



FCC RF Test Report

APPLICANT : Quectel Wireless Solutions Co., Ltd.
EQUIPMENT : Smart Module
BRAND NAME : Quectel
MODEL NAME : SC668S-NA
FCC ID : XMR2022SC668SNA
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure
TEST DATE(S) : Apr. 14, 2023

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia



Approved by: Jason Jia

Sportun International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China



TABLE OF CONTENTS

REVISION HISTORY.....	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION.....	5
1.1 Applicant	5
1.2 Manufacturer.....	5
1.3 Product Feature of Equipment Under Test.....	5
1.4 Modification of EUT	5
1.5 Testing Location	6
1.6 Test Software.....	6
1.7 Applicable Standards.....	6
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST.....	7
2.1 Test Mode.....	7
2.2 Connection Diagram of Test System.....	7
2.3 EUT Operation Test Setup	7
2.4 Unwanted Emissions Measurement.....	8
3 LIST OF MEASURING EQUIPMENT	14
4 UNCERTAINTY OF EVALUATION.....	15
APPENDIX A. RADIATED SPURIOUS EMISSION	
APPENDIX B. DUTY CYCLE PLOTS	
APPENDIX C. SETUP PHOTOGRAPHS	



REVISION HISTORY



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
2.4	15.407(b)	Unwanted Emissions	15.407(b) & 15.209(a)	Pass	Under limit 6.08 dB at 5350.01 MHz

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Applicant

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233,China

1.2 Manufacturer

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233,China

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Smart Module
Brand Name	Quectel
Model Name	SC668S-NA
FCC ID	XMR2022SC668SNA
SN	Radiation: D1C22LT14000064
HW Version	R1.0
SW Version	SC668SNANAR02A02
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Modification of EUT

No modifications are made to the EUT during all test items.



1.5 Testing Location

Sportun International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sportun International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sportun Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH04-KS	CN1257	314309

1.6 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH04-KS	AUDIX	E3	6.2009-8-24a1

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

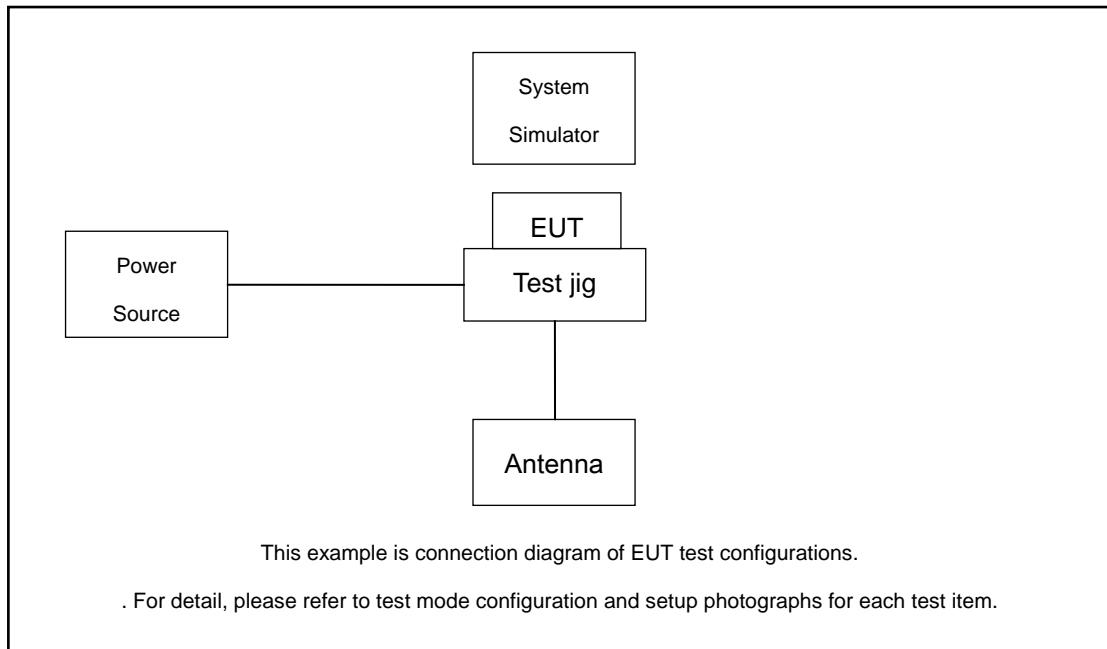
The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

2.1 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

Simultaneous transmission
802.11ac VHT80 CH58 (5290MHz)+ LTE Band 14 (BW=5M)

2.2 Connection Diagram of Test System



2.3 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit.



2.4 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

2.4.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5725 MHz band: all emissions outside of the 5470-5725 MHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency (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



EIRP (dBm)	Field Strength at 3m (dB μ V/m)
- 27	68.3

Note: The following formula is used to convert the EIRP to field strength.

$$\text{EIRP} = E_{\text{Meas}} + 20\log(d_{\text{Meas}}) - 104.7$$

where

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dB μ V/m

d_{Meas} is the measurement distance, in m

(3) ANSI C63.10-2013 clause 12.7.3 note 97

As specified by regulatory requirements, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit. However, an out-of-band emission that complies with both the average and peak general regulatory limits is not required to satisfy the peak emission limit.

2.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.



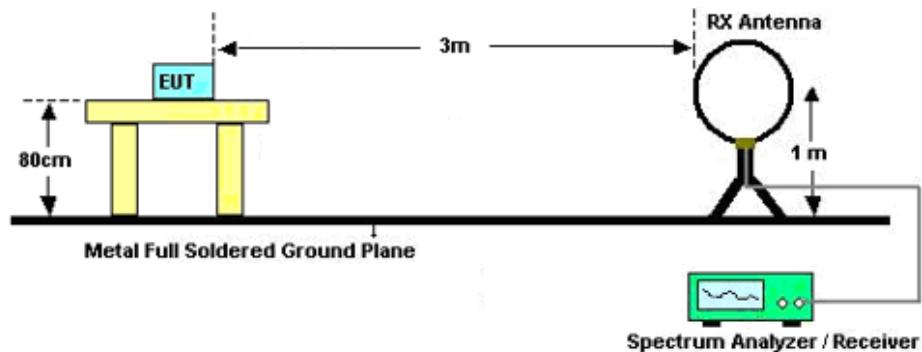
2.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW \geq 3 MHz
 - Detector = Peak
 - Sweep time = auto
 - Trace mode = max hold
 - (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
 - RBW = 1 MHz
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW \geq 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

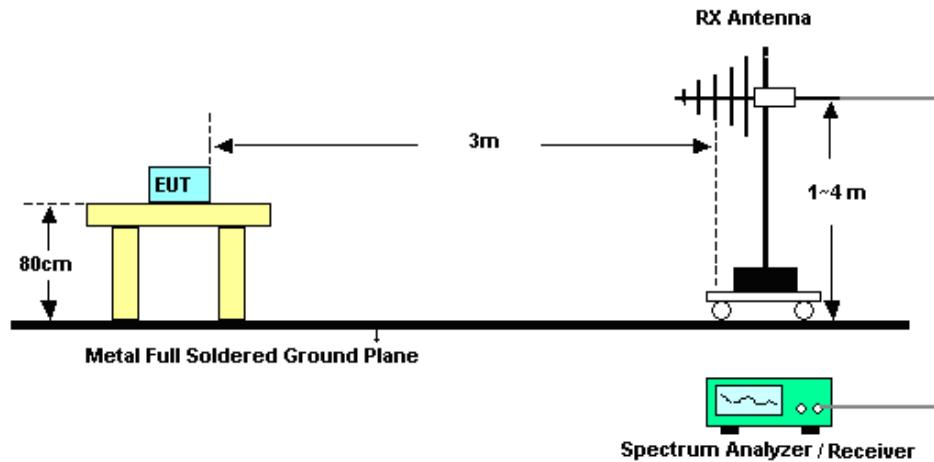


2.4.4 Test Setup

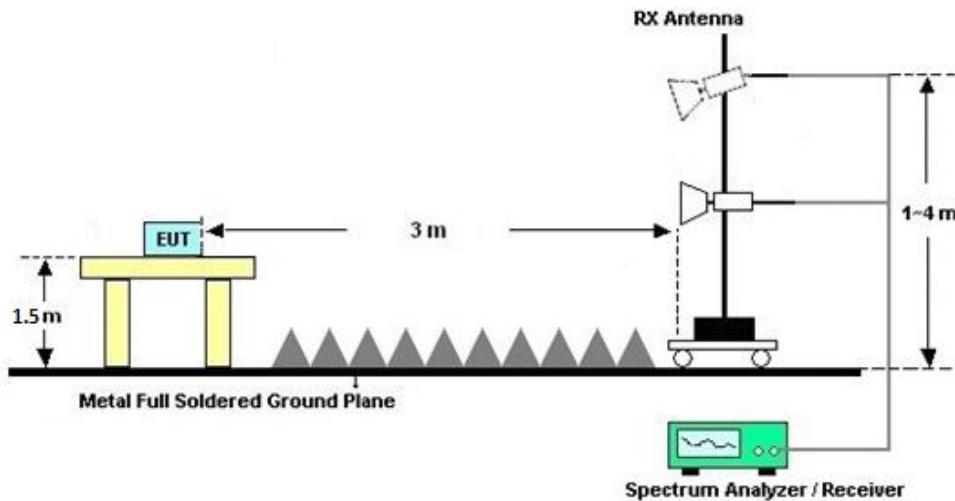
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



2.4.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

2.4.7 Duty Cycle

Please refer to Appendix B.

2.4.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix A.



3 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz; Max 30dBm	Oct. 13, 2022	Apr. 14, 2023	Oct. 12, 2023	Radiation (03CH04-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY57471079	10Hz~44G, MAX 30dB	Oct. 12, 2022	Apr. 14, 2023	May 23, 2023	Radiation (03CH04-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 16, 2022	Apr. 14, 2023	Oct. 15, 2023	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz~1GHz	May 24, 2022	Apr. 14, 2023	May 23, 2023	Radiation (03CH04-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1284	1GHz~18GHz	Oct. 16, 2022	Apr. 14, 2023	Oct. 15, 2023	Radiation (03CH04-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 08, 2023	Apr. 14, 2023	Jan. 07, 2024	Radiation (03CH04-KS)
Amplifier	SONOMA	310N	187289	9KHz~1GHz	May 24, 2022	Apr. 14, 2023	May 23, 2023	Radiation (03CH04-KS)
Amplifier	MITEQ	EM18G40GG A	060728	18~40GHz	Jan. 05, 2023	Apr. 14, 2023	Jan. 04, 2024	Radiation (03CH04-KS)
high gain Amplifier	EM	EM01G18GA	060840	1Ghz-18Ghz	Oct. 12, 2022	Apr. 14, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
Amplifier	Agilent	8449B	3008A02370	1Ghz-18Ghz	Oct. 12, 2022	Apr. 14, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Apr. 14, 2023	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Apr. 14, 2023	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Apr. 14, 2023	NCR	Radiation (03CH04-KS)

NCR: No Calibration Required



4 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB
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----- THE END -----



Appendix A. Radiated Spurious Emission Test Data

Test Engineer :	Carry Xu	Relative Humidity :	41 ~ 42 %
		Temperature :	22 ~ 23 °C

Radiated Spurious Emission Test Modes

Mode	Band	Band (GHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 1	U-NII-2A	5.25-5.35	4+5	802.11ac VHT80	58	5290	MCS0	-	-
LTE Band 14 BW=5M									

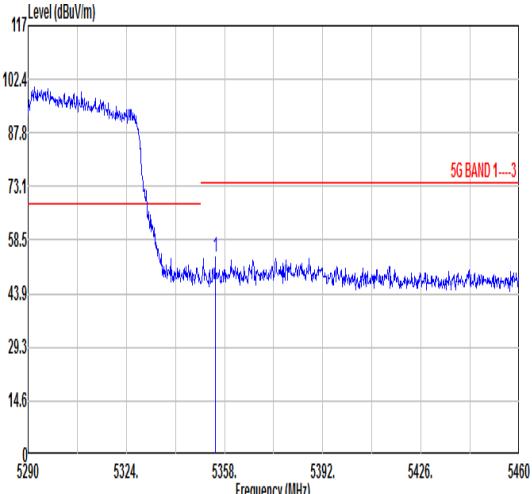
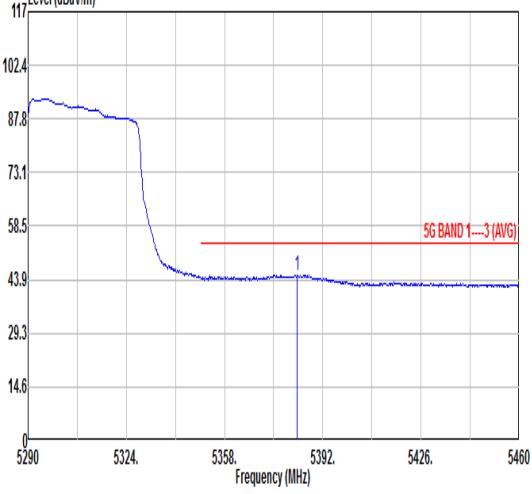
Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	802.11ac VHT80	58	5350.01	47.92	54.00	-6.08	V	AVERAGE	Pass	Band Edge
	802.11ac VHT80	58	10580.00	44.47	68.30	-23.83	V	PEAK	Pass	Harmonic

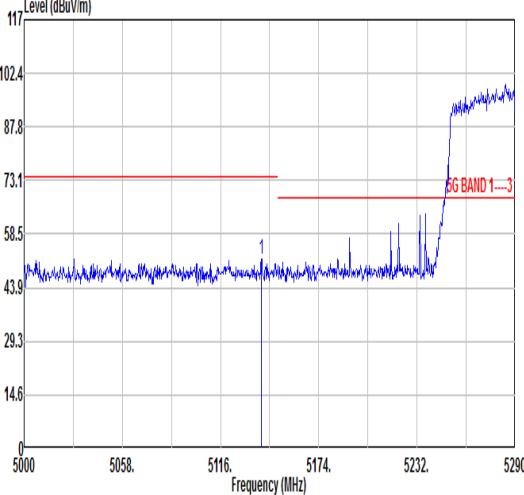
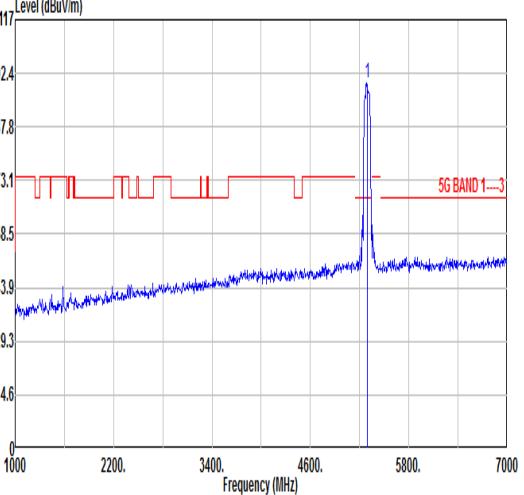
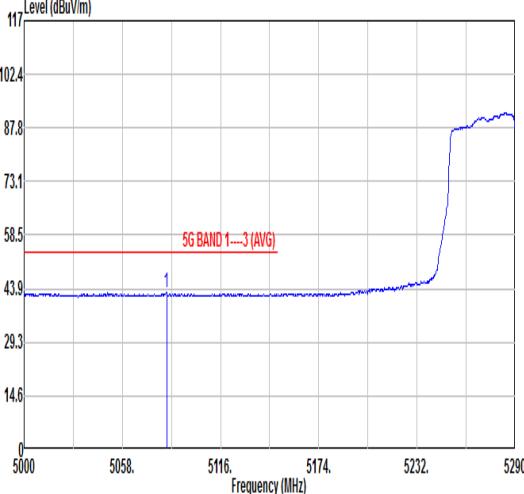
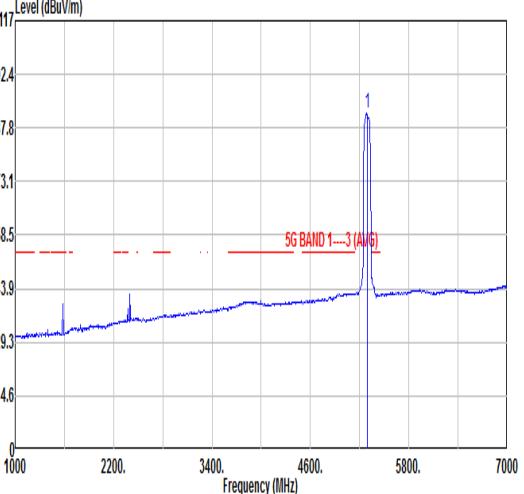


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Pol.	Horizontal	Fundamental																																																																																																				
Peak	<table border="1"> <thead> <tr> <th colspan="10">Limit Read Ant Cable Preamp Aux APos TPos</th> </tr> <tr> <th>Freq</th> <th>Level</th> <th>Line Margin</th> <th>Read</th> <th>Ant</th> <th>Cable</th> <th>Preamp</th> <th>Aux</th> <th>APos</th> <th>TPos</th> </tr> <tr> <th>MHz</th> <th>dBuV/m</th> <th>dBuV/m</th> <th>dB</th> <th>dBuV</th> <th>dB/m</th> <th>dB</th> <th>dB</th> <th>cm</th> <th>deg</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>5101.21</td> <td>51.56</td> <td>74.00</td> <td>-22.44</td> <td>42.75</td> <td>34.98</td> <td>10.63</td> <td>36.80</td> <td>0.00</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>397</td> <td>271 PEAK</td> </tr> </tbody> </table>	Limit Read Ant Cable Preamp Aux APos TPos										Freq	Level	Line Margin	Read	Ant	Cable	Preamp	Aux	APos	TPos	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	cm	deg	1	5101.21	51.56	74.00	-22.44	42.75	34.98	10.63	36.80	0.00									397	271 PEAK	<table border="1"> <thead> <tr> <th colspan="10">Limit Read Ant Cable Preamp Aux APos TPos</th> </tr> <tr> <th>Freq</th> <th>Level</th> <th>Line Margin</th> <th>Read</th> <th>Ant</th> <th>Cable</th> <th>Preamp</th> <th>Aux</th> <th>APos</th> <th>TPos</th> </tr> <tr> <th>MHz</th> <th>dBuV/m</th> <th>dBuV/m</th> <th>dB</th> <th>dBuV</th> <th>dB/m</th> <th>dB</th> <th>dB</th> <th>cm</th> <th>deg</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>5290.00</td> <td>100.67</td> <td>-----</td> <td>-----</td> <td>91.40</td> <td>35.18</td> <td>10.90</td> <td>36.81</td> <td>0.00</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>397</td> <td>271 PEAK</td> </tr> </tbody> </table>	Limit Read Ant Cable Preamp Aux APos TPos										Freq	Level	Line Margin	Read	Ant	Cable	Preamp	Aux	APos	TPos	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	cm	deg	1	5290.00	100.67	-----	-----	91.40	35.18	10.90	36.81	0.00									397	271 PEAK
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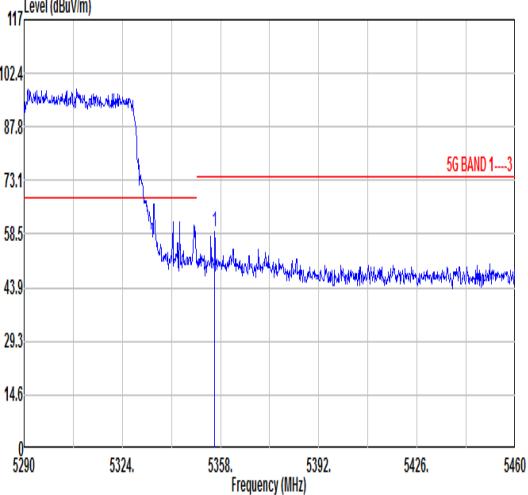
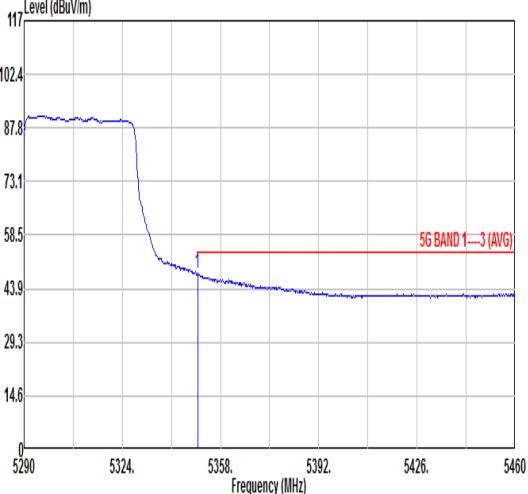


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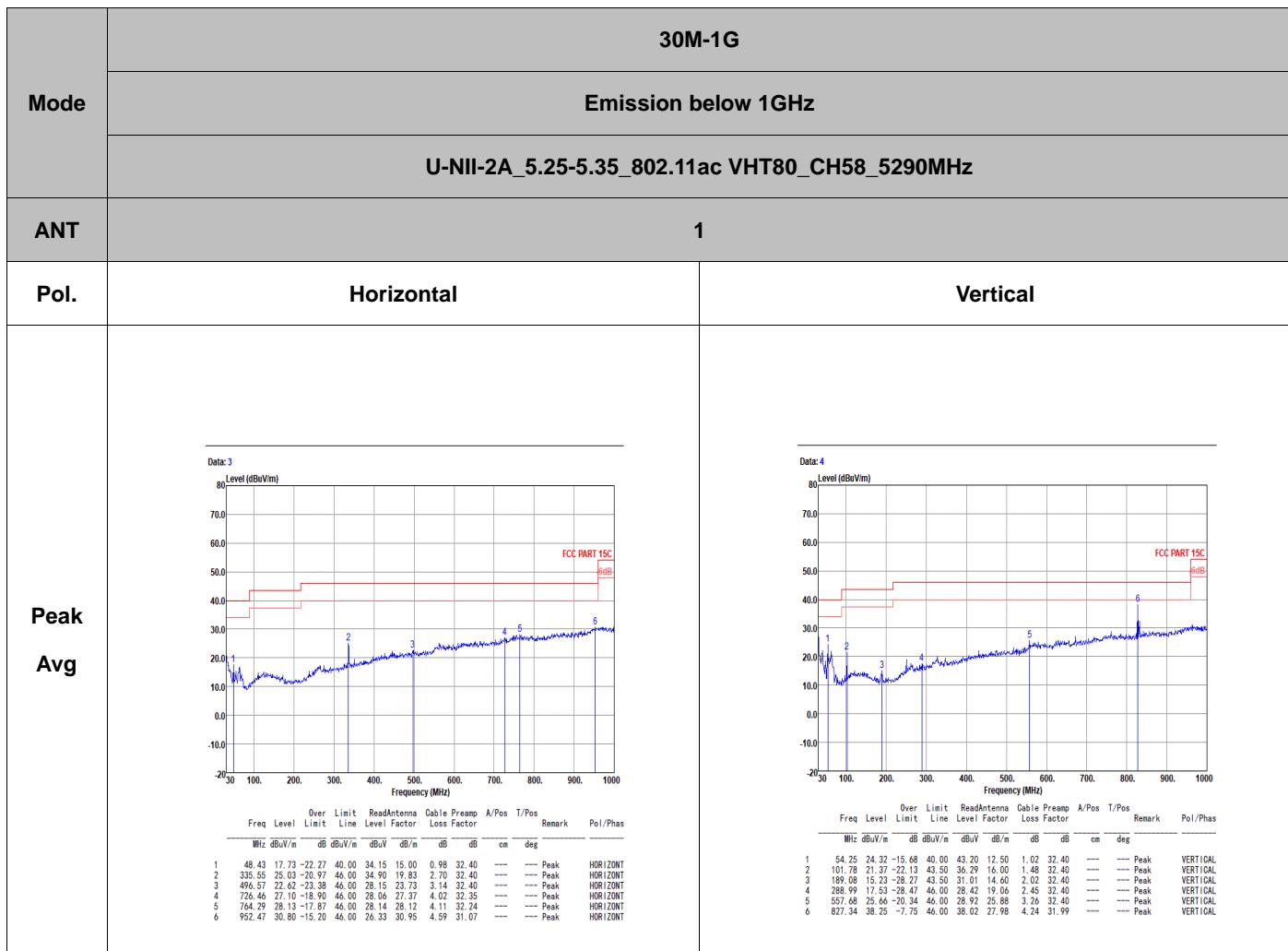
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Appendix B. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11ac VHT80	92.73	0.462	2.163	2.2khz

802.11ac VHT80

