FCC Test Report

Equipment	:	**802.11 3T3R a/n/ac module**
Brand Name	:	**Senao**
Model No.	:	**PCE4553AH**
FCC ID	:	**U2M-PCE4553AH**
Standard	:	**47 CFR FCC Part 15.407**
Operating Band	:	**5150 MHz – 5250 MHz**
FCC Classification	:	**NII**
Applicant	:	**Senao Networks, Inc.** **3F, No. 529, Chung Cheng Rd., Hsintien,Taipei,Taiwan**

The product sample received on Nov. 05, 2013 and completely tested on Feb. 20, 2014. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2009 and shown 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., the test report shall not be reproduced except in full.

Reviewed by:

James Fan / Assistant Manager

Testing Laboratory
1190

Table of Contents

Summary of Test Result

Conformance Test Specifications					
Report Clause	**Ref. Std. Clause**	**Description**	**Measured**	**Limit**	**Result**
1.1.2	15.203	Antenna Requirement	Antenna connector mechanism complied	FCC 15.203	Complied
3.1	15.207	AC Power-line Conducted Emissions	[dBuV]: 0.152MHz 44.85 (Margin 11.02dB) - AV 52.36 (Margin 13.51dB) - QP	FCC 15.207	Complied
3.2	15.407(a)	Emission Bandwidth	Bandwidth [MHz] 20M:24.64 / 40M:46.96 / 80M: 88.58	Information only	Complied
3.3	15.407(a)	RF Output Power (Maximum Conducted Output Power)	Power [dBm] 5150-5250MHz:16.53	Power [dBm] 5150-5250MHz:17	Complied
3.4	15.407(a)	Peak Power Spectral Density	PPSD [dBm/MHz] 5150-5250MHz:1.15	PPSD [dBm/MHz] 5150-5250MHz:4	Complied
3.5	15.407(a)	Peak Excursion	10.42 dB	13 dB	Complied
3.6	15.407(b)	Transmitter Unwanted Emissions and Band Edge	Restricted Bands [dBuV/m at 3m]:898.25MHz 42.83 (Margin 3.17dB) - PK	Non-Restricted Bands: ≤ -27dBm (68.3dBuV/m@3m) Restricted Bands: FCC 15.209	Complied
3.7	15.407(g)	Frequency Stability	3.4596 ppm	Signal shall remain in-band	Complied

Revision History

Report No.	Version	Description	Issued Date
FR3N0541AN	Rev. 01	Initial issue of report	Mar. 28, 2014

1 General Description

1.1 Information

1.1.1 RF General Information

RF General Information						
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N_{TX})	RF Output Power (dBm)	Co-location
5150-5250	a	5180-5240	36-48 [4]	3	13.86	N/A
5150-5250	n(HT20)	5180-5240	36-48 [4]	3	13.43	N/A
5150-5250	n(HT40)	5190-5230	38-46 [2]	3	16.43	N/A
5150-5250	ac(VHT20)	5180-5240	36-48 [4]	3	13.50	N/A
5150-5250	ac(VHT40)	5190-5230	38-46 [2]	3	16.53	N/A
5150-5250	ac(VHT80)	5210	42 [1]	3	16.12	N/A

Note 1: RF output power specifies that Maximum Conducted Output Power.
Note 2: 802.11a/n uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
Note 3: 802.11ac uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation.
Note 4: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (i.e., EUT has simultaneously co-transmitting that operating 2.4GHz and 5GHz.)

1.1.2 Antenna Information

Antenna Category		
☐	Equipment placed on the market without antennas	
☐	Integral antenna (antenna permanently attached)	
	☐	Temporary RF connector provided
	☐	No temporary RF connector provided Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.
☒	External antenna (dedicated antennas)	
	☐	Single power level with corresponding antenna(s).
	☐	Multiple power level and corresponding antenna(s).
	☒	RF connector provided
		☒ Unique antenna connector. (e.g., MMCX, U.FL, IPX, and RP-SMA, RP-N type…)
		☐ Standard antenna connector. (e.g., SMA, N, BNC, and TNC type…)

Antenna General Information					
No.	**Ant. Cat.**	**Ant. Model**	**Ant. Type**	**Connector**	**Gain (dBi)**
1	External	Ant 2 (1002299)	PCB Dipole	UFL	3.875
2	External	Ant 4 (1002300)	PCB Dipole	UFL	2.6248
3	External	Ant 6 (1002301)	PCB Dipole	UFL	4.1618

1.1.3 Type of EUT

Identify EUT	
EUT Serial Number	N/A
Presentation of Equipment	☐ Production ; ☒ Pre-Production ; ☐ Prototype
Type of EUT	
☐	Stand-alone
☐	Combined (EUT where the radio part is fully integrated within another device) Combined Equipment - Brand Name / Model No.: …
☒	Plug-in radio
☐	Other:

1.1.4 Test Signal Duty Cycle

Operated Mode for Worst Duty Cycle	
☐ Operated normally mode for worst duty cycle	
☒ Operated test mode for worst duty cycle	
Test Signal Duty Cycle (x)	**Power Duty Factor [dB] – (10 log 1/x)**
☒ 100.00% - IEEE 802.11a	0
☒ 100.00% - IEEE 802.11ac (VHT20)	0
☒ 100.00% - IEEE 802.11ac (VHT40)	0
☒ 100.00% - IEEE 802.11ac (VHT80)	0

1.1.5 EUT Operational Condition

Supply Voltage	☐ AC mains	☒ DC	
Type of DC Source	☐ Internal DC supply	☐ External DC adapter	☒ Host
Test Voltage (Host)	☒ Vnom (110 Vac)	☒ Vmax (126.5 Vac)	☒ Vmin (93.5 Vac)
Test Climatic	☒ Tnom (20°C)	☒ Tmax (55°C)	☒ Tmin (-30°C)

1.2 Support Equipment

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**Serial No.**
1	Notebook	DELL	E6430	DoC
2	Power Supply	GW INSTEK	GPC-6030D	---
3	Extender card	NA	adapter	NA

1.3 Testing Applied Standards

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

- 47 CFR FCC Part 15
- ANSI C63.10-2009
- FCC KDB 789033 v01r03
- FCC KDB 662911 v02r01
- FCC KDB 412172 v01

1.4 Testing Location Information

Testing Location					
☒	Sporton Lab	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-318-0055			
☒	ICC Lab	ADD : No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsein 333, Taiwan (R.O.C.) TEL : 886-3-271-8666 FAX : 886-3-318-0155			
Test Condition		**Test Site No.**	**Test Engineer**	**Test Environment**	**Test Date**
RF Conducted		TH01-HY	Mark Liao	22°C / 62%	Feb. 19, 2014
*AC Conduction		CO01-WS	Skys Huang	15°C / 70%	Feb. 20, 2014
*Radiated Emission		03CH01-WS	Aska Huang	16-19°C / 62-64%	Feb. 07 ~ Feb. 10, 2014
Test site registered number [657002] with FCC. Test site registered number [10807A-1] with IC.					

Note: * Sporton Lab subcontracts this test item to ICC lab (TAF: 2732).
ICC lab is a TAF accreditation test firm and also is an approved provider of Sporton lab.

1.5 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty			
Test Item		**Uncertainty**	**Limit**
AC power-line conducted emissions		±2.26 dB	N/A
Emission bandwidth		±1.42 %	N/A
RF output power, conducted		±0.63 dB	N/A
Power density, conducted		±0.81 dB	N/A
All emissions, radiated	30 – 1000 MHz	±3.9 dB	N/A
	Above 1GHz	±4.2 dB	N/A
Temperature		±0.8 °C	N/A
Humidity		±3 %	N/A
DC and low frequency voltages		±3 %	N/A
Time		±1.42 %	N/A
Duty Cycle		±1.42 %	N/A

2 Test Configuration of EUT

2.1 The Worst Case Modulation Configuration

Worst Modulation Used for Conformance Testing (5150-5250MHz)			
Modulation Mode	**Transmit Chains (N_{TX})**	**Data Rate / MCS**	**Worst Data Rate / MCS**
11a	3	6-54Mbps	6 Mbps
HT20	3	M0-23	M0
HT40	3	M0-23	M0
VHT20	3	M0-8	M0
VHT40	3	M0-9	M0
VHT80	3	M0-9	M0

2.2 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter (5150-5250 MHz band)							
Test Software Version	art2, Version: 4_9_575_5_CS_U3						
Modulation Mode	**N_{TX}**	**Test Frequency (MHz)**					
		NCB: 20MHz			**NCB: 40MHz**		**NCB: 80MHz**
		5180	**5200**	**5240**	**5190**	**5230**	**5210**
11a,6-54Mbps	3	8.5	8.5	9.5	---	---	---
HT20,M0-23	3	8.5	8.5	9.5	---	---	---
HT40,M0-23	3	---	---	---	11.5	11.5	---
VHT20,M0-8	3	8.5	8.5	9.5	---	---	---
VHT40,M0-9	3	---	---	---	11.5	11.5	---
VHT80,M0-9	3	---	---	---	---	---	11.5

2.3 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
Operating Mode	Operating Mode Description
1	DC Power & Radio link (WLAN)

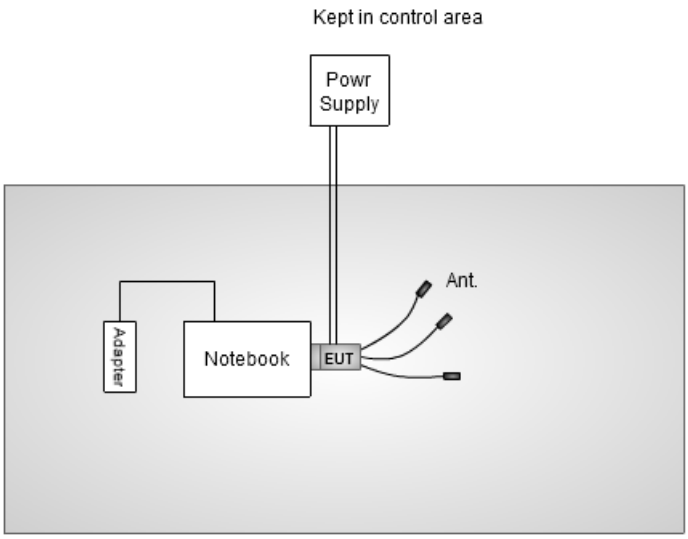
The Worst Case Mode for Following Conformance Tests	
Tests Item	RF Output Power
Test Condition	Conducted measurement at transmit chains
Modulation Mode	11a, HT20, HT40, VHT20, VHT40, VHT80
Operating Mode	Operating Mode Description
1	DC Power & Radio link (WLAN)

The Worst Case Mode for Following Conformance Tests	
Tests Item	Peak Power Spectral Density, Emission Bandwidth, Peak Excursion
Test Condition	Conducted measurement at transmit chains
Modulation Mode	11a, VHT20, VHT40, VHT80
Operating Mode	Operating Mode Description
1	DC Power & Radio link (WLAN)
Note: 802.11n/ac modulation modes consist of HT20, HT40, VHT20, VHT40 and VHT80. After pretested, VHT20, VHT40, and VHT80 were the worst cases and were selected for final test.	

The Worst Case Mode for Following Conformance Tests			
Tests Item	Transmitter Radiated Unwanted Emissions Transmitter Radiated Bandedge Emissions		
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.		
User Position	☐ EUT will be placed in fixed position.		
	☒ EUT will be placed in mobile position and operating multiple positions. EUT shall be performed two orthogonal planes. The worst planes is X.		
	☐ EUT will be operating multiple positions. The antenna of EUT was pre-tested on the positioned of each 3 axis. The worst plane is X.		
Operating Mode	☒ 1. DC Power & Radio link (WLAN)		
Modulation Mode	11a, VHT20, VHT40, VHT80		
Orthogonal Planes of EUT	**X Plane**	**Y Plane**	**Z Plane**
			
Note: 802.11n/ac modulation modes consist of HT20, HT40, VHT20, VHT40 and VHT80. After pretested, VHT20, VHT40, and VHT80 were the worst cases and were selected for final test.			

2.4 Test Setup Diagram

Test Setup Diagram



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	**Quasi-Peak**	**Average**
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50
Note 1: * Decreases with the logarithm of the frequency.		

3.1.2 Measuring Instruments

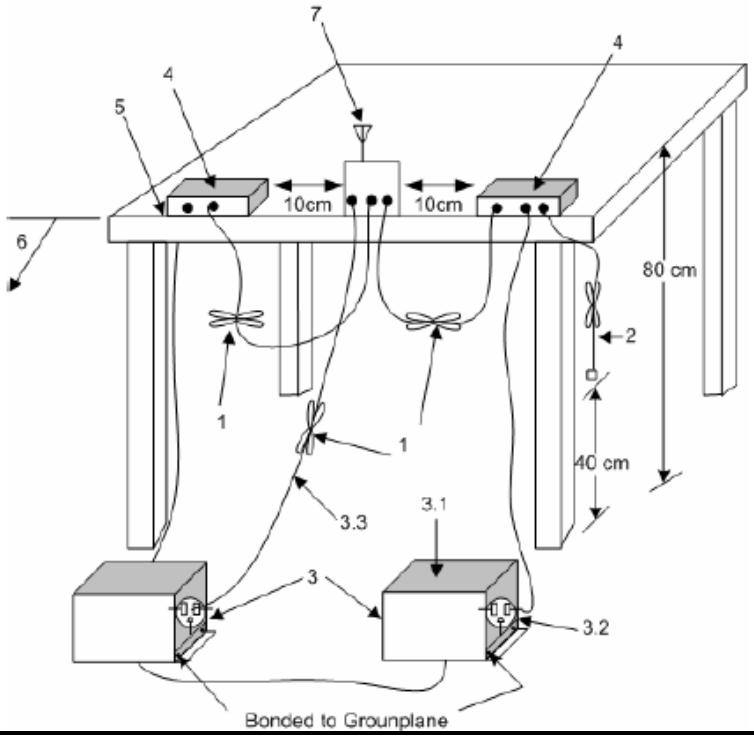
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method
☒ Refer as ANSI C63.10-2009, clause 6.2 for AC power-line conducted emissions.

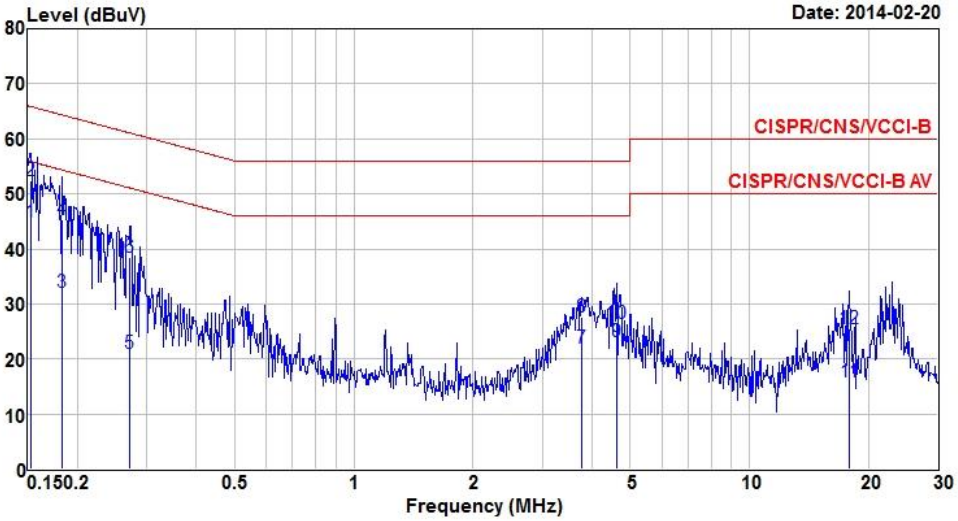
3.1.4 Test Setup

AC Power-line Conducted Emissions



3.1.5 Test Result of AC Power-line Conducted Emissions

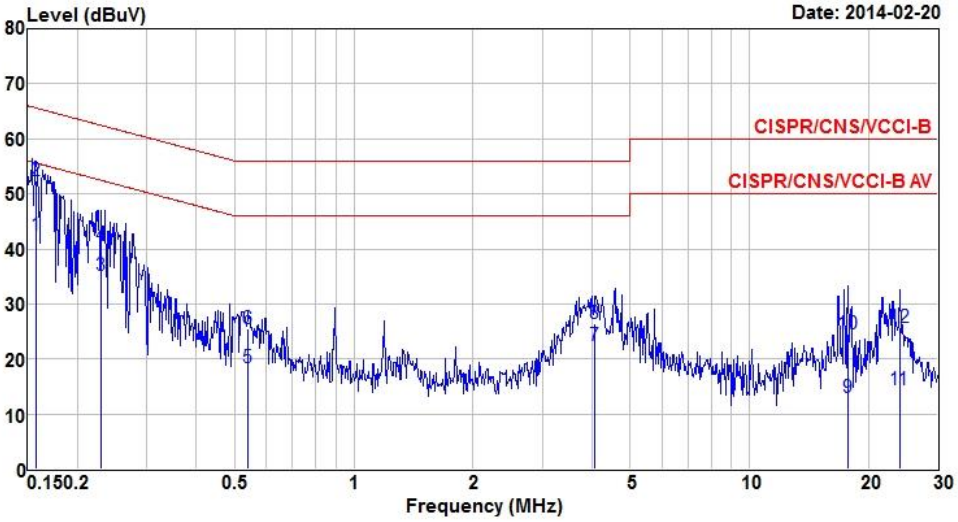
AC Power-line Conducted Emissions Result			
Operating Mode	1	**Power Phase**	Neutral
Operating Function	DC Power & Radio link (WLAN)		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1*	0.152	44.85	55.87	-11.02	44.30	0.48	0.07	Average
2	0.152	52.36	65.87	-13.51	51.81	0.48	0.07	QP
3	0.183	32.08	54.33	-22.25	31.45	0.48	0.15	Average
4	0.183	45.42	64.33	-18.91	44.79	0.48	0.15	QP
5	0.272	21.11	51.07	-29.96	20.51	0.48	0.12	Average
6	0.272	38.56	61.07	-22.51	37.96	0.48	0.12	QP
7	3.759	21.98	46.00	-24.02	21.23	0.52	0.23	Average
8	3.759	27.55	56.00	-28.45	26.80	0.52	0.23	QP
9	4.622	23.05	46.00	-22.95	22.30	0.53	0.22	Average
10	4.622	26.42	56.00	-29.58	25.67	0.53	0.22	QP
11	17.944	15.89	50.00	-34.11	15.16	0.56	0.17	Average
12	17.944	25.51	60.00	-34.49	24.78	0.56	0.17	QP

Note 1: “>20dB” means emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found emissions (No emissions were detected.)

AC Power-line Conducted Emissions Result			
Operating Mode	1	**Power Phase**	Line
Operating Function	DC Power & Radio link (WLAN)		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1*	0.157	42.59	55.60	-13.01	42.11	0.40	0.08	Average
2	0.157	52.29	65.60	-13.31	51.81	0.40	0.08	QP
3	0.230	35.15	52.44	-17.29	34.61	0.39	0.15	Average
4	0.230	40.56	62.44	-21.88	40.02	0.39	0.15	QP
5	0.541	18.49	46.00	-27.51	18.04	0.40	0.05	Average
6	0.541	25.47	56.00	-30.53	25.02	0.40	0.05	QP
7	4.070	22.39	46.00	-23.61	21.69	0.46	0.24	Average
8	4.070	26.50	56.00	-29.50	25.80	0.46	0.24	QP
9	17.755	12.89	50.00	-37.11	12.18	0.55	0.16	Average
10	17.755	24.65	60.00	-35.35	23.94	0.55	0.16	QP
11	24.015	14.41	50.00	-35.59	13.42	0.55	0.44	Average
12	24.015	25.73	60.00	-34.27	24.74	0.55	0.44	QP

Note 1: “>20dB” means emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found emissions (No emissions were detected.)

3.2 Emission Bandwidth

3.2.1 Emission Bandwidth (EBW) Limit

Emission Bandwidth (EBW) Limit	
UNII Devices	
☒	For the 5.15-5.25 GHz band, the maximum conducted output power shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz.
☐	For the 5.25-5.35 GHz band, the maximum conducted output power shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz.
☐	For the 5.47-5.725 GHz band, the maximum conducted output power shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz.
☐	For the 5.725-5.825 GHz band, the maximum conducted output power shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz
LE-LAN Devices	
☒	For the band 5.15-5.25 GHz, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.
☐	For the 5.25-5.35 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz
☐	For the 5.47-5.6 GHz band and 5.65-5.725 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz
☐	For the 5.725-5.825 GHz band, the maximum e.i.r.p. shall not exceed 4.0 W or 23 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

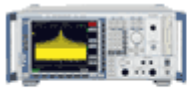
3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method			
☒	For the emission bandwidth shall be measured using one of the options below:		
	☒	Refer as FCC KDB 789033 v01r03, clause C for EBW and clause D for OBW measurement.	
	☐	Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.	
	☒	Refer as IC RSS-Gen, clause 4.6 for bandwidth testing.	
☒	For conducted measurement.		
	☐	The EUT supports single transmit chain and measurements performed on this transmit chain.	
	☐	The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.	
	☒	The EUT supports multiple transmit chains using options given below:	
		☐	Option 1: Multiple transmit chains measurements need to be performed on one of the active transmit chains (antenna outputs). All measurement had be performed on transmit chains 1.
		☒	Option 2: Multiple transmit chains measurements need to be performed on each transmit chains individually (antenna outputs). All measurement had be performed on all transmit chains.

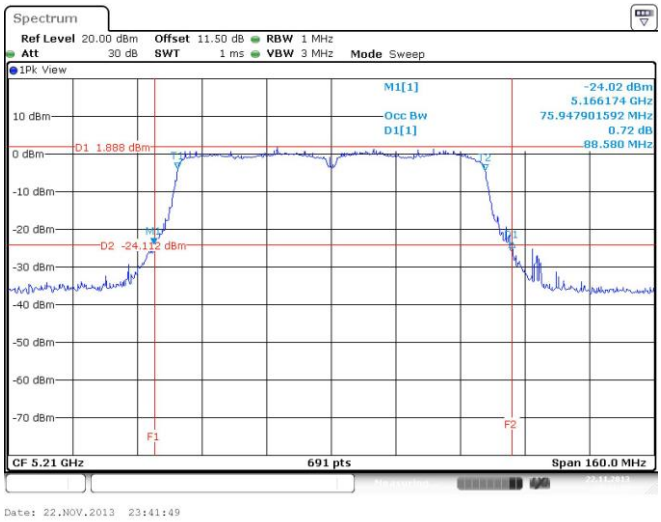
3.2.4 Test Setup

Emission Bandwidth
 Spectrum Analyzer — EUT

3.2.5 Test Result of Emission Bandwidth

UNII Emission Bandwidth Result (5150-5250MHz band)												
Condition			Emission Bandwidth (MHz)									
Modulation Mode	N_{TX}	Freq. (MHz)	99% Bandwidth				26dB Bandwidth				Power Limit	
			Chain-Port 1	Chain-Port 2	Chain-Port 3	Chain-Port 4	Chain-Port 1	Chain-Port 2	Chain-Port 3	Chain-Port 4	99% BW	26dB BW
11a	3	5180	16.93	16.82	16.79	---	22.78	23.71	22.72	---	16.25	17.00
11a	3	5200	17.00	16.82	16.79	---	23.13	22.96	22.72	---	16.25	17.00
11a	3	5240	17.04	16.86	16.82	---	23.13	23.36	22.90	---	16.26	17.00
VHT20	3	5180	18.16	17.98	18.05	---	24.06	23.71	23.42	---	16.55	17.00
VHT20	3	5200	18.09	18.05	18.02	---	24.35	23.88	23.77	---	16.56	17.00
VHT20	3	5240	18.13	18.13	17.98	---	24.64	23.42	23.59	---	16.55	17.00
VHT40	3	5190	37.25	36.99	37.12	---	46.96	46.73	46.49	---	17.00	17.00
VHT40	3	5230	37.19	37.12	37.12	---	46.96	45.10	46.49	---	17.00	17.00
VHT80	3	5210	75.77	76.14	75.77	---	88.35	88.58	87.19	---	17.00	17.00
Result			Complied									

Worst Emission Bandwidth Plots



3.3 RF Output Power

3.3.1 RF Output Power Limit

Maximum Conducted Output Power Limit	
UNII Devices	
☒	For the 5.15-5.25 GHz band, the maximum conducted output power (P_{Out}) shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. If G_{TX} > 6 dBi, then P_{Out} = 17 – (G_{TX} – 6).
☐	For the 5.25-5.35 GHz band, the maximum conducted output power (P_{Out}) shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6).
☐	For the 5.47-5.725 GHz band, the maximum conducted output power (P_{Out}) shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6).
☐	For the 5.725-5.825 GHz band:
	☐ Point-to-multipoint systems (P2M): the maximum conducted output power (P_{Out}) shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. If G_{TX} > 6 dBi, then P_{Out} = 30 – (G_{TX} – 6).
	☐ Point-to-point systems (P2P): the maximum conducted output power (P_{Out}) shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. If G_{TX} > 23 dBi, then P_{Out} = 30 – (G_{TX} – 23).
LE-LAN Devices	
☒	For the 5.15-5.25 GHz band, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.
☐	For the 5.25-5.35 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz
☐	For the 5.47-5.6 GHz band and 5.65-5.725 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz
☐	For the 5.725-5.825 GHz band, the maximum e.i.r.p. shall not exceed 4.0 W or 23 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.
	☐ Point-to-multipoint systems (P2M): the maximum e.i.r.p. shall not exceed 4.0 W or 23 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.
	☐ Point-to-point systems (P2P): the maximum e.i.r.p. shall not exceed 4.0 W or 23 + 10 log B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. If e.i.r.p. > 36 dBm, $G_{TX} \leq P_{Out}$
P_{Out} = maximum conducted output power in dBm, **G_{TX}** = the maximum transmitting antenna directional gain in dBi.	

3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.3.3 Test Procedures

Test Method	
☒	Maximum Conducted Output Power
☐	Refer as FCC KDB 789033 v01r03, clause E Method SA-1 (spectral trace averaging).
☐	Refer as FCC KDB 789033 v01r03, clause E Method SA-1 Alt. (RMS detection with slow sweep speed)
☐	Refer as FCC KDB 789033 v01r03, clause E Method SA-2 (spectral trace averaging).
☐	Refer as FCC KDB 789033 v01r03, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)
	Wideband RF power meter and average over on/off periods with duty factor
☒	Refer as FCC KDB 789033 v01r03, clause E Method PM-G (using a gated RF average power meter).
☒	For conducted measurement.
☐	The EUT supports single transmit chain and measurements performed on this transmit chain.
☐	The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.
☒	The EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
☒	If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \ldots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$

3.3.4 Test Setup

RF Output Power (Power Meter)

3.3.5 Directional Gain for Power Measurement

Directional Gain (DG) Result					
Transmit Chains No.		1	2	3	-
Maximum G_{ANT} (dBi)		3.875	2.6248	4.1618	-
Modulation Mode	**DG (dBi)**	**N_{TX}**	**N_{SS}**	**STBC**	**Array Gain (dB)**
11a,6-54Mbps	4.1618	3	1	-	-
HT20,M0-23	4.1618	3	1	-	-
HT40,M0-23	4.1618	3	1	-	-
VHT20,M0-9	4.1618	3	1	-	-
VHT40,M0-9	4.1618	3	1	-	-
VHT80,M0-9	4.1618	3	1	-	-

Note 1: For CDD transmissions, directional gain is calculated as power measurements:
Directional Gain (DG) = G_{ANT} + Array Gain, where Array Gain is as follows:
Array Gain = 0 dB (i.e., no array gain) for $N_{TX} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{TX};
Note 2: Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain

3.3.6 Test Result of Maximum Conducted Output Power

Maximum Conducted Output Power (5150-5250MHz band)										
Condition			RF Output Power (dBm)							
Modulation Mode	N_{TX}	Freq. (MHz)	Chain Port 1	Chain Port 2	Chain Port 3	Sum Chain	Power Limit	DG (dBi)	EIRP Power	EIRP Limit
11a	3	5180	8.81	8.26	10.01	13.86	17.00	4.1618	18.0218	23.00
11a	3	5200	8.69	8.03	9.88	13.71	17.00	4.1618	17.8718	23.00
11a	3	5240	8.86	8.06	9.91	13.78	17.00	4.1618	17.9418	23.00
HT20	3	5180	8.75	7.54	9.42	13.41	17.00	4.1618	17.5718	23.00
HT20	3	5200	8.16	7.78	9.56	13.34	17.00	4.1618	17.5018	23.00
HT20	3	5240	8.82	7.59	9.38	13.43	17.00	4.1618	17.5918	23.00
HT40	3	5190	11.33	10.82	12.63	16.43	17.00	4.1618	20.5918	23.00
HT40	3	5230	11.41	10.83	12.51	16.41	17.00	4.1618	20.5718	23.00
VHT20	3	5180	8.86	7.66	9.47	13.50	17.00	4.1618	17.6618	23.00
VHT20	3	5200	8.29	7.86	9.61	13.42	17.00	4.1618	17.5818	23.00
VHT20	3	5240	8.89	7.63	9.42	13.48	17.00	4.1618	17.6418	23.00
VHT40	3	5190	11.39	10.92	12.76	16.53	17.00	4.1618	20.6918	23.00
VHT40	3	5230	11.45	10.88	12.70	16.52	17.00	4.1618	20.6818	23.00
VHT80	3	5210	10.32	11.39	12.15	16.12	17.00	4.1618	20.2818	23.00
Result			Complied							

3.4 Peak Power Spectral Density

3.4.1 Peak Power Spectral Density Limit

Peak Power Spectral Density Limit	
UNII Devices	
☒	For the 5.15-5.25 GHz band, the peak power spectral density (PPSD) ≤ 4 dBm/MHz. If G_{TX} > 6 dBi, then PPSD = 4 – (G_{TX} – 6).
☐	For the 5.25-5.35 GHz band, the peak power spectral density (PPSD) ≤ 11 dBm/MHz. If G_{TX} > 6 dBi, then PPSD= 11 – (G_{TX} – 6).
☐	For the 5.47-5.725 GHz band, the peak power spectral density (PPSD) ≤ 11 dBm/MHz. If G_{TX} > 6 dBi, then PPSD= 11 – (G_{TX} – 6).
☐	For the 5.725-5.825 GHz band:
☐	Point-to-multipoint systems (P2M): the peak power spectral density (PPSD) ≤ 17 dBm/MHz. If G_{TX} > 6 dBi, then PPSD= 17 – (G_{TX} – 6).
☐	Point-to-point systems (P2P): the peak power spectral density (PPSD) ≤ 17 dBm/MHz. If G_{TX} > 23 dBi, then PPSD = 17 – (G_{TX} – 23).
LE-LAN Devices	
☒	For the 5.15-5.25 GHz band, the peak power spectral density (PPSD) ≤ 4 dBm/MHz and the e.i.r.p. peak power spectral density (PPSD) ≤ 10 dBm/MHz.
☐	For the 5.25-5.35 GHz band, the peak power spectral density (PPSD) ≤ 11 dBm/MHz and the e.i.r.p. peak power spectral density (PPSD) ≤ 17 dBm/MHz.
☐	For the 5.47-5.6 GHz band and 5.65-5.725 GHz band, the peak power spectral density (PPSD) ≤ 11 dBm/MHz and the e.i.r.p. peak power spectral density (PPSD) ≤ 17 dBm/MHz.
☐	For the 5.725-5.825 GHz band, the peak power spectral density (PPSD) ≤ 17 dBm/MHz and the e.i.r.p. peak power spectral density (PPSD) ≤ 23 dBm/MHz.
PPSD = peak power spectral density that he same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz **G_{TX}** = the maximum transmitting antenna directional gain in dBi.	

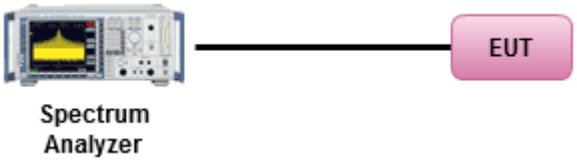
3.4.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.4.3 Test Procedures

Test Method		
☒	Peak power spectral density procedures that the same method as used to determine the conducted output power shall be used to determine the peak power spectral density and use the peak search function on the spectrum analyzer to find the peak of the spectrum. For the peak power spectral density shall be measured using below options:	
	☐	Refer as FCC KDB 789033 v01r03, F)5) power spectral density can be measured using resolution bandwidths < 1 MHz provided that the results are integrated over 1 MHz bandwidth
	☒	Refer as FCC KDB 789033 v01r03, clause E Method SA-1 (spectral trace averaging).
	☐	Refer as FCC KDB 789033 v01r03, clause E Method SA-1 Alt. (RMS detection with slow sweep speed)
	☐	Refer as FCC KDB 789033 v01r03, clause E Method SA-2 (spectral trace averaging).
	☐	Refer as FCC KDB 789033 v01r03, clause E Method SA-2 Alt. (RMS detection with slow sweep speed
☒	For conducted measurement.	
	☐	The EUT supports single transmit chain and measurements performed on this transmit chain.
	☐	The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.
	☒	The EUT supports multiple transmit chains using options given below:
		☒ Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
		☐ Option 2: Measure and add 10 log(N) dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with 10 log(N). Or each transmit chains shall be add 10 log(N) to compared with the limit.
	☒	If multiple transmit chains, EIRP PPSD calculation could be following as methods: $PPSD_{total} = PPSD_1 + PPSD_2 + \ldots + PPSD_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = PPSD_{total} + DG$
	☒	Each individually PPSD plots refer as test report clause 3.3.5 with each individually PPSD plots.

3.4.4 Test Setup

Power Spectral Density


3.4.5 Directional Gain for Power Spectral Density Measurement

Directional Gain (DG) Result					
Transmit Chains No.		1	2	3	-
Maximum G_{ANT} (dBi)		3.875	2.6248	4.1618	-
Modulation Mode	**DG (dBi)**	**N_{TX}**	**N_{SS}**	**STBC**	**Array Gain (dB)**
11a,6-54Mbps	8.35	3	1	-	-
VHT20,M0-9	8.35	3	1	-	-
VHT40,M0-9	8.35	3	1	-	-
VHT80,M0-9	8.35	3	1	-	-
Note 1: Directional gain = 10 log[($10^{3.875/20}$ + $10^{2.6248/20}$ + $10^{4.1618/20}$)^2 /3] = 8.35 dBi > 6dBi Power spectral density limit shall be reduced to 4 dBm – (8.35 dBi - 6 dBi) = 1.65 dBm					

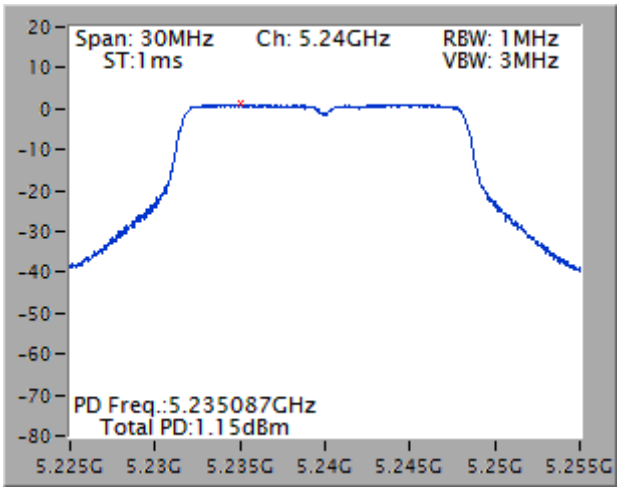
3.4.6 Test Result of Peak Power Spectral Density

Peak Power Spectral Density Result (5150-5250MHz band)							
Condition			Peak Power Spectral Density (dBm/MHz)				
Modulation Mode	N_{TX}	Freq. (MHz)	Sum Chain	PSD Limit	DG (dBi)	EIRP PSD	EIRP Limit
11a	3	5180	1.08	1.65	8.35	9.43	10.00
11a	3	5200	0.95	1.65	8.35	9.30	10.00
11a	3	5240	1.15	1.65	8.35	9.50	10.00
VHT20	3	5180	0.44	1.65	8.35	8.79	10.00
VHT20	3	5200	0.31	1.65	8.35	8.66	10.00
VHT20	3	5240	0.65	1.65	8.35	9.00	10.00
VHT40	3	5190	0.49	1.65	8.35	8.84	10.00
VHT40	3	5230	0.02	1.65	8.35	8.37	10.00
VHT80	3	5210	-3.44	1.65	8.35	4.91	10.00
Result			Complied				

Note 1: PSD = sum each transmit chains by bin-to-bin PSD

Note 2: Directional gain = 10 log[($10^{3.875/20}$ + $10^{2.6248/20}$ + $10^{4.1618/20}$)2 /3] = 8.35 dBi > 6dBi
Power spectral density limit shall be reduced to 4 dBm – (8.35 dBi - 6 dBi) = 1.65 dBm

Worst Power Spectral Density Plots



3.5 Peak Excursion

3.5.1 Peak Excursion Limit

Peak Excursion Limit
UNII Devices
☒ Peak excursion ≤ 13 dB. The ratio of the maximum of the peak-max-hold spectrum to the maximum of the average spectrum for continuous transmission does not exceed 13 dB. (Earlier procedures that required computing the ratio of the two spectra at each frequency across the emission bandwidth can lead to unintended failures at band edges and will no longer be required.)
LE-LAN Devices
☒ N/A

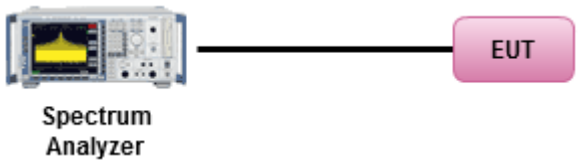
3.5.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.5.3 Test Procedures

Test Method	
☒	Refer as FCC KDB 789033 v01r03, clause G peak excursion method.
☒	Testing each modulation mode on a single channel is sufficient to demonstrate compliance with the peak excursion requirement
☒	For conducted measurement.
☒	Testing a single output port is sufficient to demonstrate compliance with the peak excursion.
☒	Test result plots refer as test report clause 3.3.5 with peak excursion ratio of the maximum of the peak-max-hold spectrum to the maximum of the average spectrum.

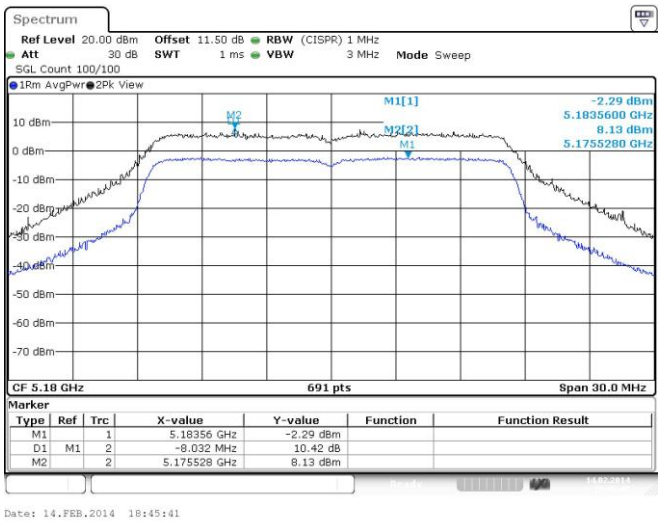
3.5.4 Test Setup

Peak Excursion


3.5.5 Test Result of Peak Excursion

UNII Peak Excursion Result								
Condition			Peak Excursion (dB)					
Modulation Mode	N_{TX}	Freq. (MHz)	BPSK	QPSK	16QAM	64QAM	256QAM	Limit
11a	3	5180	8.80	9.05	9.51	10.42	-	13.0
VHT20	3	5200	8.80	9.16	9.45	9.22	9.38	13.0
VHT40	3	5190	9.25	9.46	9.70	10.22	9.81	13.0
VHT80	3	5210	9.04	8.99	6.22	6.19	6.79	13.0
Result			Complied					

Worst Peak Excursion Plots



Note 1: Peak excursion = Mark2 value – Mark 1 value

3.6 Transmitter Radiated Unwanted Emissions and Band Edge

3.6.1 Transmitter Radiated Unwanted Emissions and Band Edge Limit

Unwanted emissions below 1 GHz and restricted band emissions above 1GHz limit			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Un-restricted band emissions above 1GHz Limit	
Operating Band	**Limit**
5.15 - 5.25 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.25 - 5.35 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.47 - 5.725 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.725 - 5.825 GHz	5.715 5.725 GHz: e.i.r.p. -17 dBm [78.2 dBuV/m@3m] 5.825 5.835 GHz: e.i.r.p. -17 dBm [78.2 dBuV/m@3m] Other un-restricted band: e.i.r.p. -27 dBm [68.2 dBuV/m@3m]

Note 1: Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

3.6.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

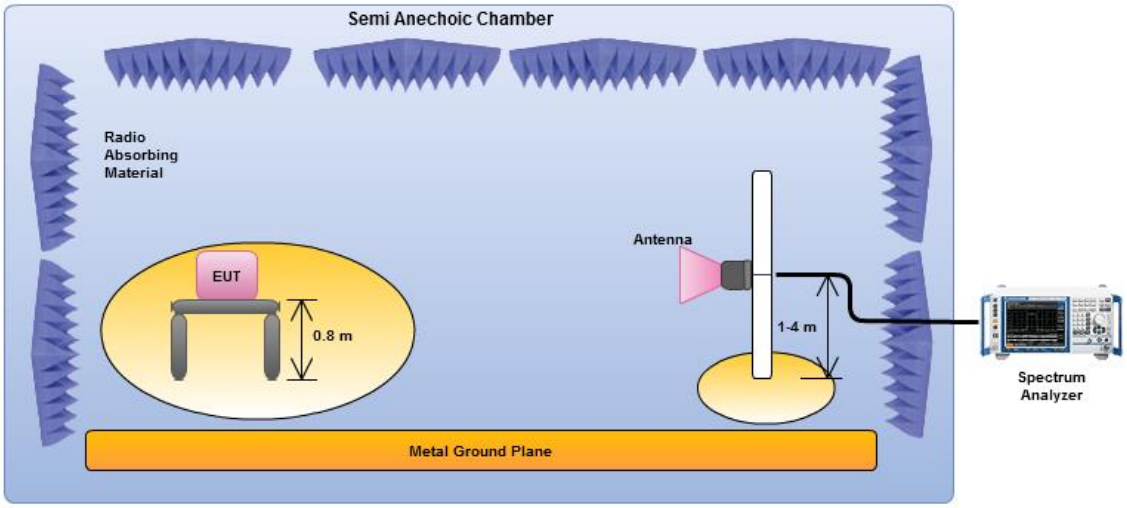
3.6.3 Test Procedures

Test Method		
☒	Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 m for frequencies above 30 MHz, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).	
☒	The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].	
☒	For the transmitter unwanted emissions shall be measured using following options below:	
	☒	Refer as FCC KDB 789033 v01r03, clause H)2) for unwanted emissions into non-restricted bands.
	☒	Refer as FCC KDB 789033 v01r03, clause H)1) for unwanted emissions into restricted bands.
		☐ Refer as FCC KDB 789033 v01r03, H)6) Method AD (Trace Averaging).
		☐ Refer as FCC KDB 789033 v01r03, H)6) Method VB (Reduced VBW).
		☒ Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.
		☐ Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
		☒ Refer as FCC KDB 789033 v01r03, clause H)5) measurement procedure peak limit.
		☐ Refer as ANSI C63.10, clause 4.2.3.2.2 measurement procedure peak limit.
☒	For radiated measurement.	
	☒	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz.
	☒	Refer as ANSI C63.10, clause 6.5 for radiated emissions from 30 MHz to 1000 MHz.
	☒	Refer as ANSI C63.10, clause 6.6 for radiated emissions from above 1 GHz.

Test Method		
☐	For conducted and cabinet radiation measurement, refer as FCC KDB 789033 v01r03, clause H)3).	
	☐	For conducted unwanted emissions into non-restricted bands (relative emission limits). Devices with multiple transmit chains: Refer as FCC KDB 662911, when testing out-of-band and spurious emissions against relative emission limits, tests may be performed on each output individually without summing or adding 10 log(N) if the measurements are made relative to the in-band emissions on the individual outputs.
	☐	For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB

3.6.4 Test Setup

Transmitter Radiated Unwanted Emissions



Magnetic field tests shall be performed in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna. Electric field tests shall be performed in the frequency range of 30 MHz to 1000 MHz using a calibrated bi-log antenna and the frequency range of 1 GHz to 40 GHz using a calibrated horn antenna.

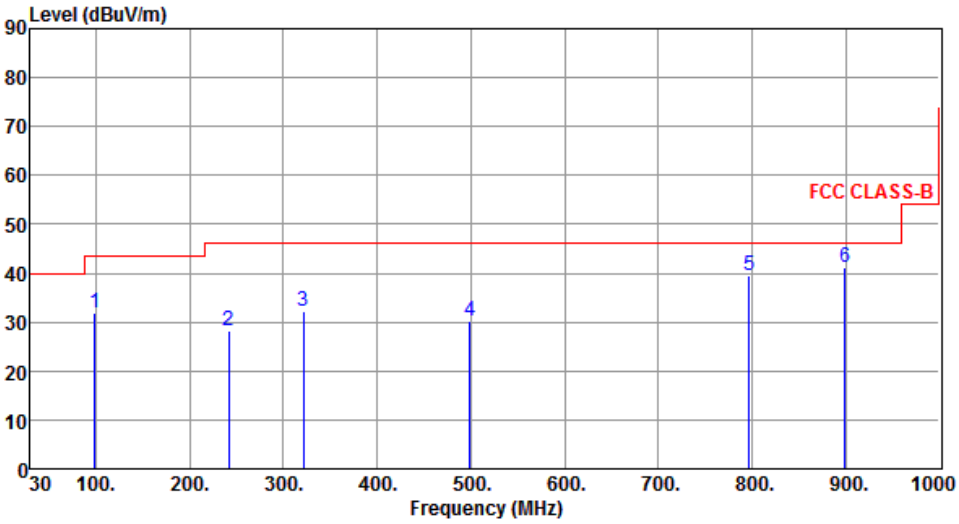
Note: The test distance is 3m.

3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

3.6.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

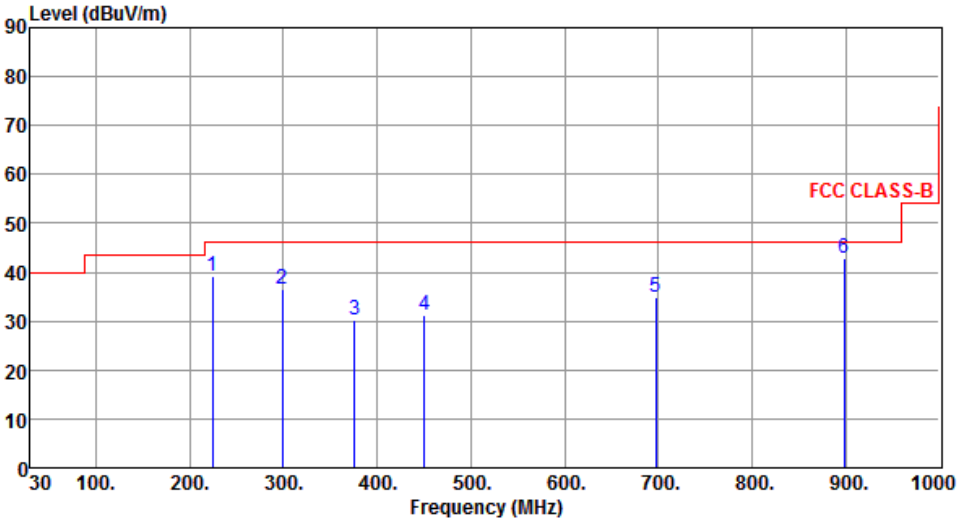
Transmitter Radiated Unwanted Emissions (Below 1GHz)			
Modulation Mode	VHT40	**Test Freq. (MHz)**	5190
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	98.87	32.00	43.50	-11.50	53.96	-21.96	Peak	---	---
2	241.57	28.34	46.00	-17.66	46.46	-18.12	Peak	---	---
3	321.36	32.33	46.00	-13.67	48.01	-15.68	Peak	---	---
4	498.59	30.18	46.00	-15.82	41.76	-11.58	Peak	---	---
5	797.13	39.58	46.00	-6.42	46.38	-6.80	Peak	---	---
6	899.38	41.03	46.00	-4.97	46.53	-5.50	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

Transmitter Radiated Unwanted Emissions (Below 1GHz)			
Modulation Mode	VHT40	**Test Freq. (MHz)**	5190
Operating Mode	1	**Polarization**	H

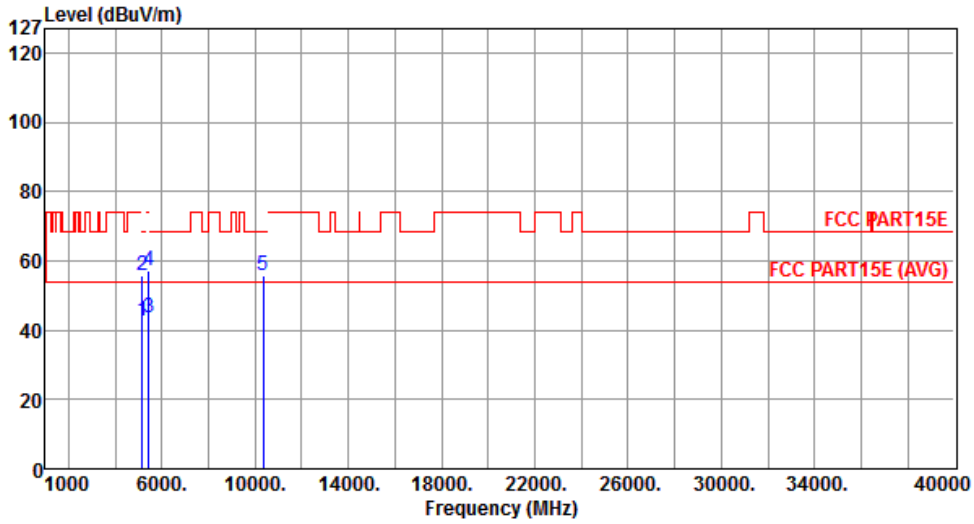


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	224.16	39.13	46.00	-6.87	58.02	-18.89	Peak	---	---
2	298.47	36.52	46.00	-9.48	52.72	-16.20	Peak	---	---
3	375.58	30.36	46.00	-15.64	44.69	-14.33	Peak	---	---
4	450.15	31.24	46.00	-14.76	43.76	-12.52	Peak	---	---
5	697.43	34.86	46.00	-11.14	43.13	-8.27	Peak	---	---
6	898.25	42.83	46.00	-3.17	48.34	-5.51	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

3.6.7 Transmitter Radiated Unwanted Emissions (Above 1GHz) for 11a

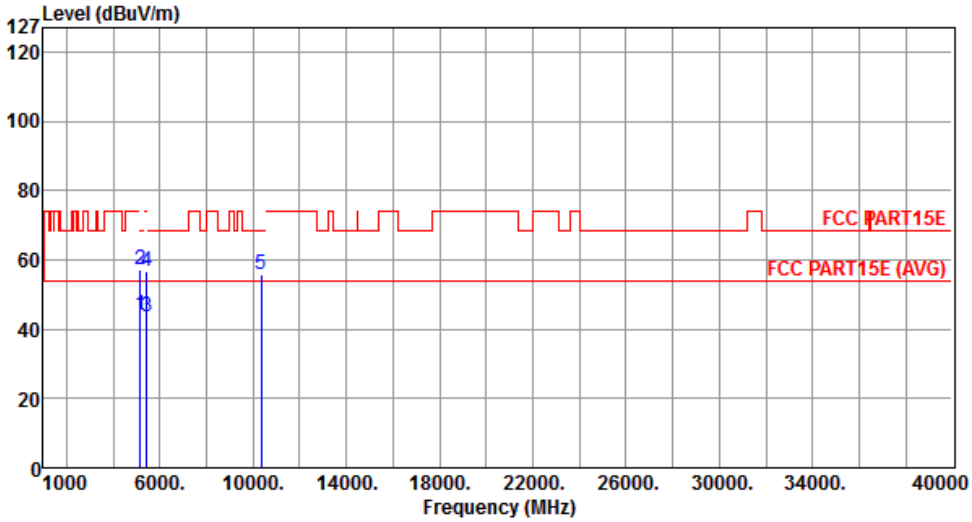
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	11a	**Test Freq. (MHz)**	5180
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	42.55	54.00	-11.45	36.52	6.03	Average	---	---
2	5150.00	55.60	74.00	-18.40	49.57	6.03	Peak	---	---
3	5427.00	43.51	54.00	-10.49	37.39	6.12	Average	---	---
4	5427.00	57.08	74.00	-16.92	50.96	6.12	Peak	---	---
5	10360.00	55.65	68.20	-12.55	40.41	15.24	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

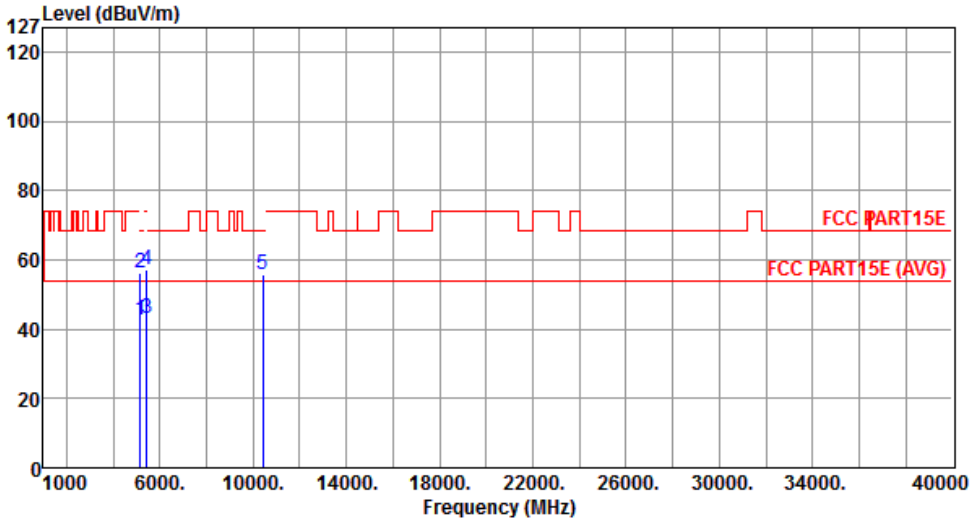
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	11a	**Test Freq. (MHz)**	5180
Operating Mode	1	**Polarization**	H



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	43.96	54.00	-10.04	37.93	6.03	Average	---	---
2	5150.00	57.37	74.00	-16.63	51.34	6.03	Peak	---	---
3	5427.00	43.44	54.00	-10.56	37.32	6.12	Average	---	---
4	5427.00	56.62	74.00	-17.38	50.50	6.12	Peak	---	---
5	10360.00	55.62	68.20	-12.58	40.38	15.24	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

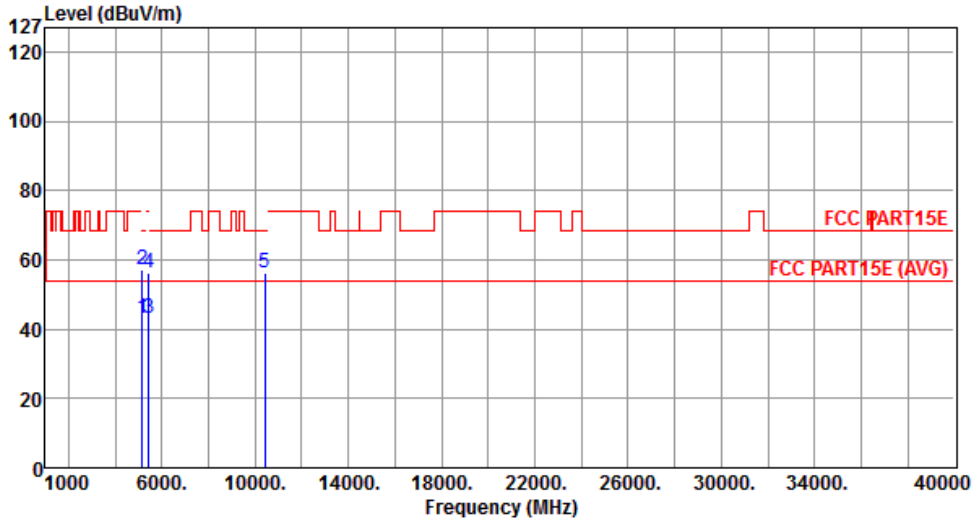
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	11a	**Test Freq. (MHz)**	5200
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	42.85	54.00	-11.15	36.82	6.03	Average	---	---
2	5150.00	56.20	74.00	-17.80	50.17	6.03	Peak	---	---
3	5427.00	43.19	54.00	-10.81	37.07	6.12	Average	---	---
4	5427.00	56.98	74.00	-17.02	50.86	6.12	Peak	---	---
5	10400.00	55.57	68.20	-12.63	40.26	15.31	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

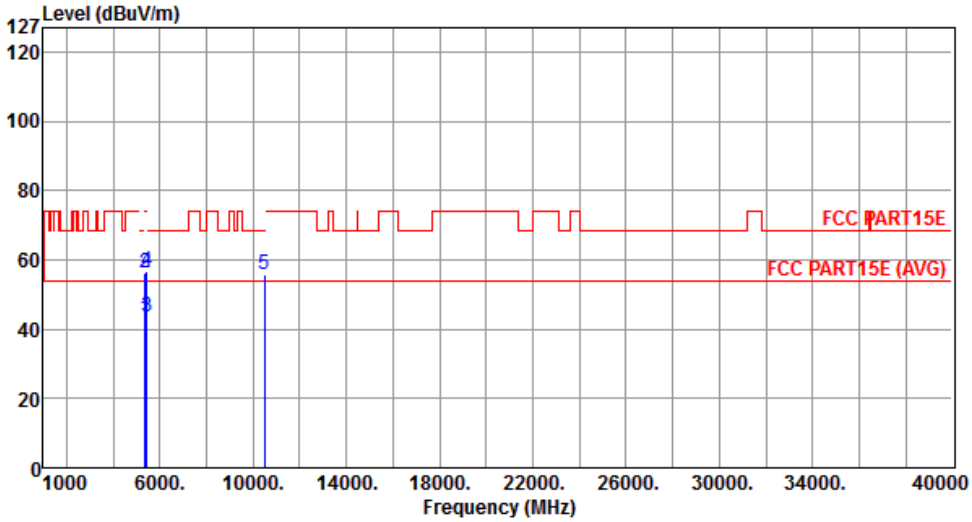
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	11a	**Test Freq. (MHz)**	5200
Operating Mode	1	**Polarization**	H



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	43.01	54.00	-10.99	36.98	6.03	Average	---	---
2	5150.00	57.30	74.00	-16.70	51.27	6.03	Peak	---	---
3	5427.00	43.28	54.00	-10.72	37.16	6.12	Average	---	---
4	5427.00	56.22	74.00	-17.78	50.10	6.12	Peak	---	---
5	10400.00	56.24	68.20	-11.96	40.93	15.31	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

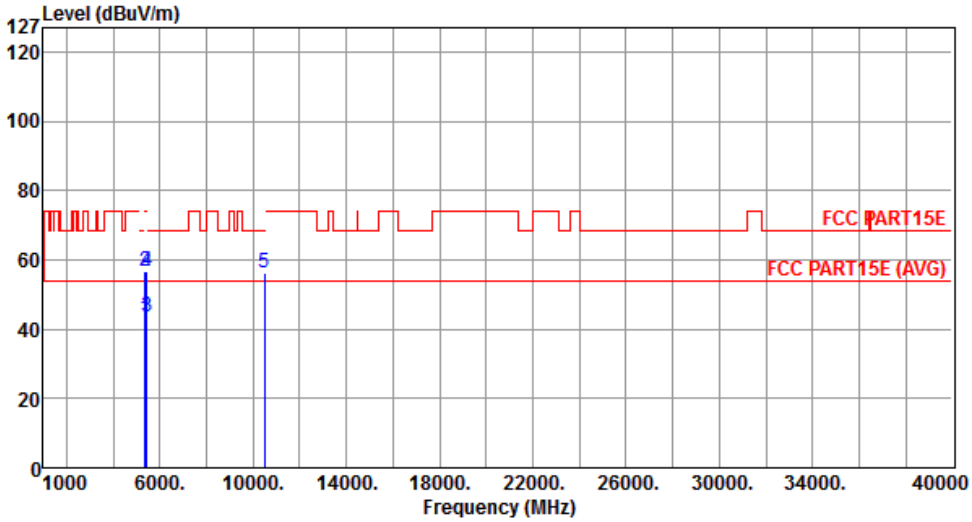
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	11a	**Test Freq. (MHz)**	5240
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5350.00	43.30	54.00	-10.70	37.16	6.14	Average	---	---
2	5350.00	56.12	74.00	-17.88	49.98	6.14	Peak	---	---
3	5427.00	43.57	54.00	-10.43	37.45	6.12	Average	---	---
4	5427.00	56.71	74.00	-17.29	50.59	6.12	Peak	---	---
5	10480.00	55.62	68.20	-12.58	40.19	15.43	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	11a	**Test Freq. (MHz)**	5240
Operating Mode	1	**Polarization**	H

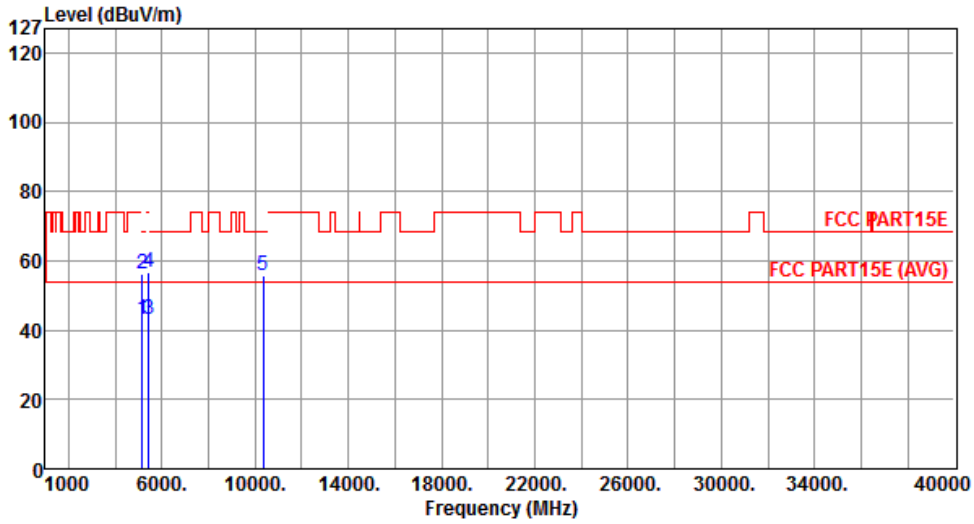


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5350.00	43.19	54.00	-10.81	37.05	6.14	Average	---	---
2	5350.00	56.51	74.00	-17.49	50.37	6.14	Peak	---	---
3	5427.00	43.77	54.00	-10.23	37.65	6.12	Average	---	---
4	5427.00	56.74	74.00	-17.26	50.62	6.12	Peak	---	---
5	10480.00	56.10	68.20	-12.10	40.67	15.43	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

3.6.8 Transmitter Radiated Unwanted Emissions (Above 1GHz) for VHT20

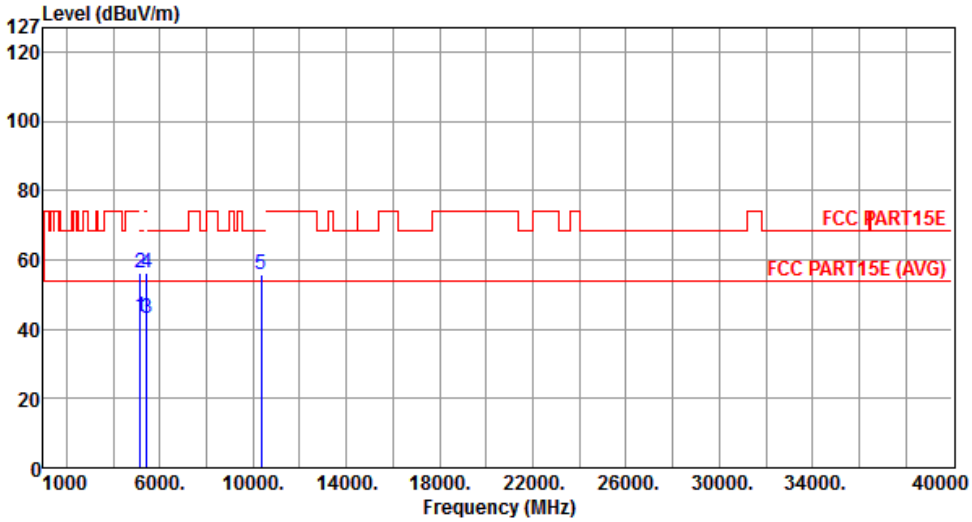
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT20	**Test Freq. (MHz)**	5180
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	43.04	54.00	-10.96	37.01	6.03	Average	---	---
2	5150.00	56.34	74.00	-17.66	50.31	6.03	Peak	---	---
3	5427.00	43.28	54.00	-10.72	37.16	6.12	Average	---	---
4	5427.00	56.59	74.00	-17.41	50.47	6.12	Peak	---	---
5	10360.00	55.81	68.20	-12.39	40.57	15.24	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

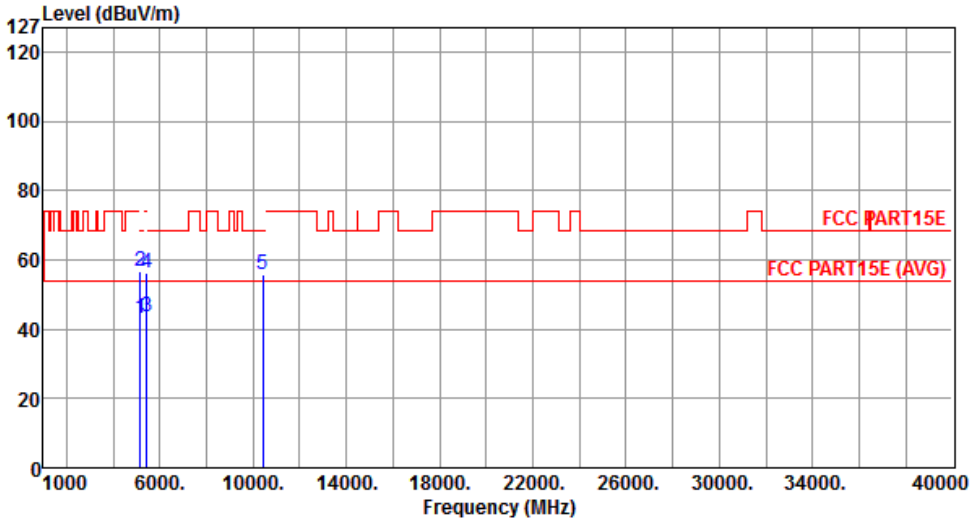
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT20	**Test Freq. (MHz)**	5180
Operating Mode	1	**Polarization**	H



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	43.43	54.00	-10.57	37.40	6.03	Average	---	---
2	5150.00	56.36	74.00	-17.64	50.33	6.03	Peak	---	---
3	5427.00	43.21	54.00	-10.79	37.09	6.12	Average	---	---
4	5427.00	56.34	74.00	-17.66	50.22	6.12	Peak	---	---
5	10360.00	55.73	68.20	-12.47	40.49	15.24	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

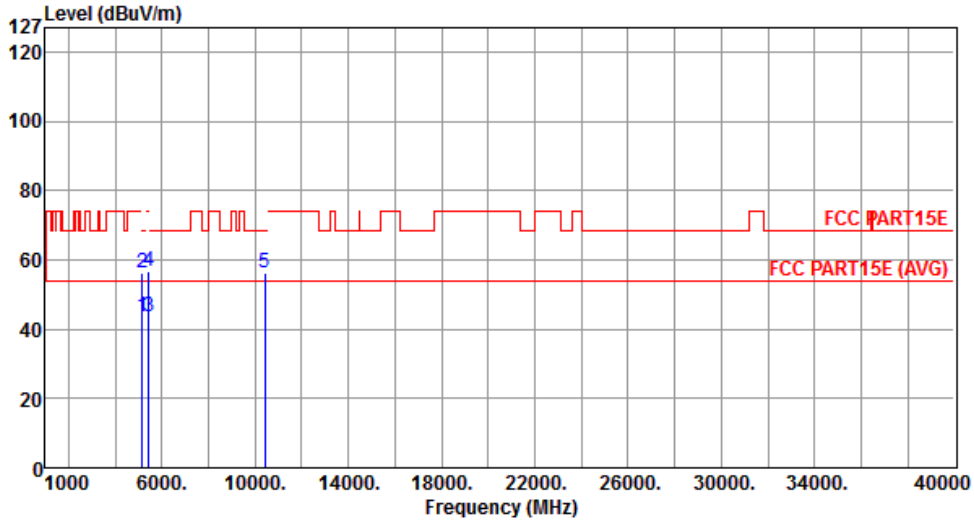
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT20	**Test Freq. (MHz)**	5200
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	42.91	54.00	-11.09	36.88	6.03	Average	---	---
2	5150.00	56.59	74.00	-17.41	50.56	6.03	Peak	---	---
3	5427.00	43.55	54.00	-10.45	37.43	6.12	Average	---	---
4	5427.00	56.29	74.00	-17.71	50.17	6.12	Peak	---	---
5	10400.00	55.84	68.20	-12.36	40.53	15.31	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

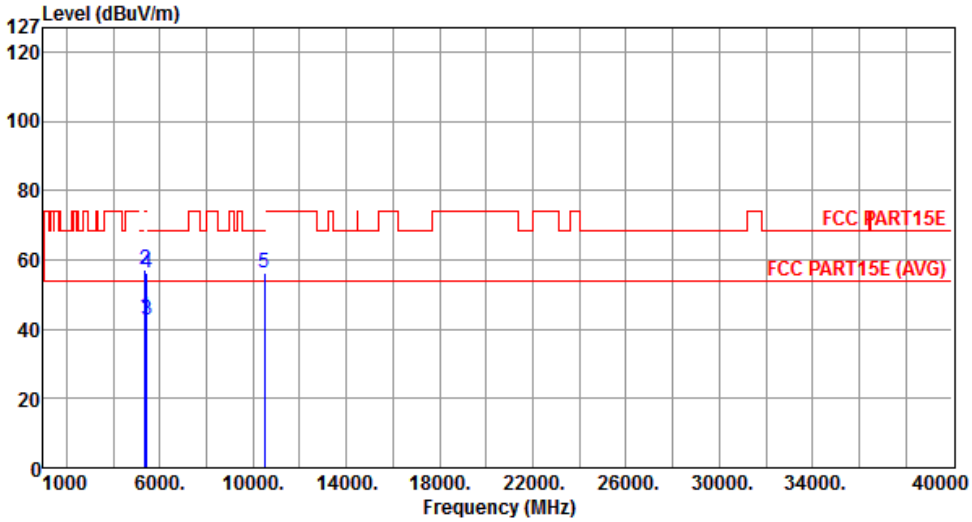
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT20	**Test Freq. (MHz)**	5200
Operating Mode	1	**Polarization**	H



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	43.41	54.00	-10.59	37.38	6.03	Average	---	---
2	5150.00	56.22	74.00	-17.78	50.19	6.03	Peak	---	---
3	5427.00	43.37	54.00	-10.63	37.25	6.12	Average	---	---
4	5427.00	56.70	74.00	-17.30	50.58	6.12	Peak	---	---
5	10400.00	56.03	68.20	-12.17	40.72	15.31	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

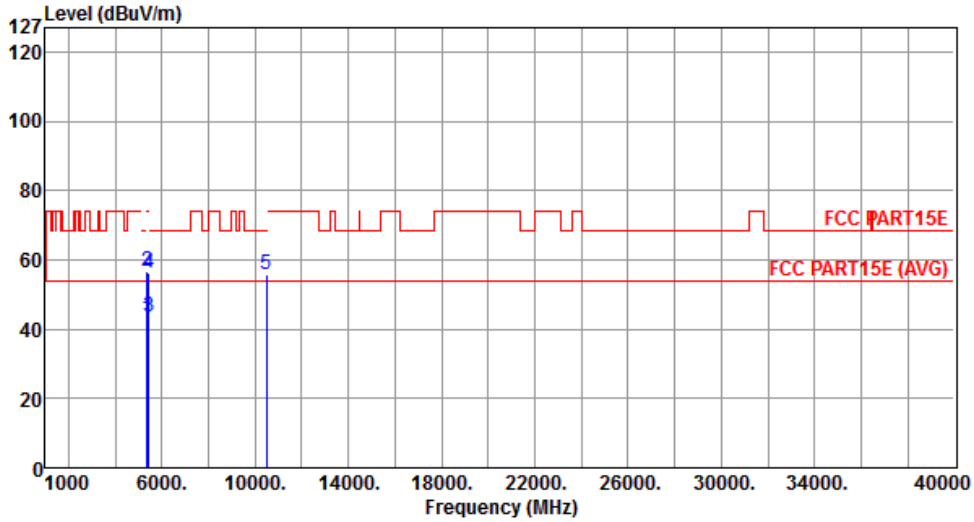
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT20	**Test Freq. (MHz)**	5240
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5350.00	43.55	54.00	-10.45	37.41	6.14	Average	---	---
2	5350.00	56.94	74.00	-17.06	50.80	6.14	Peak	---	---
3	5427.00	42.88	54.00	-11.12	36.76	6.12	Average	---	---
4	5427.00	56.18	74.00	-17.82	50.06	6.12	Peak	---	---
5	10480.00	56.27	68.20	-11.93	40.84	15.43	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT20	**Test Freq. (MHz)**	5240
Operating Mode	1	**Polarization**	H

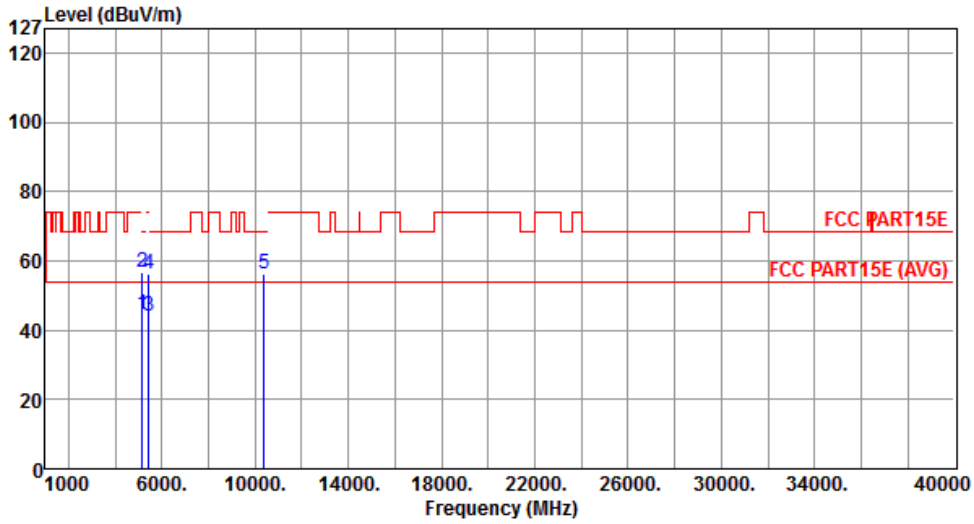


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5350.00	43.31	54.00	-10.69	37.17	6.14	Average	---	---
2	5350.00	56.55	74.00	-17.45	50.41	6.14	Peak	---	---
3	5427.00	43.39	54.00	-10.61	37.27	6.12	Average	---	---
4	5427.00	56.40	74.00	-17.60	50.28	6.12	Peak	---	---
5	10480.00	55.74	68.20	-12.46	40.31	15.43	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

3.6.9 Transmitter Radiated Unwanted Emissions (Above 1GHz) for VHT40

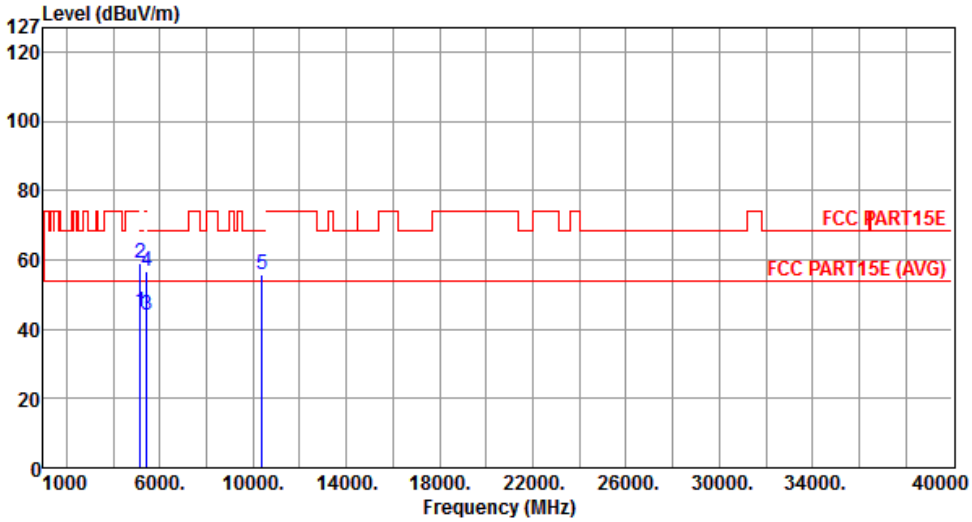
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT40	**Test Freq. (MHz)**	5190
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	44.38	54.00	-9.62	38.35	6.03	Average	---	---
2	5150.00	56.63	74.00	-17.37	50.60	6.03	Peak	---	---
3	5427.00	43.88	54.00	-10.12	37.76	6.12	Average	---	---
4	5427.00	56.38	74.00	-17.62	50.26	6.12	Peak	---	---
5	10380.00	56.16	68.20	-12.04	40.88	15.28	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

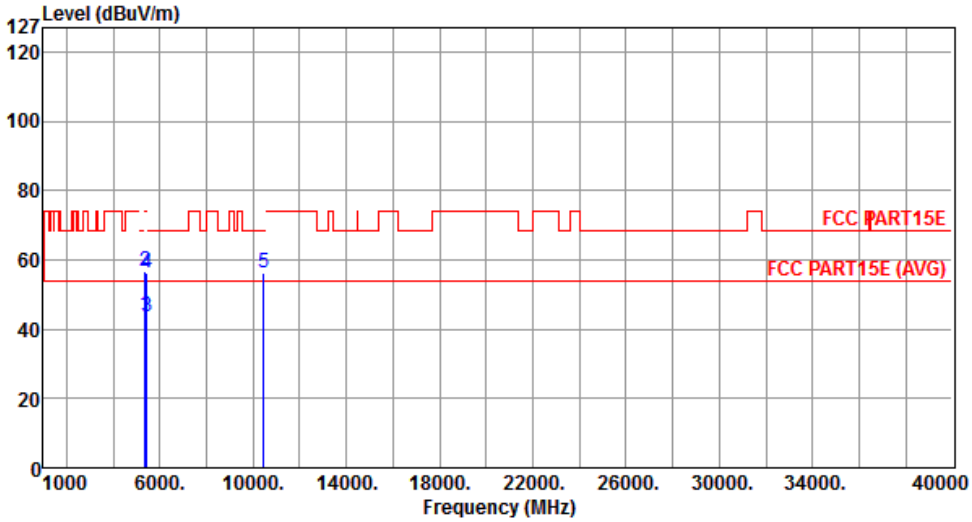
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT40	**Test Freq. (MHz)**	5190
Operating Mode	1	**Polarization**	H



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	45.10	54.00	-8.90	39.07	6.03	Average	---	---
2	5150.00	58.90	74.00	-15.10	52.87	6.03	Peak	---	---
3	5427.00	43.86	54.00	-10.14	37.74	6.12	Average	---	---
4	5427.00	56.62	74.00	-17.38	50.50	6.12	Peak	---	---
5	10380.00	55.92	68.20	-12.28	40.64	15.28	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

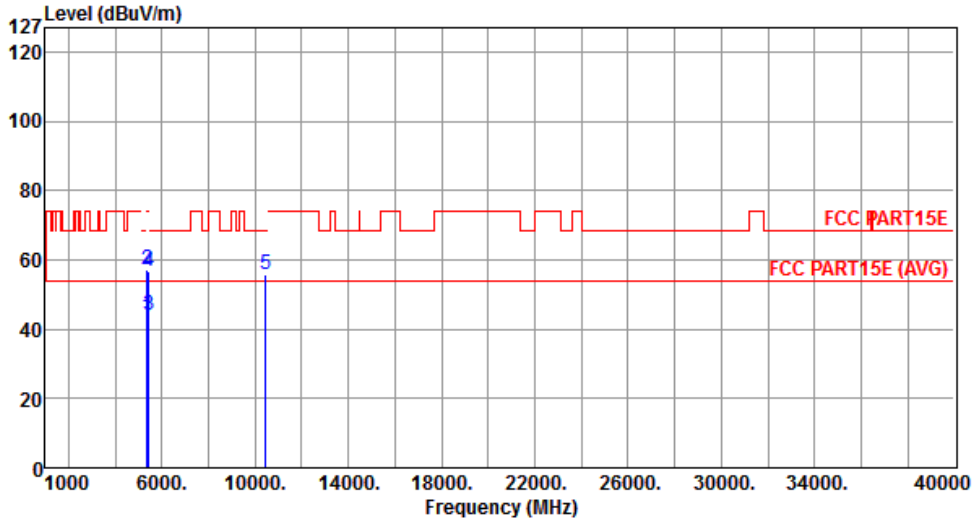
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT40	**Test Freq. (MHz)**	5230
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5350.00	43.93	54.00	-10.07	37.79	6.14	Average	---	---
2	5350.00	56.64	74.00	-17.36	50.50	6.14	Peak	---	---
3	5427.00	43.81	54.00	-10.19	37.69	6.12	Average	---	---
4	5427.00	56.32	74.00	-17.68	50.20	6.12	Peak	---	---
5	10460.00	56.37	68.20	-11.83	40.97	15.40	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT40	**Test Freq. (MHz)**	5230
Operating Mode	1	**Polarization**	H

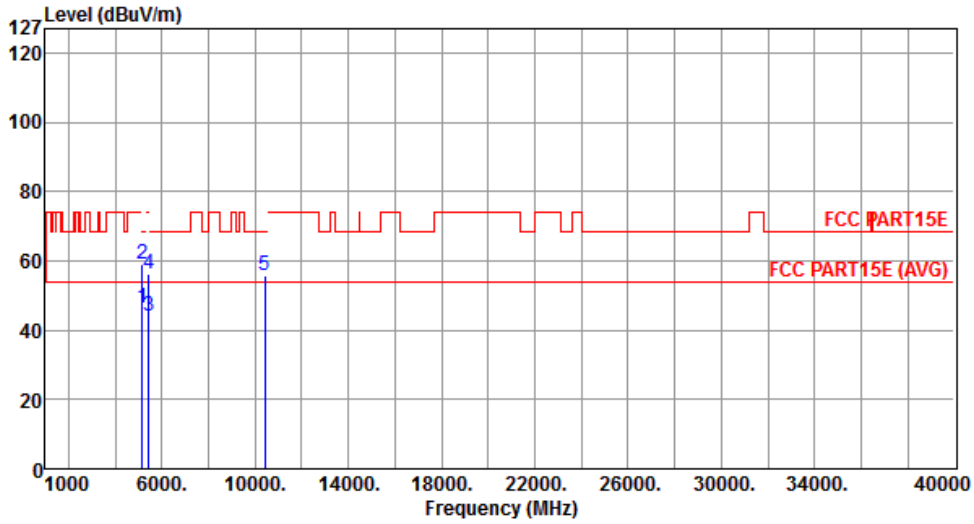


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5350.00	43.63	54.00	-10.37	37.49	6.14	Average	---	---
2	5350.00	57.24	74.00	-16.76	51.10	6.14	Peak	---	---
3	5427.00	43.99	54.00	-10.01	37.87	6.12	Average	---	---
4	5427.00	56.58	74.00	-17.42	50.46	6.12	Peak	---	---
5	10460.00	55.59	68.20	-12.61	40.19	15.40	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

3.6.10 Transmitter Radiated Unwanted Emissions (Above 1GHz) for VHT80

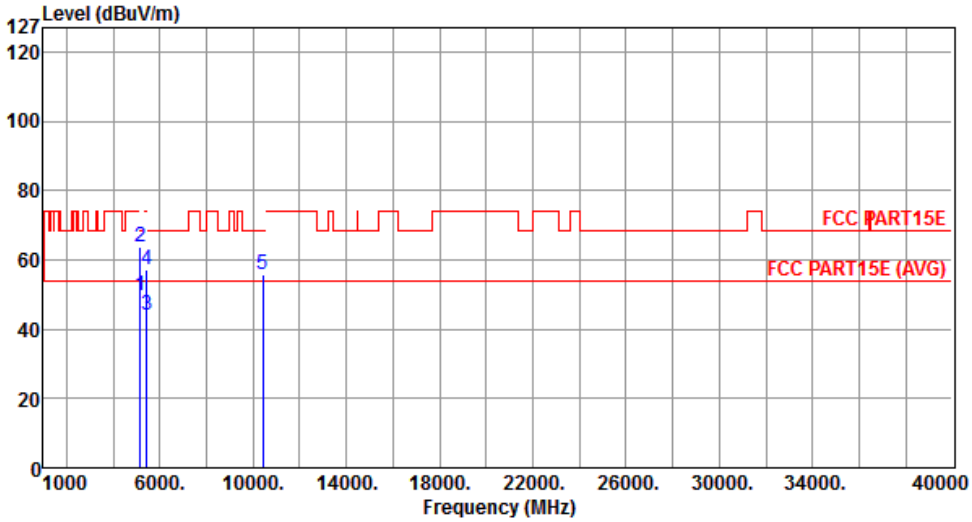
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT80	**Test Freq. (MHz)**	5210
Operating Mode	1	**Polarization**	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	46.60	54.00	-7.40	40.57	6.03	Average	---	---
2	5150.00	59.02	74.00	-14.98	52.99	6.03	Peak	---	---
3	5427.00	43.98	54.00	-10.02	37.86	6.12	Average	---	---
4	5427.00	56.19	74.00	-17.81	50.07	6.12	Peak	---	---
5	10420.00	55.83	68.20	-12.37	40.49	15.34	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Modulation Mode	VHT80	**Test Freq. (MHz)**	5210
Operating Mode	1	**Polarization**	H



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5150.00	49.63	54.00	-4.37	43.60	6.03	Average	---	---
2	5150.00	63.58	74.00	-10.42	57.55	6.03	Peak	---	---
3	5427.00	44.01	54.00	-9.99	37.89	6.12	Average	---	---
4	5427.00	56.97	74.00	-17.03	50.85	6.12	Peak	---	---
5	10420.00	55.71	68.20	-12.49	40.37	15.34	Peak	---	---

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

3.7 Frequency Stability

3.7.1 Frequency Stability Limit

Frequency Stability Limit
UNII Devices
☒ In-band emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.
LE-LAN Devices
☒ N/A
IEEE Std. 802.11n-2009
☒ The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band and ± 25 ppm maximum for the 2.4 GHz band.

3.7.2 Measuring Instruments

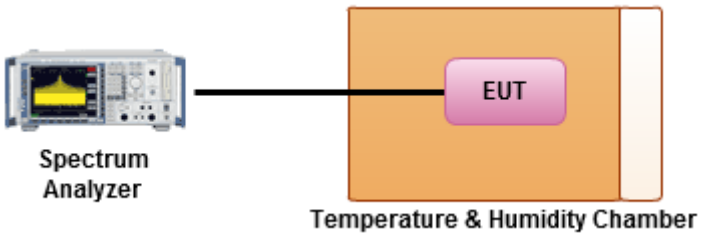
Refer a test equipment and calibration data table in this test report.

3.7.3 Test Procedures

Test Method	
☒	Refer as ANSI C63.10, clause 6.8 for frequency stability tests
	☒ Frequency stability with respect to ambient temperature
	☒ Frequency stability when varying supply voltage
☒	For conducted measurement.
	☒ For conducted measurements on devices with multiple transmit chains: Measurements need only to be performed on one of the active transmit chains (antenna outputs)
☐	For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level.

3.7.4 Test Setup

Frequency Stability



3.7.5 Test Result of Frequency Stability

Frequency Stability Result			
Mode		**Frequency Stability (ppm)**	
Condition	**Freq. (MHz)**	**Test Frequency (MHz)**	**Frequency Stability (ppm)**
$T_{20°C}$Vmax	5200	5200.01537	2.9558
$T_{20°C}$Vmin	5200	5200.01528	2.9385
$T_{55°C}$Vnom	5200	5200.00871	1.6750
$T_{50°C}$Vnom	5200	5200.01250	2.4038
$T_{40°C}$Vnom	5200	5200.00933	1.7942
$T_{30°C}$Vnom	5200	5200.01423	2.7365
$T_{20°C}$Vnom	5200	5200.00788	1.5154
$T_{10°C}$Vnom	5200	5200.01799	3.4596
$T_{0°C}$Vnom	5200	5200.01590	3.0577
$T_{-10°C}$Vnom	5200	5200.01668	3.2077
$T_{-20°C}$Vnom	5200	5200.01007	1.9365
$T_{-30°C}$Vnom	5200	5200.01635	3.1442
Limit (ppm)		20	
Result		**Complied**	

Note 1: Measure at 85 % [Vmin] and 115 % [Vmax] of the nominal voltage [Vnom].
Note 2: The nominal voltage refer test report clause 1.1.5 for EUT operational condition.

4 Test Equipment and Calibration Data

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
EMC Receiver	R&S	ESCS 30	100169	Oct. 15, 2013	Oct. 14, 2014
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 23, 2013	Nov. 22, 2014
LISN (Support Unit)	SCHWARZBECK	Schwarzbeck 8127	8127-666	Dec. 04, 2013	Dec. 03, 2014
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Apr. 24, 2013	Apr. 23, 2014
50 ohm terminal (Support Unit)	NA	50	04	Apr. 22, 2013	Apr. 21, 2014
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101498	Jan. 25, 2014	Jan. 24, 2015
Receiver	R&S	ESR3	101658	Jan. 10, 2014	Jan. 09, 2015
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jan. 02, 2014	Jan. 01, 2015
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120D	BBHA 9120 D 1095	Jan. 07, 2014	Jan. 06, 2015
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Dec. 27, 2013	Dec. 26, 2014
Preamplifier	Burgeon	BPA-530	SN:100219	Nov. 22, 2013	Nov. 21, 2014
Preamplifier	Agilent	83017A	MY39501308	Dec. 16, 2013	Dec. 15, 2014
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 16, 2013	Dec. 15, 2014
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 16, 2013	Dec. 15, 2014
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 16, 2013	Dec. 15, 2014
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 16, 2013	Dec. 15, 2014
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 16, 2013	Dec. 15, 2014
Note: Calibration Interval of instruments listed above is one year.					

Loop Antenna	R&S	HFH2-Z2	100330	Nov. 15, 2012	Nov. 14, 2014
Preamplifier	EM	EM18G40G	060572	Jun. 20, 2013	Jun. 19, 2014
Note: Calibration Interval of instruments listed above is two year.					

Test Item	RF Conducted				
Test Site	TH01-HY				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV 40	101013	Jan. 25, 2014	Jan. 24, 2015
AC Power Source	G.W	APS-9102	EL920581	Jul. 16, 2013	Jul. 15, 2014
Temp. and Humidity Chamber	Giant Force	GTH-225-20-SP-SD	MAA1112-007	Nov. 20, 2013	Nov. 19, 2014
Signal Generator	R&S	SMR40	100116	Jun. 27, 2013	Jun. 26, 2014
Power Sensor	Anritsu	MA2411B	0917017	Jan. 28, 2014	Jan. 27, 2015
Power Meter	Anritsu	ML2495A	0949003	Jan. 28, 2014	Jan. 27, 2015
RF Cable-2m	HUBER+SUHNER	SUCOFLEX_104	SN 345675/4	Dec. 02, 2013	Dec. 01, 2014
RF Cable-3m	HUBER+SUHNER	SUCOFLEX_104	SN 345669/4	Dec. 02, 2013	Dec. 01, 2014
DC Power Source	G.W.	GPC-6030D	C671845	Jun. 21, 2013	Jun. 20, 2014
Note: Calibration Interval of instruments listed above is one year.					