20dB 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:	30 dBm
Attenuation:	24 dB
Sweep Time:	5 s
Resolution Bandwidth:	1%-3% of 20 dB Bandwidth
Video Bandwidth:	≥Resolution Bandwidth
X dB Bandwidth:	20 dB
Detector:	Peak
Trace:	Single

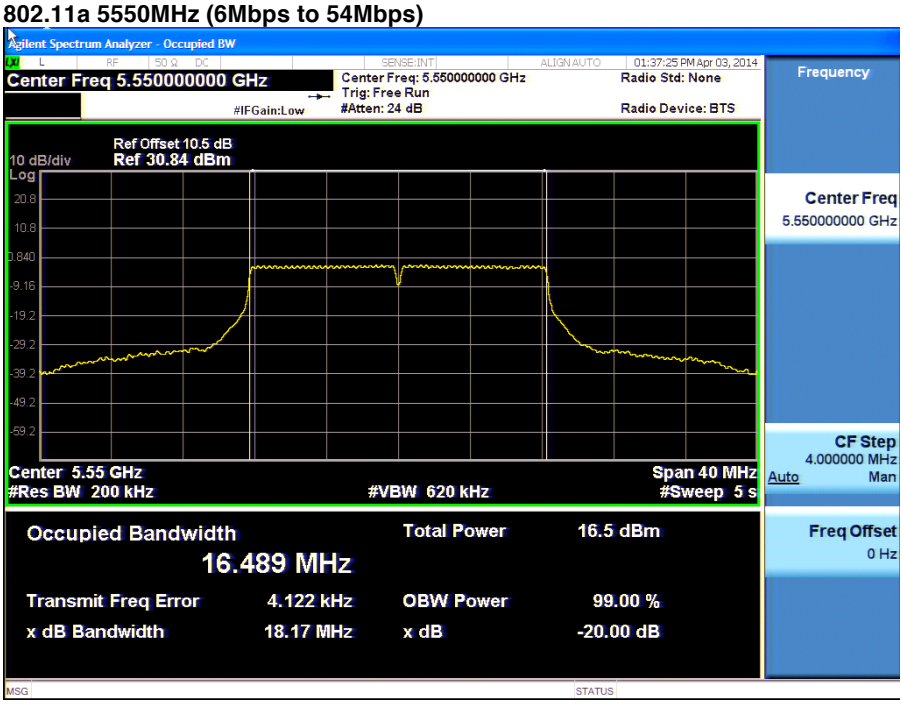
Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:

Test Results:

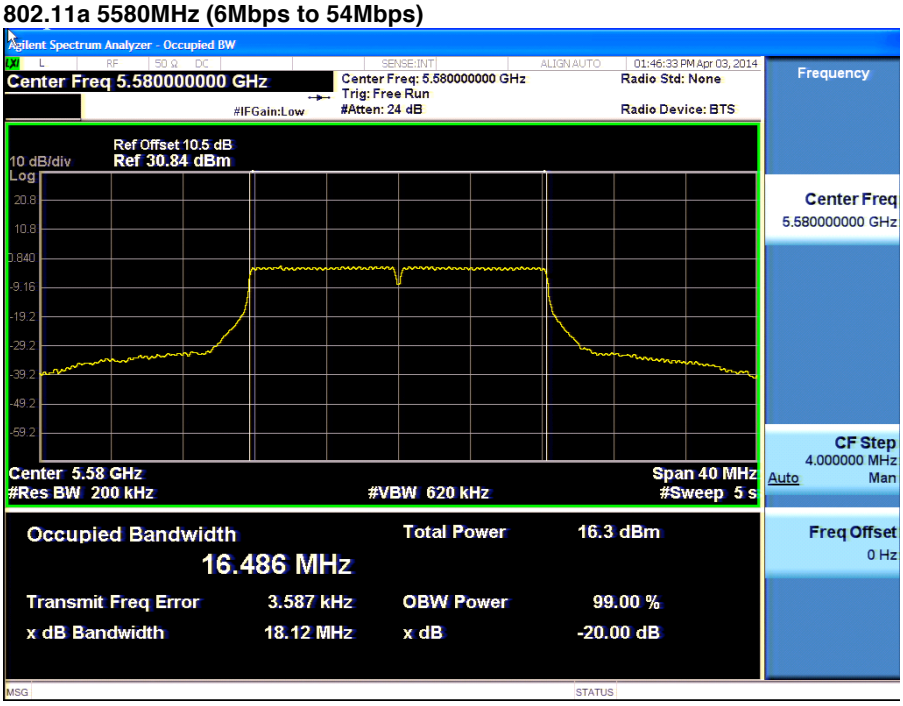
Frequency (MHz)	Mode	Data Rate	20dB BW (MHz)	Limit (MHz)	Margin (MHz)
5550	802.11a	6	18.17	20	-1.83
5580	802.11a	6	18.12	20	-1.88
5660	802.11a	6	18.14	20	-1.86
5550	802.11n HT20	MCS0	19.19	20	-0.81
5580	802.11n HT20	MCS0	19.17	20	-0.83
5660	802.11n HT20	MCS0	19.19	20	-0.81
5670	802.11n HT40	MCS0	38.64	40	-1.36

Graphical Data:

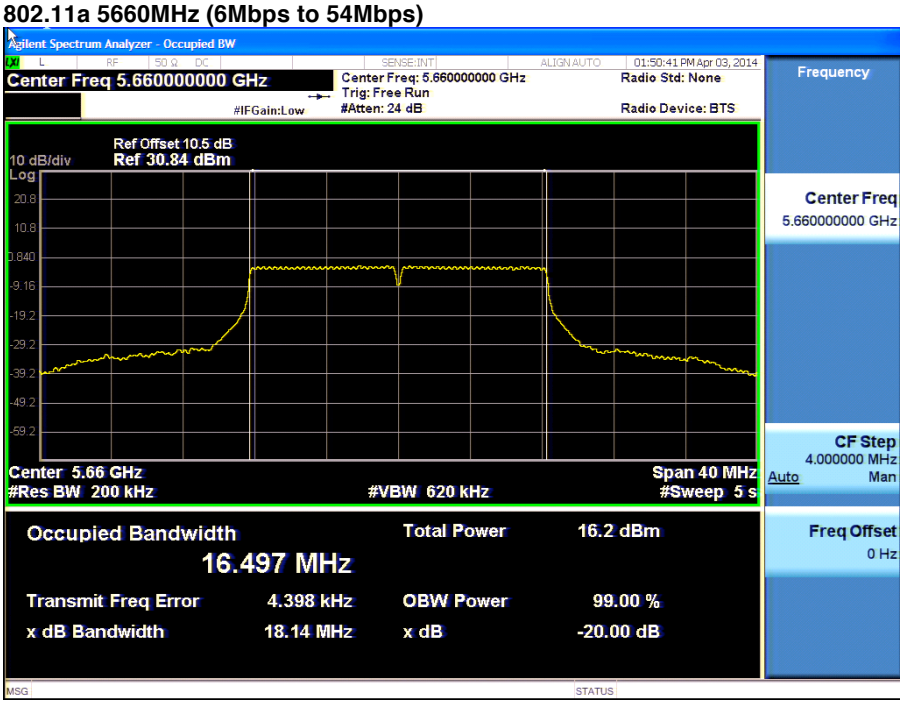
802.11a 5550MHz (6Mbps to 54Mbps)



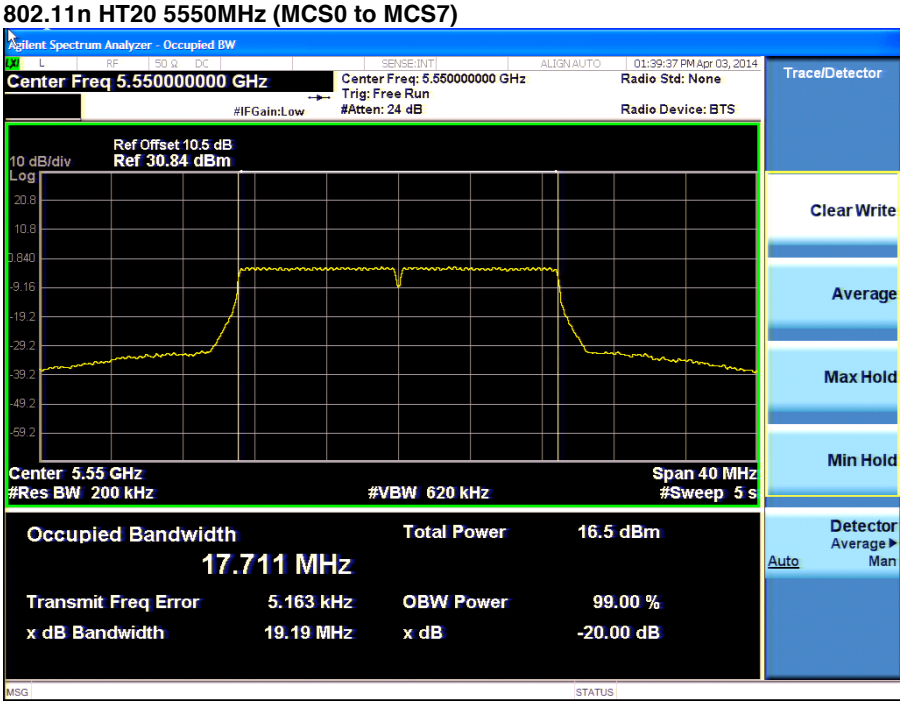
802.11a 5580MHz (6Mbps to 54Mbps)



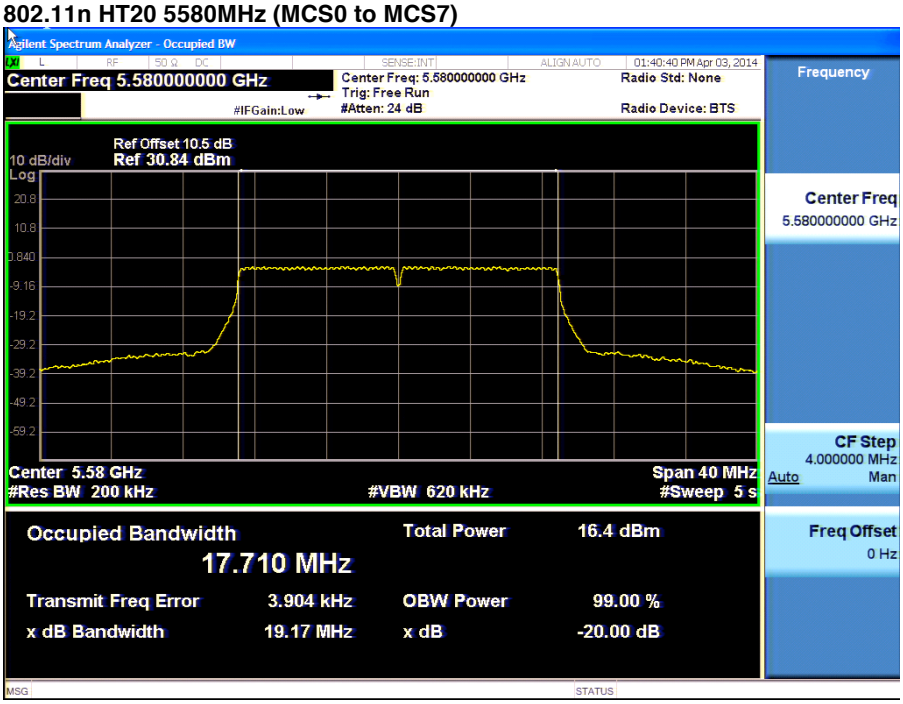
802.11a 5660MHz (6Mbps to 54Mbps)



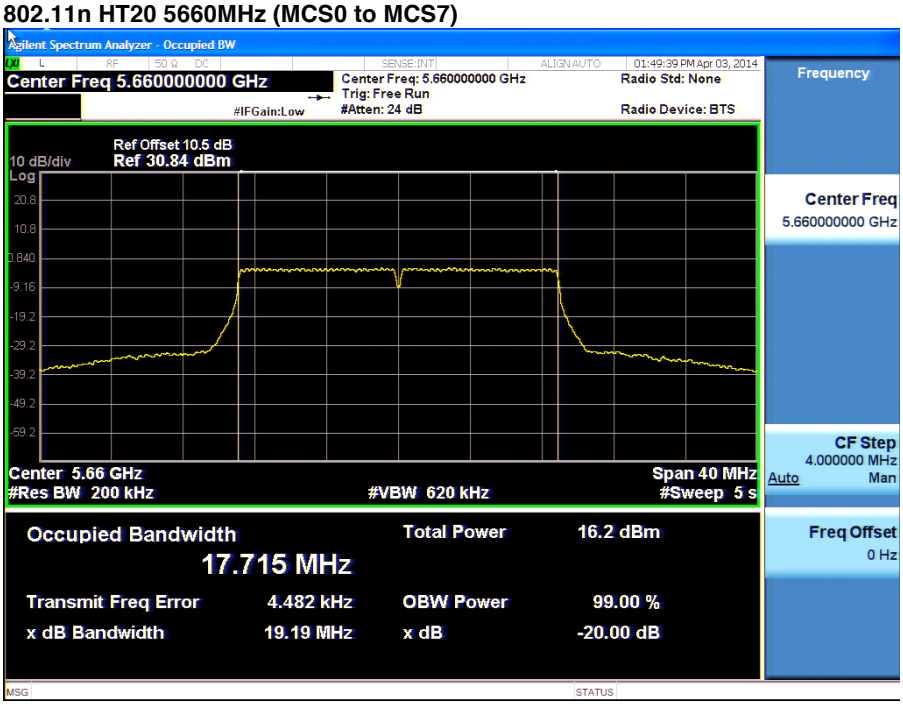
802.11n HT20 5550MHz (MCS0 to MCS7)



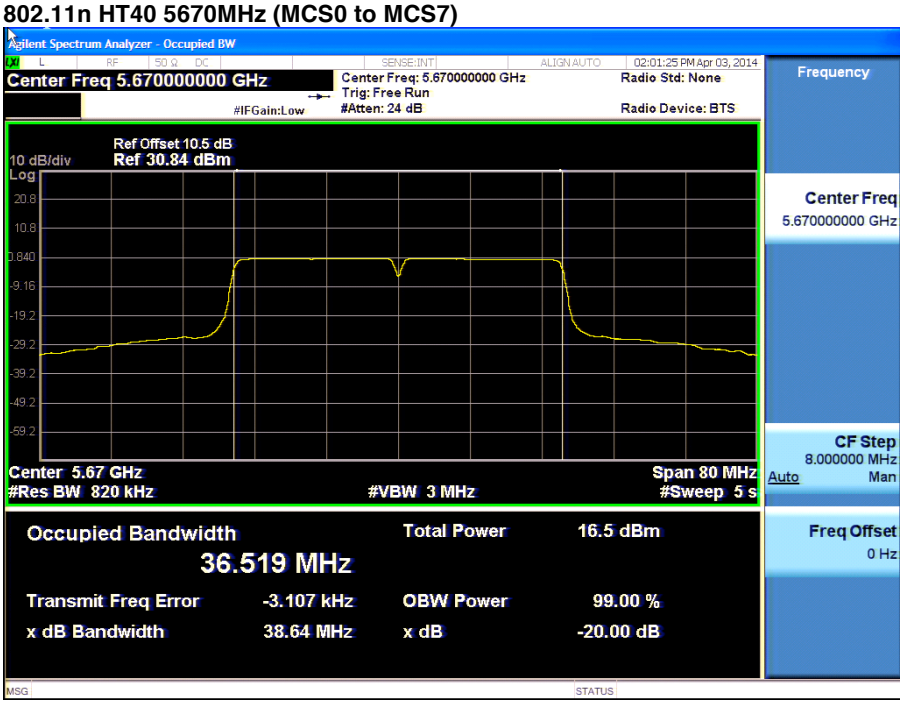
802.11n HT20 5580MHz (MCS0 to MCS7)



802.11n HT20 5660MHz (MCS0 to MCS7)



802.11n HT40 5670MHz (MCS0 to MCS7)



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:	30MHz – 40GHz
Reference Level:	90 dBuV
Attenuation:	0 dB
Sweep Time:	Coupled
Resolution Bandwidth:	1MHz
Video Bandwidth:	1 MHz for peak, 10 Hz for average
Detector:	Peak

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.

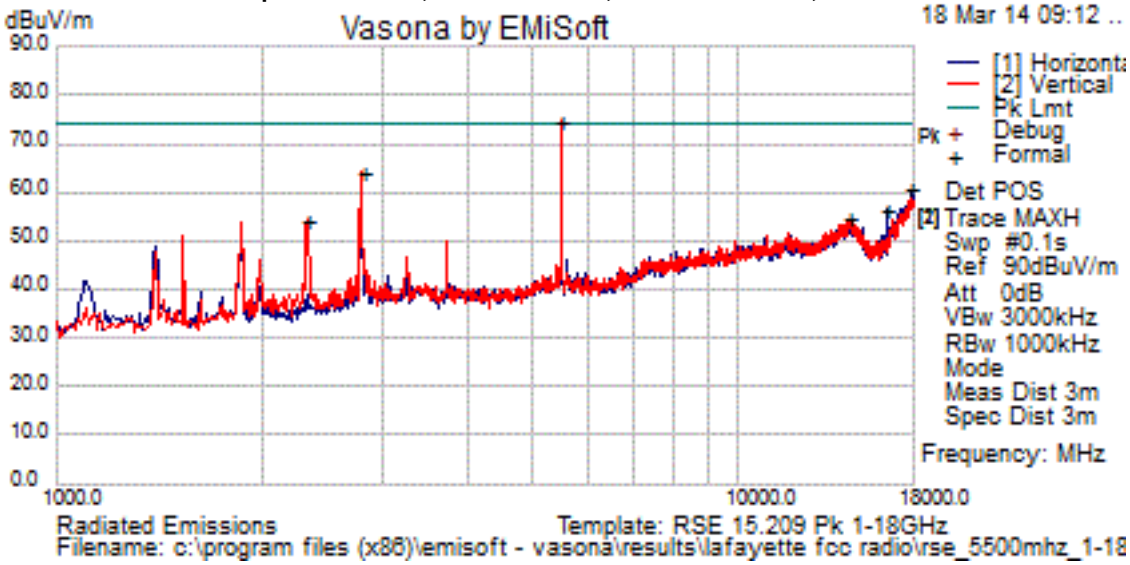
This report represents the worst case data for all supported operating modes and antennas. There are no measurable emissions above 18 GHz.

Notes:
A Notch Filter was used during formal testing from 1 – 18GHz (Average Graphs) 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.

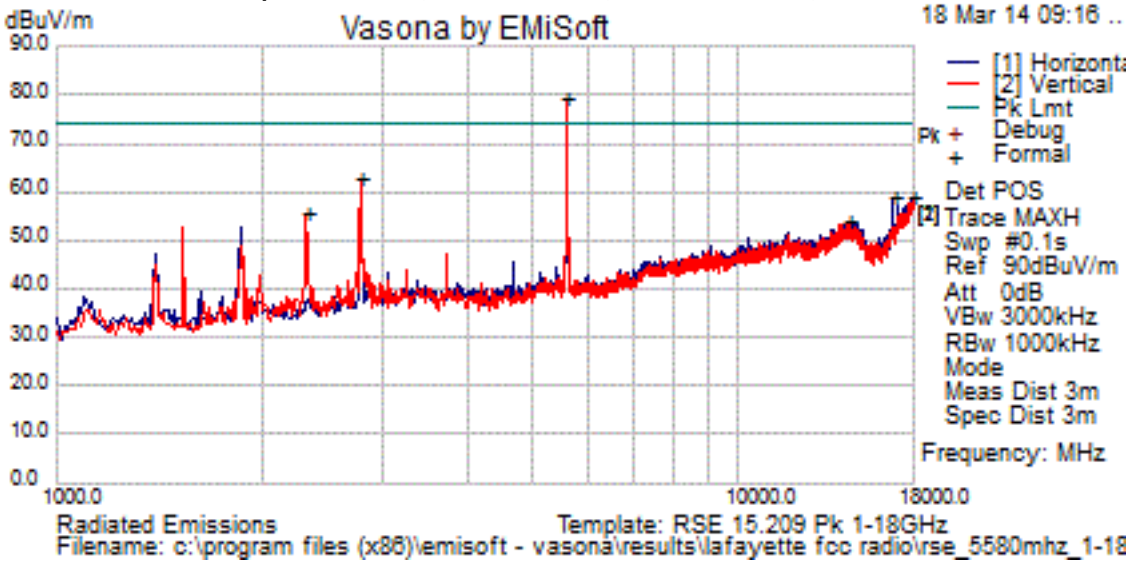
- A1MHz Video Bandwidth and peak detector was used for the average preview plots resulting in a higher level. The correct bandwidth of 10Hz was used for any formal measurements.
- The emissions between 2GHz and 3GHz will be evaluated during EMC testing and assessed against the applicable limits. These 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.

Transmitter Radiated Spurious Emissions

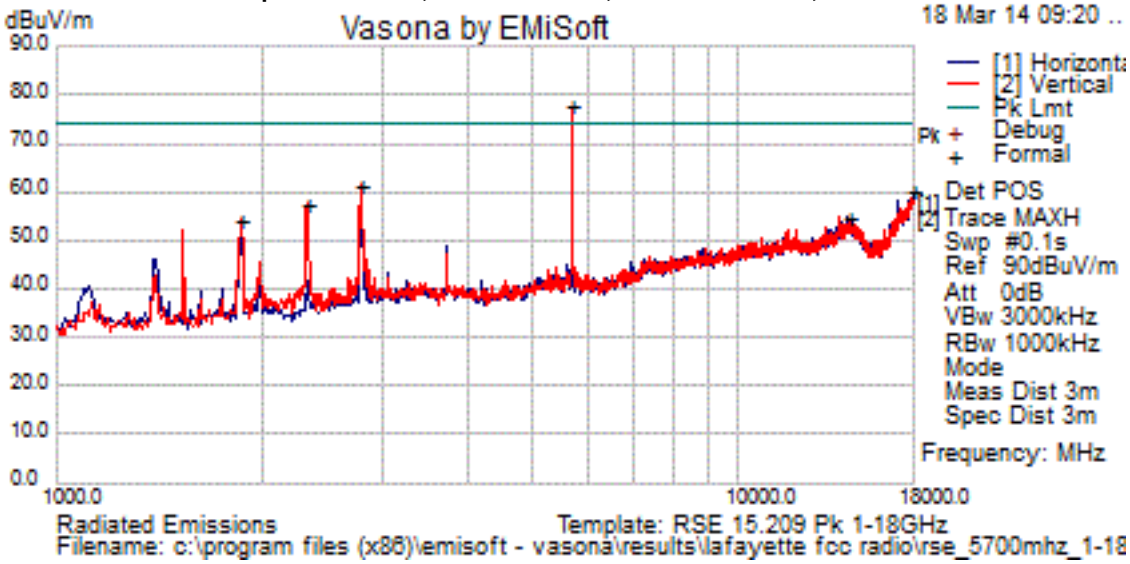
Radiated Transmitter Spurs 5500MHz, All bandwidths, rates and modes, Peak



Radiated Transmitter Spurs 5580MHz, All bandwidths, rates and modes, Peak



Radiated Transmitter Spurs 5700MHz, All bandwidths, rates and modes, Peak

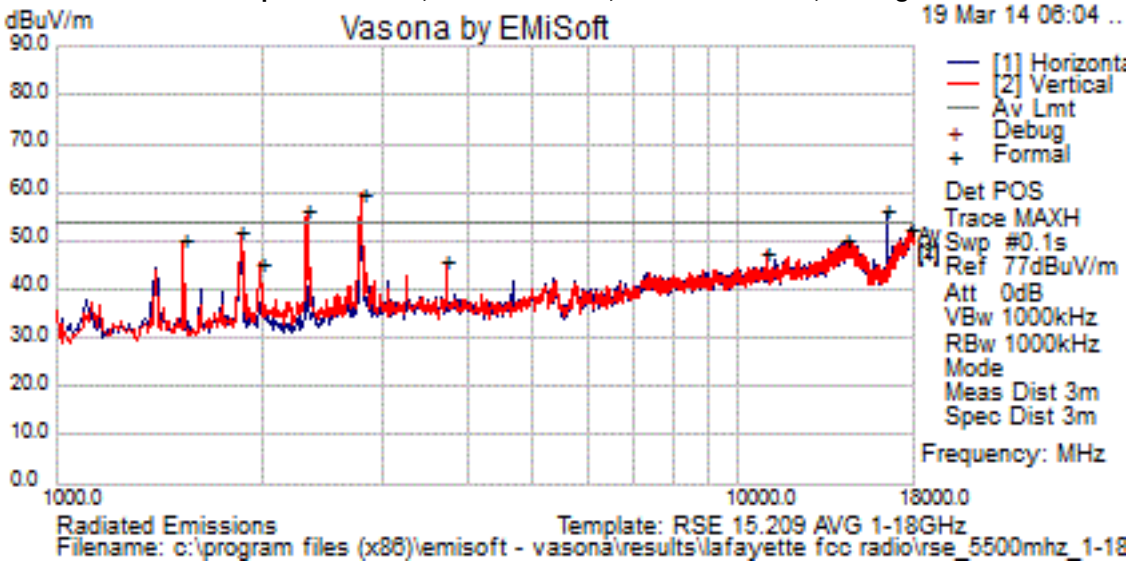


Worst Case Results Table (Peak)

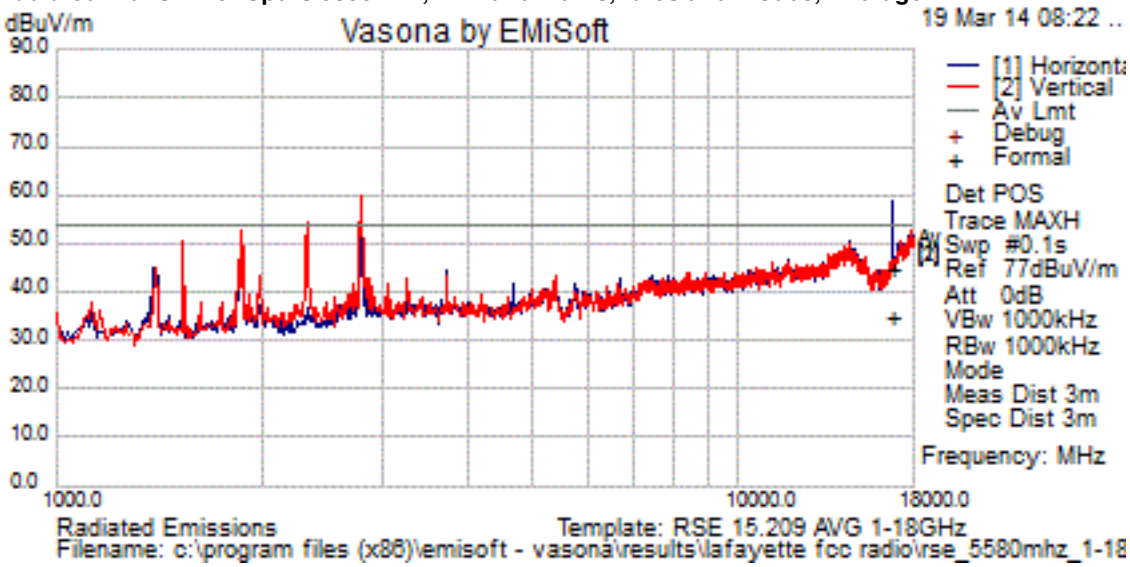
Formal Data

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	5496.500	69.6	8.8	-3.7	74.7	Peak [Scan]	H	120	200	74.0	.7	N/A	TX Freq
2	2802.000	63.8	6.3	-5.9	64.2	Peak [Scan]	V	120	200	74.0	-9.8	Pass	
3	17872.500	34.7	16.3	9.7	60.6	Peak [Scan]	H	120	200	74.0	-13.4	Pass	
4	16504.000	38.6	15.3	2.5	56.4	Peak [Scan]	H	120	200	74.0	-17.6	Pass	
5	14455.500	32.1	14.4	8.0	54.5	Peak [Scan]	V	120	200	74.0	-19.5	Pass	
6	2334.500	54.4	5.7	-5.8	54.3	Peak [Scan]	V	120	200	74.0	-19.7	Pass	

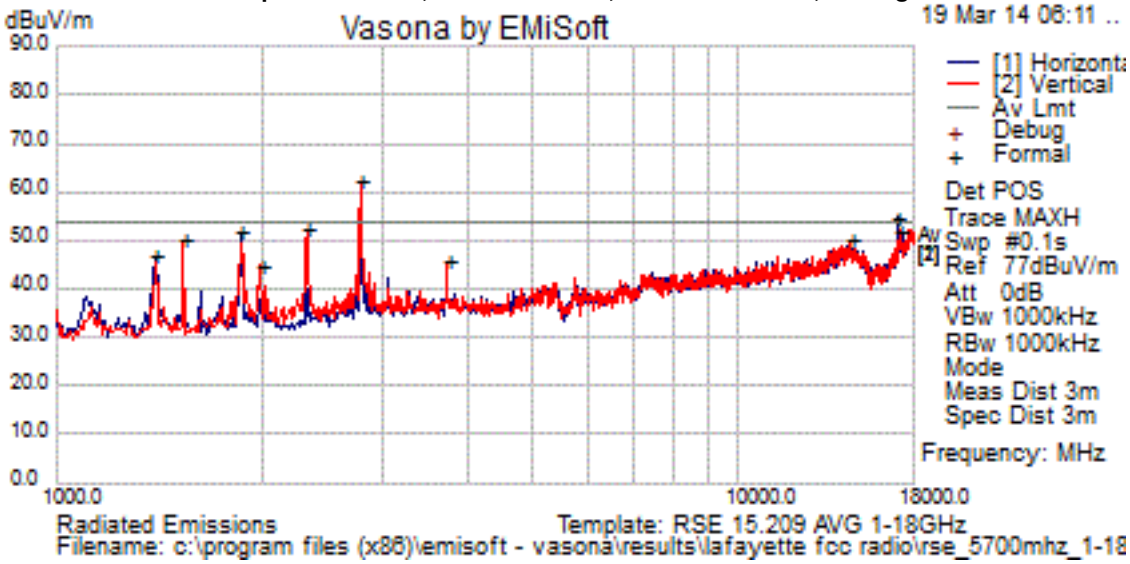
Radiated Transmitter Spurs 5500MHz, All Bandwidths, rates and modes, Average



Radiated Transmitter Spurs 5580MHz, All Bandwidths, rates and modes, Average



Radiated Transmitter Spurs 5700MHz, All Bandwidths, rates and modes, Average



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	

A 1MHz Video Bandwidth was used for the preview plots. The average detector at 10Hz was used for any formal measurements.

The emissions below 3GHz were digital emissions and were not from the radio or its antenna port.

Receiver Radiated Spurious Emissions

Radiated Receiver Spurs, 30MHz to 40GHz, All Rates, All Modes, Peak

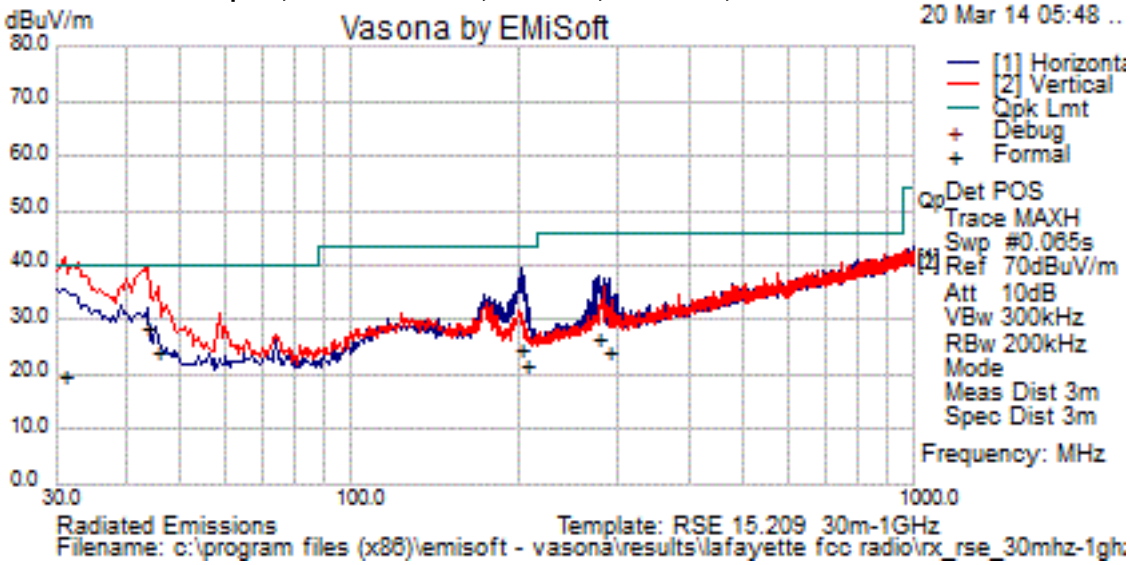
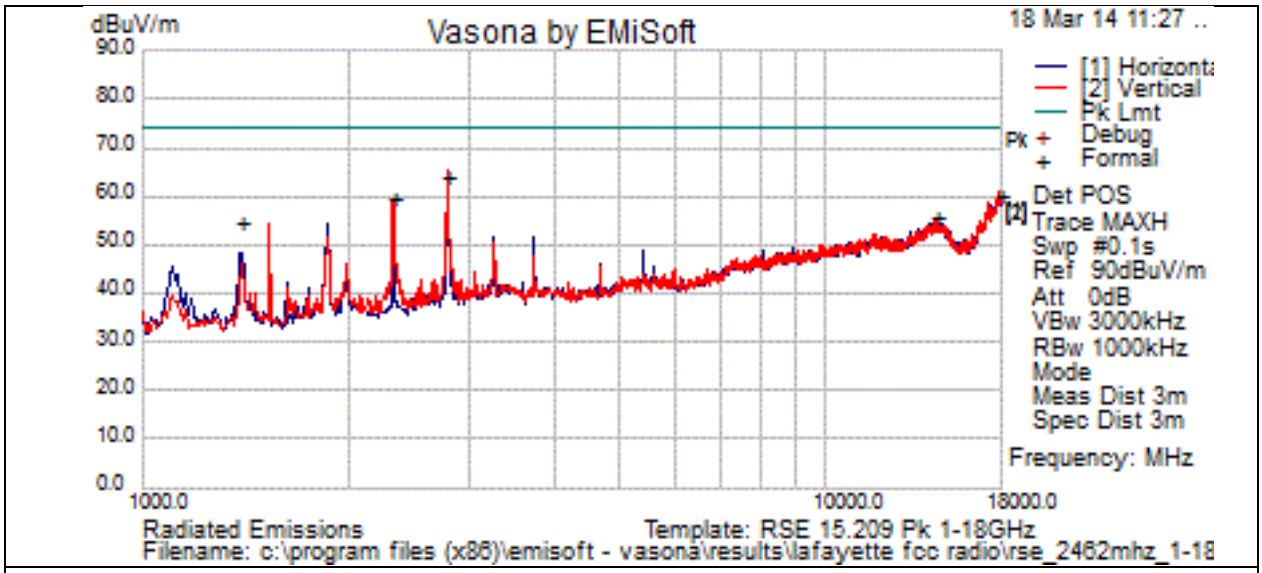


Table of Results:

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	17.2	.6	11.2	29.0	Quasi Max	V	102	18	40.0	-11.0	Pass	
2	45.520	13.6	.6	10.0	24.3	Quasi Max	V	102	92	40.0	-15.7	Pass	
3	201.205	11.7	1.3	12.2	25.2	Quasi Max	H	102	50	43.5	-18.3	Pass	
4	275.410	11.6	1.5	13.5	26.6	Quasi Max	H	102	50	46.0	-19.4	Pass	
5	30.970	-.2	.5	19.6	19.9	Quasi Max	V	102	114	40.0	-20.1	Pass	
6	205.085	9.1	1.3	11.0	21.4	Quasi Max	H	102	44	43.5	-22.1	Pass	
7	287.535	9.5	1.6	13.3	24.4	Quasi Max	H	102	46	46.0	-21.6	Pass	

Radiated Receiver Spurs, 1GHz to 18GHz, All Channels, All Bandwidths, All Rates, All Modes, Peak
Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'.

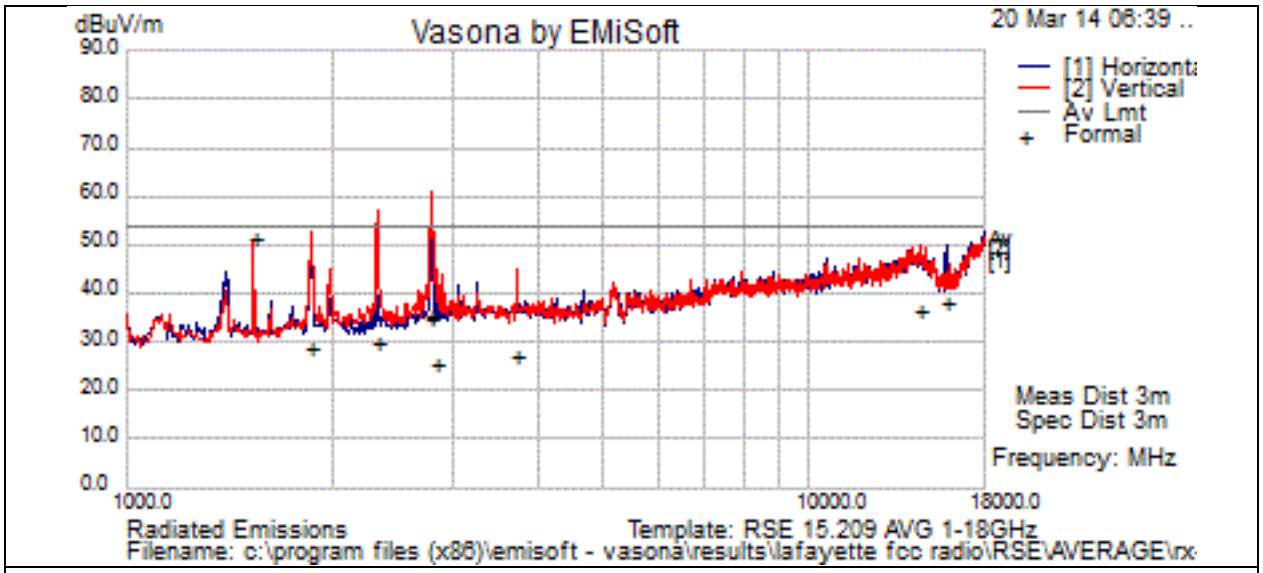


Title: Receiver Spurious 1GHz – 18GHz (Peak). The EUT was operating at 2462MHz and 5700MHz Receiver mode simultaneously.

There were no emissions within 6dB of the specification limit when measured with a peak detector.

Graphical Test Results 1GHz-18GHz (Average)

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



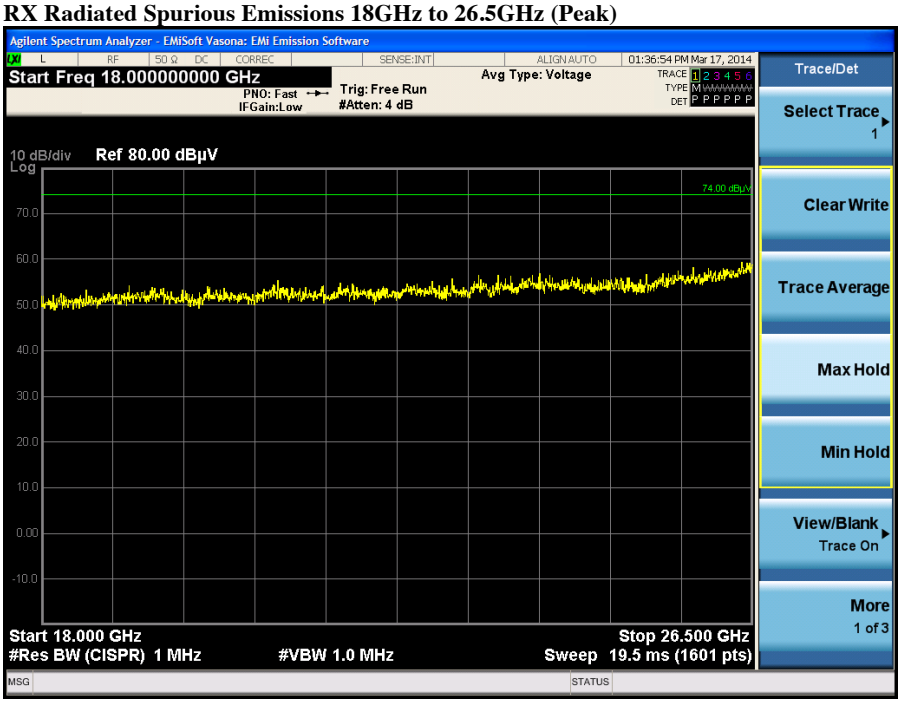
Title: Receiver Spurious 1GHz – 18GHz (Average). The EUT was operating at 2462MHz and 5700MHz Receiver mode simultaneously.

Test Results Table

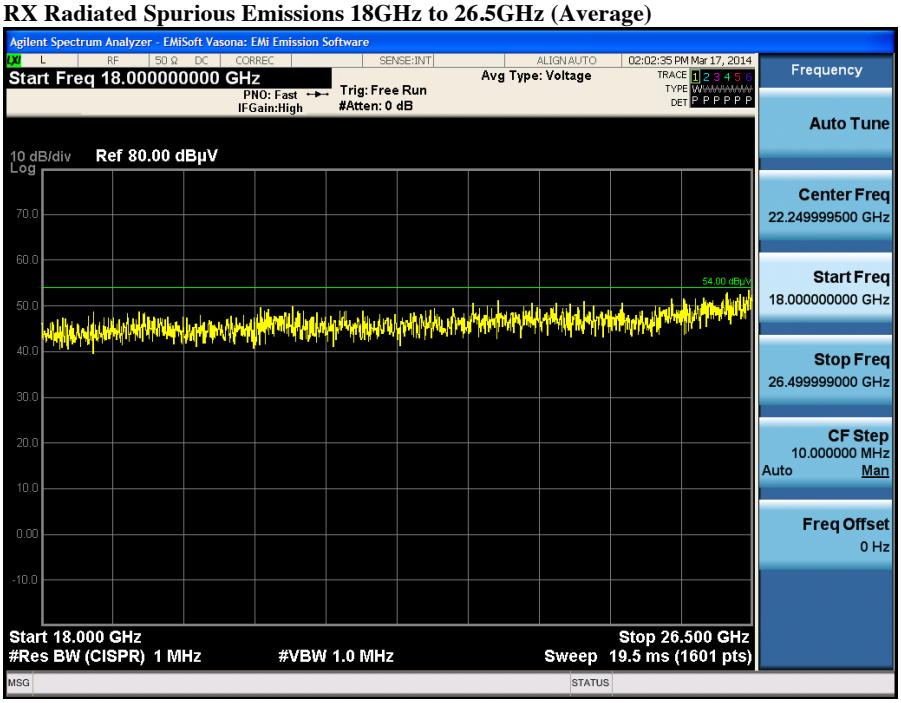
Formal Data

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	1536.113	55.2	4.0	-7.9	51.3	Average Max	V	112	174	54.0	-2.7	Pass	
2	2799.736	38.6	5.5	-5.9	38.3	Average Max	V	126	188	54.0	-15.7	Pass	
3	2333.078	32.3	5.0	-5.8	31.5	Average	V	127	178	54.0	-22.5	Pass	
4	1866.380	29.9	4.4	-7.0	27.4	Average Max	H	130	184	54.0	-26.6	Pass	
5	3733.668	24.1	6.5	-3.5	27.1	Average Max	V	120	97	54.0	-26.9	Pass	
6	1400.142	30.1	3.8	-7.6	26.3	Average Max	V	165	147	54.0	-27.7	Pass	

RX Radiated Spurious Emissions 18GHz to 26.5GHz (Peak)

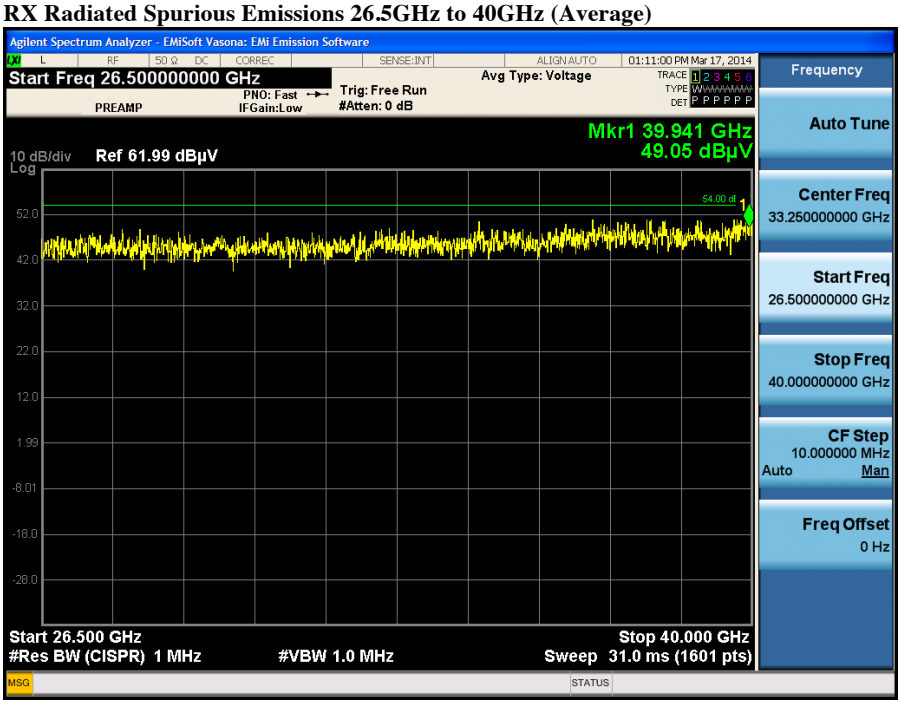


RX Radiated Spurious Emissions 18GHz to 26.5GHz (Average)

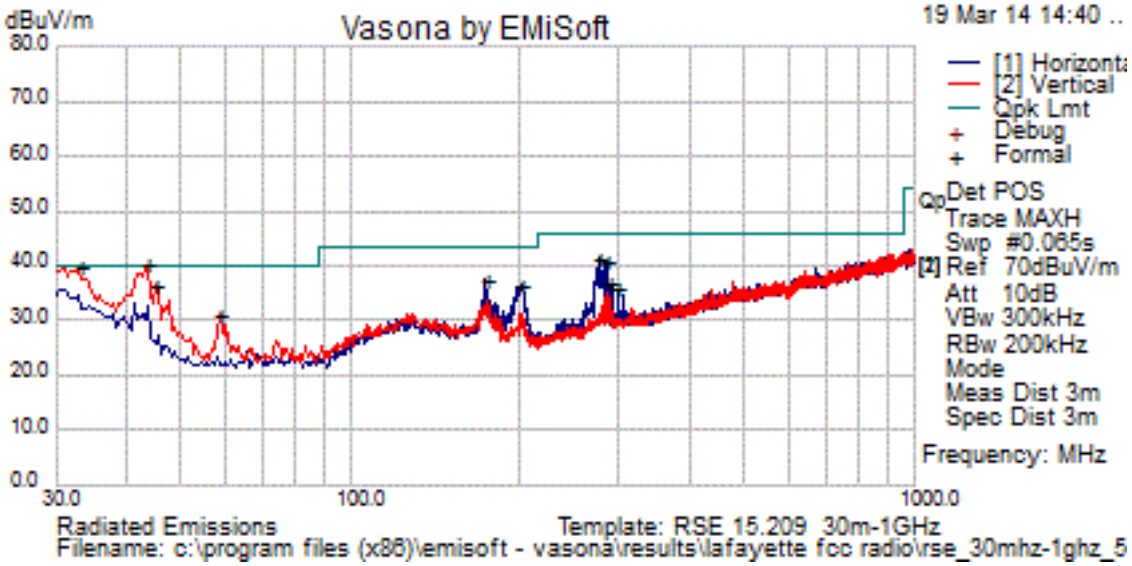


RX Radiated Spurious Emissions 26.5GHz to 40GHz (Peak)

RX Radiated Spurious Emissions 26.5GHz to 40GHz (Average)



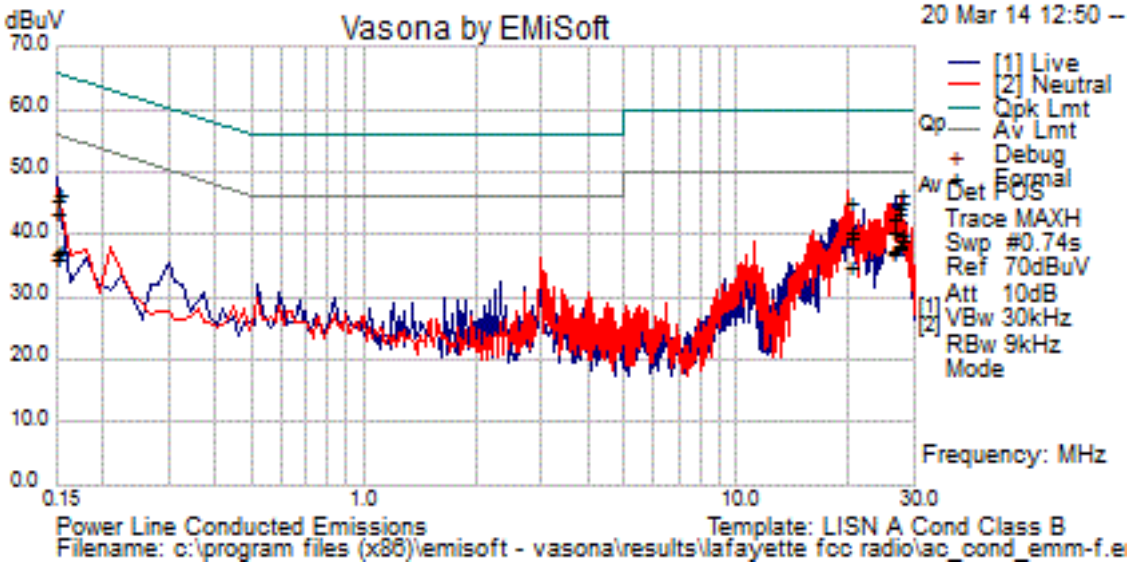
TX Radiated emissions 30MHz to 1GHz



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



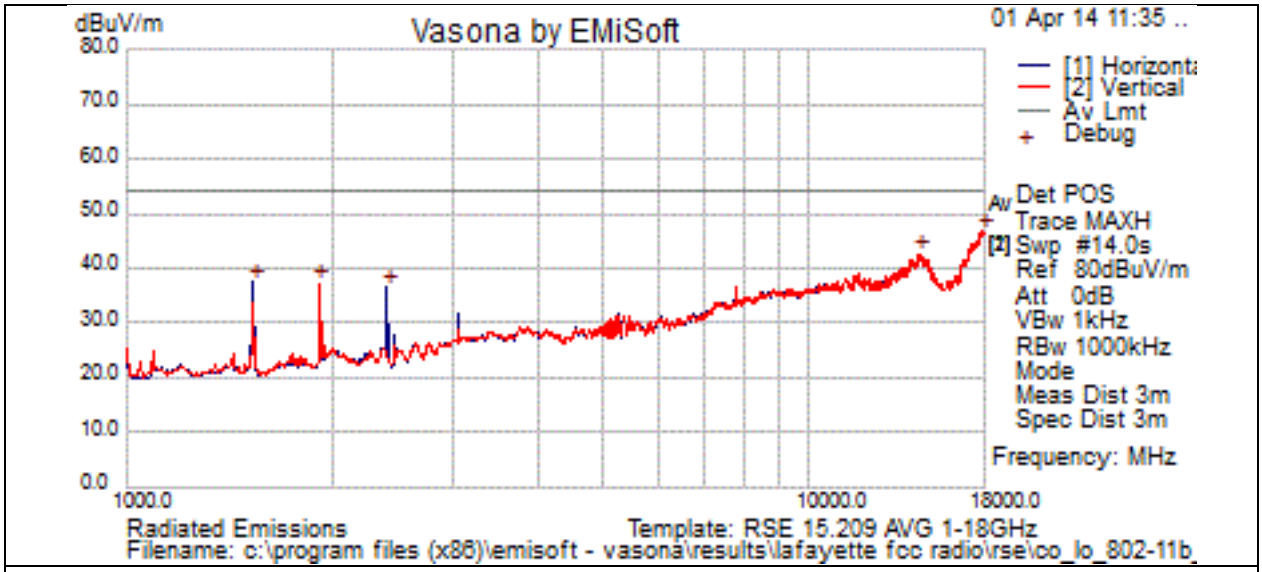
Formal Data

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	

Co-Locator Emission Results

Graphical Test Results for Bluetooth & UNII Band 2e channels (Average)

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



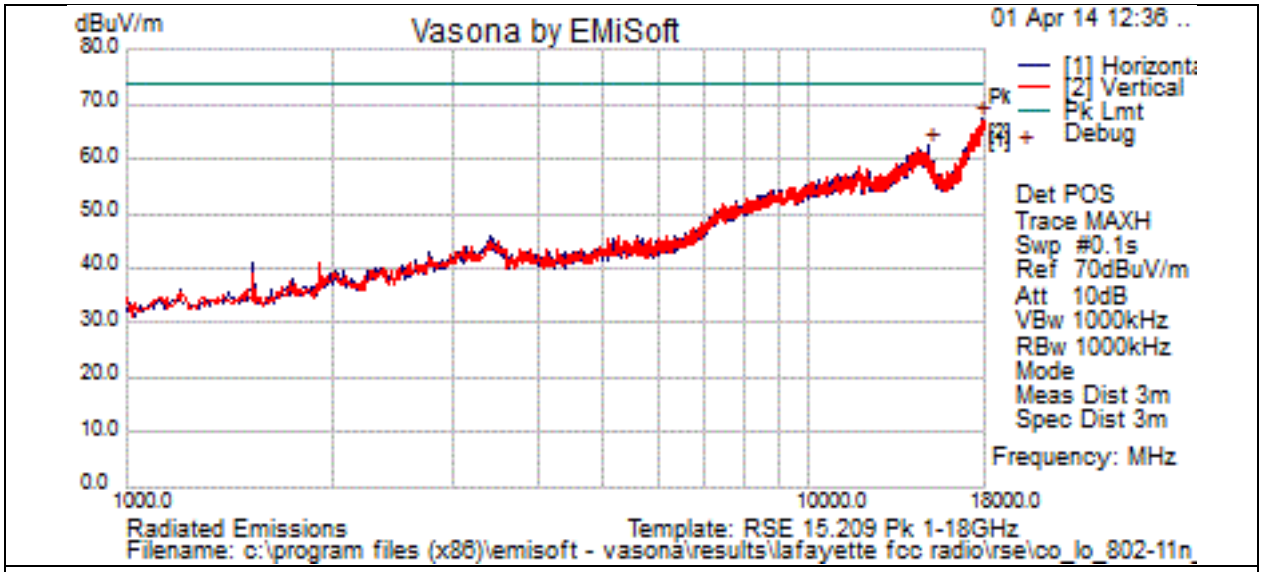
Co-Locator Radiated Spurious Emissions Results for Bluetooth & UNII Band 2e channels: 1 - 18GHz (Peak)

Test Results Table

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	18000.000	20.8	16.3	9.7	46.8	Peak [Scan]	H	150	0	54.0	-7.2	Pass	
2	14472.500	20.6	14.1	7.7	42.5	Peak [Scan]	H	150	0	54.0	-11.5	Pass	
3	1918.000	39.6	4.5	-6.5	37.5	Peak [Scan]	V	150	0	54.0	-16.5	Pass	
4	1535.500	41.2	4.0	-7.9	37.3	Peak [Scan]	H	150	0	54.0	-16.7	Pass	

Graphical Test Results for Bluetooth & UNII Band 2e channels(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



Title: Co-Locator Radiated Spurious Emissions Results for Bluetooth & UNII-2e channels: 1 - 18GHz (Peak)

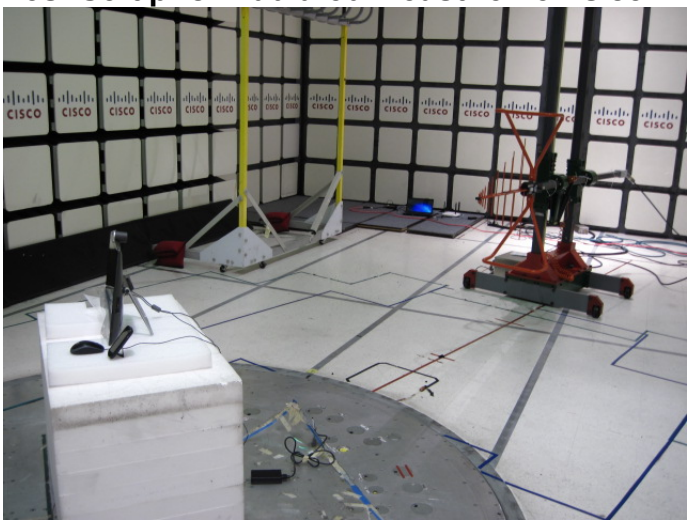
Test Results Table

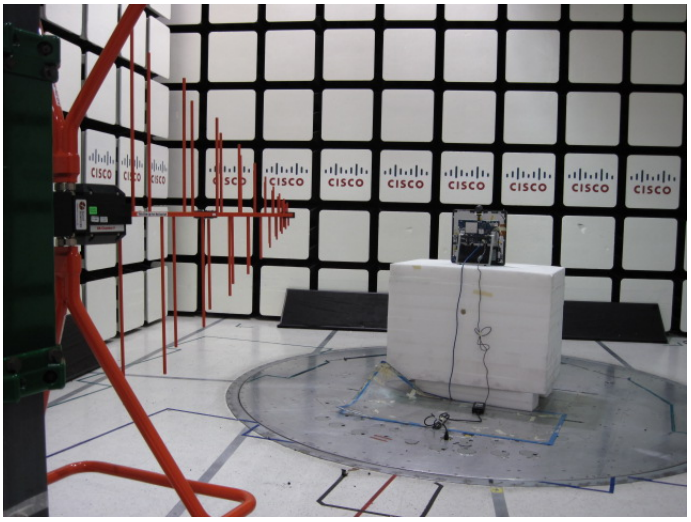
Formal Data

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	17804.500	41.4	16.2	9.8	67.4	Peak [Scan]	H	150	0	74.0	-6.6	Pass	
2	14965.500	42.2	14.4	5.7	62.3	Peak [Scan]	H	150	0	74.0	-11.7	Pass	

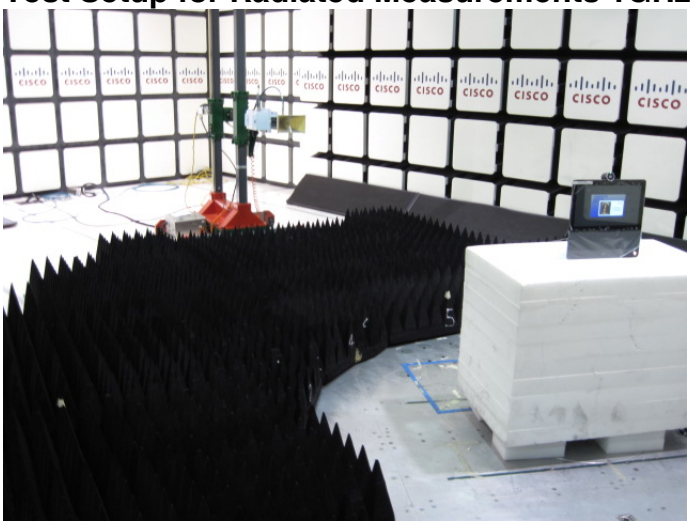
Appendix B: Photographs of Test Setups:

Test Setup for Radiated Measurements 30MHz to 1GHz

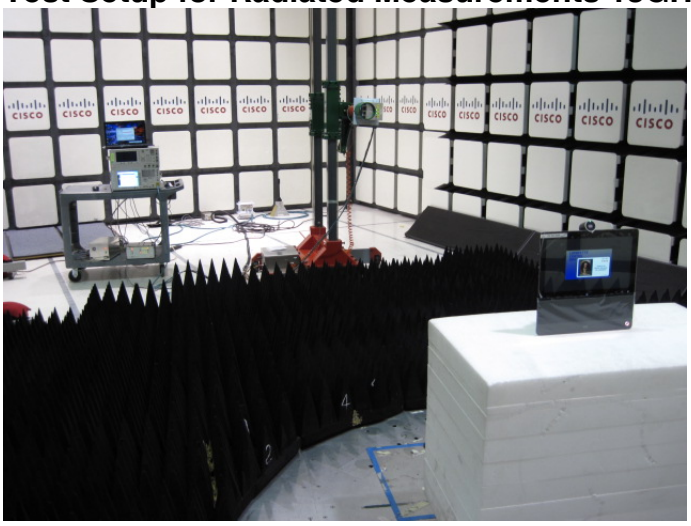




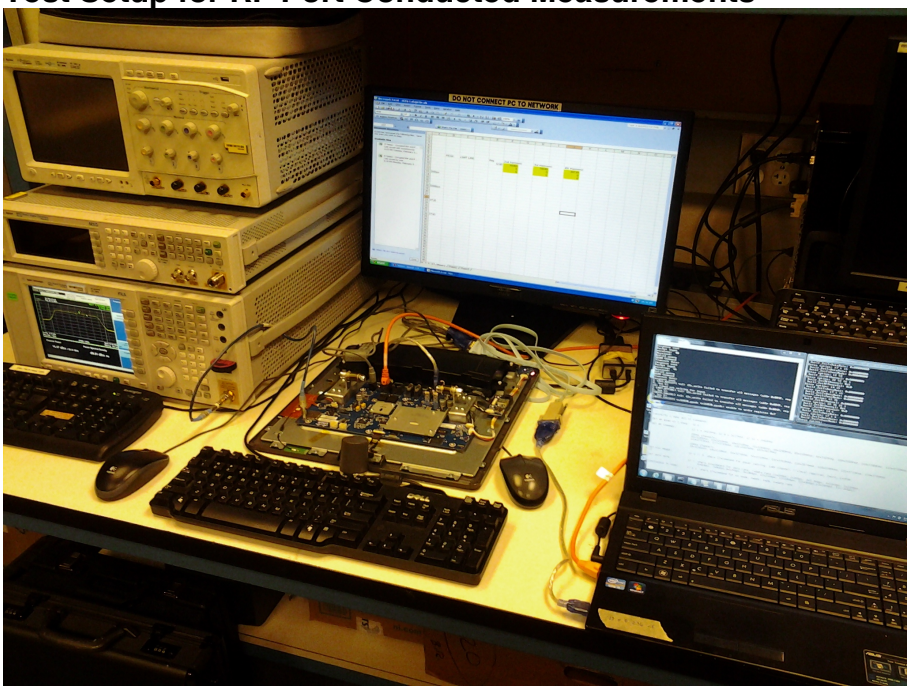
Test Setup for Radiated Measurements 1GHz to 18GHz



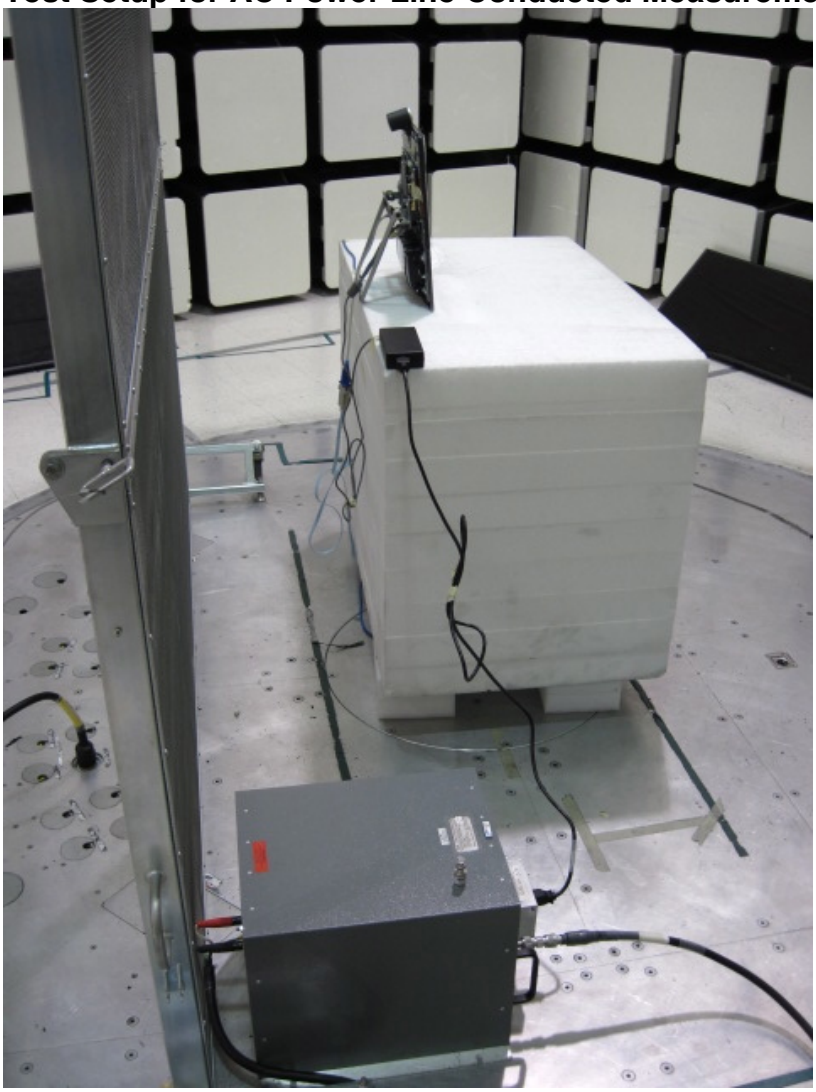
Test Setup for Radiated Measurements 18GHz to 40GHz



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
CIS049489*	JFW	50HF-010	SMA 10 dB Attenuator	21-MAR-2014	21-MAR-2015
CIS047282*	Huber + Suhner	Sucoflex 102E	40GHz Cable K Connector	02-MAY-2014	02-MAY-2015
CIS040503*	Agilent	E4440A	Precision Spectrum Analyzer	06-JUN-2014	06-JUN-2015

* Equipment used for re-measurements of conducted bandedge tests 07/18/2014.

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 & 20dB Bandwidth	EDCS # - 422115
Co-Located Transmitter	EDCS # - 422118
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