



Castra Zigbee Conducted Test Report

80-VR584-3 Rev. A

June 8, 2009

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Castra Zigbee Conducted Test Report
80-VR584-3 Rev. A

Revision history

Revision	Date	Description
A	June 2009	Initial release

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Castra Zigbee Conducted Test Report

FCC Part 15	
FCC ID:	J9CCAstra
Model:	Castra

STATEMENT OF CERTIFICATION	
<p><i>The data, data evaluation and equipment configuration represented herein are a true and accurate representation of the measurements of the sample’s radio frequency interference emissions characteristics as of the dates and at the times of the test under the conditions herein specified.</i></p>	
Test performed by:	QUALCOMM Incorporated 5775 Morehouse Drive San Diego, CA 92121-1714
Report Prepared by:	QUALCOMM Incorporated 5775 Morehouse Drive San Diego, CA 92121-1714
Tests that required an OATS site were performed by Nemko Product Services.	

Table of Contents

1 Introduction and Purpose..... 1

2 Description of Device Under Test..... 2

3 Test Summary 3

4 RF Power Output Verification 4

 4.1 Measurement Procedures4

4.1.1 For Zigbee.....4

 4.2 Test Results5

 4.3 Plots.....5

5 Occupied Bandwidth..... 7

 5.1 Test Procedures7

 5.2 Test Results8

 5.3 Plots.....9

6 Band Edge Compliance 11

 6.1 Test Procedures11

 6.2 Test Results12

 6.3 Plots.....13

7 Conducted Spurious Emission at Antenna Terminals..... 14

 7.1 Test Procedure.....14

 7.2 Test Result.....15

 7.3 Plots.....16

8 Power Spectral Density 18

 8.1 Test Procedure.....18

 8.2 Test Results19

 8.3 Plots.....20

9 Test Equipment 22

1 Introduction and Purpose

This document provides the FCC test data for the Castra Qualcomm® second generation dedicated tracking module. The tests included in this report are limited to all conducted tests required for FCC Part 22 and 24. The radiated tests were performed at Nemko USA, Inc. in San Diego, CA, and are reported in a separate document.

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2 Description of Device Under Test

The Castra module is the Qualcomm® second generation dedicated tracking module. Castra is a CDMA2000®-1X module powered by the Qualcomm QSC6055™ chipset. The module supports CDMA BC0 and BC1, with a single diversity in addition to GPS. The module also hosts, as options, a Bosch three axes accelerometer, and a ZigBee transceiver. The module tested included the Bosch three axes accelerometer and the ZigBee transceiver.

The Castra modules are meant to be integrated into various dedicated tracking devices and can include a customized UI, antenna, and additional proprietary circuitry. Castra is a 7.3 gram, 21 mm x 46 mm x 5 mm sized devices. While CDMA2000 1X compliant, the HTT design is optimized for minimal cost, minimal size, maximum battery life and superb position location performance. The device uses A-GPS to obtain position location and sends this information back to the network by SMS or packed data. For the most active mode of operation, a position fix occurs about every 15 seconds followed by a 3 second SMS message or packet data stream. Other modes of simplified operation request position fixes less often. The hibernation mode extends the battery life beyond normal cellular phone standby time. Hibernation technology comprises of several innovative modes of battery saving. Smart mechanism selects the best fit mode based on future activities of the device.

Only 850 MHz (Cellular) and 1900 MHz (PCS) bands are used for operation. The DUT is a pre-production sample

3 Test Summary

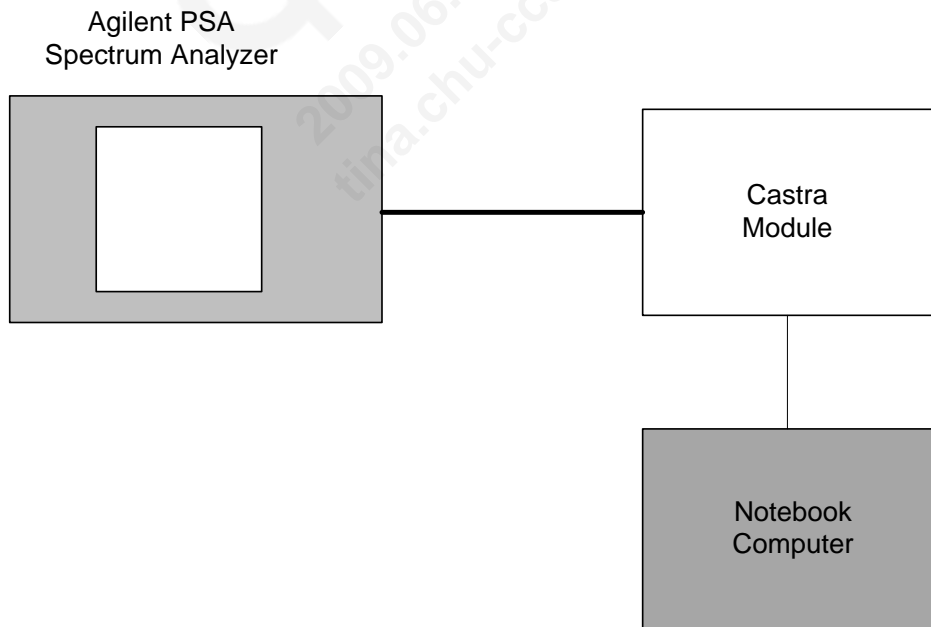
FCC/IC Rule	Description of Test	Result	Page
§15.247(b)	RF Power Output	Complies	3
§2.1049,15.247(a)(2)	Occupied Bandwidth	Complies	7
§15.247(d)	Block Edge Requirement	Complies	11
§15.247(d)	Coducted Spurious Emission at Antenna Terminals	Complies	14
§15.247(e)	Power Spectral Density	Complies	18
§1.1310, 2.1091	RF Exposure	Complies	See Exhibit 4
§2.1053, 15.247(d)	Field Strength of Spurious Radiation	Complies	See Exhibit 3

4 RF Power Output Verification

FCC:	§ 15.247(b)
Limit:	The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.
DUT SN	B0A4F5

4.1 Measurement Procedures

As shown in the figure below, connect the Zigbee transmitter output of the Castra module to the Agilent PSA Spectrum Analyzer. Following the FCC’s “Measurement of Digital Transmission Systems operating under Section 15.247, March 23, 2005” instructions, use the spectrum analyzer to measure the low, mid and high frequency channel’s conducted power output in accordance with the Power Output Option 1. The relevant cable loss is measured for the specific frequencies under test and added as a correction factor for all the tests.



4.1.1 For Zigbee

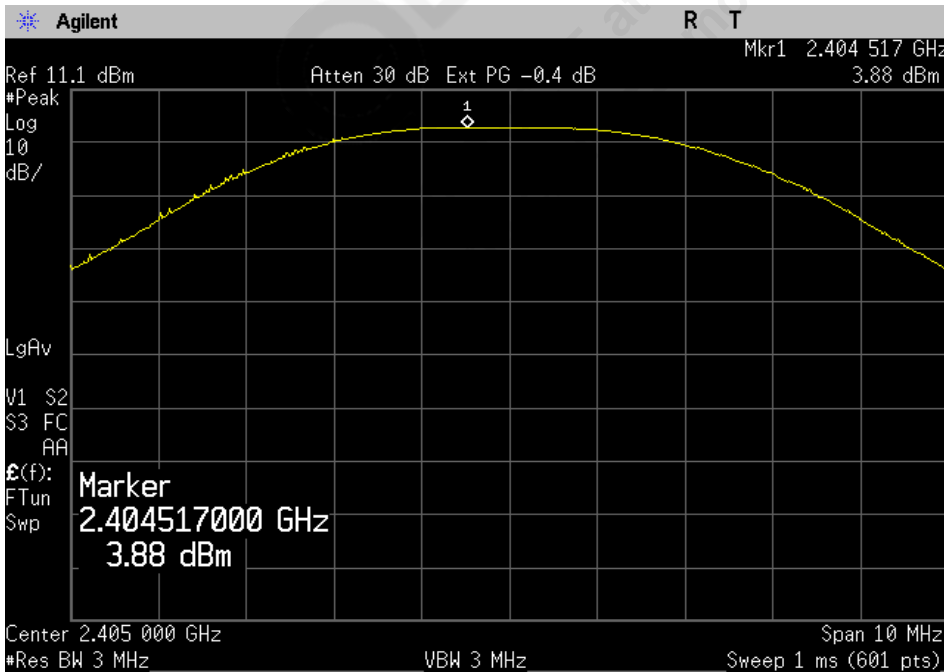
Measure the power at Ch 11, 18 and 26.

The notebook computer was used to configure the Zigbee transmitter to run in continuous transmit mode, at maximum output power and modulated. The spectrum analyzer was set up with a resolution and video bandwidth of 3MHz, and a span of 10 MHz, with measurements from a peak detector presented in the chart below.

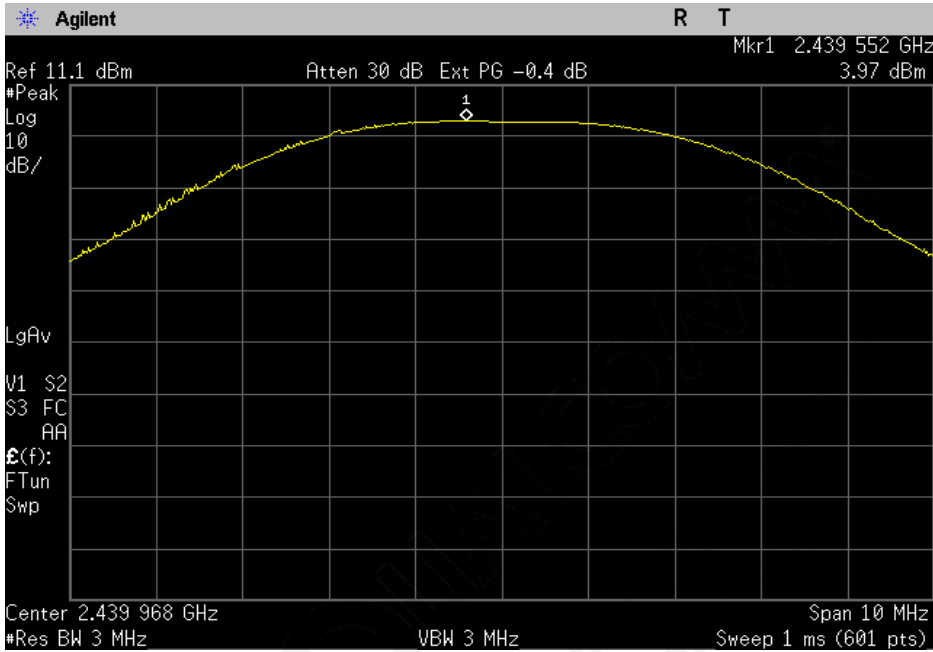
4.2 Test Results

CHANNEL	CENTER FREQ (GHz)	LIMIT (dBm)	MEASURED POWER (dBm)	MARGIN (dB)
11	2.405	30	3.88	26.12
18	2.44	30	3.97	26.03
26	2.48	30	3.66	26.34

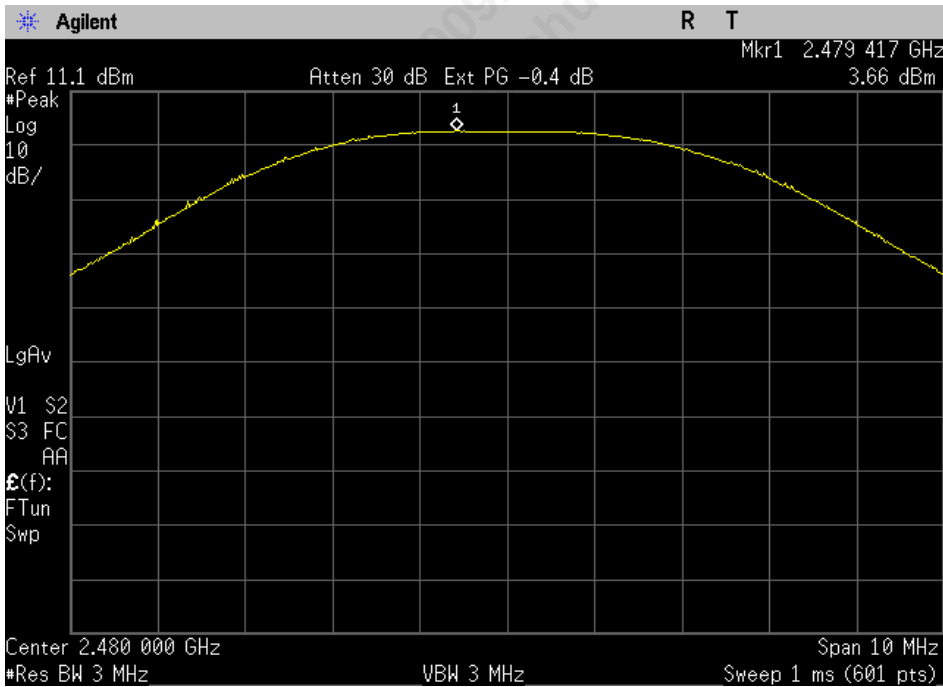
4.3 Plots



Plot 4.3 - 1 (Ch11)



Plot 4.3 - 2 (Ch18)



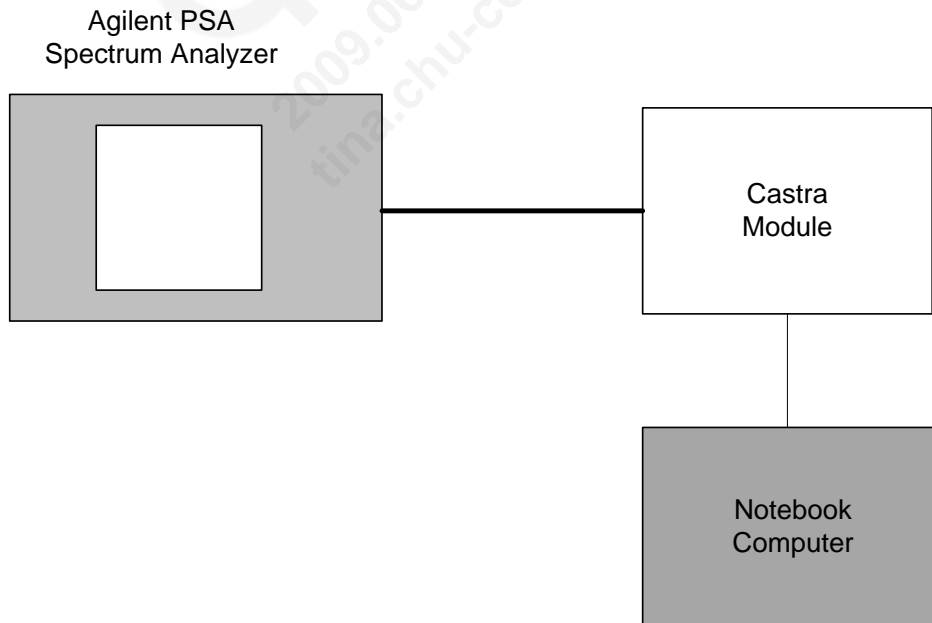
Plot 4.3 - 3 (Ch26)

5 Occupied Bandwidth

FCC:	§15.247(a)(2)
Limit:	The minimum 6 dB bandwidth shall be at least 500 kHz.
DUT SN	B0A4F5

5.1 Test Procedures

As shown in the figure below, connect the Zigbee transmitter output of the Castra module to the Agilent PSA Spectrum Analyzer. Following the FCC’s “Measurement of Digital Transmission Systems operating under Section 15.247, March 23, 2005” instructions, use the spectrum analyzer to measure the low, mid and high frequency channel’s 6 dB bandwidth. The resolution and video bandwidth for the spectrum analyzer is set to 100 kHz. The relevant cable loss is measured for the specific frequencies under test and added as a correction factor for all the tests.



5.2 Test Results

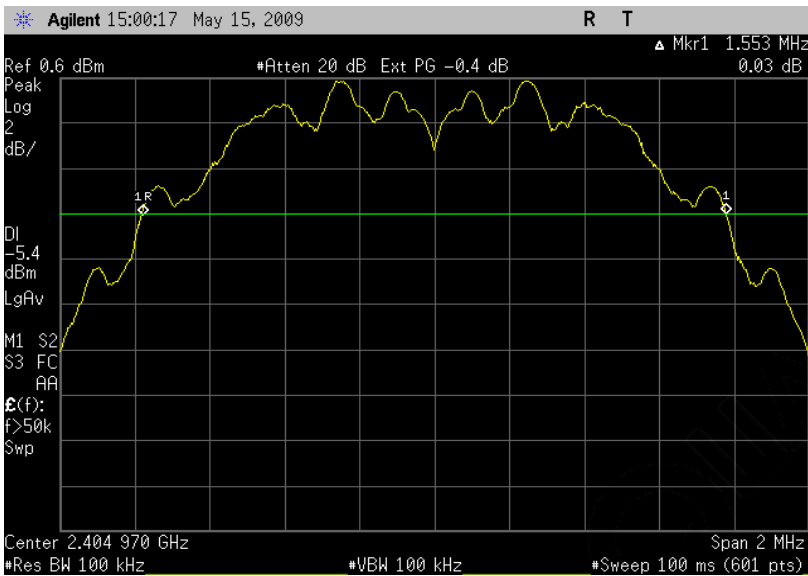
The occupied bandwidth was measured at low, mid and high channels in each band. The results are shown below in the table below.

Channel	Center Freq. (GHz)	Measured -6 dBc Occ. BW (kHz)	Minimum -6 dBc Limit (kHz)	Measured -20 dBc Occ. BW (kHz)
11	2.405	1553	500	26.12
18	2.44	1563	500	26.03
26	2.48	1597	500	26.34

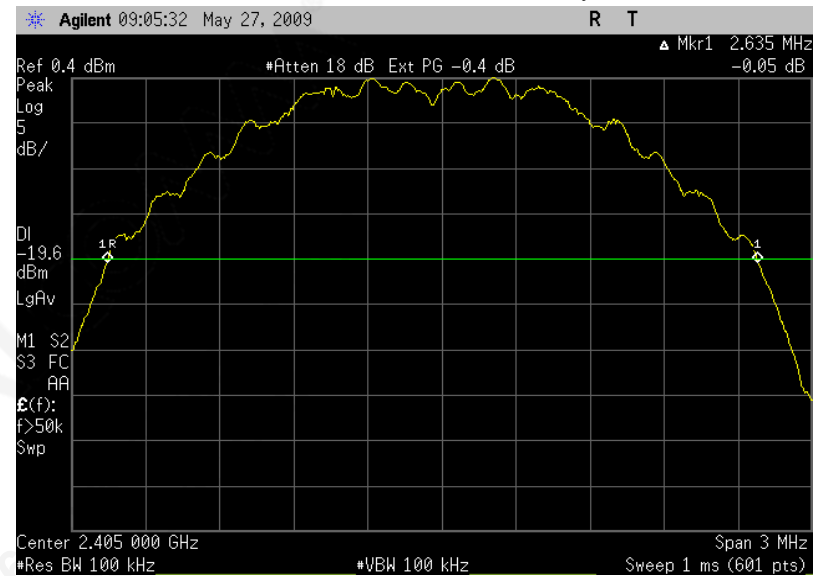
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5.3 Plots

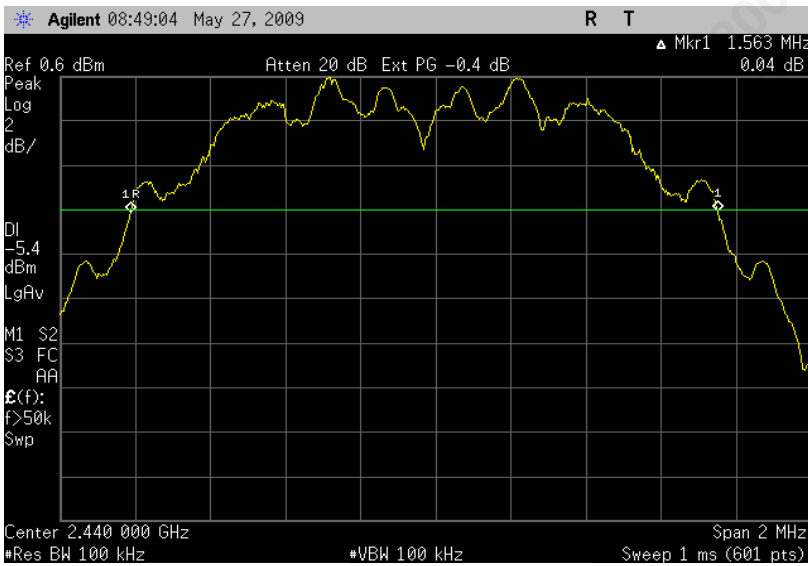
Plot 5.3 - 1 (Ch11, 6dB bandwidth)



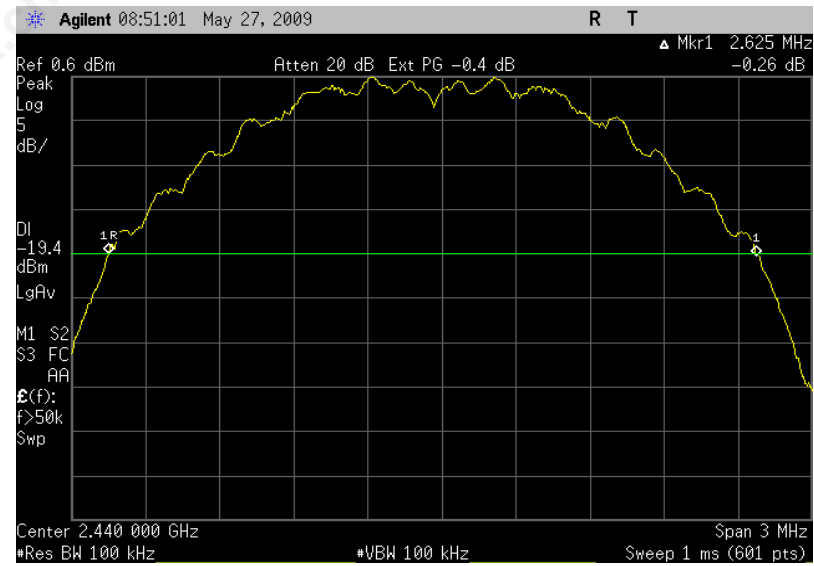
Plot 5.3 - 2 (Ch11, 20 dB bandwidth, information only)



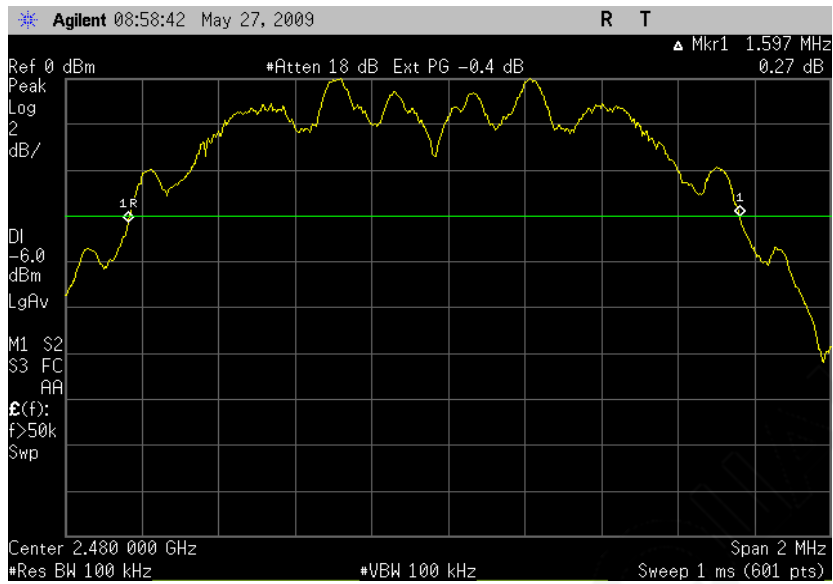
Plot 5.3 - 3 (Ch18, 6dB bandwidth)



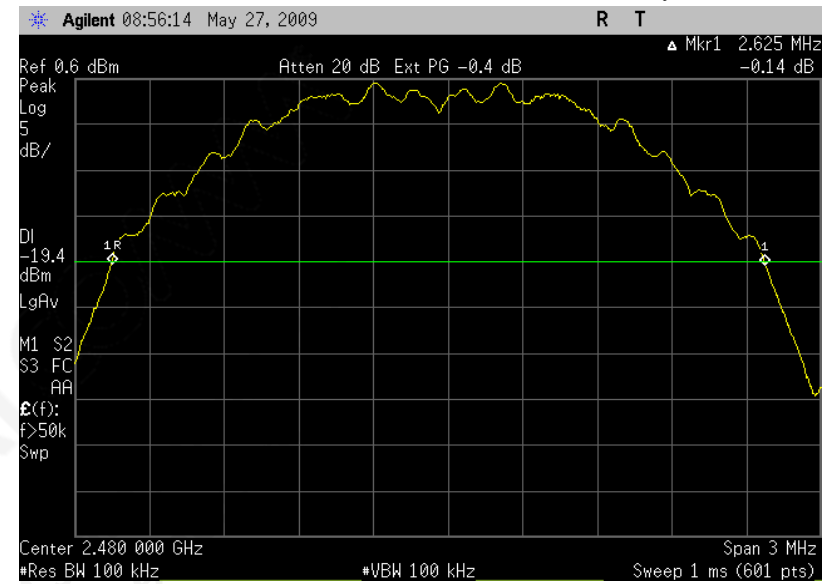
Plot 5.3 - 4 (Ch18, 20dB bandwidth, information only)



Plot 5.3-5 (Ch26, 6dB bandwidth)



Plot 5.3 - 6 (Ch600, Ch26, 20dB bandwidth, information only)

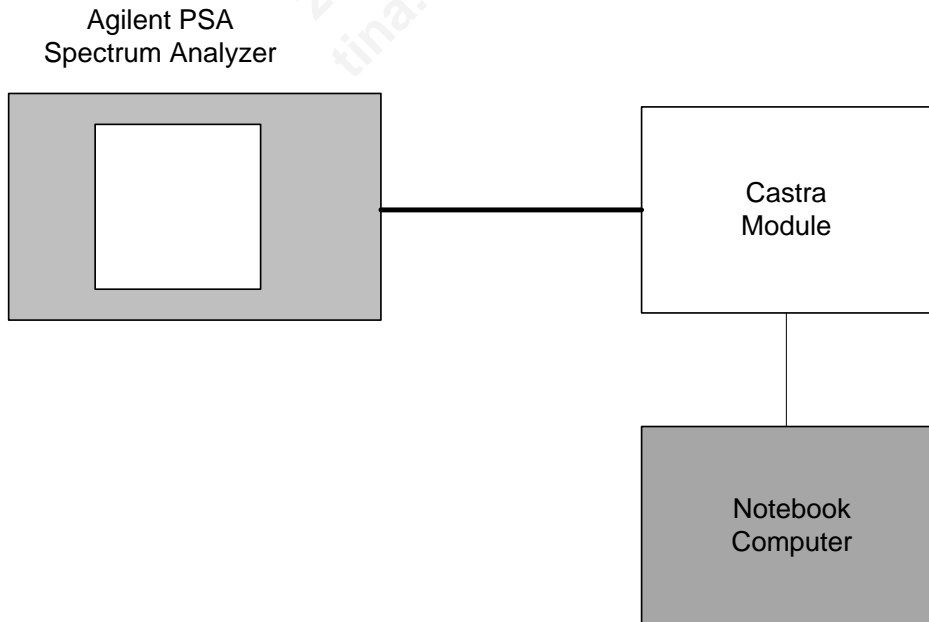


6 Band Edge Compliance

FCC:	§15.247(d)
Limit:	-20 dB below the fundamental emission level
DUT SN	B0A4F5

6.1 Test Procedures

As the figure below indicates, the Castra module device was connected to the Agilent PSA Spectrum Analyzer through a calibrated coaxial cable. FCC 15.247(d) requires a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band Edges where the intentional radiator operates. The following plots demonstrate compliance of the intentional at the 2400-2483.5 MHz Band Edges. The EUT was operated in continuous transmit mode and continuous modulation. The EUT was operated at the lowest frequency channel for the investigation of the lower Band Edge and at the highest frequency channel for the investigation of the upper Band Edge.



6.2 Test Results

The test was conducted at block edges in each band

Frequency (MHz)	Channel Tested	Corresponding Plot number	Test Result
2400	11	Plot 6.2 - 1	Complies
2483.5	26	Plot 6.2 - 2	Complies

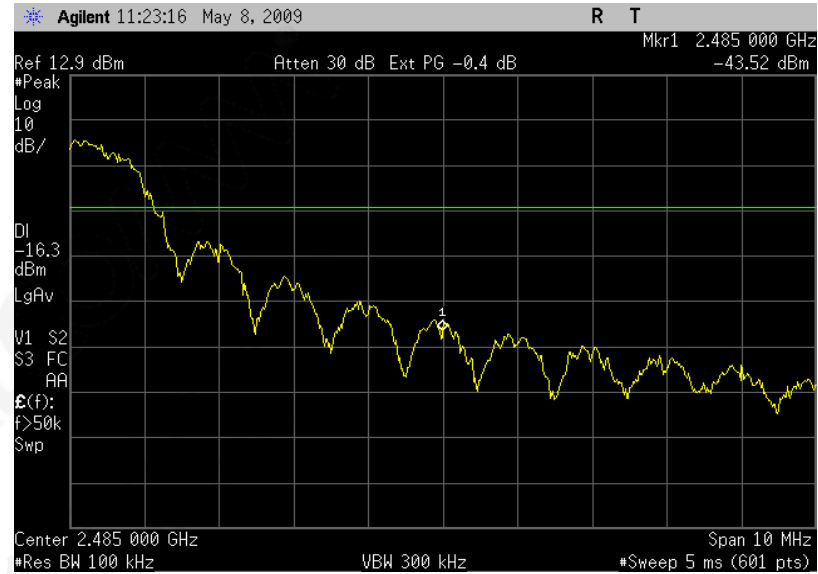
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6.3 Plots

Plot 6.3 -1 (Ch11 Band Edge)



Plot 6.3-2 (Ch26 Band Edge)

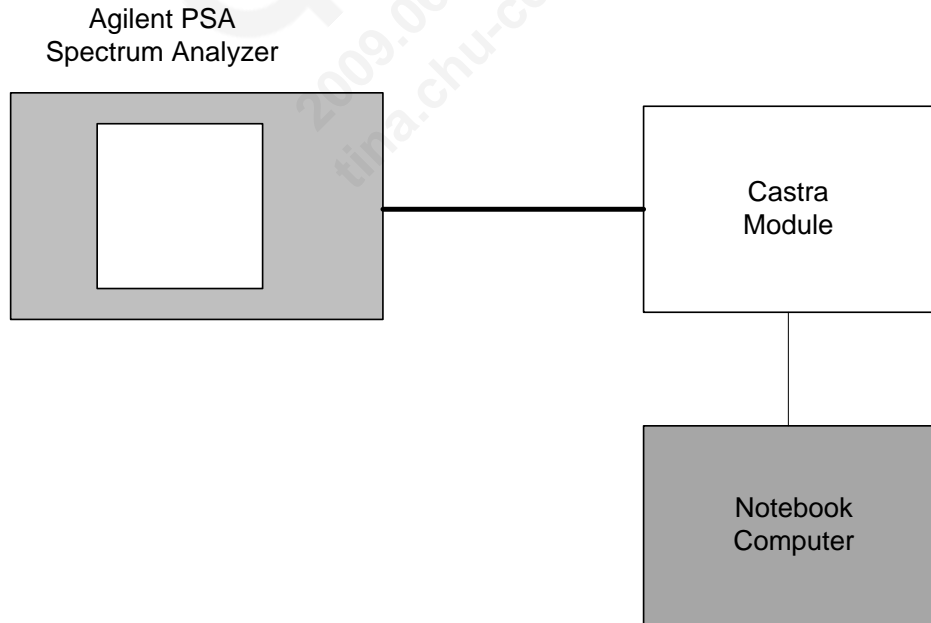


7 Conducted Spurious Emission at Antenna Terminals

FCC:	§15.247(d)
Limit:	-13dBm
DUT SN	B0A4F5

7.1 Test Procedure

As the figure below indicates, the Castra module was connected to the Agilent PSA Spectrum Analyzer through a calibrated coaxial cable and directional coupler. 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. The EUT was operated in continuous transmit mode and continuous modulation.



7.2 Test Result

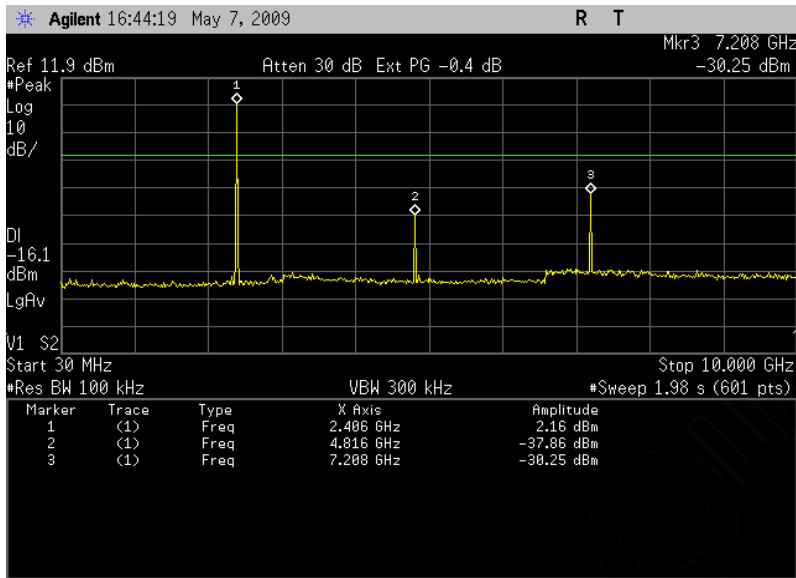
The test was conducted at low, mid and high channels.

Frequency (MHz)	Channel Tested	Corresponding Plot number	Test Result
0 ~ 26 GHz	11	Plot 7.3 – 1,2	Complies
0 ~ 26 GHz	18	Plot 7.3 – 3,4	Complies
0 ~ 26 GHz	26	Plot 7.3 – 5,6	Complies

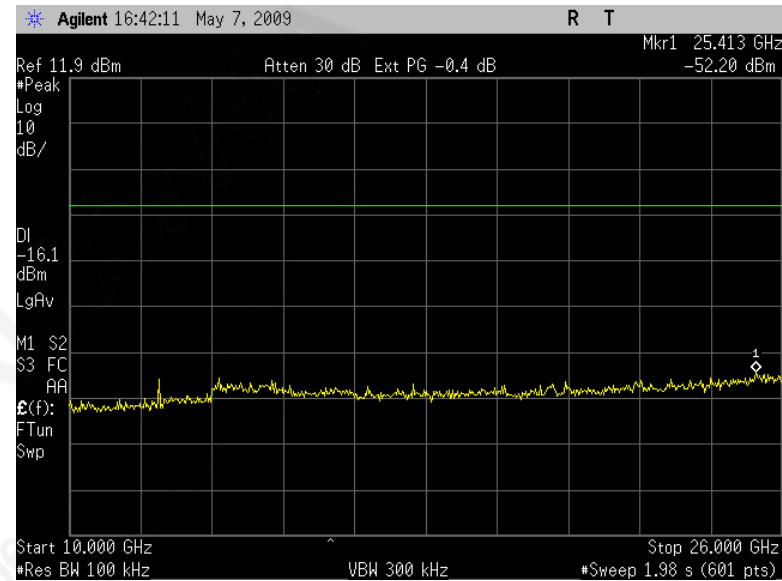
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7.3 Plots

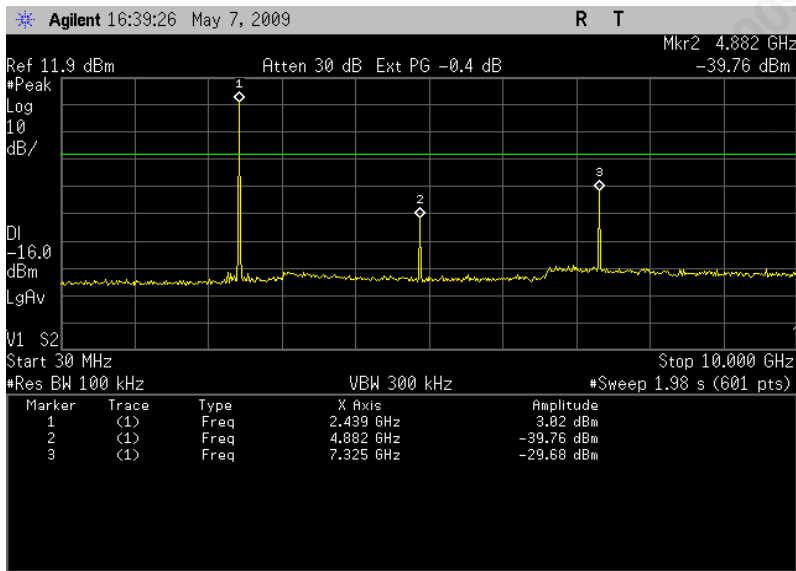
Plot 7.3-1 (Ch11)



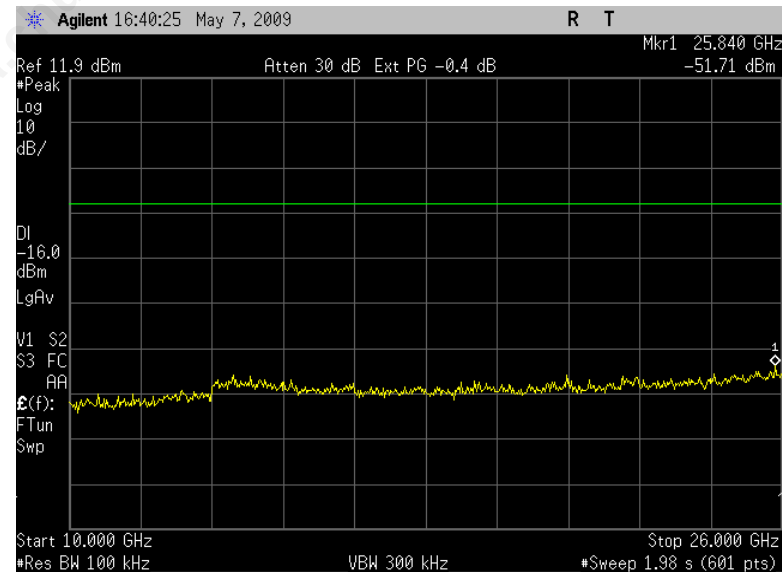
Plot 7.3-2 (Ch11)

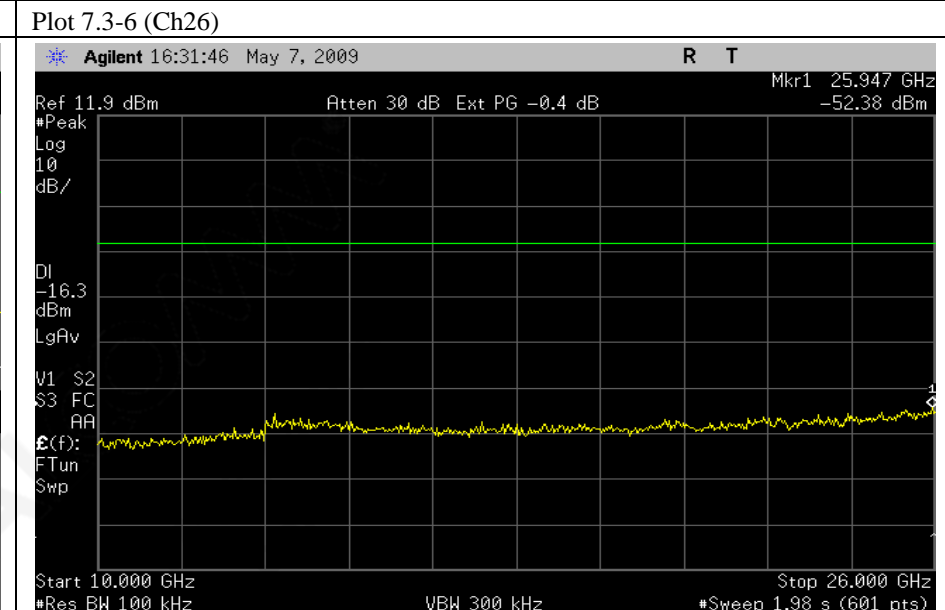
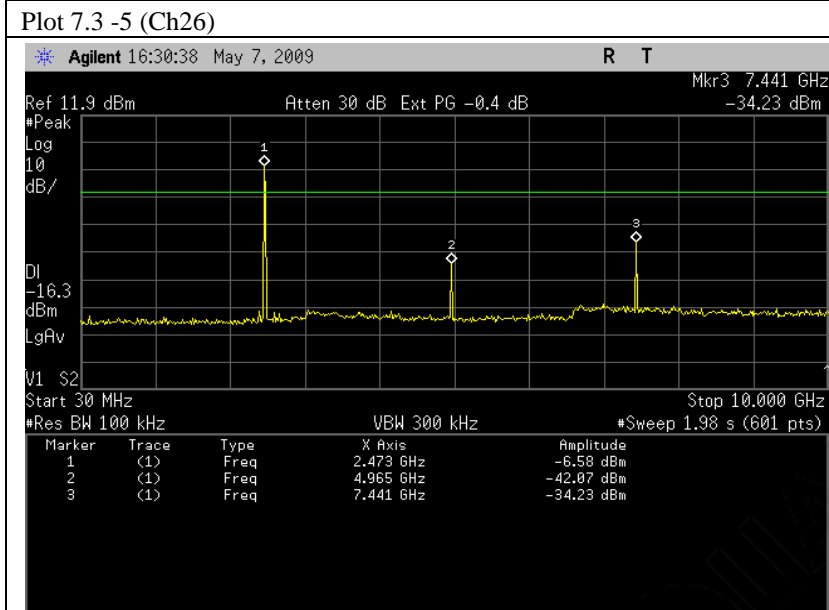


Plot 7.3-3 (Ch18)



Plot 7.3-4 (Ch18)



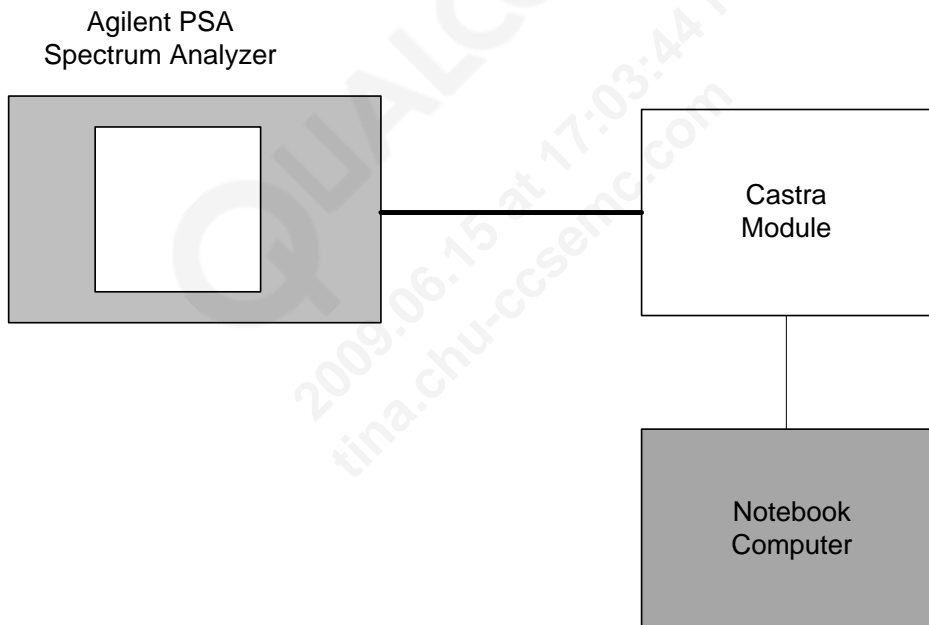


8 Power Spectral Density

FCC:	§15.247(e)
Limit:	8dBm in any 3kHz frequency band
DUT SN	B0A4F5

8.1 Test Procedure

As the figure below indicates, the Castra module was connected to the Agilent PSA Spectrum Analyzer through a calibrated coaxial cable and directional coupler. The output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document “Measurement of Digital Transmission Systems Operating under Section 15.247”, March 23, 2005.



8.2 Test Results

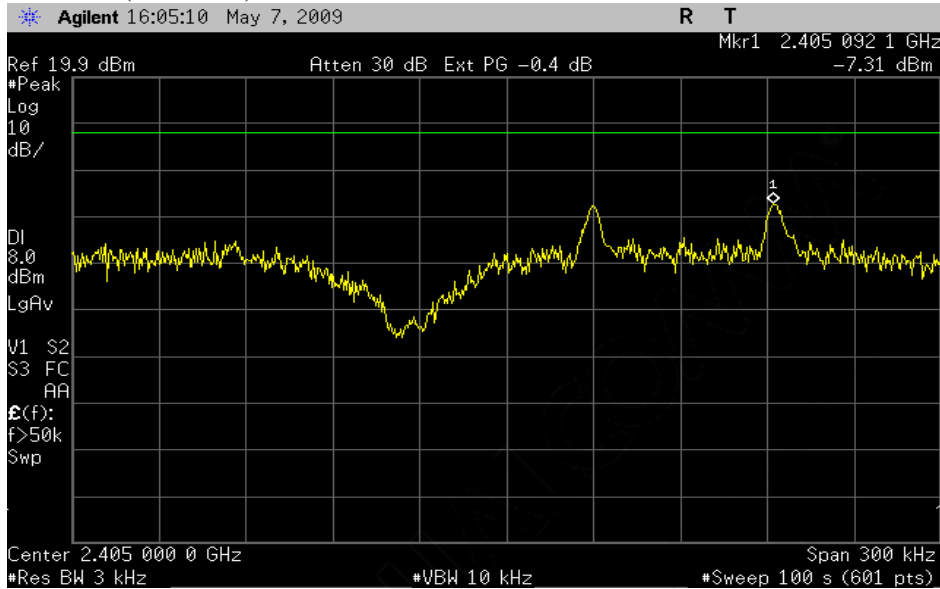
The test was conducted at low, mid and high channels.

Channel	Center Freq. (GHz)	PSD (dBm)	Limit (dBm)	Margin (dBm)
11	2.405	-7.31	8	15.31
18	2.44	-7.19	8	15.19
26	2.48	-8.22	8	16.22

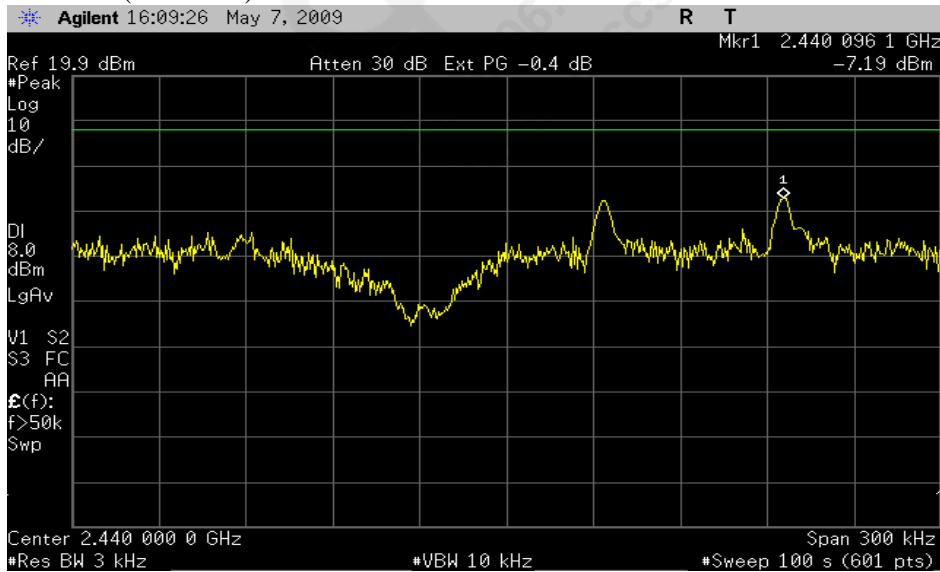
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8.3 Plots

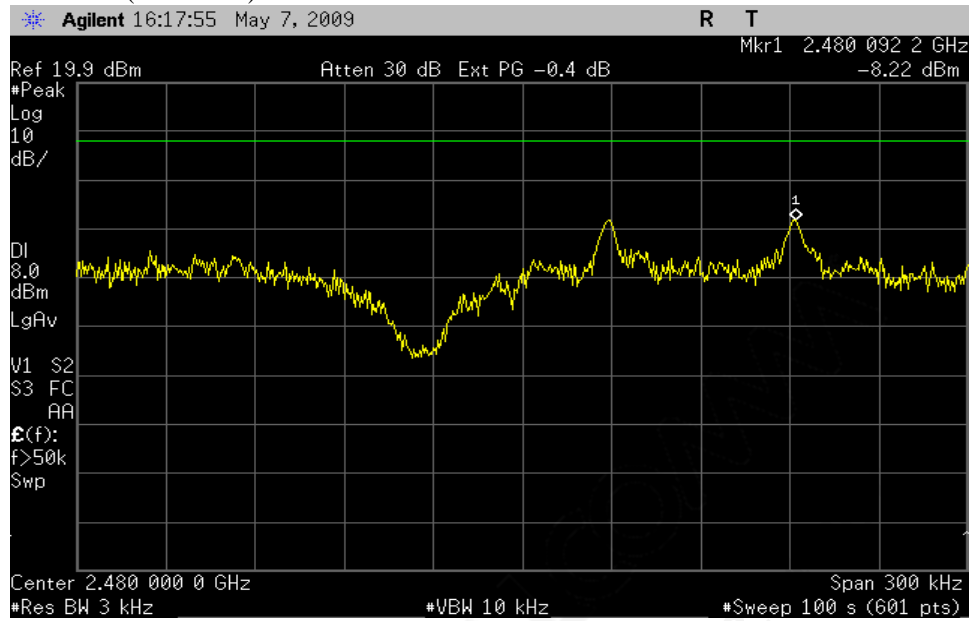
Plot 8.3 -1 (Ch11 PSD)



Plot 8.3 -2 (Ch18 PSD)



Plot 8.3 -2 (Ch26 PSD)



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9 Test Equipment

The following test equipment was used.

Model	Manufacturer	Description	S/N	Cal Data	Cal Due Date
8960 Series 10 E5515C	Agilent	Wireless Communication Set	K119302	09/15/2008	09/15/2009
E4440A PSA Series	Agilent	Spectrum Analyzer	K159342	09/15/2008	09/15/2009
Model 105	TestEquity	Temperature Chamber	K162535	08/04/2008	08/04/2009
8541C	Gigatronics	Power Meter	X07077	06/23/2008	06/23/2009
80601A	Gigatronics	Power Meter Sensor	K60750	02/12/2009	02/12/2010