7. Band Edge

7.1. Test Equipment

RF Conducted Measurement

The following test equipments are used during the band edge tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2011
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2011
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2011

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

RF Radiated Measurement:

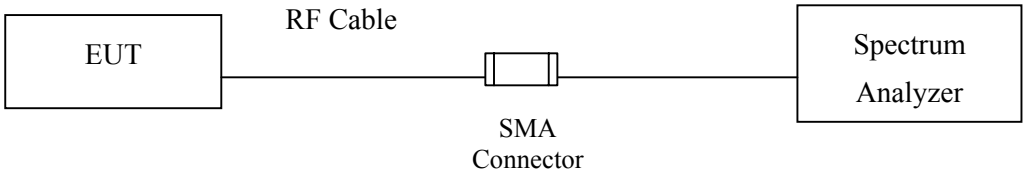
The following test equipments are used during the band edge tests:

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒Site # 3		Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2011
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2011
		Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2011
		Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2011
	X	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2011
		Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2011
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2011
		Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2011
	X	Coaxial Cable	QuieTek	QTK-CABLE/ CAB5	Feb., 2011
	X	Controller	QuieTek	QTK-CONTROLLER/ CTRL3	N/A
	X	Coaxial Switch	Anritsu	MP59B/6200265729	N/A

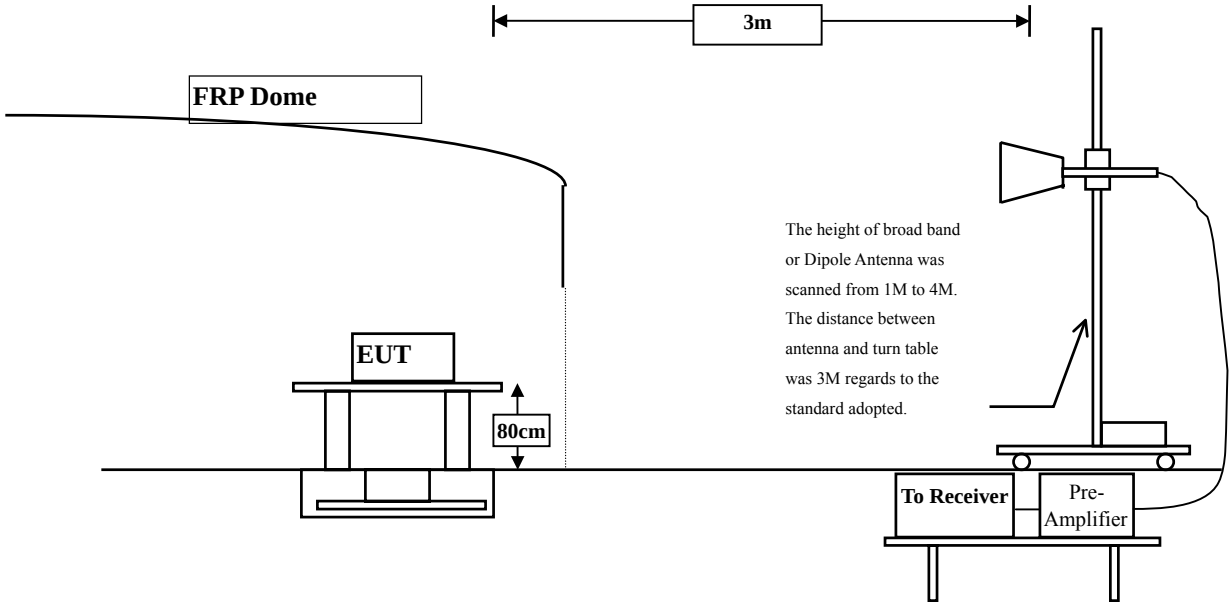
Note: 1. All instruments are calibrated every one year.
2. The test instruments marked by "X" are used to measure the final test results.

7.2. Test Setup

RF Conducted Measurement



RF Radiated Measurement:



7.3. Limits

The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

Radiated emissions which fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209:

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	uV/m @3m	dBuV/m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remarks : 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)

2. In the Above Table, the tighter limit applies at the band edges.

3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

7.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:2009 on radiated measurement.

The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz.

The EUT was setup to ANSI C63.4, 2009; tested to DTS test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

7.5. Uncertainty

± 3.8 dB below 1GHz

± 3.9 dB above 1GHz

7.6. Test Result of Band Edge

Product : WHDI Tx Stick
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - 20BW -Channel 36

Fundamental Filed Strength

Antenna Pole	Frequency [MHz]	Reading Level [dBuV]	Correction Factor [dB/m]	Emission Level [dBuV/m]	Detector
Horizontal	5180	34.966	63.61	98.576	Peak
Horizontal	5180	34.966	46.74	81.706	Average
Vertical	5180	37.073	61.95	99.024	Peak
Vertical	5180	37.073	46.49	83.564	Average

Note: 1:Spectrum Analyzer setting:

Peak detector: RBW=1MHz, VBW=1MHz

Average detector: RBW=1MHz, VBW=10Hz

Band Edge Test Data (Chain A)

Antenna Pole	Test Frequency (MHz)	Fundamental (dBuV/m)	Δ (dB)	Band Edge Field Strength (dBuV/m)	Requiqment Limit (dBuV/m)	Detector
Horizontal	5146.9	98.576	45.34	53.236	74.000	Peak
Horizontal	5149.9	81.706	44.29	37.416	54.000	Average
Vertical	5146.9	99.024	45.34	53.684	74.000	Peak
Vertical	5149.9	83.564	44.29	39.274	54.000	Average

Band Edge Test Data (Chain B)

Antenna Pole	Test Frequency (MHz)	Fundamental (dBuV/m)	Δ (dB)	Band Edge Field Strength (dBuV/m)	Requiqment Limit (dBuV/m)	Detector
Horizontal	5135.1	98.576	44.55	54.026	74.000	Peak
Horizontal	5148.6	81.706	41.96	39.746	54.000	Average
Vertical	5135.1	99.024	44.55	54.474	74.000	Peak
Vertical	5148.6	83.564	41.96	41.604	54.000	Average

Note:

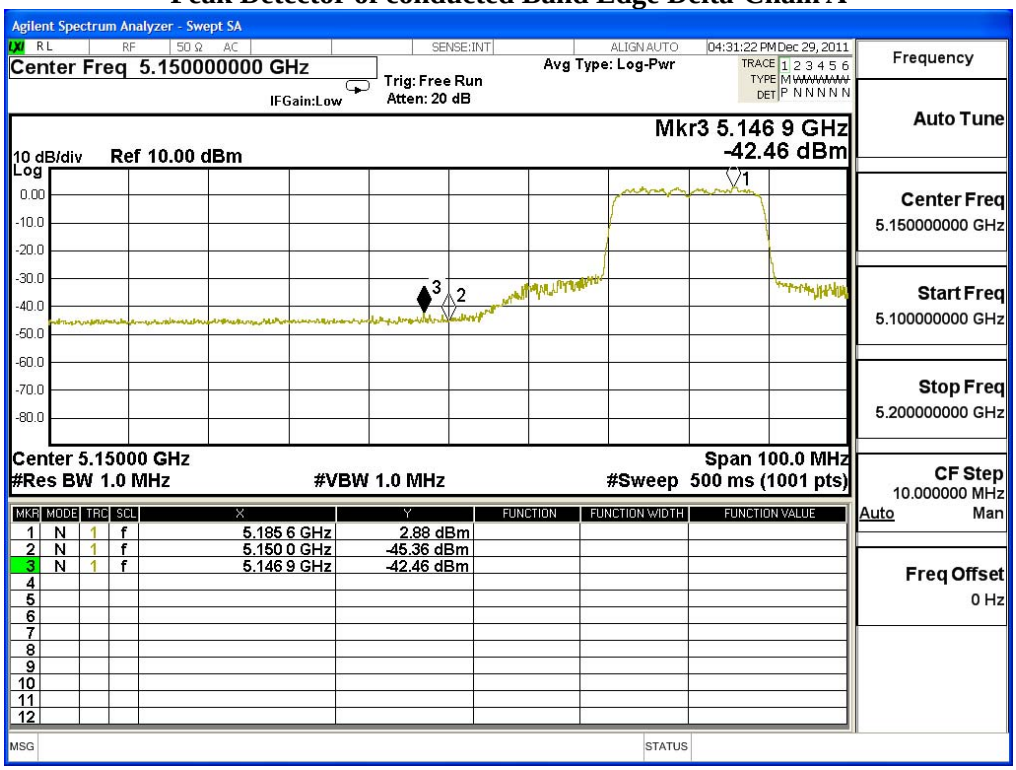
The Band Edge Field Strength was calculated using the Fundamental and Conducted Band Edge measurements per the Marker-Delta Method with the following formula:

Band Edge field Strength = F - Δ

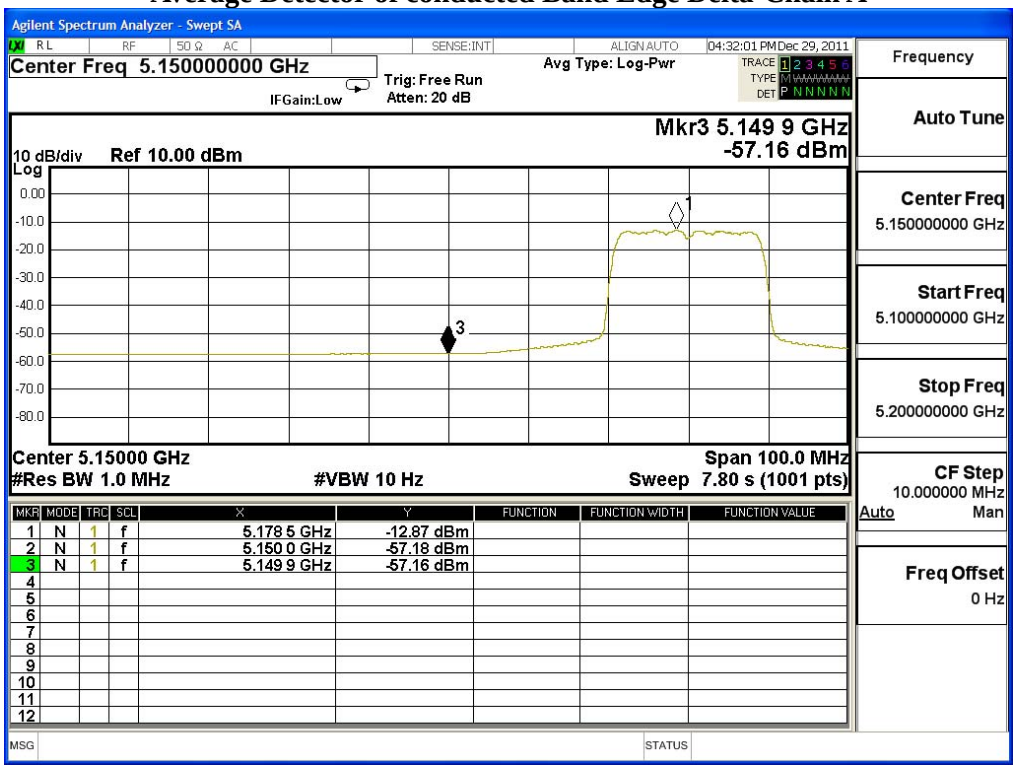
F = Fundamental field Strength (Peak or Average)

Δ = Conducted Band Edge Delta (Peak or Average)

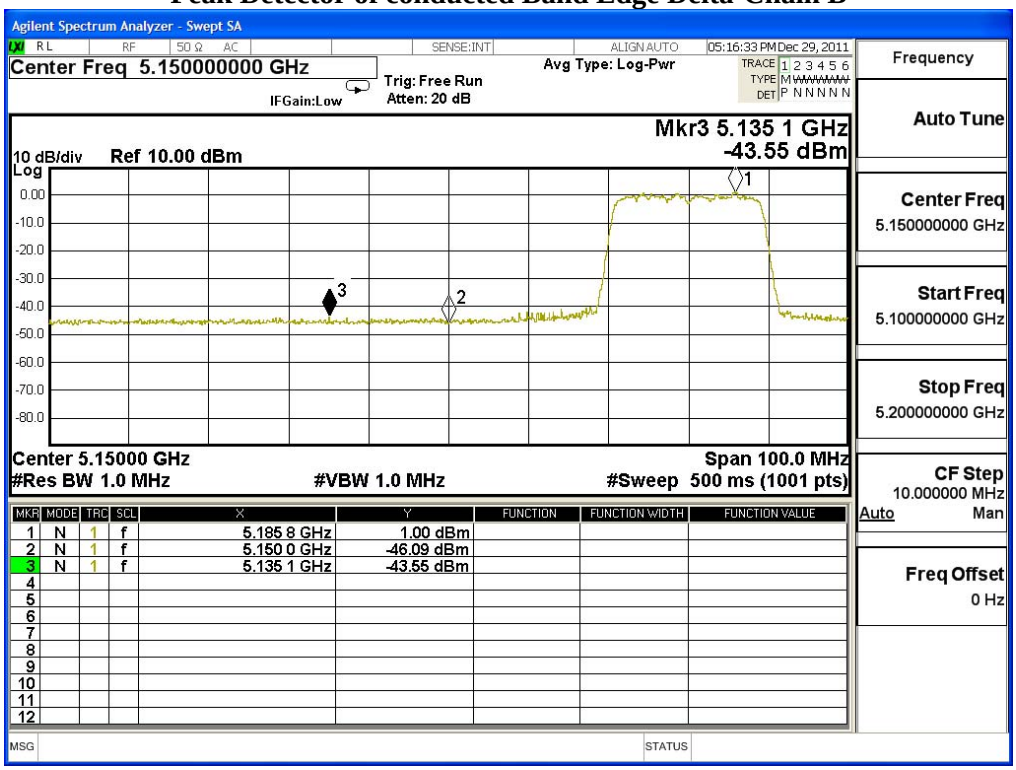
Peak Detector of conducted Band Edge Delta-Chain A



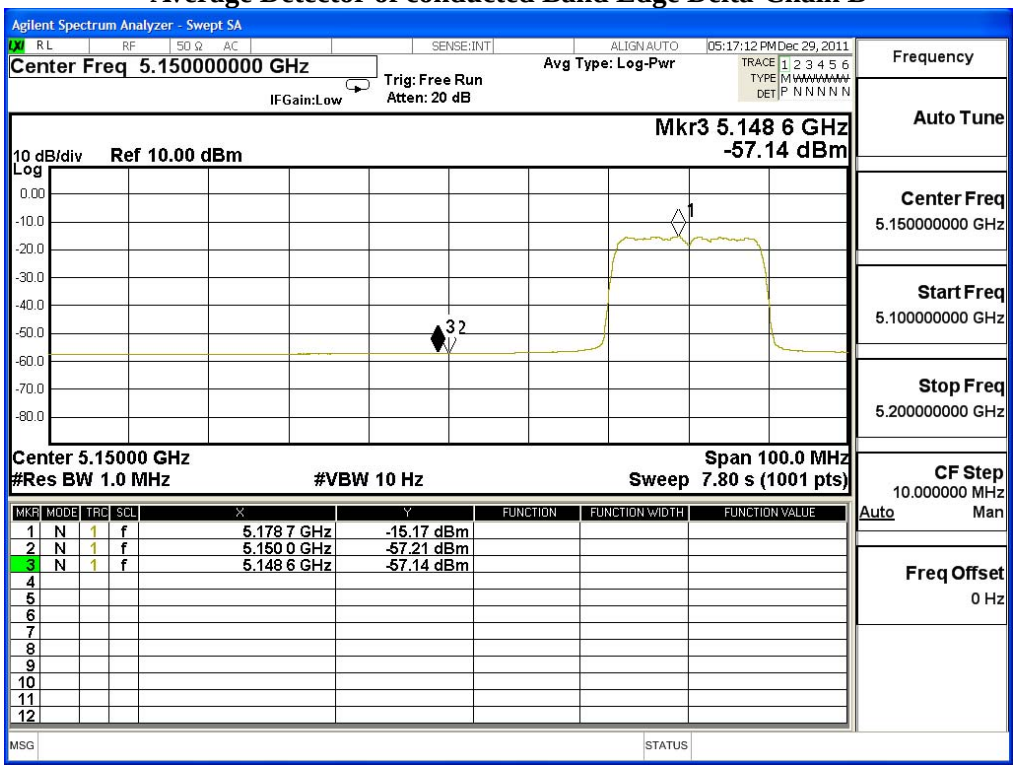
Average Detector of conducted Band Edge Delta-Chain A



Peak Detector of conducted Band Edge Delta-Chain B



Average Detector of conducted Band Edge Delta-Chain B

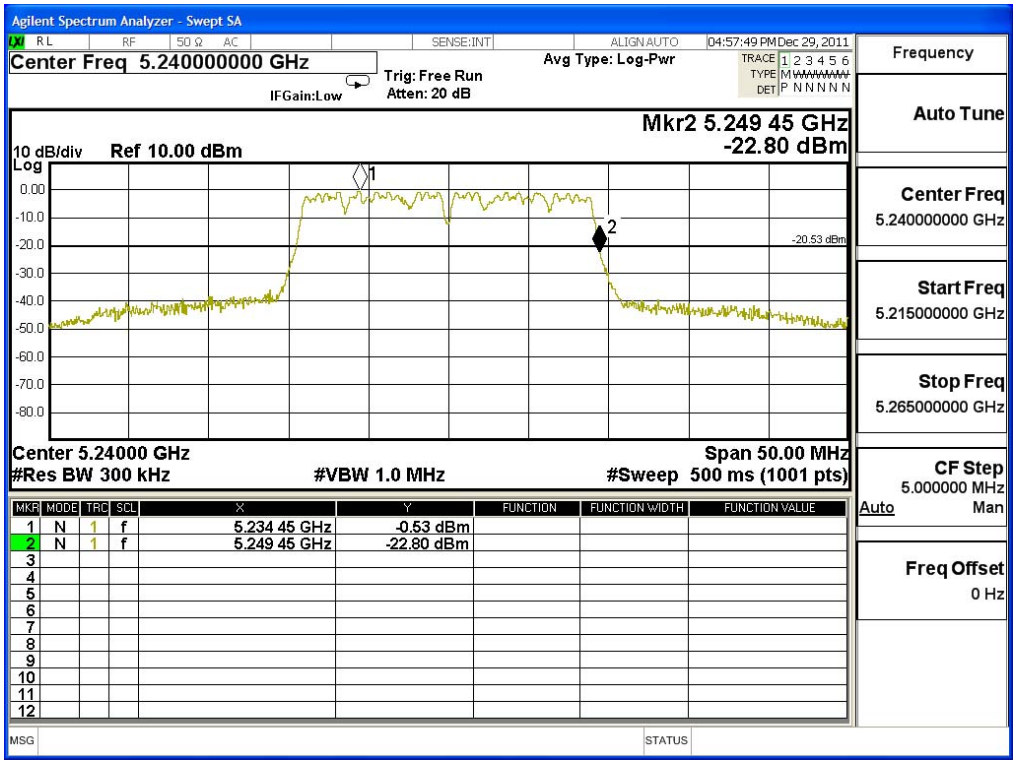


Product : WHDI Tx Stick
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - 20BW-Channel 48

Chain A

Test Frequency (MHz)	Measurement Level (20dB BW) (MHz)	Limit (MHz)	Result
5240	5249.45	<5250	PASS

NOTE: Accordance with 15.215 requirement.

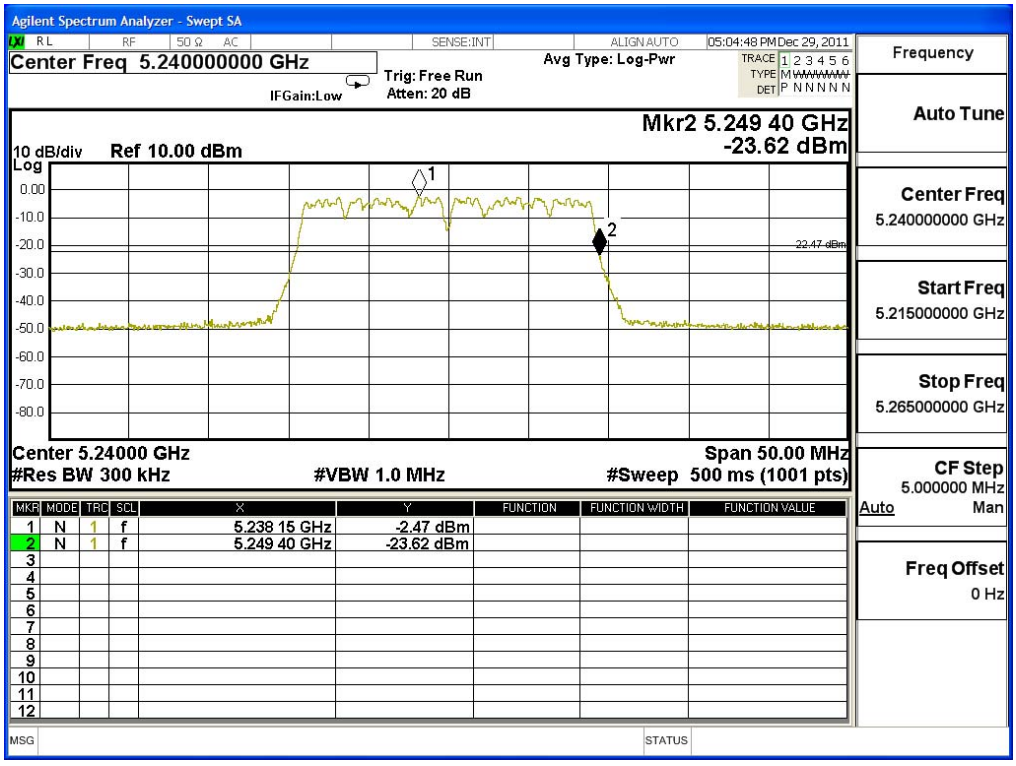


Product : WHDI Tx Stick
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - 20BW-Channel 48

Chain B

Test Frequency (MHz)	Measurement Level (20dB BW) (MHz)	Limit (MHz)	Result
5240	5249.40	<5250	PASS

NOTE: Accordance with 15.215 requirement.



Product : WHDI Tx Stick
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 2: Transmit - 40BW -Channel 38

Fundamental Filed Strength

Antenna Pole	Frequency [MHz]	Reading Level [dBuV]	Correction Factor [dB/m]	Emission Level [dBuV/m]	Detector
Horizontal	5190	34.907	57.85	92.758	Peak
Horizontal	5190	34.907	42.1	77.008	Average
Vertical	5190	37.077	55.86	92.938	Peak
Vertical	5190	37.077	41.46	78.538	Average

Note: 1:Spectrum Analyzer setting:

Peak detector: RBW=1MHz, VBW=1MHz

Average detector: RBW=1MHz, VBW=30Hz

Band Edge Test Data (Chain A)

Antenna Pole	Test Frequency (MHz)	Fundamental (dBuV/m)	Δ (dB)	Band Edge Field Strength (dBuV/m)	Requiqment Limit (dBuV/m)	Detector
Horizontal	5104.6	92.758	40.07	52.688	74.000	Peak
Horizontal	5150	77.008	39.24	37.768	54.000	Average
Vertical	5104.6	92.938	40.07	52.868	74.000	Peak
Vertical	5150	78.538	39.24	39.298	54.000	Average

Band Edge Test Data (Chain B)

Antenna Pole	Test Frequency (MHz)	Fundamental (dBuV/m)	Δ (dB)	Band Edge Field Strength (dBuV/m)	Requiqment Limit (dBuV/m)	Detector
Horizontal	5146.2	92.758	39.75	53.008	74.000	Peak
Horizontal	5149	77.008	39.02	37.988	54.000	Average
Vertical	5146.2	92.938	39.75	53.188	74.000	Peak
Vertical	5149	78.538	39.02	39.518	54.000	Average

Note:

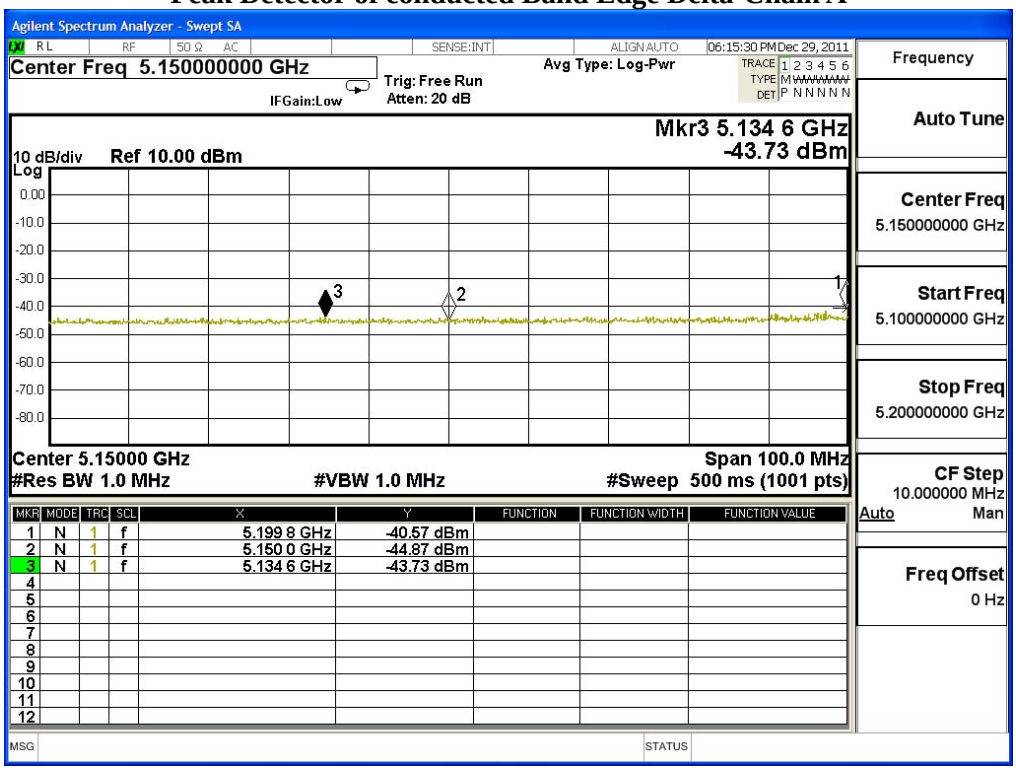
The Band Edge Field Strength was calculated using the Fundamental and Conducted Band Edge measurements per the Marker-Delta Method with the following formula:

Band Edge field Strength = F - Δ

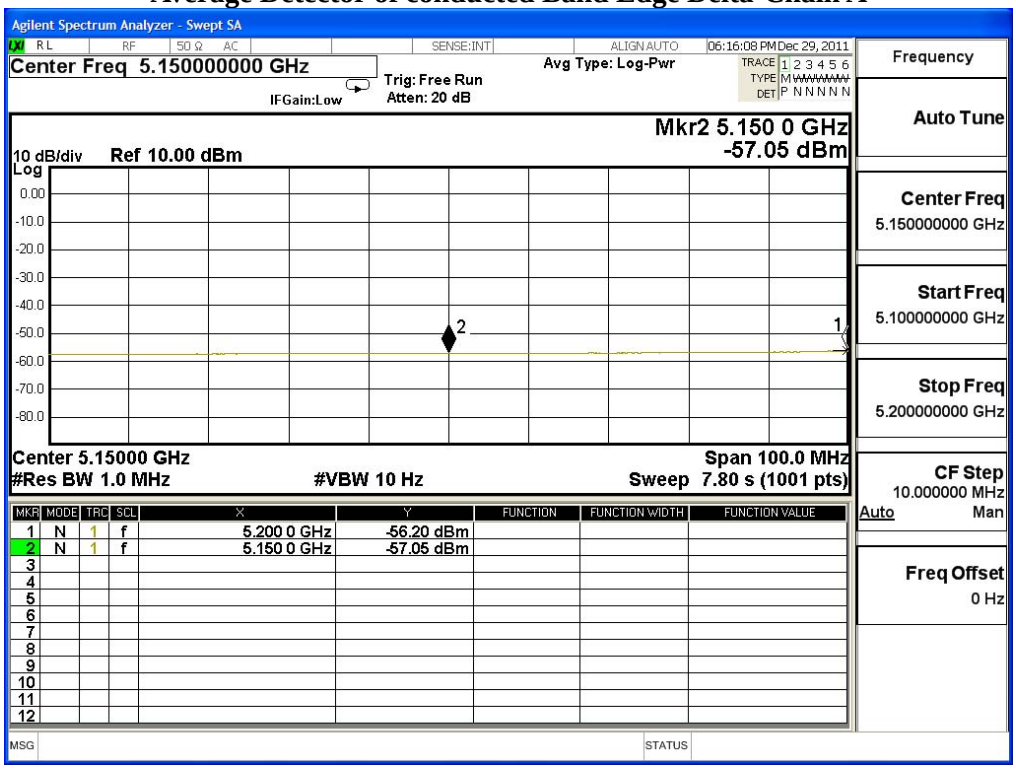
F = Fundamental field Strength (Peak or Average)

Δ = Conducted Band Edge Delta (Peak or Average)

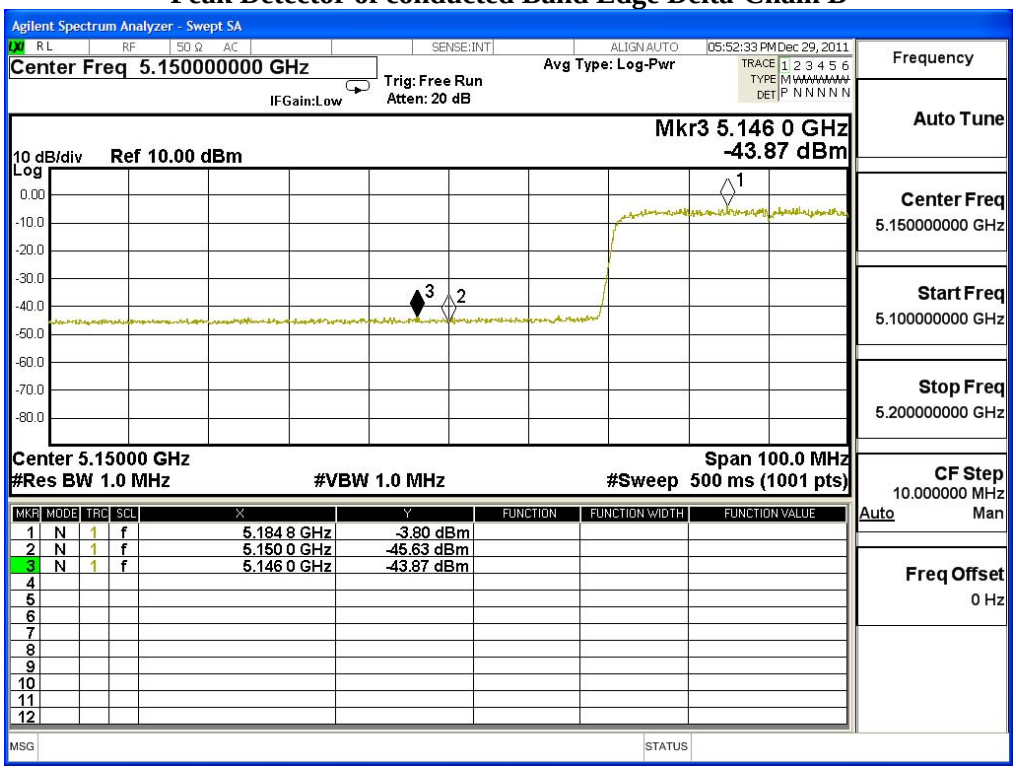
Peak Detector of conducted Band Edge Delta-Chain A



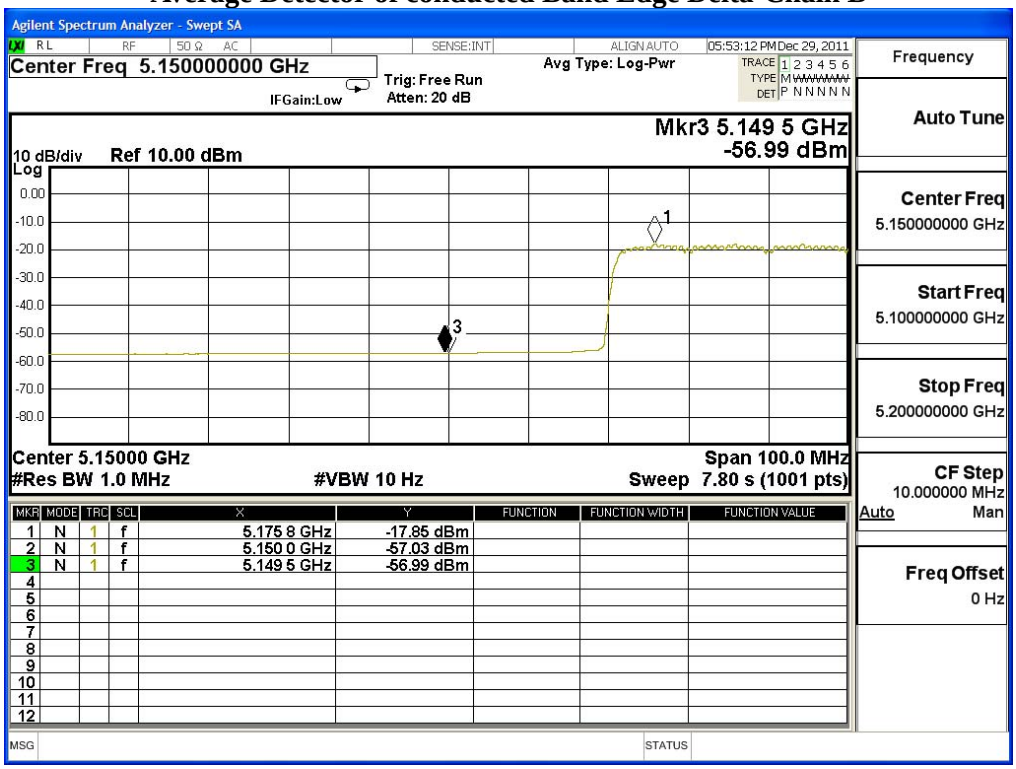
Average Detector of conducted Band Edge Delta-Chain A



Peak Detector of conducted Band Edge Delta-Chain B



Average Detector of conducted Band Edge Delta-Chain B

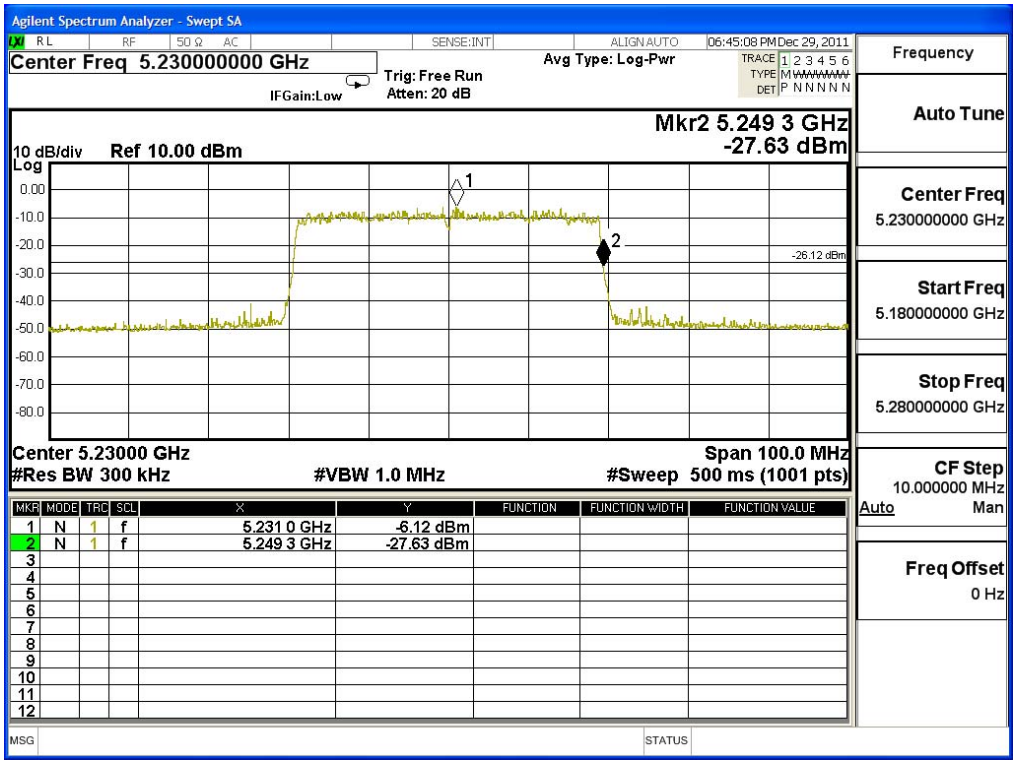


Product : WHDI Tx Stick
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - 20BW-Channel 48

Chain A

Test Frequency (MHz)	Measurement Level (20dB BW) (MHz)	Limit (MHz)	Result
5230	5249.30	<5250	PASS

NOTE: Accordance with 15.215 requirement.

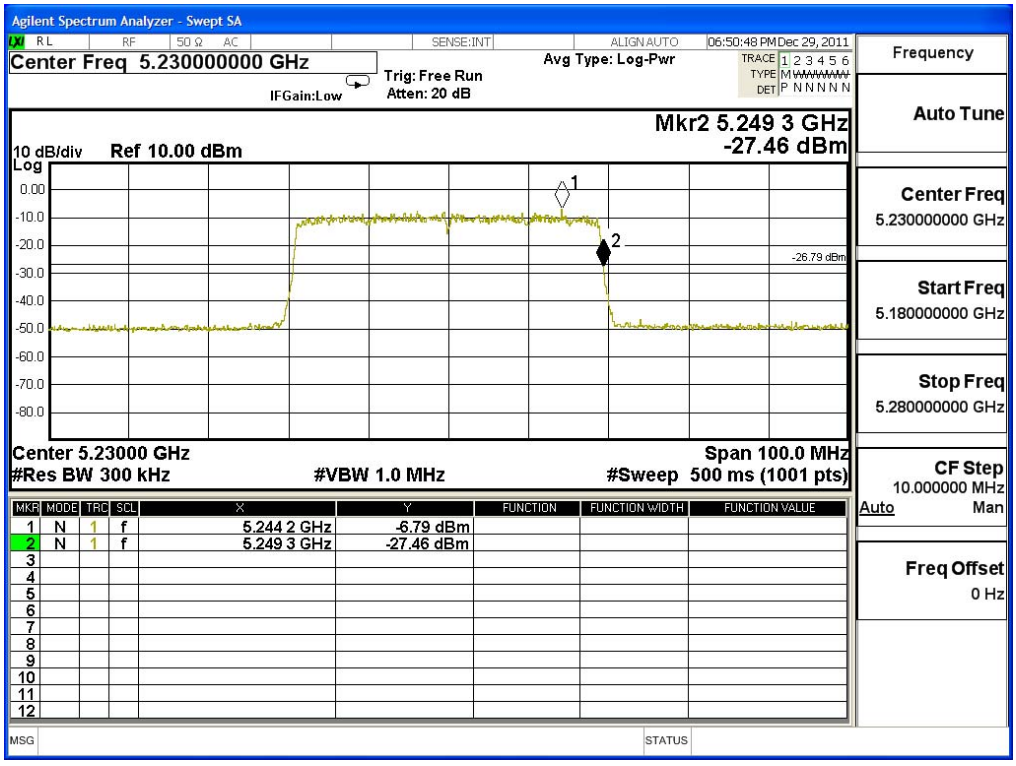


Product : WHDI Tx Stick
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - 20BW-Channel 48

Chain B

Test Frequency (MHz)	Measurement Level (20dB BW) (MHz)	Limit (MHz)	Result
5230	5249.30	<5250	PASS

NOTE: Accordance with 15.215 requirement.



8. Frequency Stability

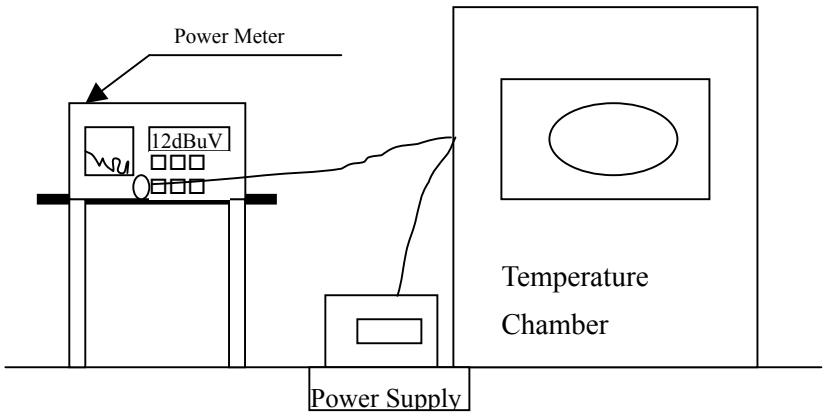
8.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2011
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2011
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2011

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

8.2. Test Setup



8.3. Limits

Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified

8.4. Test Procedure

The EUT was setup to ANSI C63.4, 2009; tested to DTS test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

8.5. Uncertainty

± 150 Hz

8.6. Test Result of Frequency Stability

Product : WHDI Tx Stick
Test Item : Frequency Stability
Test Site : Temperature Chamber
Test Mode : Carrier Wave

Chain A

Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tnom (20) °C	Vnom (110)V	36	5180.0000	5180.0002	-0.0002
		38	5190.0000	5190.0010	-0.0010
		44	5220.0000	5220.0008	-0.0008
		46	5230.0000	5230.0011	-0.0011
		48	5240.0000	5240.0004	-0.0004
Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tmax (50) °C	Vmax (126.5)V	36	5180.0000	5180.0003	-0.0003
		38	5190.0000	5190.0010	-0.0010
		44	5220.0000	5220.0009	-0.0009
		46	5230.0000	5230.0007	-0.0007
		48	5240.0000	5240.0004	-0.0004
Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tmax (50) °C	Vmin (93.5)V	36	5180.0000	5180.0004	-0.0004
		38	5190.0000	5190.0010	-0.0010
		44	5220.0000	5220.0010	-0.0010
		46	5230.0000	5230.0004	-0.0004
		48	5240.0000	5240.0005	-0.0005

Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tmin (0) °C	Vmax (126.5)V	36	5180.0000	5180.0003	-0.0003
		38	5190.0000	5190.0010	-0.0010
		44	5220.0000	5220.0009	-0.0009
		46	5230.0000	5230.0005	-0.0005
		48	5240.0000	5240.0006	-0.0006
Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tmin (0) °C	Vmin (93.5)V	36	5180.0000	5180.0003	-0.0003
		38	5190.0000	5190.0010	-0.0010
		44	5220.0000	5220.0009	-0.0009
		46	5230.0000	5230.0005	-0.0005
		48	5240.0000	5240.0006	-0.0006

Chain B

Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tnom (20) °C	Vnom (110)V	36	5180.0003	5180.0003	-0.0003
		38	5190.0009	5190.0009	-0.0009
		44	5220.0005	5220.0005	-0.0005
		46	5230.0010	5230.0010	-0.0010
		48	5240.0004	5240.0004	-0.0004
Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tmax (50) °C	Vmax (126.5)V	36	5180.0000	5180.0003	-0.0003
		38	5190.0000	5190.0009	-0.0009
		44	5220.0000	5220.0010	-0.0010
		46	5230.0000	5230.0006	-0.0006
		48	5240.0000	5240.0005	-0.0005
Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tmax (50) °C	Vmin (93.5)V	36	5180.0000	5180.0006	-0.0006
		38	5190.0000	5190.0011	-0.0011
		44	5220.0000	5220.0010	-0.0010
		46	5230.0000	5230.0003	-0.0003
		48	5240.0000	5240.0005	-0.0005

Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tmin (0) °C	Vmax (126.5)V	36	5180.0000	5180.0003	-0.0003
		38	5190.0000	5190.0010	-0.0010
		44	5220.0000	5220.0008	-0.0008
		46	5230.0000	5230.0006	-0.0006
		48	5240.0000	5240.0005	-0.0005
Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	△F (MHz)
Tmin (0) °C	Vmin (93.5)V	36	5180.0000	5180.0005	-0.0005
		38	5190.0000	5190.0010	-0.0010
		44	5220.0000	5220.0008	-0.0008
		46	5230.0000	5230.0005	-0.0005
		48	5240.0000	5240.0005	-0.0005

9. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs