



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8
CLASS II PERMISSIVE CHANGE
CERTIFICATION TEST REPORT**

FOR

**802.11 3X3 A/B/G/N MINI PCIE CARD. 20MHZ BW.PCB ANTENNA
DFS CLIENT DEVICE**

MODEL NUMBER: PLAY3

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

**REPORT NUMBER: 13U16719-2, REVISION B
ISSUE DATE: MAY 7, 2014**

Prepared for
**SONOS, INC.
223 E. DE LA GUERRA
SANTA BARBARA, CA 93101, U.S.A.**

Prepared by
**UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	02/13/14	Initial Issue	G. Quizon
A	04/28/14	Added FCC KDB 662911 D01	M. Mekuria
B	05/07/14	Revised Output Power and PSD Data	T. Chu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SONOS, INC.
223 E. DE LA GUERRA ST.
SANTA BARBARA, CA 93101, U.S.A

EUT DESCRIPTION: 802.11 3X3 A/B/G/N MINI PCIE CARD. 20MHZ BW.PCB
ANTENNA DFS CLIENT DEVICE

MODEL: PLAY3

SERIAL NUMBER: 1308000E58FD280E4 (Radiated), 1308000E58FD280A0
(Conducted)

DATE TESTED: JANUARY 06 - FEBRUARY 06, 2014

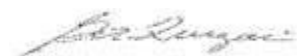
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

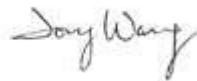
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:

Tested By:



George Quizon
PROJECT LEADER
UL Verification Services Inc.



Tony Wang
Lab Technician
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, ANSI C63.10-2009, FCC KDB 662911 D01 v02r01, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

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

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

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:

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

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

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. 20MHz BW.PCB antenna. DFS client device that is embedded inside the Sonos Play3 wireless sound system.

The radio module is manufactured by Sonos, Inc.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

This is a Class II permissive change project. The change is to add a higher gain antennas on all 5GHz frequencies. The EUT tested did not support legacy mode. The original report, RF110223E04-1 R1 was issued by Bureau Veritas Consumer Products Services (H.K.) Ltd.

Note: Since the original report issued more than two years ago and some changes have made on FCC standards, this Class II permissive change report has a complete set of test data.

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	27.07	509.33

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT is using 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 Sonos software version is V3.6 17.1-48020.

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.

Based on the baseline scan, the worst-case data rates were:

802.11n HT20 mode: 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	W510	R9-BK0RH 11/02	DOC
Laptop AC adapter	Lenovo	45N0058	11S45N0058Z1ZJA40C1GZXP	DOC
Router	Netgear	FS105	1D52163D0AADA	DOC
Router AC adapter	Netgear	MU08A9075100-A1	2411201651023902JT	N/A

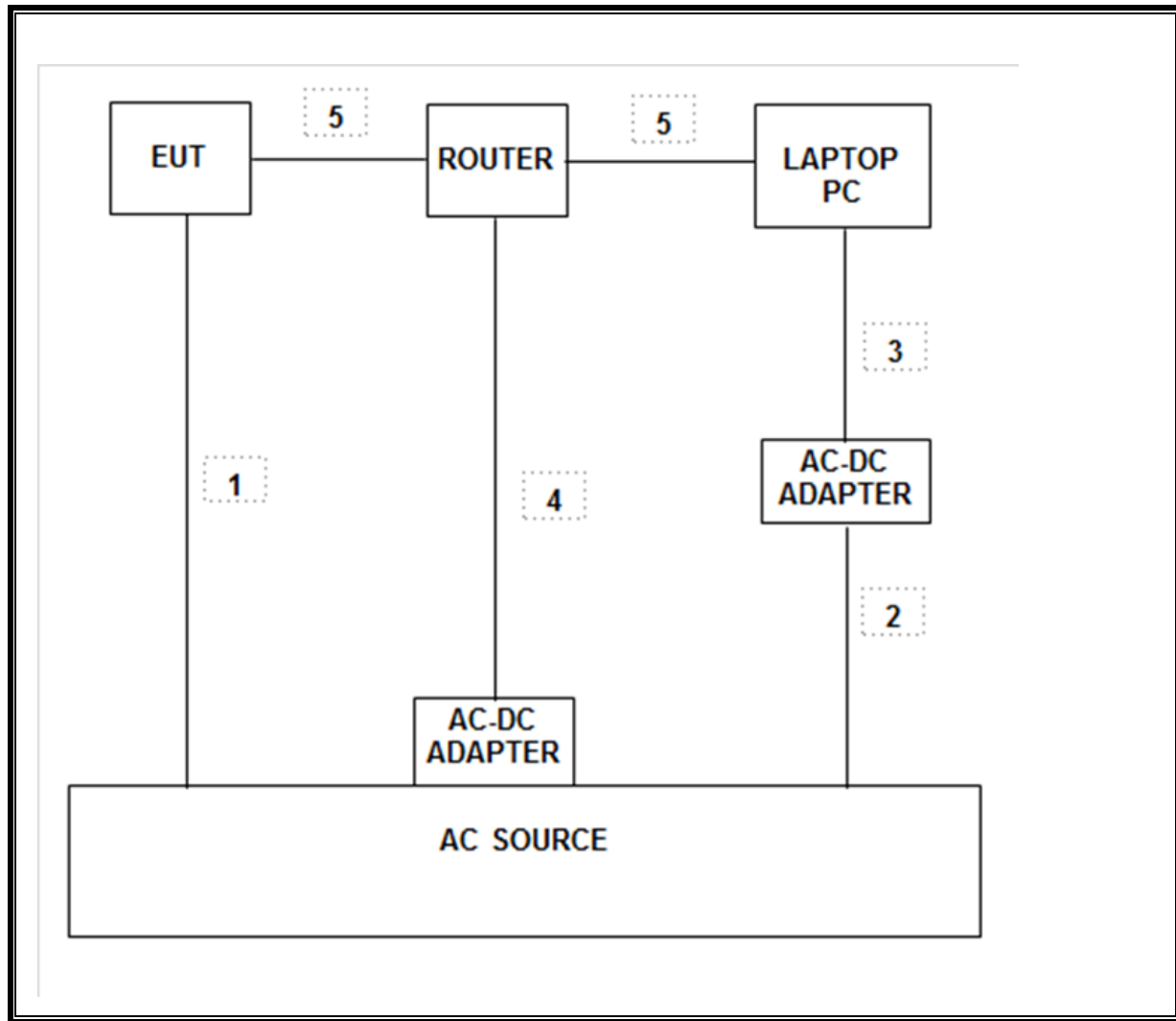
I/O CABLES

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

TEST SETUP

Test 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	Asset	Cal Due
Horn Antenna 1-18GHz	ETS Lindgren	3117	F00131	02/19/14
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	05/08/14
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	05/06/14
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB3	F00027	03/07/14
Peak / Average Power Sensor	Agilent / HP	E9323A	F00163	04/03/14
P-Series single channel Power Meter	Agilent / HP	N1911A	F00164	04/03/14
Spectrum Analyzer, 3Hz-44GHz	Agilent	N9030A	F00127	02/22/14
Spectrum Analyzer, 40 GHz	Agilent / HP	8564E	C00951	07/29/14
PreApmplifier, 1-26.5GHz	Agilent	8449B	F10067	03/23/14
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	F00194	05/14/14
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/15/14
LISN 30MHz	FCC	50/250-25-2	C00626	01/14/14
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/20/14

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

7.1. 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)
5.8GHz Band						
802.11n HT20 CH 0	1.296	1.479	0.876	87.63%	0.57	0.772

7.2. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v03r01, Section 8.1.

Output Power: KDB 558074 D01 v03r01, Section 9.1.2.

Power Spectral Density: KDB 558074 D01 v03r01, Section 10.2.

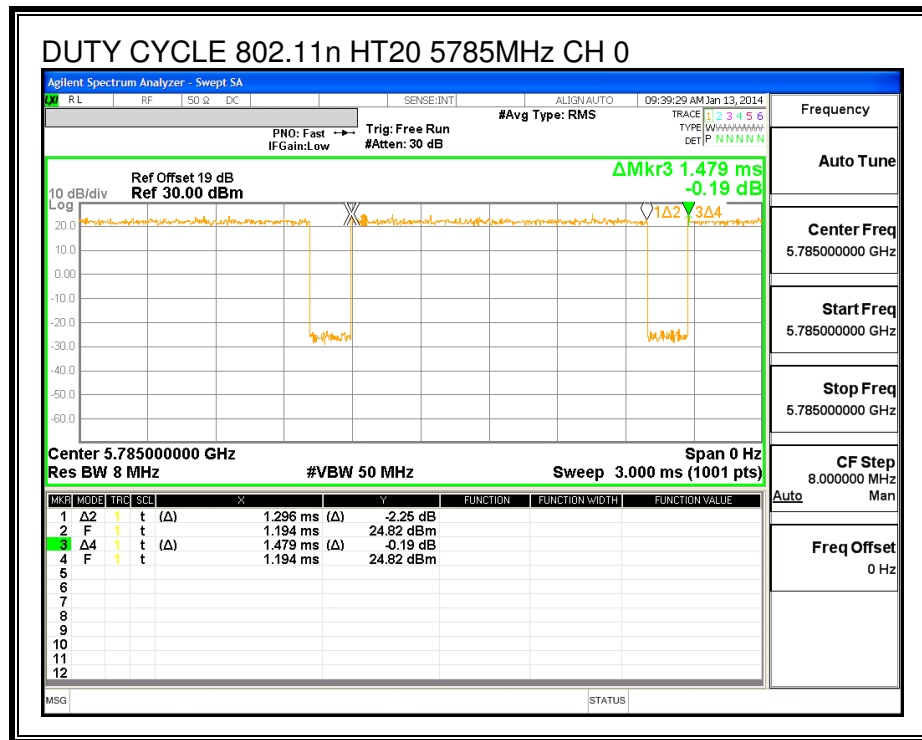
Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r01, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r01, Section 12.2.

KDB 662911 D01 is referred for transmitters with Multiple Outputs in the Same Band.

7.3. DUTY CYCLE PLOTS

5.8GHz BANDS



8. ANTENNA PORT TEST RESULTS

8.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

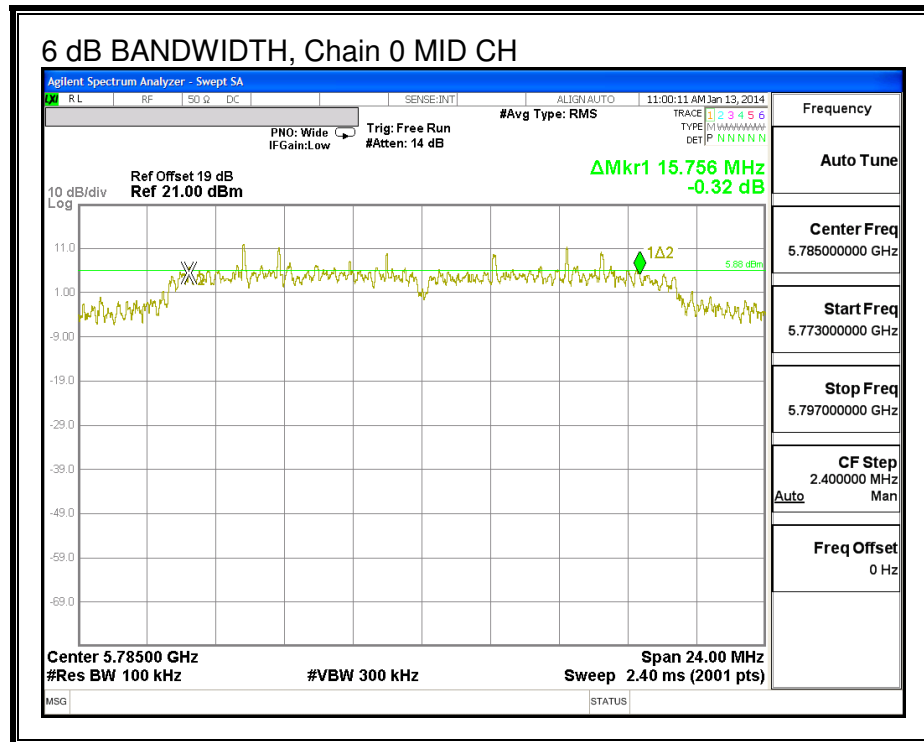
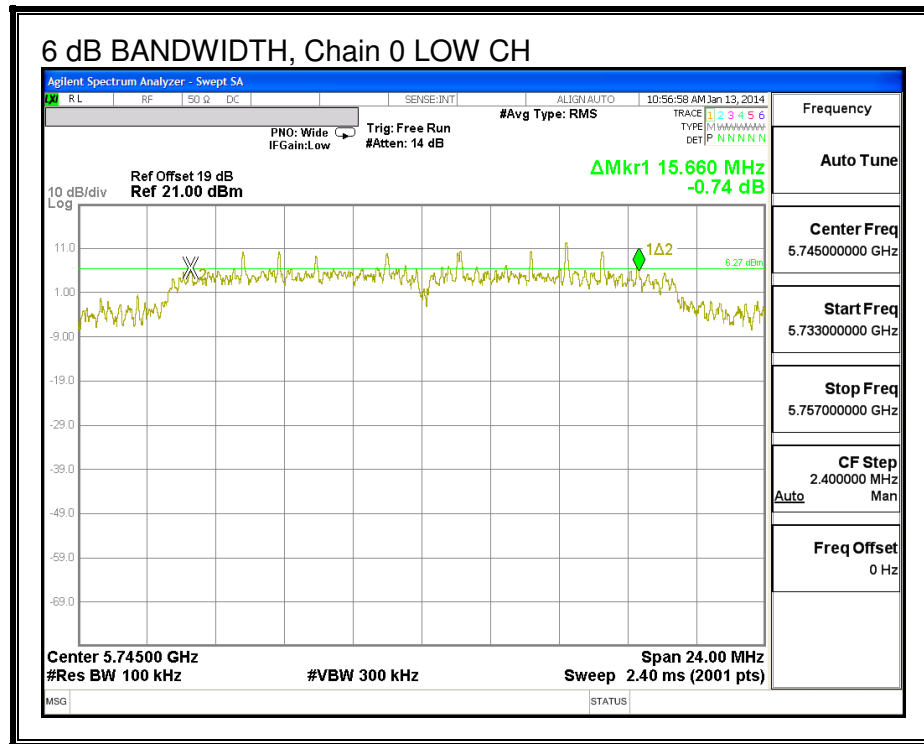
IC RSS-210 A8.2 (a)

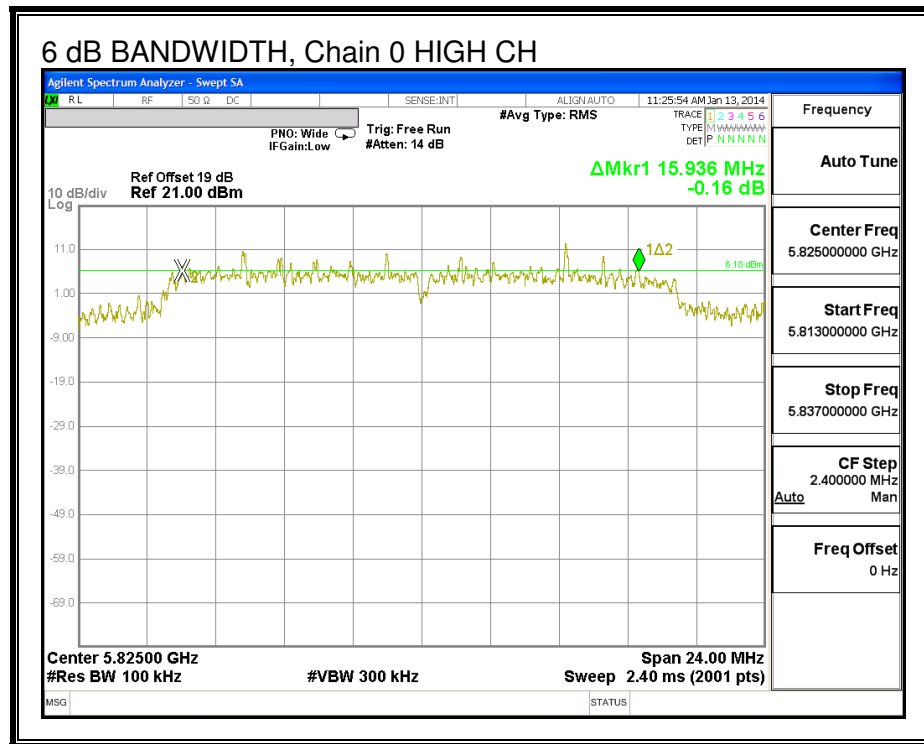
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

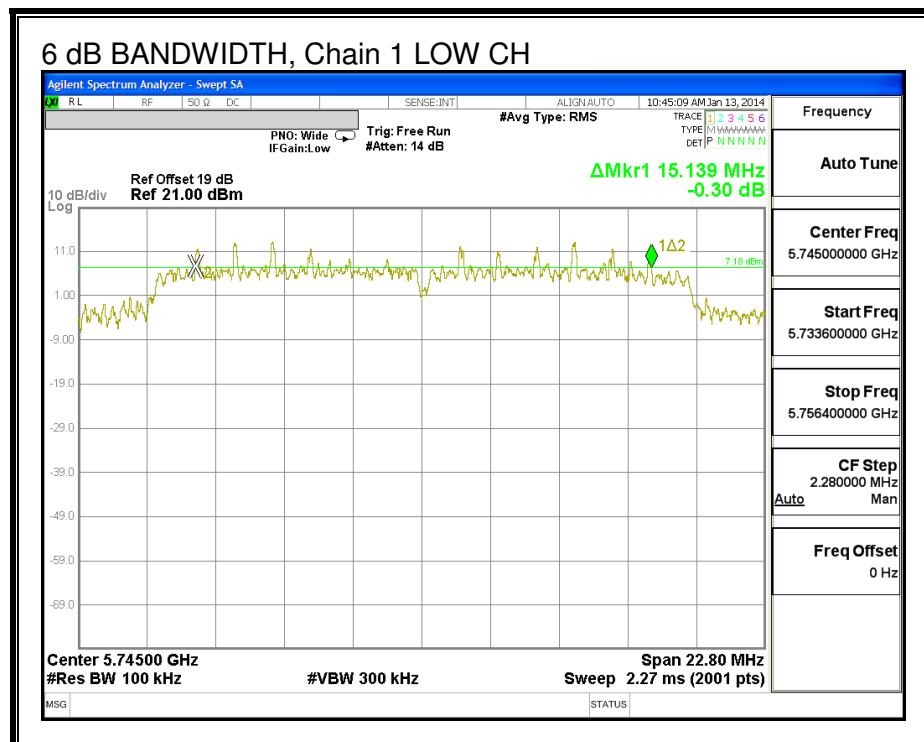
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	Minimum Limit (MHz)
Low	5745	15.660	15.139	15.096	0.5
Mid	5785	15.756	15.912	15.720	0.5
High	5825	15.936	15.960	15.996	0.5

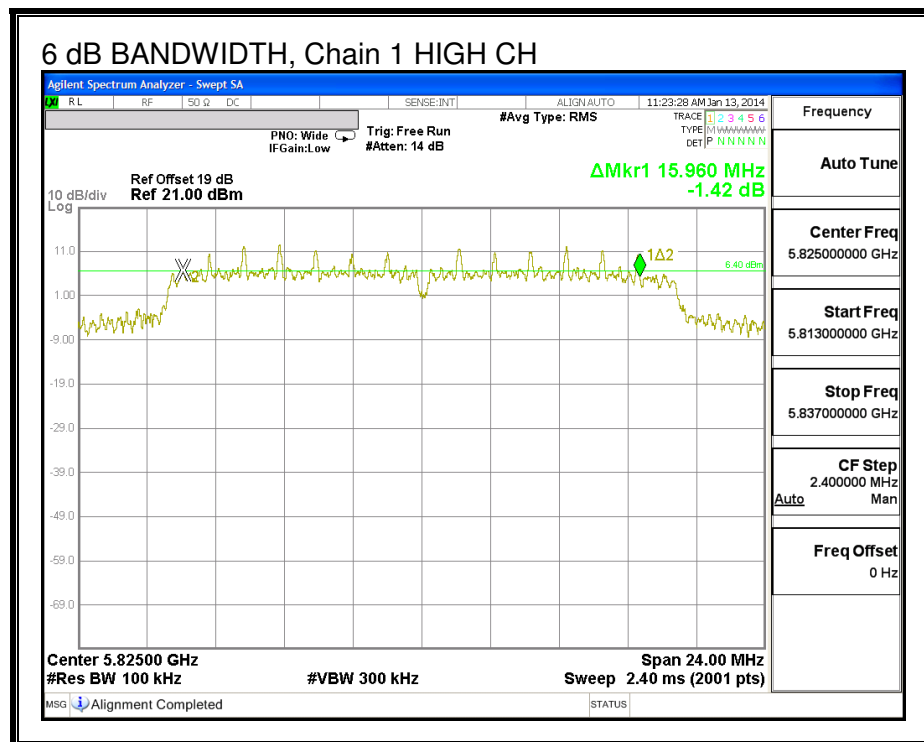
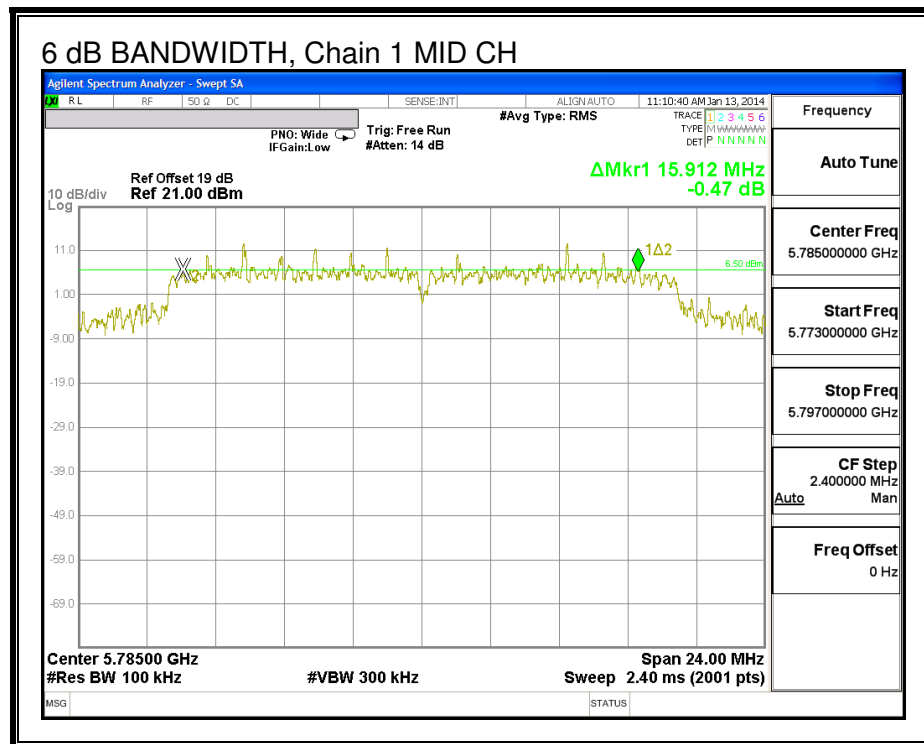
6 dB BANDWIDTH, Chain 0



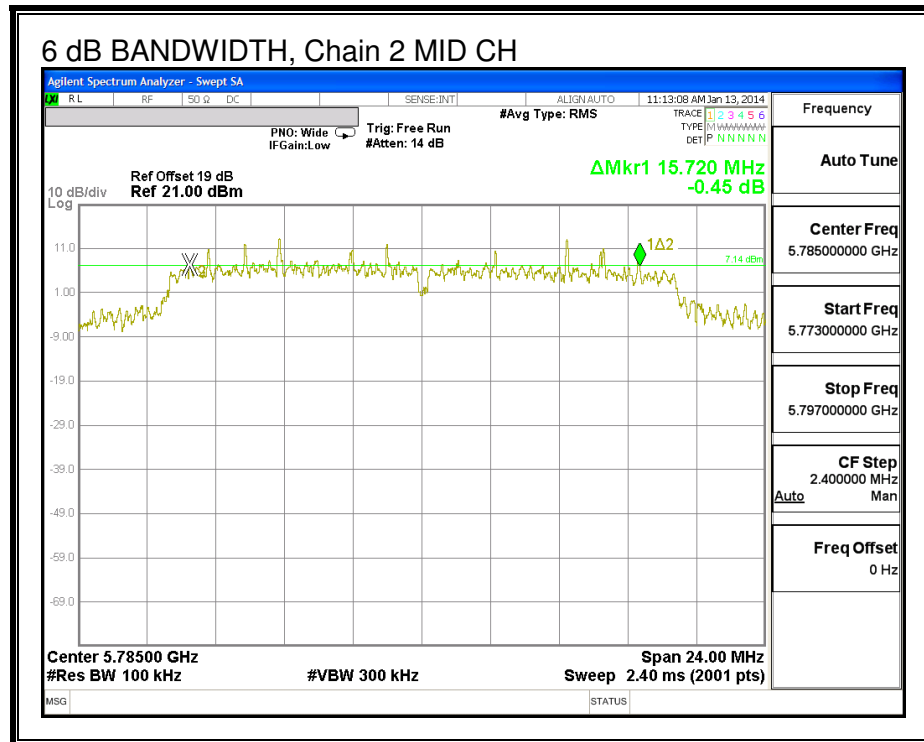
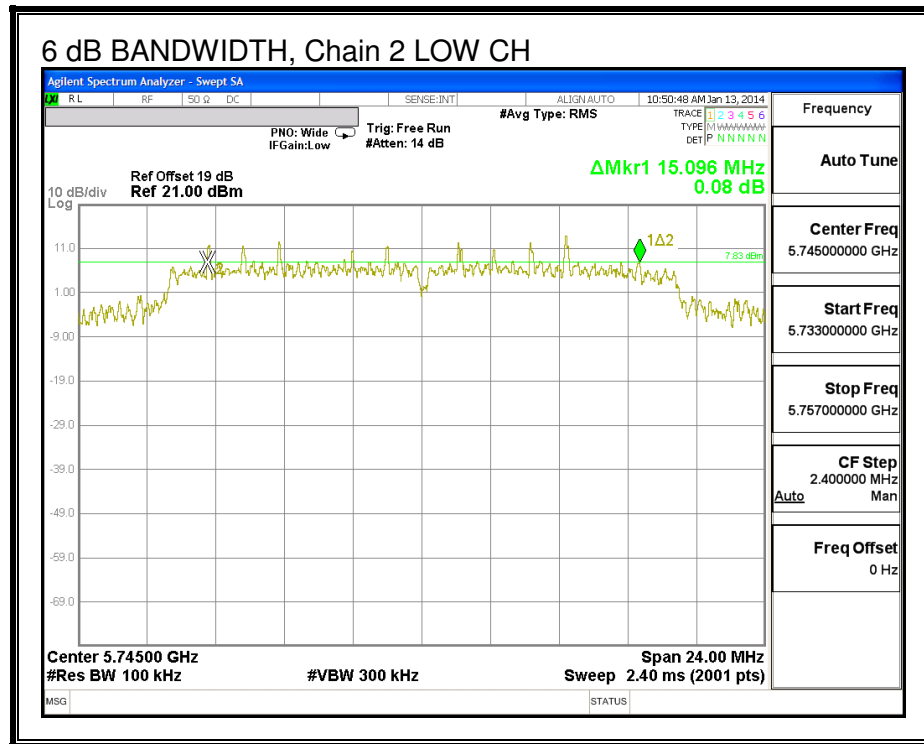


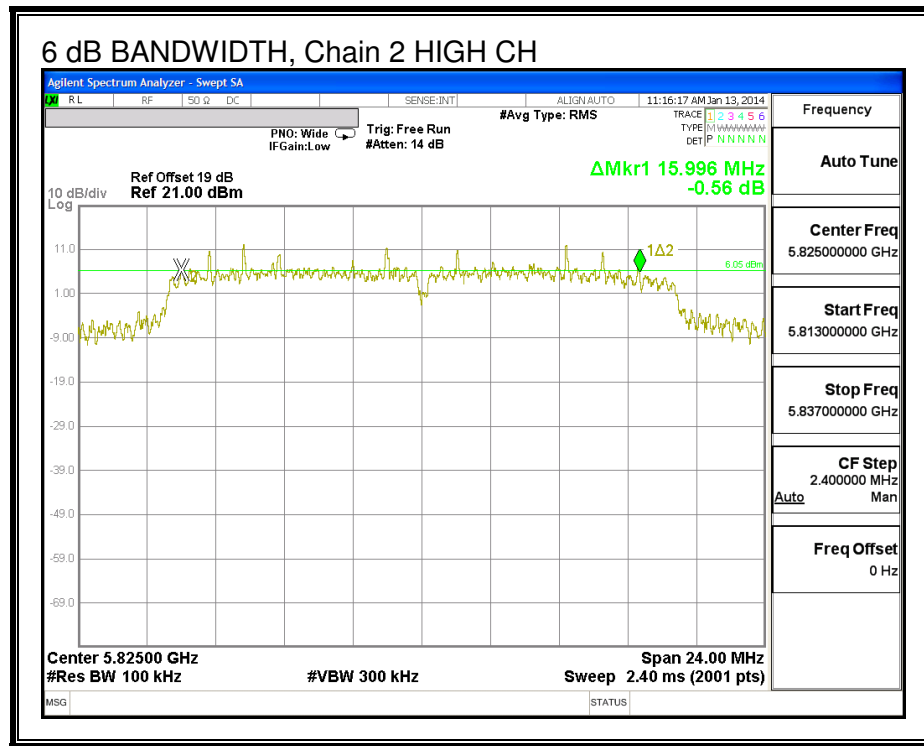
6 dB BANDWIDTH, Chain 1





6 dB BANDWIDTH, Chain 2





8.2. 99% BANDWIDTH

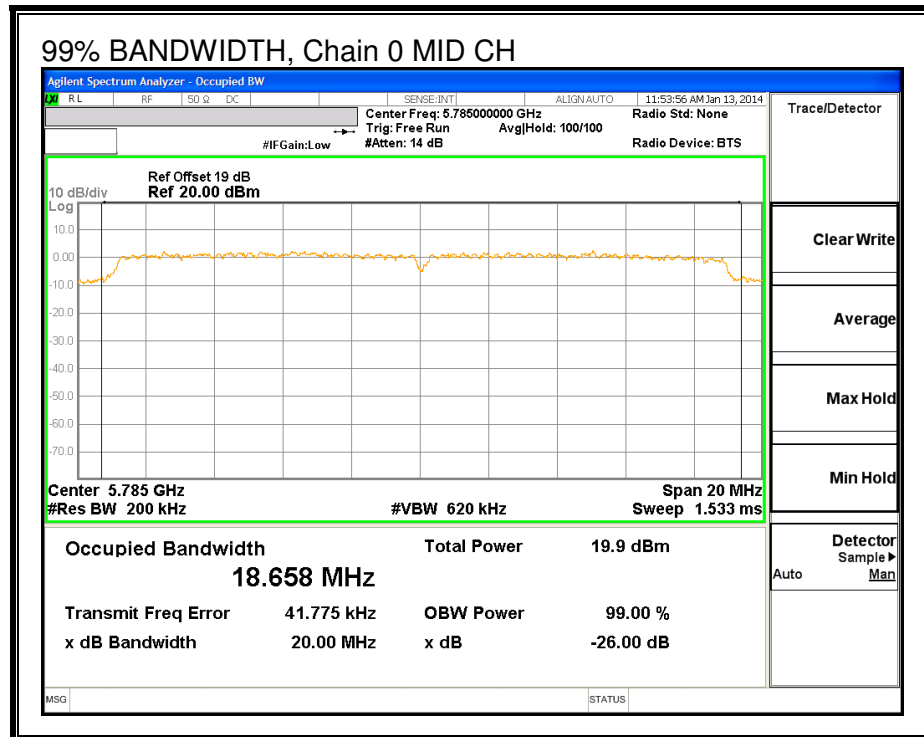
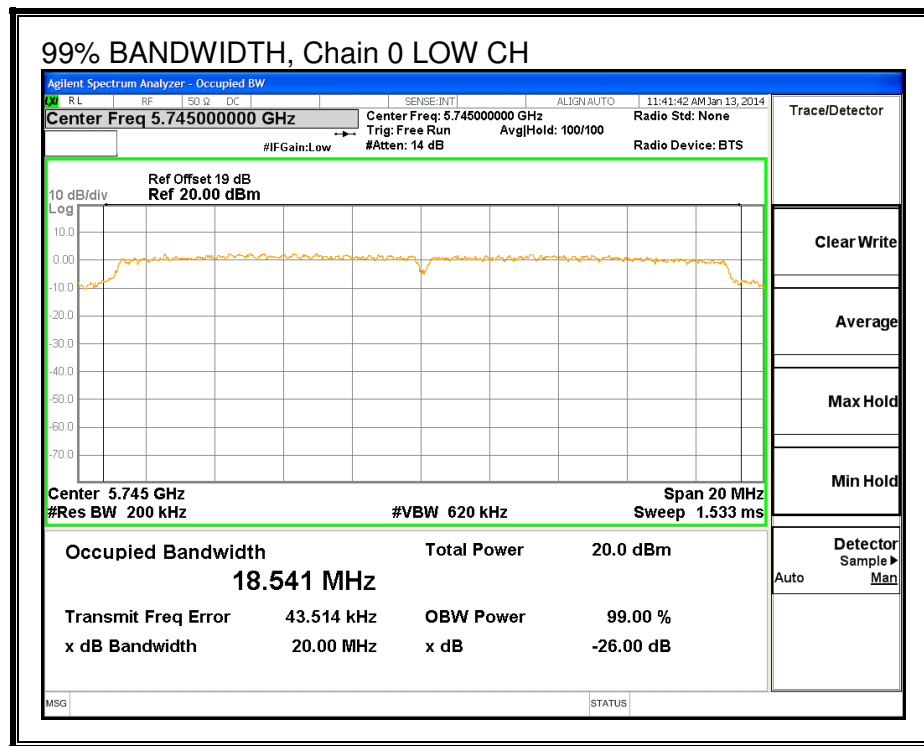
LIMITS

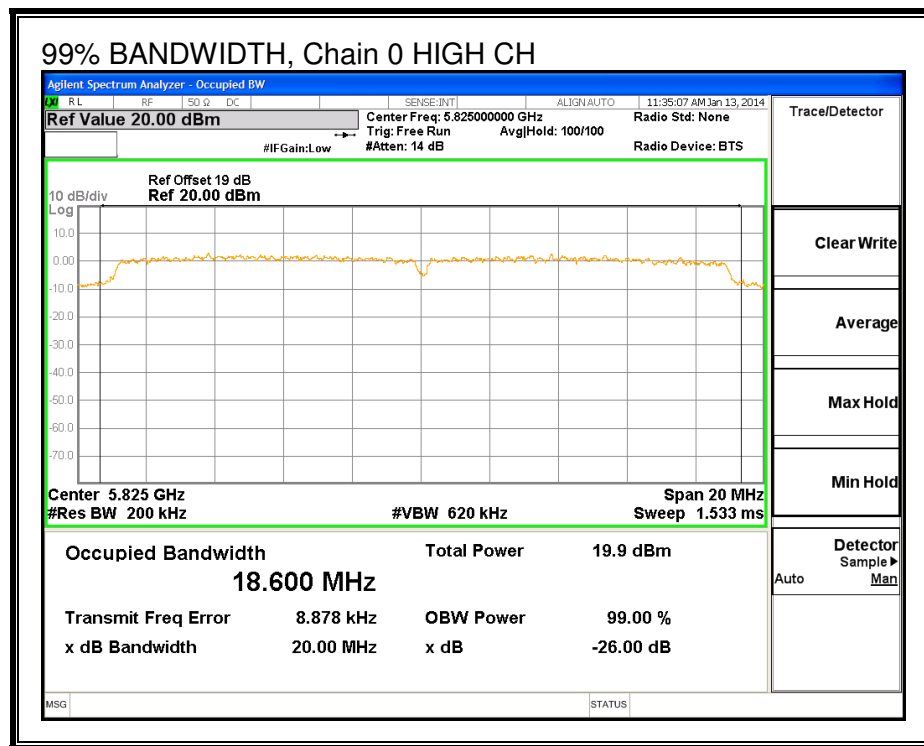
None; for reporting purposes only.

RESULTS

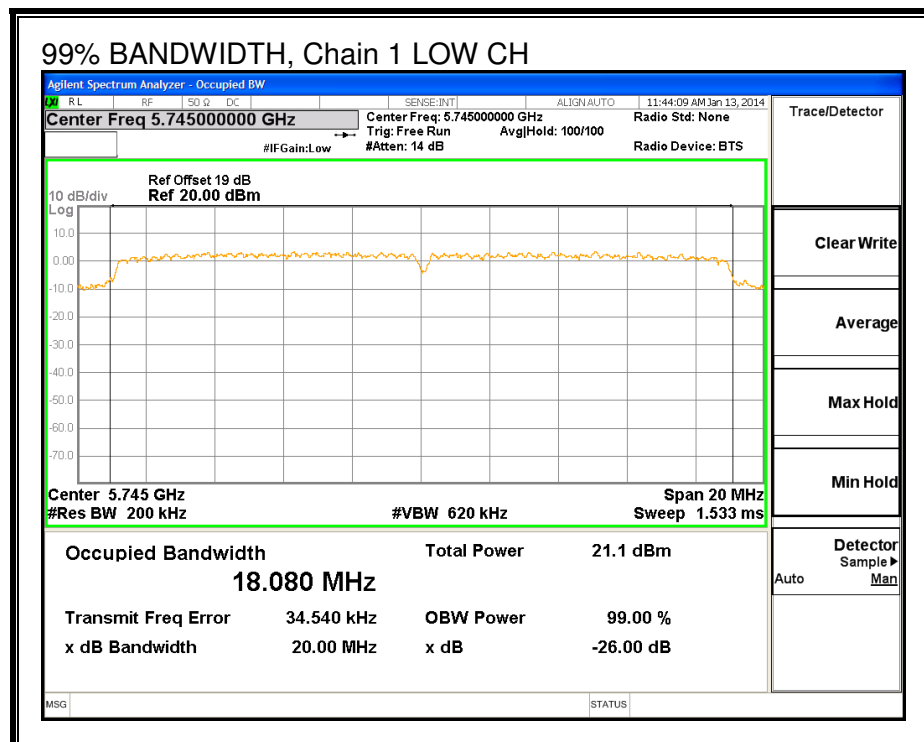
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)
Low	5745	18.541	18.080	18.208
Mid	5785	18.658	18.036	17.853
High	5825	18.600	17.824	17.772

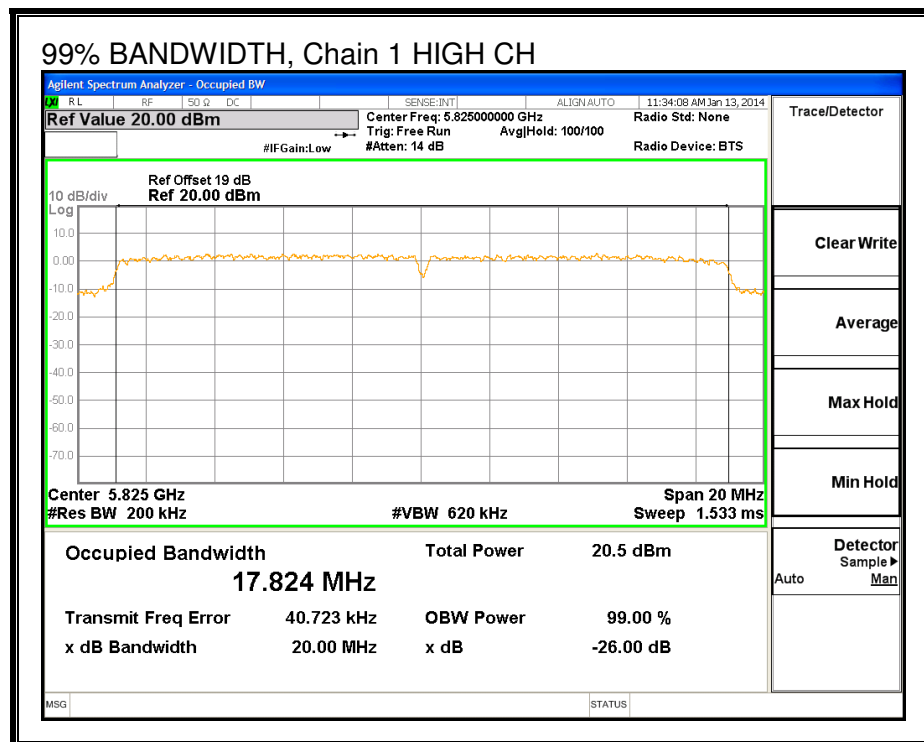
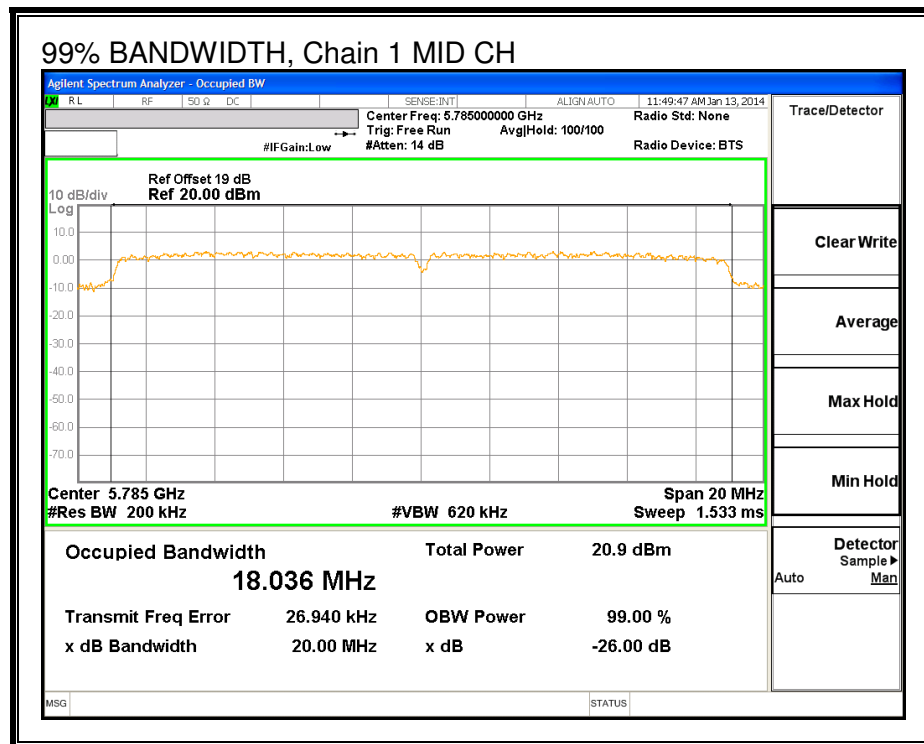
99% BANDWIDTH, Chain 0



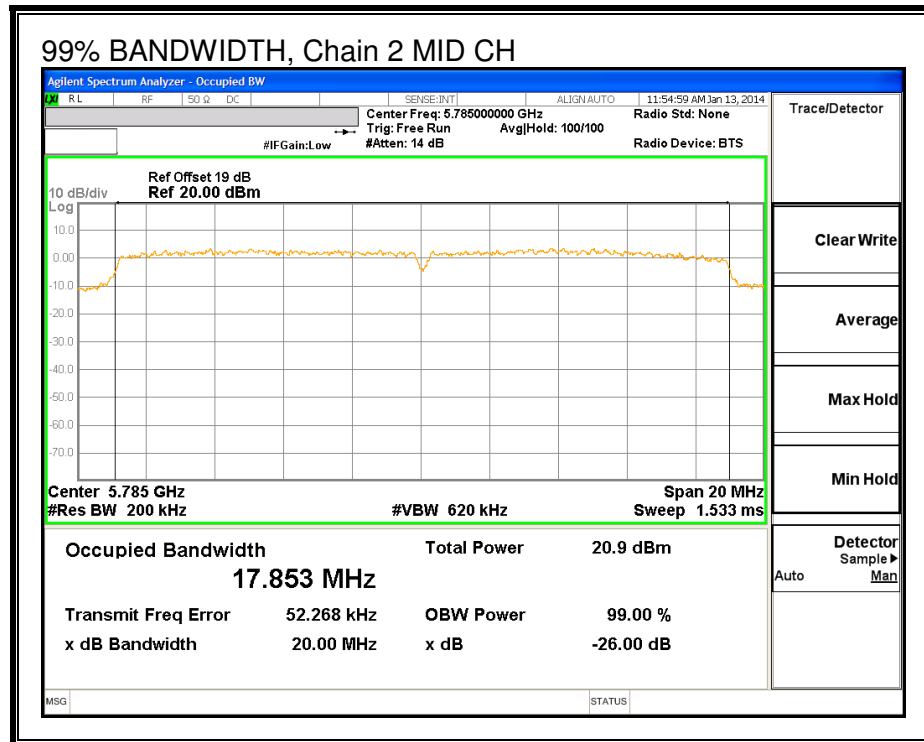
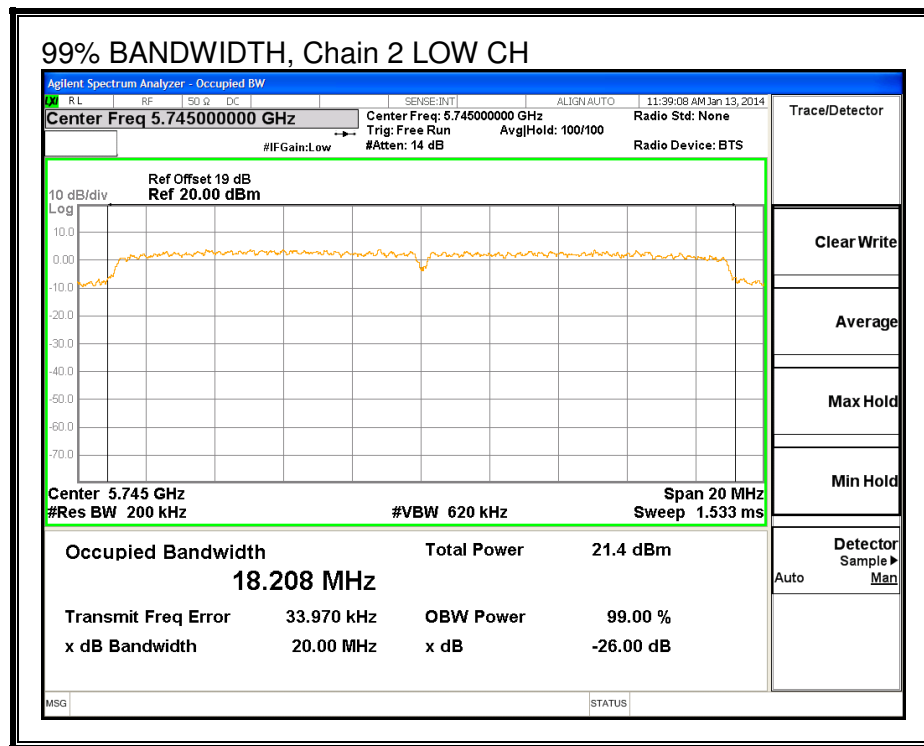


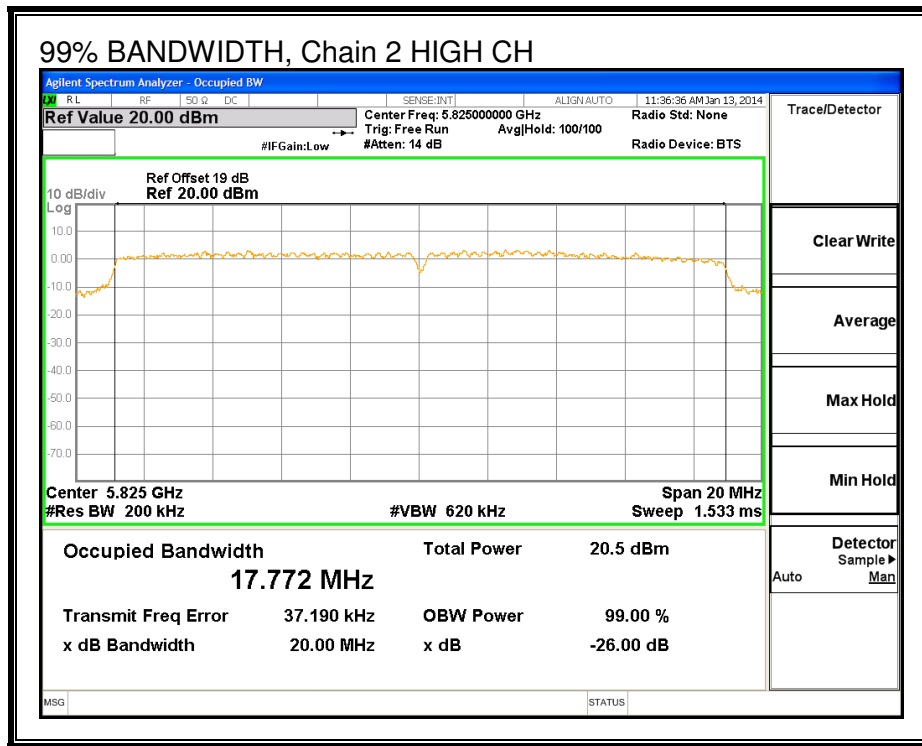
99% BANDWIDTH, Chain 1





99% BANDWIDTH, Chain 2





8.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Power Setting	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)
Low	5745	15	16.13	15.79	17.99
Mid	5785	15	17.23	16.78	18.13
High	5825	15	16.84	16.18	17.29

8.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator 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

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

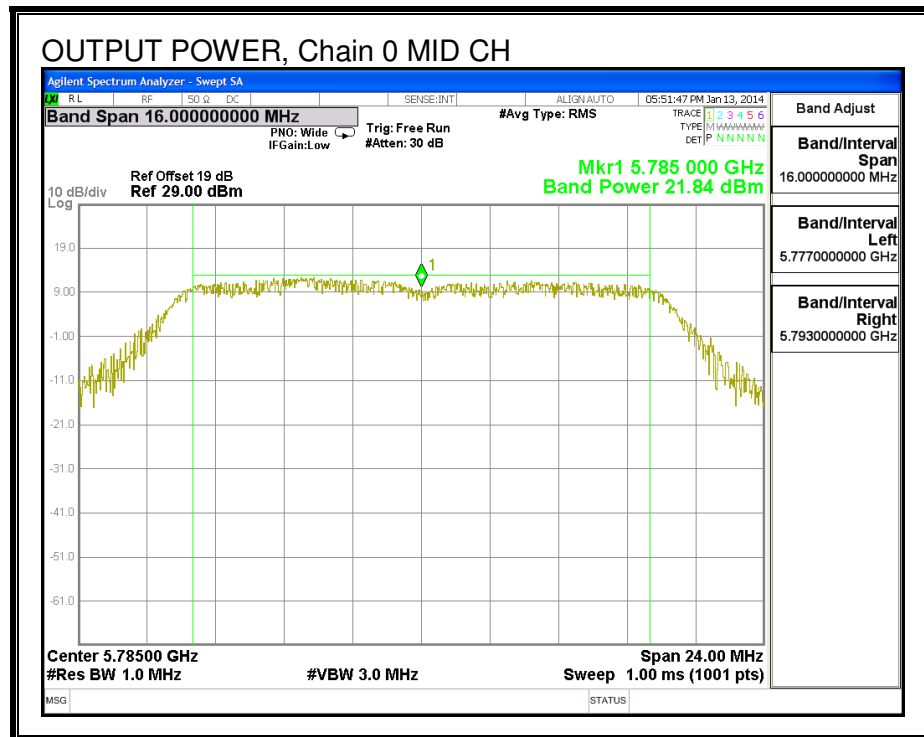
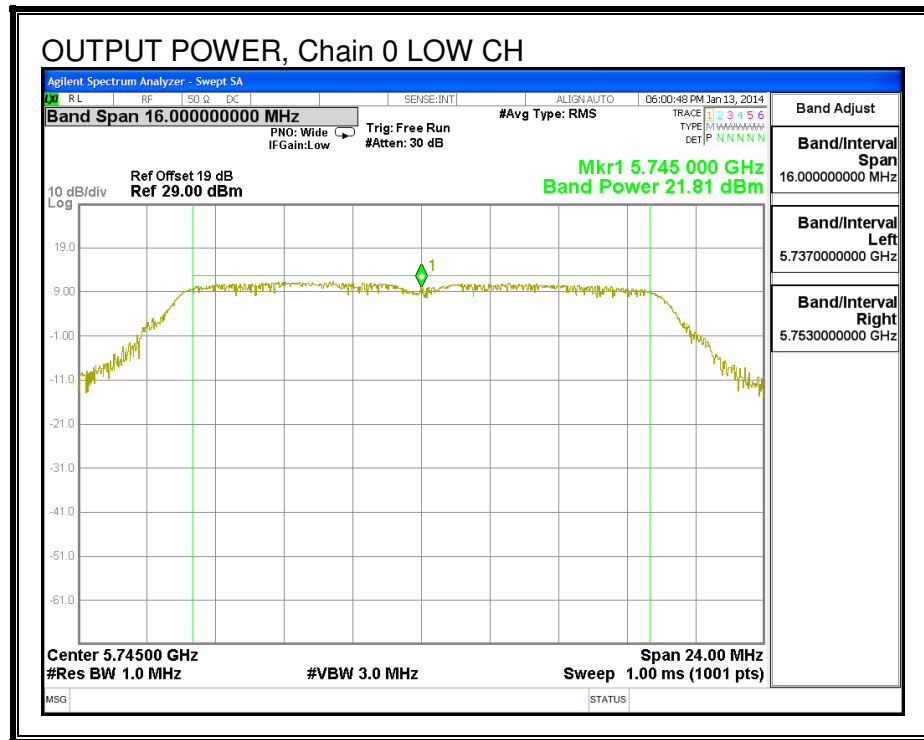
Limits

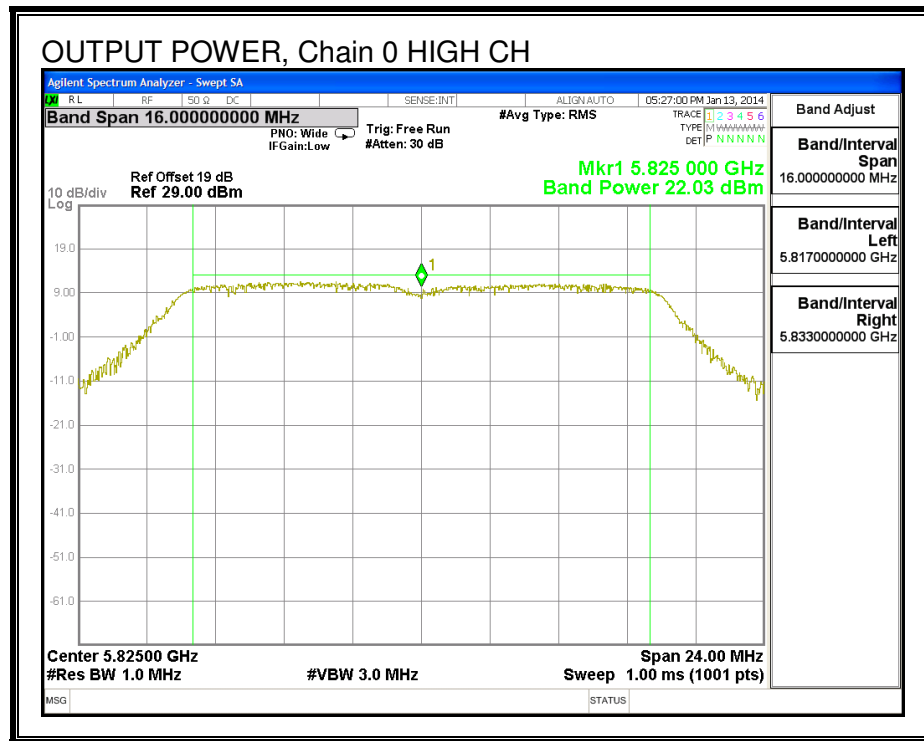
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	5745	4.01	30.00	30	36	30.00
Mid	5785	4.01	30.00	30	36	30.00
High	5825	4.01	30.00	30	36	30.00

Results

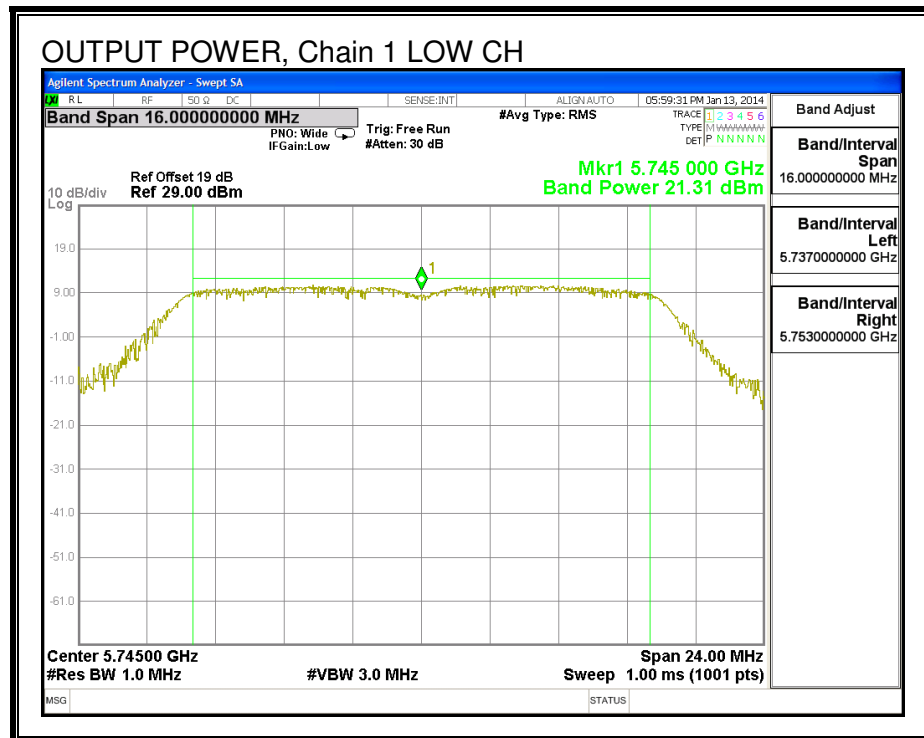
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	5745	21.81	21.31	23.47	27.07	30.00	-2.93
Mid	5785	21.84	21.54	23.13	27.00	30.00	-3.00
High	5825	22.03	21.05	23.10	26.91	30.00	-3.09

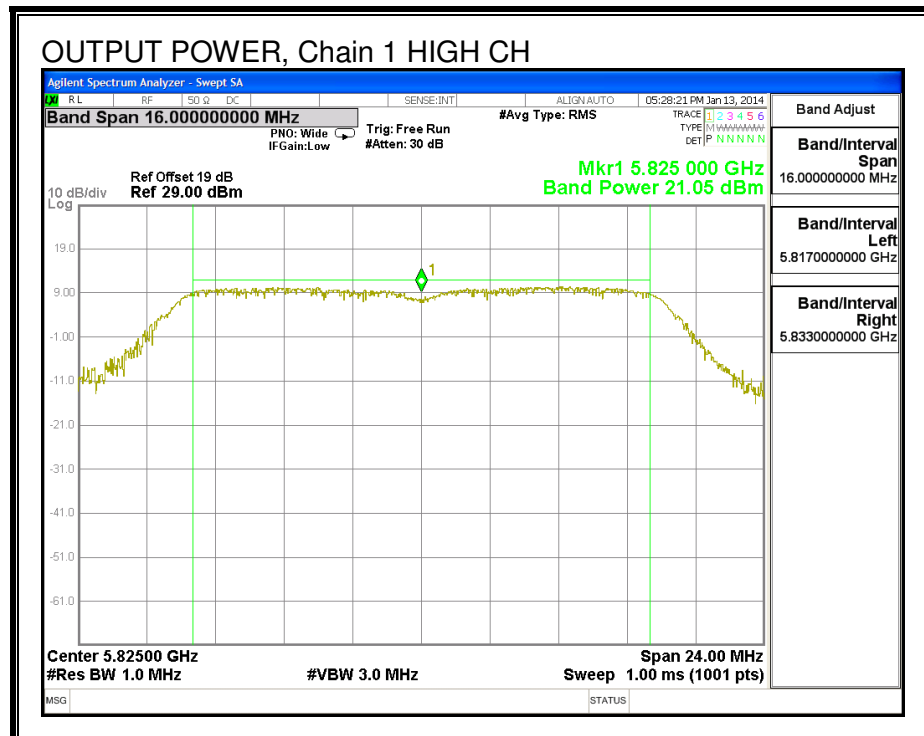
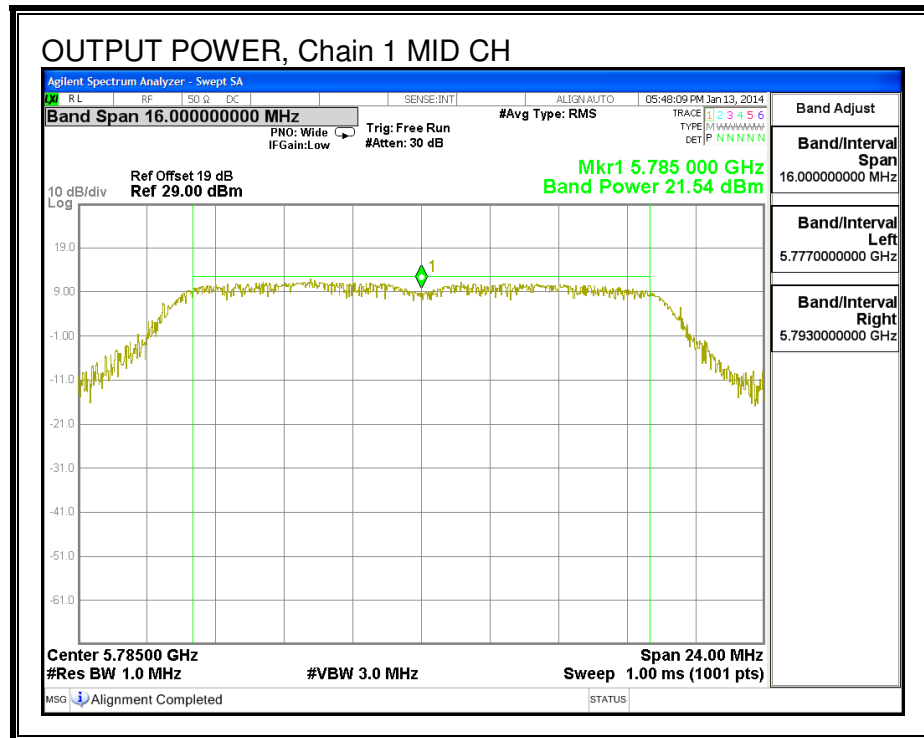
OUTPUT POWER, Chain 0

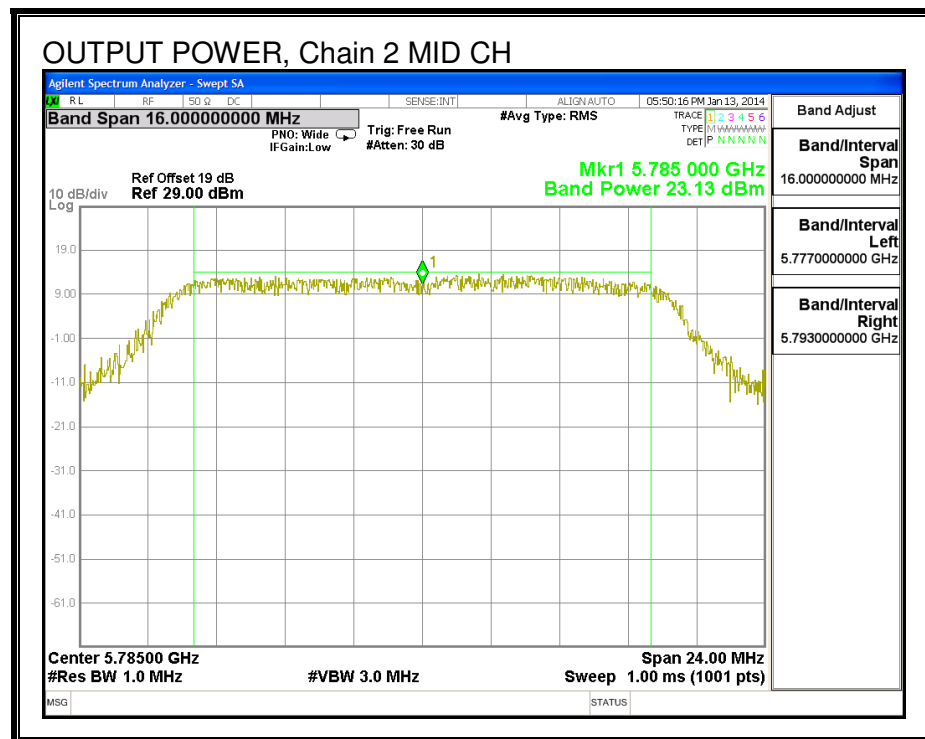
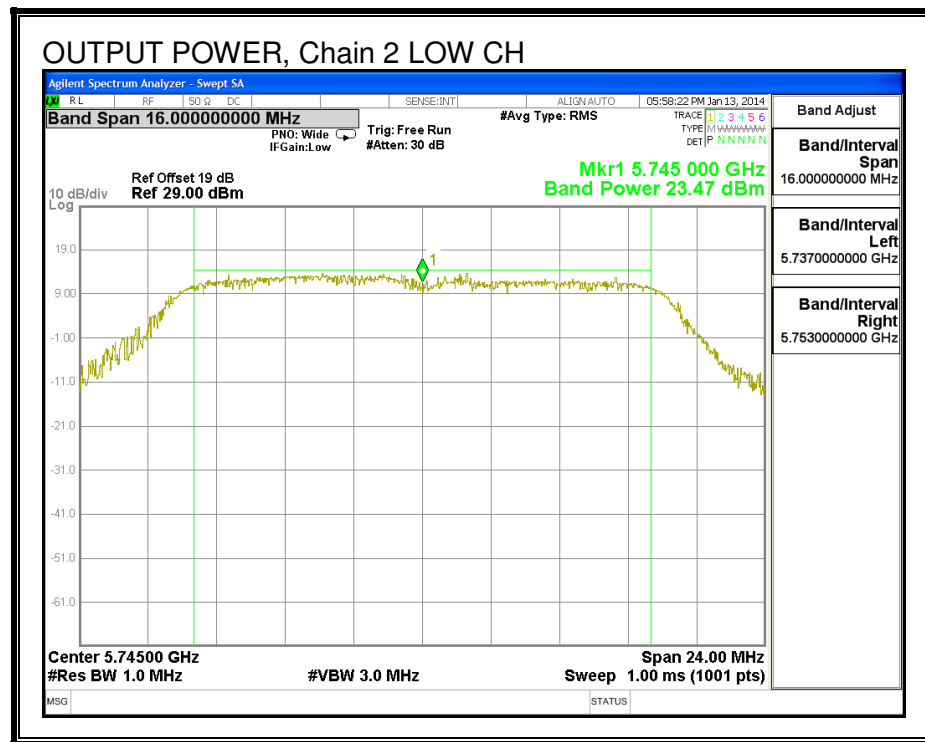


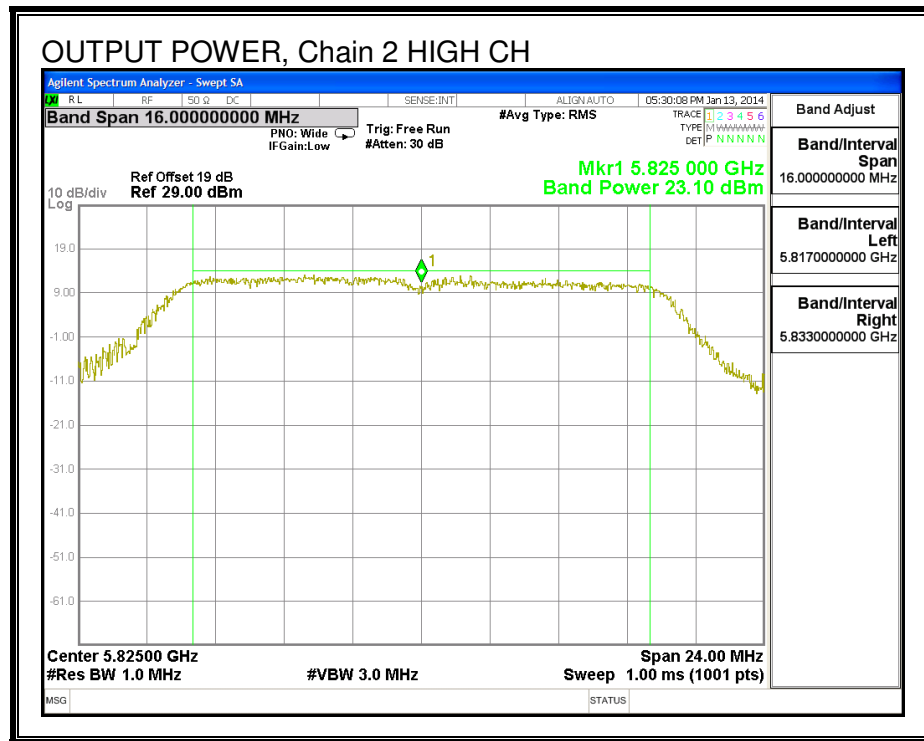


OUTPUT POWER, Chain 1









8.5. PSD

LIMITS

FCC §15.247

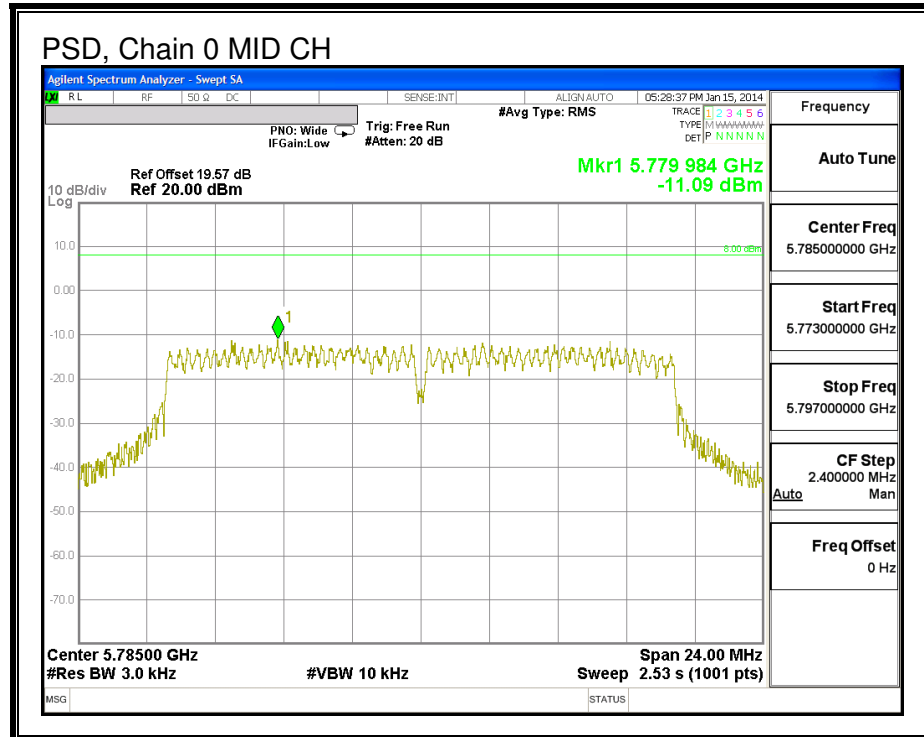
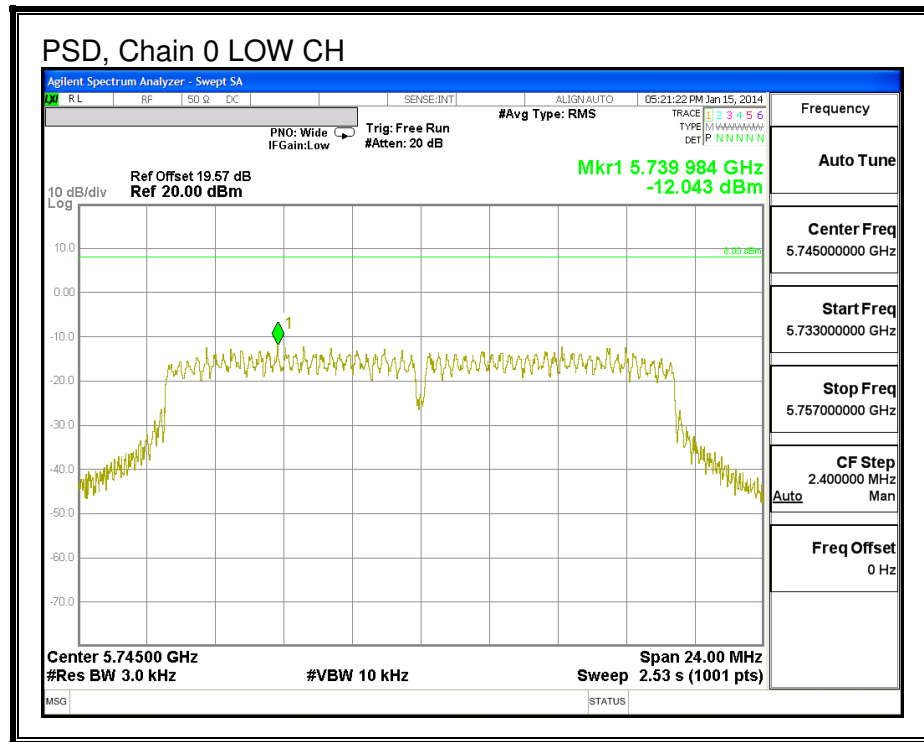
IC RSS-210 A8.2

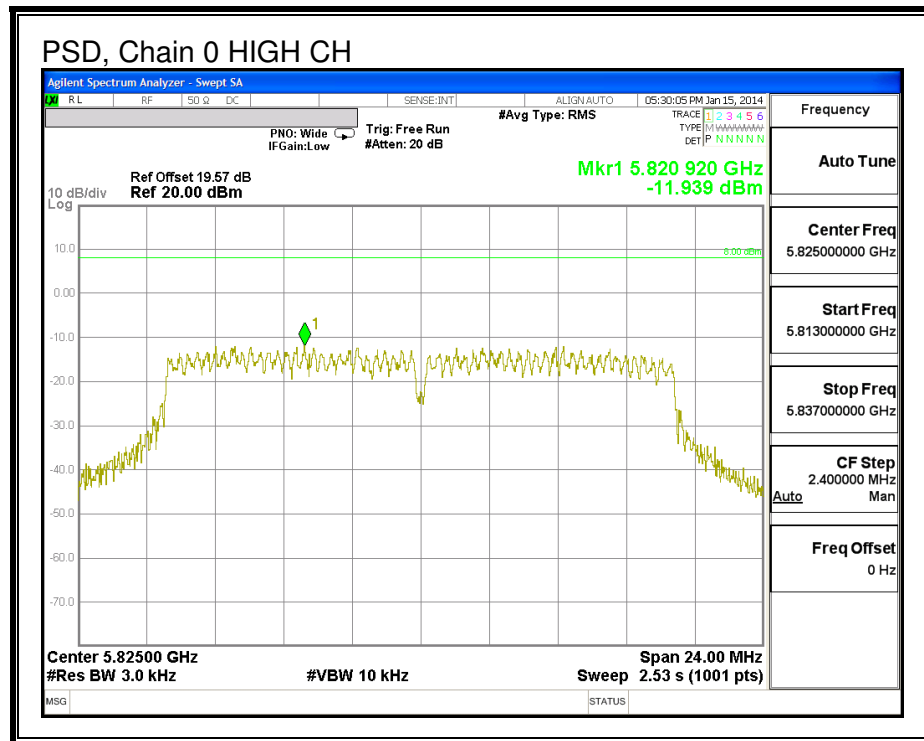
RESULTS

PSD Results

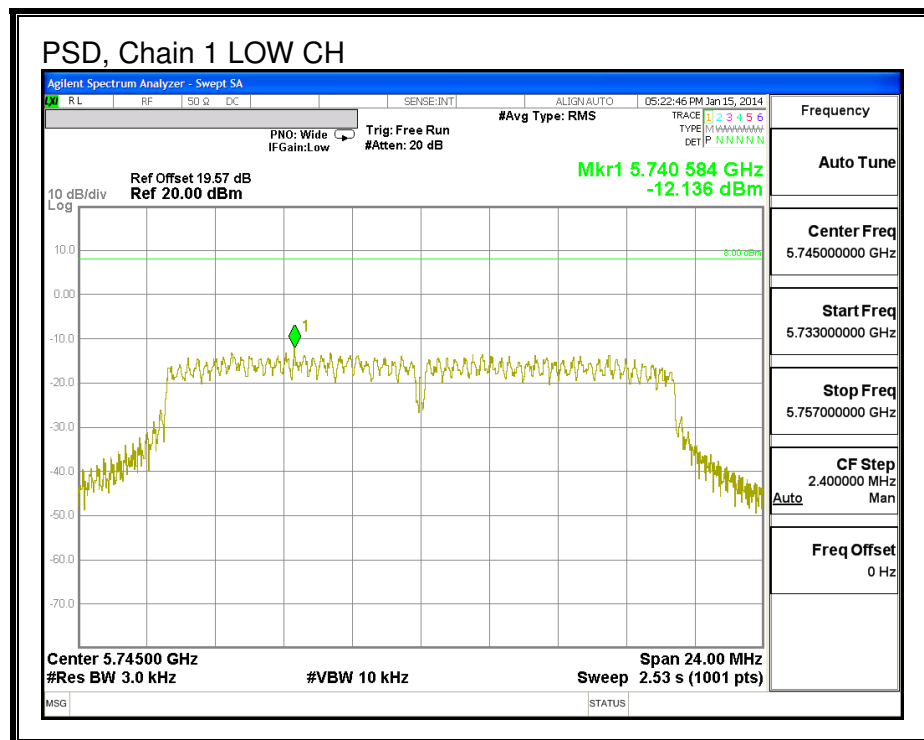
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-11.04	-12.14	-9.66	-6.06	8.0	-14.1
Mid	5785	-11.09	-11.02	-8.70	-5.35	8.0	-13.4
High	5825	-11.94	-10.29	-10.01	-5.89	8.0	-13.9

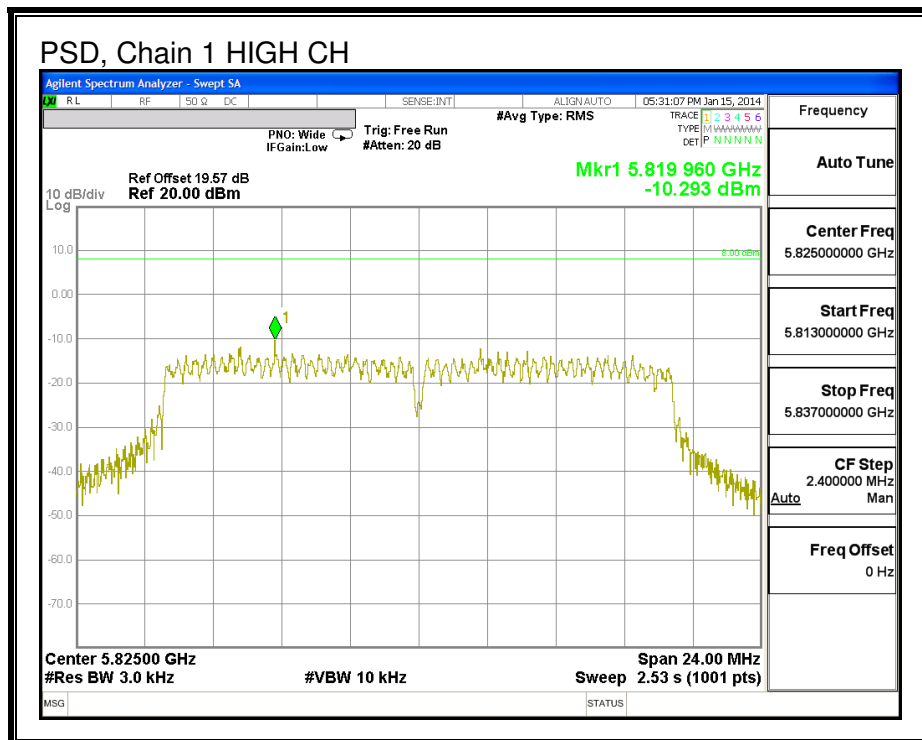
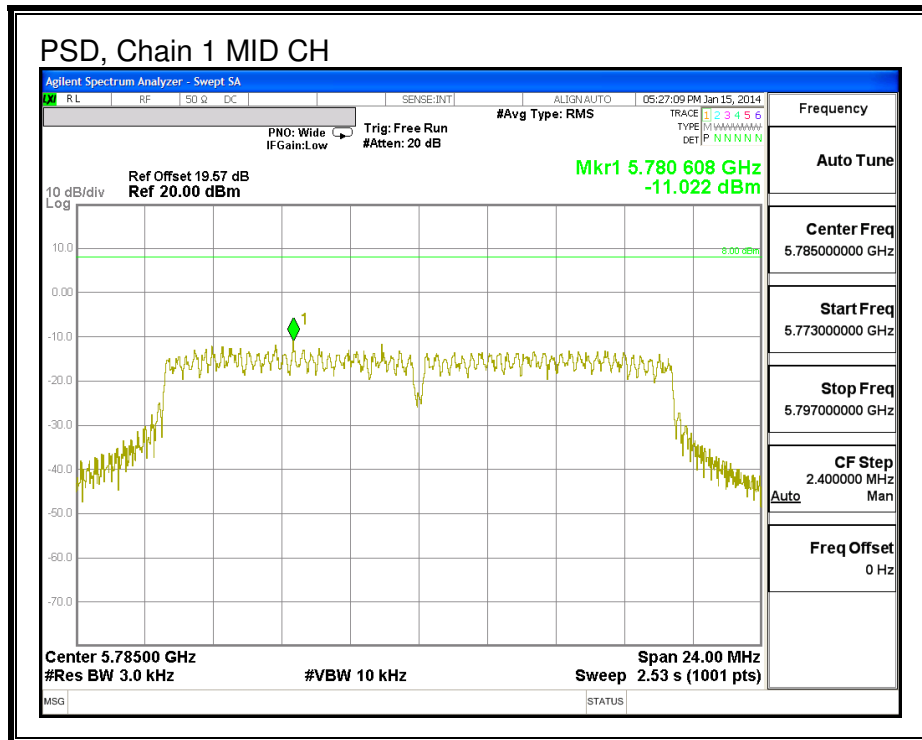
PSD, Chain 0



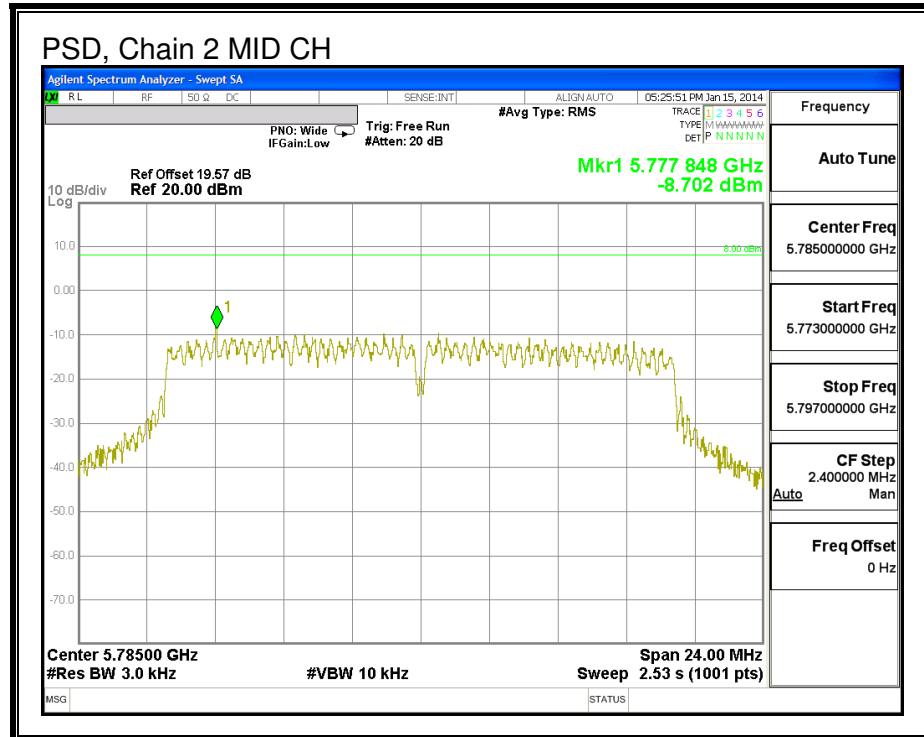
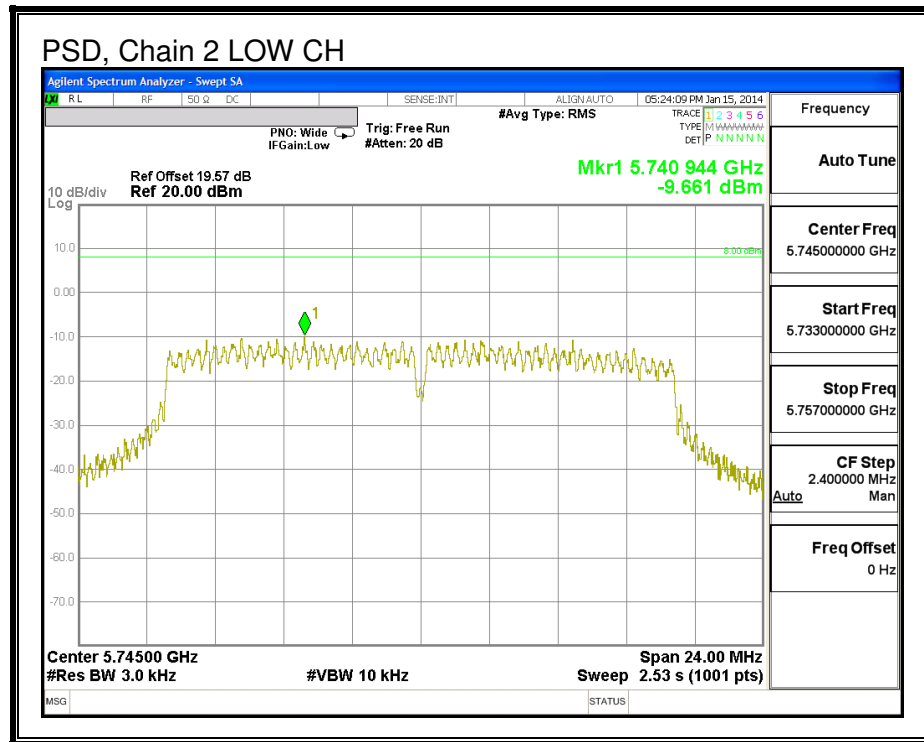


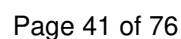
PSD, Chain 1





PSD, Chain 2





8.6. OUT-OF-BAND EMISSIONS

LIMITS

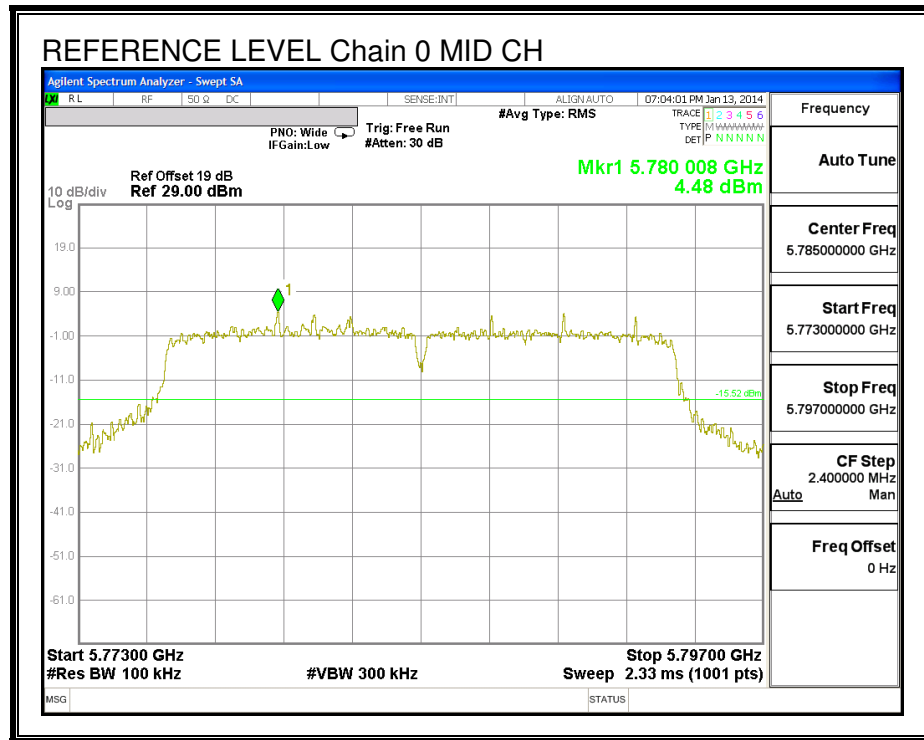
FCC §15.247 (d)

IC RSS-210 A8.5

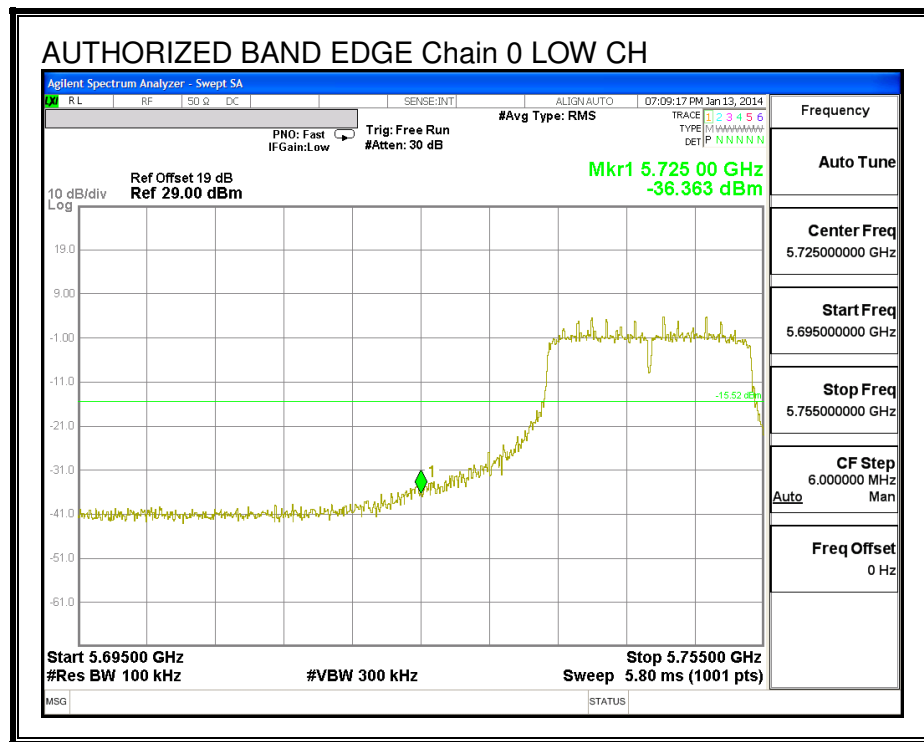
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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.

RESULTS

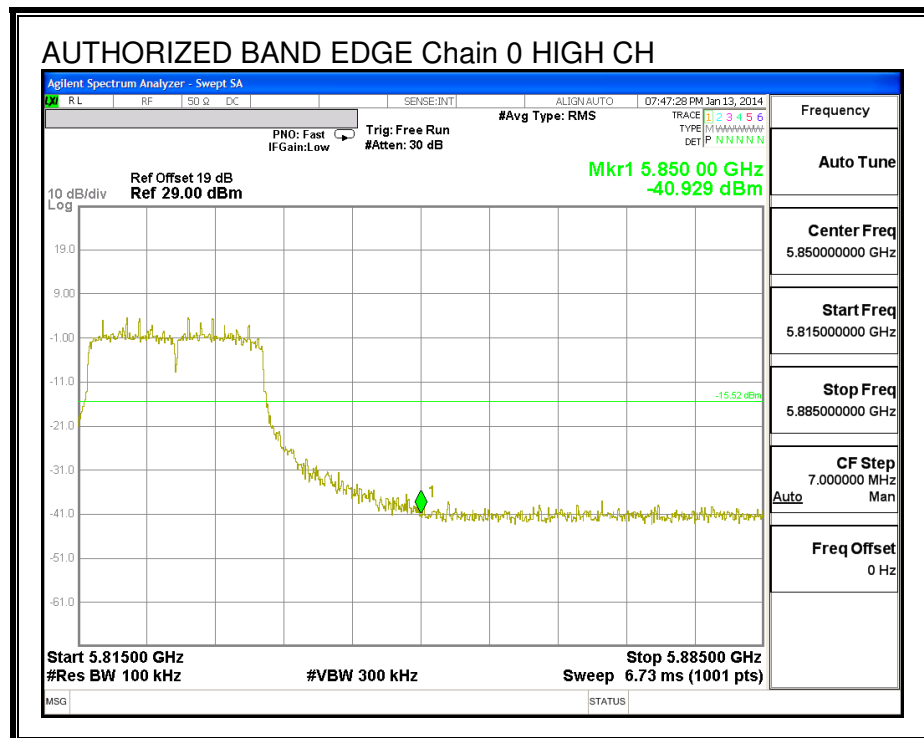
IN-BAND REFERENCE LEVEL, Chain 0



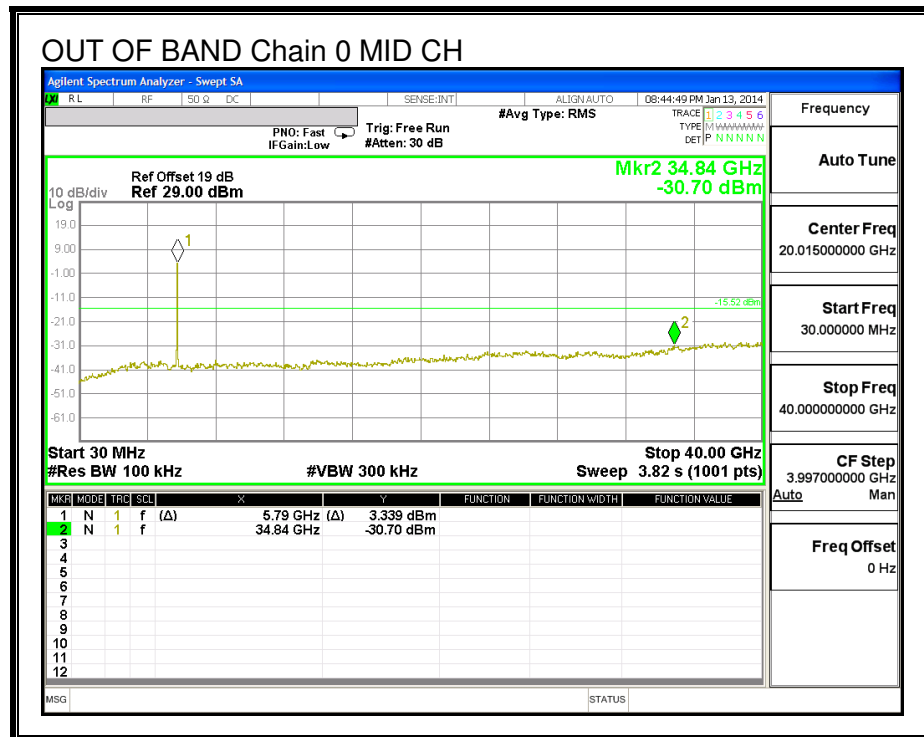
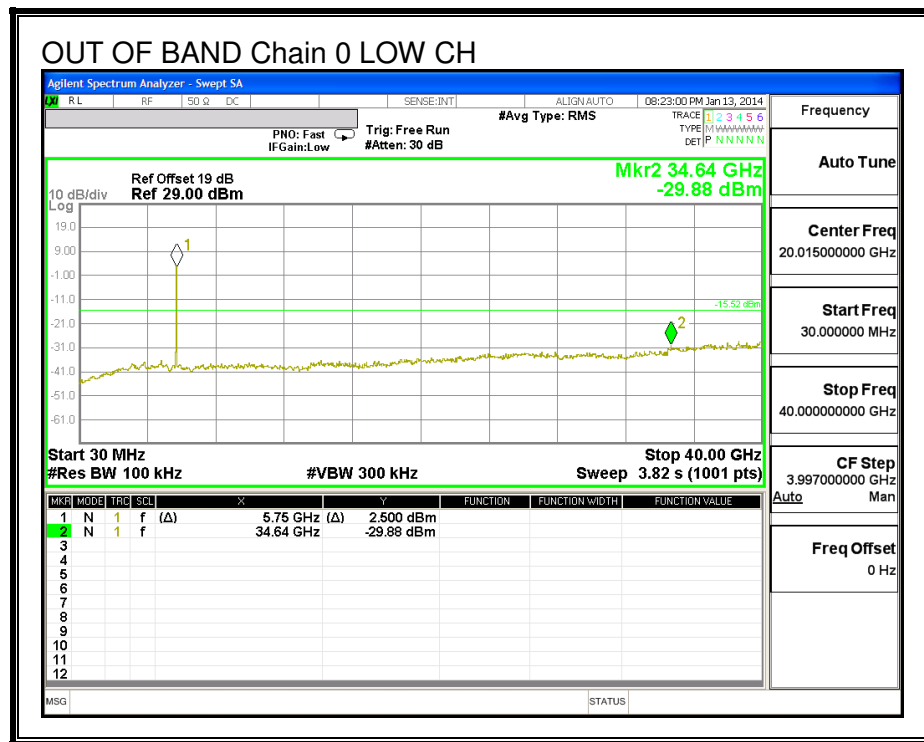
LOW CHANNEL BANDEDGE, Chain 0

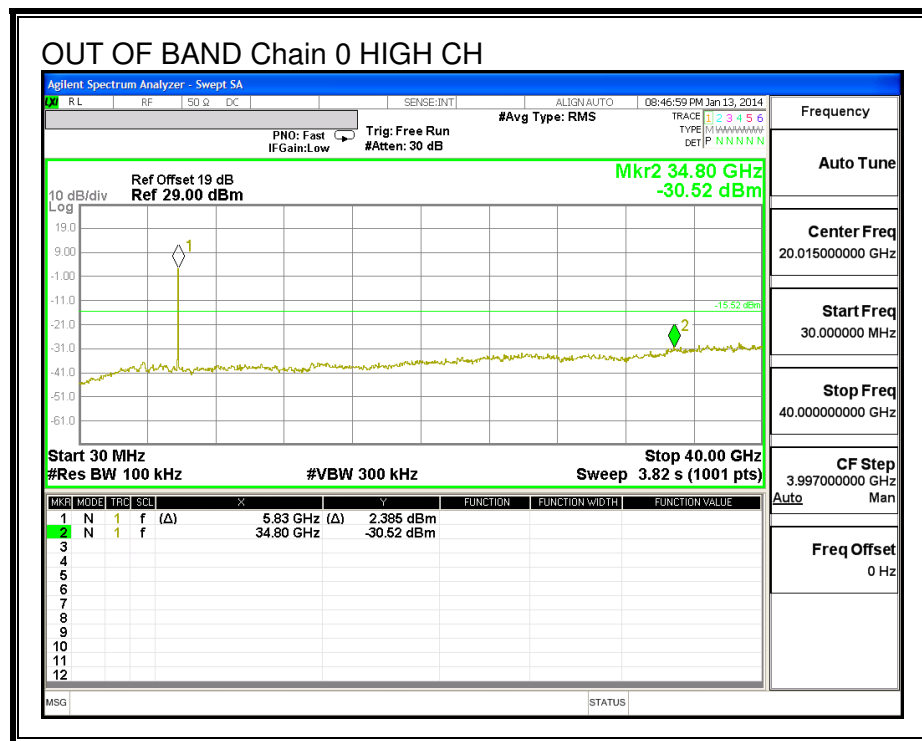


HIGH CHANNEL BANDEDGE, Chain 0



OUT-OF-BAND EMISSIONS, Chain 0





REFERENCE LEVEL Chain 1 MID CH

Agilent Spectrum Analyzer – Swept SA

M	RL	RF	50 Ω	DC		SENSE:INT	ALIGN:AUTO	07:49:57 PM Jan 13, 2014
---	----	----	------	----	--	-----------	------------	--------------------------

#Avg Type: RMS

PNO: Wide IF Gain: Low Trig: Free Run #Atten: 30 dB

TRACE 1 2 3 4 5 6
TYPE P NNNNNN
DET P NNNNN

**Ref Offset 19 dB
Ref 29.00 dBm**

**Mkr1 5.780 008 GHz
4.07 dBm**

10 dB/div Log

-15.93 dBm

**Start 5.77300 GHz
#Res BW 100 kHz**

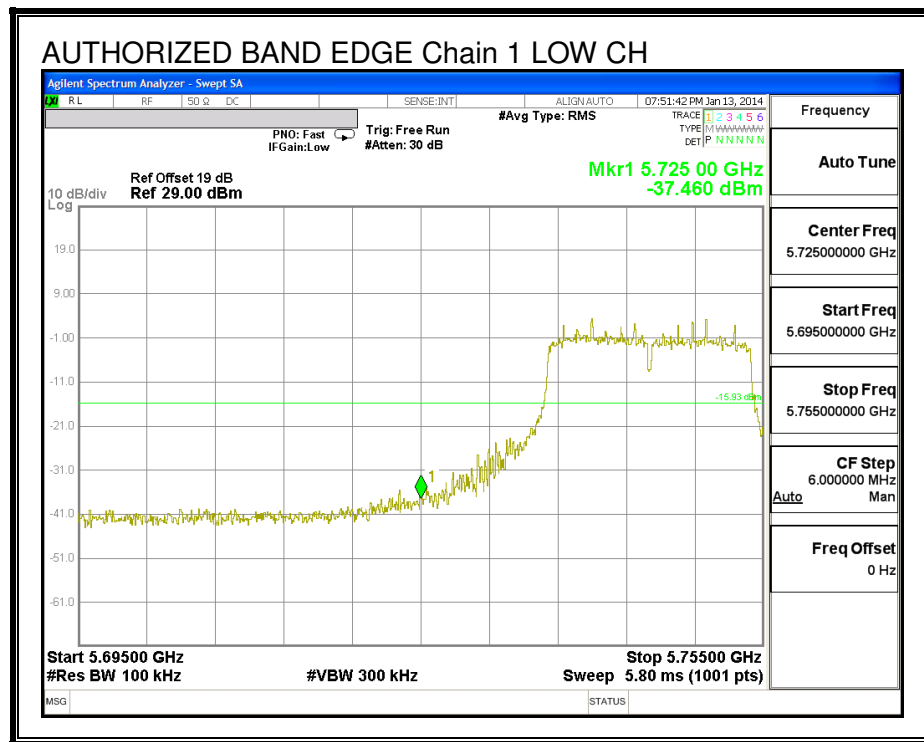
**Stop 5.79700 GHz
Sweep 2.33 ms (1001 pts)**

#VBW 300 kHz

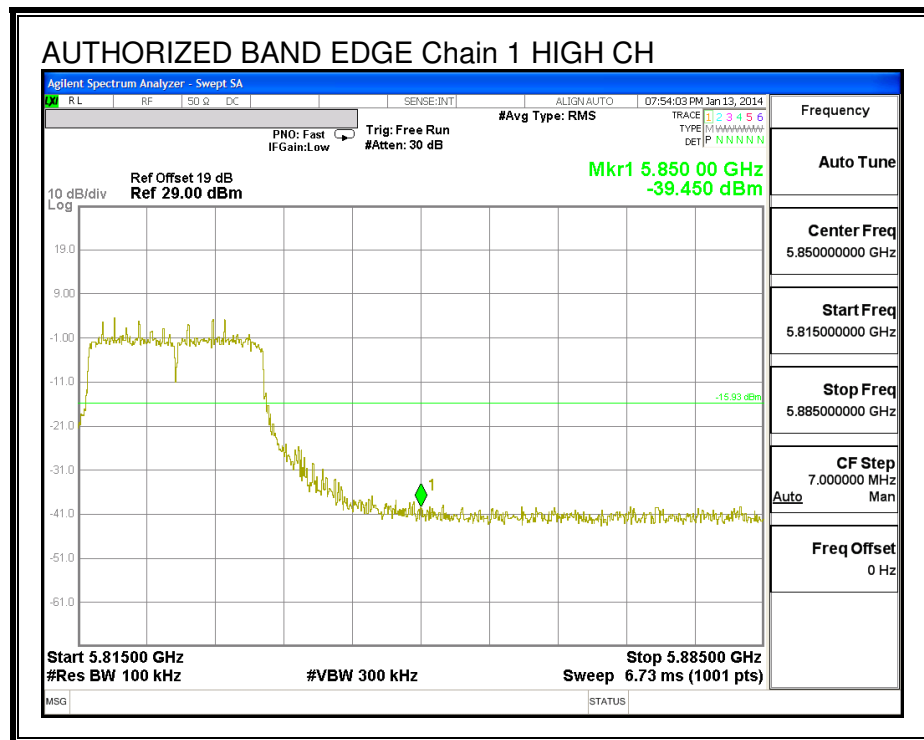
Frequency	
Auto Tune	
Center Freq	5.785000000 GHz
Start Freq	5.773000000 GHz
Stop Freq	5.797000000 GHz
CF Step	2.400000 MHz
Auto	Man
Freq Offset	0 Hz

MSG STATUS

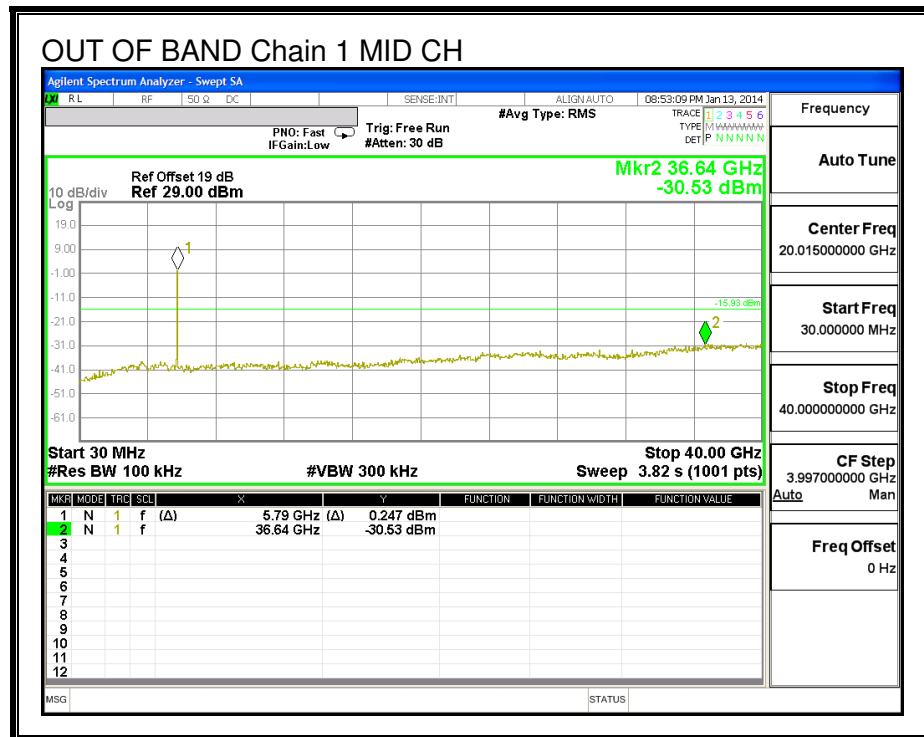
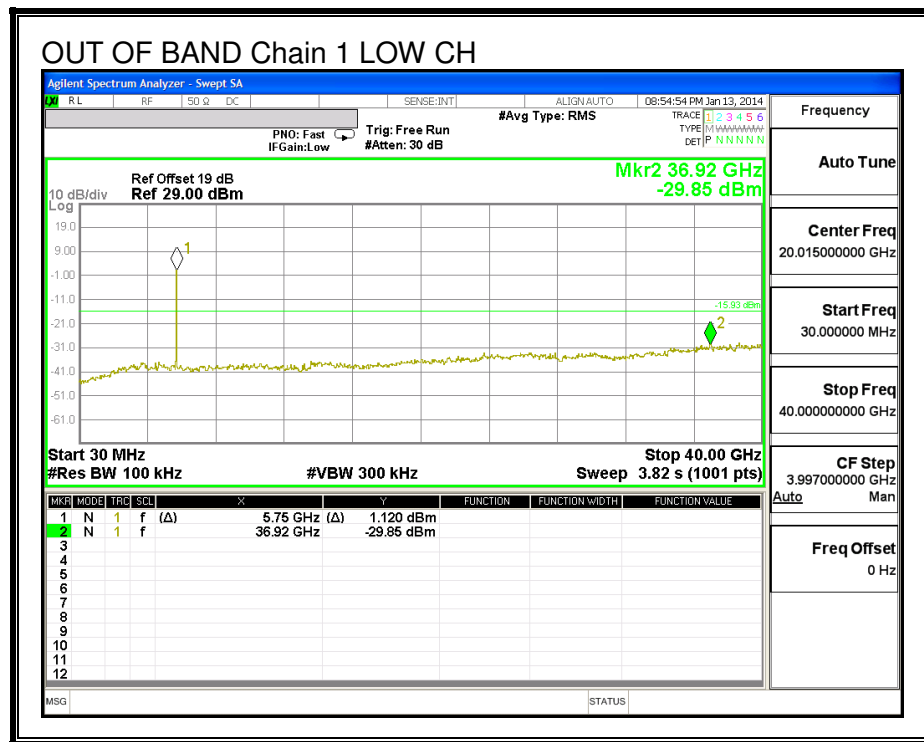
LOW CHANNEL BANDEDGE, Chain 1

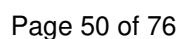


HIGH CHANNEL BANDEDGE, Chain 1

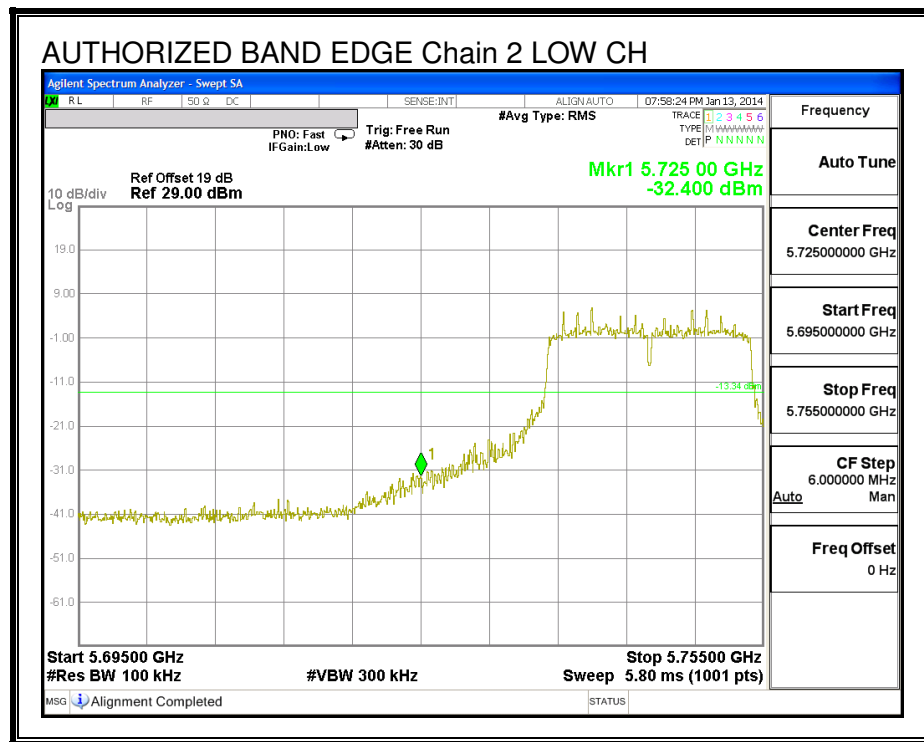


OUT-OF-BAND EMISSIONS, Chain 1

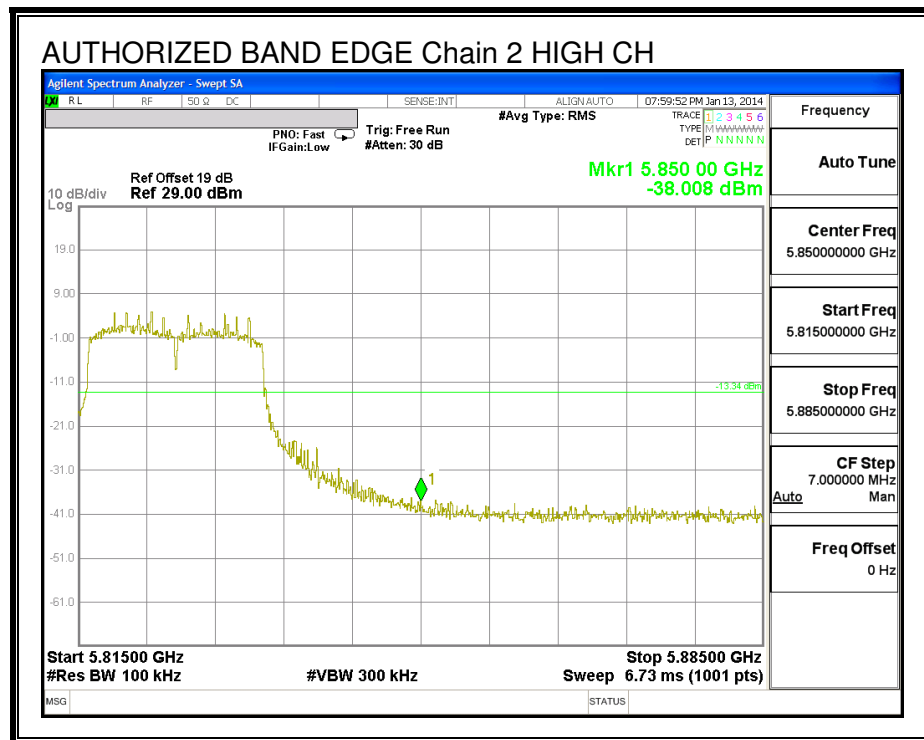




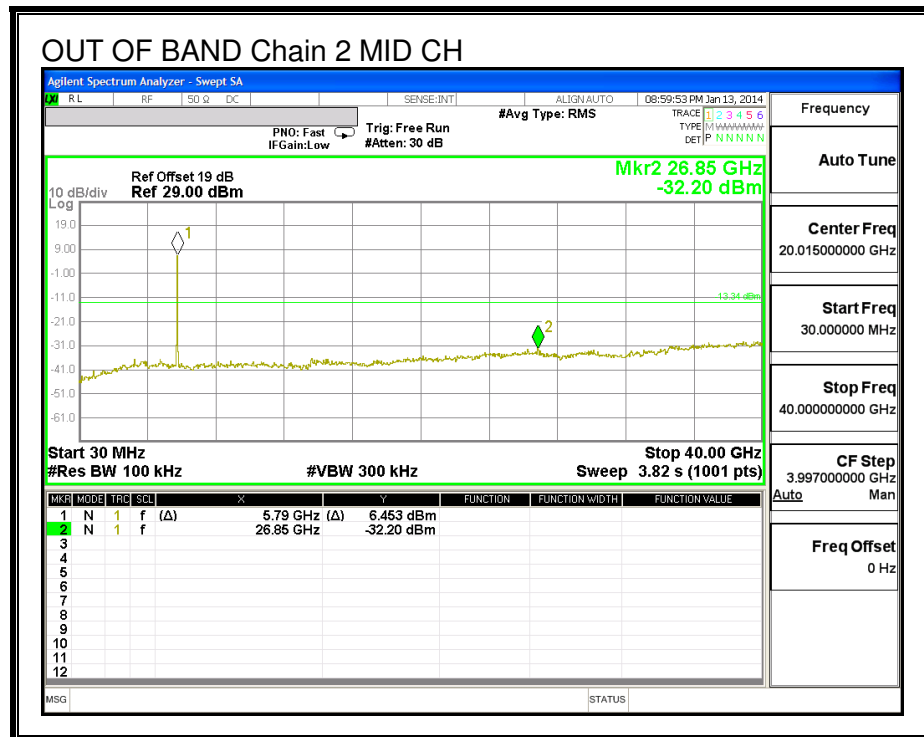
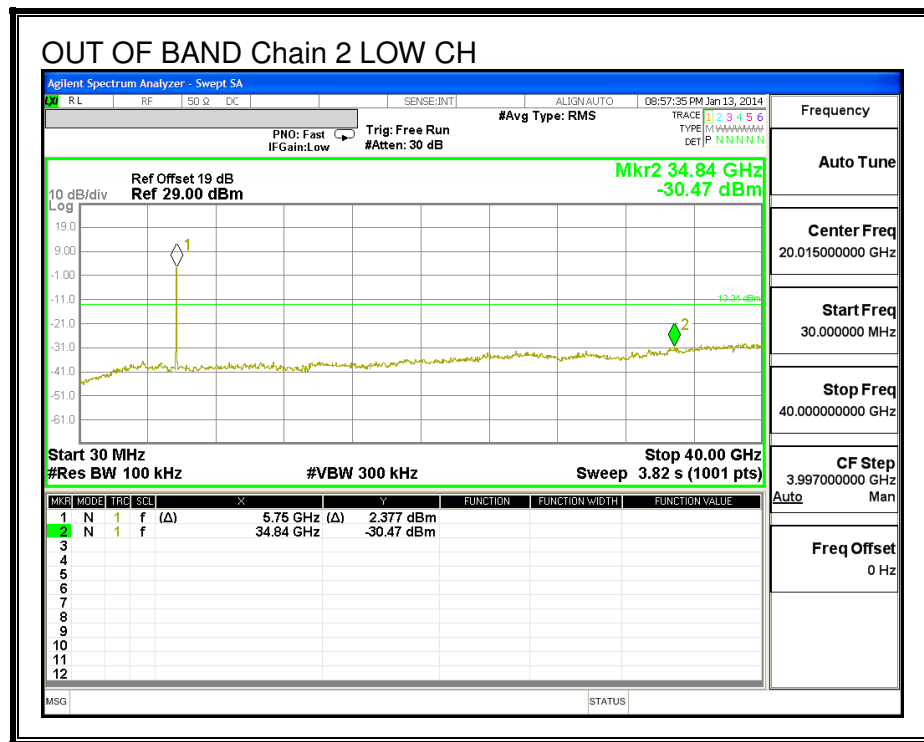
LOW CHANNEL BANDEDGE, Chain 2

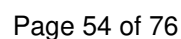


HIGH CHANNEL BANDEDGE, Chain 2



OUT-OF-BAND EMISSIONS, Chain 2





9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

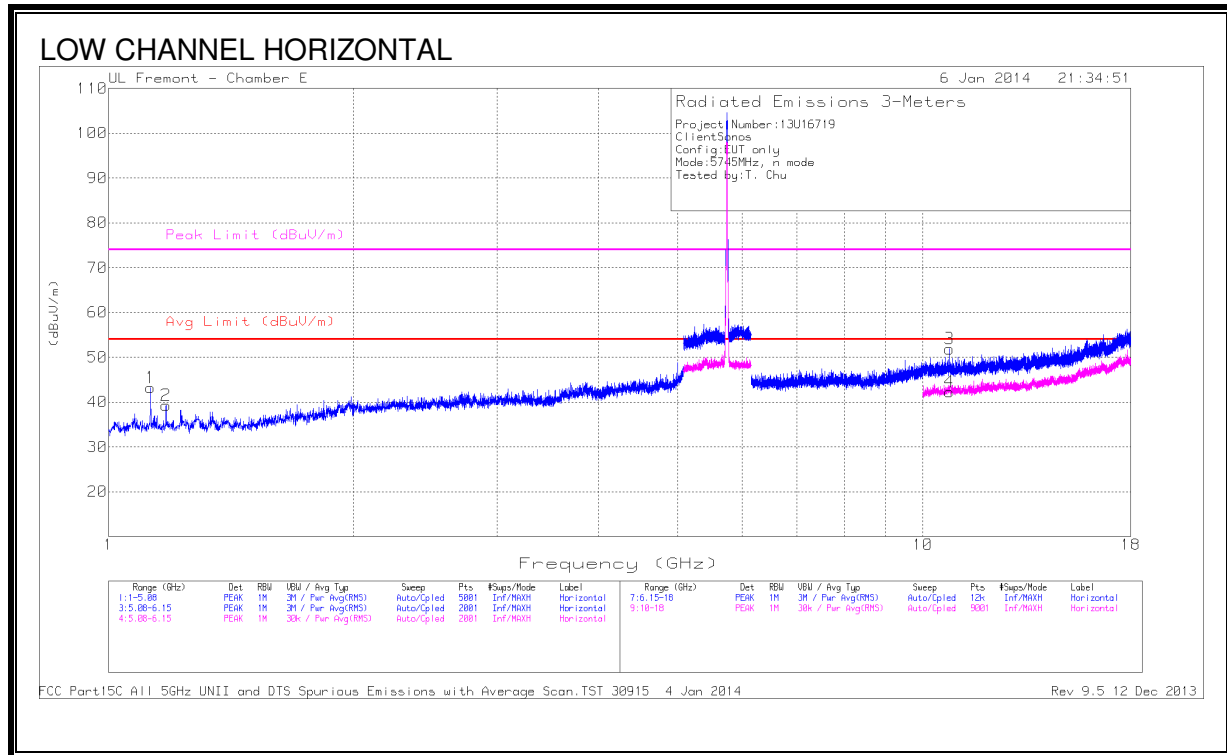
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements.

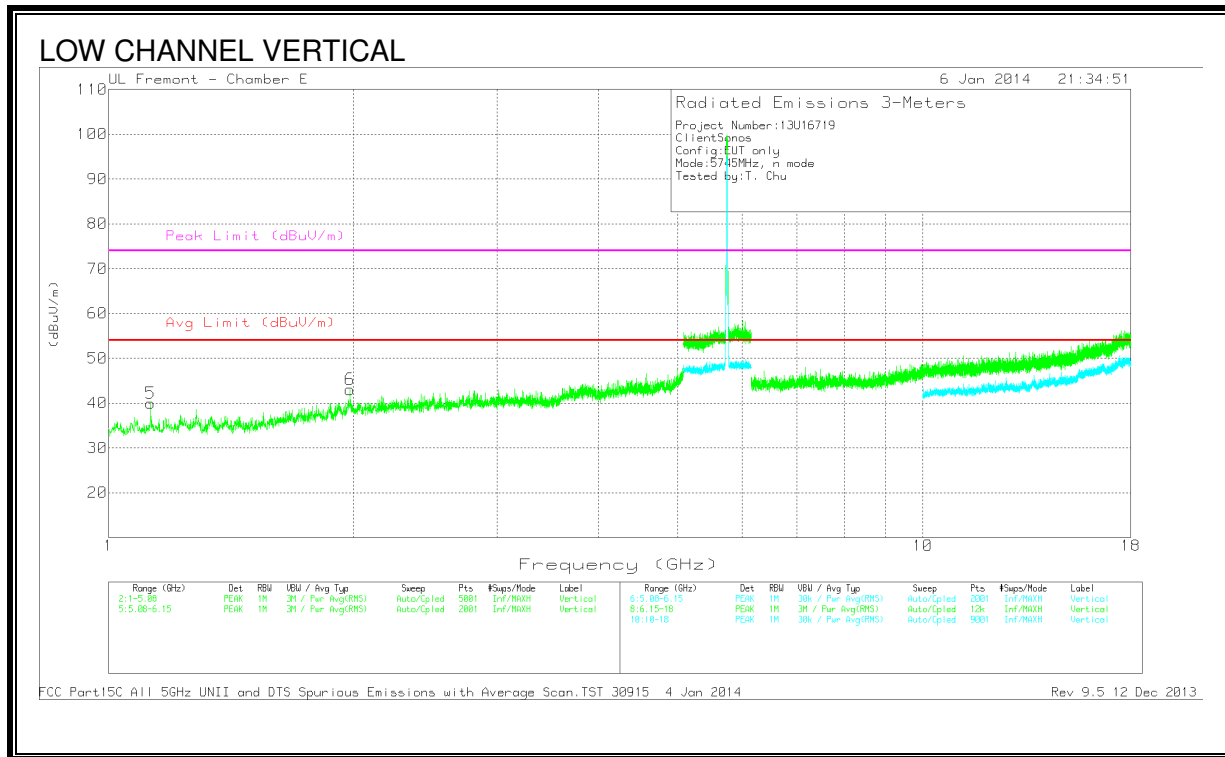
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

9.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS





Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/5 GHz LPF	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.126	49.53	PK	28.7	-35	43.23	-	-	74	-30.77	0-360	99	H
2	* 1.176	45.6	PK	28.9	-35.2	39.3	-	-	74	-34.7	0-360	199	H
3	* 10.78	37.68	PK	38.5	-24.3	51.88	-	-	74	-22.12	0-360	199	H
4	* 10.78	28.1	Avg	38.5	-24.3	42.3	54	-11.7	-	-	0-360	199	H
5	* 1.126	46.26	PK	28.7	-35	39.96	-	-	74	-34.04	0-360	101	V
6	1.978	43.75	PK	32	-32.7	43.05	-	-	68.2	-25.15	0-360	101	V

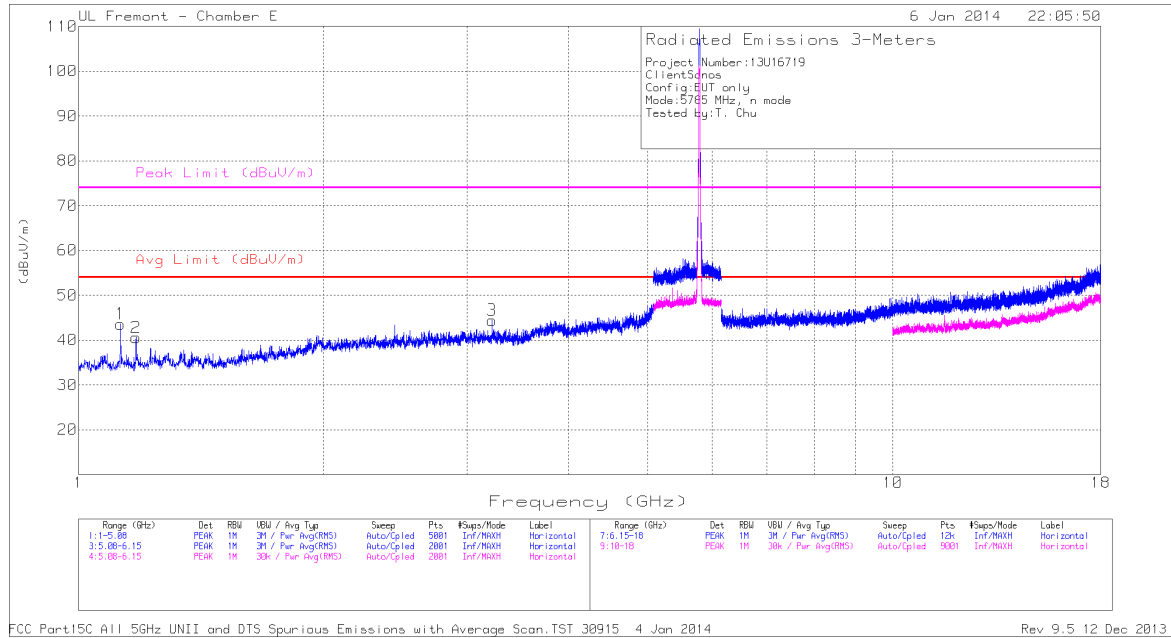
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

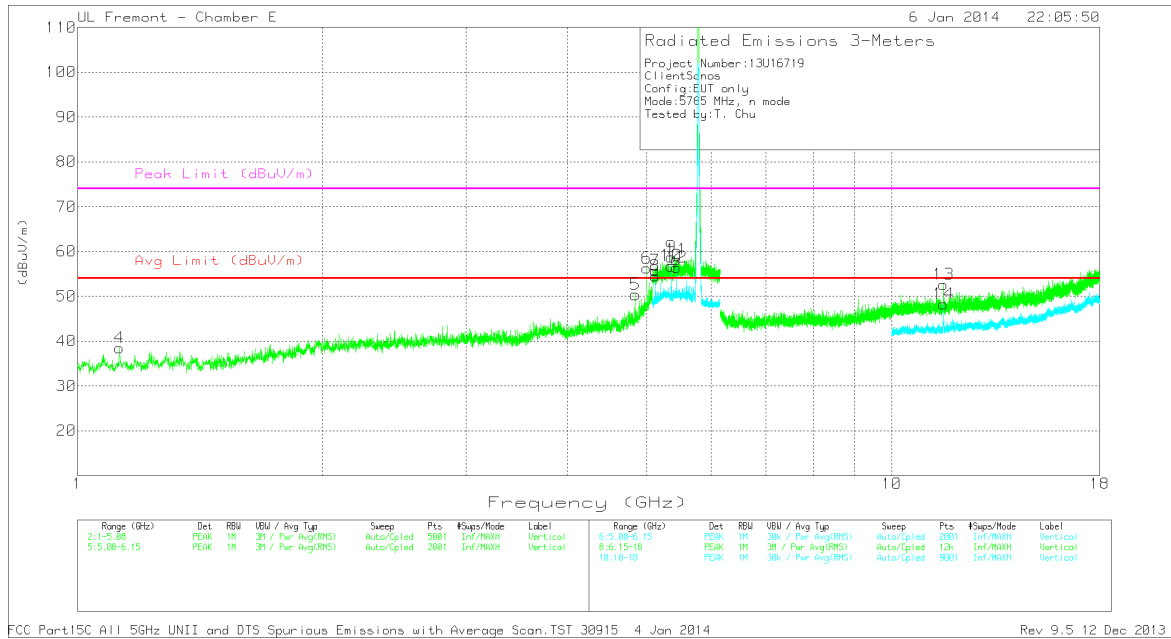
Avg - Video bandwidth < Resolution bandwidth

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MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/5 GHz LPF	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.126	49.9	PK	28.7	-35	43.6	-	-	74	-30.4	0-360	101	H
2	* 1.176	46.88	PK	28.9	-35.2	40.58	-	-	74	-33.42	0-360	101	H
3	3.22	43.1	PK	33.4	-32.1	44.4	-	-	68.2	-23.8	0-360	199	H
4	* 1.126	44.82	PK	28.7	-35	38.52	-	-	74	-35.48	0-360	200	V
5	* 4.841	46.29	PK	34.4	-30.3	50.39	-	-	74	-23.61	0-360	200	V
	* 4.84	34.8	AD1	34.4	-30.3	38.9	54	-15.1	-	-	8	111	V
6	* 5.001	51.02	PK	34.4	-29.1	56.32	-	-	74	-17.68	0-360	101	V
	*5.001	43.01	AD1	34.4	-29.1	48.31	54	-5.69	-	-	193	277	V
7	* 5.12	42.9	PK	34.5	-21.6	55.8	-	-	74	-18.2	0-360	101	V
8	* 5.12	36.62	AD1	34.5	-21.6	49.52	54	-4.48	-	-	339	206	V
9	* 5.361	45.77	PK	34.7	-21.7	58.77	-	-	74	-15.23	0-360	199	V
10	* 5.36	36.2	AD1	34.7	-21.7	49.2	54	-4.8	-	-	4	218	V
11	* 5.441	44.85	PK	34.8	-21.4	58.25	-	-	74	-15.75	0-360	199	V
12	* 5.44	35.65	AD1	34.8	-21.4	49.05	54	-4.95	-	-	4	232	V
13	* 11.57	39.27	PK	38.7	-25.3	52.67	-	-	74	-21.33	0-360	101	V
14	*11.570	31.14	AD1	38.7	-25.3	44.54	54	-9.46	-	-	271	315	V

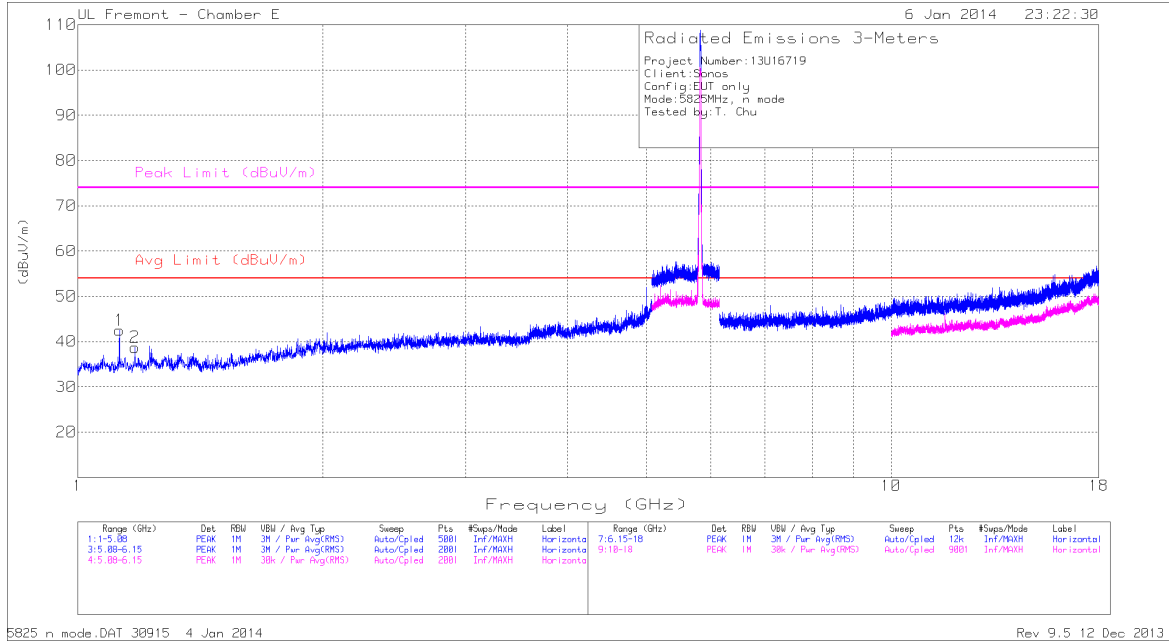
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

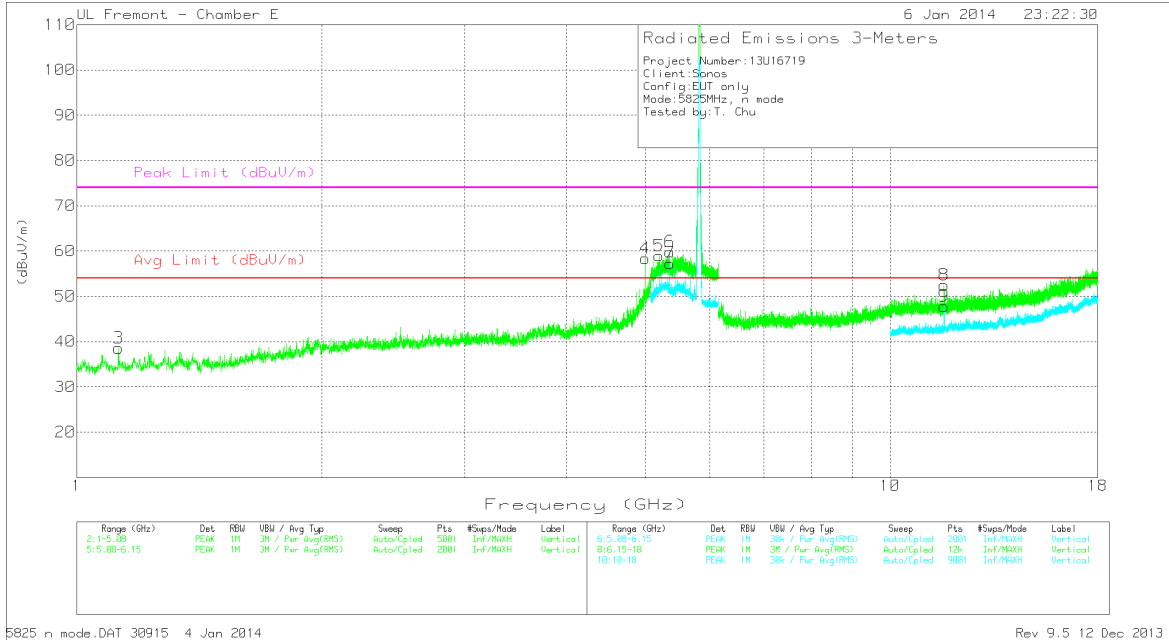
Avg - Video bandwidth < Resolution bandwidth

FCC Part15C All 5GHz UNII and DTS Spurious Emissions with Average Scan.TST 30915 4 Jan 2014 Rev 9.5 12 Dec 2013

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/5 GHz LPF	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.126	48.81	PK	28.7	-35	42.51	-	-	74	-31.49	0-360	199	H
2	* 1.176	45.04	PK	28.9	-35.2	38.74	-	-	74	-35.26	0-360	101	H
3	* 1.126	44.9	PK	28.7	-35	38.6	-	-	74	-35.4	0-360	101	V
4	* 5.001	53.09	PK	34.4	-29.1	58.39	-	-	74	-15.61	0-360	101	V
5	5.2	45.68	PK	34.6	-21.3	58.98	-	-	68.2	-9.22	0-360	101	V
6	* 5.361	46.81	PK	34.7	-21.7	59.81	-	-	74	-14.19	0-360	199	V
7	*5.36	37.03	AD1	34.7	-21.7	50.03	54	-3.97	-	-	137	200	V
8	* 11.65	38.62	PK	38.8	-24.9	52.52	-	-	74	-21.48	0-360	200	V
	*11.65	32.77	AD1	38.8	-24.9	46.67	54	-7.33	-	-	179	150	V

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

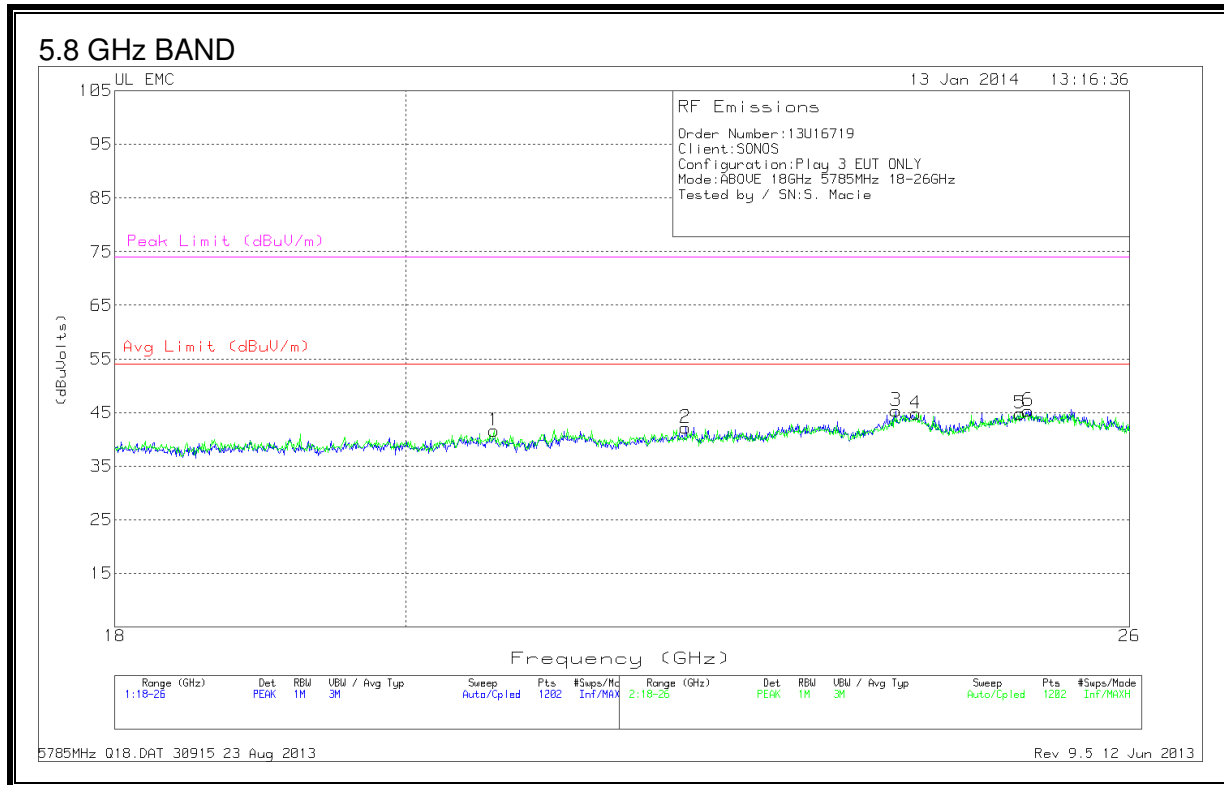
PK - Peak detector

Avg - Video bandwidth < Resolution bandwidth

FCC Part15C All 5GHz UNII and DTS Spurious Emissions with Average Scan.TST 30915 4 Jan 2014 Rev 9.5 12 Dec 2013

9.3. WORST-CASE ABOVE 18 GHz

SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL)



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T89 (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	20.651	41.67	PK	32.9	-23.4	-9.5	41.7	54	-12.3	74	-32.3
2	22.137	41.77	PK	33.3	-23.4	-9.5	42.2	54	-11.8	74	-31.8
3	23.888	43.93	PK	33.6	-22.7	-9.5	45.3	54	-8.7	74	-28.7
4	24.062	43.33	PK	33.6	-22.6	-9.5	44.8	54	-9.2	74	-29.2
5	24.988	43.23	PK	34	-22.9	-9.5	44.8	54	-9.2	74	-29.2
6	25.061	43.43	PK	34	-22.6	-9.5	45.3	54	-8.7	74	-28.7

PK - Peak detector

SPURIOUS EMISSIONS 26 TO 40 GHz (WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL)



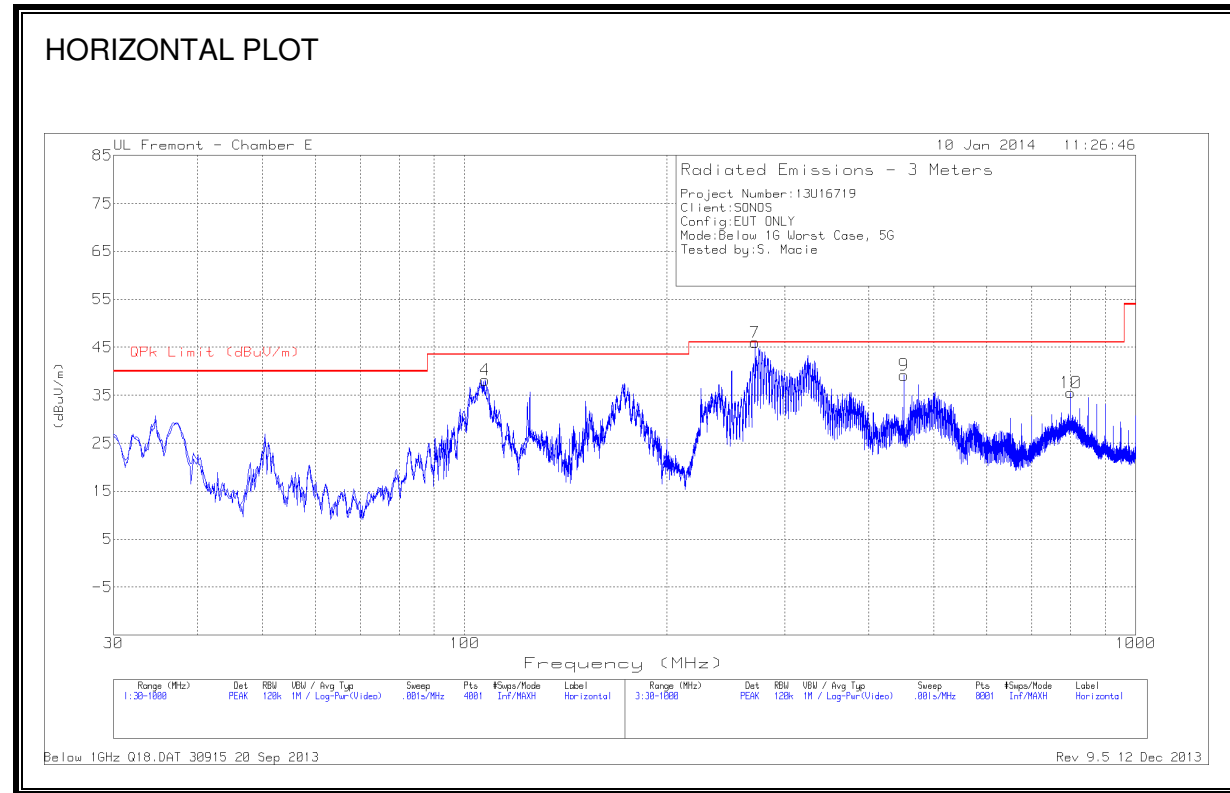
DATA

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	30.304	47.83	PK	35.9	-35.9	-9.5	38.3	54	-15.7	74	-35.7
2	32.441	46.97	PK	36.2	-36	-9.5	37.7	54	-16.3	74	-36.3
3	33.777	48.53	PK	36.8	-36.5	-9.5	39.3	54	-14.7	74	-34.7
4	35.385	49.1	PK	37.8	-37.9	-9.5	39.5	54	-14.5	74	-34.5
5	39.386	49.07	PK	37.9	-35.8	-9.5	41.7	54	-12.3	74	-32.3
6	39.596	49.13	PK	37.3	-35.6	-9.5	41.3	54	-12.7	74	-32.7

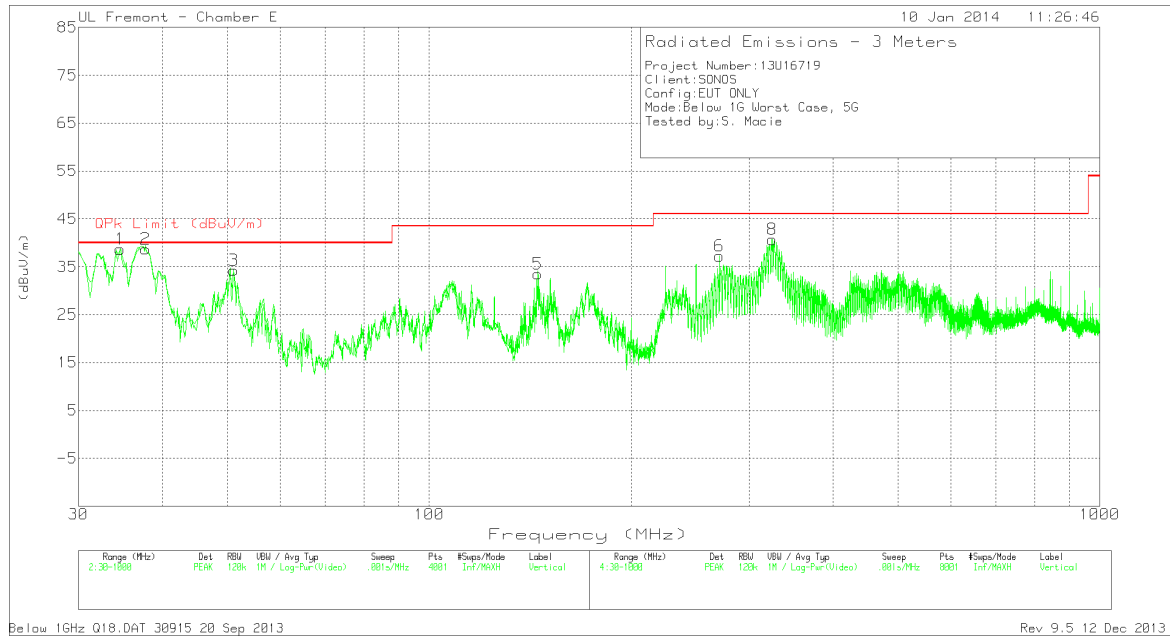
PK - Peak detector

9.4. WORST-CASE BELOW 1 GHz

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



VERTICAL PLOT



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T408 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	34.6075	48.38	PK	17.8	-27.5	38.68	-	-	0-360	100	V
	34.6075	43.76	QP	17.8	-27.5	34.06	40	-5.94	109	156	V
2	* 37.7600	51.31	PK	15.6	-27.5	39.41	-	-	0-360	100	V
	37.7600	47.77	QP	15.6	-27.5	35.87	40	-4.13	122	102	V
3	51.0975	54.51	PK	7.6	-27.6	34.51	-	-	0-360	100	V
	51.0975	49.93	QP	7.6	-27.6	29.93	40	-10.07	147	110	V
4	107.3575	54.27	PK	12	-28.1	38.17	-	-	0-360	300	H
	107.3575	50.46	QP	12	-28.1	34.36	43.52	-9.16	55	280	H
5	145.1875	48.78	PK	12.5	-27.1	34.18	43.52	-9.34	0-360	100	V
6	* 270.9238	50.87	PK	13.1	-26.7	37.27	46.02	-8.75	0-360	200	V
7	* 271.0450	59.5	PK	13.1	-26.6	46.00	-	-	0-360	101	H
	271.0450	54.42	QP	13.3	-26.4	41.32	46.02	-4.70	133	115	H
8	* 324.8800	53.9	PK	14	-27.2	40.7	-	-	0-360	100	V
	324.8800	49.2	QP	14	-27.2	36.00	46.02	-10.02	6	107	V
9	451.7075	49.63	PK	16.8	-27.5	38.93	46.02	-7.09	0-360	201	H
10	800.0588	39.73	PK	21.5	-25.7	35.53	46.02	-10.49	0-360	100	H

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

PK - Peak detector

QP – Quasi-Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

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

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

RESULTS

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

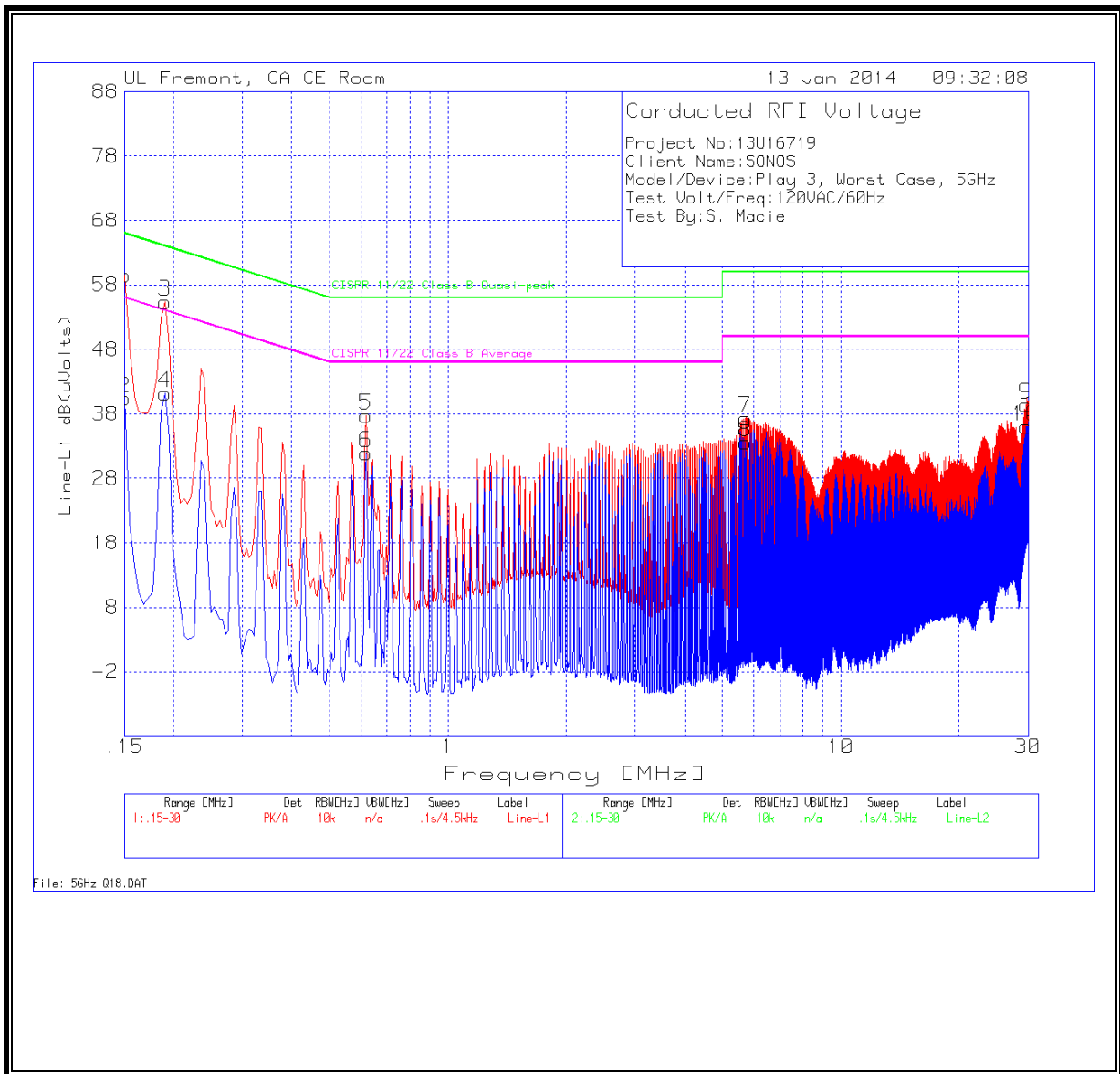
Trace Markers

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

