

FCC Test Report

Report No.: FCC_RF_SL21081301-ROK-006_5G_Rev 1.0

FCC ID: TC2-R1039

Test Model (host): RC-MC1

Series Model: N/A

Received Date: 08/05/2021

Test Date: 08/15/2021-11/16/2021

Issued Date: 11/24/2021

Applicant: Roku, Inc.

Address: 1155 Coleman Ave., San Jose, CA 95110 USA

Manufacturer: Roku, Inc.

Address: 1155 Coleman Ave., San Jose, CA 95110 USA

Issued By: Bureau Veritas Consumer Products Services, Inc.

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FCC Test Site Reg No.: 540430



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Table of Contents

Release Control Record	3
1 Certificate of Conformity	4
2 Summary of Test Results	5
2.1 Measurement Uncertainty.....	5
2.2 Modification Record.....	5
3 General Information	6
3.1 General Description of EUT	6
3.2 Description of Operation Modes	7
3.2.1 Test Mode Applicability and Tested Channel Detail	8
3.3 Description of Support Units	9
3.3.1 Duty Cycle of Test Signal	10
3.4 General Description of Applied Standard	11
4 Test Types and Results.....	12
4.1 Antenna Requirement.....	12
4.2 Radiated Emission and Bandedge Measurement	13
4.2.1 Limits of Radiated Emission Measurement	13
4.2.2 Test Instruments	14
4.2.3 Test Procedure.....	14
4.2.4 Deviation from Test Standard.....	15
4.2.5 Test Setup.....	16
4.2.6 EUT Operating Condition	17
4.2.7 Test Results	18
4.3 Conducted Emission Measurement	52
4.3.1 Limits of Conducted Emission Measurement	52
4.3.2 Test Instruments	52
4.3.3 Test Procedure.....	53
4.3.4 Deviation from Test Standard.....	53
4.3.5 Test Setup.....	53
4.3.6 EUT Operating Condition	53
4.3.7 Test Results	54
4.4 Transmit Power Measurement.....	55
4.4.1 Limits of Transmit Power Measurement	55
4.4.2 Test Setup.....	56
4.4.3 Test Instruments	56
4.4.4 Test Procedure.....	56
4.4.5 Deviation from Test Standard.....	57
4.4.6 EUT Operating Condition	57
4.4.7 Test Results	58
5 Pictures of Test Arrangements.....	59
Appendix – Information on the Testing Laboratories	60

Release Control Record

Issue No.	Description	Date Issued
FCC_RF_SL21081301-ROK-006_5G	Original release	11/15/2021
FCC_RF_SL21081301-ROK-006_5G_Rev 1.0	Updated Section: 2 4.1.2 4.2.7	11/24/2021

1 Certificate of Conformity

Product: WiFi Remote Control

Brand: Roku, Inc.

Test Model: RC-MC1

Series Model: N/A

Sample Status: Engineering Sample

Applicant: Roku, Inc.

Test Date: 05/06/2021-11/16/2021

Standard: 47 CFR FCC Part 15, Subpart E (Section 15.407)
789033 D02 General UNII Test Procedures New Rules v02r01
ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc. Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Francisco COLMENARES **Date:** 11/24/2021
Francisco COLMENARES / Test
Engineer

Approved by : Gary Chou **Date:** 11/24/2021
Gary Chou / Engineer Reviewer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
Standard Section	Test Item	Result	Remarks
15.203	Antenna Requirement	Pass	The EUT uses Chip Antenna and permanently attach to the device.
15.407 (b)(6)	AC Power Conducted Emissions	Not Performed	Note*
15.209(a) 15.205(a) 15.407 (b)	Radiated Emissions	Pass	Meet the requirement of limit.
15.407 (a)(1/2/3)	Max Average Transmit Power	Pass	Meet the requirement of limit.
-	Occupied Bandwidth	Not Performed	Note*
15.407 (e)	6 dB Emission Bandwidth	Not Performed	Note*
15.407 (a)(1/2/3)	Peak Power Spectral Density	Not Performed	Note*
15.407(g)	Frequency Stability	Not Performed	Note*

Note*:

Please refer FCC ID Report: TC2-R1039

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	WiFi Remote Control
Brand	Roku, Inc.
Test Model (host)	RC-MC1
Identification No. of EUT	N/A
Series Model	N/A
Status of EUT	Engineering Sample
Power Supply Rating	5Vdc powered by Adaptor/ 3.8Vdc powered by battery
Modulation Type	64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11a: up to 54Mbps 802.11n: up to 450Mbps
Operating Frequency	5150 ~ 5250MHz, 5745~5825MHz
Number of Channel	5150~5250MHz: 802.11a, 802.11n (HT20): 4 5745~5825MHz: 802.11a, 802.11n (HT20): 5
Antenna Type	Chip Antenna
Antenna Gain (dBi)	5150~5250MHz:2.9 dBi 5745~5825MHz:3.9 dBi
Antenna Connector	N/A

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Operation Modes

FOR 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20):

Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz		

Power setting is as below:

802.11a			802.11n		
Channel	Power Setting		Channel	Power Setting	
	Chain 0	Chain 1		Chain 0	Chain 1
36	89	89	36	90	90
40	89	89	40	89	89
48	88	88	48	89	89
149	81	81	149	82	82
157	81	81	157	82	82
165	84	84	165	85	85

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	APCM	
A	-	-	-	-	Powered by battery
B	√	√	-	√	Powered by adapter (Continue transmit)

Where **RE≥1G**: Radiated Emission above 1GHz

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

NOTE:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.
2. "-" means no effect.

Radiated Emission Test (Above 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	FREQ. Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
B	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6
B	802.11n (HT20)		36 to 48	36, 40, 48	OFDM	BPSK	6.5
B	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
B	802.11n (HT20)		149 to 165	149, 157, 165	OFDM	BPSK	6.5

Radiated Emission Test (Below 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	FREQ. Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
B	802.11a	5180-5320	36 to 64	40	OFDM	BPSK	6

Power Line Conducted Emission Test:

- ☐ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☐ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	FREQ. Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
B	802.11a	5180-5320	36 to 64	62	OFDM	BPSK	6
B	802.11a	5745-5825	149 to 165	149	OFDM	BPSK	6

Antenna Port Conducted Measurement:

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	FREQ. Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
B	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6
B	802.11n (HT20)		36 to 48	36, 40, 48	OFDM	BPSK	6.5
B	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
B	802.11n (HT20)		149 to 165	149, 157, 165	OFDM	BPSK	6.5

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE $\geq$ 1G	25deg. C, 65%RH	5Vdc	Francisco COLMENARES
RE<1G	25deg. C, 65%RH	5Vdc	Francisco COLMENARES
PLC	25deg. C, 68%RH	5Vdc	Francisco COLMENARES
APCM	21deg. C, 60%RH	5Vdc	Francisco COLMENARES

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	Dell	Latitude 3550	N/A	N/A	N/A
B.						
C.						
D.						
E.						
F.						
G.						

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB	1	0.2m	No	0	Connect from EUT to Laptop
2.	Data Cable	1	0.8m	Yes	0	Connect to Adaptor
3.						

3.3.1 Duty Cycle of Test Signal

MODULATION TYPE: BPSK

Duty cycle of test signal is $\geq 98\%$, duty factor is not required.

If Duty cycle of test signal is $< 98\%$, duty factor is required.

802.11a: Duty cycle = 100%

802.11n (HT20): Duty cycle = 100%



3.4 General Description of Applied Standard

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR FCC Part 15, Subpart E (Section 15.407)

789033 D02 General UNII Test Procedures New Rules v02r01

ANSI C63.10:2013

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Antenna Requirement

Spec	Requirement	Applicable
15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. Antenna requirement must meet at least one of the following: a) Antenna must be permanently attached to the device. b) The antenna must use a unique type of connector to attach to the device. c) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.	☒
Remark	The EUT uses a Chip Antenna antenna to permanently attach to the device.	
Result	☒ PASS ☐ FAIL	

4.2 Radiated Emission and Bandedge Measurement

4.2.1 Limits of Radiated Emission Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Limits of unwanted emission out of the restricted bands

Applicable To			Limit	
789033 D02 General UNII Test Procedure New Rules v02r01			Field Strength at 3m	
			PK:74 (dBμV/m)	AV:54 (dBμV/m)
Frequency Band	Applicable To		EIRP Limit	Equivalent Field Strength at 3m
5150~5250 MHz	15.407(b)(1)		PK:-27 (dBm/MHz)	PK:68.2(dBμV/m)
5250~5350 MHz	15.407(b)(2)			
5470~5725 MHz	15.407(b)(3)			
5725~5850 MHz	☒	15.407(b)(4)(i)	PK:-27 (dBm/MHz) * ¹ PK:10 (dBm/MHz) * ² PK:15.6 (dBm/MHz) * ³ PK:27 (dBm/MHz) * ⁴	PK: 68.2(dBμV/m) * ¹ PK:105.2 (dBμV/m) * ² PK: 110.8(dBμV/m) * ³ PK:122.2 (dBμV/m) * ⁴
	☐	15.407(b)(4)(ii)	Emission limits in section 15.247(d)	
^{*1} beyond 75 MHz or more above of the band edge.			^{*2} below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.	
^{*3} below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.			^{*4} from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.	

Note:

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000 \sqrt{30 P}}{3} \mu\text{V/m, where } P \text{ is the eirp (Watts).}$$

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Biconilog Antenna Sunol	JB6	A111717	9/4/2020	9/4/2022
Horn Antenna ETS-Lindgren	3117	218554	4/21/2021	4/21/2022
Pre-Amplifier RF-Lambda	RAMP00M50GA	18040300055	5/7/2021	5/7/2022
PXA Signal Analyzer (Keysight)	N9030B	MY57140100	07/22/2020	07/22/2022
SMA Fixed Attenuator (50ohms, 2w, 30dB, DC-6GHz)	VAT-03W2+	n/a	07/21/2020	07/21/2022
FSB Antenna Cable, 0.5m (Microwave Town)	FSB360PK-KMKM-00.50M	201906110002	07/21/2020	07/21/2022
FSB Antenna Cable, 4m (Microwave Town)	FSB360PK-KMKM-400M	21030447-002	07/21/2020	07/21/2022
10m Semi-Anechoic Chambe (ETS-Lindgren)	S2010BL8X8	1462	07/21/2020	07/21/2022
Notch Filters MICRO-TRONICS	BRM50705	041	07/21/2020	07/21/2022
Loop Antenna	N/A	00049120	11/25/2020	11/25/2021
Power Meter ETS-LINDGREN	7002-006	13I00030SNO82	01/16/2020	01/16/2023

4.2.3 Test Procedure

For Radiated emission below 30MHz

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

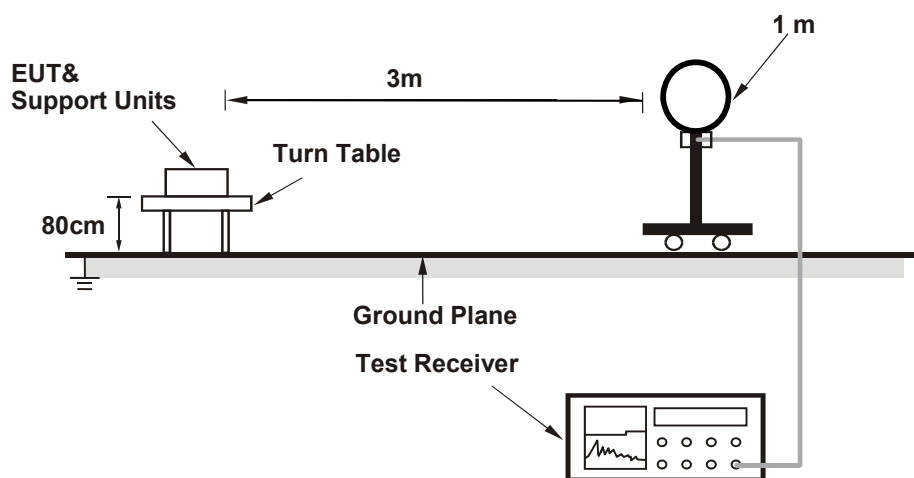
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 Deviation from Test Standard

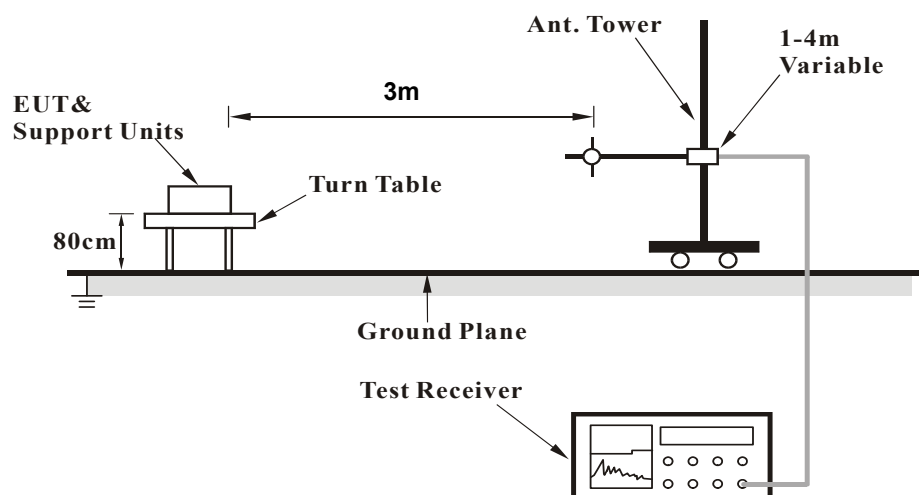
No deviation.

4.2.5 Test Setup

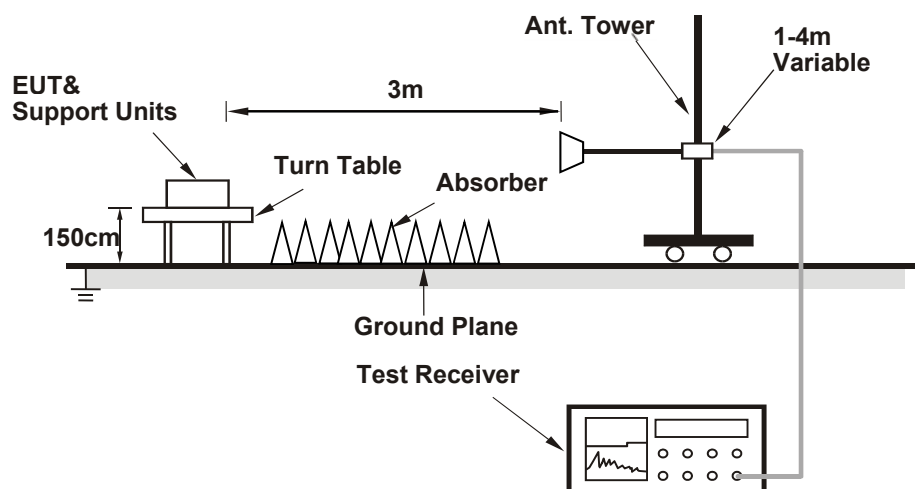
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Condition

- Placed the EUT on the testing table.
- Prepared notebooks to act as communication partner and placed it outside of testing area.
- The communication partner connected with EUT via a USB cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the system in full functions.

4.2.7 Test Results

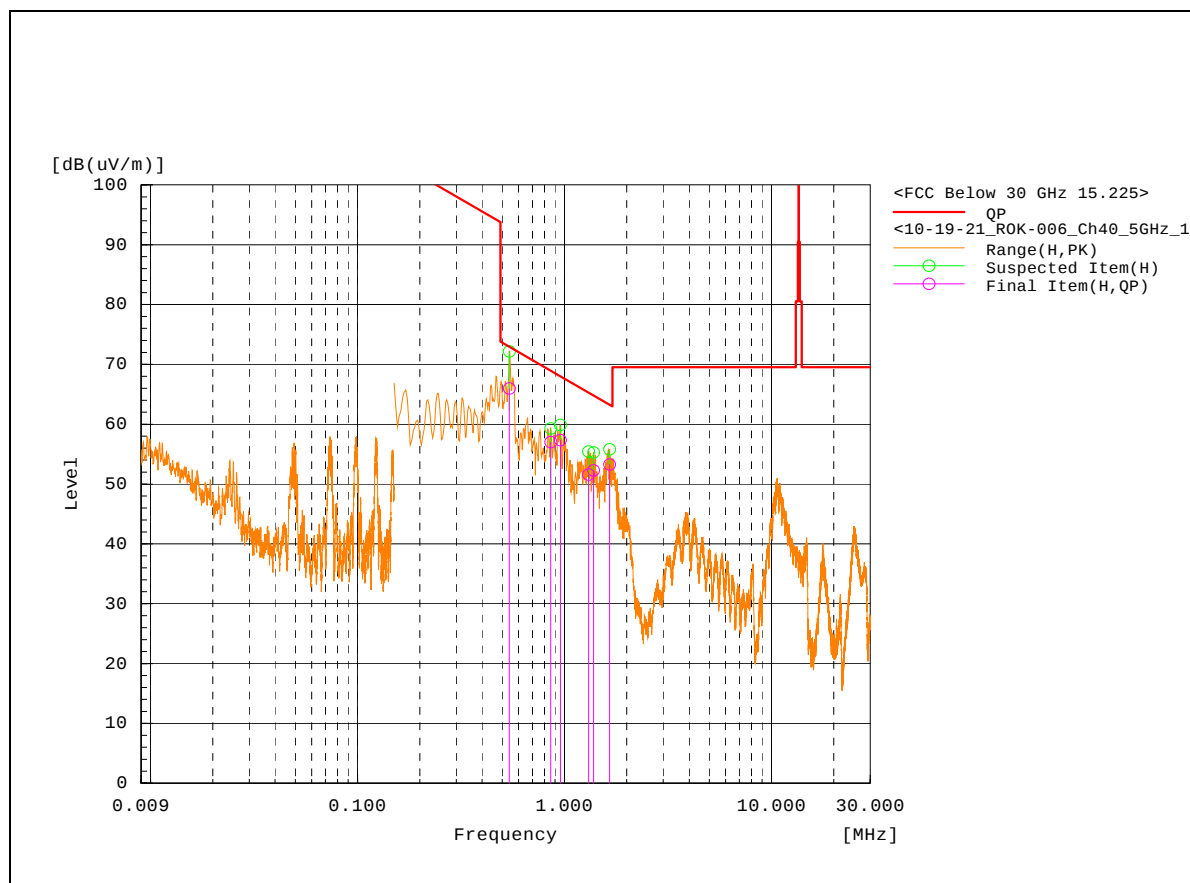
Below 30MHz Worst-Case Data:

CHANNEL	802.11a Channel 40	DETECTOR FUNCTION	Quasi Peak
FREQUENCY RANGE	9KHz-30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m- 0 Degree										
No.	Frequency (MHz)	Degree (0/90)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.541	0	48.2	17.8	66	72.9	6.9	100	149.6	Pass
2	0.857	0	42.9	14.1	57	68.9	11.9	100	91.2	Pass
3	0.956	0	44.1	13.2	57.3	68	10.7	100	129.4	Pass
4	1.308	0	40.7	10.9	51.6	65.3	13.7	100	176.2	Pass
5	1.383	0	41.8	10.5	52.3	64.8	12.5	100	165.4	Pass
6	1.651	0	44.1	9.2	53.3	63.2	9.9	100	209.4	Pass

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Pre-amplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

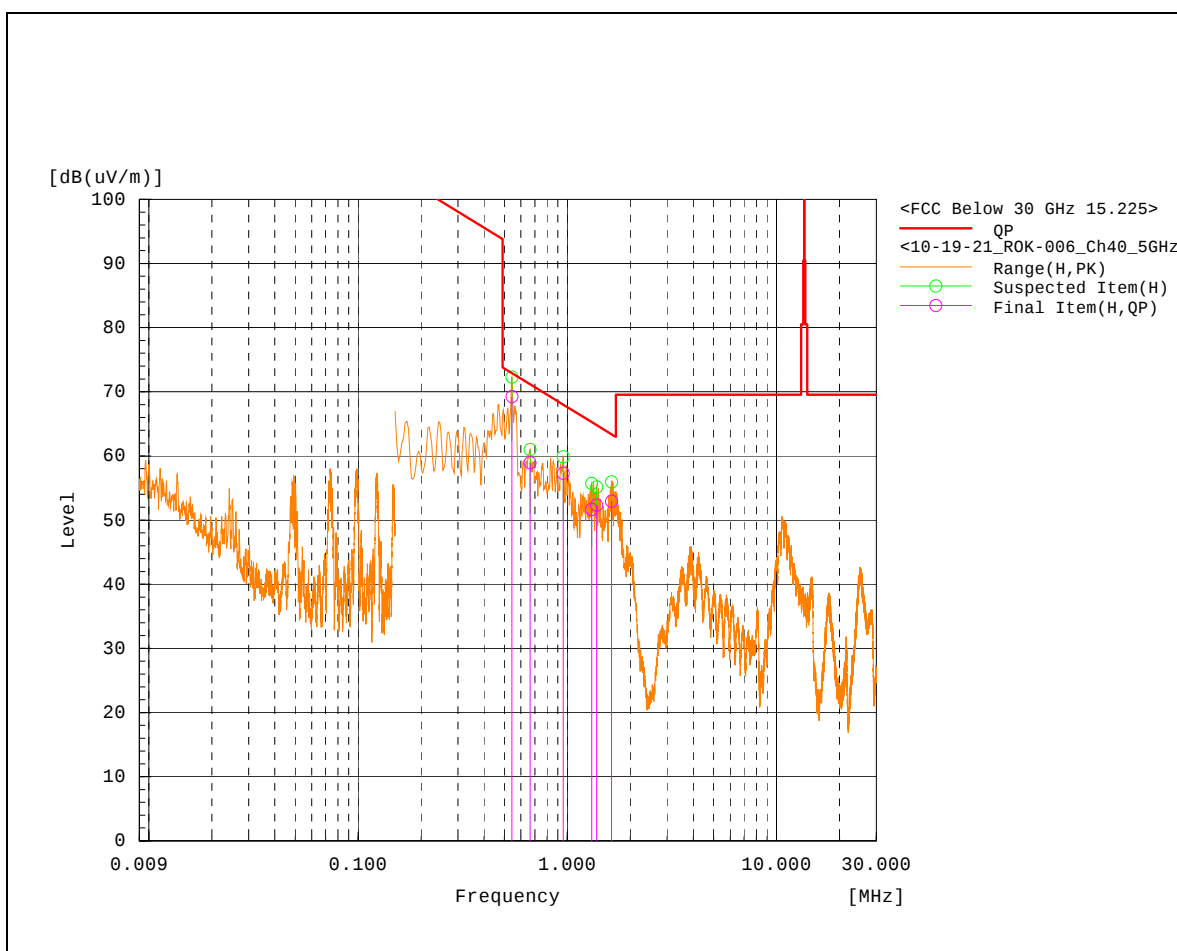


CHANNEL	802.11a Channel 40	DETECTOR FUNCTION	Quasi Peak
FREQUENCY RANGE	9KHz-30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m- 0 Degree										
No.	Frequency (MHz)	Degree (0/90)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.544	90	51.6	17.7	69.3	72.9	3.6	100	115.7	Pass
2	0.956	90	44.1	13.2	57.3	68	10.7	100	227.5	Pass
3	1.308	90	40.8	10.9	51.7	65.3	13.6	100	142.1	Pass
4	1.383	90	41.8	10.5	52.3	64.8	12.5	100	111.8	Pass
5	1.628	90	43.6	9.3	52.9	63.4	10.5	100	212.1	Pass
6	0.663	90	42.7	16.2	58.9	71.2	12.3	100	161.8	Pass

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



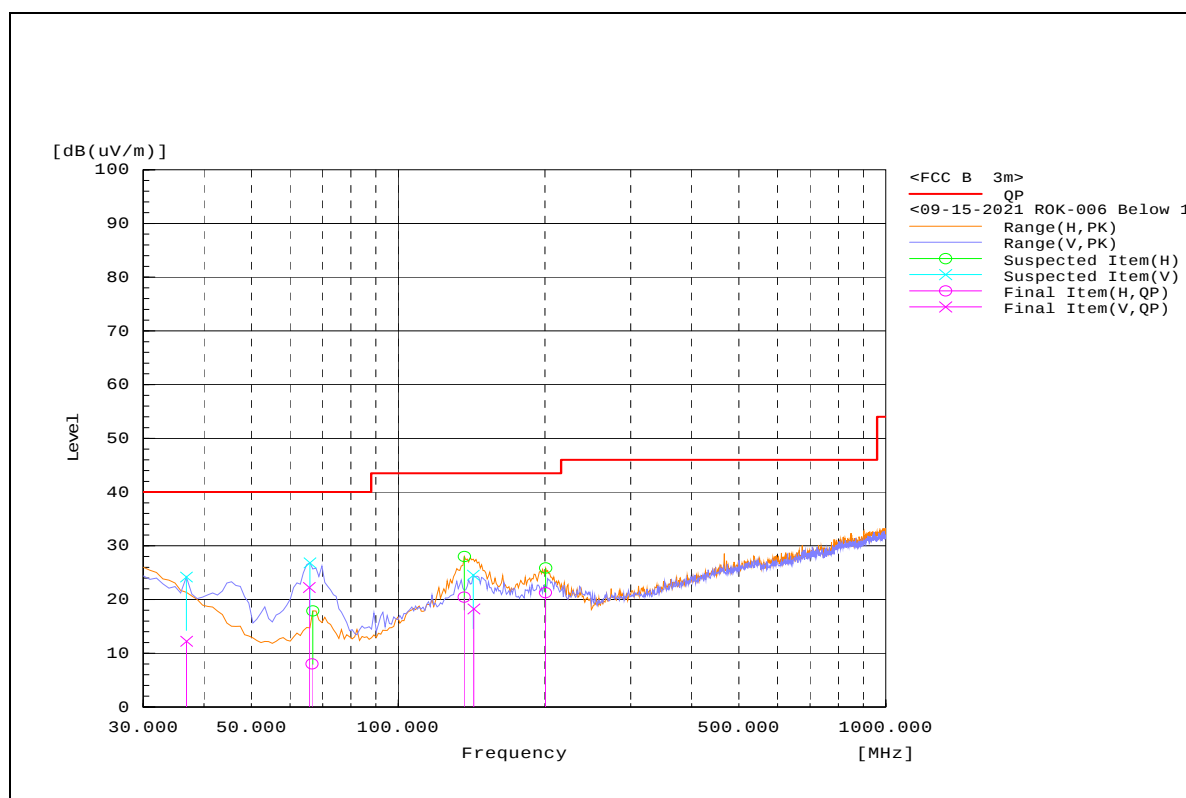
Below 1GHz Worst-Case Data:

CHANNEL	802.11n Channel 40	DETECTOR FUNCTION	Quasi Peak
FREQUENCY RANGE	30MHz – 1GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	36.838	V	-8.5	20.7	12.2	40	27.8	134	49.9	Pass
2	65.745	V	9.1	13.1	22.2	40	17.8	106	0	Pass
3	66.586	H	-5.3	13.3	8	40	32	309	91.1	Pass
4	136.589	H	1.2	19.2	20.4	43.5	23.1	205	245	Pass
5	142.972	V	-1	19.3	18.3	43.5	25.2	124	212.5	Pass
6	200.463	H	2.1	19.2	21.3	43.5	22.2	153	267	Pass

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



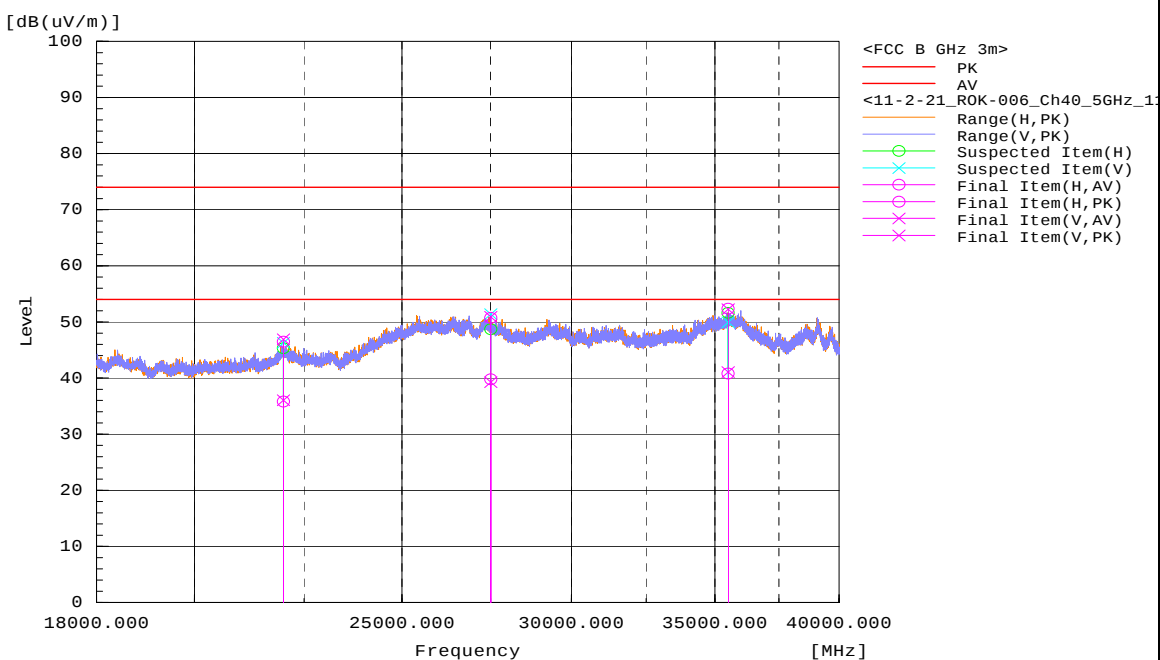
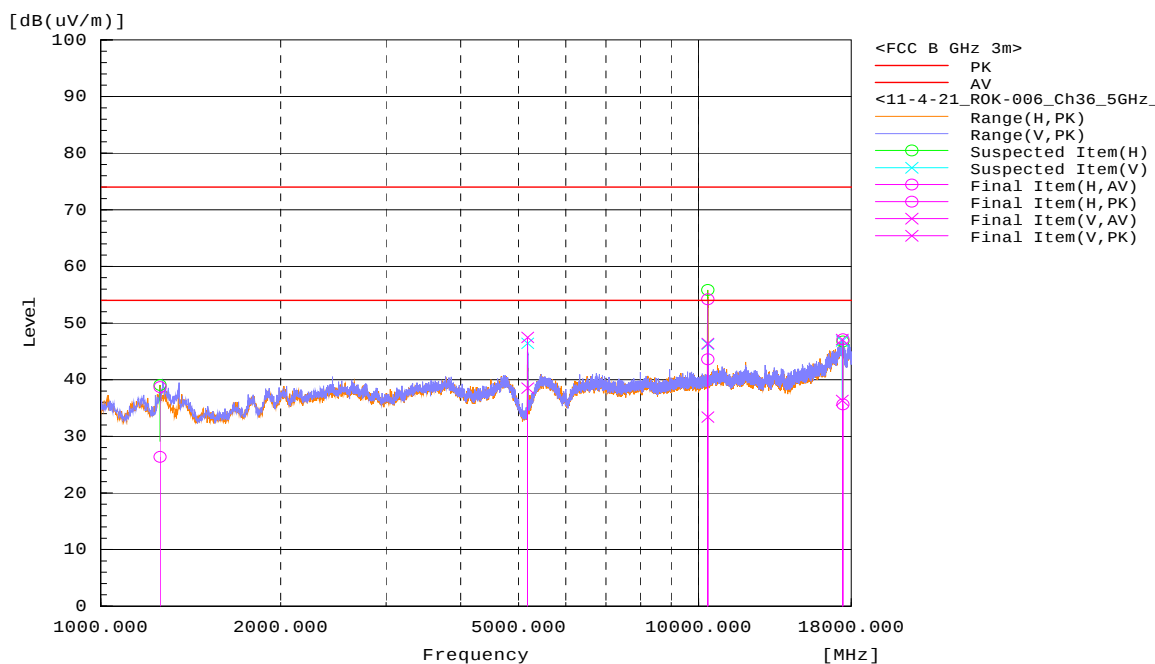
Above 1GHz Test Data:

Above 1GHz – 802.11a – 5180MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No.	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK dB(uV/m)	Limit AV dB(uV/m)	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	10359.3	H	38.5	49.1	5.1	43.6	54.2	-	68.2	-	14	208	356.3	-
2	5175.569	V	44.2	53.2	-5.7	38.5	47.5	-	68.2	-	20.7	307	327.4	-
3	17374.4	V	20.8	31.5	15.6	36.4	47.1	-	68.2	-	21.1	192	70.4	-
4	17426.38	H	19.6	31.1	16	35.6	47.1	-	68.2	-	21.1	298	22.5	-
5	10358.78	V	28.3	41.3	5.1	33.4	46.4	-	68.2	-	21.8	147	313.8	-
6	1256.878	H	42.9	55.2	-16.5	26.4	38.7	-	68.2	-	29.5	253	104.6	-
7	22006.09	H	20.9	31.6	14.9	35.8	46.5	-	68.2	-	21.7	125	115.9	-
8	22005.26	V	21.2	32	14.9	36.1	46.9	-	68.2	-	21.3	268	3.2	-
9	27503.09	V	19.7	31.3	19.6	39.3	50.9	-	68.2	-	17.3	389	150.1	-
10	27502.6	H	20.2	31.1	19.6	39.8	50.7	-	68.2	-	17.5	382	0.1	-
11	35501.16	H	22.9	34.5	17.9	40.8	52.4	-	68.2	-	15.8	192	342.4	-
12	35500.94	V	23.2	34.4	17.9	41.1	52.3	-	68.2	-	15.9	344	64.6	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
- 4.”-“: Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).

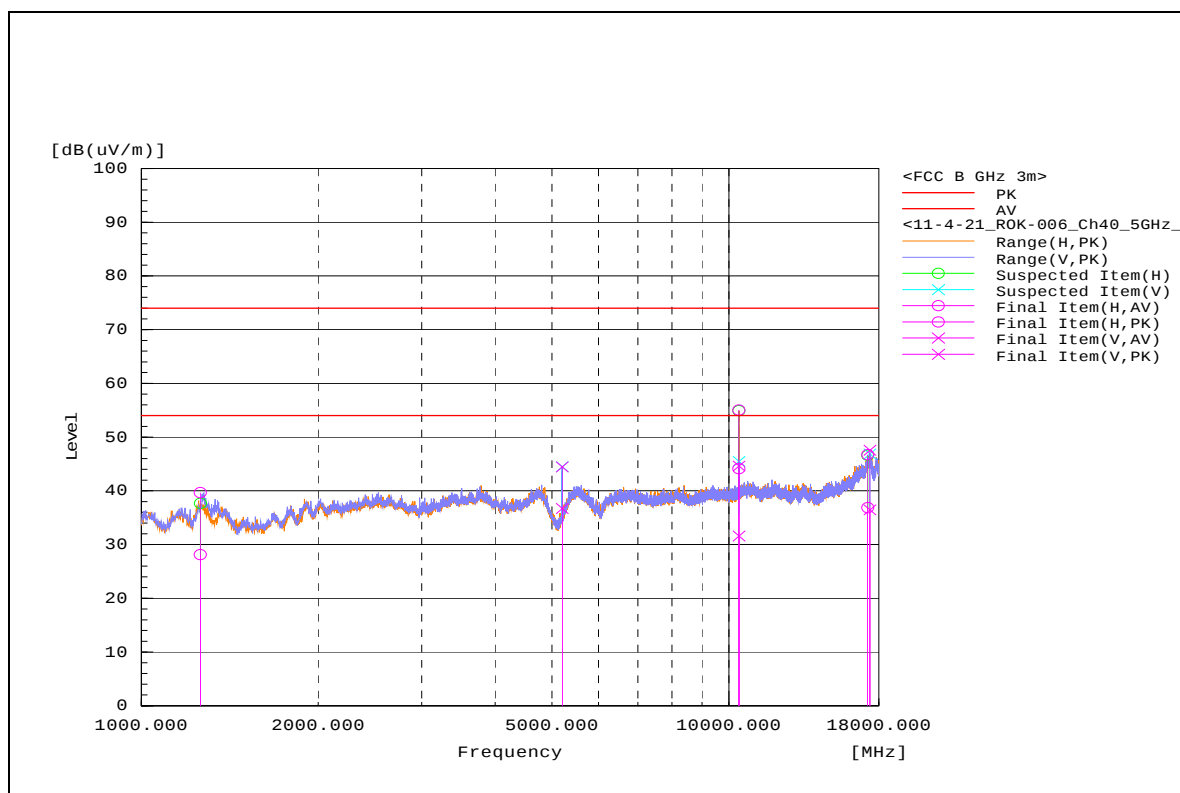


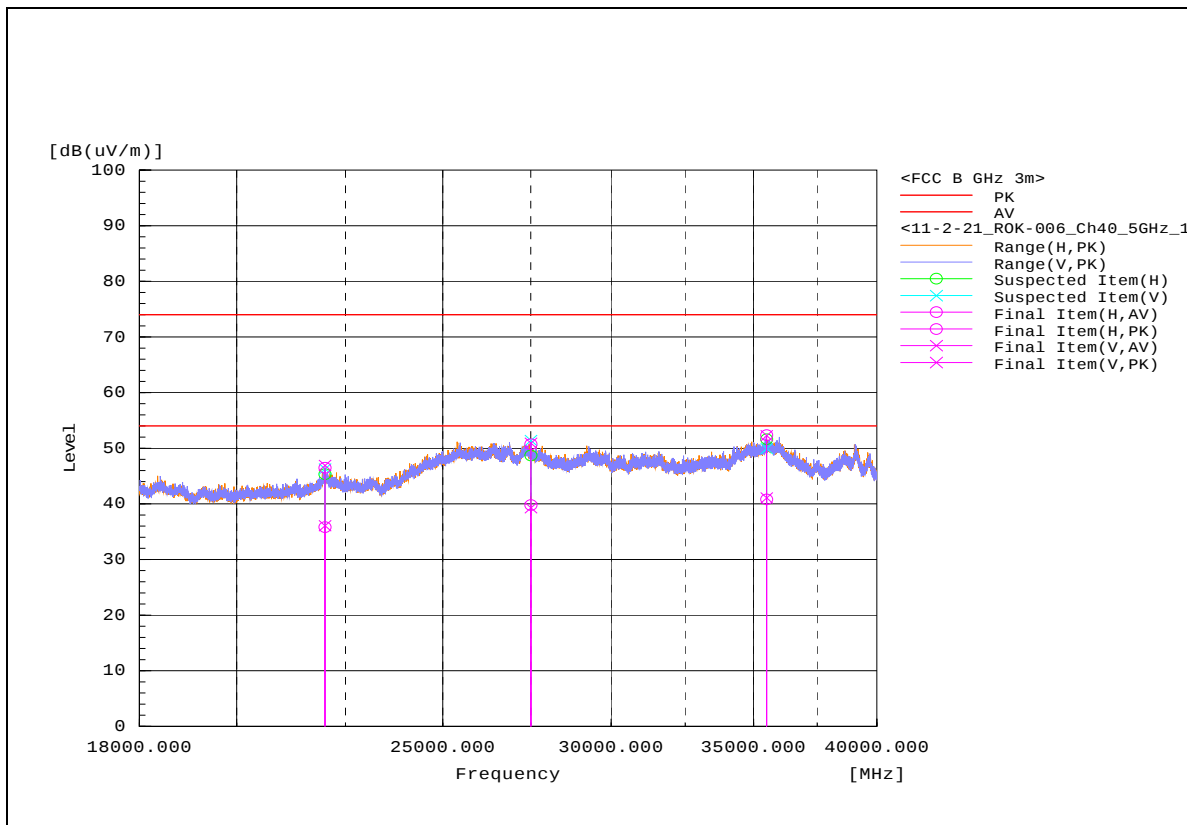
Above 1GHz – 802.11a – 5200MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	10400.31	H	38.9	49.8	5.2	44.1	55	-	68.2	-	13.2	177	2.2	-
2	17374.04	V	20.9	32	15.6	36.5	47.6	-	68.2	-	20.6	132	290.2	-
3	17237.38	H	21.5	31.3	15.4	36.9	46.7	-	68.2	-	21.5	359	0	-
4	10404.28	V	26.4	39.4	5.2	31.6	44.6	-	68.2	-	23.6	313	186.2	-
5	5202.581	V	42.3	50.1	-5.6	36.7	44.5	-	68.2	-	23.7	359	318.6	-
6	1259.78	H	44.6	56.2	-16.5	28.1	39.7	-	68.2	-	28.5	170	348.1	-
7	22006.09	H	20.9	31.6	14.9	35.8	46.5	-	68.2	-	21.7	125	115.9	-
8	22005.26	V	21.2	32	14.9	36.1	46.9	-	68.2	-	21.3	268	3.2	-
9	27503.09	V	19.7	31.3	19.6	39.3	50.9	-	68.2	-	17.3	389	150.1	-
10	27502.6	H	20.2	31.1	19.6	39.8	50.7	-	68.2	-	17.5	382	0.1	-
11	35501.16	H	22.9	34.5	17.9	40.8	52.4	-	68.2	-	15.8	192	342.4	-
12	35500.94	V	23.2	34.4	17.9	41.1	52.3	-	68.2	-	15.9	344	64.6	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the general field strength limits specified in FCC § 15.205/ RSS-Gen is not required.



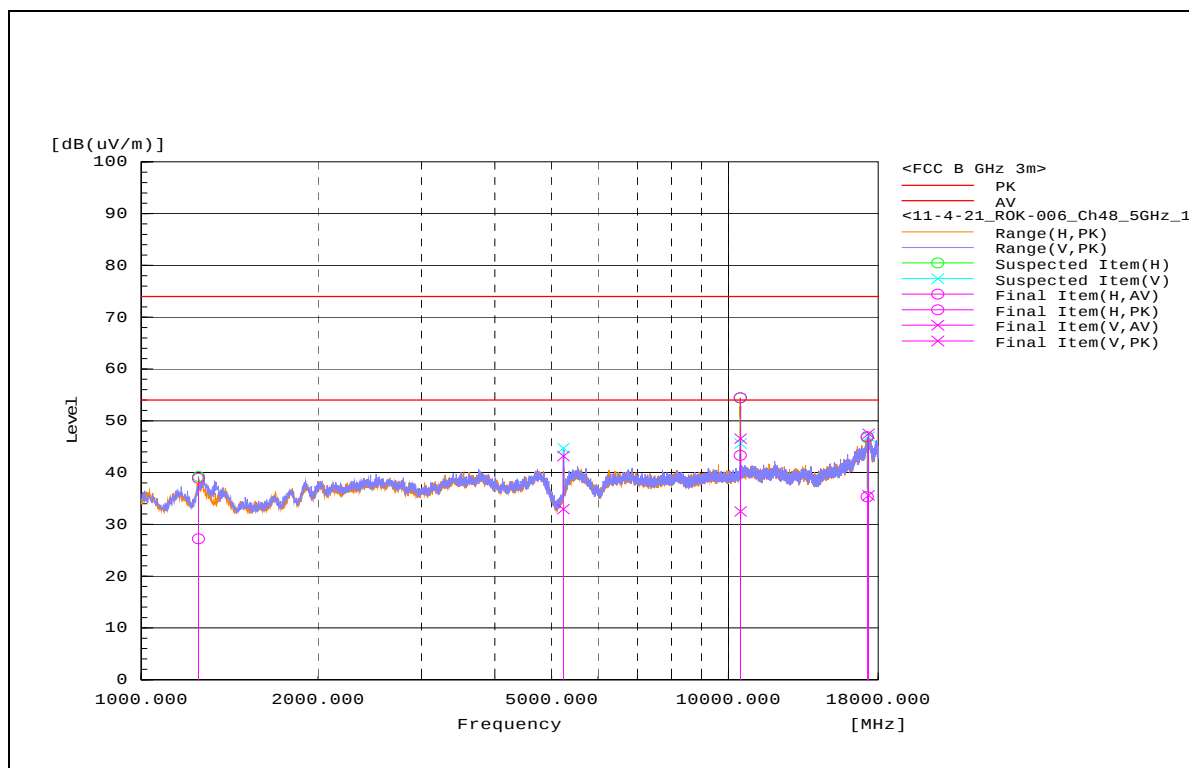


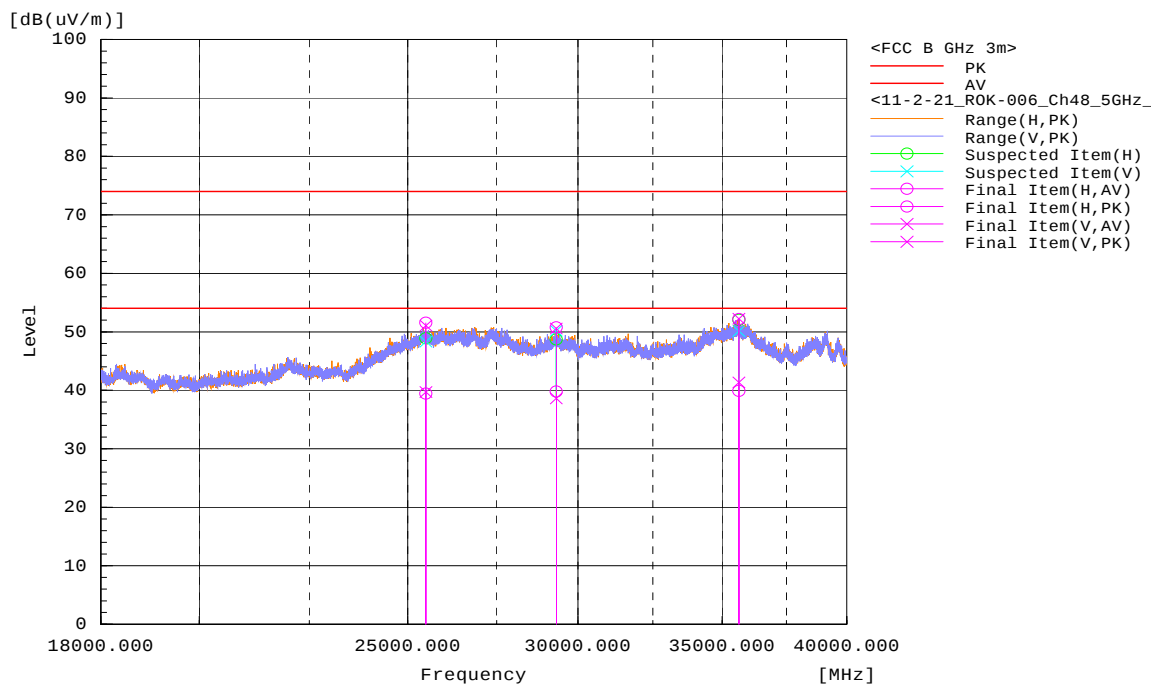
Above 1GHz – 802.11a – 5240MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	5236.359	V	38.5	48.7	-5.5	33	43.2	-	68.2	-	25	283	2.3	-
2	10480.31	H	38	49.1	5.3	43.3	54.4	-	68.2	-	13.8	223	18.1	-
3	10483.01	V	27.2	41.2	5.3	32.5	46.5	-	68.2	-	21.7	147	26.4	-
4	17238.2	H	19.9	31.5	15.4	35.3	46.9	-	68.2	-	21.3	216	318.9	-
5	17324.92	V	20.3	32.2	15.3	35.6	47.5	-	68.2	-	20.7	367	124.5	-
6	1250.554	H	43.7	55.4	-16.5	27.2	38.9	-	68.2	-	29.3	367	255.4	-
7	25492.6	H	20.7	32.8	18.7	39.4	51.5	-	68.2	-	16.7	285	191.8	-
8	25493.1	V	21	32.4	18.7	39.7	51.1	-	68.2	-	17.1	228	193.3	-
9	29309.75	V	19.1	31	19.6	38.7	50.6	-	68.2	-	17.6	329	0	-
10	29309.93	H	20.2	31.2	19.6	39.8	50.8	-	68.2	-	17.4	103	0	-
11	35635.24	H	22.1	34.4	17.8	39.9	52.2	-	68.2	-	16	400	0	-
12	35634.69	V	23.6	34.4	17.8	41.4	52.2	-	68.2	-	16	396	0	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).



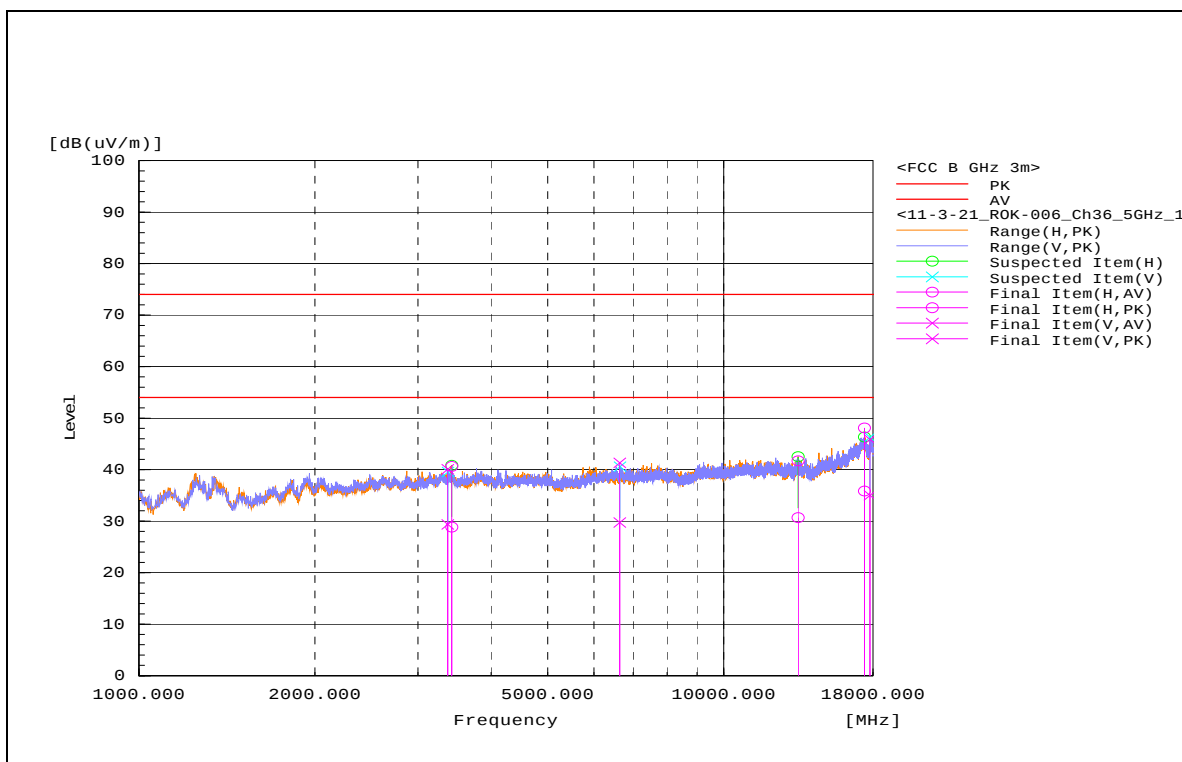


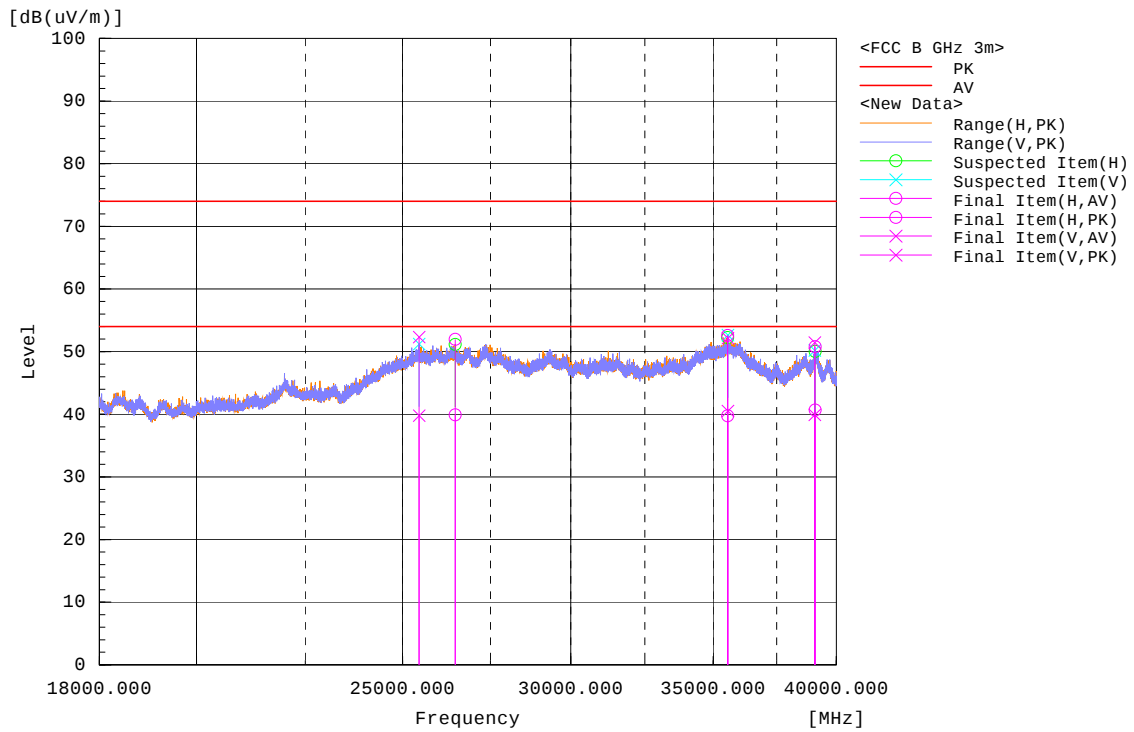
Above 1GHz – 802.11n – 5180MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	3373.983	V	37.9	48.6	-8.5	29.4	40.1	-	68.2	-	28.1	103	349.9	-
2	3427.206	H	37.4	49.2	-8.6	28.8	40.6	-	68.2	-	27.6	103	111.4	-
3	6641.581	V	31.5	43.1	-1.8	29.7	41.3	-	68.2	-	26.9	103	0	-
4	13401.47	H	23.8	34.8	6.9	30.7	41.7	-	68.2	-	26.5	100	239.4	-
5	17407.58	H	20	32.2	15.9	35.9	48.1	-	68.2	-	20.1	100	21.7	-
6	17781.34	V	18.6	29.5	16.4	35	45.9	-	68.2	-	22.3	147	48.5	-
7	25455.42	V	21.1	33.6	18.7	39.8	52.3	-	68.2	-	15.9	238	18.6	-
8	26465.68	H	21.2	33.3	18.7	39.9	52	-	68.2	-	16.2	208	87.3	-
9	35553.27	H	21.9	34.7	17.9	39.8	52.6	-	68.2	-	15.6	322	258.1	-
10	35561.62	V	22.6	34.3	17.9	40.5	52.2	-	68.2	-	16	201	48.4	-
11	39070.2	V	24.6	36.2	15.3	39.9	51.5	-	68.2	-	16.7	216	120.2	-
12	39089.7	H	25.4	35.5	15.3	40.7	50.8	-	68.2	-	17.4	400	109.3	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).



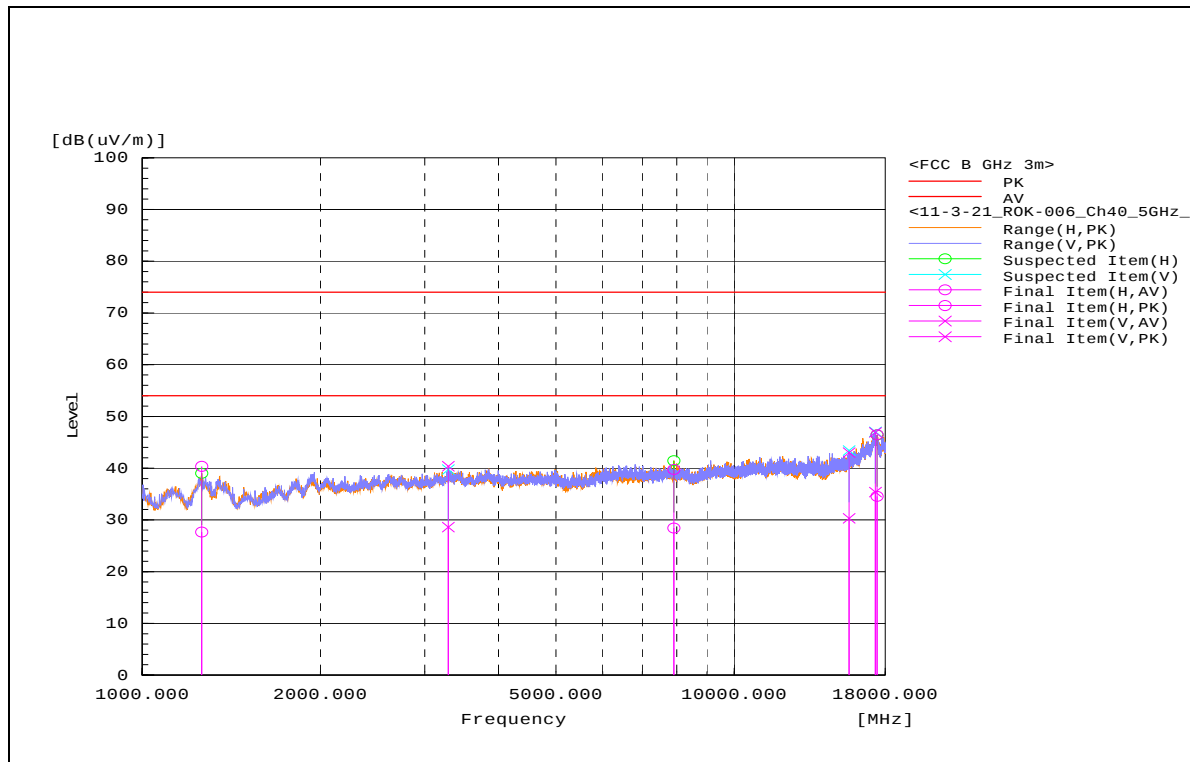


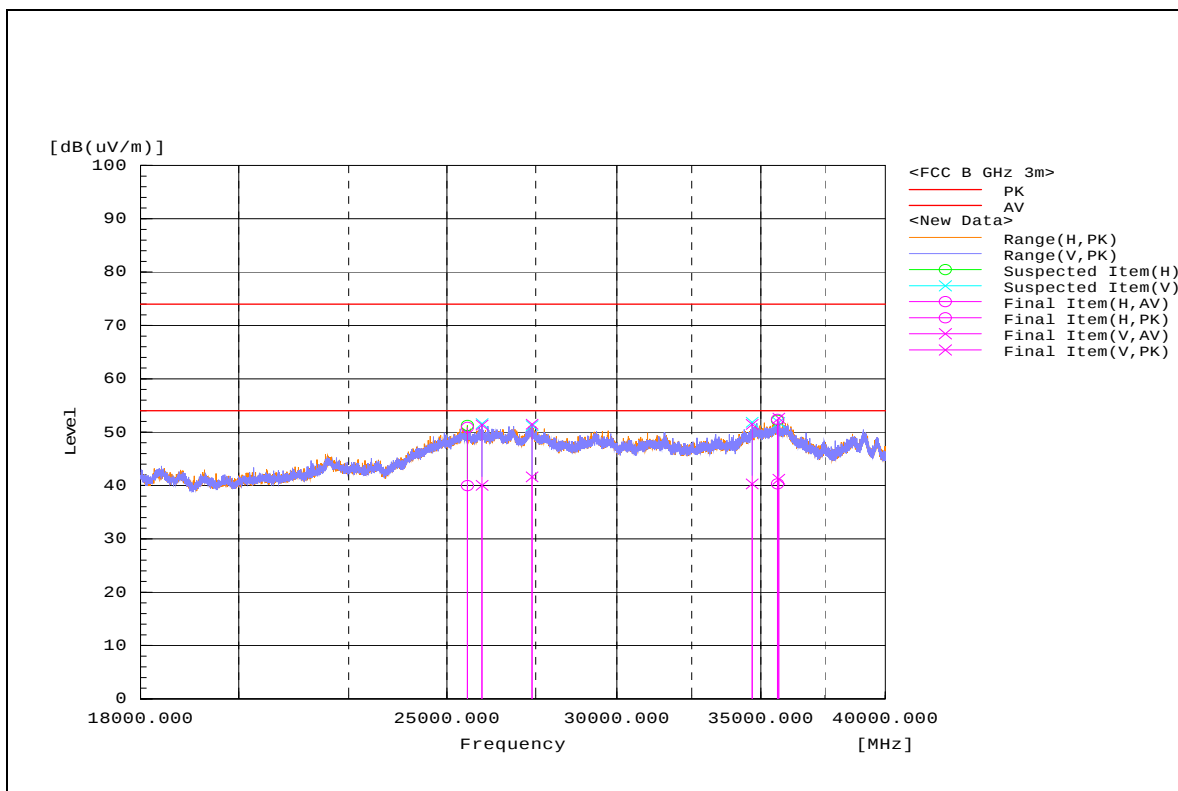
Above 1GHz – 802.11n – 5200MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	17320.38	V	20.1	31.6	15.3	35.4	46.9	-	68.2	-	21.3	193	313.7	-
2	15637.73	V	18.3	31	12	30.3	43	54	74	23.7	31	178	151	Pass
3	3289.649	V	37.4	49.2	-8.8	28.6	40.4	-	68.2	-	27.8	147	344.2	-
4	17443.02	H	18.5	30.3	16.1	34.6	46.4	-	68.2	-	21.8	314	292.9	-
5	7909.969	H	27.6	39	0.8	28.4	39.8	-	68.2	-	28.4	359	156.8	-
6	1260.618	H	44.1	56.8	-16.5	27.6	40.3	-	68.2	-	27.9	352	60.4	-
7	25555.08	H	21.2	32.1	18.8	40	50.9	-	68.2	-	17.3	132	245	-
8	25958.73	V	21.4	32.7	18.6	40	51.3	-	68.2	-	16.9	396	224.2	-
9	27386.68	V	22	31.9	19.6	41.6	51.5	-	68.2	-	16.7	344	109	-
10	34682	V	22.3	33.5	18	40.3	51.5	-	68.2	-	16.7	298	239.9	-
11	35636.12	H	22.5	34.6	17.8	40.3	52.4	-	68.2	-	15.8	389	279	-
12	35685.1	V	23.5	34.9	17.7	41.2	52.6	-	68.2	-	15.6	352	149.7	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).



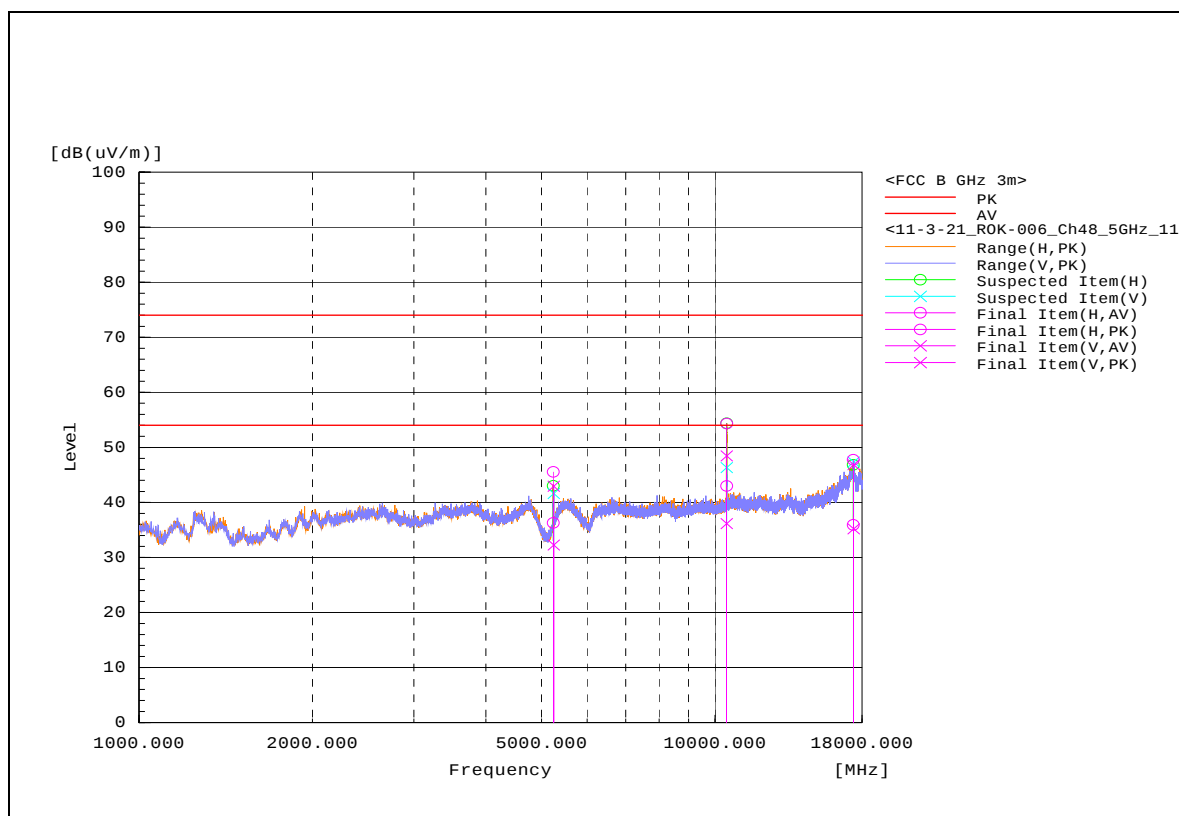


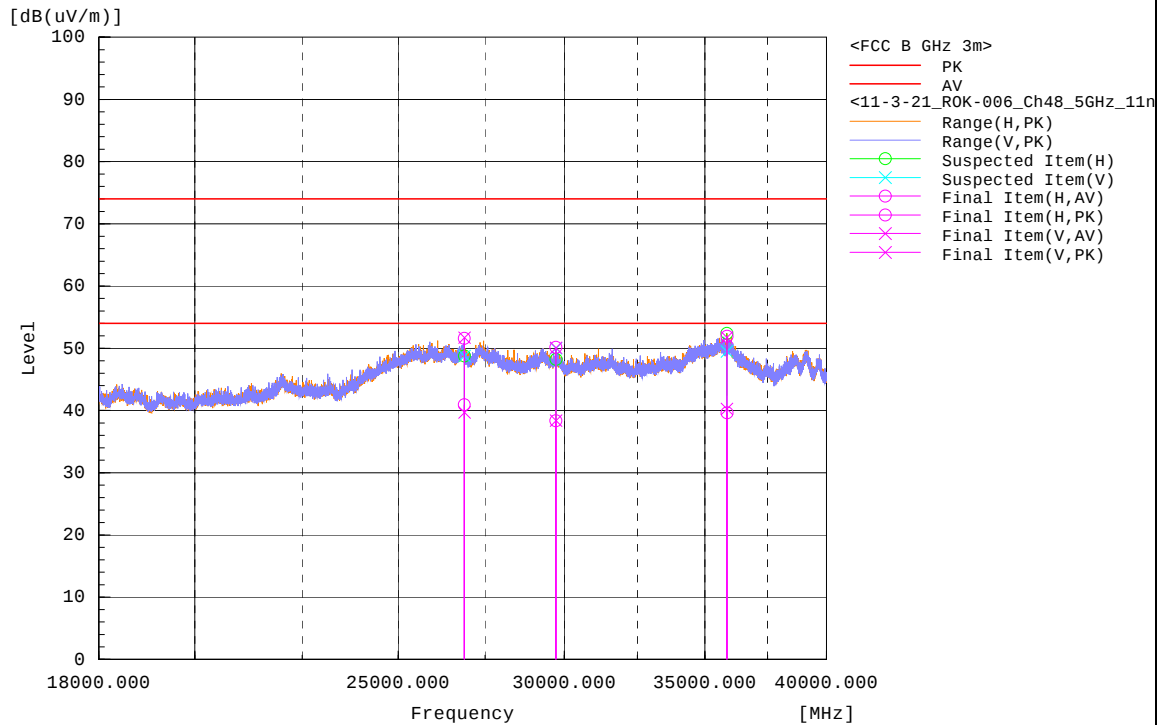
Above 1GHz – 802.11n – 5240MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	10479.87	H	37.7	49	5.3	43	54.3	-	68.2	-	13.9	103	0	-
2	10478.72	V	30.9	43.2	5.3	36.2	48.5	-	68.2	-	19.7	208	175.1	-
3	17375.73	H	20.3	32.2	15.6	35.9	47.8	-	68.2	-	20.4	374	0	-
4	17400.81	V	19.4	31.1	15.8	35.2	46.9	-	68.2	-	21.3	291	292.3	-
5*	5236.994	H	41.8	51.1	-5.5	36.3	45.6	-	68.2	-	22.6	291	359.2	-
6*	5246.296	V	37.7	48.3	-5.4	32.3	42.9	-	68.2	-	25.3	238	334.7	-
7	26880.69	H	22	32.7	18.9	40.9	51.6	-	68.2	-	16.6	400	11.9	-
8	26881.42	V	20.8	32.8	18.9	39.7	51.7	-	68.2	-	16.5	261	318.8	-
9	29724.06	V	18.7	30.4	19.7	38.4	50.1	-	68.2	-	18.1	140	52.9	-
10	29722.48	H	18.7	30.5	19.7	38.4	50.2	-	68.2	-	18	337	104.9	-
11	35860.49	H	22.3	34.6	17.3	39.6	51.9	-	68.2	-	16.3	389	287.4	-
12	35859.22	V	23	34.5	17.3	40.3	51.8	-	68.2	-	16.4	314	287.3	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).



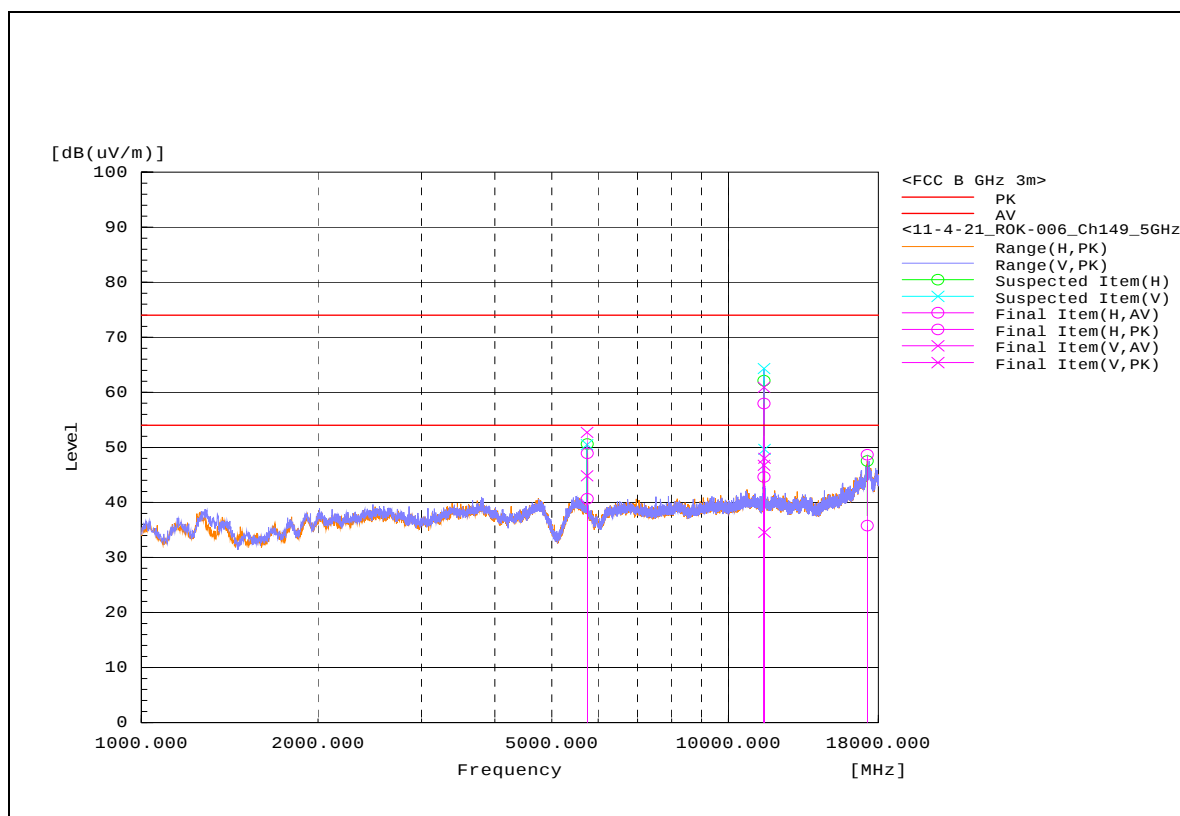


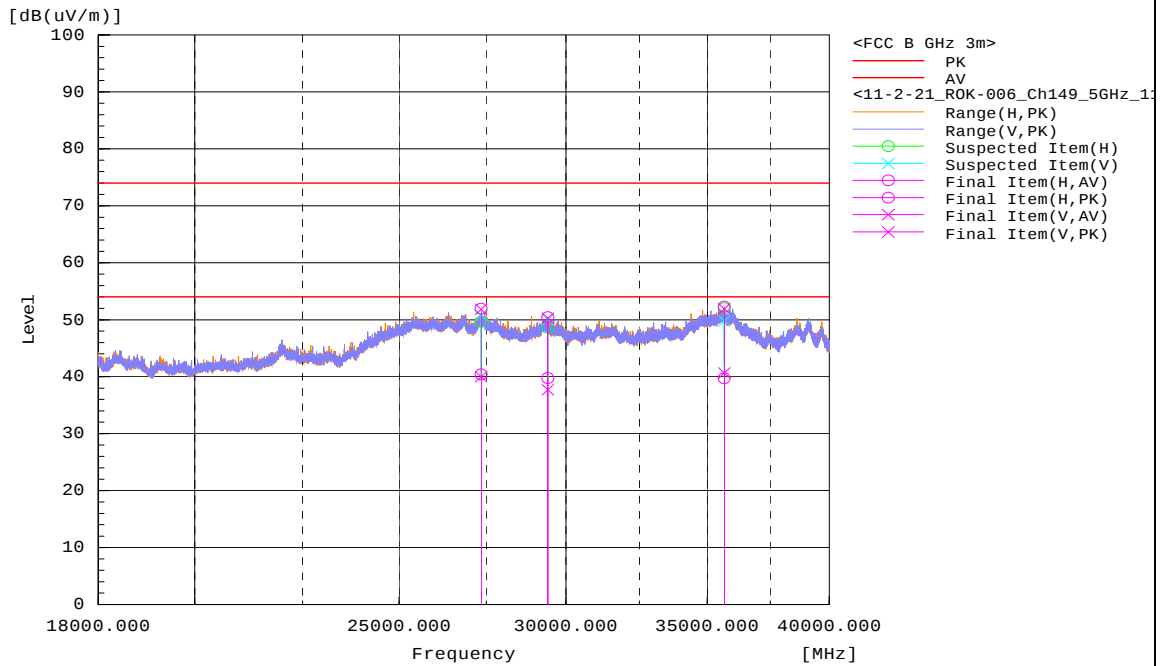
Above 1GHz – 802.11a – 5745 MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	11489.46	V	40.7	54.8	6.1	46.8	60.9	54	74	7.2	13.1	238	24.7	Pass
2	11489.27	H	38.5	51.9	6.1	44.6	58	54	74	9.4	16	162	186.8	Pass
3*	5747.867	H	44.8	53.1	-4.2	40.6	48.9	-	68.2	-	19.3	253	0	-
4*	5742.258	V	49	56.9	-4.2	44.8	52.7	-	68.2	-	15.5	307	297.8	-
5	11508.31	V	28.4	41.9	6.1	34.5	48	54	74	19.5	26	147	29.6	Pass
6	17235.43	H	20.4	33.3	15.4	35.8	48.7	-	68.2	-	19.5	147	256.9	-
7	27341.1	H	20.9	32.4	19.5	40.4	51.9	54	74	13.6	22.1	213	96.6	Pass
8	27339.34	V	20.5	32.4	19.5	40	51.9	-	68.2	-	16.3	163	143	-
9	29407.67	V	17.9	30.5	19.8	37.7	50.3	-	68.2	-	17.9	300	36.5	-
10	29408.59	H	20	30.6	19.8	39.8	50.4	-	68.2	-	17.8	138	175.9	-
11	35661.89	H	22	34.6	17.7	39.7	52.3	-	68.2	-	15.9	147	49.9	-
12	35660.82	V	22.9	34.2	17.7	40.6	51.9	-	68.2	-	16.3	396	56.2	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).



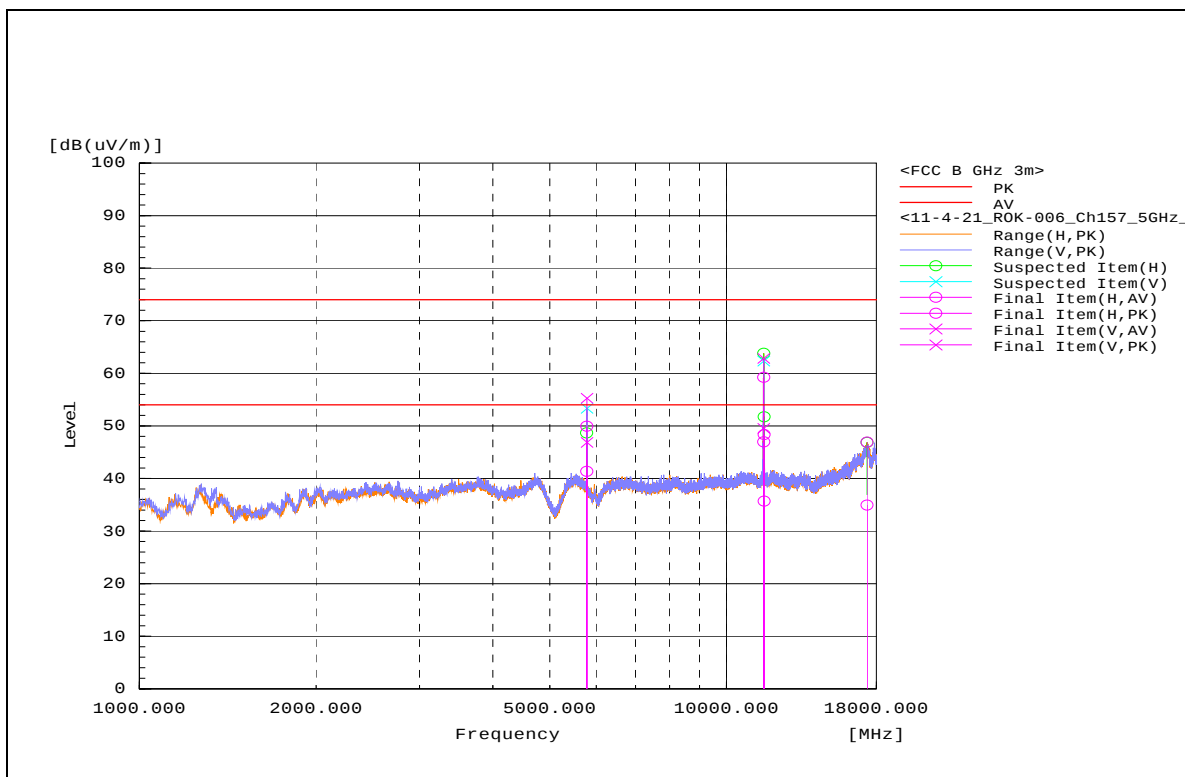


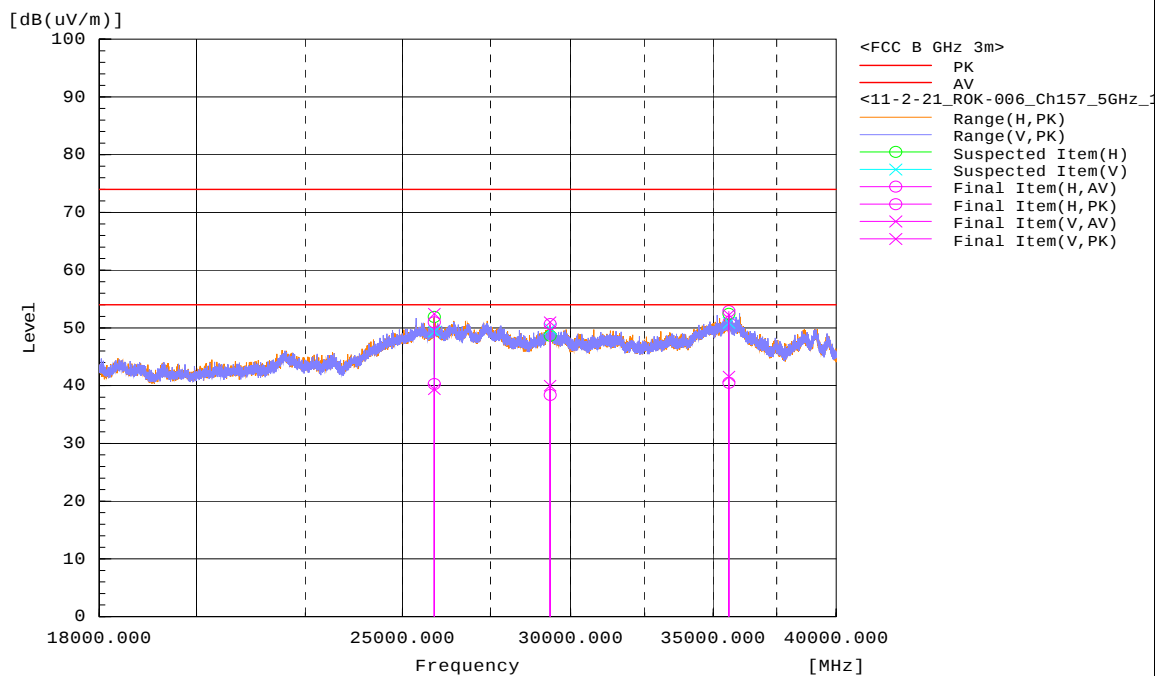
Above 1GHz – 802.11a – 5785 MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	11575.29	H	40.8	53	6.2	47	59.2	54	74	7	14.8	103	224	Pass
2	11568.65	V	43.3	56.7	6.2	49.5	62.9	54	74	4.5	11.1	207	179	Pass
3*	5786.323	V	51	59.4	-4.1	46.9	55.3	-	68.2	-	12.9	322	294.7	-
4	11588.79	H	29.5	42.2	6.2	35.7	48.4	54	74	18.3	25.6	117	186.6	Pass
5*	5779.743	H	45.5	54.1	-4.1	41.4	50	-	68.2	-	18.2	238	2.3	-
6	17355.35	H	19.5	31.4	15.4	34.9	46.9	-	68.2	-	21.3	253	241.4	-
7	25876.11	H	21.6	32.3	18.7	40.3	51	-	68.2	-	17.2	396	27.9	-
8	25875.59	V	20.7	33.8	18.7	39.4	52.5	-	68.2	-	15.7	313	3.8	-
9	29336.03	V	20.3	31.3	19.7	40	51	-	68.2	-	17.2	253	204.4	-
10	29337.65	H	18.7	31	19.7	38.4	50.7	-	68.2	-	17.5	231	1.4	-
11	35609.4	H	22.7	35.1	17.8	40.5	52.9	-	68.2	-	15.3	185	17.3	-
12	35609.16	V	23.8	34.4	17.8	41.6	52.2	-	68.2	-	16	291	10.5	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).



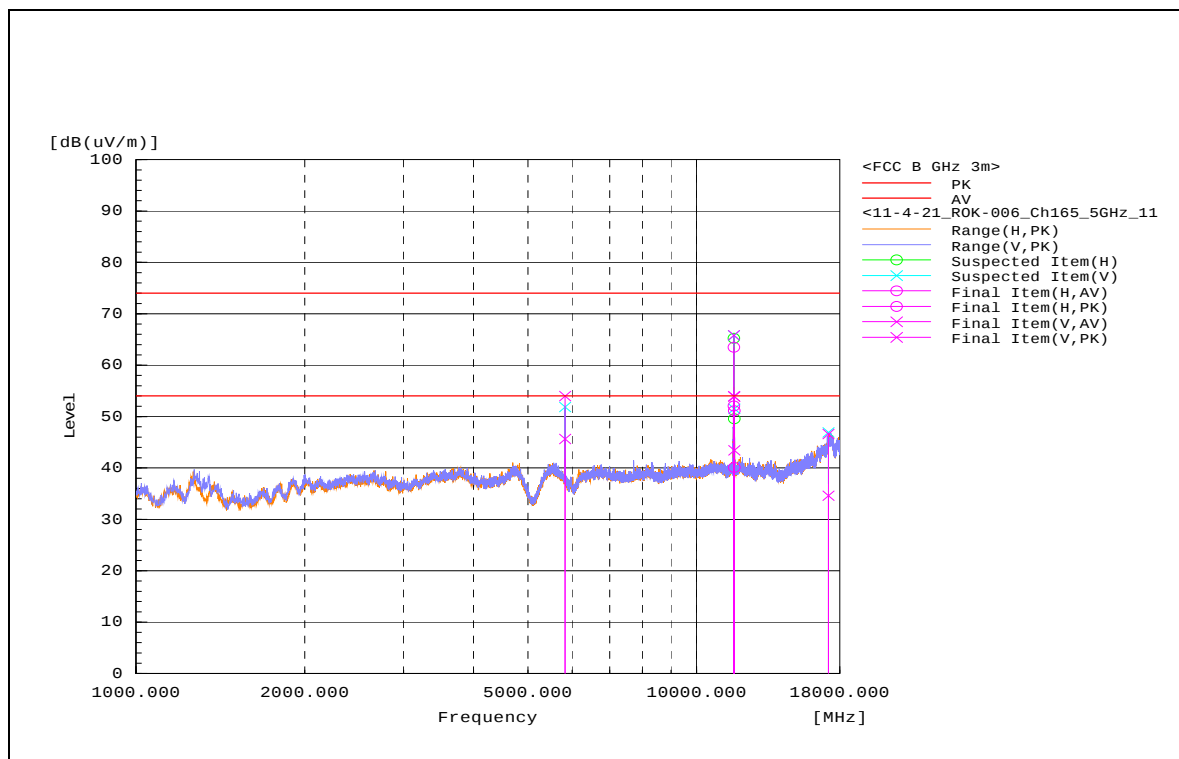


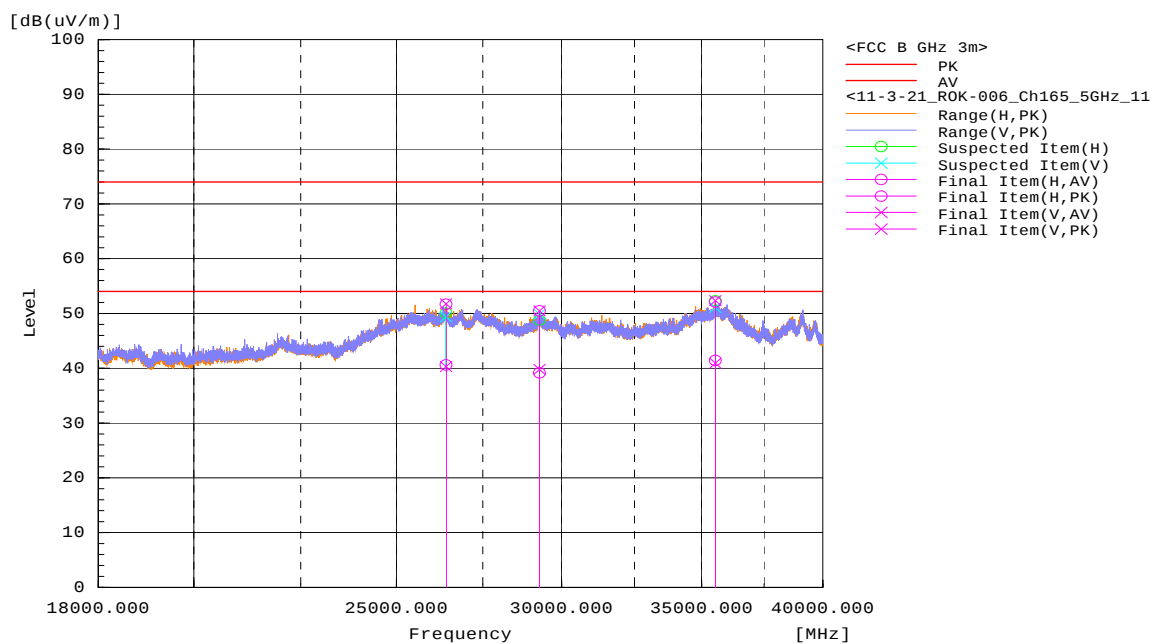
Above 1GHz – 802.11a – 5825 MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	11649.61	V	47.7	59.6	6.2	54	65.8	54	74	0.1	8.2	132	228.9	Pass
2	11649.55	H	45.9	57.3	6.2	52.1	63.5	54	74	1.9	10.5	177	199.5	Pass
3*	5828.004	V	49.6	58	-4	45.6	54	-	68.2	-	14.2	307	325.5	-
4	11667.2	V	37.2	47.7	6.2	43.4	53.9	54	74	10.6	20.1	103	169.1	Pass
5	11673.88	H	33.9	44.9	6.2	40.1	51.1	54	74	13.9	22.9	132	202.6	Pass
6	17183.27	V	18.9	30.9	15.7	34.6	46.6	-	68.2	-	21.6	337	287.5	-
7	26405	H	21.9	33	18.7	40.6	51.7	-	68.2	-	16.5	367	287.2	-
8	26406.42	V	21.6	33.1	18.7	40.3	51.8	-	68.2	-	16.4	276	183	-
9	29272.76	V	20.2	30.9	19.6	39.8	50.5	-	68.2	-	17.7	400	87.1	-
10	29271.54	H	19.6	30.9	19.6	39.2	50.5	-	68.2	-	17.7	132	230.4	-
11	35529.42	H	23.5	34.2	17.9	41.4	52.1	-	68.2	-	16.1	337	243.9	-
12	35529.07	V	23	34.5	17.9	40.9	52.4	-	68.2	-	15.8	147	0	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).



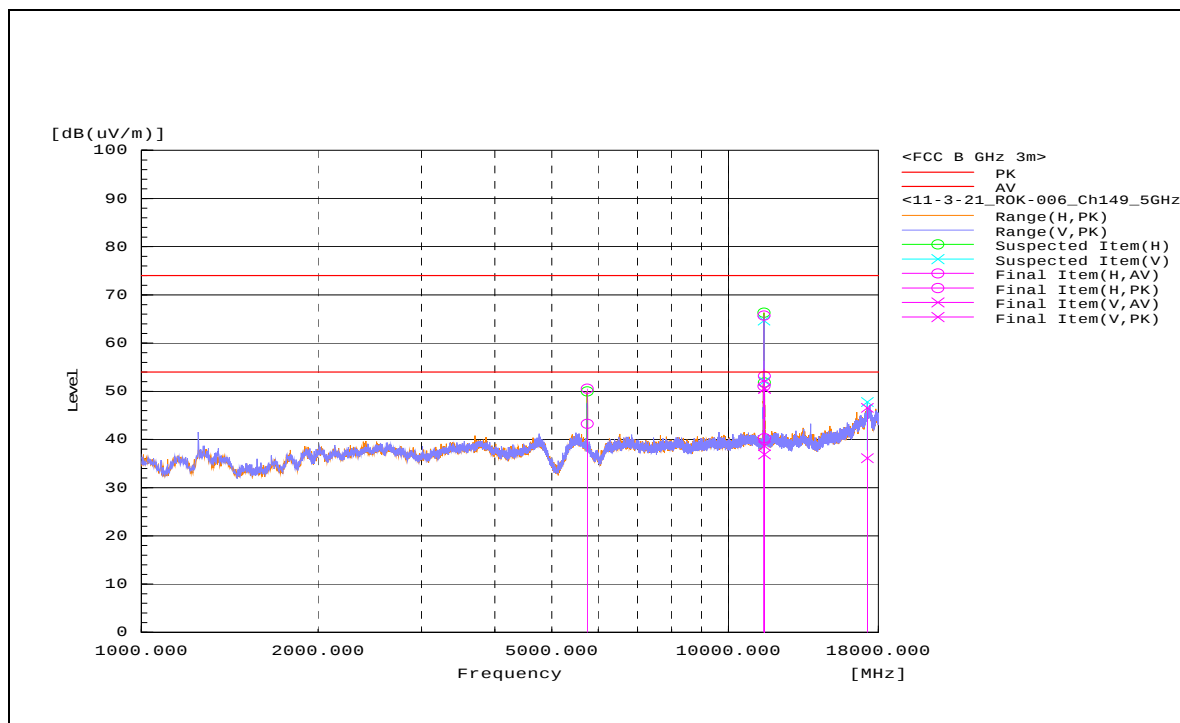


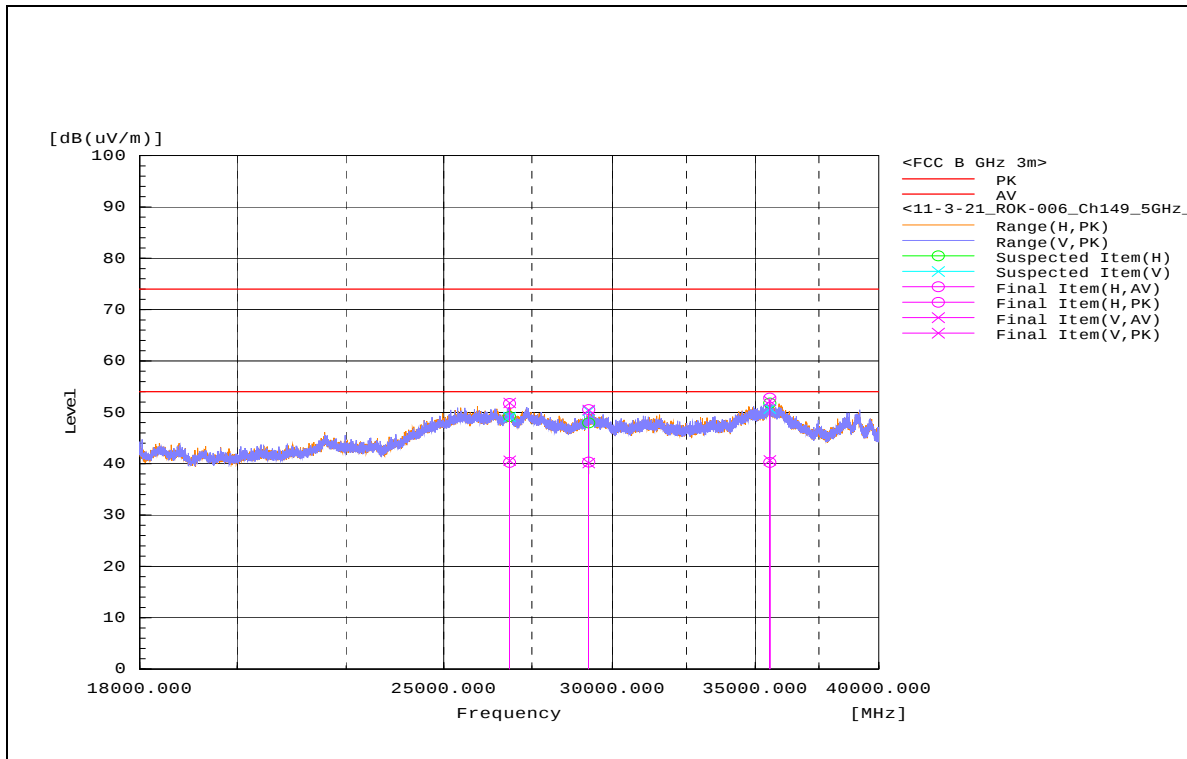
Above 1GHz – 802.11n – 5745 MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	11491.42	H	45	59.6	6.1	51.1	65.7	54	74	2.9	8.3	162	0	-
2	11511.34	V	30.8	44.5	6.1	36.9	50.6	54	74	17.1	23.4	100	353.4	Pass
3	11509.54	V	32.5	44.4	6.1	38.6	50.5	54	74	15.4	23.5	100	353.6	Pass
4	11509.98	H	34.2	47.1	6.1	40.3	53.2	54	74	13.7	20.8	177	0	Pass
5	5748.695	H	47.5	54.7	-4.2	43.3	50.5	-	68.2	-	17.7	276	334.3	-
6	17229.59	V	20.7	31.2	15.4	36.1	46.6	-	68.2	-	21.6	177	334.8	-
7	26846.15	H	21.3	32.8	18.9	40.2	51.7	-	68.2	-	16.5	291	325.8	-
8	26846.1	V	21.7	33	18.9	40.6	51.8	-	68.2	-	16.4	400	245.6	-
9	29241.25	V	20.6	31	19.5	40.1	50.5	-	68.2	-	17.7	367	222.7	-
10	29239.79	H	20.8	31.1	19.5	40.3	50.6	-	68.2	-	17.6	147	168.2	-
11	35562.69	H	22.4	34.9	17.9	40.3	52.8	-	68.2	-	15.4	147	270.8	-
12	35562.56	V	22.8	34.3	17.9	40.7	52.2	-	68.2	-	16	306	6.4	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).



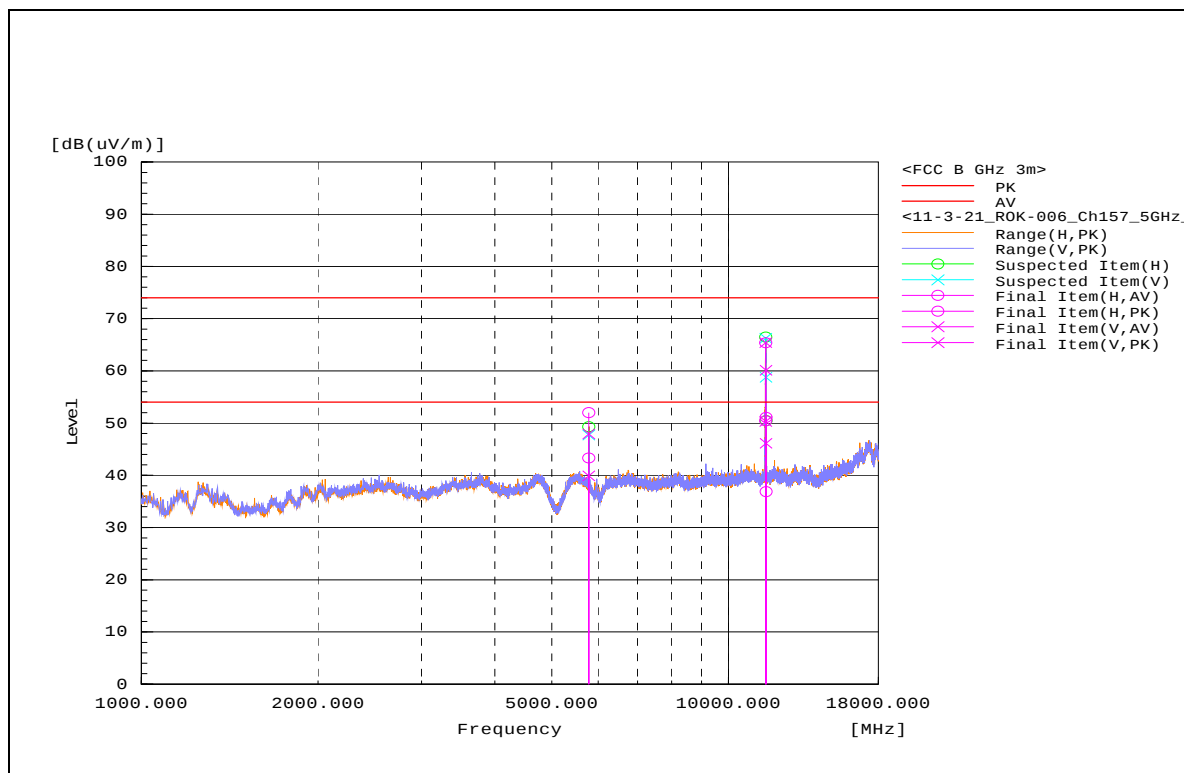


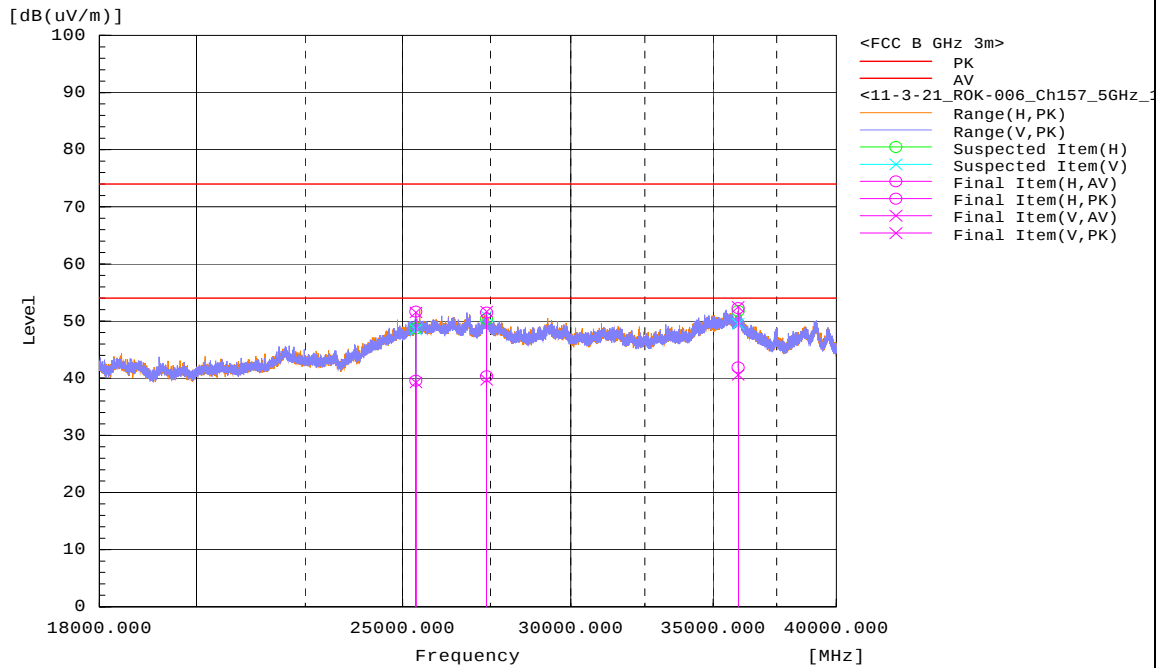
Above 1GHz – 802.11n – 5785 MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	11571.74	H	44.3	59.2	6.2	50.5	65.4	54	74	3.5	8.6	117	0.1	Pass
2	11571.76	V	44.1	59.2	6.2	50.3	65.4	54	74	3.7	8.6	100	25.3	Pass
3	11582.39	V	40	53.9	6.2	46.2	60.1	54	74	7.8	13.9	117	332.1	Pass
4	11593.16	H	30.7	44.9	6.2	36.9	51.1	54	74	17.1	22.9	147	350.7	Pass
5*	5781.767	H	47.4	56.1	-4.1	43.3	52	-	68.2	-	16.2	253	10.6	-
6*	5783.784	V	44	52	-4.1	39.9	47.9	-	68.2	-	20.3	140	334.9	-
7	25364	H	20.9	33	18.7	39.6	51.7	-	68.2	-	16.5	117	139.1	-
8	25363.68	V	20.6	32.8	18.7	39.3	51.5	-	68.2	-	16.7	322	92.3	-
9	27380.35	V	20.1	32.1	19.6	39.7	51.7	-	68.2	-	16.5	291	40.9	-
10	27380.72	H	20.7	31.9	19.6	40.3	51.5	-	68.2	-	16.7	231	116.7	-
11	35962.88	H	24.9	35.3	17	41.9	52.3	-	68.2	-	15.9	352	154	-
12	35961.84	V	23.6	35.5	17	40.6	52.5	-	68.2	-	15.7	389	205.1	-

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).



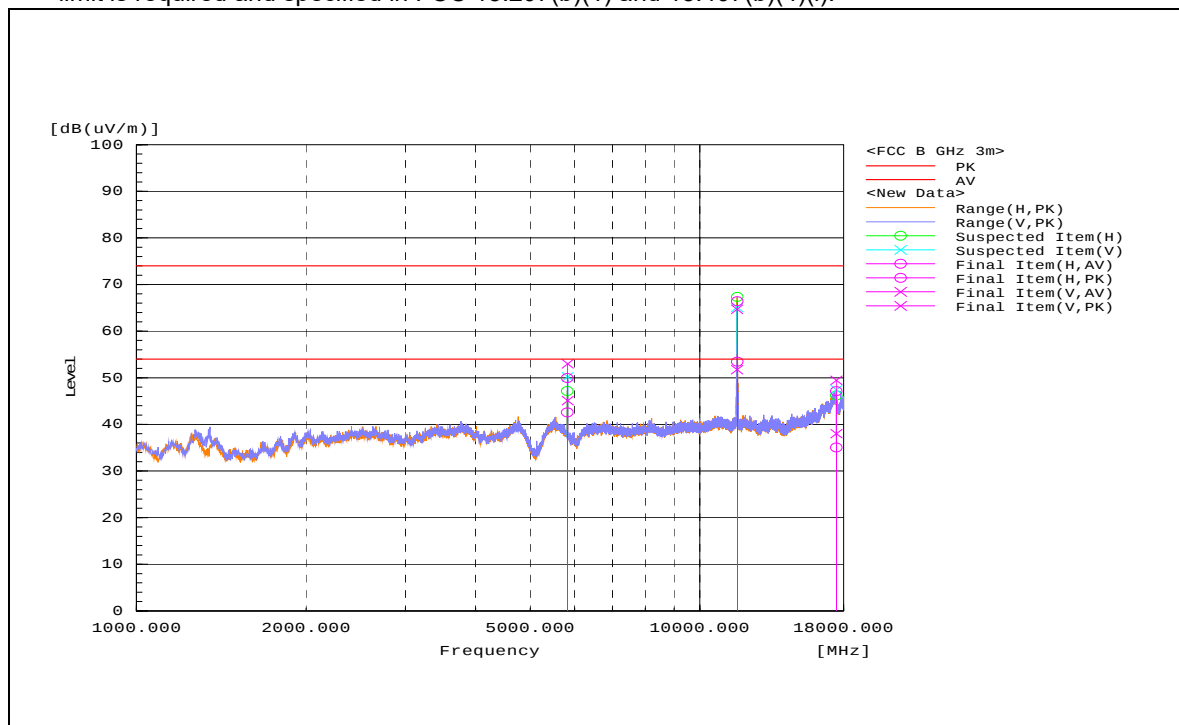


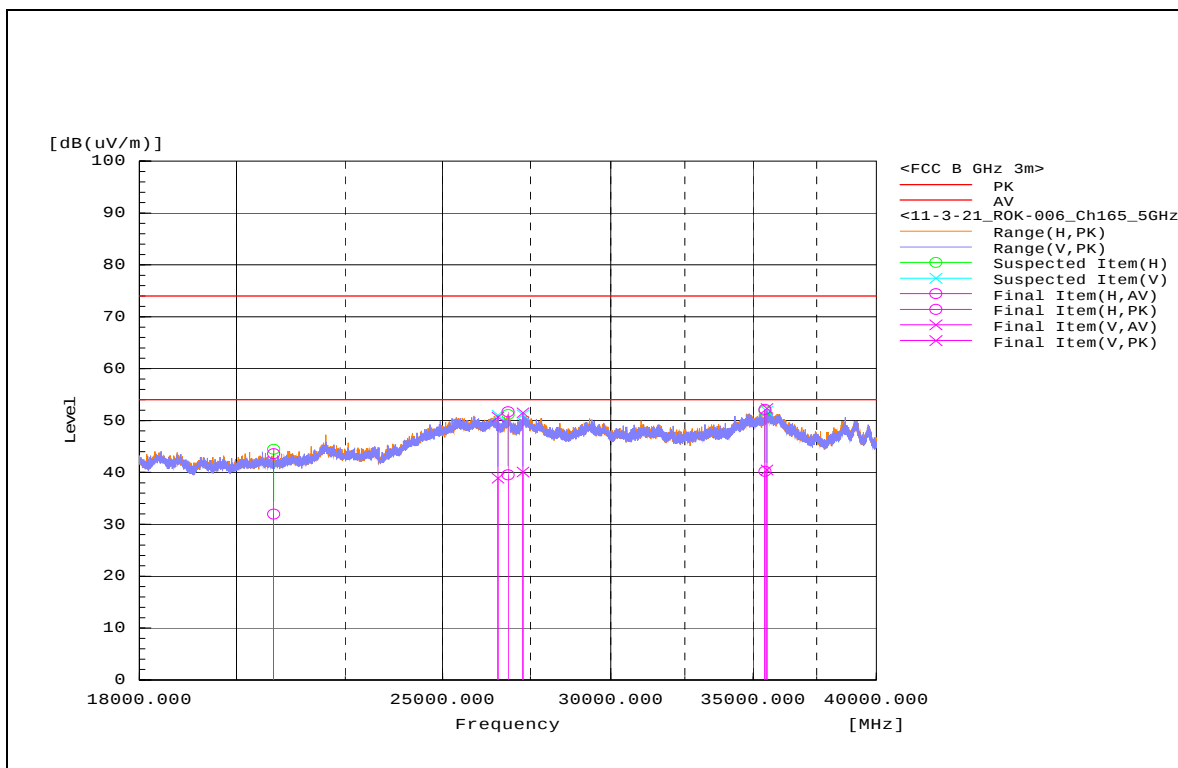
Above 1GHz – 802.11n – 5825 MHz

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	11648.97	H	47.3	60.2	6.2	53.5	66.4	54	74	0.5	7.6	117	0	Pass
2	11647.18	V	45.6	58.5	6.2	51.8	64.7	54	74	2.2	9.3	177	305.9	Pass
3*	5827.846	V	49.1	57	-4	45.1	53	-	68.2	-	15.2	322	315.5	-
4	17473.95	V	21.7	33.2	16.3	38	49.5	-	68.2	-	18.7	132	178.6	-
5*	5817.539	H	46.6	53.9	-4	42.6	49.9	-	68.2	-	18.3	223	9.6	-
6	17474.72	H	18.8	30.8	16.3	35.1	47.1	-	68.2	-	21.1	253	80.8	-
7	20818.05	H	17.5	29.1	14.5	32	43.6	54	74	22	30.4	299	34.8	Pass
8	26546.37	V	20.1	31.9	18.8	38.9	50.7	-	68.2	-	17.5	185	330.6	-
9	26837.02	H	20.7	32.9	18.8	39.5	51.7	-	68.2	-	16.5	110	284.6	-
10	27272.86	V	20.7	32.1	19.4	40.1	51.5	-	68.2	-	16.7	110	331.3	-
11	35451.2	H	22.3	34.2	17.9	40.2	52.1	-	68.2	-	16.1	192	26.9	-
12	35527.92	V	22.6	34.4	17.9	40.5	52.3	-	68.2	-	15.9	253	113	-

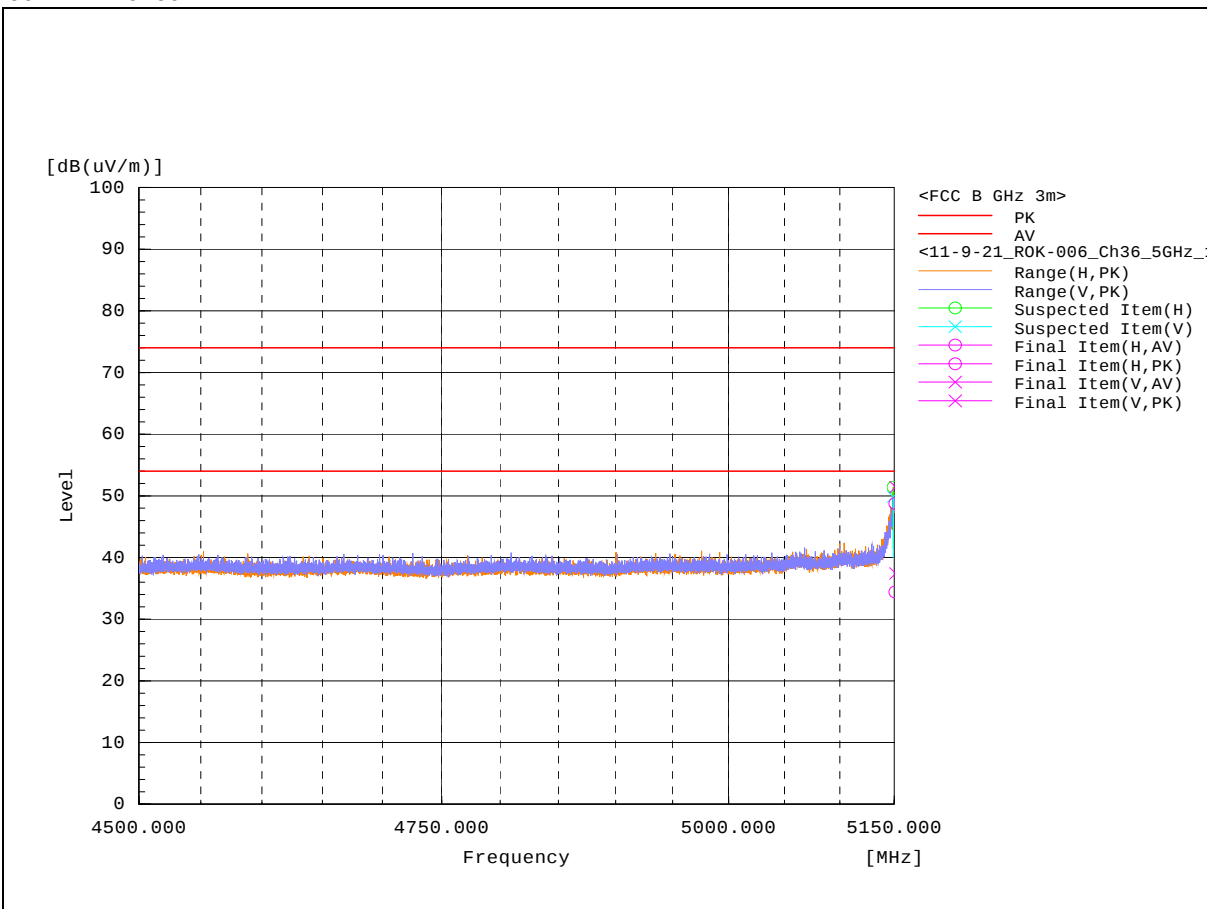
REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.
4. "-": Emissions that do not fall within the restricted frequency bands where the attenuation below the average field strength limits specified in FCC § 15.205/ RSS-Gen is not required, peak field strength limit is required and specified in FCC 15.207(b)(1) and 15.407(b)(4)(i).





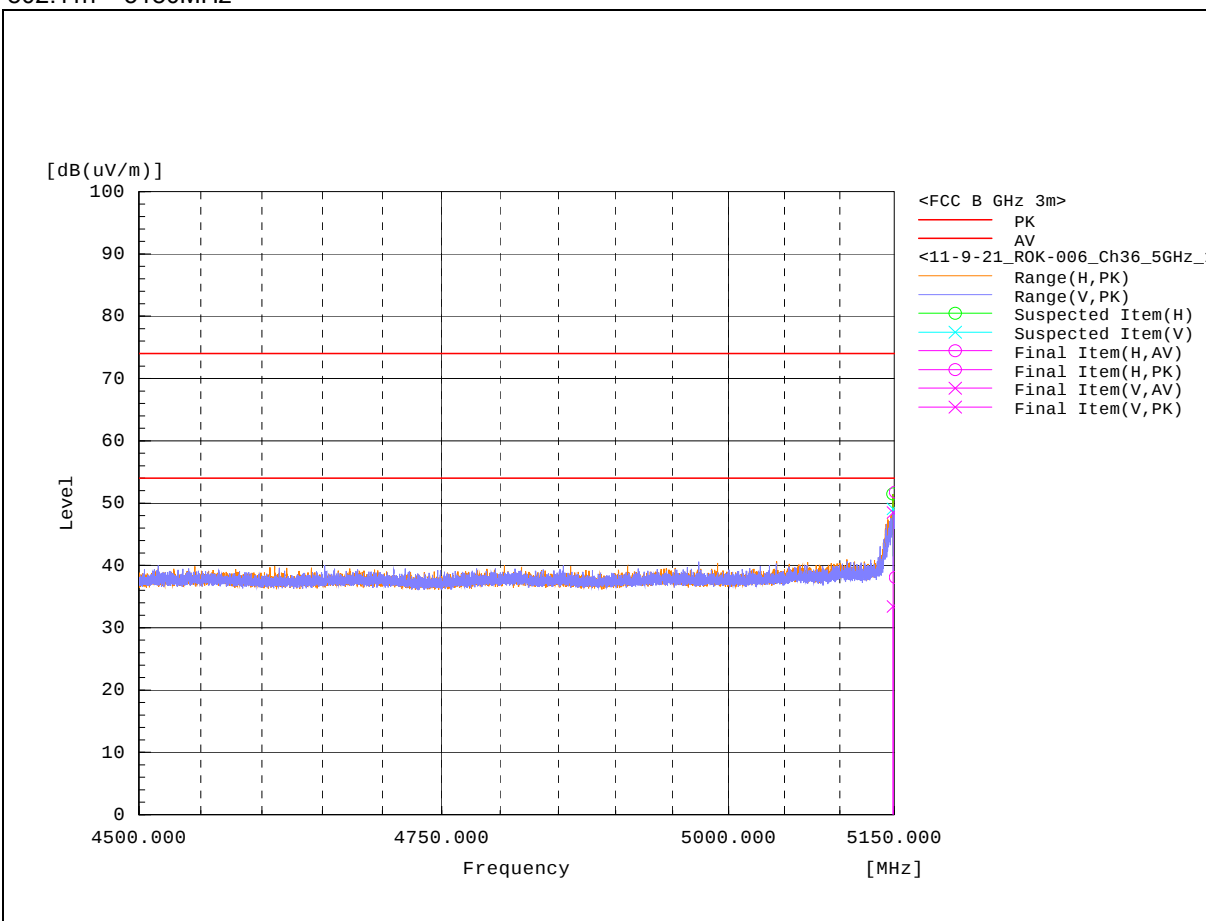
RESTRICTED BAND Test Plots 802.11a – 5180MHz



Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	5150.65	H	40.1	54.5	-5.7	34.4	48.8	54	74	19.6	25.2	269	184.9	Pass
2	5151.20	V	43.1	57.2	-5.7	37.4	51.5	54	74	16.6	22.5	117	333.6	Pass

RESTRICTED BAND

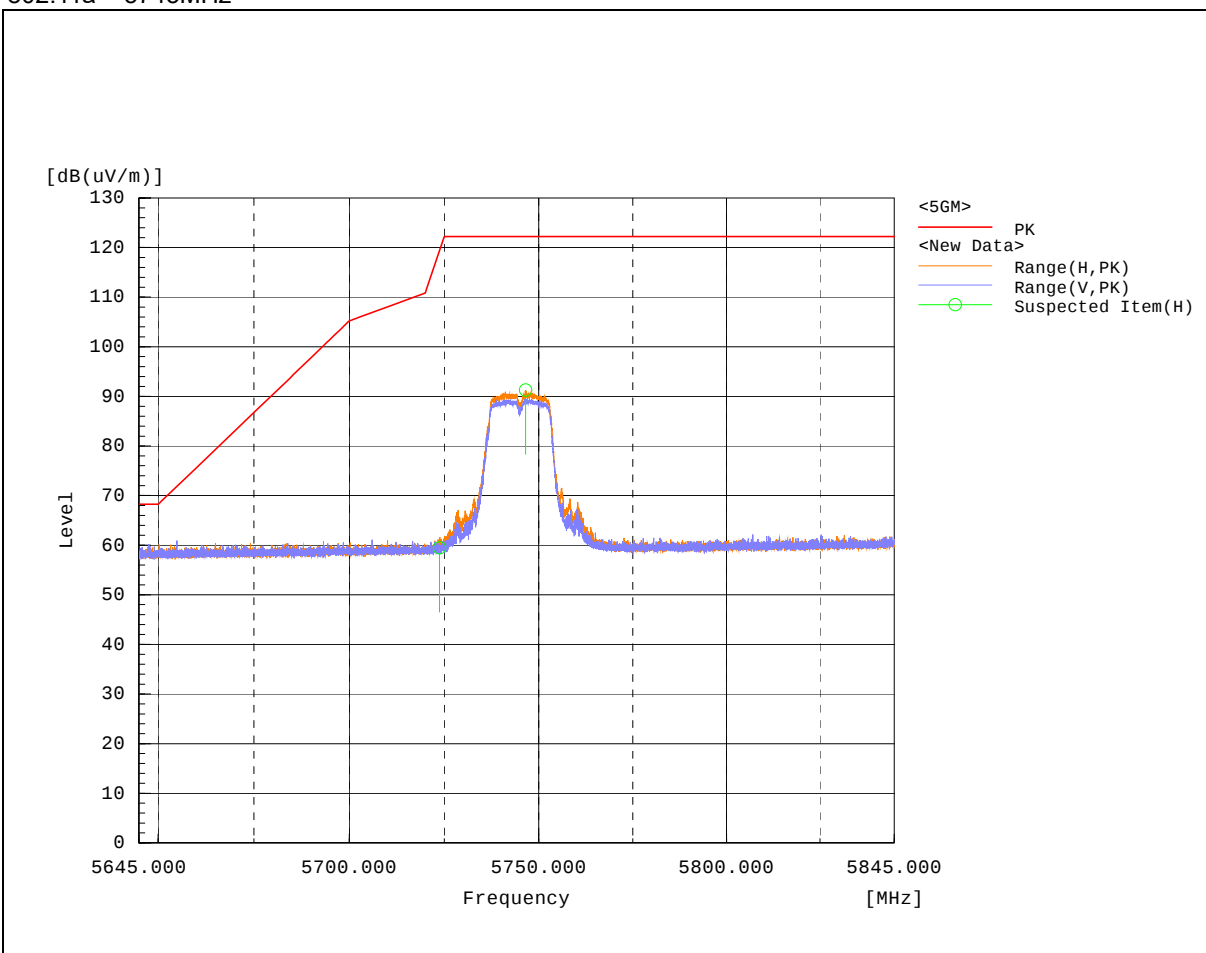
802.11n – 5180MHz



Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	5151.01	H	43.8	57.5	-5.7	38.1	51.8	54	74	15.9	22.2	147	147.6	Pass
2	5148.81	V	39.2	54.2	-5.7	33.5	48.5	54	74	20.5	25.5	147	342.3	Pass

RESTRICTED BAND

802.11a – 5745MHz



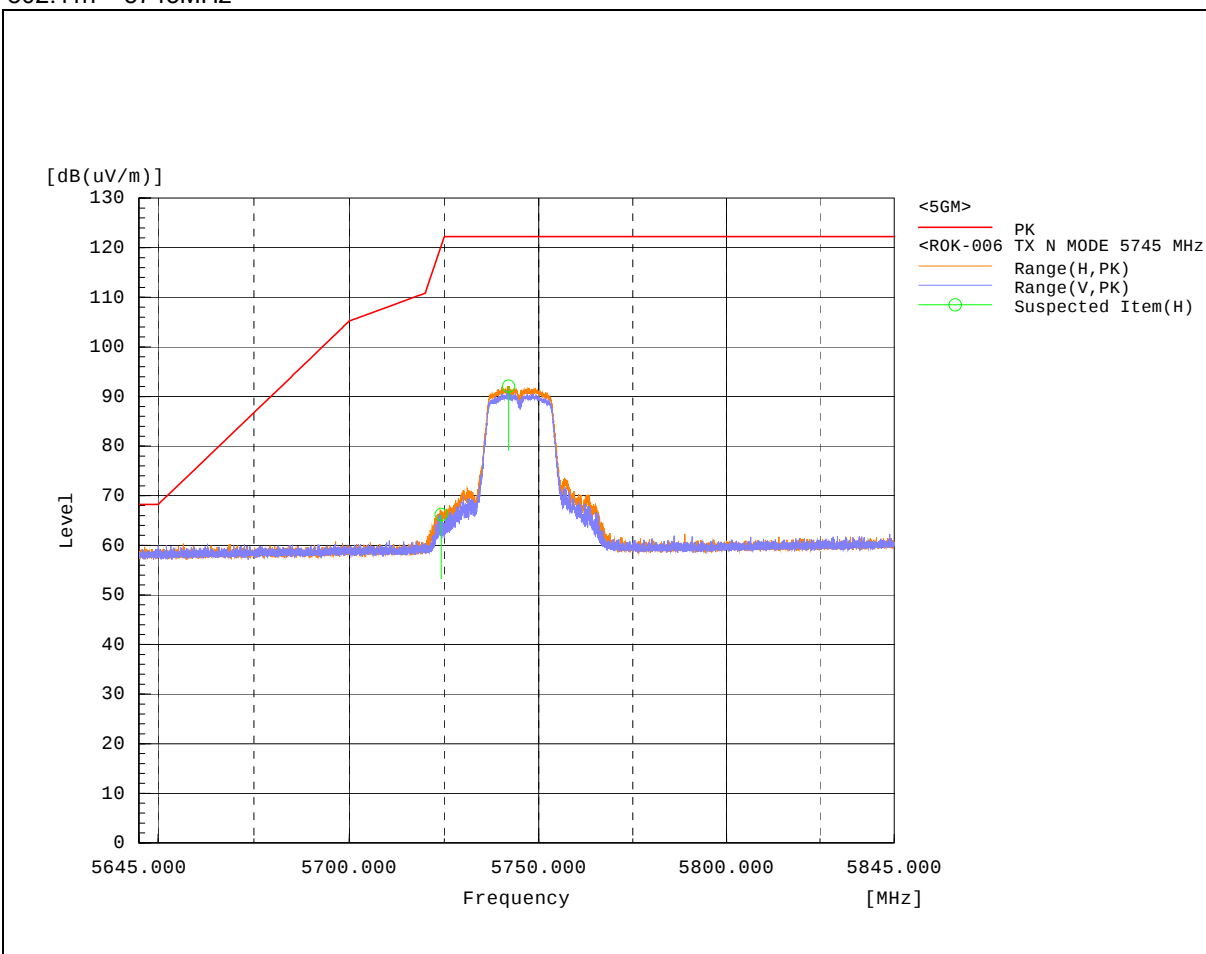
Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level PK dB(uV/m)	Limit PK [dB(uV/m)]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	5746.52	H	51.4	39.9	91.3	-	-	250	213.7	-
2	5723.78	H	19.7	39.8	59.5	119.4	59.9	300	196	Pass

Note:

- : No limit

RESTRICTED BAND

802.11n – 5745MHz

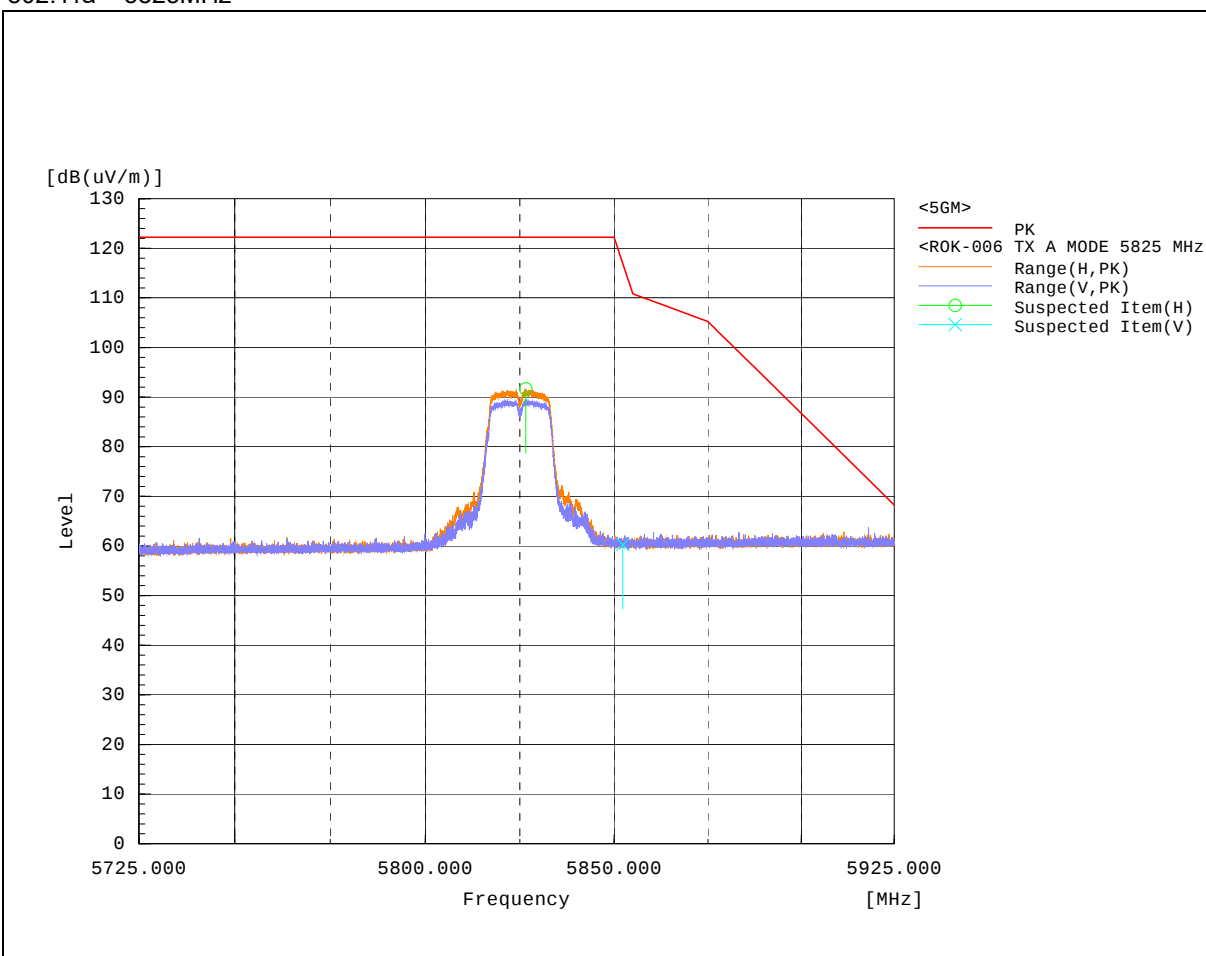


Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level PK dB(uV/m)	Limit PK [dB(uV/m)]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	5742.04	H	52.2	39.9	92.1	-	-	150	0.8	-
2	5724.22	H	26.4	39.8	66.2	120.5	54.3	200	355	Pass

Note:

- : No limit

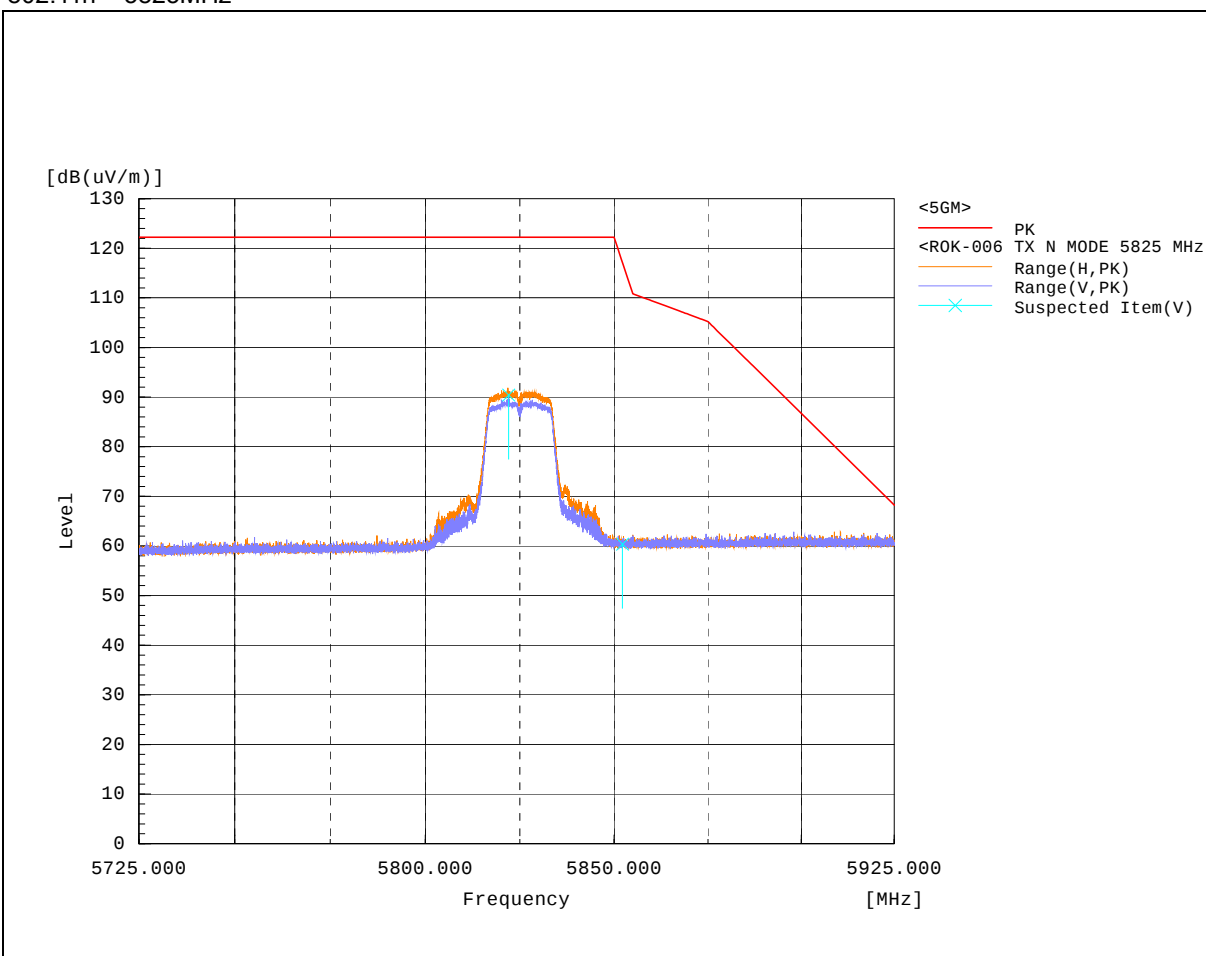
RESTRICTED BAND
802.11a – 5825MHz



Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level PK dB(uV/m)	Limit PK [dB(uV/m)]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	5826.6	H	51.6	40	91.6	-	-	250	229.1	-
2	5852.28	V	20.2	40.1	60.3	117	56.7	150	73.8	Pass

Note:
- : No limit

RESTRICTED BAND
802.11n – 5825MHz



Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level PK dB(uV/m)	Limit PK [dB(uV/m)]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	5822.02	V	50.4	40	90.4	-	-	100	159.2	-
2	5852.26	V	20.3	40.1	60.4	117.1	56.7	100	228.5	Pass

Note:
- : No limit

4.3 Conducted Emission Measurement

4.3.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.3.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
EMI Test Receiver ROHDE & SCHWARZ	ESIB 40	100179	01/29/2021	01/29/2022
Transient Limiter ELECTRO-METRICS	EM-7600-5	106	01/29/2021	01/29/2022
LISN EMCO	3816/2NM	214372	01/29/2021	01/29/2022

4.3.3 Test Procedure

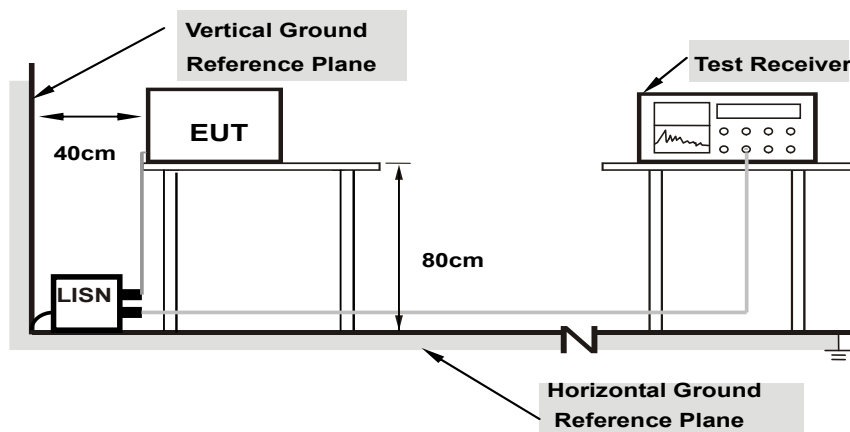
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

4.3.4 Deviation from Test Standard

No deviation.

4.3.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.3.6 EUT Operating Condition

Same as 4.1.6.

4.3.7 Test Results

N/A

4.4 Transmit Power Measurement

4.4.1 Limits of Transmit Power Measurement

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p $\leq$ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
		Fixed point-to-point Access Point	1 Watt (30 dBm)
		Indoor Access Point	1 Watt (30 dBm)
	√	Client device	250mW (24 dBm)
U-NII-2A	---		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C	---		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-3	---		1 Watt (30 dBm)

*B is the 26 dB emission bandwidth in megahertz

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

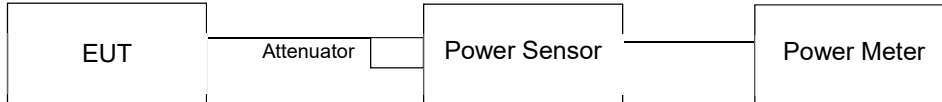
Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

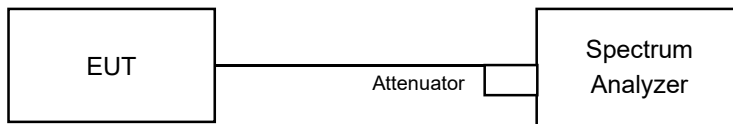
4.4.2 Test Setup

FOR POWER OUTPUT MEASUREMENT

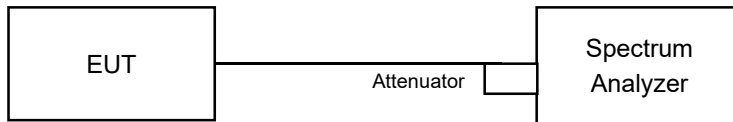
◆ Power Meter Measurement



◆ Spectrum Measurement



FOR 26dB OCCUPIED BANDWIDTH



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedure

For Average Power Measurement

For 802.11a, 802.11n (HT20), 802.11n (HT40)

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst and set the detector to AVERAGE. Duty factor is not added to measured value.

For 802.11ac (VHT80)

- 1) Set span to encompass the entire 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- 2) Set sweep trigger to "free run".
- 3) Set RBW = 1 MHz.
- 4) Set VBW ≥ 3 MHz
- 5) Number of points in sweep ≥ 2 Span / RBW.
- 6) Sweep time ≤ (number of points in sweep) * T
- 7) Using emission bandwidth to determine the frequency span for integration the channel bandwidth.
- 8) Detector = RMS.
- 9) Trace mode = max hold.
- 10) Allow max hold to run for at least 60 seconds, or longer as needed to allow the trace to stabilize.

◆ Power Meter Measurement

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

◆ Spectrum Measurement

Follow FCC KDB 789033 UNII test procedure:

Method SA-1

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1MHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Number of points in sweep $\geq 2 \text{ Span} / \text{RBW}$.
5. Sweep time = auto.
6. Set trigger to free run (duty cycle ≥ 98 percent)
7. Detector = RMS.
8. Trace average at least 100 traces in power averaging mode
9. Compute power by integrating the spectrum across the 26 dB EBW of the signal.

Follow FCC KDB 789033 UNII test procedure:

Method SA-2

1. Set span to encompass the emission bandwidth (EBW) of the signal.
2. Set RBW = 1MHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Number of points in sweep $\geq 2 \text{ Span} / \text{RBW}$.
5. Sweep time = auto.
6. Detector = RMS.
7. Trace average at least 100 traces in power averaging mode
8. Compute power by integrating the spectrum across the 26 dB EBW of the signal.
9. Duty factor need added to measured value (duty cycle < 98 percent).

FOR 26dB OCCUPIED BANDWIDTH

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW $>$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.4.7 Test Results

Output Power measurement result for UNII-1 Band

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)		Limit (dBm)	Result
				Chain 0	Chain 1		
Output Power	802.11a	5180	Low	6.52	5.82	24	Pass
		5200	Mid	6.62	5.96	24	Pass
		5240	High	6.79	6.09	24	Pass
	802.11n-HT20	5180	Low	6.5	6.4	24	Pass
		5200	Mid	6.48	6.6	24	Pass
		5240	High	6.62	6.81	24	Pass

Output Power measurement result for UNII-3 Band

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)		Limit (dBm)	Result
				Chain 0	Chain 1		
Output Power	802.11a	5745	Low	4.16	4.57	30	Pass
		5785	Mid	4.22	3.66	30	Pass
		5825	High	4.72	5.22	30	Pass
	802.11n-HT20	5745	Low	4.57	4.57	30	Pass
		5785	Mid	4.36	4.41	30	Pass
		5825	High	4.52	5.01	30	Pass

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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