EMC Test Report

Project Number: 3899336

Report Number: 3899336EMC01 **Revision Level:** 1

Client: Persistent Systems, LLC

Equipment Under Test: 3x3 MIMO 2.4GHz WLAN Module

Model Number: RF-2100

FCC ID: 2AG3J-RF2100

IC ID: 20698-RF2100

Applicable Standards: FCC Part 15 Subpart C, § 15.247

RSS-247, Issue 1, May 2015

RSS-GEN, Issue 4, November 2014

ANSI C63.10: 2013

ANSI C63.4: 2014

Report issued on: 11 January 2016

Test Result: Compliant

Tested by: _____
Jeremy O. Pickens, Senior EMC Engineer

Reviewed by: _____
David Schramm, EMC/RF/SAR/HAC Manager

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
Bandwidth	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant
Transmitter Output Power	15.247(b) (3)	RSS-247 S5.4 (4)	Compliant
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant
Conducted Spurious Emissions / Restricted Bands	15.247(d), 15.35(b),15.209	RSS-247 S5.5 RSS-GEN S8.10	Compliant
Radiated Spurious Emissions	ANSI C63.10 S11.12.2.7	ANSI C63.10 S11.12.2.7	Compliant
AC Powerline Conducted Emission	15.107, 15.207	RSS-GEN S7.2.4	N/A

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

2.1 *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

2.2 *General Information of EUT*

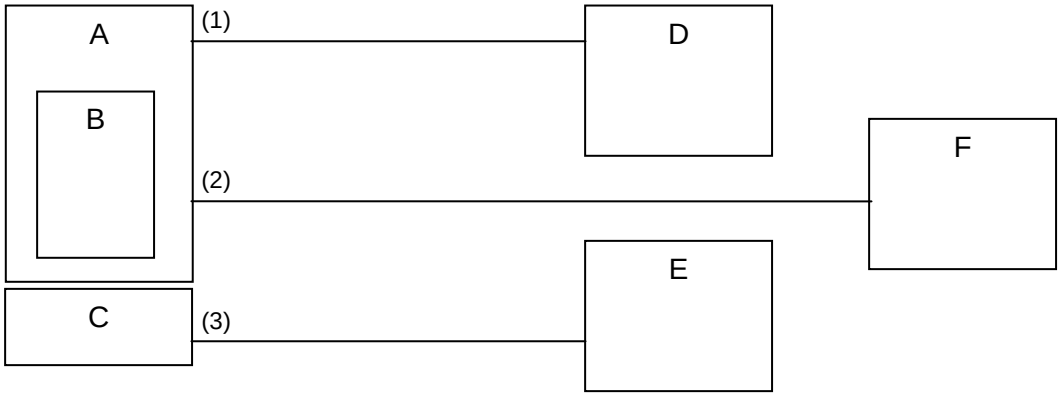
Type of Product:	3x3 MIMO 2.4GHz WLAN Module
Model:	RF-2100
Serial Number:	504
Frequency Range:	2400-2483.5MHz
Data Modes:	802.11b, 802.11g, 802.11n (HT20)
Antenna:	Persistent P/N: ANT-2001, 2.3-2.5GHz, 2.1dBi Persistent P/N: 1085-118, 1.9-2.5GHz, 4dBi Persistent P/N: WR-ANT-015, 2.4-2.5GHz, 7.4dBi
Rated Voltage:	10.8Vdc (Battery)
Sample Received Date:	30 November 2015
Dates of testing:	30 November – 15 December 2015

2.3 *Operating Modes and Conditions*

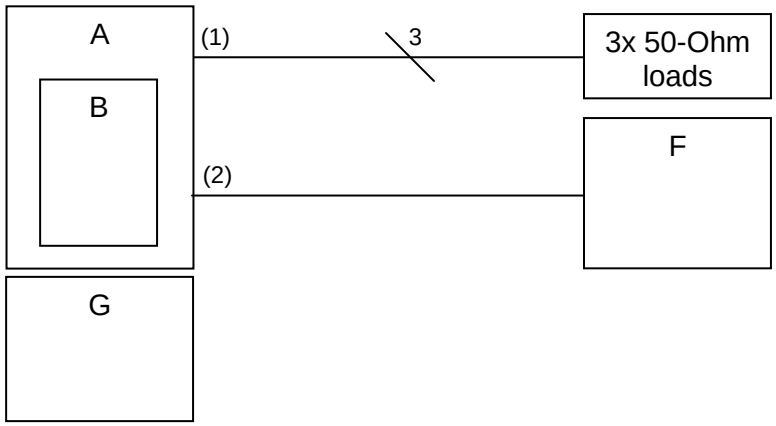
Persistent Systems provided a GUI that allowed control of the modulation, data rate, and channel for continuous transmission. Power and PSD measurements were investigated at all modulations and data rates and the worst-case is reported. Spurious emissions were then measured at only the mode that provided the worst-case PSD. All spurious and band edge emissions were performed using the conducted methods defined in KDB 558074 D01 Measurement Guidance v03r03 and followed up with cabinet radiated emissions testing with the antenna ports terminated into 50-Ohm loads.

2.4 *EUT Connection Block Diagram*

Conducted Measurements



Radiated Measurements



2.5 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Persistent Systems, LLC	Wave Relay Radio	WR-5100	18761
B	Persistent Systems, LLC	3x3 Radio Module	RF-2100	504
C	Persistent Systems, LLC	Battery Eliminator	NA	NA
D	Rohde & Schwarz	Signal Analyzer	FSV	101595
E	Extech	DC power supply	382280	EA03
F	Dell	Laptop	Latitude E5530	BPPMTZ1
G	Bren-Tronics, Inc.	Rechargeable Battery	BT-70716BG-PS	7564

2.6 *Cable List*

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
1	Antenna Port	EUT	Signal Analyzer / 50-Ohm Loads	1.2	No	No
2	Ethernet	EUT Data Port Adapter	Laptop	10	No	No
3	DC Input	AC/DC Adapter	EUT DC Input	1.5m	No	No

3 Bandwidth

3.1 *Test Result*

Test Description	Test Specification		Test Result
6 dB bandwidth / 99% OBW	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant

3.2 *Test Method*

The procedures from ANSI C63.10: 2013 clause 11.8 and KDB 558074 D01 Measurement Guidance v03r03 were used to determine the 6 dB bandwidth and 99% OBW.

3.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 23.9 °C
Relative Humidity: 43.2 %

3.4 *Test Equipment*

Test Date: 15-Dec-2015 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
10DB ATTENUATOR	10DB	ROHDE & SCHWARZ	B095592	5-Aug-2016

Note: The calibration period equipment is 1 year.

3.5 *Test Data*

Protocol	Channel	Data Rate	6dB Bandwidth (MHz)	Occupied Bandwidth (99%) (MHz)
802.11b	1	1 Mbps	9.85	13.65
802.11b	6	1 Mbps	9.85	13.75
802.11b	11	1 Mbps	9.92	13.75
802.11g	1	6 Mbps	16.38	16.4
802.11g	6	6 Mbps	16.38	16.39
802.11g	11	6 Mbps	16.45	16.39
802.11n	1	MCS0	17.71	17.62
802.11n	6	MCS0	17.68	17.65
802.11n	11	MCS0	17.76	17.64

4 Output Power

4.1 *Test Result*

Test Description	Test Specification		Test Result
Peak Output Power	15.247(b) (3)	RSS-247 S5.4 (4)	Compliant

4.2 *Test Method*

Fundamental power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.9, KDB 558074 D01 Measurement Guidance v03r03, and KDB 662911 D01 Multiple Transmitter Output v02r01.

For MIMO operations, the measured value in mW was multiplied by the number of chains.

For the 7.4dBi antenna, the minimum allowed cable loss is 0.5dB between the host and antenna(s). Therefore, this loss was accounted for in the calculation of the applied limit.

Limit
(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. For using antennas with greater than 6dBi of gain, the limit is reduced in dB by the amount the gain exceeds 6dBi (e.g. for a 7.4dBi antenna, the limit is reduced from 30dBm to 28.6dBm)

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 22.5 °C
Relative Humidity: 41.5 %

4.4 *Test Equipment*

Test Start Date: 2-Dec-2015
Test End Date: 11-Dec-2015 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
10DB ATTENUATOR	10DB	ROHDE & SCHWARZ	B095592	5-Aug-2016

Note: The calibration period equipment is 1 year.

4.5 *Test Data - SISO*

Mode	Rate (Mbps)	Channel	2.1 and 4dBi Antenna			7.4dBi Antenna (0.5dB Cable Loss)		
			Power (dBm)	Limit (dBm)	Margin (dB)	Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	1	1	27.32	30	-2.68	24.32	29.1	-4.78
		6	29.62	30	-0.38	28.62	29.1	-0.48
		11	28.72	30	-1.28	24.42	29.1	-4.68
	2	1	27.14	30	-2.86	24.14	29.1	-4.96
		6	29.74	30	-0.26	28.64	29.1	-0.46
		11	28.54	30	-1.46	24.24	29.1	-4.86
	5.5	1	27.2	30	-2.8	24.2	29.1	-4.9
		6	29.7	30	-0.3	28.6	29.1	-0.5
		11	28.6	30	-1.4	24.3	29.1	-4.8
	11	1	27.28	30	-2.72	24.28	29.1	-4.82
		6	29.58	30	-0.42	28.48	29.1	-0.62
		11	28.68	30	-1.32	24.38	29.1	-4.72
802.11g	6	1	22.64	30	-7.36	20.64	29.1	-8.46
		6	29.94	30	-0.06	28.94	29.1	-0.16
		11	23.54	30	-6.46	21.64	29.1	-7.46
	9	1	22.7	30	-7.3	20.7	29.1	-8.4
		6	30	30	0	29	29.1	-0.1
		11	23.6	30	-6.4	21.7	29.1	-7.4
	12	1	22.57	30	-7.43	20.57	29.1	-8.53
		6	29.97	30	-0.03	28.97	29.1	-0.13
		11	23.47	30	-6.53	21.57	29.1	-7.53
	18	1	22.49	30	-7.51	20.49	29.1	-8.61
		6	29.99	30	-0.01	28.99	29.1	-0.11
		11	23.39	30	-6.61	21.49	29.1	-7.61
	24	1	22.5	30	-7.5	20.5	29.1	-8.6
		6	30	30	0	29	29.1	-0.1
		11	23.4	30	-6.6	21.5	29.1	-7.6
	36	1	22.71	30	-7.29	20.71	29.1	-8.39
		6	29.91	30	-0.09	29.01	29.1	-0.09
		11	23.61	30	-6.39	21.71	29.1	-7.39
	48	1	22.48	30	-7.52	20.48	29.1	-8.62
		6	29.98	30	-0.02	29.08	29.1	-0.02
		11	23.38	30	-6.62	21.48	29.1	-7.62
	54	1	22.55	30	-7.45	20.55	29.1	-8.55
		6	29.95	30	-0.05	29.05	29.1	-0.05
		11	23.45	30	-6.55	21.55	29.1	-7.55
802.11n	MCS0	1	20.75	30	-9.25	18.95	29.1	-10.15
		6	29.65	30	-0.35	28.75	29.1	-0.35
		11	22.35	30	-7.65	19.95	29.1	-9.15
	MCS1	1	20.72	30	-9.28	18.92	29.1	-10.18
		6	29.52	30	-0.48	28.62	29.1	-0.48
		11	22.32	30	-7.68	19.92	29.1	-9.18
	MCS2	1	20.7	30	-9.3	18.9	29.1	-10.2
		6	29.5	30	-0.5	28.6	29.1	-0.5
		11	22.3	30	-7.7	19.9	29.1	-9.2
	MCS3	1	20.71	30	-9.29	18.91	29.1	-10.19
		6	29.51	30	-0.49	28.61	29.1	-0.49
		11	22.31	30	-7.69	19.91	29.1	-9.19
	MCS4	1	20.71	30	-9.29	18.91	29.1	-10.19
		6	29.61	30	-0.39	28.71	29.1	-0.39
		11	22.31	30	-7.69	19.91	29.1	-9.19
	MCS5	1	20.67	30	-9.33	18.87	29.1	-10.23
		6	29.57	30	-0.43	28.67	29.1	-0.43
		11	22.27	30	-7.73	19.87	29.1	-9.23
	MCS6	1	20.63	30	-9.37	18.83	29.1	-10.27
		6	29.63	30	-0.37	28.73	29.1	-0.37
		11	22.23	30	-7.77	19.83	29.1	-9.27
	MCS7	1	20.71	30	-9.29	18.91	29.1	-10.19
		6	29.61	30	-0.39	28.71	29.1	-0.39
		11	22.31	30	-7.69	19.91	29.1	-9.19

4.6 *Test Data – MIMO 2x2*

Two Chains Summed								
			2.1 and 4dBi Antenna				7.4dBi Antenna (0.5dB Cable Loss)	
Mode	Rate Mbps	Channel	Power (dBm)	Limit (dBm)	Margin (dB)	Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	1	1	27.93	30	-2.07	26.23	29.1	-2.87
		6	29.53	30	-0.47	28.63	29.1	-0.47
		11	29.13	30	-0.87	26.53	29.1	-2.57
	2	1	27.75	30	-2.25	26.05	29.1	-3.05
		6	29.55	30	-0.45	28.55	29.1	-0.55
		11	29.15	30	-0.85	26.35	29.1	-2.75
	5.5	1	27.81	30	-2.19	26.11	29.1	-2.99
		6	29.41	30	-0.59	28.51	29.1	-0.59
		11	29.21	30	-0.79	26.41	29.1	-2.69
	11	1	27.89	30	-2.11	26.19	29.1	-2.91
		6	29.39	30	-0.61	28.39	29.1	-0.71
		11	29.19	30	-0.81	26.49	29.1	-2.61
802.11g	6	1	24.55	30	-5.45	22.85	29.1	-6.25
		6	29.35	30	-0.65	28.35	29.1	-0.75
		11	25.45	30	-4.55	23.65	29.1	-5.45
	9	1	24.61	30	-5.39	22.91	29.1	-6.19
		6	29.41	30	-0.59	28.41	29.1	-0.69
		11	25.51	30	-4.49	23.71	29.1	-5.39
	12	1	24.48	30	-5.52	22.78	29.1	-6.32
		6	29.28	30	-0.72	28.28	29.1	-0.82
		11	25.38	30	-4.62	23.58	29.1	-5.52
	18	1	24.4	30	-5.6	22.7	29.1	-6.4
		6	29.2	30	-0.8	28.2	29.1	-0.9
		11	25.3	30	-4.7	23.5	29.1	-5.6
	24	1	24.41	30	-5.59	22.71	29.1	-6.39
		6	29.21	30	-0.79	28.21	29.1	-0.89
		11	25.31	30	-4.69	23.51	29.1	-5.59
	36	1	24.62	30	-5.38	22.92	29.1	-6.18
		6	29.42	30	-0.58	28.42	29.1	-0.68
		11	25.52	30	-4.48	23.72	29.1	-5.38
	48	1	24.39	30	-5.61	22.69	29.1	-6.41
		6	29.19	30	-0.81	28.19	29.1	-0.91
		11	25.29	30	-4.71	23.49	29.1	-5.61
	54	1	24.46	30	-5.54	22.76	29.1	-6.34
		6	29.26	30	-0.74	28.26	29.1	-0.84
		11	25.36	30	-4.64	23.56	29.1	-5.54
802.11n	MCS0	1	22.66	30	-7.34	20.86	29.1	-8.24
		6	29.36	30	-0.64	28.36	29.1	-0.74
		11	24.66	30	-5.34	22.36	29.1	-6.74
	MCS1	1	22.63	30	-7.37	20.83	29.1	-8.27
		6	29.33	30	-0.67	28.33	29.1	-0.77
		11	24.63	30	-5.37	22.33	29.1	-6.77
	MCS2	1	22.61	30	-7.39	20.81	29.1	-8.29
		6	29.31	30	-0.69	28.31	29.1	-0.79
		11	24.61	30	-5.39	22.31	29.1	-6.79
	MCS3	1	22.62	30	-7.38	20.82	29.1	-8.28
		6	29.32	30	-0.68	28.32	29.1	-0.78
		11	24.62	30	-5.38	22.32	29.1	-6.78
	MCS4	1	22.62	30	-7.38	20.82	29.1	-8.28
		6	29.32	30	-0.68	28.32	29.1	-0.78
		11	24.62	30	-5.38	22.32	29.1	-6.78
	MCS5	1	22.58	30	-7.42	20.78	29.1	-8.32
		6	29.28	30	-0.72	28.28	29.1	-0.82
		11	24.58	30	-5.42	22.28	29.1	-6.82
	MCS6	1	22.54	30	-7.46	20.74	29.1	-8.36
		6	29.24	30	-0.76	28.24	29.1	-0.86
		11	24.54	30	-5.46	22.24	29.1	-6.86
	MCS7	1	22.62	30	-7.38	20.82	29.1	-8.28
		6	29.32	30	-0.68	28.32	29.1	-0.78
		11	24.62	30	-5.38	22.32	29.1	-6.78

4.7 *Test Data – MIMO 3x3*

Three Chains Summed								
			2.1 and 4dBi Antenna			7.4dBi Antenna (0.5dB Cable Loss)		
Mode	Rate Mbps	Channel	Power (dBm)	Limit (dBm)	Margin (dB)	Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	1	1	29.49	30	-0.51	28.69	29.1	-0.41
		6	29.69	30	-0.31	28.79	29.1	-0.31
		11	29.19	30	-0.81	28.09	29.1	-1.01
	2	1	29.61	30	-0.39	28.71	29.1	-0.39
		6	29.71	30	-0.29	28.71	29.1	-0.39
		11	29.11	30	-0.89	28.01	29.1	-1.09
	5.5	1	29.67	30	-0.33	28.77	29.1	-0.33
		6	29.67	30	-0.33	28.27	29.1	-0.83
		11	29.07	30	-0.93	28.07	29.1	-1.03
	11	1	29.55	30	-0.45	28.65	29.1	-0.45
		6	29.75	30	-0.25	28.65	29.1	-0.45
		11	28.95	30	-1.05	27.95	29.1	-1.15
802.11g	6	1	25.21	30	-4.79	23.91	29.1	-5.19
		6	29.81	30	-0.19	28.81	29.1	-0.29
		11	26.31	30	-3.69	24.31	29.1	-4.79
	9	1	25.27	30	-4.73	23.97	29.1	-5.13
		6	29.77	30	-0.23	28.67	29.1	-0.43
		11	26.37	30	-3.63	24.37	29.1	-4.73
	12	1	25.24	30	-4.76	23.94	29.1	-5.16
		6	29.74	30	-0.26	28.64	29.1	-0.46
		11	26.24	30	-3.76	24.24	29.1	-4.86
	18	1	25.16	30	-4.84	23.86	29.1	-5.24
		6	29.76	30	-0.24	28.66	29.1	-0.44
		11	26.16	30	-3.84	24.16	29.1	-4.94
	24	1	25.17	30	-4.83	23.87	29.1	-5.23
		6	29.87	30	-0.13	28.67	29.1	-0.43
		11	26.17	30	-3.83	24.17	29.1	-4.93
	36	1	25.18	30	-4.82	23.88	29.1	-5.22
		6	29.88	30	-0.12	28.78	29.1	-0.32
		11	26.38	30	-3.62	24.38	29.1	-4.72
	48	1	24.85	30	-5.15	23.55	29.1	-5.55
		6	29.85	30	-0.15	28.85	29.1	-0.25
		11	26.15	30	-3.85	24.15	29.1	-4.95
	54	1	24.82	30	-5.18	23.52	29.1	-5.58
		6	29.82	30	-0.18	28.82	29.1	-0.28
		11	26.22	30	-3.78	24.22	29.1	-4.88
802.11n	MCS0	1	24.02	30	-5.98	21.82	29.1	-7.28
		6	29.02	30	-0.98	27.92	29.1	-1.18
		11	25.52	30	-4.48	23.12	29.1	-5.98
	MCS1	1	24.19	30	-5.81	21.99	29.1	-7.11
		6	29.19	30	-0.81	28.09	29.1	-1.01
		11	25.49	30	-4.51	23.09	29.1	-6.01
	MCS2	1	24.17	30	-5.83	21.97	29.1	-7.13
		6	29.17	30	-0.83	28.07	29.1	-1.03
		11	25.47	30	-4.53	23.07	29.1	-6.03
	MCS3	1	24.08	30	-5.92	21.88	29.1	-7.22
		6	29.08	30	-0.92	27.98	29.1	-1.12
		11	25.48	30	-4.52	23.08	29.1	-6.02
	MCS4	1	23.98	30	-6.02	21.78	29.1	-7.32
		6	28.98	30	-1.02	27.88	29.1	-1.22
		11	25.48	30	-4.52	23.08	29.1	-6.02
	MCS5	1	23.84	30	-6.16	21.64	29.1	-7.46
		6	28.84	30	-1.16	27.74	29.1	-1.36
		11	25.44	30	-4.56	23.04	29.1	-6.06
	MCS6	1	23.9	30	-6.1	21.7	29.1	-7.4
		6	28.9	30	-1.1	27.8	29.1	-1.3
		11	25.4	30	-4.6	23	29.1	-6.1
	MCS7	1	23.88	30	-6.12	21.68	29.1	-7.42
		6	28.88	30	-1.12	27.78	29.1	-1.32
		11	25.48	30	-4.52	23.08	29.1	-6.02

5 Power Spectral Density

5.1 *Test Result*

Test Description	Test Specification		Test Result
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant

5.2 *Test Method*

Fundamental power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.10, KDB 558074 D01 Measurement Guidance v03r03, and KDB 662911 D01 Multiple Transmitter Output v02r01.

Limit
The limit is 8 dBm.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 22.1 °C
Relative Humidity: 47.4 %

5.4 *Test Equipment*

Test Date: 14-Dec-2015 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
10DB ATTENUATOR	10DB	ROHDE & SCHWARZ	B095592	5-Aug-2016

Note: The calibration period equipment is 1 year.

5.5 *Test Data*

Protocol	Channel	Data Rate	PSD (dBm)	Limit (dBm)	Margin (dB)
802.11b	1	1 Mbps	3.16	8	-4.84
802.11b	6	1 Mbps	5.76	8	-2.24
802.11b	11	1 Mbps	4.48	8	-3.52
802.11g	1	6 Mbps	-3.86	8	-11.86
802.11g	6	6 Mbps	4.00	8	-4.00
802.11g	11	6 Mbps	-3.08	8	-11.08
802.11n	1	MCS0	-6.31	8	-14.31
802.11n	6	MCS0	2.66	8	-5.34
802.11n	11	MCS0	-4.72	8	-12.72

6 Conducted Spurious Emissions

6.1 *Test Result*

Test Description	Test Specification		Test Result
Conducted Spurious Emissions	15.247(d)	RSS-247 S5.5	Compliant

6.2 *Test Method*

Spurious emissions in non-restricted frequency bands were recorded using the methods defined in ANSI C63.10: 2013 clause 11.11, KDB 558074 D01 Measurement Guidance v03r03, and KDB 662911 D01 Multiple Transmitter Output v02r01.

Lowest, middle, and highest channels were investigated. Only the worst-case (lowest data rate) for each modulation was reported.

Because the maximum conducted (average) output power was used to determine compliance with the output power limits, the limit is 30 dB below the maximum in-band peak PSD level in 100 kHz.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.1 °C
Relative Humidity: 43.2 %

6.4 *Test Equipment*

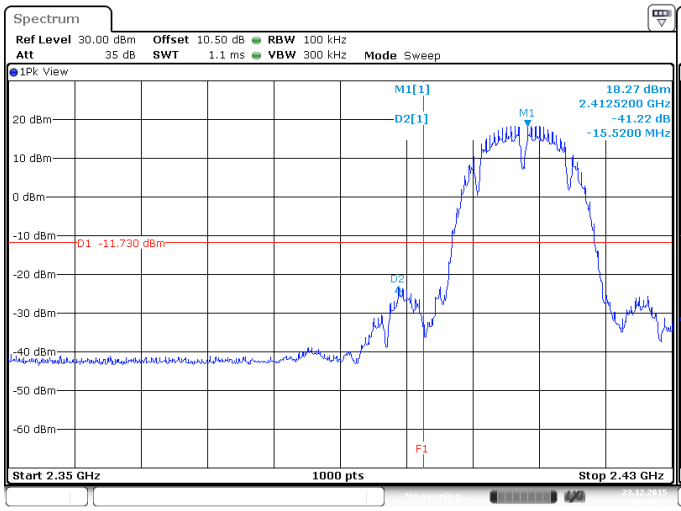
Test Date: 23-Dec-2015 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
10DB ATTENUATOR	10DB	ROHDE & SCHWARZ	B095592	5-Aug-2016

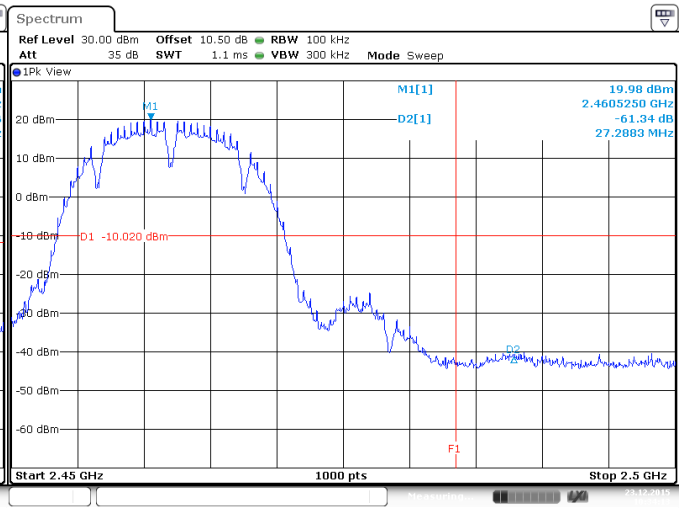
Note: The calibration period equipment is 1 year except for the FSV30 which is on a 2-year cycle.

6.5 *Test Data – DTS Bandedge*

802.11b
Lower band edge / Upper band edge
Channel 1 / Channel 11
1Mbit/s

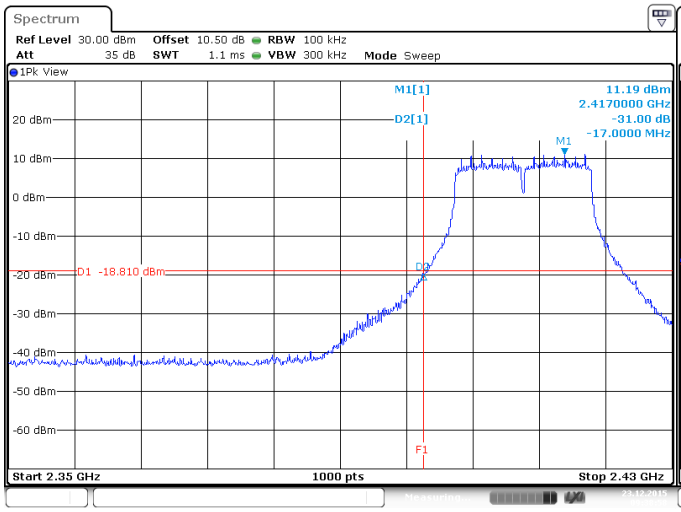


Date: 23.DEC.2015 09:40:15

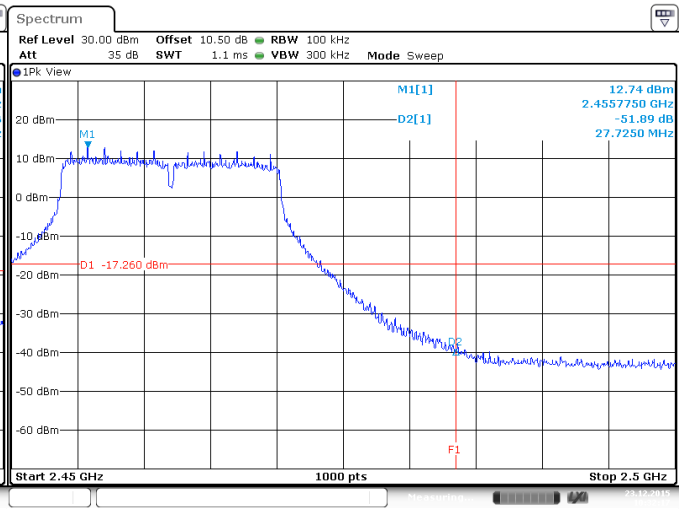


Date: 23.DEC.2015 10:34:13

802.11g
Lower band edge / Upper band edge
Channel 1 / Channel 11
6Mbit/s

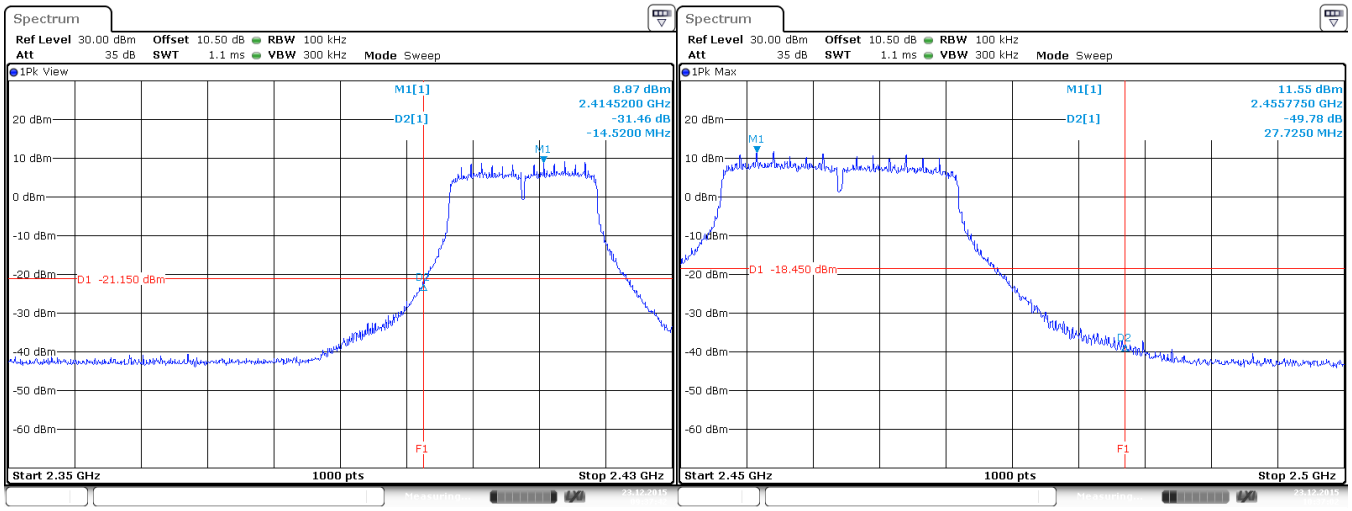


Date: 23.DEC.2015 09:38:58



Date: 23.DEC.2015 10:32:17

802.11n
Lower band edge / Upper band edge
Channel 1 / Channel 11
MCS0

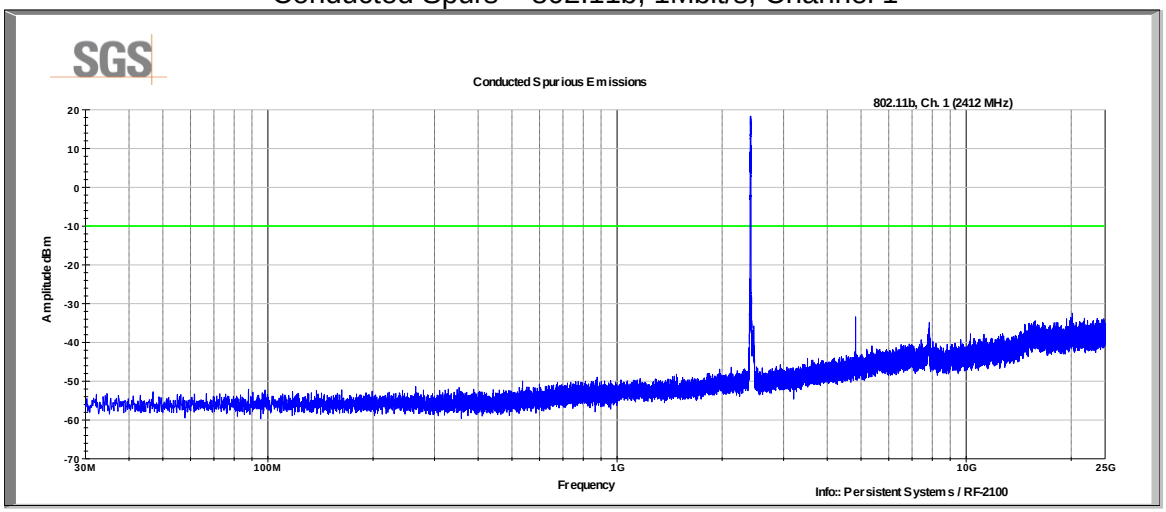


Date: 23.DEC.2015 09:37:42

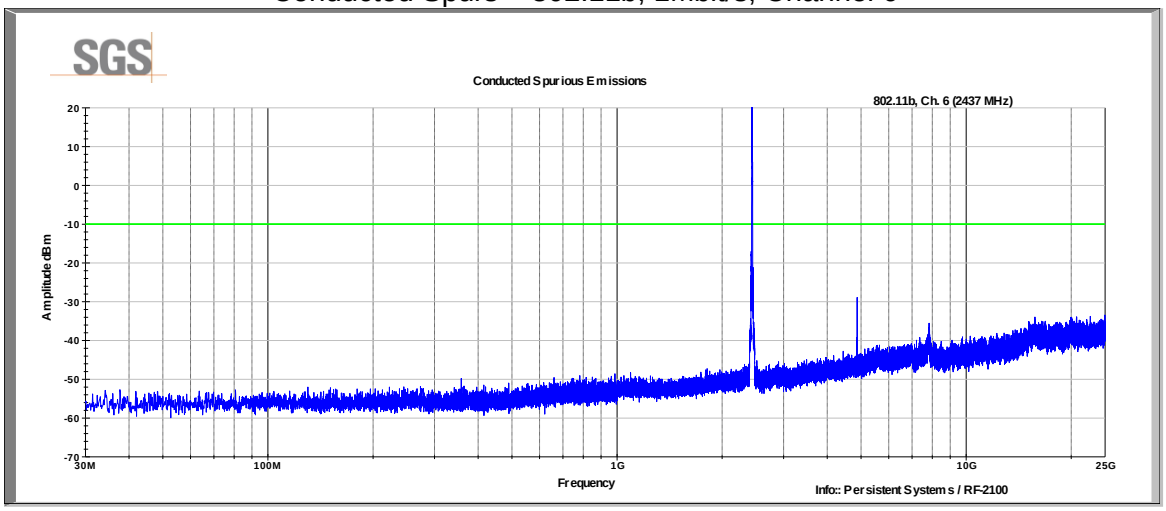
Date: 23.DEC.2015 10:37:02

6.6 *Test Data – Conducted Spurious Emissions*

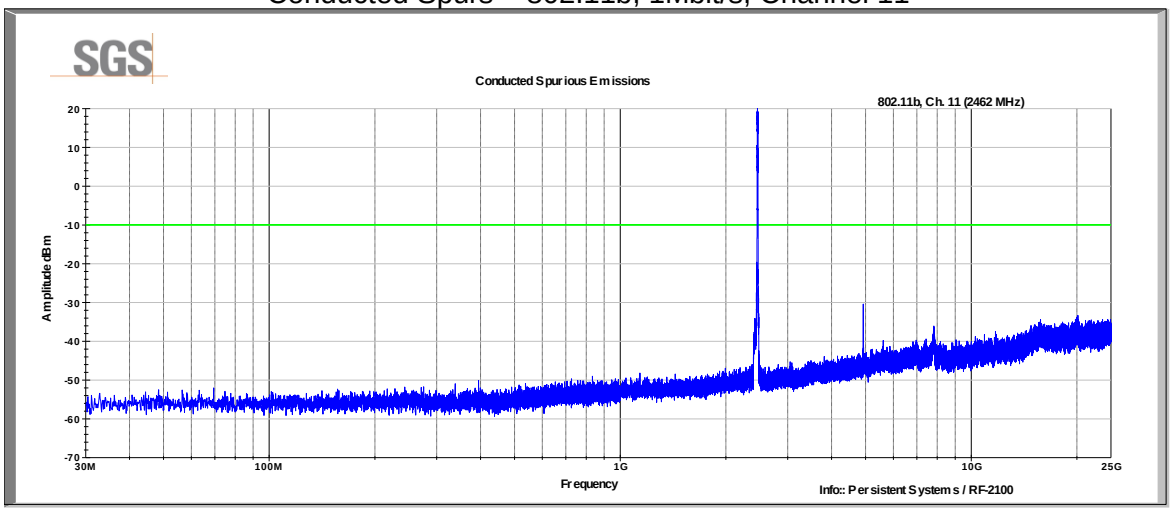
Conducted Spurs – 802.11b, 1Mbit/s, Channel 1



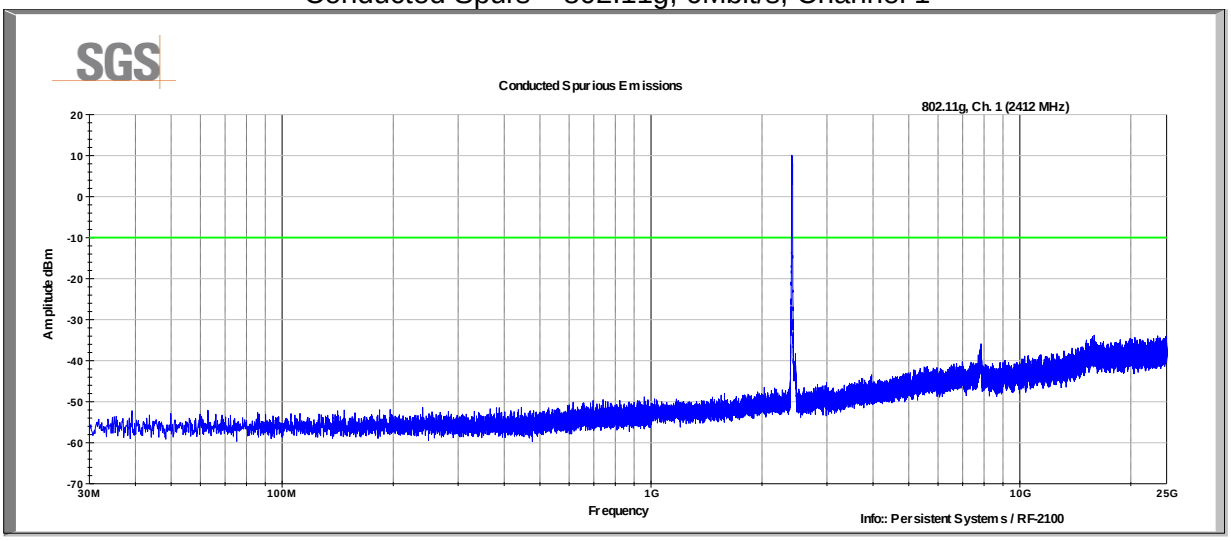
Conducted Spurs – 802.11b, 1Mbit/s, Channel 6



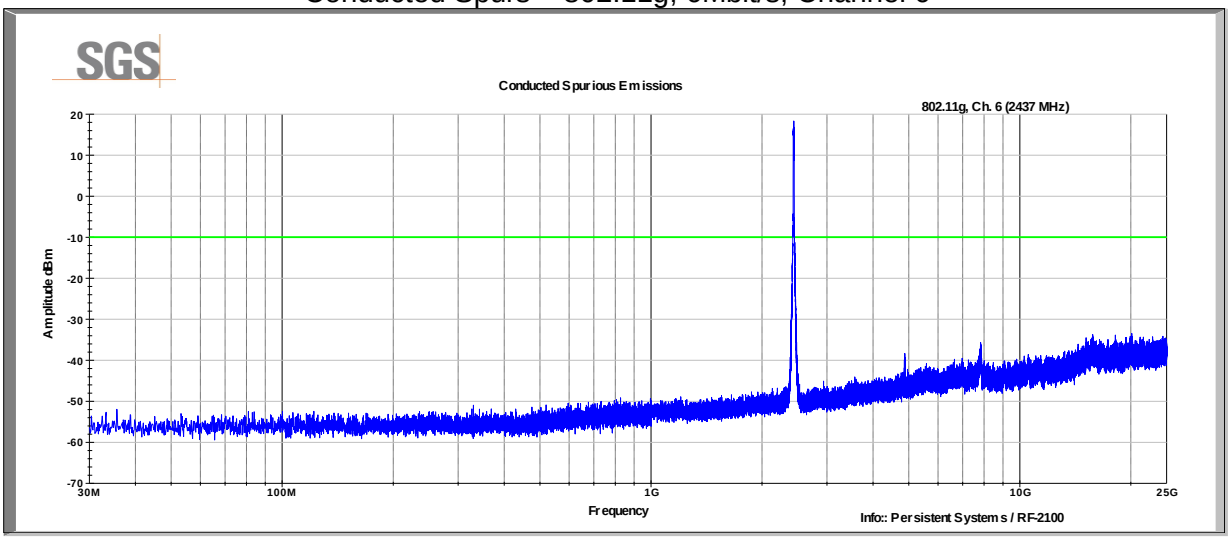
Conducted Spurs – 802.11b, 1Mbit/s, Channel 11



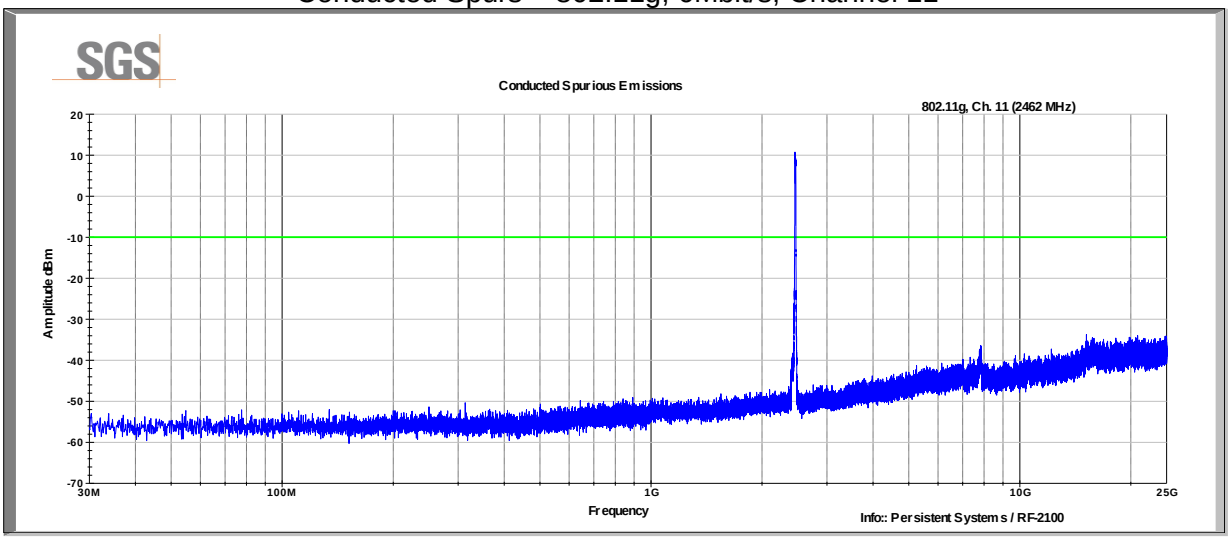
Conducted Spurs – 802.11g, 6Mbit/s, Channel 1



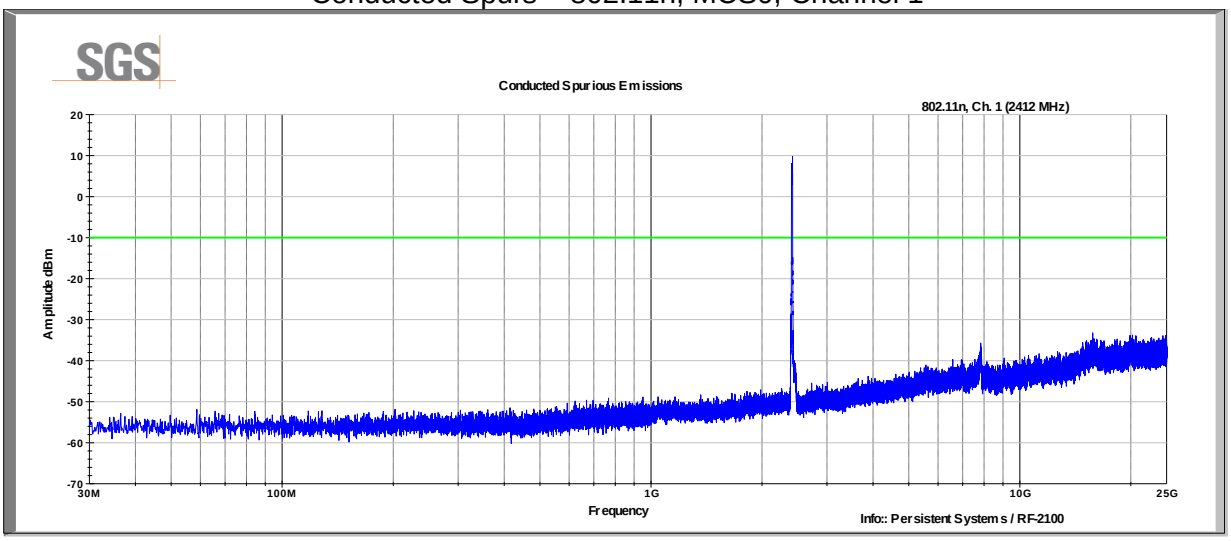
Conducted Spurs – 802.11g, 6Mbit/s, Channel 6



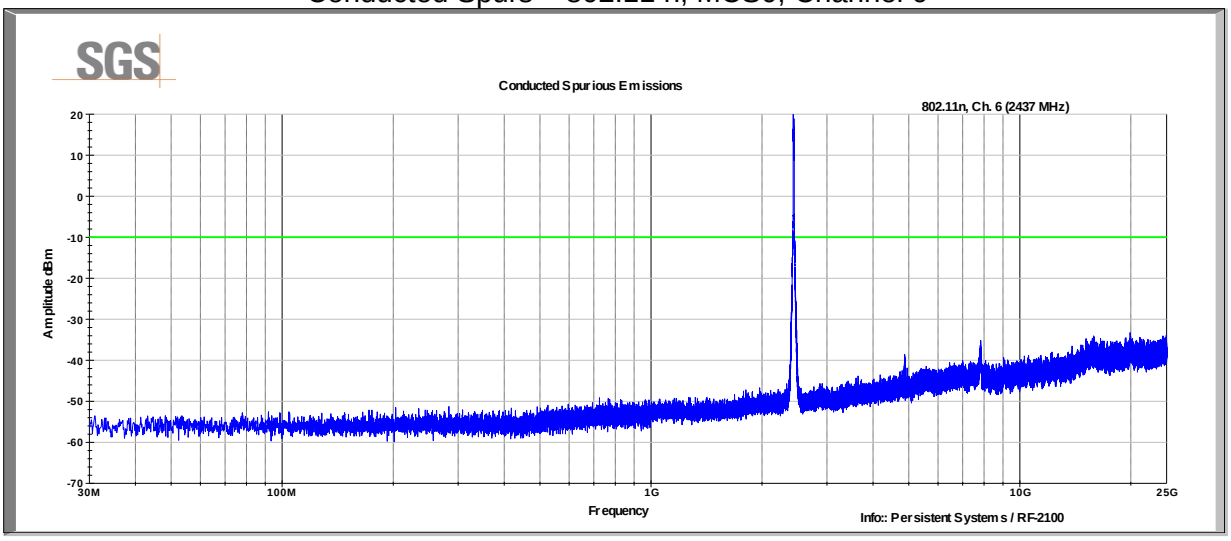
Conducted Spurs – 802.11g, 6Mbit/s, Channel 11



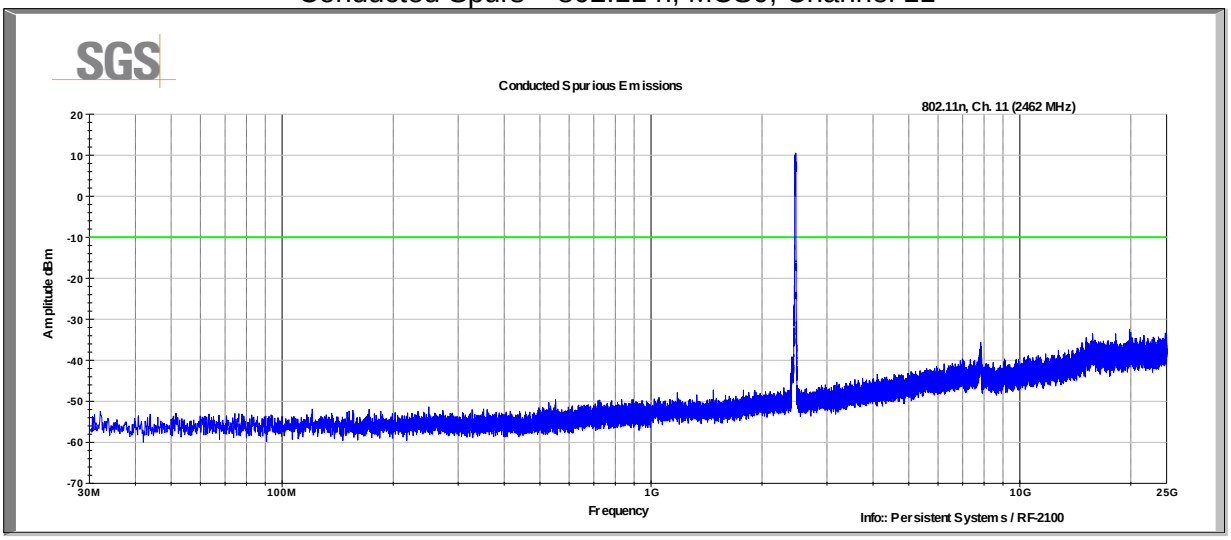
Conducted Spurs – 802.11n, MCS0, Channel 1



Conducted Spurs – 802.11 n, MCS0, Channel 6



Conducted Spurs – 802.11 n, MCS0, Channel 11



7 Field Strength of Spurious Radiation

7.1 *Test Result*

Test Description	Test Specification		Test Result
Spurious Emissions	15.247 (d) and 15.209	RSS-247 S5.5	Compliant

7.2 *Test Method*

Cabinet radiation emission measurements were performed with the antennas replaced with 50-Ohm loads. The measurement methods defined in ANSI C63.4: 2014 were used.

Lowest, middle, and highest channels were investigated. Only the worst-case (802.11b, 1Mbps) was reported except at the restricted band edges where all three modulations were measured.

Additionally, the 2310-2390MHz and 2483.5-2500MHz restricted band measurements were taken using the conducted methods defined in ANSI C63.10: 2013 clause 11.12.2, KDB 558074 D01 Measurement Guidance v03r03, and KDB 662911 D01 Multiple Transmitter Output v02r01.

The conducted measurements for restricted band emissions were converted to a field strength reading and compared to the three meter 15.209 limit of 74dBµV/m (Peak) and 54dBµV (Average).

The second and third harmonic measurements which fell within restricted bands were measured using radiated methods.

Test distance:

30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters
1 to 10 GHz - The EUT to measurement antenna distance was 3 meters
10 to 26 GHz - The EUT to measurement antenna distance was 1 meter

Limits within restricted bands of operation:

Frequency	Limits(1)		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 (2)	--
88 - 216 MHz	150	43.5 (2)	--
216 - 960 MHz	200	46 (2)	--
960 - 1000 MHz	500	54 (2)	--
1 - 40 GHz	500	54 (3)	74

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.
(2) Quasi-peak limit
(3) Average limit

7.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.2 – 24.1 °C
Relative Humidity: 32.4 - 42.6 %

7.4 *Test Equipment*

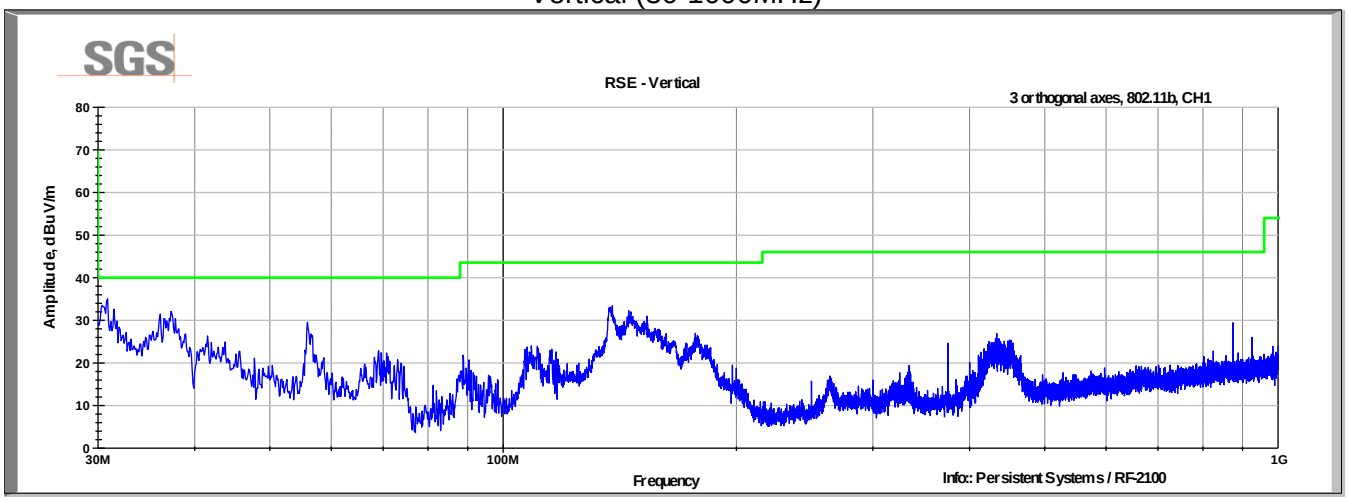
Test Start Date: 3-Dec-2015
Test End Date: 23-Dec-2015 Tester: KS/JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	4-Aug-2016
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079691	9-Jul-2016
10DB ATTENUATOR	10DB	ROHDE & SCHWARZ	B095592	5-Aug-2016
DRG HORN (SMALL)	3116B	ETS-LINDGREN	B079697	11-Mar-2016
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079822	4-Aug-2016
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079823	4-Aug-2016
FIXED GAIN AMPLIFIER	NSP1840-HG	MITEQ	B087572	15-Oct-2016
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2016
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	4-Aug-2016
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	4-Aug-2016
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	3-Aug-2016
ANTENNA, BILOG	JB6	SUNOL	B079689	11-Sep-2016

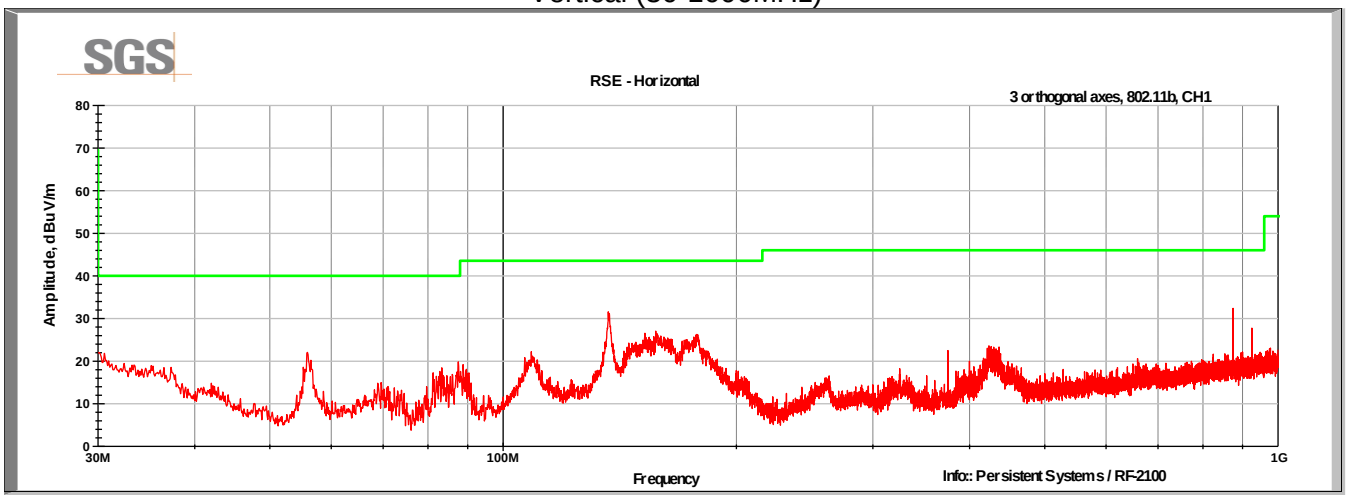
Note: The calibration period equipment is 1 year except for the FSV30 which is on a 2-year cycle.

7.5 *Test Data – Cabinet Radiation*

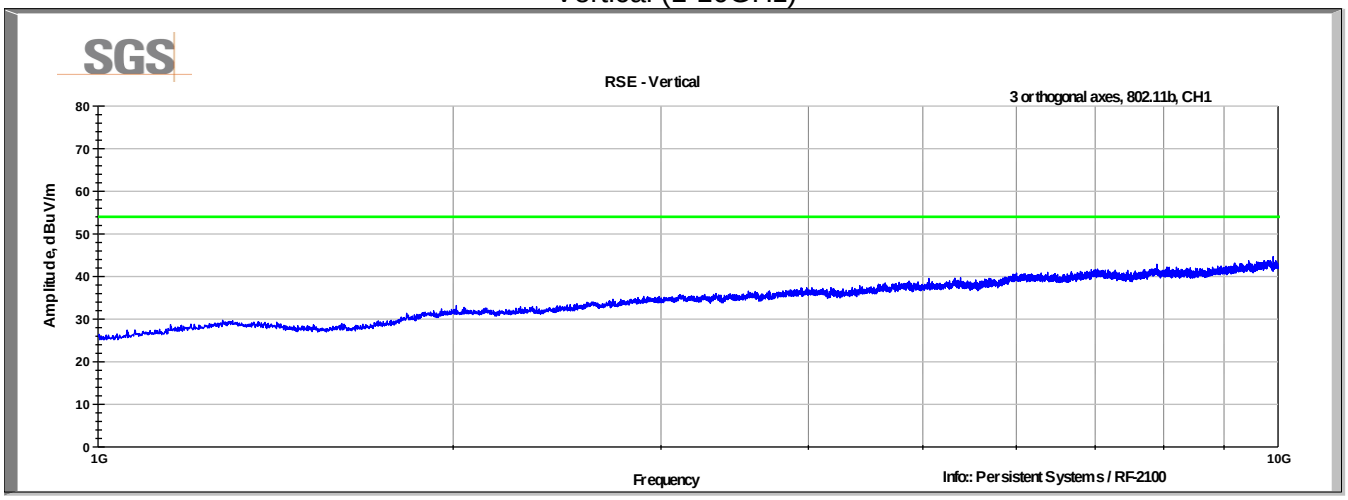
CH 1 802.11b, 1Mbps
Vertical (30-1000MHz)



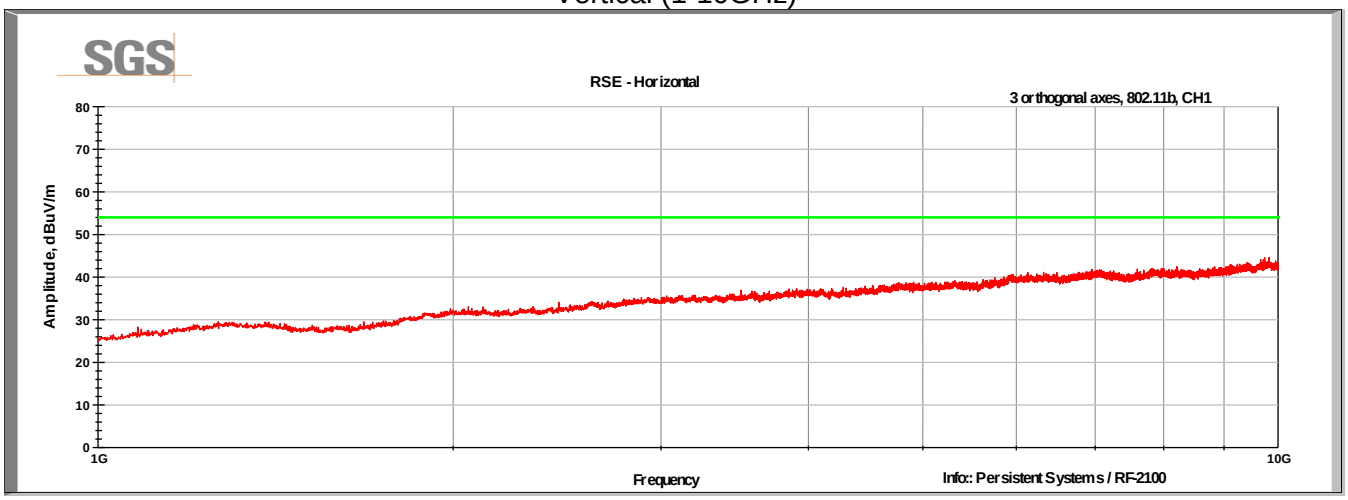
Horizontal
Vertical (30-1000MHz)



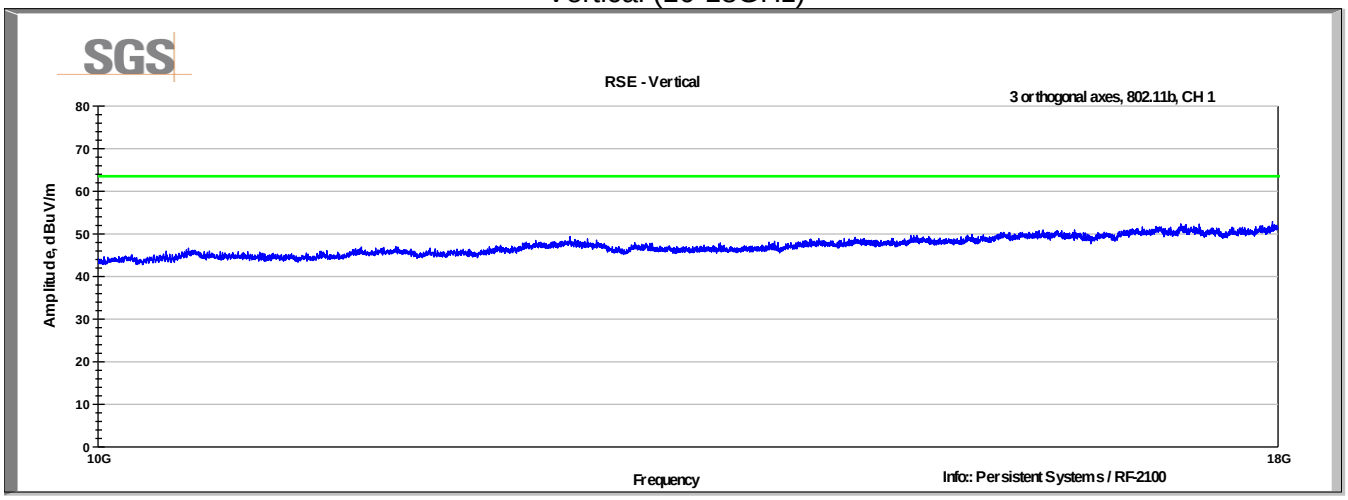
CH 1 802.11b, 1Mbps
Vertical (1-10GHz)



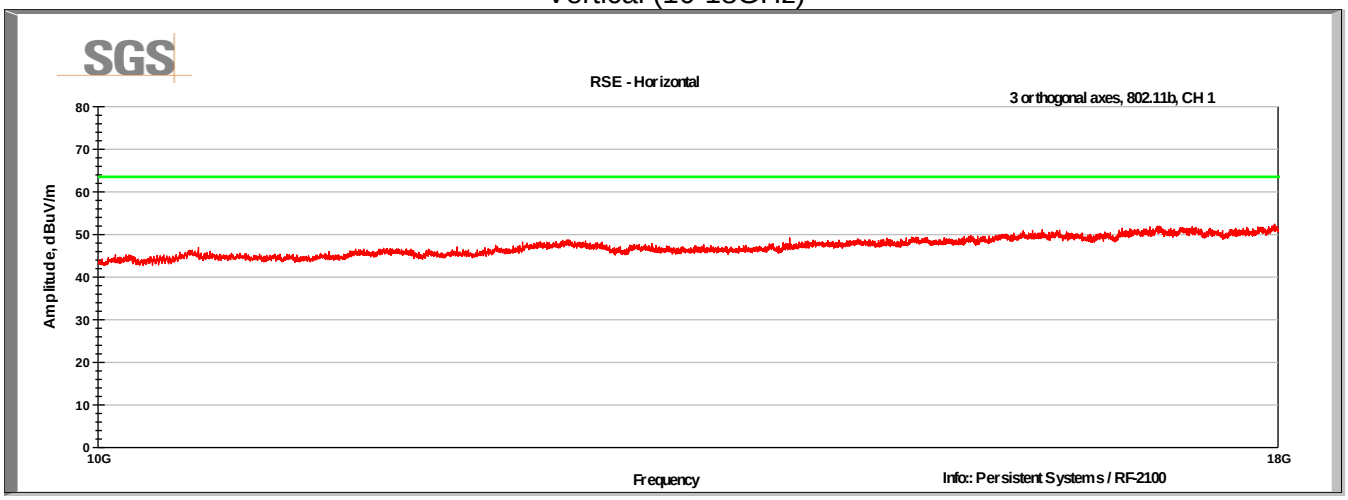
Horizontal
Vertical (1-10GHz)



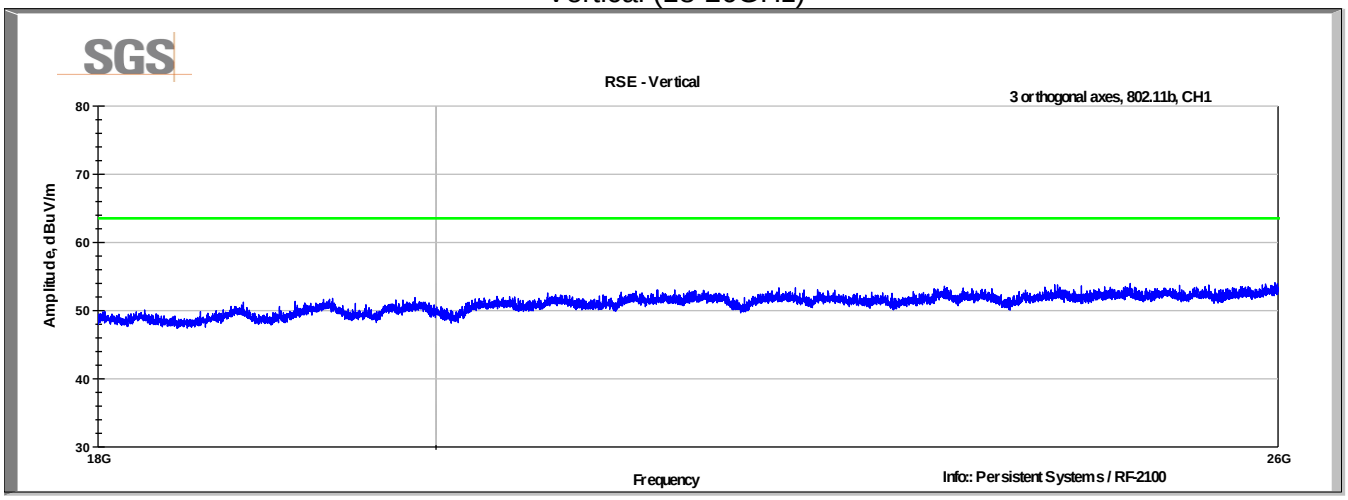
CH 1 802.11b, 1Mbps
Vertical (10-18GHz)



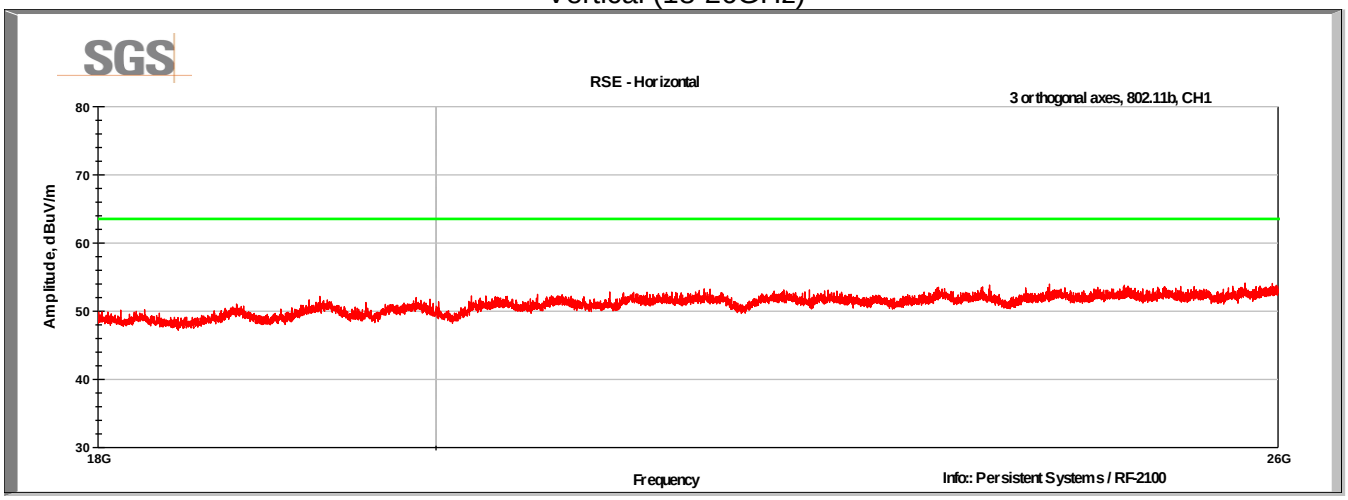
Horizontal
Vertical (10-18GHz)



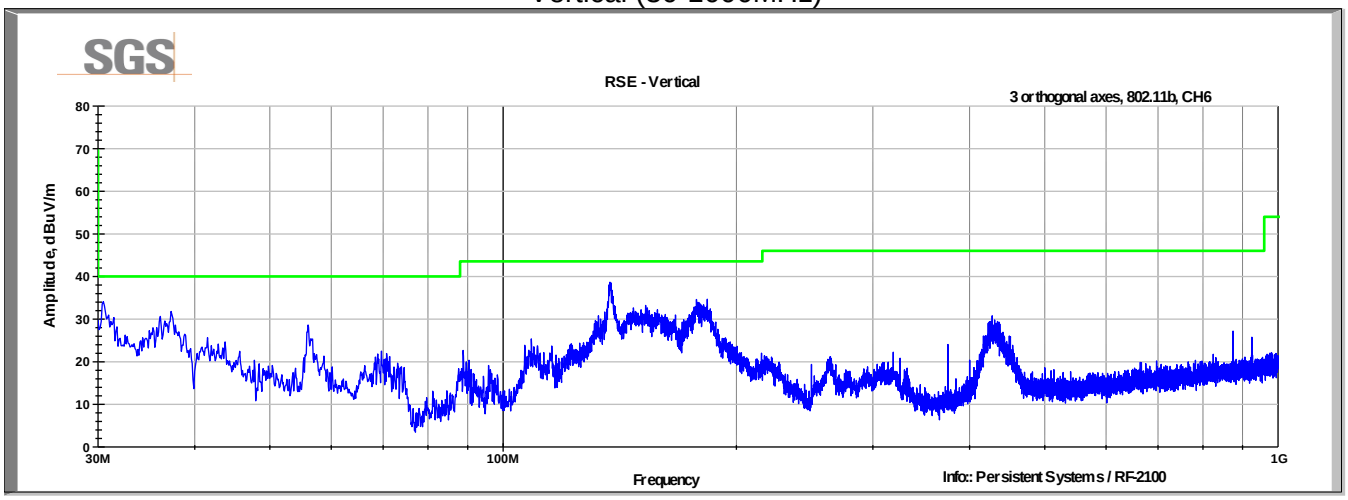
CH 1 802.11b, 1Mbps
Vertical (18-26GHz)



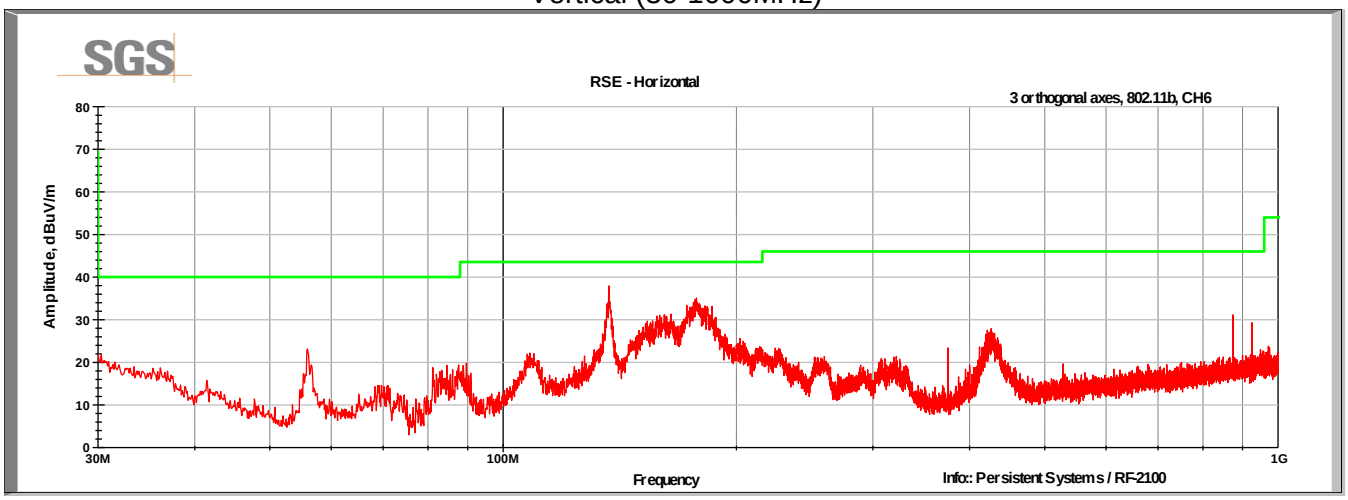
Horizontal
Vertical (18-26GHz)



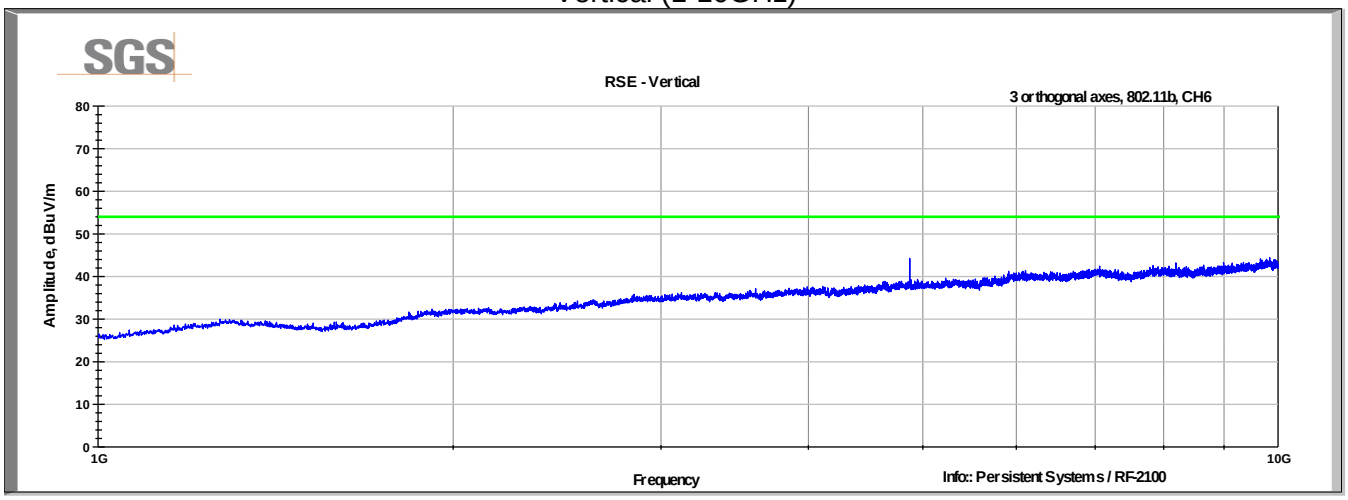
CH 6 802.11b, 1Mbps
Vertical (30-1000MHz)



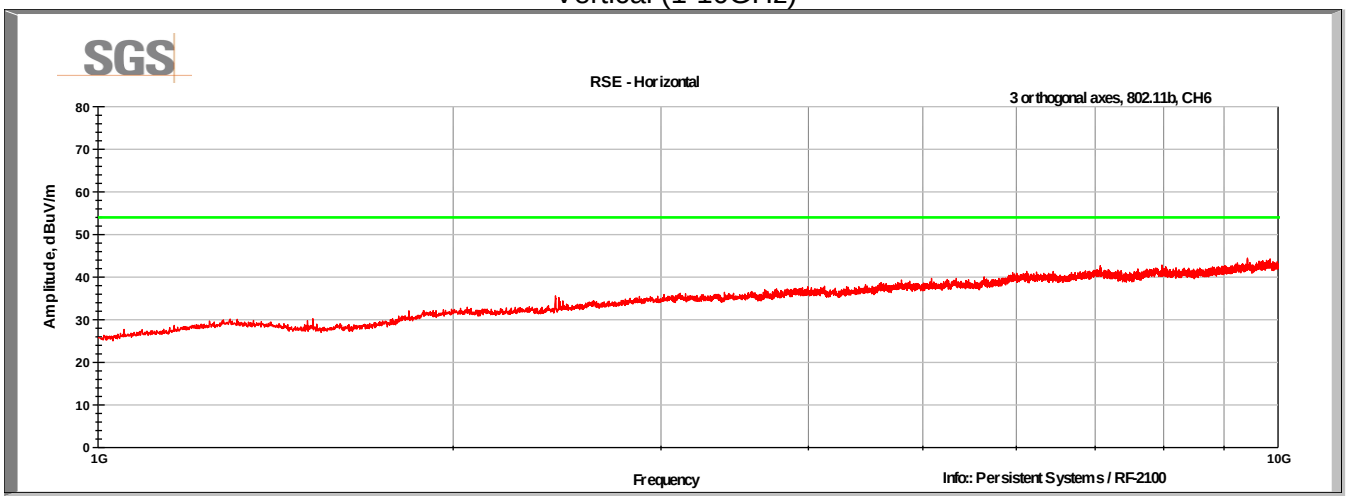
Horizontal
Vertical (30-1000MHz)



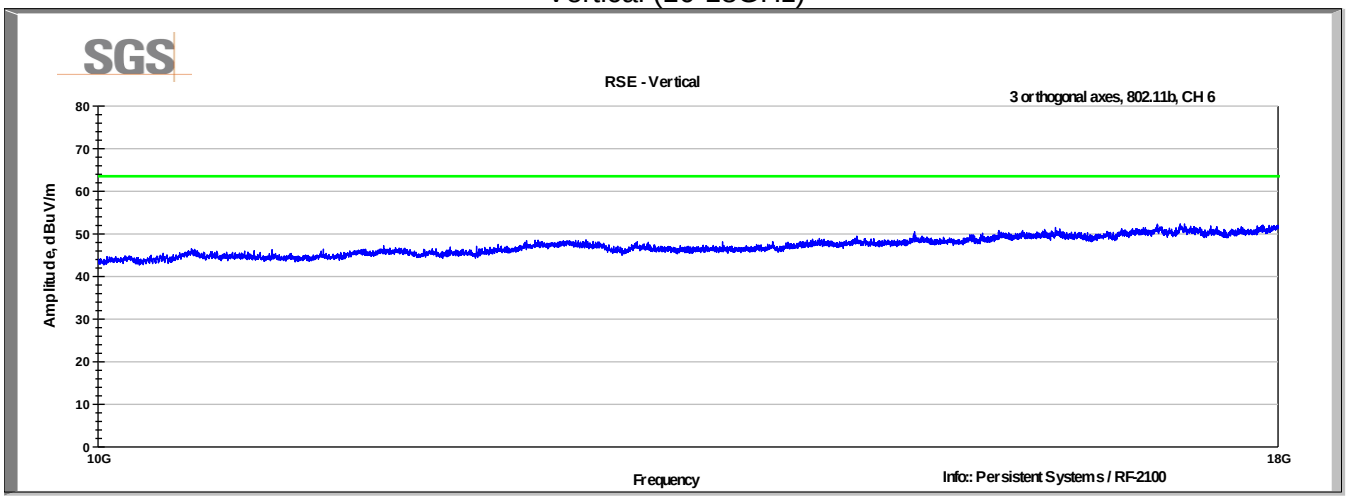
CH 6 802.11b, 1Mbps
Vertical (1-10GHz)



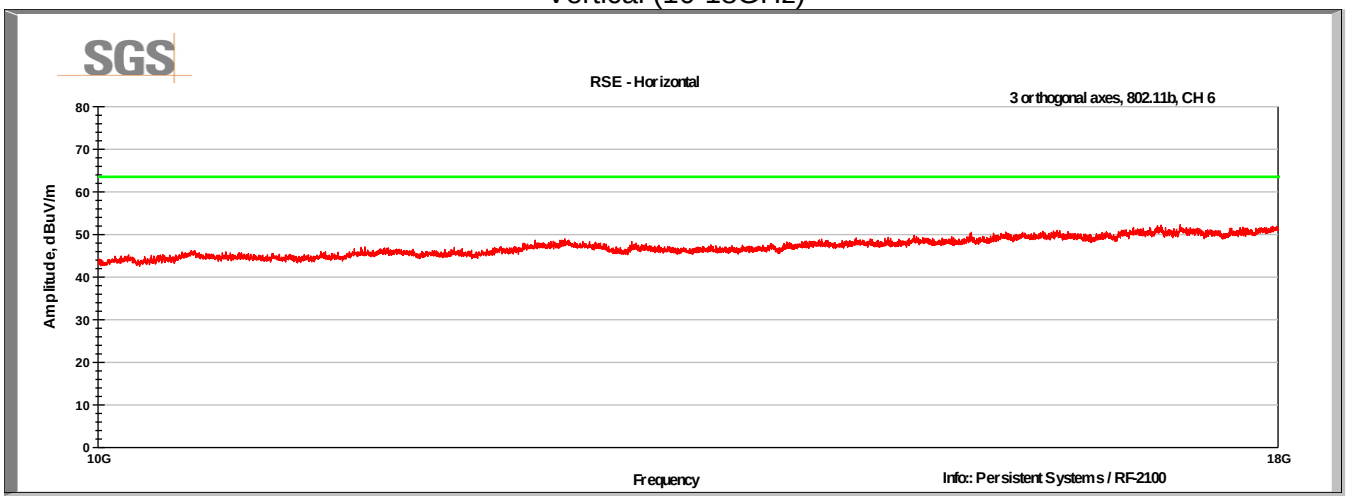
Horizontal
Vertical (1-10GHz)



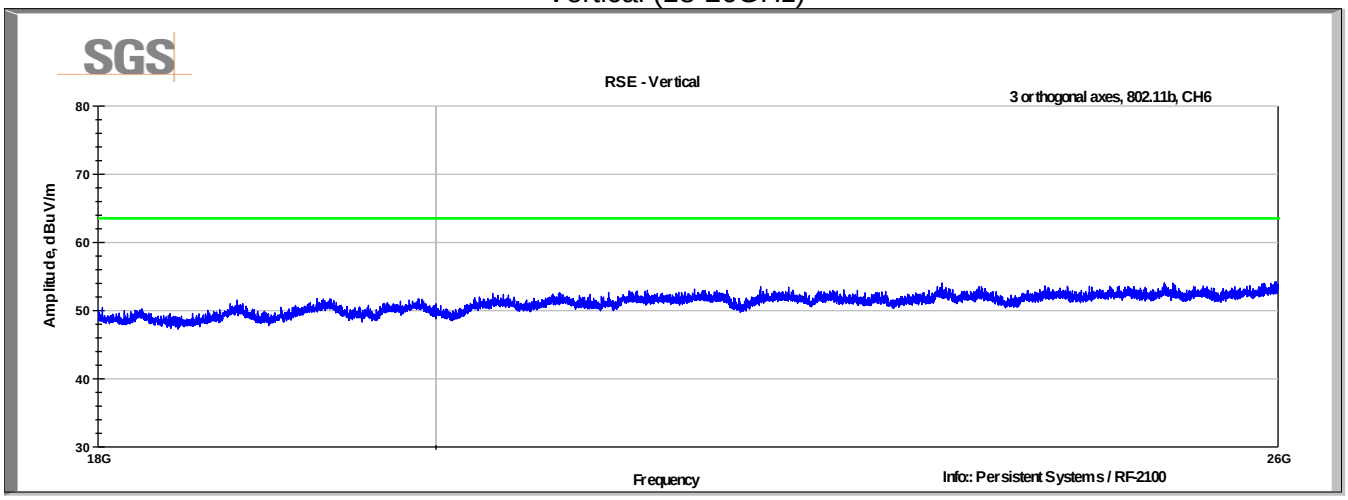
CH 6 802.11b, 1Mbps
Vertical (10-18GHz)



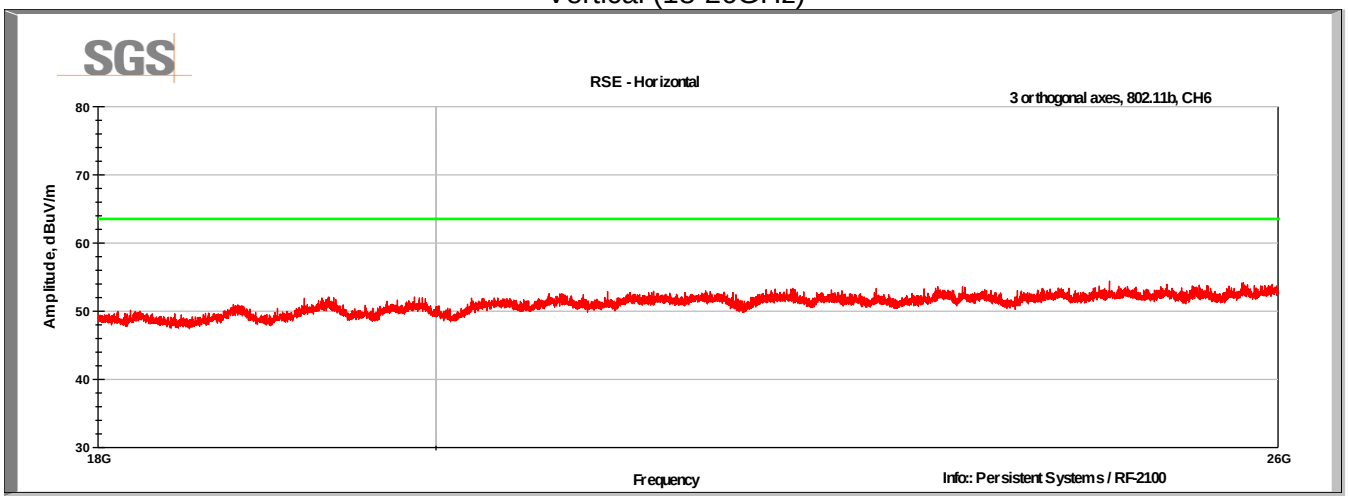
Horizontal
Vertical (10-18GHz)



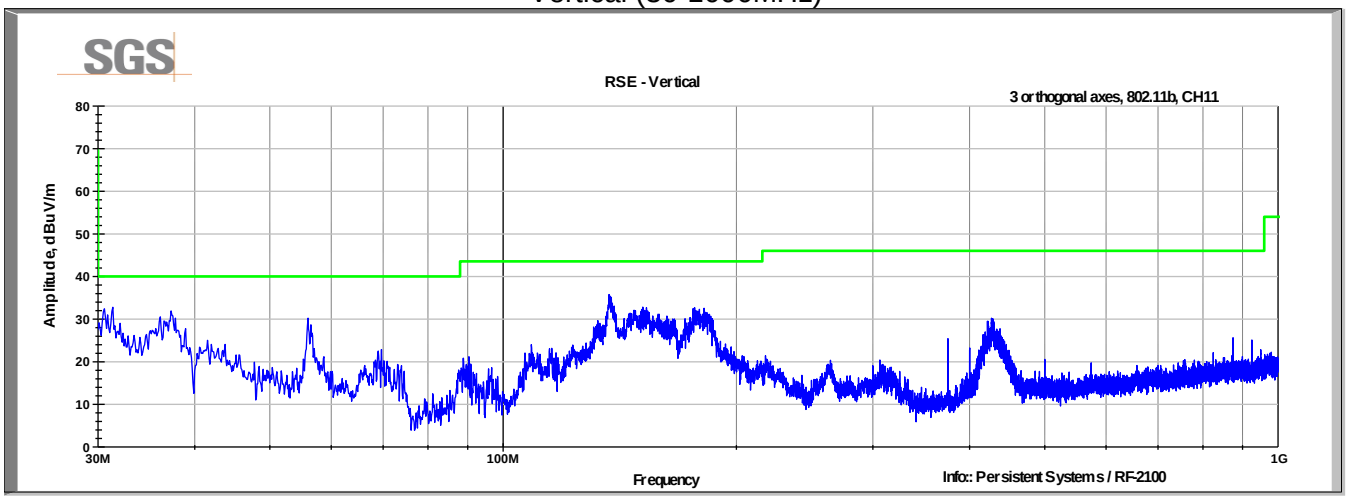
CH 6 802.11b, 1Mbps
Vertical (18-26GHz)



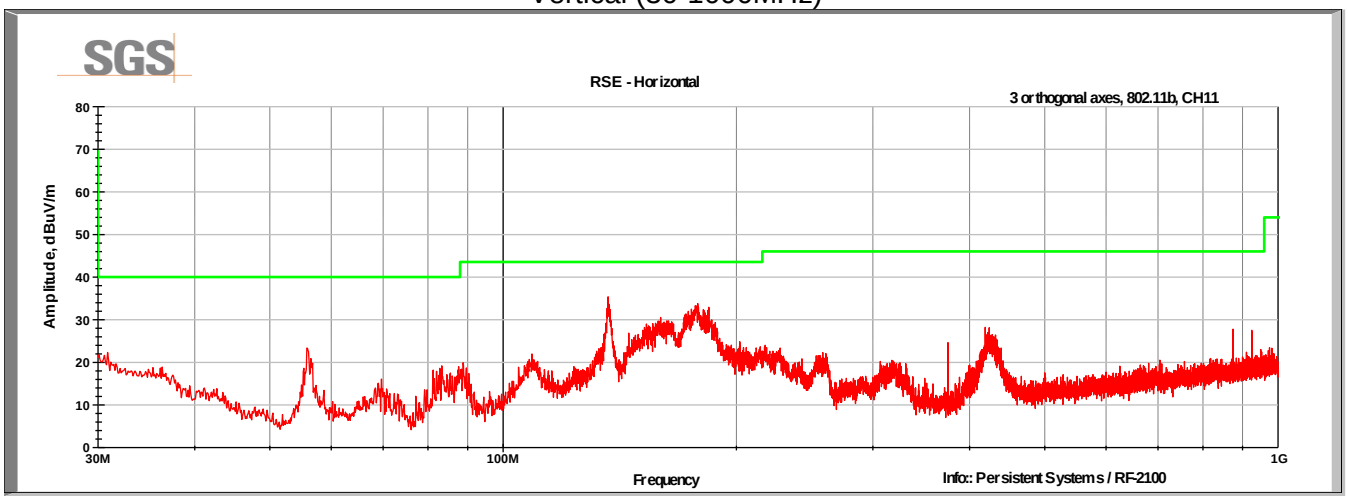
Horizontal
Vertical (18-26GHz)



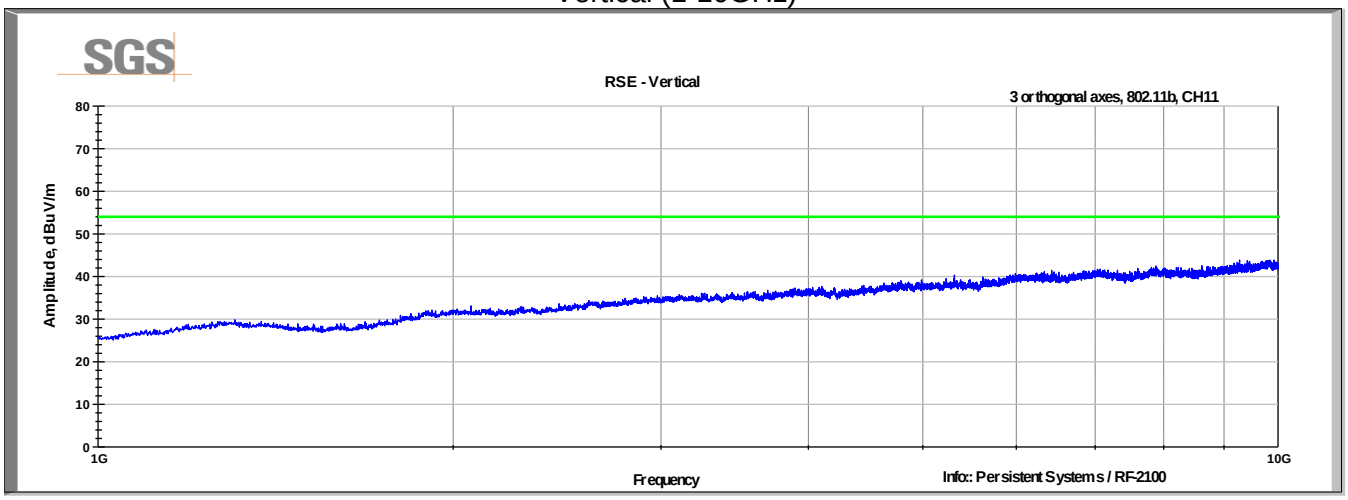
CH 11 802.11b, 1Mbps
Vertical (30-1000MHz)



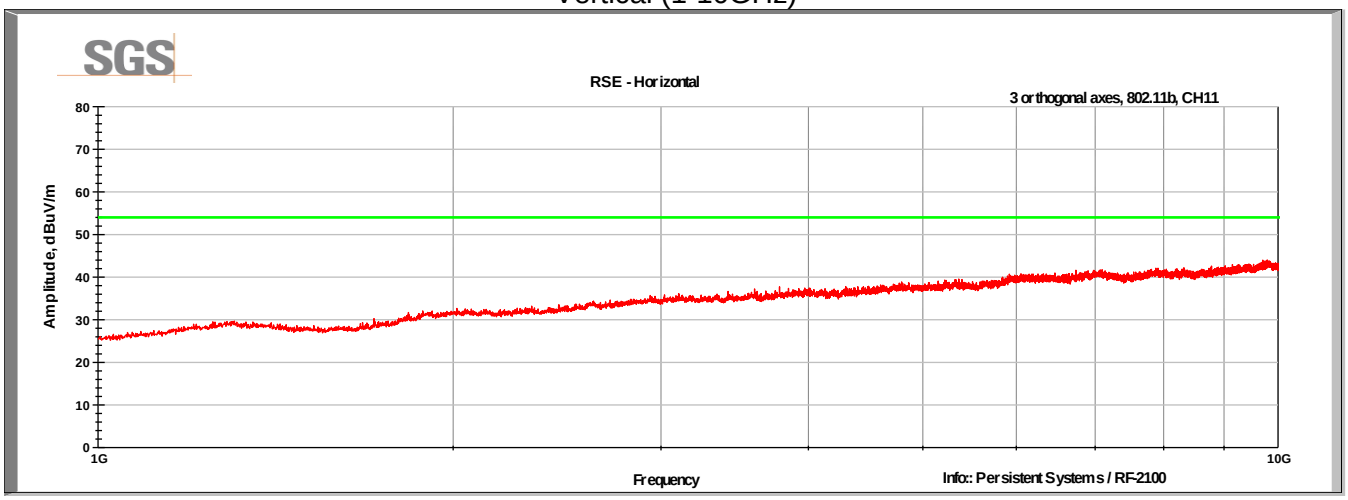
Horizontal
Vertical (30-1000MHz)



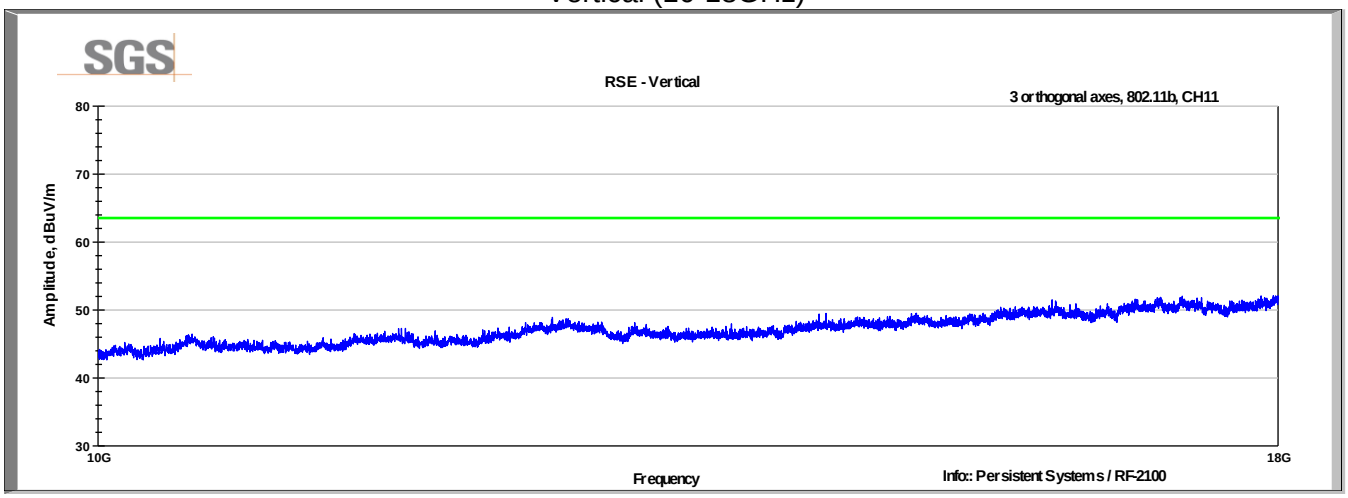
CH 11 802.11b, 1Mbps
Vertical (1-10GHz)



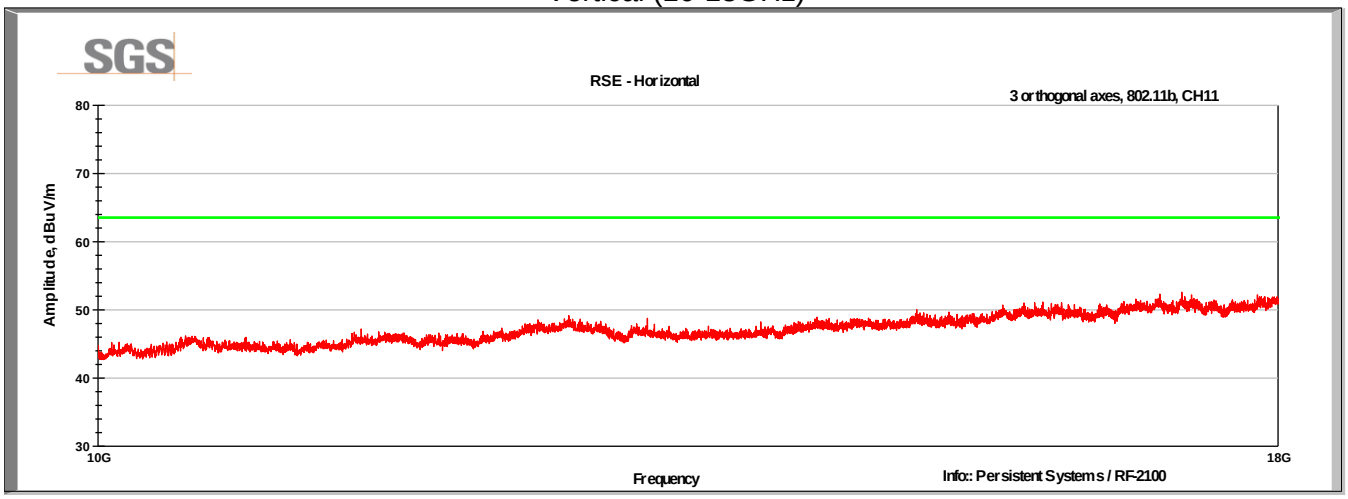
Horizontal
Vertical (1-10GHz)



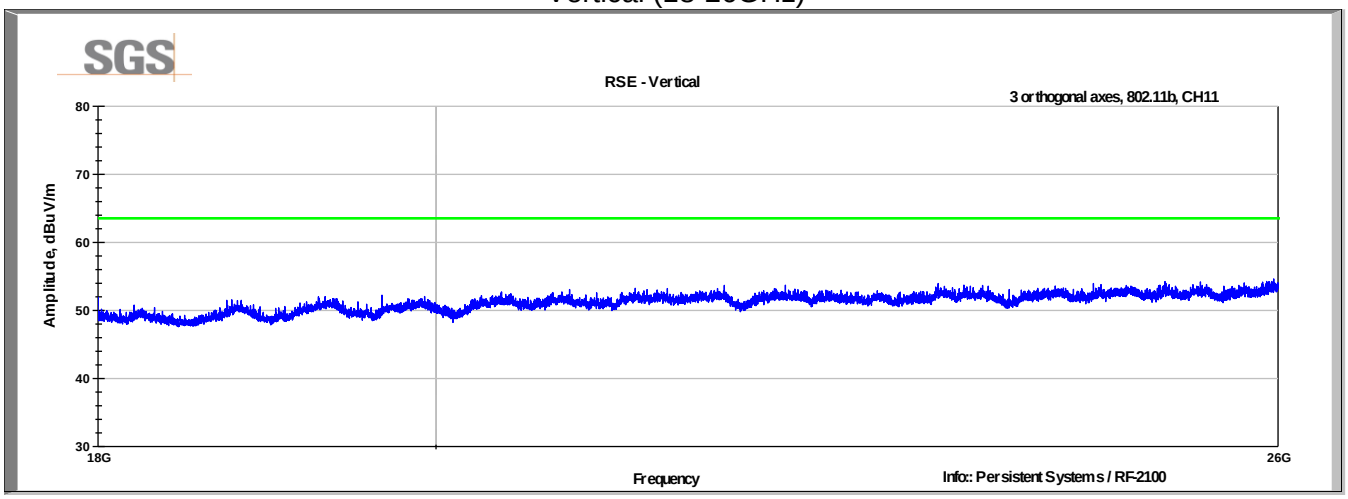
CH 11 802.11b, 1Mbps
Vertical (10-18GHz)



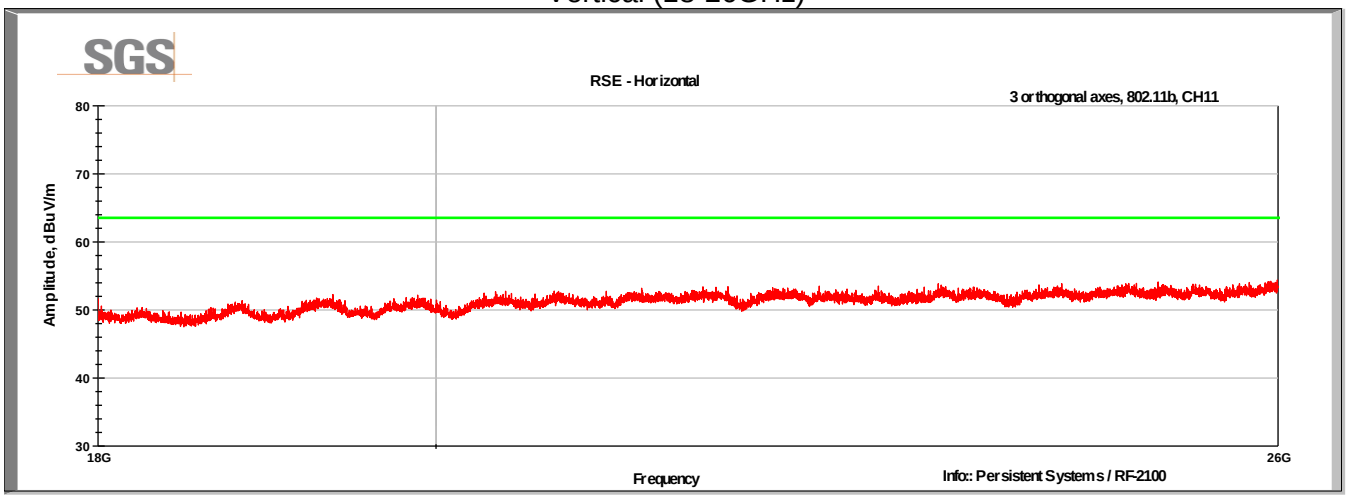
Horizontal
Vertical (10-18GHz)



CH 11 802.11b, 1Mbps
Vertical (18-26GHz)



Horizontal
Vertical (18-26GHz)



7.6 *Test Data – Restricted Bands*

SISO

Frequency MHz	Raw Meas (dBm)	Antenna Gain (dBi)	Path Loss (dB)	Distance Corr (dB)	Conversion (dB)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector
Channel 1									
802.11b, 1Mbps									
2386.11	-54.0	7.4	10.5	9.5	104.8	59.2	74.0	-14.8	Peak
2386.11	-60.5	7.4	10.5	9.5	104.8	52.7	54.0	-1.3	Average
2386.11	-48.8	4.0	10.5	9.5	104.8	61.0	74.0	-13.0	Peak
2386.11	-56.2	4.0	10.5	9.5	104.8	53.6	54.0	-0.4	Average
802.11g, 6Mbps									
2390.00	-48.8	7.4	10.5	9.5	104.8	64.4	74.0	-9.6	Peak
2390.00	-59.8	7.4	10.5	9.5	104.8	53.4	54.0	-0.6	Average
2390.00	-44.0	4.0	10.5	9.5	104.8	65.8	74.0	-8.2	Peak
2390.00	-56.8	4.0	10.5	9.5	104.8	53.0	54.0	-1.0	Average
802.11n, MCS0									
2390.00	-46.9	7.4	10.5	9.5	104.8	66.3	74.0	-7.7	Peak
2390.00	-60.1	7.4	10.5	9.5	104.8	53.1	54.0	-0.9	Average
2390.00	-40.9	4.0	10.5	9.5	104.8	68.9	74.0	-5.1	Peak
2390.00	-56.4	4.0	10.5	9.5	104.8	53.4	54.0	-0.6	Average
Channel 11									
802.11b, 1Mbps									
2487.95	-50.5	7.4	10.5	9.5	104.8	62.7	74.0	-11.3	Peak
2487.95	-59.4	7.4	10.5	9.5	104.8	53.8	54.0	-0.2	Average
2487.95	-50.3	4.0	10.5	9.5	104.8	59.5	74.0	-14.5	Peak
2487.95	-56.4	4.0	10.5	9.5	104.8	53.4	54.0	-0.6	Average
802.11g, 6Mbps									
2483.50	-47.3	7.4	10.5	9.5	104.8	65.9	74.0	-8.1	Peak
2483.50	-59.6	7.4	10.5	9.5	104.8	53.6	54.0	-0.4	Average
2483.50	-44.2	4.0	10.5	9.5	104.8	65.6	74.0	-8.4	Peak
2483.50	-57.3	4.0	10.5	9.5	104.8	52.5	54.0	-1.5	Average
802.11n, MCS0									
2483.50	-47.5	7.4	10.5	9.5	104.8	65.7	74.0	-8.3	Peak
2483.50	-59.4	7.4	10.5	9.5	104.8	53.8	54.0	-0.2	Average
2483.50	-43.9	4.0	10.5	9.5	104.8	65.9	74.0	-8.1	Peak
2483.50	-56.2	4.0	10.5	9.5	104.8	53.6	54.0	-0.4	Average

2x2 MIMO

Frequency MHz	Raw Meas (dBm)	Antenna Gain (dBi)	Aggregate Corr (dB)	Path Loss (dB)	Distance Corr (dB)	Conversion (dB)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector
Channel 1										
802.11b, 1Mbps										
2386.27	-55.8	7.4	3.0	10.5	9.5	104.8	60.4	74.0	-13.6	Peak
2386.27	-63.8	7.4	3.0	10.5	9.5	104.8	52.4	54.0	-1.6	Average
2386.27	-53.3	4.0	3.0	10.5	9.5	104.8	59.5	74.0	-14.5	Peak
2386.27	-59.4	4.0	3.0	10.5	9.5	104.8	53.4	54.0	-0.6	Average
802.11g, 6Mbps										
2390.00	-47.7	7.4	3.0	10.5	9.5	104.8	68.5	74.0	-5.5	Peak
2390.00	-64.1	7.4	3.0	10.5	9.5	104.8	52.1	54.0	-1.9	Average
2390.00	-39.0	4.0	3.0	10.5	9.5	104.8	73.8	74.0	-0.2	Peak
2390.00	-59.0	4.0	3.0	10.5	9.5	104.8	53.8	54.0	-0.2	Average
802.11n, MCS0										
2390.00	-47.7	7.4	3.0	10.5	9.5	104.8	68.5	74.0	-5.5	Peak
2390.00	-64.1	7.4	3.0	10.5	9.5	104.8	52.1	54.0	-1.9	Average
2390.00	-43.3	4.0	3.0	10.5	9.5	104.8	69.5	74.0	-4.5	Peak
2390.00	-60.0	4.0	3.0	10.5	9.5	104.8	52.8	54.0	-1.2	Average
Channel 11										
802.11b, 1Mbps										
2487.88	-53.8	7.4	3.0	10.5	9.5	104.8	62.4	74.0	-11.6	Peak
2487.88	-63.3	7.4	3.0	10.5	9.5	104.8	52.9	54.0	-1.1	Average
2487.88	-51.9	4.0	3.0	10.5	9.5	104.8	60.9	74.0	-13.1	Peak
2487.88	-59.1	4.0	3.0	10.5	9.5	104.8	53.7	54.0	-0.3	Average
802.11g, 6Mbps										
2483.50	-49.3	7.4	3.0	10.5	9.5	104.8	66.9	74.0	-7.1	Peak
2483.50	-63.4	7.4	3.0	10.5	9.5	104.8	52.8	54.0	-1.2	Average
2483.50	-45.0	4.0	3.0	10.5	9.5	104.8	67.8	74.0	-6.2	Peak
2483.50	-60.9	4.0	3.0	10.5	9.5	104.8	51.9	54.0	-2.1	Average
802.11n, MCS0										
2483.50	-47.9	7.4	3.0	10.5	9.5	104.8	68.3	74.0	-5.7	Peak
2483.50	-63.8	7.4	3.0	10.5	9.5	104.8	52.4	54.0	-1.6	Average
2483.50	-46.4	4.0	3.0	10.5	9.5	104.8	66.4	74.0	-7.6	Peak
2483.50	-60.9	4.0	3.0	10.5	9.5	104.8	51.9	54.0	-2.1	Average

3x3 MIMO

Frequency MHz	Raw Meas (dBm)	Antenna Gain (dBi)	Aggregate Corr (dB)	Path Loss (dB)	Distance Corr (dB)	Conversion (dB)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector
Channel 1										
802.11b, 1Mbps										
2386.59	-55.1	7.4	4.8	10.5	9.5	104.8	62.9	74.0	-11.1	Peak
2386.59	-66.5	7.4	4.8	10.5	9.5	104.8	51.5	54.0	-2.5	Average
2386.59	-53.7	4.0	4.8	10.5	9.5	104.8	60.9	74.0	-13.1	Peak
2386.59	-64.6	4.0	4.8	10.5	9.5	104.8	50.0	54.0	-4.0	Average
802.11g, 6Mbps										
2390.00	-47.5	7.4	4.8	10.5	9.5	104.8	70.5	74.0	-3.5	Peak
2390.00	-64.8	7.4	4.8	10.5	9.5	104.8	53.2	54.0	-0.8	Average
2390.00	-45.2	4.0	4.8	10.5	9.5	104.8	69.4	74.0	-4.6	Peak
2390.00	-61.7	4.0	4.8	10.5	9.5	104.8	52.9	54.0	-1.1	Average
802.11n, MCS0										
2390.00	-50.3	7.4	4.8	10.5	9.5	104.8	67.7	74.0	-6.3	Peak
2390.00	-65.0	7.4	4.8	10.5	9.5	104.8	53.0	54.0	-1.0	Average
2390.00	-45.5	4.0	4.8	10.5	9.5	104.8	69.1	74.0	-4.9	Peak
2390.00	-62.0	4.0	4.8	10.5	9.5	104.8	52.6	54.0	-1.4	Average
Channel 11										
802.11b, 1Mbps										
2487.95	-56.2	7.4	4.8	10.5	9.5	104.8	61.8	74.0	-12.2	Peak
2487.95	-64.7	7.4	4.8	10.5	9.5	104.8	53.3	54.0	-0.7	Average
2487.95	-55.1	4.0	4.8	10.5	9.5	104.8	59.5	74.0	-14.5	Peak
2487.95	-63.0	4.0	4.8	10.5	9.5	104.8	51.6	54.0	-2.4	Average
802.11g, 6Mbps										
2483.50	-51.9	7.4	4.8	10.5	9.5	104.8	66.1	74.0	-7.9	Peak
2483.50	-65.0	7.4	4.8	10.5	9.5	104.8	53.0	54.0	-1.0	Average
2483.50	-49.9	4.0	4.8	10.5	9.5	104.8	64.7	74.0	-9.3	Peak
2483.50	-63.0	4.0	4.8	10.5	9.5	104.8	51.6	54.0	-2.4	Average
802.11n, MCS0										
2483.50	-52.4	7.4	4.8	10.5	9.5	104.8	65.6	74.0	-8.4	Peak
2483.50	-65.4	7.4	4.8	10.5	9.5	104.8	52.6	54.0	-1.4	Average
2483.50	-47.4	4.0	4.8	10.5	9.5	104.8	67.2	74.0	-6.8	Peak
2483.50	-62.1	4.0	4.8	10.5	9.5	104.8	52.5	54.0	-1.5	Average

Radiated Harmonics in Restricted Bands (SISO, 802.11b, 1Mbps)

Frequency MHz	Raw (dBuV)	Polarity (V/H)	AF (dB/m)	CL (dB)	Amp (dB)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector (Pk / Avg)
Channel 1 - 4dBi Antennas									
4824.00	41.7	V	34.0	5.0	33.1	47.7	74.0	-26.3	Pk
4824.00	30.4	V	34.0	5.0	33.1	36.4	54.0	-17.6	Avg
Channel 6 - 4dBi Antennas									
4874.00	44.7	V	34.0	5.1	33.1	50.7	74.0	-23.3	Pk
4874.00	34.7	V	34.0	5.1	33.1	40.6	54.0	-13.4	Avg
7311.00	41.7	V	35.6	6.3	33.1	50.5	74.0	-23.5	Pk
7311.00	30.0	V	35.6	6.3	33.1	38.8	54.0	-15.2	Avg
Channel 11 - 4dBi Antennas									
4924.00	45.1	V	34.0	5.1	33.1	51.1	74.0	-22.9	Pk
4924.00	35.8	V	34.0	5.1	33.1	41.8	54.0	-12.2	Avg
7386.00	42.4	V	35.6	6.3	33.1	51.3	74.0	-22.7	Pk
7386.00	30.0	V	35.6	6.3	33.1	38.8	54.0	-15.2	Avg
Channel 1 - 7.4dBi Antennas									
4824.00	45.0	V	34.0	5.0	33.1	51.0	74.0	-23.0	Pk
4824.00	34.6	V	34.0	5.0	33.1	40.6	54.0	-13.4	Avg
Channel 6 - 7.4dBi Antennas									
4874.00	44.3	V	34.0	5.1	33.1	50.3	74.0	-23.7	Pk
4874.00	34.5	V	34.0	5.1	33.1	40.5	54.0	-13.5	Avg
7311.00	41.7	V	35.6	6.3	33.1	50.4	74.0	-23.6	Pk
7311.00	30.1	V	35.6	6.3	33.1	38.9	54.0	-15.1	Avg
Channel 11 - 7.4dBi Antennas									
4924.00	43.1	V	34.0	5.1	33.1	49.2	74.0	-24.8	Pk
4924.00	31.2	V	34.0	5.1	33.1	37.2	54.0	-16.8	Avg
7386.00	41.7	V	35.6	6.3	33.1	50.6	74.0	-23.4	Pk
7386.00	30.0	V	35.6	6.3	33.1	38.8	54.0	-15.2	Avg
Corr Value = Level + AF + CL - Amp									
Margin = Avg Value - Limit									

8 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	23 December 2015
1	- Added references to KDB 662911 in the test method sections on pages 8, 12, 13, and 19	11 January 2016