



**FCC 47 CFR PART 15 SUBPART E
INDUSTRY CANADA RSS-247 ISSUE 1**

CLASS II PERMISSIVE CHANGE

TEST REPORT

FOR

802.11 3x3 a/b/g/n MINI PCIE CARD

MODEL NUMBER: PLAY3

**FCC ID: SBVRM004
IC: 5373A-RM004**

REPORT NUMBER: 15U21734- E1

ISSUE DATE: JANUARY 8, 2016

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	1/8/16	Initial Issue	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: 802.11 3x3 a/b/g/n MINI PCIE CARD

MODEL: PLAY3

SERIAL NUMBER: 80-E9-37-DA-46-B6-F

DATE TESTED: OCTOBER 20, 2015 to NOVEMBER 02, 2015
JANUARY 13, 2014

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.

Approved & Released For
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Huda Mustapha



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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 v01, 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
<input checked="" type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input checked="" type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input type="checkbox"/> 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:

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 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 an 802.11 3x3 abgn Mini PCIe Card, 20 MHz BW, PCB antenna.

The radio module is manufactured by Sonos, Inc.

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 v01 and RSS-247.

For UNII-1, UNII-2 and UNII-2C bands, we have reviewed the original test report (report no. 13U16719-1B) 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 no additional testing is done.

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	22.91	195.43

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT uses 3 antennas as follow:

Antenna	Frequency	Peak gain with cable loss (dBi)
Antenna (1)	5.8G (5745-5825)	2.2
Antenna (2)	5.8G (5745-5825)	5.5
Antenna (3)	5.8G (5745-5825)	3.7

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 11n HT20 (5.8 GHz band): MCS0

The EUT is for desktop applications; all radiated testing was performed with EUT laid out in desktop configuration.

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

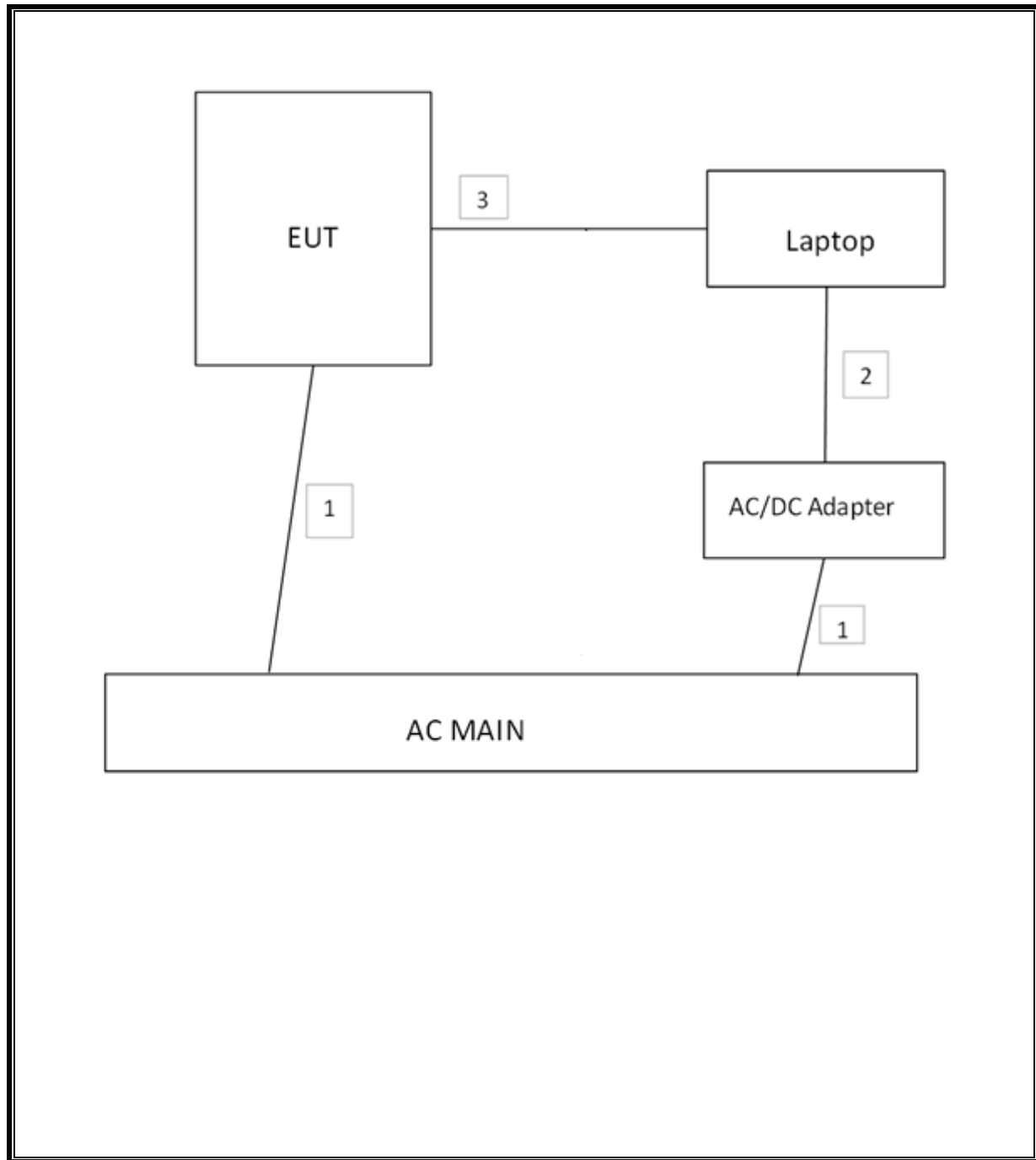
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	2	US 115V	Un-shielded	1.8m	N/A
2	DC	1	DC	Un-shielded	1.8m	N/A
3	Ethernet	1	RJ45	Un-shielded	1.5m	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	10/22/15	10/22/16
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	01/31/15	01/31/16
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	1223	06/07/15	02/06/16

7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 789033 D02 v01, Section B.

6 dB Emission BW: KDB 789033 D02 v01, Section C.2.

99% Occupied BW: KDB 789033 D02 v01, Section D.

Conducted Output Power: KDB 789033 D02 v01, Section E.3.a (Method PM), and KDB 662911 D01 v02r01.

Power Spectral Density: KDB 789033 D02 v01, Section F.

Unwanted emissions in restricted bands: KDB 789033 D02 v01, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01, Sections G.3, G.4, and G.5.

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

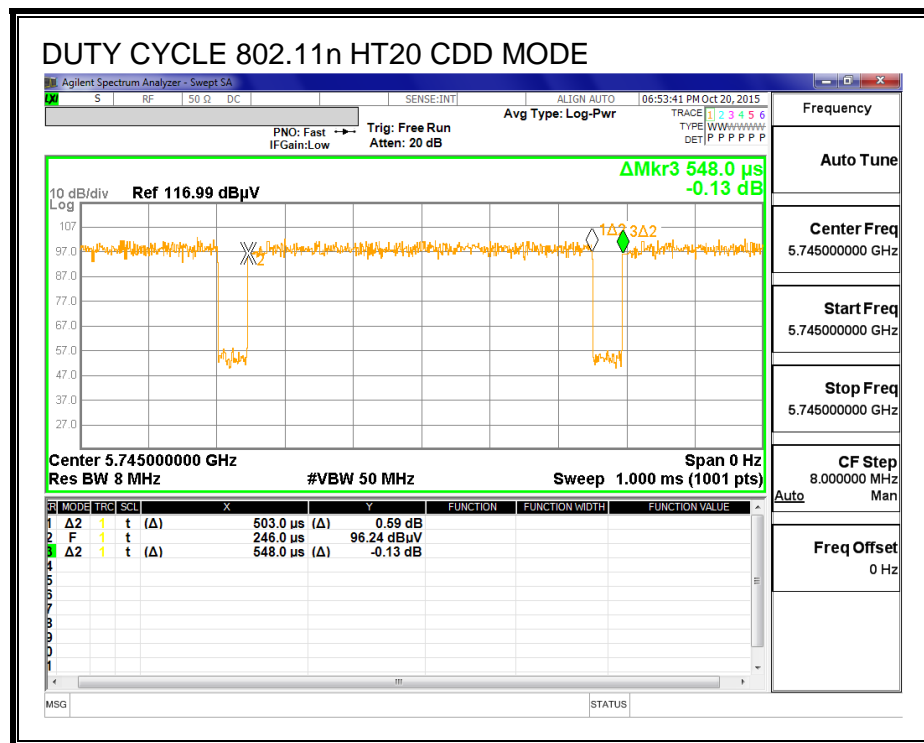
LIMITS

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	0.503	0.548	0.918	91.79%	0.37	1.988

DUTY CYCLE PLOTS



8.2. 6 dB BANDWIDTH

LIMITS

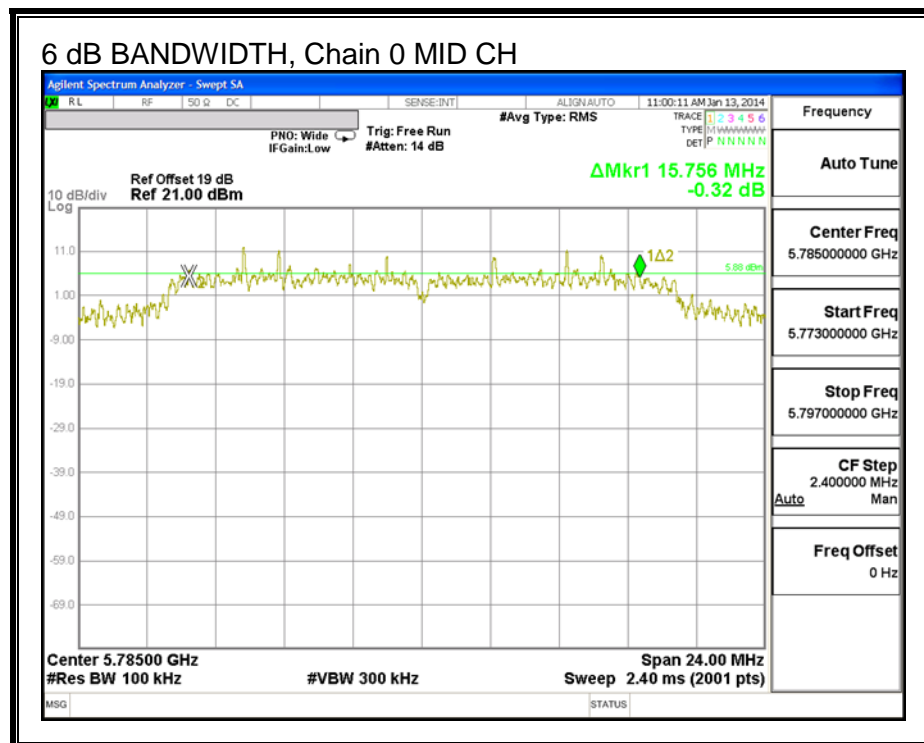
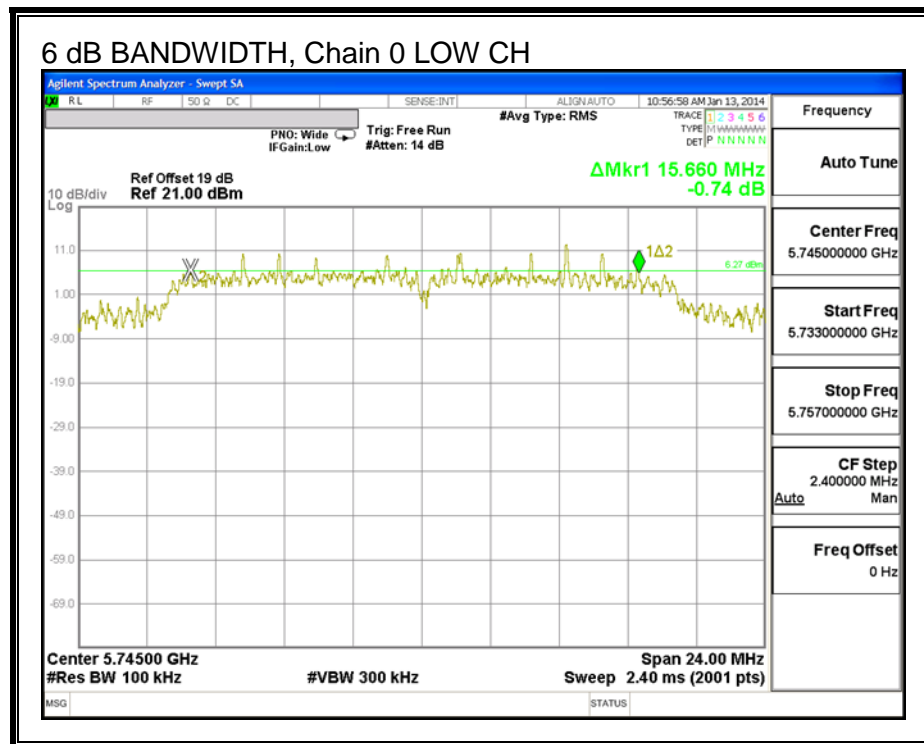
FCC §15.247 (a) (2)

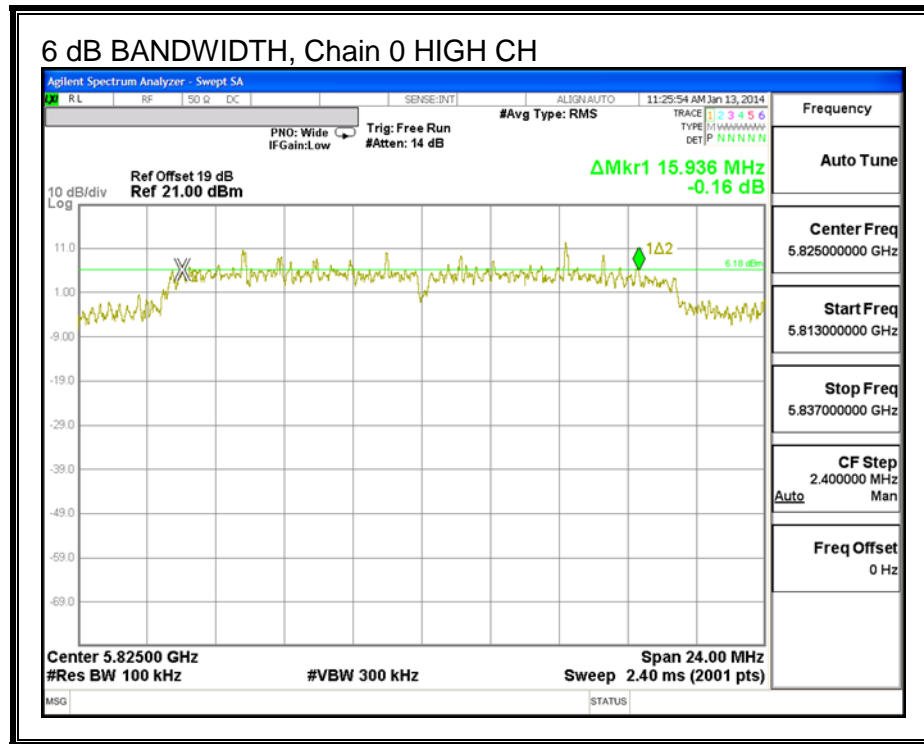
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

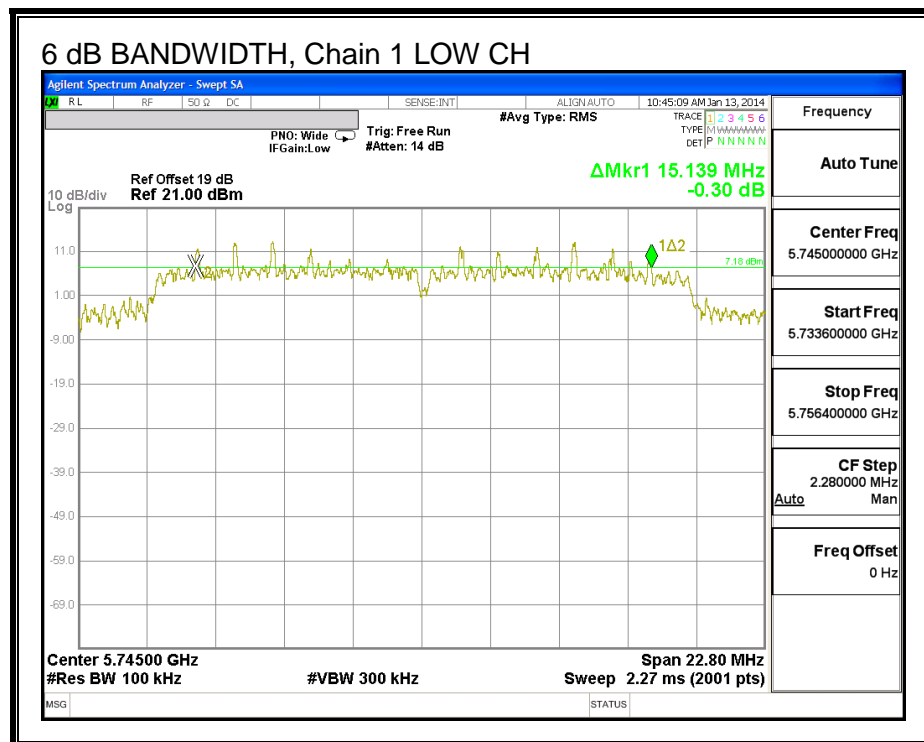
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	Minimum Limit (MHz)
Low	5745	15.660	15.139	15.096	0.5
Mid	5785	15.756	15.912	15.720	0.5
High	5825	15.936	15.960	15.996	0.5

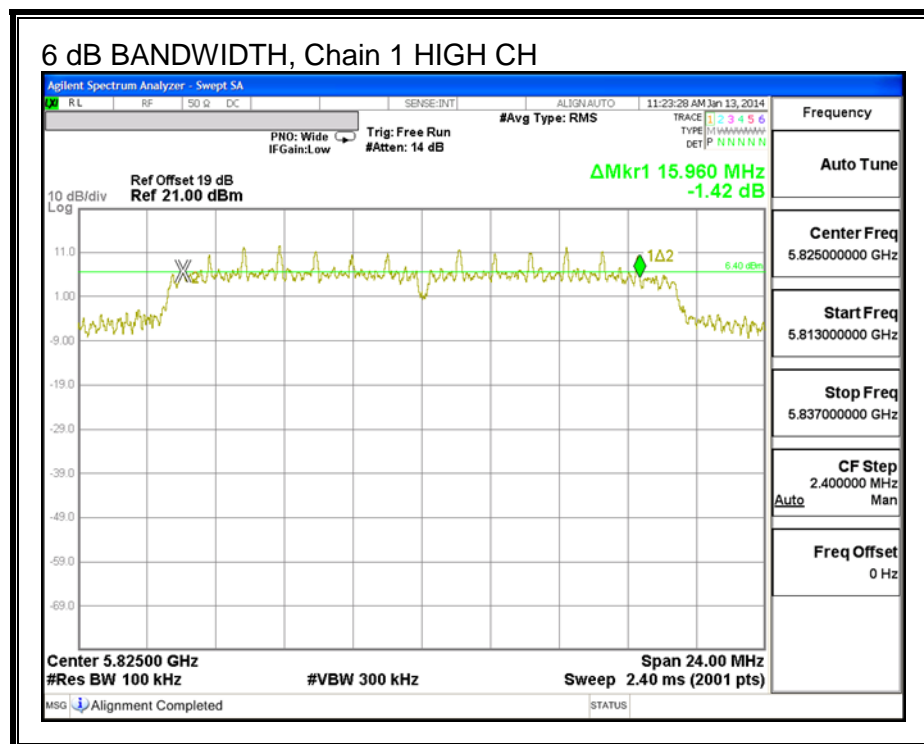
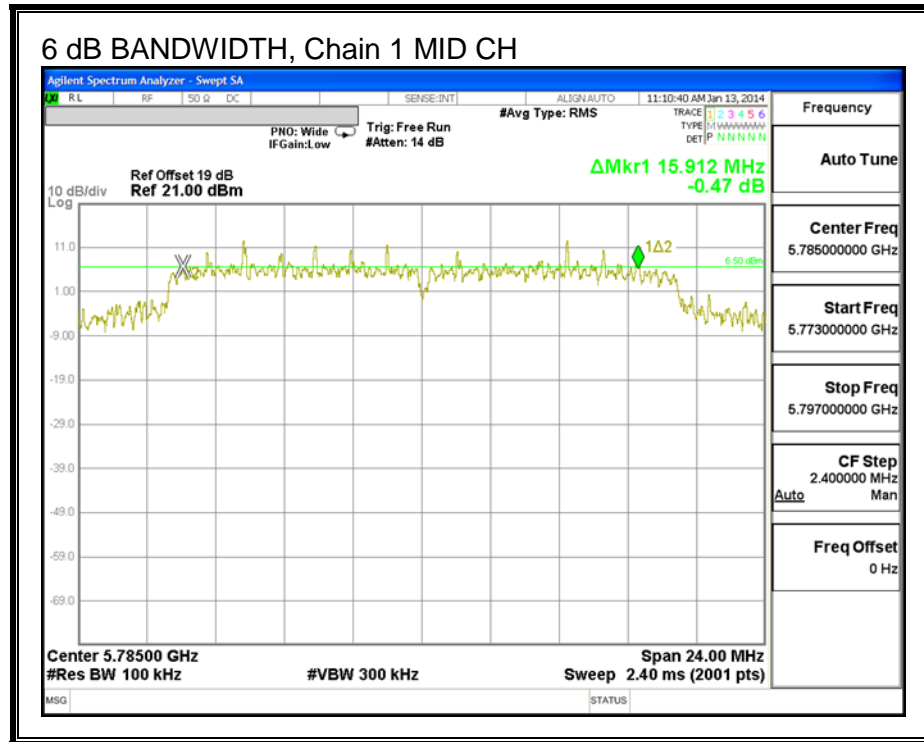
6 dB BANDWIDTH, Chain 0



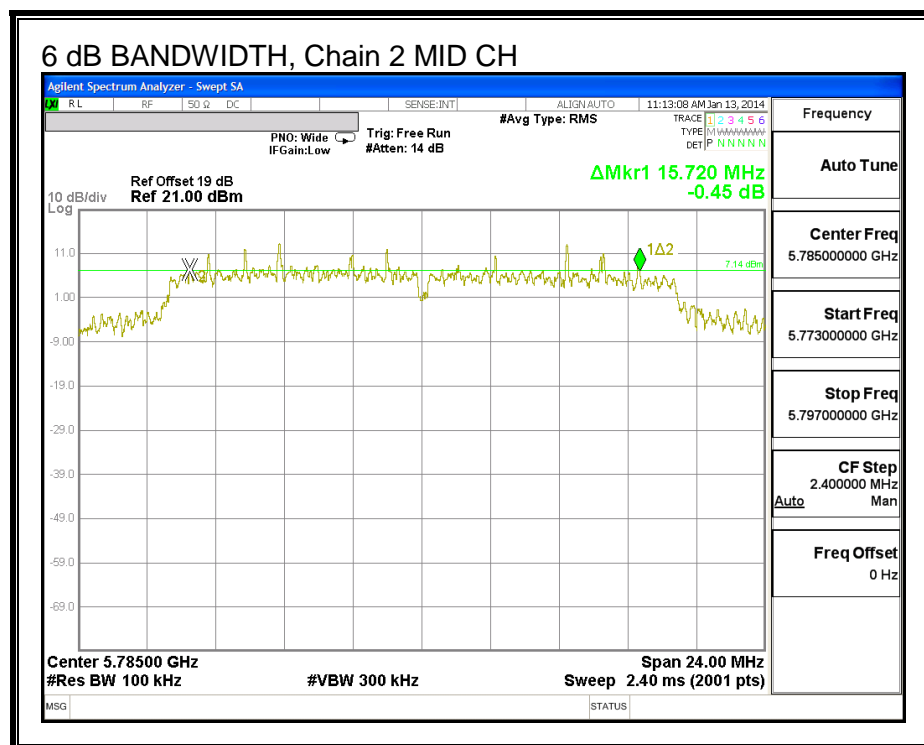
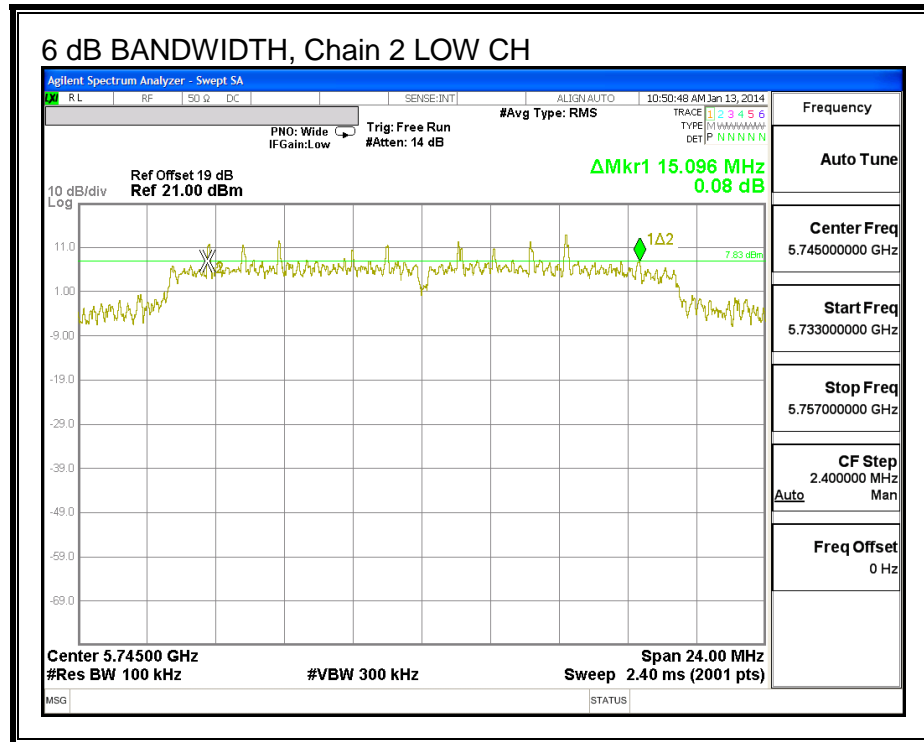


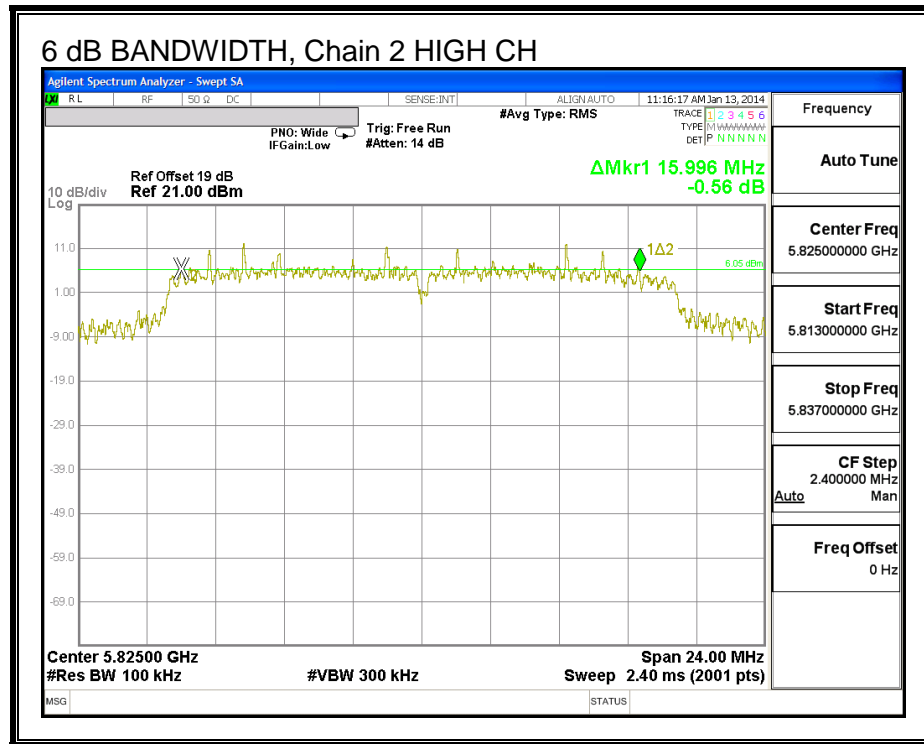
6 dB BANDWIDTH, Chain 1





6 dB BANDWIDTH, Chain 2





8.3. 99% BANDWIDTH

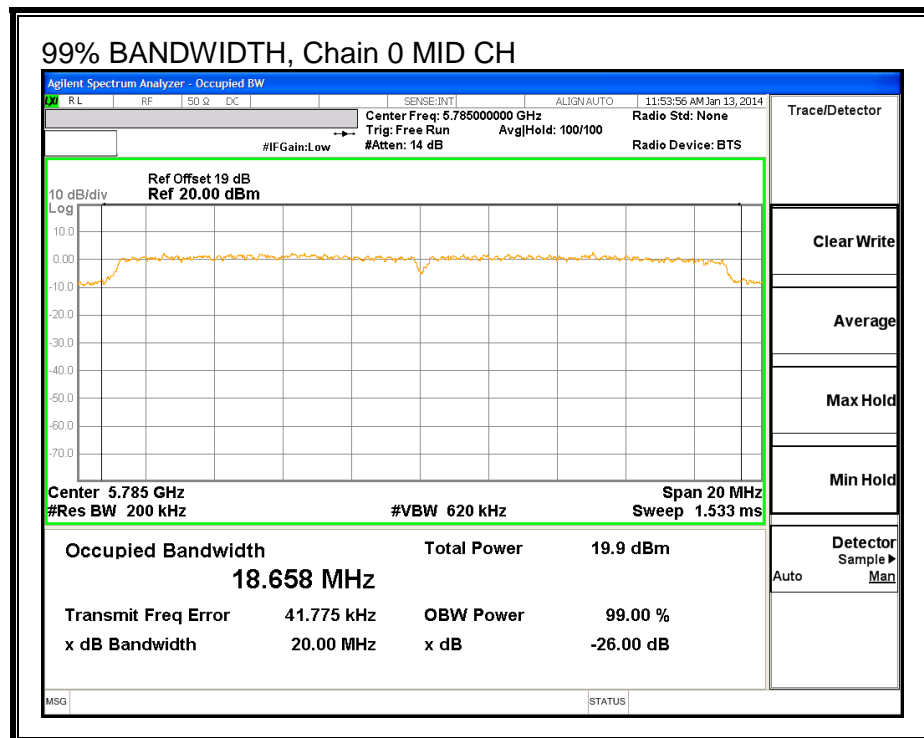
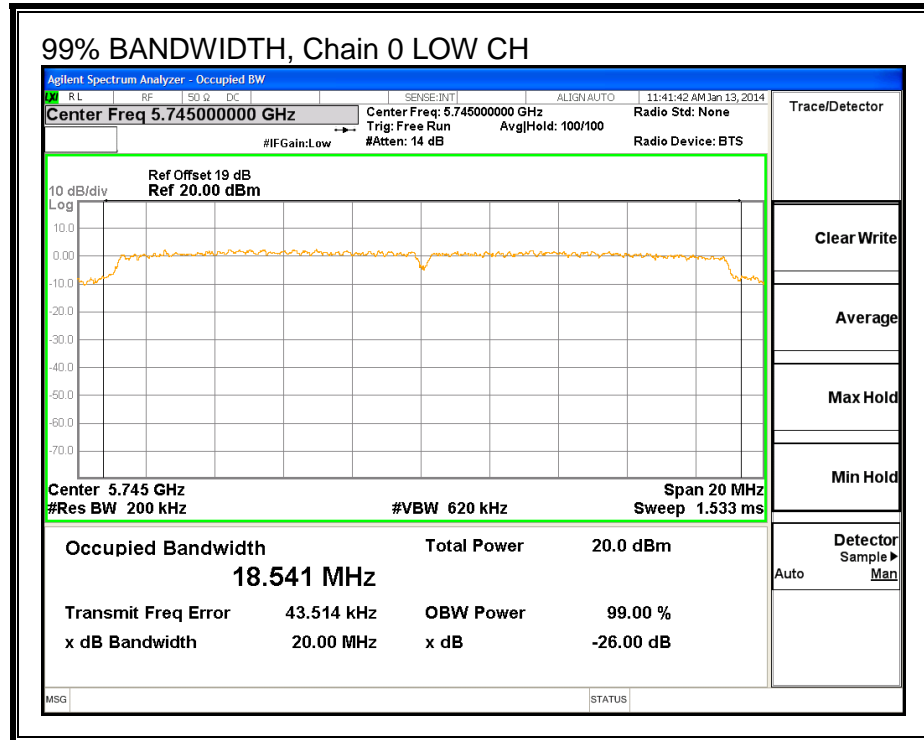
LIMITS

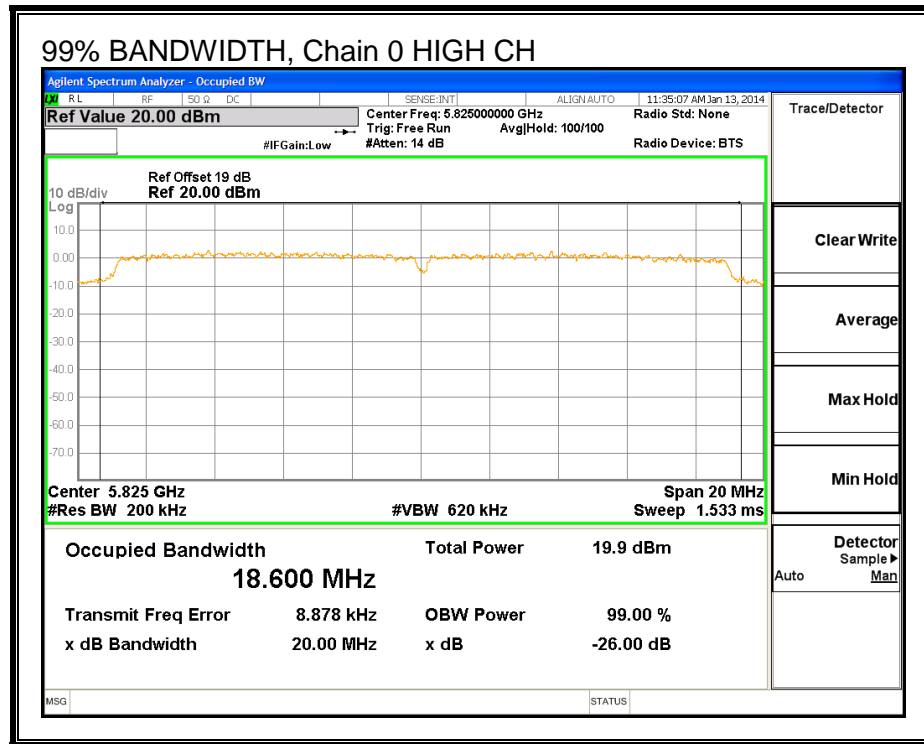
None; for reporting purposes only.

RESULTS

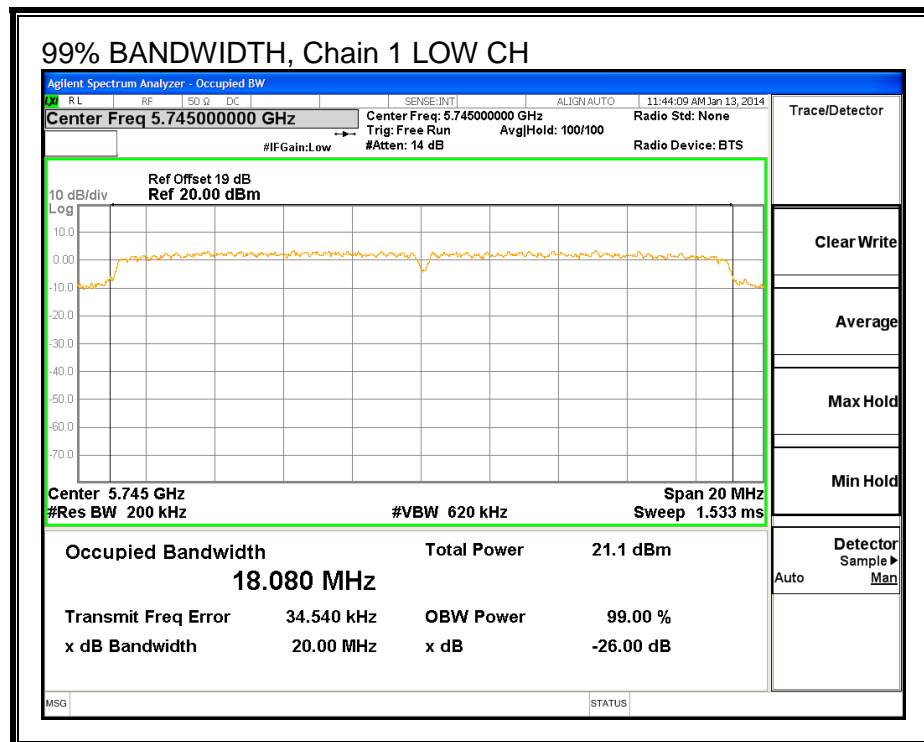
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)
Low	5745	18.541	18.080	18.208
Mid	5785	18.658	18.036	17.853
High	5825	18.600	17.824	17.772

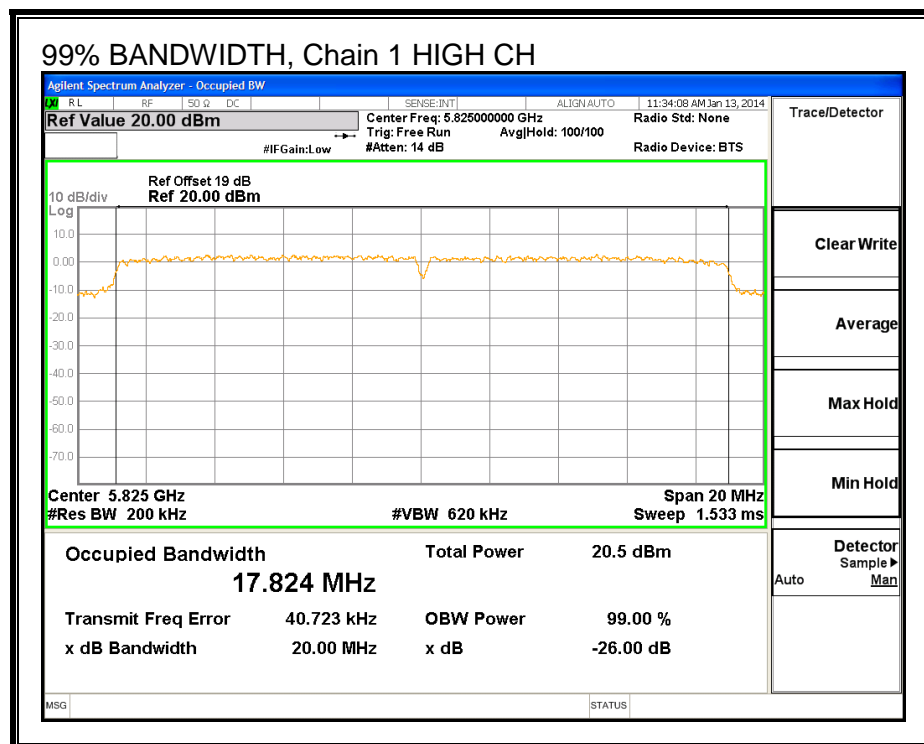
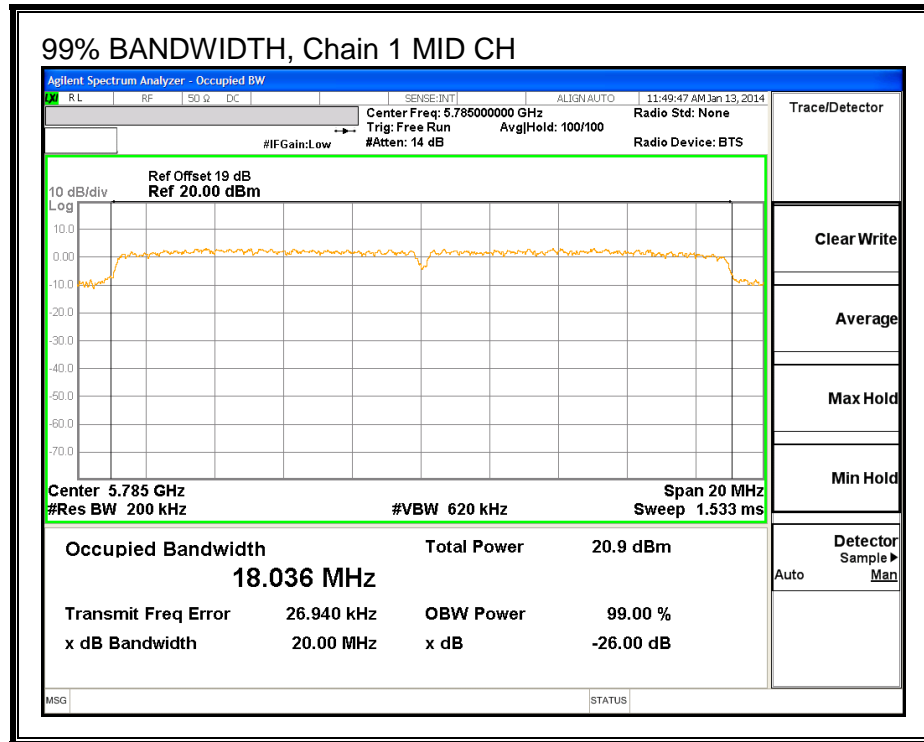
99% BANDWIDTH, Chain 0



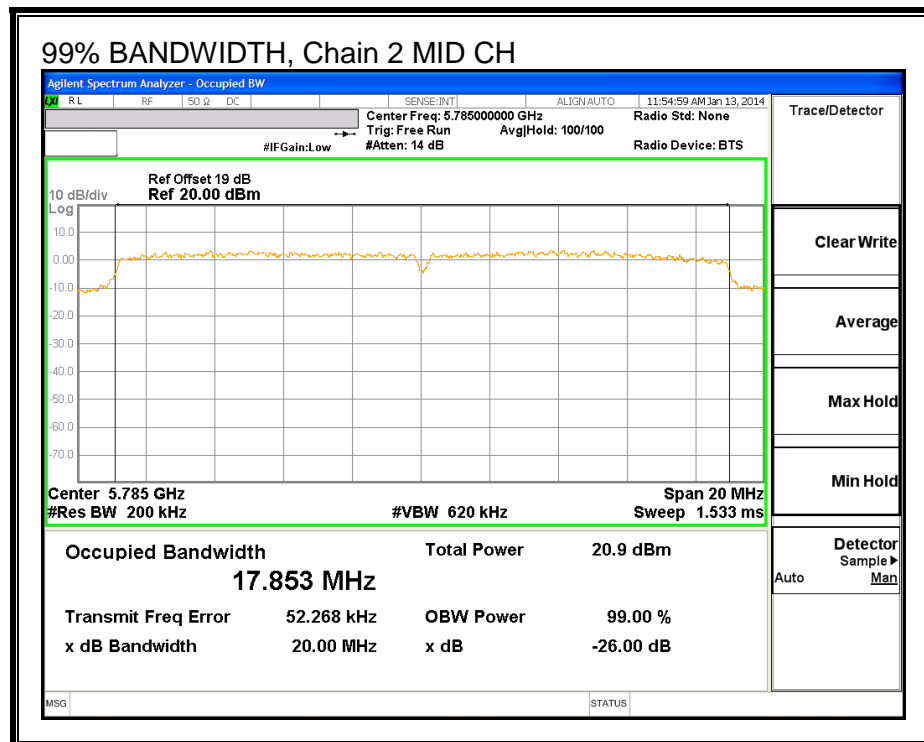
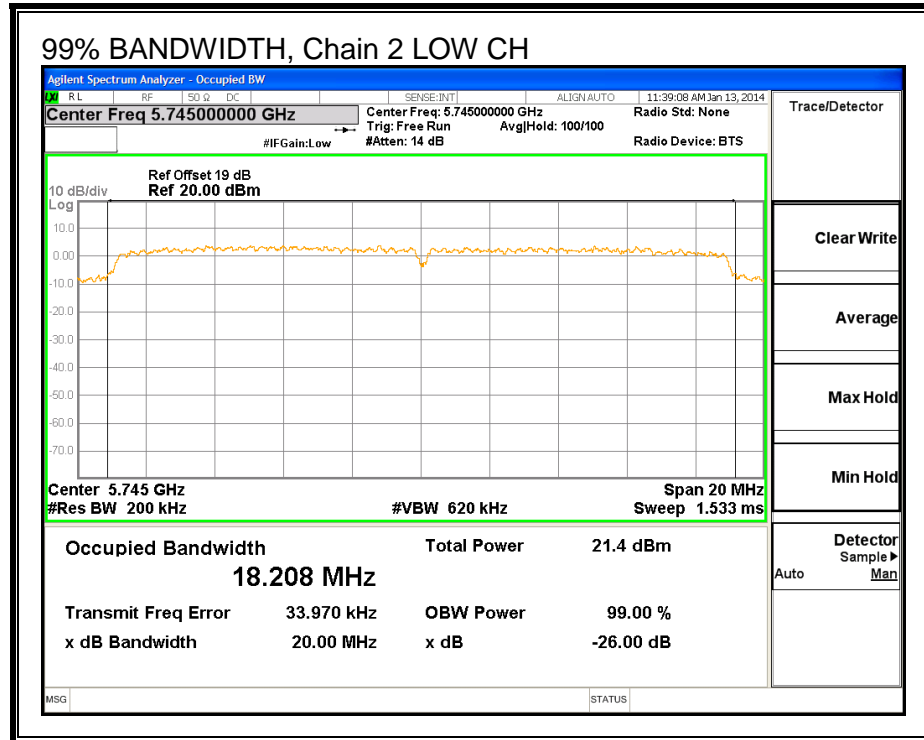


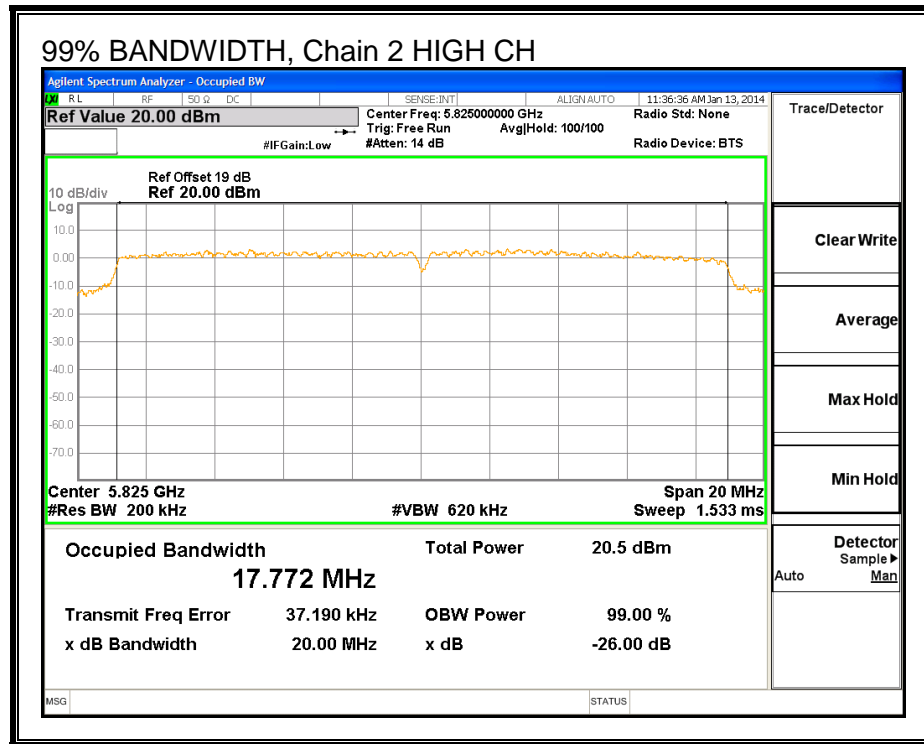
99% BANDWIDTH, Chain 1





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

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.20	5.50	3.70	4.01

RESULTS

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain (dBi)	Power Limit (dBm)
Low	5745	4.01	30.00
Mid	5785	4.01	30.00
High	5825	4.01	30.00

Duty Cycle CF (dB)	0.37	Included in Calculations of Corr'd Power
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Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	14.00	14.05	14.10	19.19	30.00	-10.81
Mid	5785	17.50	17.82	17.98	22.91	30.00	-7.09
High	5825	16.02	16.88	16.75	21.71	30.00	-8.29

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)	Chain 2 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
2.20	5.50	3.70	8.68

RESULTS

Antenna Gain and Limits

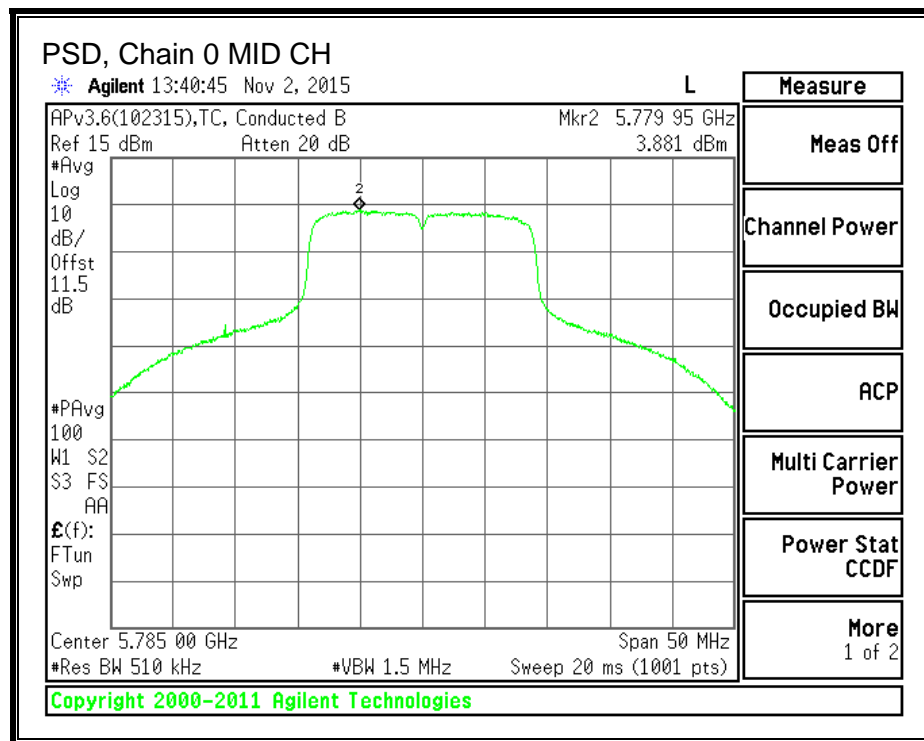
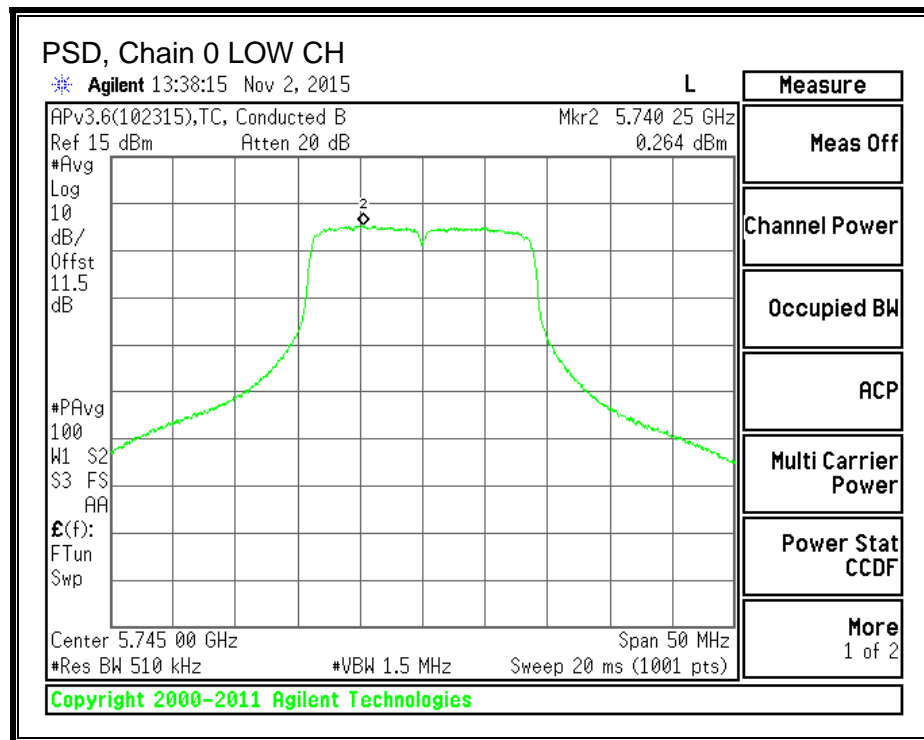
Channel	Frequency (MHz)	Directional Gain (dBi)	PSD Limit (dBm)
Low	5745	8.68	27.32
Mid	5785	8.68	27.32
High	5825	8.68	27.32

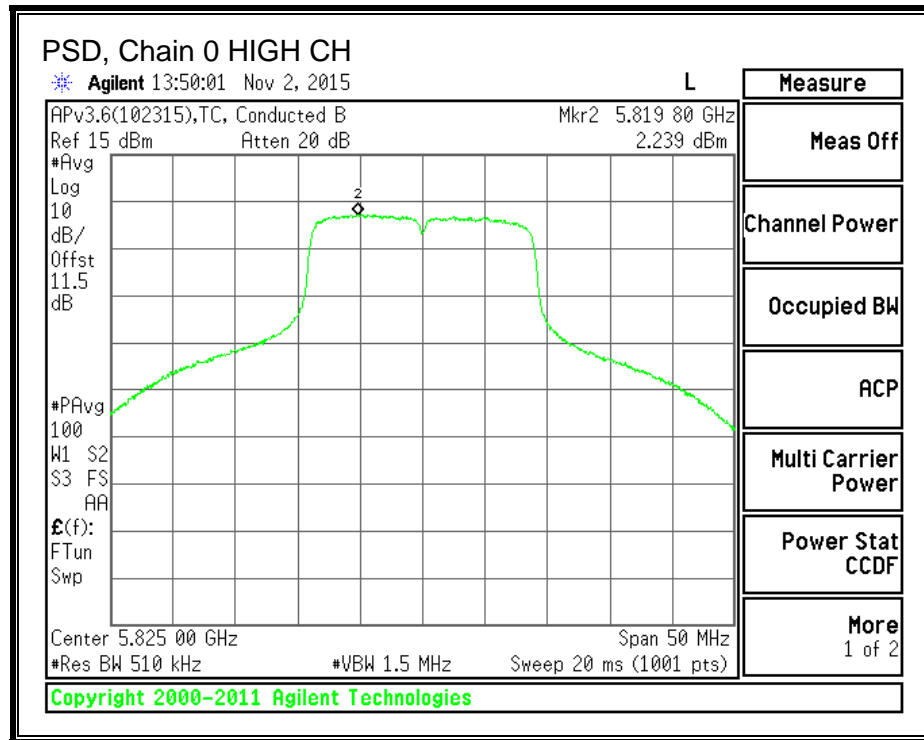
Duty Cycle CF (dB)	0.37	Included in Calculations of Corr'd PSD
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PSD Results

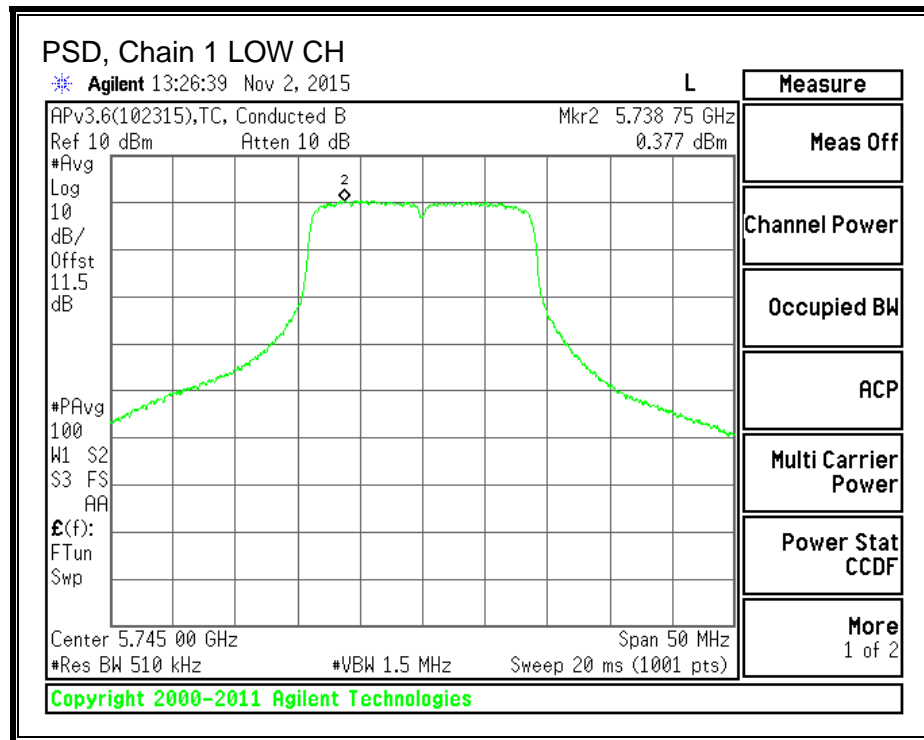
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Chain 2 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5745	0.264	0.377	0.075	3.701	27.320	-23.619
Mid	5785	3.881	3.650	4.237	7.147	27.320	-20.173
High	5825	2.239	3.228	3.068	6.142	27.320	-21.178

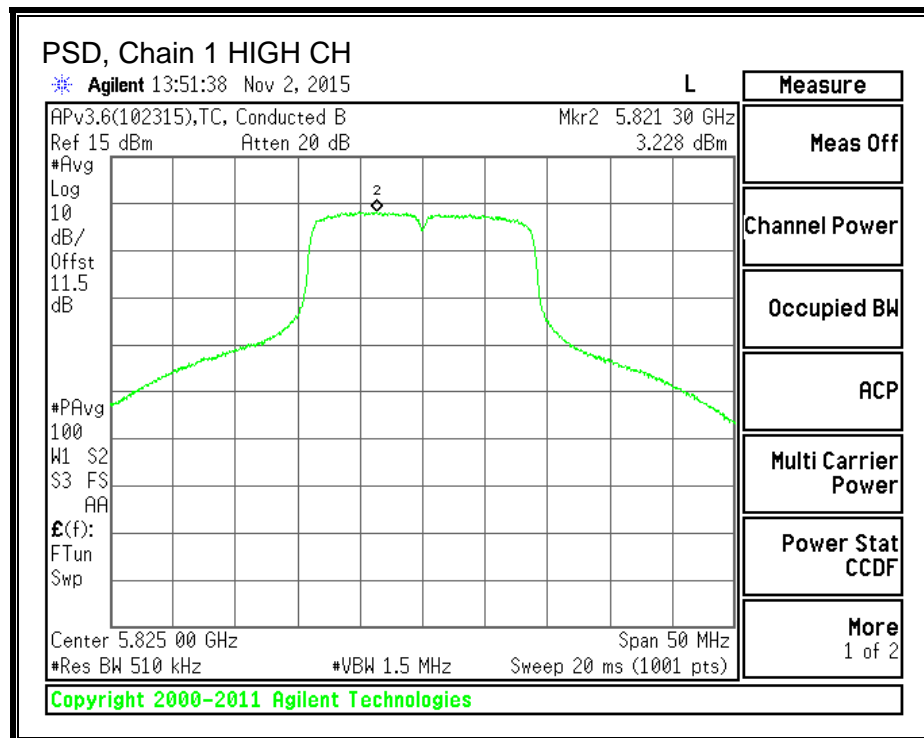
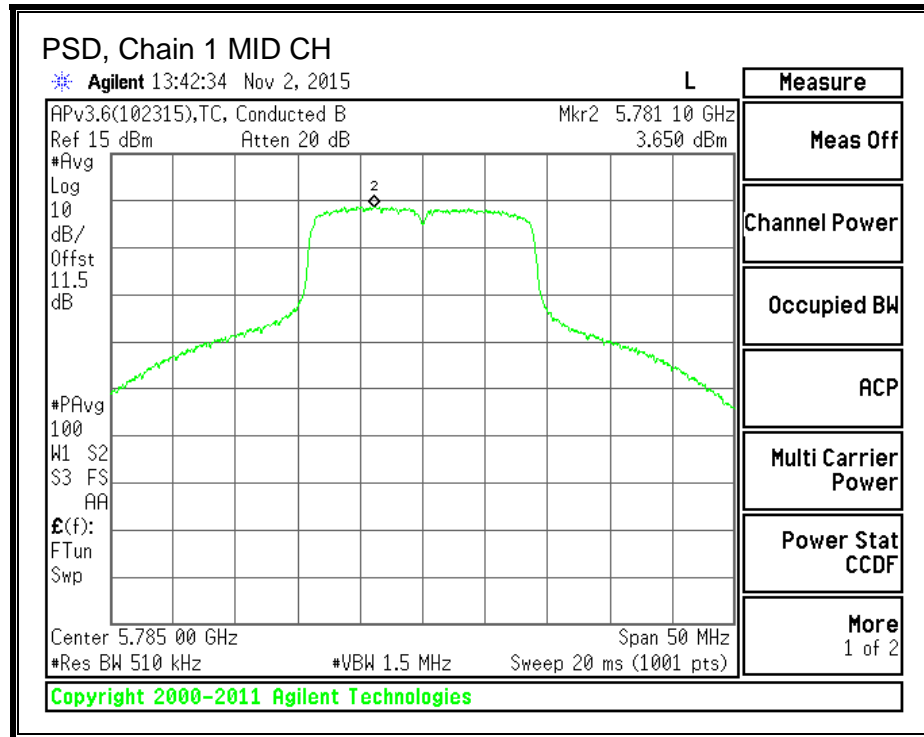
PSD, Chain 0



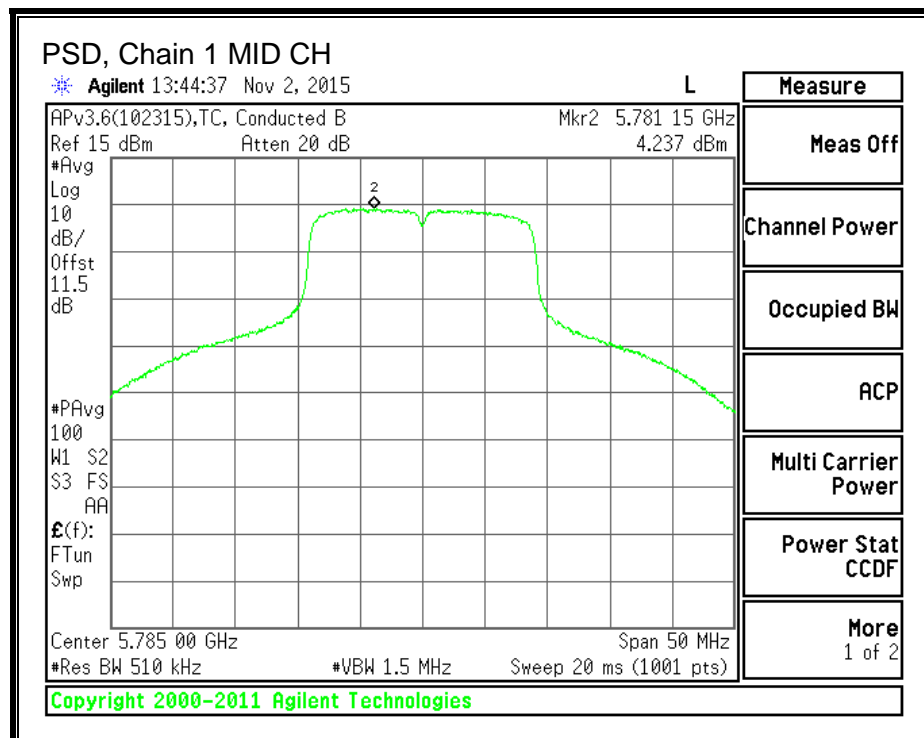
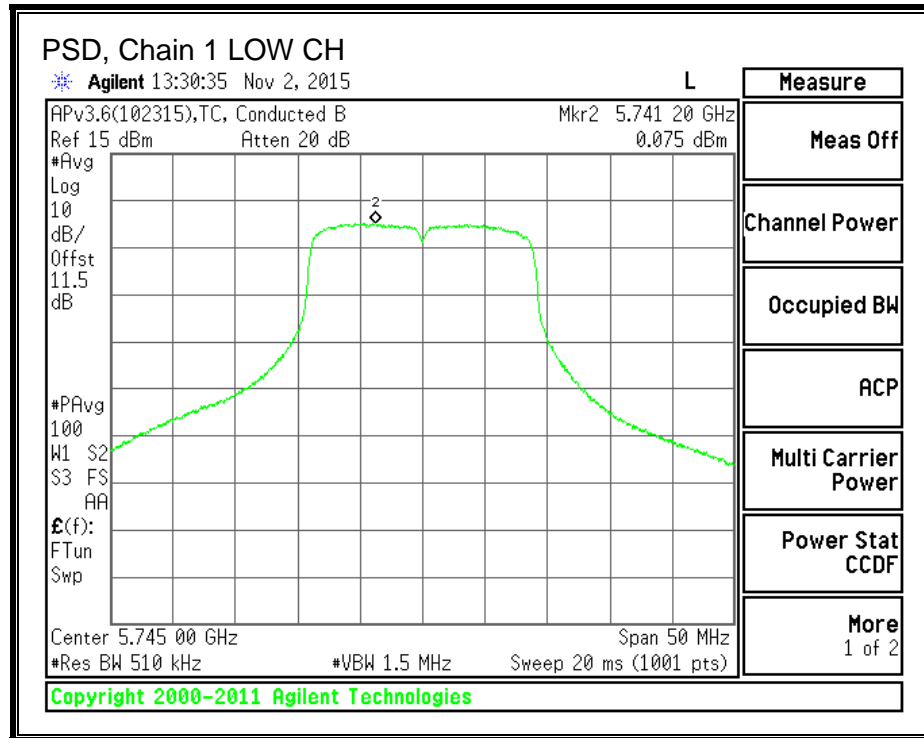


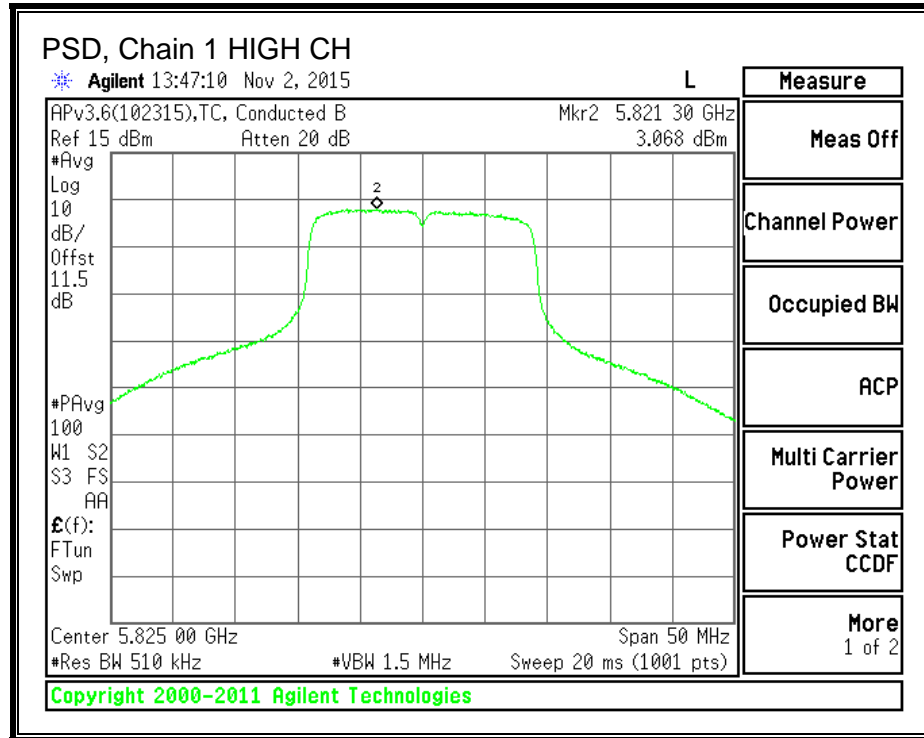
PSD, Chain 1





PSD, Chain 3





9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

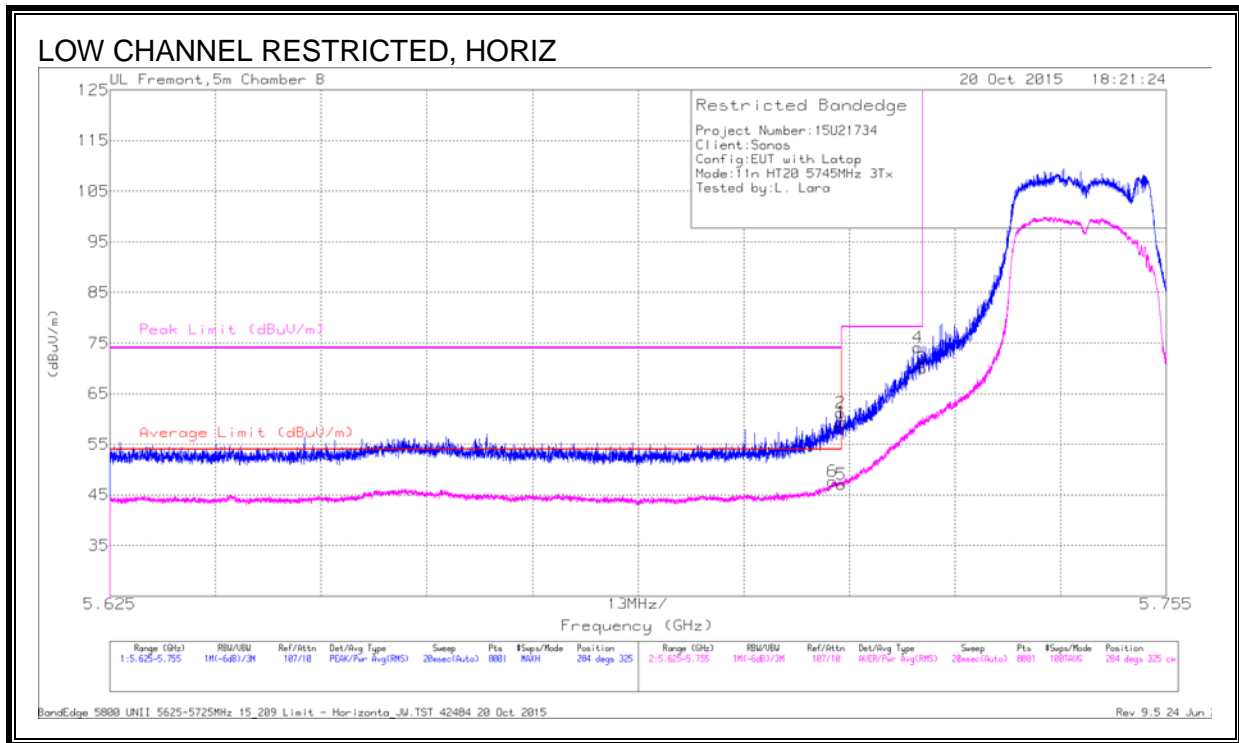
FCC §15.205 and §15.209

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

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

RESTRICTED BANDEDGE (LOW CHANNEL)



Trace Markers

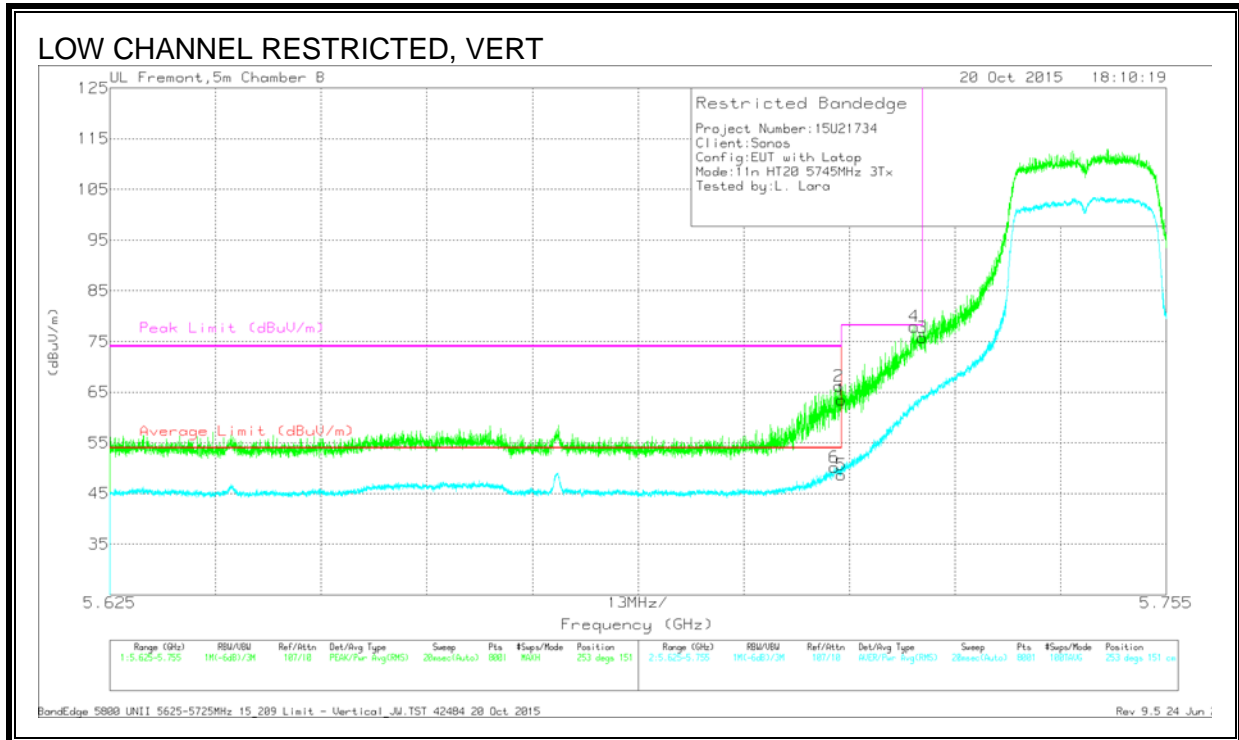
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Filt/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	5.714	33.17	RMS	35	-20.8	.37	47.74	54	-6.26	-	-	284	325	H
1	5.715	45.36	Pk	35	-21	0	59.36	-	-	74	-14.64	284	325	H
2	5.715	47.17	Pk	35	-21	0	61.17	-	-	74	-12.83	284	325	H
5	5.715	32.67	RMS	35	-21	.37	47.04	54	-6.96	-	-	284	325	H
4	5.724	60.08	Pk	35	-21	0	74.08	-	-	78.2	-4.12	284	325	H
3	5.725	55.86	Pk	35	-20.8	0	70.06	-	-	78.2	-8.14	284	325	H

Pk - Peak detector

RMS - RMS detection

BandEdge 5800 UNII 5625-5725MHz 15_209 Limit - Horizontal_JW.TST 42484 20 Oct 2015

Rev 9.5 24 Jun 2015



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cb/Fl tr/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
6	5.714	35.62	RMS	35	-20.8	.37	50.19	54	-3.81	-	-	253	151	V
1	5.715	49.46	Pk	35	-21	0	63.46	-	-	74	-10.54	253	151	V
2	5.715	52.14	Pk	35	-20.9	0	66.24	-	-	74	-7.76	253	151	V
5	5.715	34.29	RMS	35	-21	.37	48.66	54	-5.34	-	-	253	151	V
4	5.724	63.92	Pk	35	-21	0	77.92	-	-	78.2	-2.28	253	151	V
3	5.725	61.6	Pk	35	-20.8	0	75.8	-	-	78.2	-2.4	253	151	V

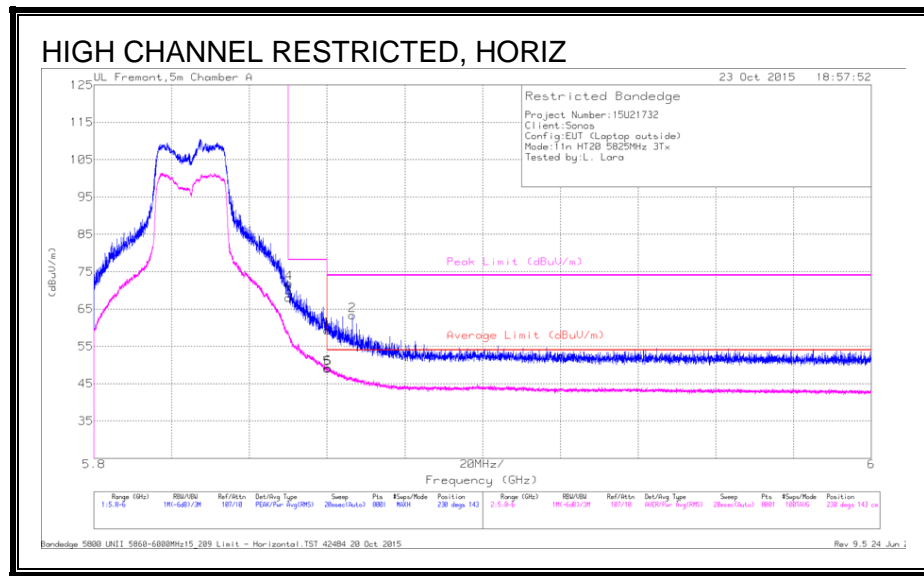
Pk - Peak detector

RMS - RMS detection

BandEdge 5800 UNII 5625-5725MHz 15_209 Limit - Vertical_JW.TST 42484 20 Oct 2015

Rev 9.5 24 Jun 2015

RESTRICTED BANDEGE (HIGH CHANNEL)



Trace Markers

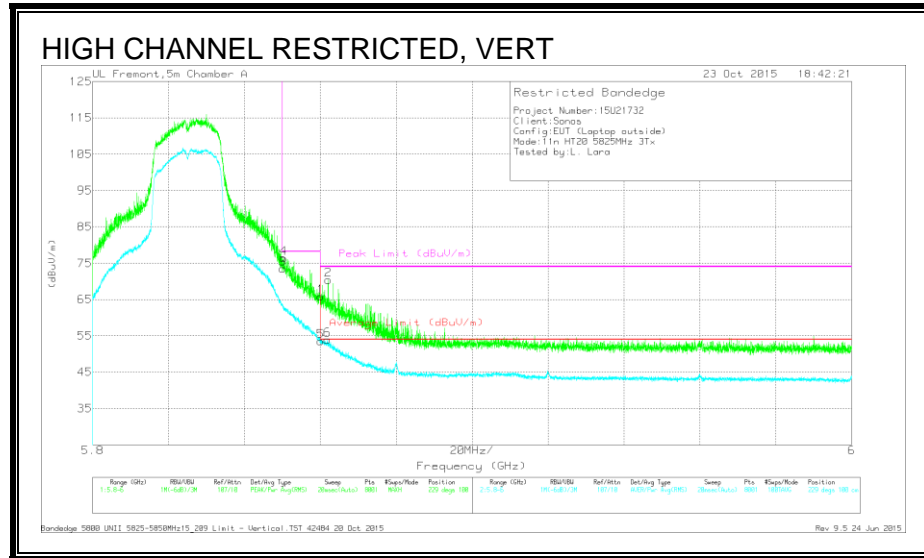
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	53.26	Pk	35.1	-20.3	0	68.06	-	-	78.2	-10.14	230	143	H
4	5.85	57.09	Pk	35.1	-20.3	0	71.89	-	-	78.2	-6.31	230	143	H
1	5.86	44.59	Pk	35.1	-20.3	0	59.39	-	-	74	-14.61	230	143	H
5	5.86	33.87	RMS	35.1	-20.3	.37	49.04	54	-4.96	-	-	230	143	H
6	5.86	34.03	RMS	35.1	-20.3	.37	49.2	54	-4.8	-	-	230	143	H
2	5.866	48.39	Pk	35.1	-20.2	0	63.29	-	-	74	-10.71	230	143	H

Pk - Peak detector

RMS - RMS detection

Bandedge 5800 UNII 5860-6000MHz15_209 Limit - Horizontal.TST 42484 20 Oct 2015

Rev 9.5 24 Jun 2015



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/FI tr/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	58.72	Pk	35.1	-20.3	0	73.52	-	-	78.2	-4.68	229	100	V
4	5.85	61.58	Pk	35.1	-20.3	0	76.38	-	-	78.2	-1.82	229	100	V
1	5.86	50.98	Pk	35.1	-20.3	0	65.78	-	-	74	-8.22	229	100	V
5	5.86	38.32	RMS	35.1	-20.3	.37	53.49	54	-51	-	-	229	100	V
2	5.862	55.58	Pk	35.1	-20.3	0	70.38	-	-	74	-3.62	229	100	V
6	5.862	38.72	RMS	35.1	-20.3	.37	53.89	54	-11	-	-	229	100	V

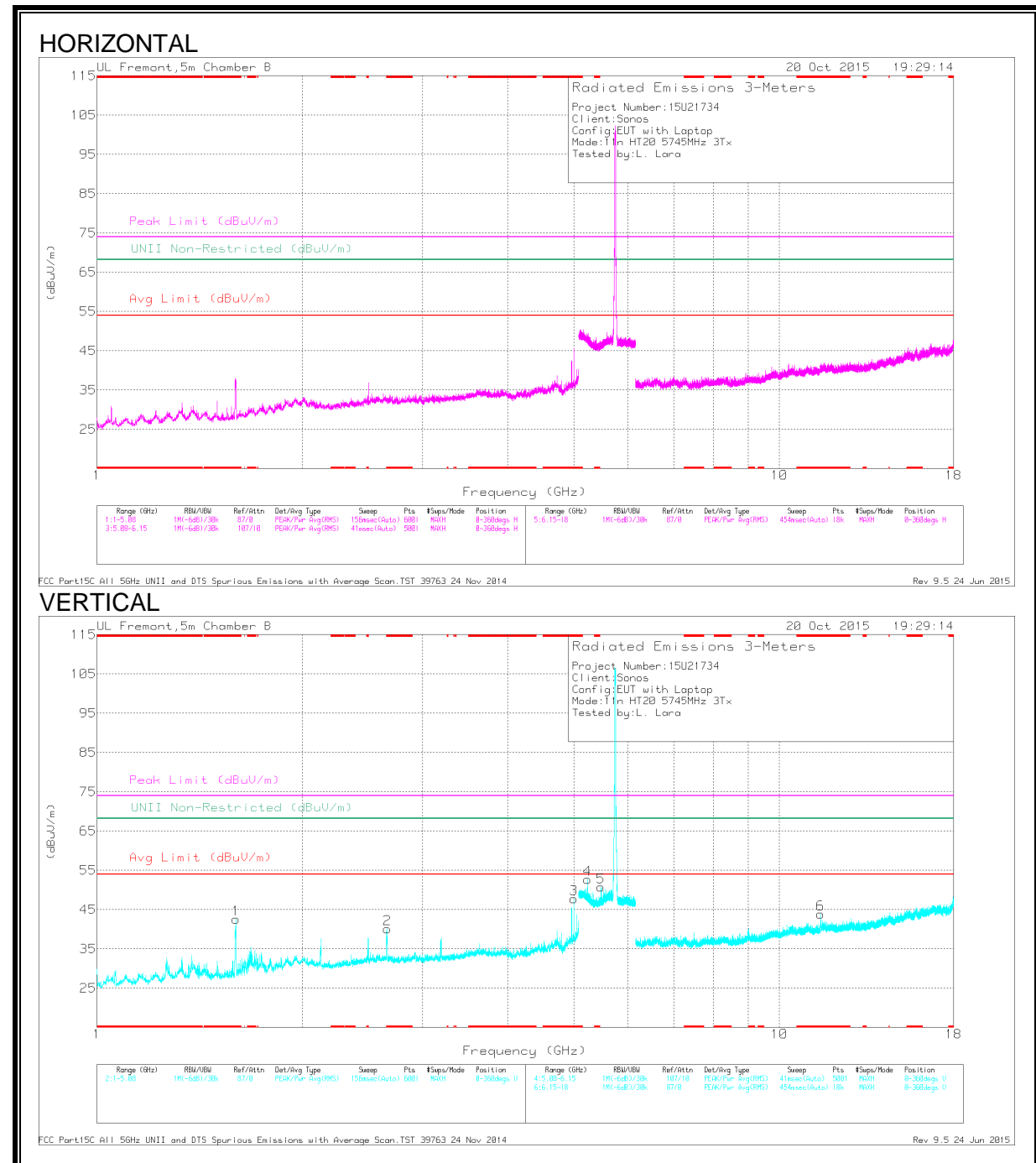
Pk - Peak detector

RMS - RMS detection

Bandedge 5800 UNII 5825-5850MHz15_209 Limit - Vertical.TST 42484 20 Oct 2015
Rev 9.5 24 Jun 2015

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL



Radiated Emissions

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/FI tr/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	* 1.594	61.38	PK-U	28.8	-35.3	0	54.88	-	-	74	-19.12	-	-	112	213	V
	* 1.594	37.4	ADR	28.8	-35.3	-37	31.27	54	-22.73	-	-	-	-	112	213	V
2	* 2.664	53.18	PK-U	32.7	-33.7	0	52.18	-	-	74	-21.82	-	-	334	234	V
	* 2.662	32.7	ADR	32.7	-33.7	-37	32.07	54	-21.93	-	-	-	-	334	234	V
3	* 5	48.73	PK-U	34	-29.9	0	52.83	-	-	74	-21.17	-	-	157	110	V
	* 5	42.4	ADR	34	-29.9	-37	46.87	54	-7.13	-	-	-	-	157	110	V
6	* 11.49	45.58	PK-U	38.3	-25.4	0	58.48	-	-	74	-15.52	-	-	275	240	V
	* 11.49	32.46	ADR	38.3	-25.4	-37	45.73	54	-8.27	-	-	-	-	275	240	V
4	5.24	44.57	PK-U	34.3	-19.2	0	59.67	-	-	-	-	68.2	-8.53	137	203	V
5	5.48	44.22	PK-U	34.5	-20.2	0	58.52	-	-	-	-	68.2	-9.68	251	115	V

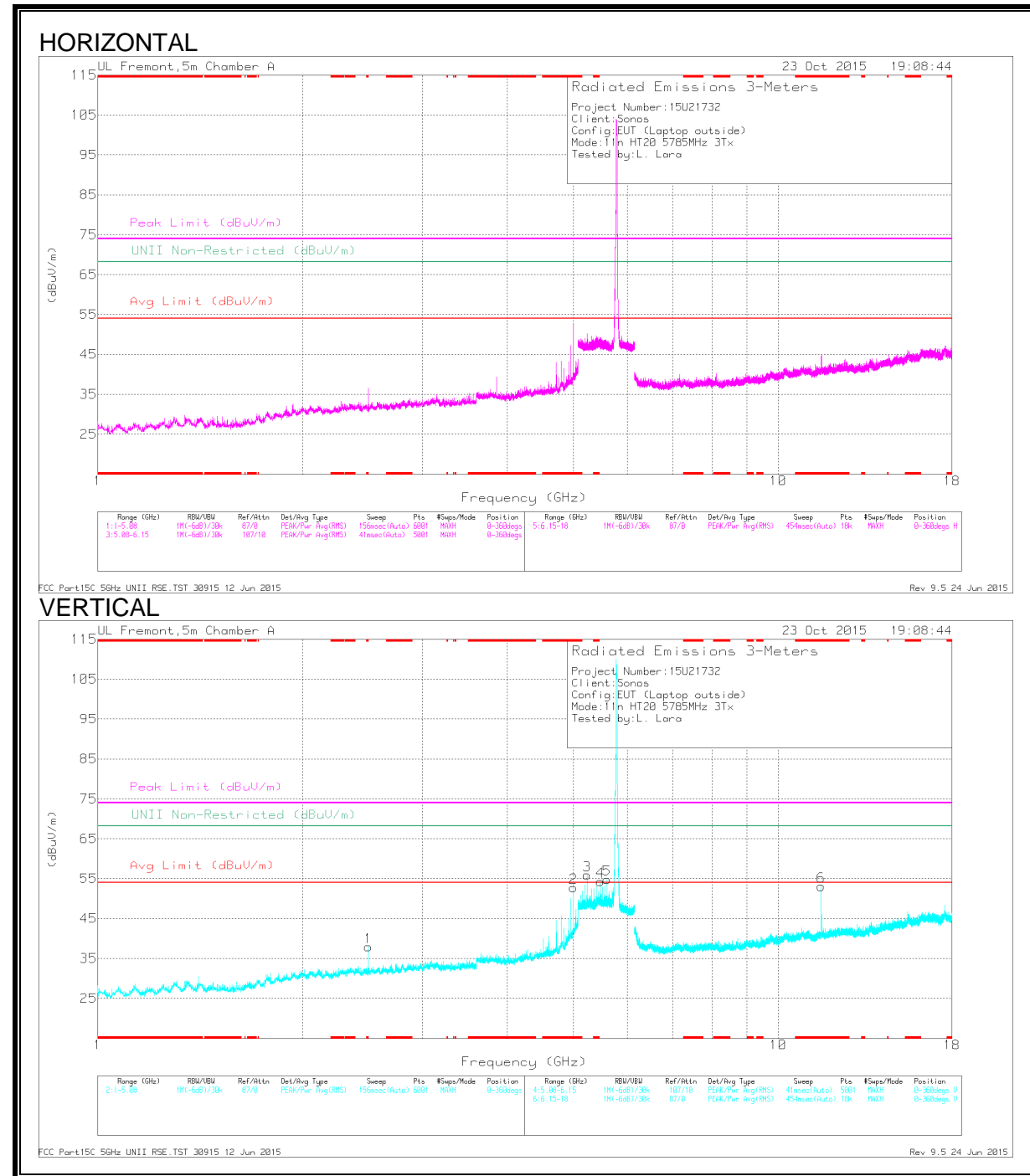
* - indicates frequency in CFR15.205.

PK - Peak detector

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

MID CHANNEL



Radiated Emissions

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fr tr/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	* 5	53.4	PK-U	34	-28.9	0	58.5	-	-	74	-15.5	-	-	91	167	V
	* 5	46.7	ADR	34	-28.9	.37	52.17	54	-1.83	-	-	-	-	91	167	V
6	* 11.57	45.17	PK-U	38.1	-22.8	0	60.47	-	-	74	-13.53	-	-	263	266	V
	* 11.57	32.06	ADR	38.1	-22.8	.37	47.73	54	-6.27	-	-	-	-	263	266	V
1	2.5	46.78	PK-U	32.1	-34.4	0	44.48	-	-	-	-	68.2	-23.72	122	254	V
3	5.24	47	PK-U	34.4	-20.9	0	60.5	-	-	-	-	68.2	-7.7	128	194	V
4	5.24	47.05	PK-U	34.4	-20.9	0	60.55	-	-	-	-	68.2	-7.65	132	195	V
5	5.6	48.08	PK-U	34.5	-21.1	0	61.48	-	-	-	-	68.2	-6.72	257	114	V

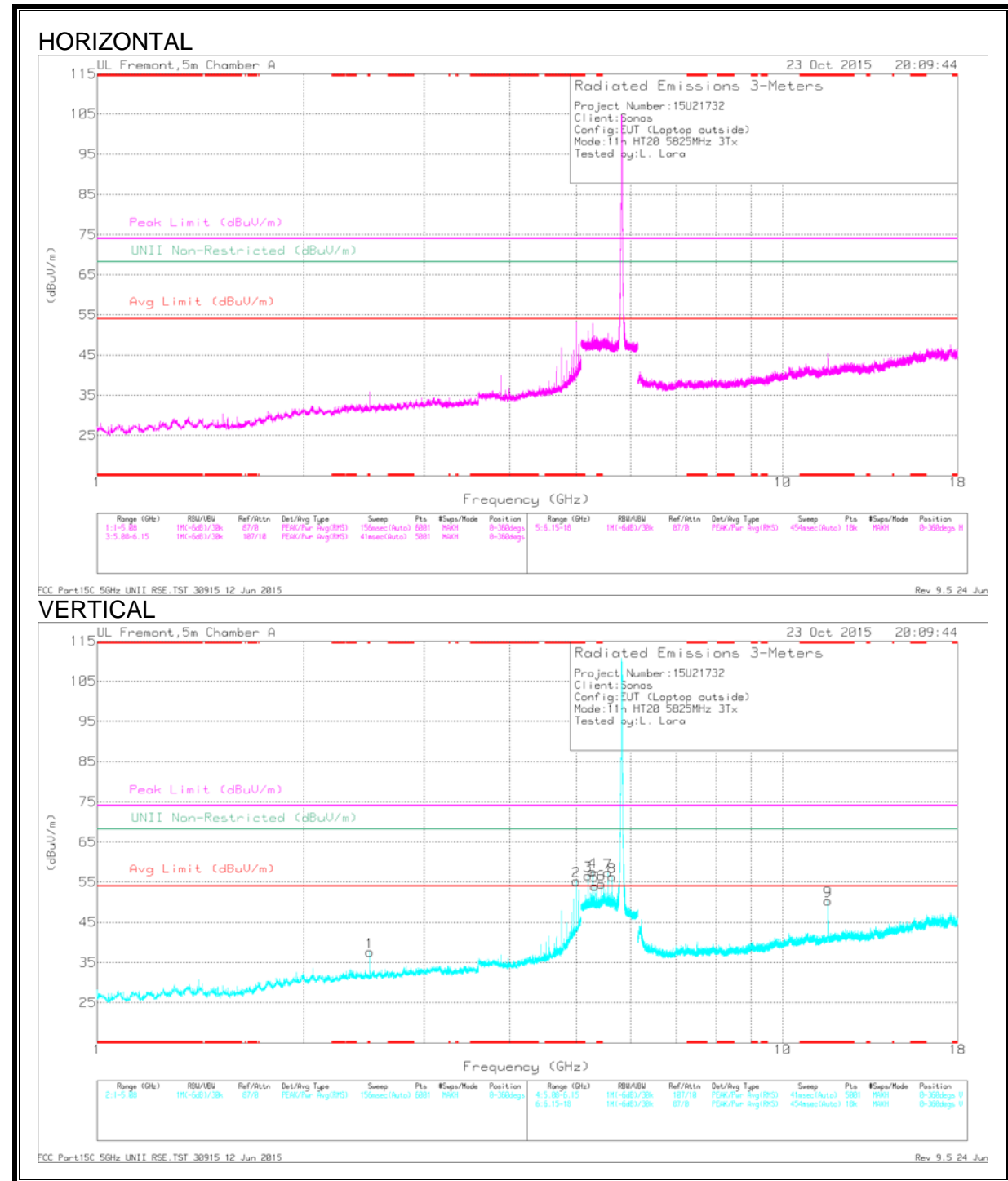
* - indicates frequency in CFR15.205 Restricted Band.

PK - Peak detector

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

HIGH CHANNEL



Radiated Emissions

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fr tr/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	* 5.44	47.24	PK-U	34.5	-20.8	0	60.94	-	-	74	-13.06	-	-	238	154	V
	* 5.44	35.28	ADR	34.5	-20.8	.37	49.35	54	-4.65	-	-	-	-	238	154	V
9	* 11.651	42.6	PK-U	38.2	-22.4	0	58.4	-	-	74	-15.6	-	-	263	276	V
	* 11.65	30.52	ADR	38.2	-22.4	.37	46.69	54	-7.31	-	-	-	-	263	276	V
1	2.5	46.81	PK-U	32.1	-34.4	0	44.51	-	-	-	-	68.2	-23.69	122	225	V
3	5.2	48	PK-U	34.4	-20.9	0	61.5	-	-	-	-	68.2	-6.7	133	197	V
4	5.28	48.56	PK-U	34.5	-20.9	0	62.16	-	-	-	-	68.2	-6.04	157	185	V
5	5.32	47.86	PK-U	34.5	-21	0	61.36	-	-	-	-	68.2	-6.84	160	197	V
7	5.56	51.45	PK-U	34.5	-21	0	64.95	-	-	-	-	68.2	-3.25	243	123	V
8	5.641	47.71	PK-U	34.5	-21	0	61.21	-	-	-	-	68.2	-6.99	215	100	V

* - indicates frequency in CFR15.205 Restricted Band.

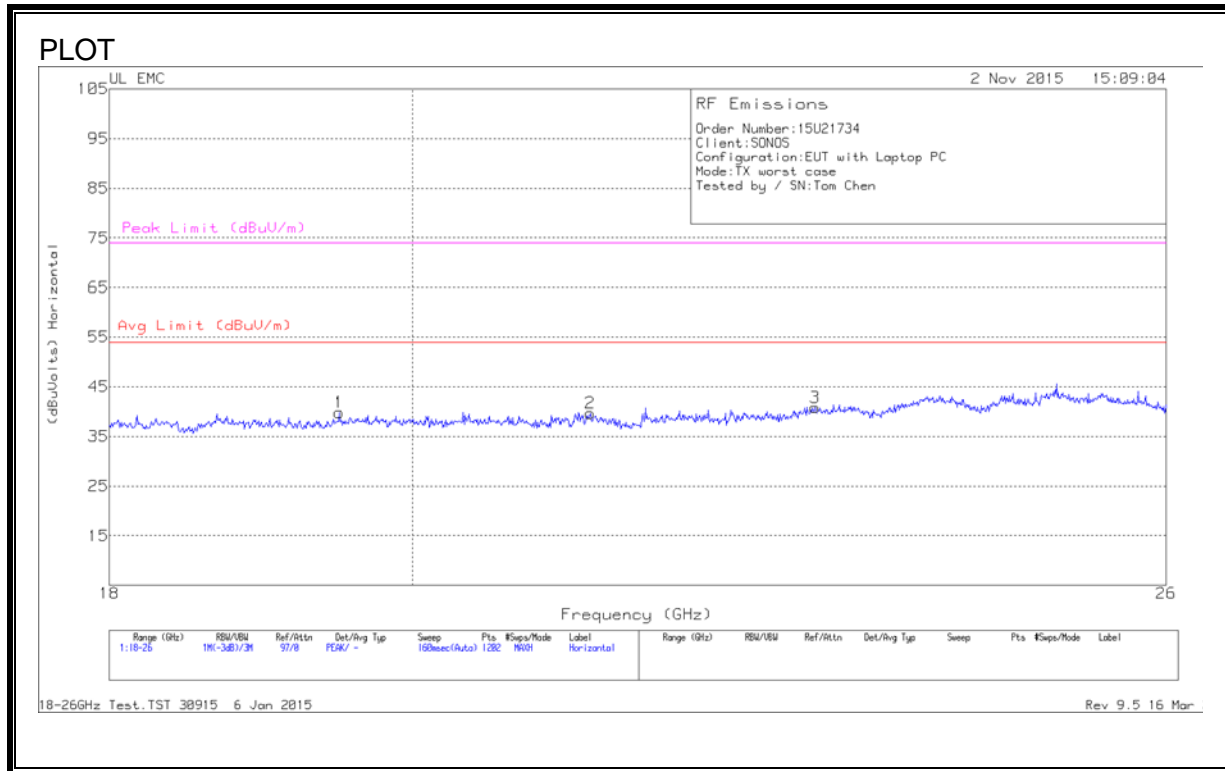
PK - Peak detector

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





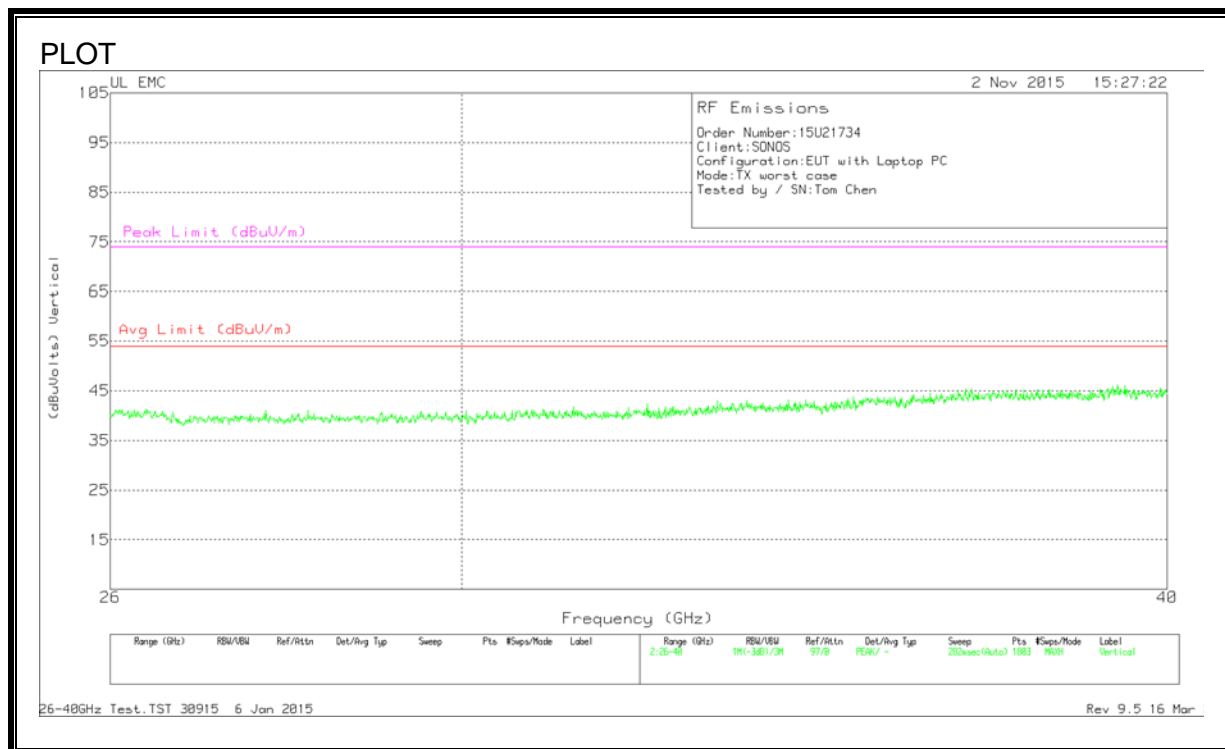
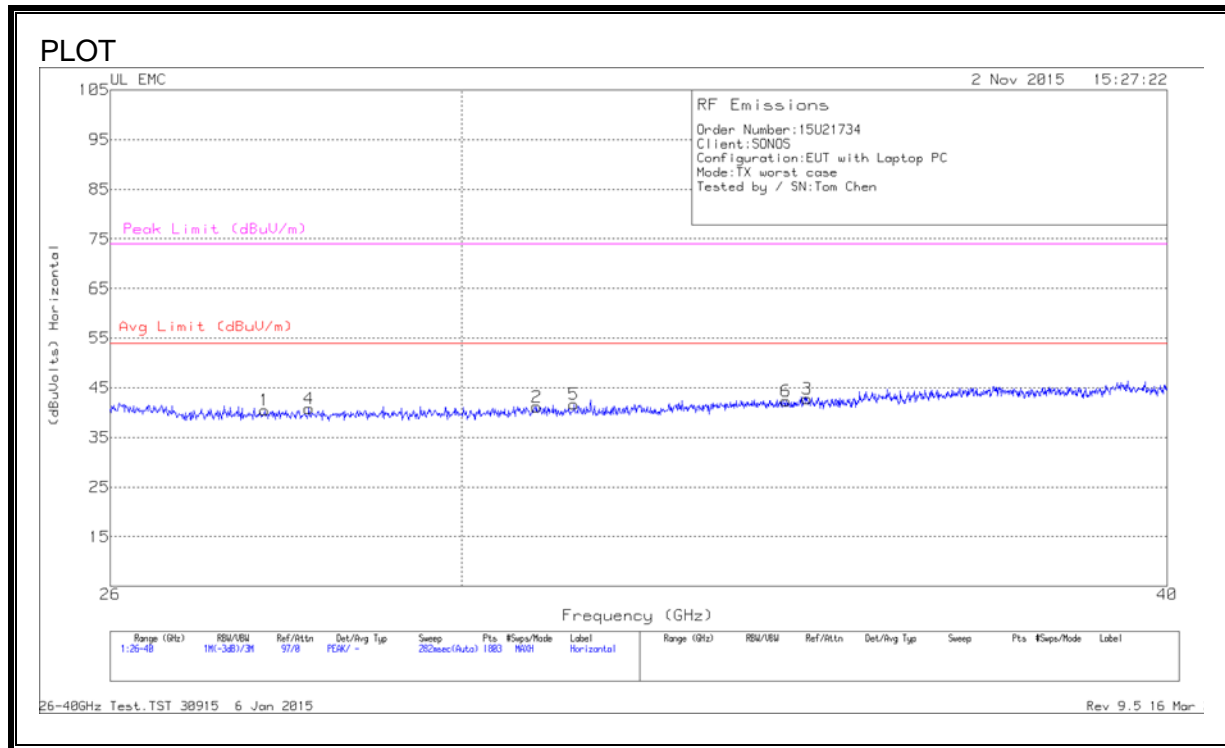
Trace Markers

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	41.93	Pk	32.5	-25.1	-9.5	39.83	54	-14.17	74	-34.17
2	21.277	41.27	Pk	33.2	-25.3	-9.5	39.67	54	-14.33	74	-34.33
3	23.009	41.93	Pk	33.6	-25.2	-9.5	40.83	54	-13.167	74	-33.17
4	19.545	40.77	Pk	32.5	-25.1	-9.5	38.67	54	-15.33	74	-35.33
5	21.311	40.83	Pk	33.2	-25.2	-9.5	39.33	54	-14.67	74	-34.67
6	22.936	42.17	Pk	33.5	-25	-9.5	41.17	54	-12.83	74	-32.83

Pk - Peak detector

18-26GHz Test.TST 30915 6 Jan 2015
Rev 9.5 16 Mar 2015

SPURIOUS EMISSIONS 26 – 40GHz



Trace Markers

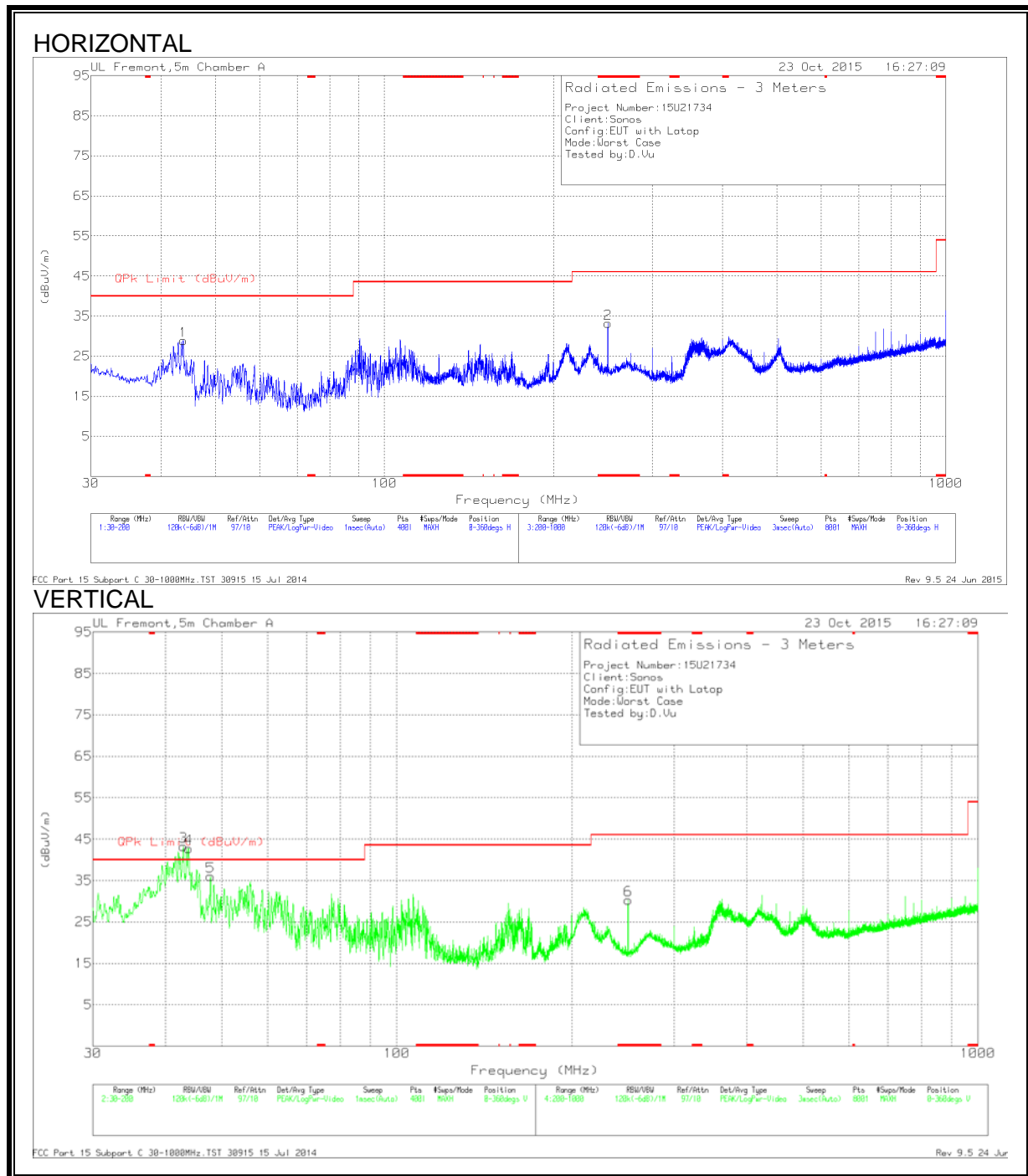
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T90 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	27.686	45.4	Pk	35.8	-31.2	-9.5	40.5	54	-13.5	74	-33.5
2	30.933	47.57	Pk	35.9	-32.8	-9.5	41.17	54	-12.83	74	-32.83
3	34.538	48.03	Pk	37.4	-33.1	-9.5	42.83	54	-11.17	74	-31.17
4	28.191	46.13	Pk	35.9	-31.7	-9.5	40.83	54	-13.17	74	-33.17
5	31.407	47.97	Pk	36.1	-32.9	-9.5	41.67	54	-12.33	74	-32.33
6	34.243	47.83	Pk	36.9	-32.9	-9.5	42.33	54	-11.67	74	-31.67

Pk - Peak detector

26-40GHz Test.TST 30915 6 Jan 2015

Rev 9.5 16 Mar 2015

9.4. WORST-CASE TX RADIATED EMISSIONS (30 MHz – 1000 MHz)



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

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
2	* 250	47.42	Pk	15.4	-29.6	33.22	46.02	-12.8	0-360	101	H
6	* 250	44.44	Pk	15.4	-29.6	30.24	46.02	-15.78	0-360	199	V
3	42.92	58.56	Pk	15.8	-31.1	43.26	-	-	0-360	101	V
1	43.8125	44.94	Pk	15.1	-31.1	28.94	40	-11.06	0-360	399	H
4	43.8125	58.77	Pk	15.1	-31.1	42.77	-	-	0-360	101	V
5	47.8075	54.38	Pk	12.7	-31.1	35.98	40	-4.02	0-360	101	V

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
42.9439	55.04	Qp	15.7	-31.1	39.64	40	-.36	36	105	V
43.8012	55.94	Qp	15.1	-31.1	39.94	40	-.06	316	104	V
47.7982	51.96	Qp	12.7	-31.1	33.56	40	-6.44	146	101	V

* - indicates frequency in CFR15.205 Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

FCC Part 15 Subpart C 30-1000MHz.TST 30915 15 Jul 2014

Rev 9.5 24 Jun 2015

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-GEN Clause 8.8

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

^{*} Decreases with the logarithm of the frequency.

6 WORST EMISSIONS

Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin to Limit (dB)	CISPR 11/22 Class B Average	Margin to Limit (dB)
1	.15	59.39	PK	.1	0	59.49	66	-6.51	-	-
2	.15	40.26	Av	.1	0	40.36	-	-	56	-15.64
3	.1905	55.28	PK	.1	0	55.38	64	-8.62	-	-
4	.1905	41.15	Av	.1	0	41.25	-	-	54	-12.75
5	.618	37.67	PK	.1	0	37.77	56	-18.23	-	-
6	.618	31.76	Av	.1	0	31.86	-	-	46	-14.14
7	5.7075	37.13	PK	.1	.1	37.33	60	-22.67	-	-
8	5.7075	33.33	Av	.1	.1	33.53	-	-	50	-16.47
9	29.643	38.57	PK	.5	.3	39.37	60	-20.63	-	-
10	29.643	35.18	Av	.5	.3	35.98	-	-	50	-14.02

PK - Peak detector
Av - average detection

Line-L2 .15 - 30MHz

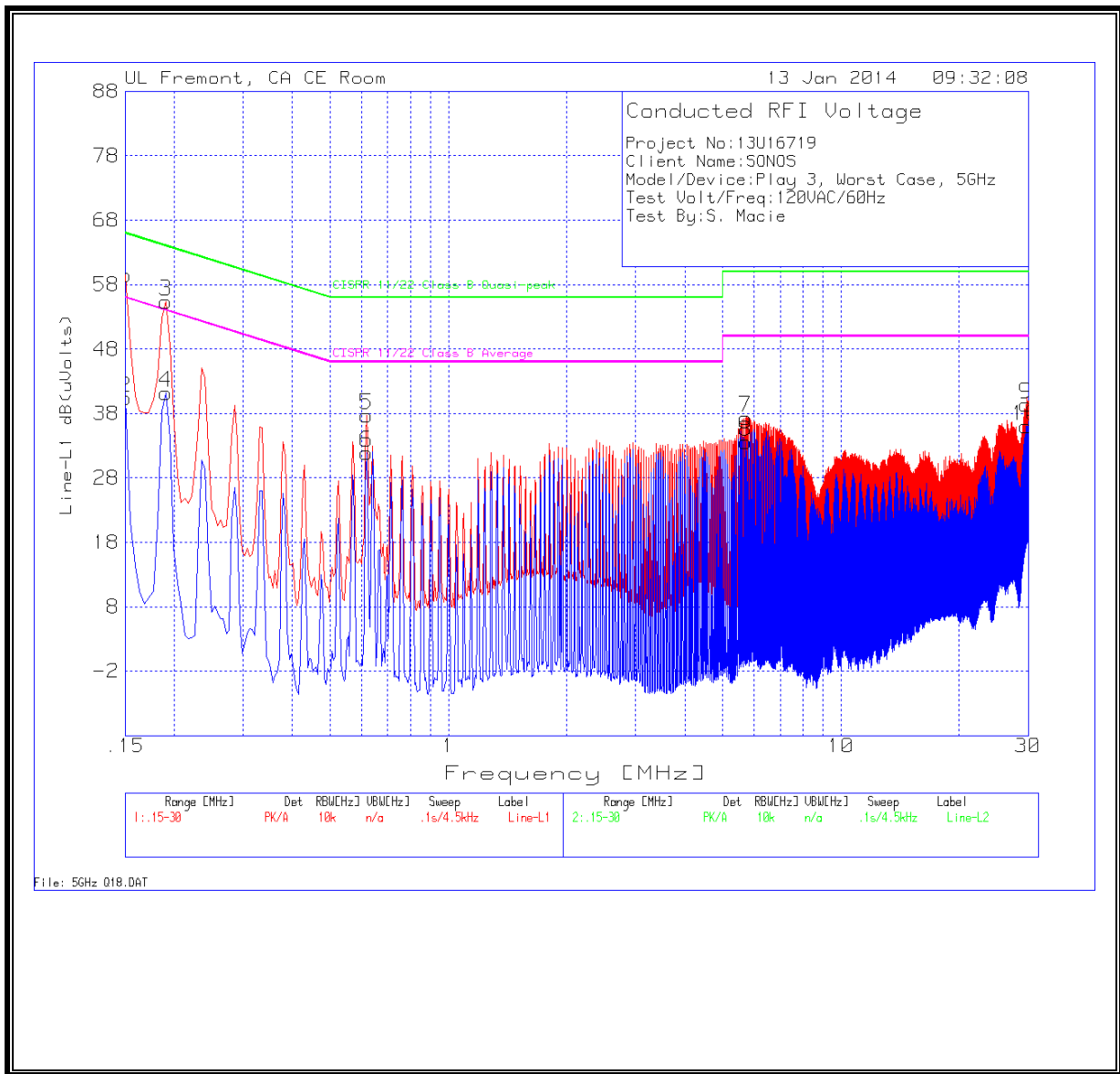
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin to Limit (dB)	CISPR 11/22 Class B Average	Margin to Limit (dB)
11	.15	56.26	PK	.1	0	56.36	66	-9.64	-	-
12	.15	36.95	Av	.1	0	37.05	-	-	56	-18.95
13	.1905	53.43	PK	.1	0	53.53	64	-10.47	-	-
14	.1905	39.65	Av	.1	0	39.75	-	-	54	-14.25
15	.618	35.72	PK	.1	0	35.82	56	-20.18	-	-
16	.618	31.99	Av	.1	0	32.09	-	-	46	-13.91
17	5.604	36.42	PK	.1	.1	36.62	60	-23.38	-	-
18	5.604	33.2	Av	.1	.1	33.4	-	-	50	-16.6
19	29.4765	35.62	PK	.5	.3	36.42	60	-23.58	-	-
20	29.4765	28.43	Av	.5	.3	29.23	-	-	50	-20.77

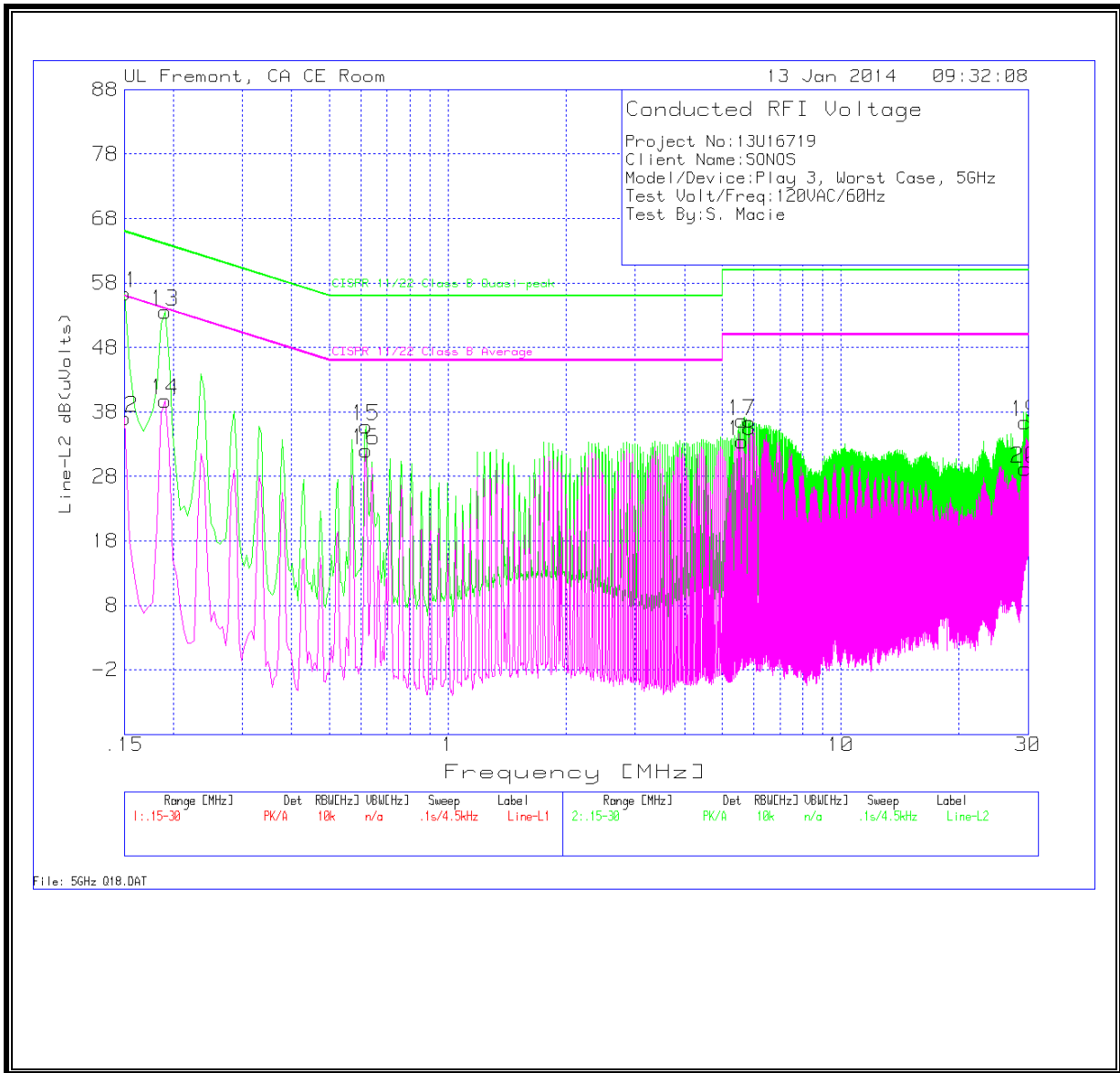
PK - Peak detector

Av - average detection

LINE 1 RESULTS



LINE 2 RESULTS



12. ART POWER SETTINGS TABLE

Channel	Frequency	FCC (Region 1)		
		11b	11g	11n
149	5745			14
157	5785			15
165	5825			15

END OF REPORT