Radio Test Report: EDCS - 1401017

CP-DX70
Desktop Telepresence

FCC ID:LDKDX700976 IC: **2461B- DX700976**

5150-5250 MHz

Against the following Specifications:

CFR47 Part 15.407

RSS210

Cisco Systems
EMC Laboratory
170 West Tasman Drive
San Jose, CA 95134

Author: Allan Beecroft
Approved By: See EDCS
Title: See EDCS

This report replaces any previously entered test report under EDCS - 1401017

This test report has been electronically authorized and archived using the CISCO Engineering Document Control system.

Section 1: Overview

1.1 Test Summary

Samples were assessed against the tests detailed in section 3 under the requirements of the following specifications:

Emission	Immunity
CFR47 Part 15.407 RSS-210	N/A

The specifications listed above represent actual tests performed to demonstrate compliance against the specifications and basic standards listed on the front cover of this report. This list is not a one to one match to the front cover for one or more of the following reasons.

1. Basic standards call up many different test phenomena specifications such as the 61000-4-X series. The basic standards define which elements and levels shall be applied from these specifications and as such it is not appropriate to list the individual specifications on the front cover.
2. A Standard listed on the front cover may be required in a particular country but is not appropriate for the particular technologies included in the equipment under test. E.g. You cannot test a DC product to the mains Harmonics requirements in EN61000-3-2. See section 3.2.
3. Test results against a particular standard or specification may be included in a different test report. See section 3.2 for an EDCS reference of this data.
4. Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
5. Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.
6. Testing may have been performed to an equivalent test that satisfies the requirements of the standards and specifications listed on the front cover of the report. See section 3.2.
7. Where radiated emissions testing has been performed to EN55022/CISPR22 the additional requirements of VCCI: V-3/2006.04, EN55022: 1994 +A1/2 and CAN/CSA- CISPR 22-02 have also been evaluated unless otherwise stated.
8. Testing to the requirements of CFR47 Part 15 was performed against the CISPR22 limits. The results are therefore deemed satisfactory evidence of compliance with Industry Canada Interference Causing Equipment Standard ICES-003.
9. Where assessment has been performed to CISPR24, all the applicable test requirements may have not been covered. Refer to the results section for the tests performed.

Notes:

1) Where a specification listed on the front cover of this report has deviations from the basic standards listed above, the additional technical requirements of the specification were also assessed.
2) Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
3) Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.

Section 2: Assessment Information

2.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on the samples submitted. The testing was performed by and for the use of Cisco systems Inc:

With regard to this assessment, the following points should be noted:

a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results due to production and measurement tolerances.

b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.

c) Where relevant, the apparatus was only assessed using the susceptibility criteria defined in this report and the Test Assessment Plan (TAP).

d) All testing was performed under the following environmental conditions:

Temperature	15°C to 35°C (54°F to 95°F)
Atmospheric Pressure	860mbar to 1060mbar (25.4" to 31.3")
Humidity	10% to 75*%

*[Where applicable] For ESD testing the humidity limits used were 30% to 60% and for EFT/B tests the humidity limits used were 25% to 75%.

e) All AC testing was performed at the following supply voltage:
110V 60 Hz (+/-20%)

2.2 Date of testing

04-MARCH-2014

2.3 Report Issue Date

Cisco uses an electronic system to issue, store and control the revision of test reports. This system is called the Engineering Document Control System (EDCS). The actual report issue date is embedded into the original file on EDCS. Any copies of this report, either electronic or paper, that are not on EDCS must be considered uncontrolled

2.4 Testing facilities

This assessment was performed by:

Testing Laboratory

Cisco Systems, Inc.,
170 West Tasman Drive
San Jose, CA 95134,
USA

Registration Numbers for Industry Canada

Cisco System Site	Site Identifier
Building P, 10m Chamber	Company #: 2461N-2
Building P, 5m Chamber	Company #: 2461N-1
Building I, 5m Chamber	Company #: 2461M-1

Test Engineers

Allan Beecroft, Technical Leader, CISCO Systems Inc.

2.5 Equipment Assessed (EUT)

CP-DX70 Desktop TelePresence

2.6 EUT Description

The Cisco DX70 offers uncompromised collaboration for every desk. Experience best in class HD video and expanded collaboration capabilities such as UC features, Android applications and email all within a single integrated device. Now is the time for simple to use Collaboration experience at a price so affordable you can empower every office and home office desktop.

Section 3: Result Summary

Conducted Tests

Basic Standard	Result
99% and 26dB Bandwidth	Pass
Peak Output Power	Pass
Power Spectral Density	Pass
Peak Excursion	Pass
Conducted Spurious Emissions	Pass
Restricted Band Edge Measurements	Pass
AC Power Line Conducted Emissions	Pass

Radiated Tests

Basic Standard	Result
Radiated Spurious and Harmonic Emissions	Pass
Radiated Emissions 30MHz to 1GHz	Pass

Section4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing. During preliminary testing all three planes (X,Y & Z) were evaluated to determine “Worst Case”. The orientation used for this report was demined “Worst Case”.

4.1 Sample Details

Sample Number	Equipment Details	Serial Number	Part Number
S01	CP-DX70 Desktop TelePresence (Charcoal)	FOC1803N9SE	CP-DX70
S02	LITEON PA-1600-2A-LF AC/DC Adapter	LIT1748098P	N/A
S03	CP-DX70 Desktop TelePresence (Charcoal)	FOC1803N9PR	CP-DX70
S04	AIR-CAP2702I-A-K9 Access Point	RFDP1BVZ017	N/A

The following antennas were evaluated as part of this testing process. The antennas listed reflect the maximum gain allowed for each family type of antenna:

Fixed internal Amphenol Dual Band Antenna at 5GHz, Gain: (no external antenna can be used.)

5150 – 5250MHz: 3.3dBi
5250 – 5350MHz: 3.1dBi
5500 – 5700MHz: 3.5dBi
5745 – 5805MHz: 4dBi

4.2 System Details

System #	Description	Samples
1	Radio Test Sample and Power Supply	S01 & S02
2	Radio Test Sample for DFS Tests	S03, S02 & S04

4.3 Mode of Operation Details

Mode#	Description	Comments
1	802.11a/n Test Mode	System is placed in a continuous Transmit Mode at various channels per Test Requirements. Worse Case Data Rate used for all Testing. 802.11a set to 6Mbps, HT20 set to MCS0 & HT40 set to MCS0
2	802.11a/n & Bluetooth Test Mode	System is placed in a continuous Transmit Mode with wi-fi & Bluetooth active at various channels per Test Requirements. Worse Case Data Rate used for all Testing. 802.11a set to 6Mbps, HT20 set to MCS0 & HT40 set to MCS0.

Section 5: Modifications

5.1 Sample Modifications Performed During Assessment

No modifications were performed during assessment.

Appendix A: Test Results

Target Maximum Channel Power

The following table details the maximum supported Total Channel Power for all operating modes.

Operating Mode	Maximum Channel Power (dBm)		
	Frequency (MHz)		
	5180	5200	5240
802.11a (6-54 Mbps)	16	16	15
802.11n HT20 (MCS0 – MCS7) up to 72 Mbps	16	15	16
	5190	5230	
802.11n HT40 (MCS0 – MCS7) up to 150 Mbps	16	16	

Frequency Stability 802.11a:

Test Conditions (see EN 301 893 V1.6.1, clause 5.3.2.1):

Power Setting (for a single TX chain): 16 dBm (5180MHz) ☐ EIRP ☒ Conducted

Duty Cycle: 100 %

Rel. Humidity: 34 %

Test Frequency: **5 180 MHz**

						Test results			
						Measured Frequency (MHz)	Delta Frequency (kHz)	20 ppm Limit (+/- kHz)	Margin (kHz)
T_{nom}	23	°C	V_{nom}	230	Vac	5179.9400	-60.0	103.6	43.6
T_{min}	0	°C	V_{min}	207	Vac	5179.9505	-49.5	103.6	54.1
			V_{max}	253	Vac	5179.9340	-66.0	103.6	37.6
T_{max}	40	°C	V_{min}	207	Vac	5179.9685	-31.5	103.6	72.1
			V_{max}	253	Vac	5179.9160	-84.0	103.6	19.6

Frequency Stability 802.11n (HT20):

Test Conditions (see EN 301 893 V1.6.1, clause 5.3.2.1):								
Power Setting (for a single TX chain):	15 dBm	(5180MHz)	☐ EIRP		☒ Conducted			
Duty Cycle:	100	%			Test results			
Rel. Humidity:	34	%			Measured Frequency (MHz)	Delta Frequency (kHz)	20 ppm Limit (+/- kHz)	Margin (kHz)
Test Frequency:	**5 180 MHz**							
T_{nom}	23	°C	V_{nom}	230 Vac	5179.9395	-60.5	103.6	43.1
T_{min}	0	°C	V_{min}	207 Vac	5179.9235	-76.5	103.6	27.1
			V_{max}	253 Vac	5179.9035	-96.5	103.6	7.1
T_{max}	40	°C	V_{min}	207 Vac	5179.9500	-50.0	103.6	53.6
			V_{max}	253 Vac	5179.9600	-40.0	103.6	63.6

Frequency Stability 802.11n (HT40):

Test Conditions (see EN 301 893 V1.6.1, clause 5.3.2.1):								
Power Setting (for a single TX chain):	15 dBm	(5190MHz)	☐ EIRP		☒ Conducted			
Duty Cycle:	100	%			Test results			
Rel. Humidity:	34	%			Measured Frequency (MHz)	Delta Frequency (kHz)	20 ppm Limit (+/- kHz)	Margin (kHz)
Test Frequency:	**5 190 MHz**							
T_{nom}	23	°C	V_{nom}	230 Vac	5190.0475	47.5	103.8	56.3
T_{min}	0	°C	V_{min}	207 Vac	5190.0485	48.5	103.8	55.3

			V_{max}	253	Vac	5190.0310	31.0	103.8	72.8
T_{max}	40	°C	V_{min}	207	Vac	5190.0620	62.0	103.8	41.8
			V_{max}	253	Vac	5190.0590	59.0	103.8	44.8

99% and 26dB Bandwidth

Connect the antenna port(s) to the spectrum analyzer input. Using the spectrum analyzer Channel Bandwidth mode, configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).

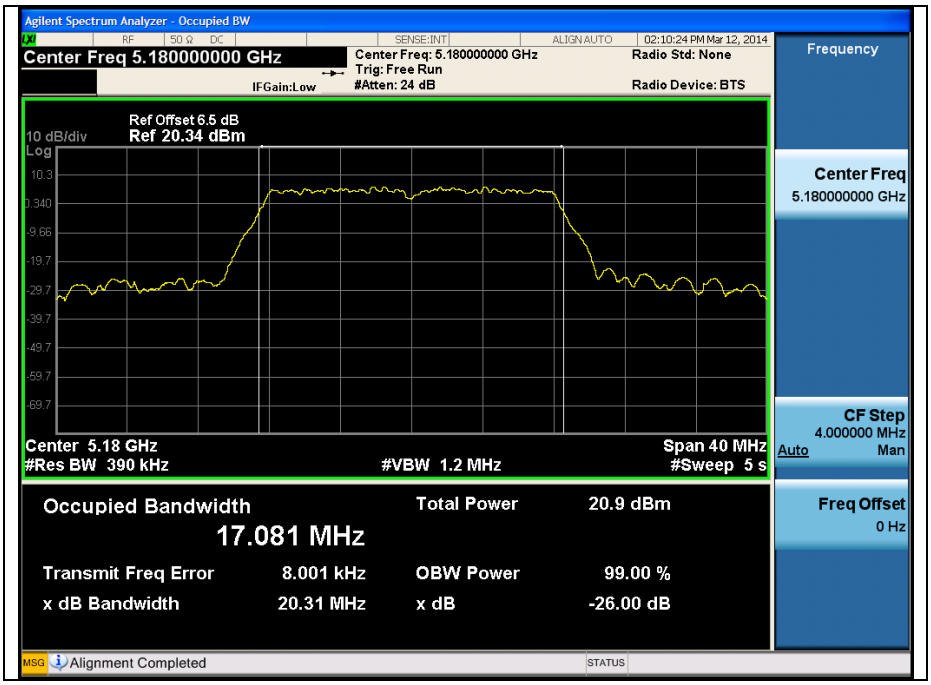
Center Frequency:	Frequency from table below
Span:	2 x Nominal Bandwidth (e.g. 40MHz for a 20MHz channel)
Reference Level:	20 dBm
Attenuation:	24 dB
Sweep Time:	5 s
Resolution Bandwidth:	1%-3% of 26 dB Bandwidth
Video Bandwidth:	≥Resolution Bandwidth
X dB Bandwidth:	26 dB
Detector:	Peak
Trace:	Single

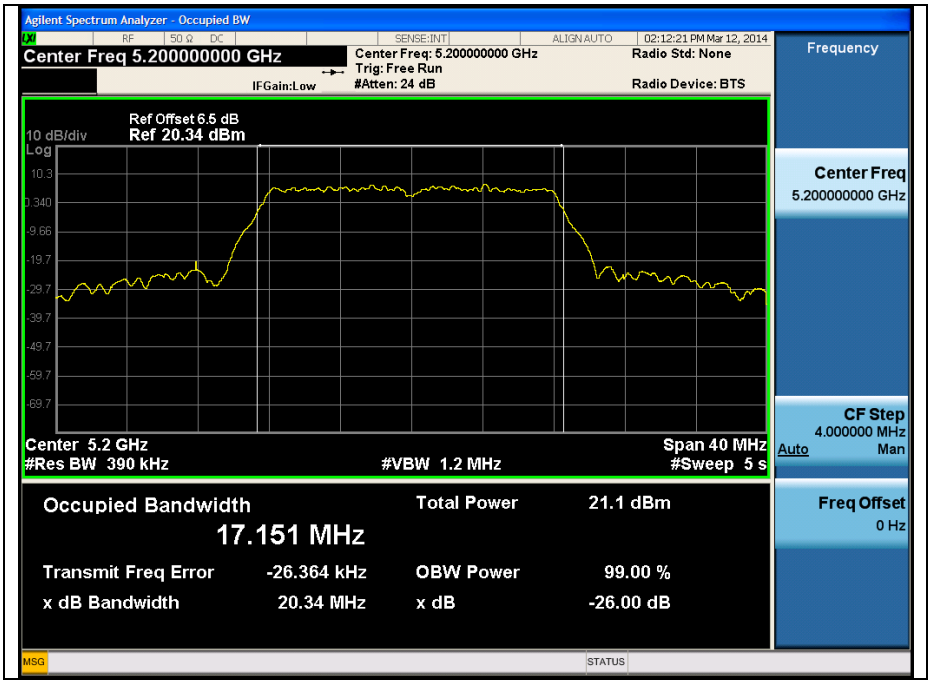
Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:

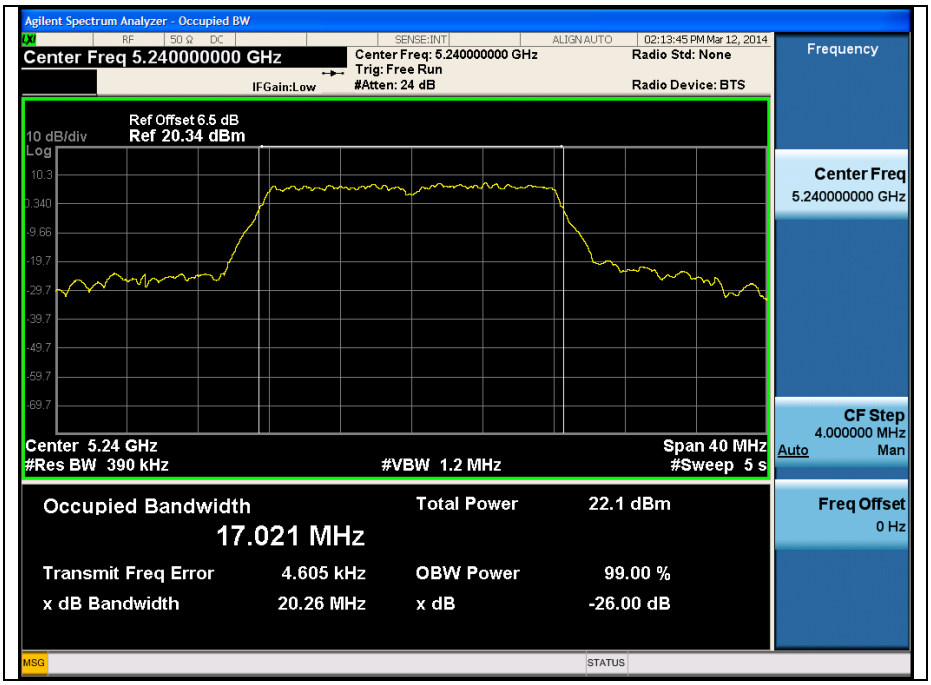
99% and 26dB Bandwidth for 802.11a

FREQUENCY (MHz)	DATA RATE	99% BANDWIDTH (MHz)	26dB BANDWIDTH (MHz)
5180	**6Mbps**	**17.081**	**20.31**
5200	**6Mbps**	**17.151**	**20.34**
5240	**6Mbps**	**17.021**	**20.26**

Graphical Test Results:



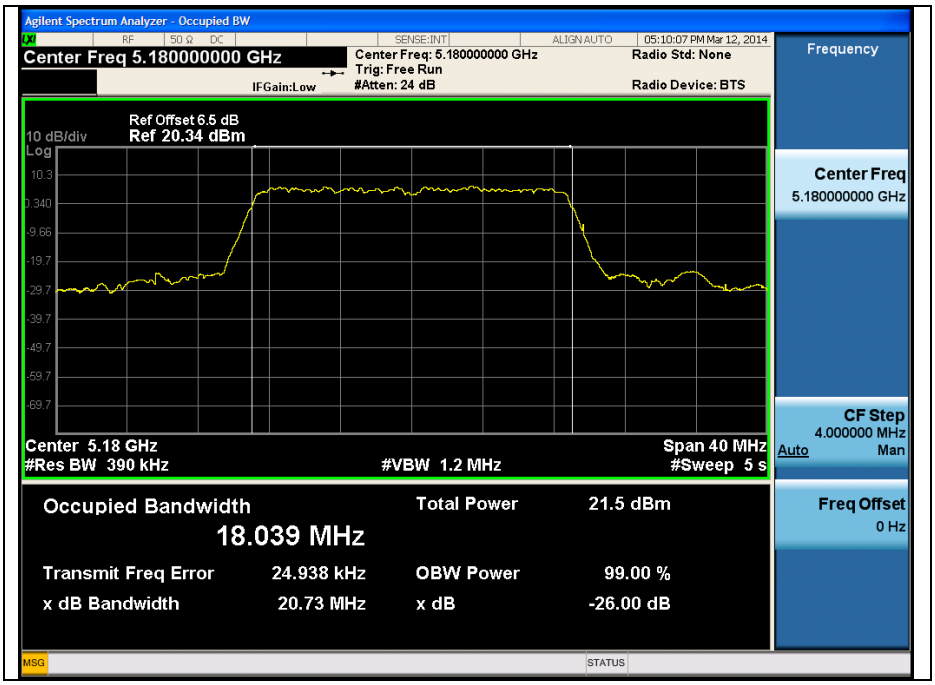


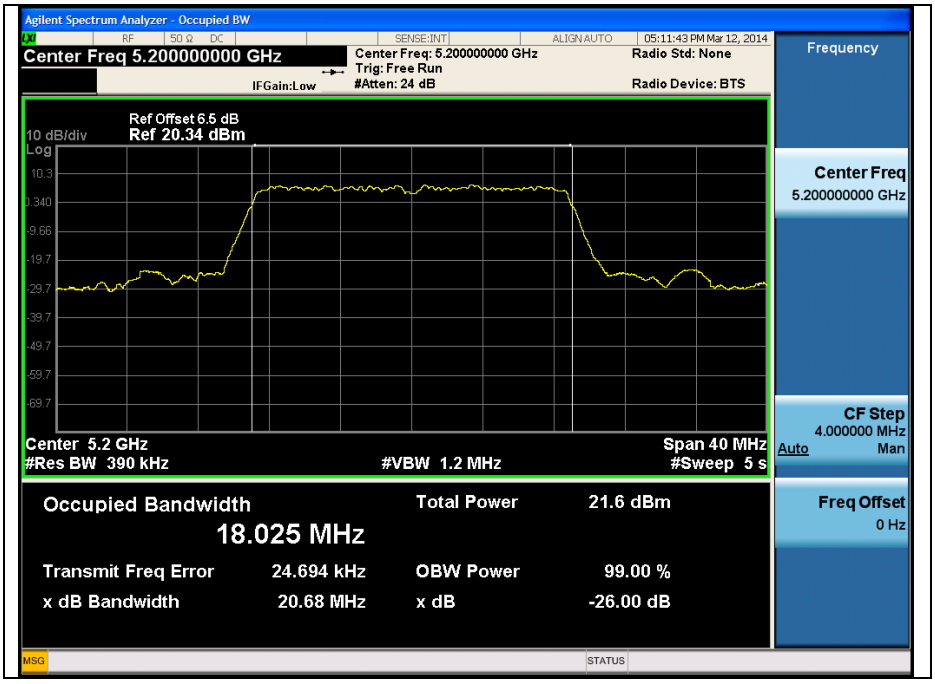


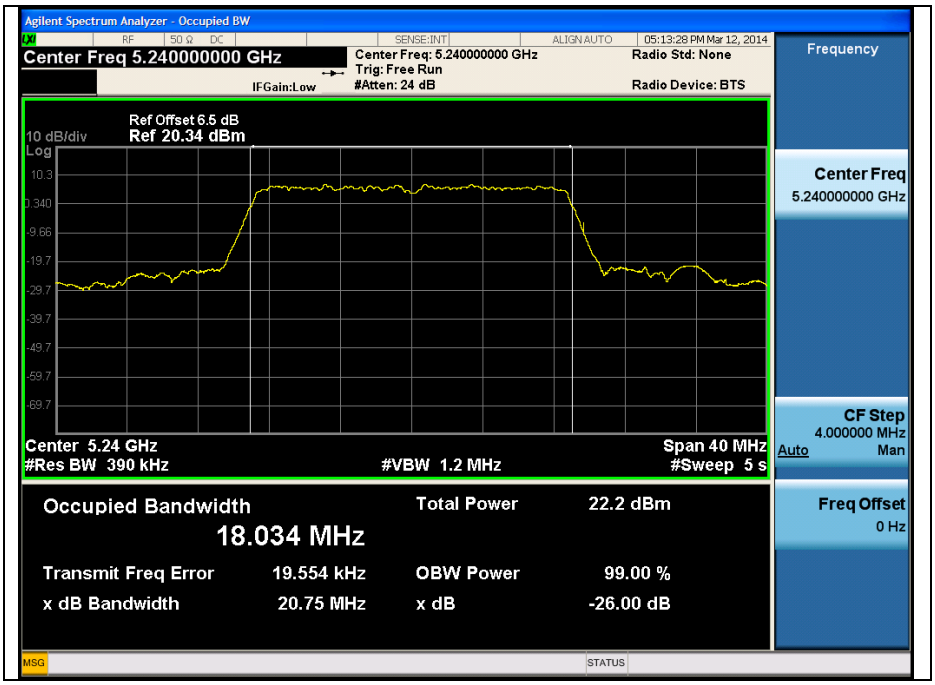
99% and 26dB Bandwidth for 802.11n (HT20)

FREQUENCY (MHz)	DATA RATE	99% BANDWIDTH (MHz)	26dB BANDWIDTH (MHz)
5180	MCS0	18.039	20.73
5200	MCS0	18.025	20.68
5240	MCS0	18.034	20.75

Graphical Test Results :



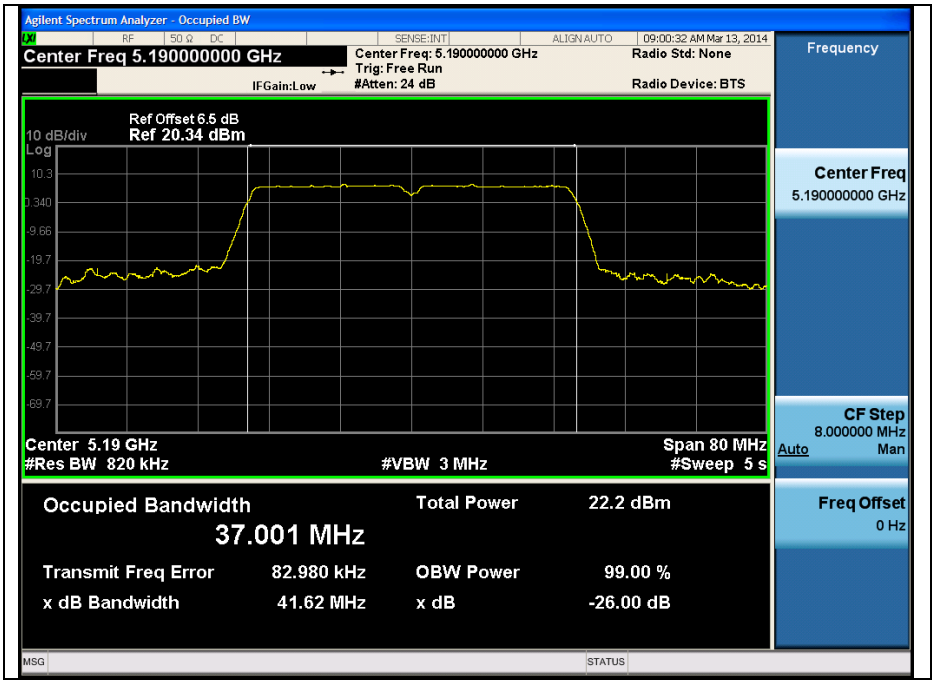


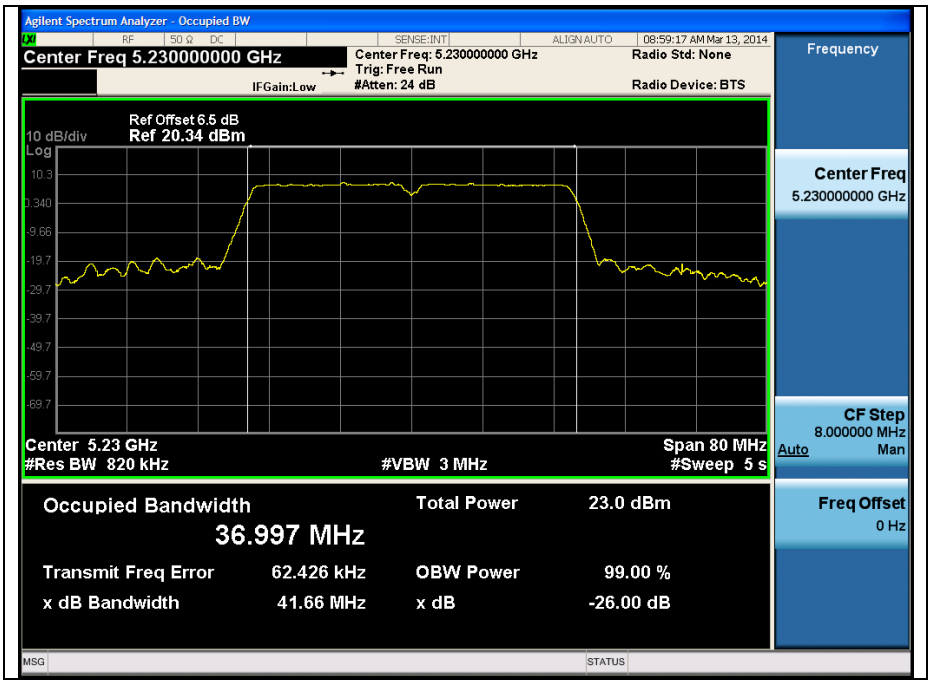


99% and 26dB Bandwidth for 802.11n (HT40)

FREQUENCY (MHz)	DATA RATE	99% BANDWIDTH (MHz)	26dB BANDWIDTH (MHz)
5190	MCS0	37.001	41.62
5230	MCS0	36.997	41.66

Graphical Test Results:





Peak Output Power for 802.11a

15.407: For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The smallest 26dB bandwidth for all channels is 19.48 MHz. The maximum conducted output power is calculated as 4dBm+10*log(19.48MHz) = 16.9dBm

FREQUENCY (MHZ)	DATA RATE	PEAK OUTPUT POWER (dBm)	LIMIT (dBm)	MARGIN (dB)
5180	**6**	**14.52**	**16.9**	**-2.38**
5200	**6**	**14.49**	**16.9**	**-2.41**
5240	**6**	**15.43**	**16.9**	**-1.47**

RSS-210 (A9.2)

Band 5150–5250 MHz

Power limits

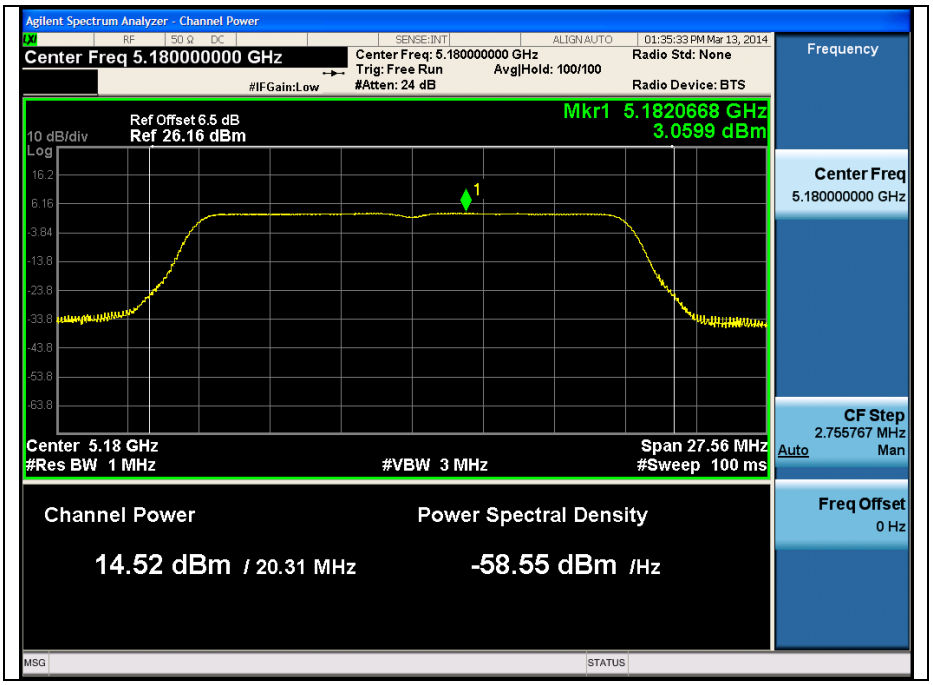
The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 $\log_{10}$ B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

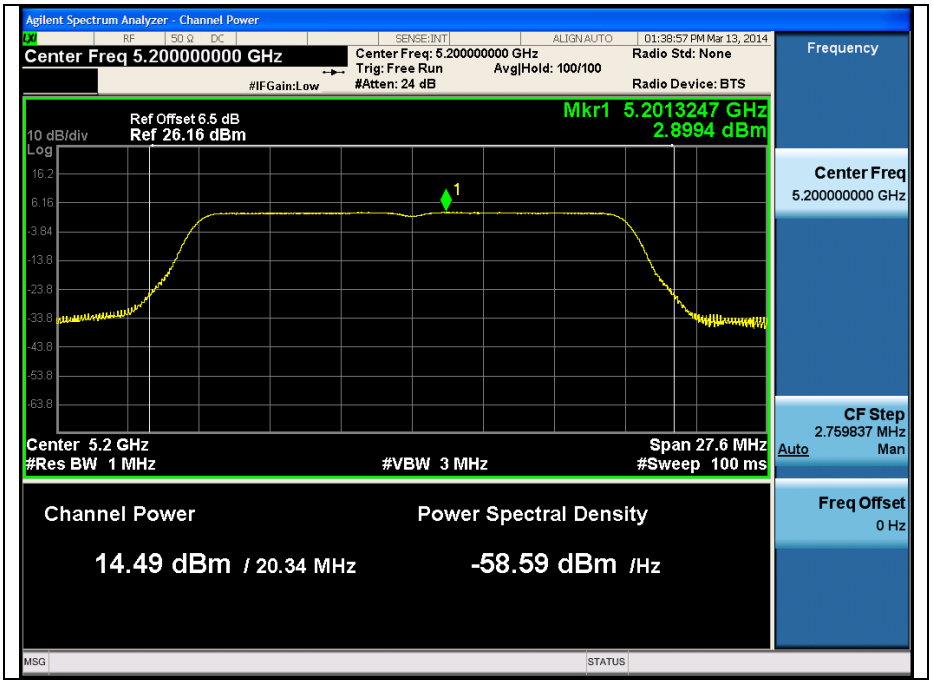
The smallest 99dB bandwidth for all channels is 17.021MHz. The maximum conducted output power is calculated as 10dBm+10*log(17.021MHz) = 22.31dBm, which is less than 200mW (23dBm). The value of 3.3dBi is then subtracted from 22.31dBm to account for antenna gain, resulting in a limit of 19.01dBm.

Frequency (MHz)	Data Rate (Mbps)	Peak Output Power (dBm)	EIRP Limit (dBm)	Margin (dB)
5180	6	**14.52**	19.01	-4.49
5200	6	**14.49**	19.01	-4.52
5240	6	**15.43**	19.01	-3.58

The maximum supported antenna gain is 3.3dBi.

Graphical Test Results:





Peak Output Power for 802.11n HT20

15.407: For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The smallest 26dB bandwidth for all channels is 20.68 MHz. The maximum conducted output power is calculated as 4dBm+10*log(20.68MHz) = 17.2dBm

FREQUENCY (MHZ)	DATA RATE	PEAK OUTPUT POWER (dBm)	LIMIT (dBm)	MARGIN (dB)
5180	**MCS0**	**14.85**	**17.2**	**-2.35**
5200	**MCS0**	**14.66**	**17.2**	**-2.54**
5240	**MCS0**	**15.14**	**17.2**	**-2.06**

RSS-210 (A9.2)

Band 5150–5250 MHz

Power limits

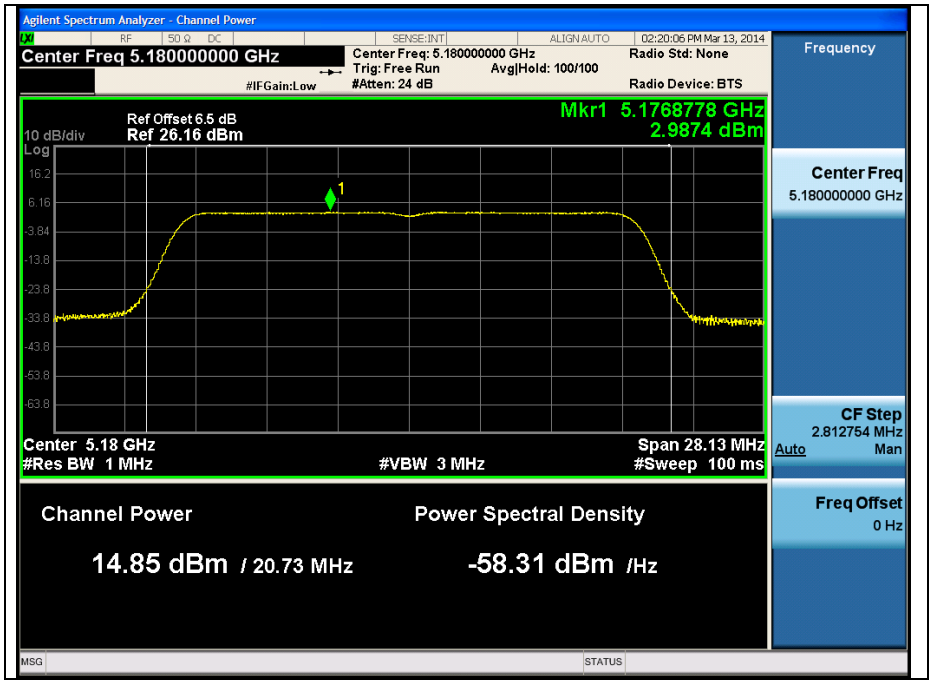
The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 $\log_{10}$ B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

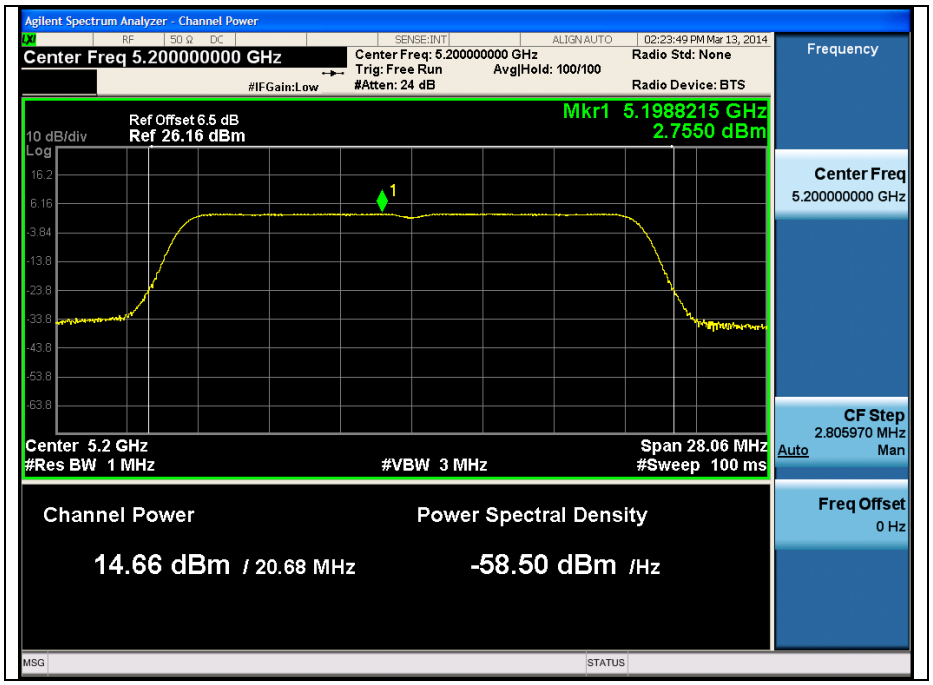
The smallest 99dB bandwidth for all channels is 18.025MHz. The maximum conducted output power is calculated as 10dBm+10*log(18.025MHz) = 22.56dBm, which is less than 200mW (23dBm). The value of 3.3dBi is then subtracted from 22.56dBm to account for antenna gain, resulting in a limit of 19.26dBm.

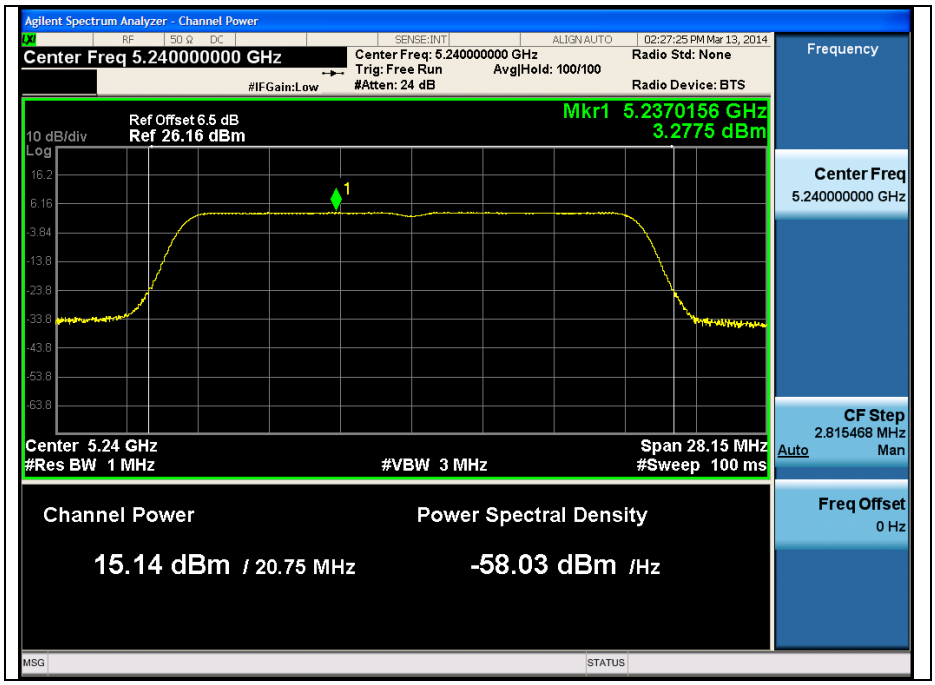
Frequency (MHz)	Data Rate (Mbps)	Peak Output Power (dBm)	EIRP Limit (dBm)	Margin (dB)
5180	MCS0	**14.85**	19.26	-4.41
5200	MCS0	**14.66**	19.26	-4.60
5240	MCS0	**15.14**	19.26	-4.12

The maximum supported antenna gain is 3.3dBi.

Graphical Test Results:







Peak Output Power for 802.11n HT40

15.407: For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The smallest 26dB bandwidth for all channels is 41.62MHz. The maximum conducted output power is calculated as 4dBm+10*log(41.62MHz) = 20.2dBm

Peak Output Power for 802.11n (HT40):

FREQUENCY (MHZ)	DATA RATE	PEAK OUTPUT POWER (dBm)	LIMIT (dBm)	MARGIN (dB)
5190	**MCS0**	**14.87**	**20.2**	**-5.33**
5230	**MCS0**	**15.50**	**20.2**	**-4.70**

RSS-210 (A9.2)

Band 5150–5250 MHz

Power limits

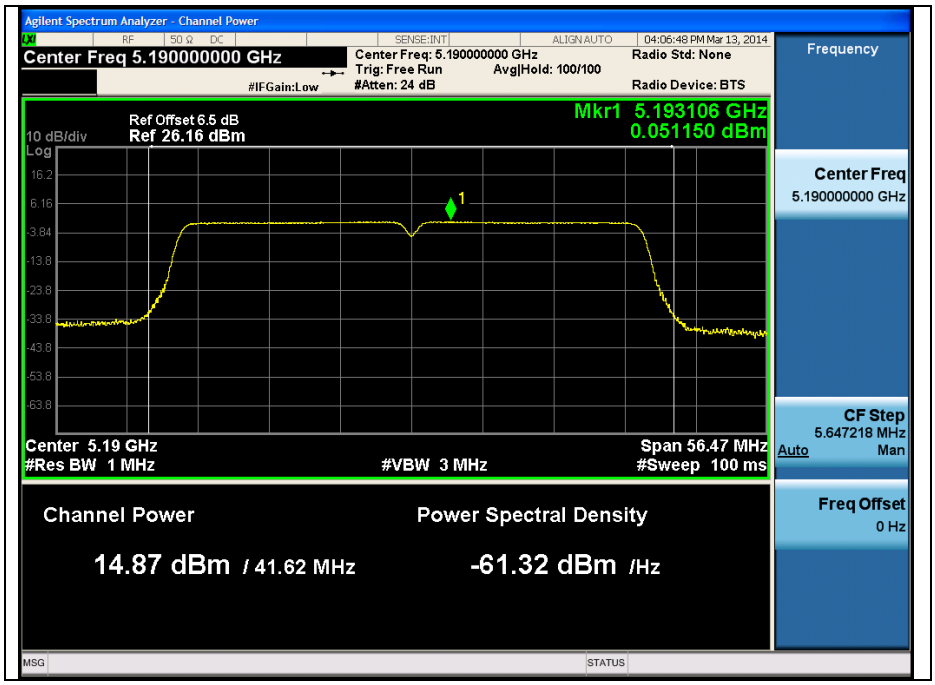
The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 $\log_{10}$ B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

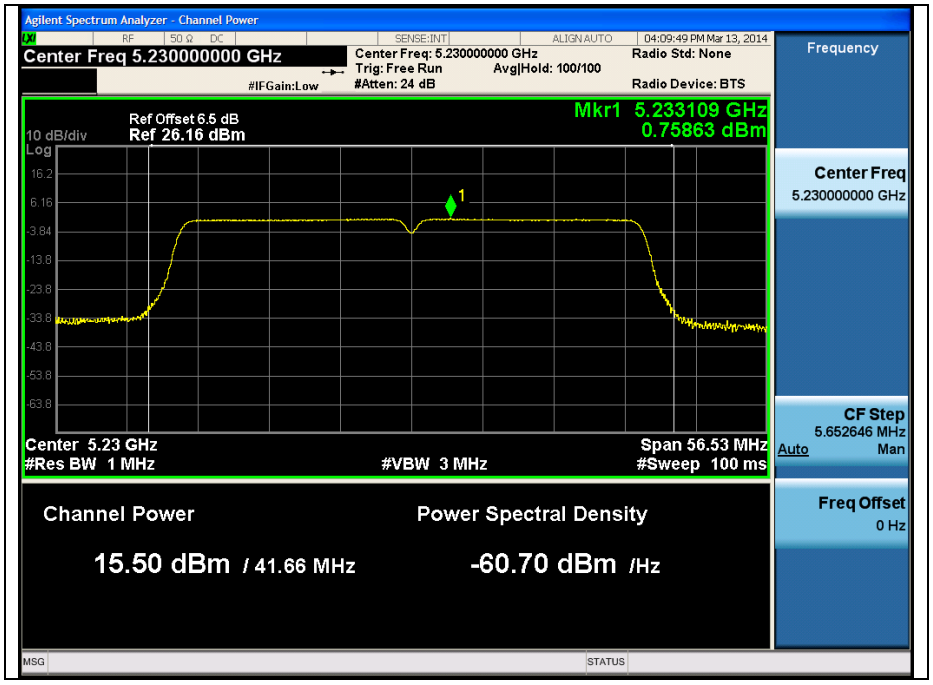
The smallest 99dB bandwidth for all channels is 37MHz. The maximum conducted output power is calculated as 10dBm+10*log(37MHz) = 25.68dBm, which is greater than 200mW (23dBm). The value of 3.3dBi is then subtracted from 25.68dBm to account for antenna gain, resulting in a limit of 22.38dBm.

Frequency (MHz)	Data Rate (Mbps)	Peak Output Power (dBm)	EIRP Limit (dBm)	Margin (dB)
5190	MCS0	**14.87**	22.38	-7.51
5230	MCS0	**15.50**	22.38	-6.88

The maximum supported antenna gain is 3.3dBi.

Graphical Test Results:





Power Spectral Density

15.407: For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-210 A9.2: The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

The results table below shows the FCC peak power spectral density limit. The maximum supported antenna gain is 3.3dBi. If the antenna gain is subtracted from the eirp spectral density limit from RSS-210, the limit is 6.7dBm. Compliance to the more stringent limit of 4dBm shows compliance to RSS-210 as well.

The maximum supported antenna gain is 3.3dBi. The peak correlated gain for each mode is listed in the table below. See the Theory of Operation for details on the correlated gain for each mode.

Method SA-1 from KDB 789033
Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below.

Enable "Channel Power" function of analyzer
Center Frequency: Frequency from table below
Span: 20 MHz (must be greater than 26dB bandwidth, adjust as necessary)
Ref Level Offset: Correct for attenuator and cable loss.
Reference Level: 20 dBm
Attenuation: 20 dB
Sweep Time: Auto
Resolution Bandwidth: 1 MHz
Video Bandwidth: 3 MHz
Detector: Sample
Trace: Trace Average 100 traces in Power Averaging Mode
Integration BW: =99 % BW from 99% Bandwidth Data

After averaging 100 traces of the transmitter waveform on the spectrum analyzer, record the spectrum analyzer Channel Power. Perform a Marker Peak Search function, and record this value as the Power Spectral Density.

Power Spectral Density for 802.11a:

FREQUENCY (MHZ)	DATA RATE	PEAK POWER SPECTRAL DENSITY (dBm/MHz)	LIMIT (dBm)	MARGIN (dB)
5180	6Mbps	3.06	4	-0.94
5200	6Mbps	2.90	4	-1.1
5240	6Mbps	3.92	4	-0.08

Power Spectral Density for 802.11n (HT20):

FREQUENCY (MHZ)	DATA RATE	PEAK POWER SPECTRAL DENSITY (dBm/MHz)	LIMIT (dBm)	MARGIN (dB)
5180	MCS0	2.99	4	-1.01
5200	MCS0	2.76	4	-1.24
5240	MCS0	3.28	4	-0.72

Power Spectral Density for 802.11n (HT40):

FREQUENCY (MHZ)	DATA RATE	PEAK POWER SPECTRAL DENSITY (dBm/MHz)	LIMIT (dBm)	MARGIN (dB)
5190	MCS0	0.05	4	-3.95
5230	MCS0	0.76	4	-3.24

Peak Excursion

15.407: The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be <= 13 dB for all frequencies across the emission bandwidth.

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be <= 13 dB for all frequencies across the emission bandwidth.

1st Trace: (Peak)

- Set Span to encompass the entire emission bandwidth of the signal.
- RBW = 1 MHz, VBW = 3 MHz
- Detector = Peak
- Sweep = 10 s
- Trace 1 = Max-hold
- Ref Level Offset = correct for attenuator and cable loss
- Ref Level = 20dBm
- Atten = 10dBm

2nd Trace: (Average)

- Trace 2 = clear right
- Detector = Sample
- Avg/VBW type = Pwr(RMS)
- Average = 100
- Sweep = single

Set marker Deltas

- Trace 1 & Peak search
- Marker Delta

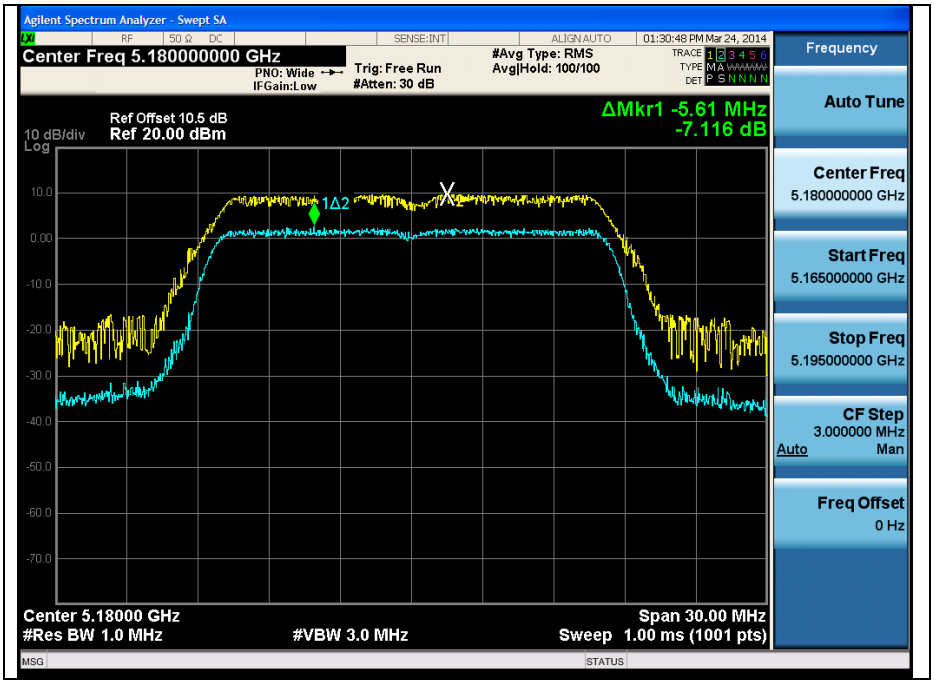
Trace 2 & Peak search

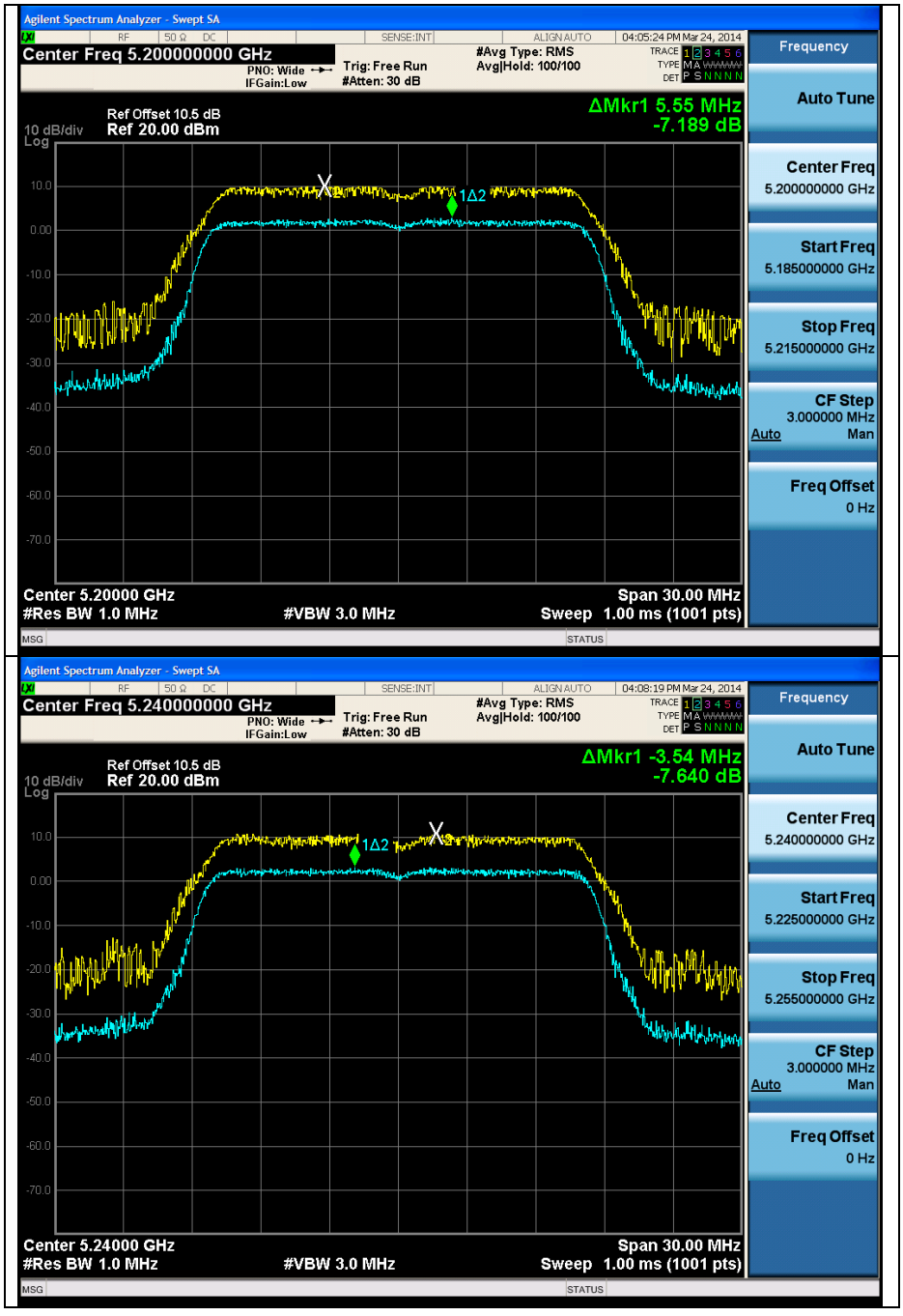
Record the difference between the Peak and Average Markers

Results for 802.11a:

FREQUENCY (MHZ)	DATA RATE	PEAK EXCURSION (dB)	LIMIT (dBm)	MARGIN (dB)
5180	6Mbps	7.12	13	-5.88
5200	6Mbps	7.19	13	-5.81
5240	6Mbps	7.64	13	-5.36

Graphical Test Result:

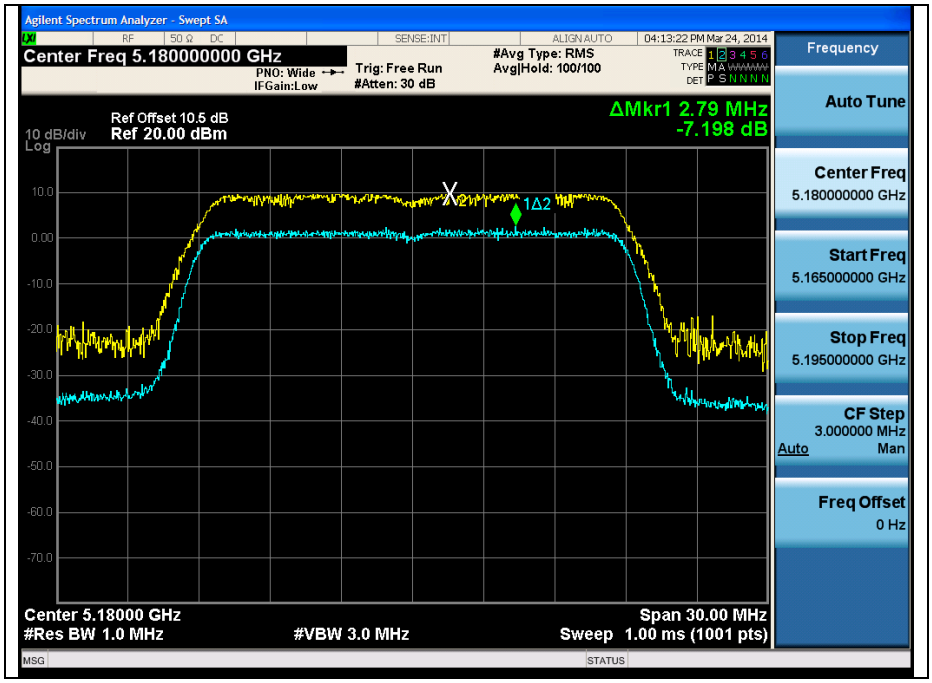




Peak Excursion Results for 802.11n (HT20):

FREQUENCY (MHZ)	DATA RATE	PEAK EXCURSION (dB)	LIMIT (dBm)	MARGIN (dB)
5180	MCS0	7.20	13	-5.80
5200	MCS0	7.20	13	-5.80
5240	MCS0	7.55	13	-5.45

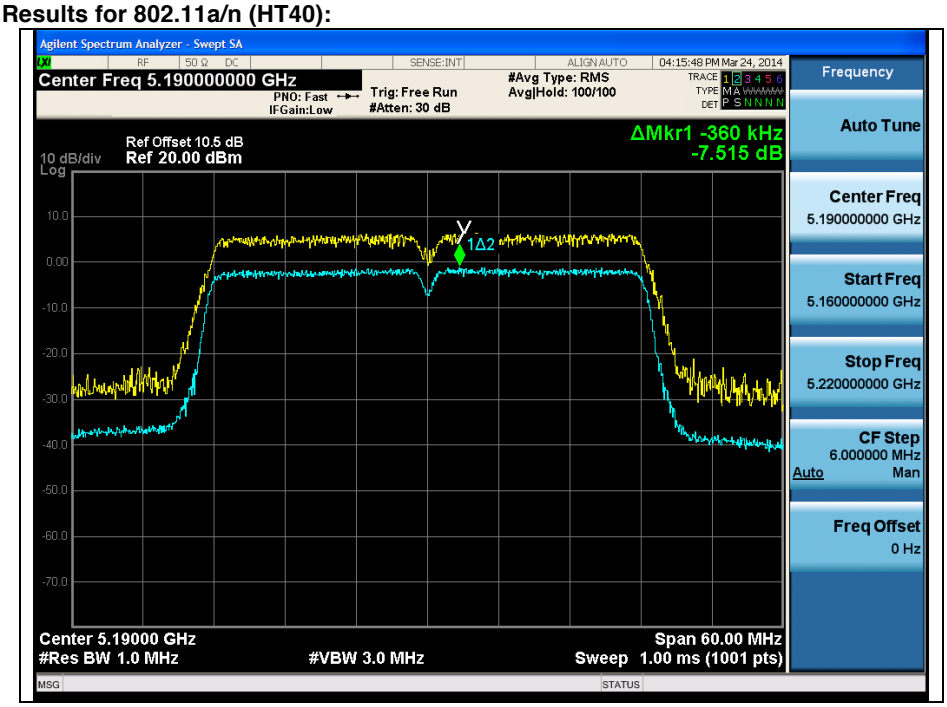
Graphical Test Results:

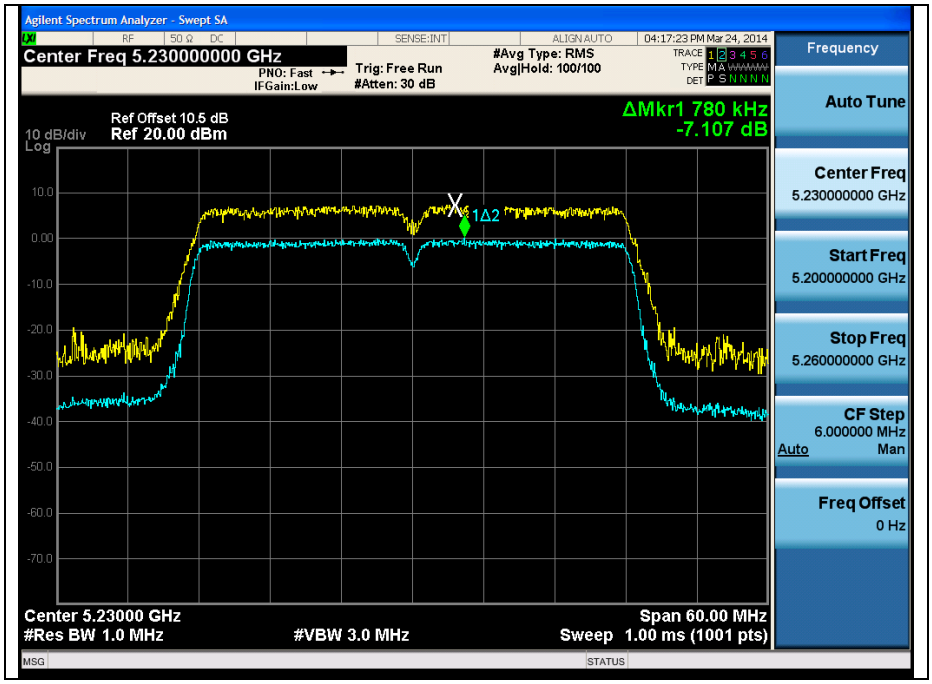


Peak Excursion Results for 802.11n (HT40):

FREQUENCY (MHZ)	DATA RATE	PEAK EXCURSION (dB)	LIMIT (dBm)	MARGIN (dB)
5190	MCS0	7.52	13	-5.48
5230	MCS0	7.11	13	-5.89

Graphical Test Results for 802.11a/n (HT40):





Conducted Spurious Emissions:

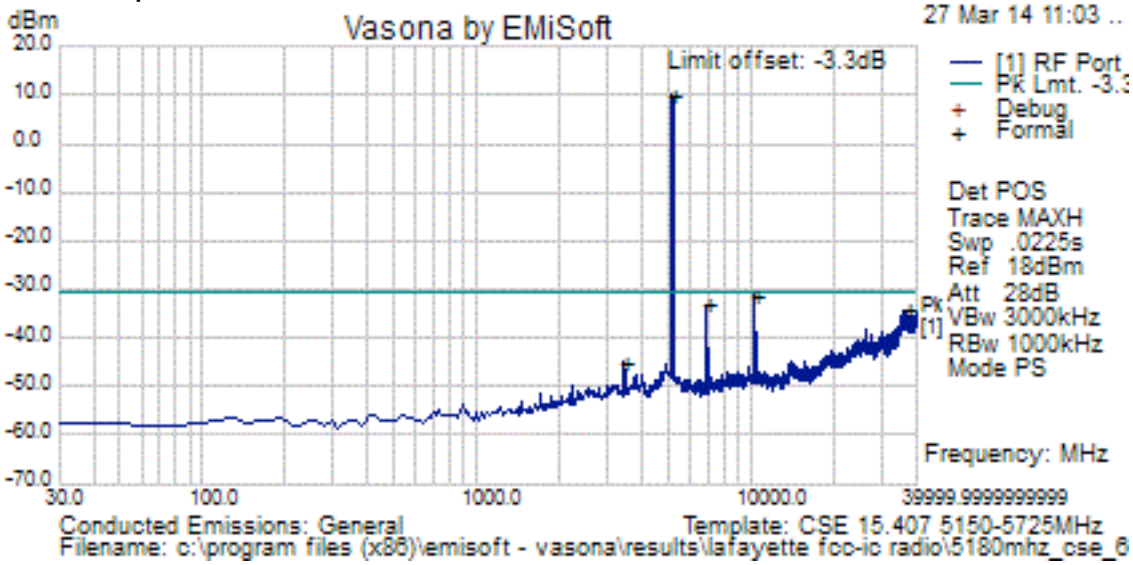
15.407: For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer).

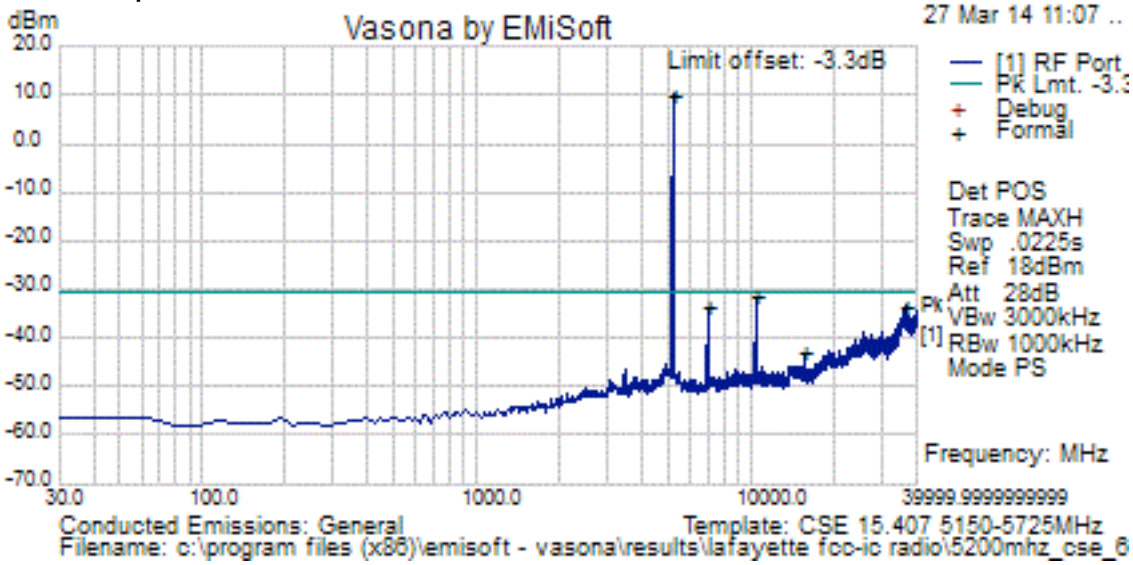
Span:	30 MHz-40 GHz
Reference Level:	18 dBm
Attenuation:	28 dB
Sweep Time:	10 s
Resolution Bandwidth:	1 MHz
Video Bandwidth:	3 MHz
Detector:	Peak
Trace:	Single
Marker:	Peak

Record the marker waveform peak to spur difference

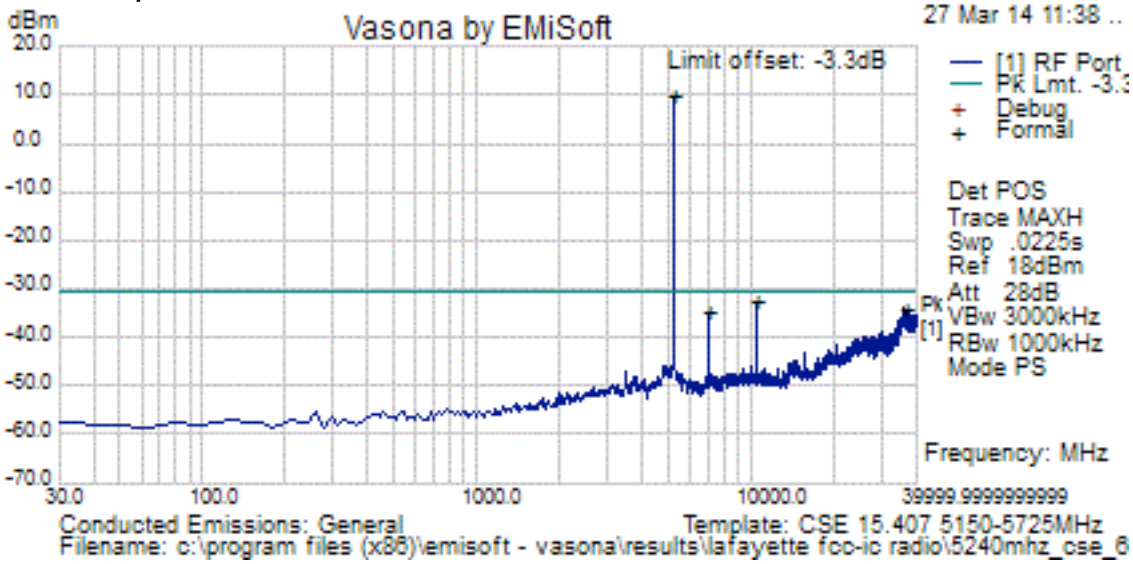
802.11a Graphical Test Results at 5180MHz:



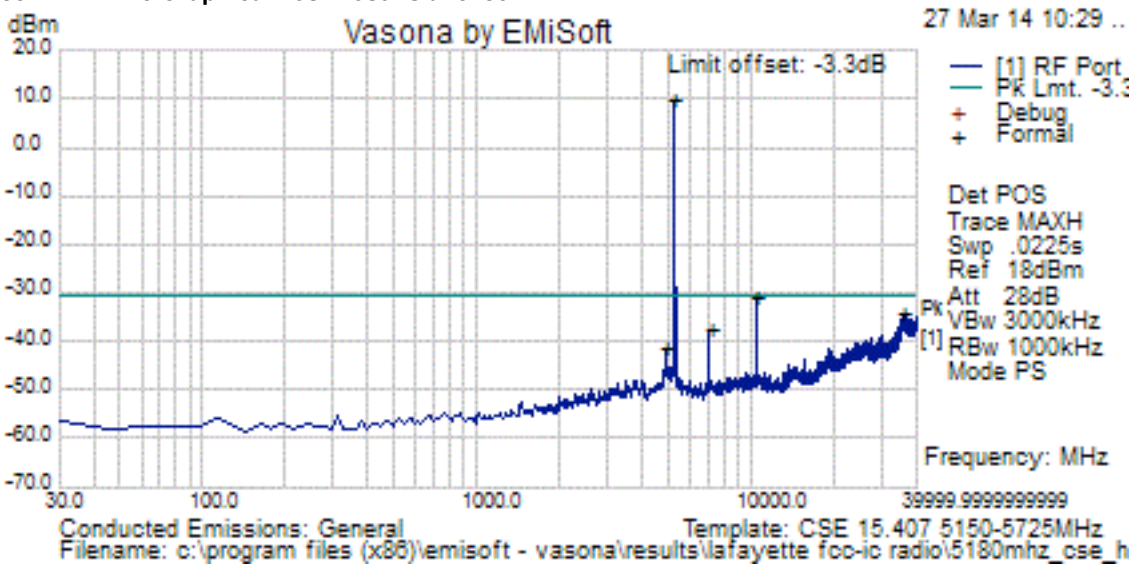
802.11a Graphical Test Results at 5200MHz:



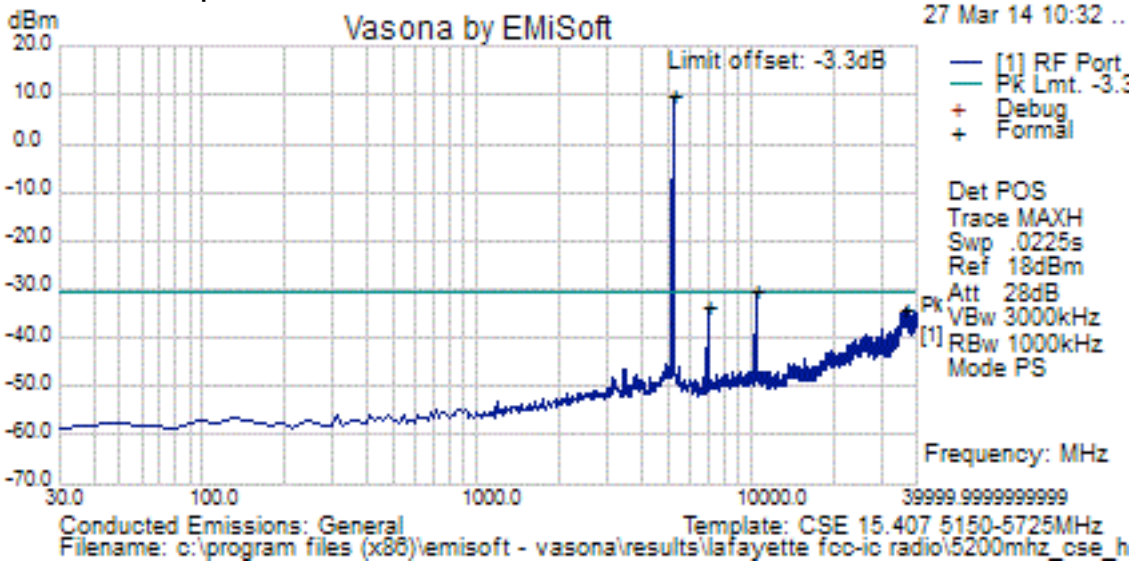
802.11a Graphical Test Results at 5240MHz:



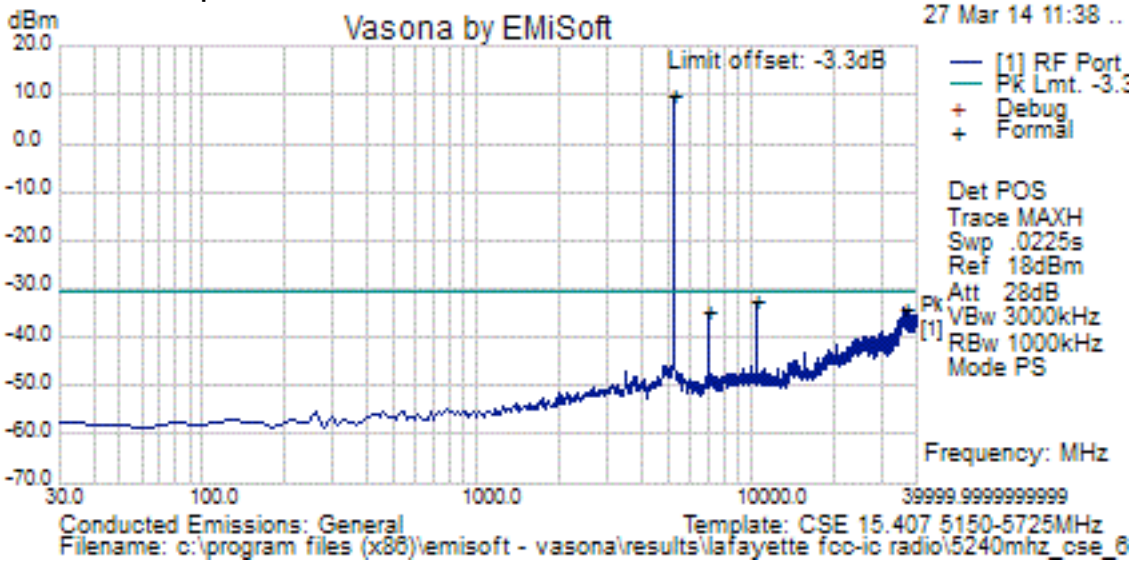
802.11n HT20 Graphical Test Results at 5180MHz:



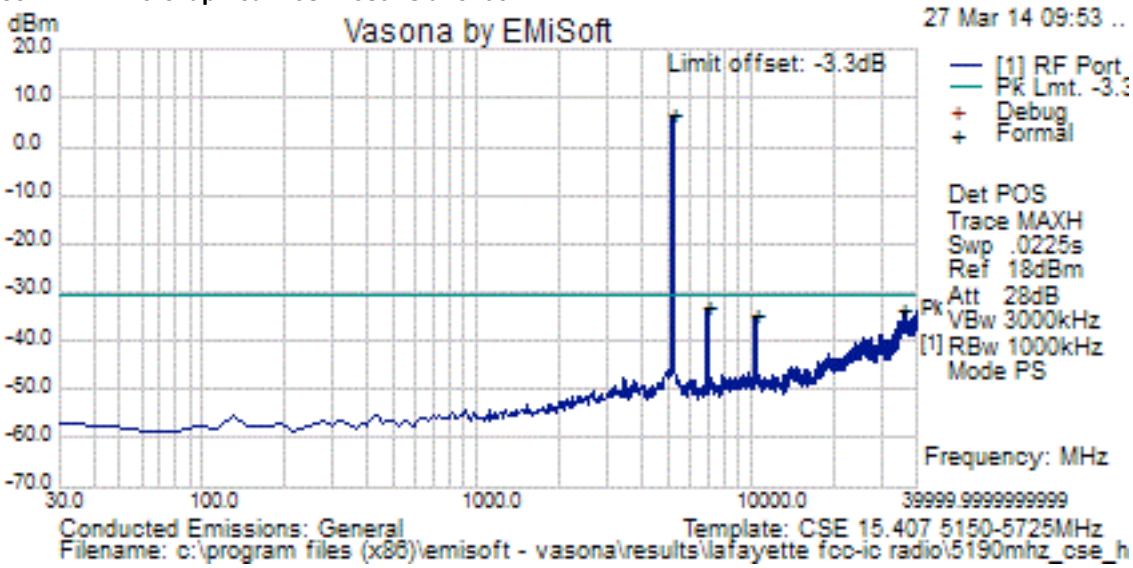
802.11a HT20 Graphical Test Results at 5200MHz:



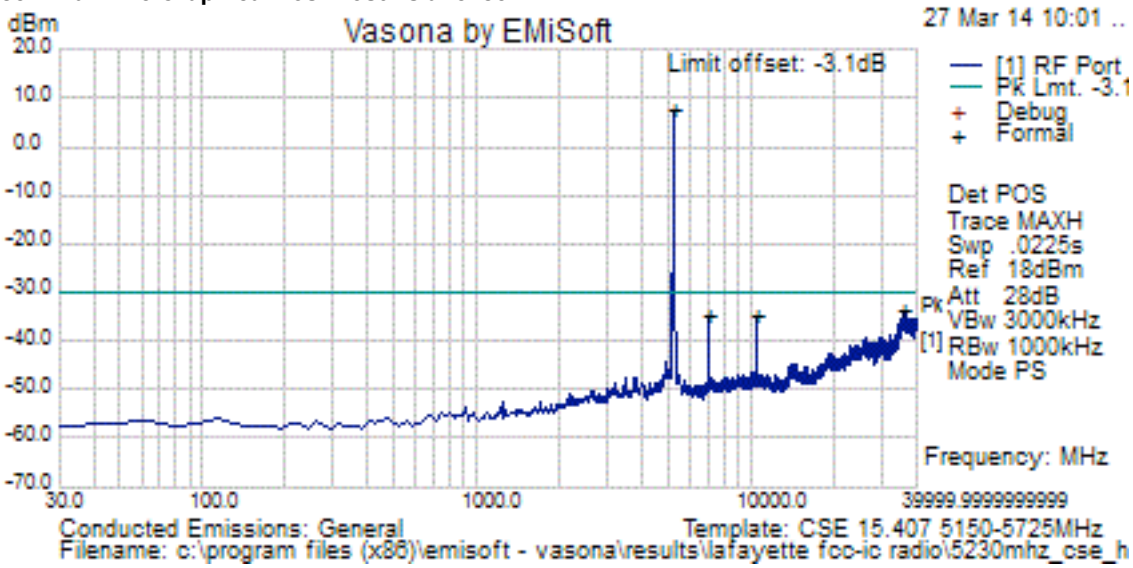
802.11a HT20 Graphical Test Results at 5240MHz:



802.11n HT40 Graphical Test Results at 5190MHz:



802.11a HT40 Graphical Test Results at 5230MHz:



Worst Case results Table:

Formal Data											
No	**Frequency MHz**	**Raw dBm**	**Cable Loss**	**Factors dB**	**Level dBm**	**Measurement Type**	**Line**	**Limit dBm**	**Margin dB**	**Pass /Fail**	**Comments**
1	5200.000	9.2	.6	.0	9.8	Peak [Scan]	RF Port	-30.3	40.1	N/A	tx freq
2	10400.000	-31.3	.8	.0	-30.5	Peak	RF Port	-30.3	-.2	Pass	2nd harmonic
3	6928.744	-34.5	.7	.0	-33.8	Peak [Scan]	RF Port	-30.3	-3.5	Pass	
4	36405.625	-35.7	1.7	.0	-34.1	Peak [Scan]	RF Port	-30.3	-3.8	Pass	

Conducted Bandedge

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Be sure to enter all losses between the transmitter output and the spectrum analyzer.

Reference Level:	10 dBm
Attenuation:	22 dB & 16dB
Sweep Time:	Coupled
Resolution Bandwidth:	1MHz
Video Bandwidth:	1 MHz for peak, 100 Hz for average
Detector:	Peak

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= -41.25 dBm eirp (54dBuV @3m)
2) Peak plot (Vertical and Horizontal), Limit = -21.25 dBm eirp (74dBuV @3m)

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands.

802.11a Bandedge Average Test Results:

FREQUENCY (MHz)	DATA RATE	BANDEDGE LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)
5180	6	-50.29	-41.25	-9.04

802.11a Bandedge Peak Test Results:

FREQUENCY (MHz)	DATA RATE	BANDEDGE LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)
5180	6	-41.40	-21.25	-20.15

802.11n HT20 Bandedge Average Test Results:

FREQUENCY (MHz)	DATA RATE	BANDEDGE LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)
5180	MCS0	-49.31	-41.25	-8.06

802.11n HT20 Bandedge Peak Test Results:

FREQUENCY (MHz)	DATA RATE	BANDEDGE LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)
5180	MCS0	-35.21	-21.25	-13.96

802.11n HT40 Bandedge Average Test Results:

FREQUENCY (MHz)	DATA RATE	BANDEDGE LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)
5190	MCS0	-47.96	-41.25	-6.71

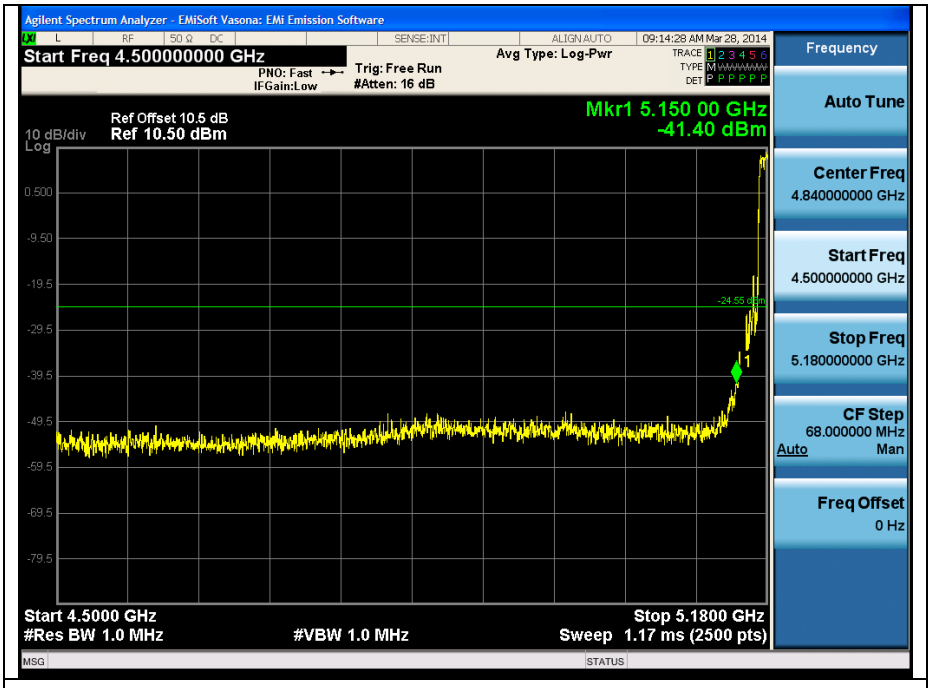
802.11n HT40 Bandedge Peak Test Results:

FREQUENCY (MHz)	DATA RATE	BANDEDGE LEVEL (dBm)	LIMIT (dBm)	MARGIN (dB)
5190	MCS0	-32.12	-21.25	-10.87

Graphical Test Results for 802.11a:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'.

Title: 802.11a HT20 5180MHz (Average)

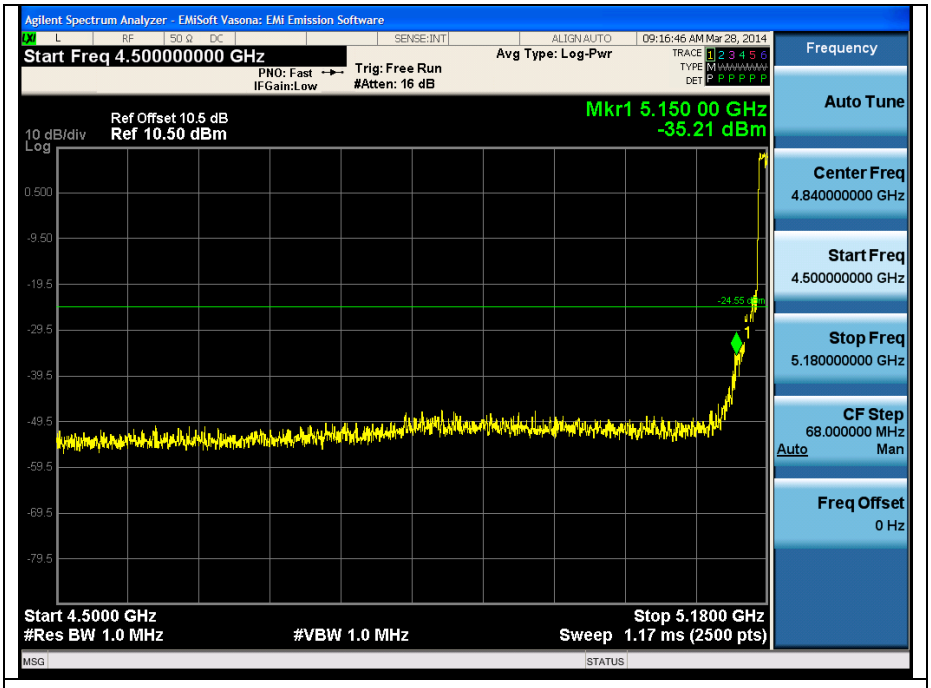


Title: 802.11a HT20 5180MHz (Peak)

Graphical Test Results for 802.11n HT20:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'.

Title: 802.11n HT20 5180MHz (Average)

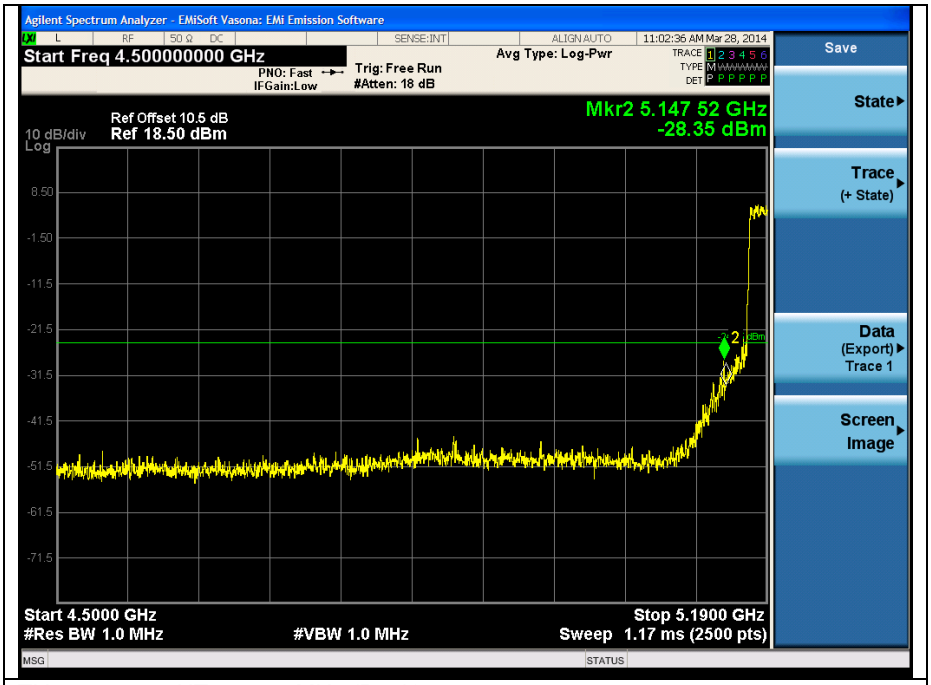


Title: 802.11n HT20 5180MHz (Peak)

Graphical Test Results for 802.11n HT40:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'.

Title: 802.11n HT20 5190MHz (Average)



Title: 802.11n HT20 5190MHz (Peak)

Appendix B: Emission Test Results

Radiated Spurious Emissions

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

Span:	1GHz – 18 GHz
Reference Level:	90 dBuV
Attenuation:	0 dB
Sweep Time:	Coupled
Resolution Bandwidth:	1MHz
Video Bandwidth:	1 MHz*
Detector:	Peak & Average

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV @3m
2) Peak plot (Vertical and Horizontal), Limit = 74dBuV @3m

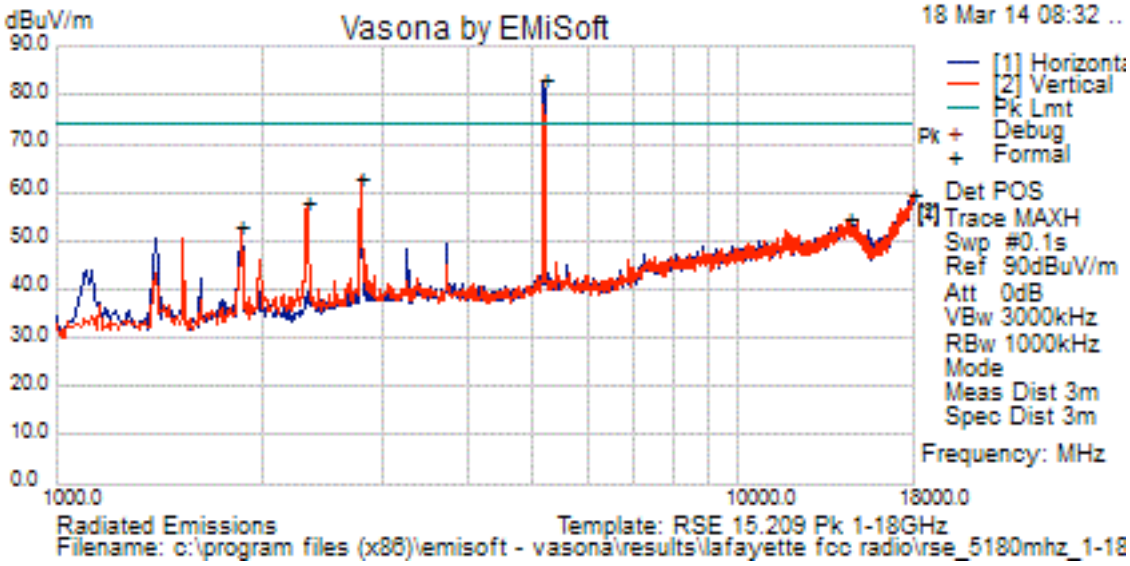
Place a marker at the end of the restricted band closest to the transmit frequency to show compliance.
Also measure any emissions in the restricted bands.

This report represents the worst case data for all supported operating modes and antennas. System was evaluated up to 40GHz but there were no measurable emissions above 18 GHz. The operating mode had no significant affect on the radiated emissions profile.

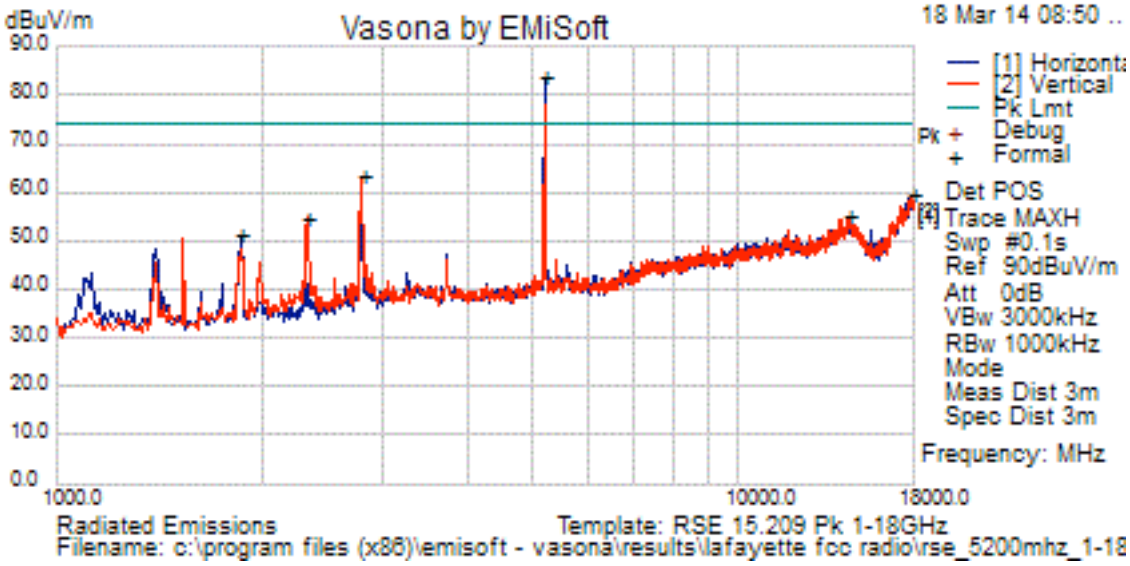
Notes:
A Notch Filter was used during formal testing from 1 – 18GHz to help prevent the front end of the analyzer from over loading. The Notch filters used are designed to suppress Tx fundamental frequency but do not effect harmonics of the fundamental frequency from being measured.

- A1MHz Video Bandwidth and peak detector was used for the average preview plots resulting in a higher level. The correct bandwidth of 10Hz was used for any formal measurements.
- The emissions between 2GHz and 3GHz will be evaluated during EMC testing and assessed against the applicable limits. These emissions were not caused by the radio. A scan was performed with the radio transmitting. Another scan was performed with the radio transmitter turned off, and the emissions were present in both cases. It can also be seen in the conducted emission plots that emissions at these frequencies were not present, showing they were not emitting from the rf port making them emc related.

Graphical Test Results: 1 – 18GHz (5180MHz – Peak)
Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

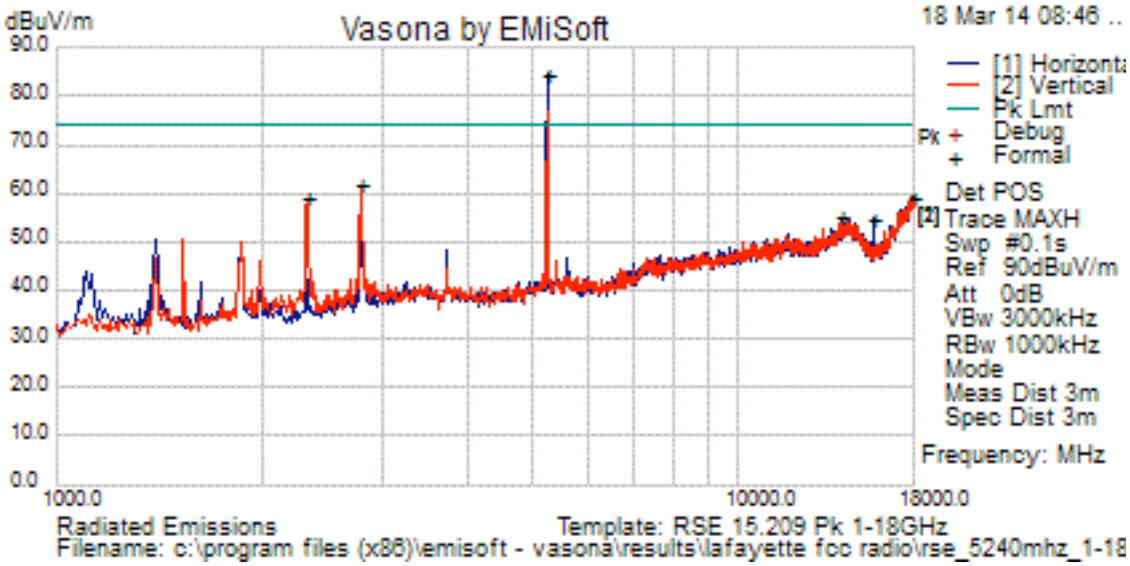


Graphical Test Results: 1 – 18GHz (5200MHz – Peak)
Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



Graphical Test Results: 1 – 18GHz (5240MHz – Peak)

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



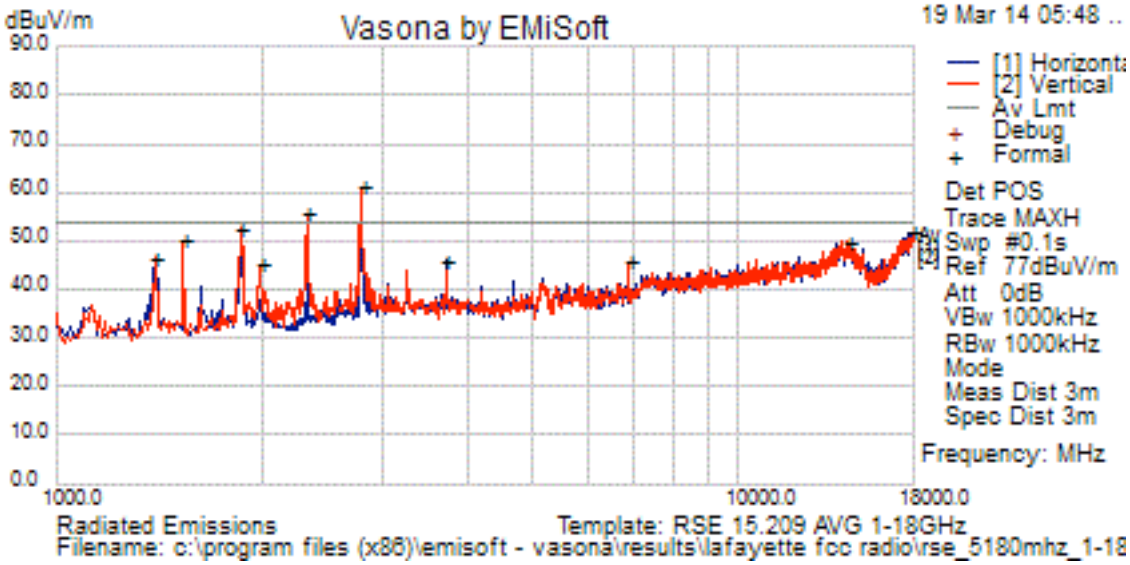
Worst case results Table (Peak)

Formal Data													
No	**Frequency MHz**	**Raw dBuV**	**Cable Loss**	**AF dB**	**Level dBuV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBuV/m**	**Margin dB**	**Pass /Fail**	**Comments**
1	5233.000	79.7	8.6	-3.6	84.6	Peak [Scan]	H	120	204	74.0	10.6	N/A	TX Freq
2	2793.500	61.2	6.3	-5.8	61.7	Peak [Scan]	V	120	204	74.0	-12.4	Pass	
3	17983.000	33.2	16.4	9.7	59.2	Peak [Scan]	H	120	204	74.0	-14.8	Pass	
4	2334.500	59.1	5.7	-5.8	59.0	Peak [Scan]	V	120	204	74.0	-15.0	Pass	
5	14115.500	33.9	14.1	6.9	54.9	Peak [Scan]	H	120	204	74.0	-19.1	Pass	
6	15730.500	38.7	14.8	1.2	54.7	Peak [Scan]	H	120	204	74.0	-19.3	Pass	

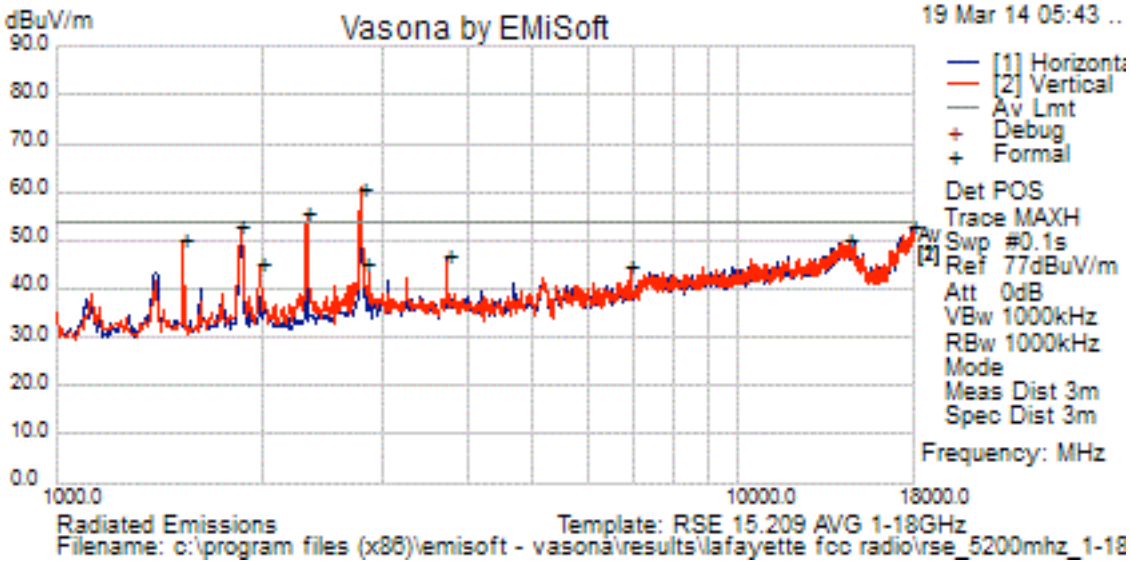
Comments on the above radiated emission results: The emissions below 3GHz were digital emissions and were not from the radio or its antenna port.

Graphical Test Results: 1 – 18GHz (5180MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 1MHz VBW and 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

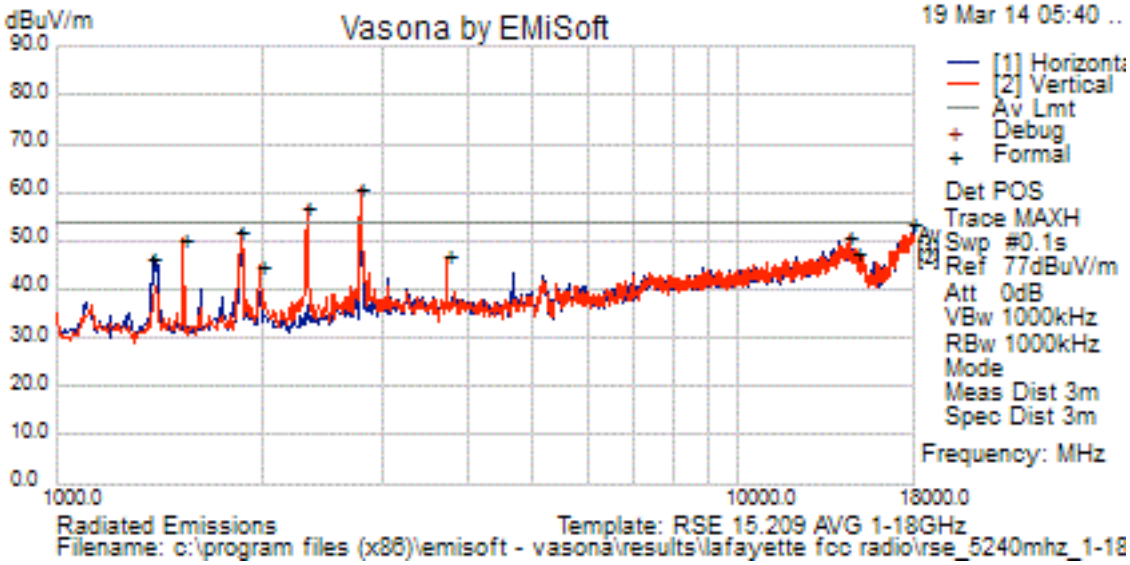


Graphical Test Results: 1 – 18GHz (5200MHz – Average)
Note that the data displayed on the plots detailed in this appendix were measured using a 1MHz VBW and 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



Graphical Test Result: 1 – 18GHz (5240MHz – Average)

Note that the data displayed on the plots detailed in this appendix were measured using a 1MHz VBW and 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



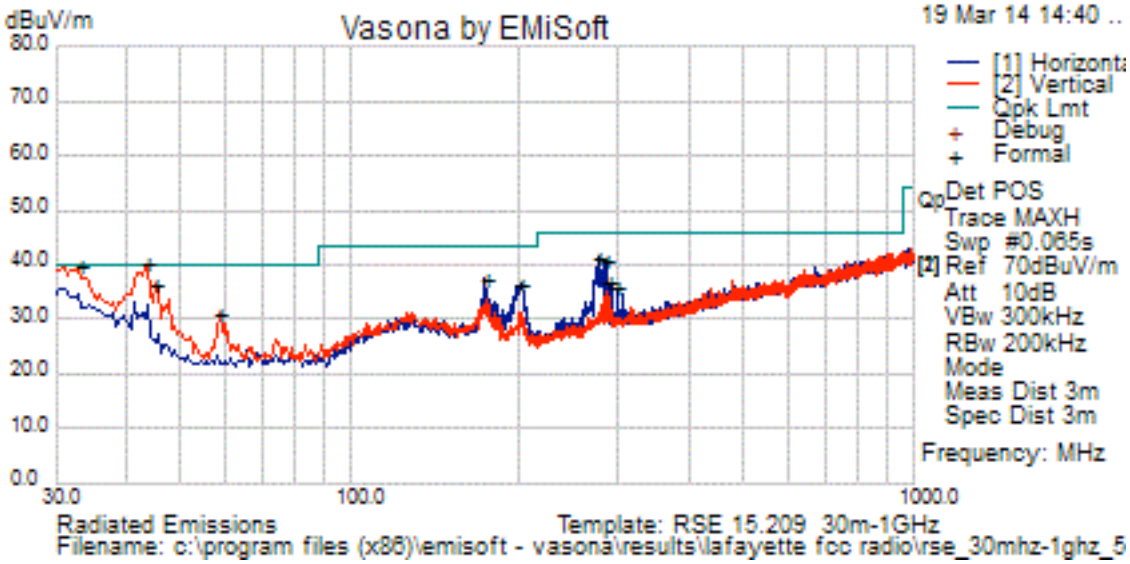
Worst case results Table (Average)

Formal Data													
No	**Frequency MHz**	**Raw dBuV**	**Cable Loss**	**AF dB**	**Level dBuV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBuV/m**	**Margin dB**	**Pass /Fail**	**Comments**
1	1536.081	55.1	4.0	-7.9	51.2	Average Max	V	126	173	54.0	-2.8	Pass	
2	15841.000	21.4	14.9	1.6	37.9	Average Max	H	106	192	54.0	-16.1	Pass	
3	14532.001	14.3	14.2	7.7	36.3	Average Max	V	146	53	54.0	-17.7	Pass	
4	2799.376	35.6	5.5	-5.9	35.3	Average Max	V	132	178	54.0	-18.7	Pass	
5	2800.009	35.3	5.5	-5.9	35.0	Average Max	V	163	177	54.0	-19.0	Pass	
6	2334.101	30.6	5.0	-5.8	29.8	Average	V	183	177	54.0	-24.2	Pass	
7	1866.433	31.1	4.4	-7.0	28.6	Average Max	V	162	189	54.0	-25.4	Pass	
8	3733.628	24.0	6.5	-3.5	26.9	Average Max	V	115	120	54.0	-27.1	Pass	
9	2851.712	25.4	5.6	-5.5	25.6	Average Max	V	103	181	54.0	-28.4	Pass	

Comments: The plot was taken with an incorrect VBW of 1MHz resulting in a higher profile level. Formal measurements were performed using the correct VBW setting. The emissions at 2.3 & 2.7GHz were digital emissions from the main unit, and not produced or emitted by the radio or it's rf port.

Radiated emissions 30MHz to 1GHz:

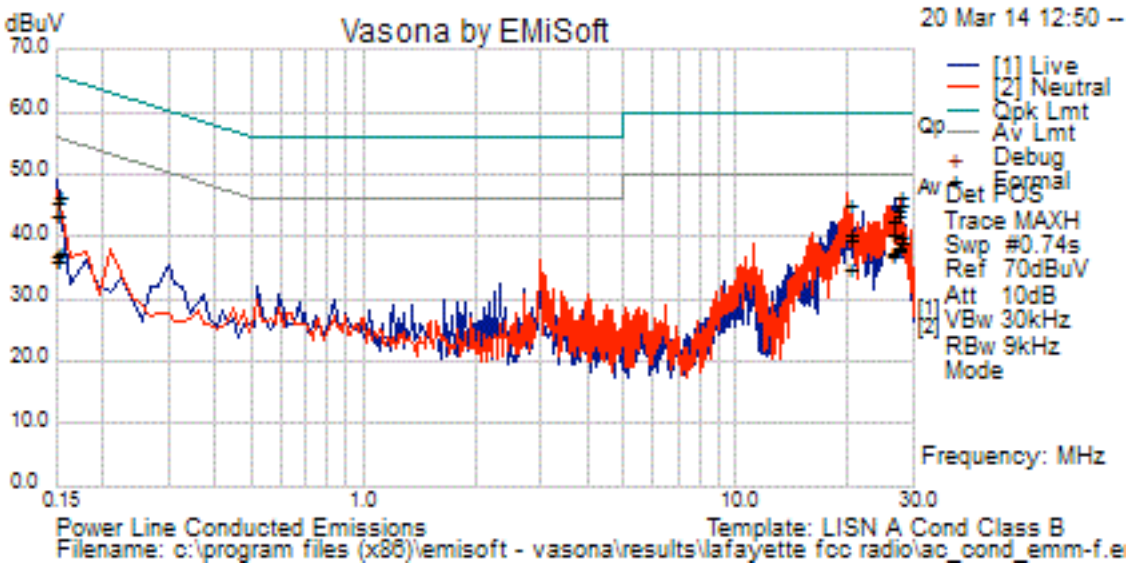
Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



Formal Data

No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1	43.580	16.6	.6	11.2	28.4	Quasi Max	V	102	18	40.0	-11.6	Pass	
2	45.520	13.3	.6	10.0	24.0	Quasi Max	V	102	92	40.0	-16.0	Pass	
3	201.205	11.1	1.3	12.2	24.6	Quasi Max	H	102	50	43.5	-18.9	Pass	
4	275.410	11.5	1.5	13.5	26.5	Quasi Max	H	102	52	46.0	-19.5	Pass	
5	30.970	-.6	.5	19.6	19.5	Quasi Max	V	102	114	40.0	-20.5	Pass	
6	205.085	9.3	1.3	11.0	21.6	Quasi Max	H	102	44	43.5	-21.9	Pass	
7	287.535	9.1	1.6	13.3	24.0	Quasi Max	H	102	48	46.0	-22.0	Pass	

AC Power Line Conducted emissions:

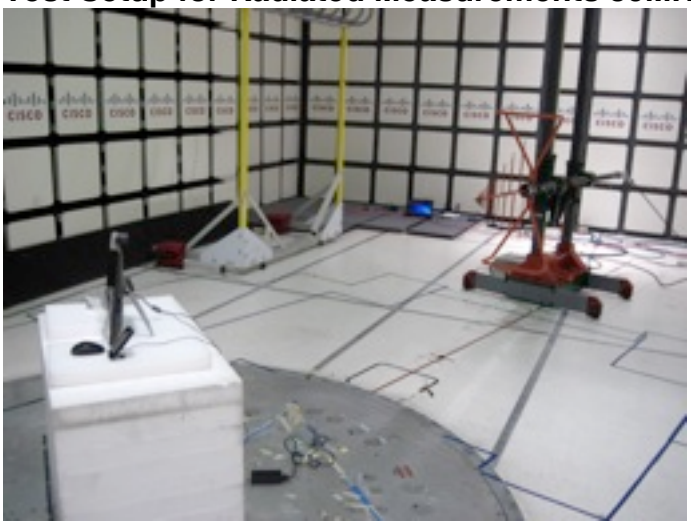


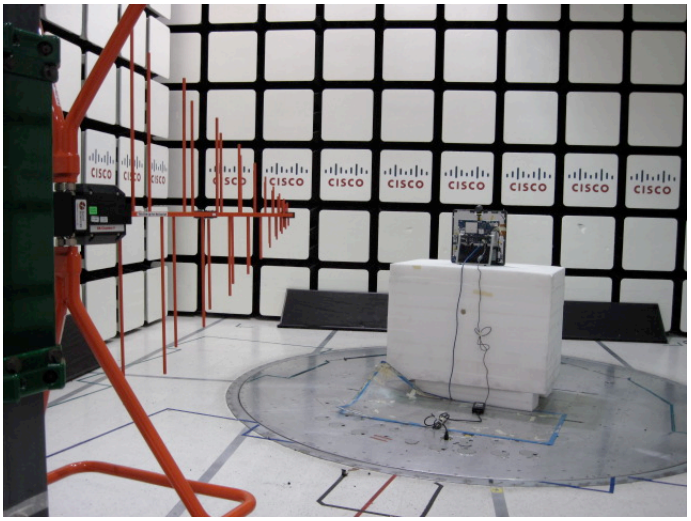
Formal Data

No	Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
1	19.998	19.4	20.5	.3	40.2	Average	Live	50.0	-9.8	Pass	
2	27.759	18.8	20.6	.5	39.9	Average.	Neutral	50.0	-10.1	Pass	
3	27.759	18.0	20.6	.5	39.0	Average	Live	50.0	-11.0	Pass	
4	27.017	17.2	20.6	.4	38.2	Average	Neutral	50.0	-11.8	Pass	
5	27.017	16.6	20.6	.4	37.6	Average	Live	50.0	-12.4	Pass	
6	26.406	16.5	20.5	.4	37.4	Average	Neutral	50.0	-12.6	Pass	
7	26.406	16.1	20.5	.4	37.1	Average.	Live	50.0	-12.9	Pass	
8	27.759	25.3	20.6	.5	46.3	Quasi Peak.	Neutral	60.0	-13.7	Pass	
9	19.998	24.4	20.5	.3	45.2	Quasi Peak	Live	60.0	-14.8	Pass	
10	27.759	24.1	20.6	.5	45.1	Quasi Peak	Live	60.0	-14.9	Pass	
11	19.997	14.1	20.5	.3	34.8	Average.	Neutral	50.0	-15.2	Pass	
12	27.017	23.1	20.6	.4	44.1	Quasi Peak	Neutral	60.0	-15.9	Pass	
13	27.017	22.3	20.6	.4	43.3	Quasi Peak	Live	60.0	-16.7	Pass	
14	26.406	21.7	20.5	.4	42.6	Quasi Peak.	Live	60.0	-17.4	Pass	
15	.151	15.7	21.4	.1	37.2	Average	Live	55.9	-18.7	Pass	
16	.150	15.6	21.4	.1	37.1	Average	Live	56.0	-18.9	Pass	
17	.151	24.7	21.4	.1	46.2	Quasi Peak	Live	65.9	-19.7	Pass	
18	26.406	19.4	20.5	.4	40.3	Quasi Peak.	Neutral	60.0	-19.7	Pass	
19	.151	14.6	21.4	.1	36.1	Average.	Neutral	55.9	-19.9	Pass	
20	.150	14.4	21.4	.1	36.0	Average	Neutral	56.0	-20.0	Pass	
21	.150	24.0	21.4	.1	45.5	Quasi Peak	Live	66.0	-20.5	Pass	
22	19.997	18.8	20.5	.3	39.5	Quasi Peak.	Neutral	60.0	-20.5	Pass	
23	.151	22.0	21.4	.1	43.5	Quasi Peak.	Neutral	65.9	-22.4	Pass	
24	.150	21.9	21.4	.1	43.5	Quasi Peak	Neutral	66.0	-22.5	Pass	

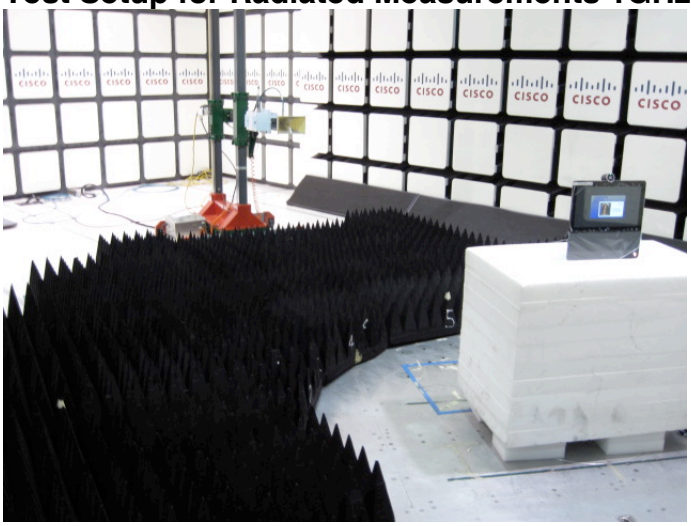
Appendix B: Photographs of Test Setups:

Test Setup for Radiated Measurements 30MHz to 1GHz

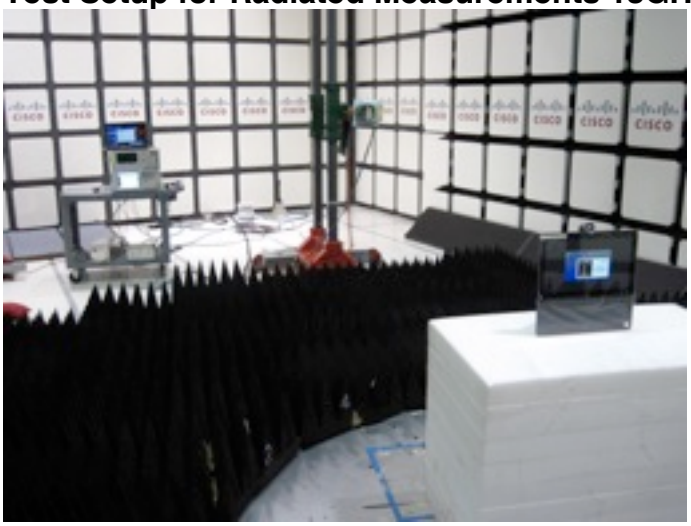




Test Setup for Radiated Measurements 1GHz to 18GHz

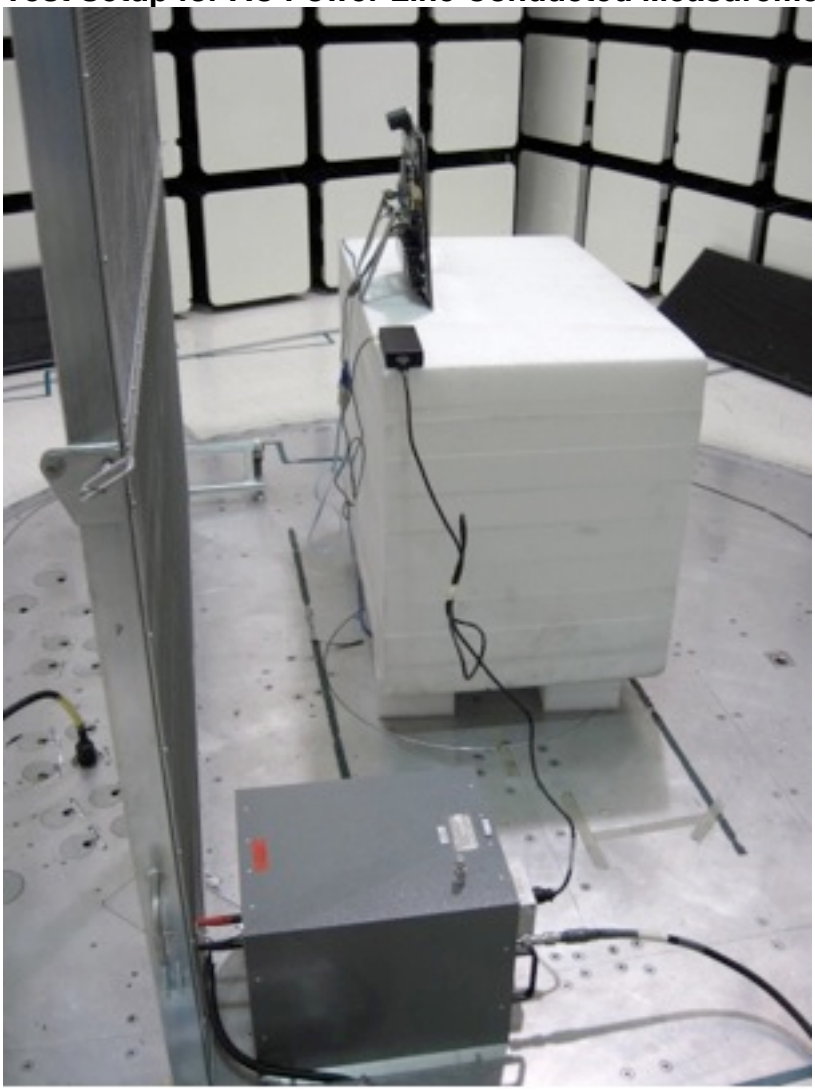


Test Setup for Radiated Measurements 18GHz to 40GHz



Test Setup for RF Port Conducted Measurements

Test Setup for AC Power Line Conducted Measurements



Appendix C: Photographs of Equipment Under Test

CP-DX70 Front View

CP-DX70 Rear View

CP-DX70 Ports

AC/DC Adapter

Appendix D: Test Equipment/Software Used to perform the test

Equipment No	Manufacturer	Model	Description	Last Cal	Next Cal Due Date
CIS004882	EMC Test Systems	3115	Double Ridged Guide Horn Antenna	28-JUN-13	28-JUN-14
CIS004883	EMC Test Systems	3115	Double Ridged Guide Horn Antenna	Cal Not Required	N/A
CIS008166	HP	8491B Opt 010	10dB Attenuator	07-FEB-14	07-FEB-15
CIS005691	Miteq	NSP1800-25-S1	Broadband Preamplifier (1-18GHz)	27-JAN-14	27-JAN-15
CIS008448	Cisco	NSA 5m Chamber	NSA 5m Chamber	03-OCT-13	03-OCT-14
CIS018963	York	CNE V	Comparison Noise Emitter, 30 - 1000MHz	Cal Not Required	N/A
CIS019206	TTE	H785-150K-50-21378	High Pas Filter,Fo=150kHz	12-SEP-13	12-SEP-14
CIS021117	Micro-Coax	UFB311A-0-2484-520520	RF Coaxial Cable, to 18GHz, 248.4 in	23-AUG-13	23-AUG-14
CIS024998	Micro-Coax	UFB197C-1-0240-504504	RF Coaxial Cable, to 18GHz, 24 in	27-FEB-14	27-FEB-15
CIS027245	Stanley	33-158	Measuring tape	29-JUN-13	29-JUN-14
CIS029959	Fischer Custom Communications	FCC-LISN-PA-NEMA-5-15	Power Adaptor, Polarized 120VAC	02-AUG-13	02-AUG-14
CIS025658	Micro-Coax	UFB311A-1-0840-504504	RF Coaxial Cable, to 18GHz, 84 in	14-FEB-14	14-FEB-15
CIS034075	Schaffner	RSG 2000	Reference Spectrum Generator, 1-18GHz	Cal Not Required	N/A
CIS040597	Cisco	Above 1GHz Site Cal	Above 1GHz Cispr Site Verification	30-MAY-13	30-MAY-14

CIS040641	Rohde & Schwarz	ESU26	EMI Test Receiver	24-JUN-13	24-JUN-14
CIS040654	Spirent	XLW-3721A	Plug-in Module	Cal Not Required	N/A
CIS047287	Huber + Suhner	Sucoflex 102E	40GHz Cable K Connector	30-MAY-13	30-MAY-14
CIS049389	Rohde & Schwarz	NRP2	Power Meter	17-OCT-13	17-OCT-14
CIS049390	Rohde & Schwarz	NRP-Z21	Power Sensor	17-OCT-13	17-OCT-14
CIS049443	Micro-Tronics	BRM50702-02	Notch Filter, SB:2.4-2.5GHz, to 18GHz	20-MAR-14	20-MAR-15
CIS049488	JFW	50HF-010	SMA 10 dB Attenuator	21-MAR-14	21-MAR-15
CIS049516	Agilent	N9030A	Spectrum Analyzer	29-OCT-13	29-OCT-14
CIS049563	Huber + Suhner	Sucoflex 106A	N Type Cable 18GHz	23-AUG-13	23-AUG-14
CIS044440	Agilent	DSO80604B	40GSa/s, 6GHz 4 CH Oscilloscope	05-SEP-13	05-SEP-14
CIS051636	Agilent	N5182B	MXG-B RF Vector Signal Generator	27-JAN-14	27-JAN-15

Software Used to perform Tests:

A: Vasona File Version 5.073, 5.089

B: WinSoft Radio Automation Software Version 1.2

Appendix E: Test Procedures

Measurements were made in accordance with

- KDB Publication No. 789033
- Measurement method of spurious emission tolerance to the International Telecommunication Union (ITU) Recommendation SM329.
- ANSI C63.4
- ANSI C63.10/D8

Test procedures are summarized below

99% and 26dB Bandwidth	EDCS # - 422115
Conducted Spurious Test	EDCS # - 422119
Peak Transmit Power Measurement	EDCS # - 422123
Power Spectral Density	EDCS # - 422113
Peak Excursion Test	EDCS # - 422121
Band Edge	EDCS # - 422124
Radiated Spurious Test	EDCS # - 422125
AC Power Line Conducted Emissions	EDCS # - 36541