EMC Test Report

Project Number: 4278380

Report Number: 4278380EMC01 **Revision Level:** 1

Client: Persistent Systems

Equipment Under Test: Upper C Band Radio

Model: RF-5100

FCC ID: 2AG3J-RF5100

Applicable Standards: FCC Part 15 Subpart C, § 15.407

ANSI C63.10: 2013

Report issued on: 3 August 2018

Test Result: Compliant

Tested by: _____
Shawn McGuinness, EMC Engineering Leader
For Jeremy Pickens, Senior EMC Engineer

Reviewed by: _____
David Schramm, Operations Manager

Table of Contents

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
Antenna Requirement	15.203	Compliant (1)
AC Powerline Conducted Emission	15.107, 15.207	NA (2)

(1) The module incorporates three unique connectors for connection to the host. The host utilizes reverse polarity TNC connectors.
(2) The device does not connect to the AC mains.

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Persistent Systems, LLC
Address:	303 Fifth Avenue Suite 306
City, State, Zip, Country:	New York, NY 10016

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

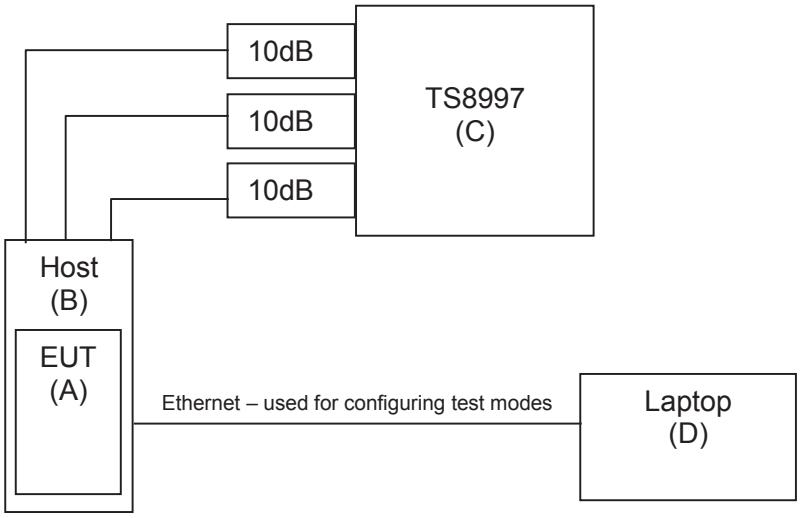
2.3 *General Information of EUT*

Type of Product:	Upper C Band Radio
Model Number:	RF-5100
Serial Number:	B-3416-4536
Frequency Range:	5150 to 5250 MHz and 5725 to 5850 MHz
Data Modes:	802.11a, 802.11n (HT20)
Antenna:	External/Detachable, 3x3 MIMO, 3.5dBi Gain
Rated Voltage:	10.8Vdc
Test Voltage:	10.8Vdc
Sample Received Date:	20 February 2018
Dates of testing:	26 February – 22 March 2018

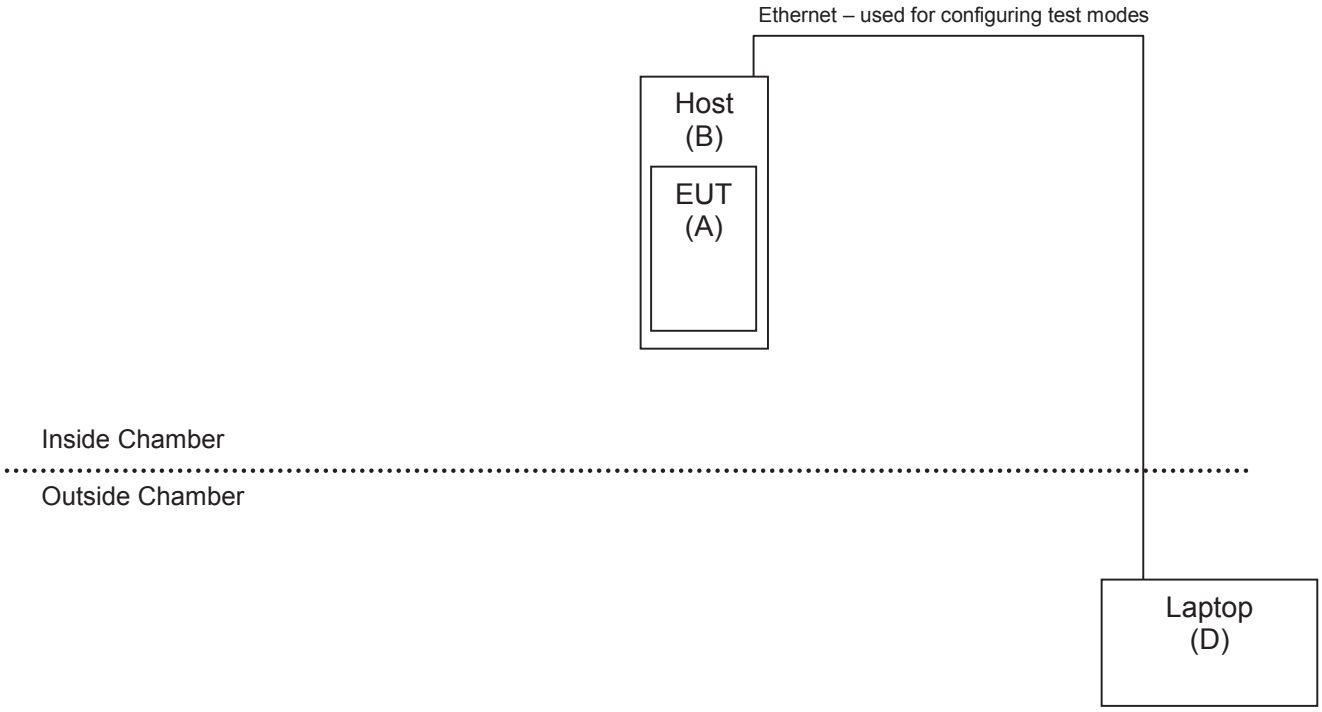
2.4 *Operating Modes and Conditions*

Using test commands, the EUT would transmit continuously on any of the UNII Band 1 or 3 channels at full power. Worst-case power and PSD were achieved at the lowest data rate. For radiated spurious emissions measurements, only the worst-case mode with respect to peak power was investigated.

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	Persistent Systems, LLC	Wave Relay Radio	WR-5100	19490
B	Persistent Systems, LLC	3x3 Radio Module	RF-5100	B-3416-4536
C	Rohde & Schwarz	Wireless Test System	TS8997	Not Labeled
D	Dell	Laptop	Latitude E5530	BPPMTZ1

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 v02r01 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: 23.4 °C
Relative Humidity: 49.9 %

3.4 *Test Equipment*

Test End Date: 1-Mar-2018 Tester: ASF

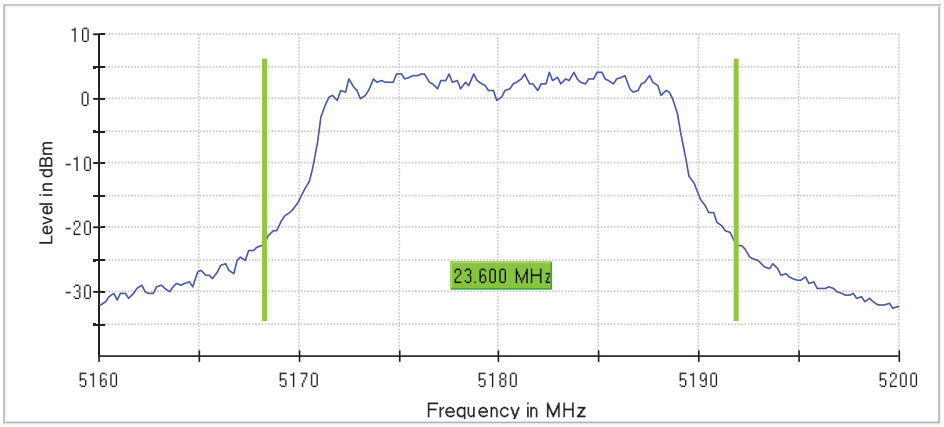
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095591	28-Jul-2018
RF CABLE	1134	GORE	B094785	26-Jul-2018
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095592	28-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095585	26-Jul-2018
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	28-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095586	26-Jul-2018

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

3.5 *Test Data – Emissions Bandwidth 26 dB*

Emissions Bandwidth 26 dB							
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
UNII Band 1							
5180	23.6	---	---	5168.3	5191.9	4.2	PASS
5220	23.8	---	---	5208.1	5231.9	4.7	PASS
5240	23.6	---	---	5228.1	5251.7	5.2	PASS
UNII Band 3							
5745	22.8	---	---	5733.5	5756.3	4.4	PASS
5785	22.8	---	---	5773.7	5796.5	4.5	PASS
5825	22.8	---	---	5813.5	5836.3	4.6	PASS

Representative Plot



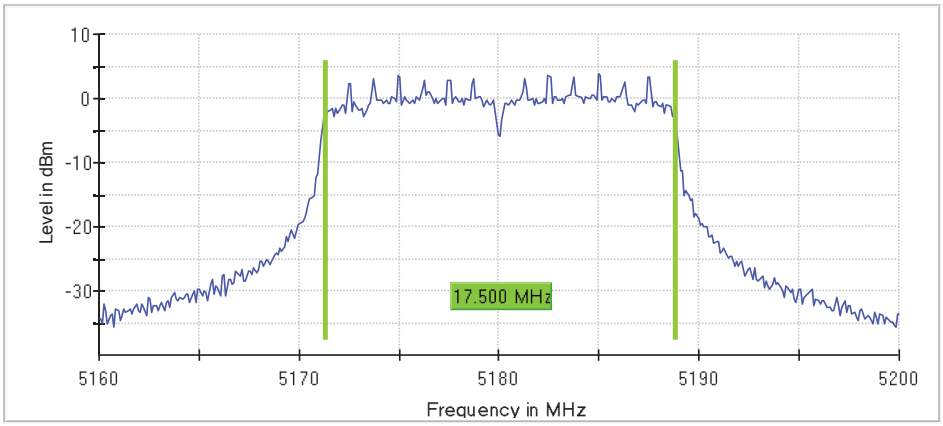
Representative Measurement Settings

Setting	Instrument Value	Target Value
Start Frequency	5.16000 GHz	5.16000 GHz
Stop Frequency	5.20000 GHz	5.20000 GHz
Span	40.000 MHz	40.000 MHz
RBW	200.000 kHz	~ 200.000 kHz
VBW	1.000 MHz	>= 600.000 kHz
SweepPoints	200	~ 200
Sweeptime	28.443 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	91 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.23 dB	0.30 dB

3.6 *Test Data – Emissions Bandwidth 6 dB*

Emissions Bandwidth 6 dB							
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
UNII Band 1							
5180	17.5	---	---	5171.35	5188.85	3.8	PASS
5220	17.3	---	---	5211.35	5228.65	4.1	PASS
5240	17.3	---	---	5231.35	5248.65	4.2	PASS
UNII Band 3							
5745	17.5	0.5	---	5736.15	5753.65	3.1	PASS
5785	17.1	0.5	---	5776.35	5793.45	3.6	PASS
5825	17.1	0.5	---	5816.35	5833.45	3.6	PASS

Representative Plot



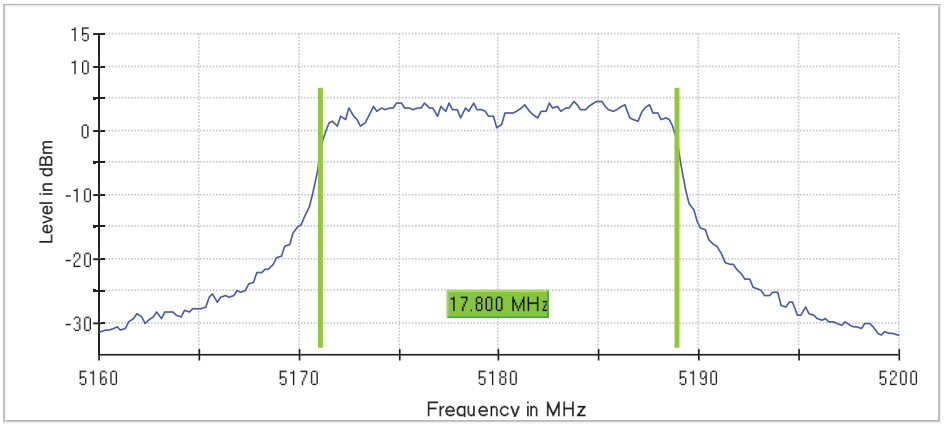
Representative Measurement Settings

Setting	Instrument Value	Target Value
Start Frequency	5.16000 GHz	5.16000 GHz
Stop Frequency	5.20000 GHz	5.20000 GHz
Span	40.000 MHz	40.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	400	~ 400
Sweeptime	56.886 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	46 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.29 dB	0.30 dB

3.7 *Test Data – Occupied Channel Bandwidth 99%*

Occupied Channel Bandwidth 99%						
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
UNII Band 1						
5180	17.8	---	---	5171.1	5188.9	PASS
5220	17.8	---	---	5211.1	5228.9	PASS
5240	18	---	---	5231.1	5249.1	PASS
UNII Band 3						
5745	17.8	---	---	5736.1	5753.9	PASS
5785	17.8	---	---	5776.1	5793.9	PASS
5825	17.8	---	---	5816.1	5833.9	PASS

Representative Plot



Representative Measurement Settings

Setting	Instrument Value	Target Value
Start Frequency	5.16000 GHz	5.16000 GHz
Stop Frequency	5.20000 GHz	5.20000 GHz
Span	40.000 MHz	40.000 MHz
RBW	200.000 kHz	<= 200.000 kHz
VBW	1.000 MHz	>= 600.000 kHz
SweepPoints	200	~ 200
Sweeptime	28.443 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	72 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.00 dB	0.30 dB

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 v02r01.

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. Additionally, the maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

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: 25.0 °C
Relative Humidity: 17.1 %

4.4 *Test Equipment*

Test End Date: 9-Mar-2018 Tester: ASF

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095591	28-Jul-2018
RF CABLE	1134	GORE	B094785	26-Jul-2018
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095592	28-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095585	26-Jul-2018
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	28-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095586	26-Jul-2018

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

4.5 *Test Data – UNII Band 1*

Note: Since the antennas used are omnidirectional, the total output power (EIRP) was limited to 21dBm to show compliance with the maximum e.i.r.p. at any elevation angle above 30 degrees. In firmware, the device will limit output power based on the number of antennas being utilized; 3x3 MIMO, 2x2MIMO, or SISO.

All 3 chains utilized

802.11a (Correlated)									
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Chain 1 (dBm)	Chain 2 (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=3)	Limit (dBm)	Margin (dB)
5180	36	7.8	7.2	8.7	12.72	3.50	4.77	21	-0.01
5200	44	7.9	7.2	8.6	12.71	3.50	4.77	21	-0.02
5240	48	8	7.1	8.2	12.56	3.50	4.77	21	-0.17

802.11n HT20 (Uncorrelated)									
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Chain 1 (dBm)	Chain 2 (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=3)	Limit (dBm)	Margin (dB)
5180	36	12.2	11.5	13.3	17.17	3.50	0.00	21	-0.33
5220	44	12.8	11.8	13.4	17.49	3.50	0.00	21	-0.01
5240	48	12.9	12.2	12.8	17.42	3.50	0.00	21	-0.08

2 chains utilized

802.11a (Correlated)								
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Chain 1 (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=2)	Limit (dBm)	Margin (dB)
5180	36	11.7	11.1	14.42	3.50	3.01	21	-0.07
5200	44	11.8	11.1	14.47	3.50	3.01	21	-0.02
5240	48	11.4	11.1	14.26	3.50	3.01	21	-0.23

802.11n HT20 (Uncorrelated)								
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Chain 1 (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=2)	Limit (dBm)	Margin (dB)
5180	36	14.3	14	17.16	3.50	0.00	21	-0.34
5220	44	14.4	14	17.21	3.50	0.00	21	-0.29
5240	48	14.5	14.1	17.31	3.50	0.00	21	-0.19

Single Chain

802.11a						
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=1)	Limit (dBm)	Margin (dB)
5180	36	17	3.50	0.00	21	-0.50
5200	44	17.4	3.50	0.00	21	-0.10
5240	48	17.2	3.50	0.00	21	-0.30

802.11n HT20						
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=1)	Limit (dBm)	Margin (dB)
5180	36	17	3.50	0.00	21	-0.50
5220	44	17.4	3.50	0.00	21	-0.10
5240	48	17.1	3.50	0.00	21	-0.40

4.6 *Test Data – UNII Band 3*

Note: In firmware, the device will limit output power based on the number of antennas being utilized; 3x3 MIMO, 2x2MIMO, or SISO.

All 3 chains utilized

802.11a (Correlated)									
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Chain 1 (dBm)	Chain 2 (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=3)	Limit (dBm)	Margin (dB)
5745	149	22.2	23	23.2	27.59	3.50	4.77	27.73	-0.14
5785	157	22.2	22.6	23.7	27.65	3.50	4.77	27.73	-0.08
5825	165	22.2	22.8	23.2	27.52	3.50	4.77	27.73	-0.21

802.11n HT20 (Uncorrelated)									
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Chain 1 (dBm)	Chain 2 (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=3)	Limit (dBm)	Margin (dB)
5745	149	24.2	24.9	25.3	29.59	3.50	0.00	30	-0.41
5785	157	24.1	24.4	25.3	29.40	3.50	0.00	30	-0.60
5825	165	24.3	25.1	25.1	29.62	3.50	0.00	30	-0.38

2 chains utilized

802.11a (Correlated)								
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Chain 1 (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=2)	Limit (dBm)	Margin (dB)
5745	149	26.3	26.5	29.41	3.50	3.01	29.49	-0.08
5785	157	26.3	26.3	29.31	3.50	3.01	29.49	-0.18
5825	165	26.4	26.5	29.46	3.50	3.01	29.49	-0.03

802.11n HT20 (Uncorrelated)								
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Chain 1 (dBm)	Total Power (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=2)	Limit (dBm)	Margin (dB)
5745	149	26.7	26.8	29.76	3.50	0.00	30	-0.24
5785	157	26.9	26.7	29.81	3.50	0.00	30	-0.19
5825	165	26.7	26.9	29.81	3.50	0.00	30	-0.19

Single Chain

802.11a						
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=1)	Limit (dBm)	Margin (dB)
5745	149	29.8	3.50	0.00	30	-0.20
5785	157	29.8	3.50	0.00	30	-0.20
5825	165	29.9	3.50	0.00	30	-0.10

802.11n HT20						
Frequency (MHz)	Channel (WLAN)	Chain 0 (dBm)	Antenna Gain (dBi)	Directional Gain (nANT=1)	Limit (dBm)	Margin (dB)
5745	149	29.8	3.50	0.00	30	-0.20
5785	157	29.8	3.50	0.00	30	-0.20
5825	165	29.8	3.50	0.00	30	-0.20

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 v02r01. 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: 23.4 °C
Relative Humidity: 49.9 %

5.4 *Test Equipment*

Test End Date: 1-Mar-2018 Tester: ASF

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019
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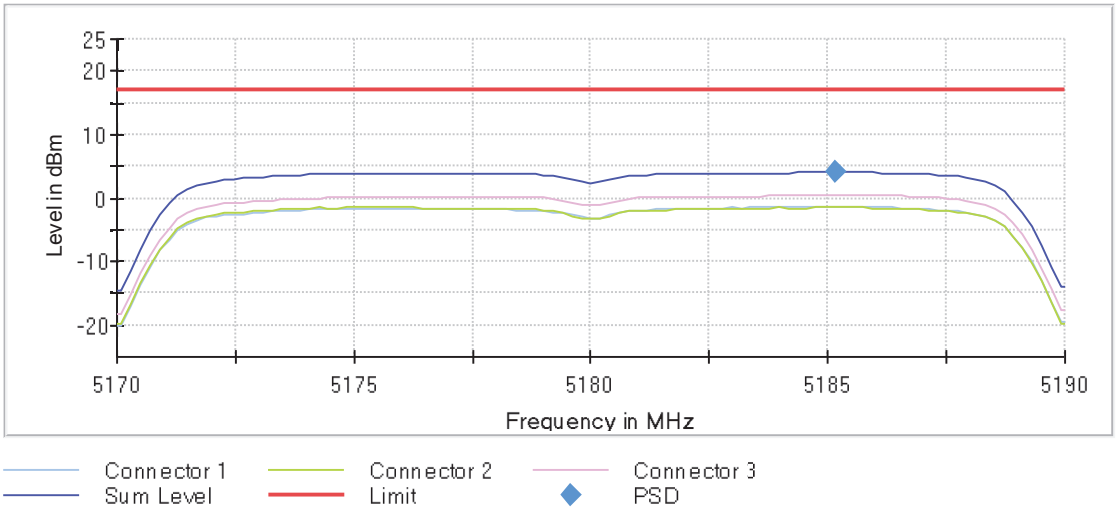
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095592	28-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095585	26-Jul-2018
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	28-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095586	26-Jul-2018

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

5.5 *Test Data (UNII Band 1)*

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result	Port 1 Duty Cycle (%)	Port 2 Duty Cycle (%)	Port 3 Duty Cycle (%)
5180	5185.1485	4.085	17	PASS	96.516	96.534	96.58
5220	5225.1485	3.69	17	PASS	96.512	96.533	96.58
5240	5244.9505	4.16	17	PASS	96.51	96.532	96.577

Representative Plot



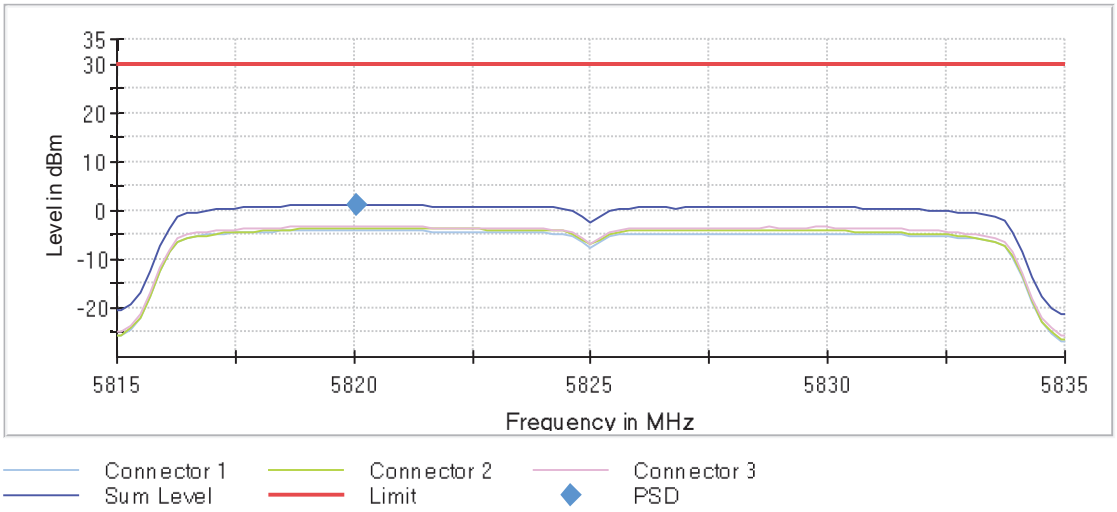
Representative Measurement Settings

Setting	Instrument Value	Target Value
Start Frequency	5.17000 GHz	5.17000 GHz
Stop Frequency	5.19000 GHz	5.19000 GHz
Span	20.000 MHz	20.000 MHz
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	101	~ 40
Sweeptime	2.020 s	2.020 s
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	RMS	RMS
SweepCount	3	3
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.14 dB	0.30 dB

5.6 *Test Data (UNII Band 3)*

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result	Port 1 Duty Cycle (%)	Port 2 Duty Cycle (%)	Port 3 Duty Cycle (%)
5745	5740.0495	1.688	30	PASS	96.515	96.534	96.58
5785	5779.6535	1.425	30	PASS	96.512	96.536	96.579
5825	5820.0495	1.104	30	PASS	96.514	96.536	96.578

Representative Plot



Representative Measurement Settings

Setting	Instrument Value	Target Value
Start Frequency	5.73500 GHz	5.73500 GHz
Stop Frequency	5.75500 GHz	5.75500 GHz
Span	20.000 MHz	20.000 MHz
RBW	500.000 kHz	<= 500.000 kHz
VBW	2.000 MHz	>= 1.500 MHz
SweepPoints	101	~ 80
Sweeptime	2.020 s	2.020 s
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	RMS	RMS
SweepCount	3	3
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	4 / max. 15	max. 15
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.30 dB

6 Unwanted Emissions

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 v02r01.

Lowest, middle, and highest channels were investigated for each band. Only the modulation providing the worst-case power was reported except at the band edges where all modulations and number of antennas were measured. During spurious emissions, the worst-case was determined to be SISO operation, 802.11a with a data-rate of 6Mbps, at the highest output power setting. The frequency range examined was 9kHz to 40GHz. A pre-scan was performed in the 9kHz-30MHz range and no emissions associated with the radio were observed.

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 shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 23.4 °C
Relative Humidity: 49.9 %

6.4 *Test Equipment – Conducted Measurements*

Test End Date: 1-Mar-2018 Tester: ASF

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095591	28-Jul-2018
RF CABLE	1134	GORE	B094785	26-Jul-2018
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095592	28-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095585	26-Jul-2018
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095593	28-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095586	26-Jul-2018

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

6.5 *Test Equipment – Radiated Measurements*

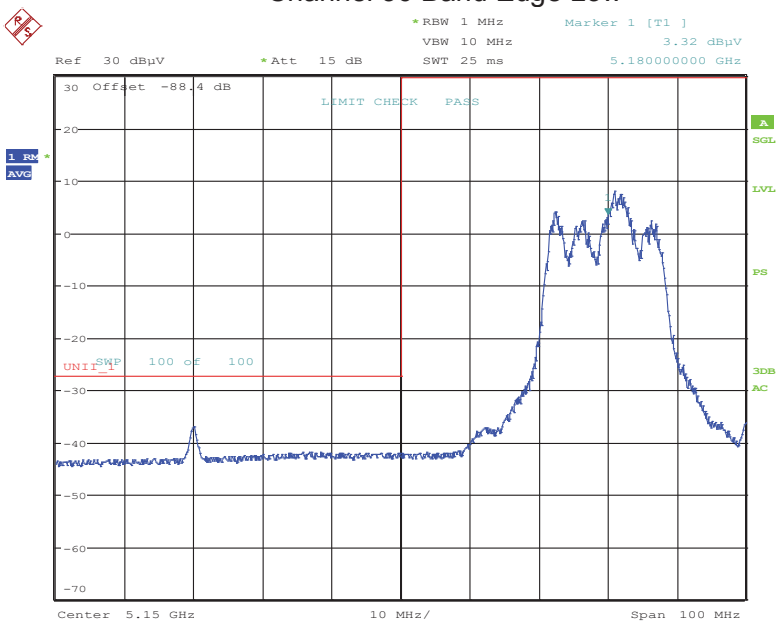
Test End Date: 19-Mar-2018 Tester: JOP/AF

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	25-Apr-2018
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	27-Jul-2018
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	28-Jul-2018
FILTER, HIGH PASS (>6000MHZ)	HPM50112	MICRO-TRONICS	B093647	27-Jul-2018
HORN(SMALL)	LB-180400-20-C-KF	A-INFO	15007	21-Mar-2018
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2018
RF CABLE	SF102	HUBER & SUHNER	B079824	26-Jul-2018
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	28-Jul-2018
ANTENNA, BILOG	JB6	SUNOL	B079690	29-Nov-2018
RF CABLE	SF106	HUBER & SUHNER	B079661	25-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079713	24-Jul-2018
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17017	25-Jul-2018
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	6-Mar-2019

Note: The equipment calibration period is 1 year unless otherwise noted.

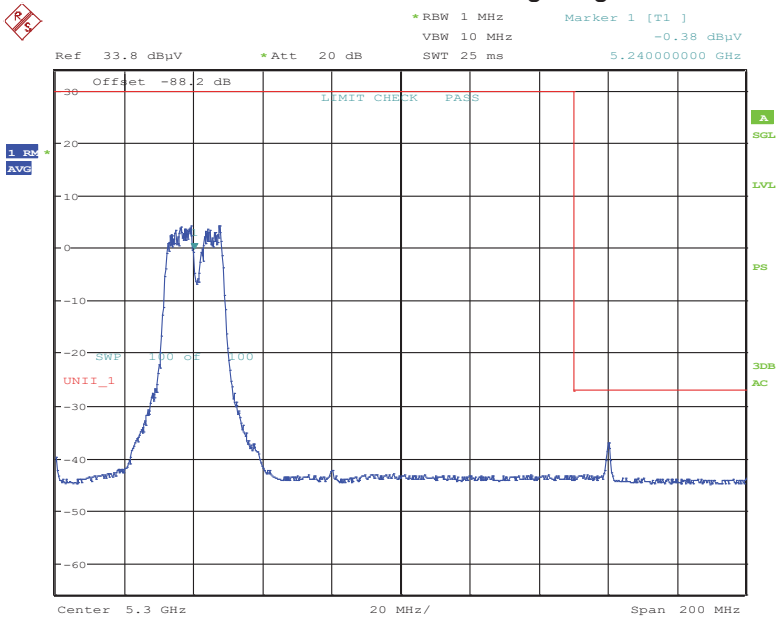
6.6 *Test Data - UNII Band 1 – Radiated Band Edge*

802.11a, 3x3
Channel 36 Band Edge Low



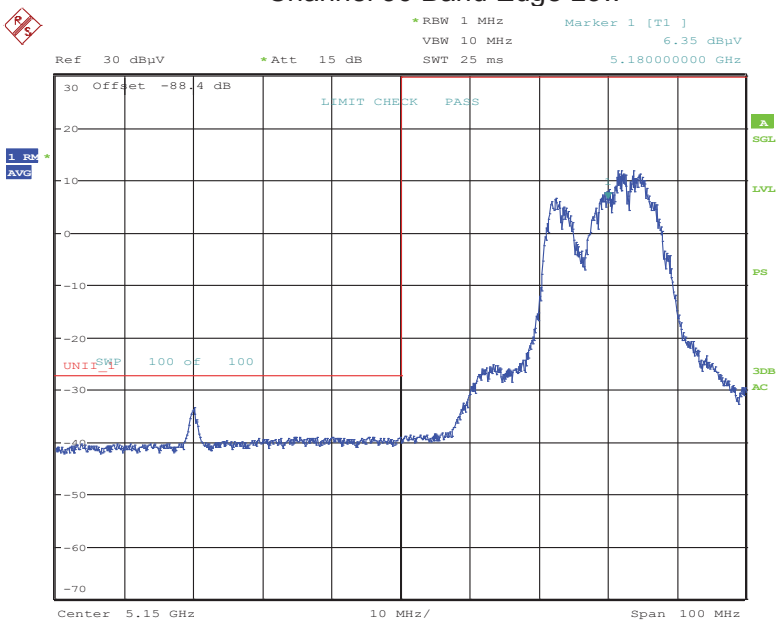
Date: 19.MAR.2018 11:41:50

802.11a, 3x3
Channel 48 Band Edge High



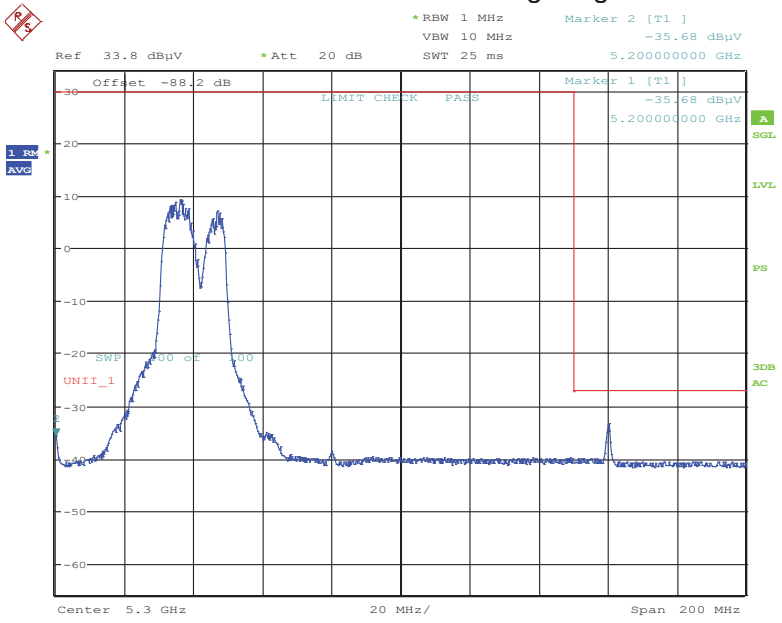
Date: 19.MAR.2018 14:31:08

802.11n, 3x3
Channel 36 Band Edge Low



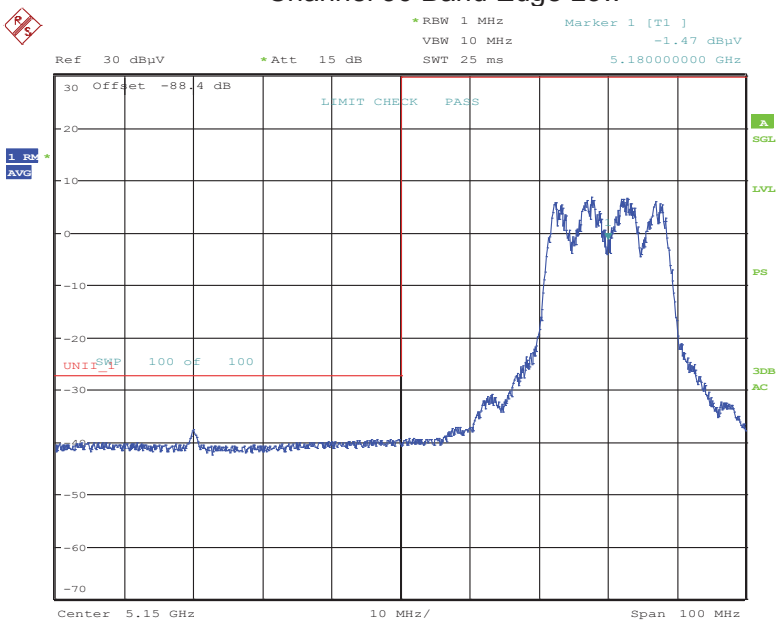
Date: 19.MAR.2018 11:40:34

802.11n, 3x3
Channel 48 Band Edge High



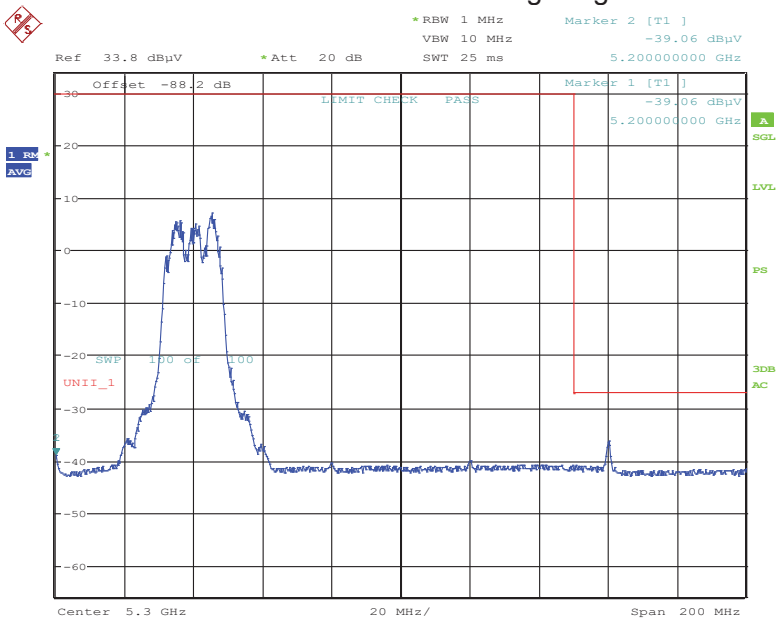
Date: 19.MAR.2018 14:29:28

802.11a, 2x2
Channel 36 Band Edge Low



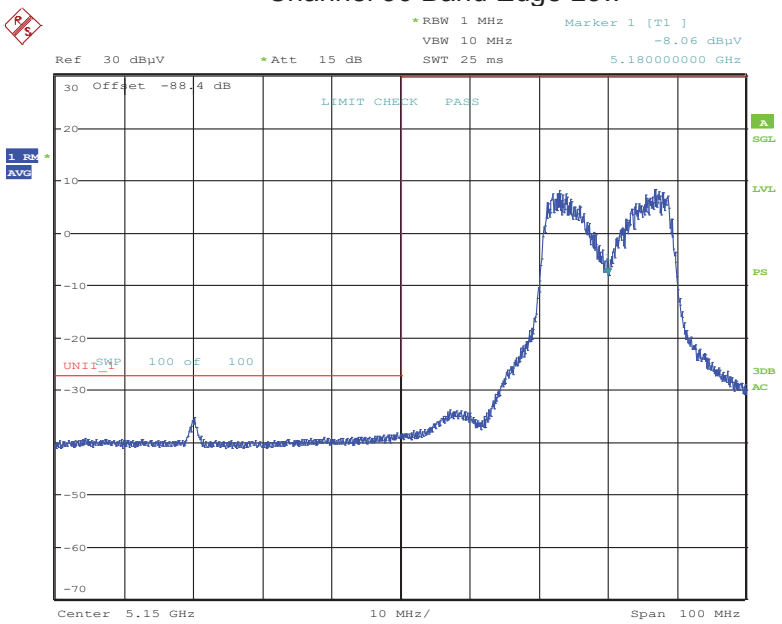
Date: 19.MAR.2018 11:47:46

802.11a, 2x2
Channel 48 Band Edge High



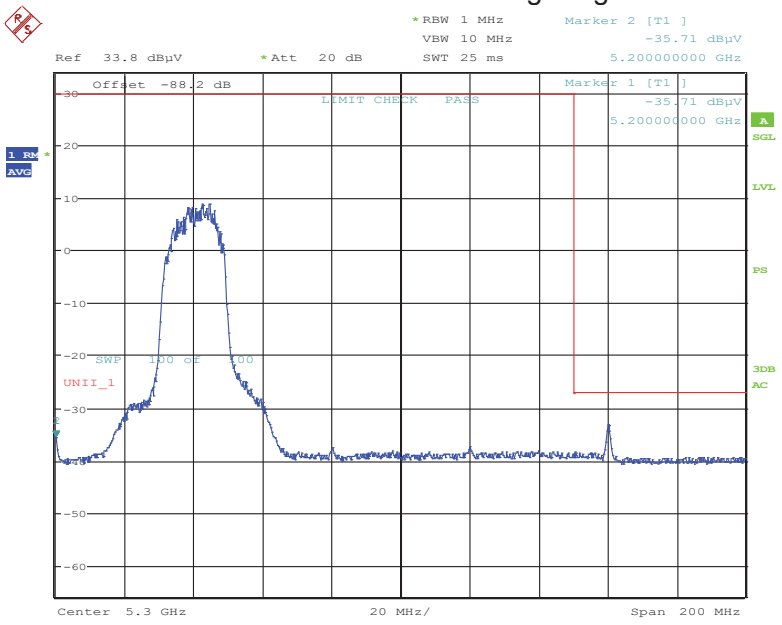
Date: 19.MAR.2018 14:24:52

802.11n, 2x2
Channel 36 Band Edge Low



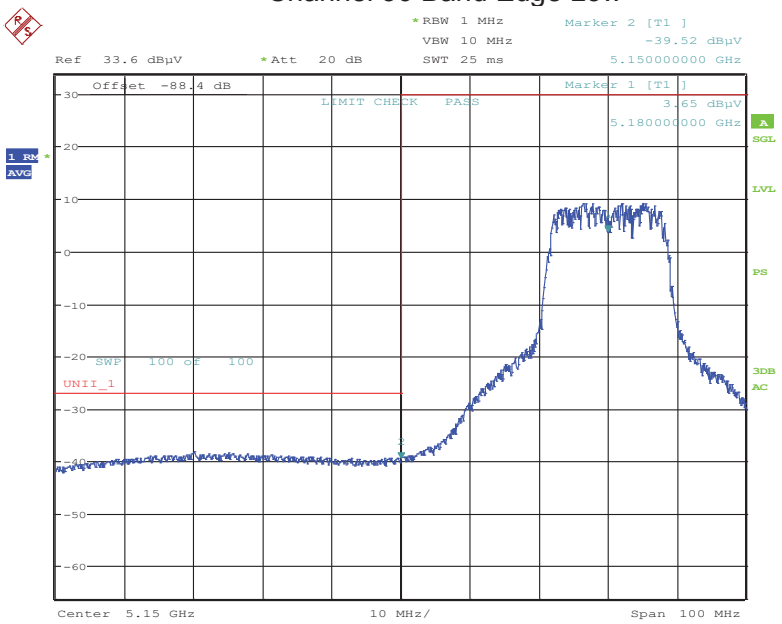
Date: 19.MAR.2018 11:49:02

802.11n, 2x2
Channel 48 Band Edge High



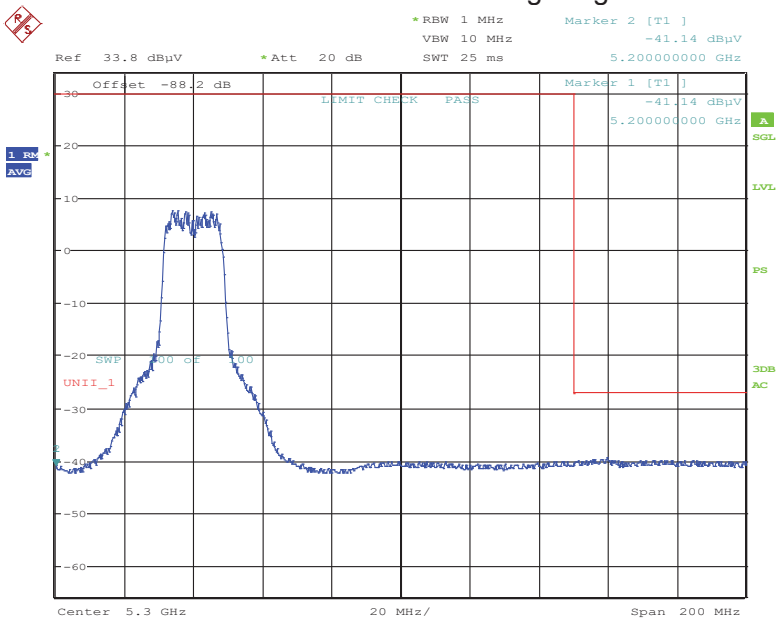
Date: 19.MAR.2018 14:26:23

802.11a, SISO
Channel 36 Band Edge Low



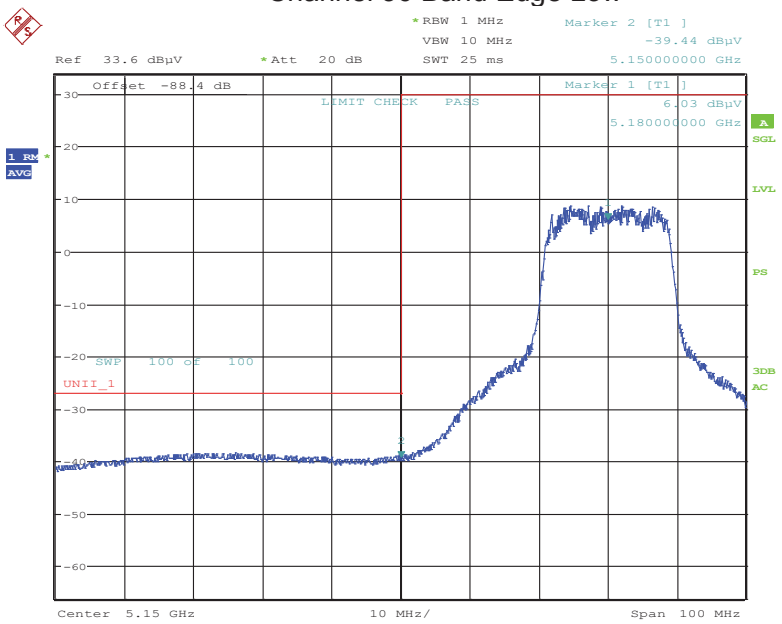
Date: 19.MAR.2018 12:20:11

802.11a, SISO
Channel 48 Band Edge High



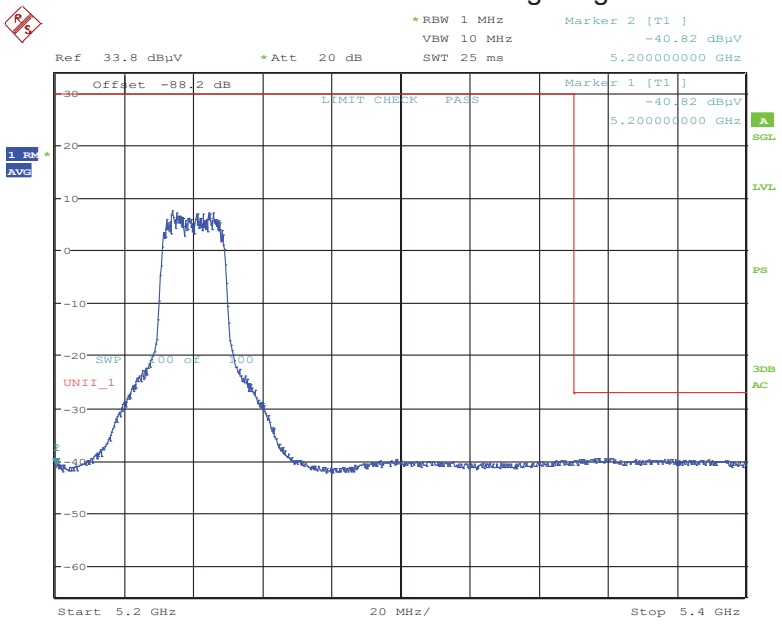
Date: 19.MAR.2018 14:21:12

802.11n, SISO
Channel 36 Band Edge Low



Date: 19.MAR.2018 12:21:34

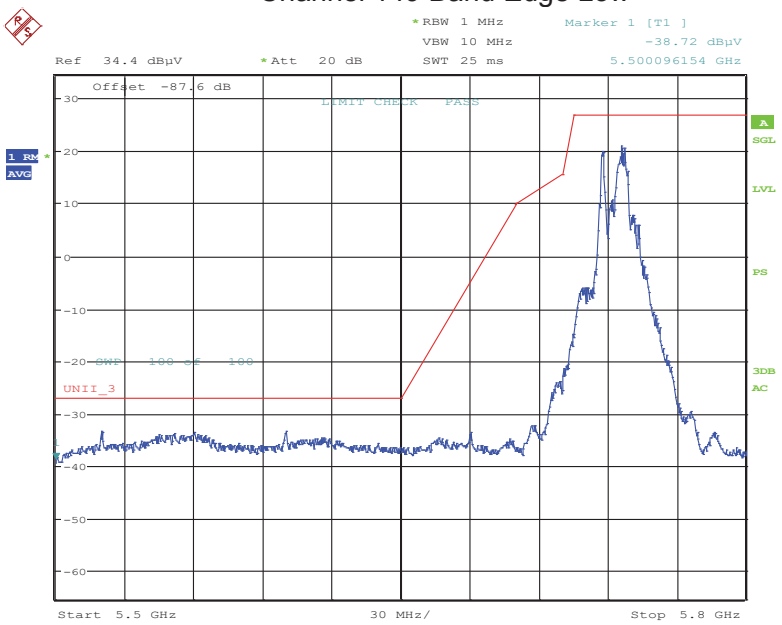
802.11n, SISO
Channel 48 Band Edge High



Date: 19.MAR.2018 14:18:01

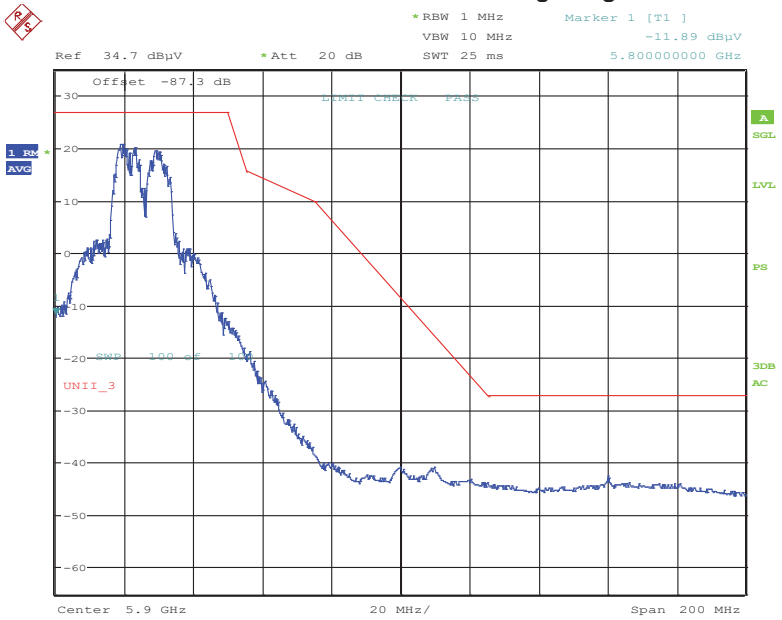
6.7 *Test Data - UNII Band 3 – Radiated Band Edge*

802.11a, 3x3
Channel 149 Band Edge Low



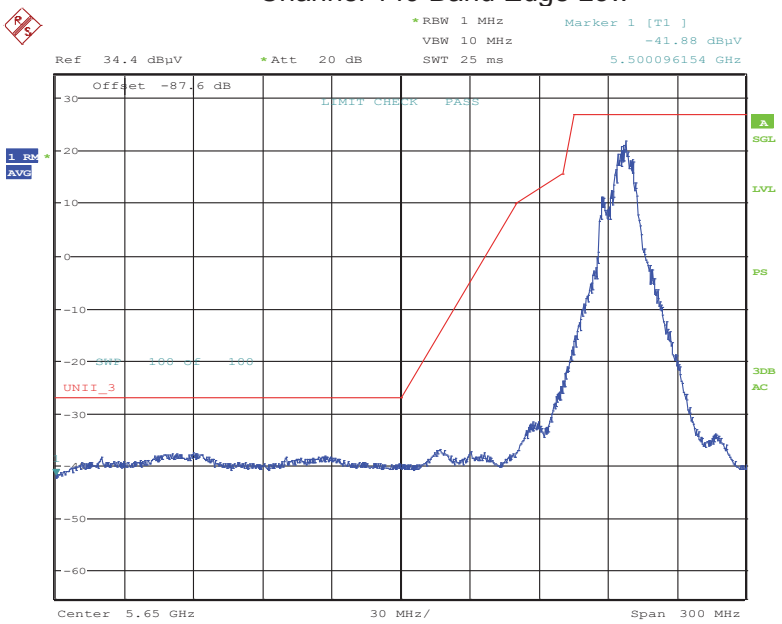
Date: 19.MAR.2018 15:09:42

802.11a, 3x3
Channel 165 Band Edge High



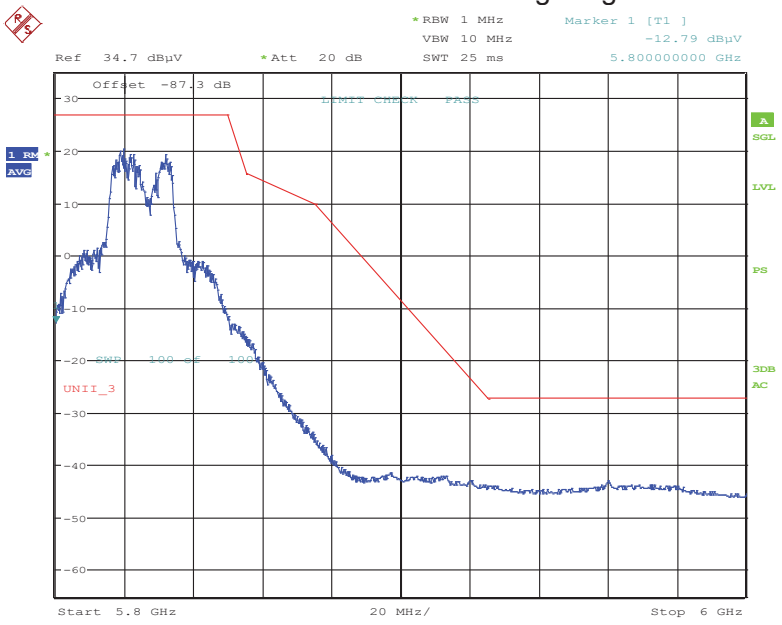
Date: 19.MAR.2018 15:22:35

802.11n (HT20), 3x3
Channel 149 Band Edge Low



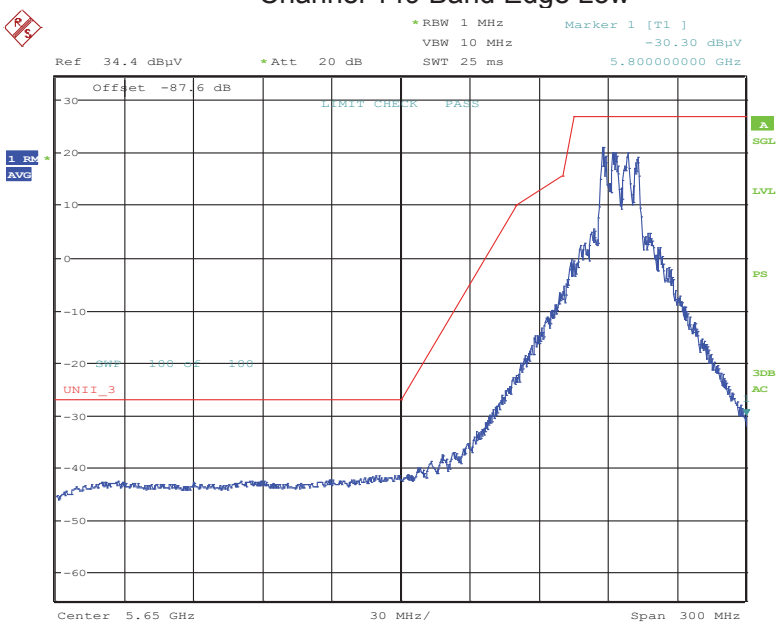
Date: 19.MAR.2018 15:13:24

802.11n (HT20), 3x3
Channel 165 Band Edge High



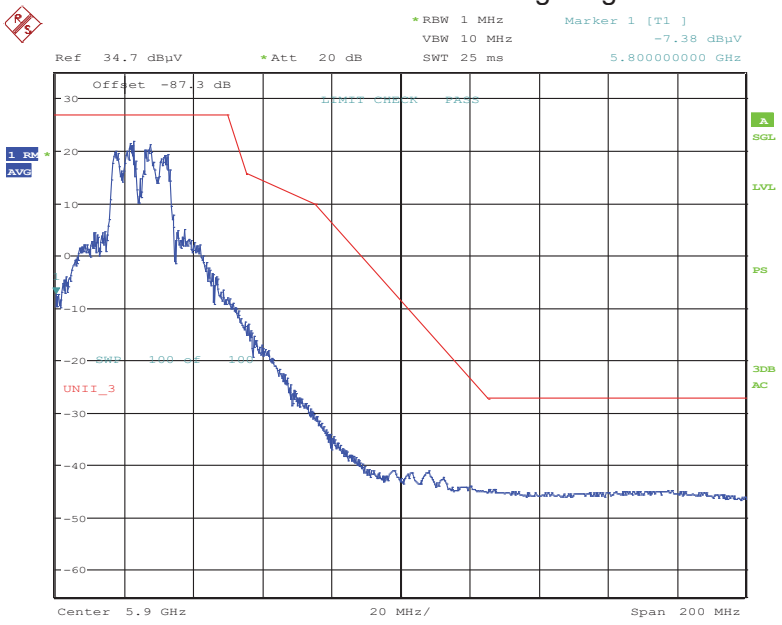
Date: 19.MAR.2018 15:19:24

802.11a, 2x2
Channel 149 Band Edge Low



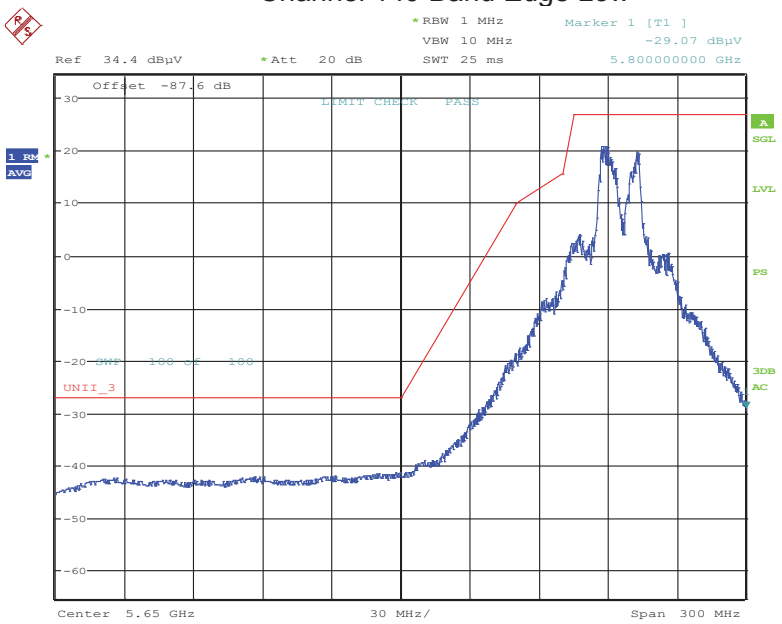
Date: 19.MAR.2018 16:02:21

802.11a, 2x2
Channel 165 Band Edge High



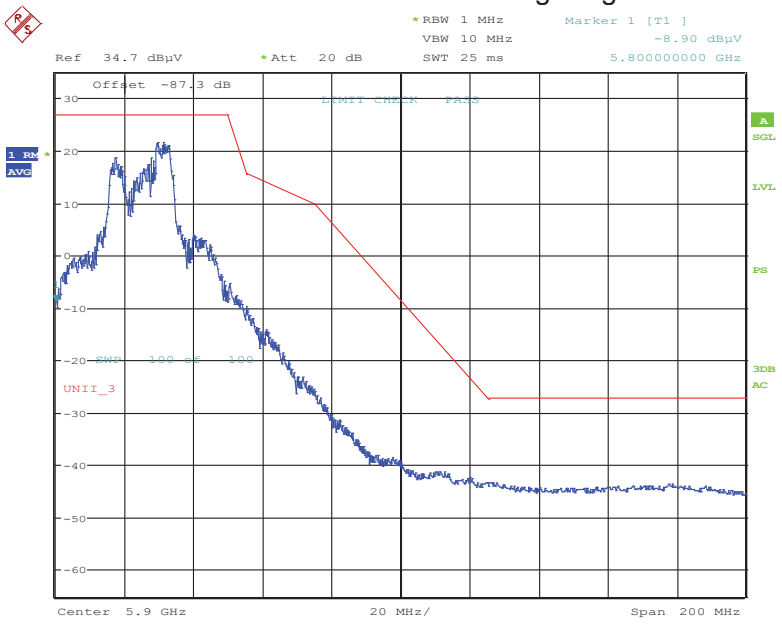
Date: 19.MAR.2018 15:25:35

802.11n (HT20), 2x2
Channel 149 Band Edge Low



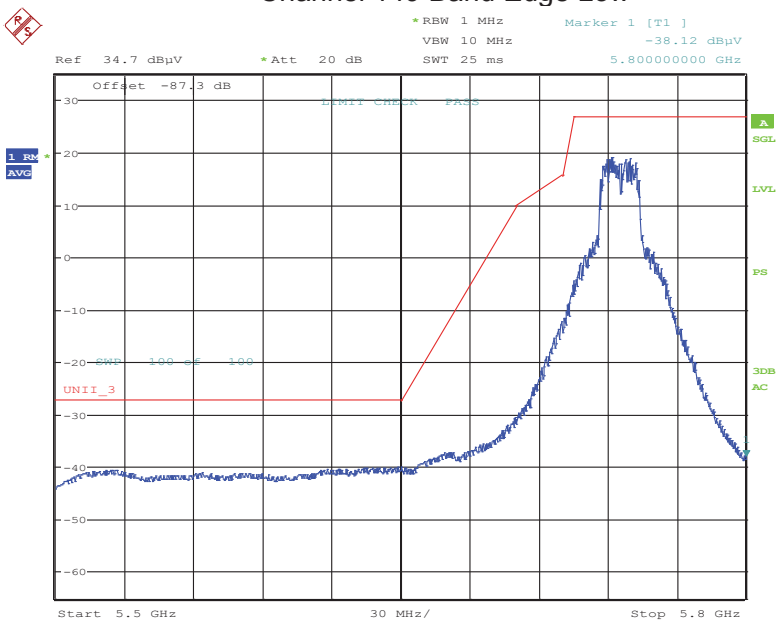
Date: 19.MAR.2018 16:05:52

802.11n (HT20), 2x2
Channel 165 Band Edge High



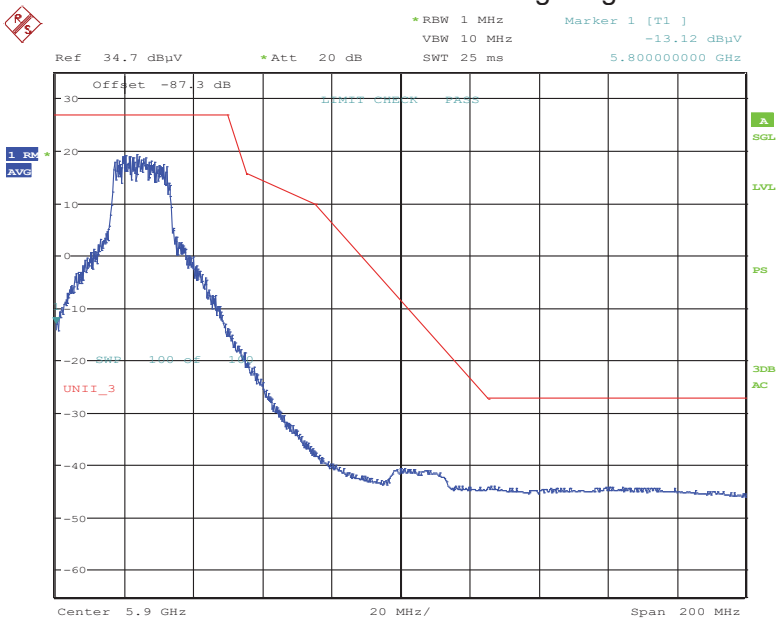
Date: 19.MAR.2018 15:27:21

802.11a, SISO
Channel 149 Band Edge Low



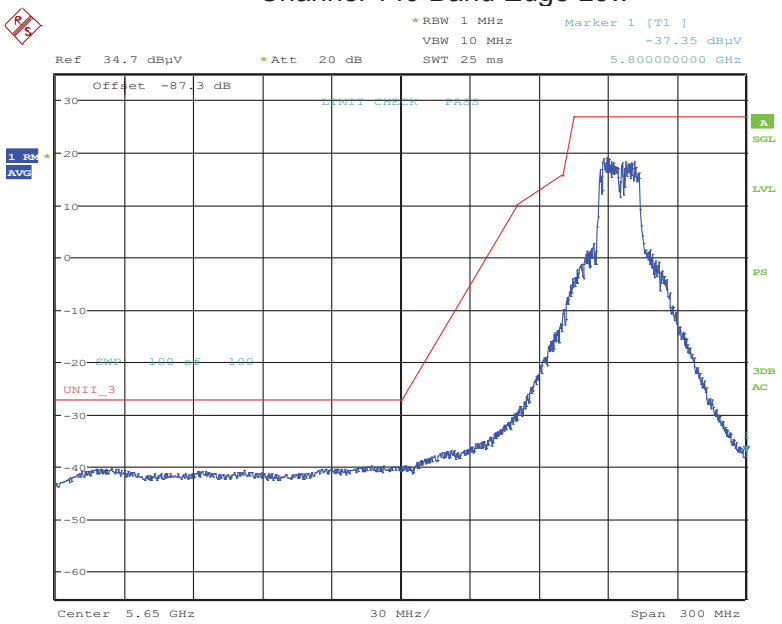
Date: 19.MAR.2018 15:53:06

802.11a, SISO
Channel 165 Band Edge High



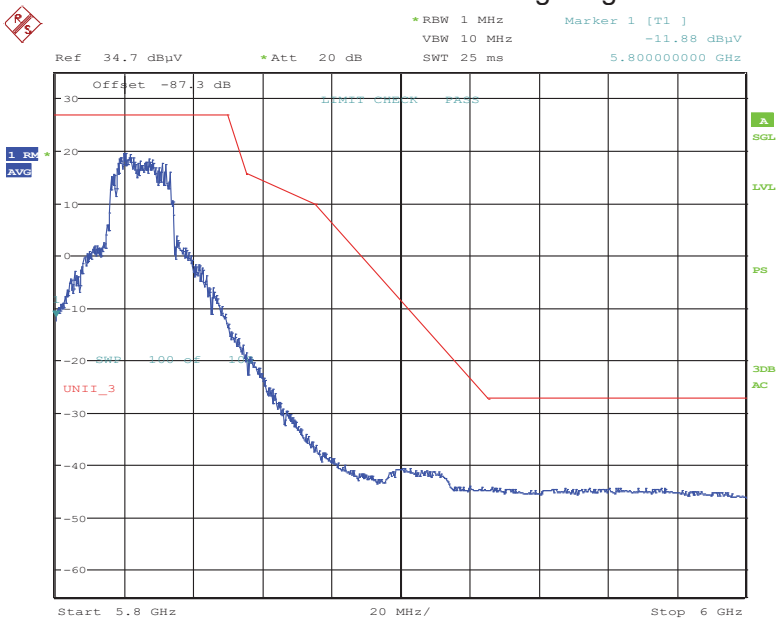
Date: 19.MAR.2018 15:50:01

802.11n (HT20), SISO
Channel 149 Band Edge Low



Date: 19.MAR.2018 15:54:37

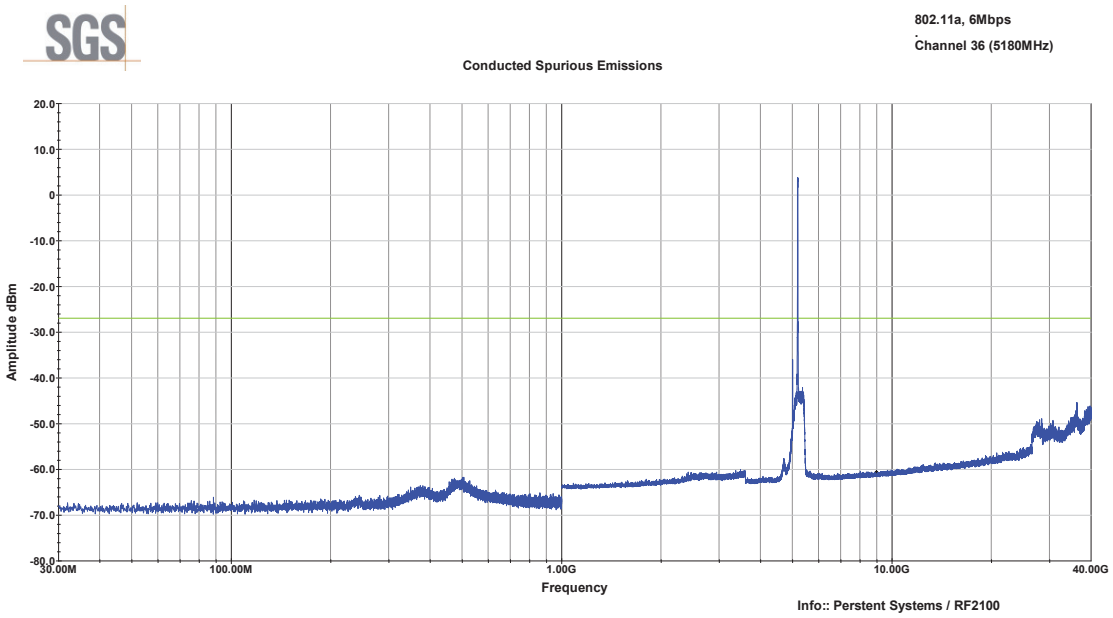
802.11n (HT20), SISO
Channel 165 Band Edge High



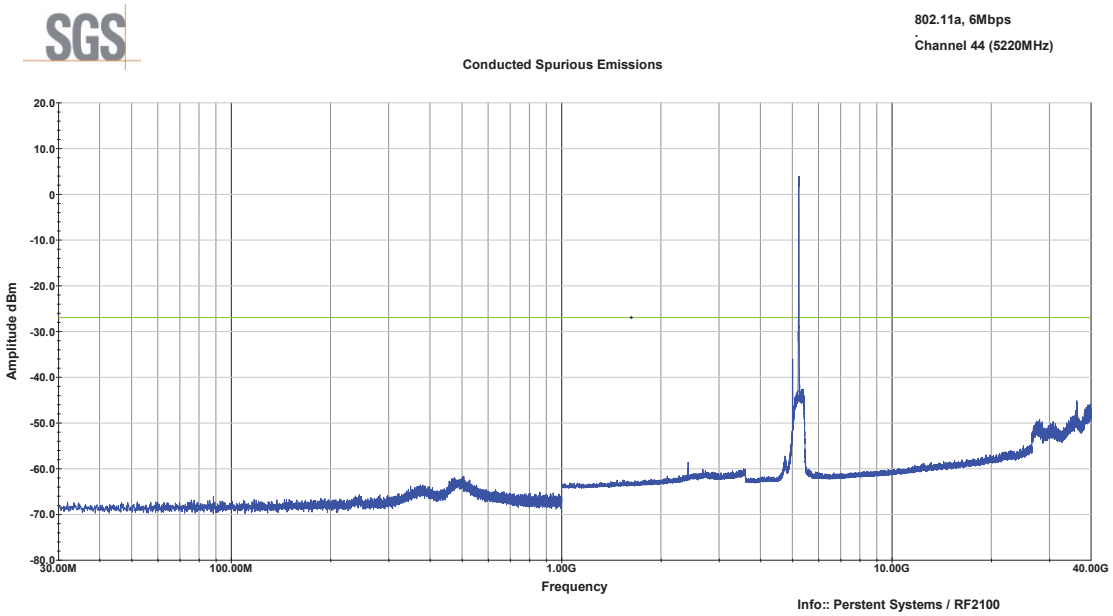
Date: 19.MAR.2018 15:46:36

6.8 *Test Data – Conducted Spurs*

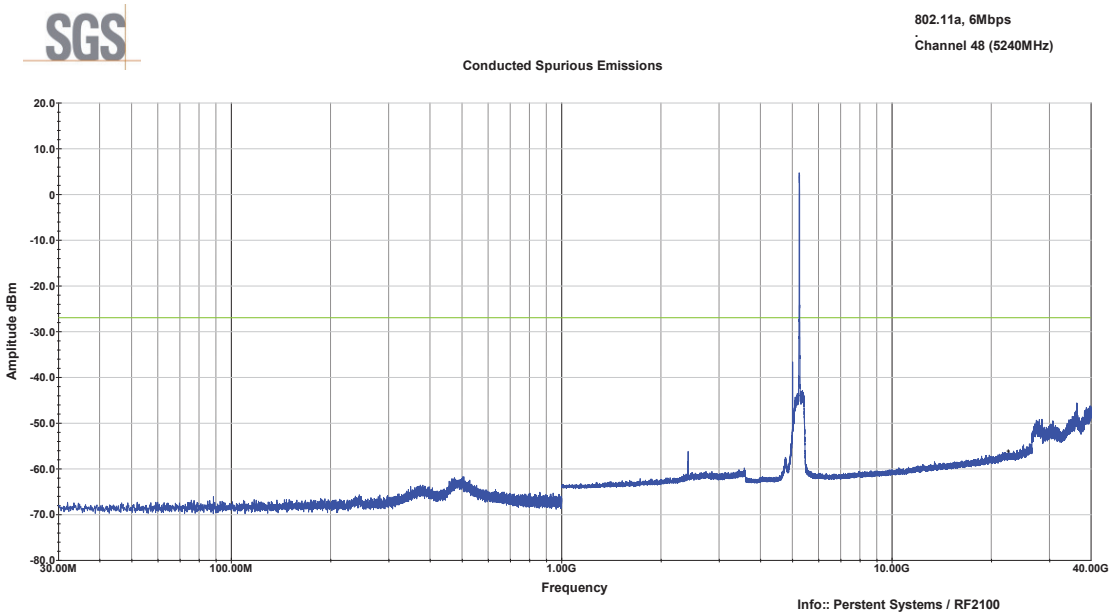
Conducted Spurs – 802.11a, 6Mbit/s, Channel 36



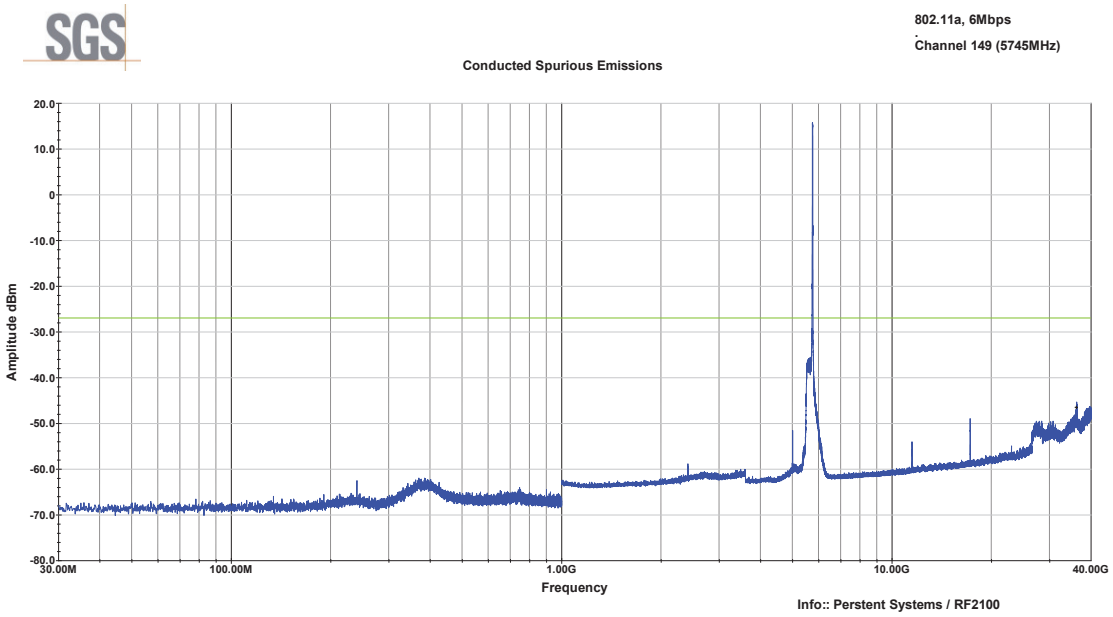
Conducted Spurs – 802.11a, 6Mbit/s, Channel 44



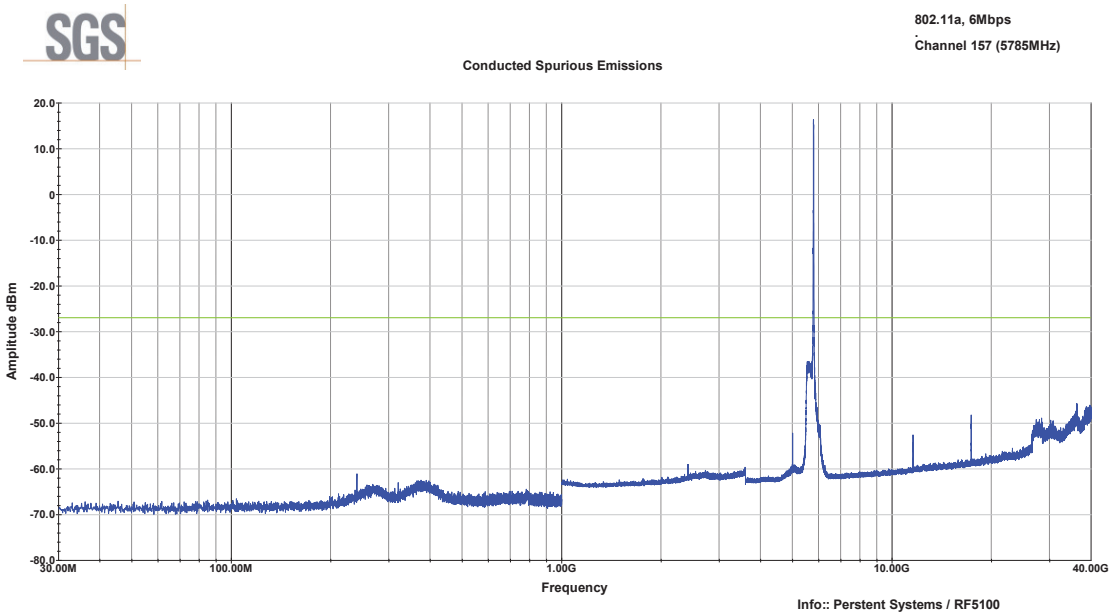
Conducted Spurs – 802.11a, 6Mbit/s, Channel 48



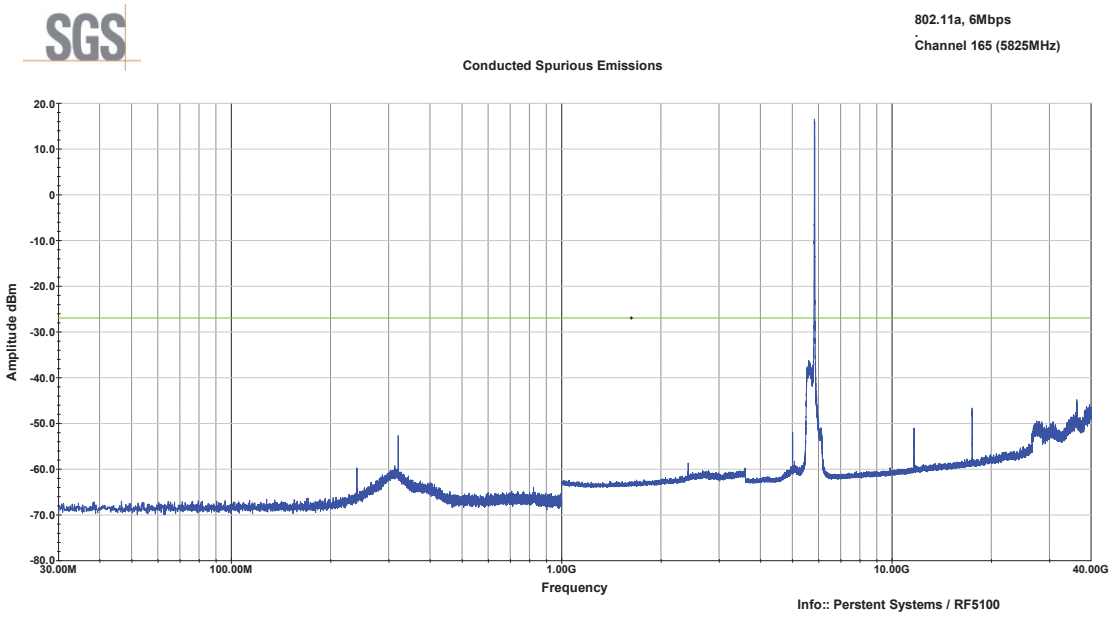
Conducted Spurs – 802.11a, 6Mbit/s, Channel 149



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

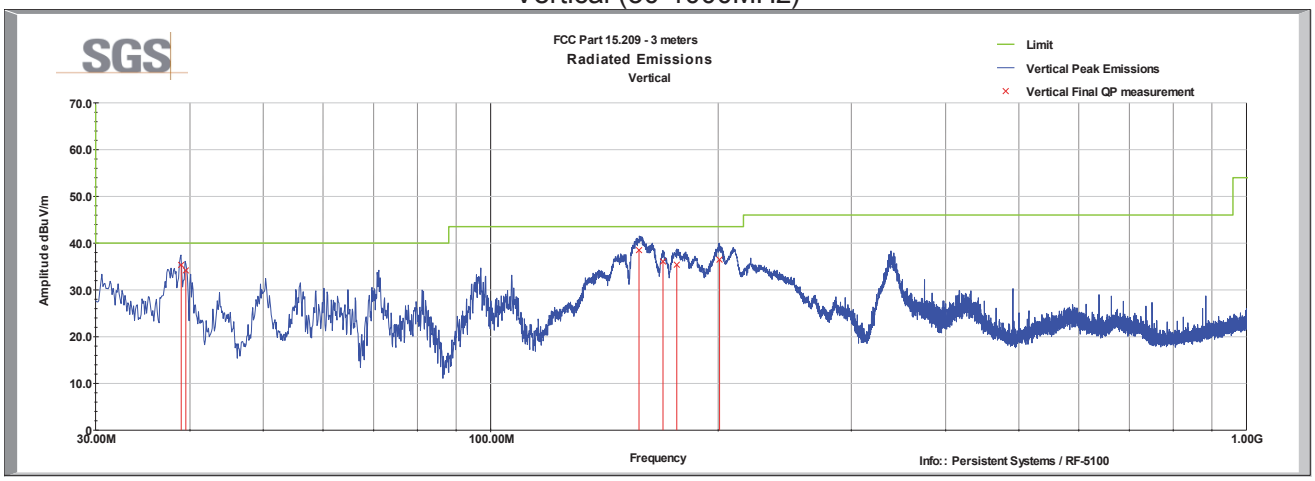


Conducted Spurs – 802.11a, 6Mbit/s, Channel 165



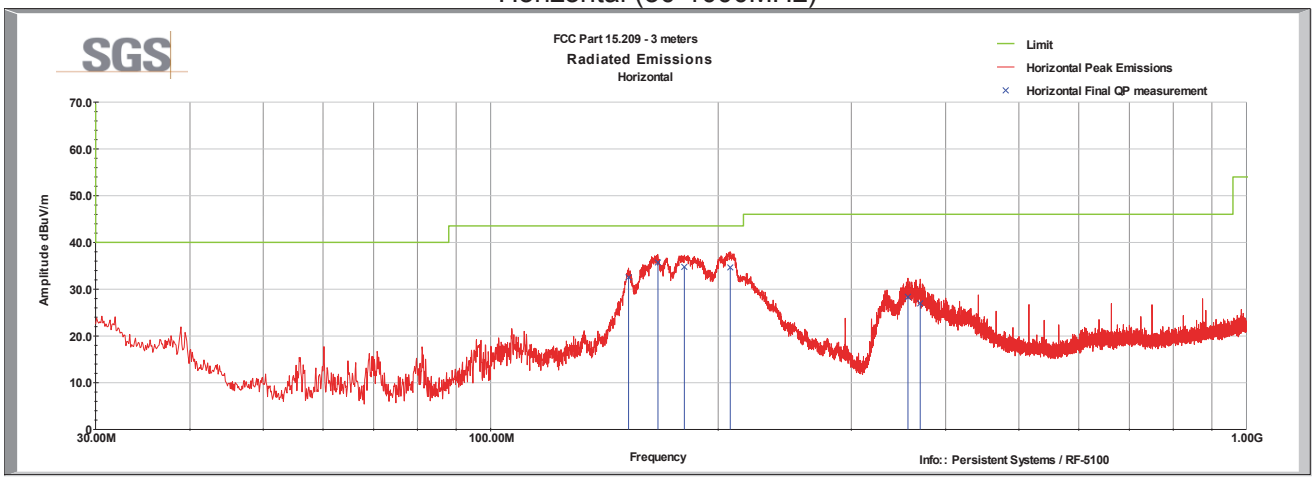
6.9 *Unwanted Emissions – Cabinet Radiation – UNII Band 1*

Channel 36
Vertical (30-1000MHz)



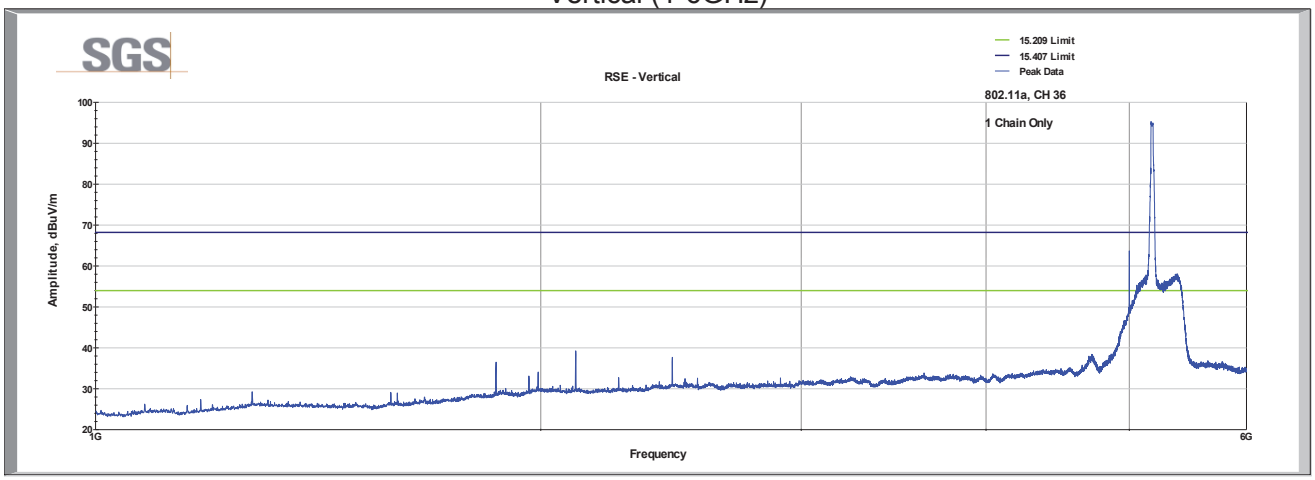
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
38.94	51.6	V	314.0	175.0	15.4	0.5	32.3	35.3	40.0	-4.7
39.50	50.8	V	225.0	175.0	15.1	0.5	32.3	34.1	40.0	-5.9
157.16	58.3	V	33.0	175.0	12.8	1.1	33.7	38.5	43.5	-5.0
169.06	56.4	V	0.0	175.0	12.2	1.2	33.7	36.1	43.5	-7.4
176.28	56.5	V	18.0	175.0	11.4	1.2	33.7	35.4	43.5	-8.1
200.80	55.9	V	0.0	325.0	13.0	1.3	33.6	36.5	43.5	-7.0
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Channel 36
Horizontal (30-1000MHz)



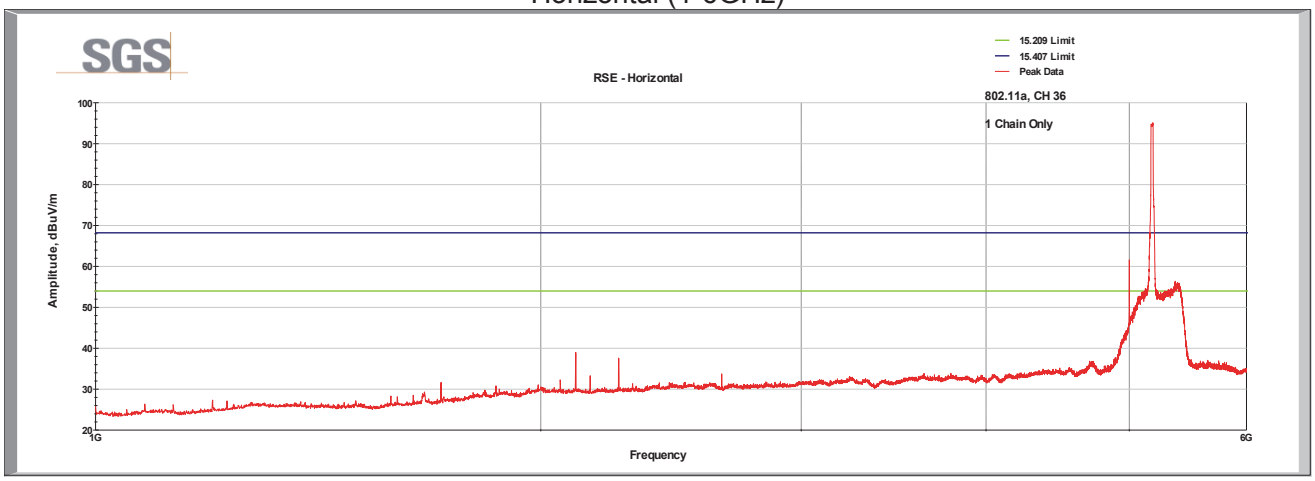
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
152.19	52.3	H	162.0	175.0	12.8	1.1	33.7	32.5	43.5	-11.0
166.44	55.8	H	320.0	175.0	12.5	1.2	33.7	35.7	43.5	-7.8
180.39	56.0	H	325.0	175.0	11.2	1.2	33.7	34.8	43.5	-8.8
207.53	55.6	H	320.0	175.0	11.4	1.3	33.6	34.6	43.5	-8.9
356.60	44.7	H	187.0	175.0	15.5	1.7	33.5	28.4	46.0	-17.7
370.16	43.1	H	180.0	175.0	15.6	1.8	33.5	26.9	46.0	-19.1
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Channel 36
Vertical (1-6GHz)



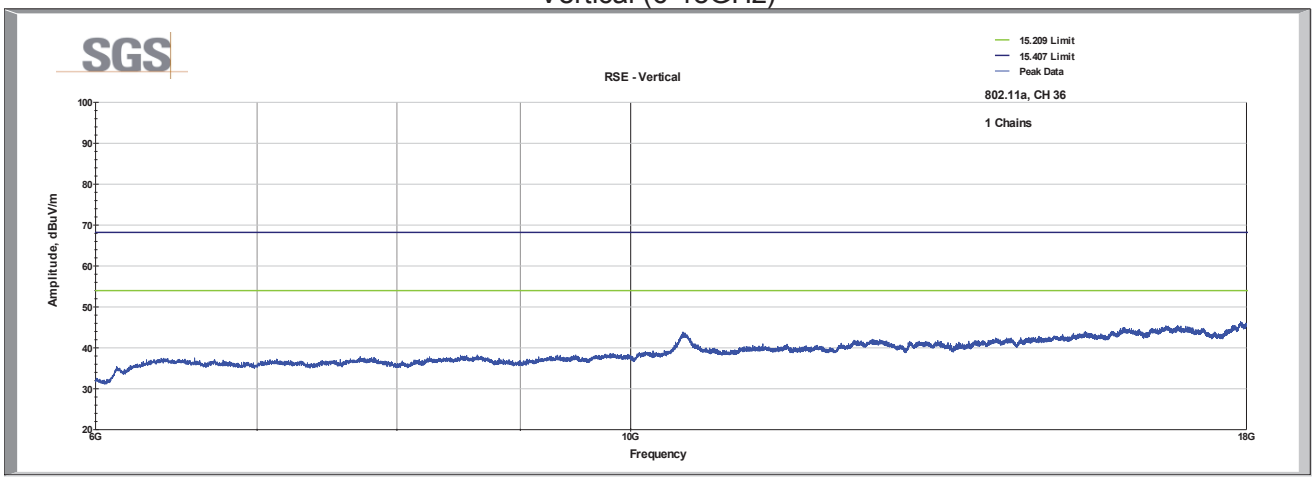
Note: The emission at 5GHz is a digital emission generated during test mode operation. It is not present during normal operation.

Channel 36
Horizontal (1-6GHz)

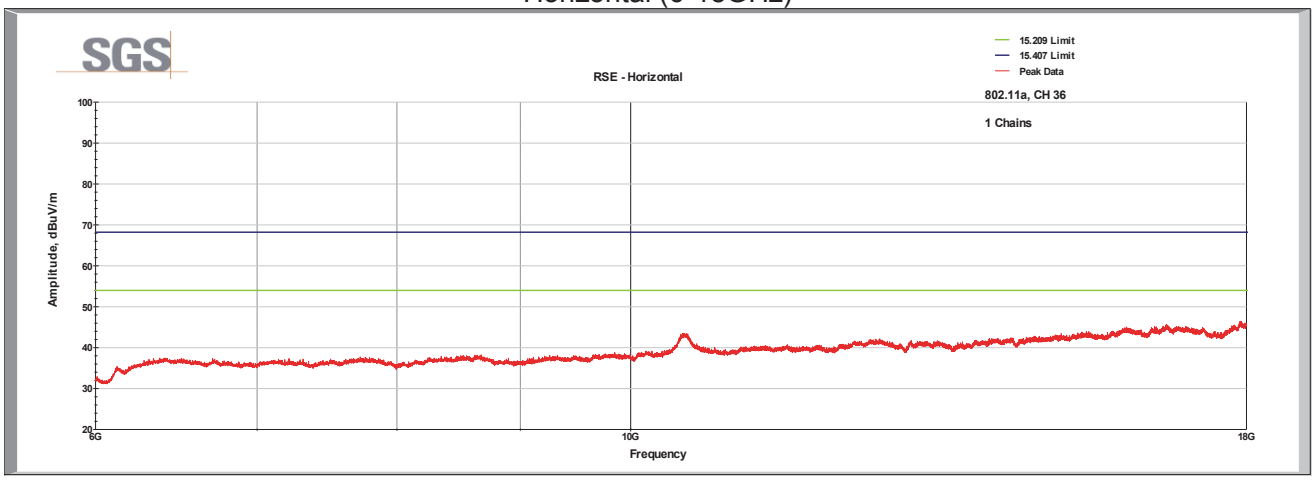


Note: The emission at 5GHz is a digital emission generated during test mode operation. It is not present during normal operation.

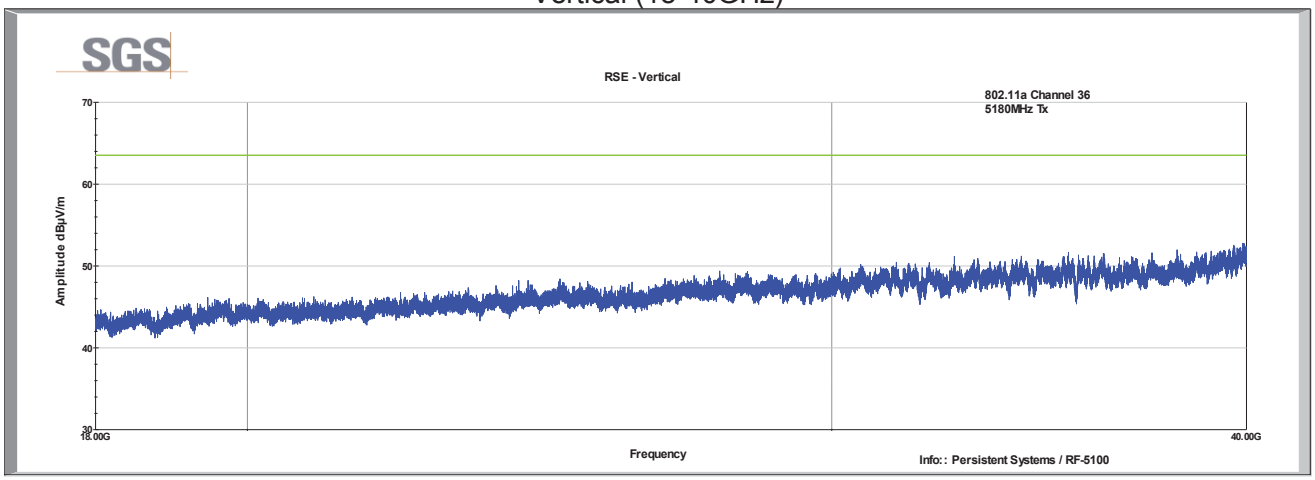
Channel 36
Vertical (6-18GHz)



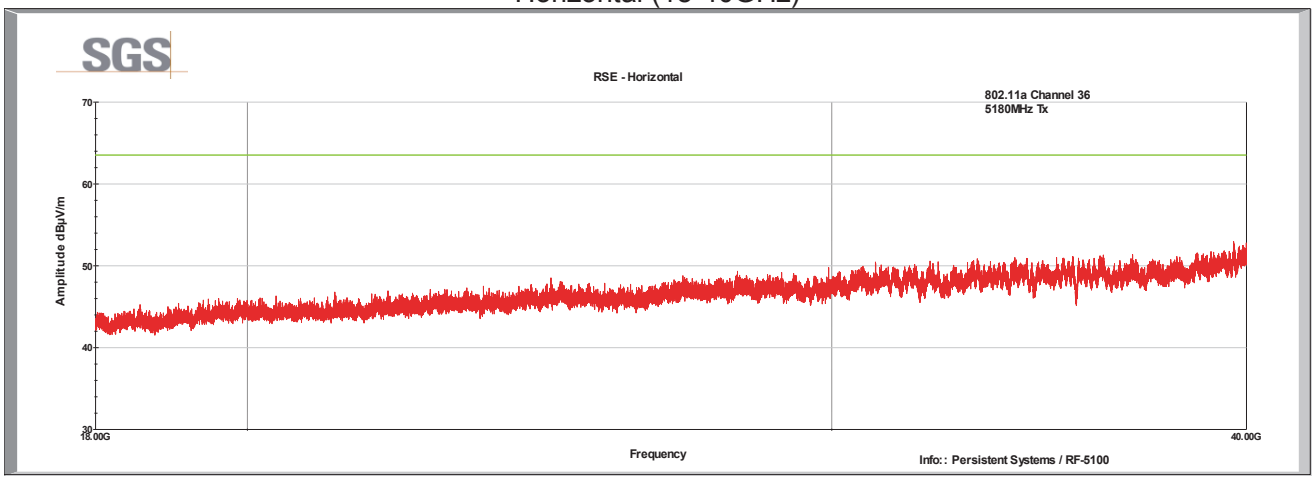
Channel 36
Horizontal (6-18GHz)



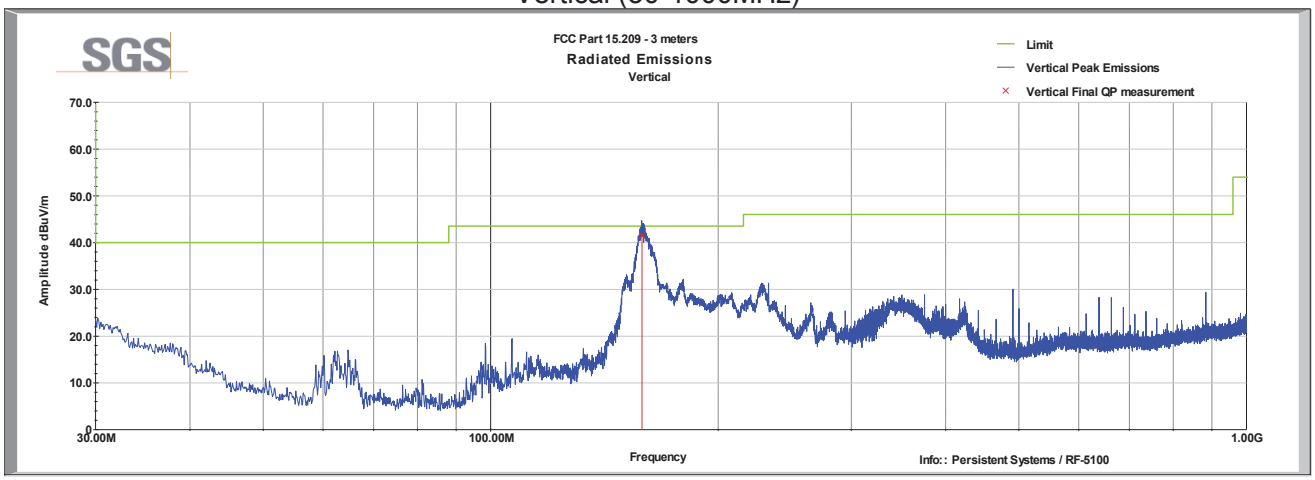
Channel 36
Vertical (18-40GHz)



Channel 36
Horizontal (18-40GHz)

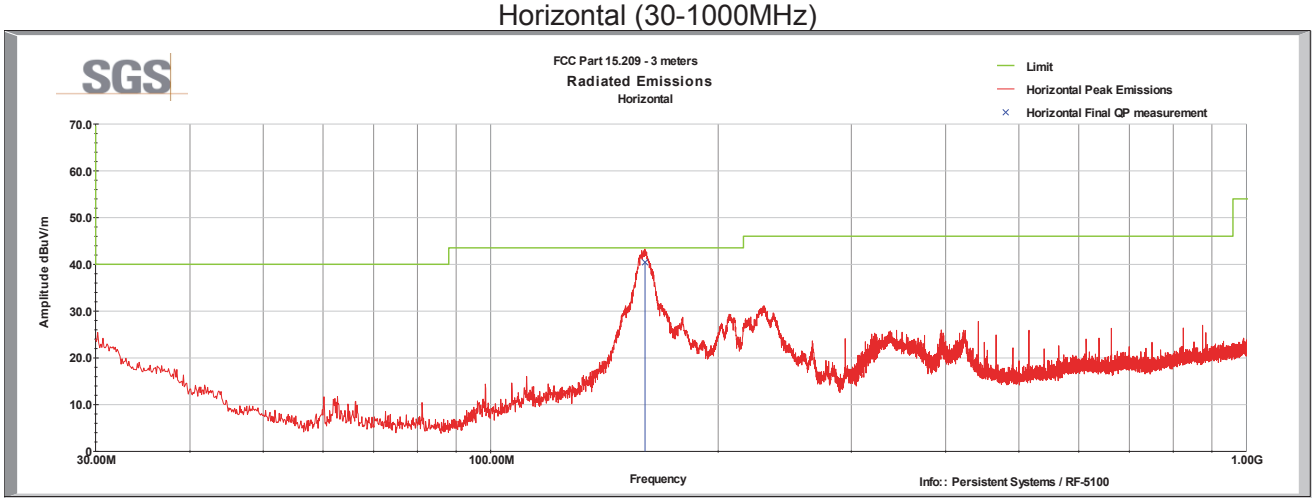


Channel 44
Vertical (30-1000MHz)



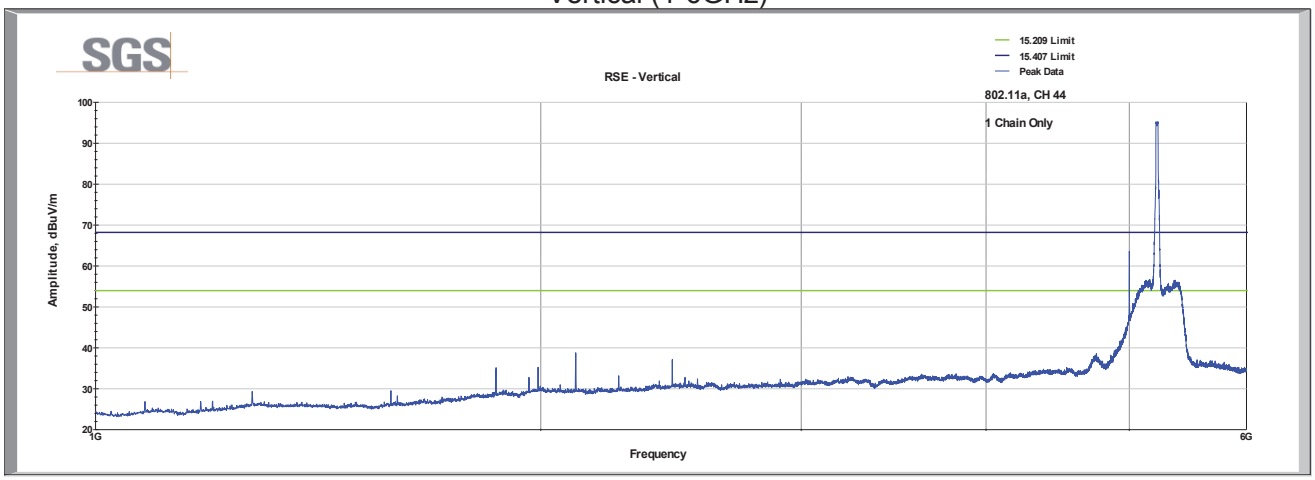
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
158.55	61.3	V	231.0	175.0	12.8	1.1	33.7	41.5	43.5	-2.0
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Channel 44
Horizontal (30-1000MHz)



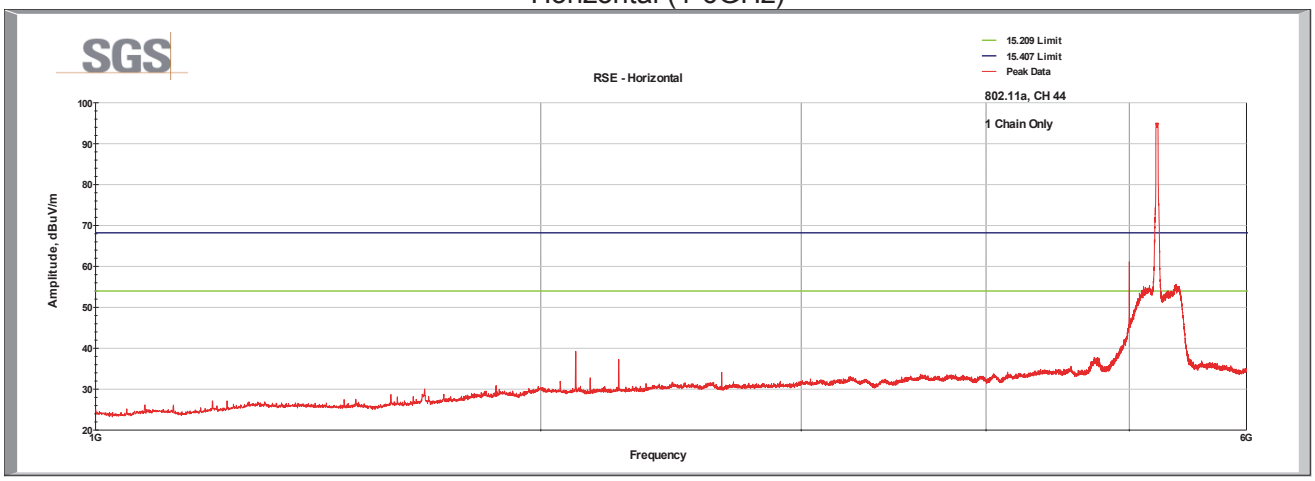
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
160.06	60.2	H	135.0	175.0	12.8	1.1	33.7	40.4	43.5	-3.1
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Channel 44
Vertical (1-6GHz)



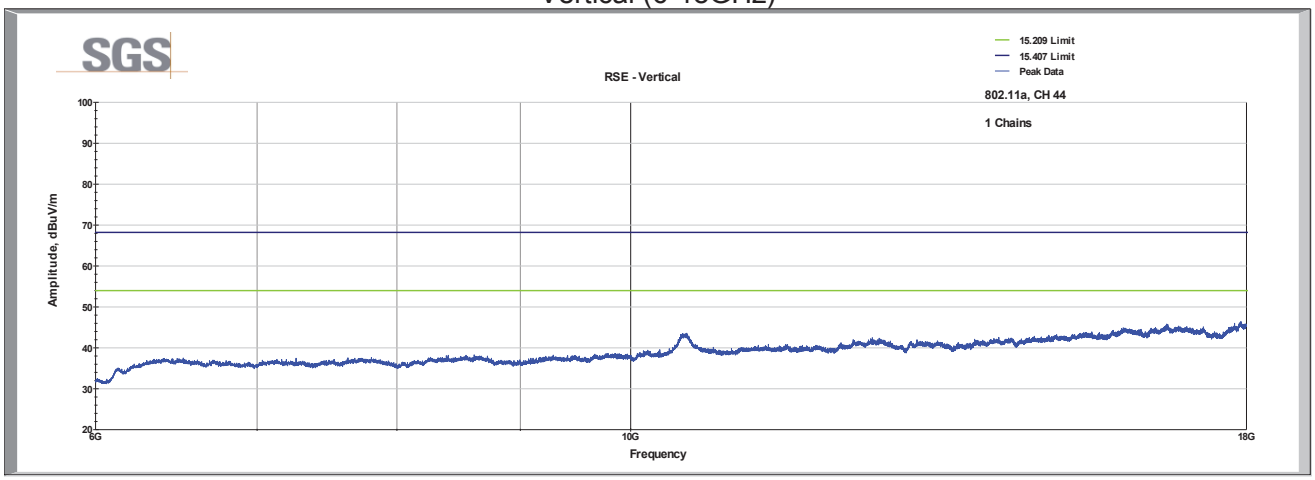
Note: The emission at 5GHz is a digital emission generated during test mode operation. It is not present during normal operation.

Channel 44
Horizontal (1-6GHz)

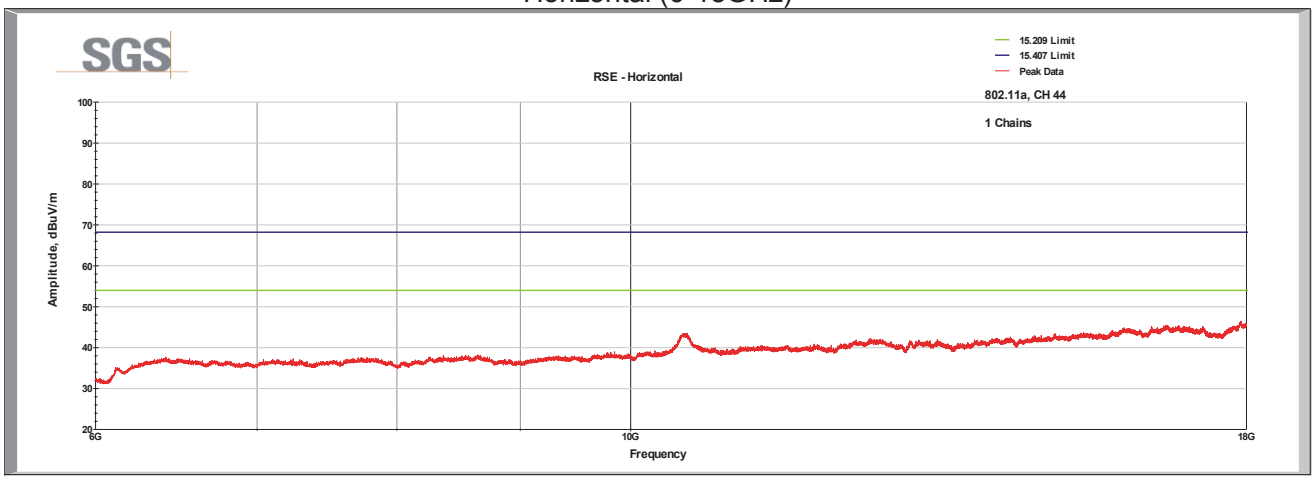


Note: The emission at 5GHz is a digital emission generated during test mode operation. It is not present during normal operation.

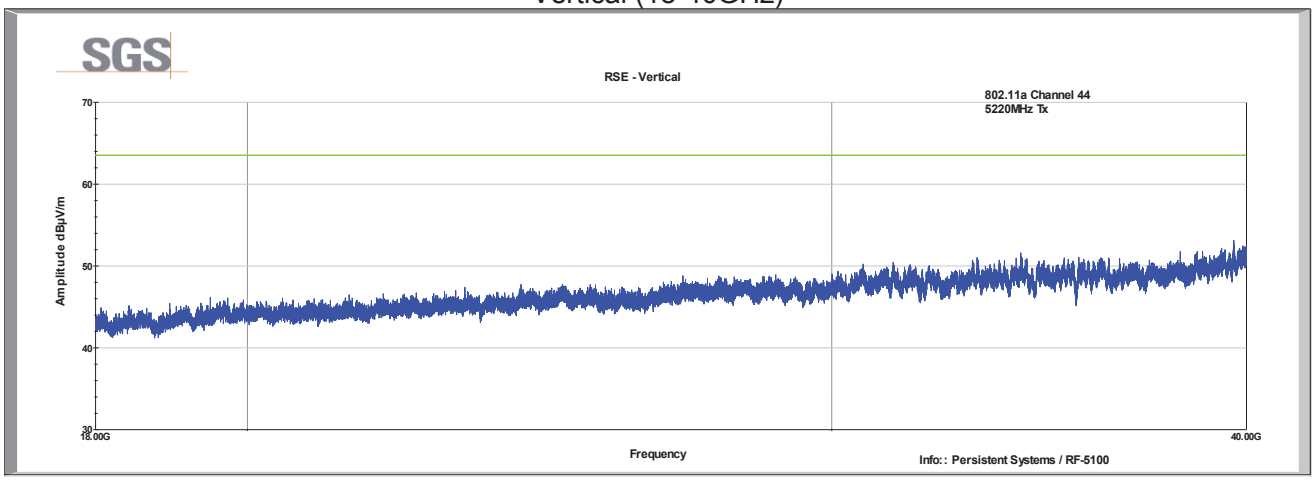
Channel 44
Vertical (6-18GHz)



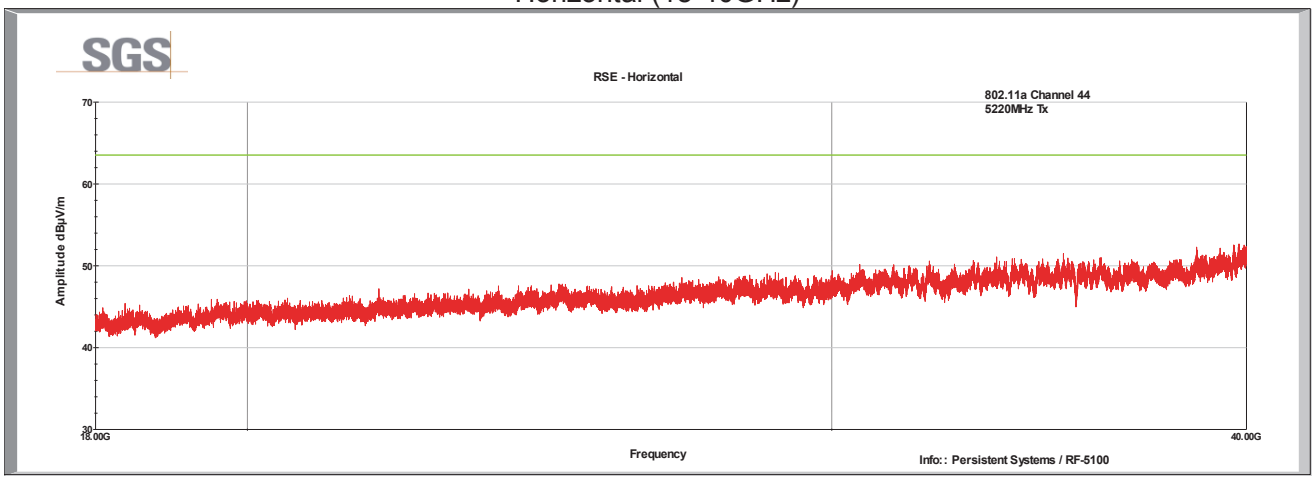
Channel 44
Horizontal (6-18GHz)



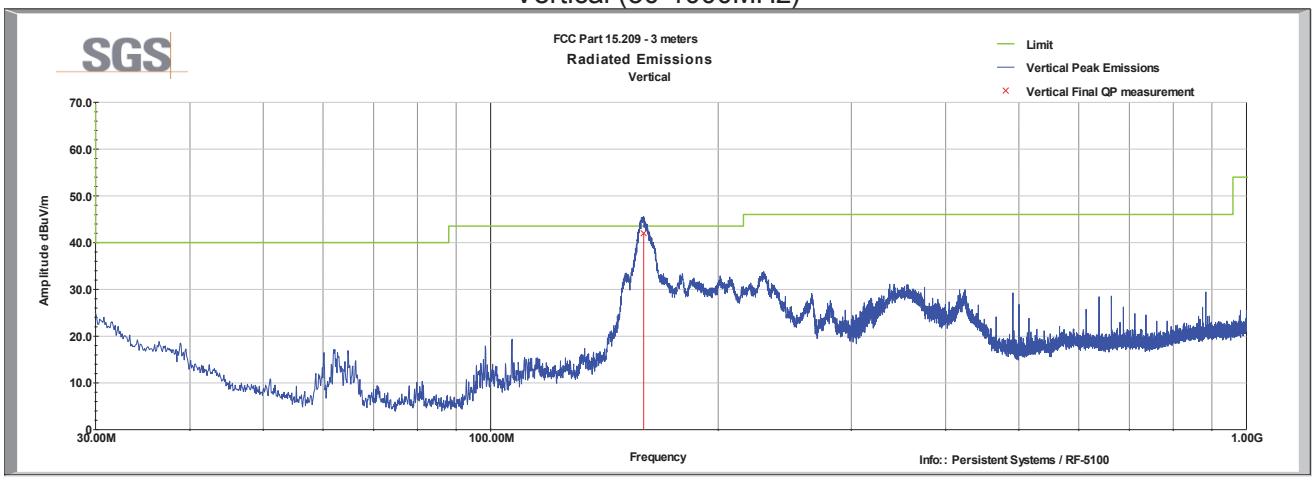
Channel 44
Vertical (18-40GHz)



Channel 44
Horizontal (18-40GHz)

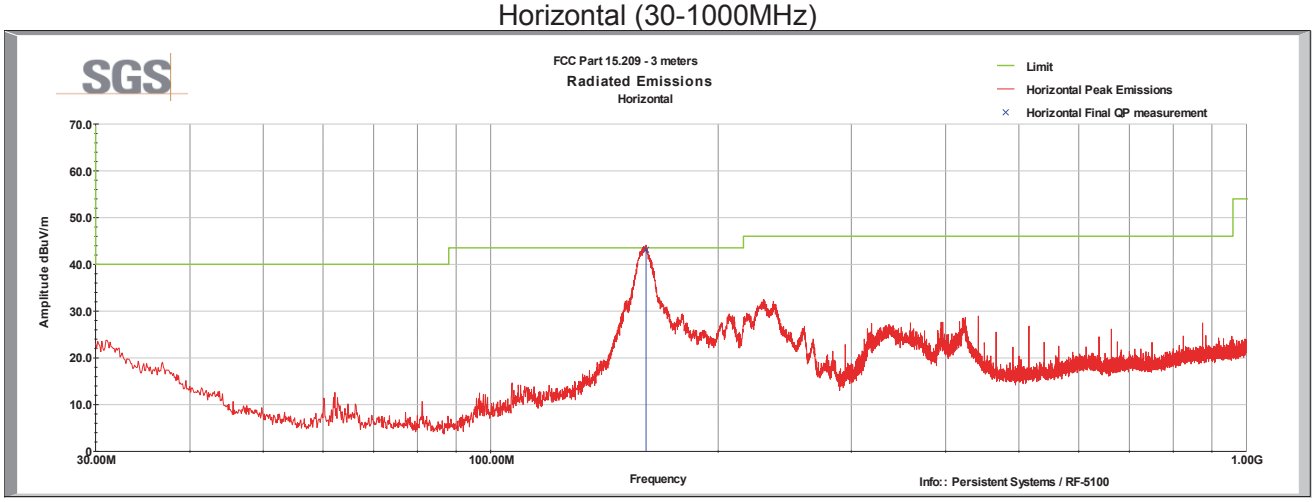


Channel 48
Vertical (30-1000MHz)



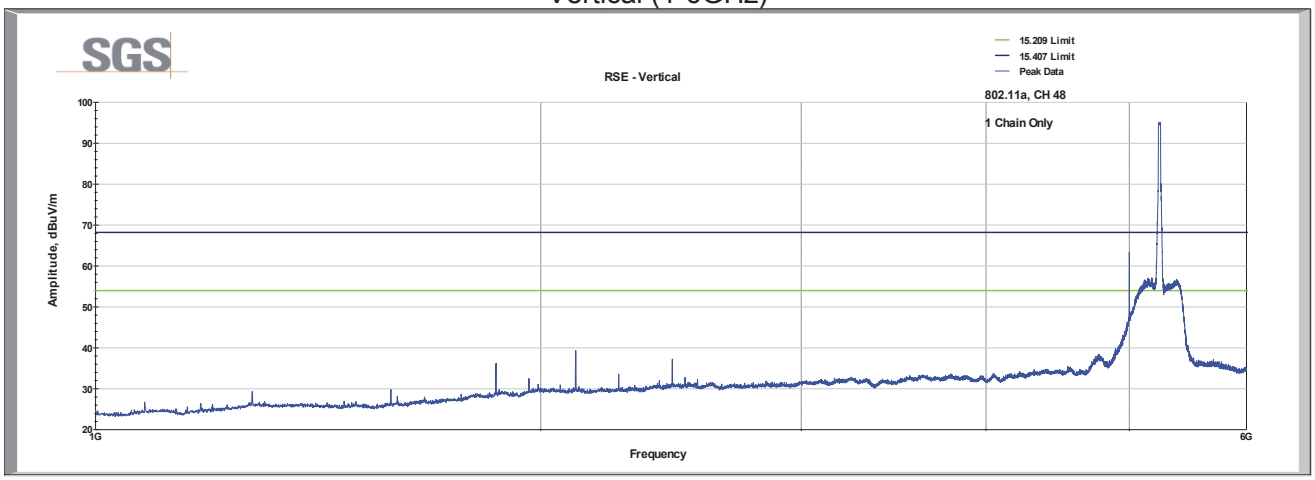
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
159.39	61.7	V	219.0	175.0	12.8	1.1	33.7	42.0	43.5	-1.5
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Channel 48
Horizontal (30-1000MHz)



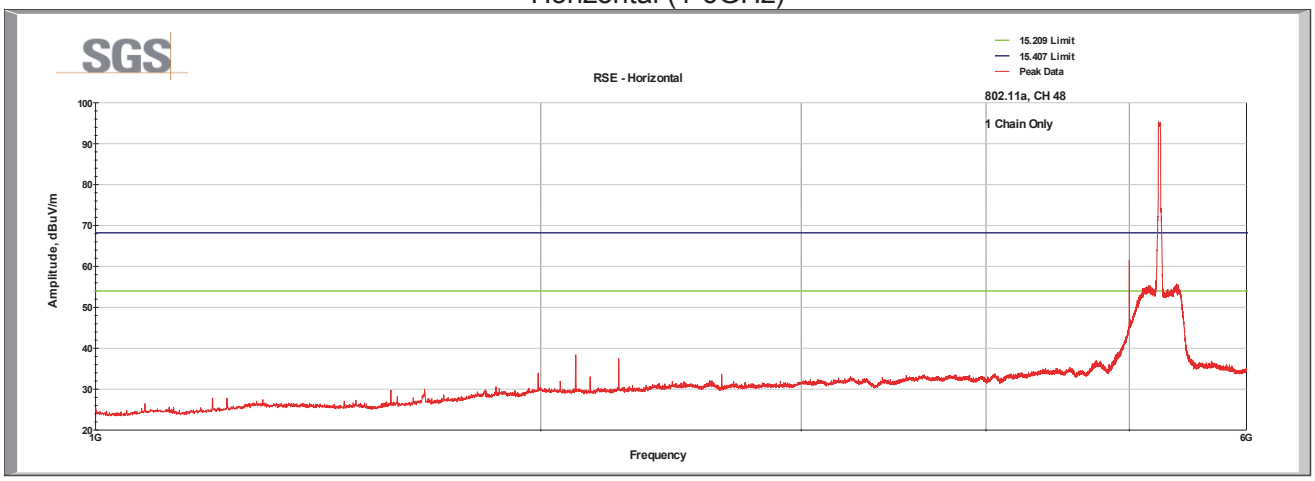
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
160.56	62.9	H	305.0	325.0	12.8	1.1	33.7	43.1	43.5	-0.4
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Channel 48
Vertical (1-6GHz)



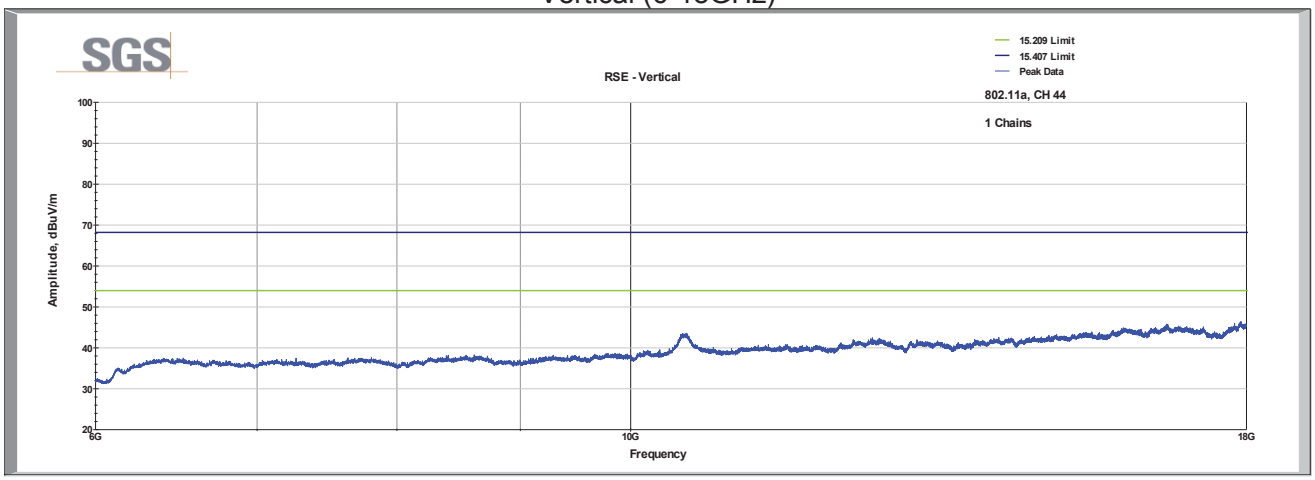
Note: The emission at 5GHz is a digital emission generated during test mode operation. It is not present during normal operation.

Channel 48
Horizontal (1-6GHz)

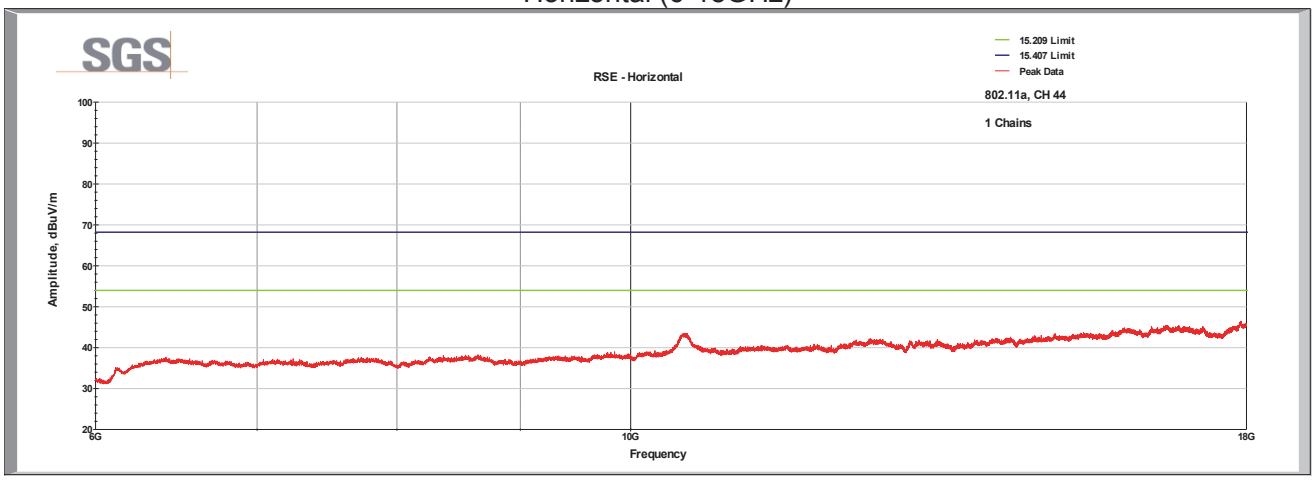


Note: The emission at 5GHz is a digital emission generated during test mode operation. It is not present during normal operation.

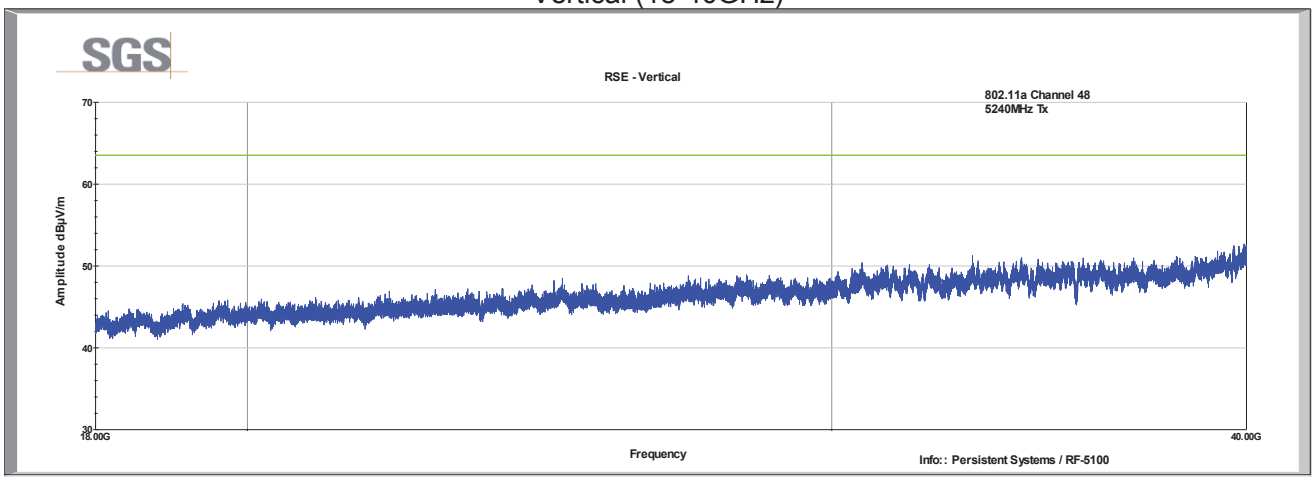
Channel 48
Vertical (6-18GHz)



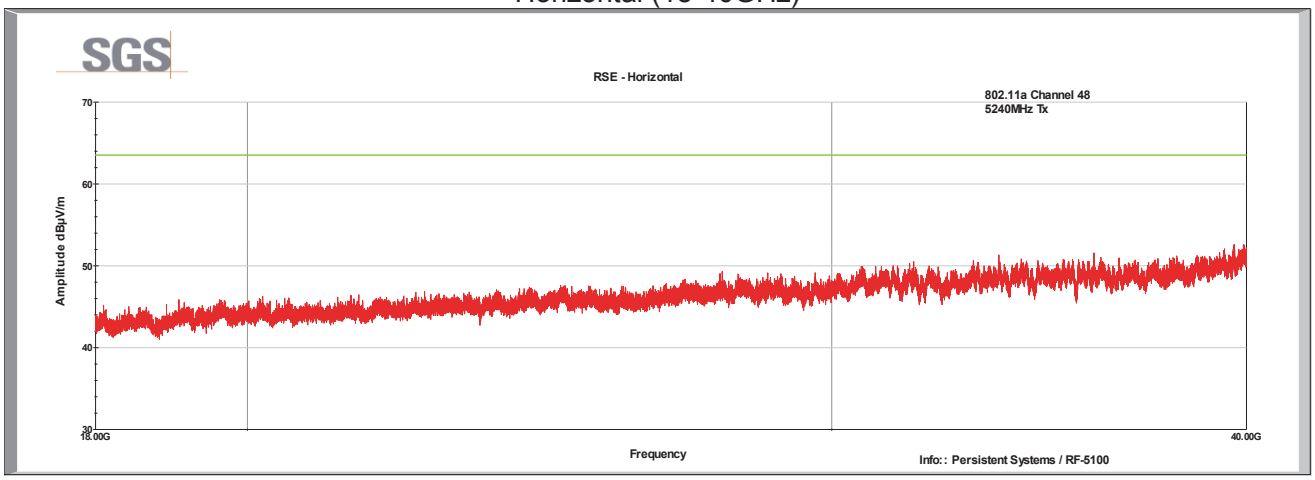
Channel 48
Horizontal (6-18GHz)



Channel 48
Vertical (18-40GHz)

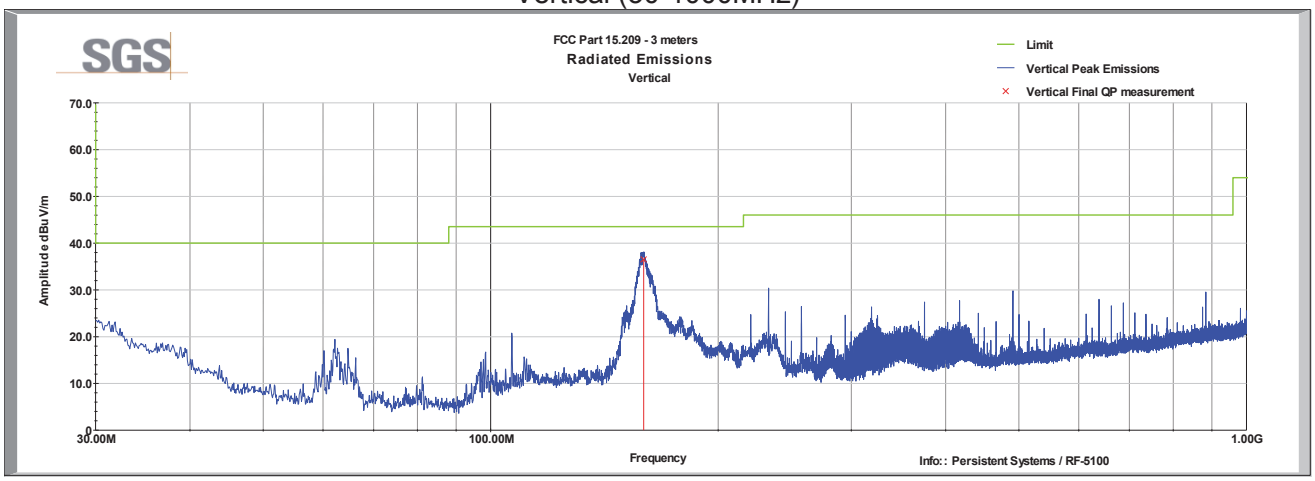


Channel 48
Horizontal (18-40GHz)



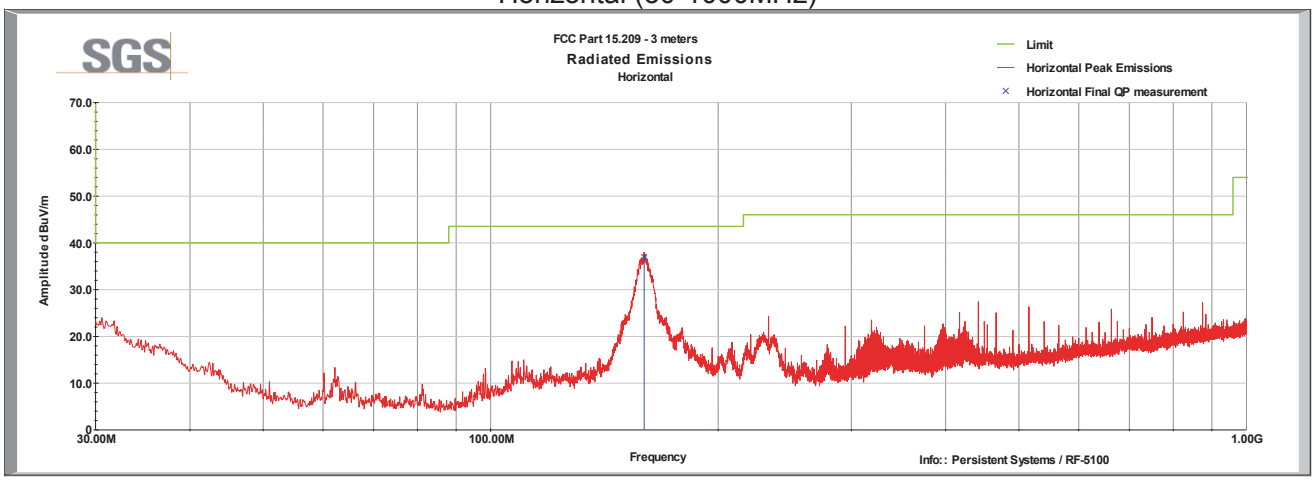
6.10 *Unwanted Emissions – Cabinet Radiation – UNII Band 3*

Channel 149
Vertical (30-1000MHz)



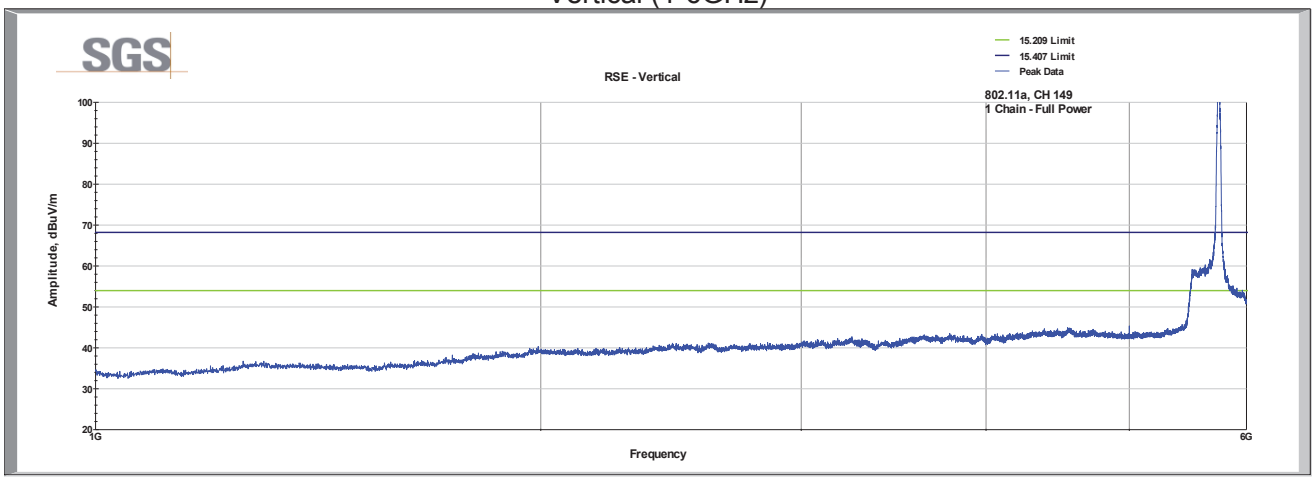
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
159.39	56.3	V	261.0	175.0	12.8	1.1	33.7	36.5	43.5	-7.0
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Channel 149
Horizontal (30-1000MHz)

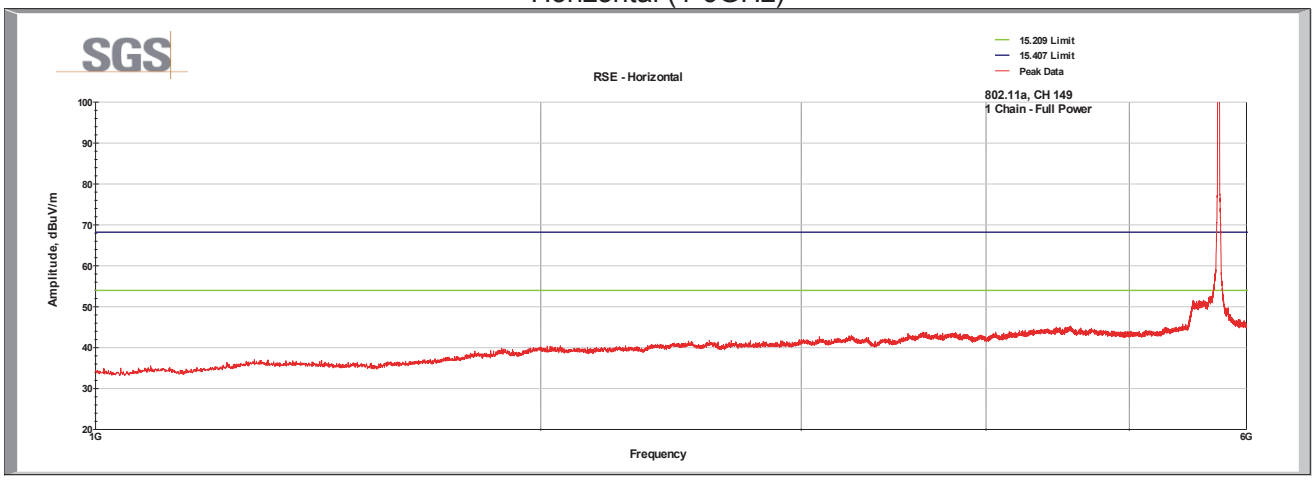


Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
159.60	56.7	H	151.0	325.0	12.8	1.1	33.7	36.9	43.5	-6.6
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

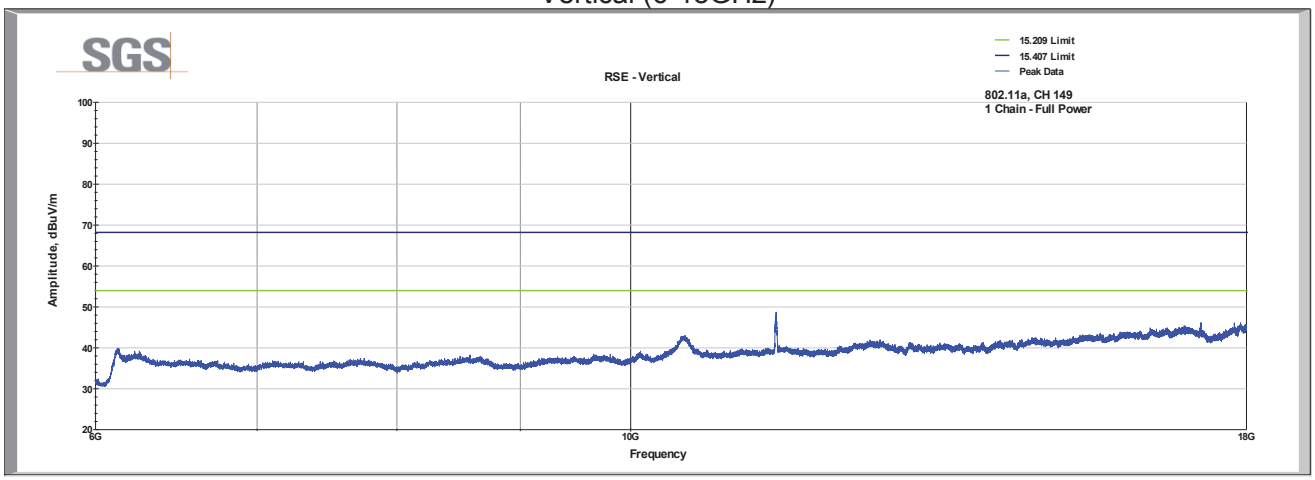
Channel 149
Vertical (1-6GHz)



Channel 149
Horizontal (1-6GHz)

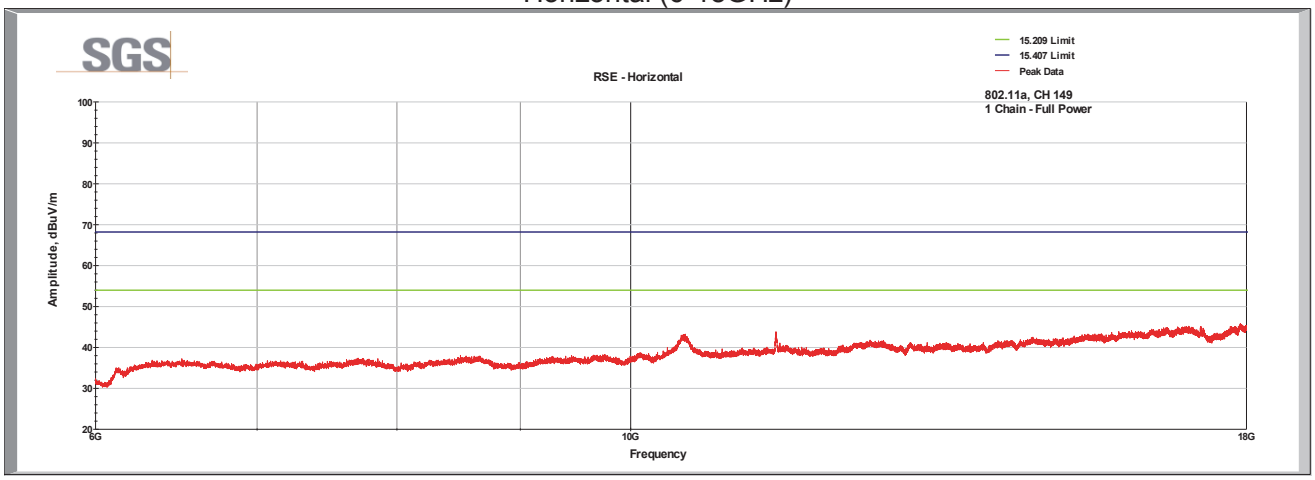


Channel 149
Vertical (6-18GHz)

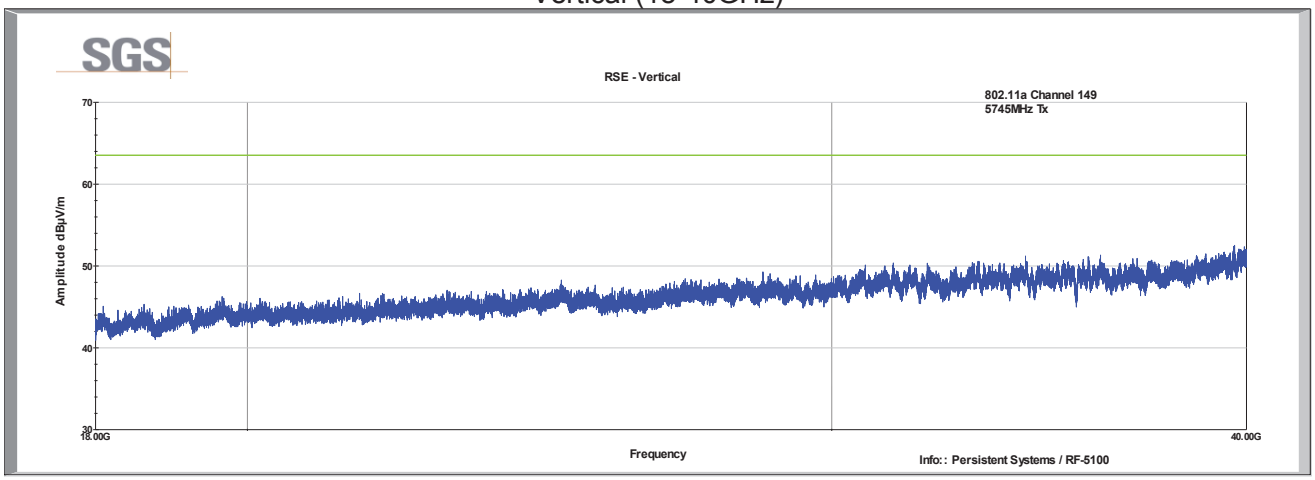


Worst-case spur: 47.5dBµV/m Peak @ 11490MHz (7.5dB below AVG limit)

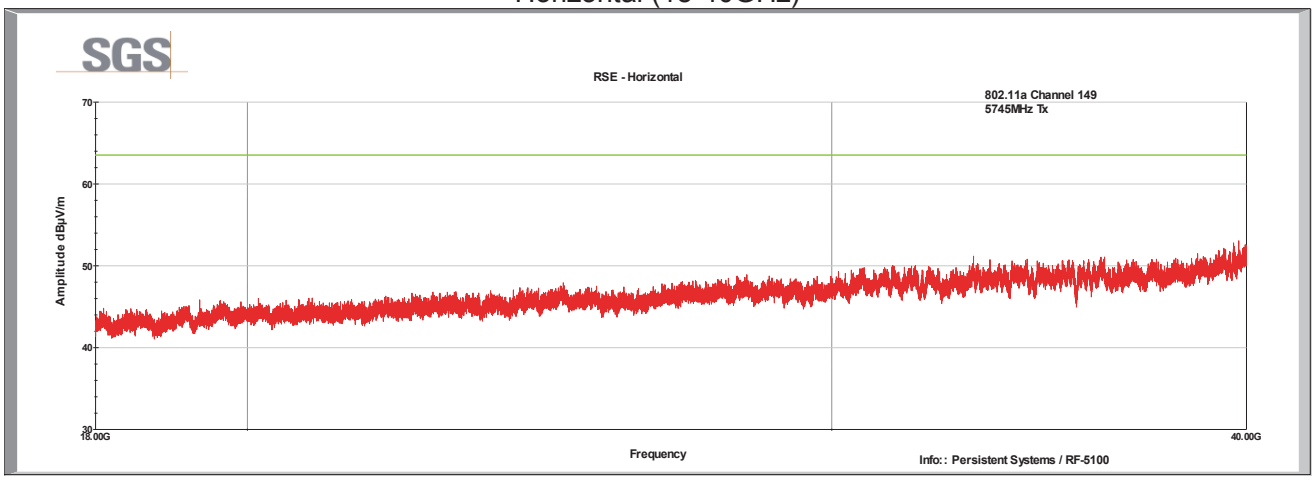
Channel 149
Horizontal (6-18GHz)



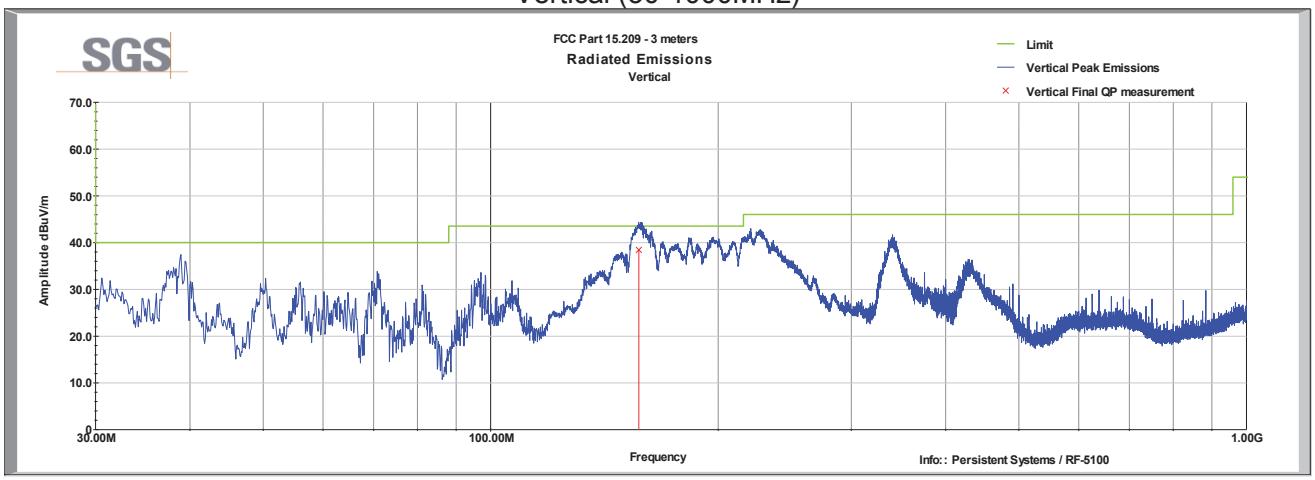
Channel 149
Vertical (18-40GHz)



Channel 149
Horizontal (18-40GHz)

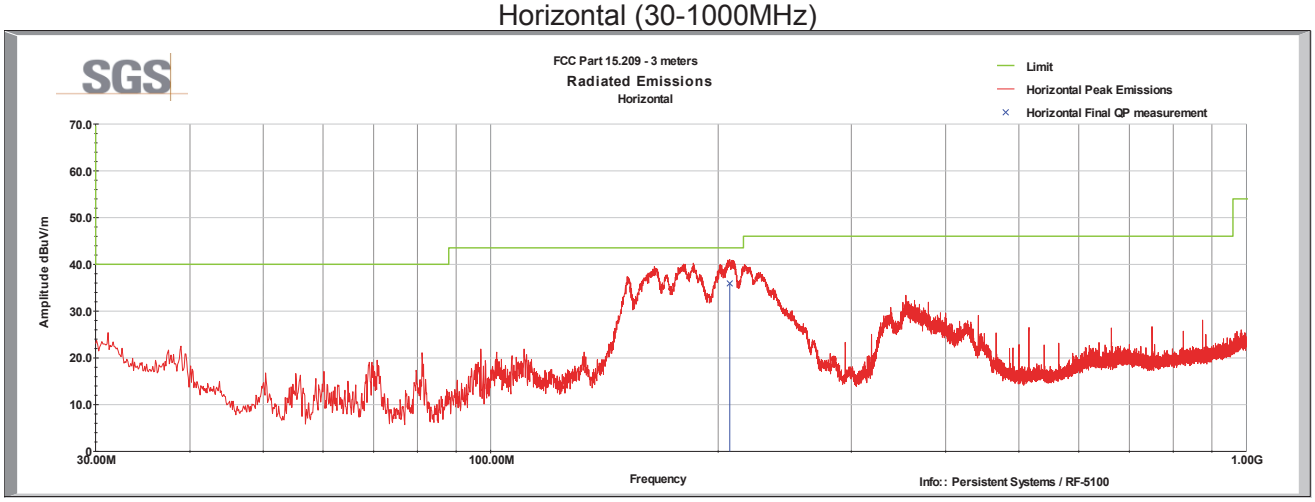


Channel 157
Vertical (30-1000MHz)



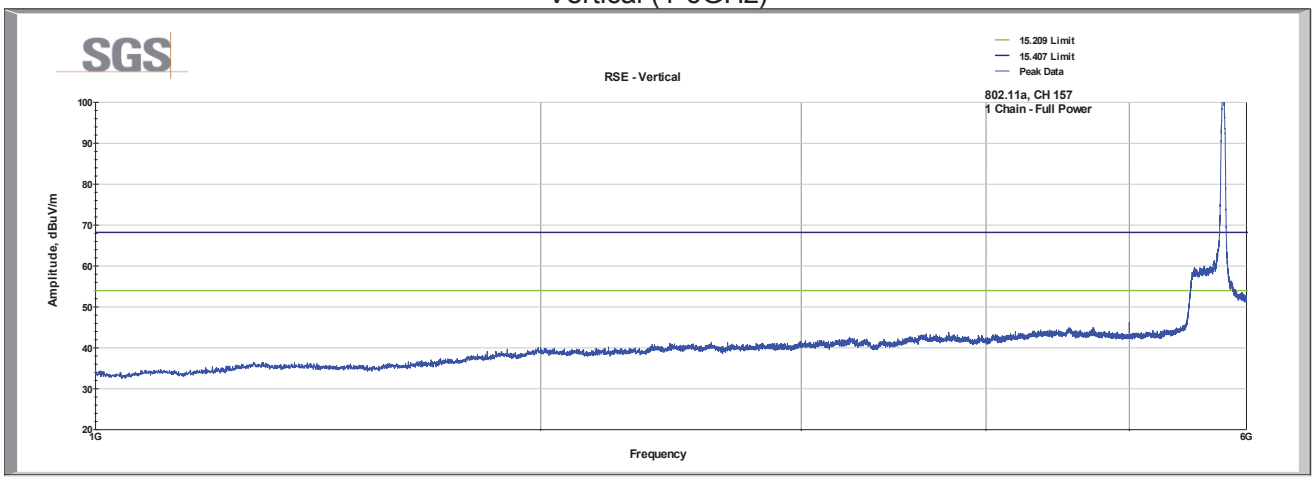
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
157.03	58.2	V	51.0	175.0	12.8	1.1	33.7	38.4	43.5	-5.1
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Channel 157
Horizontal (30-1000MHz)

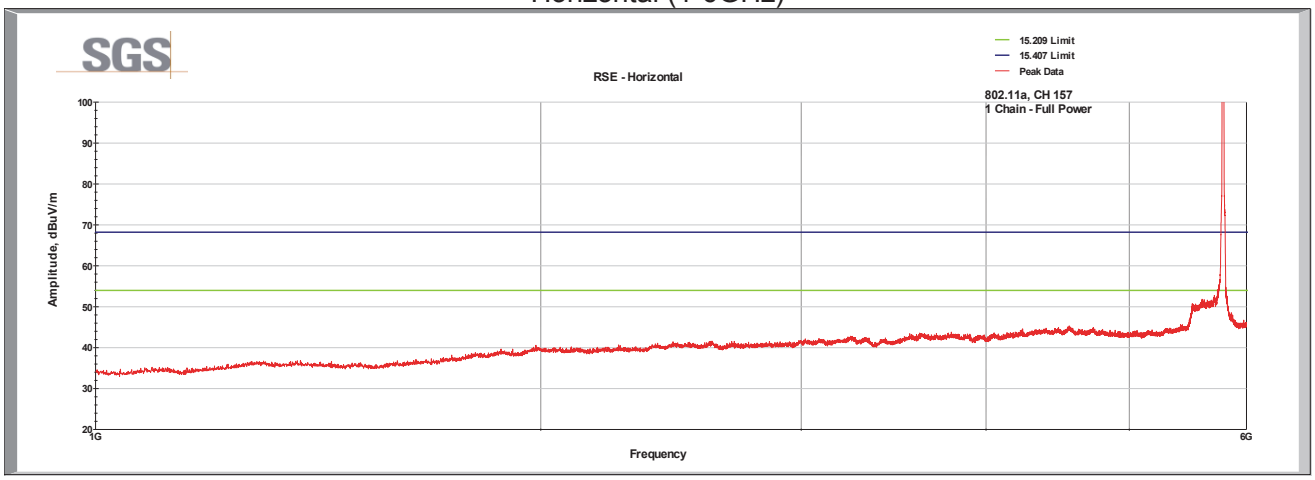


Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
207.21	56.8	H	335.0	175.0	11.5	1.3	33.6	35.9	43.5	-7.6
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

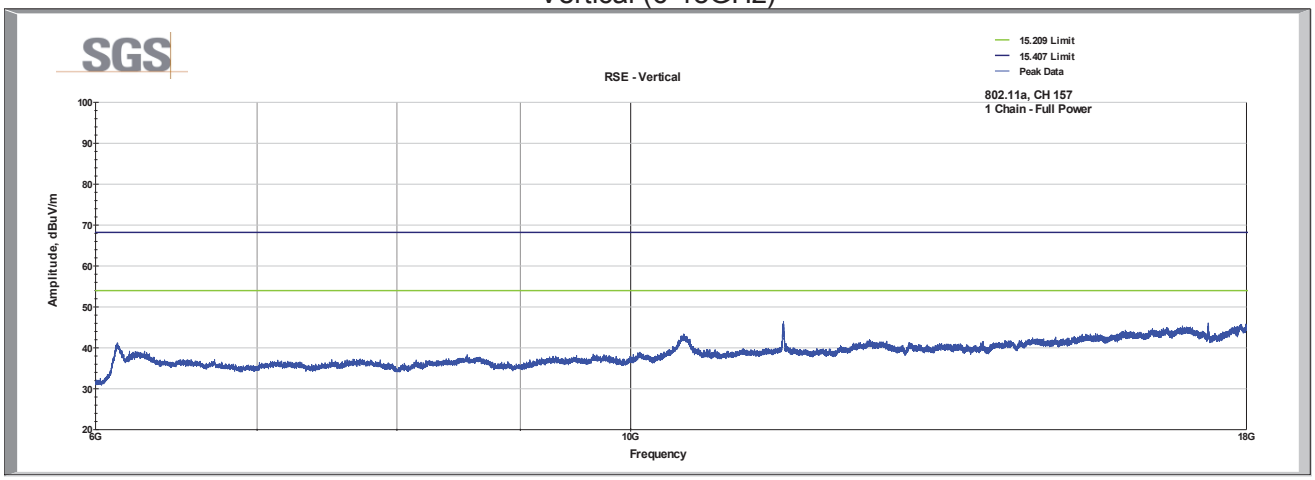
Channel 157
Vertical (1-6GHz)



Channel 157
Horizontal (1-6GHz)

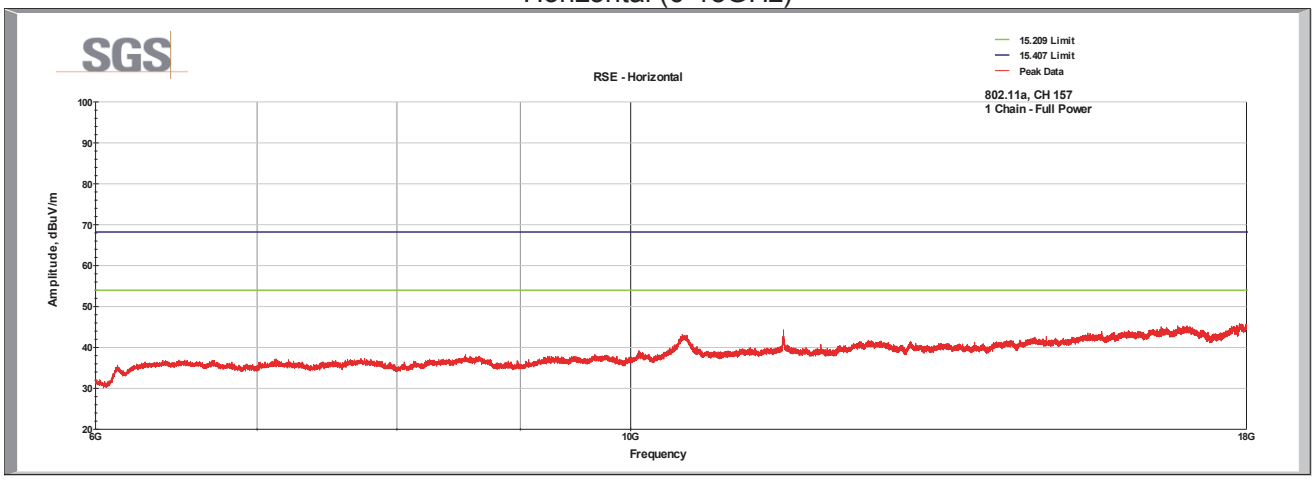


Channel 157
Vertical (6-18GHz)



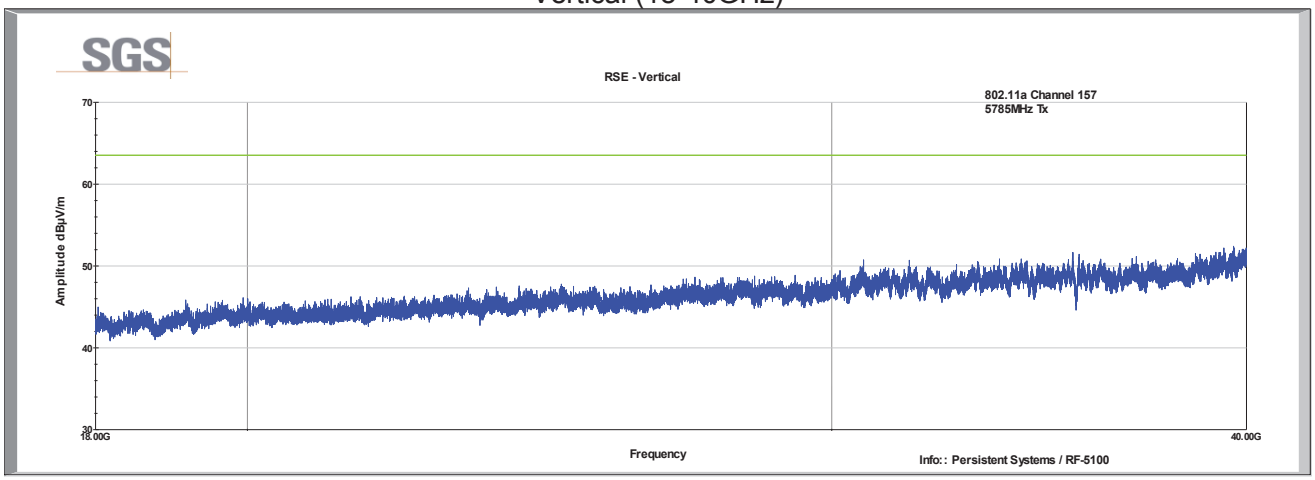
Worst-case spur: 46.5dBµV/m Peak @ 11570MHz (8.5dB below AVG limit)

Channel 157
Horizontal (6-18GHz)

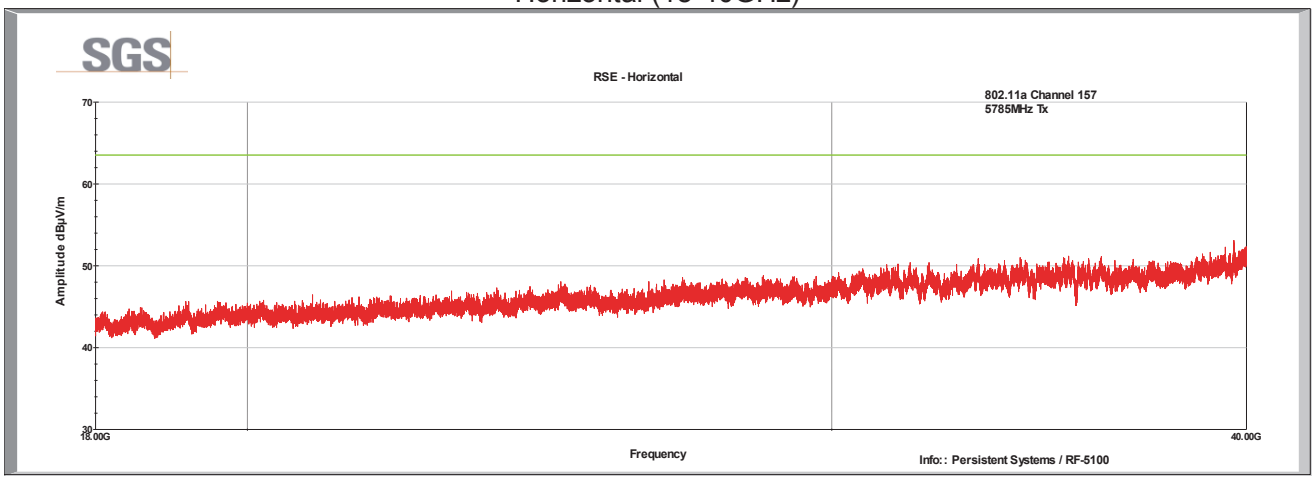


Worst-case spur: 44.2dBµV/m Peak @ 11570MHz (9.8dB below AVG limit)

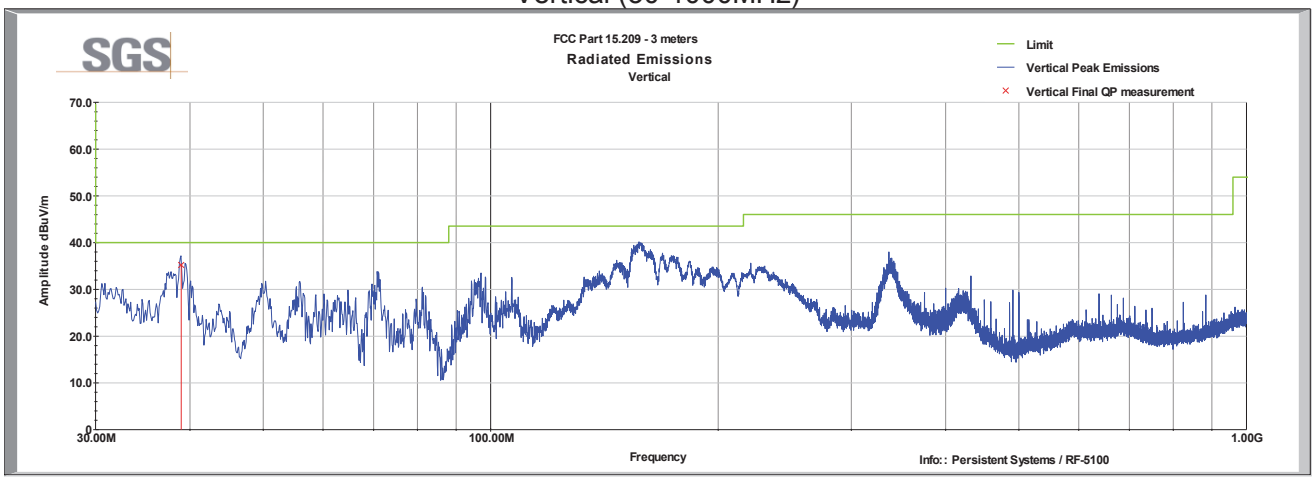
Channel 157
Vertical (18-40GHz)



Channel 157
Horizontal (18-40GHz)

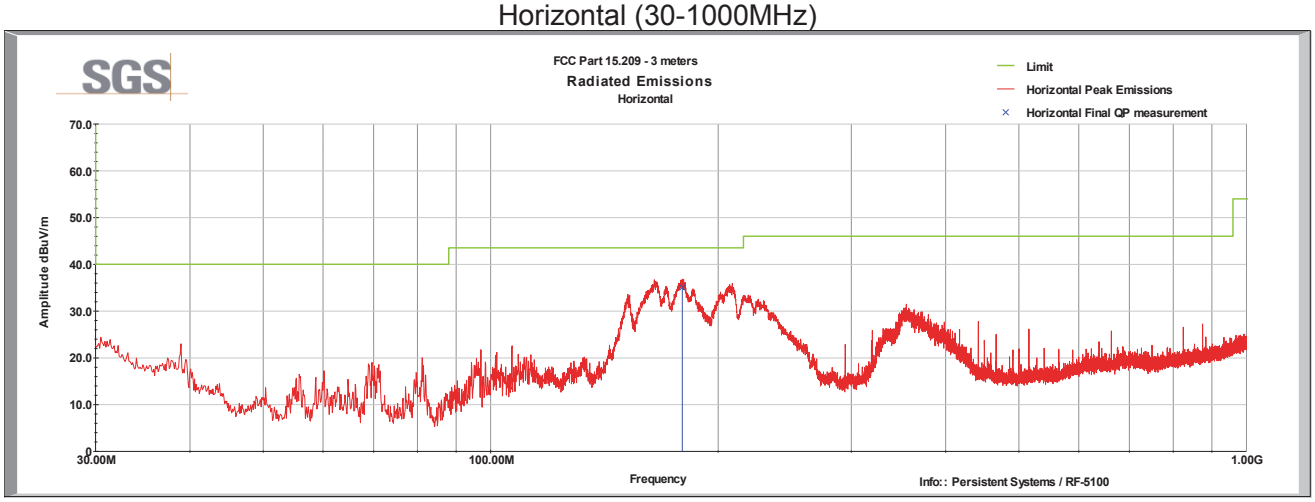


Channel 165
Vertical (30-1000MHz)



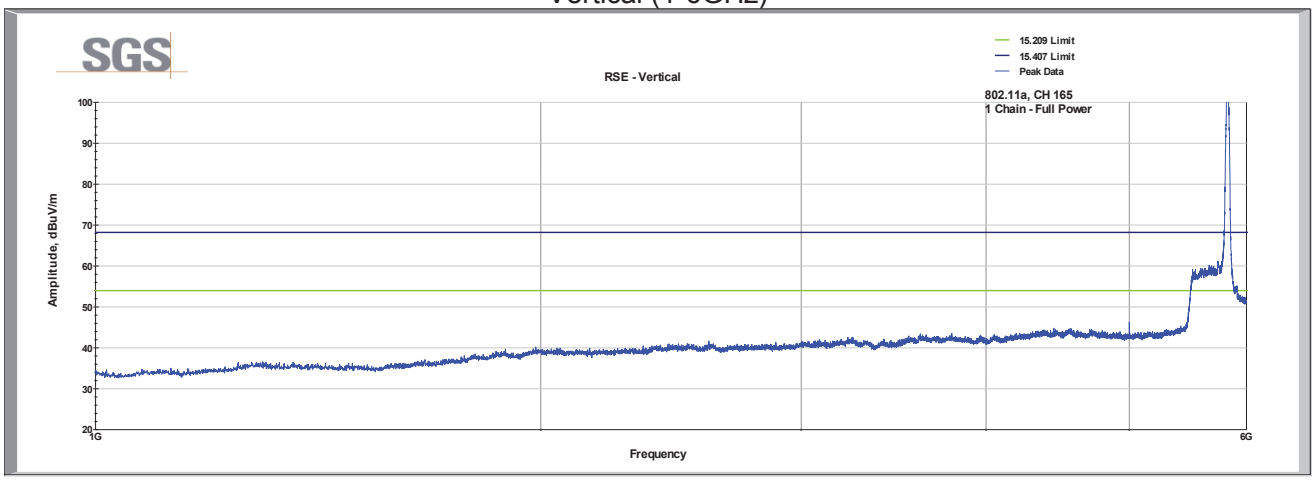
Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
38.94	51.5	V	13.0	175.0	15.4	0.5	32.3	35.2	40.0	-4.8
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Channel 165
Horizontal (30-1000MHz)

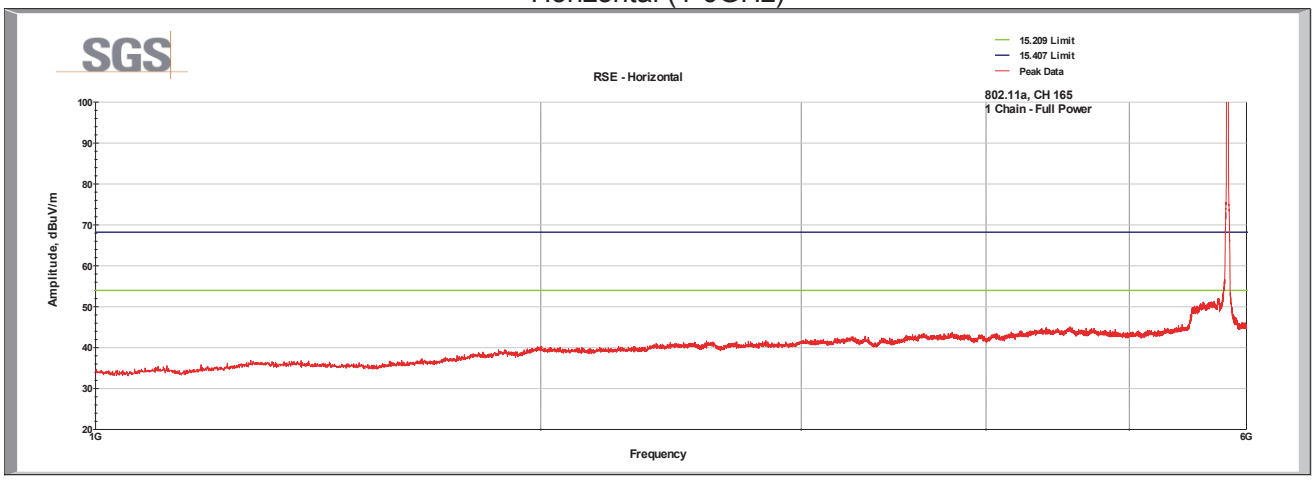


Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
179.28	56.3	H	141.0	175.0	11.2	1.2	33.7	35.1	43.5	-8.5
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

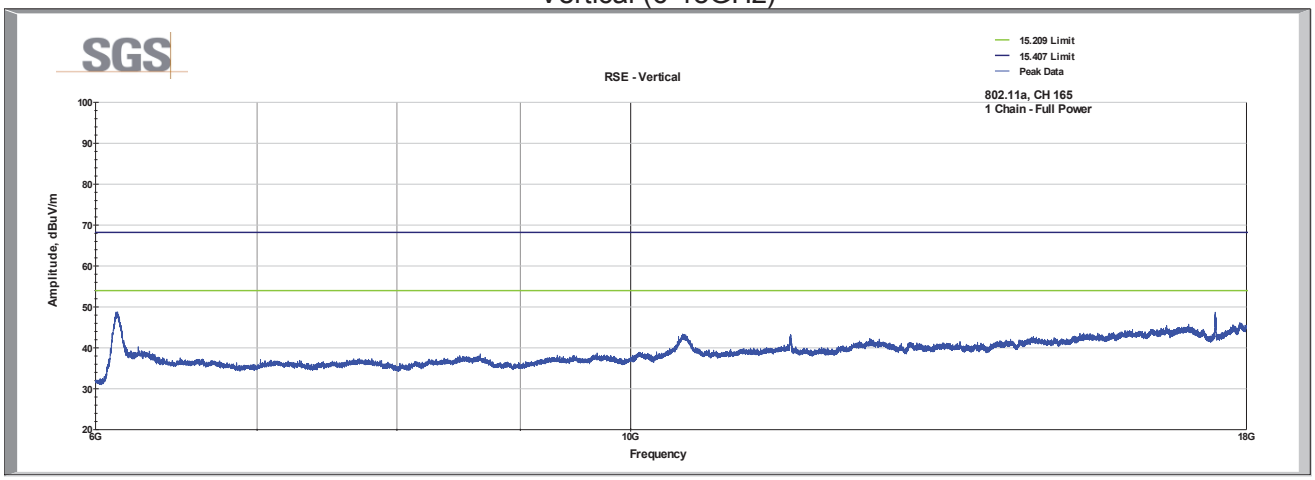
Channel 165
Vertical (1-6GHz)



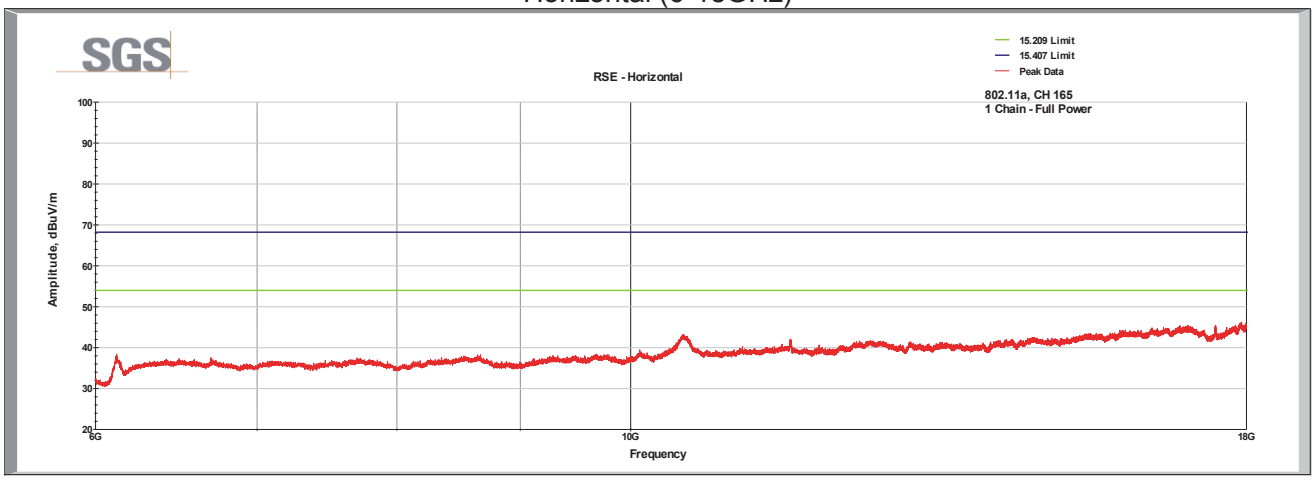
Channel 165
Horizontal (1-6GHz)



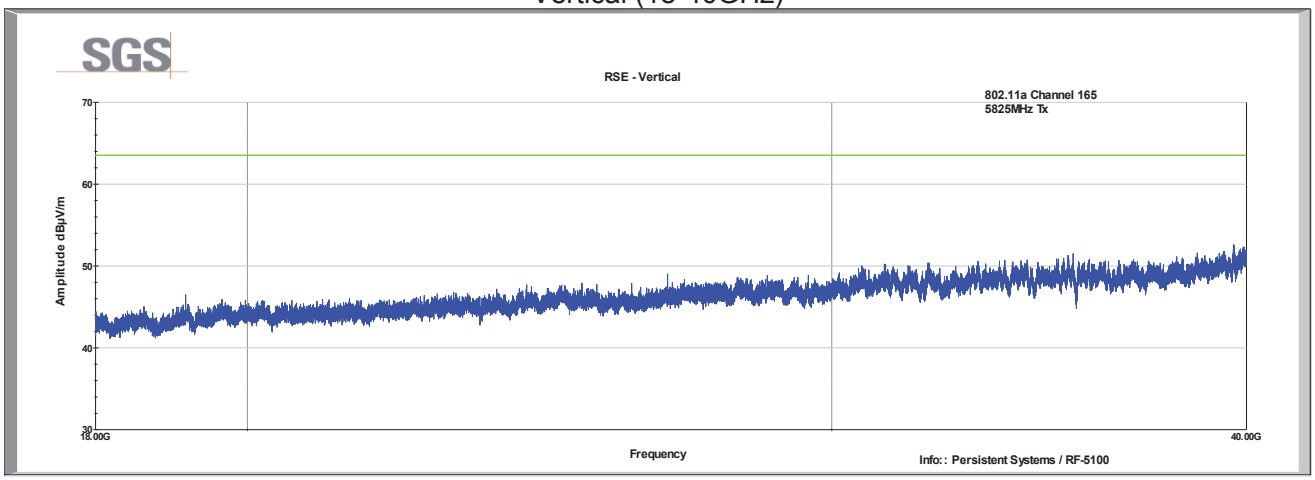
Channel 165
Vertical (6-18GHz)



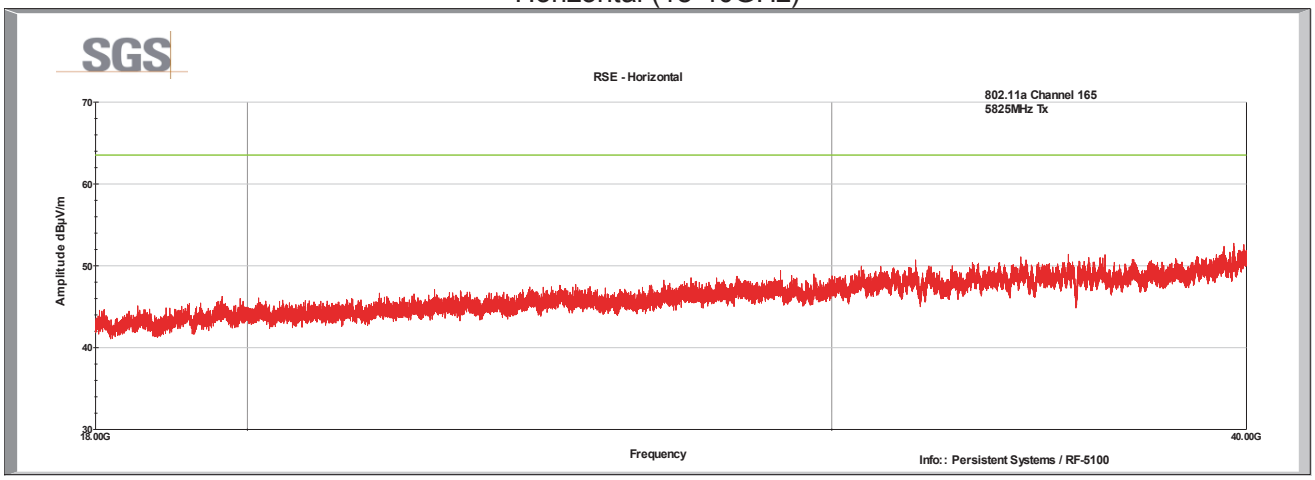
Channel 165
Horizontal (6-18GHz)



Channel 165
Vertical (18-40GHz)



Channel 165
Horizontal (18-40GHz)



8 Revision History

Revision Level	Description of changes	Revision Date
--	Initial release	26 March 2018
1	Removed reference to HT40 on page 4.	3 August 2018