FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

2400 – 2483.5 MHZ TRANSCEIVER

MODEL NUMBER: A2530R24A AND A2530R24C*

FCC ID: X7J-A11113001
IC: 8975A-A11113001

REPORT NUMBER: 12U14281-2, Revision C

ISSUE DATE: APRIL 19, 2012

Prepared for
ANAREN, INC.
6635 KIRKVILLE ROAD
EAST SYRACUSE, NEW YORK 13057-9600, U.S.A.

Prepared by
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*For model differences, please refer to details under section 5.2

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/06/12	Initial Issue	F. Ibrahim
A	03/28/12	Revised EUT description. Corrected Table error on Section 5.7	A. Zaffar
B	04/09/12	Added 18-26 GHz horn antenna to test equipment list	F. Ibrahim
C	04/19/12	Updated section 5.3	F. Ibrahim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ANAREN, INC.
6635 KIRKVILLE ROAD
EAST SYRACUSE, NY 13057-9600, U.S.A.

EUT DESCRIPTION: 2400 – 2483.5 MHZ TRANSCEIVER

MODEL: A2530R24A and A2530R24C

SERIAL NUMBER: UNIT 1 and UNIT2

DATE TESTED: FEBRUARY 13-20, 2012

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

Compliance Certification Services (UL CCS) 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 CCS 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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 CCS By:

FRANK IBRAHIM
EMC SUPERVISOR
UL CCS

Tested By:

THANH NGUYEN
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, 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 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

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

4.3. 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 a 2.4 GHz transceiver that is manufactured by Anaren, Inc.

5.2. MANUFACTURER'S DESCRIPTION OF MODEL DIFFERENCES

A2530R24A and A2530R24C are Identical, except that A2530R24C has a U.FL connector, and A2530R24A has an integral printed antenna.

5.3. MAXIMUM OUTPUT POWER

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2403 – 2480	DSSS – OQPSK	2.23	1.67

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The Module A2530R24A utilizes a PCB antenna, with a maximum gain of 2 dBi.
The Module A2530R24C utilizes a Monopole antenna, with a maximum gain of 3 dBi.

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 1.0.00

The EUT driver software installed during testing was CC2530 FCC Test Software, Ver. 1.0

The test utility software used during testing was SmartRF Studio 7, rev. 1.7.0

5.6. WORST-CASE CONFIGURATION AND MODE

EUT is a portable device, therefore, an investigation of worst-case orientation was conducted and it was found the X orientation (flat on test card) is worst-case; final testing was performed with the EUT in X orientation.

Radiated emissions and power line conducted emissions were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The EUT has a single modulation, which is DSSS-OQPSK, and the data rate is 250 kB/s.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	IBM	T43 Think Pad	L3-B8983	DoC
Smart RF TrxEB	Texas Instrument	REV 1.5.0	0x03CC	N/A
Evaluation Board	Anaren, Inc.	A253XE24AXX	N/A	N/A

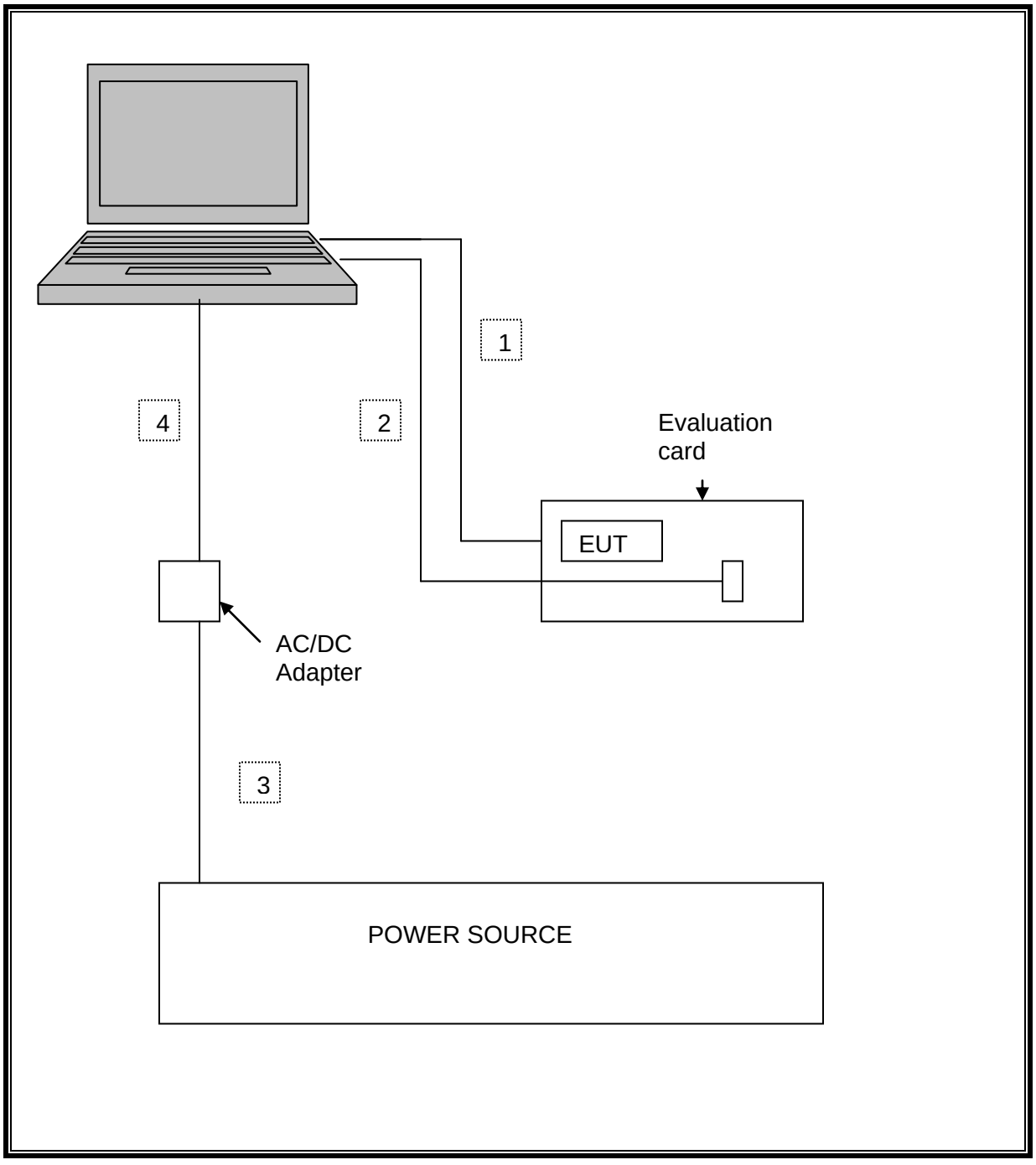
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	USB	1	USB	Shielded	1.5m	
2	6 Pin	1	TTl232R-3V3	Unshielded	1.5m	
3	AC	1	USA120V	Unshielded	1.5m	
4	DC	1	DC Plug	Unshielded	1.2m	

TEST SETUP

The EUT is installed in an Evaluation board connected to the laptop computer during the tests. 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 Date**	**Cal Due**
Preamplifier, 26.5 GHz	Agilent/HP	8449B	C01052	06/13/11	06/13/12
Preamplifier, 1300 MHz	Agilent/HP	8447D	C01048	07/16/11	07/16/12
BiLog Antenna	ETS	3117	C01005	07/25/11	07/25/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/26/11	06/26/12
PSA	Agilent	E4440A	T129	04/28/11	04/28/12
Power meter	Agilent	E4416A	PPM8	03/22/11	03/22/12
Power Sensor	Agilent	E9327A	T233	03/22/11	03/22/12
LISN 30 MHz	FCC	LISN-50/250-25-2	N02625	11/15/11	11/15/12
LISN, 10 kHz~30 MHz	Solar	8012-50-R-24-BNC	N02481	11/16/11	11/16/12
EM Test Receiver	R&S	ESC17	10000741	07/02/11	07/02/12
Antenna Horn 18-26GHz	ARA	MWH-1826/B	C00980	08/06/11	10/06/12

7. ANTENNA PORT TEST RESULTS

7.1. 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.

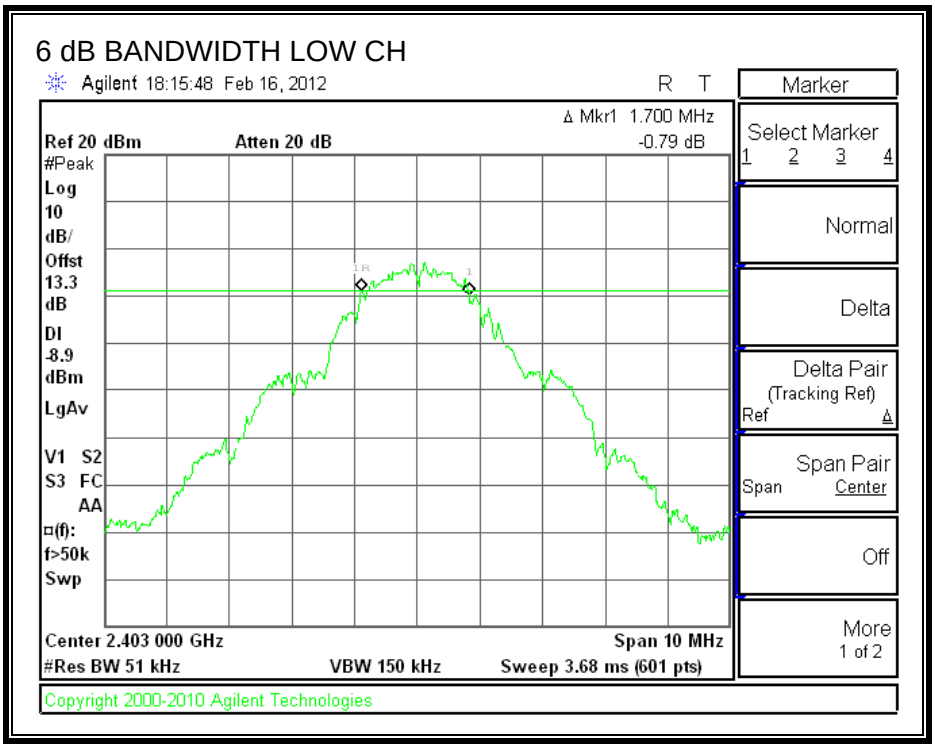
TEST PROCEDURE

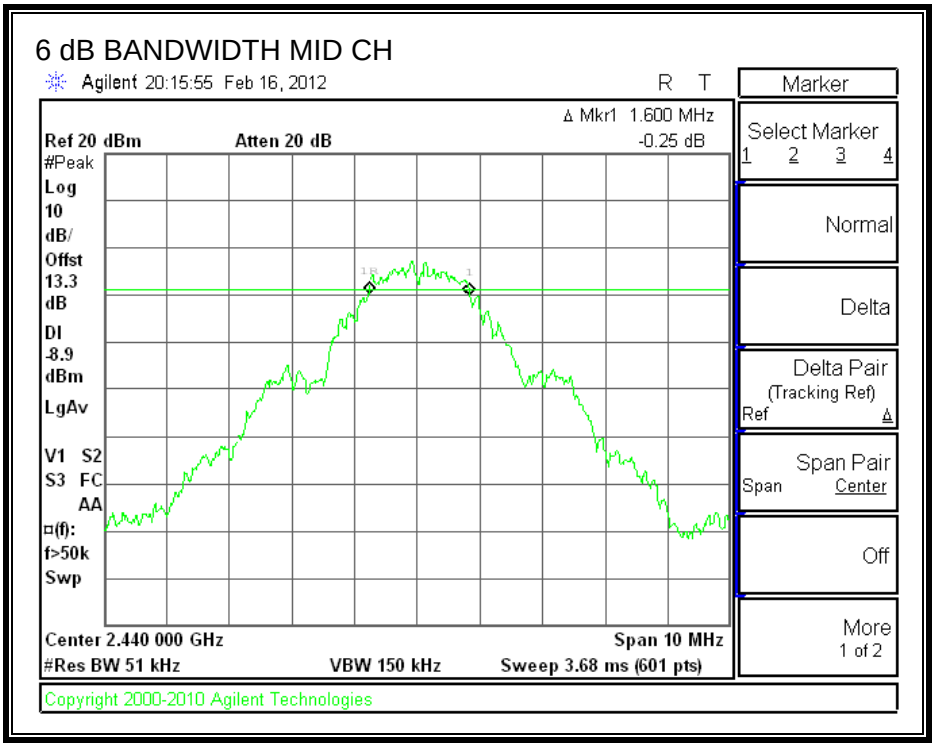
KDB 558074-D01; Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, dated 01/18/2012.

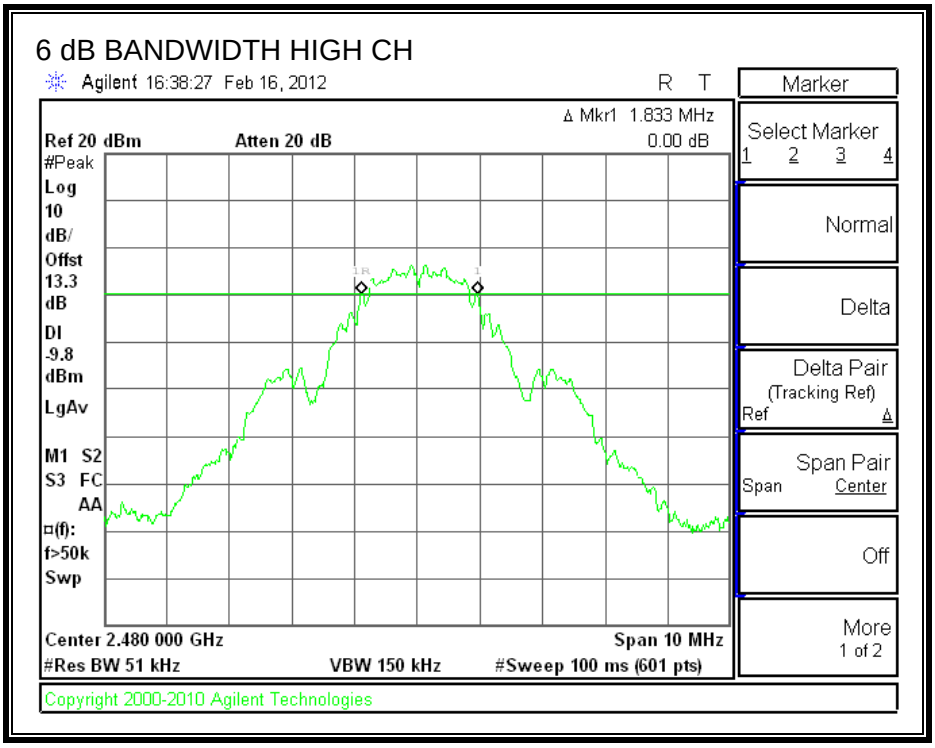
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2403	1.700	0.5
Middle	2440	1.600	0.5
High	2480	1.833	0.5

6 dB BANDWIDTH







7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

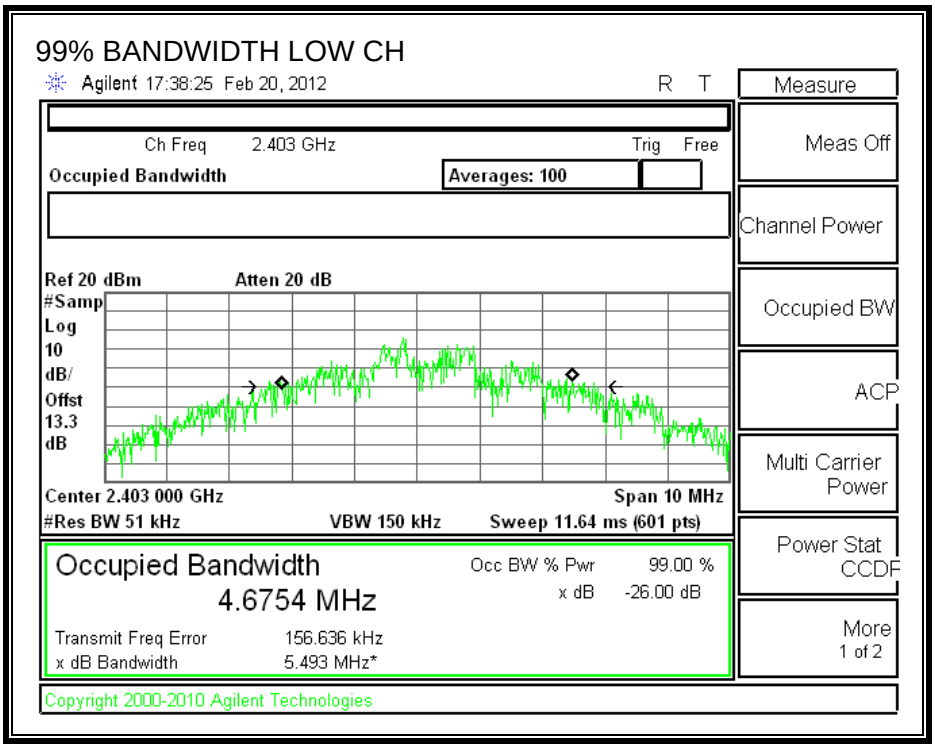
TEST PROCEDURE

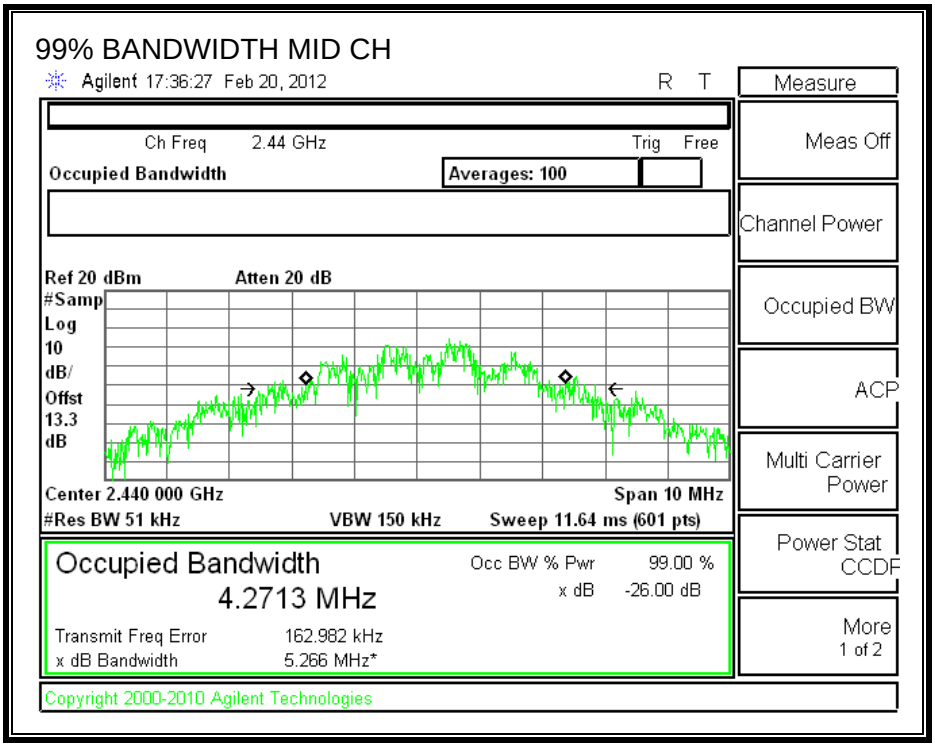
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

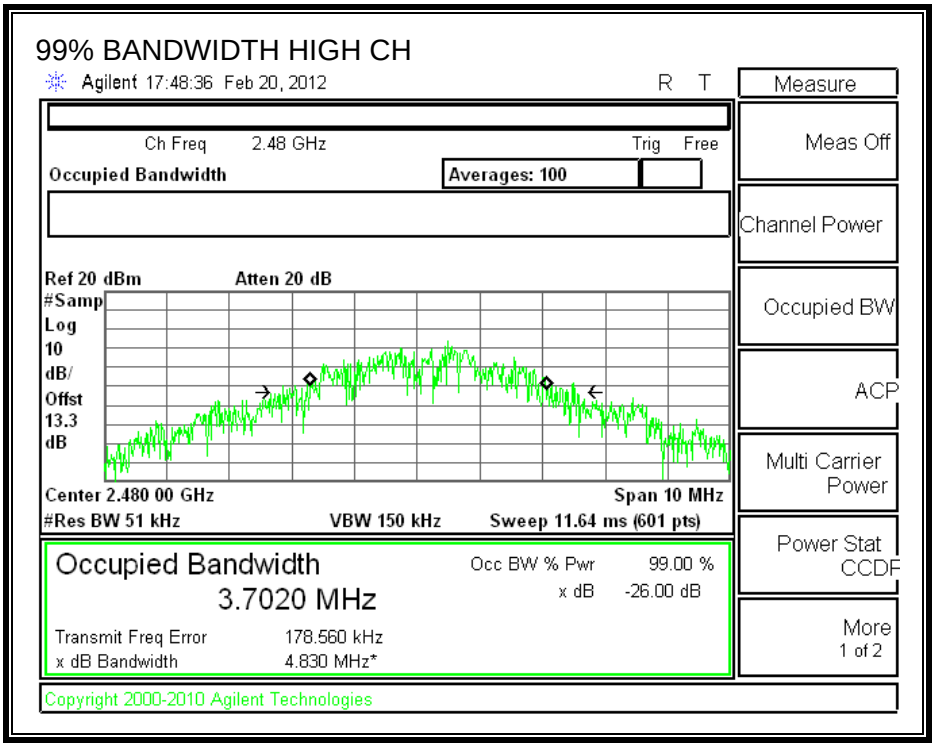
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2403	4.6754
Middle	2440	4.2713
High	2480	3.7020

99% BANDWIDTH







7.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

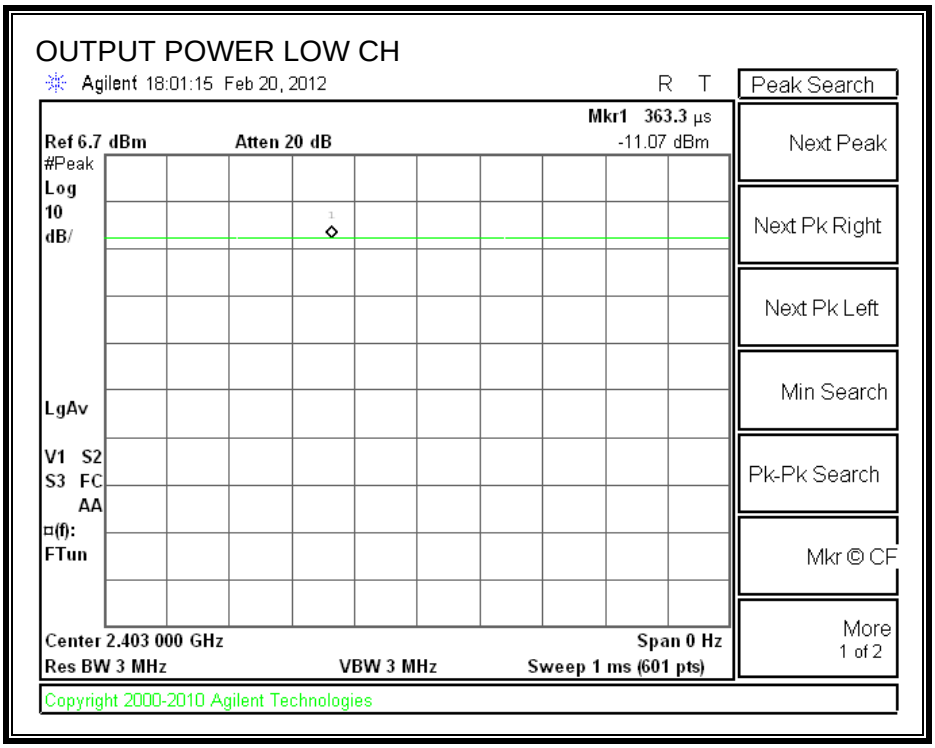
TEST PROCEDURE

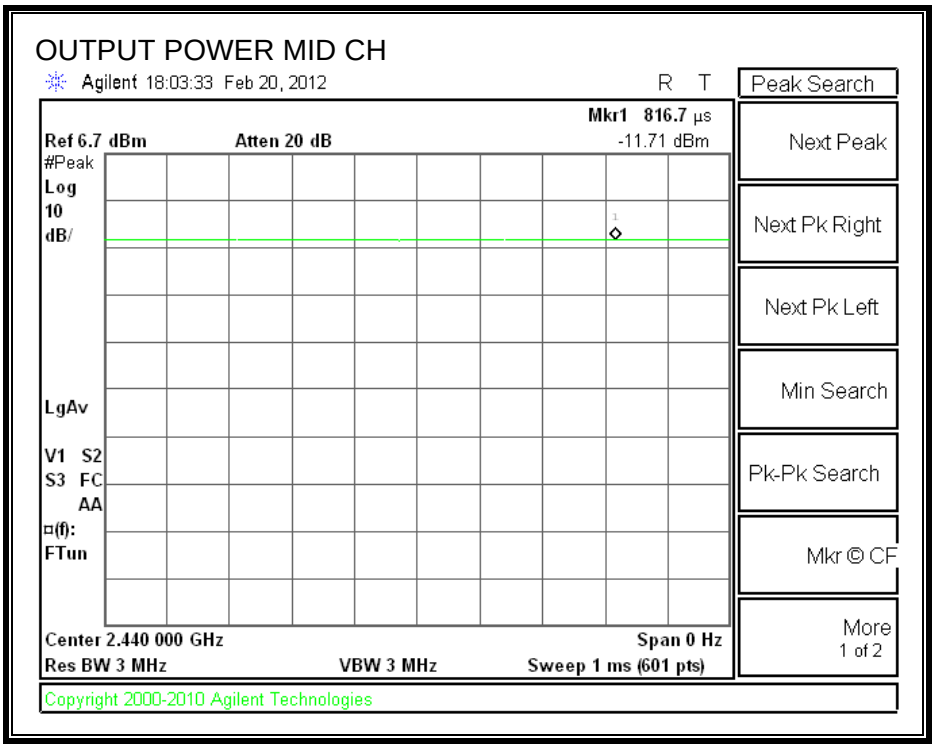
KDB 558074-D01; Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, dated 01/18/2012.

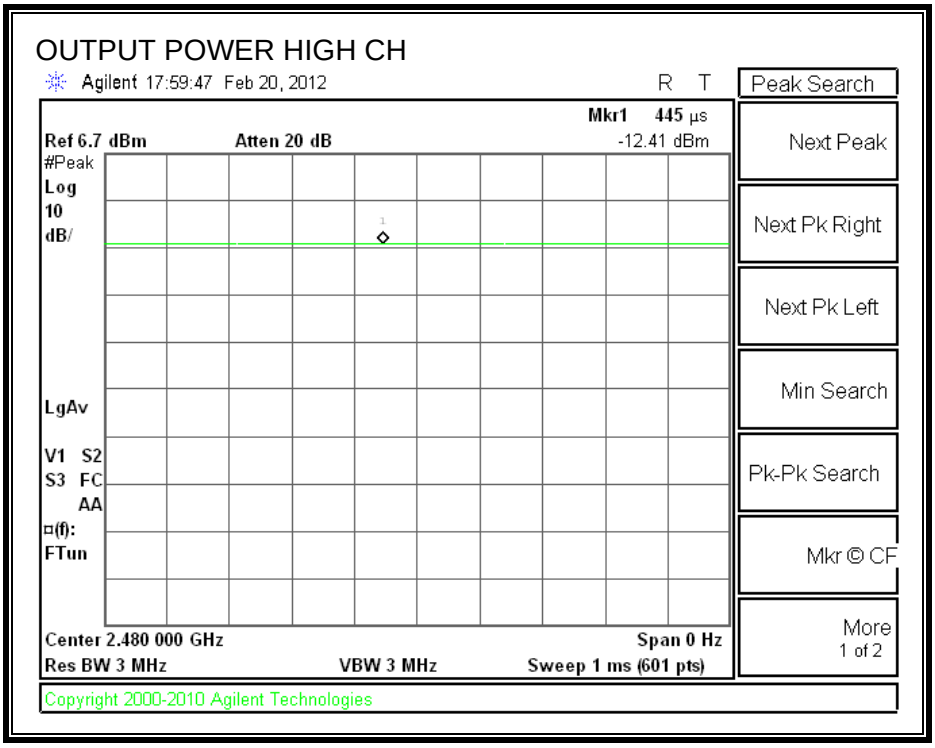
RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Attenuator and Cable Offset (dB)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2403	-11.07	13.3	2.23	30	-27.77
Middle	2440	-11.71	13.3	1.59	30	-28.41
High	2480	-12.41	13.3	0.89	30	-29.11

OUTPUT POWER







7.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 0.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	2403	1.75
Middle	2440	1.25
High	2480	0.72

7.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

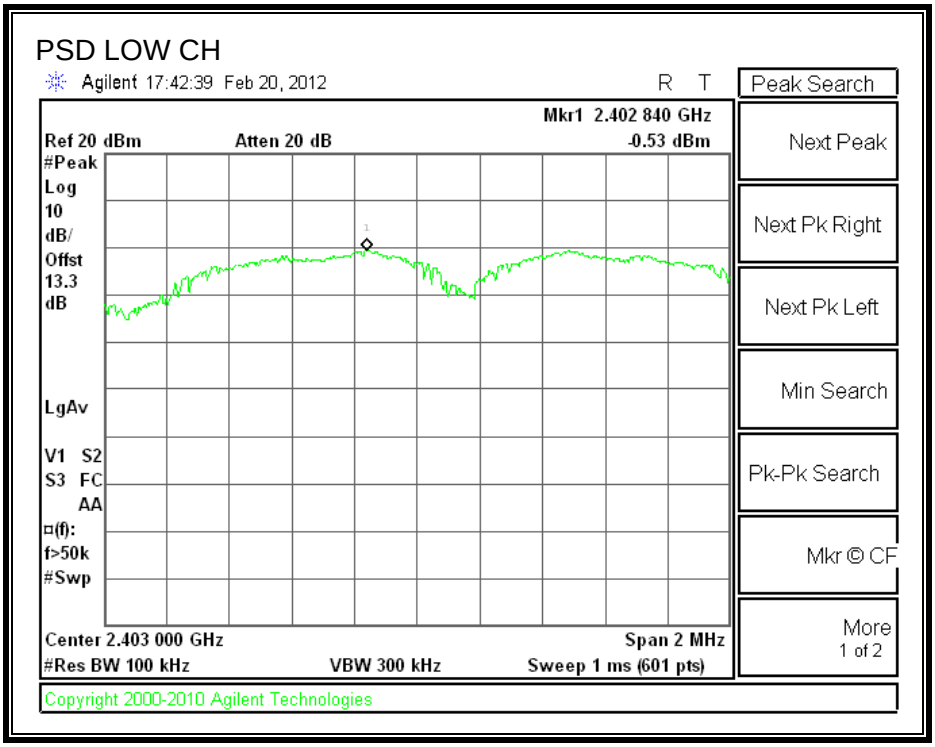
TEST PROCEDURE

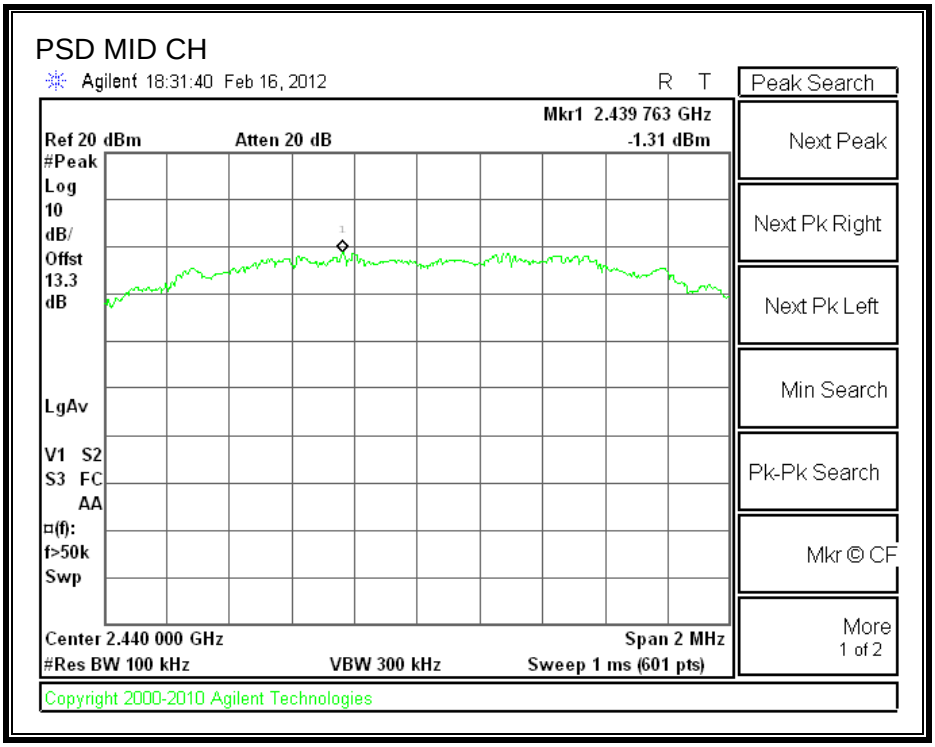
KDB 558074-D01; Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, dated 01/18/2012.

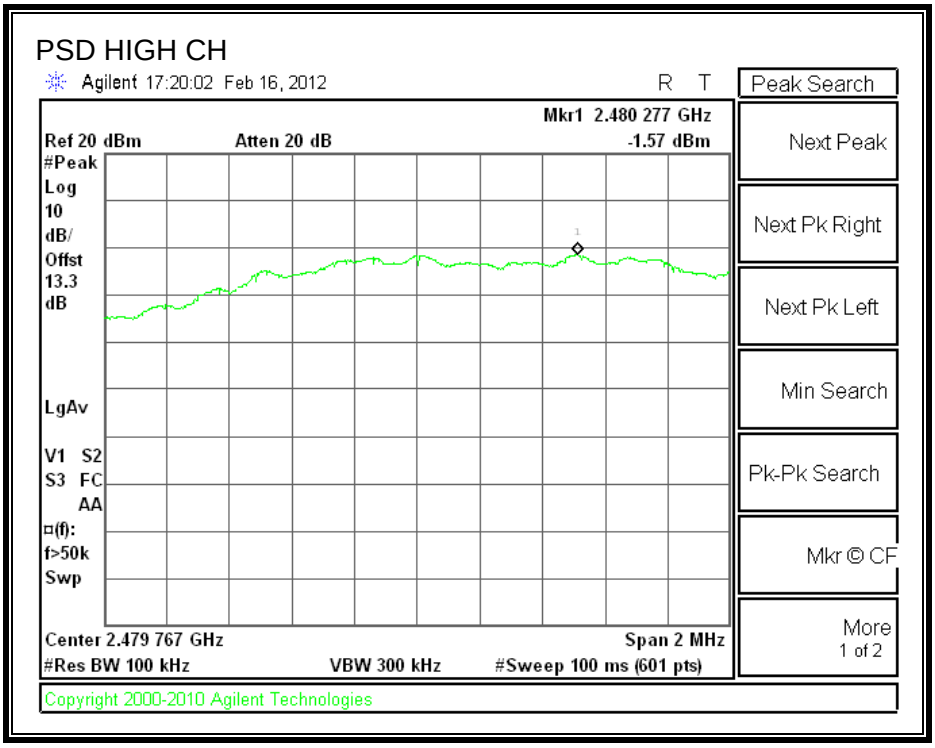
RESULTS

Channel	Frequency (MHz)	Meter Reading (dBm)	10log(3/100) (dB)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2403	-0.53	-15.20	-15.73	8	-23.73
Middle	2440	-1.31	-15.20	-16.51	8	-24.51
High	2480	-1.57	-15.20	-16.77	8	-24.77

POWER SPECTRAL DENSITY







7.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

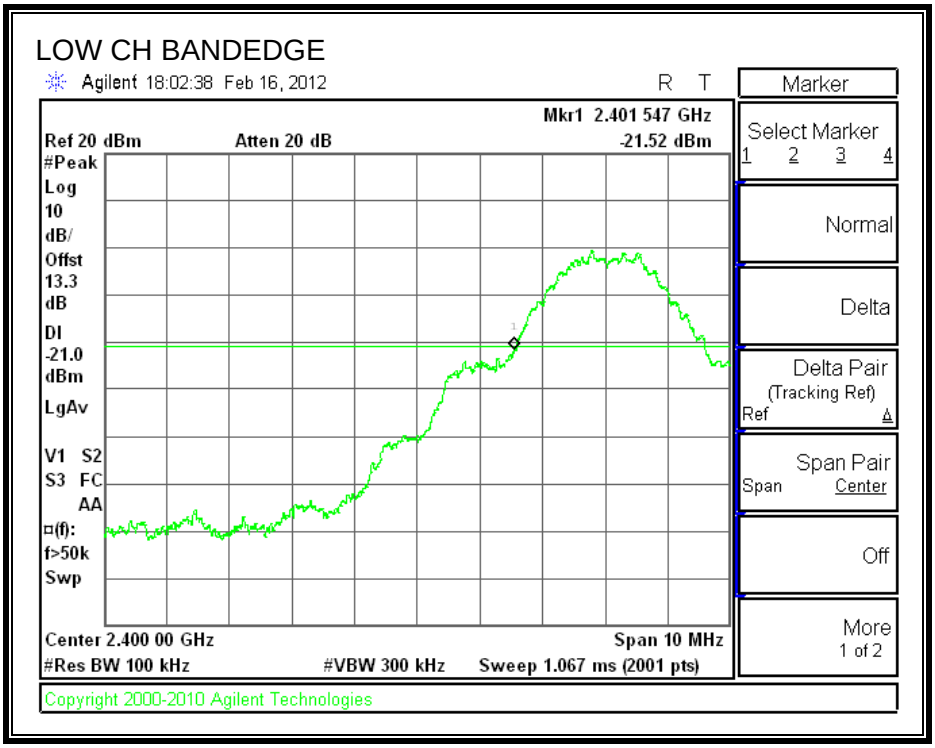
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

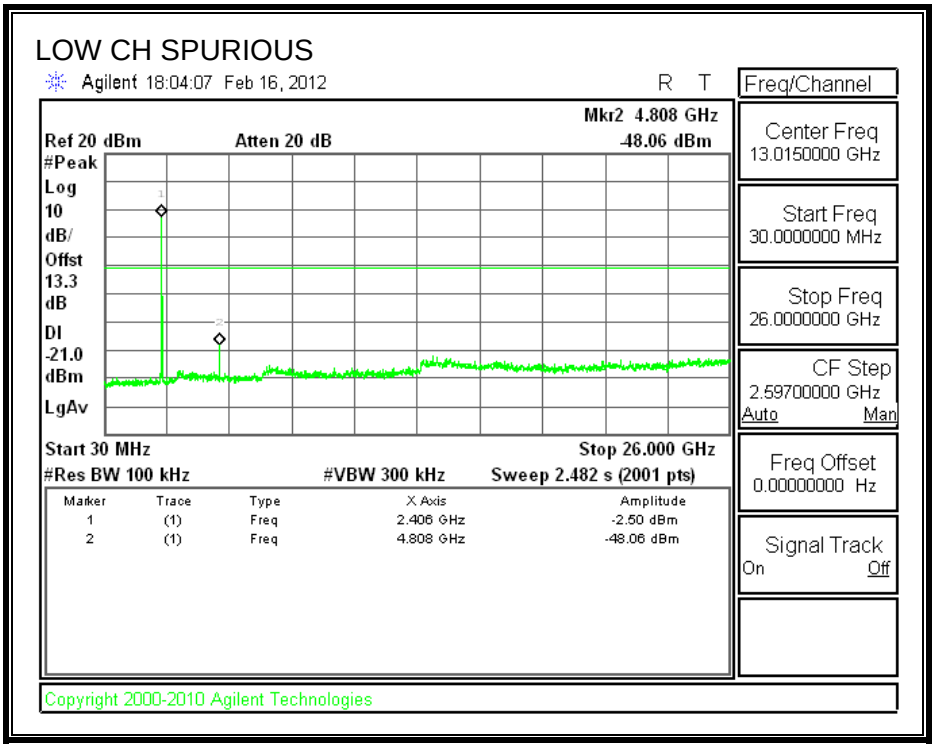
TEST PROCEDURE

KDB 558074-D01; Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, dated 01/18/2012.

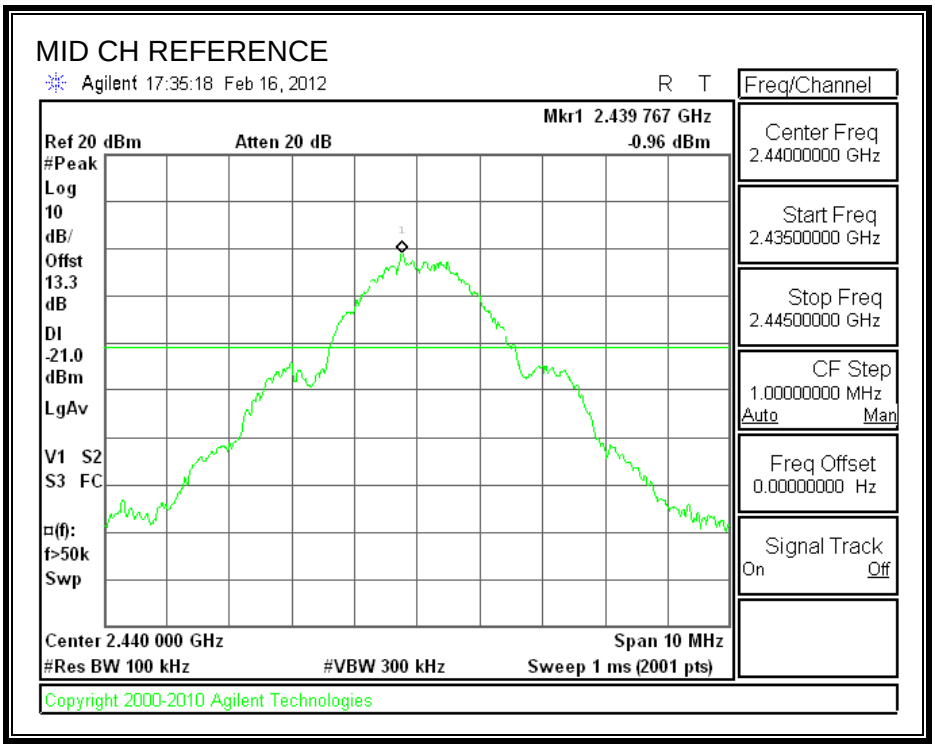
RESULTS

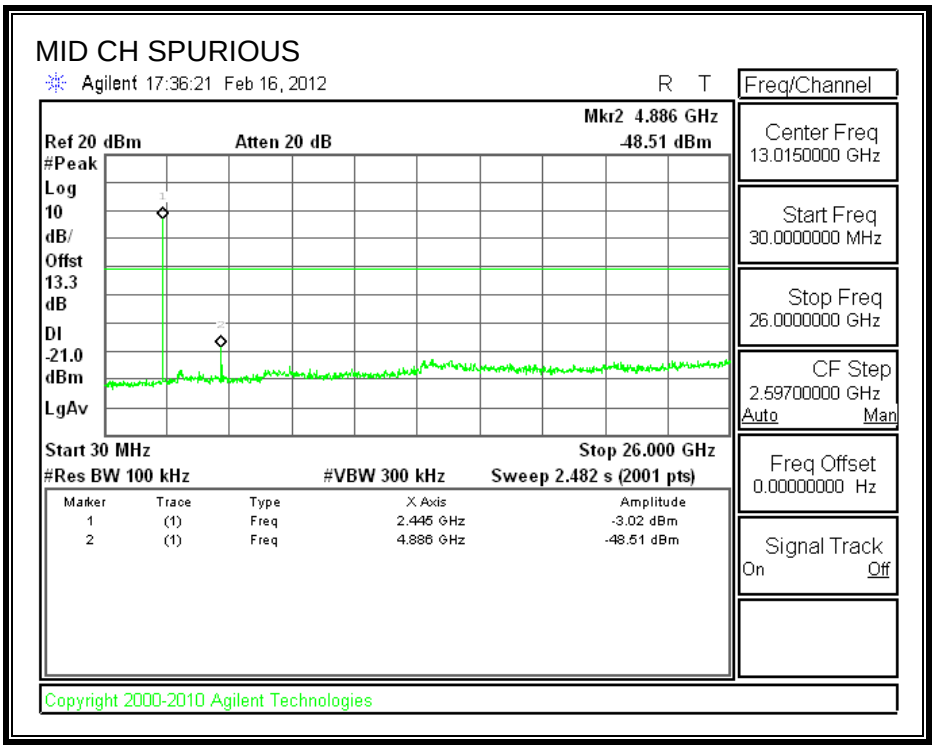
SPURIOUS EMISSIONS, LOW CHANNEL



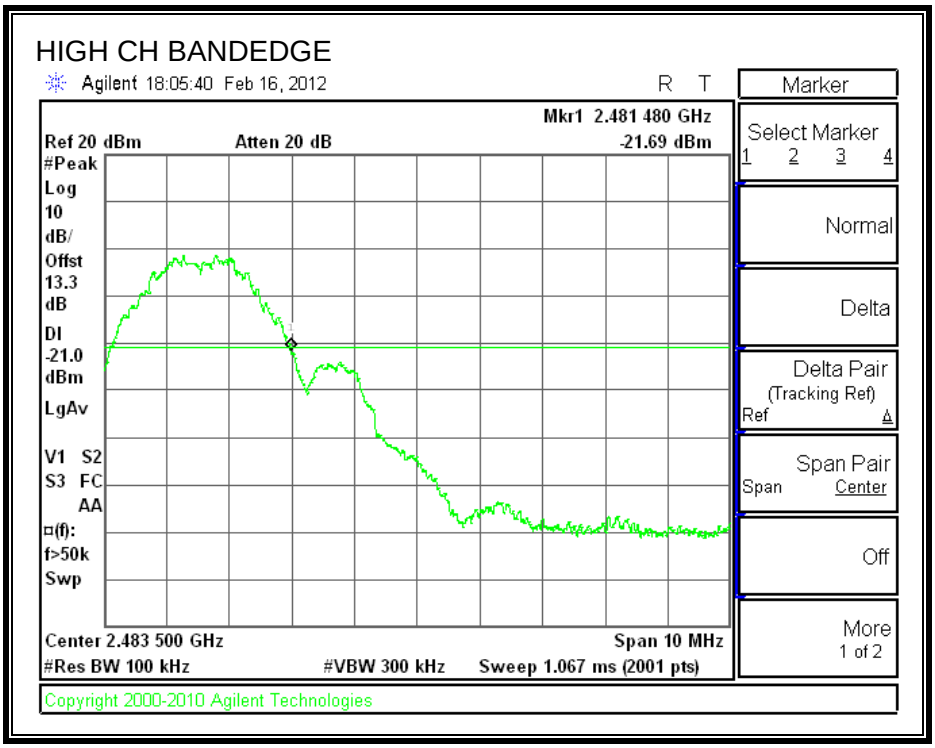


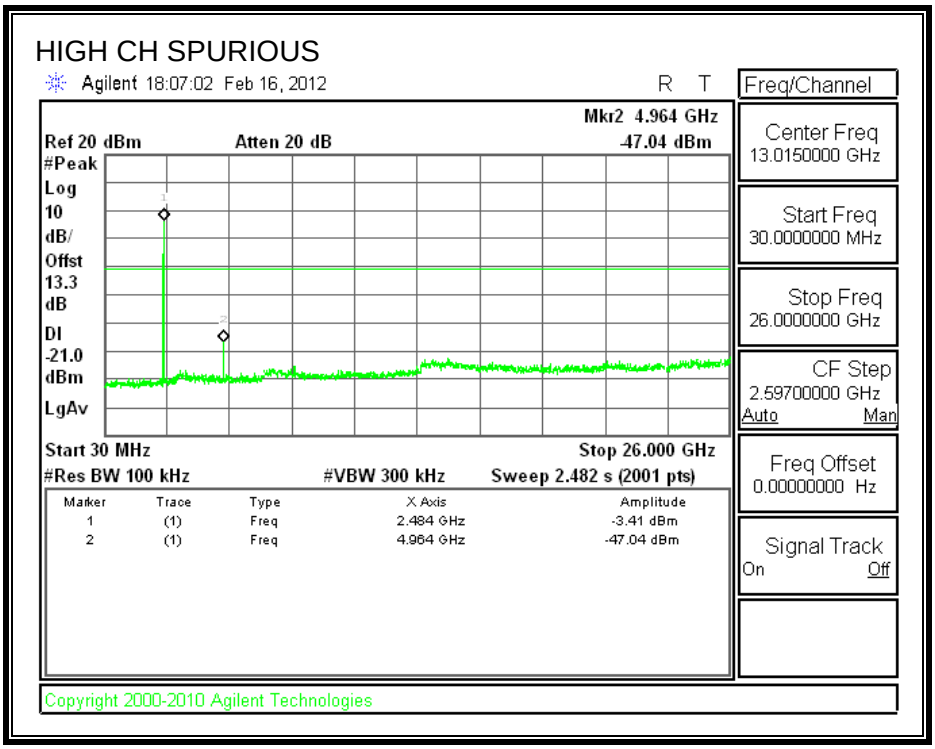
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





8. RADIATED TEST RESULTS

8.1. 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. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

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

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

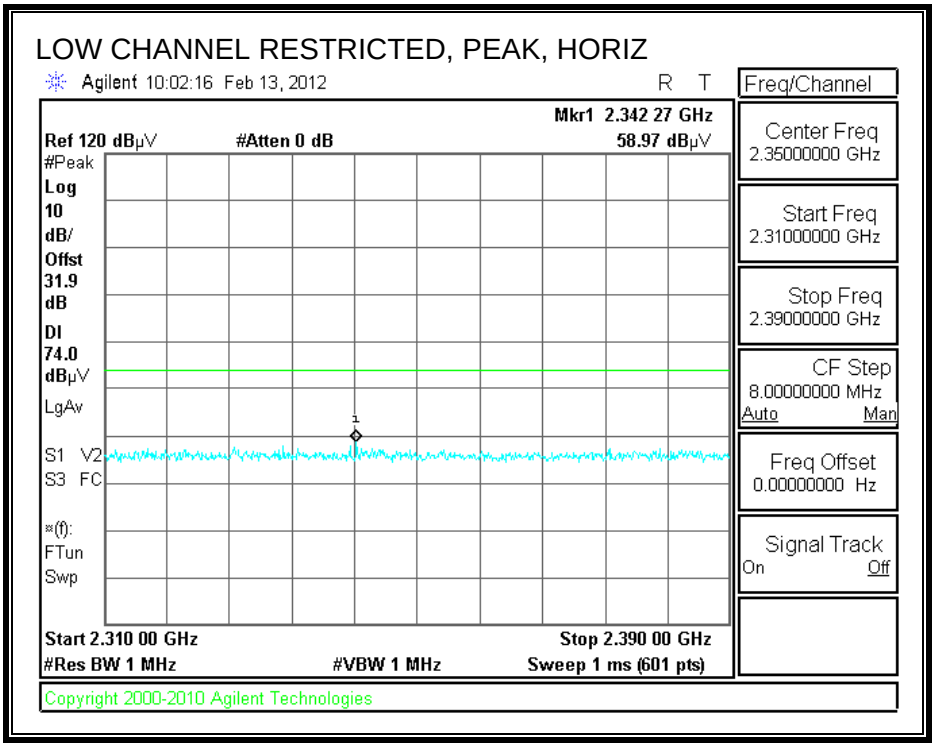
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

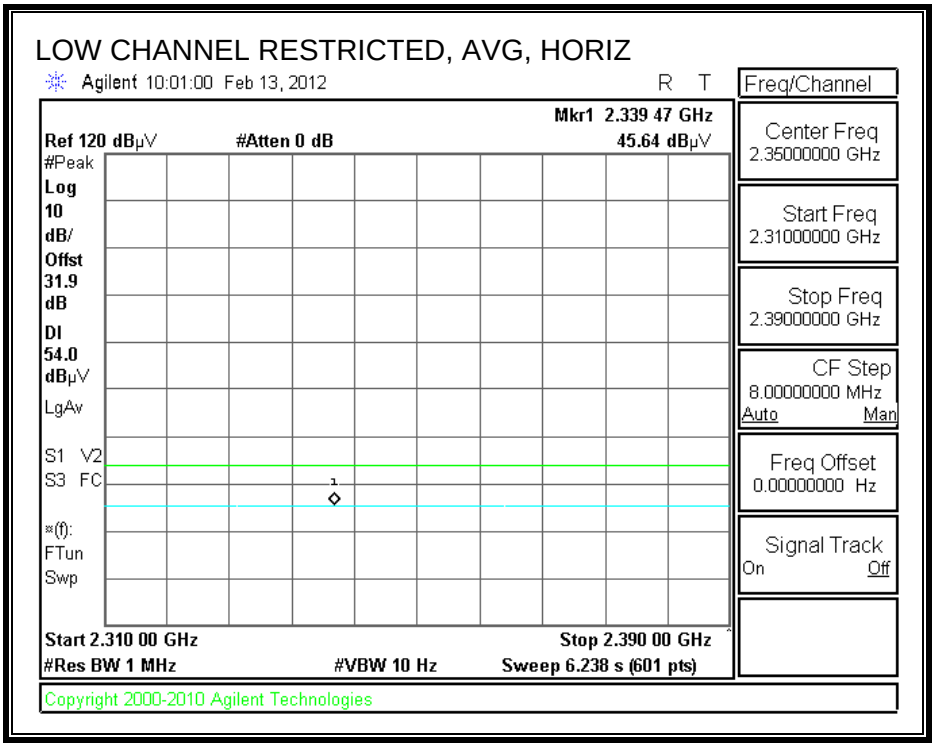
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

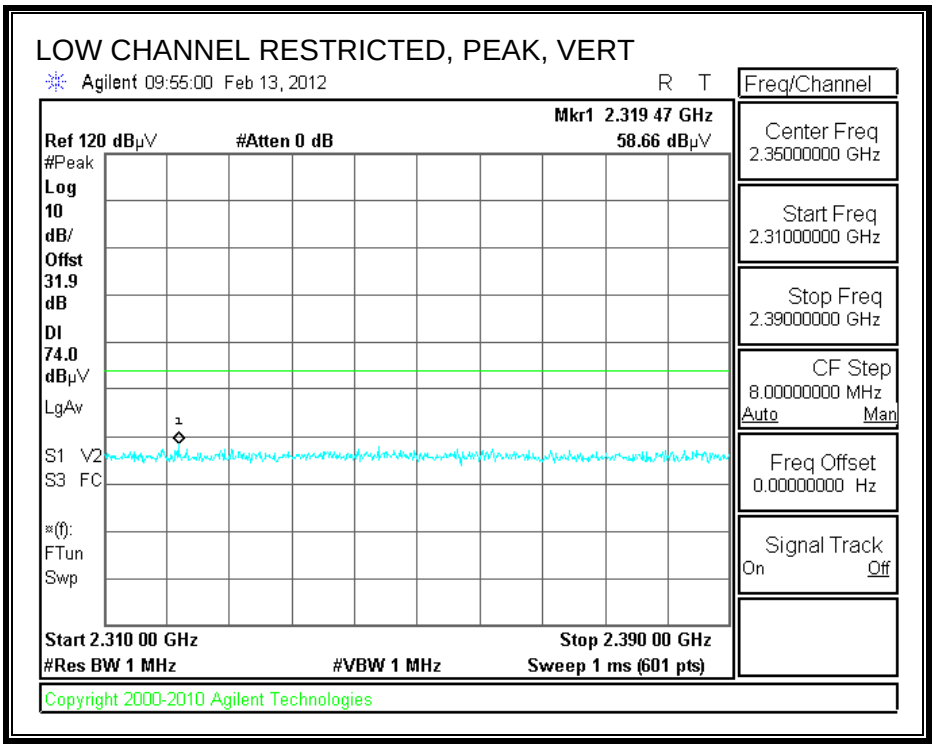
8.2.1. TX ABOVE 1 GHz IN THE 2.4 GHz BAND with PCB Antenna

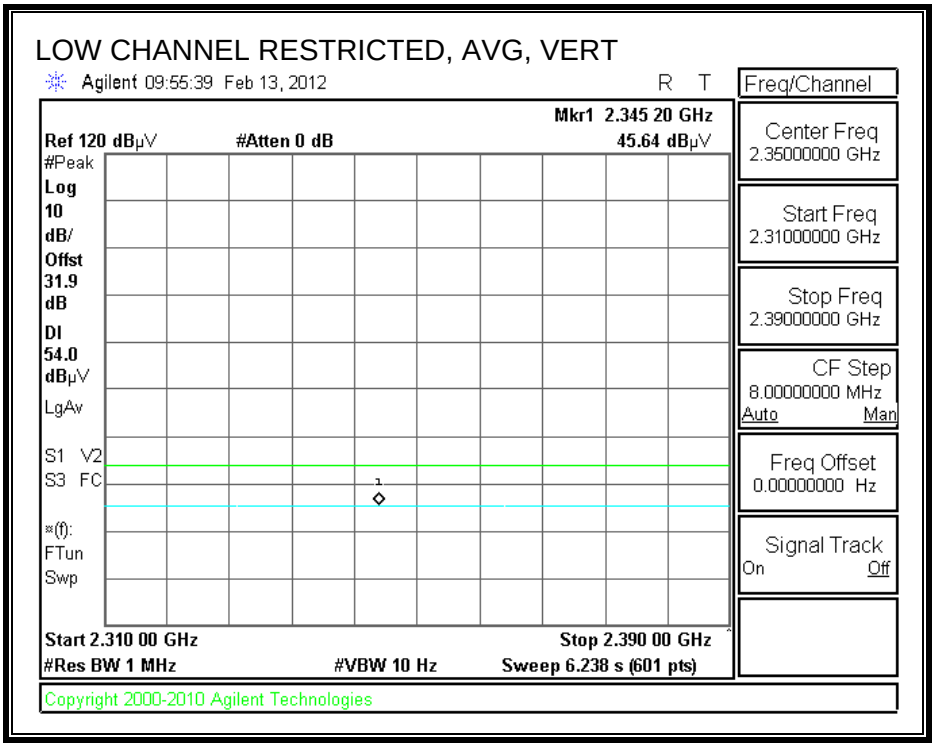
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL) PCB ANTENNA



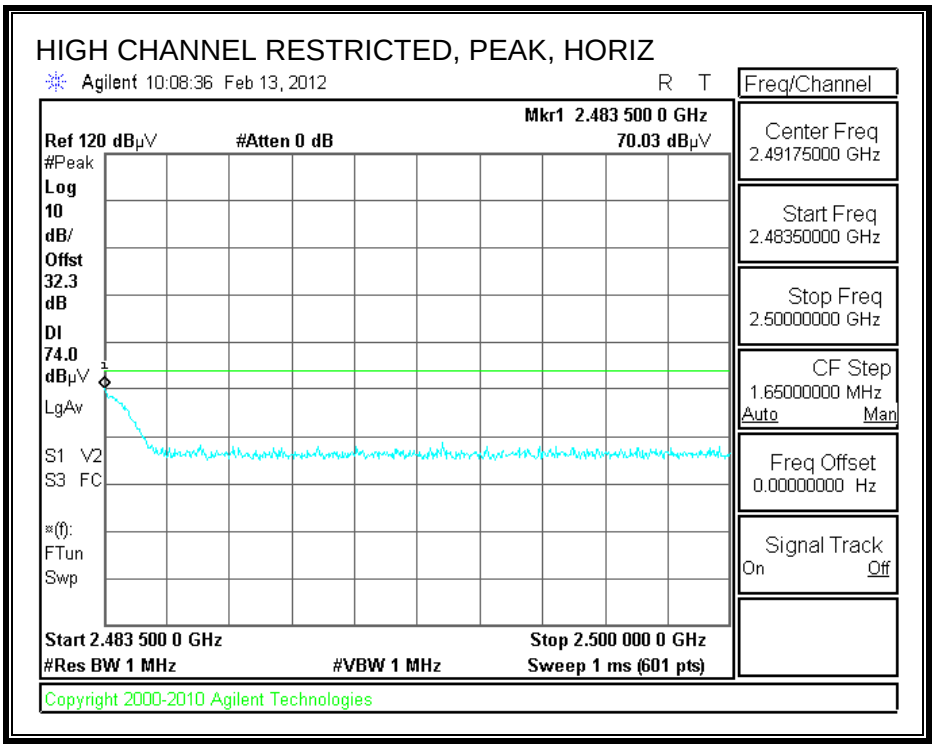


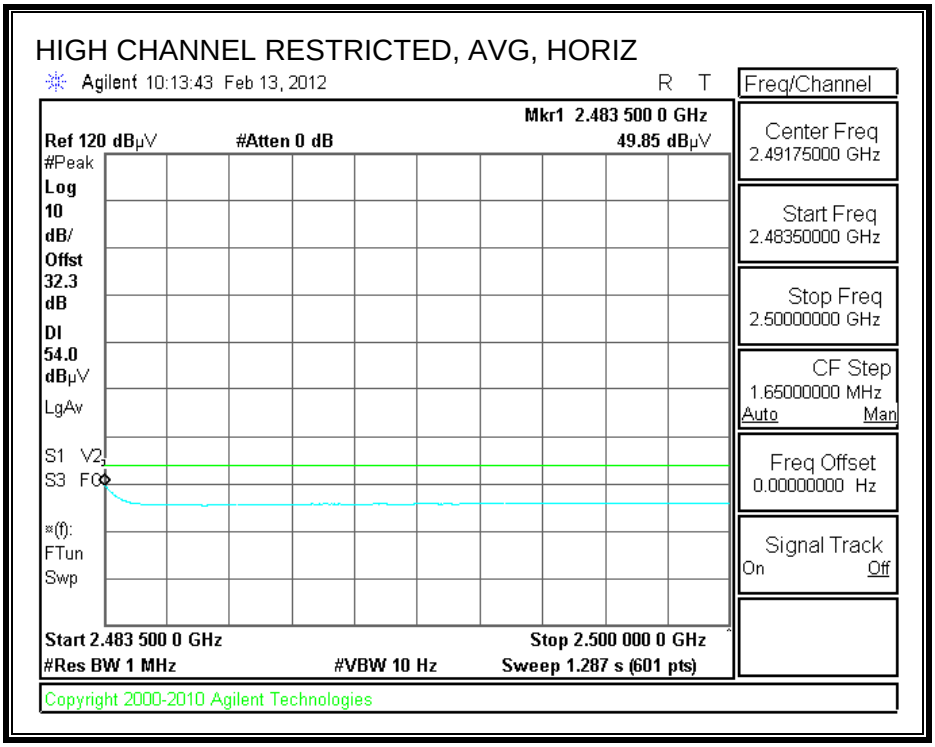
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



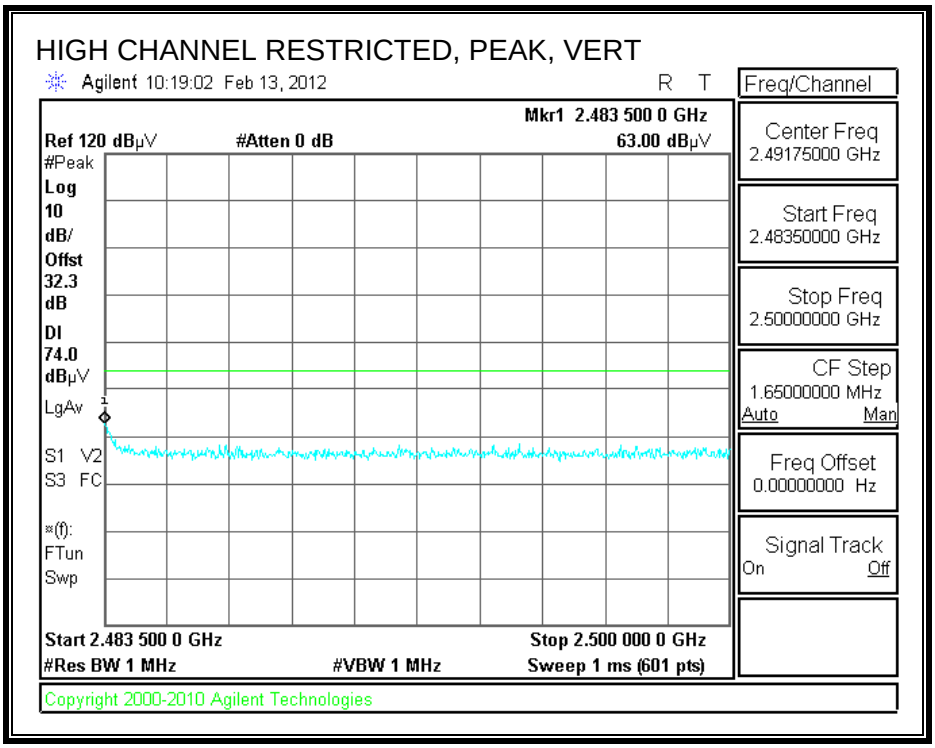


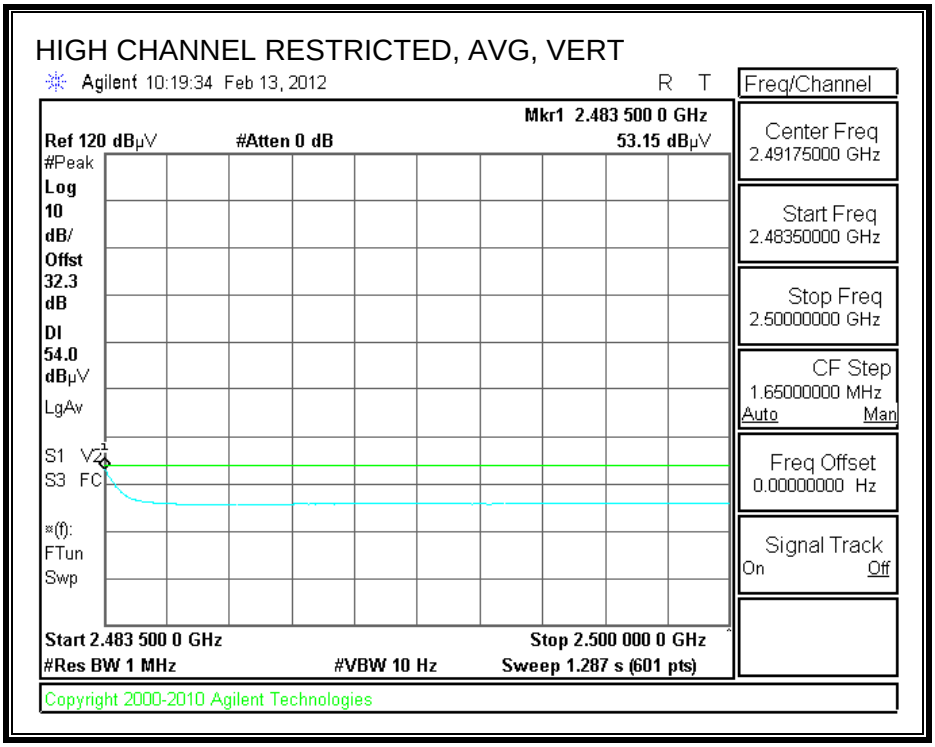
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber-B

Company: Anaren, Inc
Project #: 12U14281
Date: 2/13/2012
Test Engineer: Thanh Nguyen
Configuration: EUT A2530R24X Internal Antenna
Mode: Tx

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A0056		T89; ARA 18-26GHz; S/N:1049	FCC 15.209

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_001

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

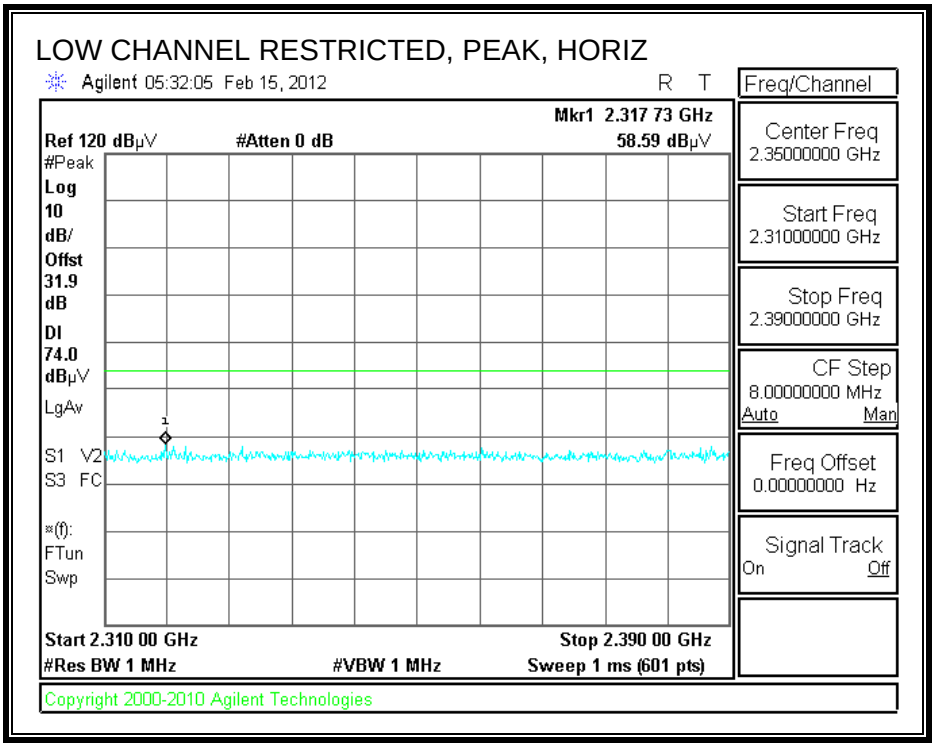
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Ch 2403MHz															
4.806	3.0	40.4	26.2	33.2	6.3	-34.8	0.0	0.0	45.0	30.8	74	54	-29.0	-23.2	V
7.209	3.0	42.1	31.9	36.0	8.5	-34.9	0.0	0.0	51.7	41.5	74	54	-22.3	-12.5	V
9.612	3.0	36.6	23.9	37.6	9.0	-34.7	0.0	0.0	48.4	35.7	74	54	-25.6	-18.3	V
4.806	3.0	39.2	25.9	33.2	6.3	-34.8	0.0	0.0	43.8	30.5	74	54	-30.2	-23.5	V
7.209	3.0	40.0	29.6	36.0	8.5	-34.9	0.0	0.0	49.6	39.2	74	54	-24.4	-14.8	V
9.612	3.0	36.0	23.8	37.6	9.0	-34.7	0.0	0.0	47.9	35.7	74	54	-26.1	-18.3	V
Mid Ch 2440MHz															V
4.880	3.0	39.9	30.1	33.2	6.3	-34.8	0.0	0.0	44.6	34.8	74	54	-29.4	-19.2	V
7.320	3.0	38.1	25.8	36.2	8.5	-34.9	0.0	0.0	47.9	35.6	74	54	-26.1	-18.4	V
9.760	3.0	36.0	23.4	37.7	9.0	-34.7	0.0	0.0	48.0	35.4	74	54	-26.0	-18.6	V
4.880	3.0	39.2	31.3	33.2	6.3	-34.8	0.0	0.0	43.9	36.0	74	54	-30.1	-18.0	V
7.320	3.0	37.3	25.7	36.2	8.5	-34.9	0.0	0.0	47.1	35.4	74	54	-26.9	-18.6	V
9.760	3.0	35.0	23.4	37.7	9.0	-34.7	0.0	0.0	47.0	35.4	74	54	-27.0	-18.6	V
High Ch															V
4.692	3.0	41.7	34.2	33.0	6.2	-34.8	0.0	0.0	46.1	38.5	74	54	-27.9	-15.5	V
7.443	3.0	39.5	26.5	36.4	8.5	-34.9	0.0	0.0	49.4	36.5	74	54	-24.6	-17.5	H
9.924	3.0	37.6	25.4	37.8	9.1	-34.7	0.0	0.0	49.9	37.6	74	54	-24.1	-16.4	H
4.692	3.0	39.3	30.2	33.0	6.2	-34.8	0.0	0.0	43.7	34.6	74	54	-30.3	-19.4	H
7.443	3.0	37.2	24.7	36.4	8.5	-34.9	0.0	0.0	47.2	34.7	74	54	-26.8	-19.3	H
9.924	3.0	36.8	23.4	37.8	9.1	-34.7	0.0	0.0	49.0	35.7	74	54	-25.0	-18.3	H
															H
No other emissions were detected above the system noise floor															

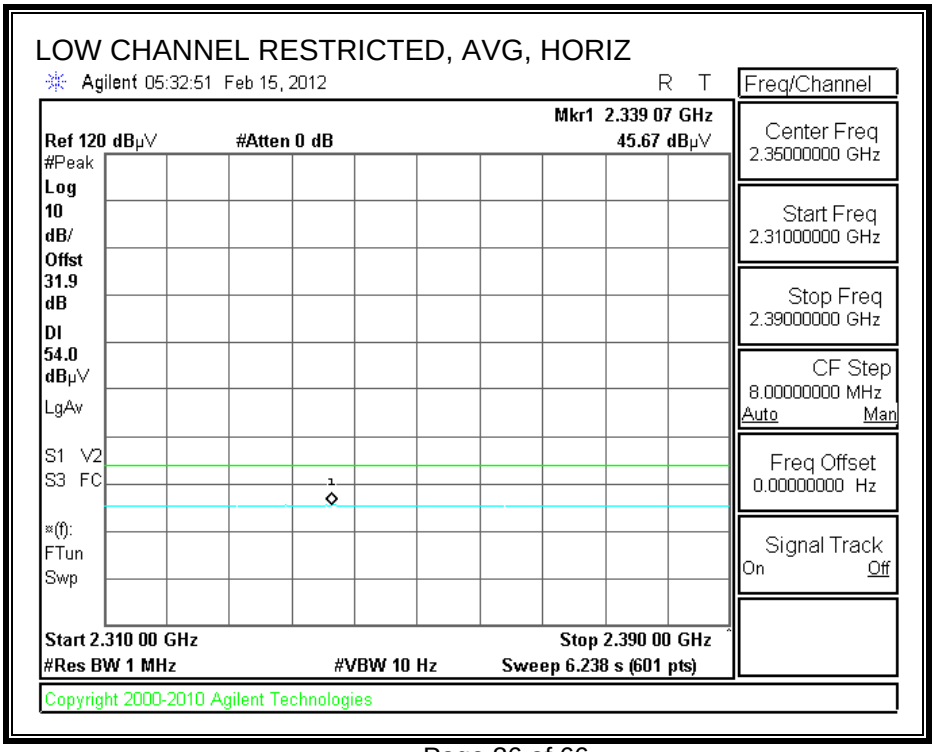
Rev. 07.08.11

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

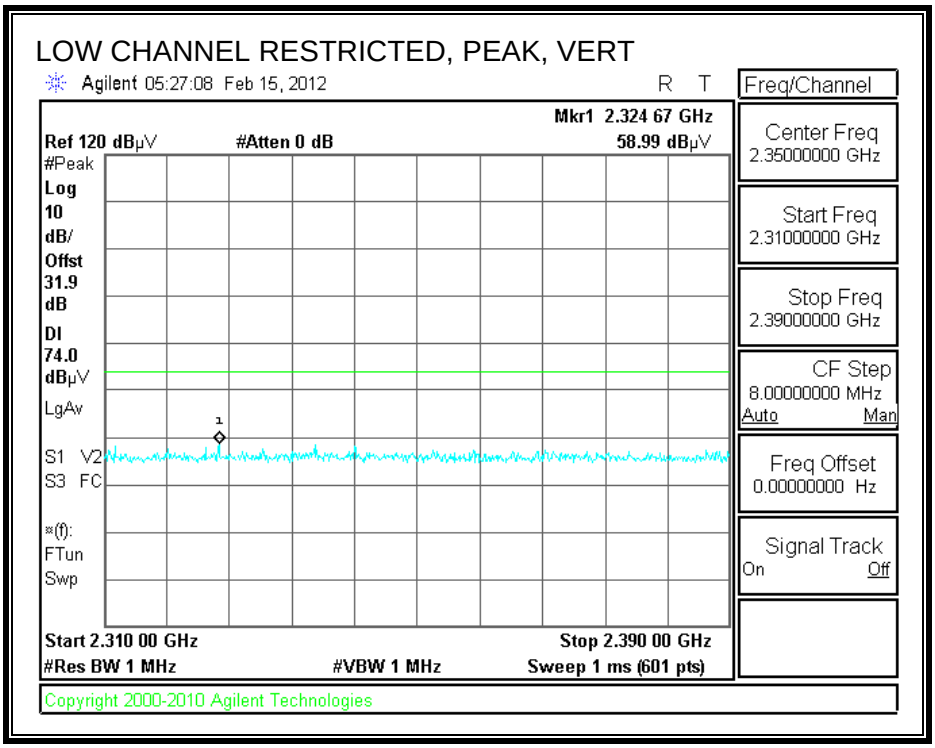
8.2.2. TX ABOVE 1 GHz IN THE 2.4 GHz BAND with External Antenna

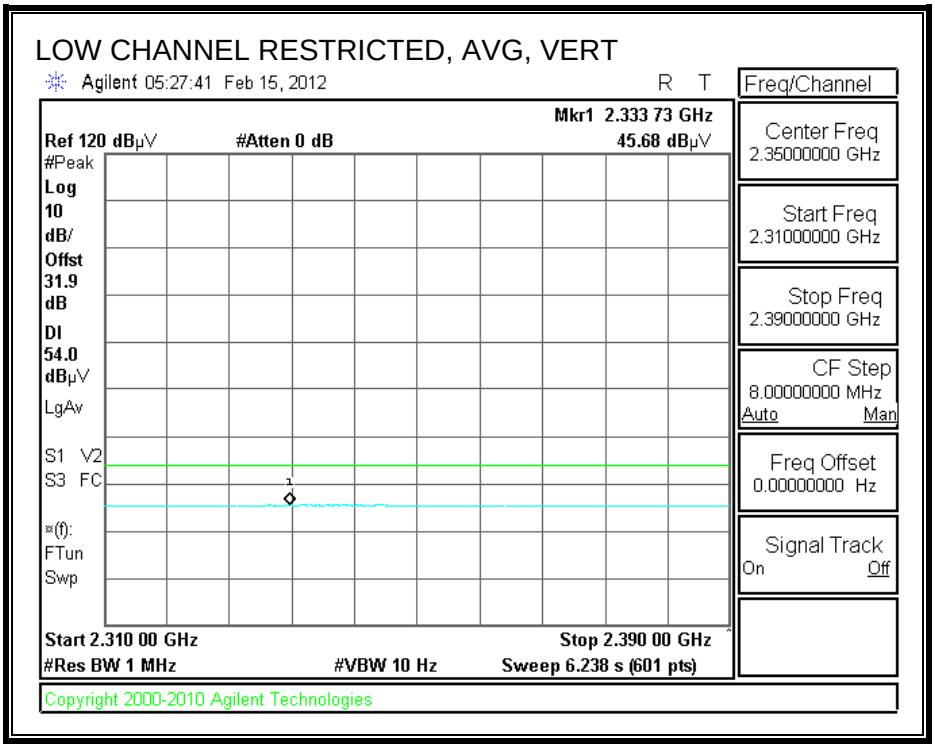
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



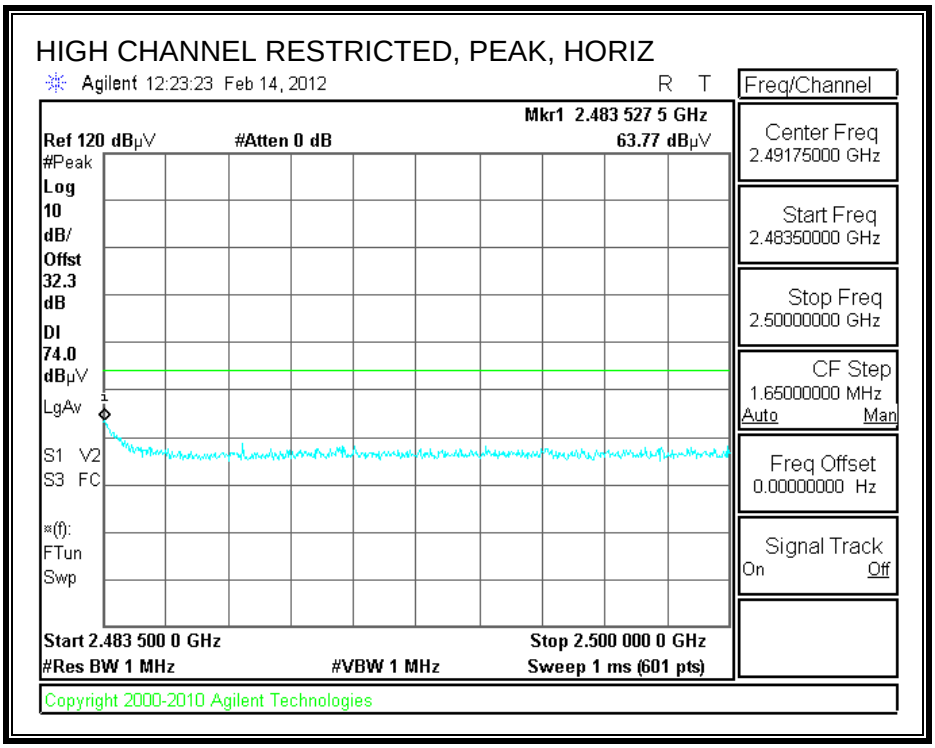


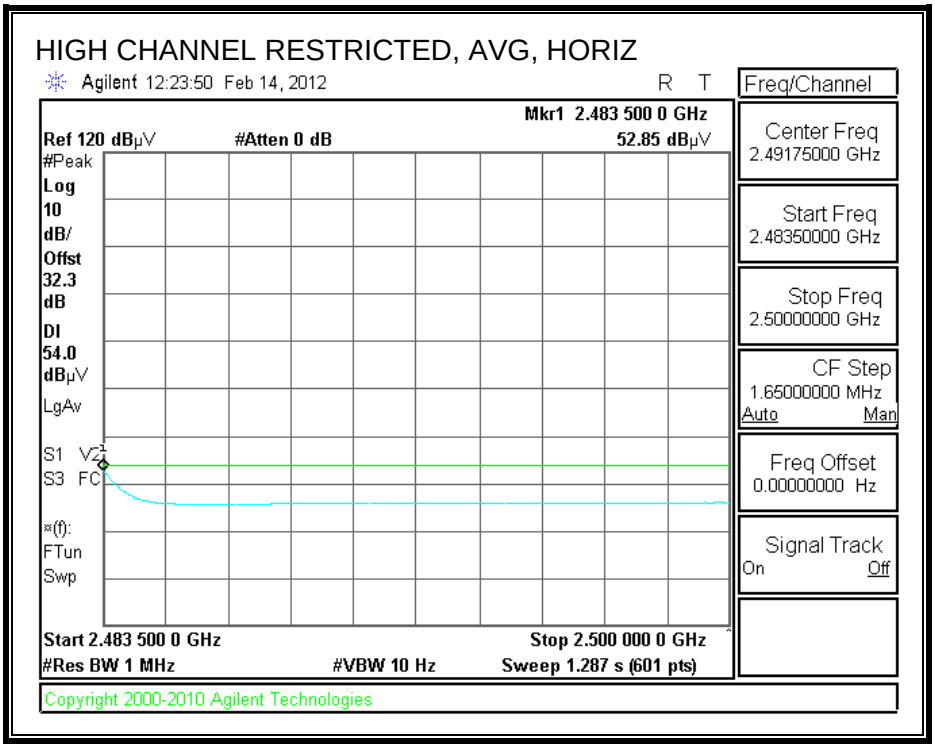
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



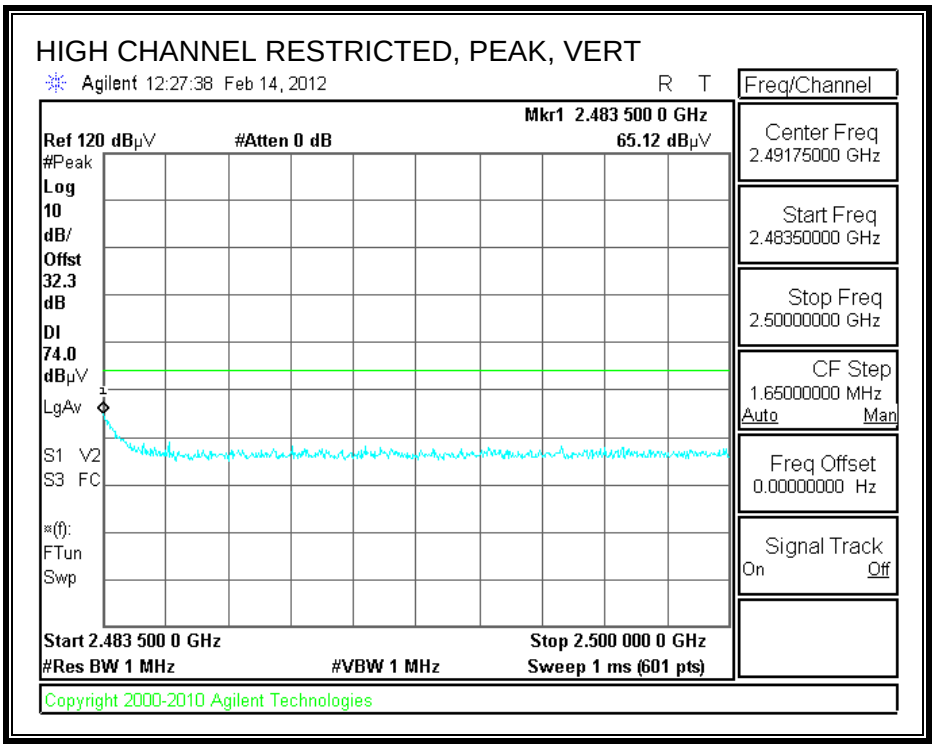


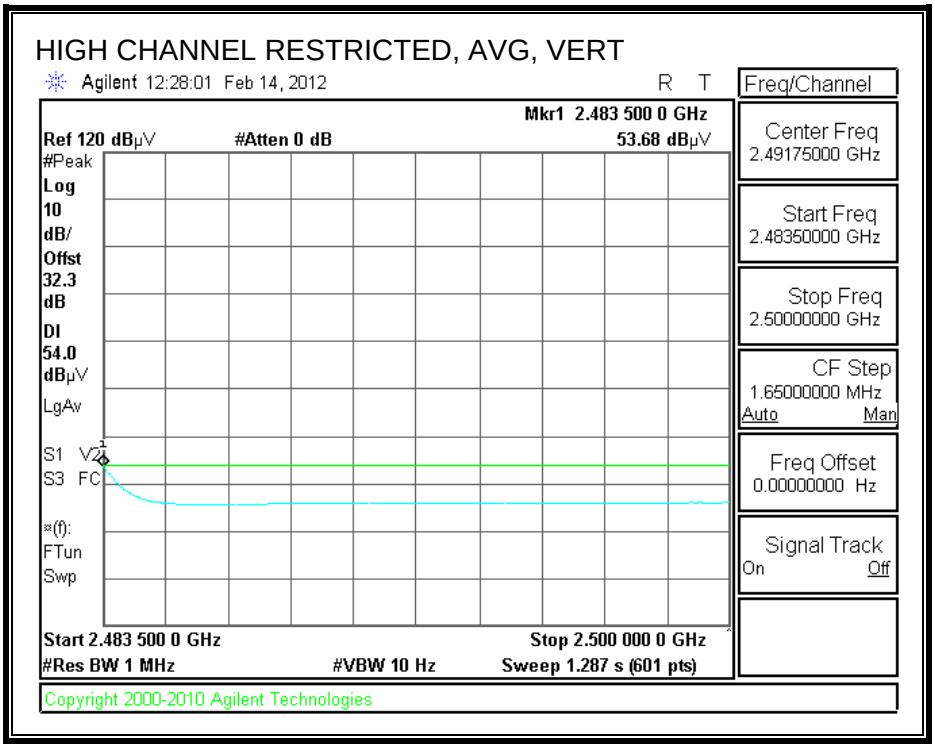
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber-B

Company: Anaren, Inc
Project #: 12U14282
Date: 2/13/2012
Test Engineer: Thanh Nguyen
Configuration: EUT A2530R24C with External Antenna
Mode: Tx

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A0056		T89; ARA 18-26GHz; S/N:1049	FCC 15.209

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_001

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Ch 2403MHz															
4.806	3.0	42.9	37.6	33.2	6.3	-34.8	0.0	0.0	47.5	42.2	74	54	-26.5	-11.8	V
7.209	3.0	41.1	30.8	36.0	8.5	-34.9	0.0	0.0	50.7	40.4	74	54	-23.3	-13.6	V
9.612	3.0	36.0	23.6	37.6	9.0	-34.7	0.0	0.0	47.8	35.5	74	54	-26.2	-18.5	V/Noise floor
4.806	3.0	41.1	31.5	33.2	6.3	-34.8	0.0	0.0	45.7	36.1	74	54	-28.3	-17.9	H
7.209	3.0	39.3	26.9	36.0	8.5	-34.9	0.0	0.0	48.9	36.5	74	54	-25.1	-17.5	H
9.612	3.0	36.0	23.5	37.6	9.0	-34.7	0.0	0.0	47.9	35.4	74	54	-26.1	-18.6	H/Noise floor
Mid Ch 2440MHz															
4.880	3.0	42.6	35.5	33.2	6.3	-34.8	0.0	0.0	47.3	40.3	74	54	-26.7	-13.7	V
7.320	3.0	42.9	29.9	36.2	8.5	-34.9	0.0	0.0	52.7	39.7	74	54	-21.3	-14.3	V
9.760	3.0	36.6	24.4	37.7	9.0	-34.7	0.0	0.0	48.6	36.4	74	54	-25.4	-17.6	V/Noise floor
4.880	3.0	40.9	28.5	33.2	6.3	-34.8	0.0	0.0	45.7	33.2	74	54	-28.3	-20.8	H
7.320	3.0	40.0	28.4	36.2	8.5	-34.9	0.0	0.0	49.8	38.1	74	54	-24.2	-15.9	H
9.760	3.0	36.5	23.2	37.7	9.0	-34.7	0.0	0.0	48.5	35.2	74	54	-25.5	-18.8	H/Noise floor
High Ch															
4.960	3.0	42.6	35.3	33.3	6.4	-34.8	0.0	0.0	47.5	40.2	74	54	-26.5	-13.8	V
7.443	3.0	40.0	27.6	36.4	8.5	-34.9	0.0	0.0	50.0	37.6	74	54	-24.0	-16.4	V
9.924	3.0	35.5	23.4	37.8	9.1	-34.7	0.0	0.0	47.7	35.7	74	54	-26.3	-18.3	V/Noise floor
4.692	3.0	40.0	28.3	33.0	6.2	-34.8	0.0	0.0	44.4	32.7	74	54	-29.6	-21.3	H
7.443	3.0	38.0	26.5	36.4	8.5	-34.9	0.0	0.0	47.9	36.5	74	54	-26.1	-17.5	H
9.924	3.0	36.2	23.5	37.8	9.1	-34.7	0.0	0.0	48.4	35.7	74	54	-25.6	-18.3	H/Noise floor

No other emissions were detected above the system noise floor

Rev. 07.08.11

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.3. RECEIVER ABOVE 1 GHz

8.3.1. RECEIVER ABOVE 1 GHz with PCB Antenna

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber-B

Company:	Anaren, Inc
Project #:	12U14282
Date:	2/14/2012
Test Engineer:	Thanh Nguyen
Configuration:	EUT A2530R24X
Mode:	Receive with internal Antenna.

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26 GHz	Pre-amplifer 26-40 GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A0056			RX RSS 210

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		1.053

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Mid Ch 2440MHz															
1.167	3.0	51.8	32.5	24.6	2.8	-35.9	0.0	0.0	43.3	24.0	74	54	-30.7	-30.0	V
1.400	3.0	44.8	31.3	25.6	3.1	-35.7	0.0	0.0	37.8	24.3	74	54	-36.2	-29.7	V
3.273	3.0	42.6	30.3	31.0	5.1	-35.1	0.0	0.0	43.6	31.2	74	54	-30.4	-22.8	V
1.047	3.0	44.6	28.4	24.0	2.7	-35.9	0.0	0.0	35.4	19.1	74	54	-38.6	-34.9	H
3.173	3.0	43.6	31.3	30.9	5.0	-35.2	0.0	0.0	44.2	31.9	74	54	-29.8	-22.1	H
No other emissions were detected above the system noise floor															

Rev. 07.08.11

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.3.2. RECEIVER ABOVE 1 GHz with External Antenna

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber-B

Company: Anaren, Inc
Project #: 12U14281
Date: 2/14/2012
Test Engineer: Thanh Nguyen
Configuration: EUT A2530R24C with external Antenna
Mode: Receive

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26 GHz	Pre-amplifer 26-40 GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A0056			RX RSS 210

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		1.053

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Mid Ch 2440MHz															
1.867	3.0	46.5	30.5	27.8	3.6	-35.5	0.0	0.0	42.4	26.4	74	54	-31.6	-27.6	V
2.560	3.0	41.9	28.4	29.0	4.4	-35.2	0.0	0.0	40.1	26.6	74	54	-33.9	-27.4	V
4.880	3.0	43.3	36.6	33.2	6.3	-34.8	0.0	0.0	48.1	41.4	74	54	-25.9	-12.6	V
1.853	3.0	52.3	30.6	27.7	3.6	-35.5	0.0	0.0	48.1	26.4	74	54	-25.9	-27.6	H
No other emissions were detected above the system noise floor															

Rev. 07.08.11

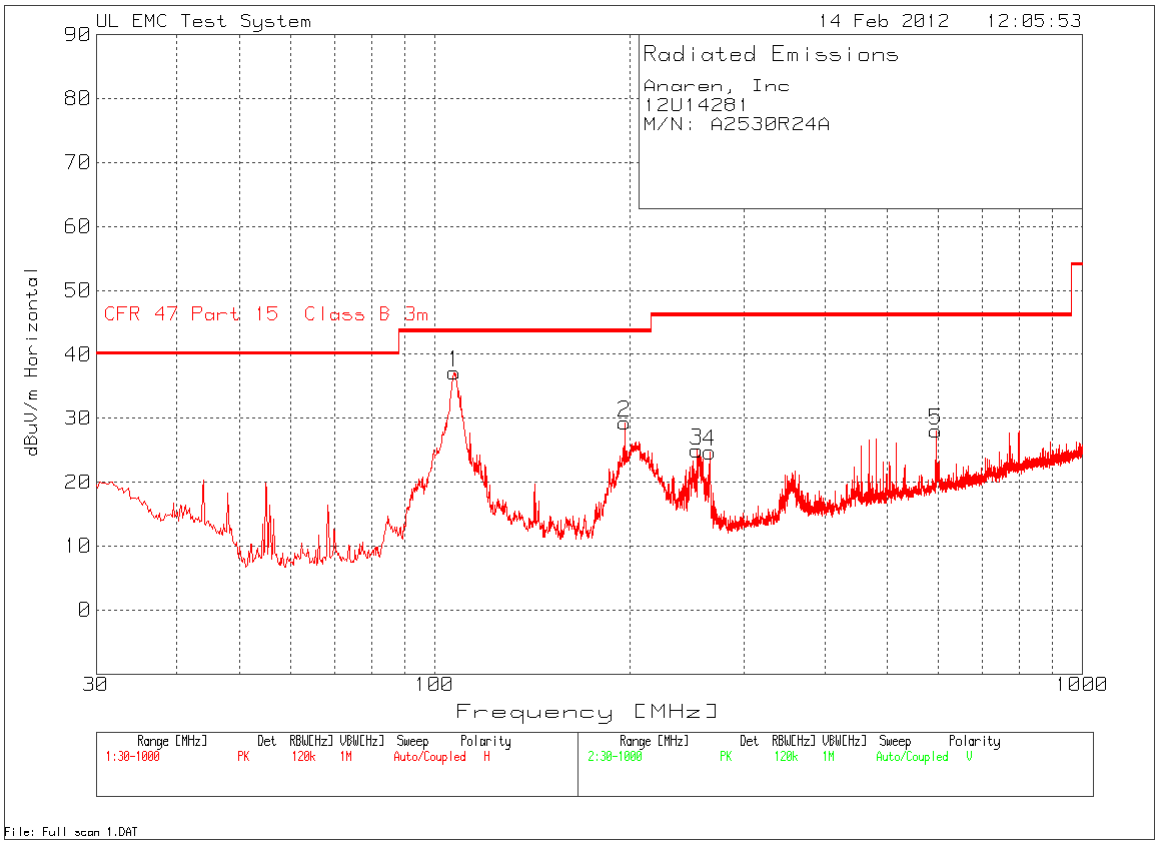
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

8.4. WORST-CASE BELOW 1 GHz

8.4.1. WORST-CASE BELOW 1 GHz with PCB Antenna

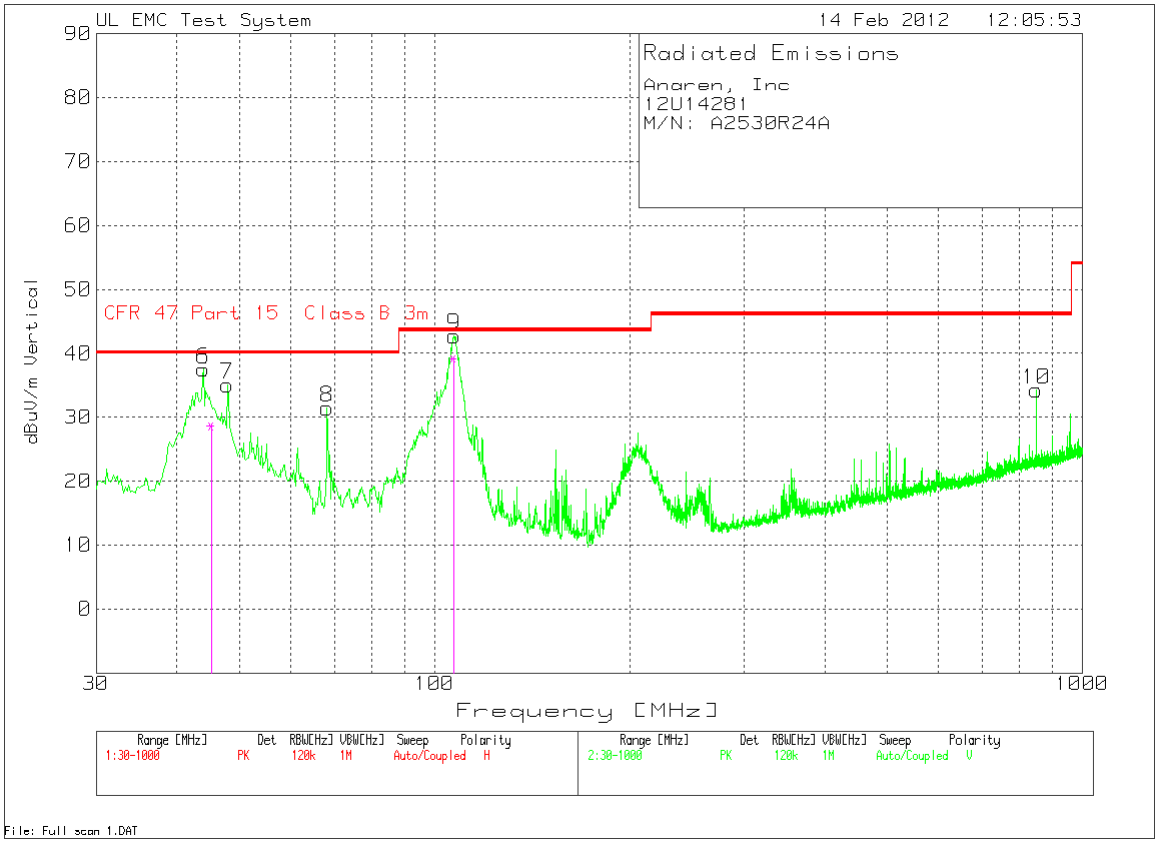
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



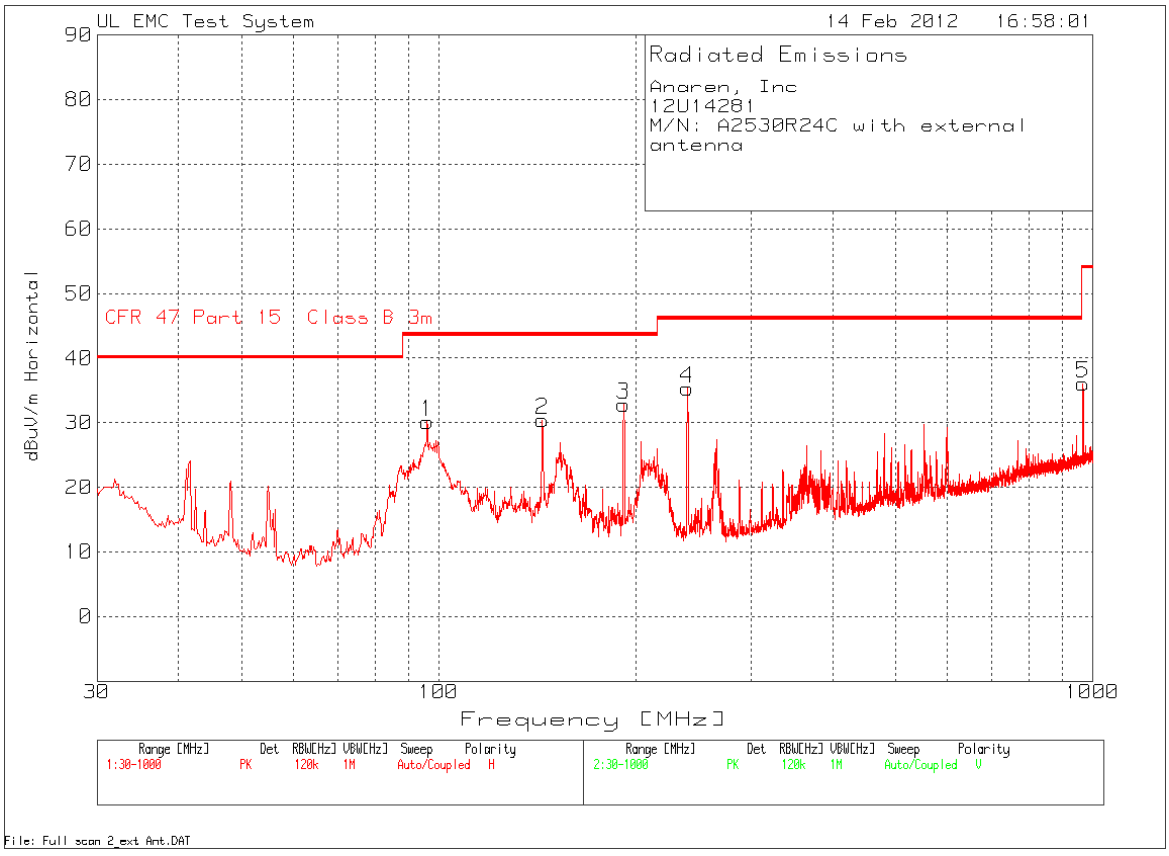
EMI DATA

Anaren, Inc									
12U14281									
M/N: A2530R24A									
Range 1 30 - 1000MHz									
Test Frequency	Meter Reading	Detector	Pre-Amp Gain+cbl Loss	Antenna Factor	Corrected Reading dBuV/m	CFR 47 Class B Limit	Margin	Height [cm]	Polarity
107.1503	54.24	PK	-28.5	11.4	37.14	43.5	-6.36	300	Horz
196.5128	45.24	PK	-27.6	11.7	29.34	43.5	-14.16	200	Horz
254.0847	40.19	PK	-27.1	11.9	24.99	46	-21.01	100	Horz
265.9093	39.4	PK	-27	12.3	24.7	46	-21.3	100	Horz
593.8949	36.55	PK	-26.7	18.2	28.05	46	-17.95	100	Horz
Range 2 30 - 1000MHz									
Test Frequency	Meter Reading	Detector	Pre-Amp Gain+cbl Loss	Antenna Factor	Corrected Reading dBuV/m	CFR 47 Class B Limit	Margin	Height [cm]	Polarity
43.9568	54.9	PK	-29.1	11.7	37.5	40	-2.5	200	Vert
45.2029	46.77	QP	-29.1	10.9	28.57	40	-11.43	121	Vert
47.8337	54.88	PK	-29.1	9.3	35.08	40	-4.92	100	Vert
68.1875	52.16	PK	-28.9	8.2	31.46	40	-8.54	300	Vert
107.1503	59.84	PK	-28.5	11.4	42.74	43.5	-0.76	100	Vert
107.01	56.35	QP	-28.5	11.3	39.15	43.5	**-4.35**	111	Vert
848.9948	37.95	PK	-25	21.3	34.25	46	-11.75	100	Vert

8.4.1. WORST-CASE BELOW 1 GHz with External Antenna

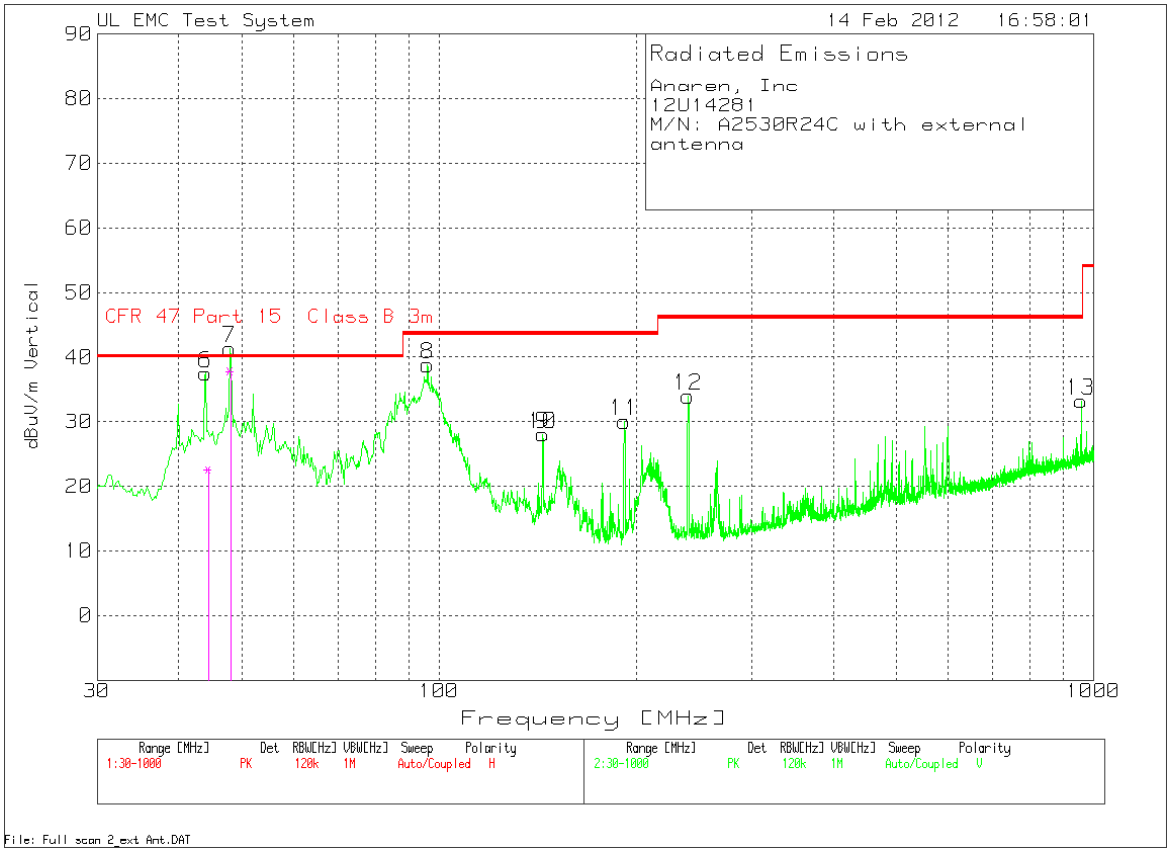
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



EMI DATA

Anaren, Inc
12U14281
M/N: A2530R24C with external antenna

Range 1 30 - 1000MHz									
Test Frequency	Meter Reading	Detector	PreAmp Gain	Antenna Factors [dB]	Value (dBuV/m)	CFR 47 Part 15 Limit	Margin	Height [cm]	Polarity
95.9073	49.77	PK	-28.6	9	30.17	43.5	-13.33	200	Horz
143.9808	45.52	PK	-28.1	13	30.42	43.5	-13.08	200	Horz
191.8605	49.2	PK	-27.7	11.3	32.8	43.5	-10.7	100	Horz
239.9341	50.81	PK	-27.3	11.8	35.31	46	-10.69	100	Horz
966.6587	38.15	PK	-24.3	22.2	36.05	54	-17.95	200	Horz

Range 1 30 - 1000MHz									
Test Frequency	Meter Reading	Detector	PreAmp Gain	Antenna Factors [dB]	Value (dBuV/m)	CFR 47 Part 15 Limit	Margin	Height [cm]	Polarity
43.9568	54.91	PK	-29.1	11.7	37.51	40	-2.49	100	Vert
44.4064	40.23	QP	-29.1	11.4	22.53	40	-17.47	340	Vert
47.8337	61.1	PK	-29.1	9.3	41.3	40	1.3	100	Vert
48.006	57.66	QP	-29.1	9.2	37.76	40	-2.24	201	Vert
95.9073	58.42	PK	-28.6	9	38.82	43.5	-4.68	100	Vert
143.9808	43.18	PK	-28.1	13	28.08	43.5	-15.42	200	Vert
143.9808	43.18	PK	-28.1	13	28.08	43.5	-15.42	200	Vert
191.8605	46.45	PK	-27.7	11.3	30.05	43.5	-13.45	100	Vert
240.1279	49.47	PK	-27.3	11.8	33.97	46	-12.03	100	Vert
956.7726	35.54	PK	-24.4	22.1	33.24	46	-12.76	100	Vert

9. 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

ANSI C63.4

RESULTS

6 WORST EMISSIONS

ANAREN, INC.
12U14281
A2530R24C with Ext. Antenna

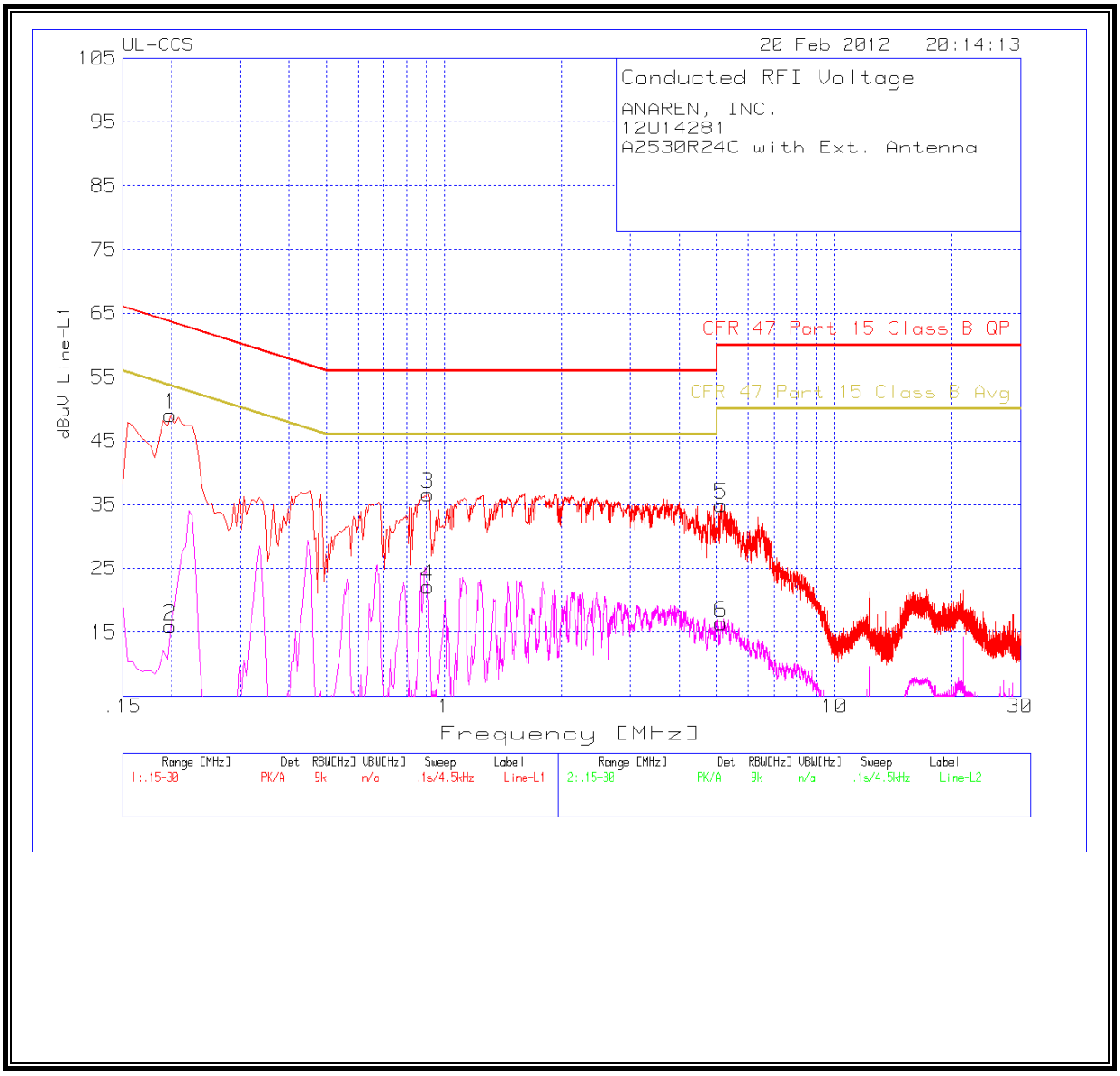
Line-L1 .15 - 30MHz

Test Freq. (MHz)	Meter Reading (dBuV)	Detector Type	LISN Factor [dB]	Path Loss (dB)	Corrected Reading (dBuV)	Class B Quasi-peak	Quasi-Peak Margin	Class B Average Limit	Average Margin
0.1995	48.98	PK	0.1	0	49.08	63.6	-14.52		
0.1995	15.83	Av	0.1	0	15.93	63.6	-47.67	53.6	-37.67
0.9105	36.55	PK	0.1	0	36.65	56	-19.35		
0.9105	22.02	Av	0.1	0	22.12	56	-33.88	46	-23.88
5.127	34.8	PK	0.1	0.1	35	60	-25		
5.127	16.28	Av	0.1	0.1	16.48	60	-43.52	50	-33.52

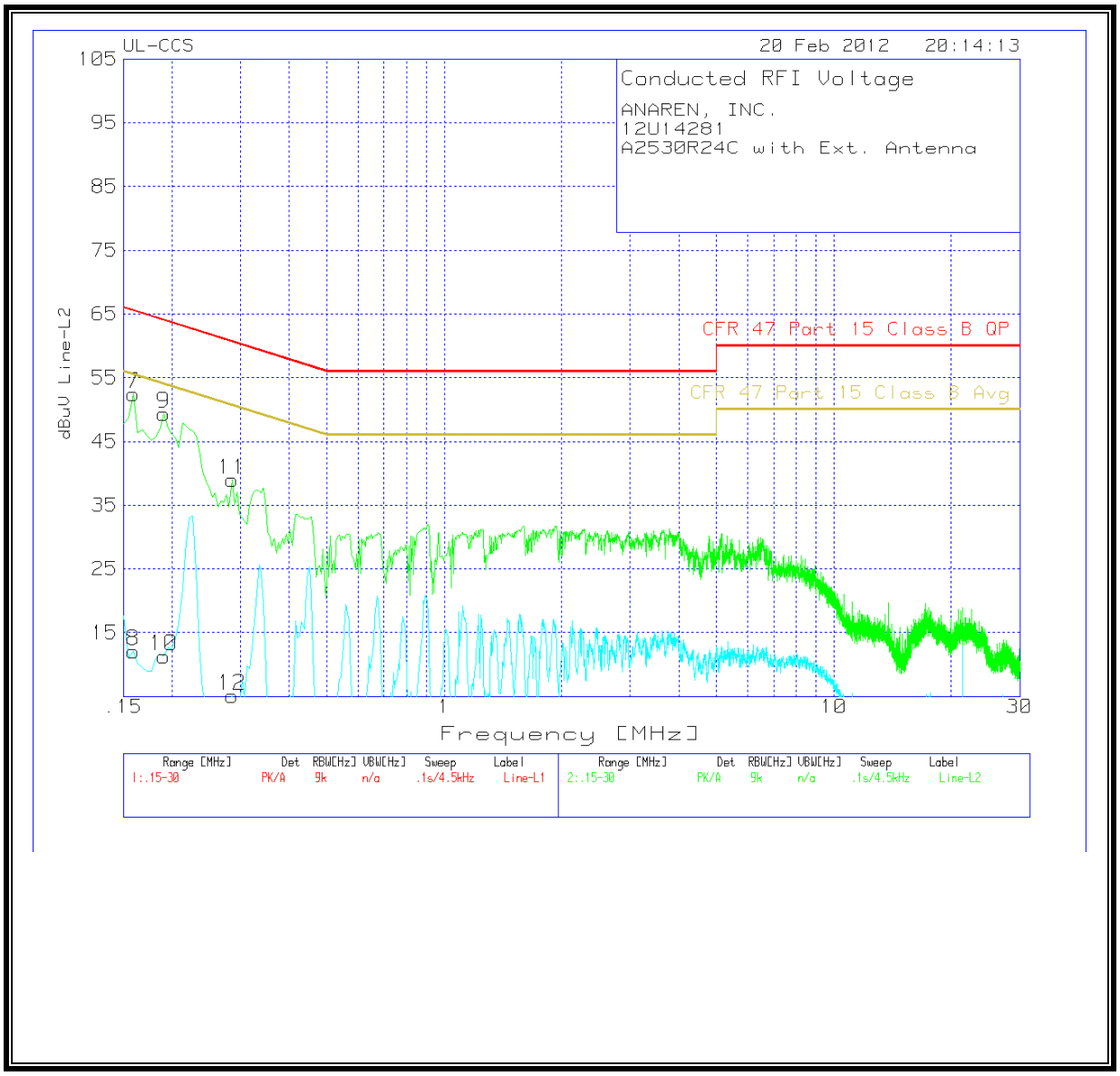
Line-L2 .15 - 30MHz

Test Freq. (MHz)	Meter Reading (dBuV)	Detector Type	LISN Factor [dB]	Path Loss (dB)	Corrected Reading (dBuV)	Class B Quasi-peak	Quasi-Peak Margin	Class B Average Limit	Average Margin
0.159	52.29	PK	0.1	0	52.39	65.5	-13.11		
0.159	11.99	Av	0.1	0	12.09	65.5	-53.41	55.5	-43.41
0.1905	49.23	PK	0.1	0	49.33	64	-14.67		
0.1905	11.21	Av	0.1	0	11.31	64	-52.69	54	-42.69
0.285	38.83	PK	0.1	0	38.93	60.7	-21.77		
0.285	5.02	Av	0.1	0	5.12	60.7	-55.58	50.7	-45.58

LINE 1 RESULTS



LINE 2 RESULTS



10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

Band	Mode	Separation Distance (m)	Output AV Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m^2)	FCC Power Density (mW/cm^2)
2.4 GHz	OQPSK	0.20	2.23	3.00	0.01	0.001