FCC 47 CFR PART 15 SUBPART E

INDUSTRY CANADA RSS-247 ISSUE 1

CLASS II PERMISSIVE CHANGE

TEST REPORT

FOR

802.11a/g/n FLOOR STANDING PRODUCT

MODEL NUMBER: SUB

FCC ID: SBVRM005
IC: 5373A-RM005

REPORT NUMBER: 15U21733-E1V3

ISSUE DATE: MARCH 1, 2016

Prepared for
Sonos, Inc.
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Santa Barbara, CA 93101, U.S.A.

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	11/16/15	Initial Issue	H. Mustapha
V2	2/10/16	Updated section 9 with bandedge data for 5.6 GHz band	H. Mustapha
V3	3/1/16	Updated the frequency range in section 5.3 table	H. Mustapha

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Sonos, Inc.
614 Chapala Street
Santa Barbara, CA 93101, U.S.A.

EUT DESCRIPTION: 802.11a/g/n FLOOR STANDING PRODUCT

MODEL: SUB

SERIAL NUMBER: B8-E9-37-66-B8-04-5

DATE TESTED: OCTOBER 22 to NOVEMBER 02, 2015
FEBRUARY 9, 2016
DECEMBER 16-23, 2011

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	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.

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Huda Mustapha

HUDA MUSTAPHA
PROJECT LEAD
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Tested By:

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EMC ENGINEER
UL Verification Services Inc.

FRANK IBRAHIM
PROGRAM MANAGER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033 D02 v01r01, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

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

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

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

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.1. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a floor standing product with 802.11a/g/n 2x2 MIMO.

The radio module is manufactured by Sonos.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The purpose of this C2PC is to upgrade the device described under section 5.1 of this report to the new rules per KDB 789033 D02 v01r01 and RSS-247.

Except for radiated bandedge for channel 100, we have reviewed the original test report (report no. 12U14339-2) and are hereby attesting that all the current technical requirements are still met and all applicable test procedures remain the same. Therefore, the original test report is still applicable and further no additional testing is done.

The retesting of radiated bandedge for channel 100 did not result in any change in output power levels from the original test report (report no. 12U14339-2).

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5825	802.11n HT20	16.52	44.87

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two dipole antennas on PCB, the antennas gains are as follows:

Frequency	Antenna-01(dB)		Antenna-02 (dB)	
	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)
2400MHz	3.86	49.82	2.79	49.82
2450MHz	3.97	48.91	2.71	50.04
2500MHz	3.81	44.56	3.17	47.93
4900MHz	4.27	53.64	3.17	55.06
5150MHz	4.98	56.08	3.00	57.87
5250MHz	4.10	51.39	3.92	59.00
5350MHz	4.03	56.90	3.55	53.41
5725MHz	4.09	50.56	4.27	54.51
5825MHz	3.55	54.82	4.38	59.36
5850MHz	3.42	54.97	4.38	57.25

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Atheros Radio Test 2 (ART2-GUI).

5.6. WORST-CASE CONFIGURATION AND MODE

For Radiated Emissions below 1 GHz and Power line Conducted Emissions, the channel with the highest conducted output power was selected as worst-case scenario.

Worst-case data rate as provided by the manufacturer was:
For 11n HT20 (5.8 GHz band): MCS9

To determine the worst orientation of the EUT for highest emissions, the EUT's antenna was investigated for X and Y orientations; the worst orientation was Y orientation; therefore, all final radiated emissions were performed with the EUT's antenna laid in the Y orientation.

This report covers only 802.11n HT20 mode.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	X201	R9-6KTFV	N/A
Laptop AC Adapter	Lenovo	ADLX65NCT2A	11S45N0323Z1ZH3B4HPD	N/A

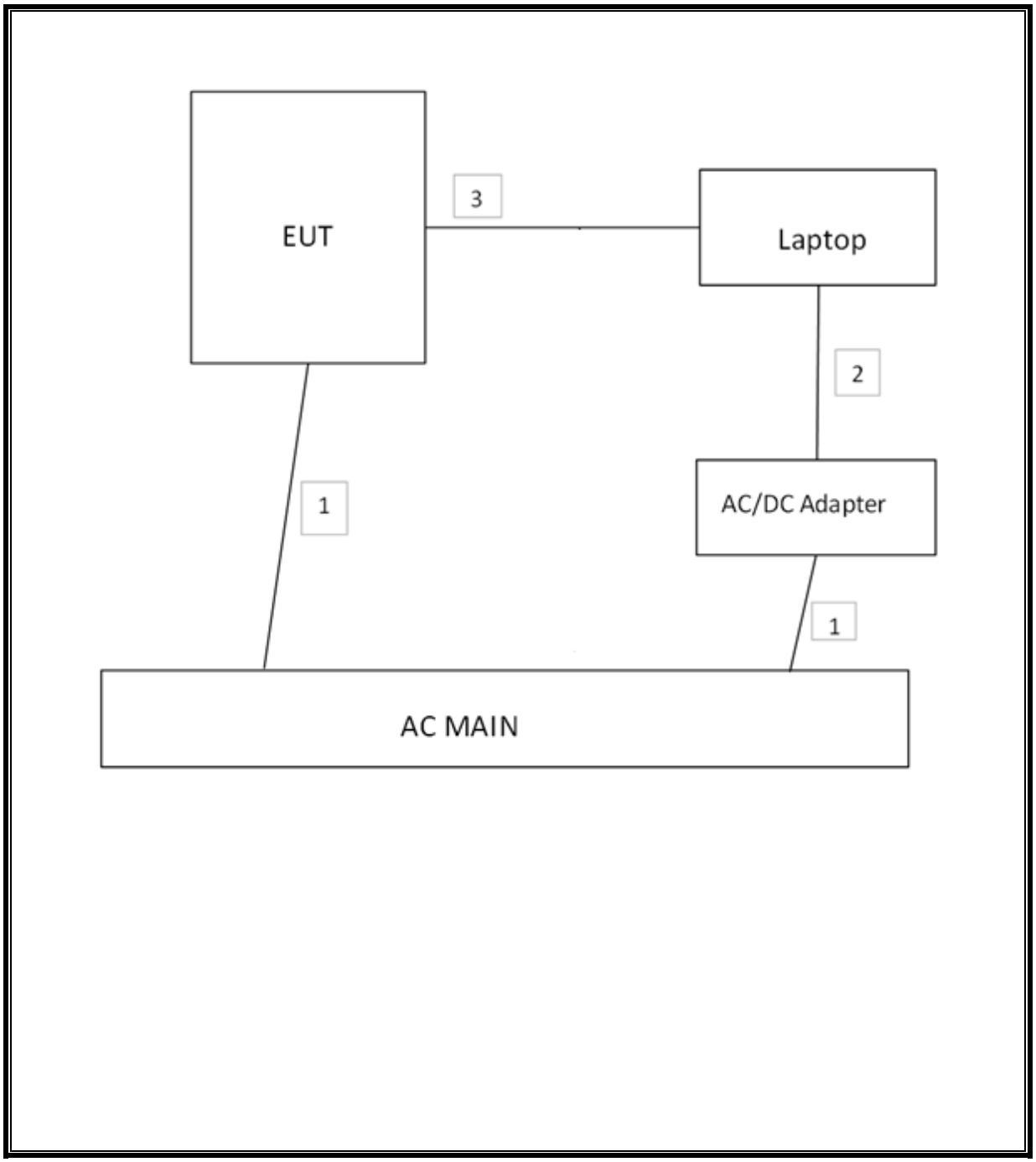
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	2	US 115V	Unshielded	1.8 m	N/A
2	DC	1	DC	Unshielded	1.8 m	N/A
3	Ethernet	1	RJ45	Unshielded	1.5 m	N/A

TEST SETUP

The EUT is connected to a laptop via an Ethernet cable during the tests and software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List					
Description	Manufacturer	Model	T No.	Cal Date	Cal Due
Radiated Software	UL	UL EMC	Ver 9.5, June 6, 2015		
Conducted Software	UL	UL EMC	Ver 9.5, May 17 2012		
Bilog Antenna 30-1000MHz	Sunol	JB1	130	09/01/15	09/01/16
Horn Antenna 1-18GHz	ETS	3117	136	03/03/15	03/03/16
Horn Antenna 18-26GHz	ARA	SWH-28	98	12/17/14	12/17/15
Horn Antenna 26.5- 40GHz	ARA	MWH-2640/B	90	07/28/15	07/28/16
Preamp 10kHz-1000MHz	HP	8447D	10	01/16/15	01/16/16
Preamp 1-8GHz	Miteq	AMF-4D-01000800-30-29P	782	12/17/15	12/17/16
Preamp 1-26.5GHz	Agilent	8449B	404	04/13/15	04/13/16
Amplifier, 26-40GHz	Miteq	NSP4000-SP2	88	04/07/15	04/07/16
Spectrum Analyzer 3kHz - 44GHz	Agilent	N9030A	907	05/15/15	05/15/16
Spectrum Analyzer 9kHz - 40GHz	HP	8564E	106	08/14/15	08/14/16
Coaxial Switchbox	Agilent	SP6T	927	03/03/15	03/03/16
3GHz HPF	Micro-Tronics	HPM17543	487	01/26/16	01/26/17
5GHz LPF	Micro-Tronics	LPS17541	482	01/16/15	01/16/16
6GHz HPF	Micro-Tronics	HPS17542	483	01/16/15	01/16/16
EMI Test Receiver	Rohde & Schwarz	ECSI 7	212	08/07/15	08/07/16
Power Meter	Agilent	N1911A	T1268	06/07/15	06/07/16
Power Sensor	Agilent	N1921A	1224	07/06/15	03/06/16

7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 789033 D02 v01r01, Section B.

6 dB Emission BW: KDB 789033 D02 v01r01, Section C.2.

99% Occupied BW: KDB 789033 D02 v01r01, Section D.

Conducted Output Power: KDB 789033 D02 v01r01, Section E.3.a (Method PM), and KDB 662911 D01 v02r01.

Power Spectral Density: KDB 789033 D02 v01r01, Section F.

Unwanted emissions in restricted bands: KDB 789033 D02 v01r01, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01r01, Sections G.3, G.4, and G.5.

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

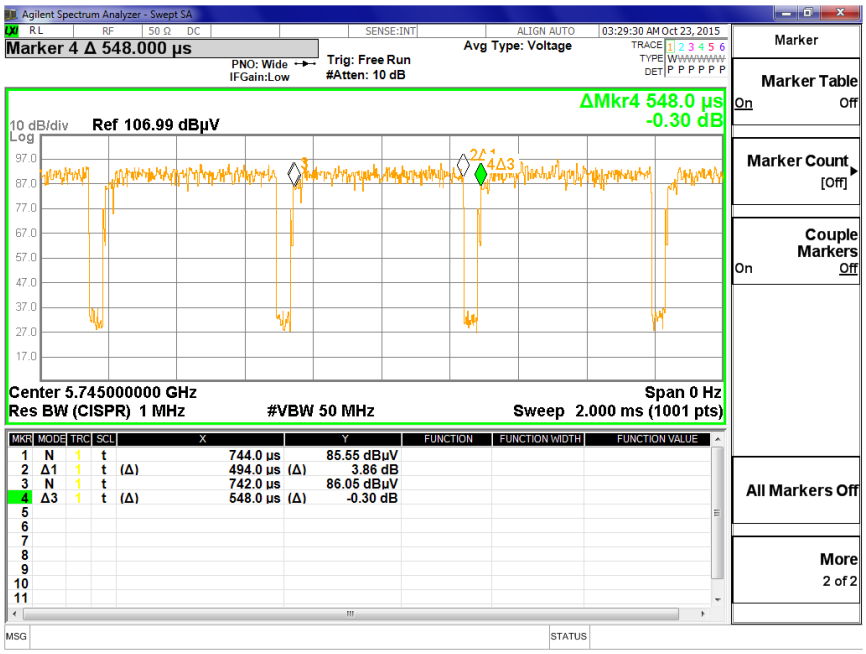
None; for reporting purposes only.

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)
802.11n HT20 CDD	0.494	0.548	0.901	90.15%	0.45	2.024

DUTY CYCLE PLOT

DUTY CYCLE 802.11n HT20 CDD MODE



8.2. 6 dB BANDWIDTH

LIMITS

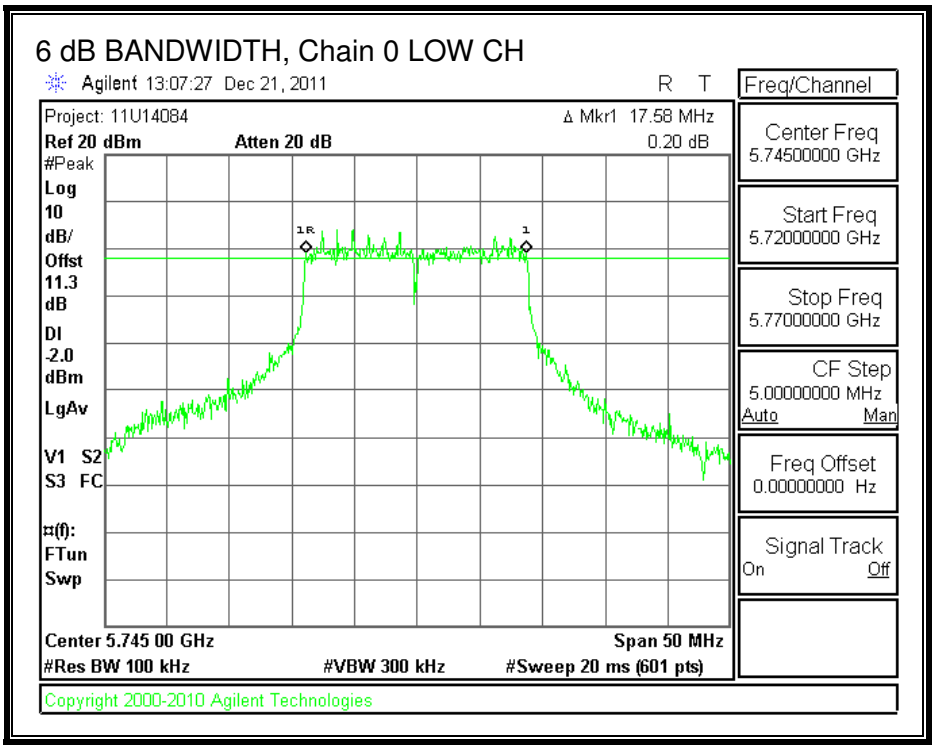
FCC §15.247 (a) (2)

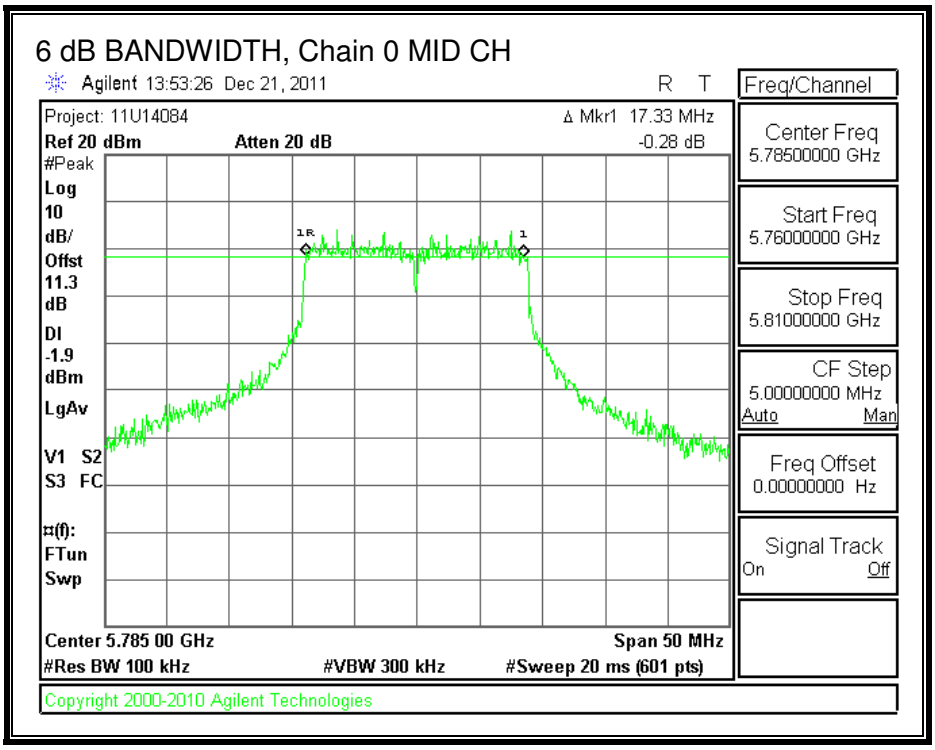
The minimum 6 dB bandwidth shall be at least 500 kHz.

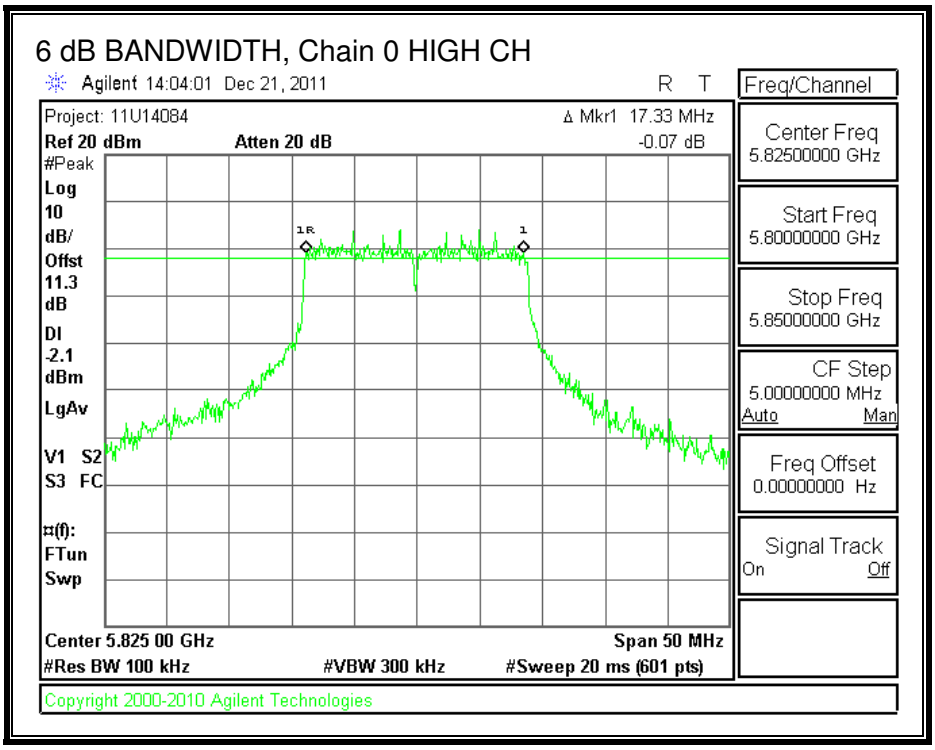
RESULTS

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	5745	17.58	17.67	0.5
Mid	5785	17.33	17.67	0.5
High	5825	17.33	17.33	0.5

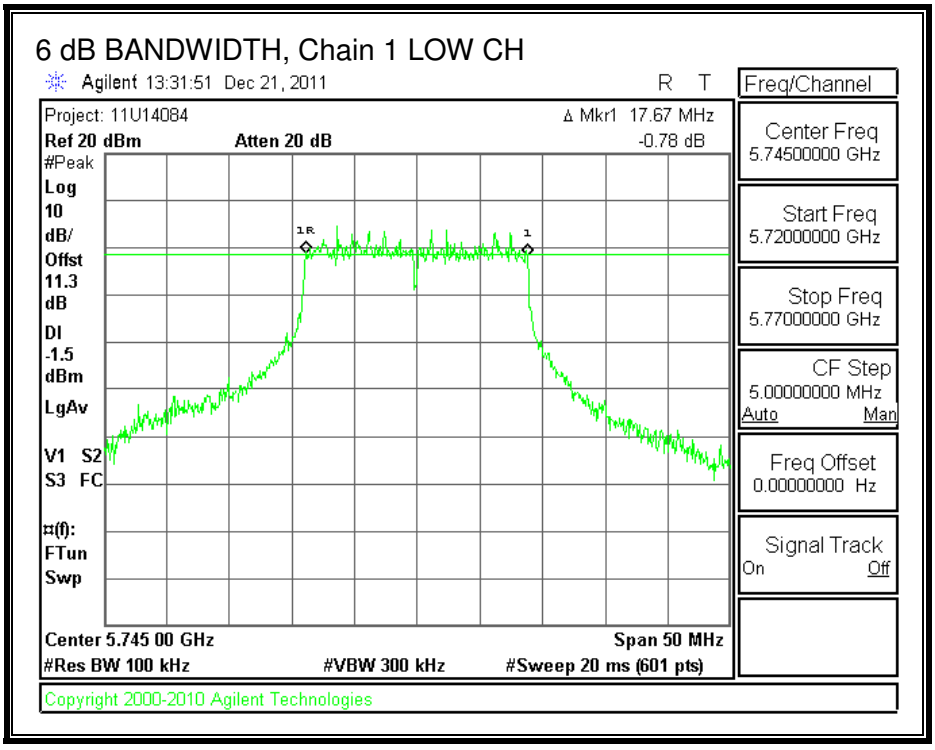
6 dB BANDWIDTH, Chain 0

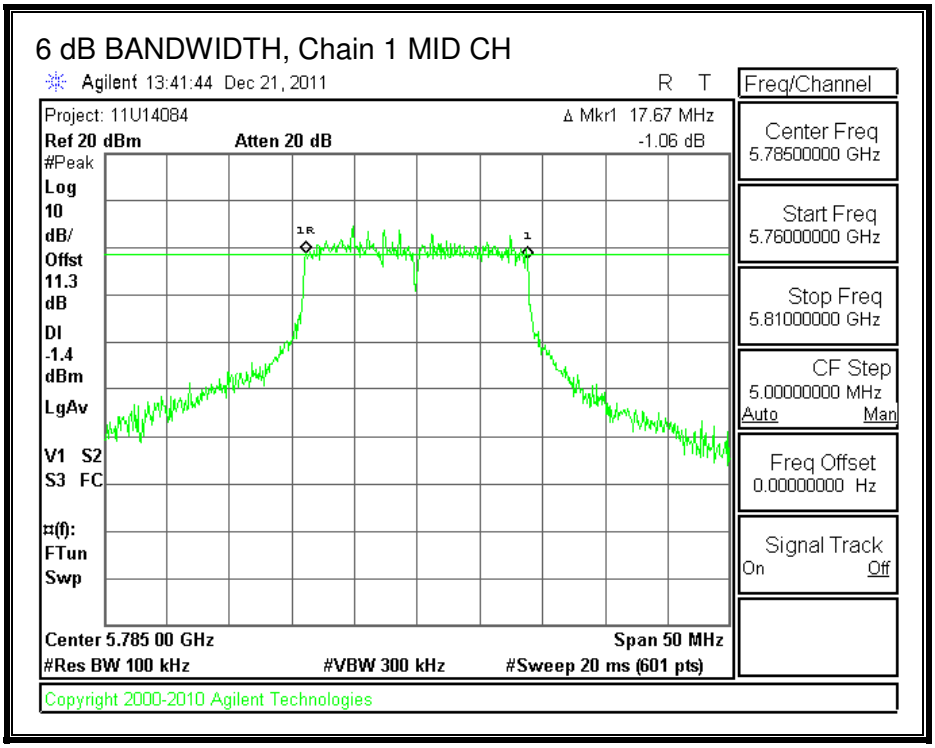


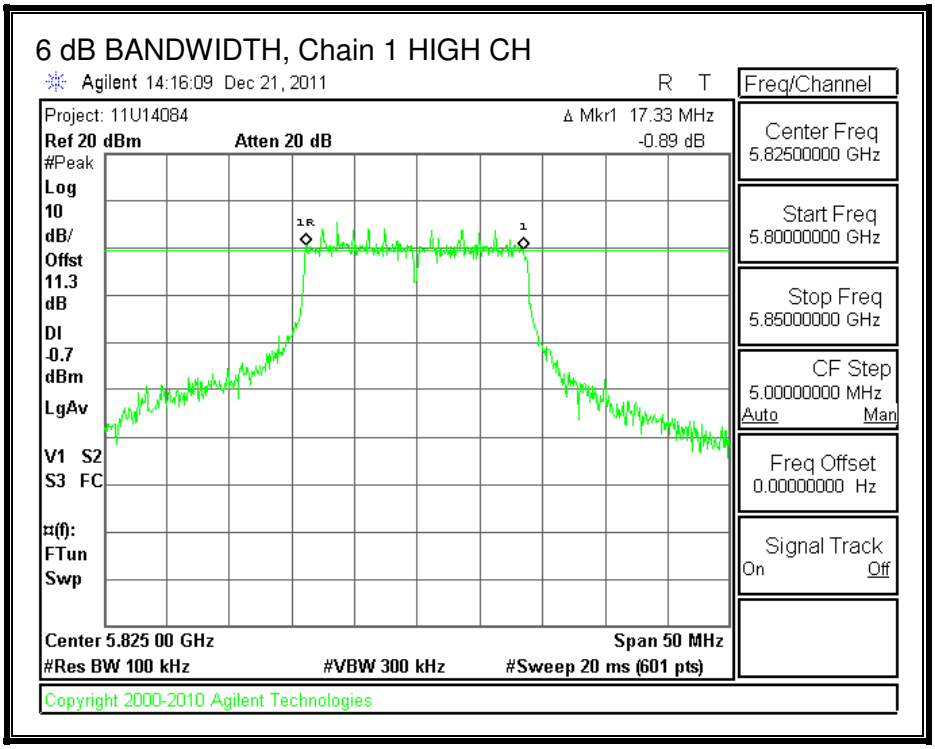




6 dB BANDWIDTH, Chain 1







8.3. 99% BANDWIDTH

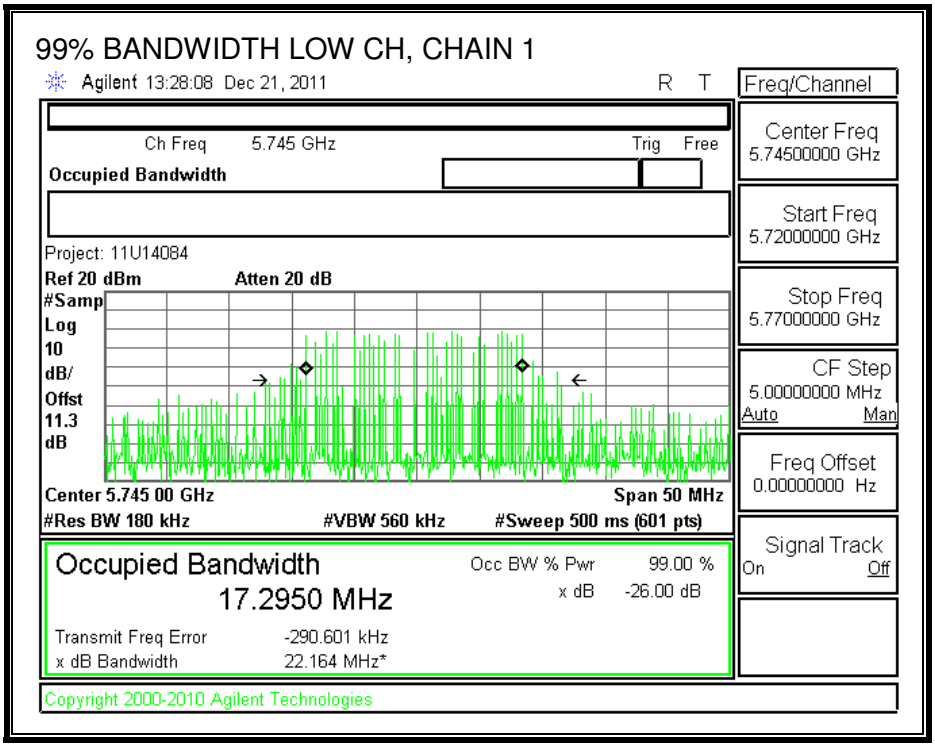
LIMITS

None; for reporting purposes only.

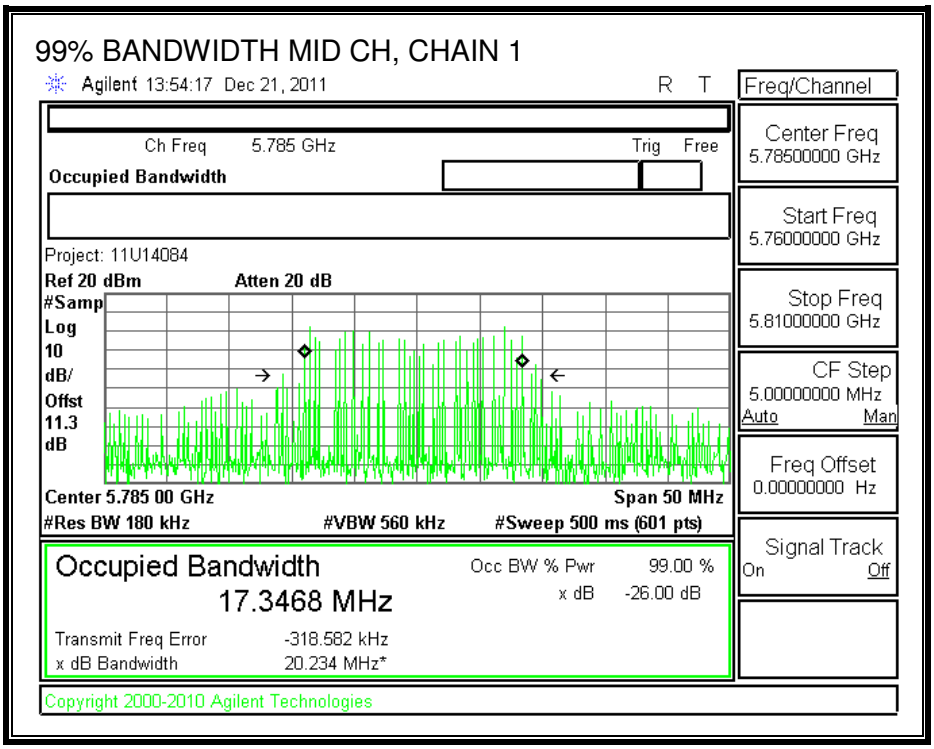
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	5745	17.295	17.3751
Middle	5785	17.3468	17.271
High	5825	17.2865	17.2712

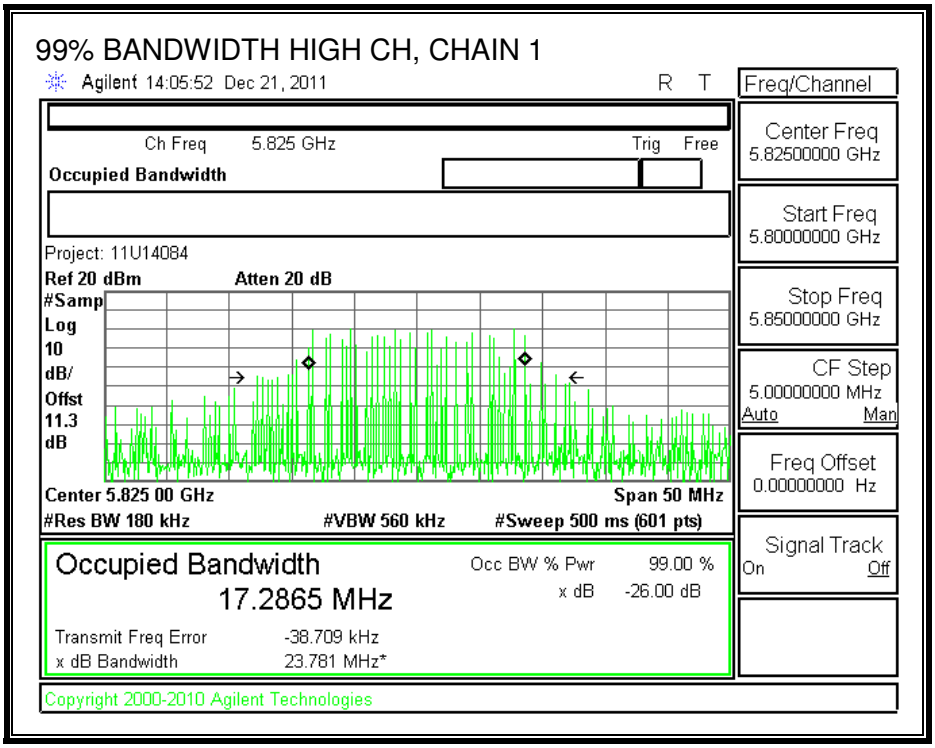
99% BANDWIDTH, CHAIN 1



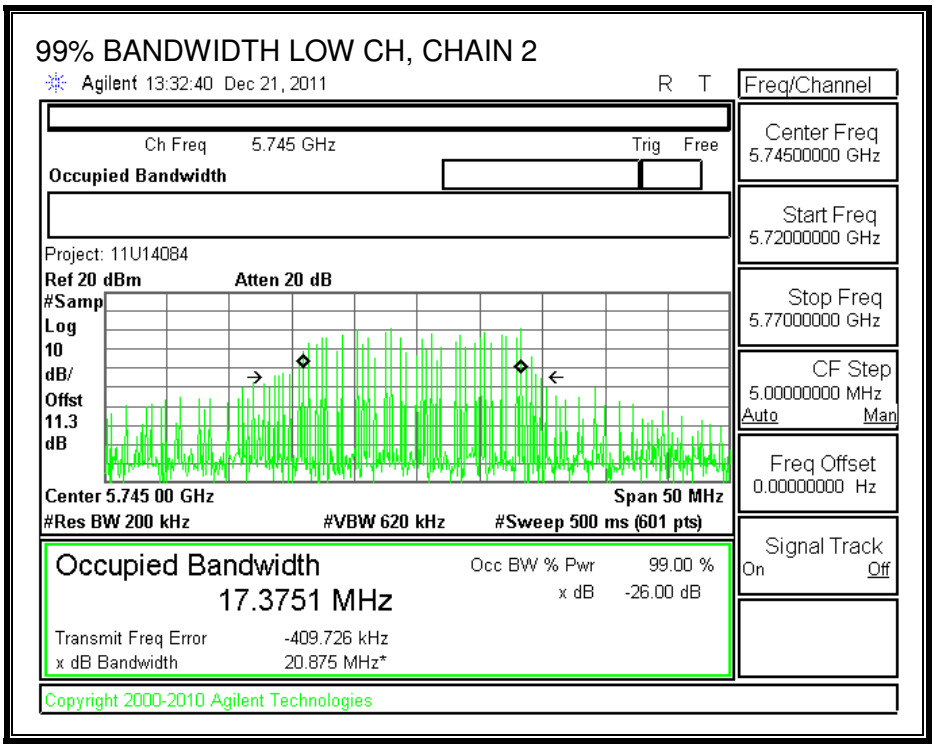
99% BANDWIDTH MID CH, CHAIN 1

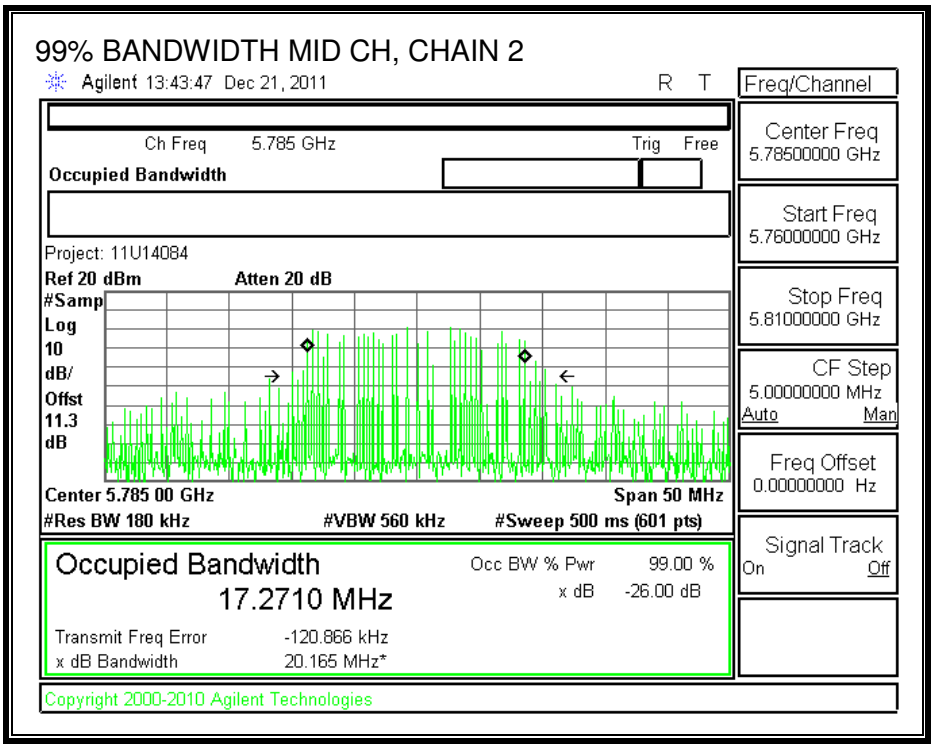


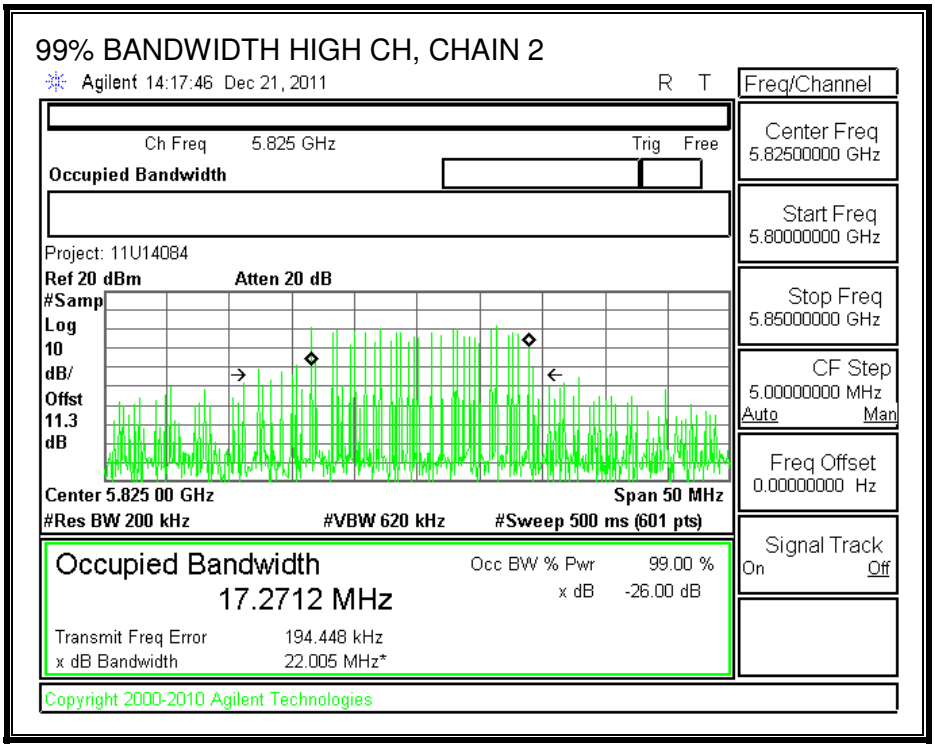
99% BANDWIDTH HIGH CH, CHAIN 1



99% BANDWIDTH, CHAIN 2







8.4. OUTPUT POWER

LIMITS

FCC §15.407 (a) (3)

IC RSS-247 6.2.4 (1)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
4.09	4.38	4.24

RESULTS

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Power Limit (dBm)
Low	5745	4.24	30.00
Mid	5785	4.24	30.00
High	5825	4.24	30.00

Duty Cycle CF (dB)	0.45	Included in Calculations of Corr'd Power

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	12.90	12.20	16.02	30.00	-13.98
Mid	5785	13.40	12.50	16.43	30.00	-13.57
High	5825	13.30	12.80	16.52	30.00	-13.48

8.5. MAXIMUM POWER SPECTRAL DENSITY (PSD)

LIMITS

FCC §15.407 (a) (3)

IC RSS-247 6.2.4 (1)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
4.09	4.38	7.25

RESULTS

Antenna Gain and Limits

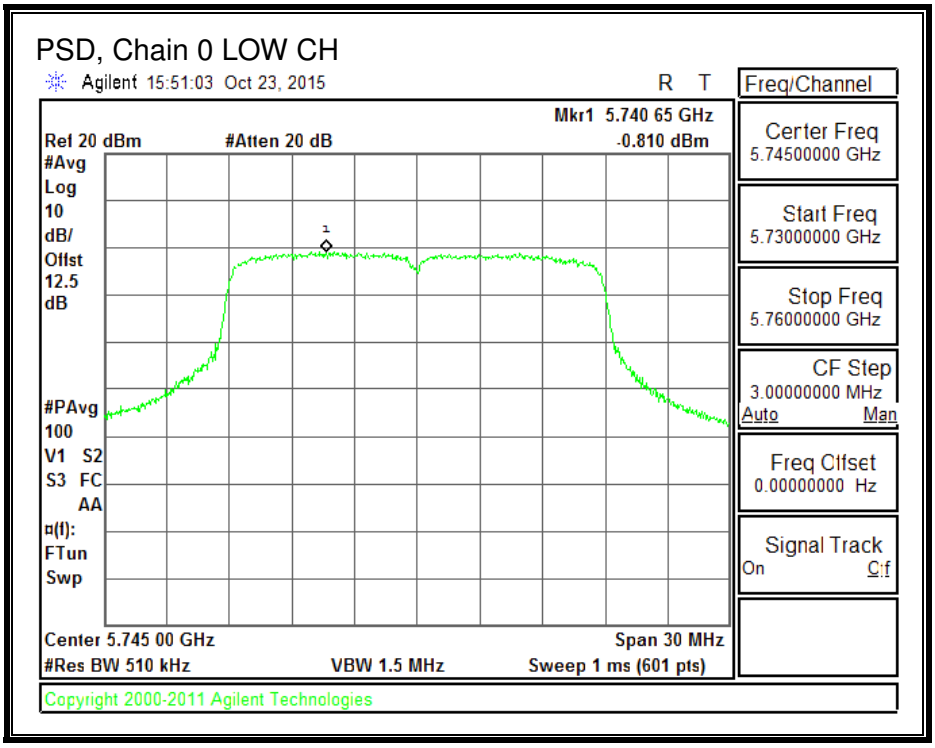
Channel	Frequency (MHz)	Directional Gain (dBi)	PSD Limit (dBm)
Low	5745	7.25	28.75
Mid	5785	7.25	28.75
High	5825	7.25	28.75

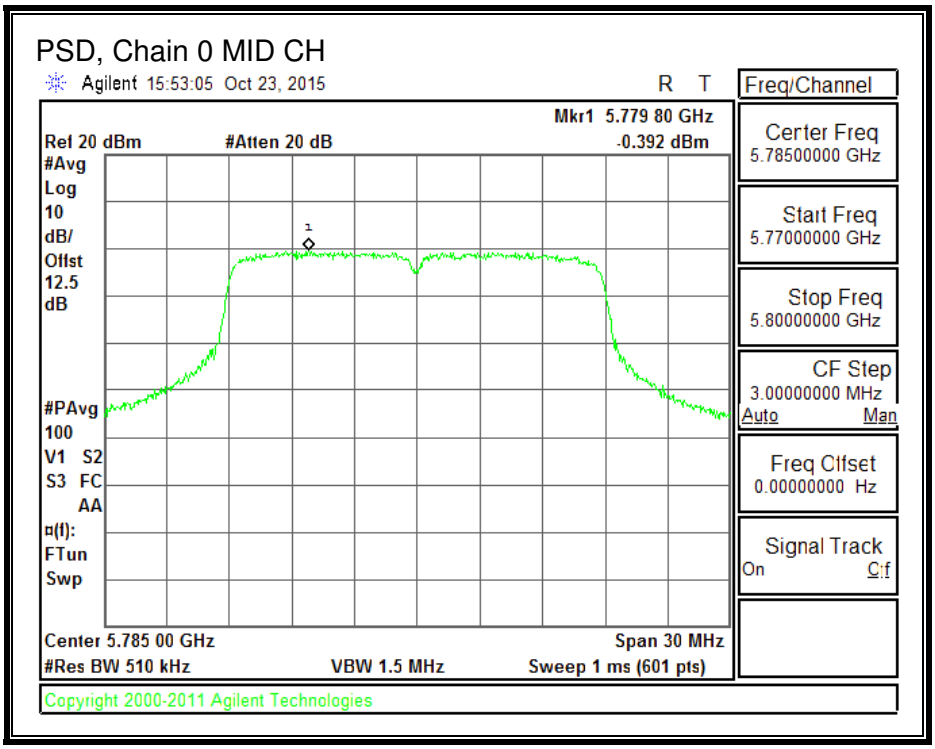
Duty Cycle CF (dB)	0.45	Included in Calculations of Corr'd PSD

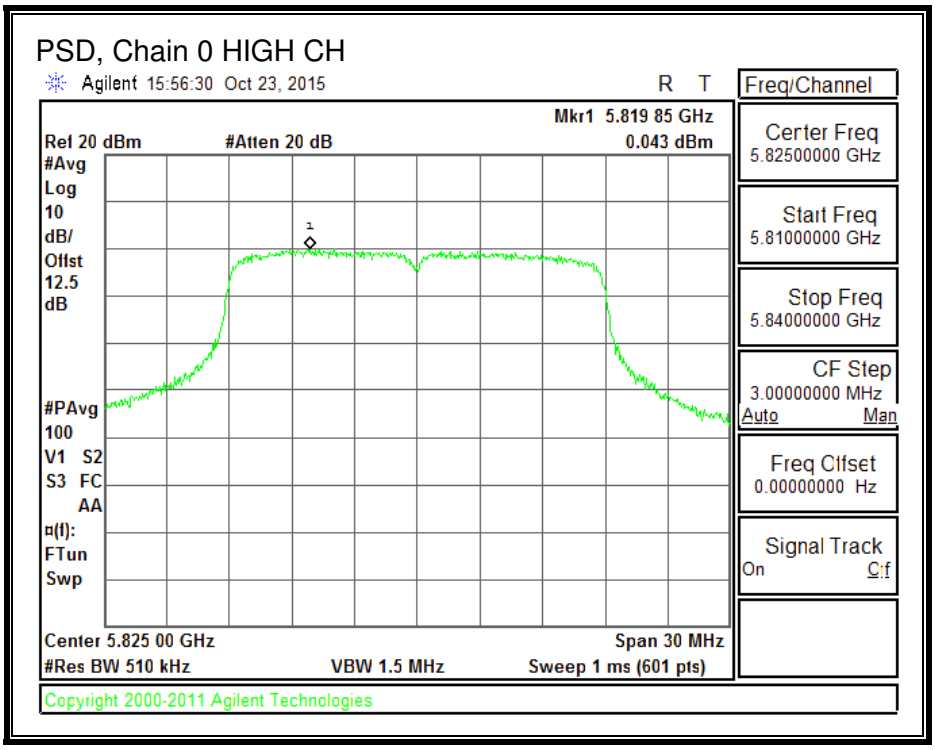
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5745	-0.810	-1.494	2.322	28.750	-26.428
Mid	5785	-0.392	-1.593	2.509	28.750	-26.241
High	5825	0.043	-0.929	3.044	28.750	-25.706

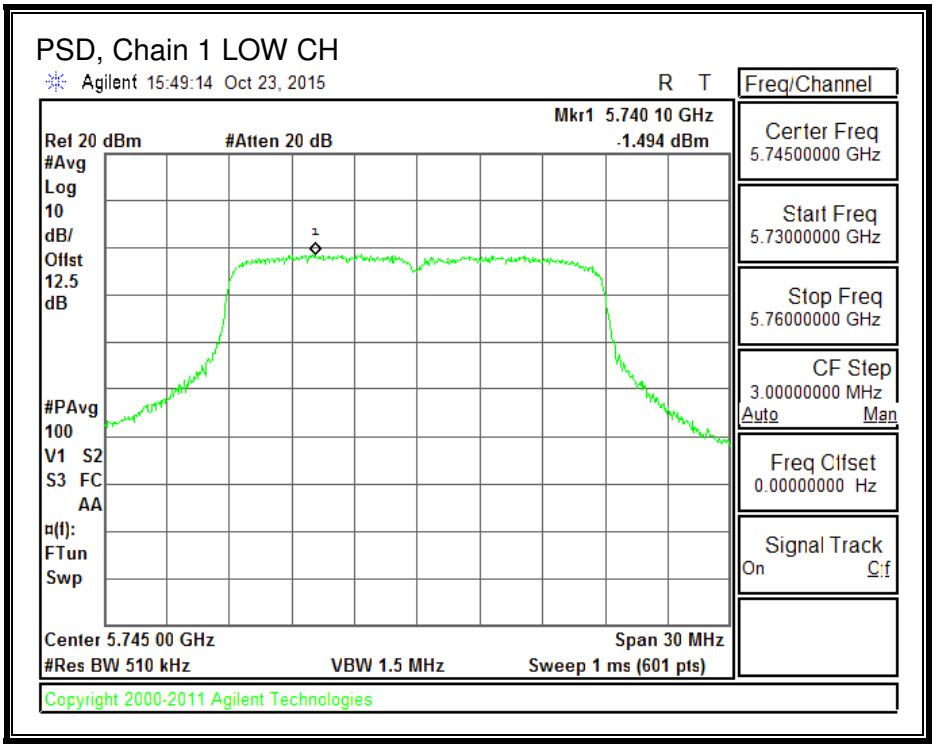
PSD, Chain 0



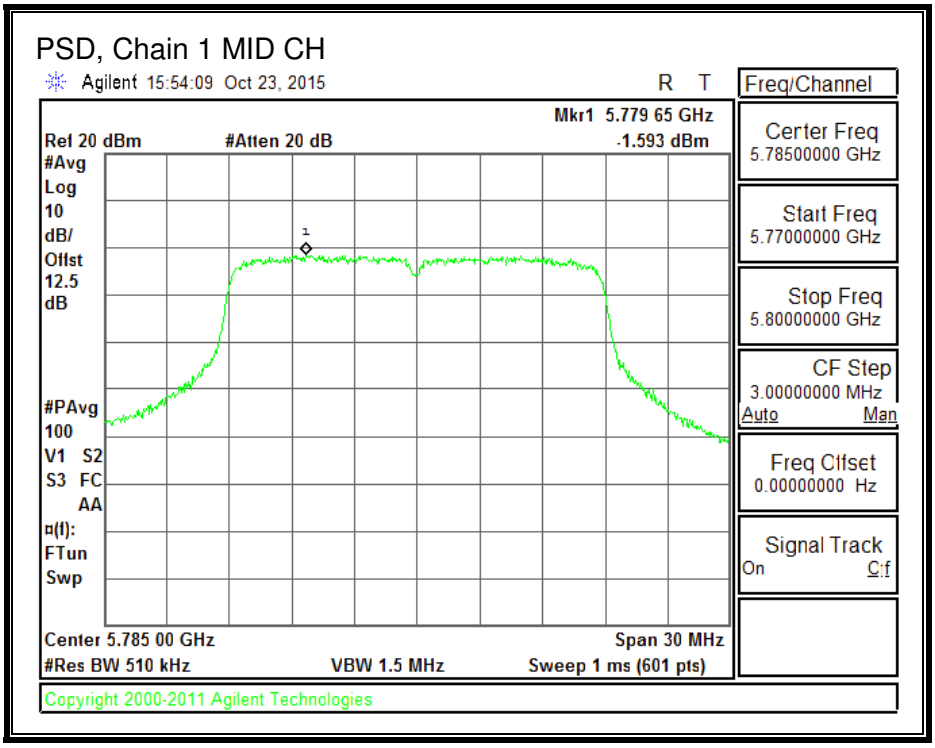




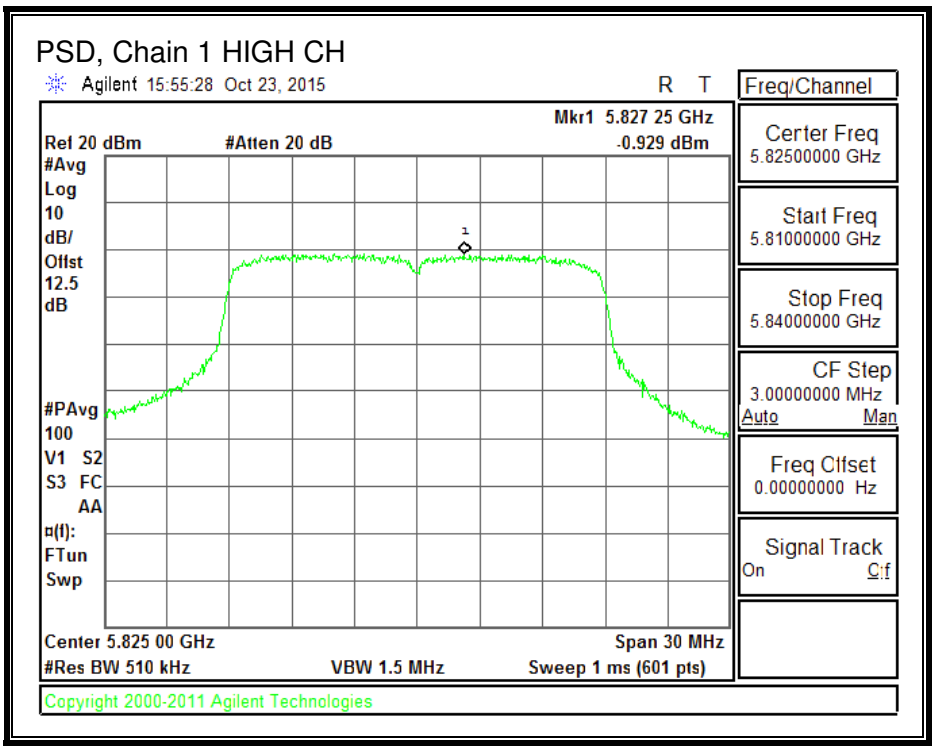
PSD, Chain 1



PSD, Chain 1 MID CH



PSD, Chain 1 HIGH CH



9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN Clause 8.9 (Transmitter)

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

For non-restricted out-of-band emissions in the 5.725-5.85 GHz band, the applied limits were either in accordance with the ones above or with FCC §15.407(b)(4). See below.

§15.407(b)(4)

For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. The antenna to EUT distance is 3 meters.

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.

Reference to KDB KD789033 D02 v01r01 UNII part G) 6) c) Method AD:

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor to the reading offset for average measurements.

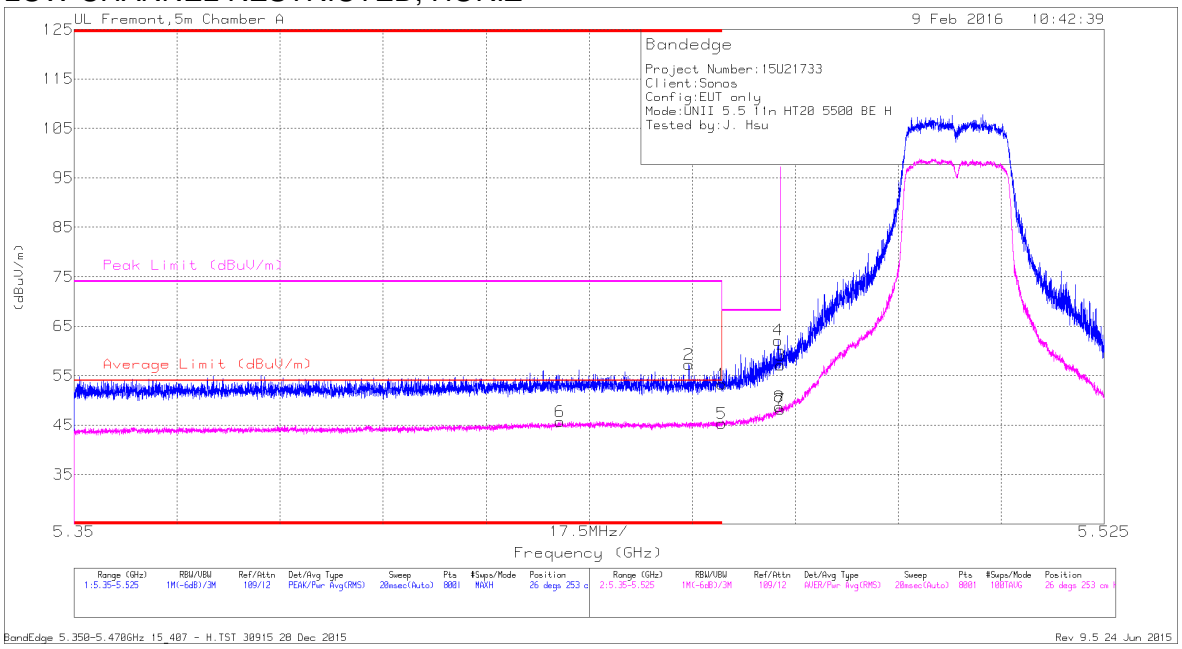
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

9.1. TX RADIATED EMISSIONS 5.6 GHz Band (1 GHz – 18 GHz)

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, HORIZ



Trace Markers

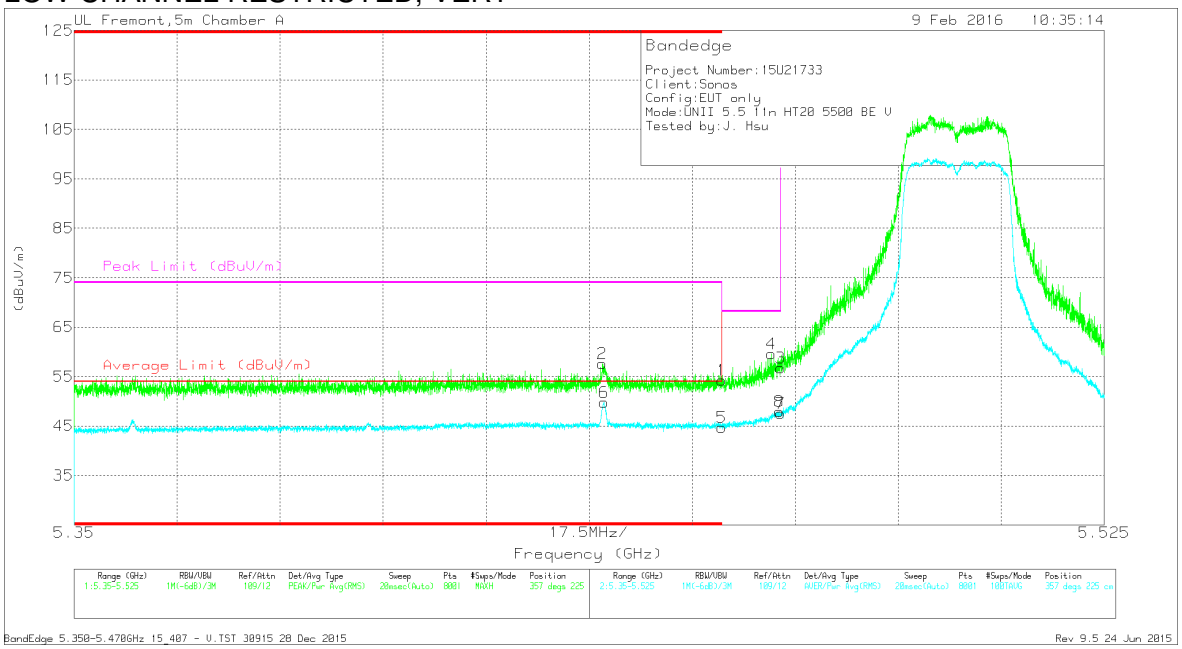
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.46	39.17	Pk	34.5	-20.4	0	53.27	-	-	74	-20.73	26	253	H
2	* 5.454	43.04	Pk	34.5	-20.3	0	57.24	-	-	74	-16.76	26	253	H
5	* 5.46	30.78	RMS	34.5	-20.4	.45	45.33	54	-8.67	-	-	26	253	H
6	* 5.433	31.1	RMS	34.5	-20.3	.45	45.75	54	-8.25	-	-	26	253	H
3	5.47	42.84	Pk	34.5	-20.2	0	57.14	-	-	68.2	-11.06	26	253	H
4	5.47	47.85	Pk	34.5	-20.2	0	62.15	-	-	68.2	-6.05	26	253	H
7	5.47	33.43	RMS	34.5	-20.2	.45	48.18	-	-	-	-	26	253	H
8	5.47	33.92	RMS	34.5	-20.2	.45	48.67	-	-	-	-	26	253	H

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

Pk - Peak detector

RMS - RMS detection

LOW CHANNEL RESTRICTED, VERT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Flt r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 5.46	40.11	Pk	34.5	-20.4	0	54.21	-	-	74	-19.79	357	225	V
2	* 5.44	43.36	Pk	34.5	-20.3	0	57.56	-	-	74	-16.44	357	225	V
5	* 5.46	30.21	RMS	34.5	-20.4	.45	44.76	54	-9.24	-	-	357	225	V
6	* 5.44	35.12	RMS	34.5	-20.3	.45	49.77	54	-4.23	-	-	357	225	V
4	5.468	45.26	Pk	34.5	-20.2	0	59.56	-	-	68.2	-8.64	357	225	V
3	5.47	42.42	Pk	34.5	-20.2	0	56.72	-	-	68.2	-11.48	357	225	V
7	5.47	32.82	RMS	34.5	-20.2	.45	47.57	-	-	-	-	357	225	V
8	5.47	33.23	RMS	34.5	-20.2	.45	47.98	-	-	-	-	357	225	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

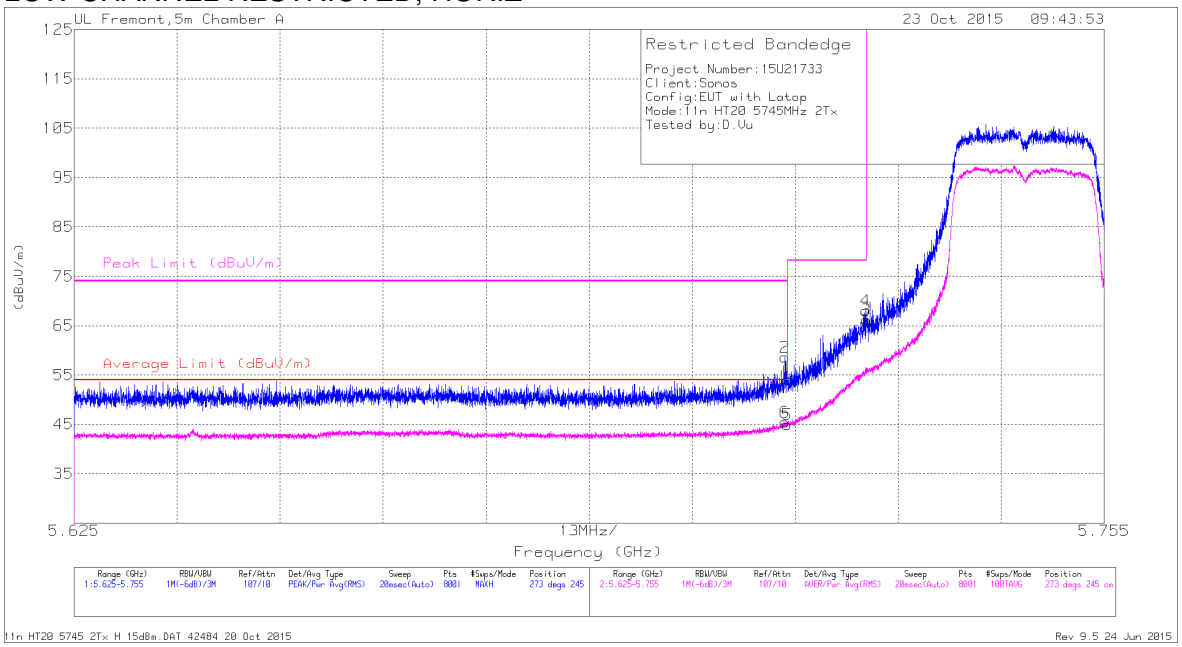
Pk - Peak detector

RMS - RMS detection

9.2. TX RADIATED EMISSIONS 5.8 GHz Band (1 GHz – 18 GHz)

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, HORIZ

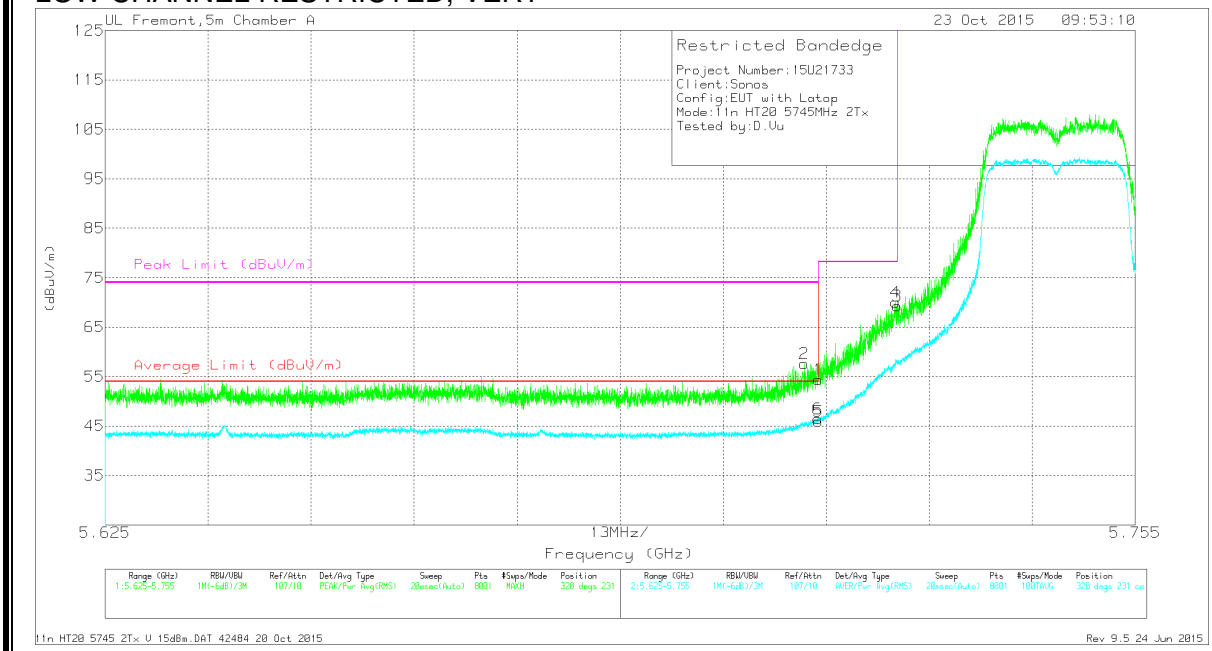


Trace Markers

Marker	Freq (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.715	40.27	Pk	34.7	-20.8	0	54.17	-	-	74	-19.83	273	245	H
2	5.715	44.66	Pk	34.7	-20.8	0	58.56	-	-	74	-15.44	273	245	H
5	5.715	30.55	RMS	34.7	-20.8	.45	44.9	54	-9.1	-	-	273	245	H
6	5.715	31.11	RMS	34.7	-20.8	.45	45.46	54	-8.54	-	-	273	245	H
3	5.725	52.21	Pk	34.7	-20.7	0	66.21	-	-	78.2	-11.99	273	245	H
4	5.725	54.04	Pk	34.7	-20.7	0	68.04	-	-	78.2	-10.16	273	245	H

Pk - Peak detector
RMS - RMS detection

LOW CHANNEL RESTRICTED, VERT



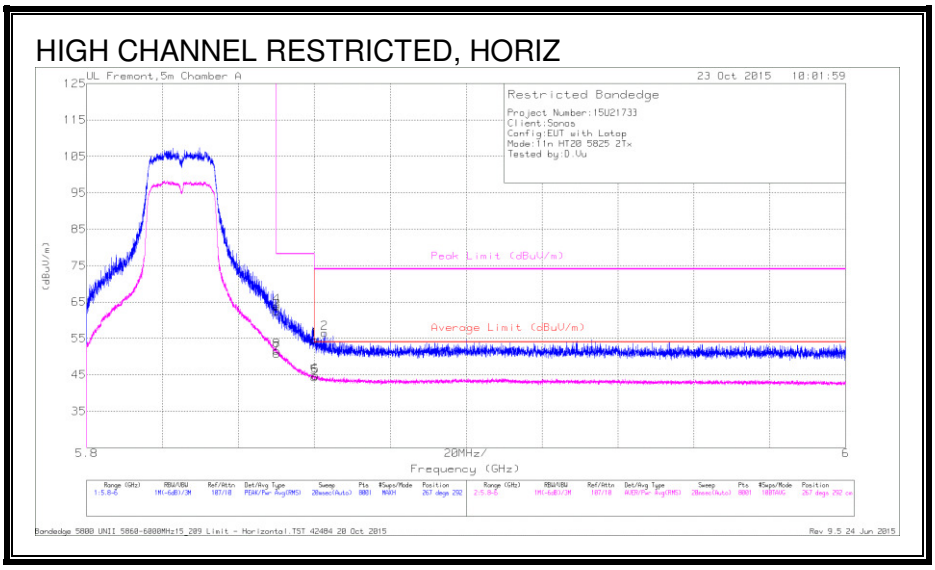
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Filt r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	5.713	43.68	Pk	34.7	-20.8	0	57.58	-	-	74	-16.42	320	231	V
1	5.715	40.53	Pk	34.7	-20.8	0	54.43	-	-	74	-19.57	320	231	V
5	5.715	31.65	RMS	34.7	-20.8	.45	46	54	-8	-	-	320	231	V
6	5.715	32.14	RMS	34.7	-20.8	.45	46.49	54	-7.51	-	-	320	231	V
3	5.725	55.25	Pk	34.7	-20.7	0	69.25	-	-	78.2	-8.95	320	231	V
4	5.725	56.05	Pk	34.7	-20.7	0	70.05	-	-	78.2	-8.15	320	231	V

Pk - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (HIGH CHANNEL)



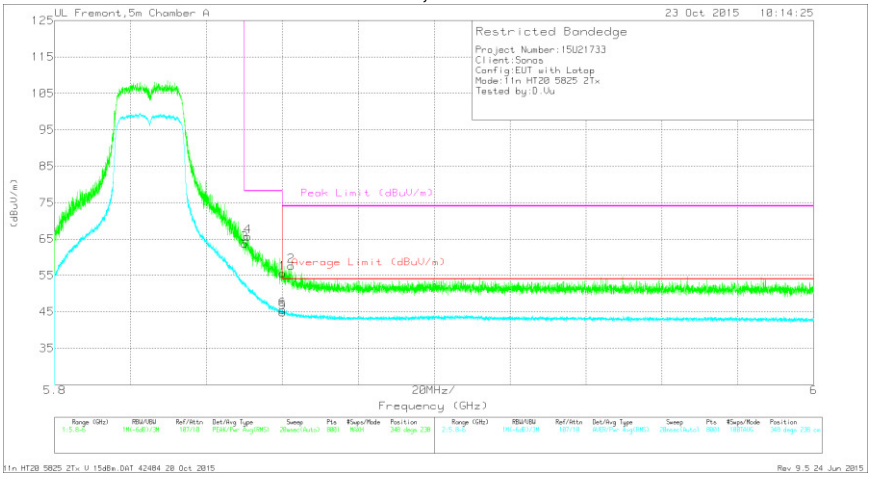
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Flt r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	47.7	Pk	35.1	-20.3	0	62.5	-	-	78.2	-15.7	267	292	H
4	5.85	49.16	Pk	35.1	-20.3	0	63.96	-	-	78.2	-14.24	267	292	H
1	5.86	39.85	Pk	35.1	-20.3	0	54.65	-	-	74	-19.35	267	292	H
5	5.86	29.24	RMS	35.1	-20.3	.45	44.39	54	-8.61	-	-	267	292	H
6	5.86	29.59	RMS	35.1	-20.3	.45	44.74	54	-8.26	-	-	267	292	H
2	5.863	41.66	Pk	35.1	-20.3	0	56.46	-	-	74	-17.54	267	292	H

Pk - Peak detector

RMS - RMS detection

HIGH CHANNEL RESTRICTED, VERT



Trace Markers

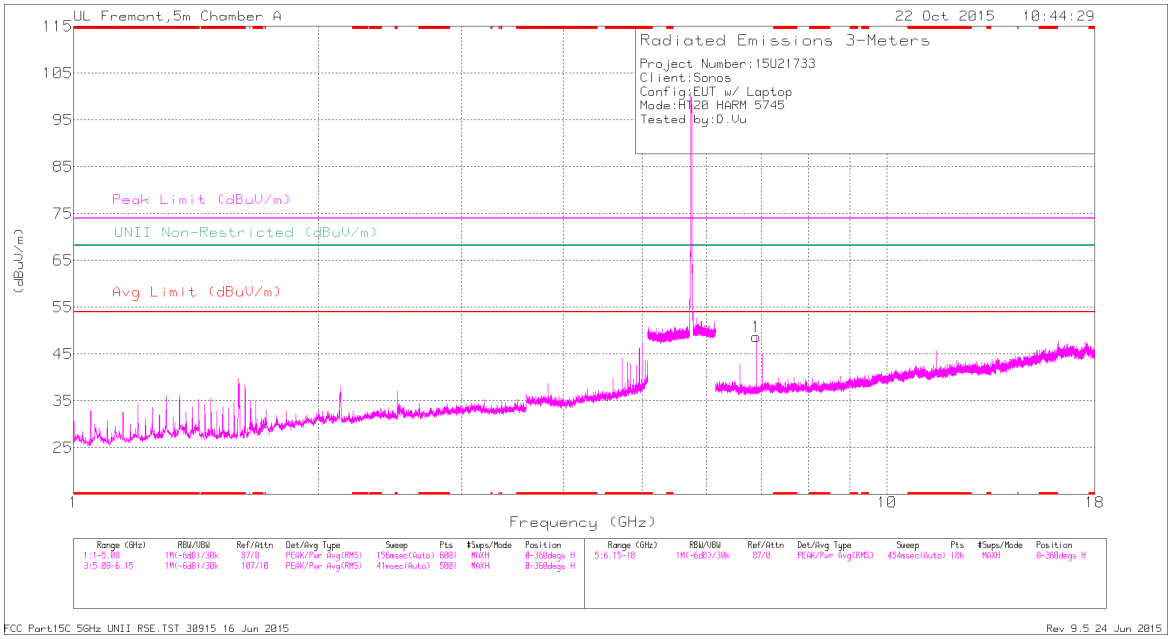
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	48.93	Pk	35.1	-20.3	0	63.73	-	-	78.2	-14.47	348	238	V
4	5.851	50.86	Pk	35.1	-20.3	0	65.66	-	-	78.2	-12.54	348	238	V
1	5.86	40.77	Pk	35.1	-20.3	0	55.57	-	-	74	-18.43	348	238	V
5	5.86	29.62	RMS	35.1	-20.3	.45	44.87	54	-9.13	-	-	348	238	V
6	5.86	30.31	RMS	35.1	-20.3	.45	45.56	54	-8.44	-	-	348	238	V
2	5.862	42.87	Pk	35.1	-20.3	0	57.67	-	-	74	-16.33	348	238	V

Pk - Peak detector
RMS - RMS detection

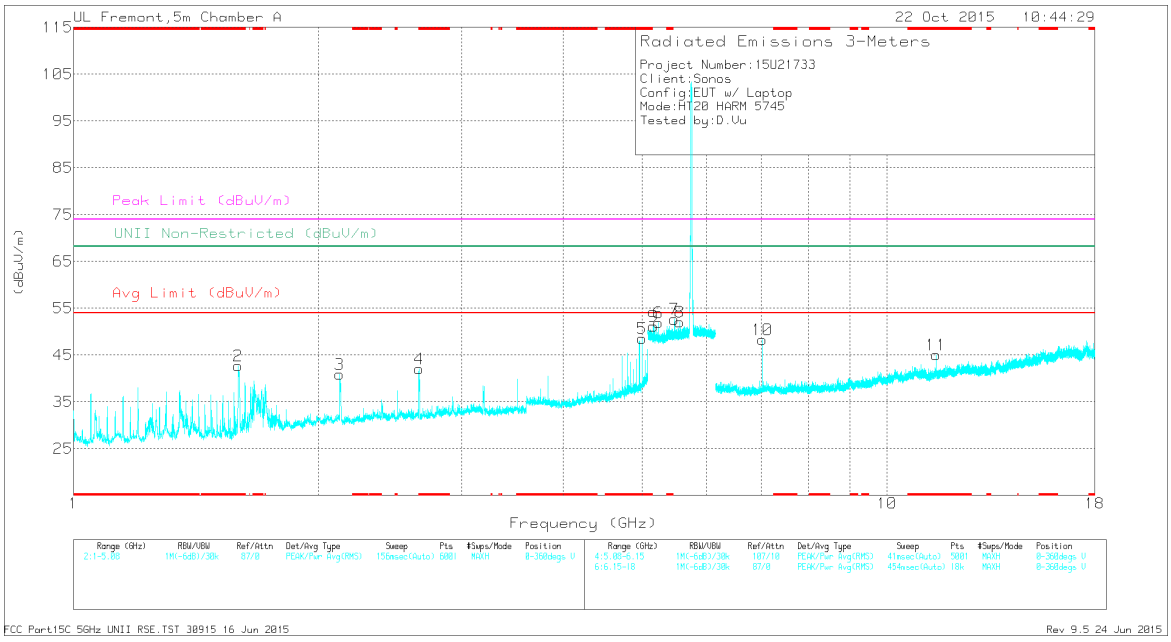
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL

HORIZONTAL



VERTICAL



Radiated Emissions

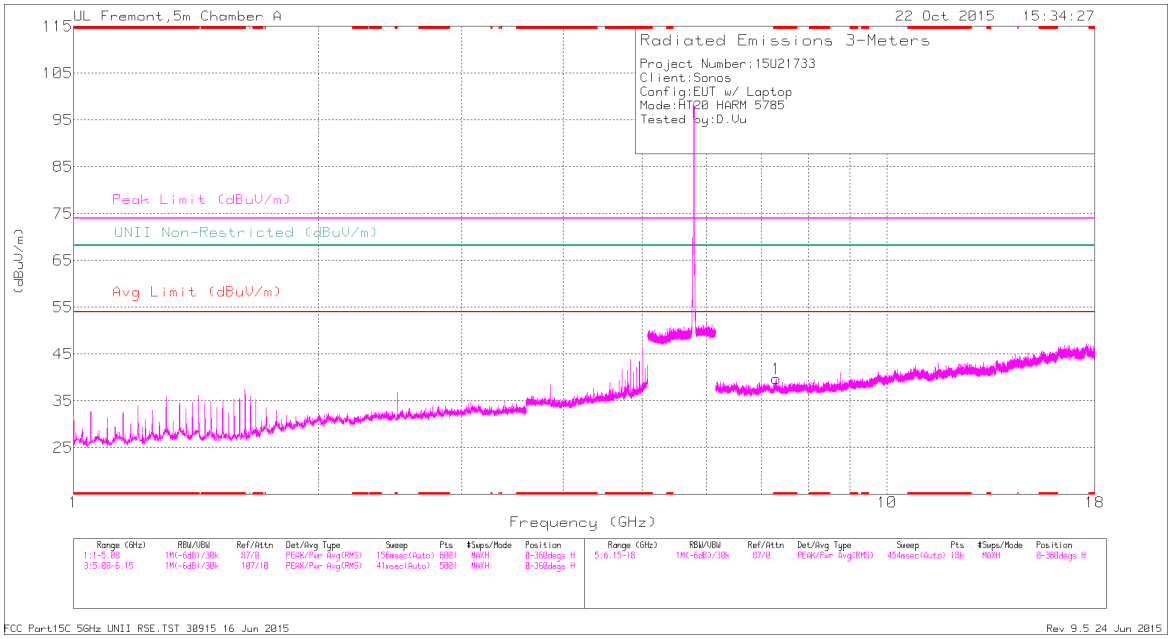
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/ Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 1.594	60.13	PK-U	27.9	-35.5	0	52.53	-	-	74	-21.47	-	-	239	307	V
	* 1.594	39.2	ADR	27.9	-35.5	.45	32.05	54	-21.95	-	-	-	-	239	307	V
4	* 2.656	54.45	PK-U	32.2	-34.2	0	52.45	-	-	74	-21.55	-	-	254	235	V
	* 2.656	34.04	ADR	32.2	-34.2	.45	32.49	54	-21.51	-	-	-	-	254	235	V
5	* 5	48.67	PK-U	34	-28.9	0	53.77	-	-	74	-20.23	-	-	79	146	V
	* 5	41.79	ADR	34	-28.9	.45	47.34	54	-6.66	-	-	-	-	79	146	V
11	* 11.49	38.2	PK-U	38	-22.6	0	53.6	-	-	74	-20.4	-	-	58	167	V
	* 11.49	25.26	ADR	38	-22.6	.45	41.11	54	-12.89	-	-	-	-	58	167	V
3	2.125	56.29	PK-U	31.4	-34.4	0	53.29	-	-	-	-	68.2	-14.91	228	362	V
9	5.16	44.8	PK-U	34.3	-20.7	0	58.4	-	-	-	-	68.2	-9.8	2	257	V
6	5.24	44.99	PK-U	34.4	-20.4	0	58.99	-	-	-	-	68.2	-9.21	144	121	V
7	5.48	45.65	PK-U	34.5	-20.1	0	60.05	-	-	-	-	68.2	-8.15	169	200	V
8	5.56	46.06	PK-U	34.5	-20.2	0	60.36	-	-	-	-	68.2	-7.84	145	129	V
1	6.908	37.26	PK-U	35.6	-27.2	0	45.66	-	-	-	-	68.2	-22.54	5	317	H
10	7.027	45.05	PK-U	35.6	-26.6	0	54.05	-	-	-	-	68.2	-14.15	220	359	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band.
** - indicates frequency covered by the radiated band edge.

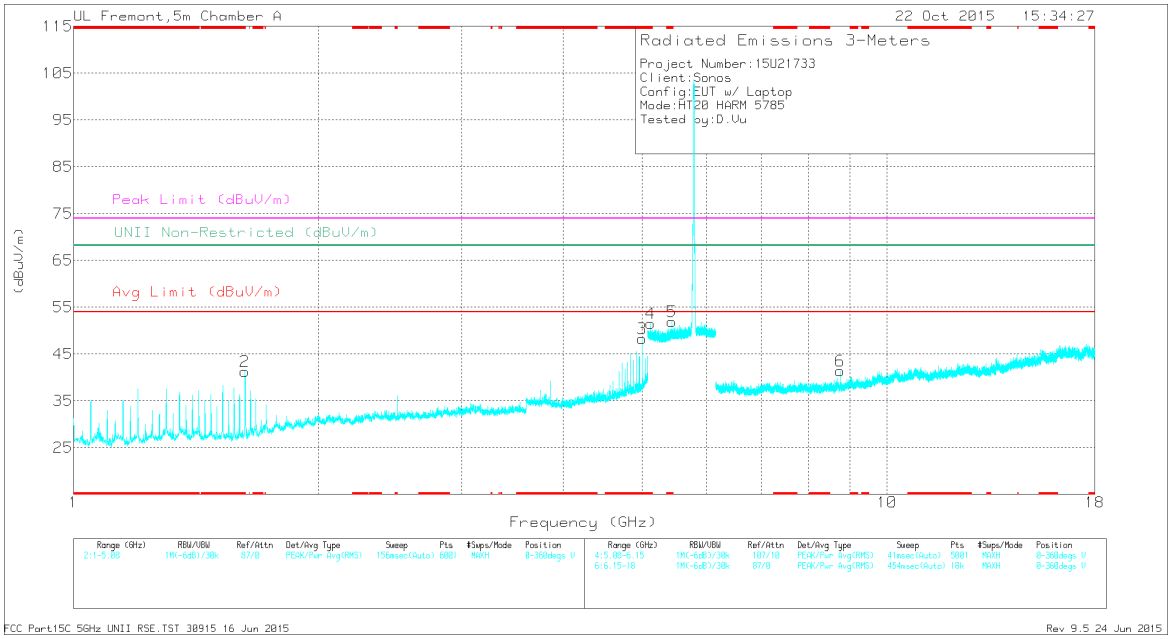
PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

MID CHANNEL

HORIZONTAL



VERTICAL



Radiated Emissions

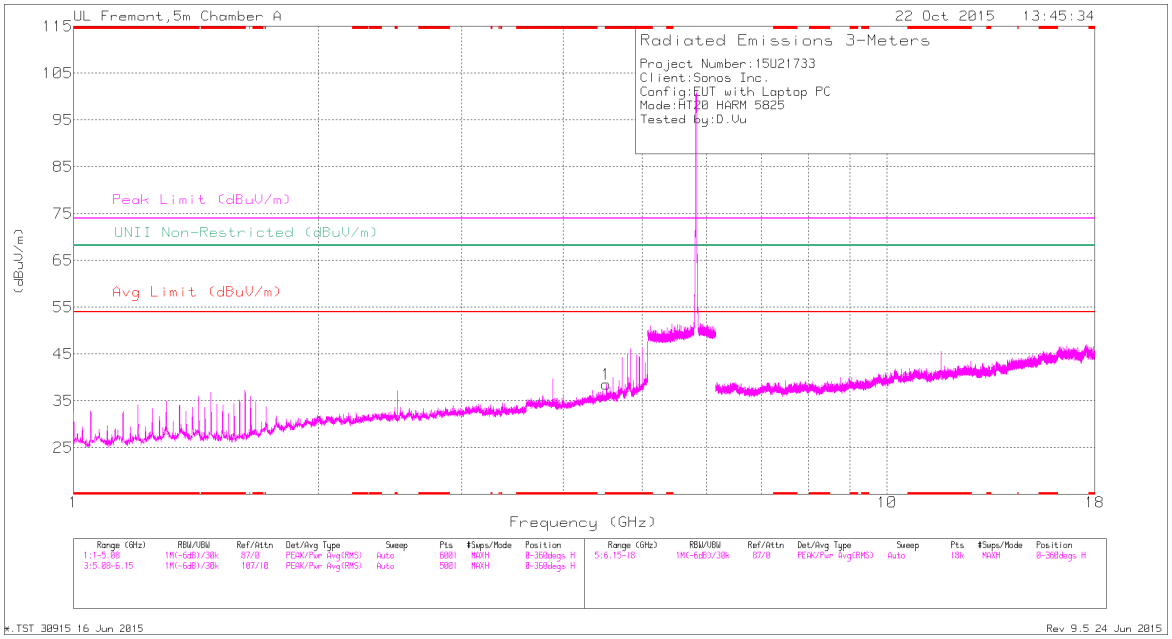
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	*1.625	52.55	PK-U	28.1	-35.3	0	45.35	-	-	74	-28.65	-	-	196	186	V
2	*1.625	48.05	ADR	28.1	-35.3	0.45	41.3	54	-12.7	-	-	-	-	196	186	V
3	*5	48.03	PK-U	34	-28.9	0	53.13	-	-	74	-20.87	-	-	249	103	V
3	*5	40.62	ADR	34	-28.9	0.45	46.17	54	-7.83	-	-	-	-	249	103	V
4	*5.12	45.95	PK-U	34.1	-20.8	0	59.25	-	-	74	-14.75	-	-	137	108	V
4	*5.12	35.71	ADR	34.1	-20.8	0.45	49.46	54	-4.54	-	-	-	-	137	108	V
5	*5.44	46.3	PK-U	34.5	-20.1	0	60.7	-	-	74	-13.3	-	-	140	150	V
5	*5.44	36.55	ADR	34.5	-20.1	0.45	51.4	54	-2.6	-	-	-	-	140	150	V
1	*7.311	36.81	PK-U	35.5	-25.9	0	46.41	-	-	74	-27.59	-	-	140	201	H
1	*7.312	25.54	ADR	35.5	-25.9	0.45	35.59	54	-18.41	-	-	-	-	140	201	H
6	8.75	24.92	ADR	36	-25.1	0.45	36.27	54	-17.73	-	-	-	-	140	201	V
6	8.751	35.92	PK-U	36	-25.1	0	46.82	-	-	-	-	68.2	-21.38	140	201	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band.
** - indicates frequency covered by the radiated band edge.

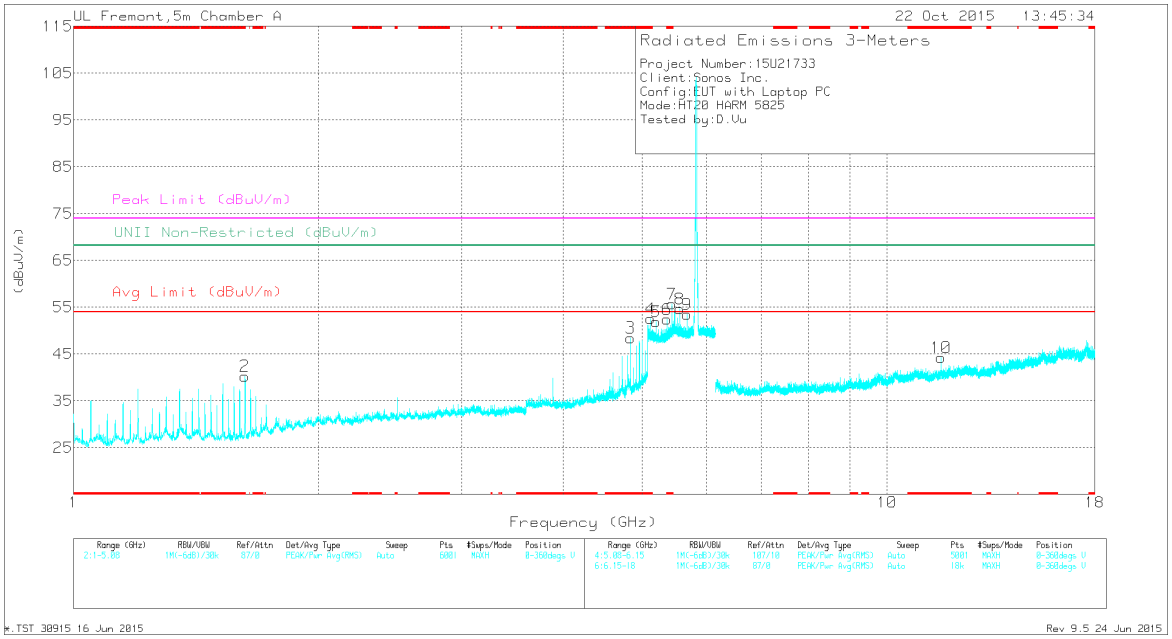
PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

HIGH CHANNEL

HORIZONTAL



VERTICAL



Radiated Emissions

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*4.52	43.86	PK-U	33.9	-30.7	0	47.06	-	-	74	-26.94	-	-	186	195	H
1	*4.52	33.54	ADR	33.9	-30.7	0.45	37.19	54	-16.81	-	-	-	-	186	195	H
3	*4.84	50.34	PK-U	33.9	-30	0	54.24	-	-	74	-19.76	-	-	84	164	V
3	*4.84	44.52	ADR	33.9	-30	0.45	48.87	54	-5.13	-	-	-	-	84	164	V
2	*1.625	51.14	PK-U	28.1	-35.3	0	43.94	-	-	74	-30.06	-	-	211	105	V
2	*1.625	45.68	ADR	28.1	-35.3	0.45	38.93	54	-15.07	-	-	-	-	211	105	V
4	*5.12	46.97	PK-U	34.1	-20.8	0	60.27	-	-	74	-13.73	-	-	138	206	V
4	*5.12	38.76	ADR	34.1	-20.8	0.45	52.51	54	-1.49	-	-	-	-	138	206	V
6	*5.36	46.04	PK-U	34.6	-20.1	0	60.54	-	-	74	-13.46	-	-	29	108	V
6	*5.36	36.68	ADR	34.6	-20.1	0.45	51.63	54	-2.37	-	-	-	-	29	108	V
10	*11.65	37	PK-U	38.2	-22.4	0	52.8	-	-	74	-21.2	-	-	44	185	V
10	*11.65	23.56	ADR	38.2	-22.4	0.45	39.81	54	-14.19	-	-	-	-	44	185	V
5	5.2	45.04	PK-U	34.4	-20.5	0	58.94	-	-	-	-	68.2	-9.26	66	249	V
5	5.2	34.49	ADR	34.4	-20.5	0.45	48.84	54	-5.16	-	-	-	-	66	249	V
8	5.56	46.95	PK-U	34.5	-20.2	0	61.25	-	-	-	-	68.2	-6.95	241	111	V
8	5.56	37.87	ADR	34.5	-20.2	0.45	52.62	54	-1.38	-	-	-	-	241	111	V
9	5.68	46.67	PK-U	34.6	-20	0	61.27	-	-	-	-	68.2	-6.93	64	225	V
9	5.68	36.48	ADR	34.6	-20	0.45	51.53	54	2.47	-	-	-	-	64	225	V

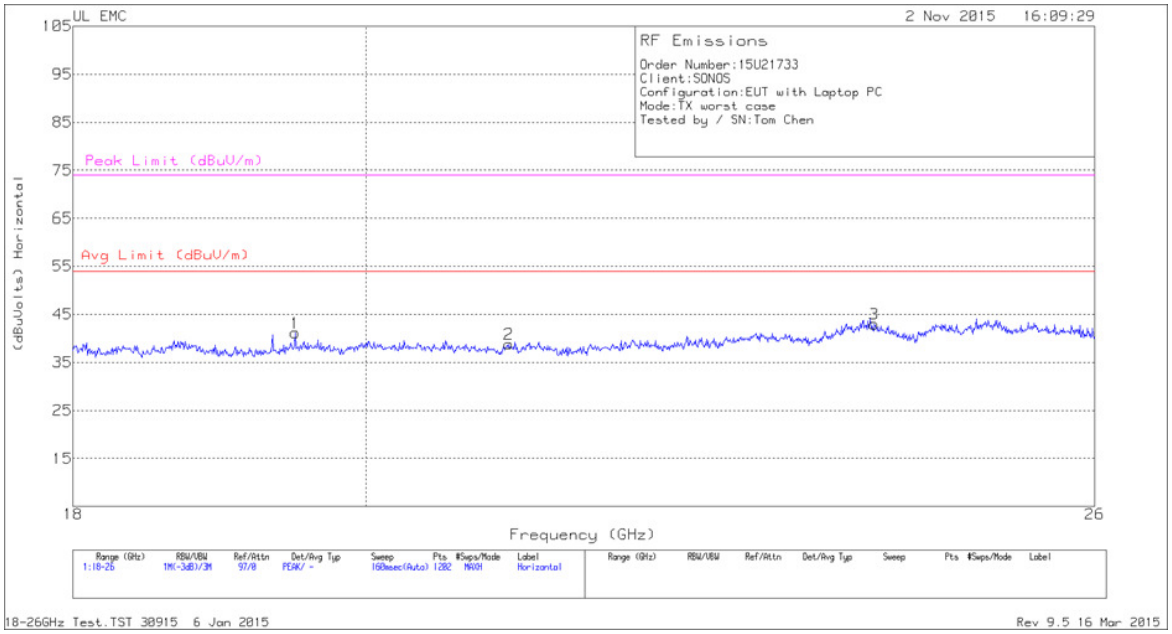
* - indicates frequency in CFR15.205/IC8.10 Restricted Band.
** - indicates frequency covered by the radiated band edge.

PK-U - U-NII: Maximum Peak
ADR - U-NII AD primary method, RMS average

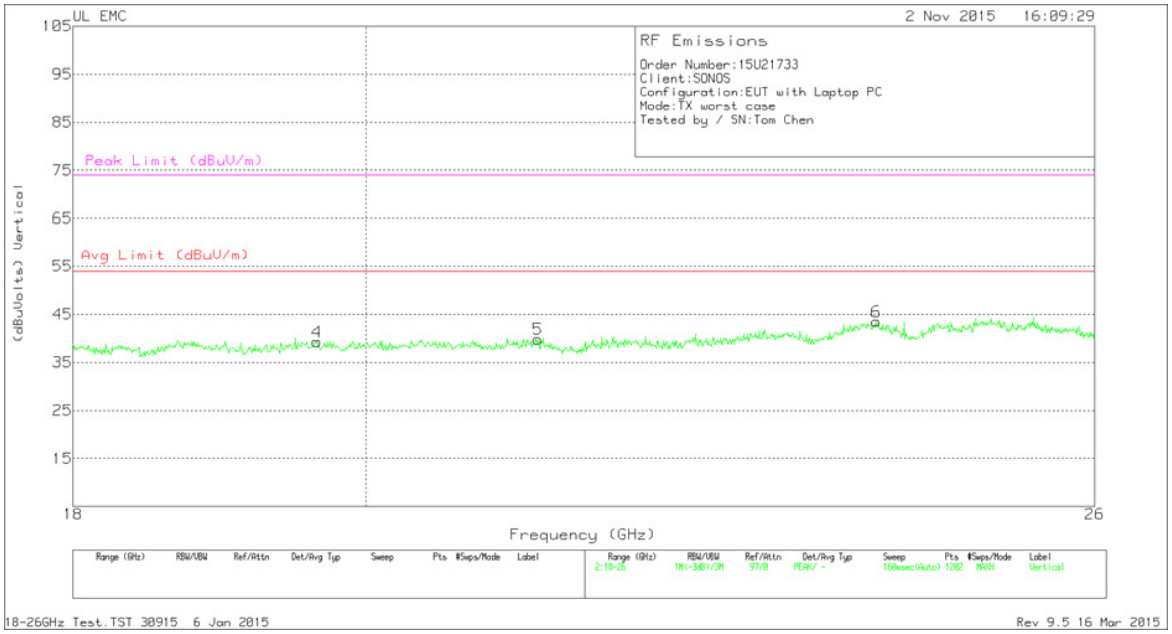
9.3. WORST-CASE TX RADIATED EMISSIONS (18 GHz – 40 GHz)

SPURIOUS EMISSIONS 18 – 26 GHz

HORIZONTAL



VERTICAL



Trace Markers

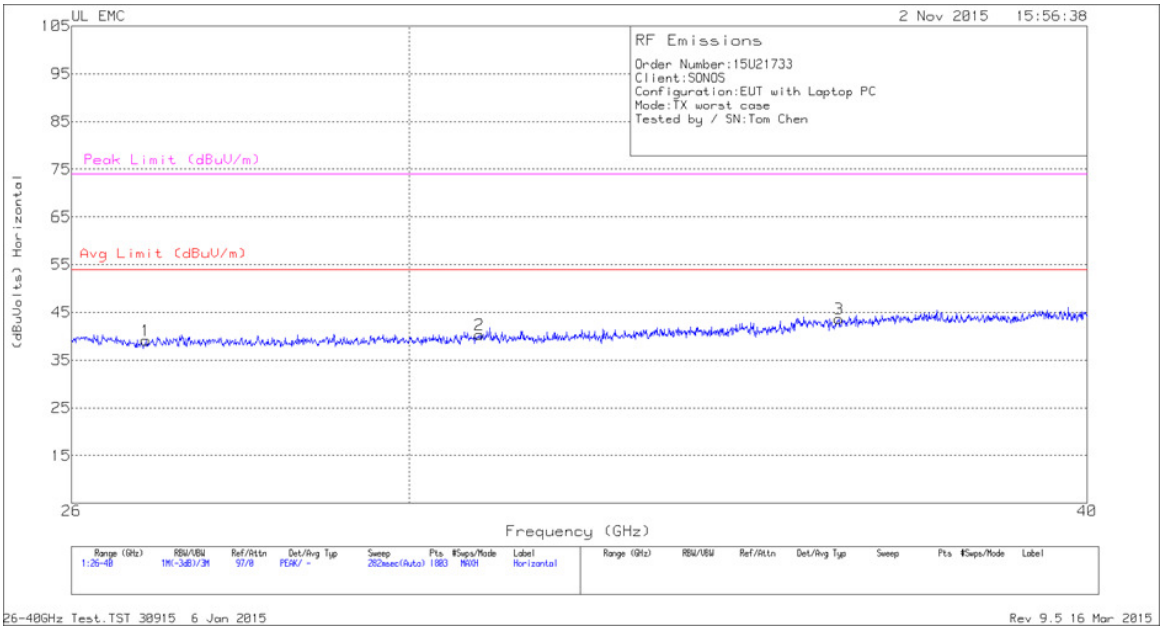
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)

1	19.499	43.27	Pk	32.5	-25.1	-9.5	41.17	54	-12.83	74	-32.83
2	21.057	41.03	Pk	32.6	-25.3	-9.5	38.83	54	-15.16	74	-35.16
3	24.015	43.5	Pk	33.3	-24.3	-9.5	43	54	-11	74	-31
4	19.652	41.33	Pk	32.5	-25	-9.5	39.33	54	-14.66	74	-34.66
5	21.277	41.43	Pk	33.2	-25.3	-9.5	39.83	54	-14.16	74	-34.17
6	24.035	44	Pk	33.3	-24.3	-9.5	43.5	54	-10.5	74	-30.5

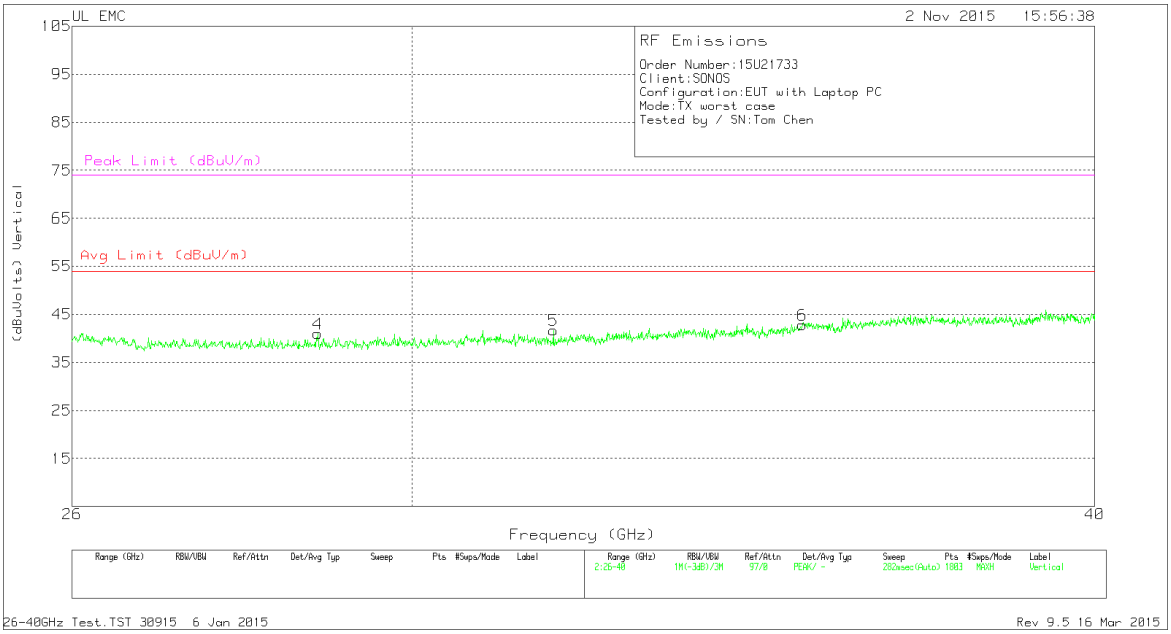
Pk - Peak detector

SPURIOUS EMISSIONS 26 – 40GHz

HORIZONTAL



VERTICAL



Trace Markers

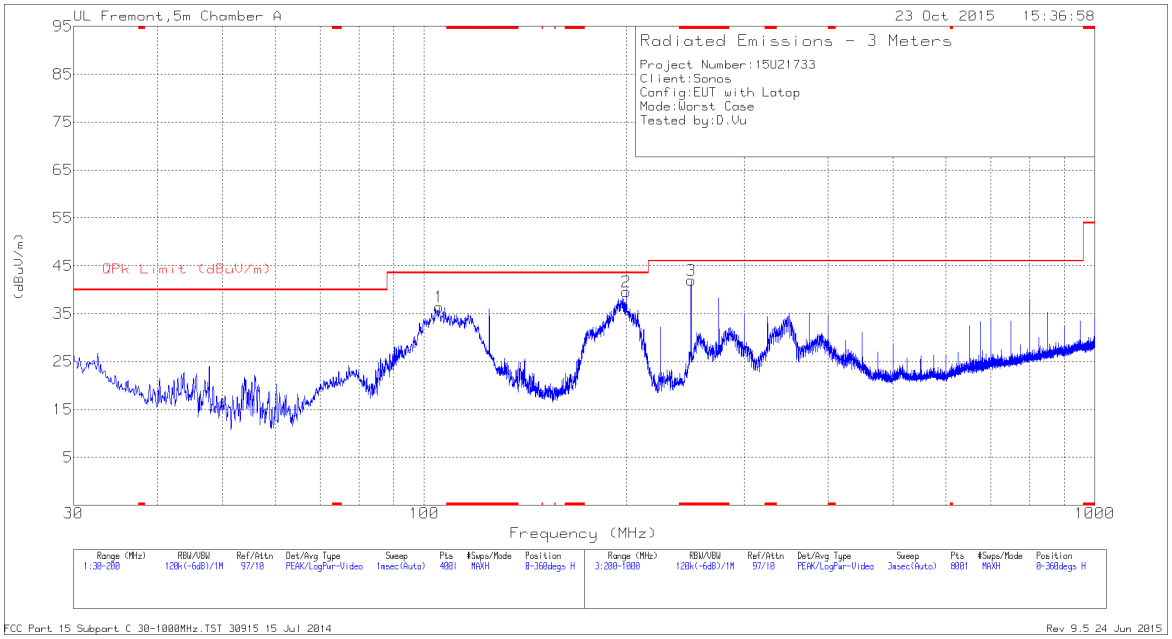
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T90 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	26.831	44.47	Pk	35.3	-31.1	-9.5	39.17	54	-14.83	74	-34.83
2	30.91	46.63	Pk	36	-32.8	-9.5	40.33	54	-13.67	74	-33.67
3	35.999	49.17	Pk	37.3	-33.3	-9.5	43.67	54	-10.33	74	-30.33
4	28.836	46.6	Pk	35.8	-31.9	-9.5	41	54	-13	74	-33
5	31.842	47.87	Pk	36.3	-33	-9.5	41.67	54	-12.33	74	-32.33
6	35.362	47.93	Pk	37.8	-33.4	-9.5	42.83	54	-11.17	74	-31.17

Pk - Peak detector

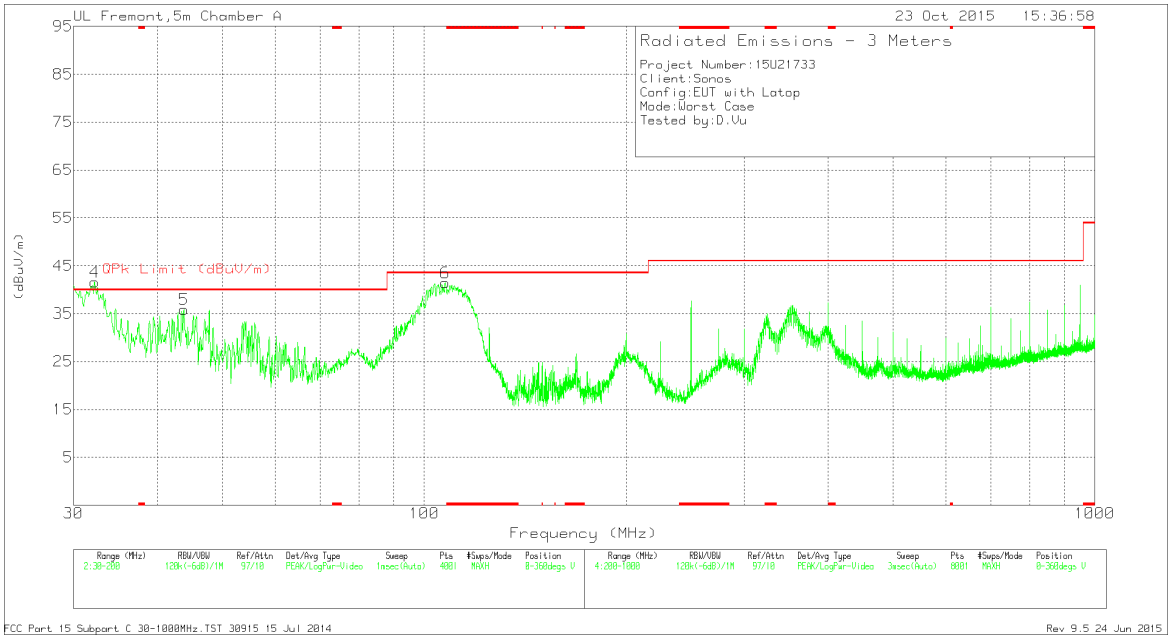
9.1. WORST-CASE BELOW 1 GHz

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

HORIZONTAL



VERTICAL



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 250	56.17	Pk	15.4	-29.6	41.97	46.02	-4.05	0-360	101	H
4	32.2525	49.2	Pk	23.6	-31.2	41.6	-	-	0-360	101	V
5	43.8125	51.85	Pk	15.1	-31.1	35.85	40	-4.15	0-360	101	V
1	105.31	51.35	Pk	15.6	-30.5	36.45	43.52	-7.07	0-360	299	H
6	107.4775	55.84	Pk	16.1	-30.5	41.44	43.52	-2.08	0-360	101	V
2	200	53	Pk	16.5	-29.9	39.6	43.52	-3.92	0-360	101	H

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 250.0024	56.06	Qp	15.4	-29.6	41.86	46.02	-4.16	250	107	H
32.0454	43.5	Qp	23.8	-31.2	36.1	40	-3.9	200	113	V
43.8029	49.36	Qp	15.1	-31.1	33.36	40	-6.64	312	114	V
105.3005	46.29	Qp	15.6	-30.5	31.39	43.52	-12.13	80	272	H
107.402	50.34	Qp	16.1	-30.5	35.94	43.52	-7.58	166	101	V
200.0497	50.46	Qp	16.5	-29.9	37.06	43.52	-6.46	266	133	H

* - indicates frequency in CFR15.205 Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

10. 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 C63.10-2013.

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

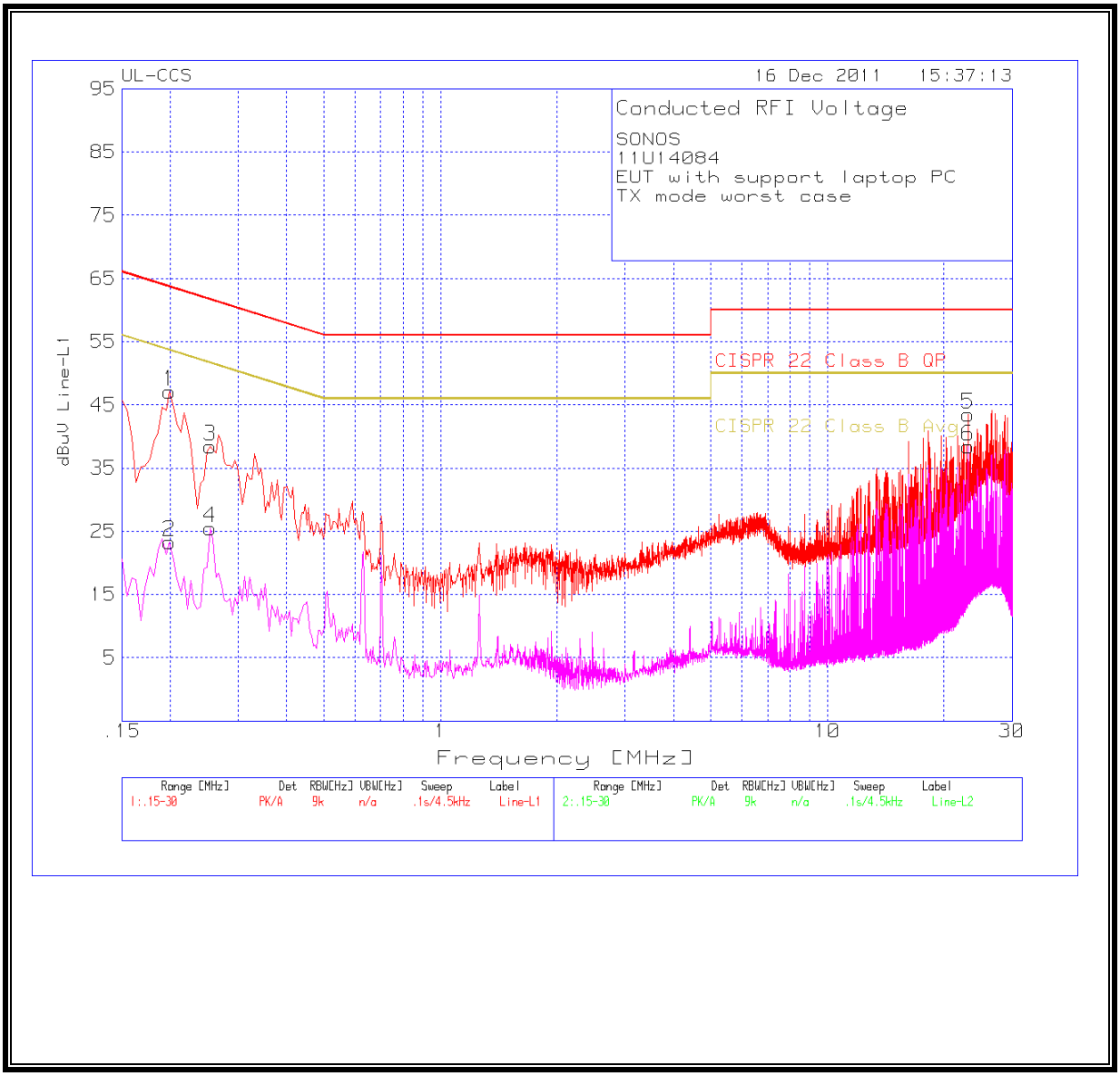
Line conducted data is recorded for both NEUTRAL and HOT lines

RESULTS

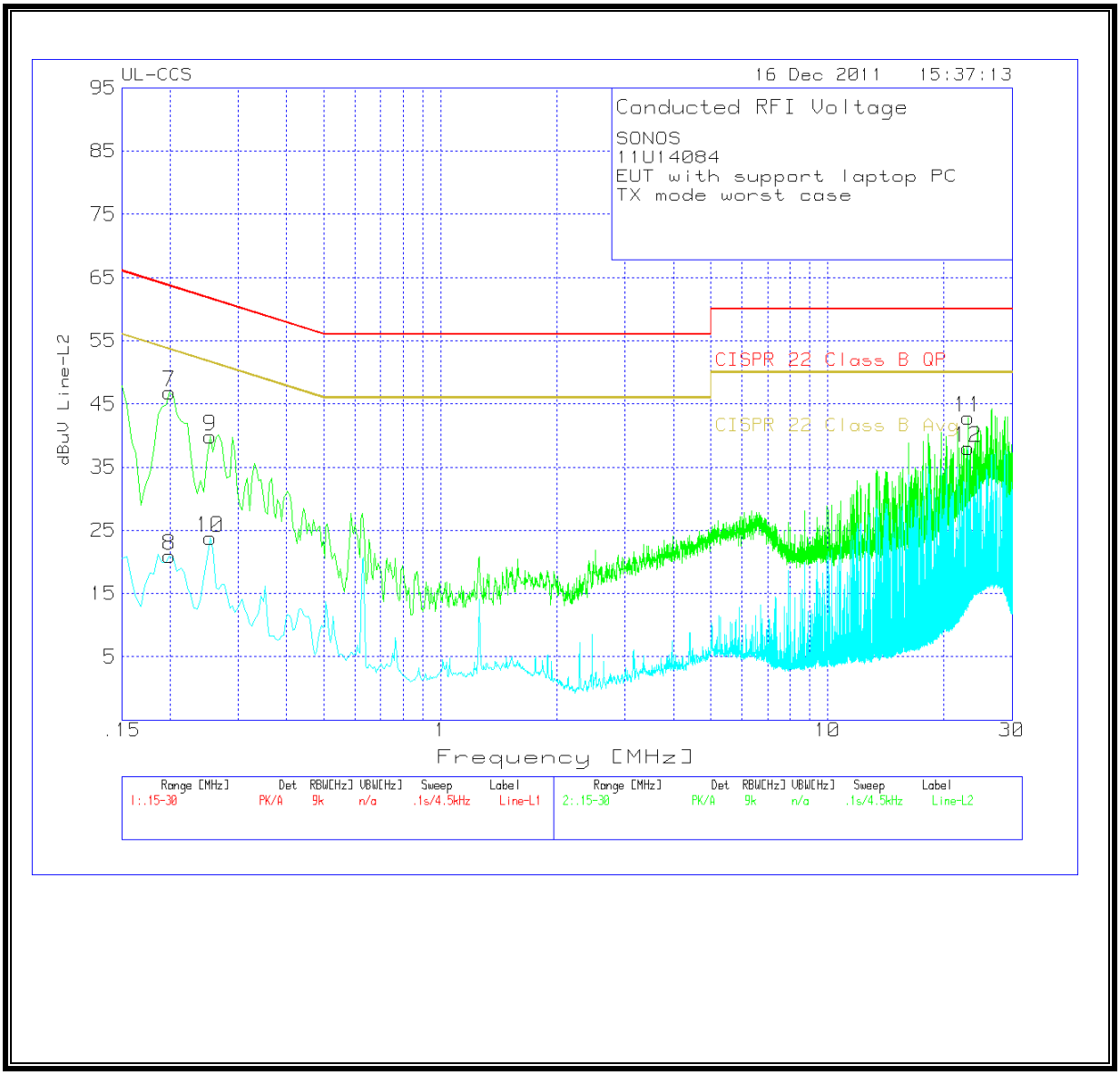
6 WORST EMISSIONS

SONOS									
11U14084									
EUT with support laptop PC									
TX mode worst case									
Line-L1 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dBuV	CISPR 22 Class B QP	Margin	CISPR 22 Class B Avg	Margin
0.1995	46.97	PK	0.1	0	47.07	63.6	-16.53	-	-
0.1995	23.16	Av	0.1	0	23.26	-	-	53.6	-30.34
0.2535	38.34	PK	0.1	0	38.44	61.6	-23.16	-	-
0.2535	25.41	Av	0.1	0	25.51	-	-	51.6	-26.09
23.1315	42.9	PK	0.4	0.2	43.5	60	-16.5	-	-
23.1315	37.8	Av	0.4	0.2	38.4	-	-	50	-11.6
Line-L2 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L2.TXT [dB]	LC Cables 2&3.TXT [dB]	dBuV	CISPR 22 Class B QP	Margin	CISPR 22 Class B Avg	Margin
0.1995	46.78	PK	0.1	0	46.88	63.6	-16.72	-	-
0.1995	20.82	Av	0.1	0	20.92	-	-	53.6	-32.68
0.2535	39.74	PK	0.1	0	39.84	61.6	-21.76	-	-
0.2535	23.72	Av	0.1	0	23.82	-	-	51.6	-27.78
23.1315	42.28	PK	0.4	0.2	42.88	60	-17.12	-	-
23.1315	37.47	Av	0.4	0.2	38.07	-	-	50	-11.93

LINE 1 RESULTS



LINE 2 RESULTS



12. ART POWER SETTINGS TABLE

Channel	Frequency	FCC (Region 1)		
		11b	11g	11n
149	5745			15.5
157	5785			15
165	5825			15

END OF REPORT