

EMC Test Report

Project Number: 3958632**Report Number:** 3958632EMC06**Revision Level:** 0**Client:** Deere & Company**Equipment Under Test:** Modular Telematics Gateway 4G LTE**Model:** MA4G**FCC ID:** OV5-MA4G**IC ID:** 11137A-MA4G**Applicable Standards:** FCC Part 15 Subpart C, § 15.407**ANSI C63.10: 2013****Report issued on:** 10 May 2016**Test Result:** Compliant

Tested by:



Fabian Nica, Senior Technician

Reviewed by:



Jeremy Pickens, Senior EMC Engineer**Remarks:**

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Summary of Test Results

Test Description	Test Specification	Test Result
Emission Bandwidth	15.407(a), 15.407(e)	Compliant
Spectral Density	15.407(a)	Compliant
Peak Power Output	15.407(a)	Compliant
Unwanted Emissions	15.407(b)	Compliant
AC Powerline Conducted Emission	15.107, 15.207	N/A(1)

(1) Not Applicable – The host device for the module is battery-powered and has no facility for connection to the AC mains.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: Deere & Company
Address: One John Deere Place
City, State, Zip, Country: Moline, IL 61265, USA

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA
Type of lab: Testing Laboratory
Certificate Number: 3212.01

2.3 General Information of EUT

Type of Product: Modular Telematics Gateway 4G LTE
Model Number: MA4G
Serial Number: PCMA4GF100254
IMEI Number: 004401081652188

FCC ID: OV5-MA4G
IC ID: 11137A-MA4G

Frequency Range: 5150 to 5250 MHz and 5725 to 5825MHz
Data Modes: 802.11a, 802.11n (HT20), 802.11n (HT40)
Antenna: External PCTEL multi-band antenna

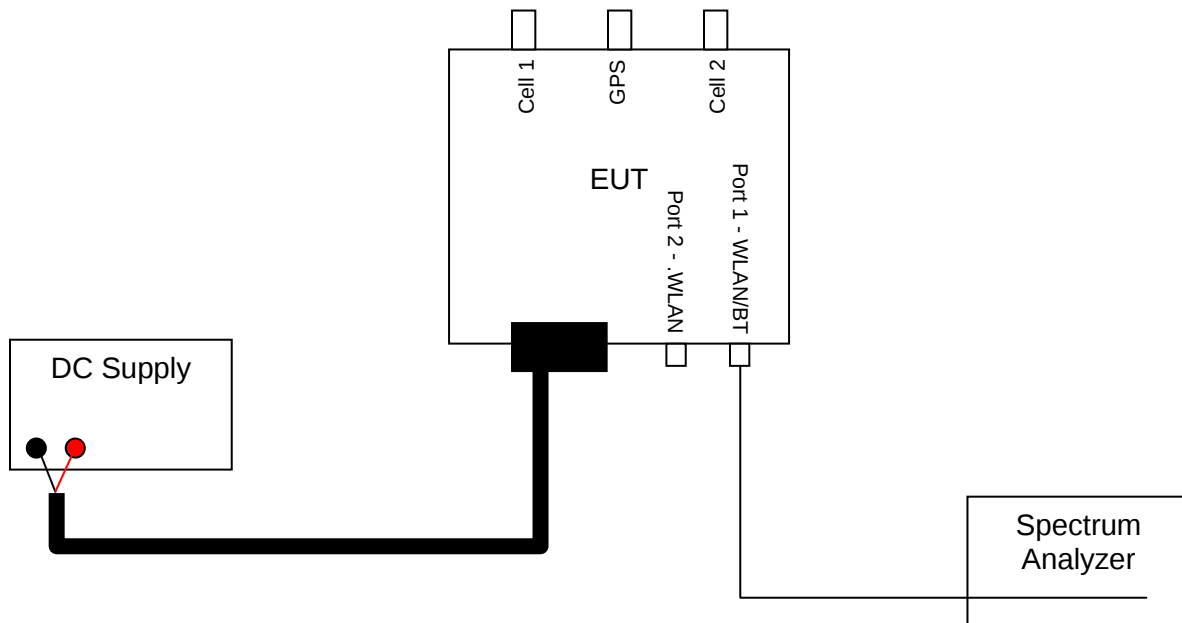
Rated Voltage: 9 – 32Vdc
Test Voltage: 12Vdc

Sample Received Date: 29 March 2016
Dates of testing: 12 April – 03 May 2016

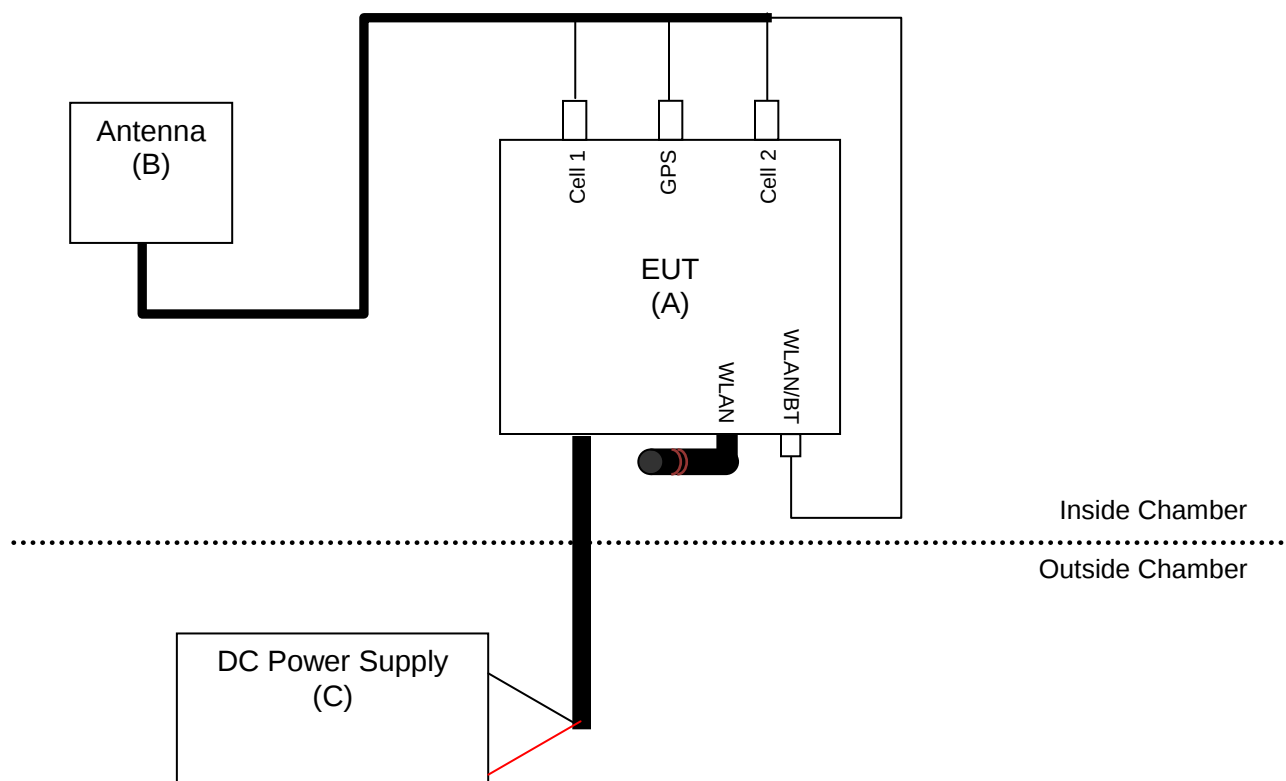
2.4 Operating Modes and Conditions

Using test commands, the EUT would transmit continuously on any of the UNII Band 1 or 3 channels at full power (Target 20dBm). All modulations and data rates were measured for power. For spurious emissions measurements, only the worst-case mode with respect to peak power was investigated: 802.11a, 6Mbps.

2.5 EUT Connection Block Diagram – Conducted Measurements



2.6 EUT Connection Block Diagram – Radiated Measurements



2.7 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Deere & Company	Modular Telematics Gateway	MA4G	PCMA4GF100254
B	PCTEL	LTE/Wi-Fi/GPS/GLONASS Antenna	PFA10877	Not Labeled
C	Kenwood	DC Power Supply	PR18-1.2A	5090198

3 Emission Bandwidth and Occupied Bandwidth

3.1 Test Result

Test Description	Test Specification	Test Result
Emission bandwidth / 99% OBW	15.407(a), 15.407(e)	Compliant

3.2 Test Method

The procedures from ANSI C63.10: 2013 clause 12.4 and KDB document 789033 D02 General UNII Test Procedures New Rules v01r02 were used to determine the 6 dB bandwidth, the 26dB bandwidth, and 99% OBW.

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.3 °C

Relative Humidity: 48.3 %

3.4 Test Equipment

Test Date: 21-Apr-2016

Tester: JOP

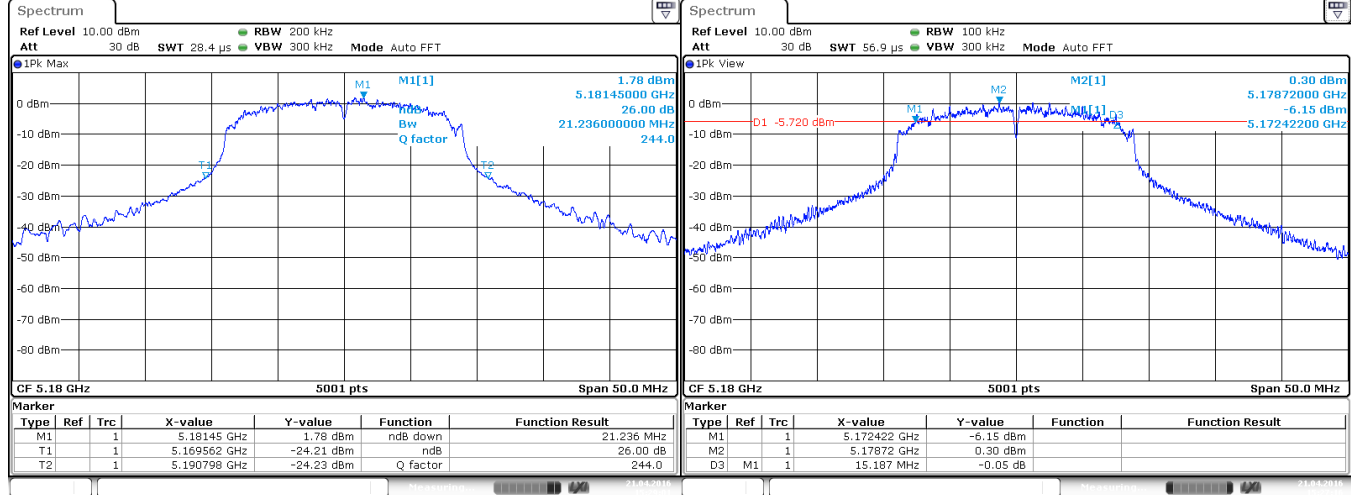
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
COAXIAL CABLE	SUCOFLEX 102	ROHDE & SCHWARZ	B079823	4-Aug-2016

Note: The calibration period equipment is 1 year except for the FSV30 which is on a 2-year cycle.

3.5 Test Data

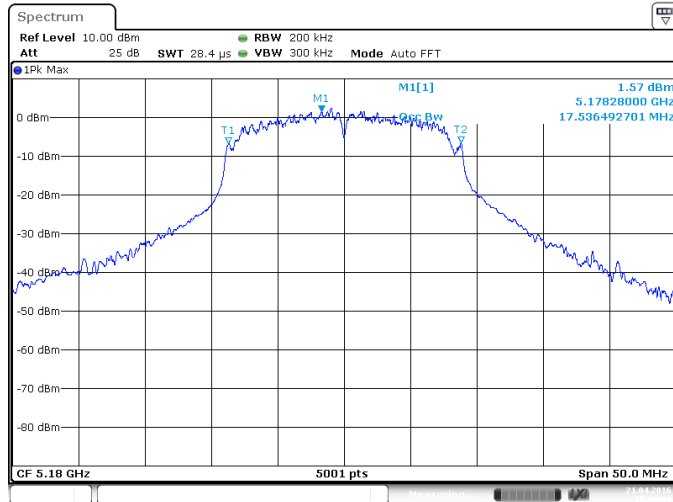
Protocol	Channel	Data Rate	26dB Bandwidth (MHz)	6dB Bandwidth (MHz)	OBW (99%) (MHz)
802.11a	36	54Mbps	21.266	15.137	16.107
802.11a	44	54Mbps	22.006	15.397	16.327
802.11a	48	54Mbps	22.316	15.167	16.257
802.11a	149	54Mbps	21.616	15.648	16.317
802.11a	157	54Mbps	20.846	15.557	16.337
802.11a	165	54Mbps	21.016	15.937	16.307
(HT20)	36	MCS7	21.236	15.187	17.536
(HT20)	44	MCS7	22.895	15.117	17.546
(HT20)	48	MCS7	23.485	15.361	17.526
(HT20)	149	MCS7	21.906	15.127	17.516
(HT20)	157	MCS7	23.205	15.14	17.526
(HT20)	165	MCS7	22.625	15.257	17.497
(HT40)	40	MCS7	43.455	35.093	35.969
(HT40)	44	MCS7	41.404	35.081	36.017
(HT40)	153	MCS7	44.283	35.057	36.017
(HT40)	157	MCS7	41.788	35.108	36.041
(HT40)	161	MCS7	41.764	35.081	36.017

Sample Plots:



Date: 21.APR.2016 15:29:01

Date: 21.APR.2016 15:27:16



Date: 21.APR.2016 15:30:09

4 Output Power

4.1 Test Result

Test Description	Test Specification	Test Result
Peak Output Power	15.407(a)	Compliant

4.2 Test Method

Fundamental power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 12.3 and KDB document 789033 D02 General UNII Test Procedures New Rules v01r02.

Limit

For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

For using antennas with greater than 6dBi of gain, the limit is reduced in dB by the amount the gain exceeds 6dBi

4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.0 °C

Relative Humidity: 48.2 %

4.4 Test Equipment

Test Date: 26-Apr-2016

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
COAXIAL CABLE	SUCOFLEX 102	ROHDE & SCHWARZ	B079823	4-Aug-2016

Note: The calibration period equipment is 1 year except for the FSV30 which is on a 2-year cycle.

4.5 Test Data – 802.11a

Mode	RateMbps	Channel	Target dBm	Final dBm
802.11a	6	36	20	15.45
		44	20	15.62
		48	20	15.72
		149	20	12.93
		157	20	12.21
		165	20	11.89
	9	36	20	15.54
		44	20	15.67
		48	20	15.81
		149	20	13
		157	20	12.28
		165	20	11.94
	12	36	20	15.61
		44	20	15.76
		48	20	15.88
		149	20	13.05
		157	20	12.33
		165	20	11.98
	18	36	20	15.69
		44	20	15.85
		48	20	15.98
		149	20	13.11
		157	20	12.39
		165	20	12.03
	24	36	20	14.59
		44	20	14.79
		48	20	14.91
		149	20	12.32
		157	20	11.6
		165	20	11.24
	36	36	20	13.65
		44	20	13.89
		48	20	14.03
		149	20	11.31
		157	20	10.66
		165	20	10.31
	48	36	20	12.82
		44	20	13.1
		48	20	13.23
		149	20	10.46
		157	20	9.79
		165	20	9.46
	54	36	20	11.92
		44	20	12.25
		48	20	12.35
		149	20	9.57
		157	20	8.88
		165	20	8.55

4.6 Test Data – 802.11n (HT20)

Mode	RateMbps	Channel	Target dBm	Final dBm
802.11n (HT20)	MCS0	36	20	15.4
		44	20	15.59
		48	20	15.68
		149	20	13.11
		157	20	12.43
		161	20	12.06
	MCS1	36	20	15.53
		44	20	15.7
		48	20	15.82
		149	20	13.17
		157	20	12.53
		165	20	12.12
	MCS2	36	20	15.62
		44	20	15.79
		48	20	15.92
		149	20	13.24
		157	20	12.61
		165	20	12.19
	MCS3	36	20	15.62
		44	20	15.79
		48	20	15.93
		149	20	13.23
		157	20	12.6
		165	20	12.17
	MCS4	36	20	13.83
		44	20	14.07
		48	20	14.21
		149	20	11.46
		157	20	10.85
		165	20	10.48
	MCS5	36	20	13.04
		44	20	13.31
		48	20	13.45
		149	20	10.64
		157	20	10.04
		165	20	9.66
	MCS6	36	20	12.16
		44	20	12.45
		48	20	12.59
		149	20	9.74
		157	20	9.15
		165	20	8.74
	MCS7	36	20	11.31
		44	20	11.62
		48	20	11.75
		149	20	8.87
		157	20	8.29
		165	20	7.86

4.7 Test Data – 802.11n (HT40)

Mode	RateMbps	Channel	Target dBm	Final dBm
802.11n (HT40)	MCS0	40	20	14.05
		44	20	14.12
		153	20	10.88
		157	20	10.49
		161	20	10.36
	MCS1	40	20	14.1
		44	20	14.18
		153	20	10.91
		157	20	10.52
		161	20	10.43
	MCS2	40	20	14.05
		44	20	14.13
		153	20	10.84
		157	20	10.47
		161	20	10.33
	MCS3	40	20	14.06
		44	20	14.13
		153	20	10.84
		157	20	10.45
		161	20	10.35
	MCS4	40	20	13.89
		44	20	13.96
		153	20	10.64
		157	20	10.26
		161	20	10.16
	MCS5	40	20	11.84
		44	20	11.93
		153	20	8.42
		157	20	8.04
		161	20	7.96
	MCS6	40	20	11.81
		44	20	11.9
		153	20	8.38
		157	20	7.99
		161	20	7.92
	MCS7	40	20	10.49
		44	20	10.61
		153	20	7.04
		157	20	6.62
		161	20	6.55

5 Power Spectral Density

5.1 Test Result

Test Description	Test Specification	Test Result
Power Spectral Density	15.407(a)	Compliant

5.2 Test Method

Fundamental power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 12.5 and KDB document 789033 D02 General UNII Test Procedures New Rules v01r02. The lowest data rate for each modulation was determined to be the worst-case.

Limit

The limit is 17dBm in any 1MHz band for channels in the 5.15-5.25GHz band and 30dBm in any 500-kHz band for channels in the 5.725-5.85GHz band.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 4.1 °C
Relative Humidity: 39.5 %

5.4 Test Equipment

Test Date: 26-Apr-2016

Tester: JOP

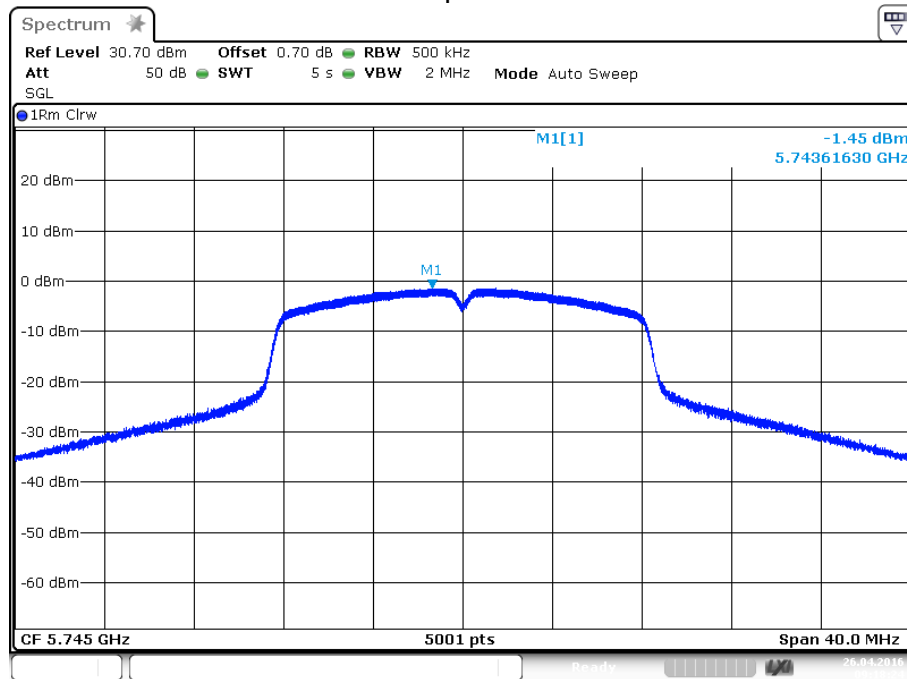
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
COAXIAL CABLE	SUCOFLEX 102	ROHDE & SCHWARZ	B079823	4-Aug-2016

Note: The calibration period for equipment is 1 year except for the FSV30 which is on a 2-year cycle.

5.5 Test Data (UNII Band 1)

Protocol	Channel	Data Rate	DC (%)	DC Corr (dB)	Meas PSD (dBm/MHz)	Corr PSD (dBm/MHz)	Limit (dBm)	Margin (dB)
802.11a	36	6 Mbps	60.1	2.21	3.37	5.58	17	-11.42
802.11a	44	6 Mbps	60.1	2.21	3.4	5.61	17	-11.39
802.11a	48	6 Mbps	60.1	2.21	3.65	5.86	17	-11.14
802.11n (HT20)	36	MCS0	56.3	2.49	2.59	5.08	17	-11.92
802.11n (HT20)	44	MCS0	56.3	2.49	2.62	5.11	17	-11.89
802.11n (HT20)	48	MCS0	56.3	2.49	2.81	5.3	17	-11.7
802.11n (HT40)	40	MCS0	40.3	3.95	-2.13	1.82	17	-15.18
802.11n (HT40)	44	MCS0	40.3	3.95	-2.03	1.92	17	-15.08

Sample Plot

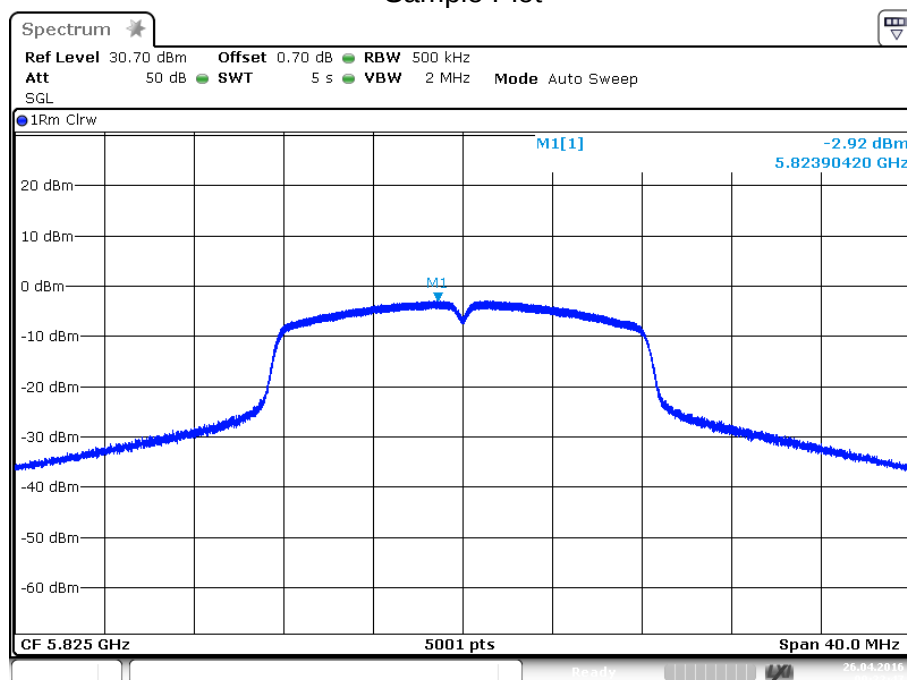


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5.6 Test Data (UNII Band 3)

Protocol	Channel	Data Rate	DC (%)	DC Corr (dB)	Meas PSD (dBm/500kHz)	Corr PSD (dBm/500kHz)	Limit (dBm)	Margin (dB)
802.11a	149	6 Mbps	60.1	2.21	-1.45	0.76	30	-29.24
802.11a	157	6 Mbps	60.1	2.21	-2.53	-0.32	30	-30.32
802.11a	165	6 Mbps	60.1	2.21	-2.92	-0.71	30	-30.71
802.11n (HT20)	149	MCS0	56.3	2.49	-1.89	0.6	30	-29.4
802.11n (HT20)	157	MCS0	56.3	2.49	-3.06	-0.57	30	-30.57
802.11n (HT20)	165	MCS0	56.3	2.49	-3.44	-0.95	30	-30.95
802.11n (HT40)	153	MCS0	40.3	3.95	-8.25	-4.3	30	-34.3
802.11n (HT40)	157	MCS0	40.3	3.95	-8.69	-4.74	30	-34.74
802.11n (HT40)	161	MCS0	40.3	3.95	-8.71	-4.76	30	-34.76

Sample Plot



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6 Unwanted Emissions – Antenna Port

6.1 Test Result

Test Description	Test Specification	Test Result
Spurious Emissions	15.407(b) ANSI C63.10: 2013	Compliant

6.2 Test Method

Testing was performed using the radiated and conducted methods defined in ANSI C63.10: 2013 clause 12.7 and KDB 789033 D02 General UNII Test Procedures New Rules v01r02. In lieu of the marker-delta or integration methods, band edge compliance was shown using a peak detector and a 1MHz resolution bandwidth. The correction factor for both the band edge measurements and the conducted spurious tests included cable loss and a 2dBi antenna gain (minimum that may be applied per the KDB for conducted methods).

Lowest, middle, and highest channels were investigated for each band. Only the worst-case (802.11a, 6Mbps) was reported except at the band edges where all three modulations were measured.

Limit:

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 e.i.r.p. of -27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.3 °C
Relative Humidity: 48.3 %

6.4 Test Equipment – Conducted Measurements

Test Date: 25-Apr-2016

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
COAXIAL CABLE	SUCOFLEX 102	ROHDE & SCHWARZ	B079823	4-Aug-2016
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	4-Aug-2016

Note: The calibration period for equipment is 1 year except for the FSV30 which is on a 2-year cycle.

6.5 Test Equipment – Radiated Measurements

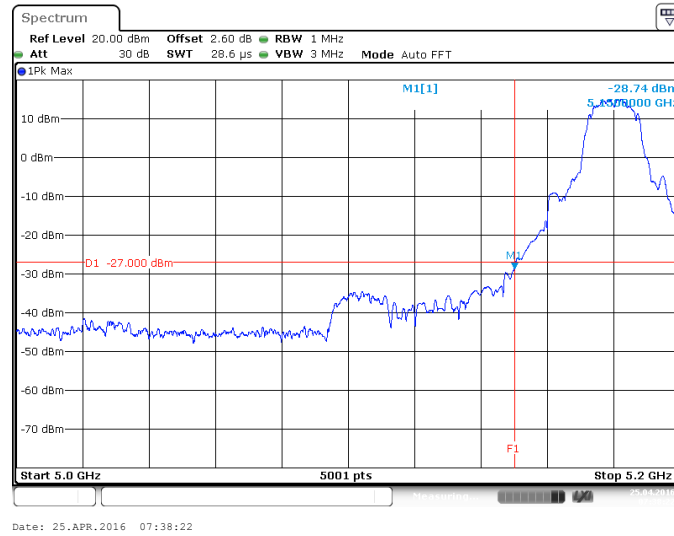
Test End Date: 3-May-2016

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	21-Oct-2016
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	3-Aug-2016
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079713	3-Aug-2016
TYPE N CABLE	104PE	HUBER&SUHNER	B079793	4-Aug-2016
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	4-Aug-2016
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079712	3-Aug-2016
PREAMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	24-Aug-2016
PREAMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079822	4-Aug-2016
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079824	4-Aug-2016
DRG HORN (SMALL)	3116B	ETS-LINDGREN	B079697	29-Mar-2017
FIXED GAIN AMPLIFIER	NSP1840-HG	MITEQ	B087572	15-Oct-2016
RF CABLE	SF106	HUBER&SUHNER	B085892	3-Aug-2016
6DB ATTENUATOR 50 Ohm	15542	Mini Circuit	15017	3-Aug-2016

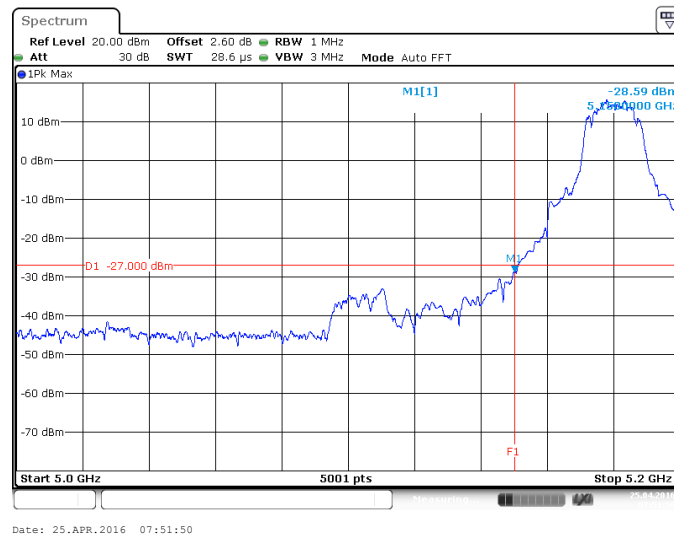
Note: The calibration period for equipment is 1 year

6.6 Test Data – Band Edge

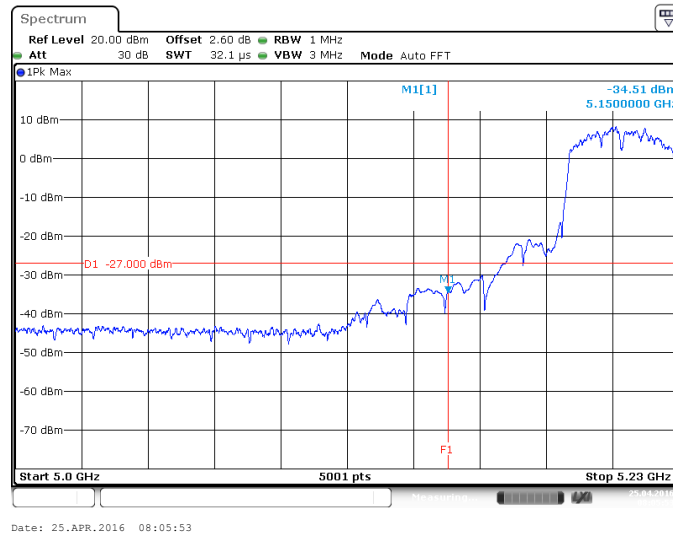
802.11a
Lower band edge
Channel 36
6Mbit/s



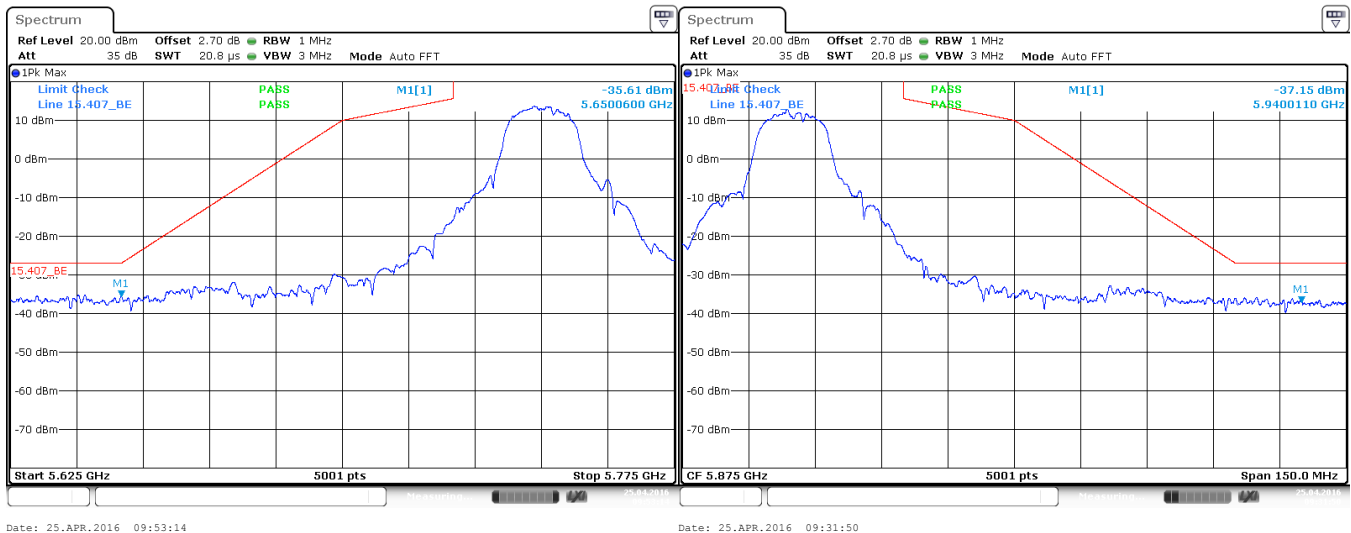
802.11n (HT20)
Lower band edge
Channel 36
MCS0



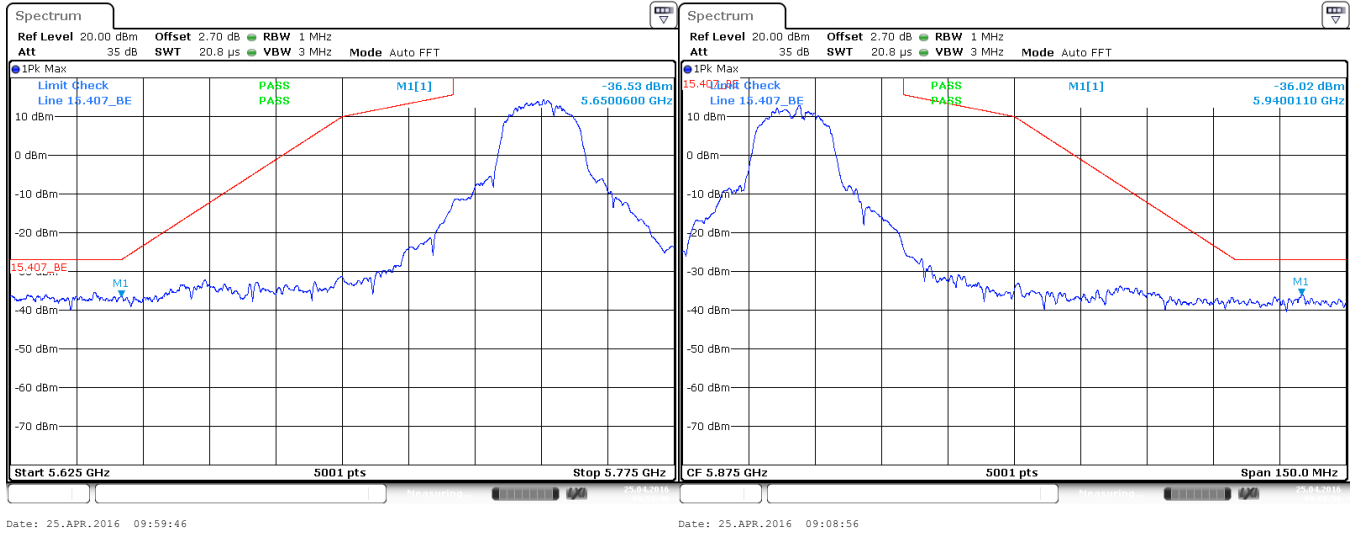
802.11n (HT40) Lower band edge Channel 40 MCS0



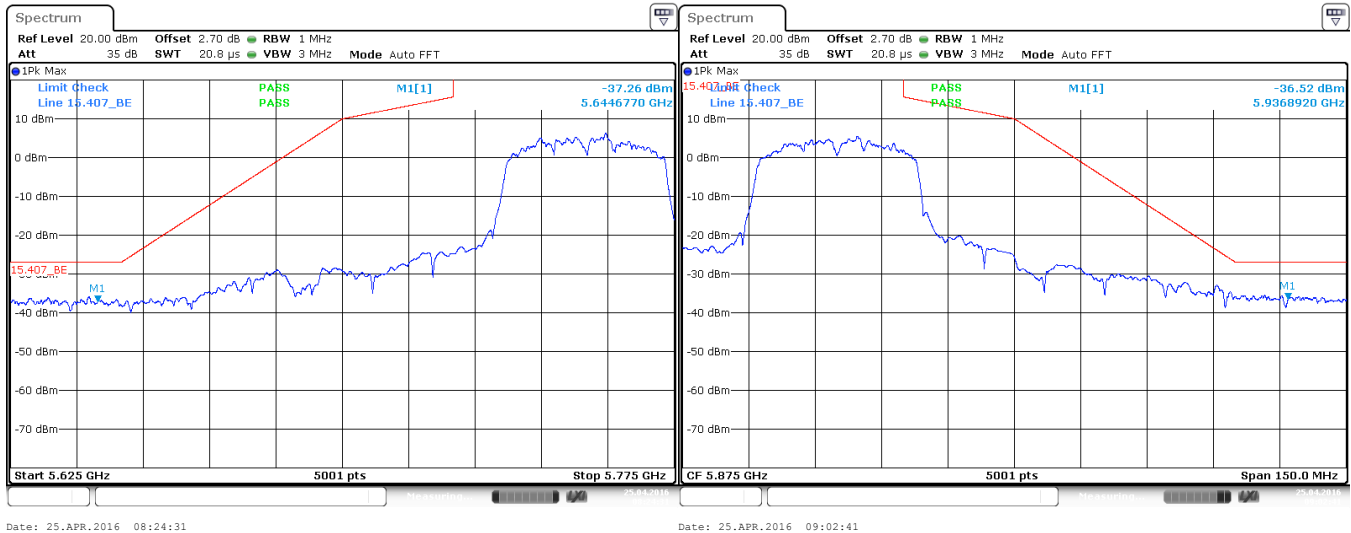
802.11a Lower band edge / Upper band edge Channel 149 / Channel 165 6Mbit/s



802.11n (HT20)
Lower band edge / Upper band edge
Channel 149 / Channel 165
MCS0

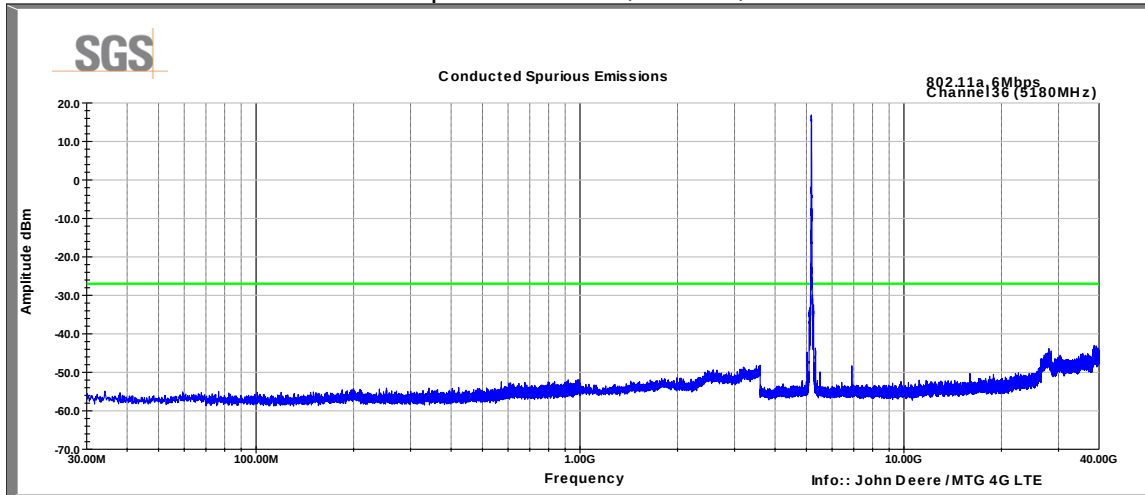


802.11n (HT40)
Lower band edge / Upper band edge
Channel 153 / Channel 161
MCS0

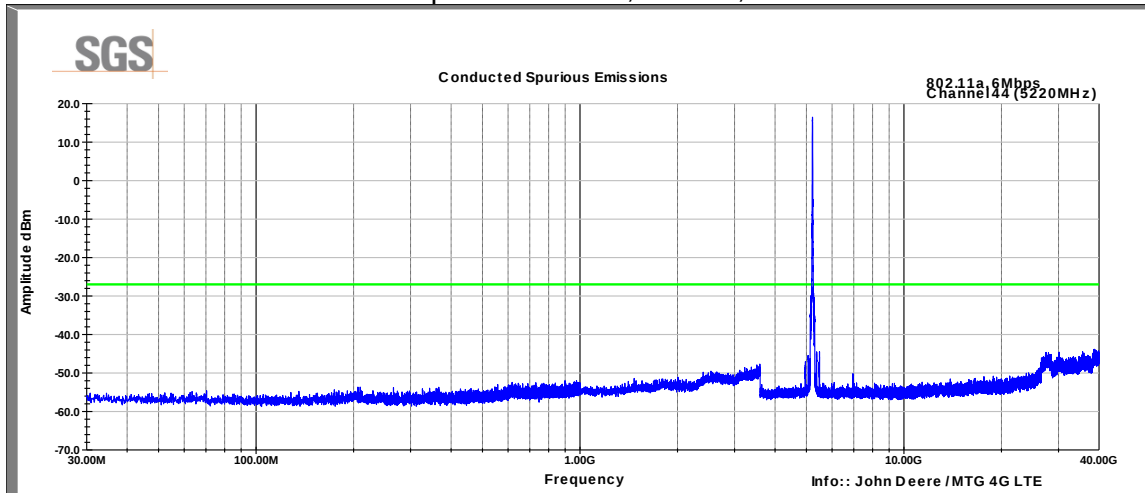


6.7 Test Data – Conducted Spurs

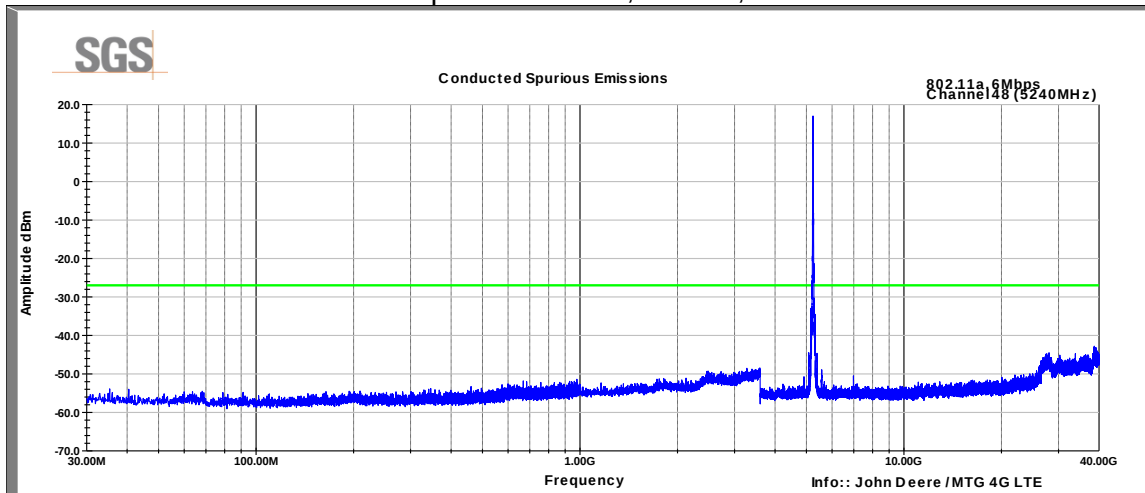
Conducted Spurs – 802.11a, 6Mbit/s, Channel 36



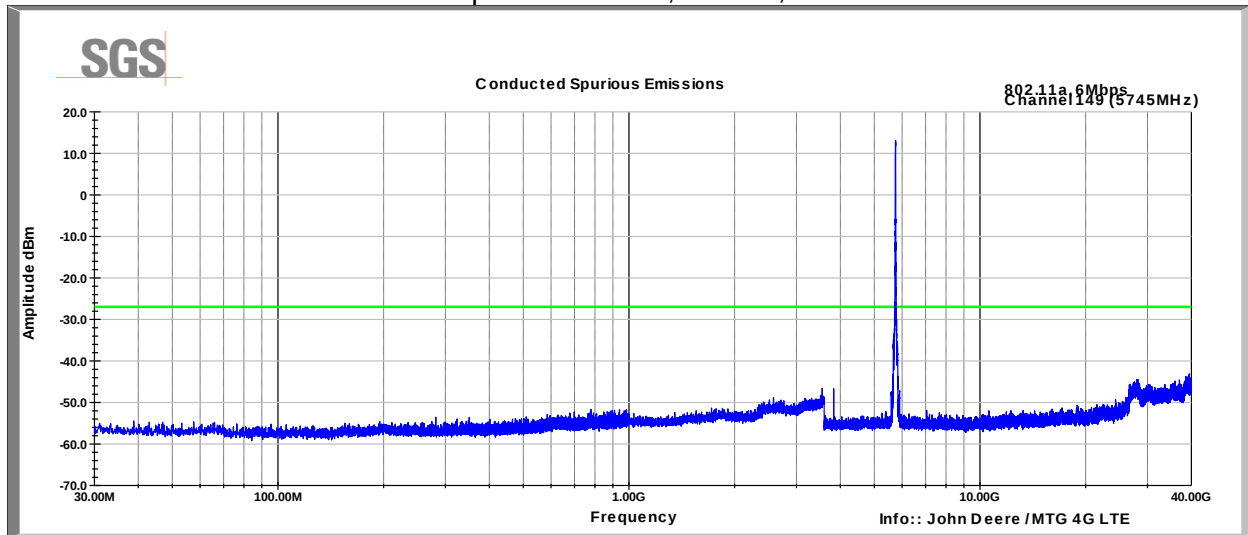
Conducted Spurs – 802.11a, 6Mbit/s, Channel 44



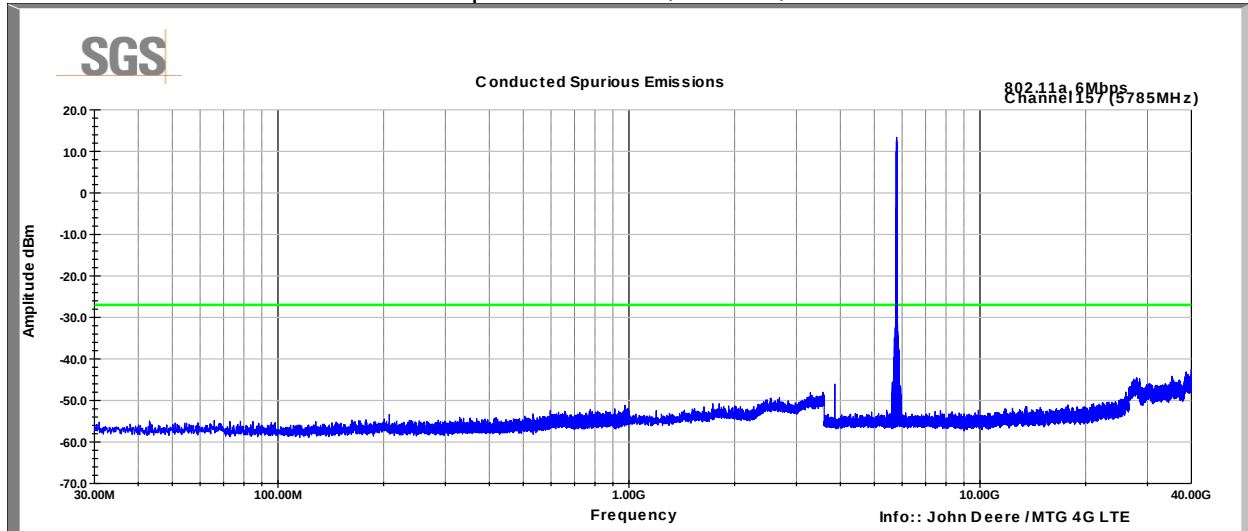
Conducted Spurs – 802.11a, 6Mbit/s, Channel 48



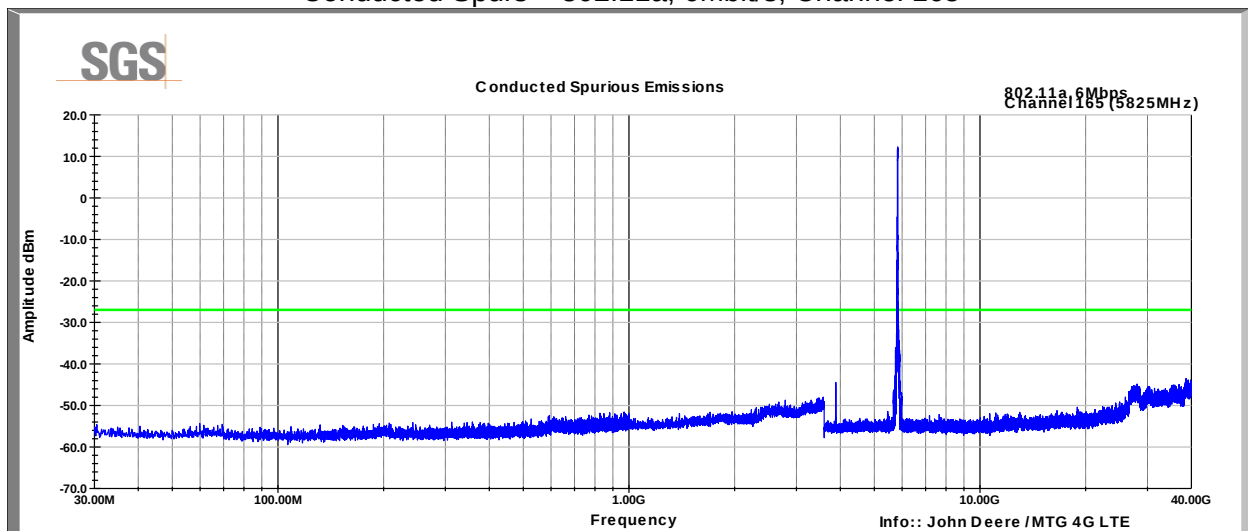
Conducted Spurs – 802.11a, 6Mbit/s, Channel 149



Conducted Spurs – 802.11a, 6Mbit/s, Channel 157



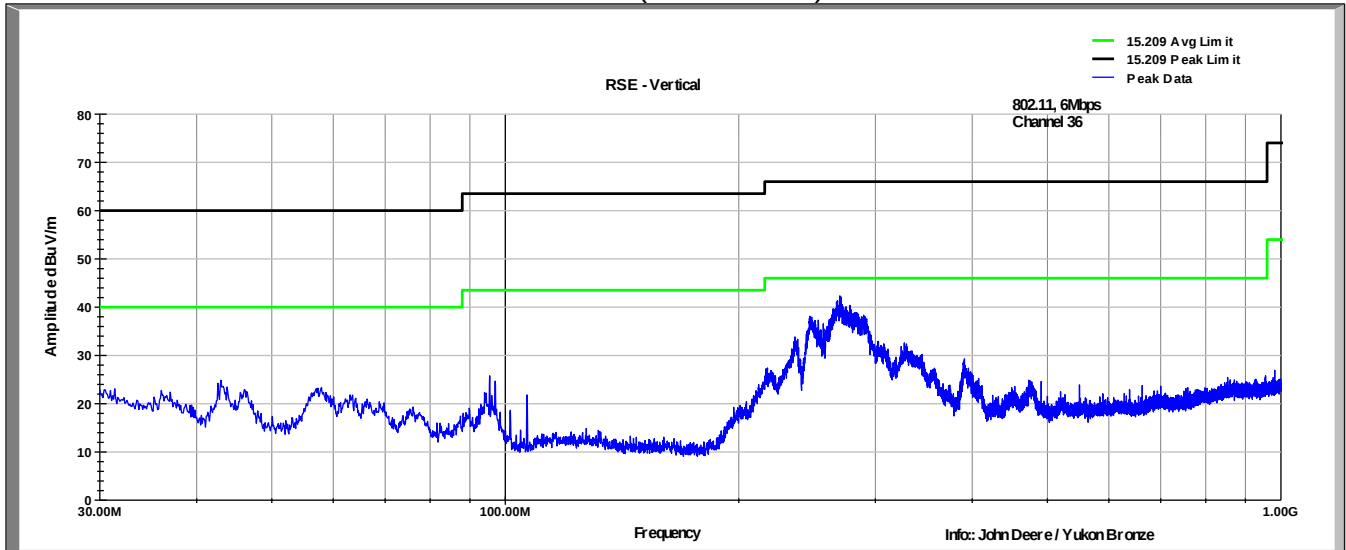
Conducted Spurs – 802.11a, 6Mbit/s, Channel 165



6.8 Unwanted Emissions – Cabinet Radiation

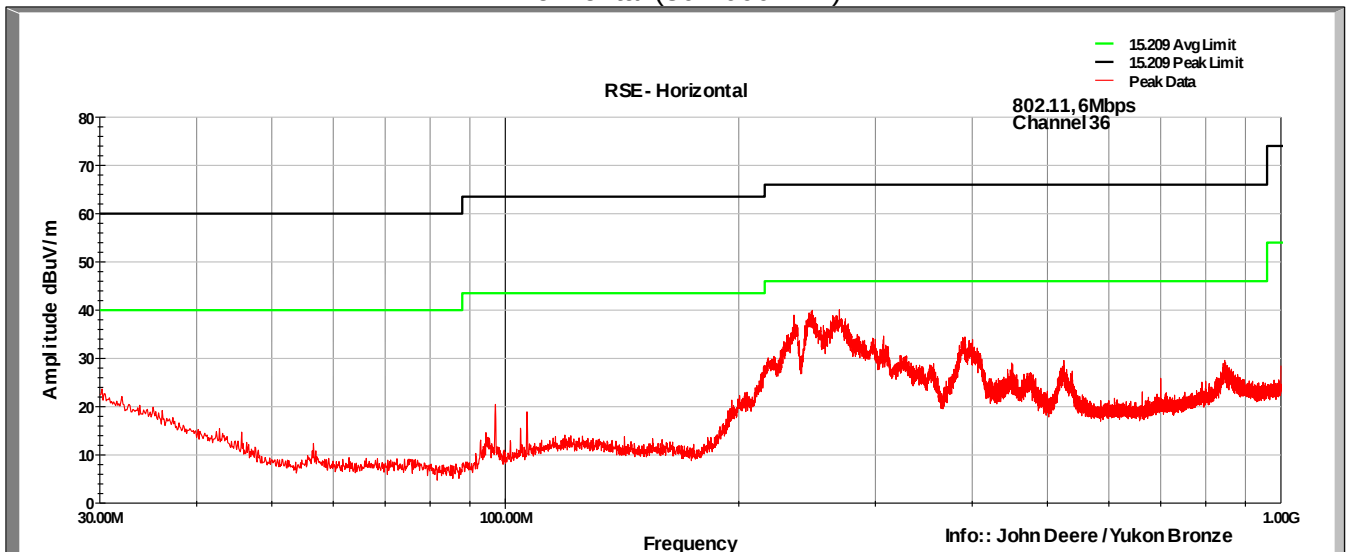
CH 36 802.11a, 6Mbps

Vertical (30-1000MHz)

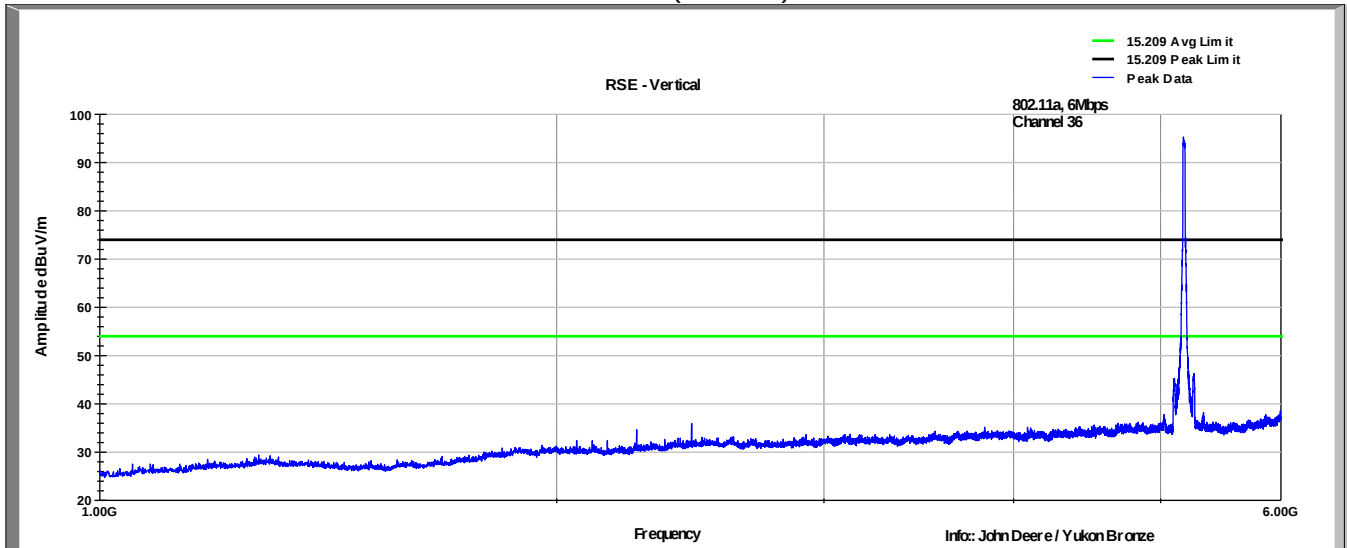


CH 36 802.11a, 6Mbps

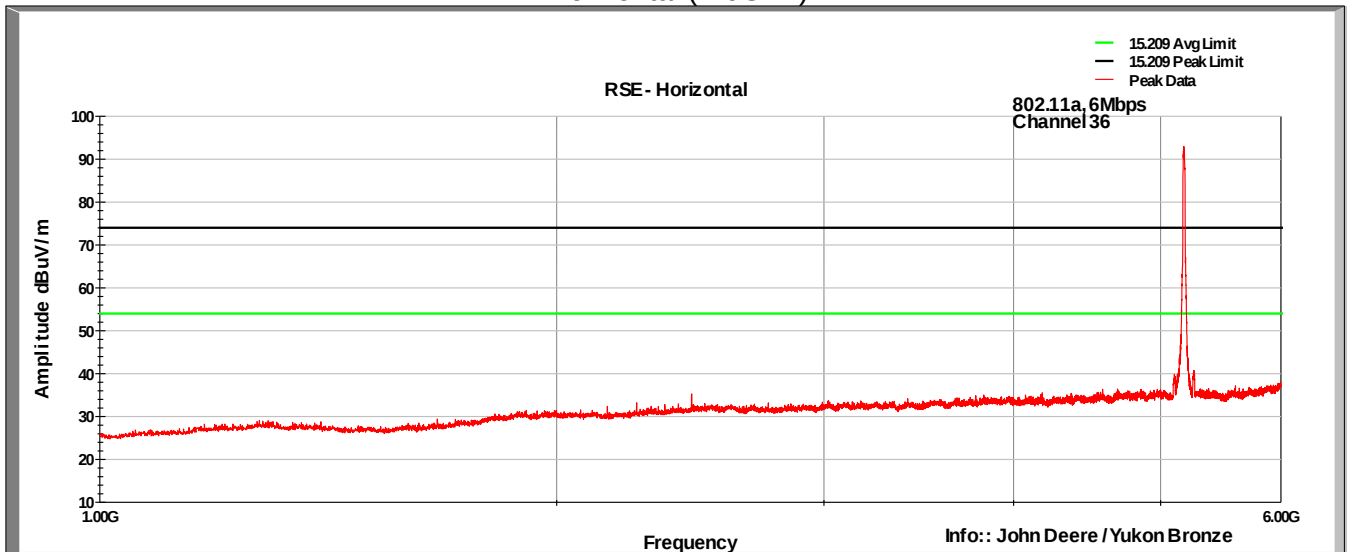
Horizontal (30-1000MHz)



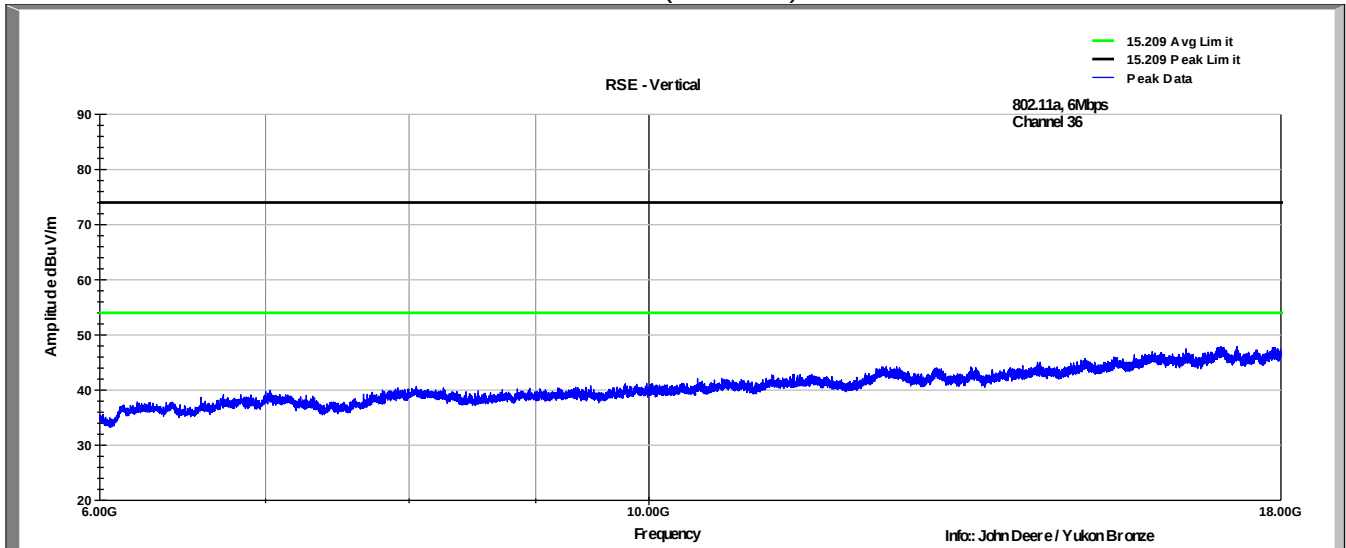
CH 36 802.11a, 6Mbps
Vertical (1-6GHz)



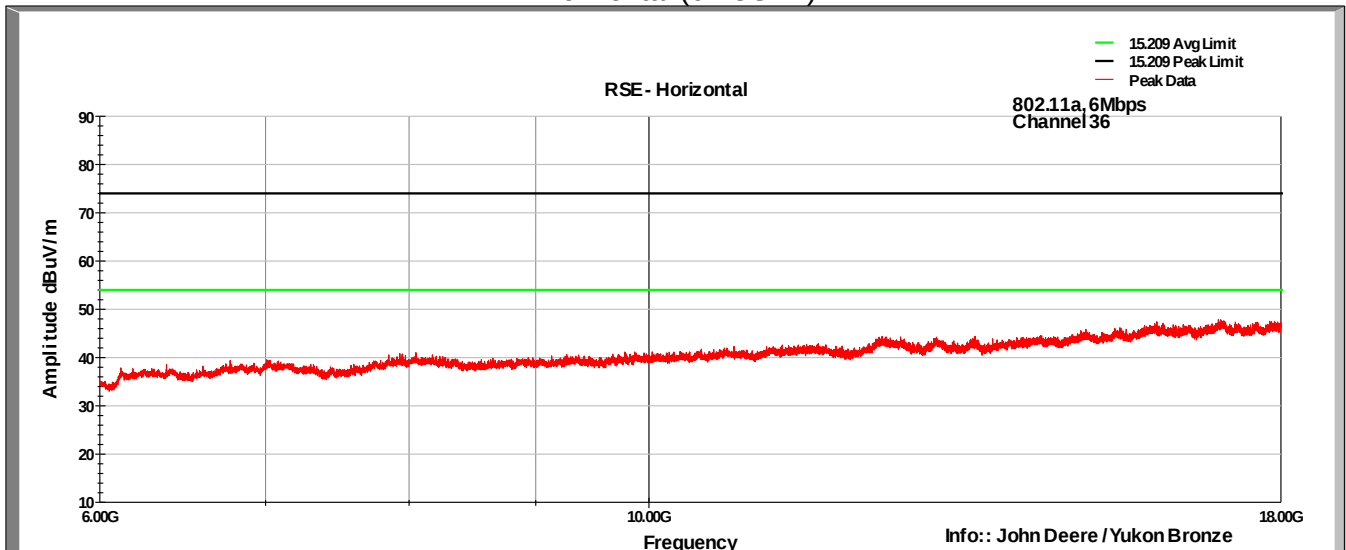
CH 36 802.11a, 6Mbps
Horizontal (1-6GHz)



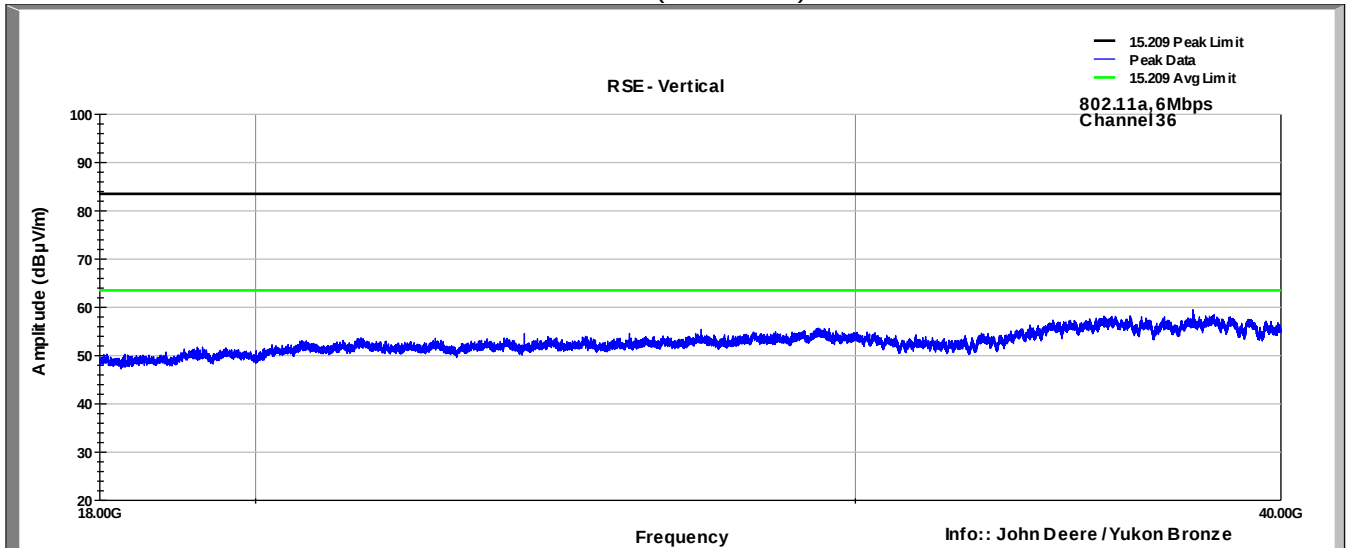
CH 36 802.11a, 6Mbps
Vertical (6-18GHz)



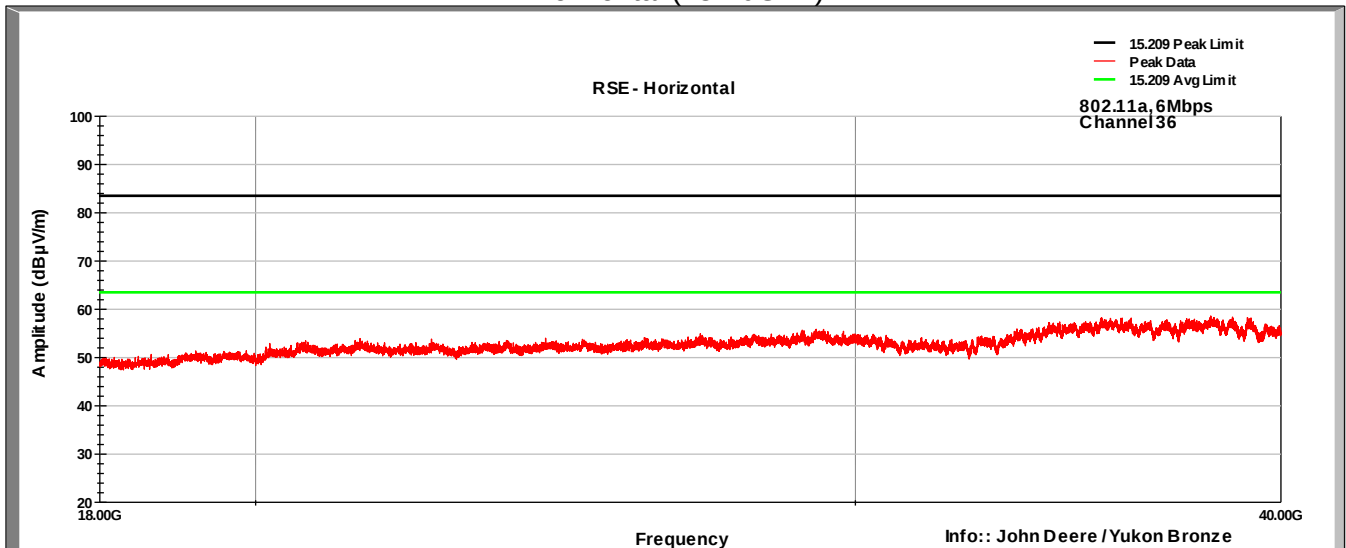
CH 36 802.11a, 6Mbps
Horizontal (6-18GHz)



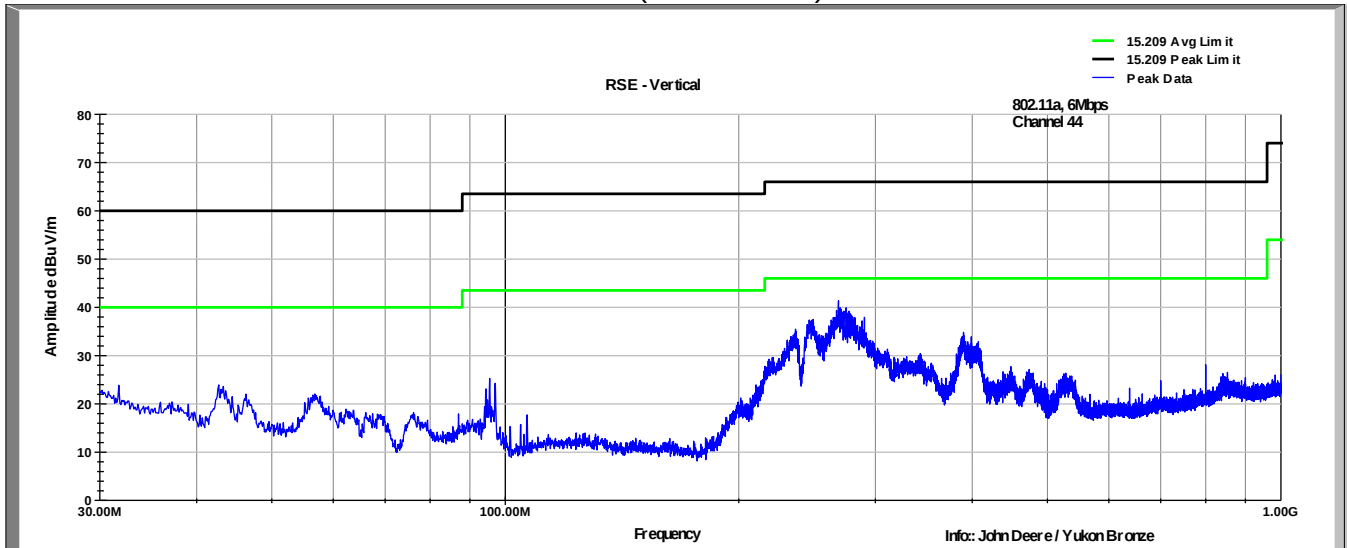
CH 36 802.11a, 6Mbps
Vertical (18-40GHz)



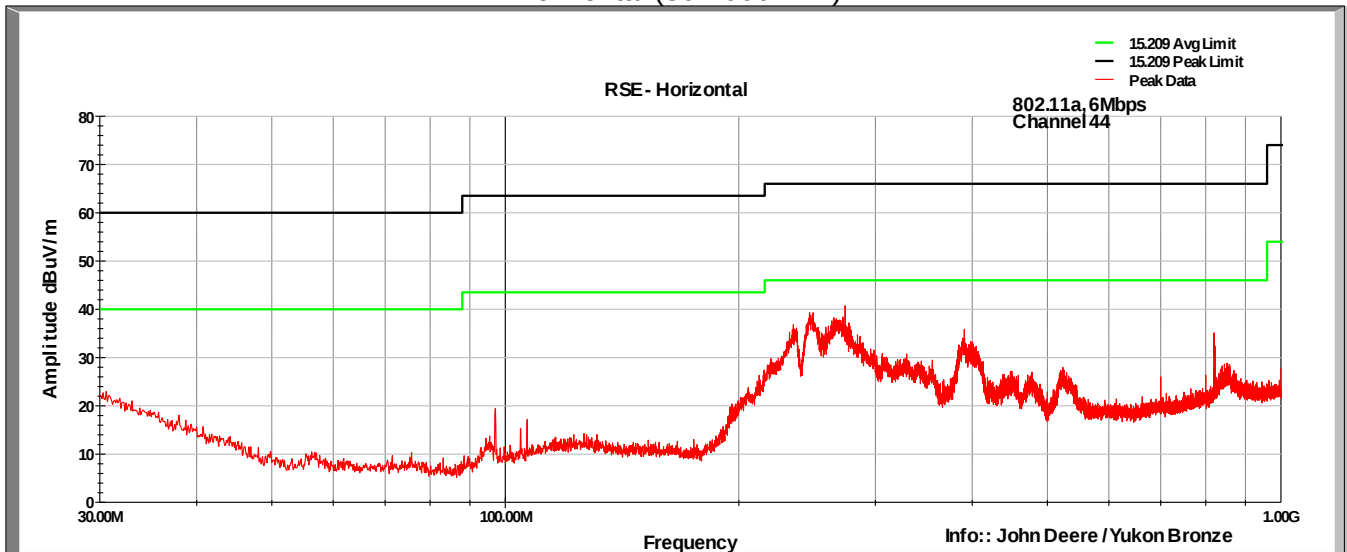
CH 36 802.11a, 6Mbps
Horizontal (18-40GHz)



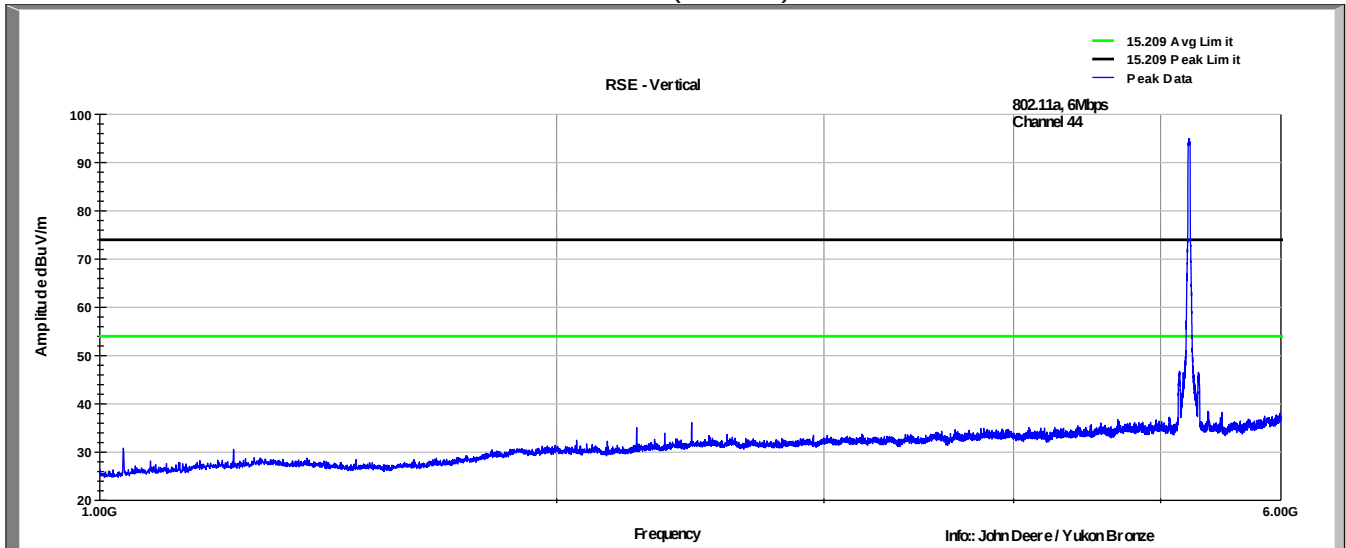
CH 44 802.11a, 6Mbps
Vertical (30-1000MHz)



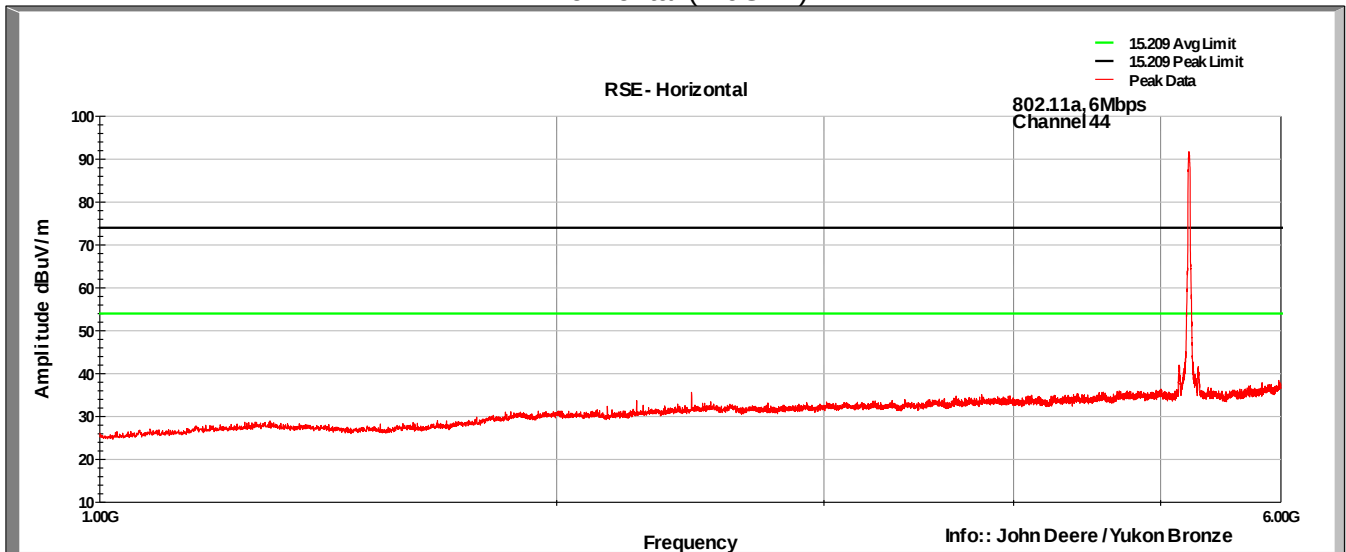
CH 44 802.11a, 6Mbps
Horizontal (30-1000MHz)



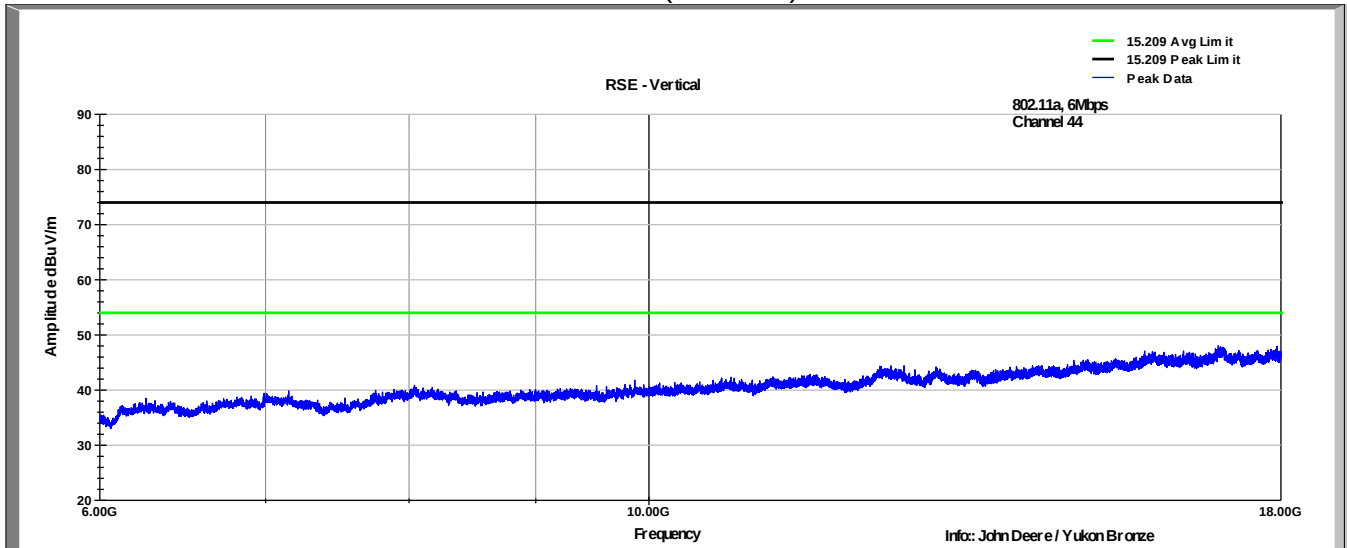
CH 44 802.11a, 6Mbps
Vertical (1-6GHz)



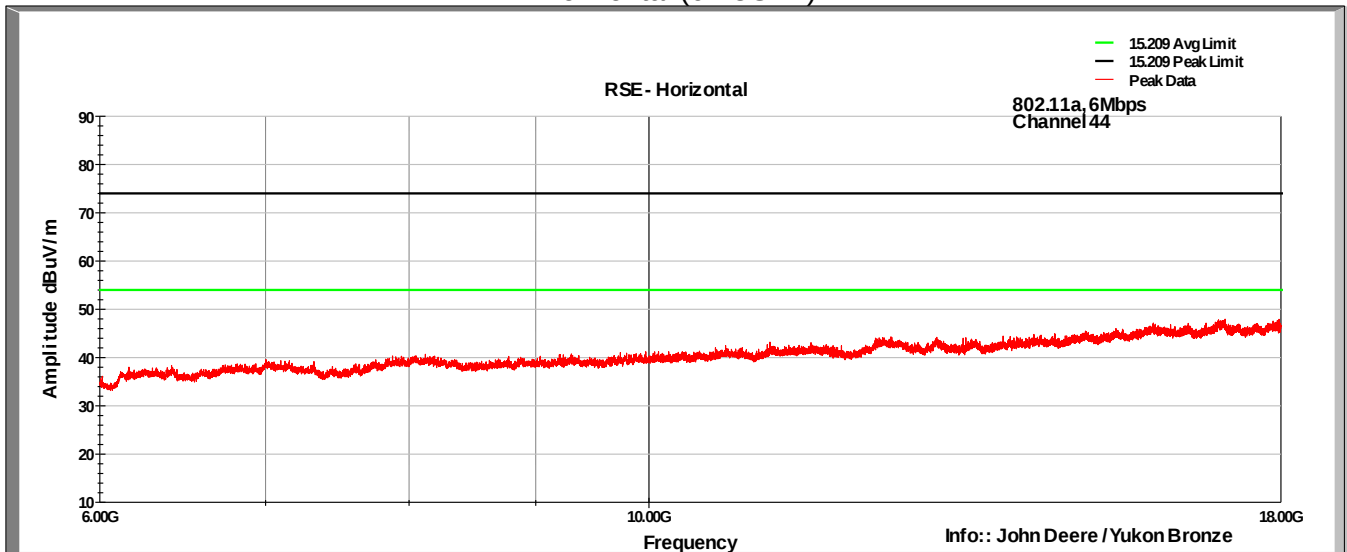
CH 44 802.11a, 6Mbps
Horizontal (1-6GHz)



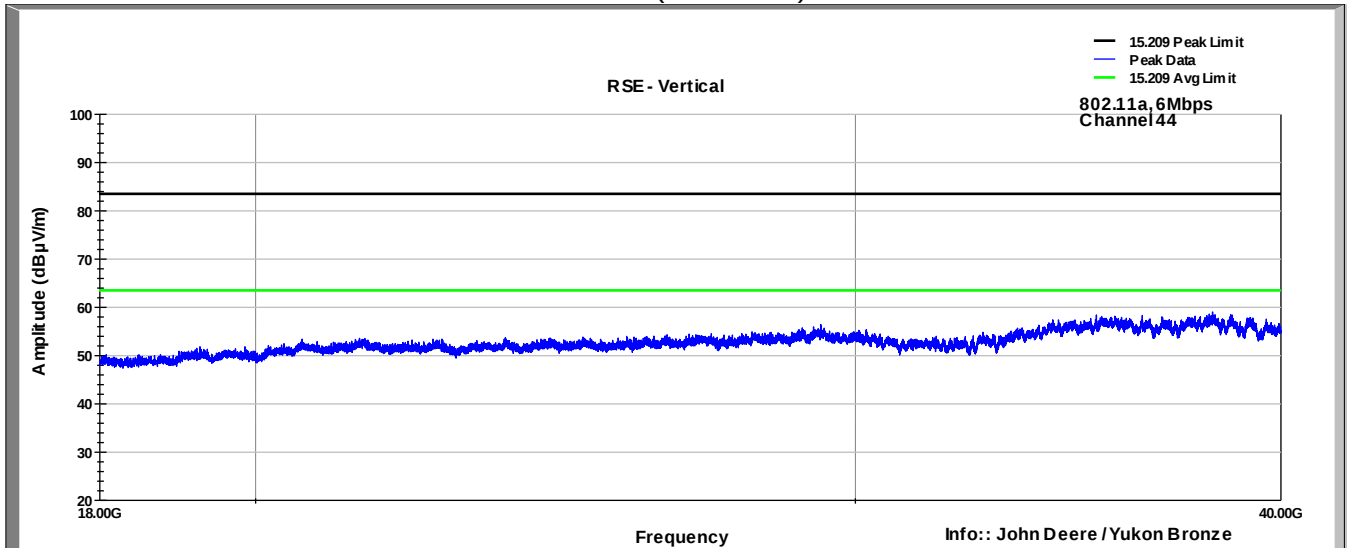
CH 44 802.11a, 6Mbps
Vertical (6-18GHz)



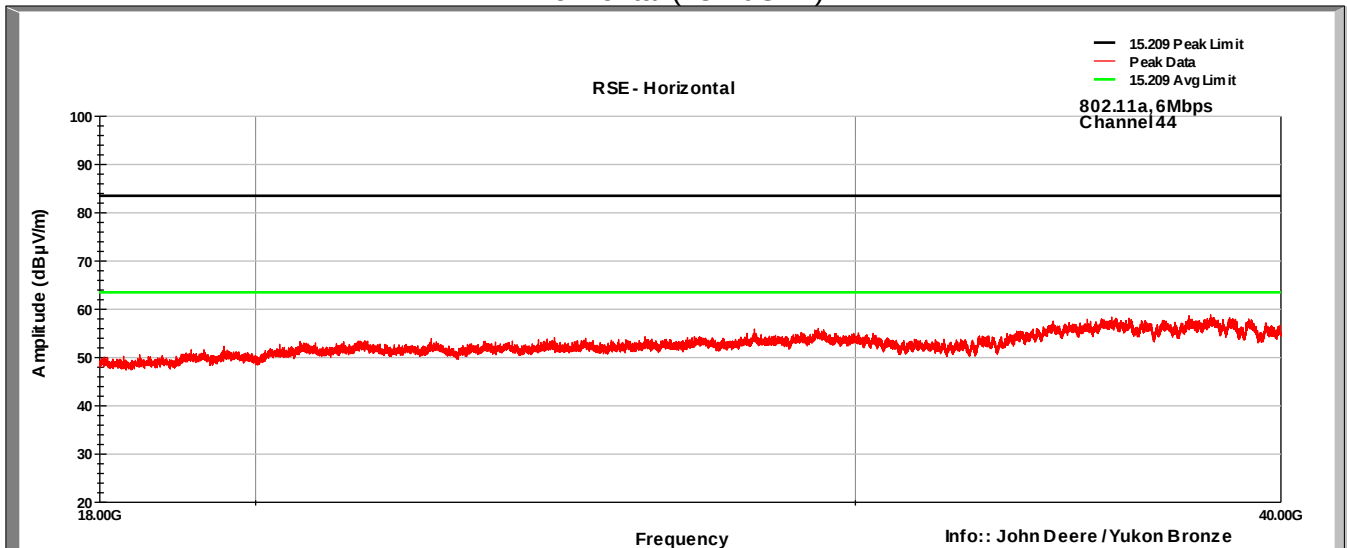
CH 44 802.11a, 6Mbps
Horizontal (6-18GHz)



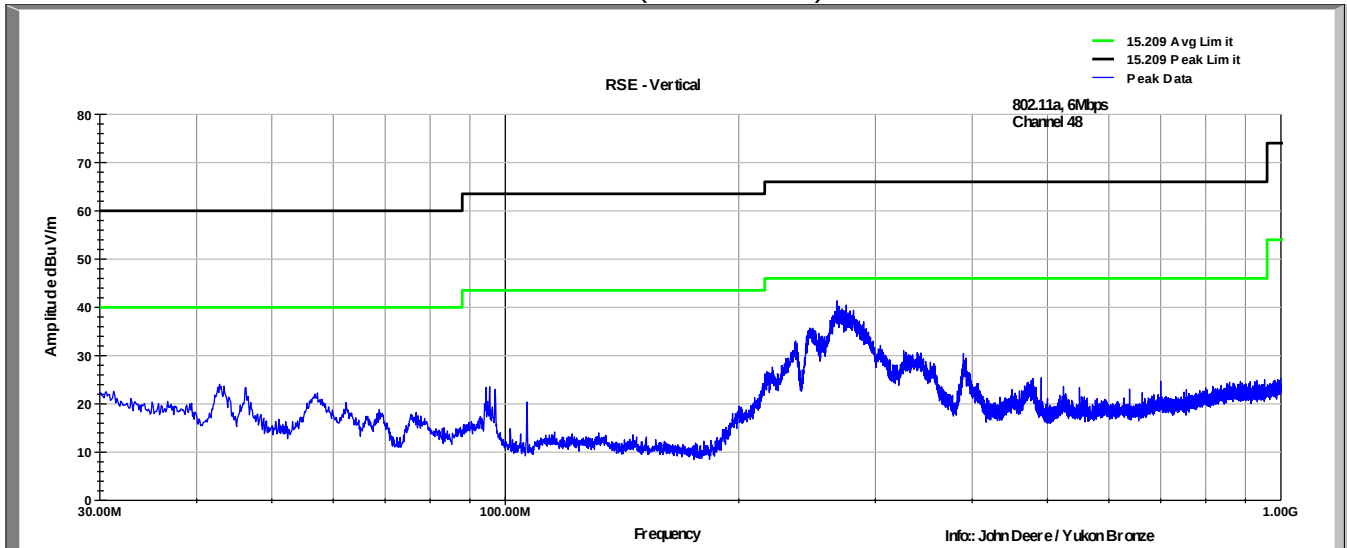
CH 44 802.11a, 6Mbps
Vertical (18-40GHz)



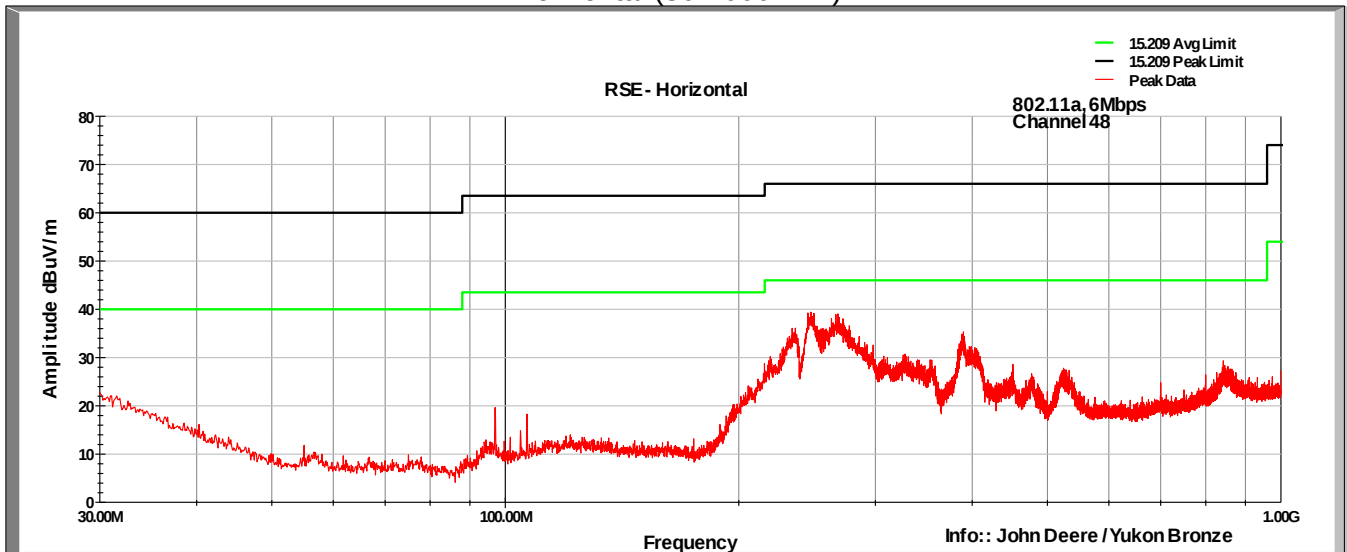
CH 44 802.11a, 6Mbps
Horizontal (18-40GHz)



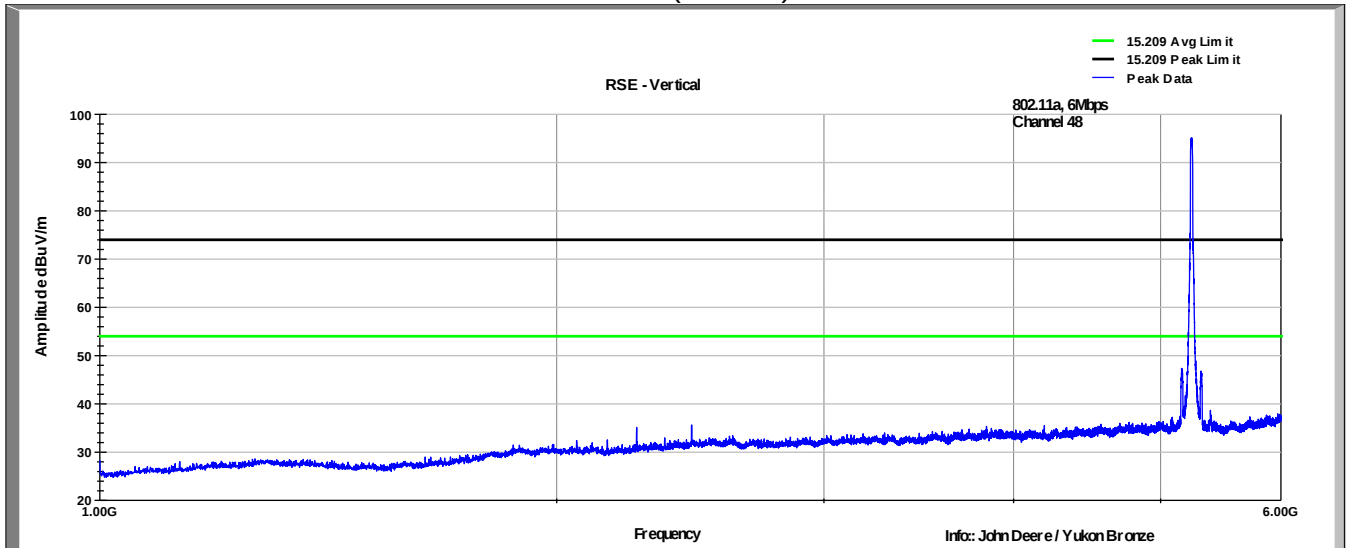
CH 48 802.11a, 6Mbps
Vertical (30-1000MHz)



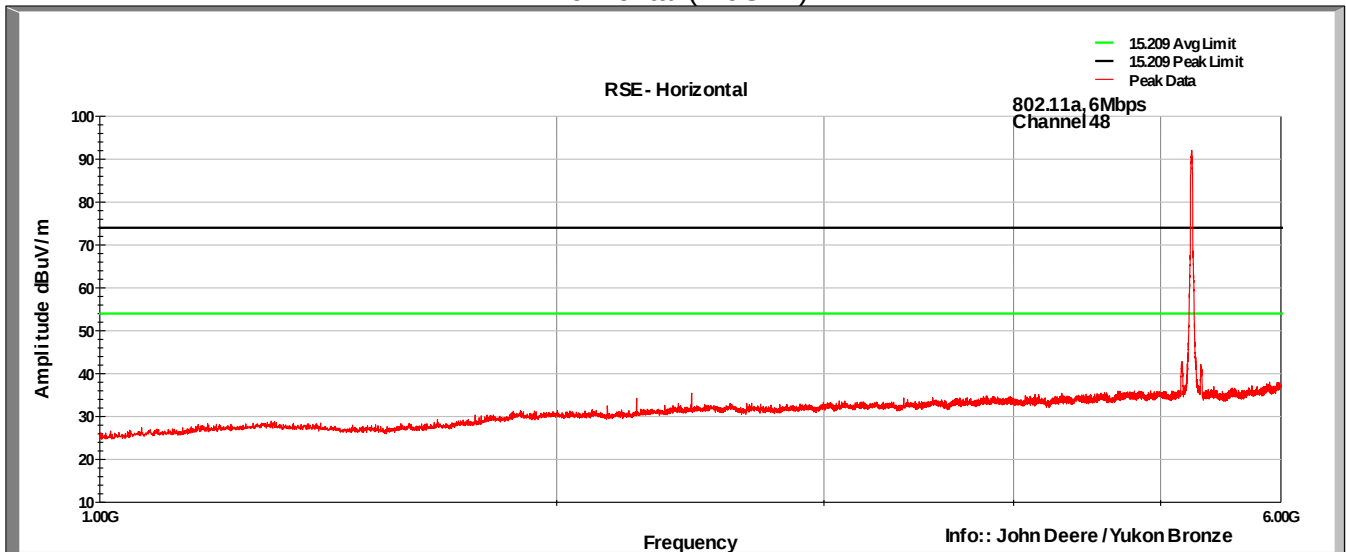
CH 48 802.11a, 6Mbps
Horizontal (30-1000MHz)



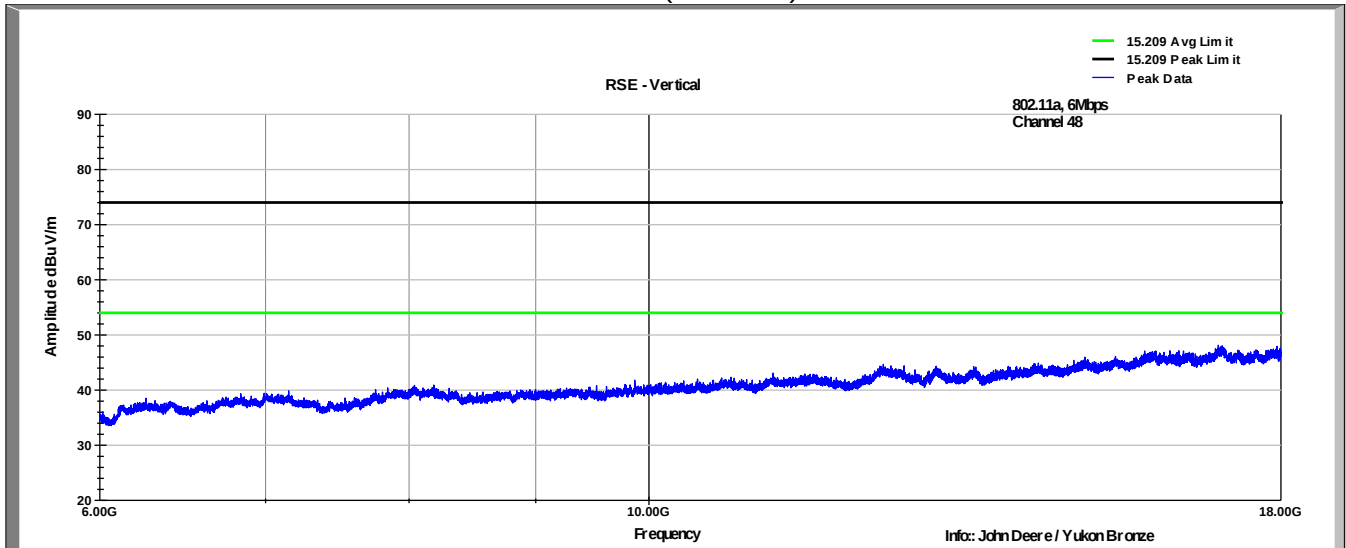
CH 48 802.11a, 6Mbps
Vertical (1-6GHz)



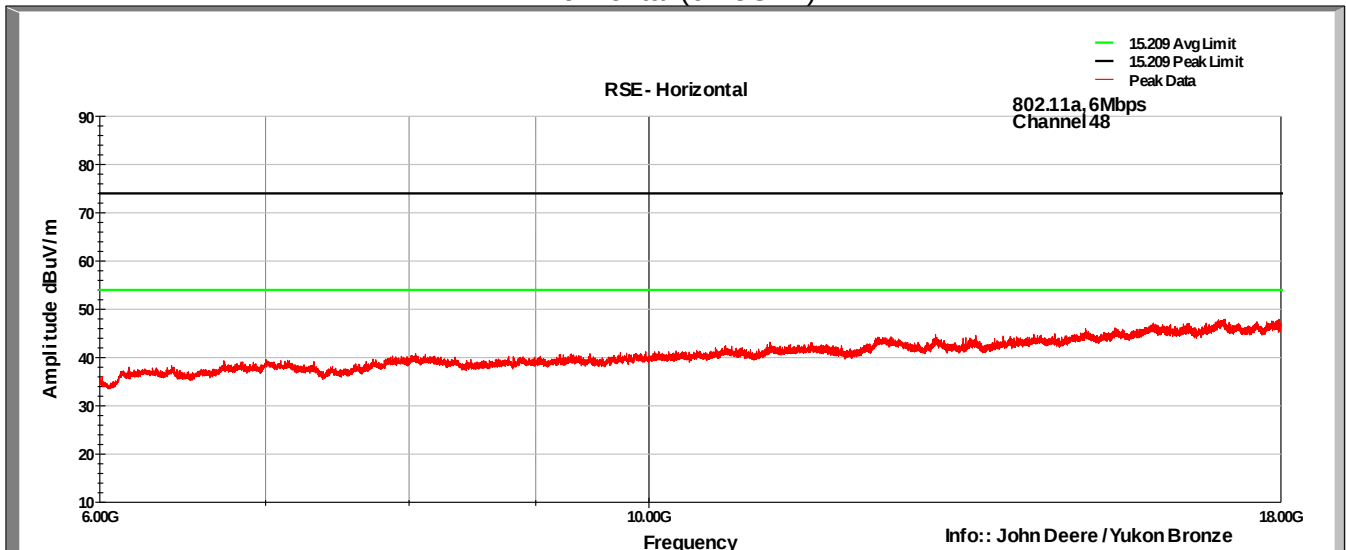
CH 48 802.11a, 6Mbps
Horizontal (1-6GHz)



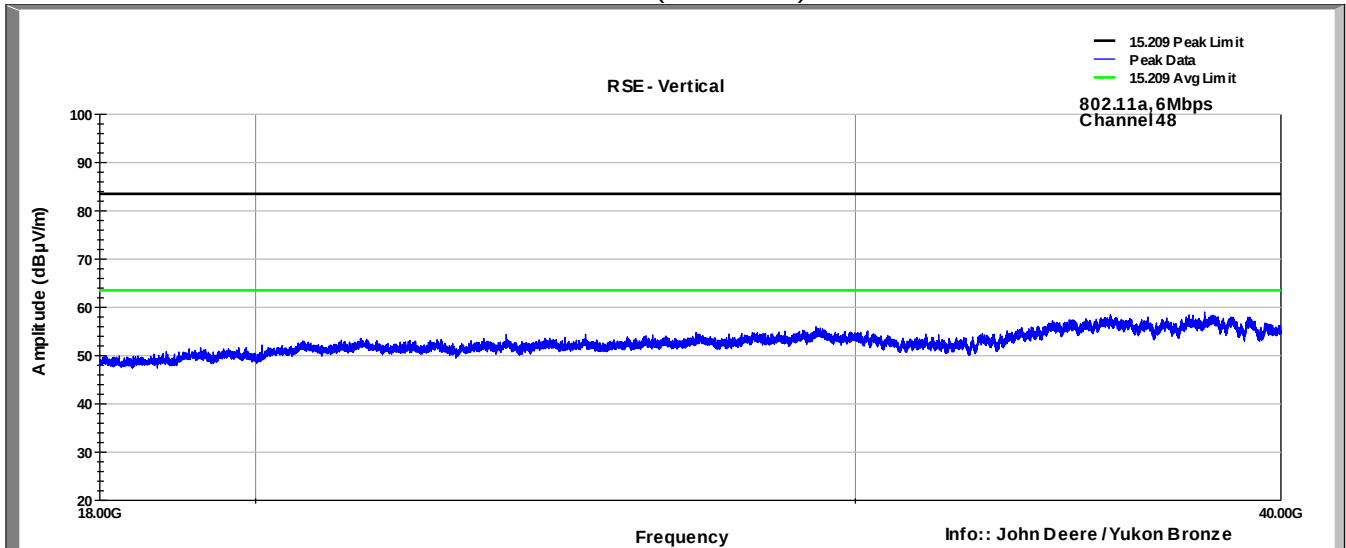
CH 48 802.11a, 6Mbps
Vertical (6-18GHz)



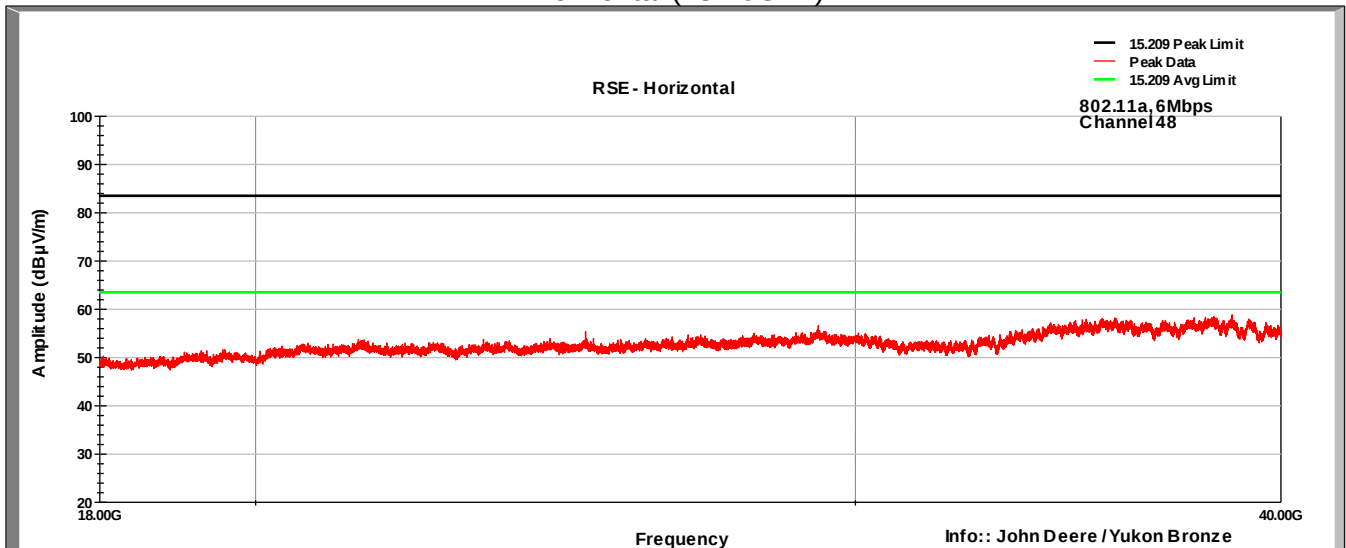
CH 48 802.11a, 6Mbps
Horizontal (6-18GHz)



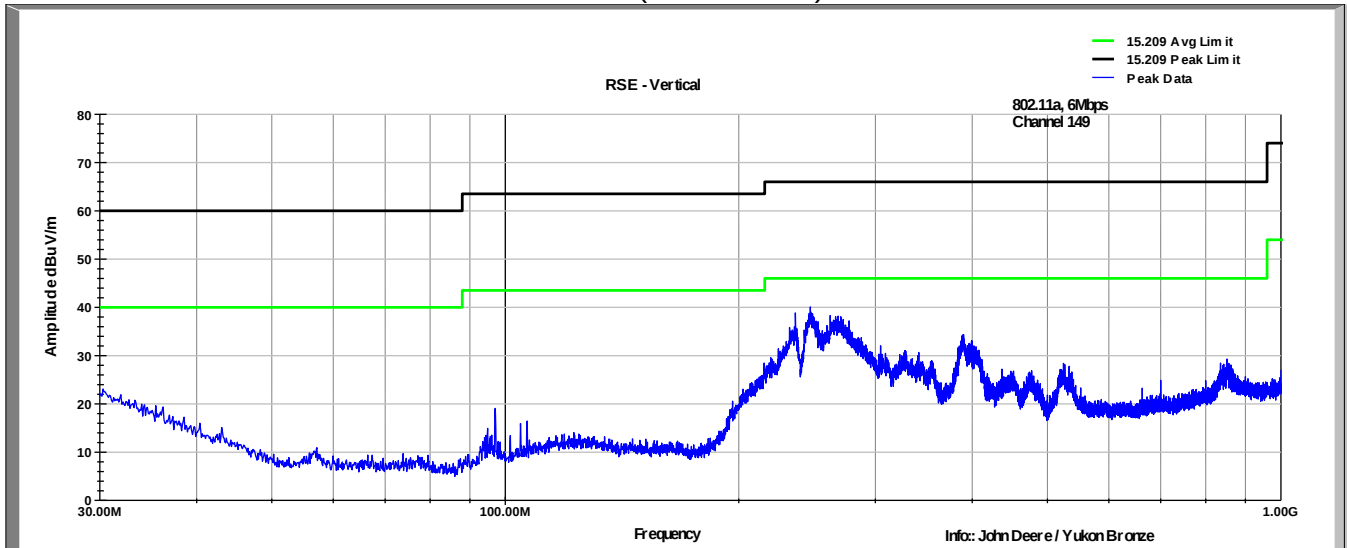
CH 48 802.11a, 6Mbps
Vertical (18-40GHz)



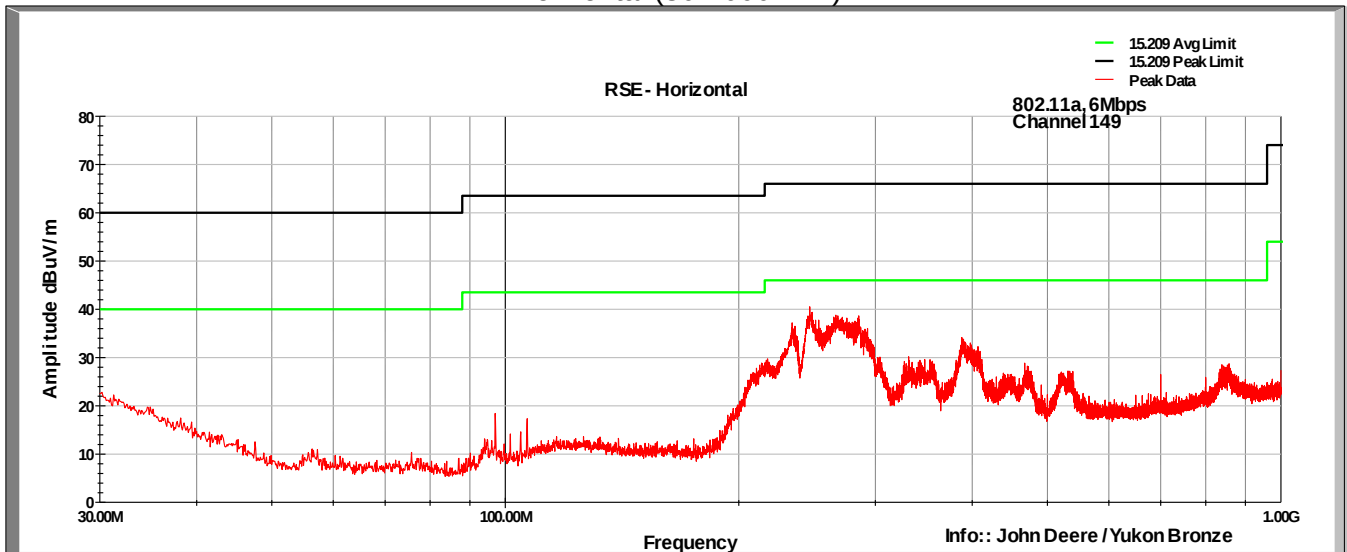
CH 48 802.11a, 6Mbps
Horizontal (18-40GHz)



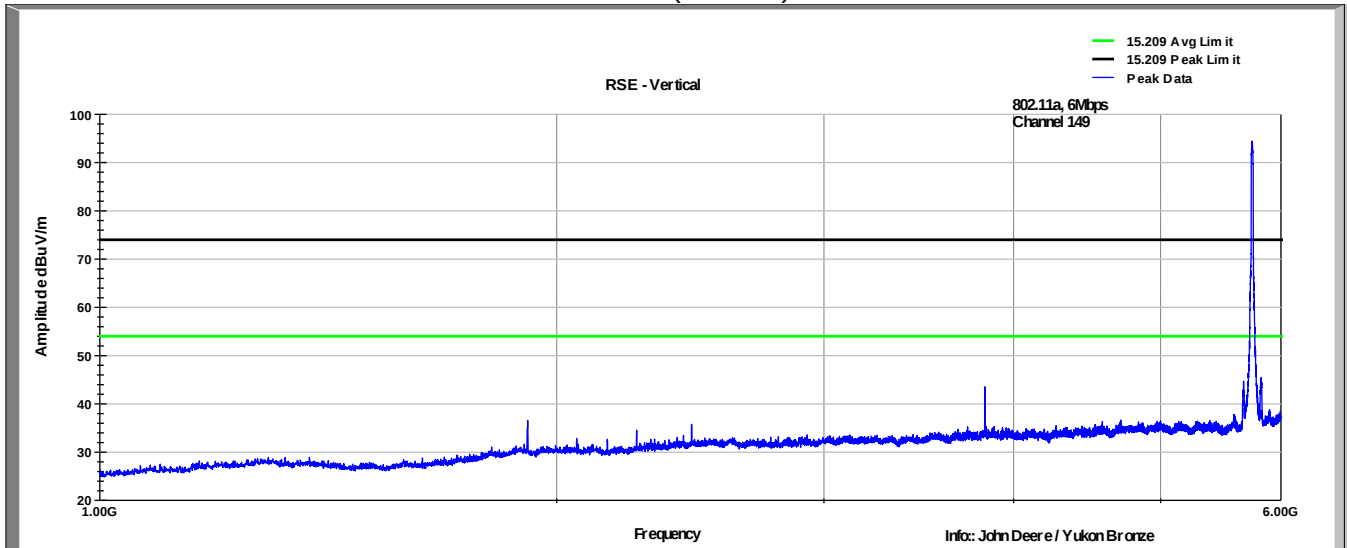
CH 149 802.11a, 6Mbps
Vertical (30-1000MHz)



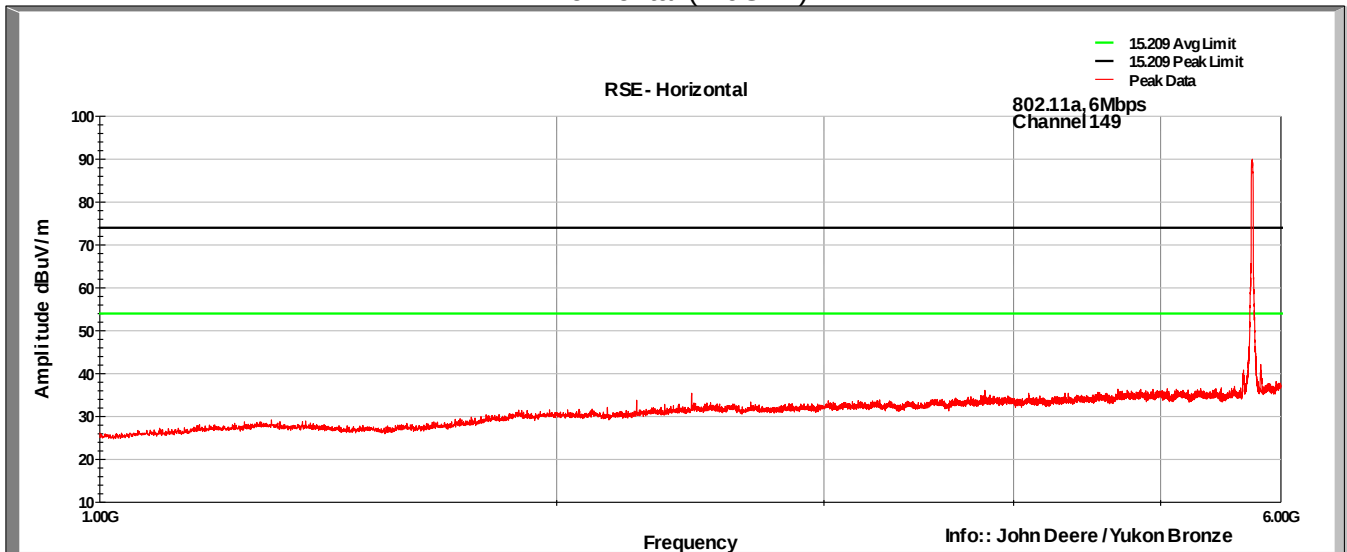
CH 149 802.11a, 6Mbps
Horizontal (30-1000MHz)



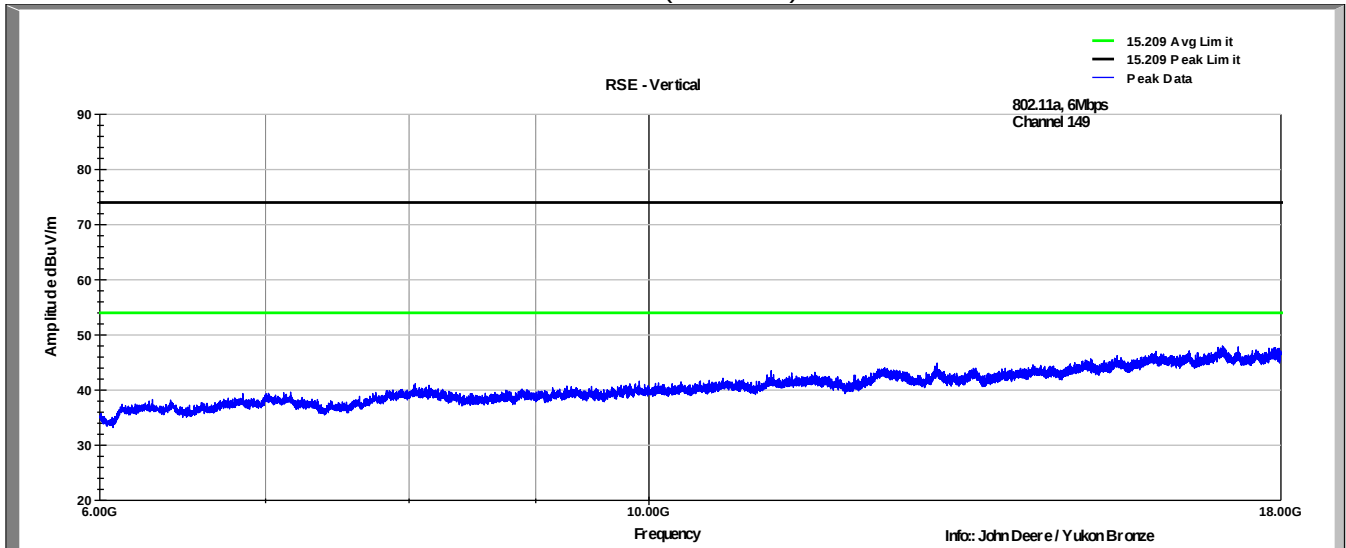
CH 149 802.11a, 6Mbps
Vertical (1-6GHz)



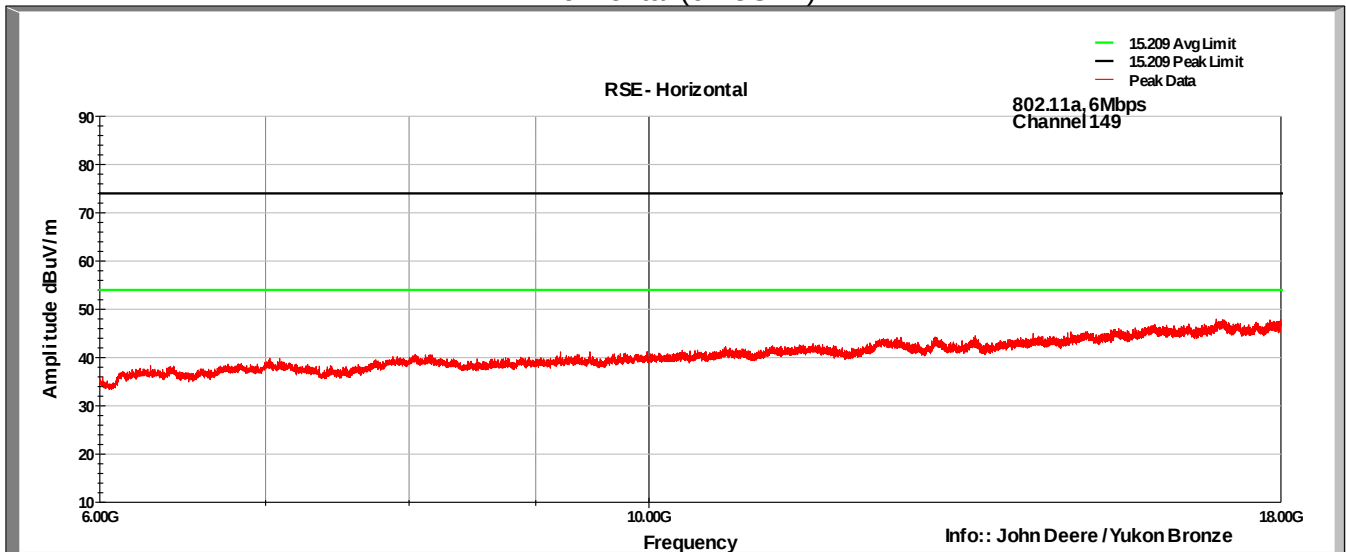
CH 149 802.11a, 6Mbps
Horizontal (1-6GHz)



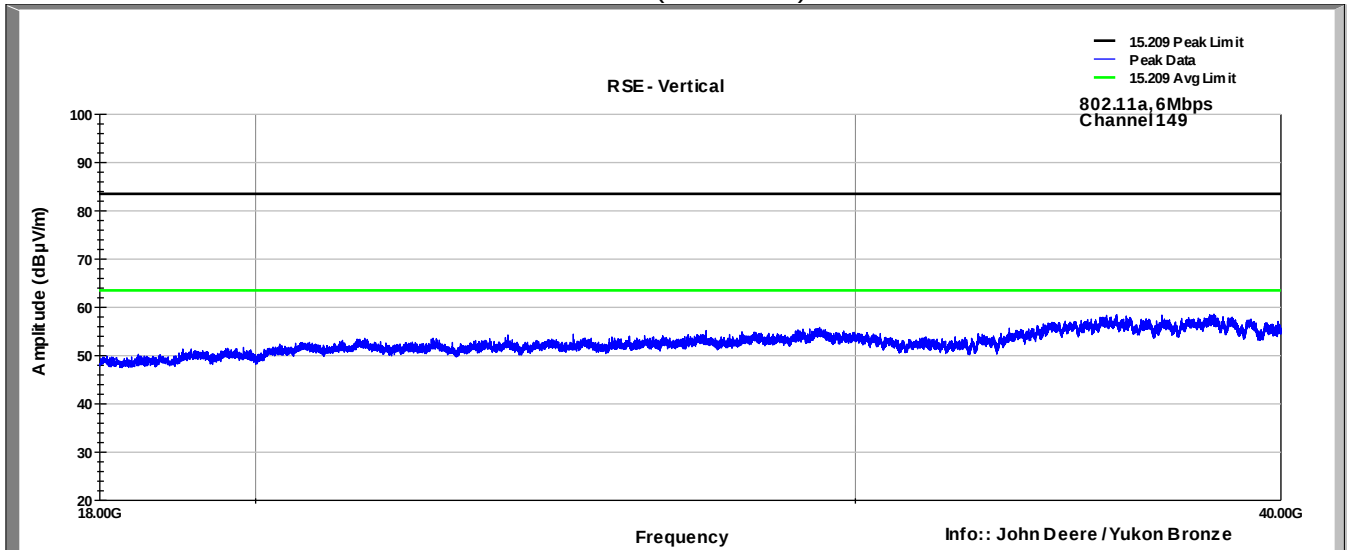
CH 149 802.11a, 6Mbps
Vertical (6-18GHz)



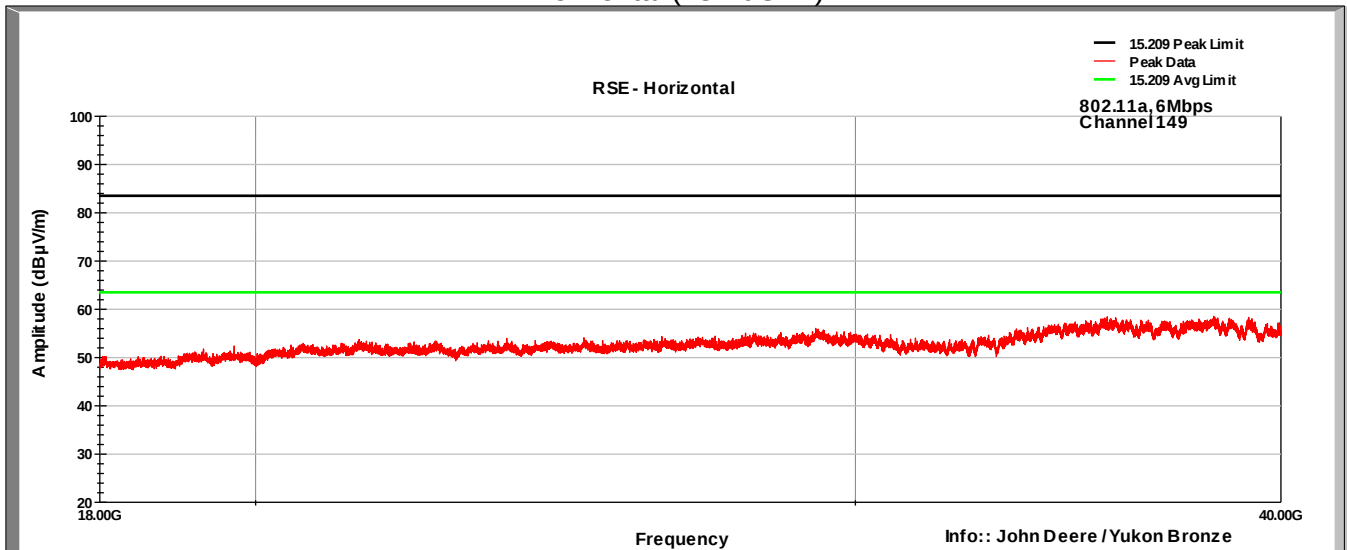
CH 149 802.11a, 6Mbps
Horizontal (6-18GHz)



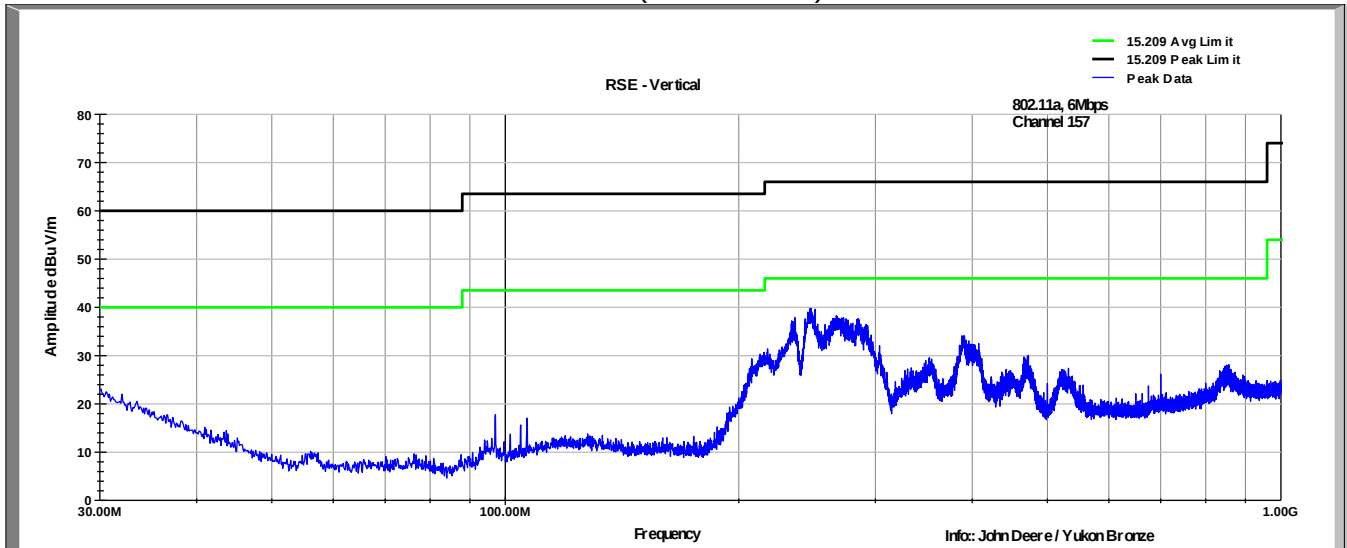
CH 149 802.11a, 6Mbps
Vertical (18-40GHz)



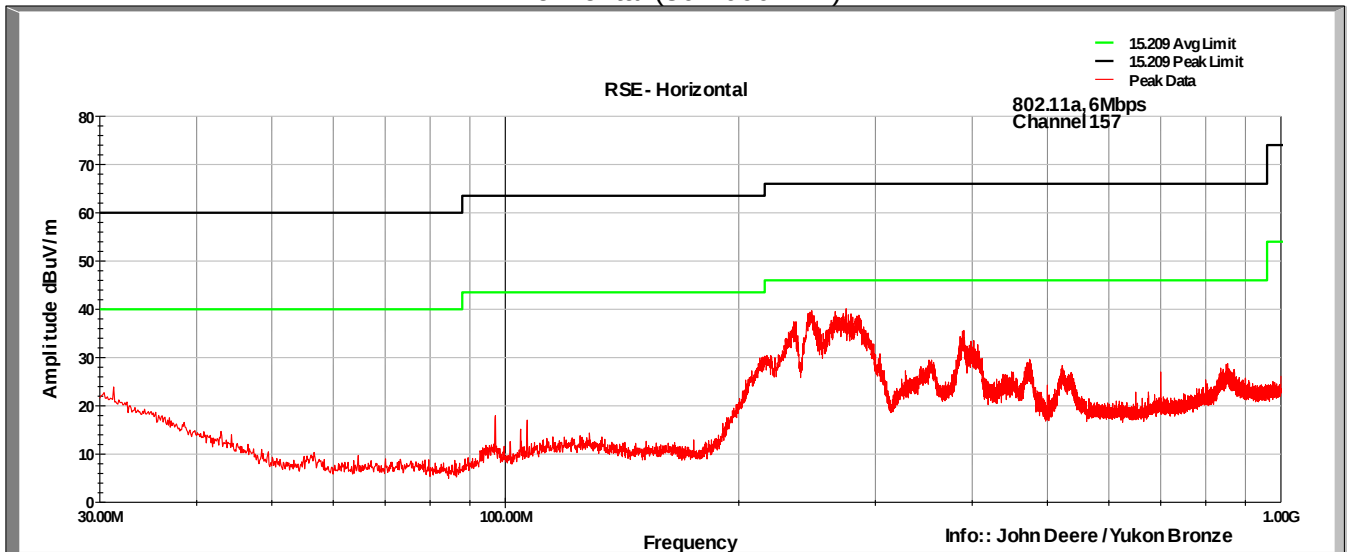
CH 149 802.11a, 6Mbps
Horizontal (18-40GHz)



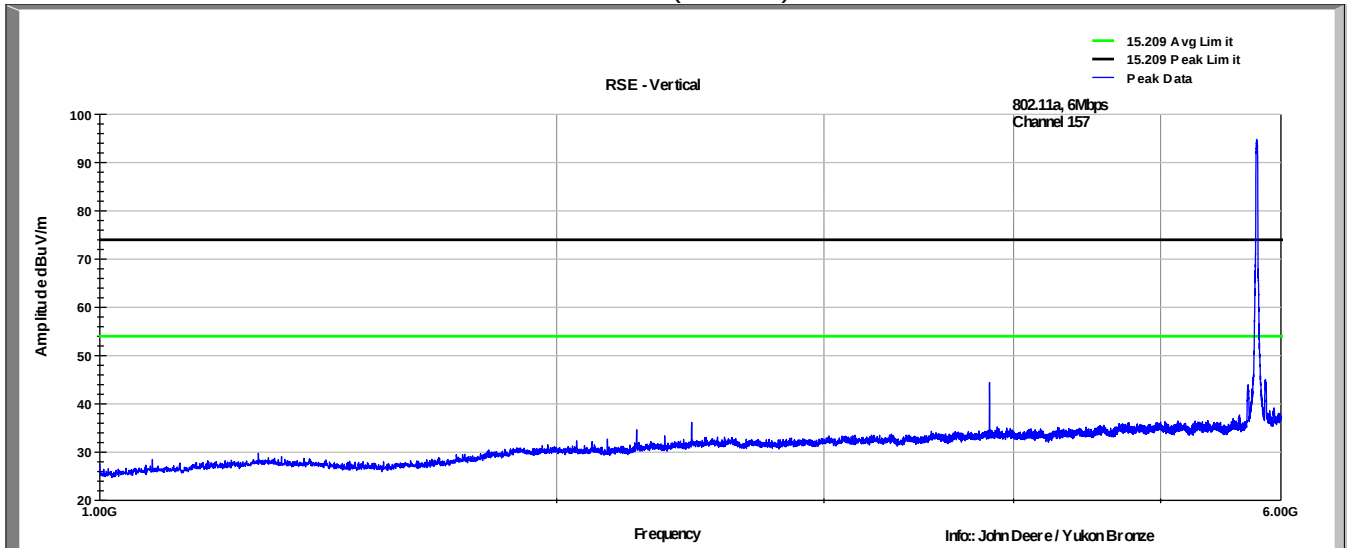
CH 157 802.11a, 6Mbps
Vertical (30-1000MHz)



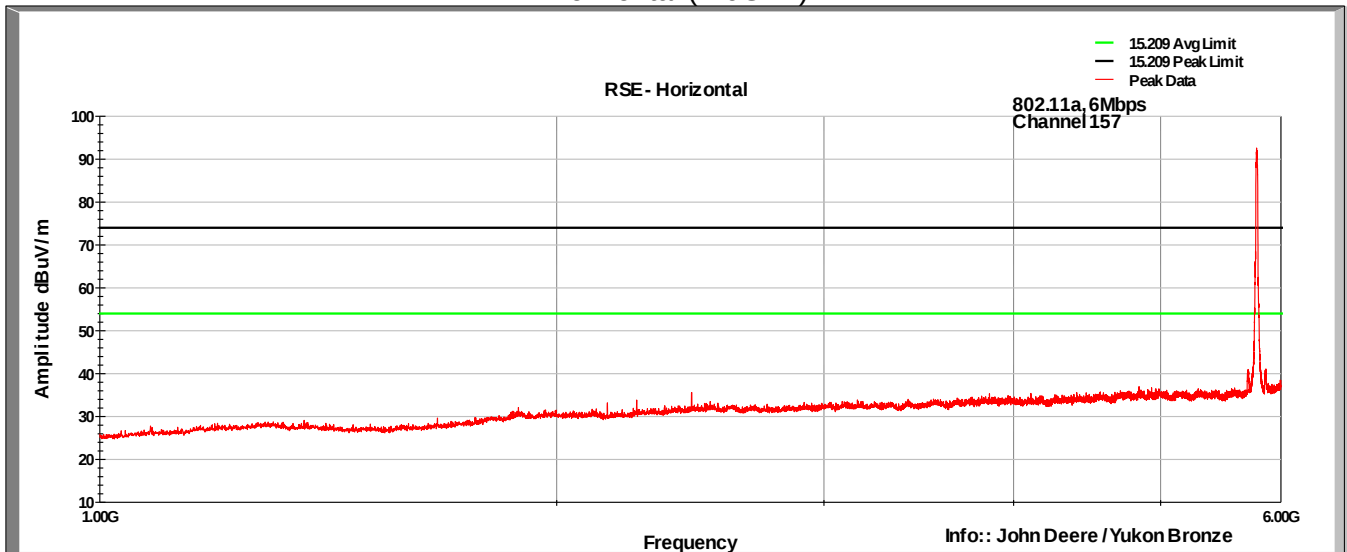
CH 157 802.11a, 6Mbps
Horizontal (30-1000MHz)



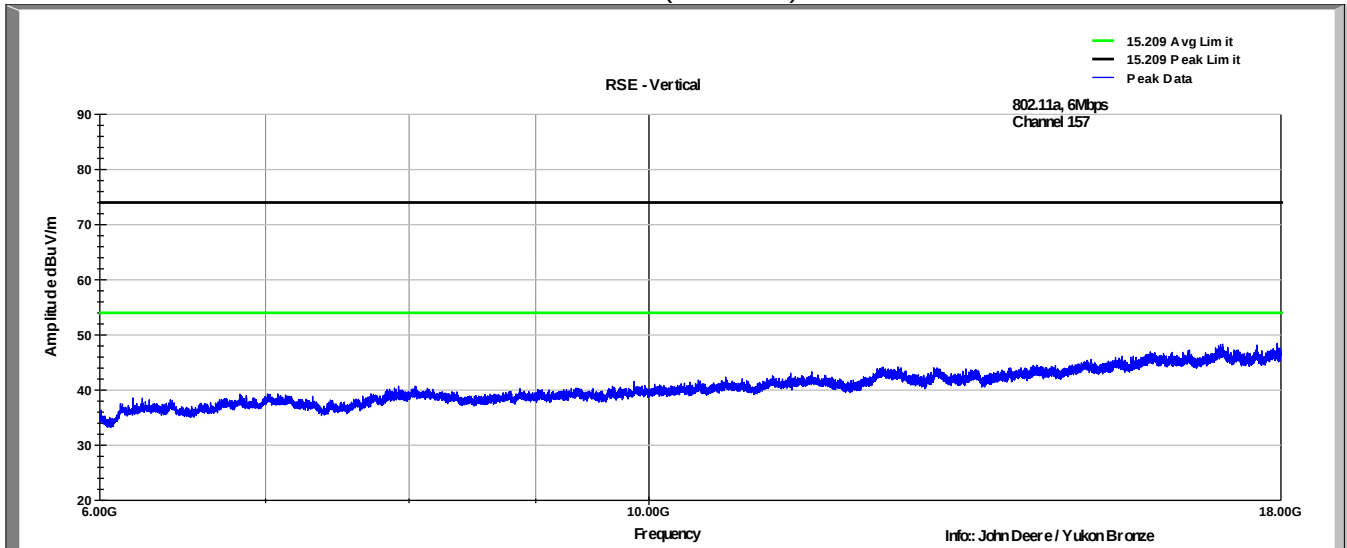
CH 157 802.11a, 6Mbps
Vertical (1-6GHz)



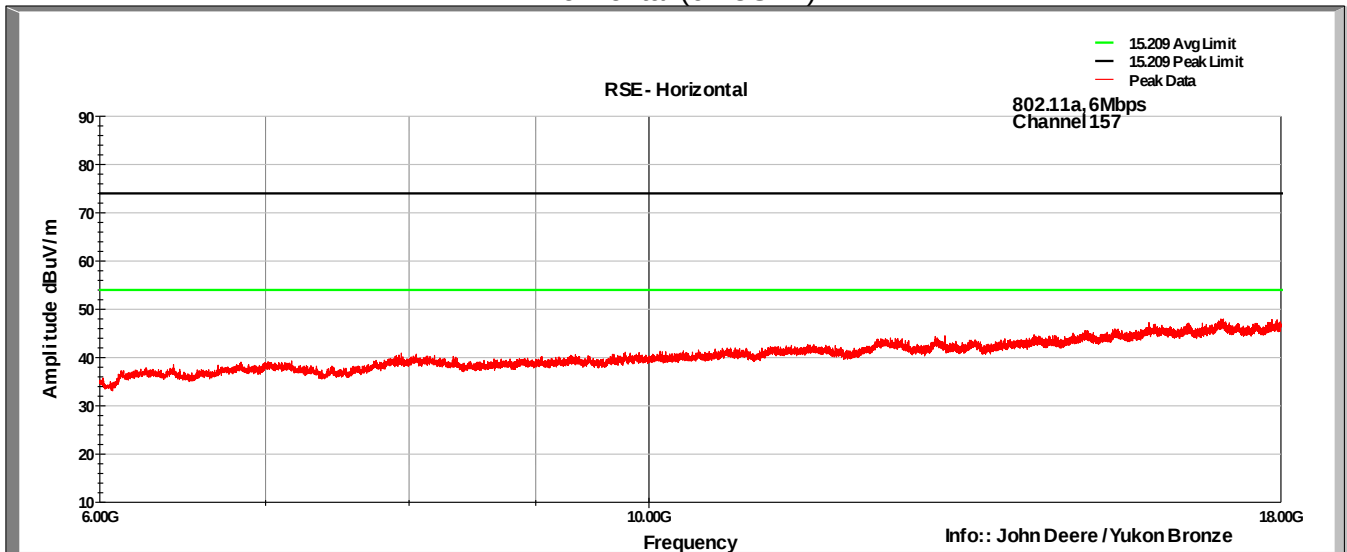
CH 157 802.11a, 6Mbps
Horizontal (1-6GHz)



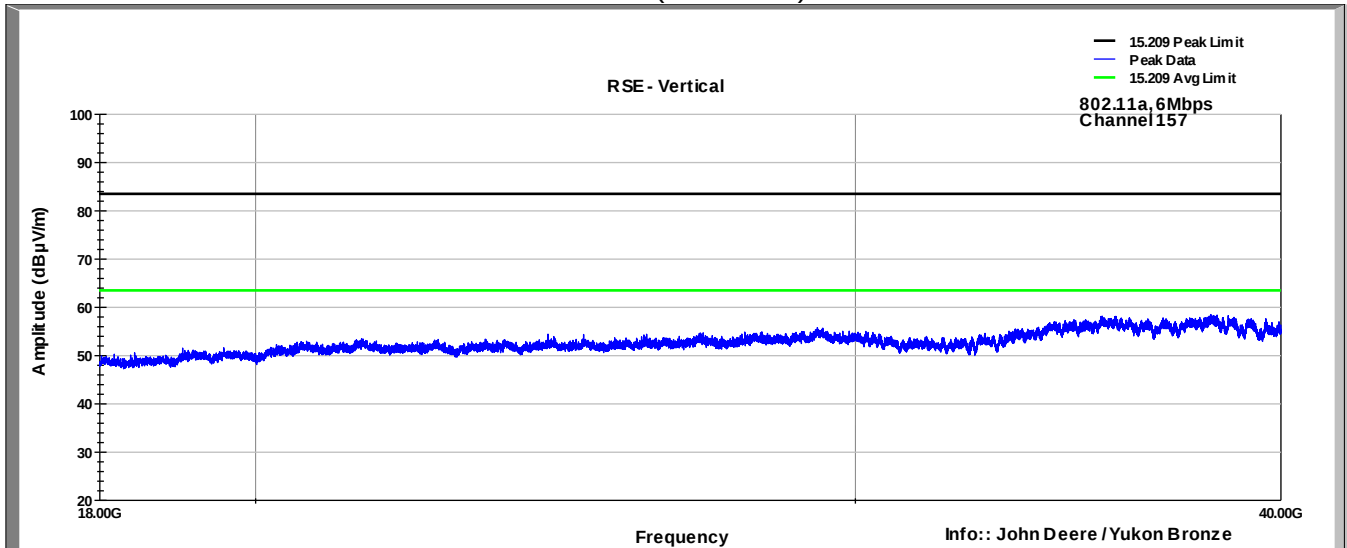
CH 157 802.11a, 6Mbps
Vertical (6-18GHz)



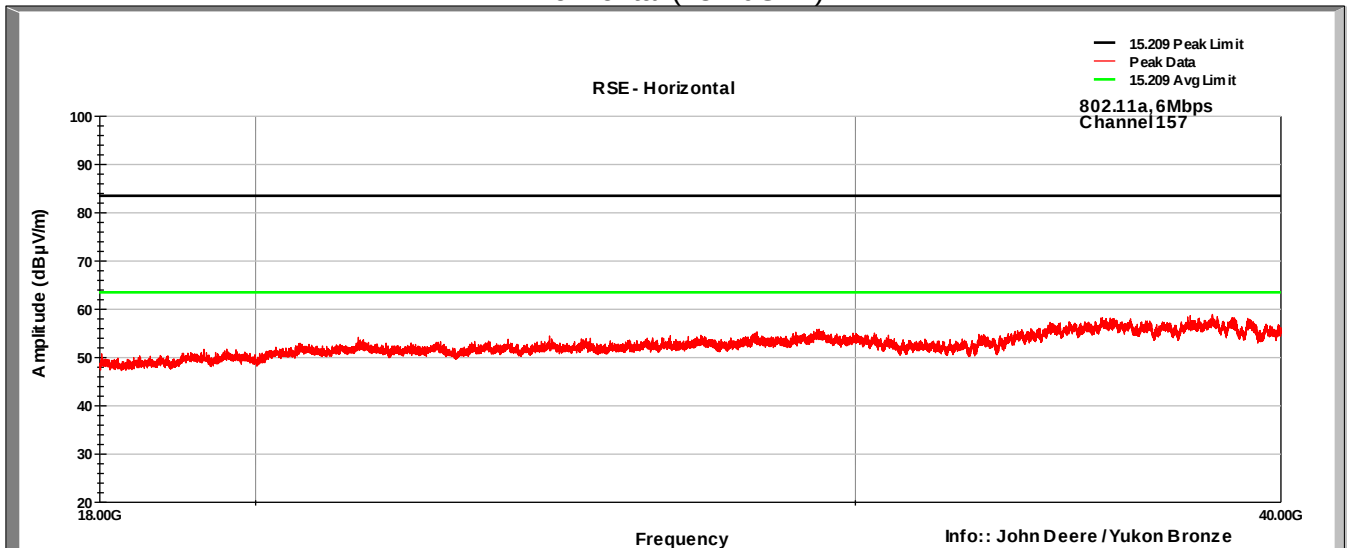
CH 157 802.11a, 6Mbps
Horizontal (6-18GHz)



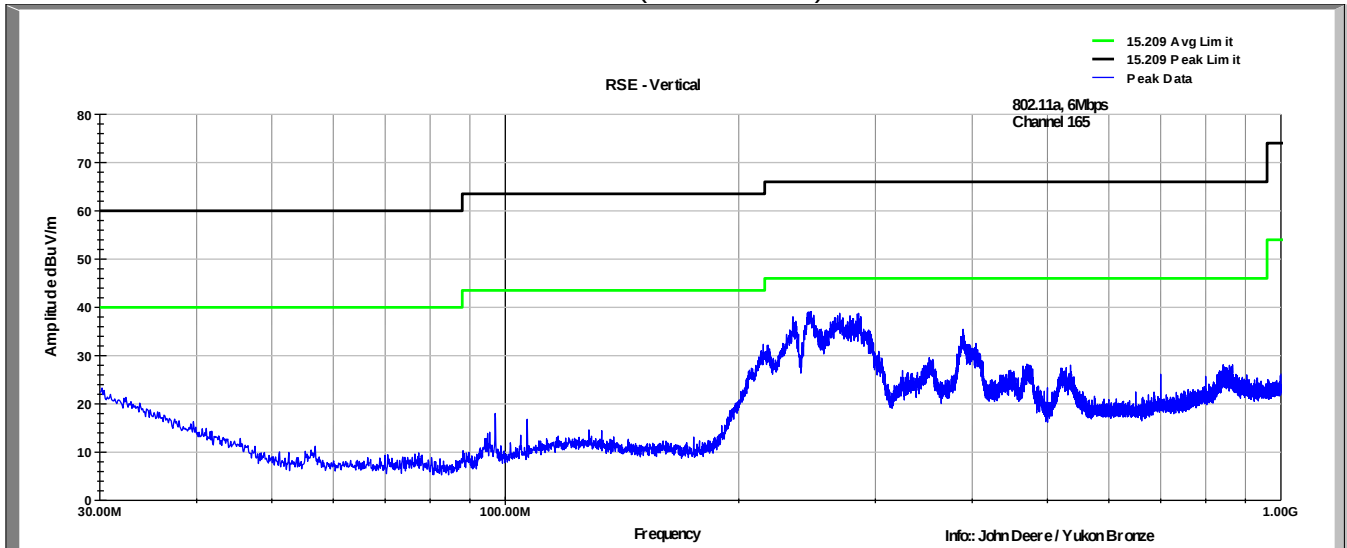
CH 157 802.11a, 6Mbps
Vertical (18-40GHz)



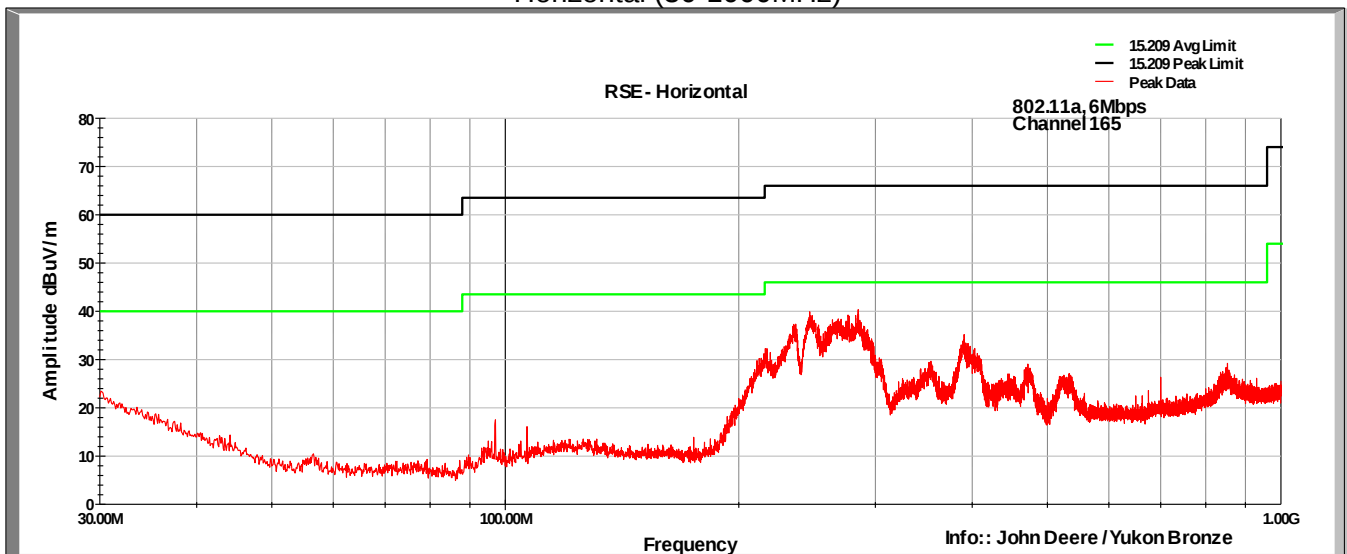
CH 157 802.11a, 6Mbps
Horizontal (18-40GHz)



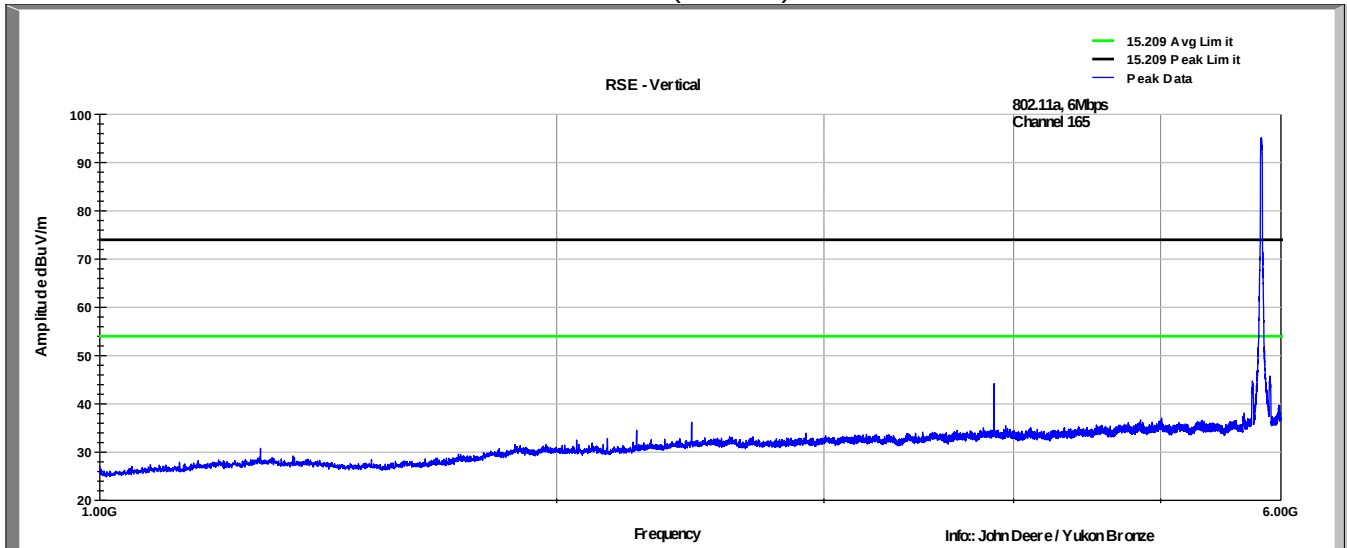
CH 165 802.11a, 6Mbps
Vertical (30-1000MHz)



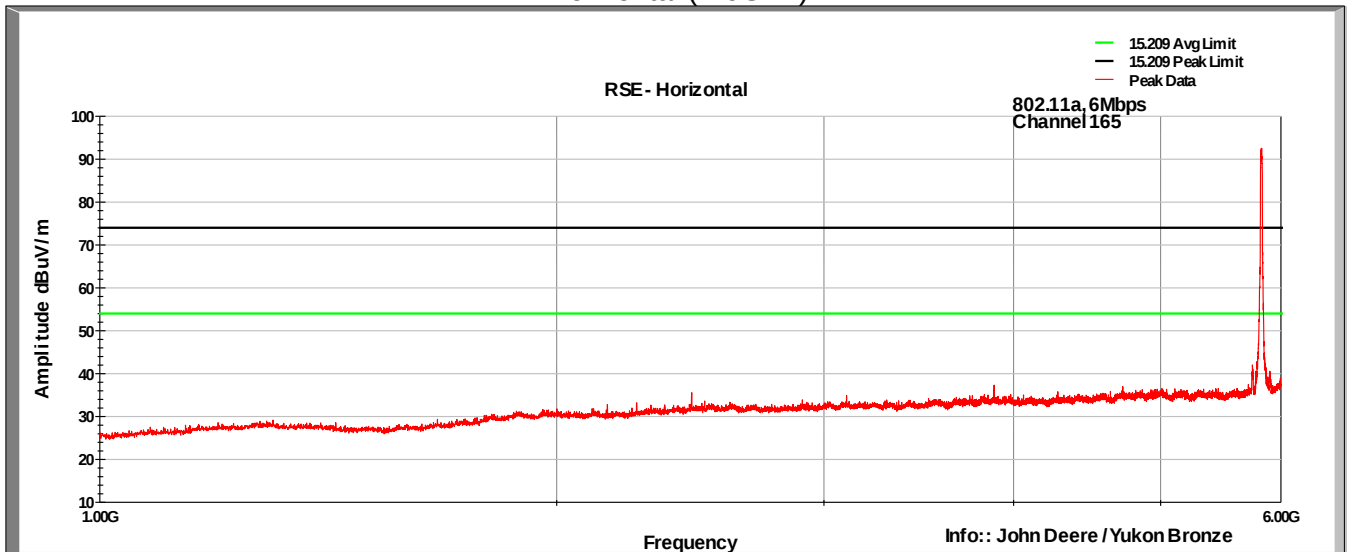
CH 165 802.11a, 6Mbps
Horizontal (30-1000MHz)



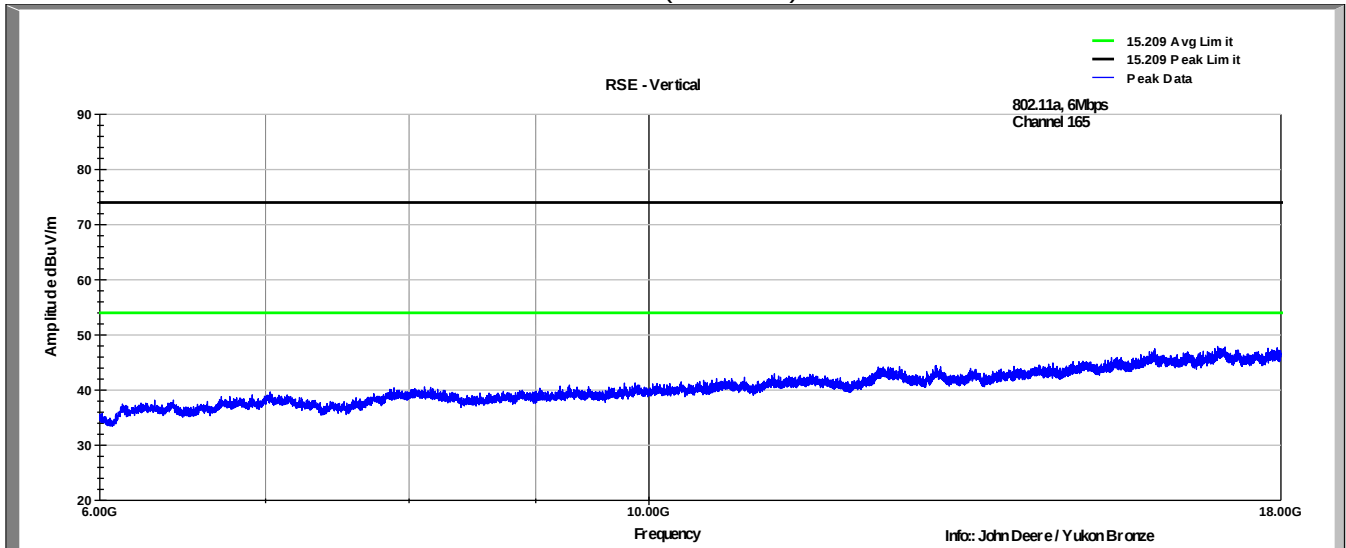
CH 165 802.11a, 6Mbps
Vertical (1-6GHz)



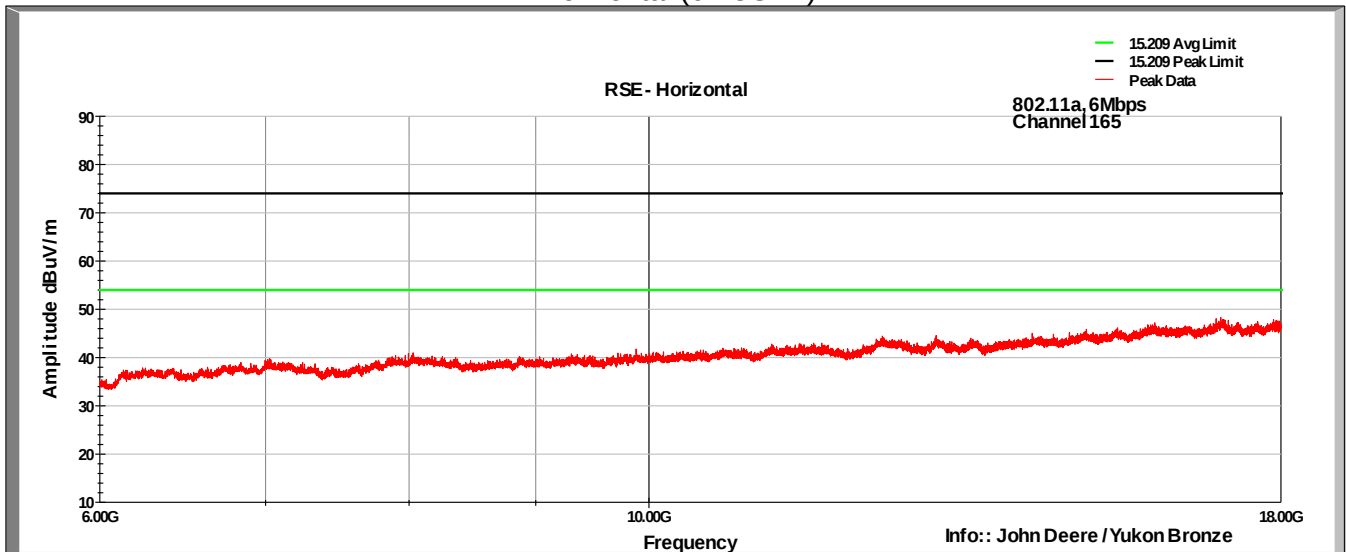
CH 165 802.11a, 6Mbps
Horizontal (1-6GHz)



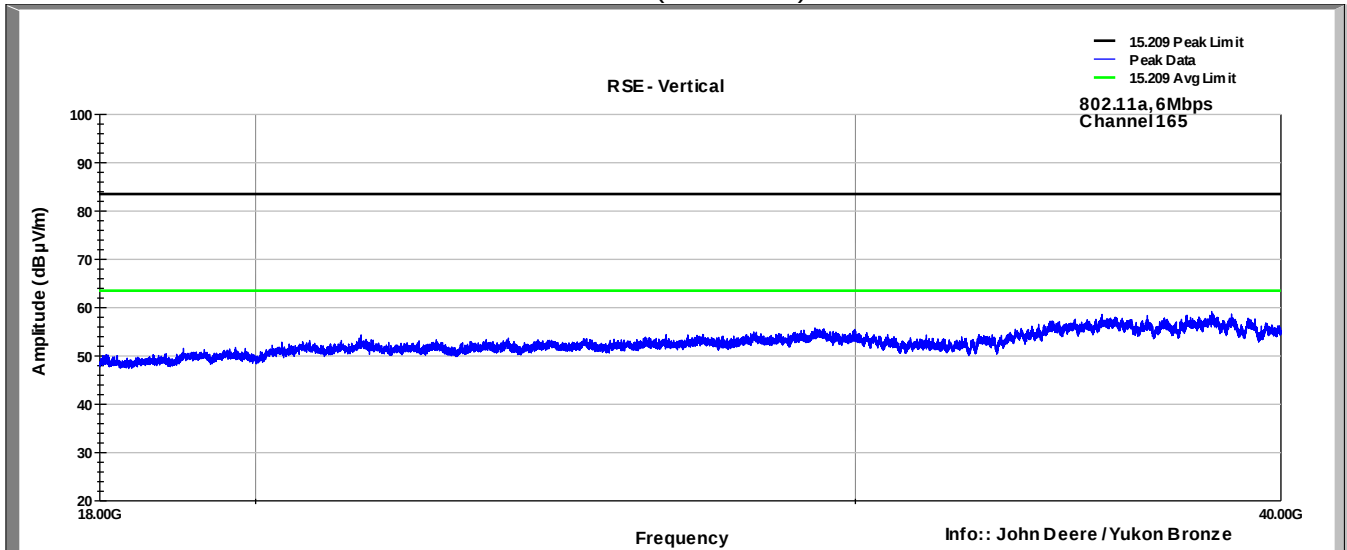
CH 165 802.11a, 6Mbps
Vertical (6-18GHz)



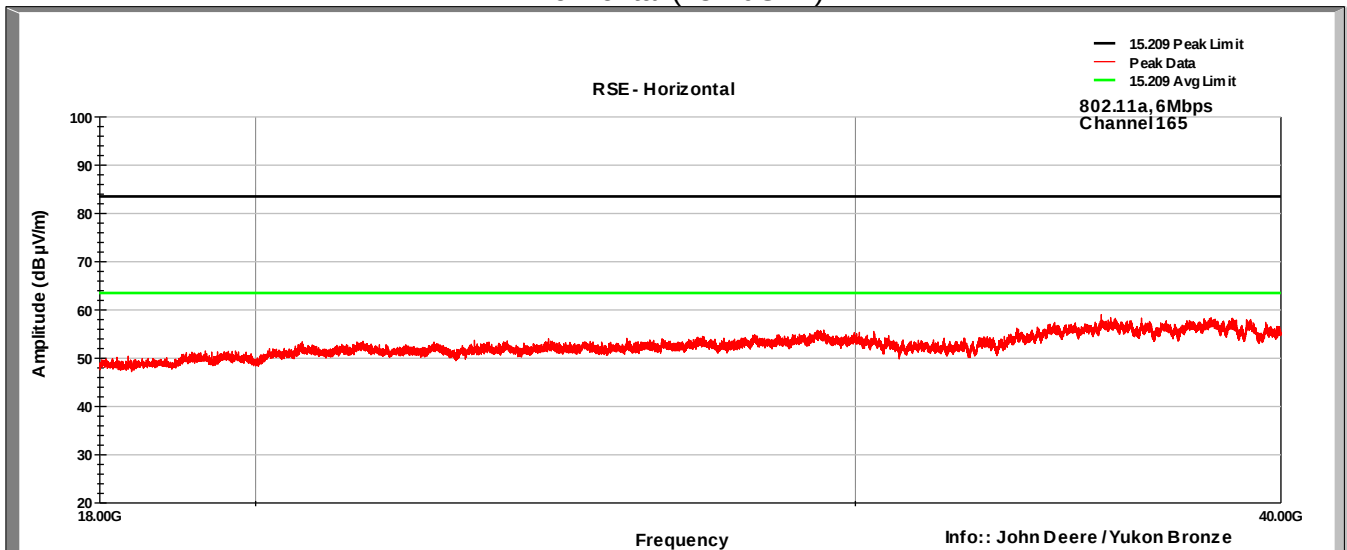
CH 165 802.11a, 6Mbps
Horizontal (6-18GHz)



CH 165 802.11a, 6Mbps
Vertical (18-40GHz)



CH 165 802.11a, 6Mbps
Horizontal (18-40GHz)



7 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	10 May 2016