

Appendix C: Test result for 5.25GHz – 5.35GHz.

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TEST CONDITIONS

Power supply (V):

Vnominal = 120 Vac

Type of power supply = AC voltage main supply.

Type of antenna = External antenna.

Declared Gain for antenna (maximum):

$G_{\text{ANTENNA SISO1}} = 3 \text{ dBi}$

$G_{\text{ANTENNA SISO2}} = 3 \text{ dBi}$

Technology Tested:	MulteFire 1.0	
Modes:	QPSK, 16QAM, 64QAM	
Antena ports:	1, 2	
Beamforming:	No	
Frequency Range:	5250 MHz to 5350 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Lowest: 52	5260
	Middle: 56	5280
	Highest: 64	5320

The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power in all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode for the channel under test.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes. FCC and Canada power setting used during the test were different to be in compliance with both limits.

SISO Port 1:

Channel	Channel Frequency (MHz)	FCC Attenuation Value	CANADA Attenuation value
Lowest: 52	5260	2	2
Middle: 56	5280	2	2
Highest: 64	5320	2	2

SISO Port 2:

Channel	Channel Frequency (MHz)	FCC Attenuation Value	CANADA Attenuation value
Lowest: 52	5260	0	0
Middle: 56	5280	0	0
Highest: 64	5320	1	1

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The AC supply voltage is applied using an external power supply.

RADIATED MEASUREMENTS

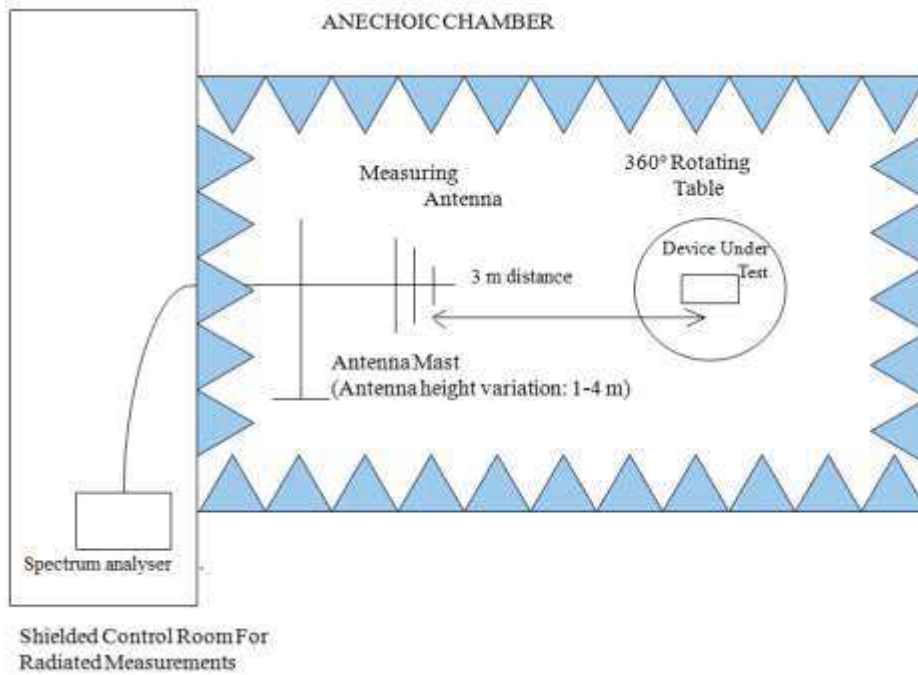
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the center of the chamber turntable to perform the measurements below 1GHz and The EUT was placed at a height of 1.5 meters above the test chamber floor in the center of the chamber turntable to perform the measurements above 1GHz. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

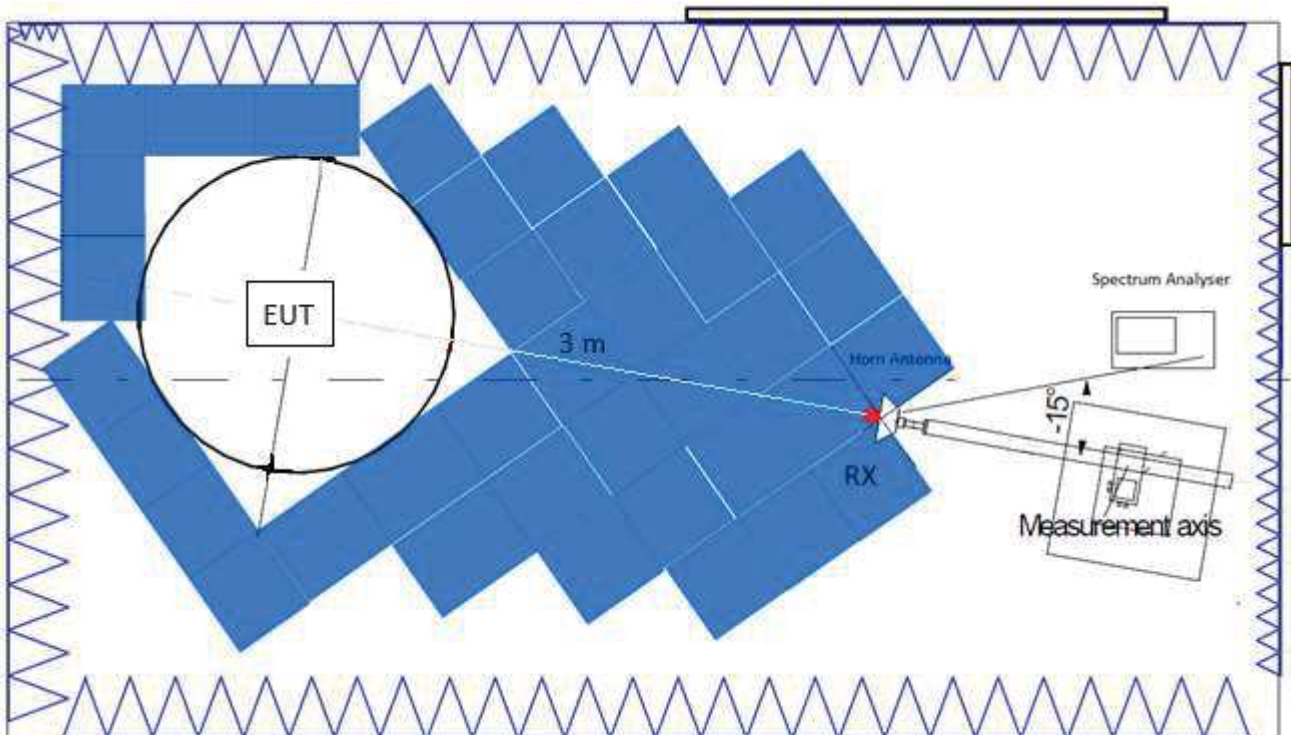
The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.

A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1MHz/3MHz for frequencies above 1 GHz.

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



FCC Section 15.407 Subclause (a)(2). Transmitter Maximum Conducted Output Power / RSS-247 Clause 6.2.2.1(a). Transmitter Maximum Equivalent Isotropically Radiated Power

SPECIFICATION

FCC 15.407: For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247: The maximum conducted output power shall not exceed 250 mW (24 dBm) or $11 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

The maximum e.i.r.p. shall not exceed 1.0 W (30 dBm) or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz.

RESULTS:

The maximum conducted output power was measured using the channel power integration method according to point E) 2) b) (Method SA-1) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is >98% and the channel power integration method according to point E) 2) d) (Method SA-2) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is <98%.

For data rates where the EUT was transmitting at <98% duty cycle, the duty calculated in Appendix A was added to the measured power in order to calculate the total average power during the actual transmission time.

The e.i.r.p. levels are calculated by adding the corresponding antenna gain (dBi).

SISO Antenna Port 1:

FCC power setting

Mode: QPSK – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.39	21.25	22.16
Conducted Power Limit (dBm)	24		
Margin (dB)	2.61	2.75	1.84
Maximum EIRP power (dBm)	24.39	24.25	25.16
EIRP power Limit (dBm)	30		
Margin (dB)	5.61	5.75	4.84
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.45	21.22	22.15
Conducted Power Limit (dBm)	24		
Margin (dB)	2.55	2.78	1.85
Maximum EIRP power (dBm)	24.45	24.22	25.15
EIRP power Limit (dBm)	30		
Margin (dB)	5.55	5.78	4.85
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.59	21.41	22.30
Conducted Power Limit (dBm)	24		
Margin (dB)	2.41	2.59	1.70
Maximum EIRP power (dBm)	24.59	24.41	25.30
EIRP power Limit (dBm)	30		
Margin (dB)	5.41	5.59	4.70
Measurement uncertainty (dB)	<±1.20		

Canada power setting

Mode: QPSK – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.39	21.25	22.16
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.14	2.28	1.37
Maximum EIRP power (dBm)	24.39	24.25	25.16
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.14	5.28	4.37
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.45	21.22	22.15
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.08	2.31	1.38
Maximum EIRP power (dBm)	24.45	24.22	25.15
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.08	5.31	4.38
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.59	21.41	22.30
Conducted Power Limit (dBm)	23.528		
Margin (dB)	1.94	2.12	1.23
Maximum EIRP power (dBm)	24.59	24.41	25.30
EIRP power Limit (dBm)	29.528		
Margin (dB)	4.94	5.12	4.23
Measurement uncertainty (dB)	<±1.20		

SISO Antenna Port 2:

FCC power setting

Mode: QPSK – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.45	21.86	21.48
Conducted Power Limit (dBm)	24		
Margin (dB)	2.55	2.14	2.52
Maximum EIRP power (dBm)	24.45	24.86	24.48
EIRP power Limit (dBm)	30		
Margin (dB)	5.55	5.14	5.52
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.41	21.76	21.55
Conducted Power Limit (dBm)	24		
Margin (dB)	2.59	2.24	2.45
Maximum EIRP power (dBm)	24.41	24.76	24.55
EIRP power Limit (dBm)	30		
Margin (dB)	5.59	5.24	5.45
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.46	21.87	21.50
Conducted Power Limit (dBm)	24		
Margin (dB)	2.54	2.13	2.50
Maximum EIRP power (dBm)	24.46	24.87	24.50
EIRP power Limit (dBm)	30		
Margin (dB)	5.54	5.13	5.50
Measurement uncertainty (dB)	<±1.20		

Canada power setting

Mode: QPSK – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.45	21.86	21.48
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.08	1.67	2.05
Maximum EIRP power (dBm)	24.45	24.86	24.48
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.08	4.67	5.05
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.41	21.76	21.55
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.12	1.77	1.98
Maximum EIRP power (dBm)	24.41	24.76	24.55
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.12	4.77	4.98
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.46	21.87	21.50
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.07	1.66	2.03
Maximum EIRP power (dBm)	24.46	24.87	24.50
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.07	4.66	5.03
Measurement uncertainty (dB)	<±1.20		

FCC Section 15.407 Subclause (a) (2) / RSS-247 Clause 6.2.2.1. Transmitter Maximum Power Spectral Density

FCC 15.407: The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247: The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

Within the emission bandwidth, when the peak spectral density per MHz over any continuous transmission exceeds the average ($10 \log_{10} B$) value by more than 3 dB, the permissible power spectral density shall be reduced by the excess amount.

RESULTS

The maximum power spectral density (PSD) was measured using the method according to point F) referencing E.2.b) (Method SA-1) of Guidance 789033 D02 General UNII Test Procedures New Rules v02r01.

SISO Antenna Port 1:

FCC & Canada power setting

Mode: QSPK – 20MHz

	channel 52 5260 MHz	channel 56 5280 MHz	channel 64 5320 MHz
PSD (dBm/MHz)	10.19	9.81	10.70
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.81	1.19	0.30
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

	channel 52 5260 MHz	channel 56 5280 MHz	channel 64 5320 MHz
PSD (dBm/MHz)	10.08	9.69	10.66
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.92	1.31	0.34
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

	channel 52 5260 MHz	channel 56 5280 MHz	channel 64 5320 MHz
PSD (dBm/MHz)	10.24	9.89	10.75
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.76	1.11	0.25
Measurement uncertainty (dB)	<±1.20		

SISO Antenna Port 2:

FCC & Canada power setting

Mode: QSPK – 20MHz

	channel 52 5260 MHz	channel 56 5280 MHz	channel 64 5320 MHz
PSD (dBm/MHz)	10.19	10.49	10.08
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.81	0.51	0.92
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

	channel 52 5260 MHz	channel 56 5280 MHz	channel 64 5320 MHz
PSD (dBm/MHz)	10.07	10.44	10.07
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.93	0.56	0.93
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

	channel 52 5260 MHz	channel 56 5280 MHz	channel 64 5320 MHz
PSD (dBm/MHz)	10.08	10.39	10.05
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.92	0.61	0.95
Measurement uncertainty (dB)	<±1.20		

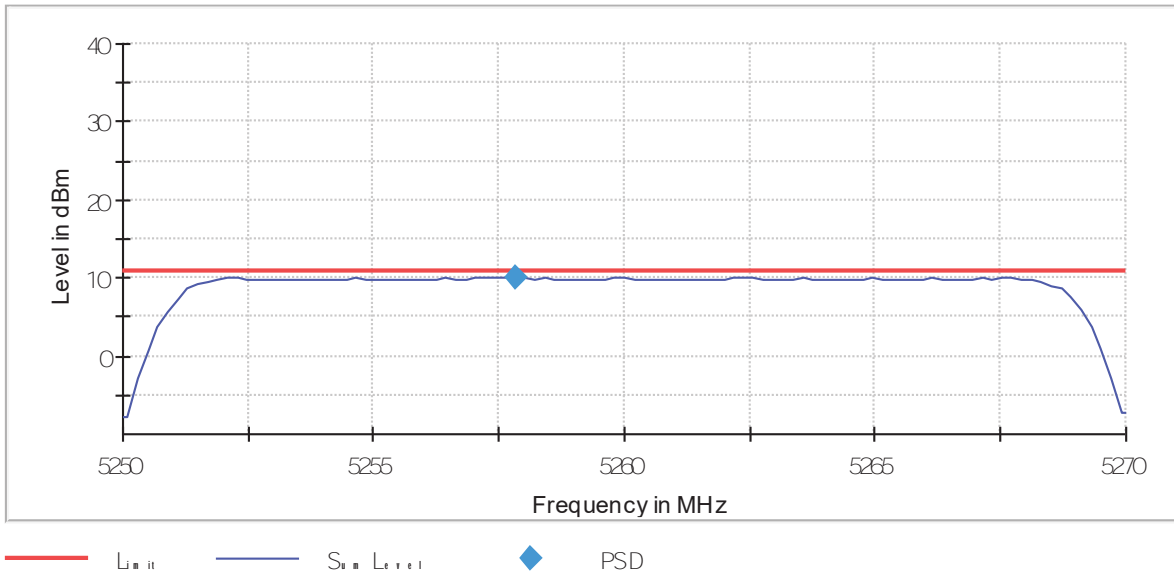
SISO Antenna Port 1:

FCC & Canada power setting

Mode: QSPK – 20MHz

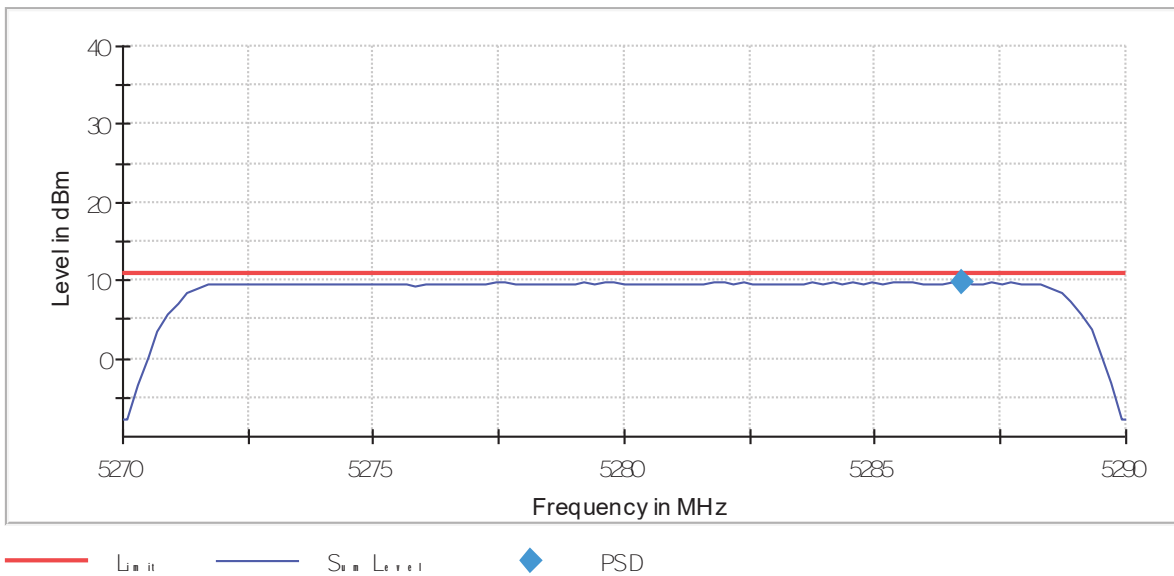
Channel 52

Power Spectral Density (SA-1)



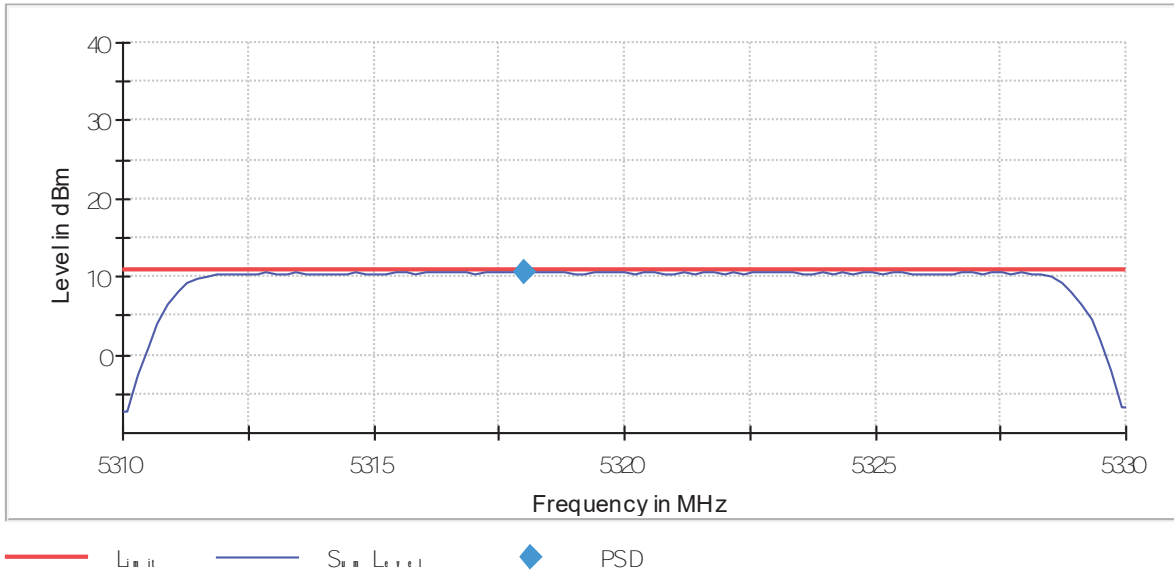
Channel 56

Power Spectral Density (SA-1)



Channel 64

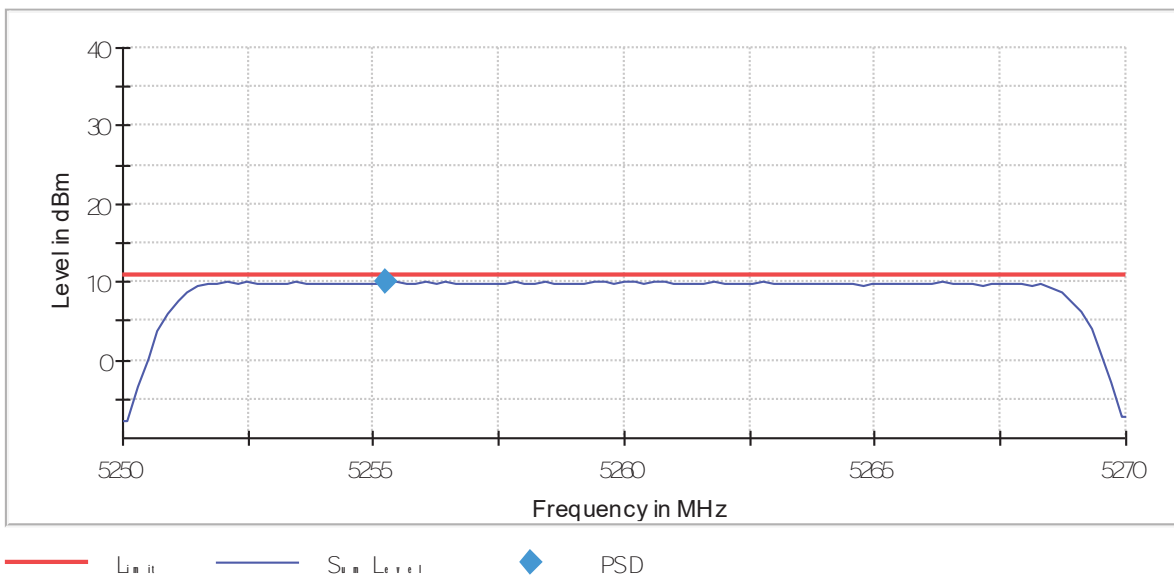
Power Spectral Density (SA-1)



Mode: 16QAM – 20MHz

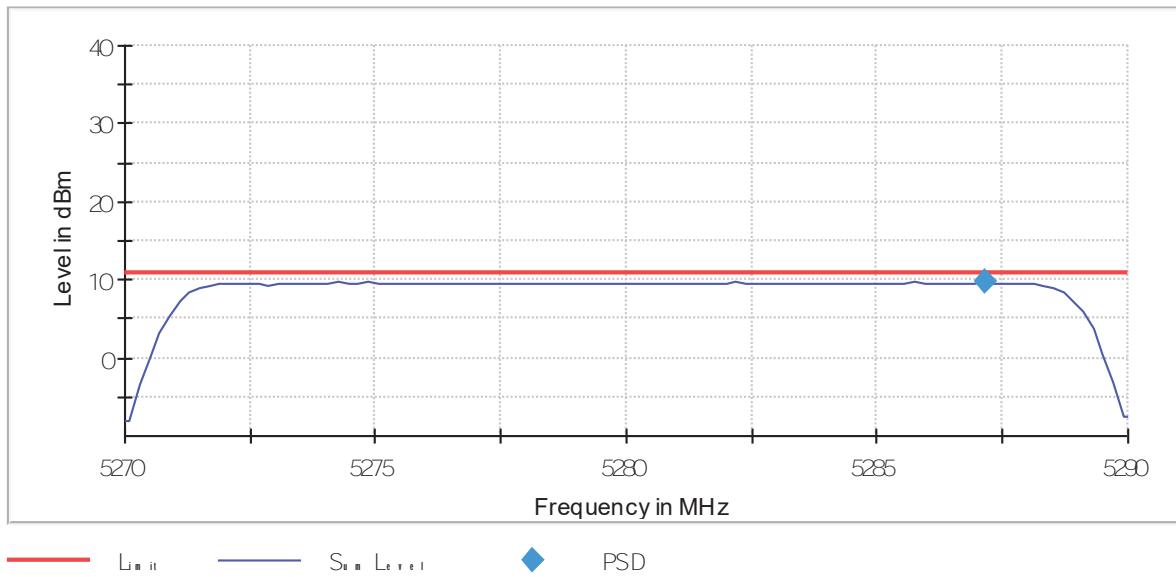
Channel 52

Power Spectral Density (SA-1)



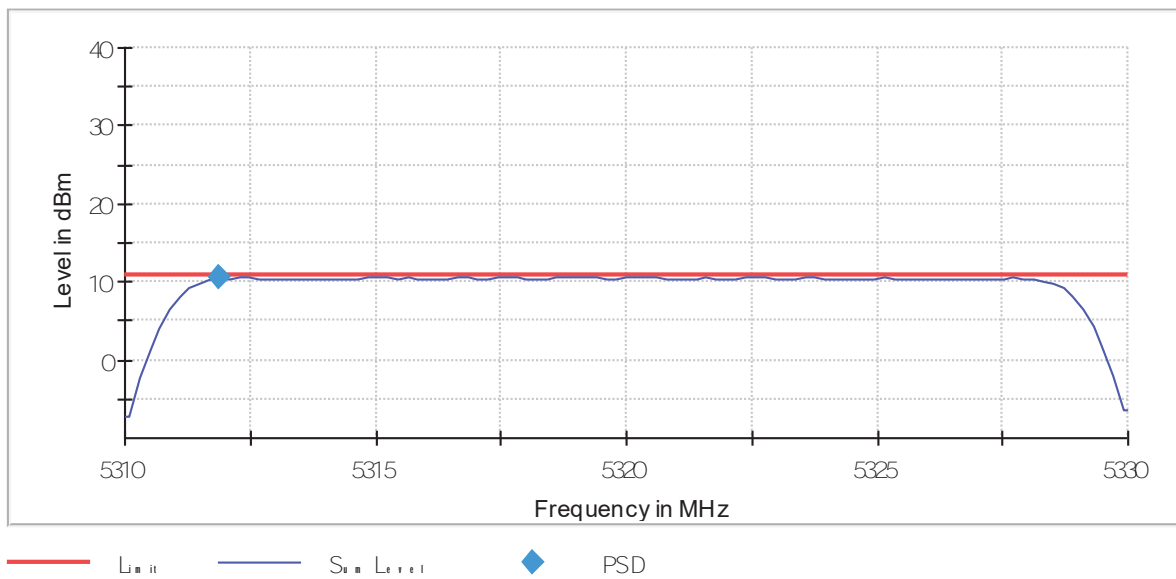
Channel 56

Power Spectral Density (SA-1)



Channel 64

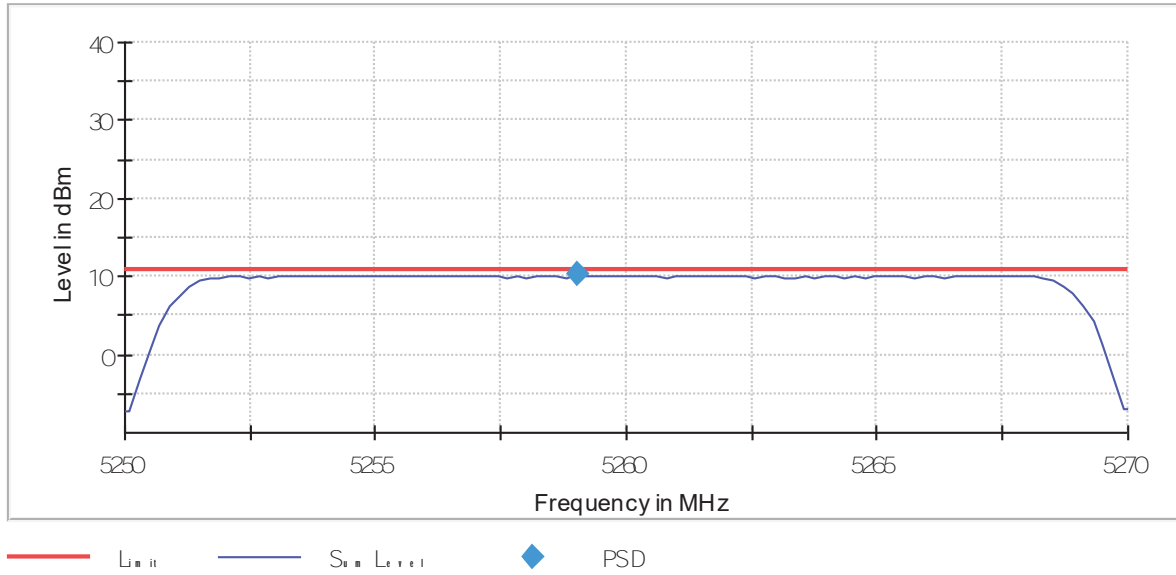
Power Spectral Density (SA-1)



Mode: 64QAM – 20MHz

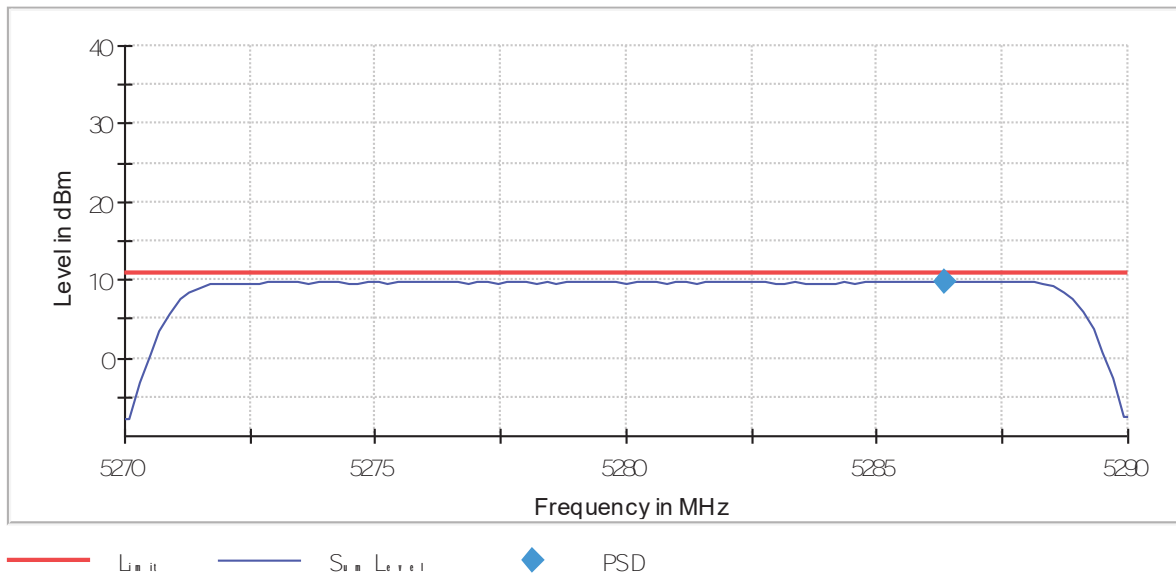
Channel 52

Power Spectral Density (SA-1)



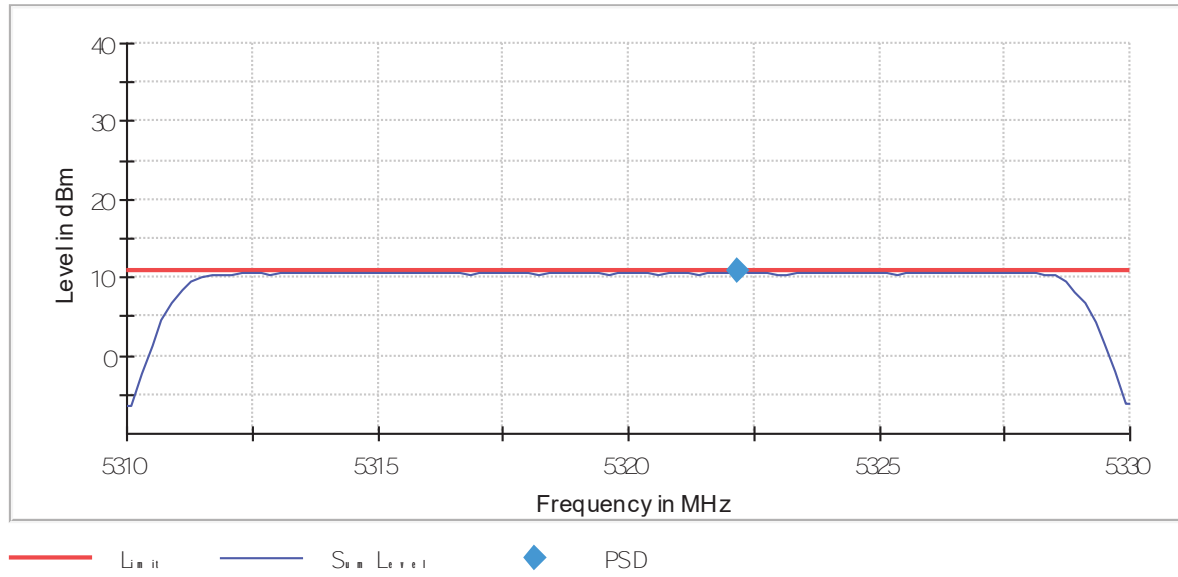
Channel 56

Power Spectral Density (SA-1)



Channel 64

Power Spectral Density (SA-1)



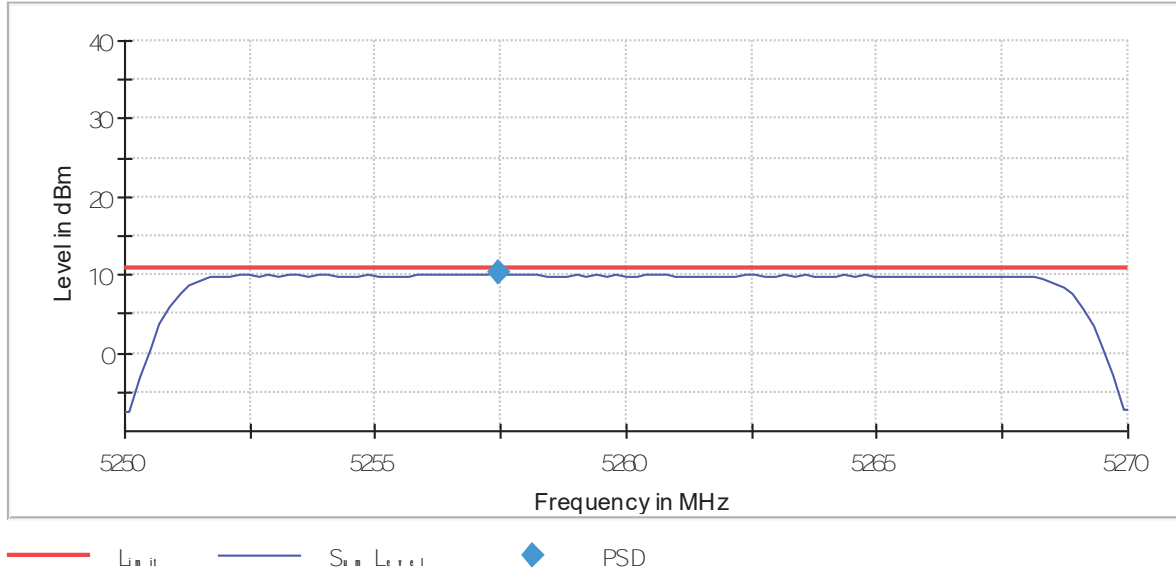
SISO Antenna Port 2:

FCC & Canada power setting

Mode: QSPK – 20MHz

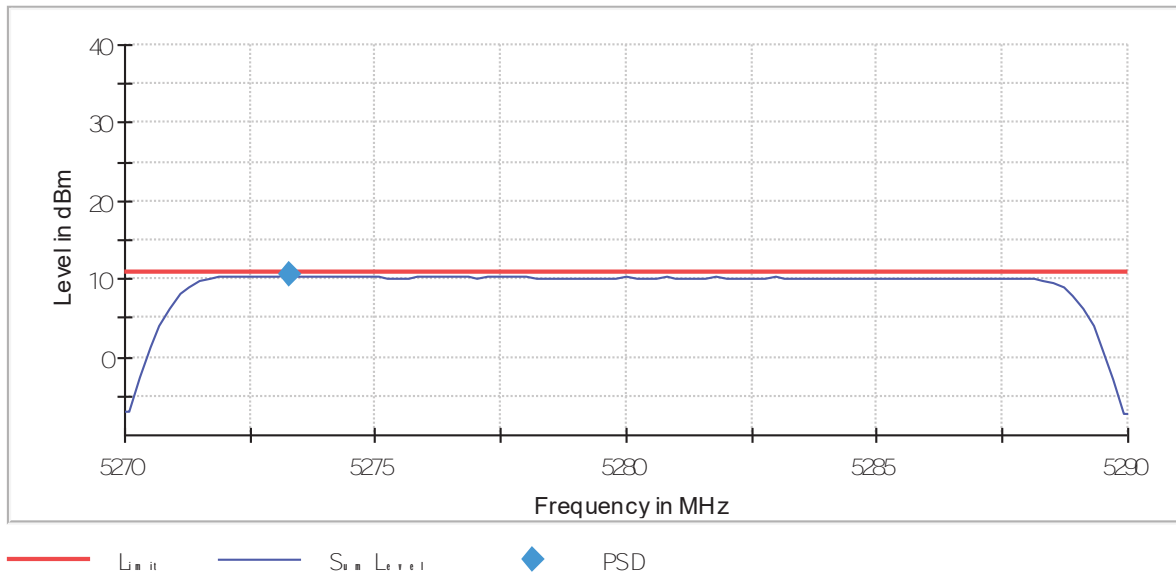
Channel 52

Power Spectral Density (SA-1)



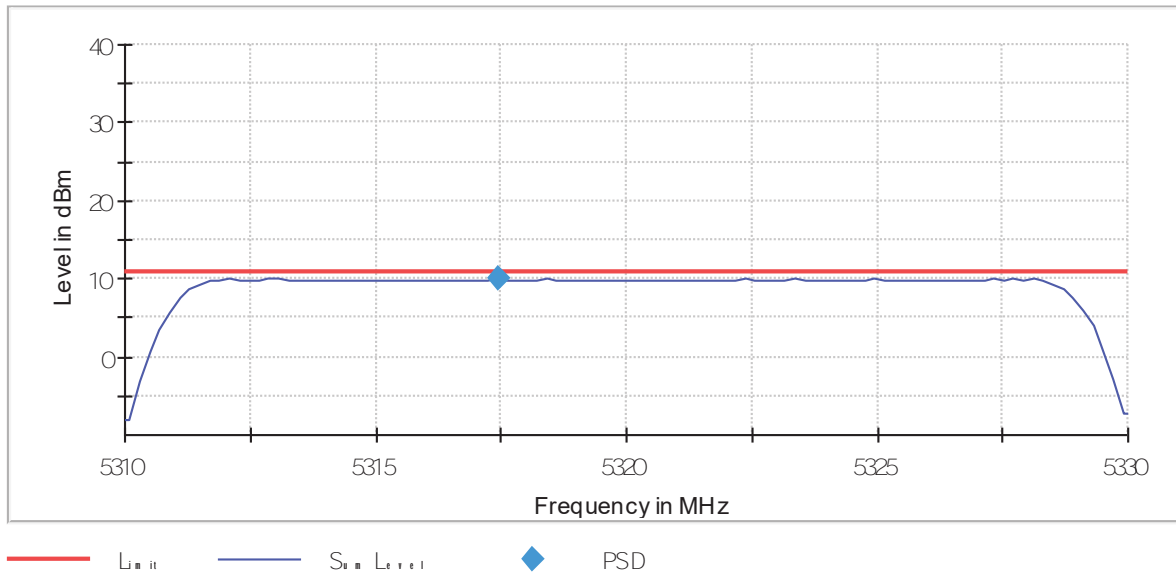
Channel 56

Power Spectral Density (SA-1)



Channel 64

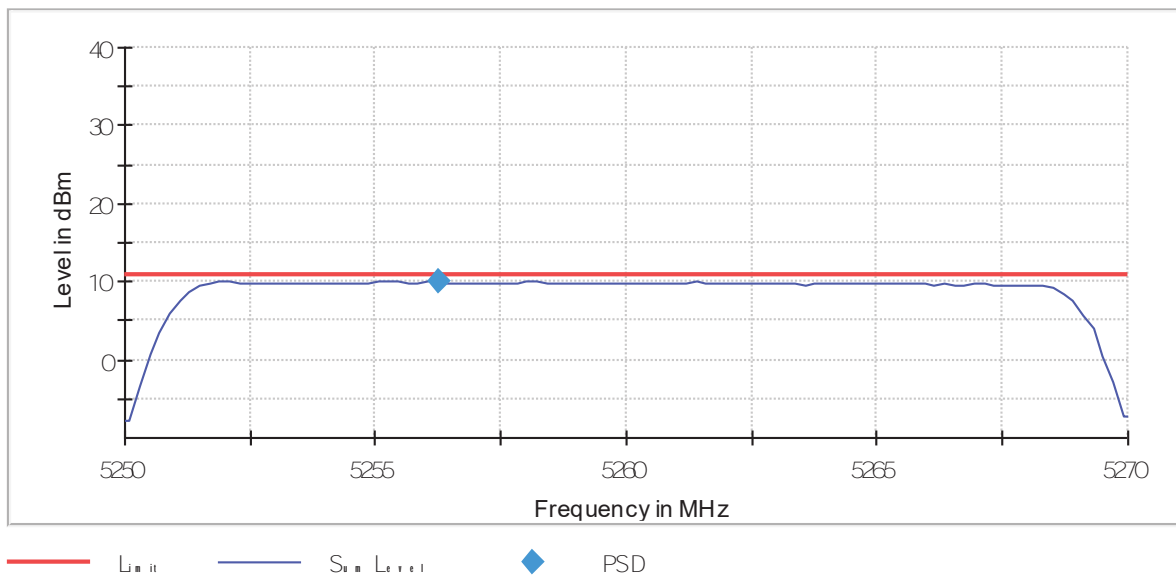
Power Spectral Density (SA-1)



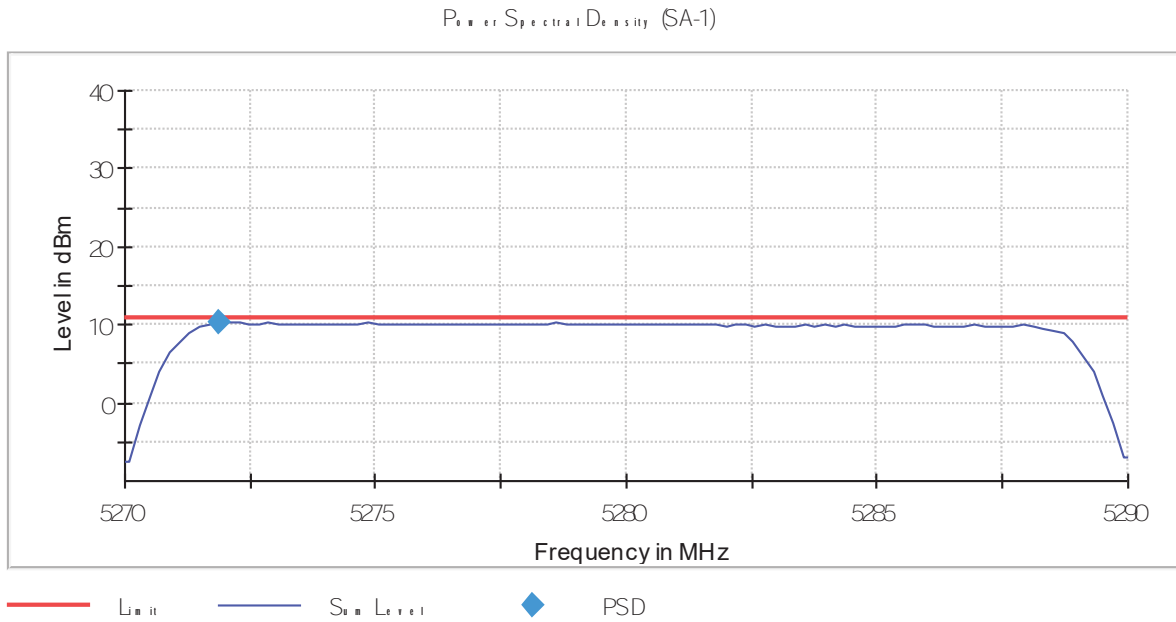
Mode: 16QAM – 20MHz

Channel 52

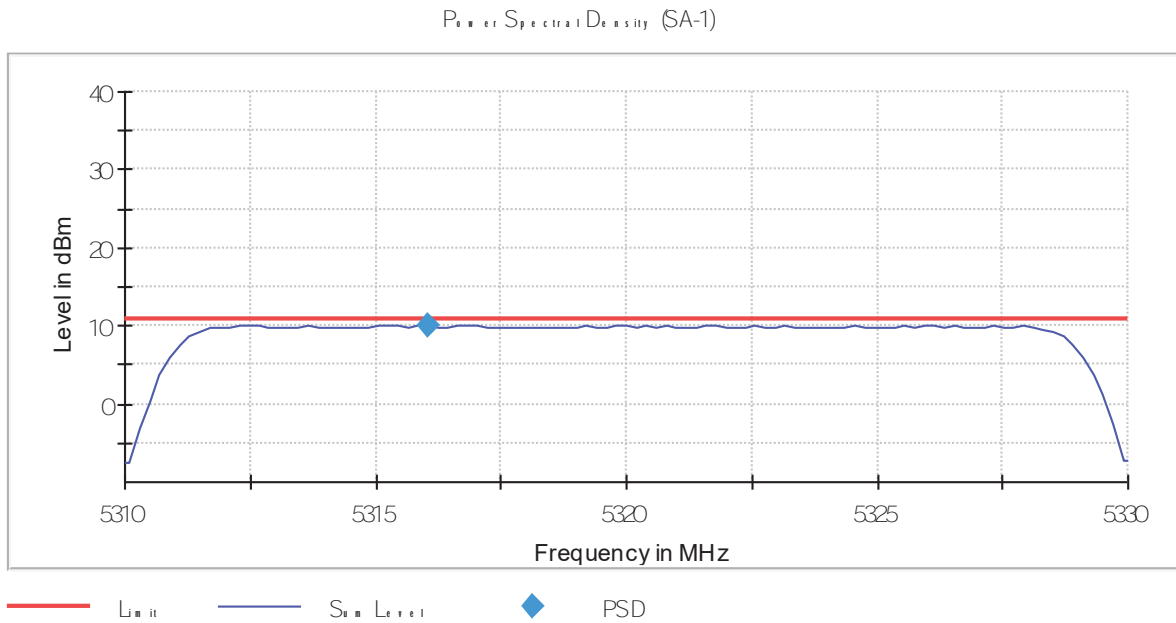
Power Spectral Density (SA-1)



Channel 56



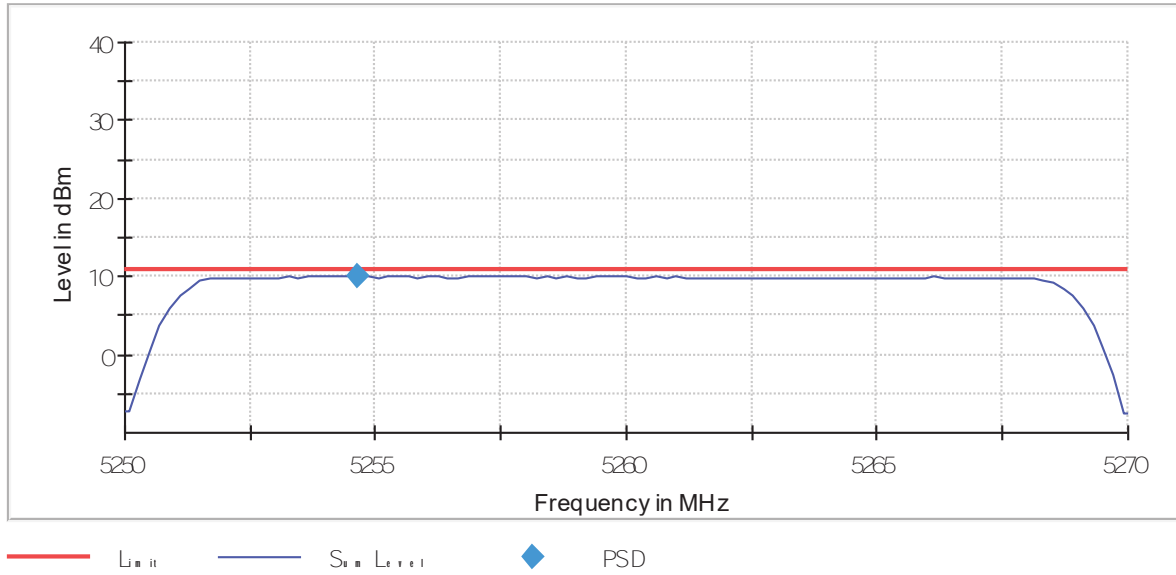
Channel 64



Mode: 64QAM – 20MHz

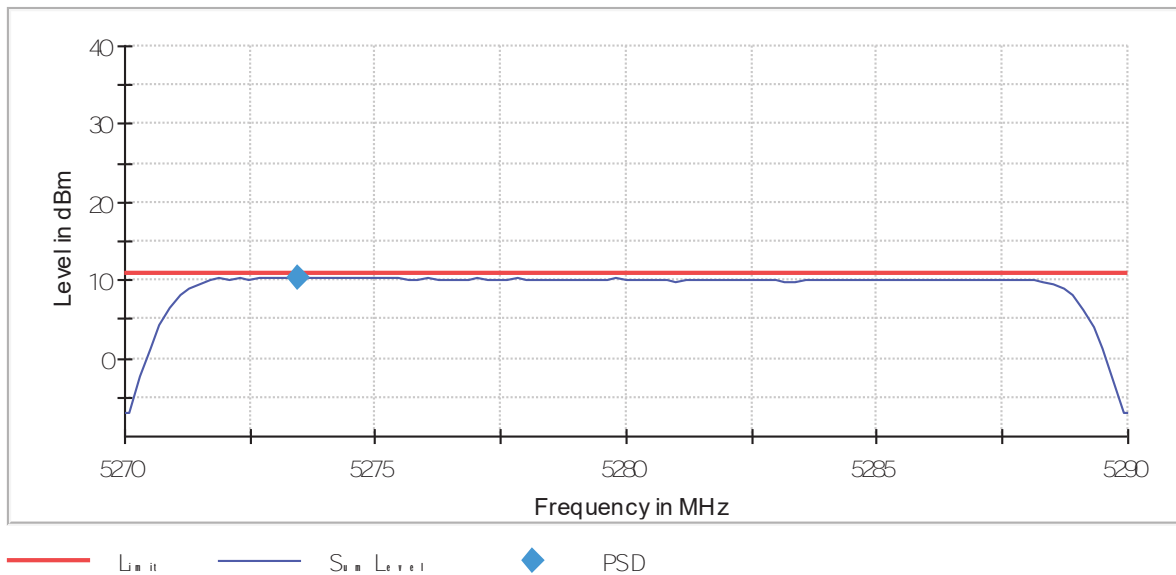
Channel 52

Power Spectral Density (SA-1)



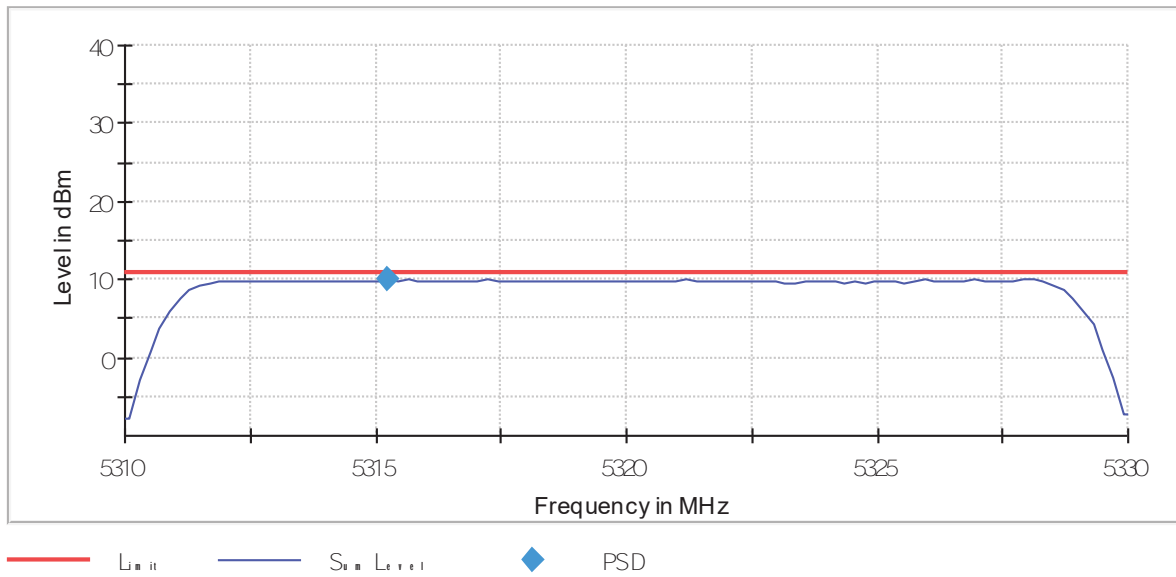
Channel 56

Power Spectral Density (SA-1)



Channel 64

Power Spectral Density (SA-1)



FCC Section 15.407(b)(2)(6) /RSS-247 6.2.2.2. Transmitter Out of Band Radiated Emissions

SPECIFICATION

For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.23 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-40 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

A preliminary scan determined the antenna port 2 and the 64QAM modulation as the worst case. The following tables and plots show the results for the worst case modulation.

SISO Antenna Port 2:

Mode 64QAM:

Frequency range 30 MHz-1000 MHz.

Note: The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

Spurious levels operating (radiated) closest to limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Uncertainty (dB)
45.7625	Vertical	Quasi-Peak	30.76	40	9.24	± 4.99
50.5155	Vertical	Quasi-Peak	31.78	40	8.22	± 4.99
70.7885	Vertical	Quasi-Peak	32.61	40	7.39	± 4.99
624.9980	Vertical	Quasi-Peak	35.80	46	10.20	± 4.99
750.0310	Horizontal	Quasi-Peak	31.83	46	14.17	± 4.99
875.0155	Horizontal	Quasi-Peak	44.89	46	1.11	± 4.99

Frequency range 1 GHz-40 GHz

The results in the next tables show the maximum measured levels in the 1-40 GHz frequency range.

Mode 64QAM:

Channel 52

- Radiated spurious signals were detected at less than 20 dB respect to the limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Uncertainty (dB)
1736.4000	Vertical	Peak	49.16	68.23	19.07	± 4.98
1838.0000	Horizontal	Peak	49.40	68.23	18.83	± 4.98
2179.2000	Horizontal	Peak	49.35	68.23	18.88	± 4.98

Channel 56

- Radiated spurious signals were detected at less than 20 dB respect to the limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Uncertainty (dB)
1827.0000	Horizontal	Peak	50.32	68.23	17.91	± 4.98
2500.4000	Horizontal	Peak	50.53	68.23	17.70	± 4.98
3080.0000	Horizontal	Peak	48.58	68.23	19.65	± 4.98

Channel 64

- Radiated spurious signals were detected at less than 20 dB respect to the limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Uncertainty (dB)
1838.6000	Horizontal	Peak	49.13	68.23	19.10	± 4.98
2563.4000	Horizontal	Peak	48.65	68.23	19.58	± 4.98

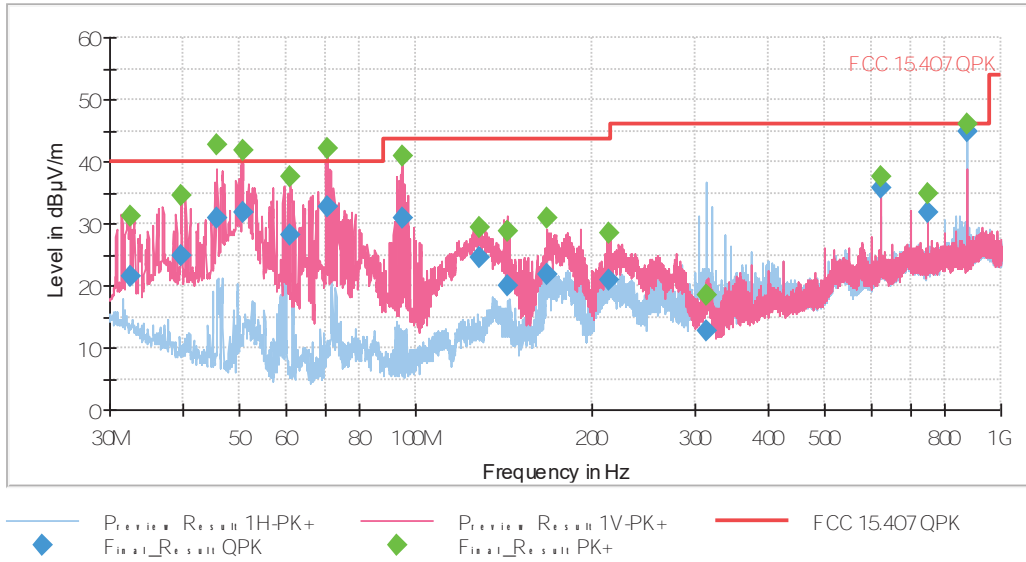
Measurement Uncertainty (dB): 1GHz to 17GHz <± 4.98

17GHz to 26.5GHz <± 5.08

26.5GHz to 40GHz <± 5.33

Verdict: PASS

SISO Antenna Port 2: FREQUENCY RANGE 30 MHz-1000 MHz.

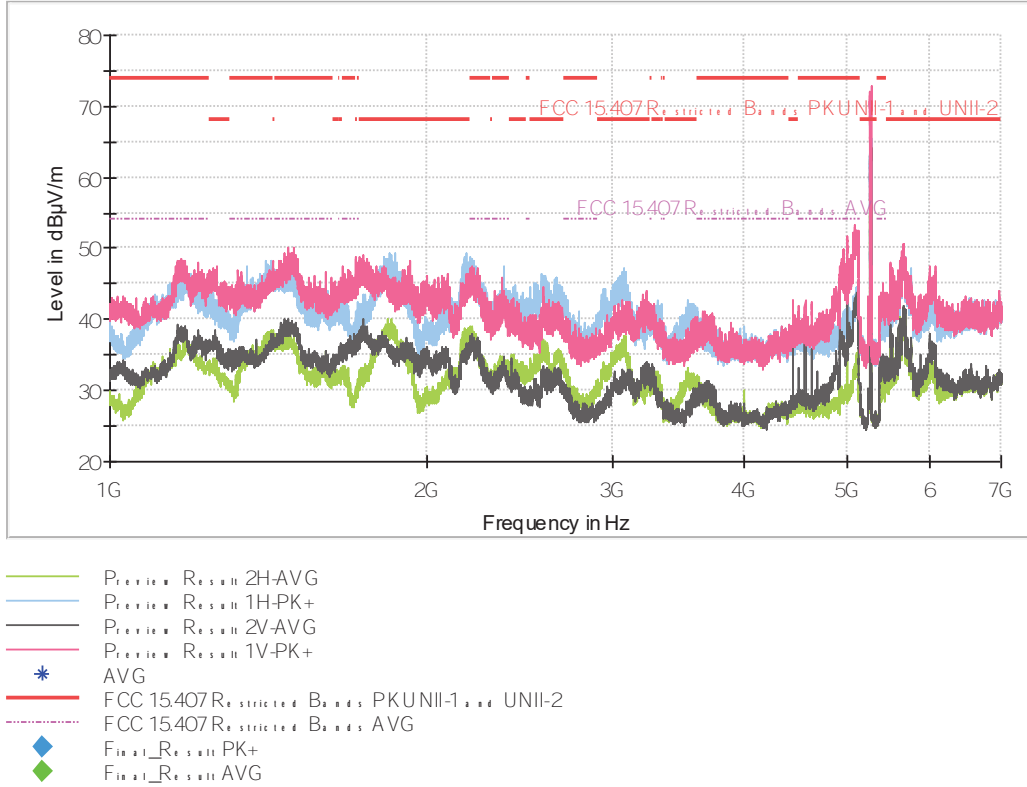


This plot is valid for all channels.

FREQUENCY RANGE 1 GHz to 7 GHz.

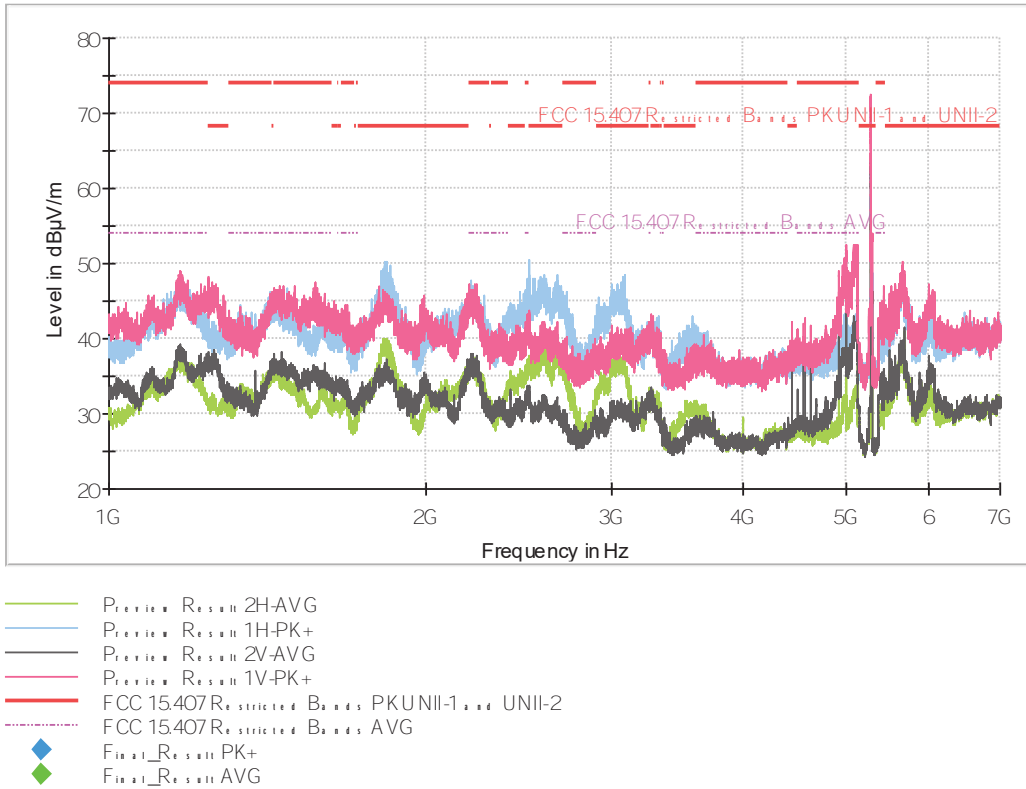
Mode 64QAM:

Channel 52:



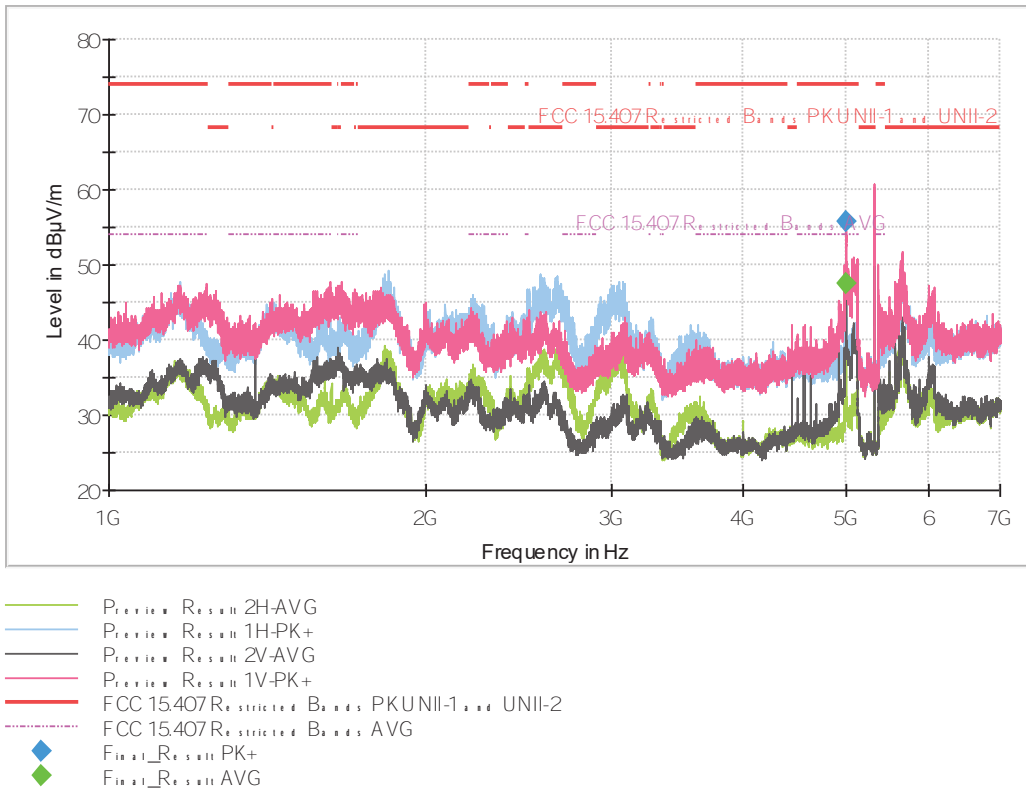
Note: The peak shown in the plot above the limit is the carrier frequency.

Channel 56:



Note: The peak shown in the plot above the limit is the carrier frequency.

Channel 64:

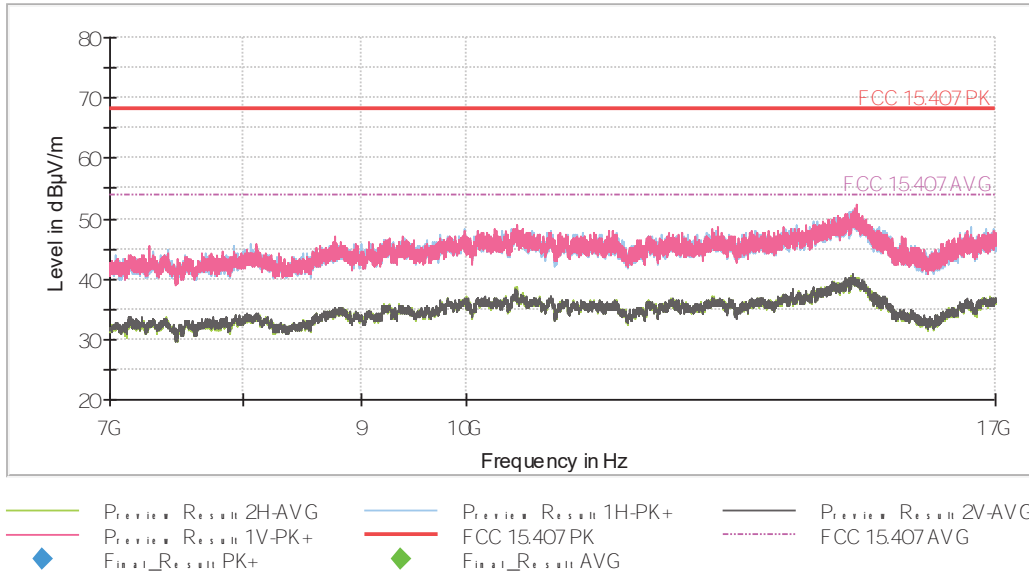


Note: The peak shown in the plot above the limit is the carrier frequency.

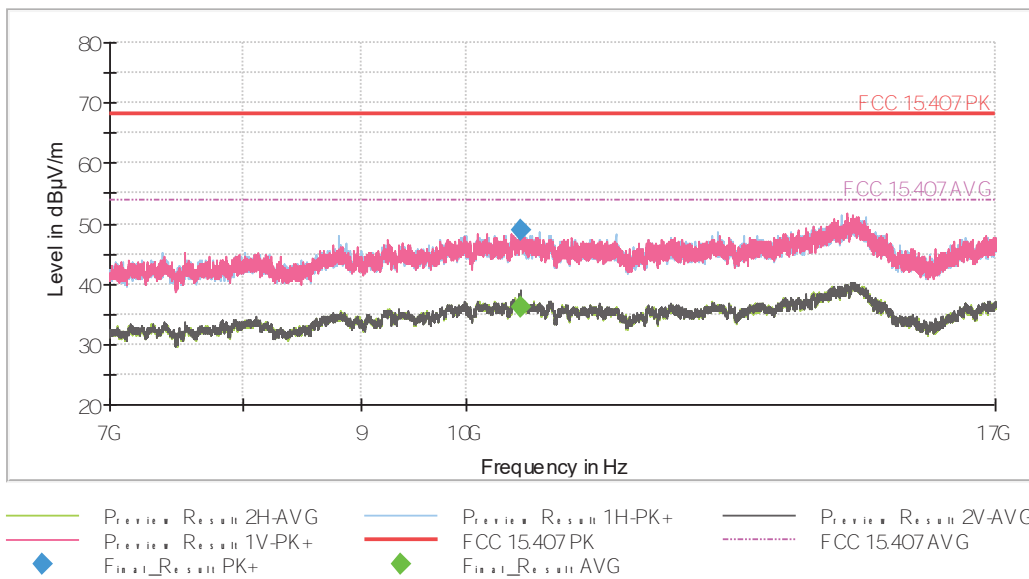
FREQUENCY RANGE 7 GHz to 17 GHz.

Mode 64QAM:

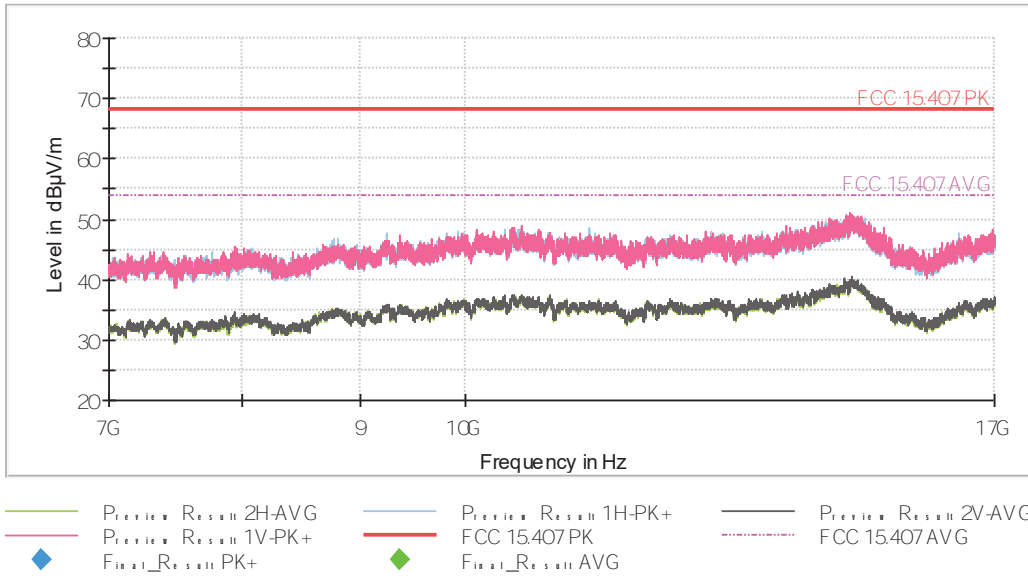
Channel 52:



Channel 56:



Channel 64:



FREQUENCY RANGE 17 GHz to 40 GHz.

Mode 64QAM:

This plot is valid for all channels.



FCC Section 15.407 Subclause (b) (2) / RSS-247 6.2.2.2. Transmitter Band Edge Radiated Emissions.

SPECIFICATION

For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.20 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

All emissions outside of the 5.15-5.35GHz band shall not exceed an EIRP of -27dBm/MHz. There are restricted bands of operation below band edge at 4.5-5.15 GHz also above the upper band edge at 5.35-5.46GHz therefore the provision of FCC Part 15.205 apply.

Field strength measurements using peak and average detector were performed in the restricted bands below 5.15GHz and above 5.35 GHz.

A preliminary scan determined the antenna port 2 as the worst case.

Test performed on the following worst cases modes in all relevant tests channels:

SISO Antenna Port 2:

Results for Mode: QPSK – 20MHz

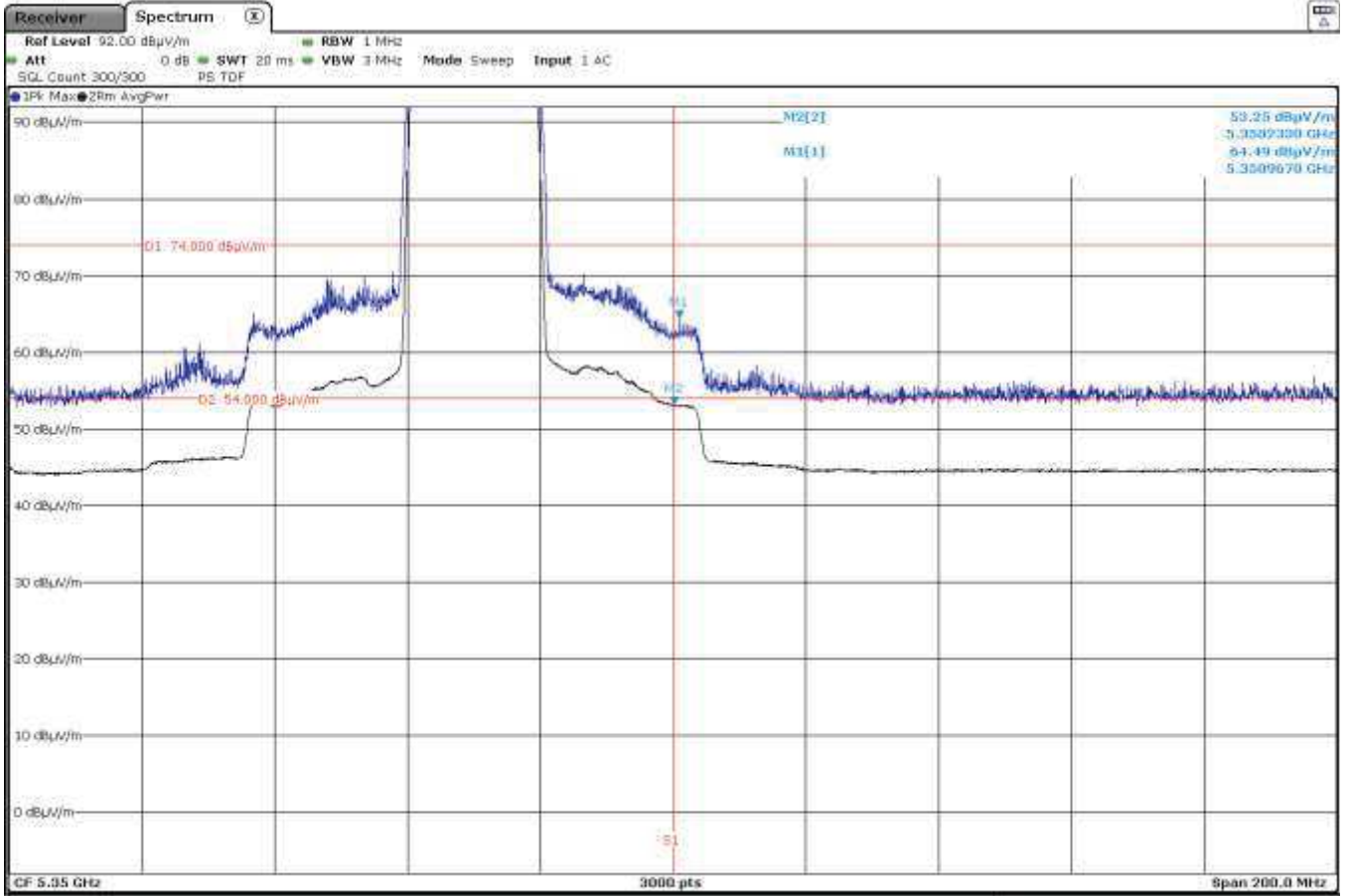
Results: Peak / Channel 64

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5350.9670	Vertical	64.49	74	9.51	<± 3.98	PASS

Results: Average / Channel 64

Frequency (MHz)	Antenna Polarity	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5350.2330	Vertical	53.25	54	0.75	<± 3.98	PASS

5350 MHz to 5460 MHz Upper Band Edge Channel 64



Results for Mode: 16QAM – 20MHz

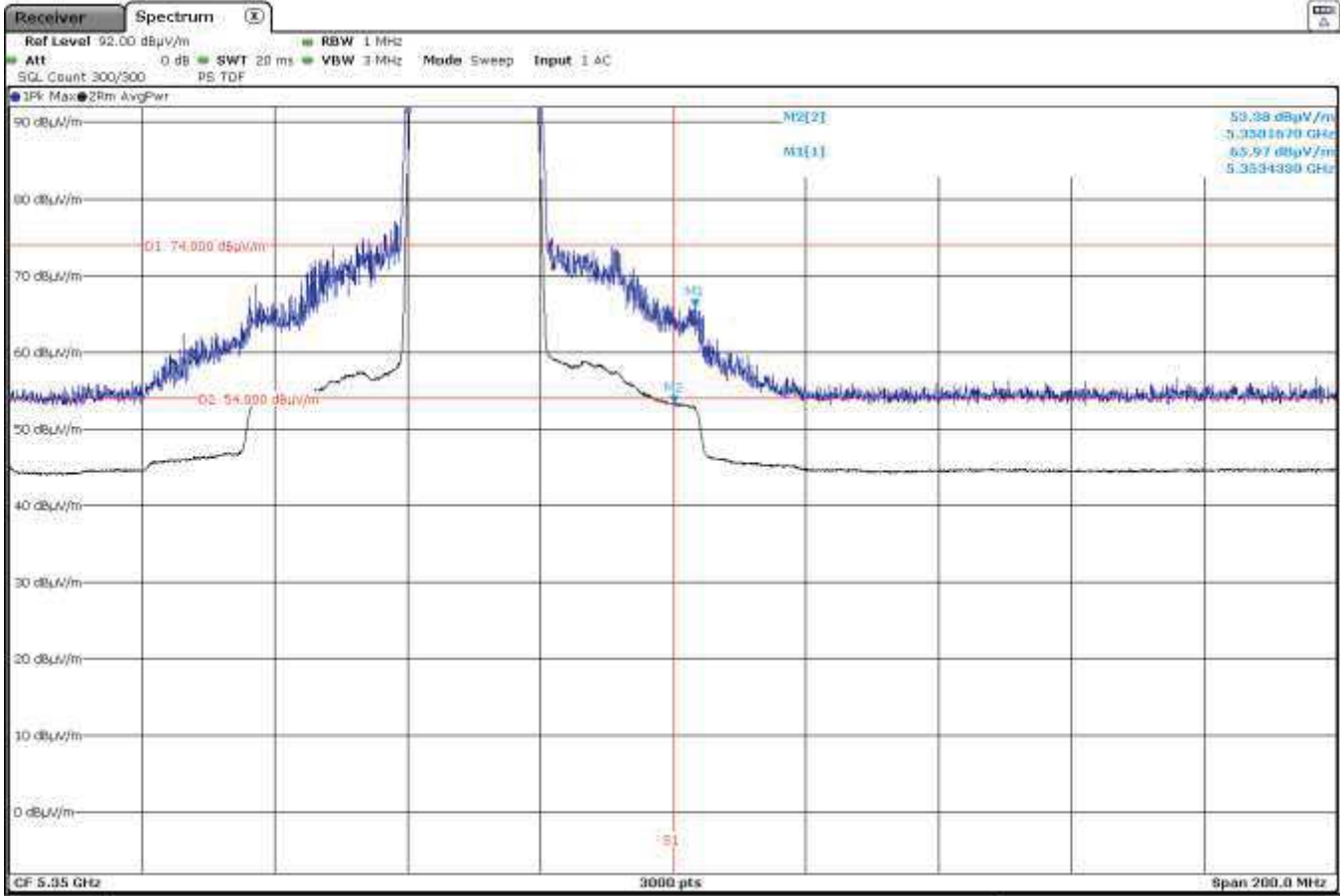
Results: Peak / Channel 64

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5353.4330	Vertical	65.97	74	8.03	<± 3.98	PASS

Results: Average / Channel 64

Frequency (MHz)	Antenna Polarity	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5350.1670	Vertical	53.38	54	0.62	<± 3.98	PASS

5350 MHz to 5460 MHz Upper Band Edge Channel 64



Results for Mode: 64QAM – 20MHz

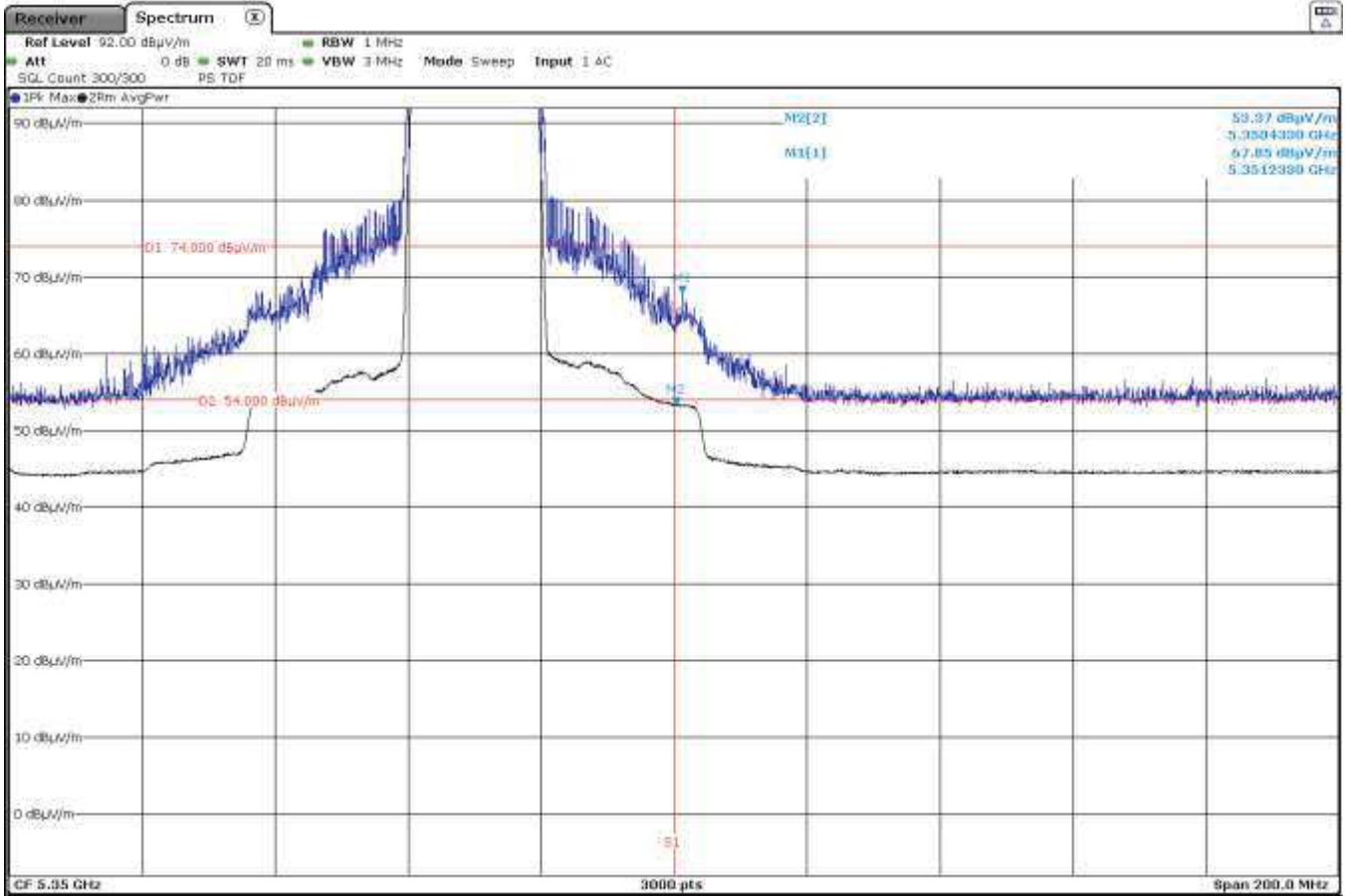
Results: Peak / Channel 64

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5351.2330	Vertical	67.85	74	6.15	<± 3.98	PASS

Results: Average / Channel 64

Frequency (MHz)	Antenna Polarity	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5350.4330	Vertical	53.37	54	0.63	<± 3.98	PASS

5350 MHz to 5460 MHz Upper Band Edge Channel 64



FCC Section 15.407(h)(1) / RSS-247 6.2.2.1 Transmitter Power Control

SPECIFICATION

FCC 15.407/RSS247: Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW (27dBm).

RESULTS:

The maximum conducted output power was measured using the channel power integration method according to point E) 2) b) (Method SA-1) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is >98%.

The e.i.r.p. levels are calculated by adding the antenna gain (dBi).

SISO Antenna Port 1:

FCC & Canada power setting

Mode: QPSK – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	20.08	19.97	20.31
Maximum EIRP power (dBm)	23.08	22.97	23.31
EIRP power Limit (dBm)	24		
Margin (dB)	0.92	1.03	0.69
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	20.04	19.88	20.26
Maximum EIRP power (dBm)	23.04	22.88	23.26
EIRP power Limit (dBm)	24		
Margin (dB)	0.96	1.12	0.74
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	20.20	20.08	20.20
Maximum EIRP power (dBm)	23.20	23.08	23.20
EIRP power Limit (dBm)	24		
Margin (dB)	0.80	0.92	0.80
Measurement uncertainty (dB)	<±1.20		

SISO Antenna Port 2:

FCC & Canada power setting

Mode: QPSK – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	20.03	20.55	20.09
Maximum EIRP power (dBm)	23.03	23.55	23.09
EIRP power Limit (dBm)	24		
Margin (dB)	0.97	0.45	0.91
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	20.19	20.43	20.07
Maximum EIRP power (dBm)	23.19	23.43	23.07
EIRP power Limit (dBm)	24		
Margin (dB)	0.81	0.57	0.98
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	20.09	20.39	20.01
Maximum EIRP power (dBm)	23.09	23.39	23.01
EIRP power Limit (dBm)	24		
Margin (dB)	0.91	0.61	0.99
Measurement uncertainty (dB)	<±1.20		

Appendix D: Test result for 5.47GHz – 5.725GHz.

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TEST CONDITIONS

Power supply (V):

Vnominal = 120 Vac

Type of power supply = AC voltage main supply.

Type of antenna = External antenna.

Declared Gain for antenna (maximum):

$G_{\text{ANTENNA SISO1}} = 3 \text{ dBi}$

$G_{\text{ANTENNA SISO2}} = 3 \text{ dBi}$

Technology Tested:	MulteFire 1.0	
Modes:	QPSK, 16QAM, 64QAM	
Antena ports:	1, 2	
Beamforming:	No	
Frequency Range:	5470 MHz to 5725 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Lowest: 100	5500
	Middle: 116	5580
	Highest: 140	5700

For RSS-247 (Canada Standard), this device shall not be capable of transmitting in the band 5600-5650 MHz. This restriction is for the protection of Environment Canada’s weather radars operating in this band.

The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power in all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode for the channel under test.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes. FCC and Canada power setting used during the test were different to be in compliance with both limits.

SISO Port 1:

Channel	Channel Frequency (MHz)	FCC Attenuation Value	CANADA Attenuation value
Lowest: 100	5500	1	1
Middle: 116	5580	2	2
Highest: 140	5700	2	2

SISO Port 2:

Channel	Channel Frequency (MHz)	FCC Attenuation Value	CANADA Attenuation value
Lowest: 100	5500	3	3
Middle: 116	5580	5	5
Highest: 140	5700	0	0

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The AC supply voltage is applied using an external power supply.

RADIATED MEASUREMENTS

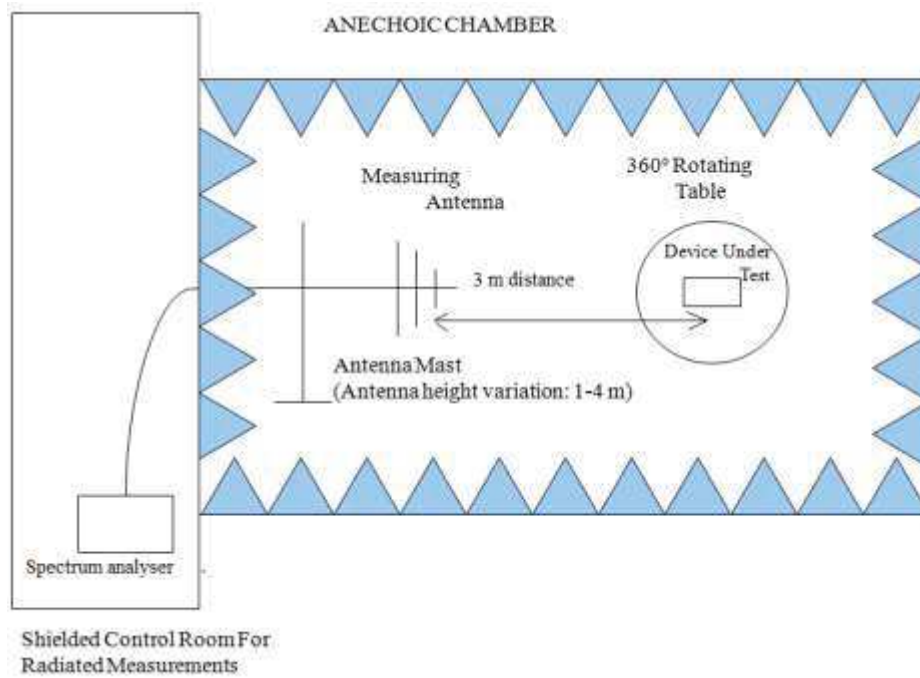
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the center of the chamber turntable to perform the measurements below 1GHz and The EUT was placed at a height of 1.5 meters above the test chamber floor in the center of the chamber turntable to perform the measurements above 1GHz. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

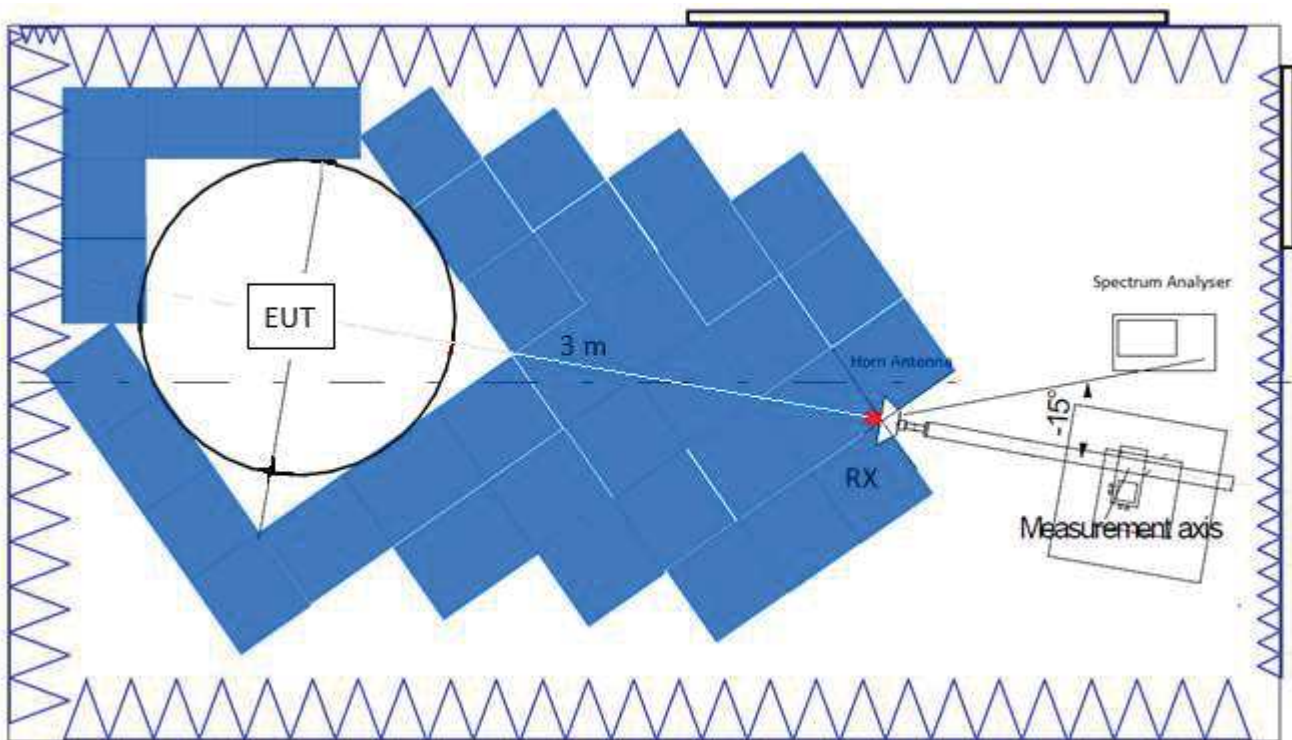
The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.

A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1MHz/3MHz for frequencies above 1 GHz.

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



FCC Section 15.407 Subclause (a)(2). Transmitter Maximum Conducted Output Power / RSS-247 Clause 6.2.3.1. Transmitter Maximum Equivalent Isotropically Radiated Power

SPECIFICATION

FCC 15.407: For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW (24 dBm) or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247: The maximum conducted output power shall not exceed 250 mW (24 dBm) or $11 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

The maximum e.i.r.p. shall not exceed 1.0 W (30 dBm) or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz.

RESULTS:

The maximum conducted output power was measured using the channel power integration method according to point E) 3) b) (Method PM-G) of 789033 D02 General UNII Test Procedures New Rules v02r01.

The e.i.r.p. levels are calculated by adding the corresponding antenna gain (dBi).

SISO Antenna Port 1:

FCC power setting

Mode: QPSK – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.47	21.44	21.86
Conducted Power Limit (dBm)	24		
Margin (dB)	2.53	2.56	2.14
Maximum EIRP power (dBm)	24.47	24.44	24.86
EIRP power Limit (dBm)	30		
Margin (dB)	5.53	5.56	5.14
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.27	21.31	21.91
Conducted Power Limit (dBm)	24		
Margin (dB)	2.73	2.69	2.09
Maximum EIRP power (dBm)	24.27	24.31	24.91
EIRP power Limit (dBm)	30		
Margin (dB)	5.73	5.69	5.09
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.57	21.24	21.92
Conducted Power Limit (dBm)	24		
Margin (dB)	2.43	2.76	2.08
Maximum EIRP power (dBm)	24.57	24.24	24.92
EIRP power Limit (dBm)	30		
Margin (dB)	5.43	5.76	5.08
Measurement uncertainty (dB)	<±1.20		

Canada power setting

Mode: QPSK – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.47	21.44	21.86
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.06	2.09	1.67
Maximum EIRP power (dBm)	24.47	24.44	24.86
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.06	5.09	4.67
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.27	21.31	21.91
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.26	2.22	1.62
Maximum EIRP power (dBm)	24.27	24.31	24.91
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.26	5.22	4.62
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.57	21.24	21.92
Conducted Power Limit (dBm)	23.528		
Margin (dB)	1.96	2.29	1.61
Maximum EIRP power (dBm)	24.57	24.24	24.92
EIRP power Limit (dBm)	29.528		
Margin (dB)	4.96	5.29	4.61
Measurement uncertainty (dB)	<±1.20		

SISO Antenna Port 2:

FCC power setting

Mode: QPSK – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.27	20.90	20.45
Conducted Power Limit (dBm)	24		
Margin (dB)	2.73	3.10	3.55
Maximum EIRP power (dBm)	24.27	23.90	23.45
EIRP power Limit (dBm)	30		
Margin (dB)	5.73	6.10	6.55
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.43	20.89	20.27
Conducted Power Limit (dBm)	24		
Margin (dB)	2.57	3.11	3.73
Maximum EIRP power (dBm)	24.43	23.89	23.27
EIRP power Limit (dBm)	30		
Margin (dB)	5.57	6.11	6.73
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.42	20.88	20.63
Conducted Power Limit (dBm)	24		
Margin (dB)	2.58	3.12	3.37
Maximum EIRP power (dBm)	24.42	23.88	23.63
EIRP power Limit (dBm)	30		
Margin (dB)	5.58	6.12	6.37
Measurement uncertainty (dB)	<±1.20		

Canada power setting

Mode: QPSK – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.27	20.90	20.45
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.26	2.63	3.08
Maximum EIRP power (dBm)	24.27	23.90	23.45
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.26	5.63	6.08
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.43	20.89	20.27
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.09	2.64	3.26
Maximum EIRP power (dBm)	24.43	23.89	23.27
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.09	5.64	6.26
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	21.42	20.88	20.63
Conducted Power Limit (dBm)	23.528		
Margin (dB)	2.11	2.65	2.89
Maximum EIRP power (dBm)	24.42	23.88	23.63
EIRP power Limit (dBm)	29.528		
Margin (dB)	5.11	5.65	5.89
Measurement uncertainty (dB)	<±1.20		

FCC Section 15.407 Subclause (a) (2) / RSS-247 Clause 6.2.3.1. Transmitter Maximum Power Spectral Density

FCC 15.407: The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247: The e.i.r.p. spectral density shall not exceed 11 dBm in any 1.0 MHz band.

RESULTS

The maximum power spectral density (PSD) was measured using the method according to point F) referencing E.2.b) (Method SA-1) of Guidance 789033 D02 General UNII Test Procedures New Rules v02r01.

SISO Antenna Port 1:

FCC & Canada power setting

Mode: QSPK – 20MHz

	channel 100 5500 MHz	channel 116 5580 MHz	channel 140 5700 MHz
PSD (dBm/MHz)	10.33	10.14	10.29
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.67	0.86	0.71
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

	channel 100 5500 MHz	channel 116 5580 MHz	channel 140 5700 MHz
PSD (dBm/MHz)	10.27	9.96	10.26
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.73	1.04	0.74
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

	channel 100 5500 MHz	channel 116 5580 MHz	channel 140 5700 MHz
PSD (dBm/MHz)	10.35	9.88	10.28
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.65	1.12	0.72
Measurement uncertainty (dB)	<±1.20		

SISO Antenna Port 2:

FCC & Canada power setting

Mode: QSPK – 20MHz

	channel 100 5500 MHz	channel 116 5580 MHz	channel 140 5700 MHz
PSD (dBm/MHz)	10.31	10.06	9.47
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.69	0.94	1.53
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

	channel 100 5500 MHz	channel 116 5580 MHz	channel 140 5700 MHz
PSD (dBm/MHz)	10.34	9.96	9.33
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.66	1.04	1.67
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

	channel 100 5500 MHz	channel 116 5580 MHz	channel 140 5700 MHz
PSD (dBm/MHz)	10.34	10.01	9.53
PSD Limit (dBm/MHz)	11		
Margin (dB)	0.66	0.99	1.47
Measurement uncertainty (dB)	<±1.20		

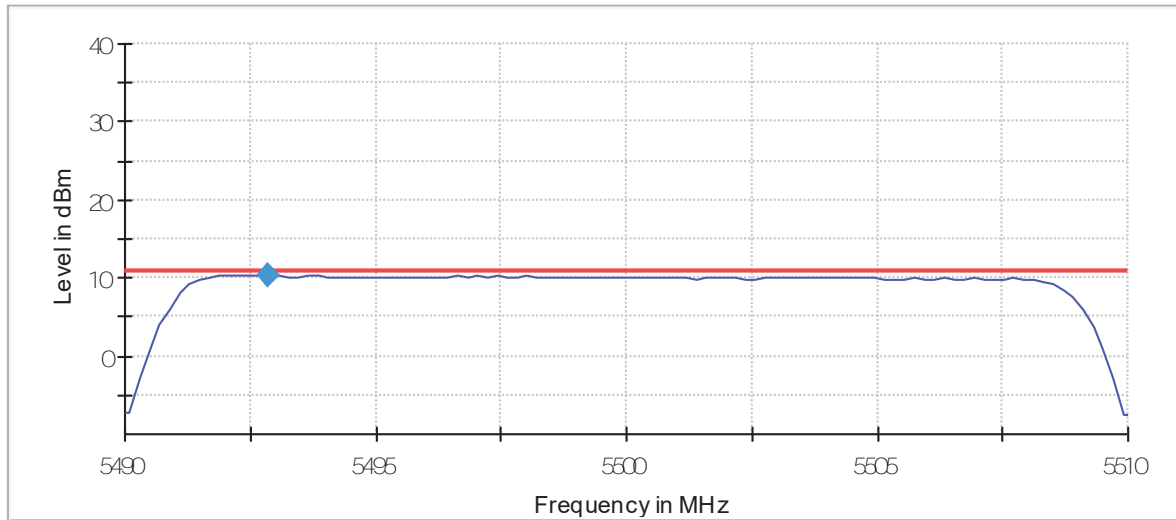
SISO Antenna Port 1:

FCC & Canada power setting

Mode: QSPK – 20MHz

Channel 100

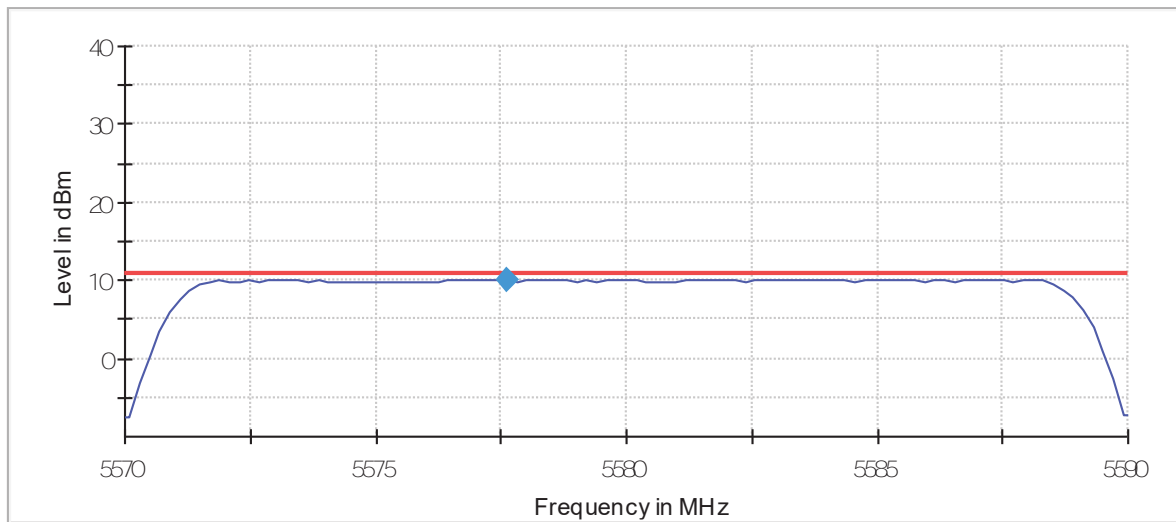
Power Spectral Density (SA-1)



— Limit — Signal Level ◆ PSD

Channel 116

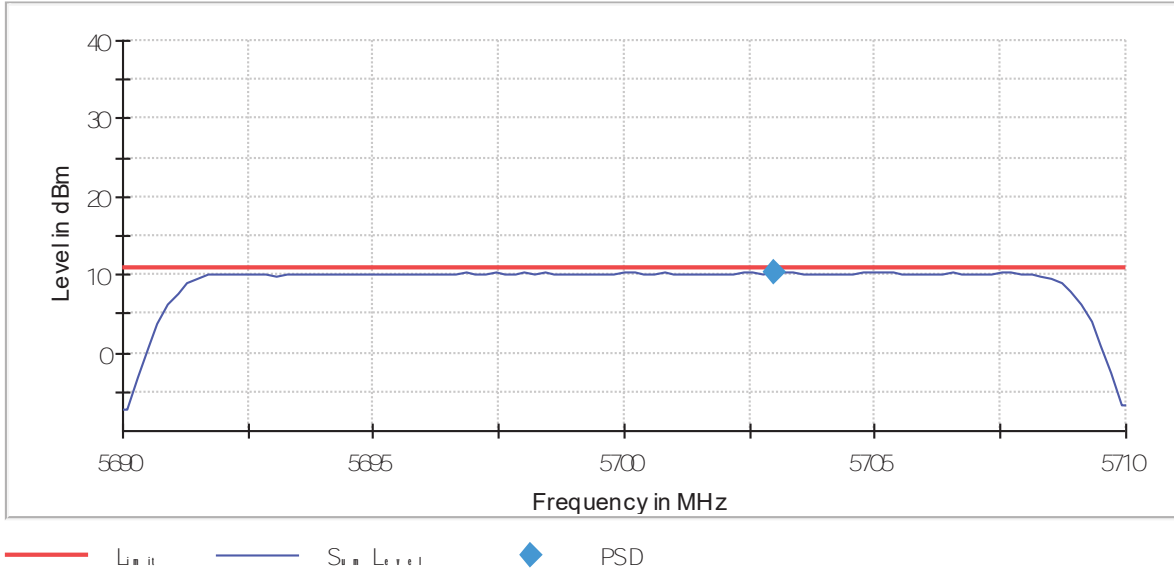
Power Spectral Density (SA-1)



— Limit — Signal Level ◆ PSD

Channel 140

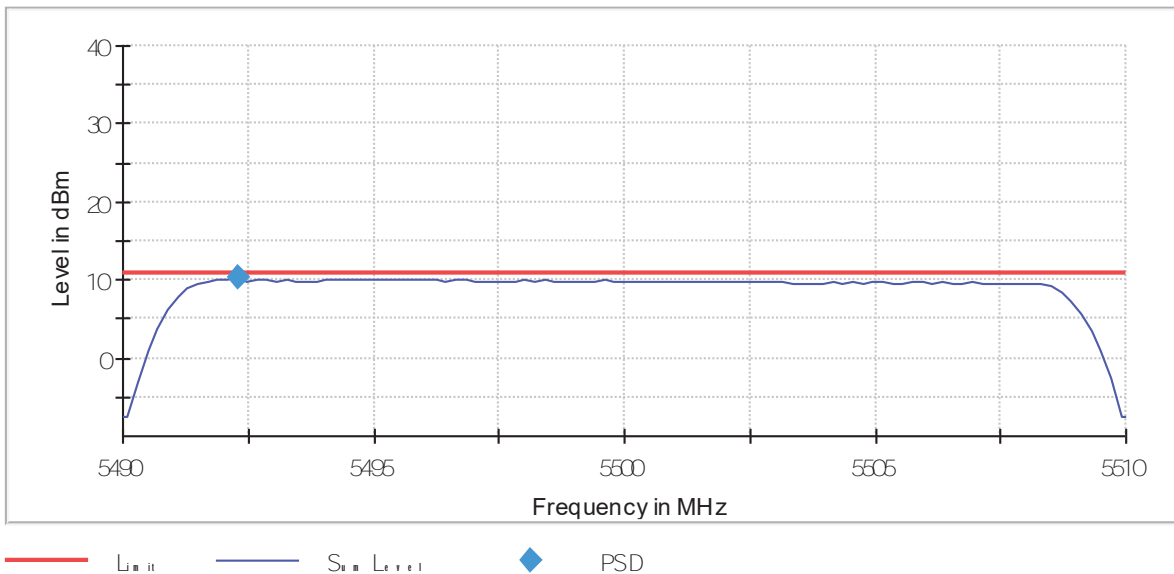
Power Spectral Density (SA-1)



Mode: 16QAM – 20MHz

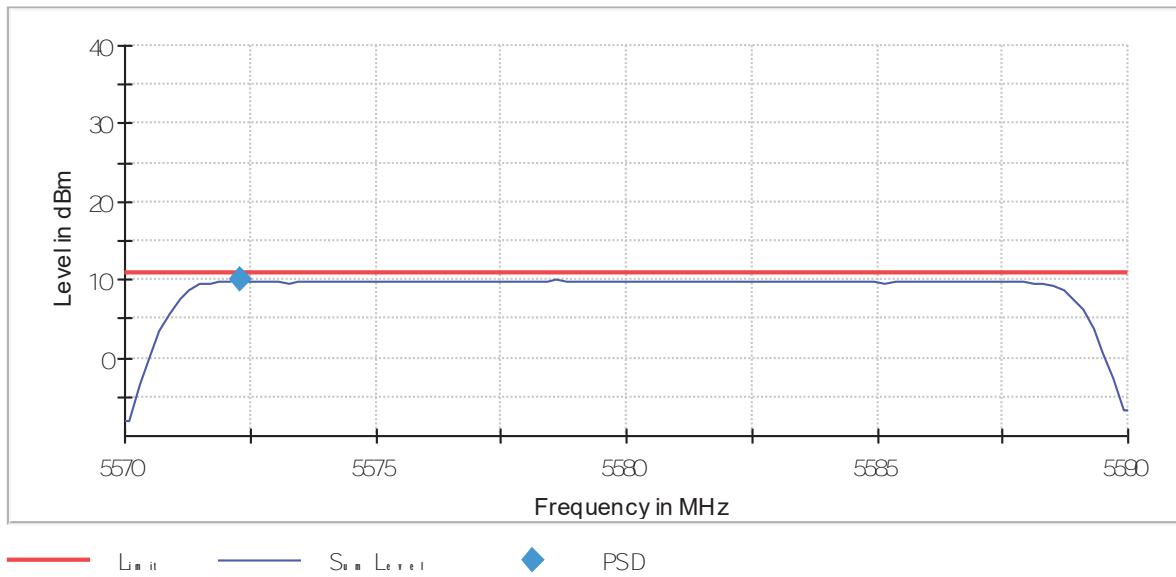
Channel 100

Power Spectral Density (SA-1)



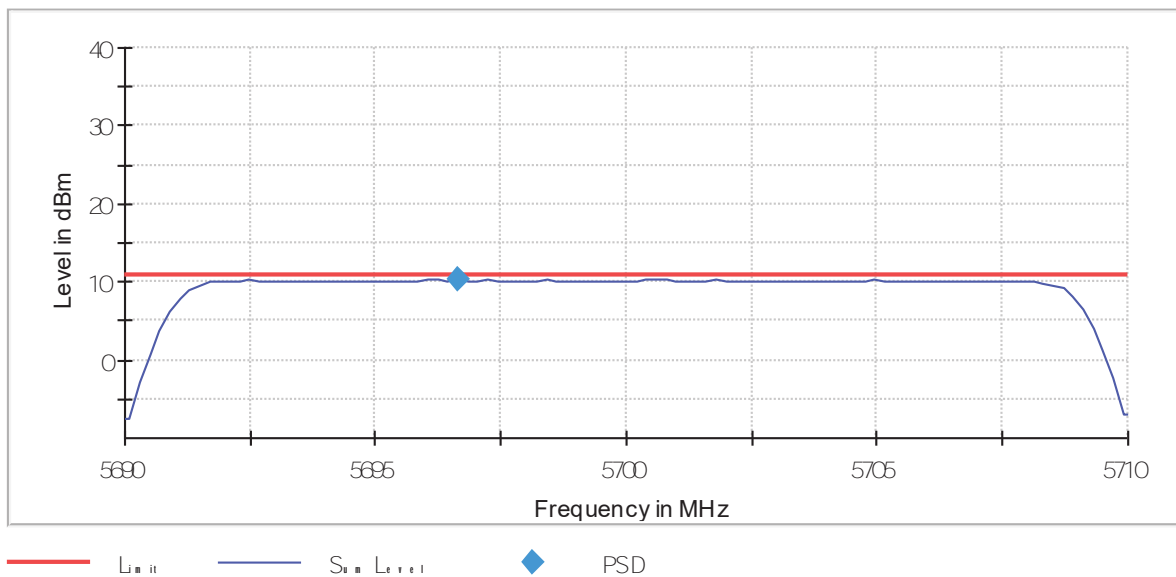
Channel 116

Power Spectral Density (SA-1)



Channel 140

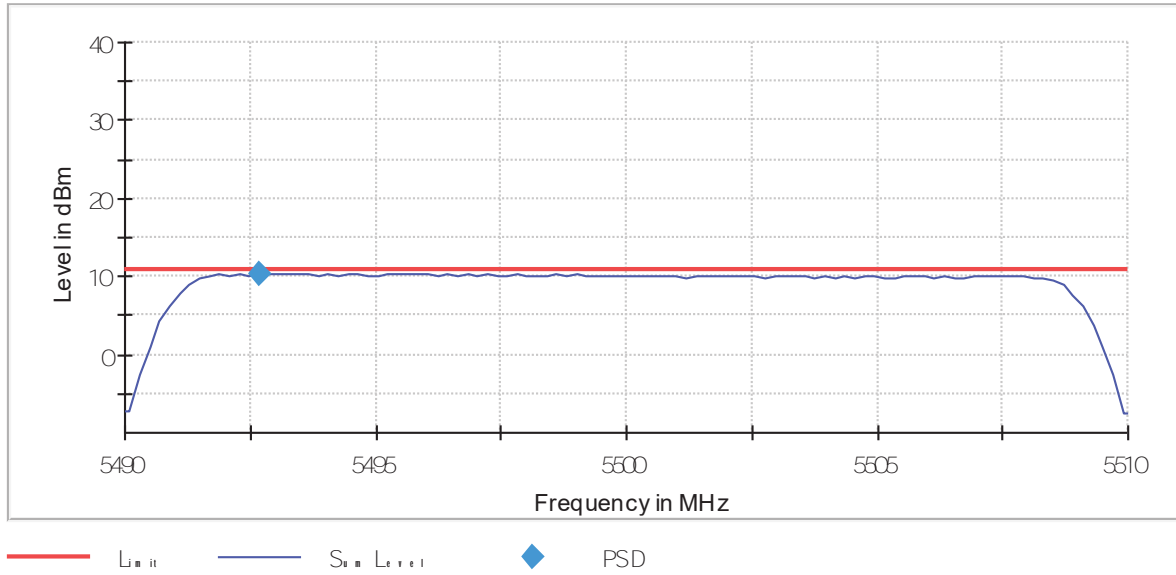
Power Spectral Density (SA-1)



Mode: 64QAM – 20MHz

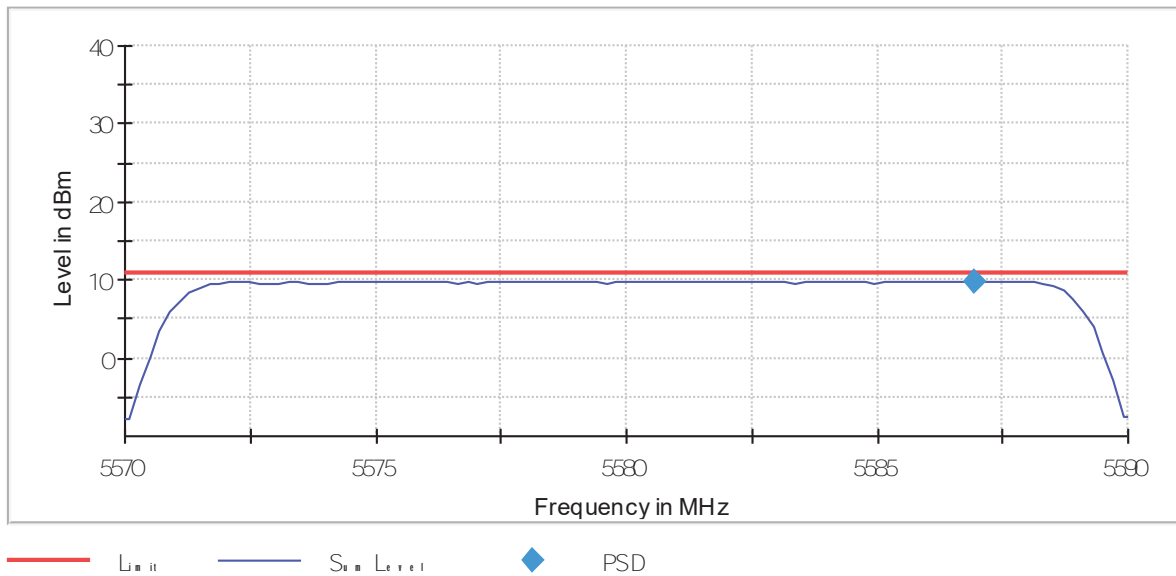
Channel 100

Power Spectral Density (SA-1)



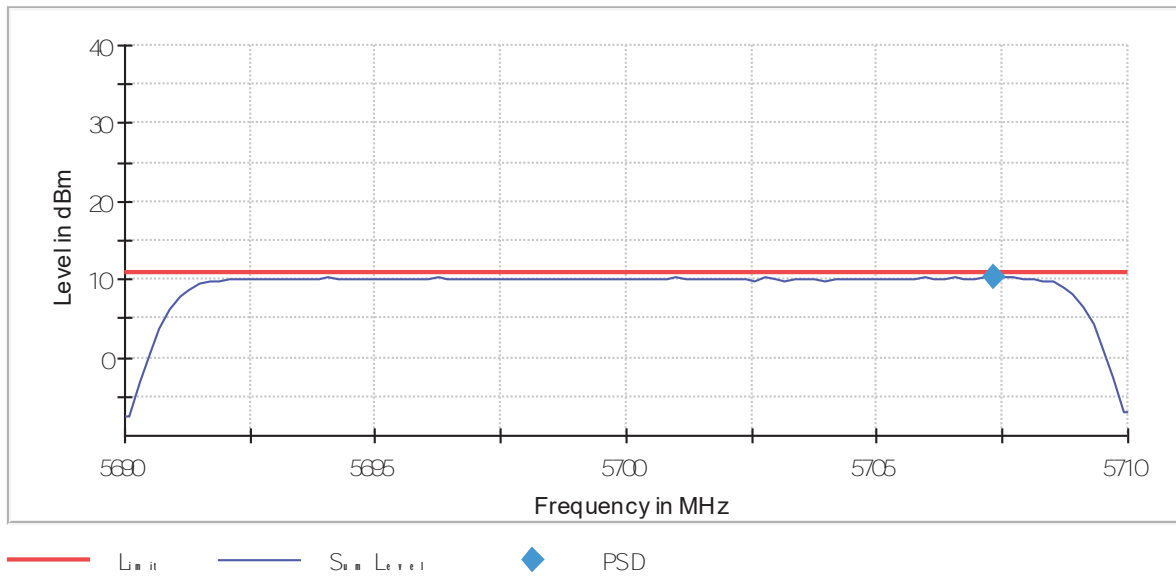
Channel 116

Power Spectral Density (SA-1)



Channel 140

Power Spectral Density (SA-1)



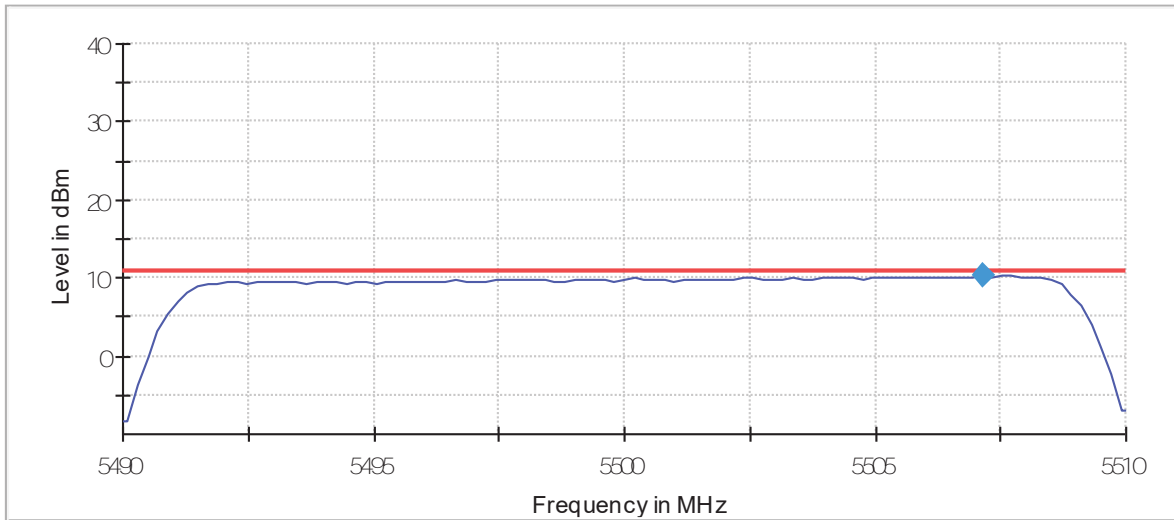
SISO Antenna Port 2:

FCC & Canada power setting

Mode: QSPK – 20MHz

Channel 100

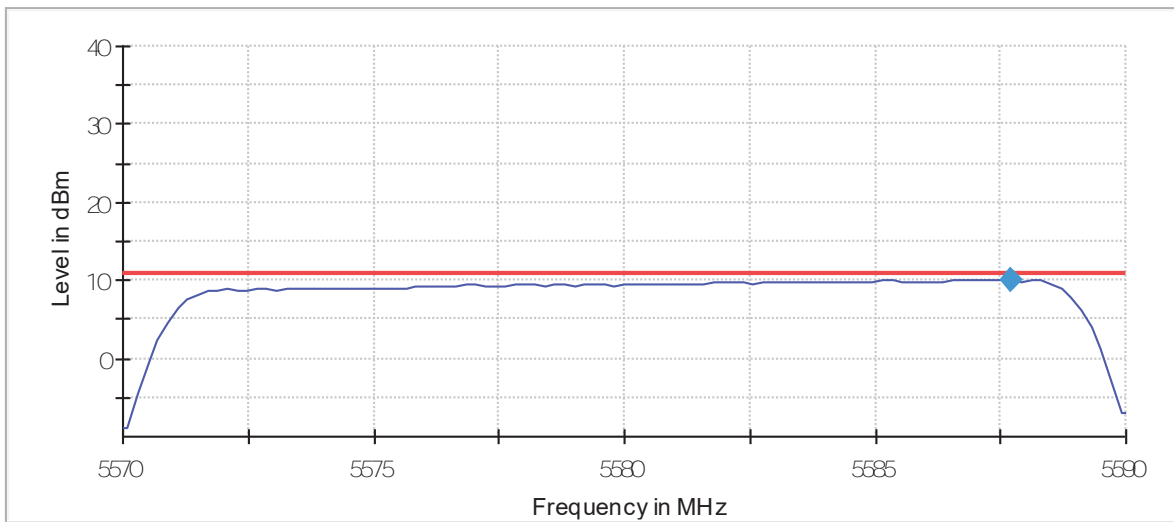
Power Spectral Density (SA-1)



— Limit — Signal — PSD

Channel 116

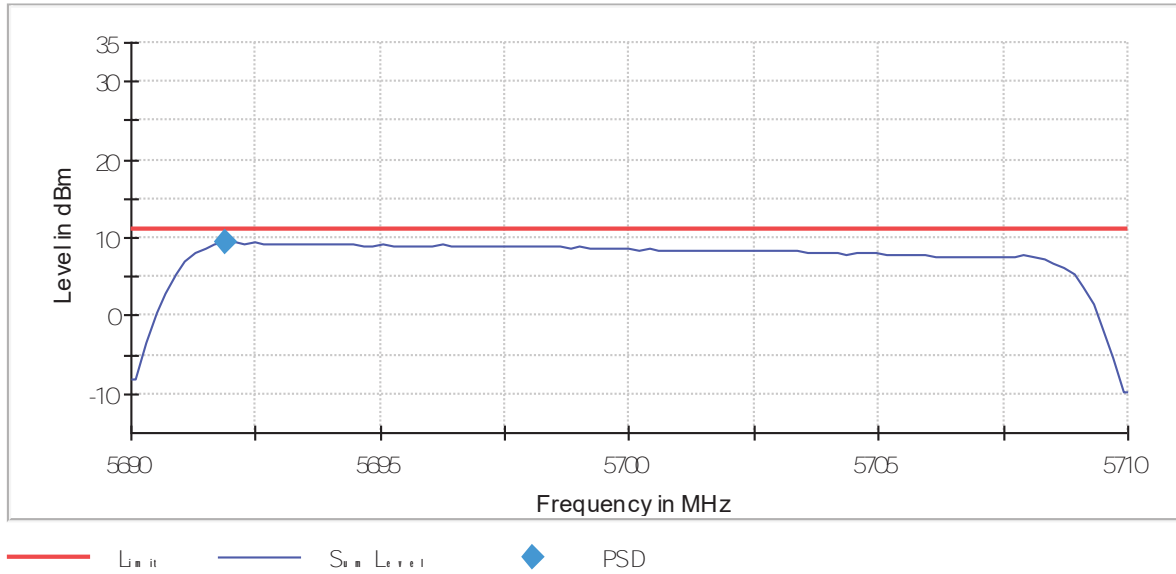
Power Spectral Density (SA-1)



— Limit — Signal — PSD

Channel 140

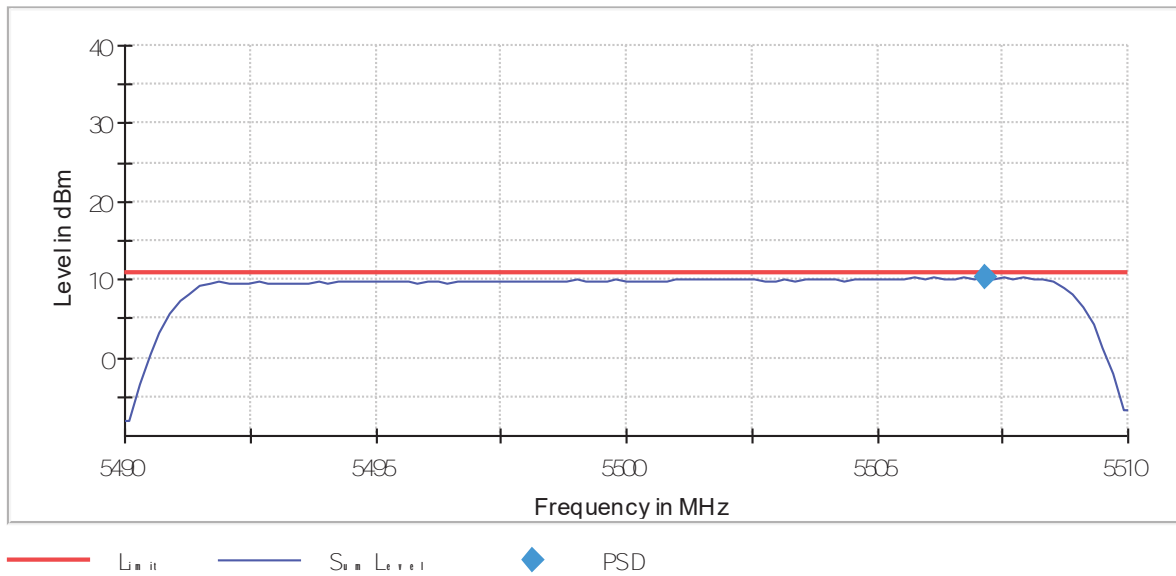
Power Spectral Density (SA-1)



Mode: 16QAM – 20MHz

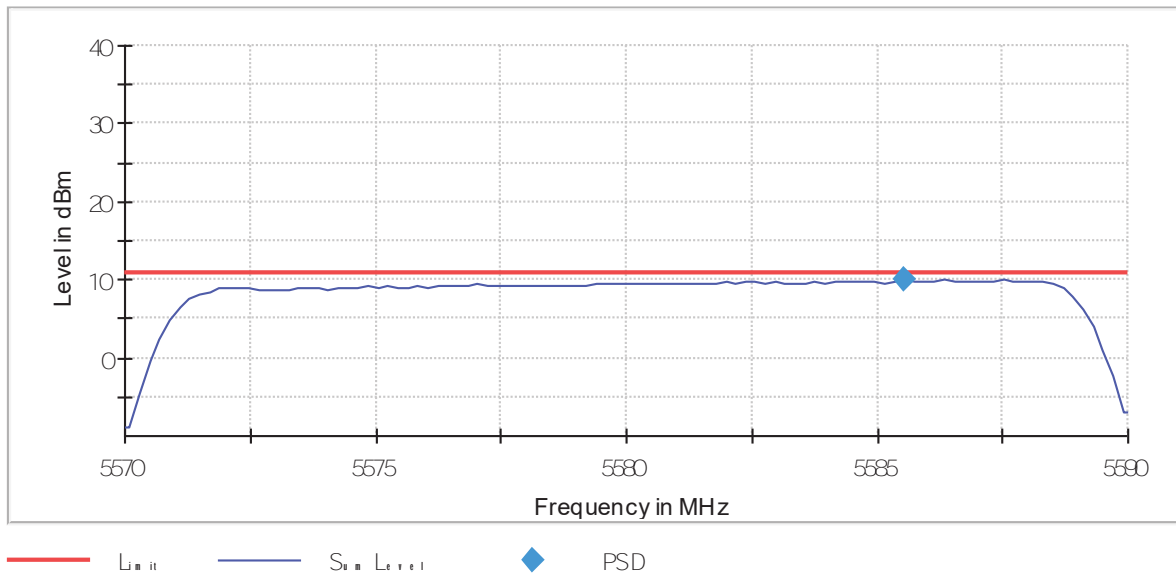
Channel 100

Power Spectral Density (SA-1)



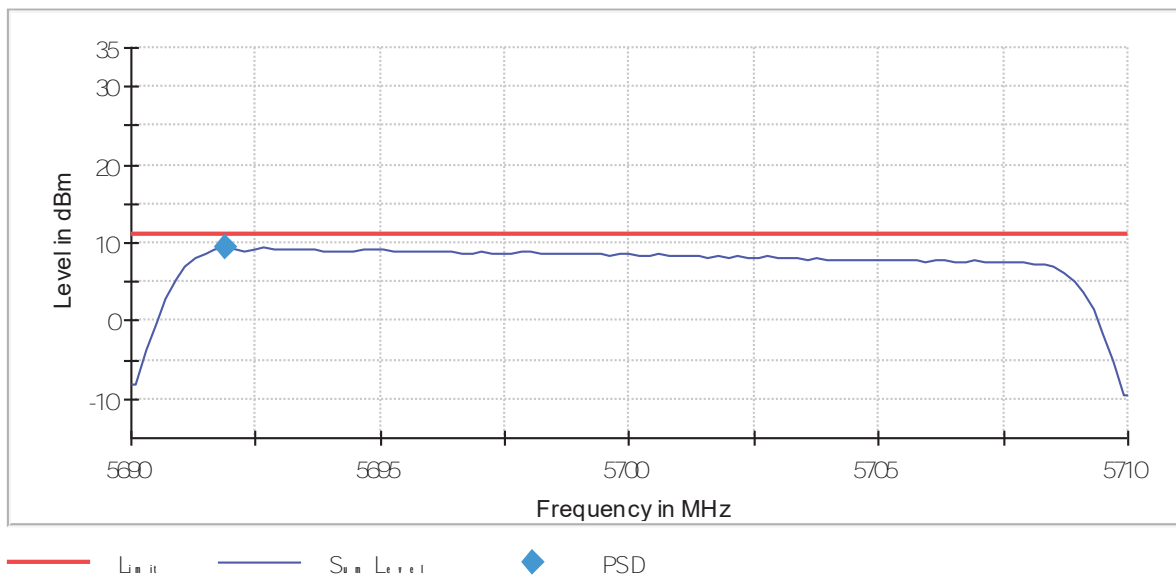
Channel 116

Power Spectral Density (SA-1)



Channel 140

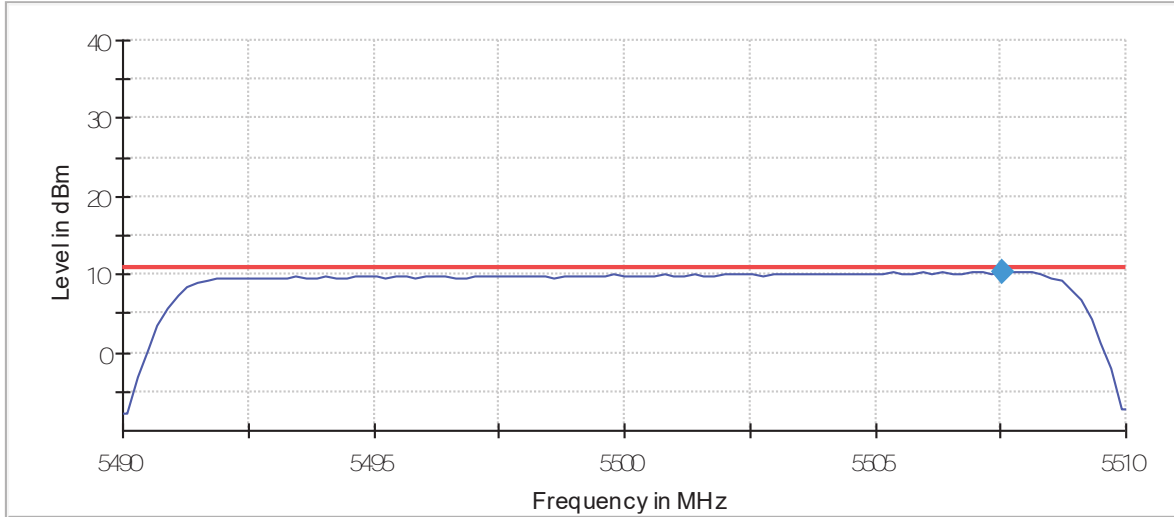
Power Spectral Density (SA-1)



Mode: 64QAM – 20MHz

Channel 100

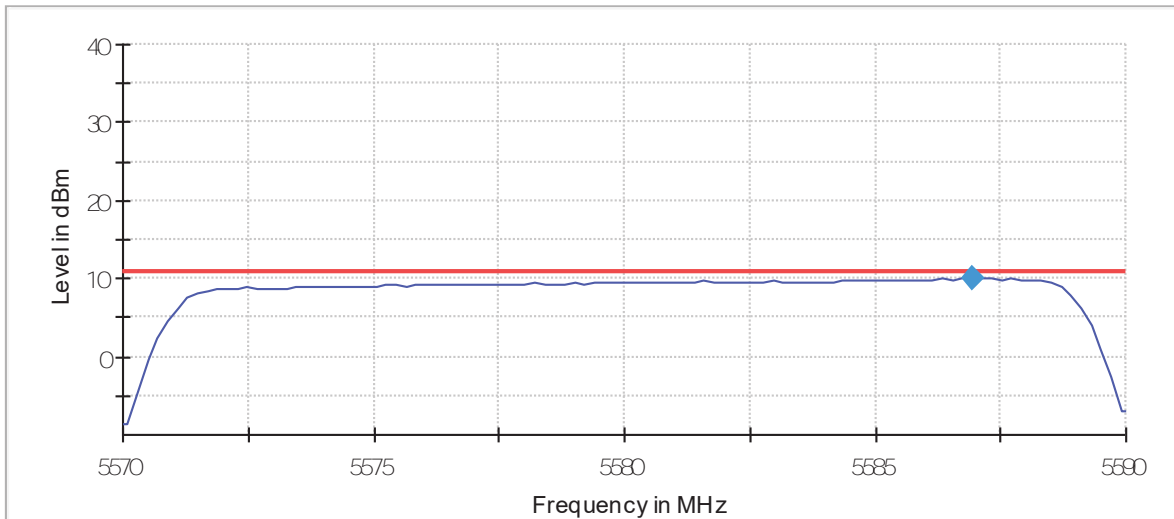
Power Spectral Density (SA-1)



— Limit — Signal Level ◆ PSD

Channel 116

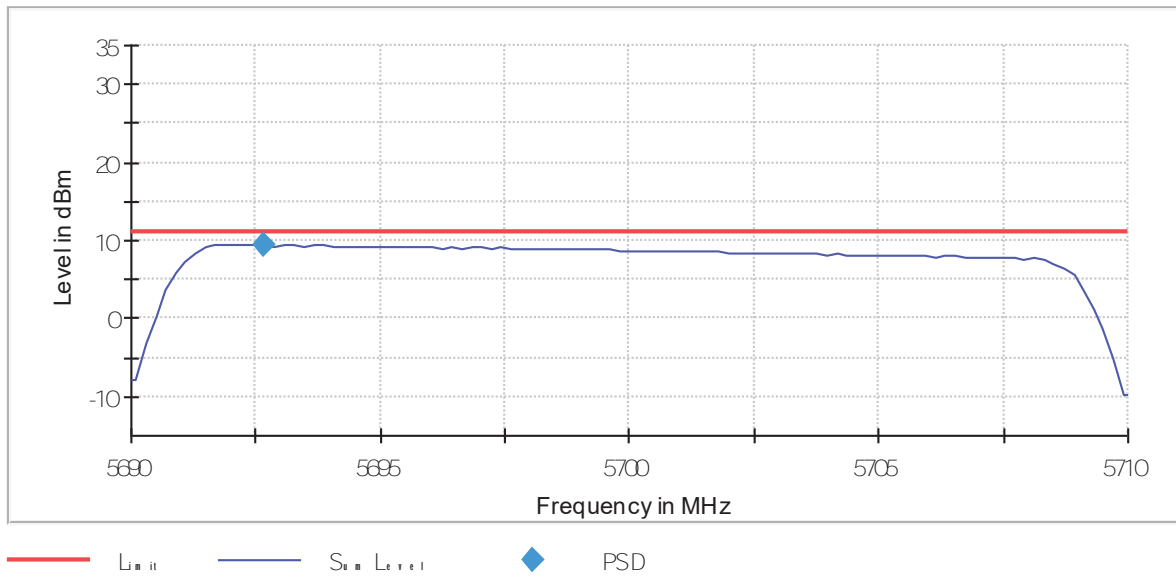
Power Spectral Density (SA-1)



— Limit — Signal Level ◆ PSD

Channel 140

Power Spectral Density (SA-1)



FCC Section 15.407(b)(3)(6) /RSS-247 6.2.3.2. Transmitter Out of Band Radiated Emissions

SPECIFICATION

For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.23 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 – 88	100	40	3
88 – 216	150	43.5	3
216 – 960	200	46	3
960 – 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-40 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

A preliminary scan determined the antenna port 2 and the 64QAM modulation as the worst case. The following tables and plots show the results for the worst case modulation.

SISO Antenna Port 2:

Mode 64QAM:

Frequency range 30 MHz-1000 MHz.

Note: The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

Spurious levels operating (radiated) closest to limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Uncertainty (dB)
45.9565	Vertical	Quasi-Peak	30.91	40	9.09	± 4.99
71.0310	Vertical	Quasi-Peak	32.84	40	7.16	± 4.99
94.8930	Vertical	Quasi-Peak	29.64	43.5	13.86	± 4.99
624.9980	Vertical	Quasi-Peak	35.36	46	10.64	± 4.99
749.9825	Horizontal	Quasi-Peak	32.79	46	13.21	± 4.99
875.0155	Horizontal	Quasi-Peak	44.98	46	1.02	± 4.99

Frequency range 1 GHz-40 GHz

The results in the next tables show the maximum measured levels in the 1-40 GHz frequency range.

Mode 64QAM:

Channel 100

- Radiated spurious signals were detected at less than 20 dB respect to the limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Uncertainty (dB)
1849.6000	Horizontal	Peak	49.02	68.23	19.21	± 4.98
2178.8000	Horizontal	Peak	50.00	68.23	18.23	± 4.98
2586.0000	Horizontal	Peak	52.06	68.23	16.17	± 4.98

Channel 116

- Radiated spurious signals were detected at less than 20 dB respect to the limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Uncertainty (dB)
2085.6000	Horizontal	Peak	49.02	68.23	19.21	± 4.98
2600.8000	Horizontal	Peak	50.80	68.23	17.43	± 4.99

Channel 140

- Radiated spurious signals were detected at less than 20 dB respect to the limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Uncertainty (dB)
2142.2000	Horizontal	Peak	48.28	68.23	19.95	± 4.98
2586.8000	Horizontal	Peak	50.89	68.23	17.34	± 4.98

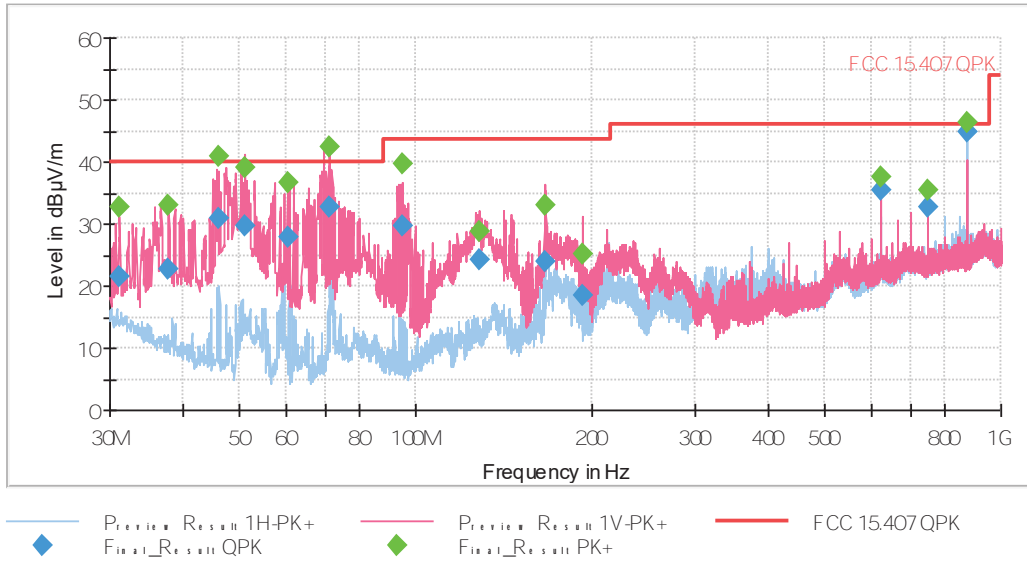
Measurement Uncertainty (dB): 1GHz to 17GHz <± 4.98

17GHz to 26.5GHz <± 5.08

26.5GHz to 40GHz <± 5.33

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

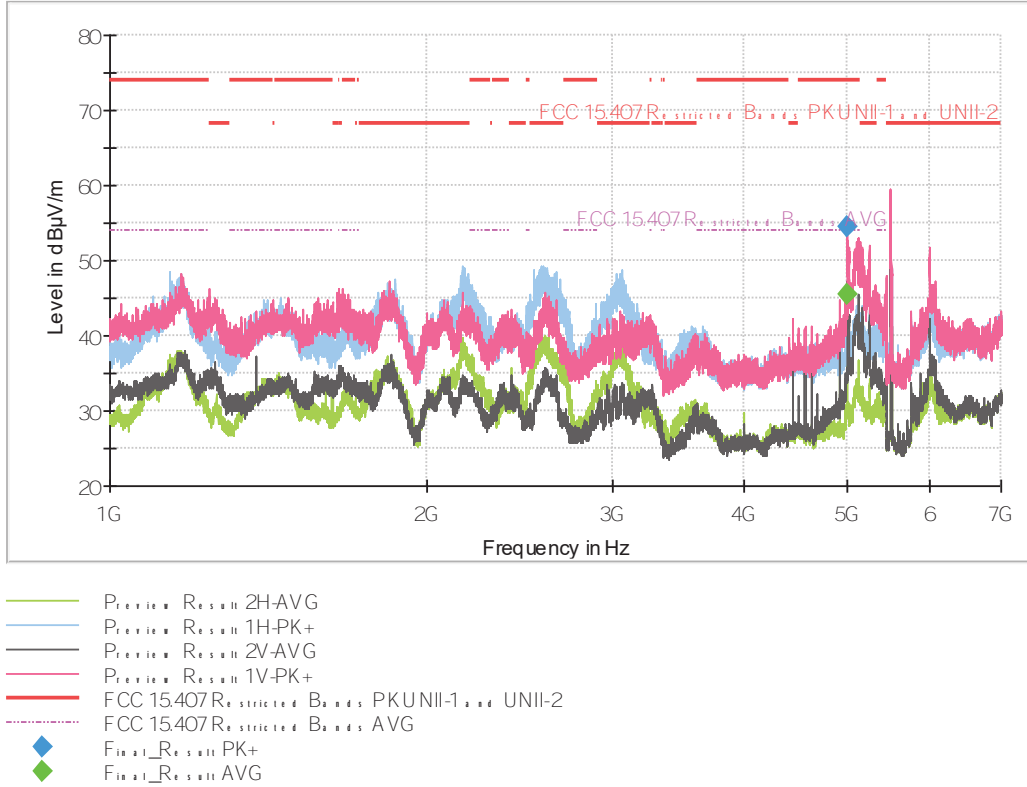


This plot is valid for all channels

FREQUENCY RANGE 1 GHz to 7 GHz.

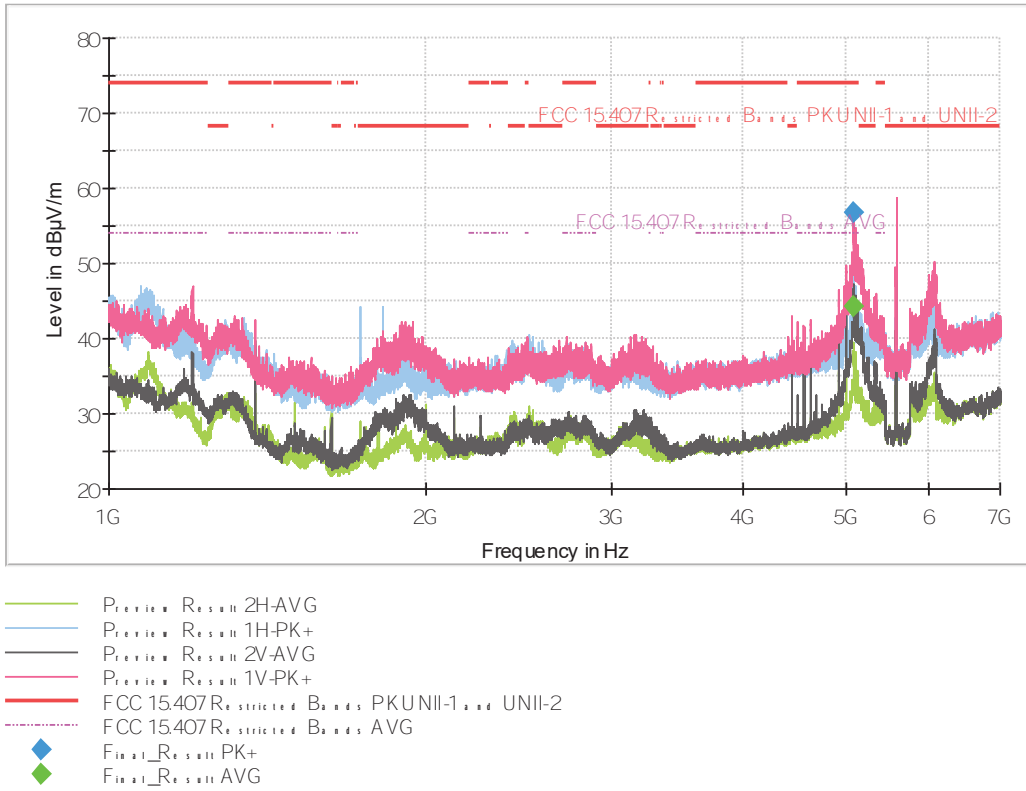
Mode 64QAM:

Channel 100



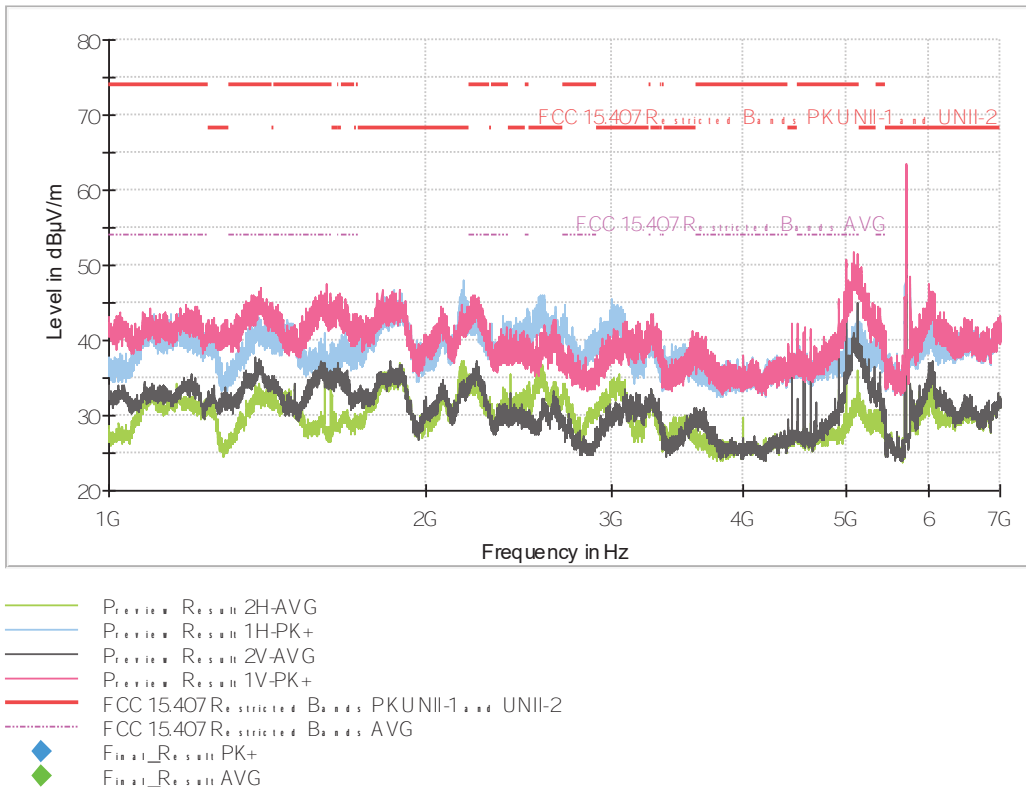
Note: The peak shown in the plot above the limit is the carrier frequency.

Channel 116



Note: The peak shown in the plot above the limit is the carrier frequency.

Channel 140

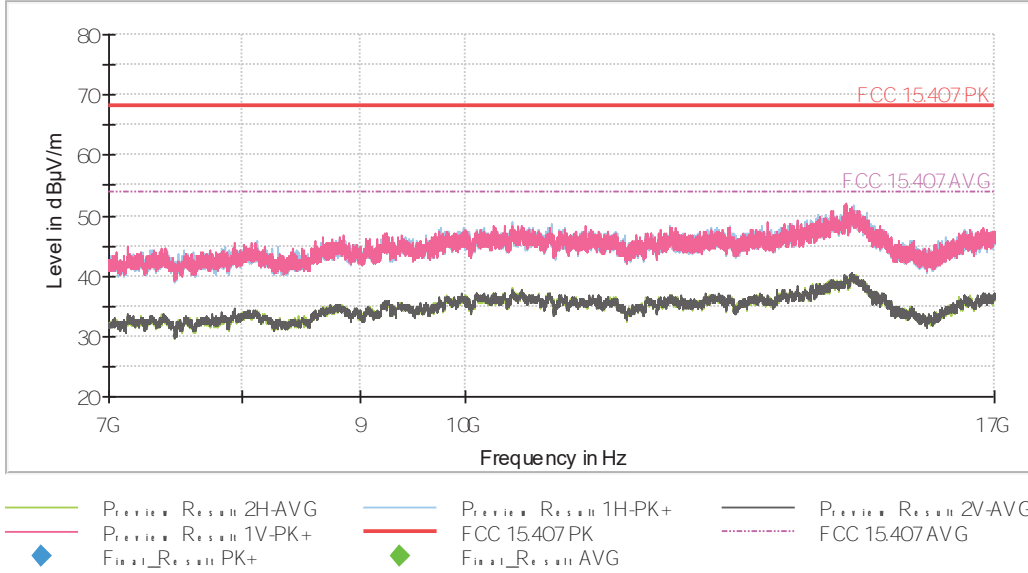


Note: The peak shown in the plot above the limit is the carrier frequency.

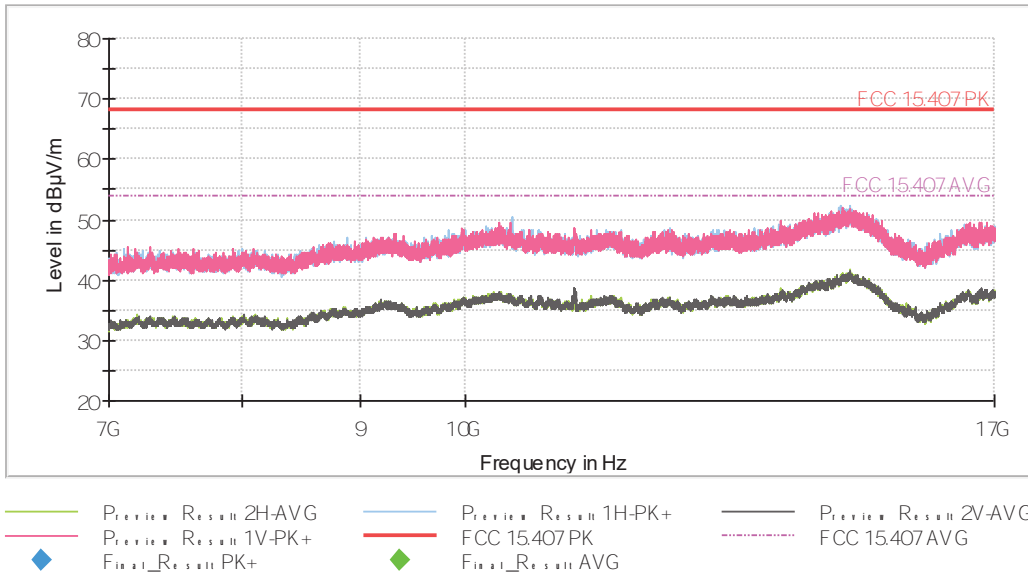
FREQUENCY RANGE 7 GHz to 17 GHz.

Mode 64QAM:

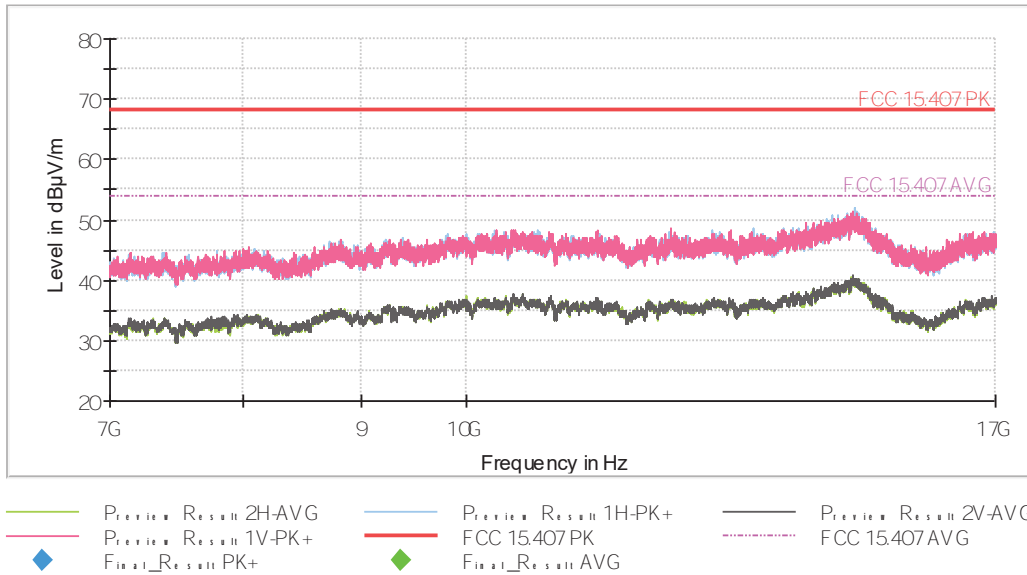
Channel 100



Channel 116

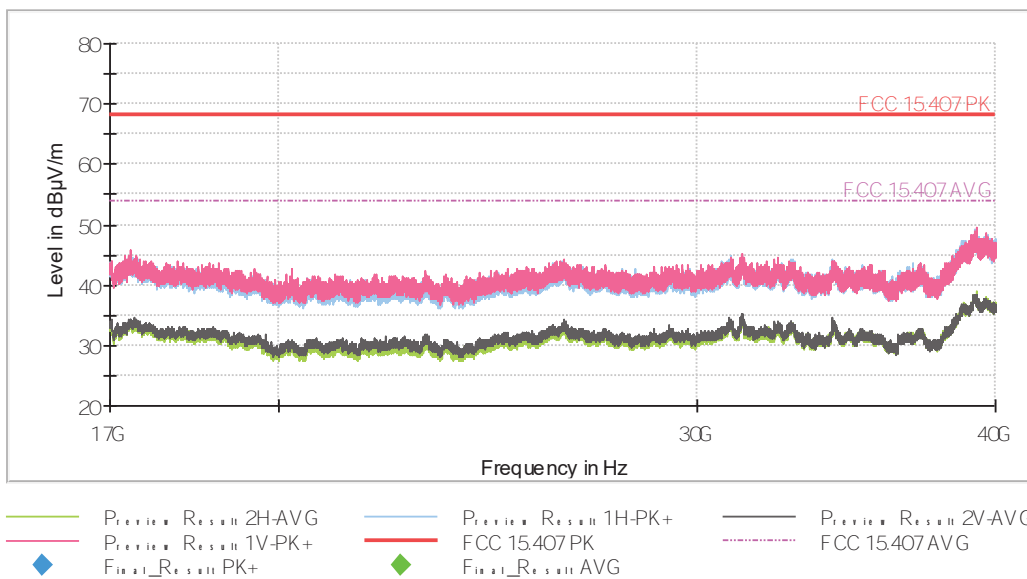


Channel 140



FREQUENCY RANGE 17 GHz to 40 GHz.

Mode 64QAM:



This plot is valid for all channels

FCC Section 15.407 Subclause (b) (2) / RSS-247 6.2.3.2. Transmitter Band Edge Radiated Emissions.

SPECIFICATION

For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.23 dBµV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

All emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of -27dBm/MHz. There are restricted bands of operation below band edge at 5.35-5.46GHz therefore the provision of FCC Part 15.205 apply.

Field strength measurements using peak and average detector performed in the restricted bands below 5.47 GHz and above 5.725 GHz.

A preliminary scan determined the antenna port 2 as the worst case.

Test performed on the following worst cases modes in all relevant tests channels:

SISO Antenna Port 2:

Results for Mode: QPSK – 20MHz

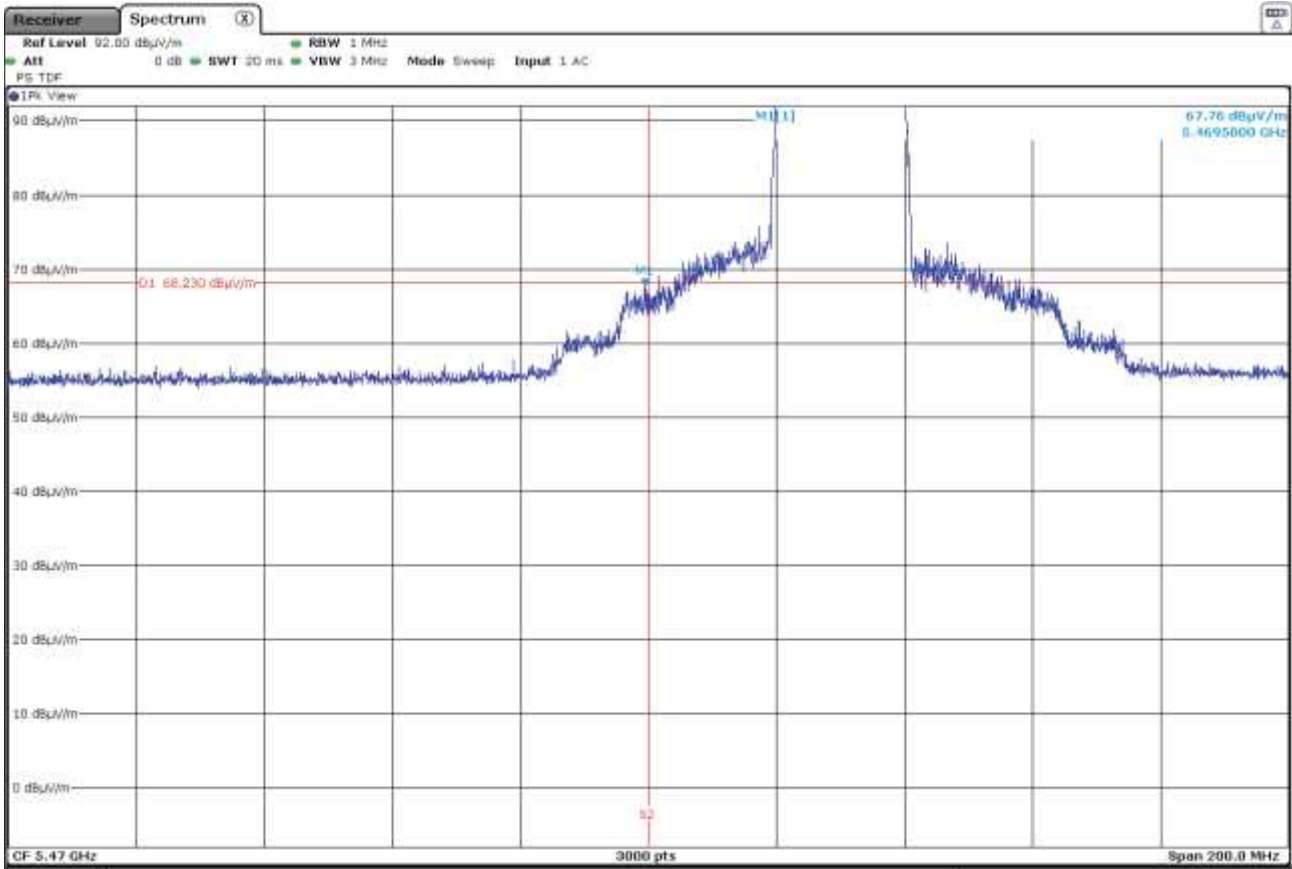
Results: Peak / Channel 100

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5469.5000	Vertical	67.76	68.20	0.44	<± 3.98	PASS

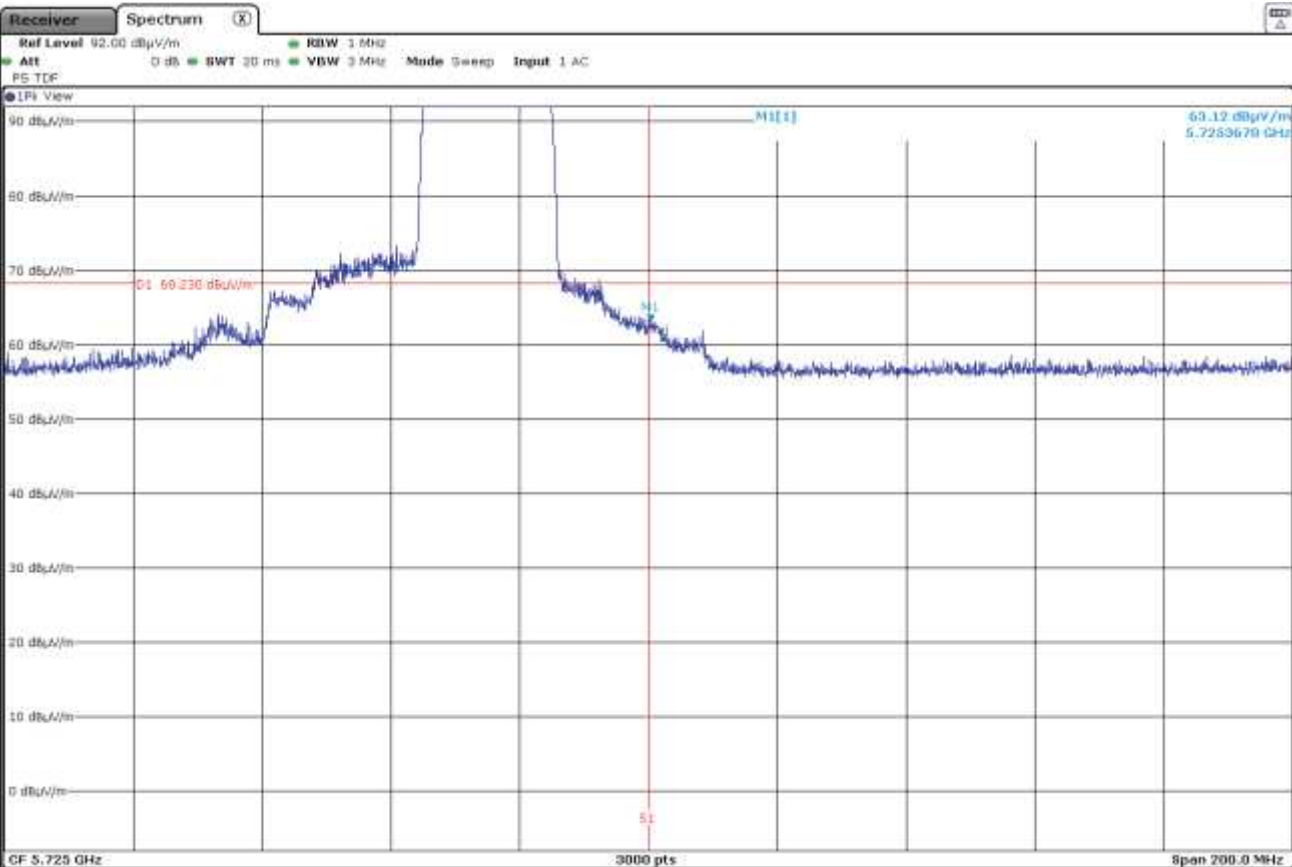
Results: Peak / Channel 140

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5725.3670	Vertical	63.12	68.20	5.08	<± 3.98	PASS

Lower Band Edge Channel 100



Upper Band Edge Channel 140



Results for Mode: 16QAM – 20MHz

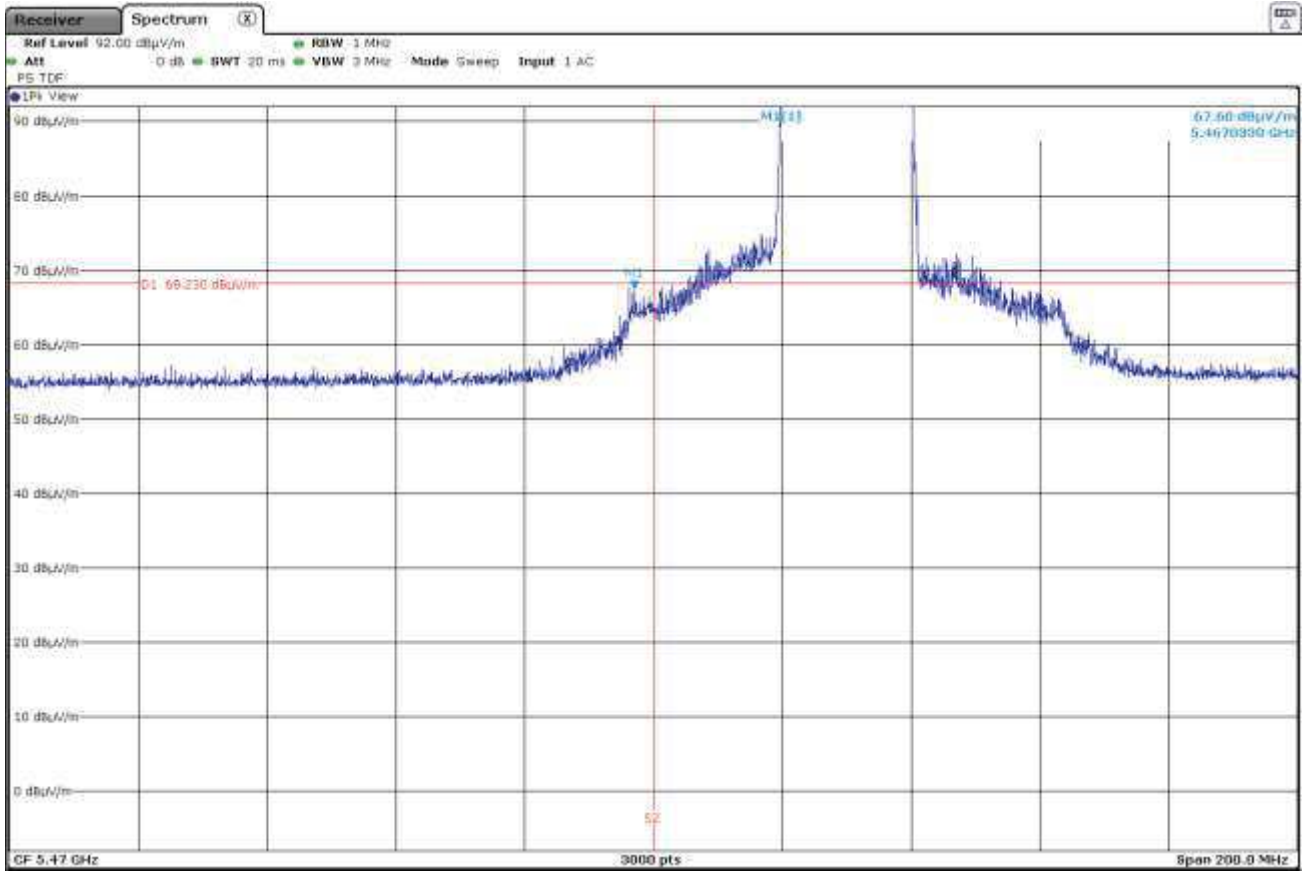
Results: Peak / Channel 100

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5467.0330	Vertical	67.60	68.20	0.6	<± 3.98	PASS

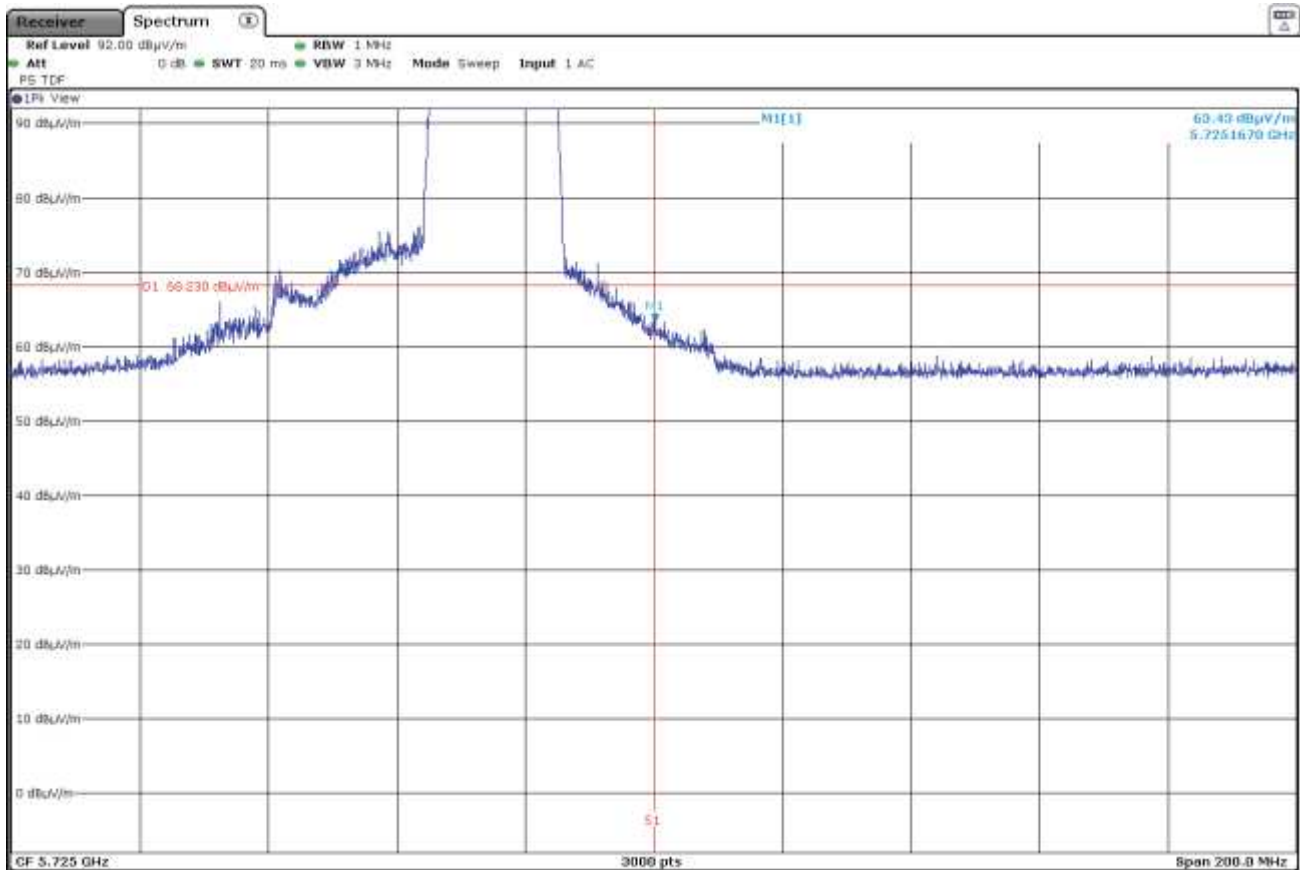
Results: Peak / Channel 140

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5725.1670	Vertical	63.43	68.20	4.77	<± 3.98	PASS

Lower Band Edge Channel 100



Upper Band Edge Channel 140



Results for Mode: 64QAM – 20MHz

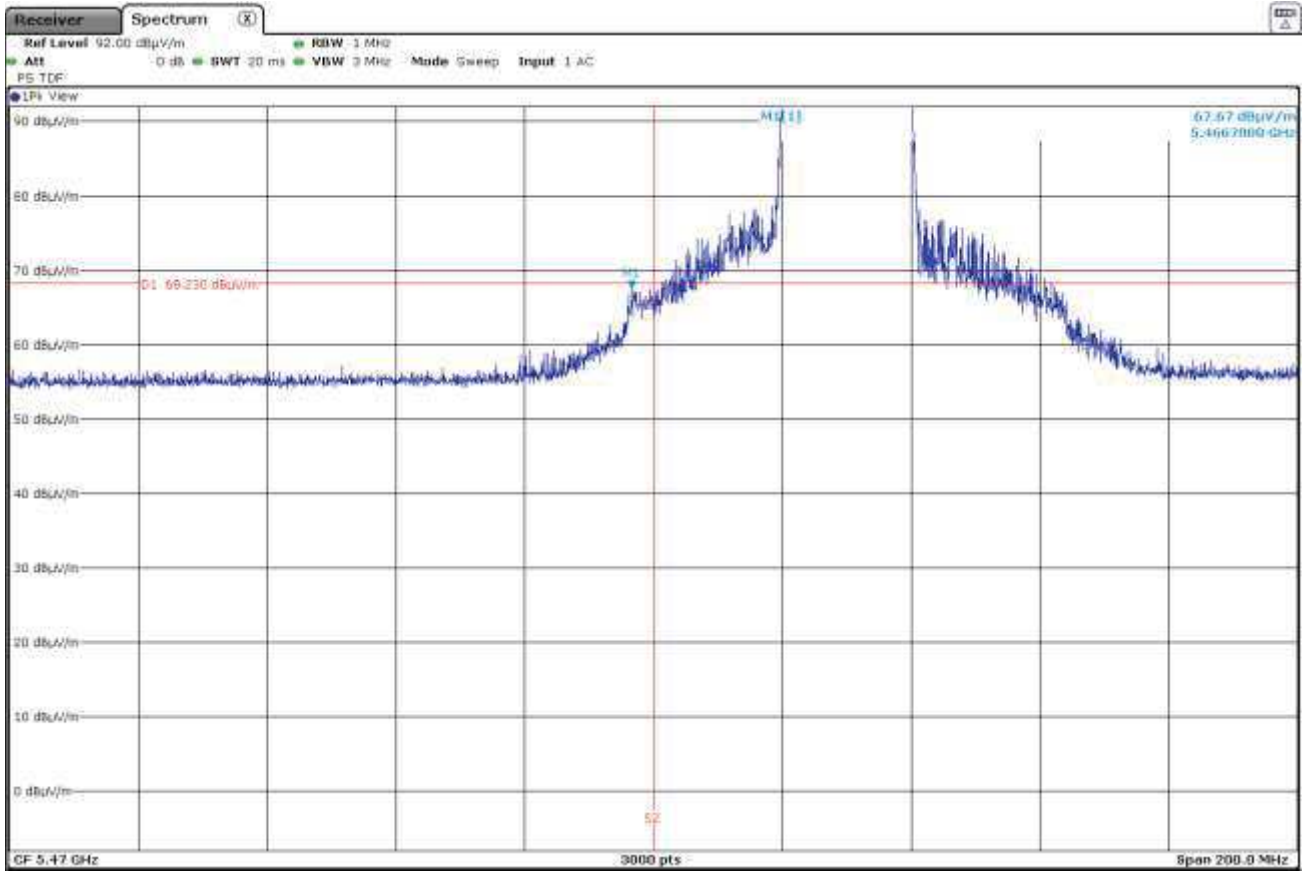
Results: Peak / Channel 100

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5466.7000	Vertical	67.67	68.20	0.53	<± 3.98	PASS

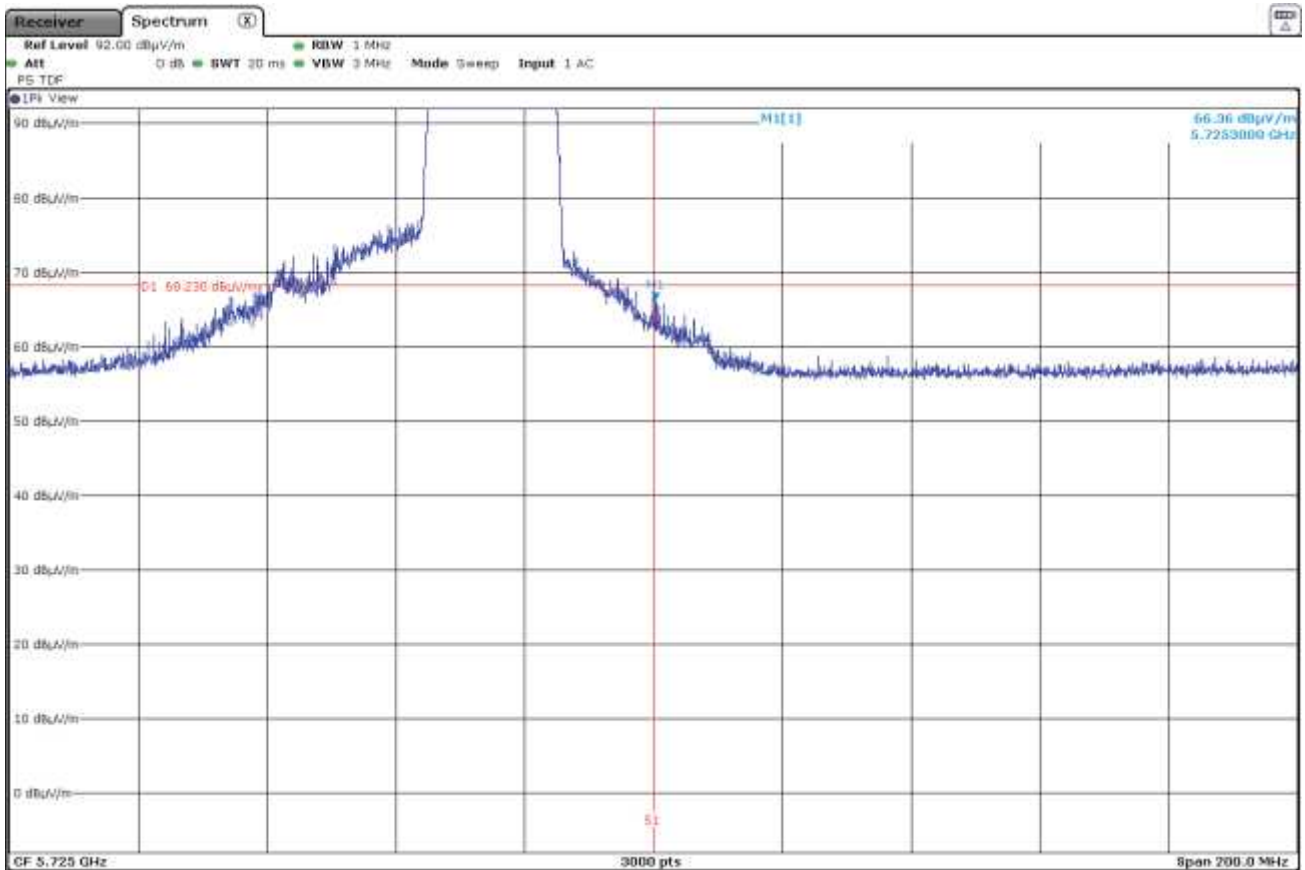
Results: Peak / Channel 140

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5725.3000	Vertical	66.36	68.20	1.84	<± 3.98	PASS

Lower Band Edge Channel 100



Upper Band Edge Channel 140



FCC Section 15.407(h)(1) / RSS-247 6.2.3.1 Transmitter Power Control

SPECIFICATION

FCC 15.407/RSS247: Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW (27dBm).

RESULTS:

The maximum conducted output power was measured using the channel power integration method according to point E) 2) b) (Method SA-1) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is >98% and the channel power integration method according to point E) 2) d) (Method SA-2) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is <98%.

The e.i.r.p. levels are calculated by adding the antenna gain (dBi).

SISO Antenna Port 1:

FCC & Canada power setting

Mode: QPSK – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	20.68	20.10	20.69
Maximum EIRP power (dBm)	23.68	23.10	23.69
EIRP power Limit (dBm)	24		
Margin (dB)	0.32	0.90	0.31
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	20.85	20.29	20.69
Maximum EIRP power (dBm)	23.85	23.29	23.69
EIRP power Limit (dBm)	24		
Margin (dB)	0.15	0.71	0.31
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	20.71	20.11	20.74
Maximum EIRP power (dBm)	23.71	23.11	23.74
EIRP power Limit (dBm)	24		
Margin (dB)	0.29	0.89	0.26
Measurement uncertainty (dB)	<±1.20		

SISO Antenna Port 2:

FCC & Canada power setting

Mode: QPSK – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	20.23	20.54	20.69
Maximum EIRP power (dBm)	23.23	23.54	23.69
EIRP power Limit (dBm)	24		
Margin (dB)	0.77	0.46	0.31
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	20.55	19.84	19.68
Maximum EIRP power (dBm)	23.55	22.84	22.68
EIRP power Limit (dBm)	24		
Margin (dB)	0.45	1.16	1.32
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz (TPC activate)

Declared antenna gain: 3 dBi

	channel 100 5500 MHz	Channel 116 5580 MHz	channel 140 5700 MHz
Max. conducted power (dBm)	20.72	20.89	20.79
Maximum EIRP power (dBm)	23.72	23.89	23.79
EIRP power Limit (dBm)	24		
Margin (dB)	0.28	0.11	0.21
Measurement uncertainty (dB)	<±1.20		