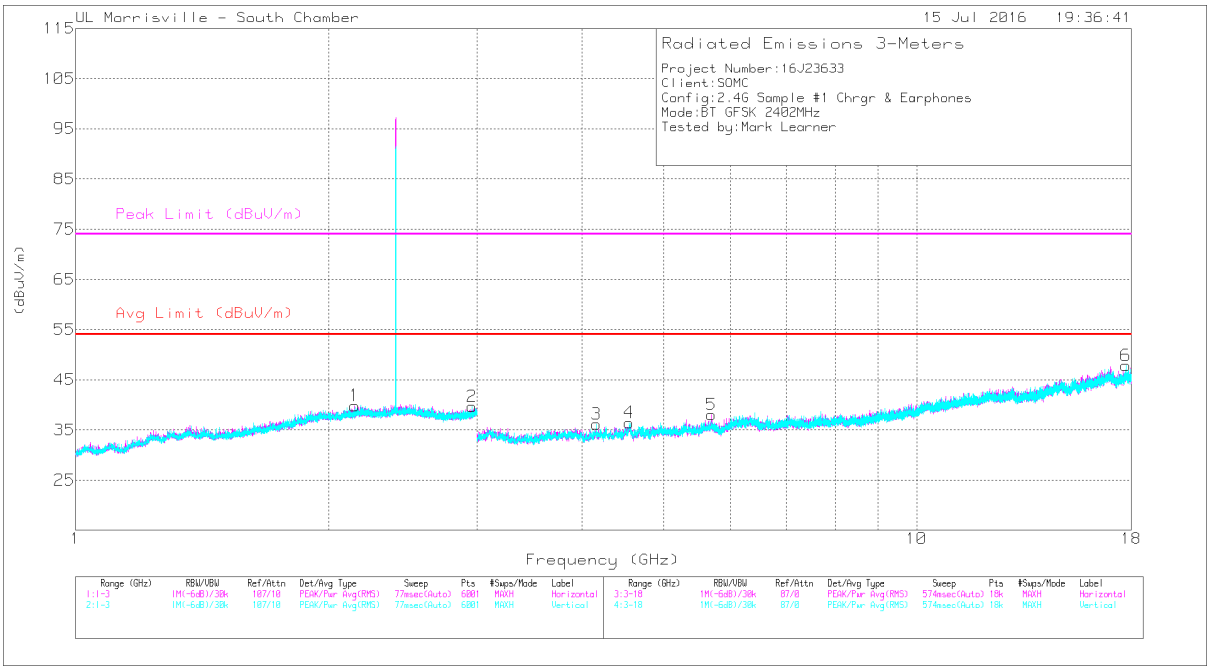


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	35.35	Pk	32.4	-24.7	43.05	-	-	74	-30.95	289	314	V
2	2.525	37.84	Pk	32.5	-24.9	45.44	-	-	74	-28.56	289	314	V
3	* 2.484	25.89	V1TR	32.4	-24.7	33.59	54	-20.41	-	-	289	314	V
4	* 2.484	26.04	V1TR	32.4	-24.7	33.74	54	-20.26	-	-	289	314	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

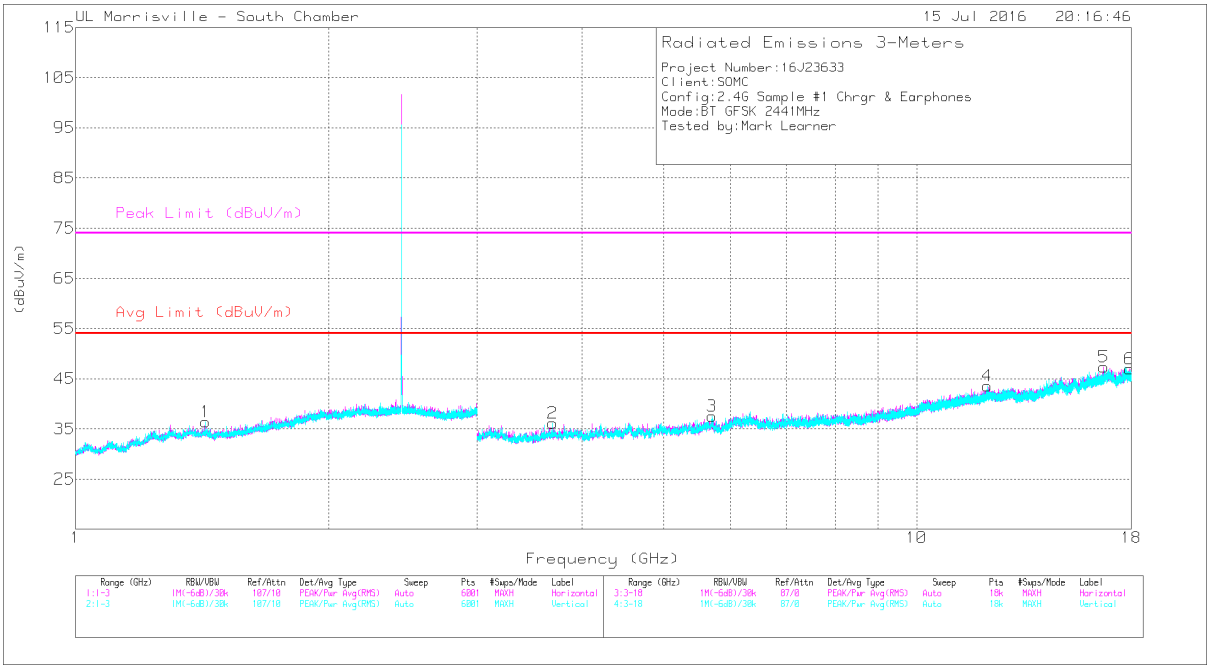
HARMONICS AND SPURIOUS EMISSIONS



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	* 4.157	40.26	PK-U	33.4	-32.2	41.46	-	-	74	-32.54	0	102	V
	* 4.157	28.91	V1TR	33.4	-32.2	30.11	54	-23.89	-	-	0	102	V
4	* 4.553	40.94	PK-U	34	-32	42.94	-	-	74	-31.06	0	198	V
	* 4.552	28.99	V1TR	34	-32	30.99	54	-23.01	-	-	0	198	V
6	* 17.733	34.32	PK-U	41.2	-22.5	53.02	-	-	74	-20.98	0	104	V
	* 17.733	23.53	V1TR	41.2	-22.6	42.13	54	-11.87	-	-	0	104	V
1	2.148	31.46	Pk	31.7	-23.3	39.86	-	-	-	-	0-360	199	H
2	2.961	33.19	Pk	32.7	-26.2	39.69	-	-	-	-	0-360	102	V
5	5.698	33.67	Pk	34.7	-30.3	38.07	-	-	-	-	0-360	199	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

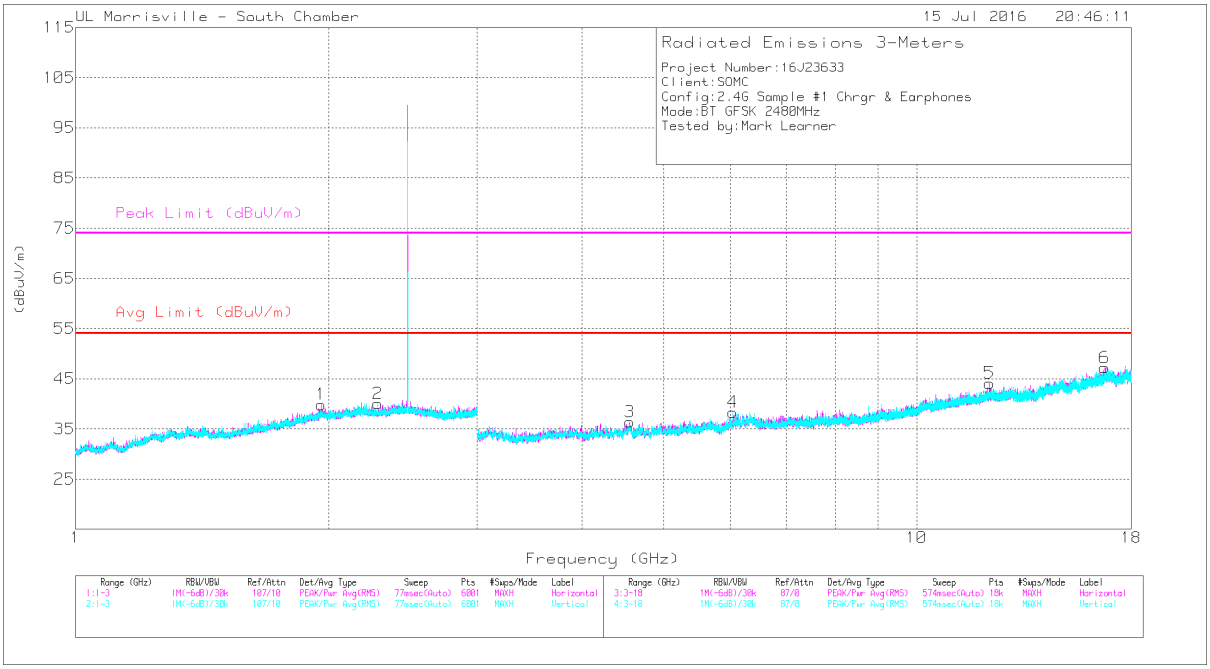
This report shall not be reproduced except in full, without the written approval of UL LLC.



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	* 17.909	33.68	PK-U	41.2	-22.8	52.08	-	-	74	-21.92	1	199	H
	* 17.911	22.98	V1TR	41.2	-22.8	41.38	54	-12.62	-	-	1	199	H
2	* 3.692	41.46	PK-U	33.3	-33.1	41.66	-	-	74	-32.34	1	102	V
	* 3.694	29.42	V1TR	33.4	-33.1	29.72	54	-24.28	-	-	1	102	V
4	* 12.146	34.58	PK-U	39	-24.9	48.68	-	-	74	-25.32	1	102	V
	* 12.146	23.29	V1TR	39	-24.9	37.39	54	-16.61	-	-	1	102	V
5	16.698	31.03	Pk	41.5	-25.2	47.33	-	-	-	-	0-360	199	H
1	1.427	30.83	Pk	28.5	-22.9	36.43	-	-	-	-	0-360	102	V
3	5.713	33.37	Pk	34.7	-30.5	37.57	-	-	-	-	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.



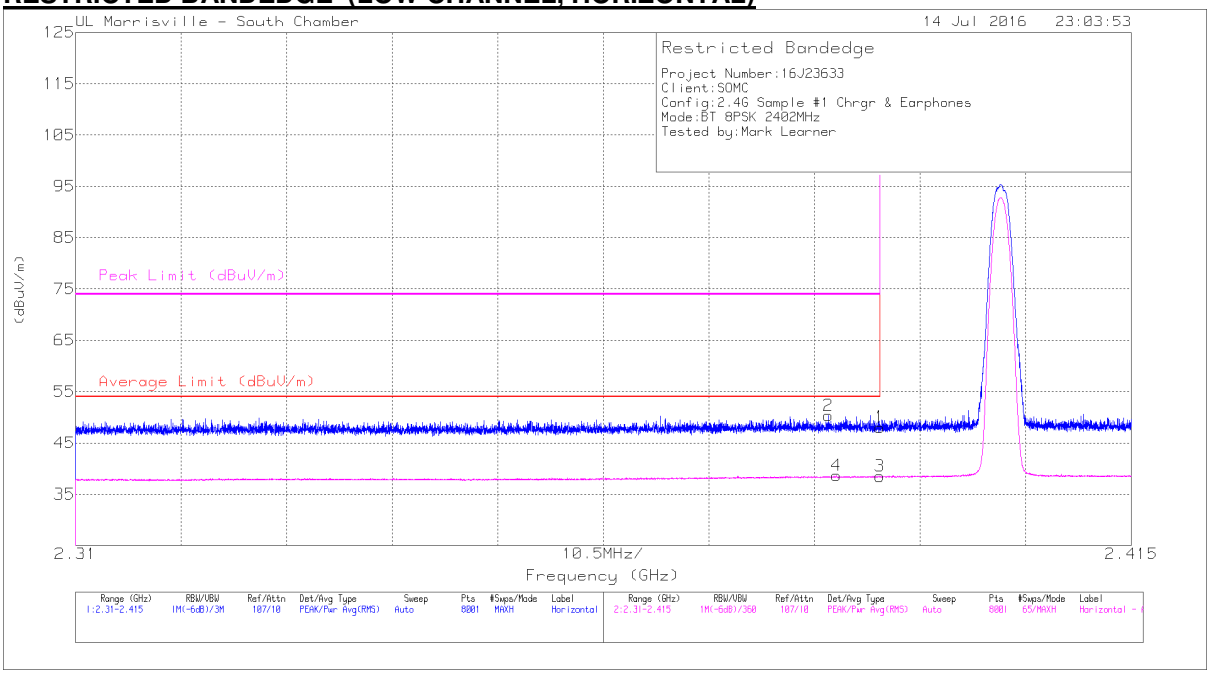
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.288	36.51	PK-U	31.7	-23.9	44.31	-	-	74	-29.69	0	199	V
	* 2.29	24.95	V1TR	31.7	-23.8	32.85	54	-21.15	-	-	0	199	V
3	* 4.563	40.31	PK-U	34	-32.1	42.21	-	-	74	-31.79	0	104	H
	* 4.561	29.05	V1TR	34	-32	31.05	54	-22.95	-	-	0	104	H
5	* 12.207	34.52	PK-U	39	-24.8	48.72	-	-	74	-25.28	0	104	H
	* 12.207	23.35	V1TR	39	-24.8	37.55	54	-16.45	-	-	0	104	H
1	1.96	31.27	Pk	31.2	-22.6	39.87	-	-	-	-	0-360	102	H
4	6.041	32.04	Pk	35.1	-28.8	38.34	-	-	-	-	0-360	101	V
6	16.728	30.89	Pk	41.6	-25.3	47.19	-	-	-	-	0-360	199	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

8.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

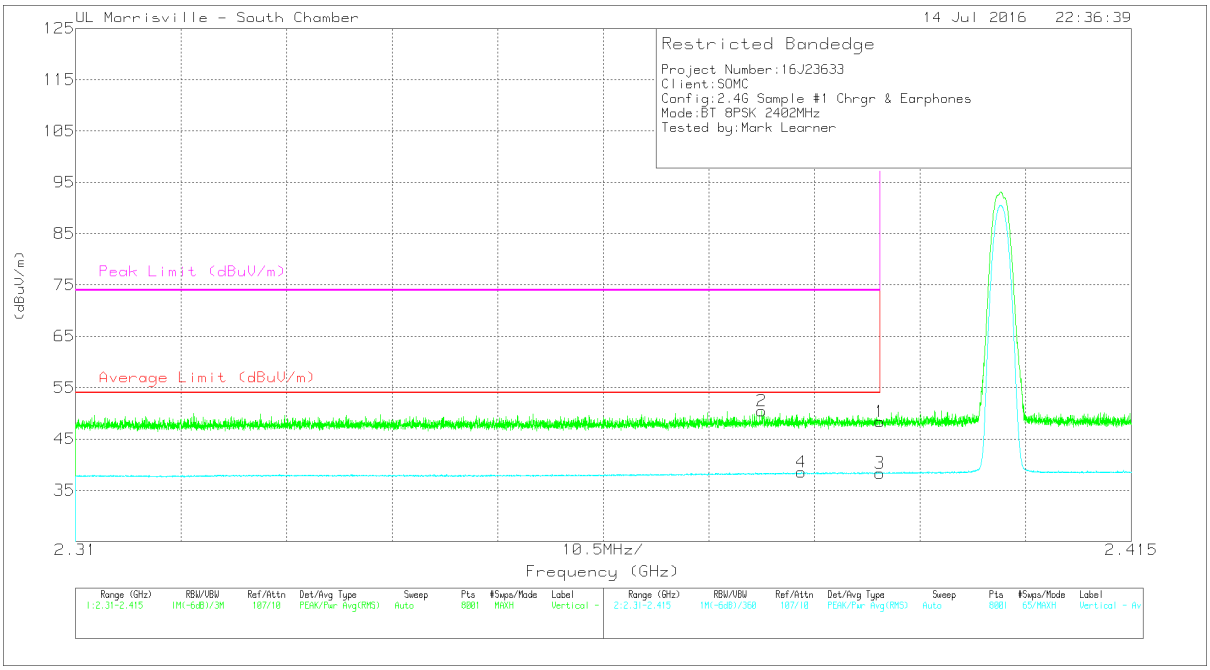


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.66	Pk	32.2	-24.8	48.06	-	-	74	-25.94	269	206	H
2	* 2.385	42.84	Pk	32.2	-24.7	50.34	-	-	74	-23.66	269	206	H
3	* 2.39	31.1	V1TR	32.2	-24.8	38.5	54	-15.5	-	-	269	206	H
4	* 2.386	31.15	V1TR	32.2	-24.7	38.65	54	-15.35	-	-	269	206	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

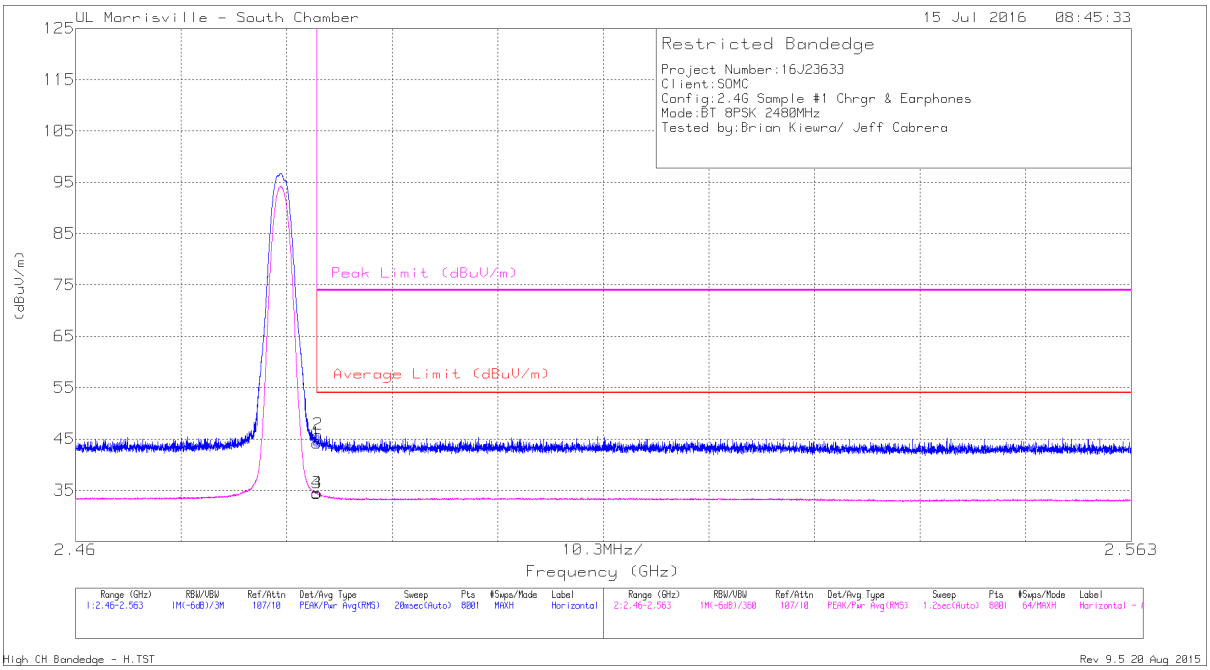


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.96	Pk	32.2	-24.8	48.36	-	-	74	-25.64	120	266	V
2	* 2.378	43.15	Pk	32.1	-24.8	50.45	-	-	74	-23.55	120	266	V
3	* 2.39	30.94	V1TR	32.2	-24.8	38.34	54	-15.66	-	-	120	266	V
4	* 2.382	31.12	V1TR	32.1	-24.7	38.52	54	-15.48	-	-	120	266	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

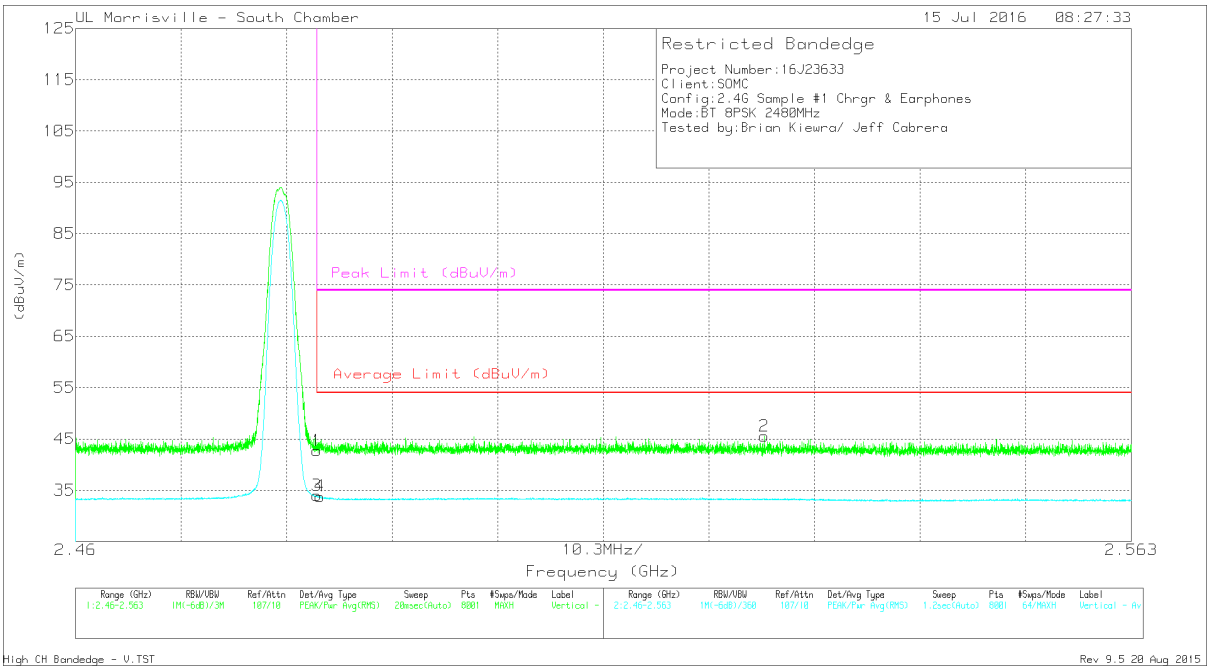


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	36.48	Pk	32.4	-24.7	44.18	-	-	74	-29.82	338	344	H
2	* 2.484	38.16	Pk	32.4	-24.7	45.86	-	-	74	-28.14	338	344	H
3	* 2.484	26.73	V1TR	32.4	-24.7	34.43	54	-19.57	-	-	338	344	H
4	* 2.484	26.77	V1TR	32.4	-24.7	34.47	54	-19.53	-	-	338	344	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

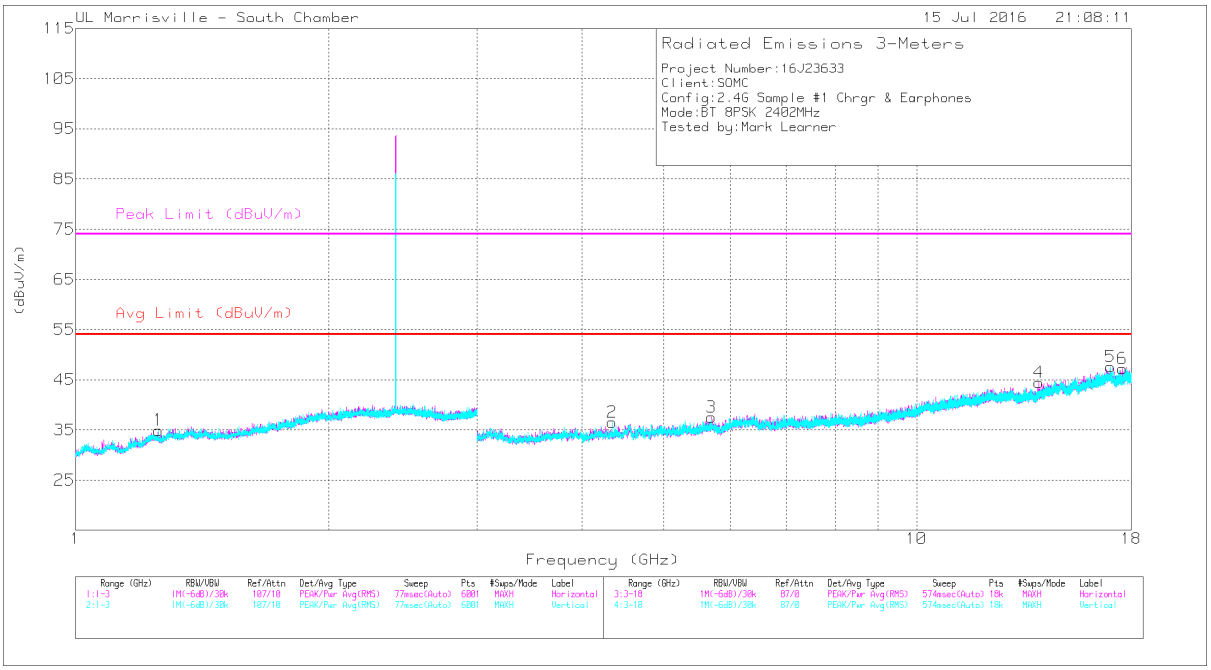


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	34.99	Pk	32.4	-24.7	42.69	-	-	74	-31.31	9	358	V
2	2.527	37.96	Pk	32.5	-24.9	45.56	-	-	74	-28.44	9	358	V
3	* 2.484	26.3	V1TR	32.4	-24.7	34	54	-20	-	-	9	358	V
4	* 2.484	26.11	V1TR	32.4	-24.7	33.81	54	-20.19	-	-	9	358	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

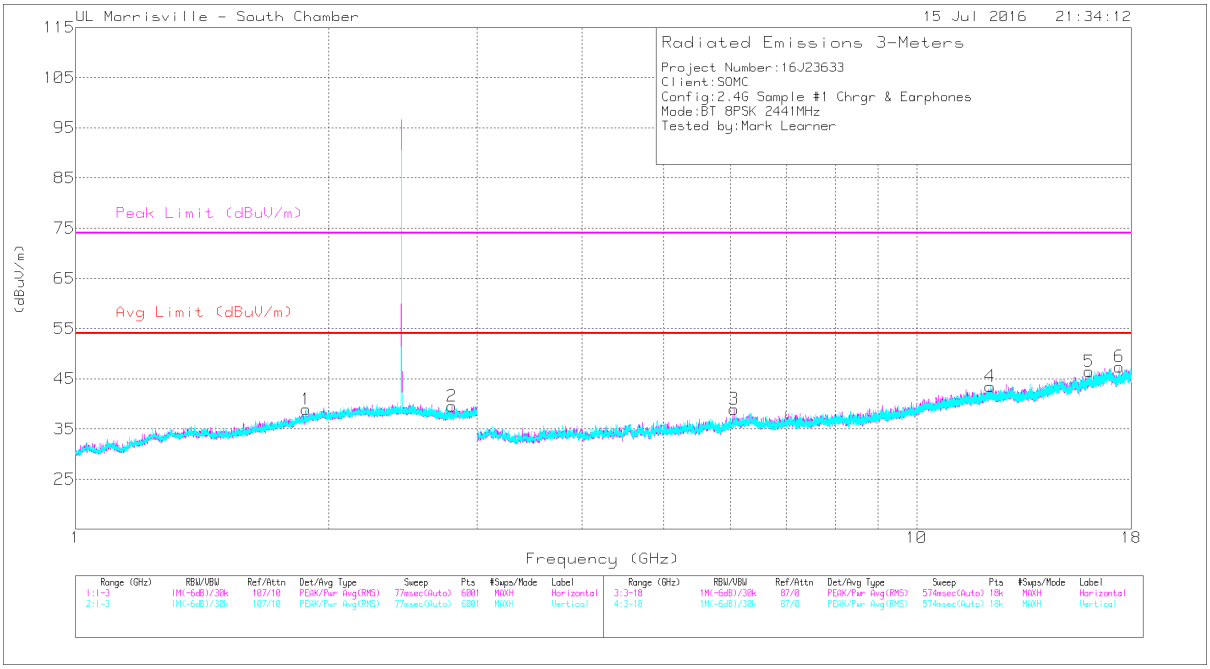
HARMONICS AND SPURIOUS EMISSIONS



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	* 1.253	35.24	PK-U	28.7	-23.6	40.34	-	-	74	-33.66	1	198	V
	* 1.253	23.56	V1TR	28.7	-23.6	28.66	54	-25.34	-	-	1	198	V
2	* 4.342	40.42	PK-U	33.6	-32.9	41.12	-	-	74	-32.88	1	198	V
	* 4.342	28.96	V1TR	33.6	-32.9	29.66	54	-24.34	-	-	1	198	V
3	5.702	33.23	Pk	34.7	-30.4	37.53	-	-	-	-	0-360	199	H
4	13.983	30.93	Pk	38.9	-25.4	44.43	-	-	-	-	0-360	199	H
5	16.992	30.97	Pk	41.5	-24.9	47.57	-	-	-	-	0-360	101	V
6	17.565	29.4	Pk	41.2	-23.4	47.2	-	-	-	-	0-360	102	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

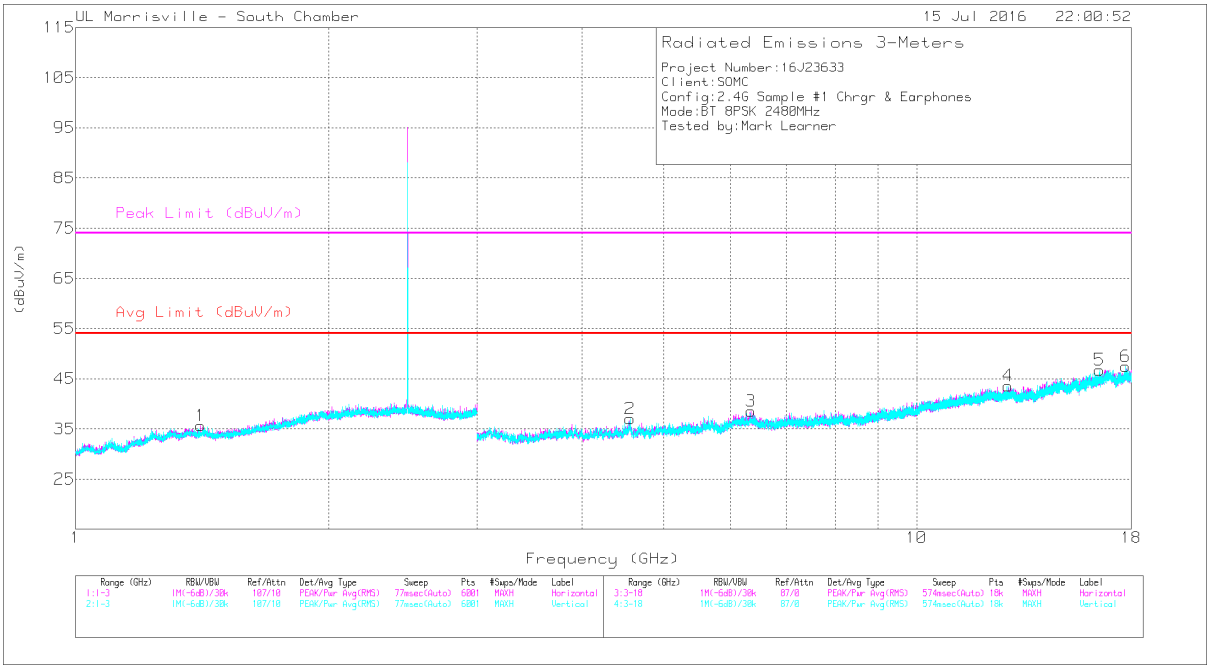
This report shall not be reproduced except in full, without the written approval of UL LLC.



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	* 2.801	38.22	PK-U	32.5	-26.1	44.62	-	-	74	-29.38	0	102	H
	* 2.803	25.91	V1TR	32.5	-26.1	32.31	54	-21.69	-	-	0	102	H
4	* 12.232	34.57	PK-U	39	-24.9	48.67	-	-	74	-25.33	0	102	V
	* 12.233	23.47	V1TR	39	-24.9	37.57	54	-16.43	-	-	0	102	V
5	* 16.039	35.94	PK-U	40.6	-24.9	51.64	-	-	74	-22.36	0	102	V
	* 16.038	24.54	V1TR	40.6	-24.9	40.24	54	-13.76	-	-	0	102	V
3	6.069	32.48	Pk	35.3	-28.8	38.98	-	-	-	-	0-360	199	H
1	1.88	30.79	Pk	30.7	-22.6	38.89	-	-	-	-	0-360	102	V
6	17.428	30.21	Pk	41.2	-24	47.41	-	-	-	-	0-360	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	* 1.406	35.47	PK-U	28.7	-23	41.17	-	-	74	-32.83	0	102	H
	* 1.409	23.85	V1TR	28.7	-23	29.55	54	-24.45	-	-	0	102	H
2	* 4.563	40.37	PK-U	34	-32.1	42.27	-	-	74	-31.73	0	198	V
	* 4.563	29.02	V1TR	34	-32.1	30.92	54	-23.08	-	-	0	198	V
6	* 17.732	34.65	PK-U	41.2	-22.6	53.25	-	-	74	-20.75	0	198	V
	* 17.729	23.57	V1TR	41.2	-22.7	42.07	54	-11.93	-	-	0	198	V
3	6.355	32.05	Pk	35.5	-29	38.55	-	-	-	-	0-360	102	H
4	12.84	29.81	Pk	39.3	-25.5	43.61	-	-	-	-	0-360	199	V
5	16.499	29.65	Pk	41.2	-24.1	46.75	-	-	-	-	0-360	199	V

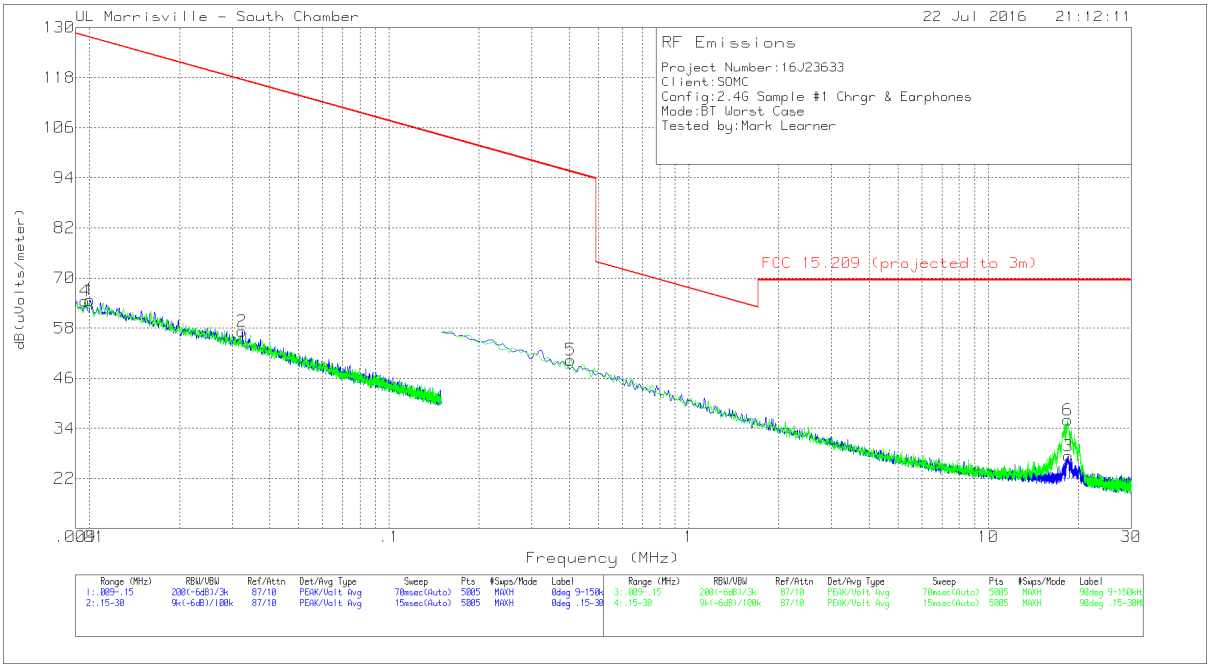
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

8.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 9kHz to 30MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (specification distance / test distance).

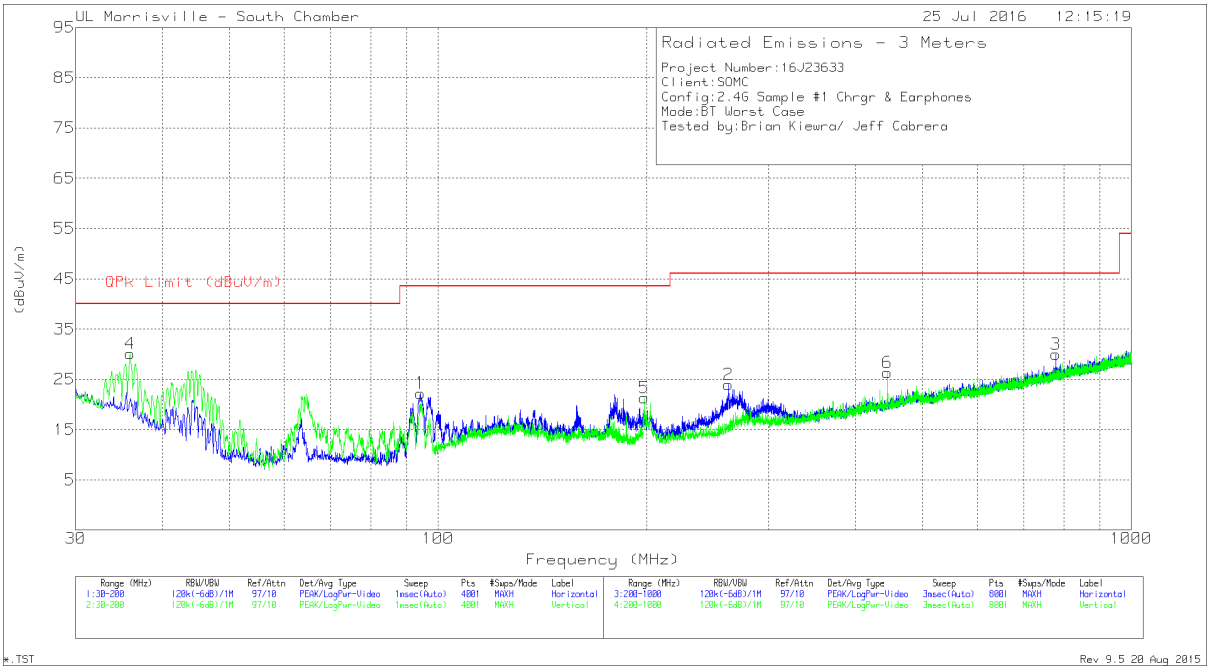


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 (projected to 3m)	Margin (dB)	Azimuth (Degs)
1	.01006	45.64	Pk	19	.1	64.74	127.55	-62.81	0-360
2	.03238	43.22	Pk	13.9	.1	57.22	117.4	-60.18	0-360
3	18.49238	16.6	Pk	10.1	.7	27.4	69.54	-42.14	0-360
4	.00967	45.17	Pk	19.2	.1	64.47	127.89	-63.42	0-360
5	.40351	38.38	Pk	11.9	.1	50.38	95.49	-45.11	0-360
6	18.39097	25.16	Pk	10.1	.7	35.96	69.54	-33.58	0-360

Pk - Peak detector

This report shall not be reproduced except in full, without the written approval of UL LLC.

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



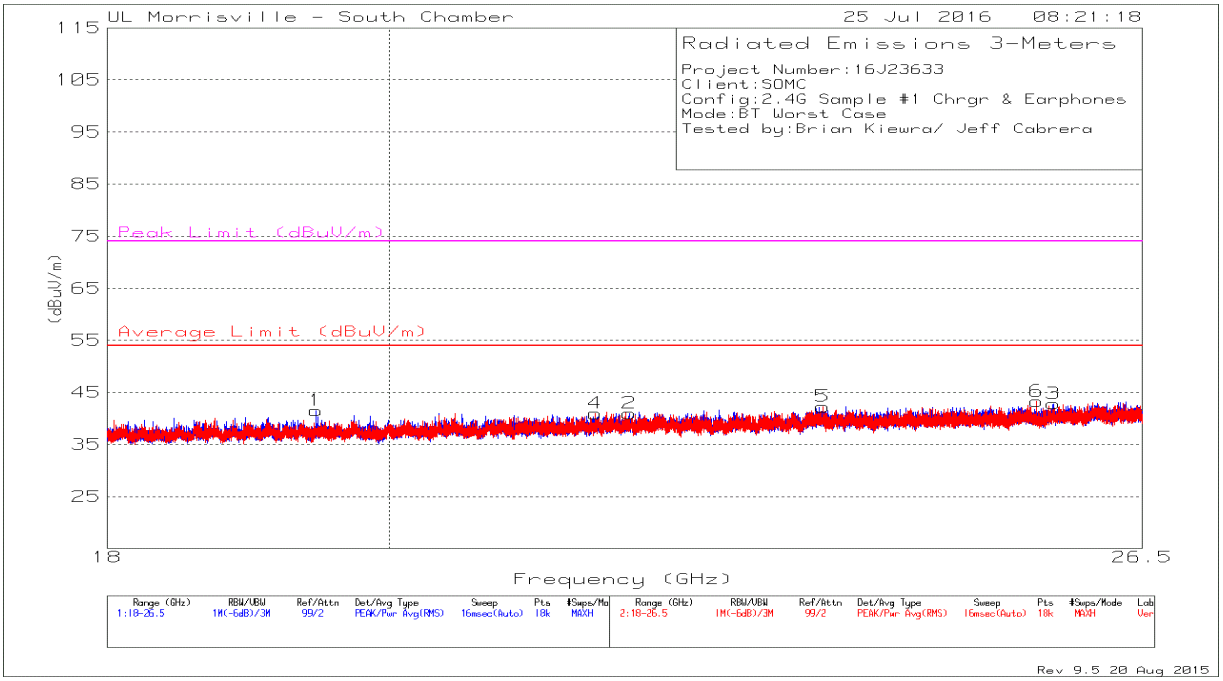
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Amp/Cbl (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 263.0235	30.57	Qp	17.2	-29.8	0	17.97	46.02	-28.05	86	105	H
1	94.2813	40.64	Pk	12.6	-31	0	22.24	43.52	-21.28	0-360	199	H
3	778.6	32.19	Pk	25.9	-28.1	0	29.99	46.02	-16.03	0-360	199	H
4	35.95	40.39	Pk	21.4	-31.7	0	30.09	40	-9.91	0-360	102	V
5	198.3	34.21	Pk	17.3	-30.2	0	21.31	43.52	-22.21	0-360	102	V
6	445.1	34.2	Pk	21.1	-29	0	26.3	46.02	-19.72	0-360	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector

This report shall not be reproduced except in full, without the written approval of UL LLC.

8.4. WORST-CASE ABOVE 18GHz

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



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0076 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 19.462	46.93	PK-U	32.9	-40.5	39.33	54	-14.67	74	-34.67	302	299	H
	* 19.461	35.64	V1TR	32.9	-40.5	28.04	54	-25.96	74	-45.96	302	299	H
2	21.878	47.29	Pk	33.6	-39.9	40.99	54	-13.01	74	-33.01	0-360	199	H
3	25.637	46.04	Pk	34.7	-37.9	42.84	54	-11.16	74	-31.16	0-360	199	H
4	21.602	47.38	Pk	33.6	-40	40.98	54	-13.02	74	-33.02	0-360	299	V
5	23.521	46.87	Pk	34.4	-39	42.27	54	-11.73	74	-31.73	0-360	102	V
6	25.477	46.88	Pk	34.5	-38.1	43.28	54	-10.72	74	-30.72	0-360	252	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, Ton is packet duration (0.0029s or 360 Hz)

This report shall not be reproduced except in full, without the written approval of UL LLC.

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

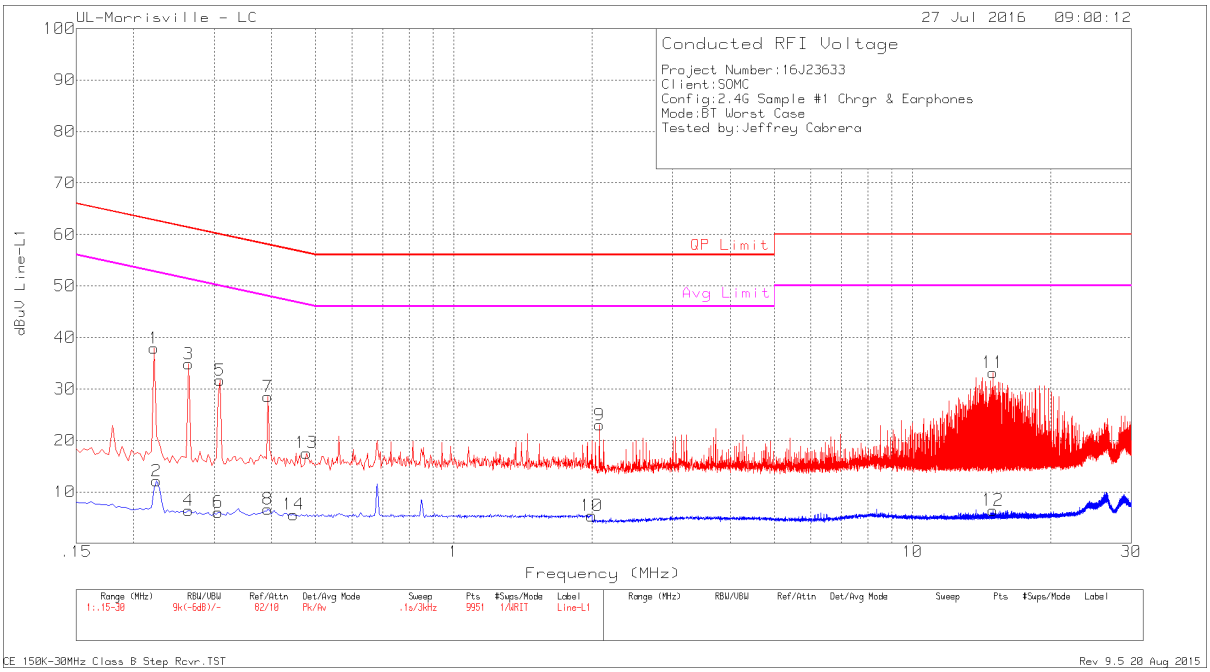
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

This report shall not be reproduced except in full, without the written approval of UL LLC.

LINE 1 RESULTS

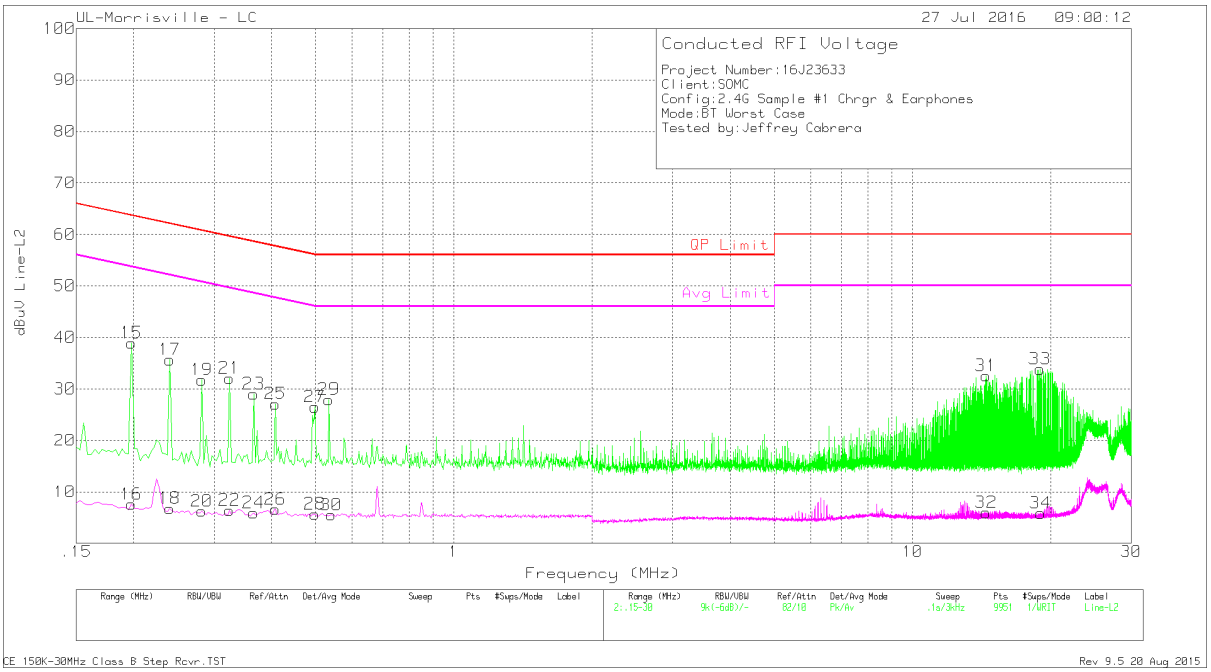


Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF [dB]	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit	Margin (dB)	Avg Limit	Margin (dB)
1	.222	27.78	Pk	.1	10	37.88	62.74	-24.86	-	-
2	.225	2.02	Av	.1	10	12.12	-	-	52.63	-40.51
3	.264	24.73	Pk	.1	10	34.83	61.3	-26.47	-	-
4	.264	-3.71	Av	.1	10	6.39	-	-	51.3	-44.91
5	.309	21.58	Pk	.1	10	31.68	60	-28.32	-	-
6	.306	-4.04	Av	.1	10	6.06	-	-	50.08	-44.02
7	.393	18.4	Pk	.1	10	28.5	58	-29.5	-	-
8	.393	-3.45	Av	.1	10	6.65	-	-	48	-41.35
9	2.076	12.79	Pk	.1	10.1	22.99	56	-33.01	-	-
10	1.998	-4.83	Av	.1	10.1	5.37	-	-	46	-40.63
11	14.982	22.56	Pk	.2	10.4	33.16	60	-26.84	-	-
12	14.982	-4.18	Av	.2	10.4	6.42	-	-	50	-43.58
13	.477	7.46	Pk	.1	10	17.56	56.39	-38.83	-	-
14	.447	-4.51	Av	.1	10	5.59	-	-	46.93	-41.34

Pk - Peak detector
Av - Average detection

This report shall not be reproduced except in full, without the written approval of UL LLC.

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF [dB]	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit	Margin (dB)	Avg Limit	Margin (dB)
15	.198	28.81	Pk	.1	10	38.91	63.69	-24.78	-	-
16	.198	-2.5	Av	.1	10	7.6	-	-	53.69	-46.09
17	.24	25.57	Pk	.1	10	35.67	62.1	-26.43	-	-
18	.24	-3.32	Av	.1	10	6.78	-	-	52.1	-45.32
19	.282	21.65	Pk	.1	10	31.75	60.76	-29.01	-	-
20	.282	-3.84	Av	.1	10	6.26	-	-	50.76	-44.5
21	.324	21.98	Pk	.1	10	32.08	59.6	-27.52	-	-
22	.324	-3.69	Av	.1	10	6.41	-	-	49.6	-43.19
23	.366	18.91	Pk	.1	10	29.01	58.59	-29.58	-	-
24	.366	-4.16	Av	.1	10	5.94	-	-	48.59	-42.65
25	.408	16.99	Pk	.1	10	27.09	57.69	-30.6	-	-
26	.408	-3.47	Av	.1	10	6.63	-	-	47.69	-41.06
27	.498	16.41	Pk	.1	10	26.51	56.03	-29.52	-	-
28	.498	-4.4	Av	.1	10	5.7	-	-	46.03	-40.33
29	.534	17.93	Pk	0	10	27.93	56	-28.07	-	-
30	.54	-4.48	Av	0	10	5.52	-	-	46	-40.48
31	14.481	22.05	Pk	.1	10.4	32.55	60	-27.45	-	-
32	14.481	-4.53	Av	.1	10.4	5.97	-	-	50	-44.03
33	18.96	23.13	Pk	.2	10.5	33.83	60	-26.17	-	-
34	19.038	-4.85	Av	.2	10.5	5.85	-	-	50	-44.15

Pk - Peak detector
Av - Average detection

This report shall not be reproduced except in full, without the written approval of UL LLC.