

7 Field Strength of Spurious Radiation (Restricted Bands)

7.1 Test Result

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

7.2 Test Method

The measurement methods defined in ANSI C63.10: 2013 were used.

Lowest, middle, and highest channels were investigated – the device was commanded to continuously transmit on low, middle, and high channels. The test system reported the following duty-cycles used for correcting the average measurements:

- 802.11b – 82.2% (0.9dB)
- 802.11g – 18.2% (7.4dB)

Test distance:

- 9k to 30 MHz – The EUT to measurement antenna distance was 3 meters
- 30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters
- 1 to 18 GHz - The EUT to measurement antenna distance was 3 meters
- 18 to 26 GHz - The EUT to measurement antenna distance was 3 meters

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

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 24.7 °C

Relative Humidity: 36.9 %

Atmospheric Pressure: 98.0 kPa

7.4 Test Equipment

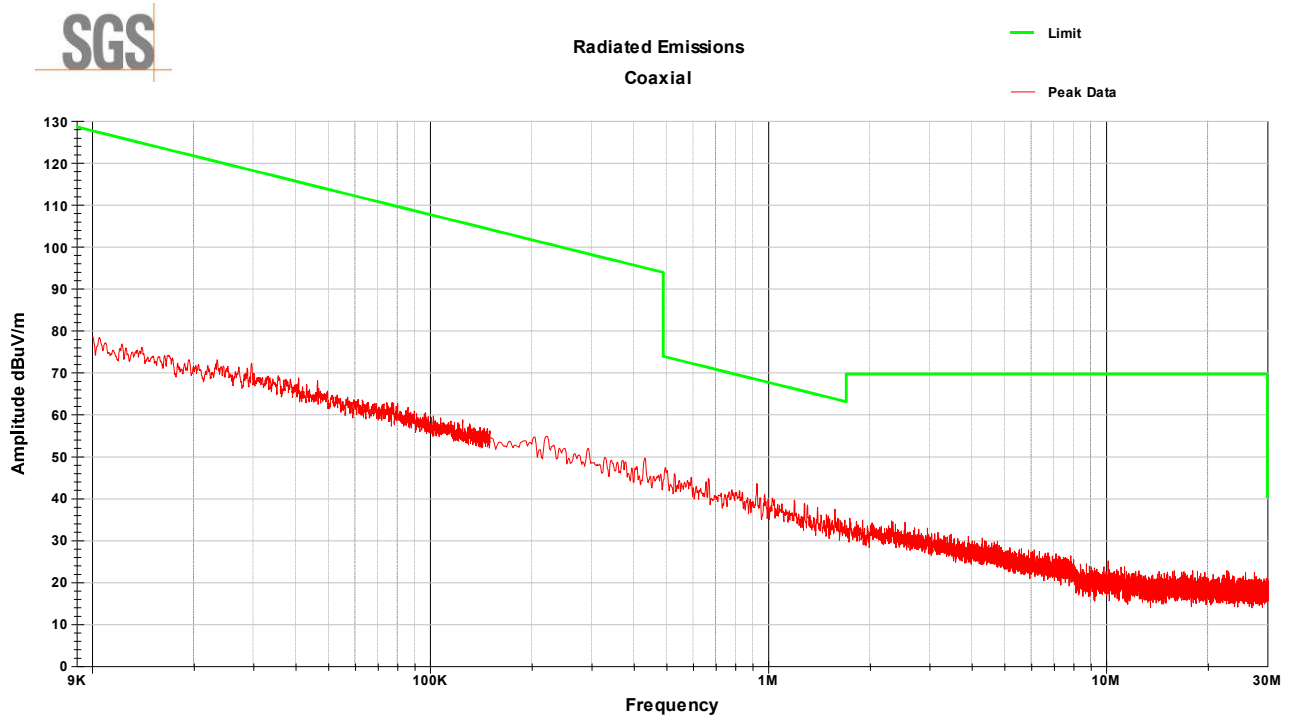
Test End Date: 26-Apr-2021

Tester: EW/PL

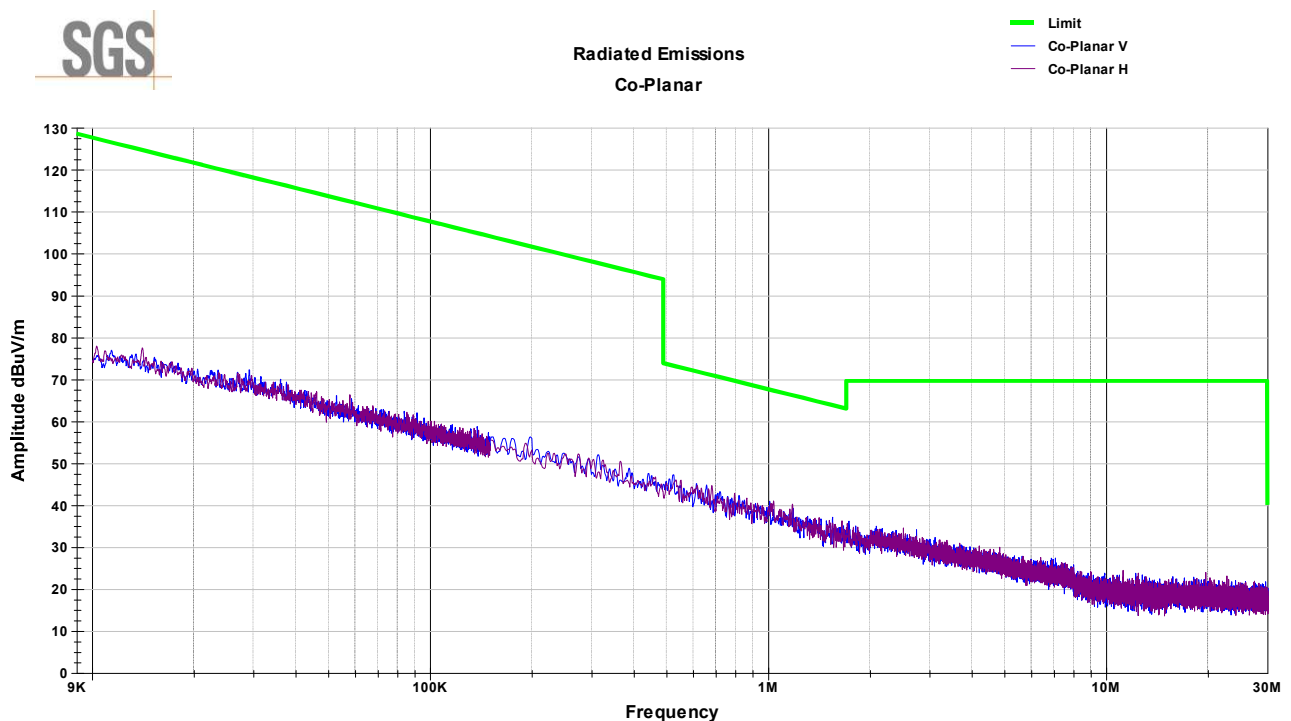
Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
RF Cable Nm to Nf, 0.01-18GHz	90-213-118	TELEDYNE STORM MICROWAVE	20117	17-Feb-2021	17-Feb-2022
RF Cable Nm to Nm, 0.01-18GHz	90-195-354	TELEDYNE STORM MICROWAVE	20120	17-Feb-2021	17-Feb-2022
RF Cable Nm to Nm, 0.01-18GHz	90-195-118	TELEDYNE STORM MICROWAVE	20125	17-Feb-2021	17-Feb-2022
RF CABLE, Nm to Nm.	90-195-157	TELEDYNE STORM MICROWAVE	21019	26-Mar-2021	26-Mar-2022
ANTENNA, DRG HORN (MEDIUM)	3117	ETS Lindgren	B079691	10-Aug-2020	10-Aug-2022
RF CABLE	104PE	HUBER & SUHNER	B079793	3-Sep-2020	3-Sep-2021
LOW NOISE AMPLIFIER	ZKL-2+	Mini-Circuits	B079817	28-Sep-2020	28-Sep-2021
FILTER, HIGH PASS, >2800MHz	HPM50111	MICRO-TRONICS	B085747	8-Sep-2020	8-Sep-2021
ANTENNA, BILOG	CBL 6143A	TESEQ	B085931	30-Jan-2020	30-Jan-2022
RF CABLE	SUCOFLEX 100	Huber & Suhner	B108523	3-Sep-2020	3-Sep-2021
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	S/N: 100280	19-Mar-2020	27-Dec-2021

7.5 Test Data – Peak Plots

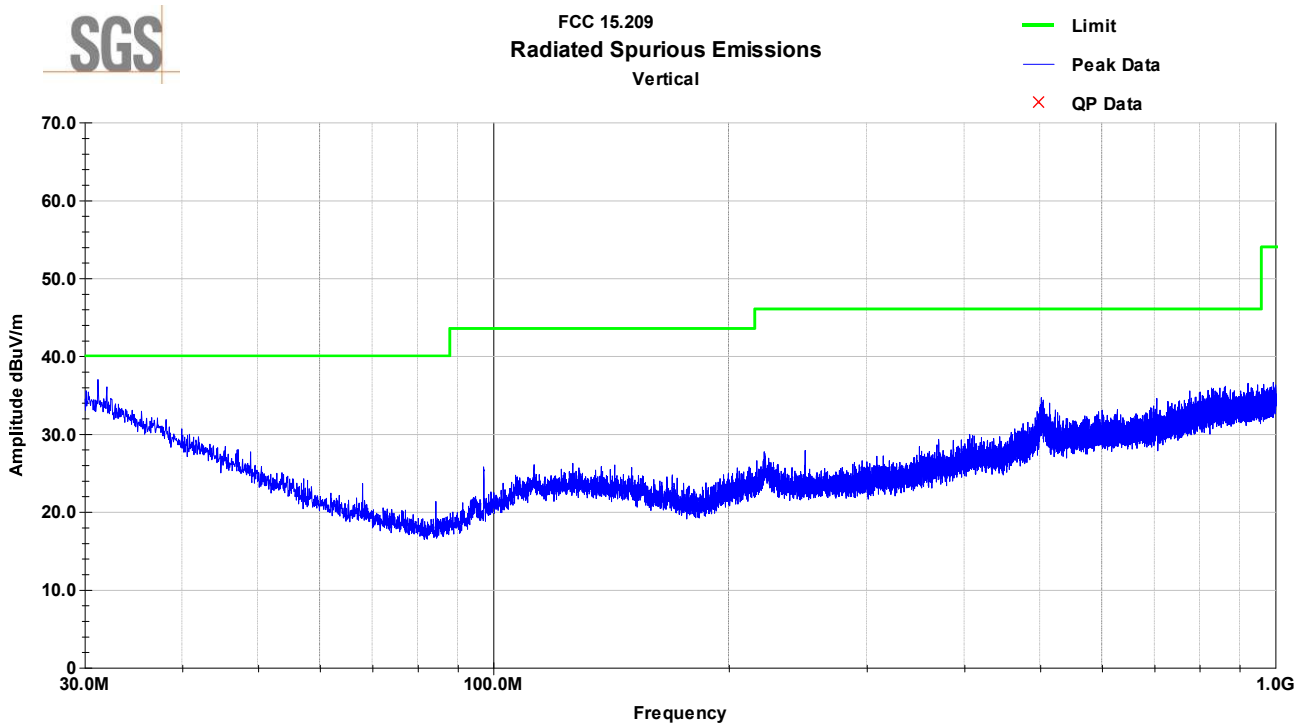
Between 9kHz and 1000MHz, there was no significant deviation with respect to axis, modulation, or channel
 Co-Axial Radiated Spurious Emissions – 9kHz-30MHz (802.11b LCH)



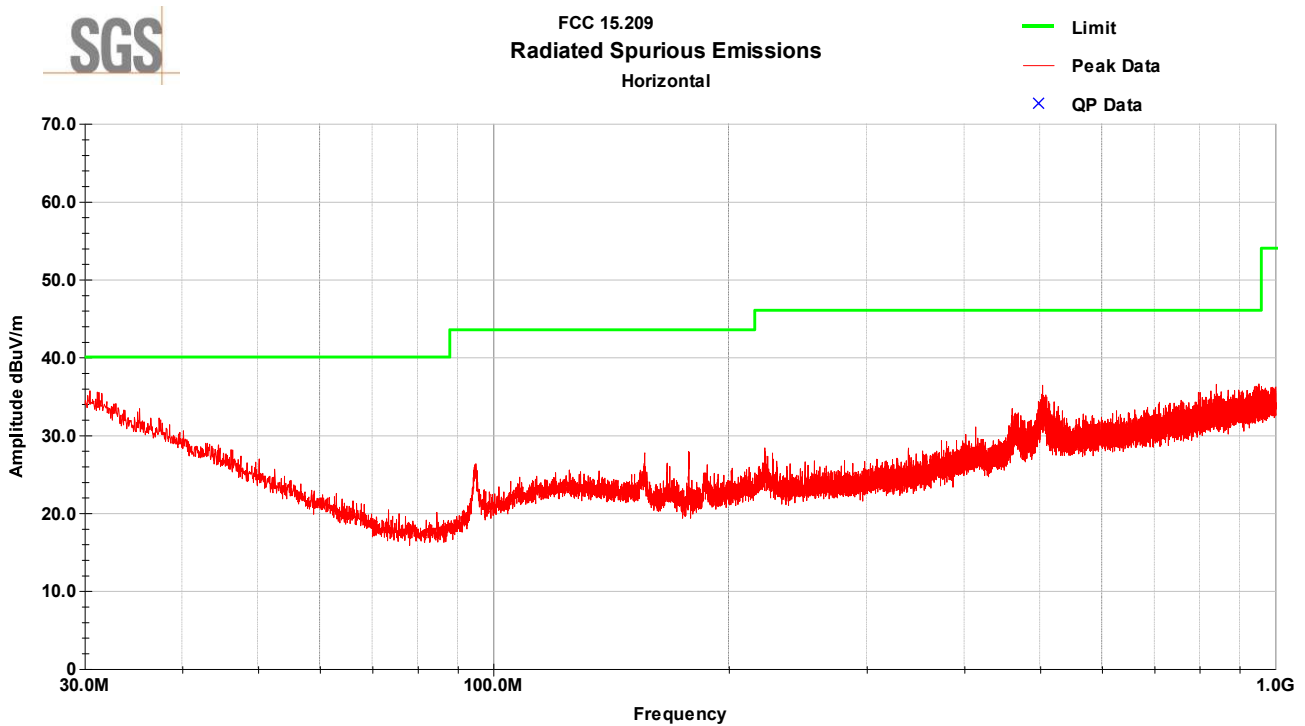
Co-Planar Radiated Spurious Emissions – 9kHz-30MHz (802.11b LCH)



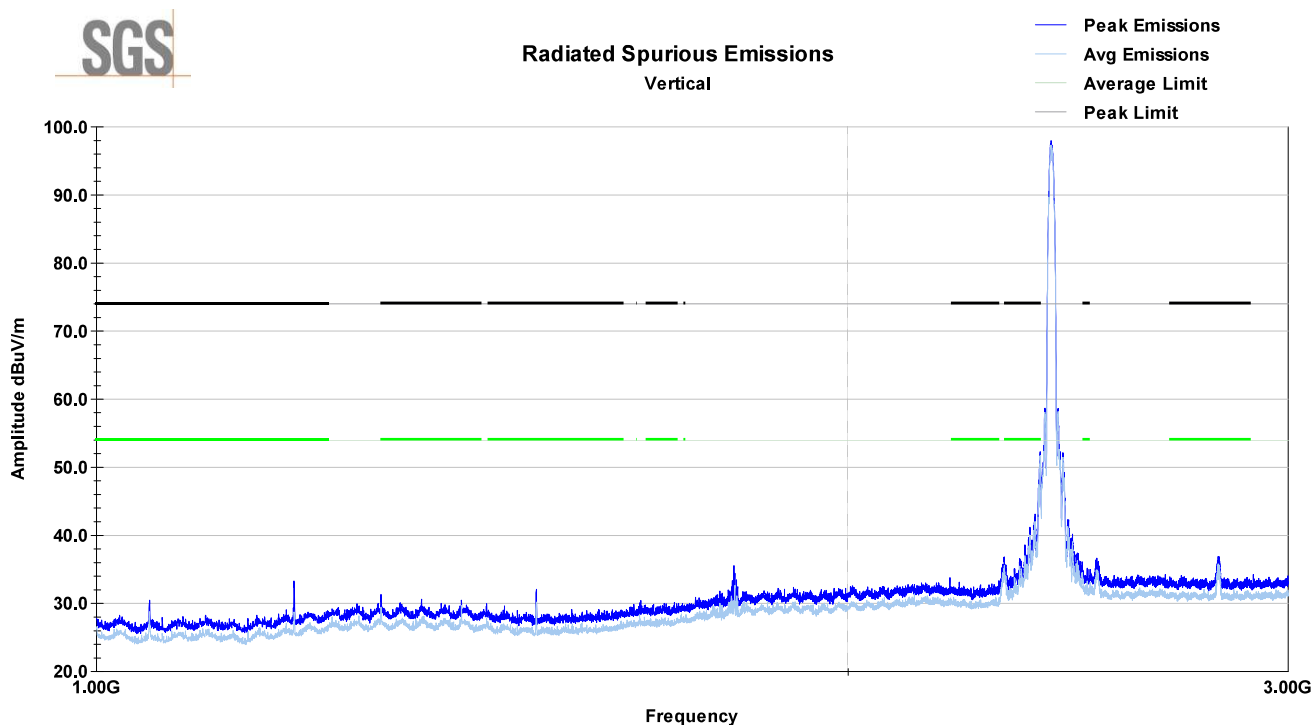
Vertical Radiated Spurious Emissions – 30-1000MHz (802.11b LCH)



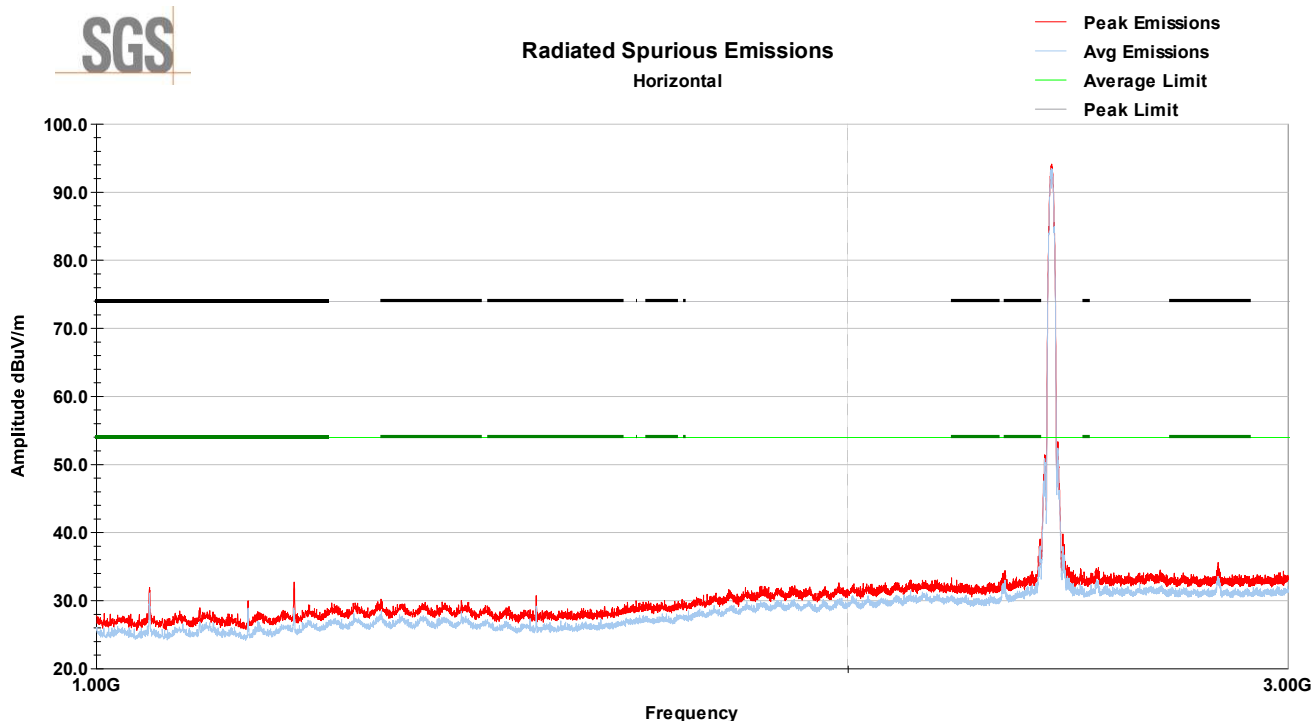
Horizontal Radiated Spurious Emissions – 30-1000MHz (802.11b LCH)



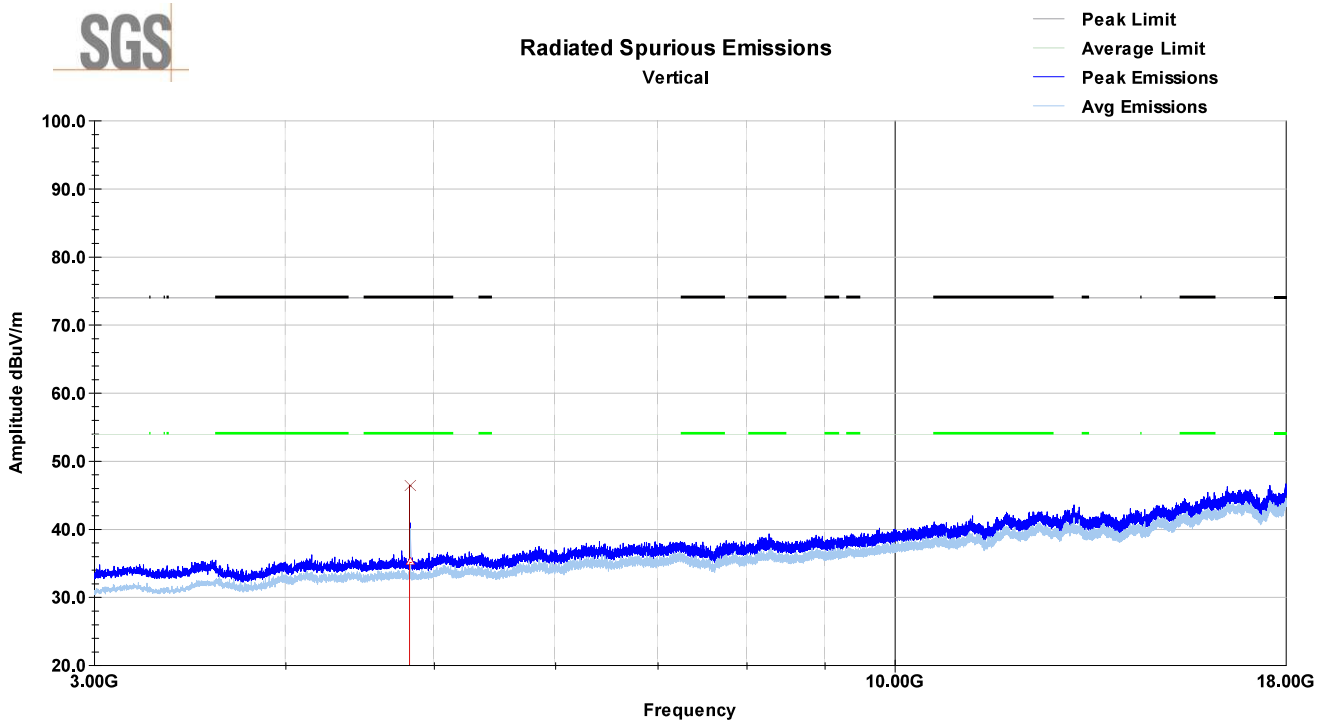
Vertical Radiated Spurious Emissions – 1-3GHz (802.11b LCH)



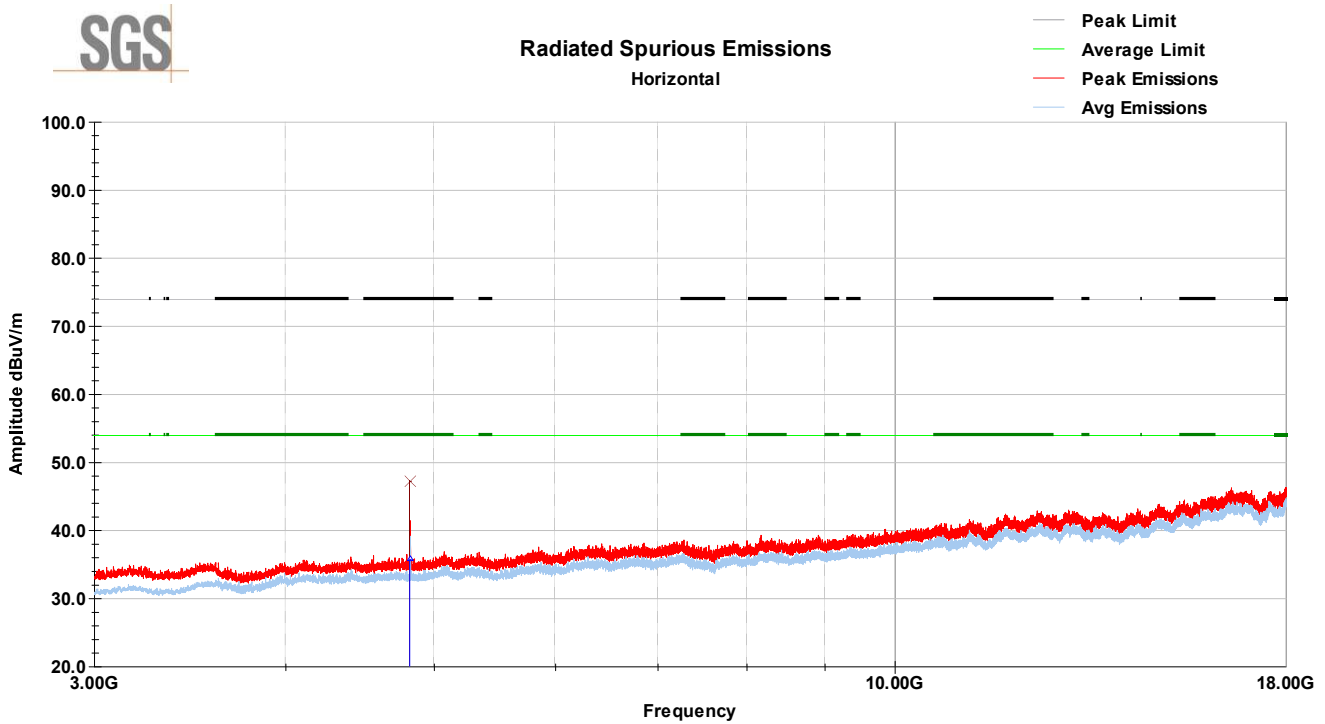
Horizontal Radiated Spurious Emissions – 1-3GHz (802.11b LCH)



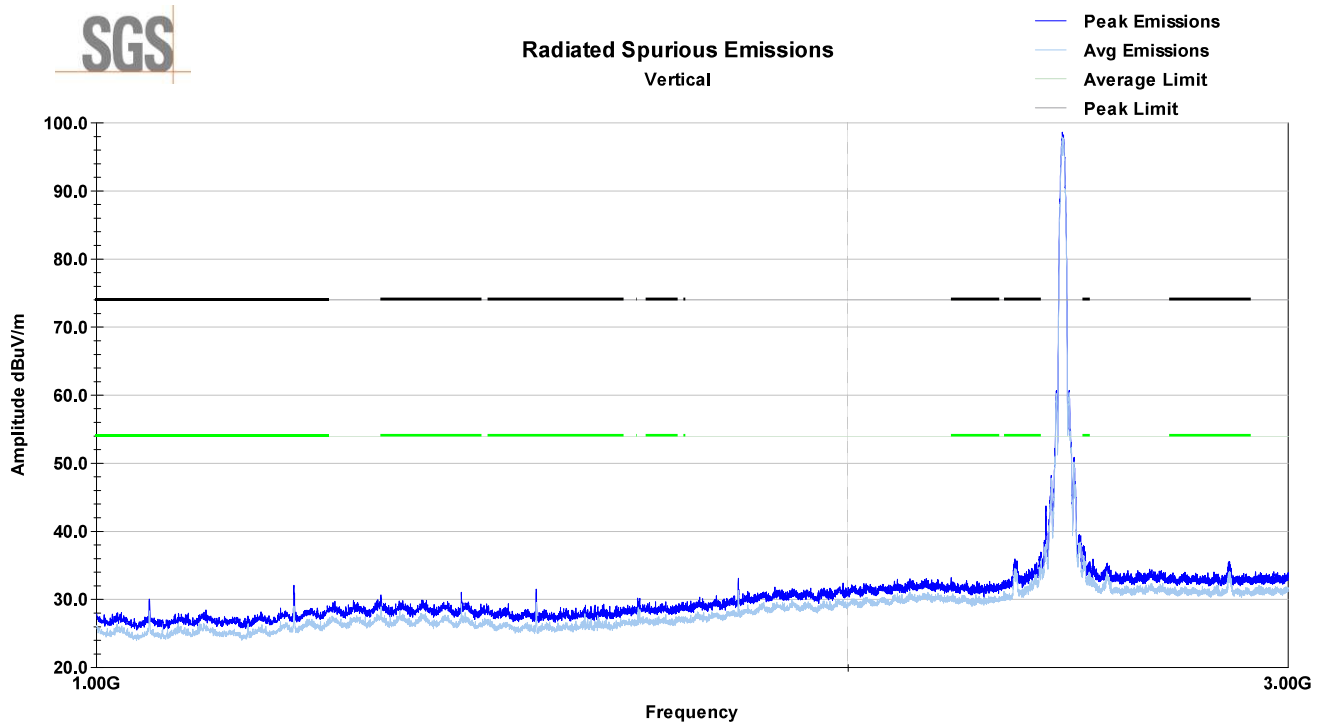
Vertical Radiated Spurious Emissions – 3-18GHz (802.11b LCH)



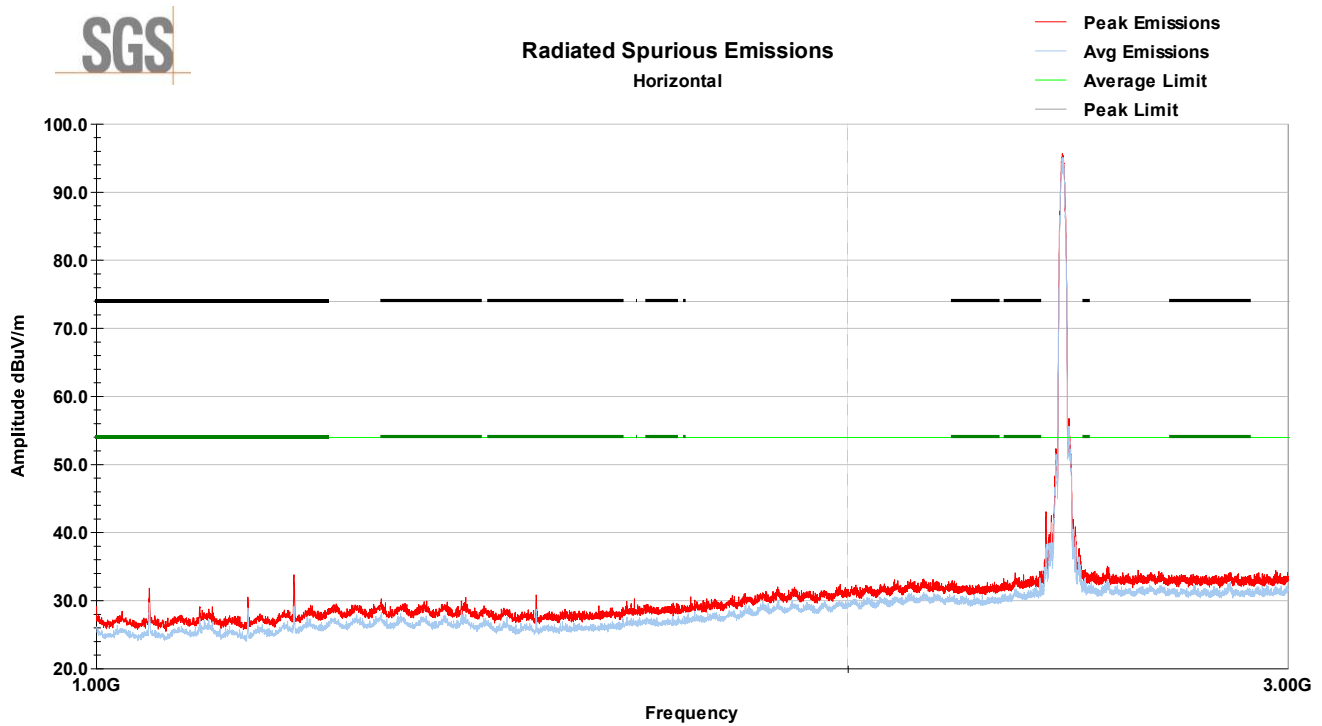
Horizontal Radiated Spurious Emissions – 3-18GHz (802.11b LCH)



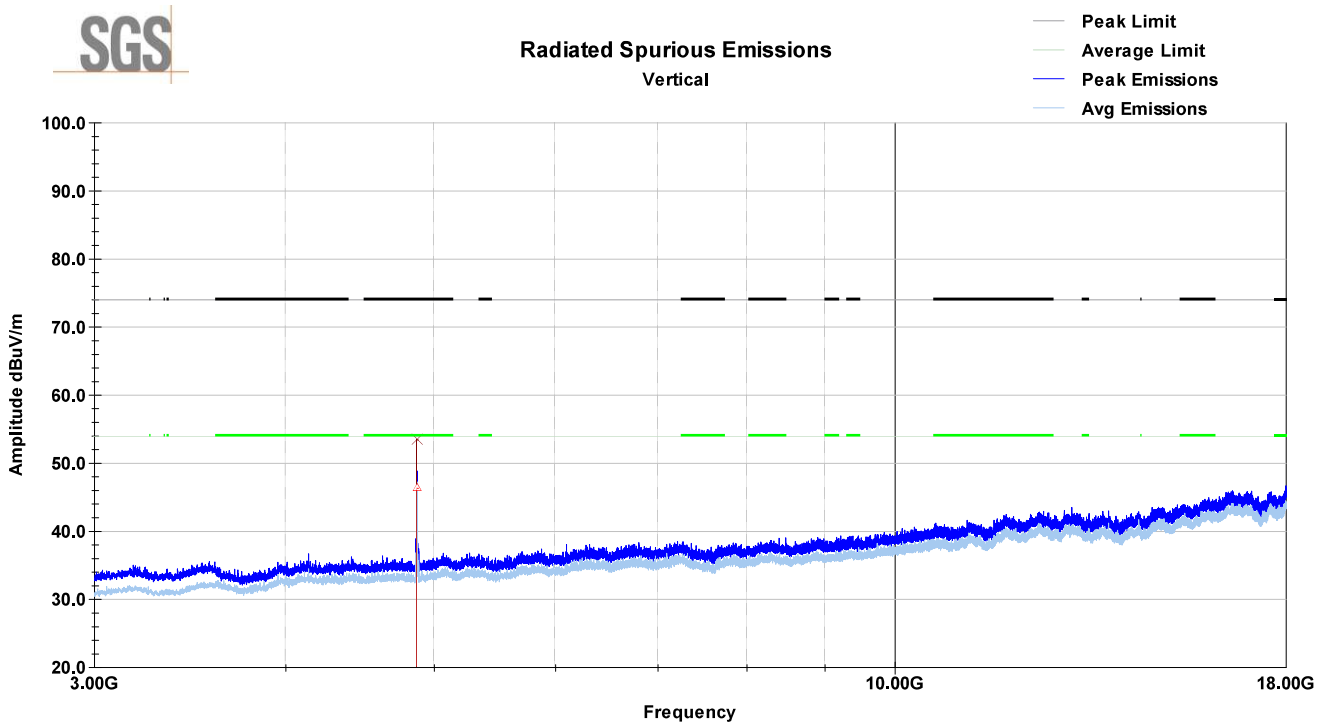
Vertical Radiated Spurious Emissions – 1-3GHz (802.11b MCH)



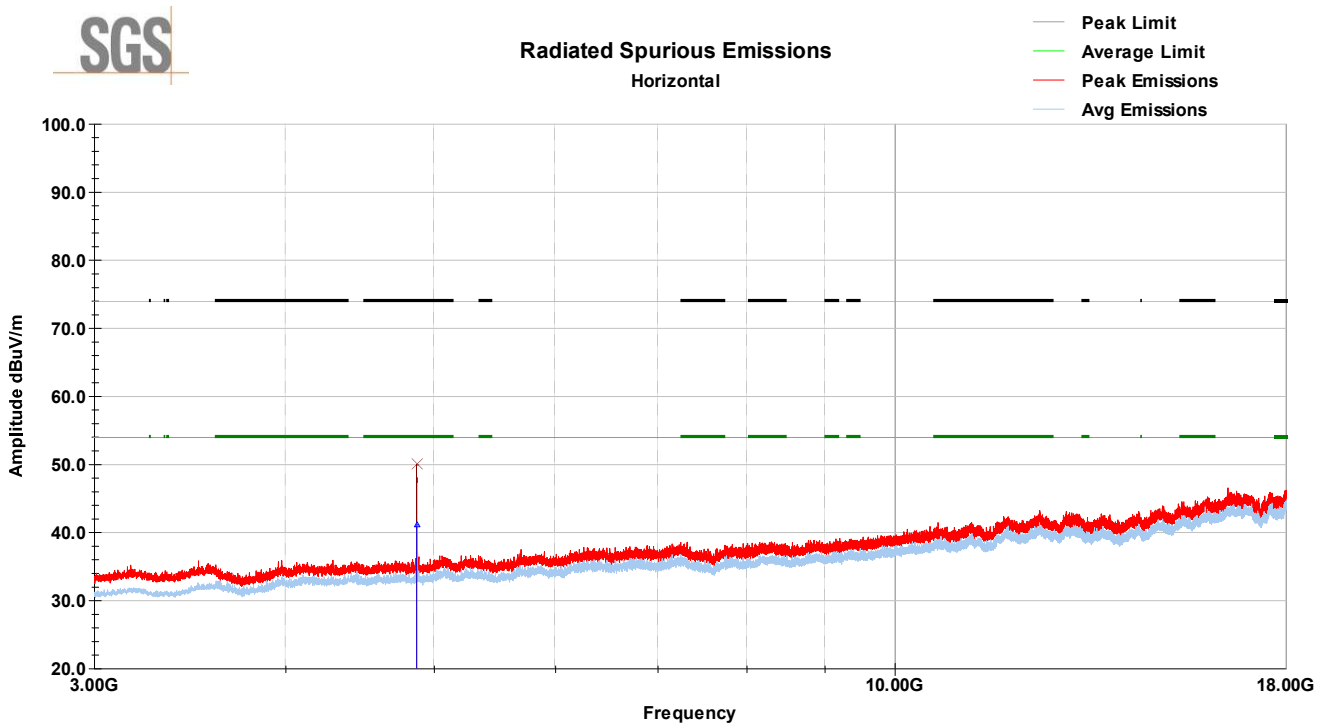
Horizontal Radiated Spurious Emissions – 1-3GHz (802.11b MCH)



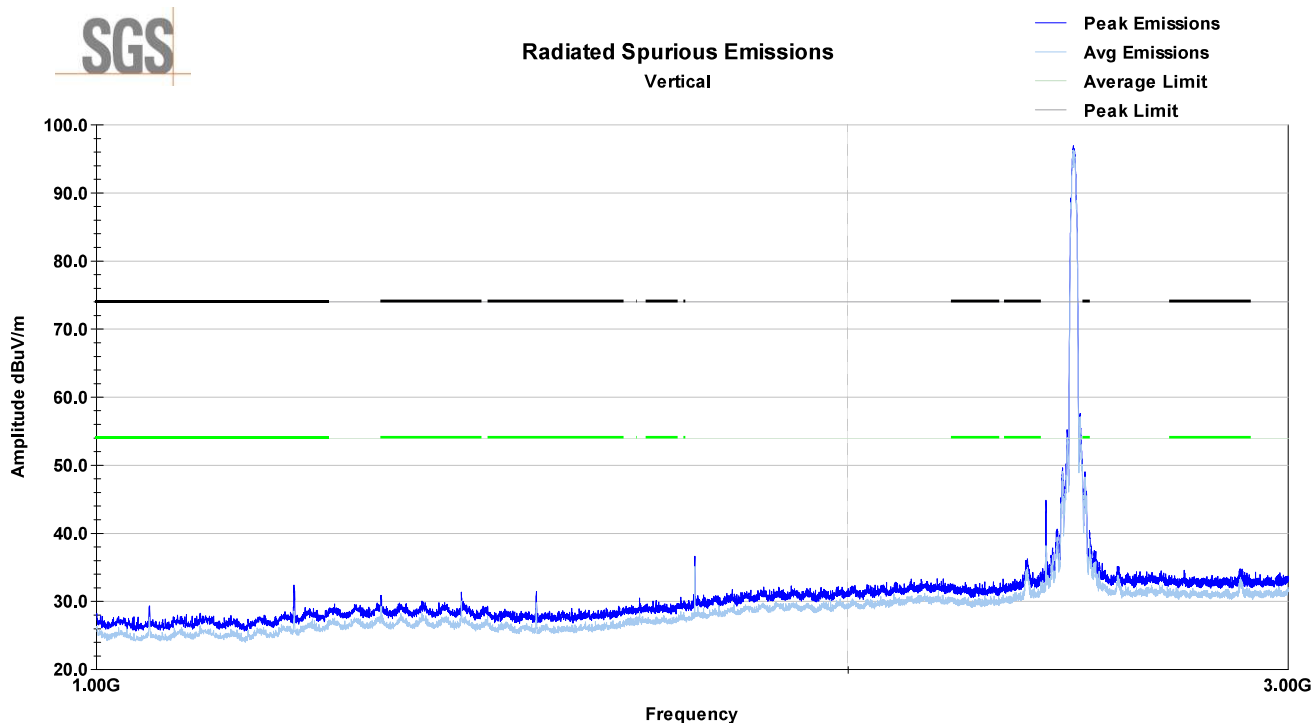
Vertical Radiated Spurious Emissions – 3-18GHz (802.11b MCH)



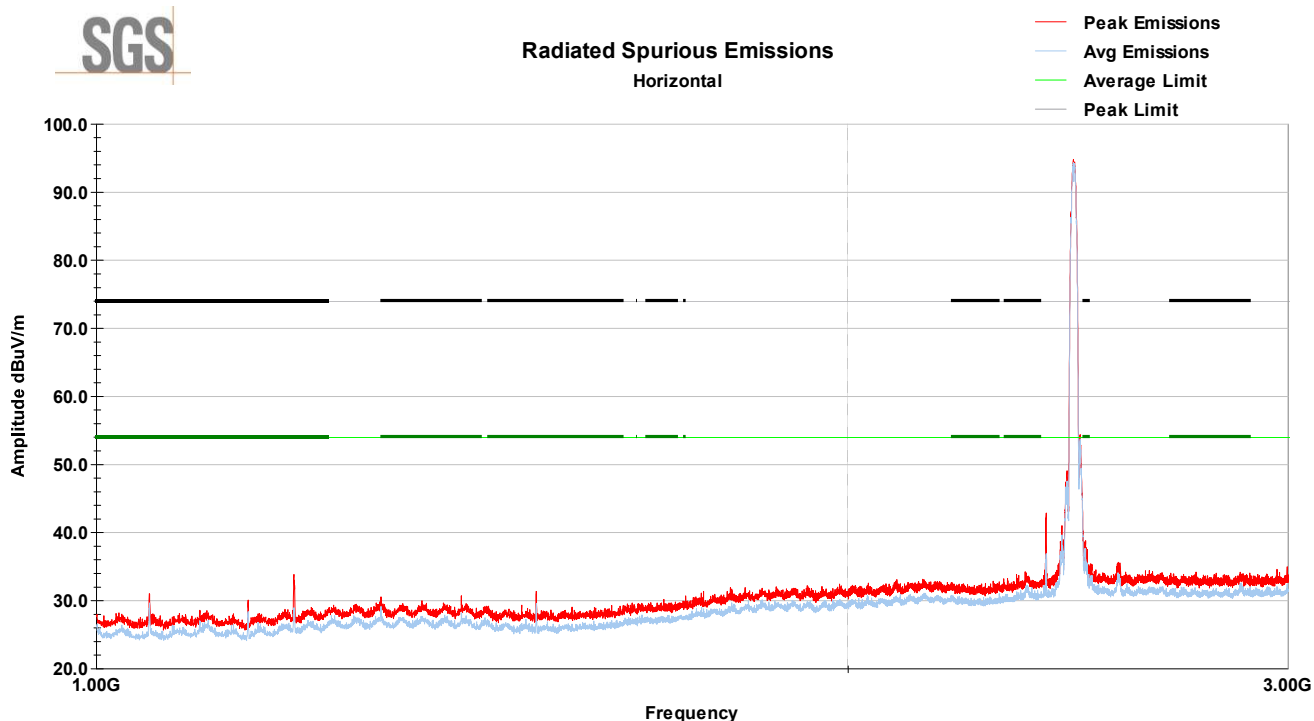
Horizontal Radiated Spurious Emissions – 3-18GHz (802.11b MCH)



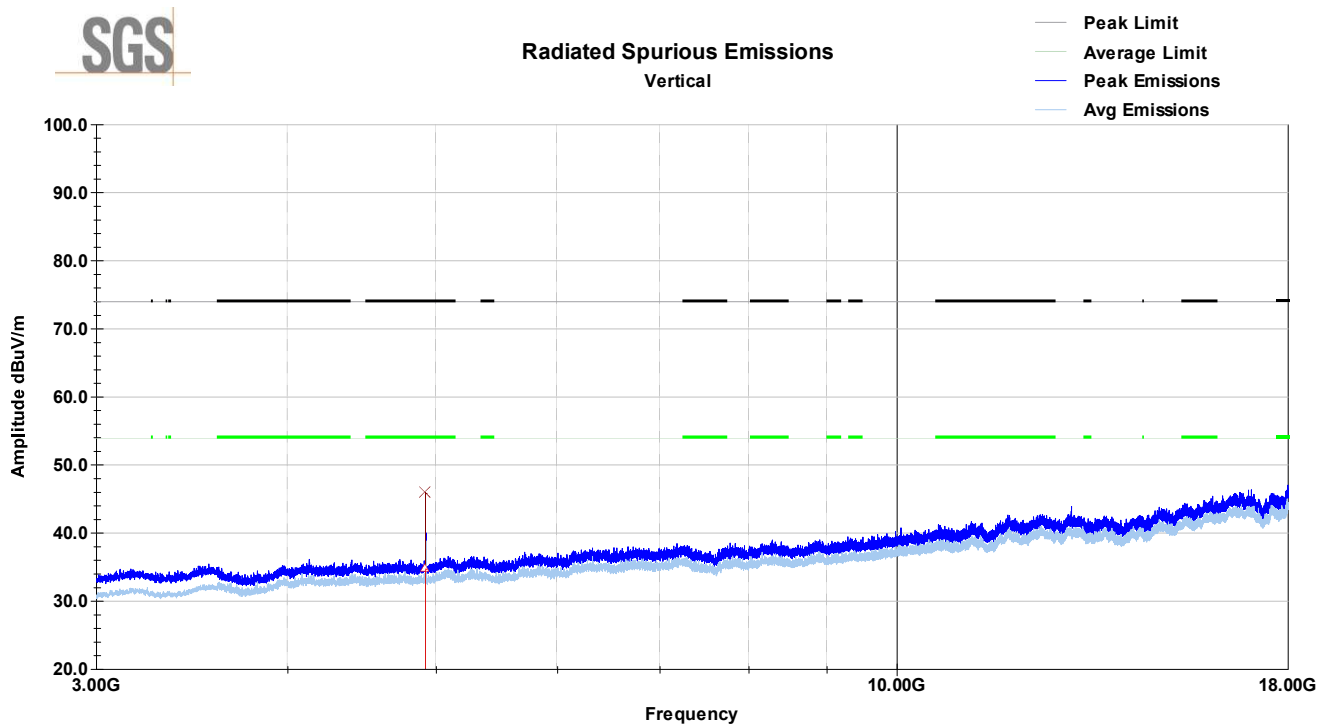
Vertical Radiated Spurious Emissions – 1-3GHz (802.11b HCH)



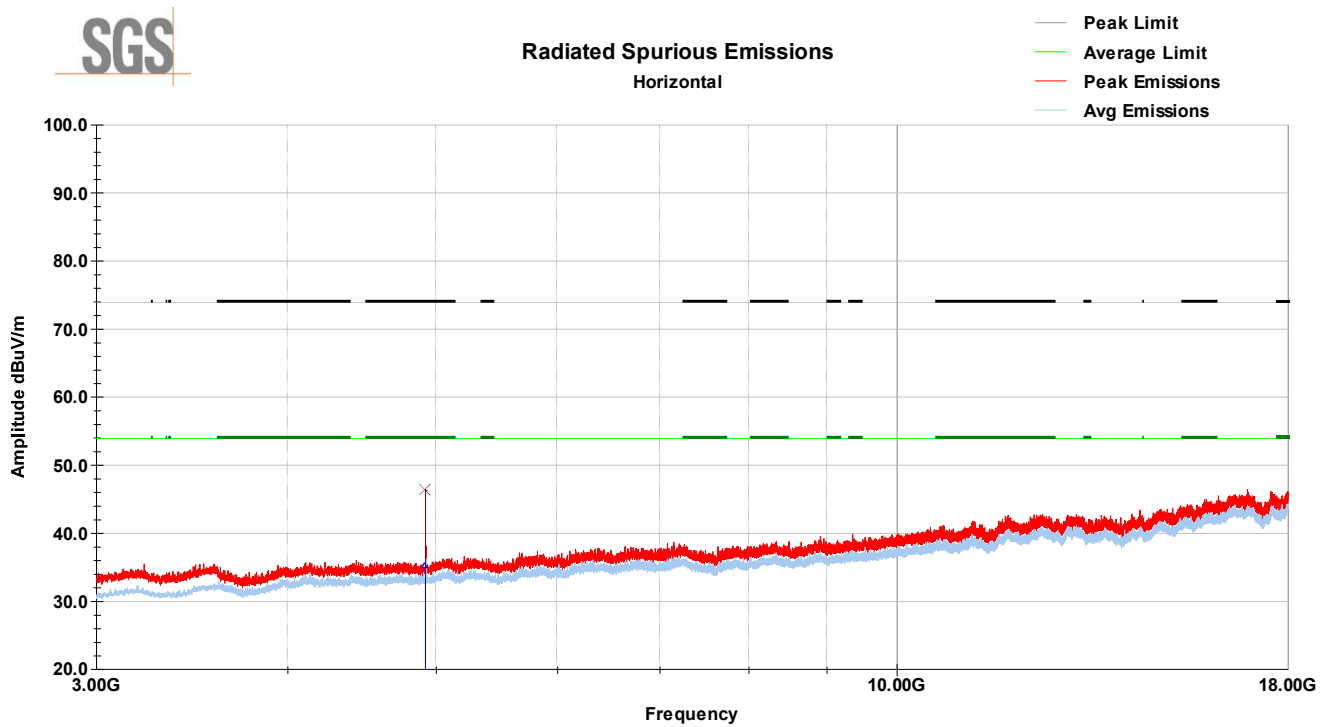
Horizontal Radiated Spurious Emissions – 1-3GHz (802.11b HCH)



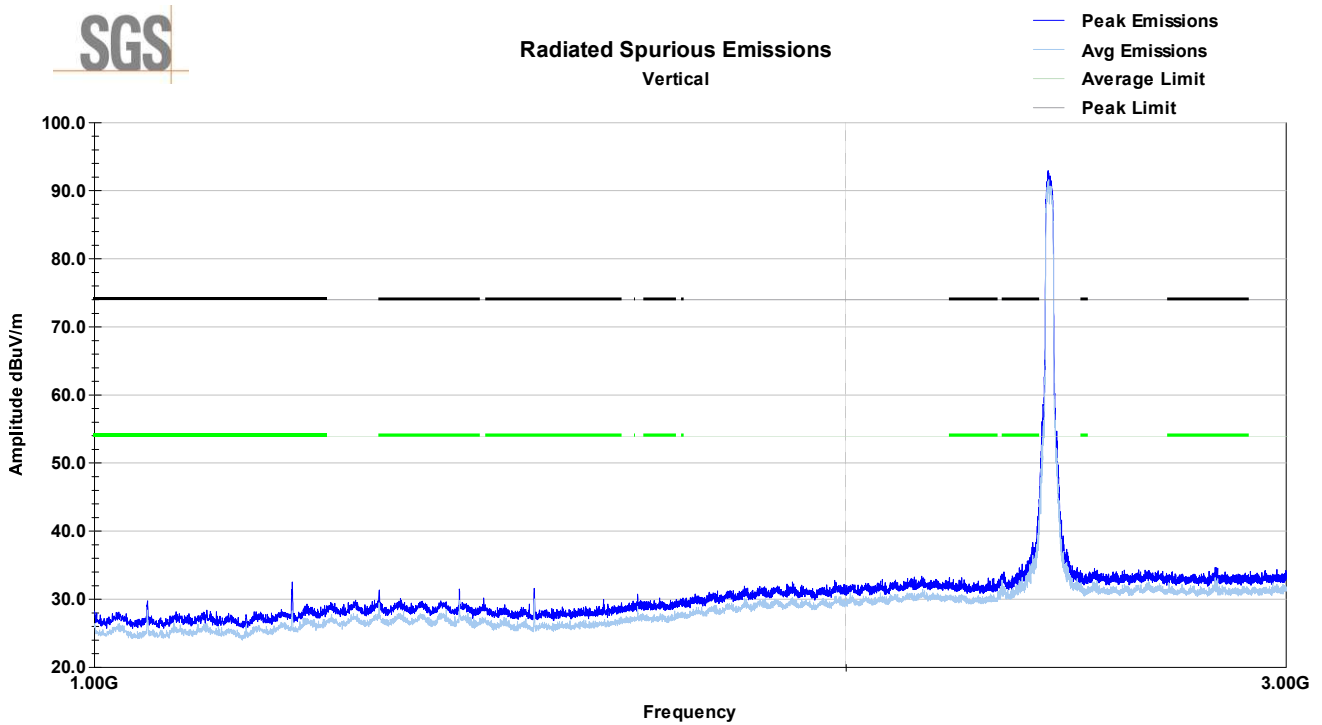
Vertical Radiated Spurious Emissions – 3-18GHz (802.11b HCH)



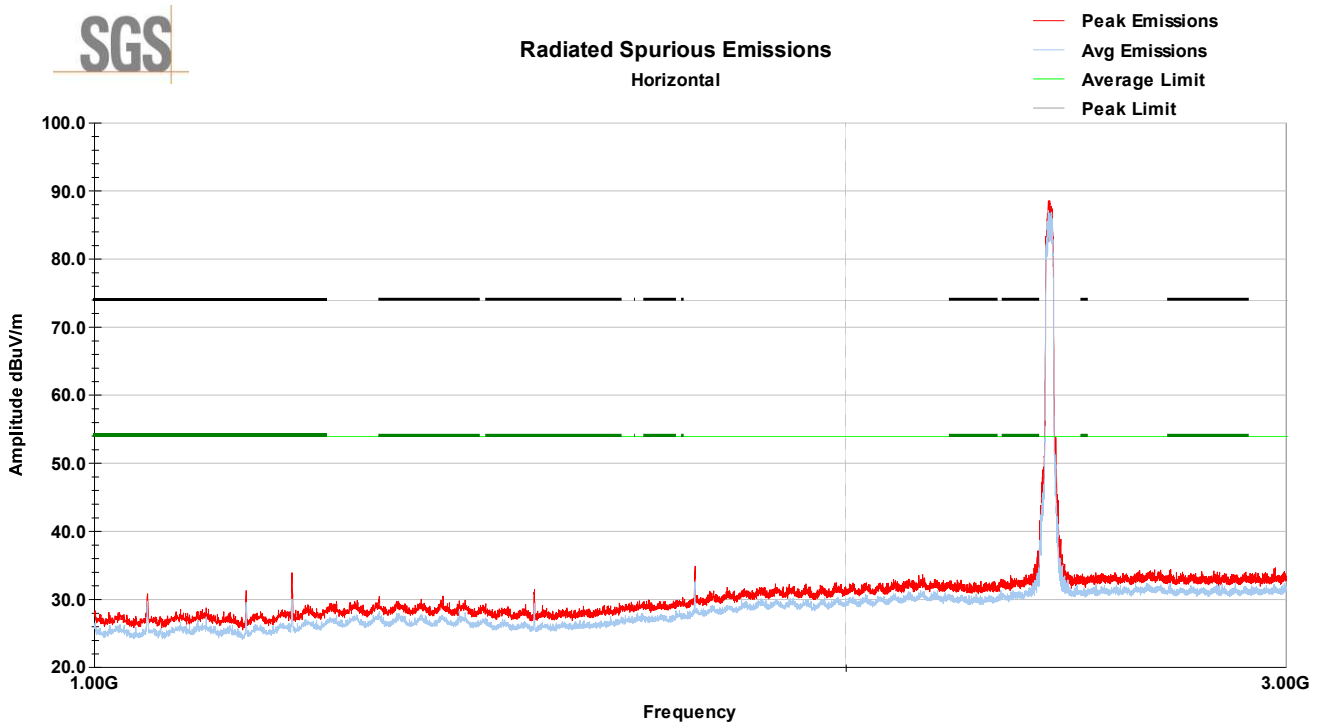
Horizontal Radiated Spurious Emissions – 3-18GHz (802.11b HCH)



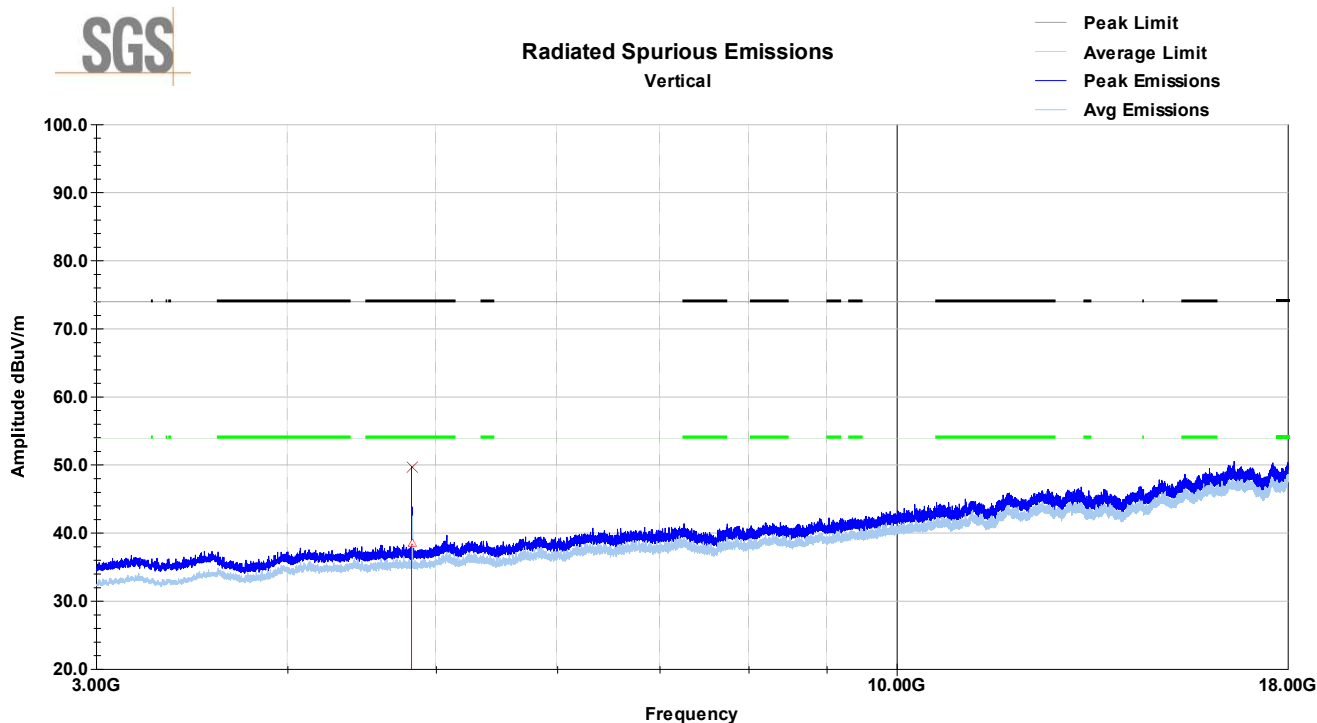
Vertical Radiated Spurious Emissions – 1-3GHz (802.11g LCH)



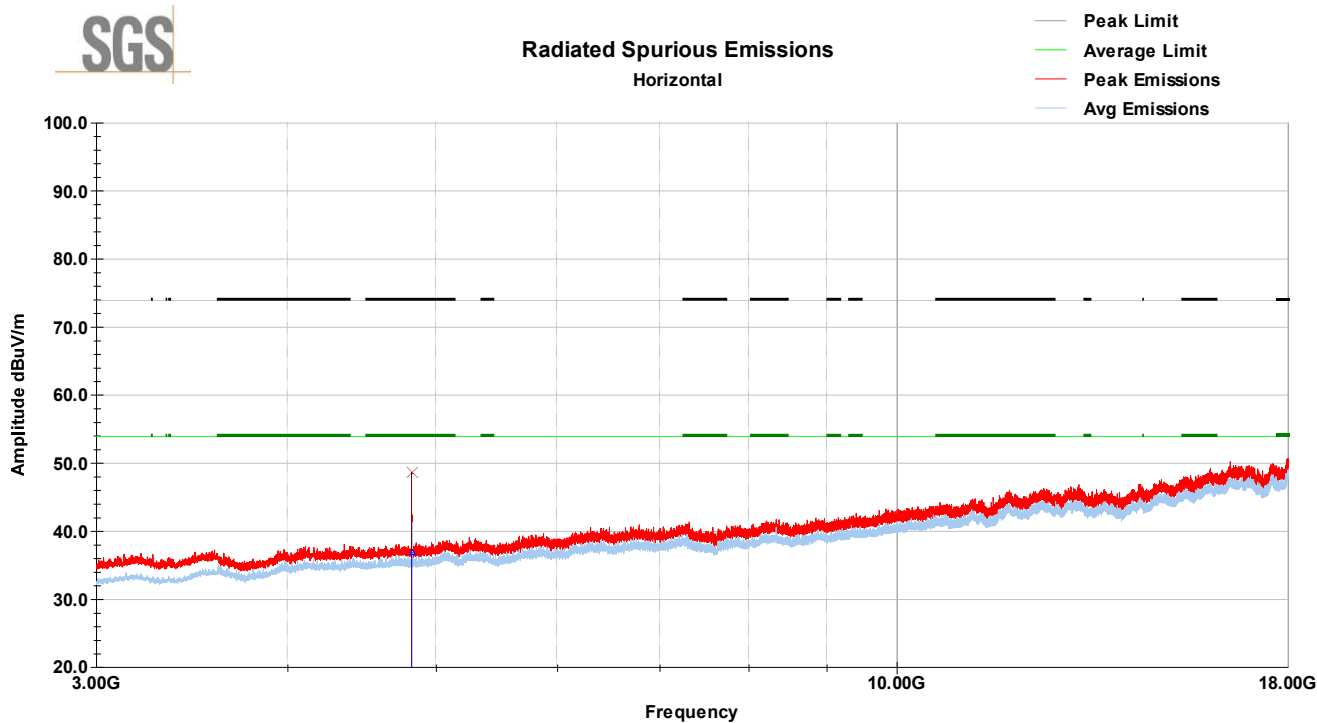
Horizontal Radiated Spurious Emissions – 1-3GHz (802.11g LCH)



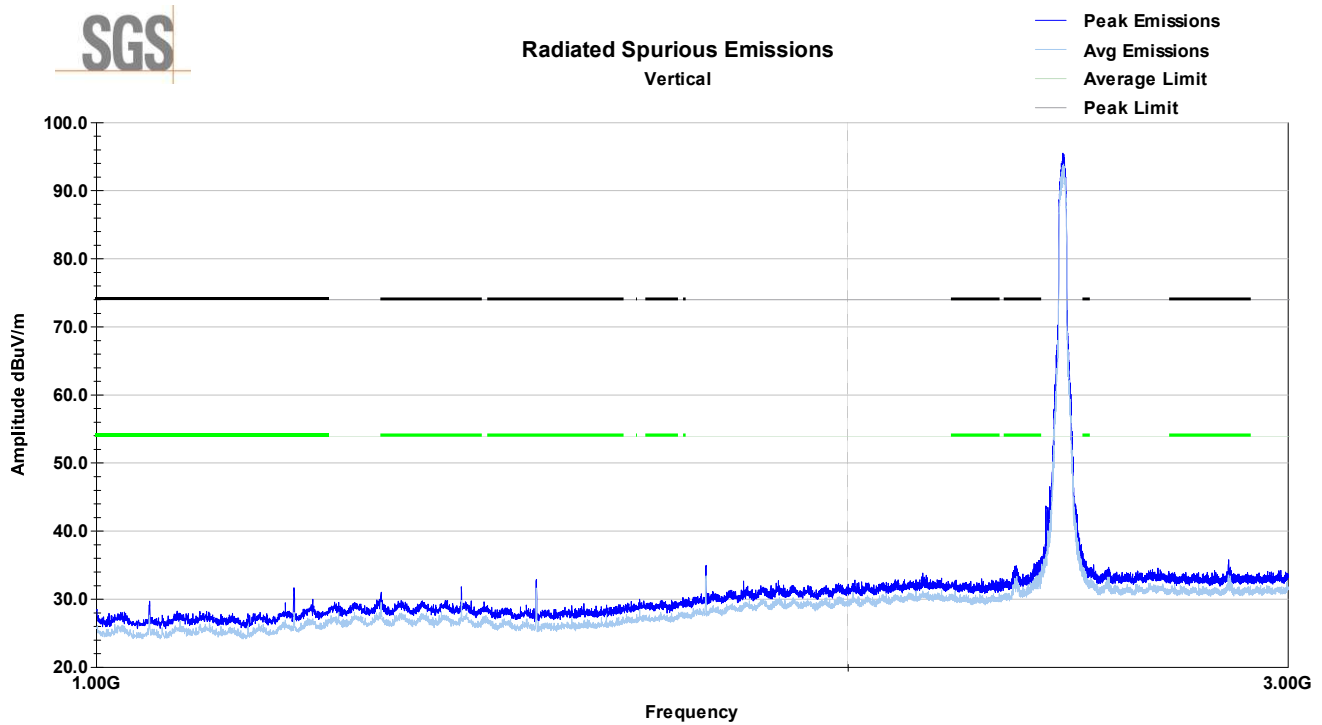
Vertical Radiated Spurious Emissions – 3-18GHz (802.11g LCH)



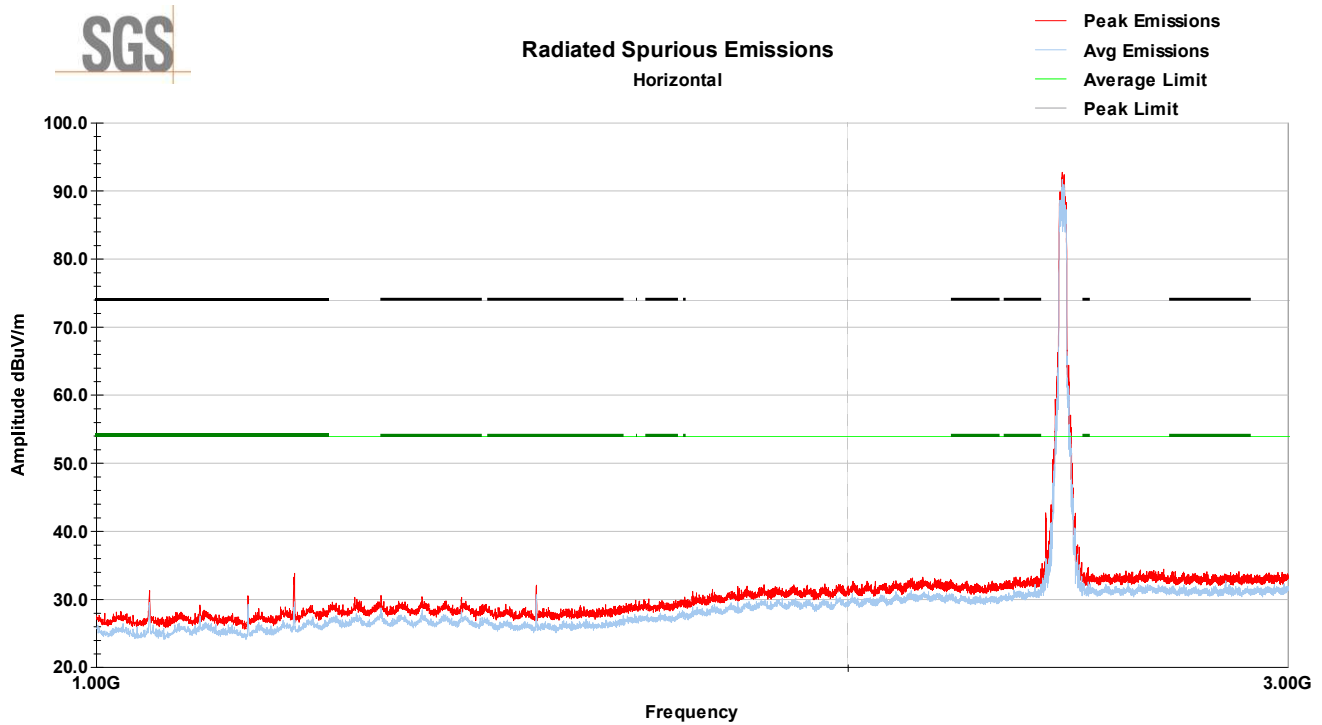
Horizontal Radiated Spurious Emissions – 3-18GHz (802.11g LCH)



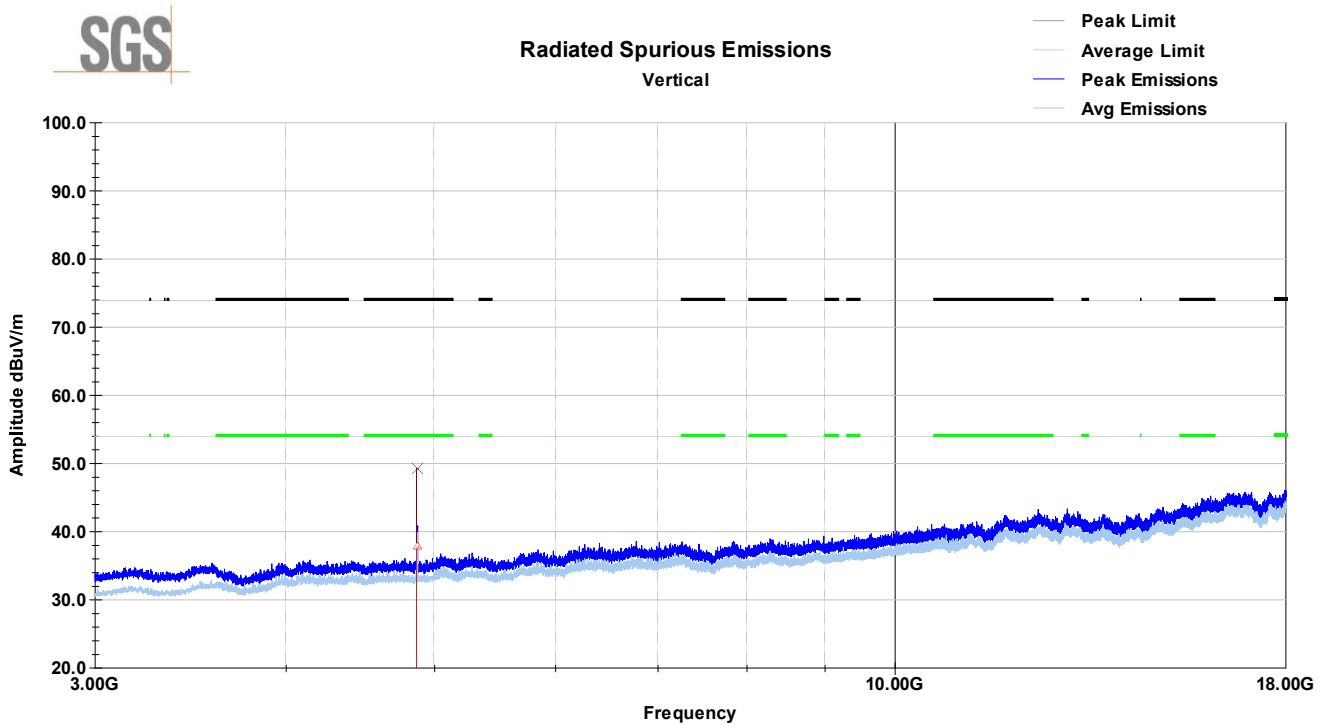
Vertical Radiated Spurious Emissions – 1-3GHz (802.11g MCH)



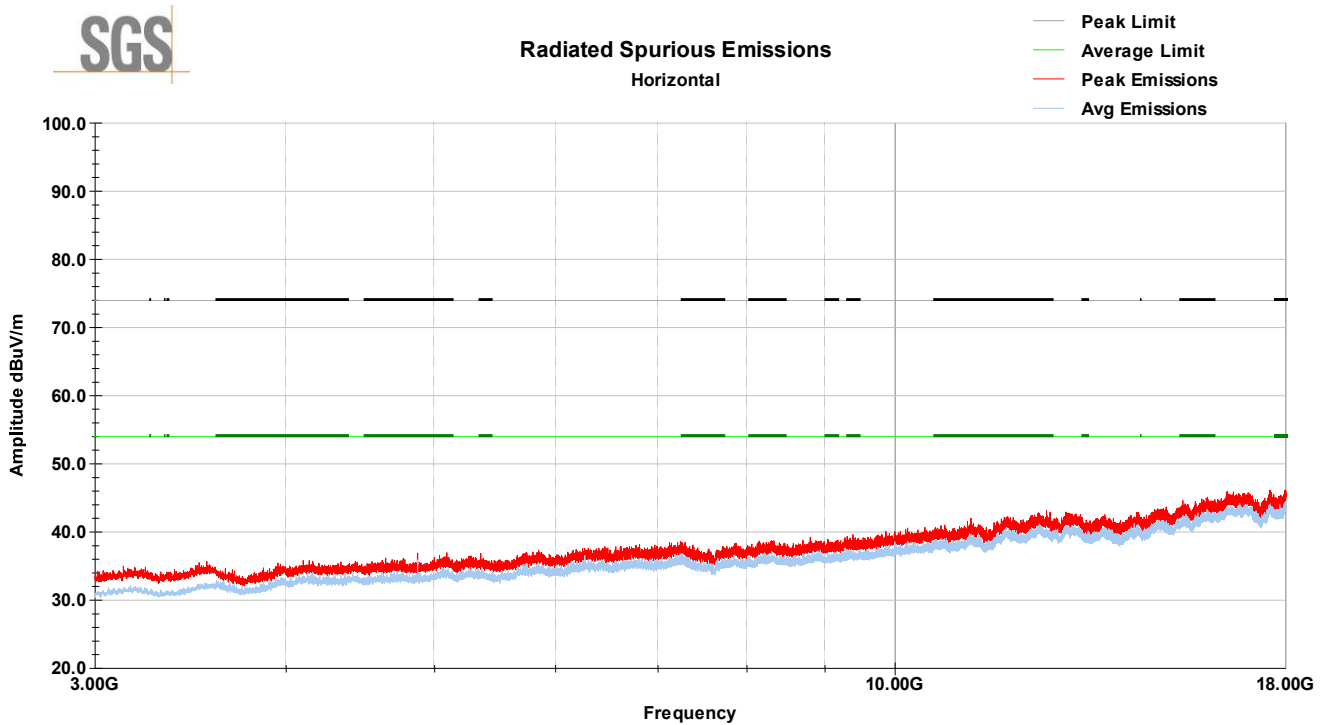
Horizontal Radiated Spurious Emissions – 1-3GHz (802.11g MCH)



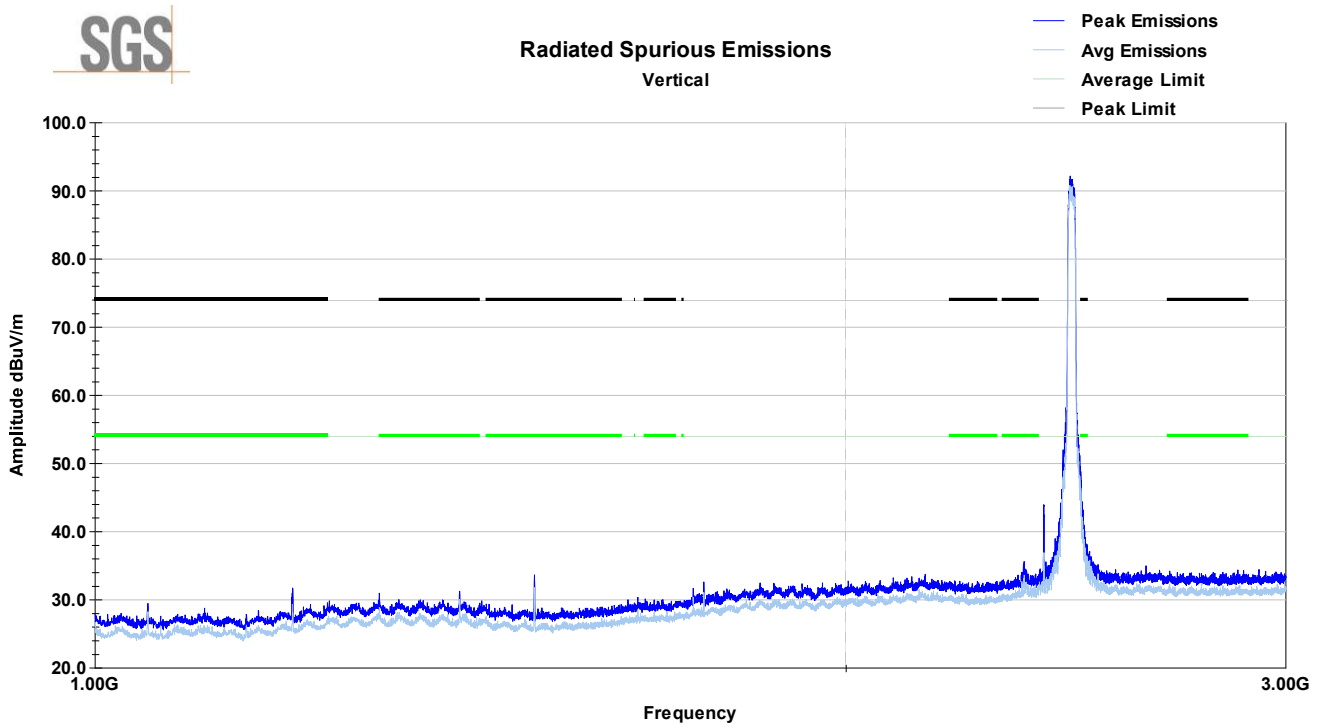
Vertical Radiated Spurious Emissions – 3-18GHz (802.11g MCH)



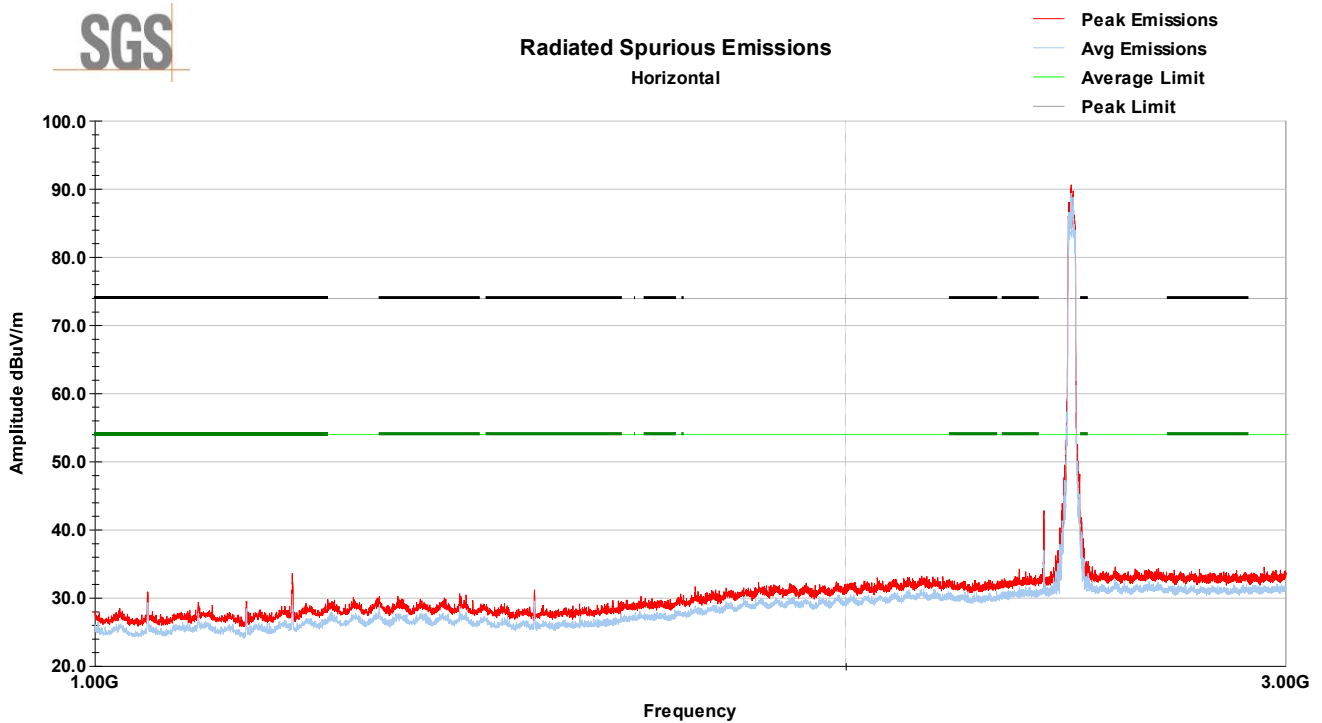
Horizontal Radiated Spurious Emissions – 3-18GHz (802.11g MCH)



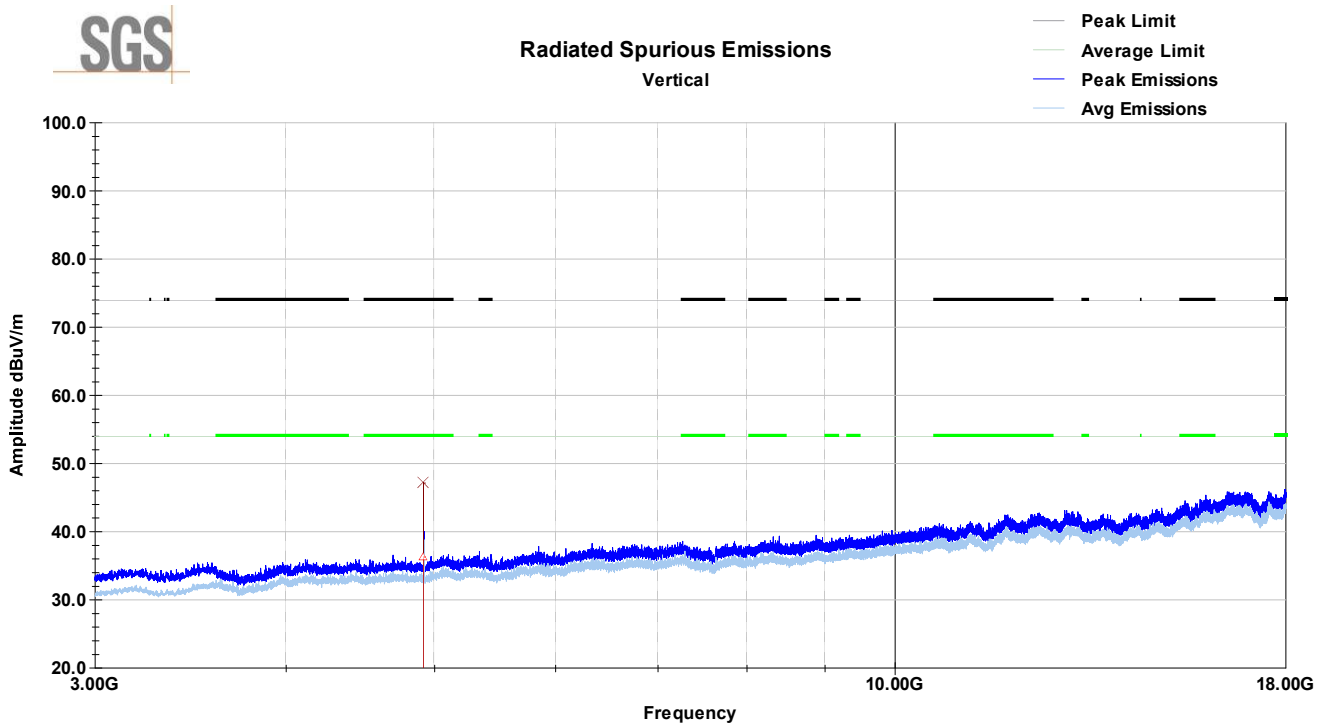
Vertical Radiated Spurious Emissions – 1-3GHz (802.11g HCH)



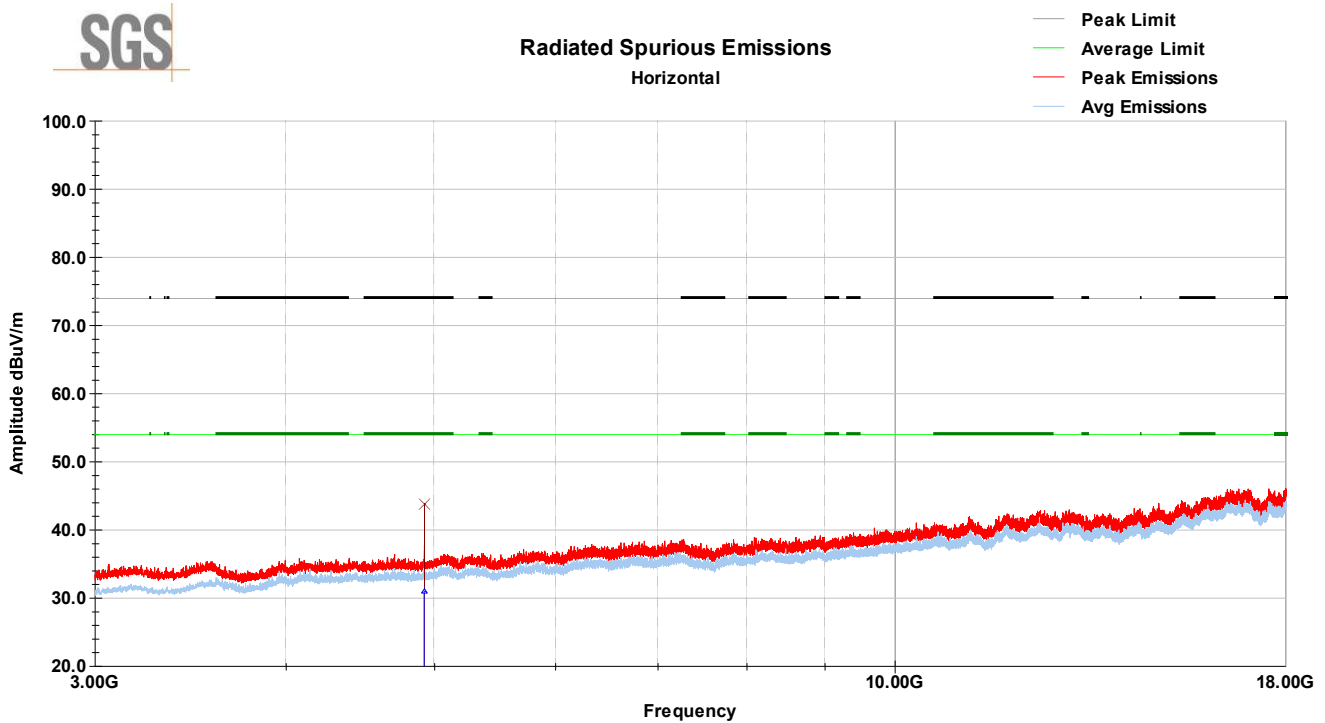
Horizontal Radiated Spurious Emissions – 1-3GHz (802.11g HCH)



Vertical Radiated Spurious Emissions – 3-18GHz (802.11g HCH)



Horizontal Radiated Spurious Emissions – 3-18GHz (802.11g HCH)



7.6 Test Data – Tabular Data

Frequency MHz	Raw Pk dBuV	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	DCCF (dB)	Final Pk dBuV/m	Limit dBuV/m	Margin dB	Detector
802.11b - Low Channel (2412MHz)												
4824.00	51.9	V	172.0	190.0	34.3	2.3	42.1	0.0	46.4	74.0	-27.6	Peak
4824.00	40.6	V	172.0	190.0	34.3	2.3	42.1	0.9	36.0	54.0	-18.0	Average
4824.00	52.7	H	145.0	173.0	34.3	2.3	42.1	0.0	47.2	74.0	-26.8	Peak
4824.00	41.2	H	145.0	173.0	34.3	2.3	42.1	0.9	36.6	54.0	-17.4	Average
802.11b - Mid Channel (2437MHz)												
4874.00	58.8	V	275.0	134.0	34.4	2.3	42.1	0.0	53.4	74.0	-20.6	Peak
4874.00	51.7	V	275.0	134.0	34.4	2.3	42.1	0.9	47.2	54.0	-6.8	Average
4874.00	55.3	H	199.0	143.0	34.4	2.3	42.1	0.0	49.9	74.0	-24.1	Peak
4874.00	46.5	H	199.0	143.0	34.4	2.3	42.1	0.9	42.0	54.0	-12.0	Average
802.11b - High Channel (2462MHz)												
4924.00	51.1	V	274.0	130.0	34.5	2.3	42.1	0.0	45.8	74.0	-28.2	Peak
4924.00	40.0	V	274.0	130.0	34.5	2.3	42.1	0.9	35.6	54.0	-18.4	Average
4924.00	51.6	H	199.0	226.0	34.5	2.3	42.1	0.0	46.3	74.0	-27.7	Peak
4924.00	40.5	H	199.0	226.0	34.5	2.3	42.1	0.9	36.1	54.0	-17.9	Average
802.11g - Low Channel (2412MHz)												
4824.40	52.9	V	59.0	225.0	34.3	4.5	42.1	0.0	49.6	74.0	-24.4	Peak
4824.40	41.6	V	59.0	225.0	34.3	4.5	42.1	7.4	45.7	54.0	-8.3	Average
4823.80	51.8	H	141.0	177.0	34.3	4.5	42.1	0.0	48.5	74.0	-25.5	Peak
4823.80	40.1	H	141.0	177.0	34.3	4.5	42.1	7.4	44.2	54.0	-9.8	Average
802.11g - Mid Channel (2437MHz)												
4874.00	52.3	V	72.0	214.0	34.4	4.5	42.1	0.0	49.1	74.0	-24.9	Peak
4874.00	40.9	V	72.0	214.0	34.4	4.5	42.1	7.4	45.1	54.0	-8.9	Average
802.11g - High Channel (2462MHz)												
4924.00	52.4	V	359.0	204.0	34.5	2.3	42.1	0.0	47.1	74.0	-26.9	Peak
4924.00	41.5	V	359.0	204.0	34.5	2.3	42.1	7.4	43.6	54.0	-10.4	Average
4924.00	49.0	H	164.0	241.0	34.5	2.3	42.1	0.0	43.7	74.0	-30.3	Peak
4924.00	36.2	H	164.0	241.0	34.5	2.3	42.1	7.4	38.3	54.0	-15.7	Average
QP Value = Level + AF + CL - Amp + DCCF												
Margin = QP Value - Limit												

8 Emissions in Restricted Frequency Bands (Band Edge)

8.1 Test Result

Test Description	Test Specification		Test Result
Restricted Band Emissions	15.205 / 15.209	RSS-GEN S8.9 / 8.10	Compliant

8.2 Test Method

Field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz for each modulation. Measurements were made using the conducted methods defined in ANSI C63.10, Section 11.12.2.

The test system reported the following duty-cycles used for correcting the average measurements:

- 802.11b – 82.2% (0.9dB)
- 802.11g – 18.2% (7.4dB)
- 802.11n(HT20) – 18.2% (7.4dB)
- 802.11n(HT40) – 17.5% (7.6dB)

8.3 Test Site

EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 25.0 °C

Relative Humidity: 38.9 %

Atmospheric Pressure: 97.9 kPa

8.4 Test Equipment

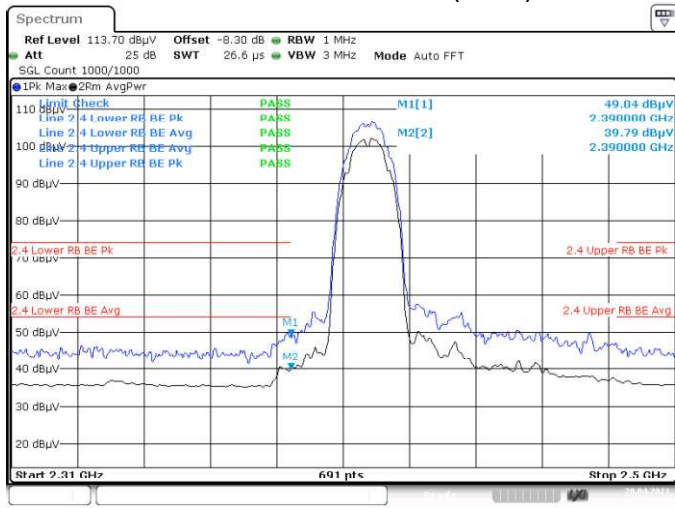
Test End Date: 21-Apr-2021

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
DC POWER SUPPLY, PROGRAMMABLE	DP711	RIGOL	18027	VBV	VBV
RF Cable SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19101	16-Mar-2021	16-Mar-2022
RF CABLE SMA	HULL150A-29P-29P-36	HASCO COMPONENTS	19102	16-Mar-2021	16-Mar-2022
TSTPASS SWITCHBOX	SB1	TSTPASS	20168	CNR	CNR
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	27-Dec-2019	27-Dec-2021

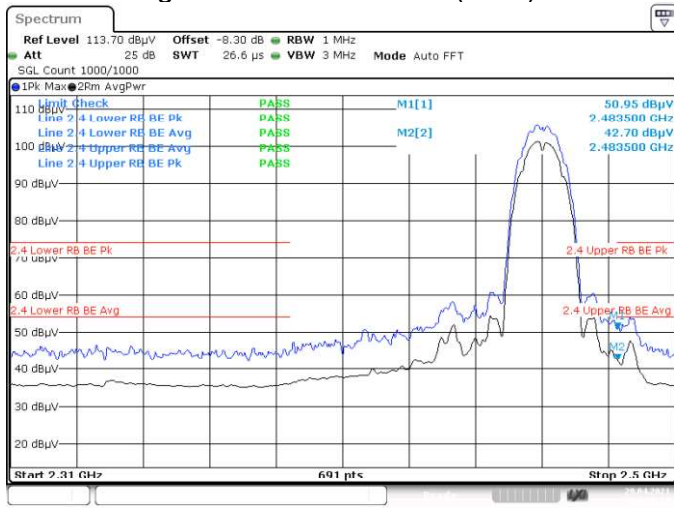
8.5 Test Data – Restricted Band Edges

Low Channel – 802.11b (WF1)



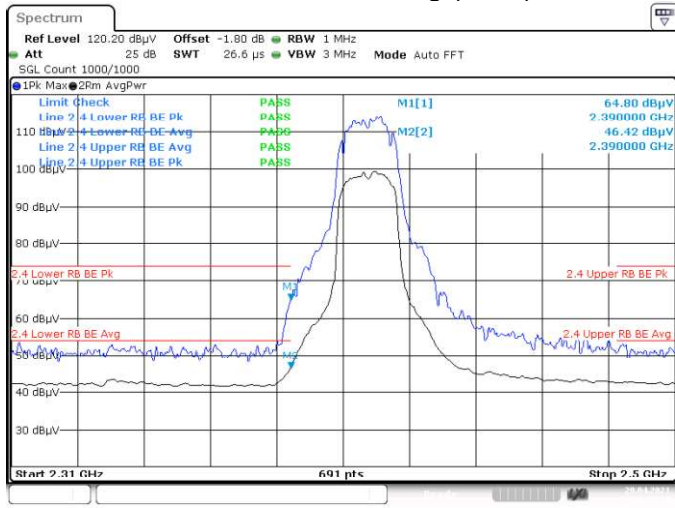
Date: 29.APR.2021 13:49:50

High Channel – 802.11b (WF1)



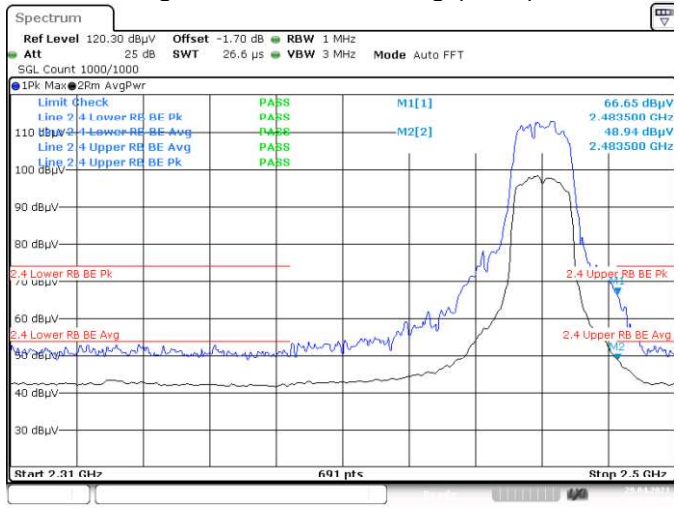
Date: 29.APR.2021 14:05:29

Low Channel – 802.11g (WF1)



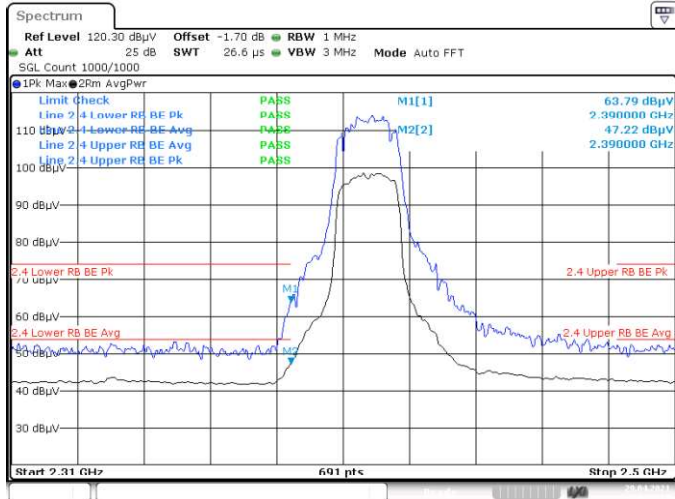
Date: 29.APR.2021 13:48:23

High Channel – 802.11g (WF1)



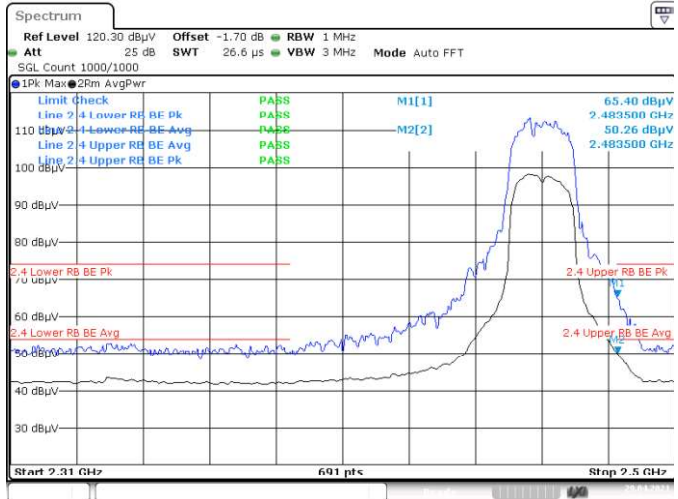
Date: 29.APR.2021 13:53:40

Low Channel – 802.11n(HT20) (WF1)



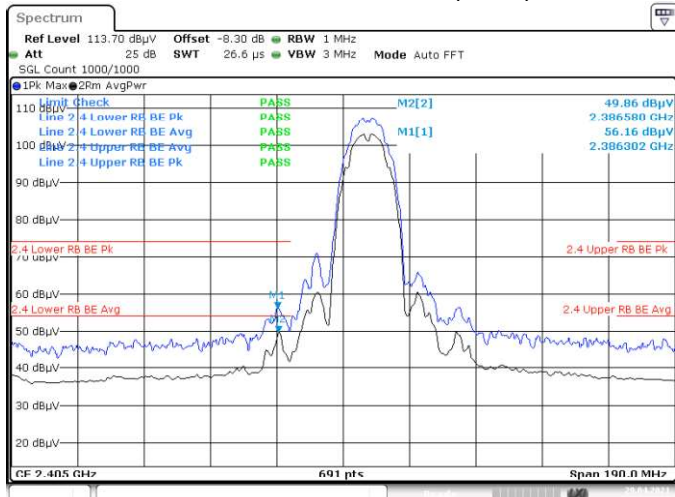
Date: 29.APR.2021 13:51:30

High Channel – 802.11n(HT20) (WF1)



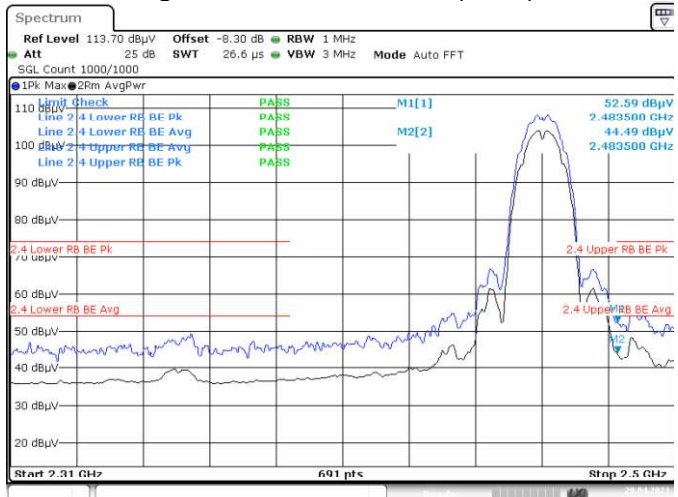
Date: 29.APR.2021 13:52:43

Low Channel – 802.11b (WF2)



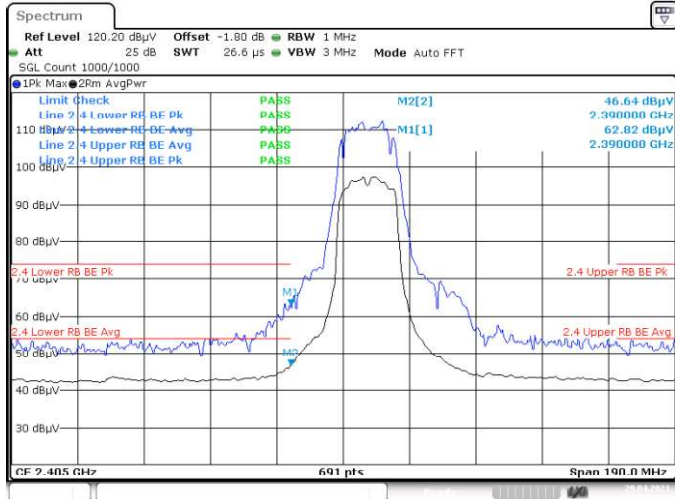
Date: 29.APR.2021 14:21:17

High Channel – 802.11b (WF2)



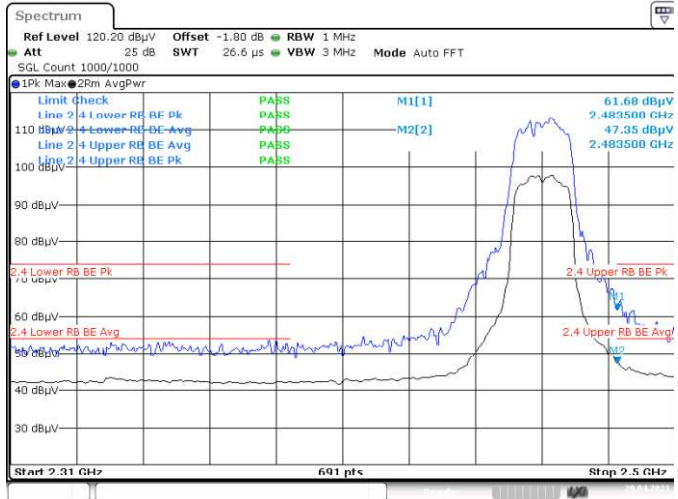
Date: 29.APR.2021 14:07:29

Low Channel – 802.11g (WF2)



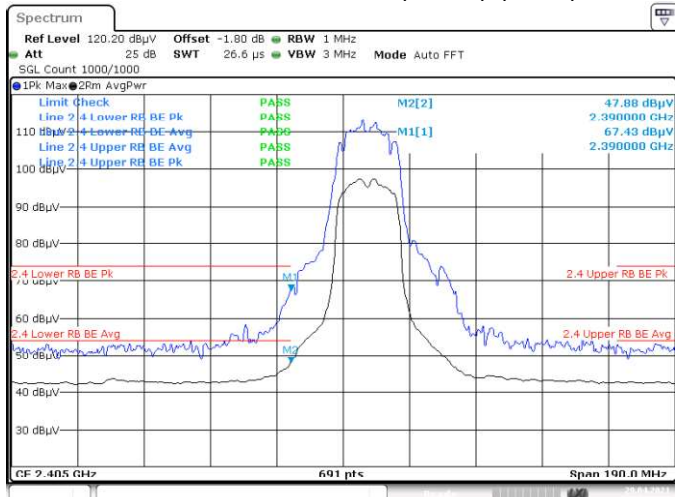
Date: 29.APR.2021 14:20:04

High Channel – 802.11g (WF2)



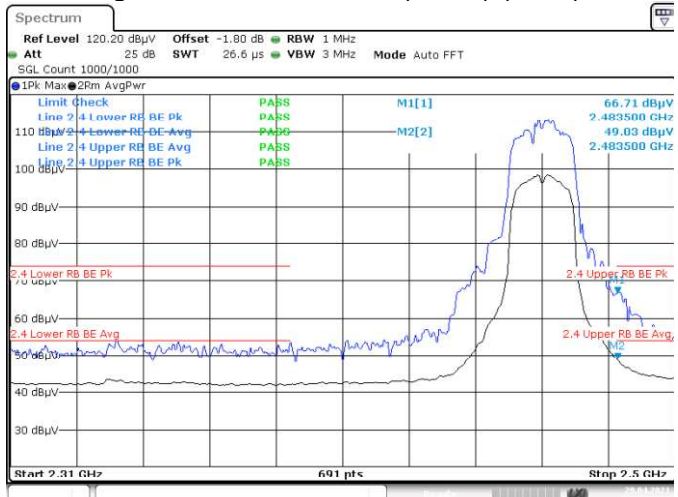
Date: 29.APR.2021 14:09:53

Low Channel – 802.11n(HT20) (WF2)



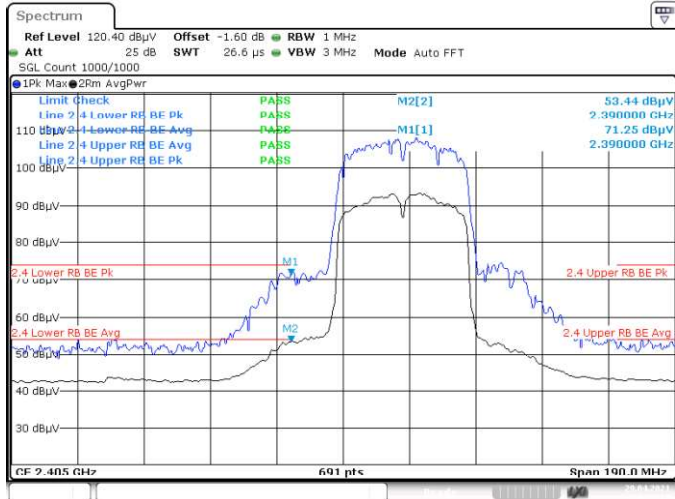
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High Channel – 802.11n(HT20) (WF2)



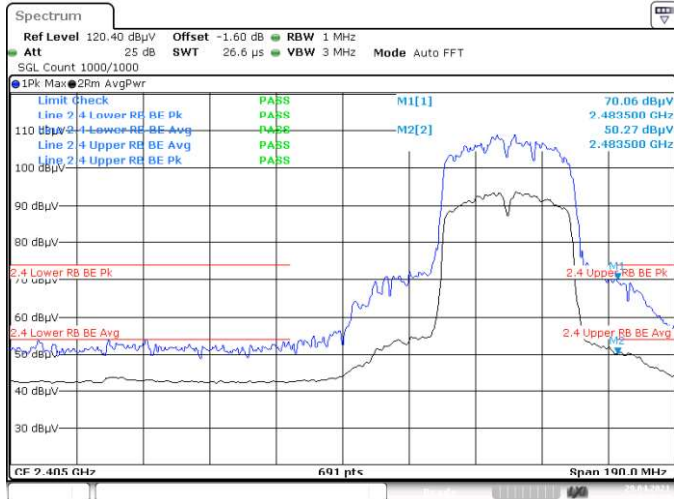
Date: 29.APR.2021 14:10:10

Low Channel – 802.11n(HT40) (WF2)



Date: 29.APR.2021 14:17:08

High Channel – 802.11n(HT40) (WF2)



Date: 29.APR.2021 14:15:58

9 Measurement Uncertainty

The measurement uncertainty figures are be calculated in accordance with TR 100 028-1 [2] and correspond to an expansion factor (coverage factor) $k = 2$ (which provide confidence levels of 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Parameter	Expanded Uncertainty for Normal k factor equal to 2	
	Required	Laboratory Actual
Radio Frequency	$\pm 1 \times 10^{-5}$	$\pm 9.8 \times 10^{-8}$
total RF power, conducted	± 1.5 dB	± 1.2 dB
RF power density, conducted	± 3 dB	± 0.7 dB
spurious emissions, conducted	± 3 dB	± 2.1 dB
all emissions, radiated	± 6 dB	± 4.8 dB
temperature	$\pm 1^{\circ}\text{C}$	$\pm 0.5^{\circ}\text{C}$
humidity	± 5 %	$\pm 3.5\%$
DC and low frequency voltages	± 3 %	$\pm 0.4\%$

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	25 August 2021
1	- Updated product marketing name throughout report - Added CAB identifier to Section 2.2	12 January 2022