

FCC Part 15E

Measurement and Test Report

For

E-sun Sky Computer Technology (Shenzhen) Co., Ltd.

FCC ID: 2BXLP-NEO

FCC Rule(s):	<u>FCC Part 15E</u>
Product Description:	<u>Solode</u>
Tested Model:	<u>Neo</u>
Report No.:	<u>MAX260840706304RF</u>
Tested Date:	<u>Aug.01~26, 2026</u>
Issued Date:	<u>Aug. 26, 2026</u>
Tested By:	<u>Lris Yao/ Engineer</u>
Reviewed By:	<u>Levi Xiao / EMC Manager</u>
Approved & Authorized By:	<u>Salon Ouyang / PSQ Manager</u>
Prepared By:	

Lris Yao
Levi Xiao
Salon Ouyang

MAXLAB TESTING CO., LTD.

1/F, Building B, Xinshidai GR Park, Shiyuan Street,
Bao'an District, Shenzhen, Guangdong, 518052, People's Republic of China
Tel: 400-882-9628 Fax: 86- 755-26508703

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by MAXLAB TESTING CO., LTD.

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	4
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
1.2 TEST STANDARDS.....	5
1.3 TEST METHODOLOGY	5
1.4 TABLE FOR PARAMETERS OF TEST SOFTWARE SETTING	5
1.5 EUT OPERATING DURING TEST	6
1.6 TEST FACILITY	6
1.7 EUT SETUP AND TEST MODE.....	6
1.8 MEASUREMENT UNCERTAINTY	7
1.9 TEST EQUIPMENT LIST AND DETAILS	7
2. SUMMARY OF TEST RESULTS	8
3. RF EXPOSURE	9
3.1 STANDARD APPLICABLE.....	9
3.2 TEST RESULT.....	9
4. ANTENNA REQUIREMENT	10
4.1 STANDARD APPLICABLE.....	10
4.2 EVALUATION INFORMATION.....	10
5. CONDUCTED EMISSIONS.....	11
5.1 TEST PROCEDURE.....	11
5.2 STANDARD APPLICABLE.....	11
5.3 BASIC TEST SETUP BLOCK DIAGRAM.....	11
5.4 ENVIRONMENTAL CONDITIONS	12
5.5 TEST RECEIVER SETUP	12
5.6 SUMMARY OF TEST RESULTS/PLOTS	12
5.7 CONDUCTED EMISSIONS TEST DATA.....	12
6. POWER SPECTRAL DENSITY	15
6.1 STANDARD APPLICABLE.....	15
6.2 TEST PROCEDURE.....	17
6.3 ENVIRONMENTAL CONDITIONS	18
6.4 TEST RESULTS/PLOTS.....	18
PLEASE REFER TO APPENDIX A.57. EMISSION BANDWIDTH AND OCCUPIED BANDWIDTH.....	18
7.1 STANDARD APPLICABLE.....	19
7.2 TEST PROCEDURE.....	19
7.3 ENVIRONMENTAL CONDITIONS	21
7.4 TEST RESULTS/PLOTS.....	21
8. MAXIMUM CONDUCTED OUTPUT POWER.....	22
8.1 STANDARD APPLICABLE.....	22
8.2 TEST PROCEDURE.....	24
8.3 ENVIRONMENTAL CONDITIONS	25
8.4 SUMMARY OF TEST RESULTS/PLOTS	25
9. EMISSIONS IN RESTRICTED BANDS	26
9.1 STANDARD APPLICABLE.....	26
9.2 TEST PROCEDURE.....	26
9.3 ENVIRONMENTAL CONDITIONS	28
9.4 TEST RESULTS/PLOTS.....	28
PLEASE REFER TO APPENDIX A.6 AND APPENDIX A.7	28
10. RADIATED SPURIOUS EMISSIONS.....	29
10.1 STANDARD APPLICABLE.....	29
10.2 TEST PROCEDURE.....	29
10.3 TEST RECEIVER SETUP	32
10.4 CORRECTED AMPLITUDE & MARGIN CALCULATION	33
10.5 ENVIRONMENTAL CONDITIONS	33
10.6 SUMMARY OF TEST RESULTS/PLOTS	33
11. FREQUENCY STABILITY	37

11.1 STANDARD APPLICABLE.....37

11.2 TEST PROCEDURE.....37

11.3 ENVIRONMENTAL CONDITIONS37

11.4 SUMMARY OF TEST RESULTS/PLOTS37

12. ON TIME AND DUTY CYCLE.....40

12.1 STANDARD REQUIREMENT40

12.2 TEST PROCEDURE.....40

12.3 ENVIRONMENTAL CONDITIONS40

12.4 SUMMARY OF TEST RESULTS/PLOTS40

14. -26DB OCCUPIED BANDWIDTH MEASUREMENT.....41

14.1 STANDARD REQUIREMENT41

14.2 TEST PROCEDURE.....41

14.3 ENVIRONMENTAL CONDITIONS41

14.4 SUMMARY OF TEST RESULTS/PLOTS41

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: E-sun Sky Computer Technology (Shenzhen) Co., Ltd.
Address of applicant: Room1401, B Bldg, West Side, Shenzhen Tech Eco-Park, Yuehai, Nanshan, Shenzhen, Guangdong, China

Manufacturer: E-sun Sky Computer Technology (Shenzhen) Co., Ltd.
Address of manufacturer: Room1401, B Bldg, West Side, Shenzhen Tech Eco-Park, Yuehai, Nanshan, Shenzhen, Guangdong, China

General Description of EUT	
Product Name:	Solode
Trade Name:	N/A
Model No.:	Neo
Adding Model:	Pro, Ultra
Rated Voltage:	DC 12V by USB TAPY-C
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Support Standards:	IEEE 802.11a/n/ac
Frequency Range:	5180-5240 MHz, 5745-5825MHz
RF Output Power:	14.76dBm, 16.56dBm (Conducted)
Type of Modulation:	64QAM, 16QAM, QPSK, BPSK
Quantity of Channels:	15
Channel Bandwidth	20/40/80 MHz
Type of Antenna:	FPC Antenna
Antenna Gain:	Ant1:2.74 dBi, ANT2: 2.74 dBi

1.2 Test Standards

The following report is prepared on behalf of the E-sun Sky Computer Technology (Shenzhen) Co., Ltd. in accordance with FCC Part 15, Subpart C&E, and section 15.203, 15.205, 15.207, 15.209 and 15.407 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C&E, and section 15.203, 15.205, 15.207, 15.209 and 15.407 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2020, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. The measurement guide KDB 789033 D02 v02r01 for Unlicensed National Information Infrastructure (U-NII) Devices and KDB 662911 D01 Multiple Transmitter Output v02r01 shall be performed also.

1.4 Table for parameters of Test Software setting

The test utility software used during testing was “RPTA1-71W.M4300.01.GD.2015Sep1”. During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

1.5 EUT Operating during test

EUT was programmed to be in continuously transmitting mode. During the test, EUT operation to normal function and programs under WIN XP were executed.

1.6 Test Facility

MAXLAB TESTING CO., LTD.

1/F, Building B, Xinshidai GR Park, Shiyan Street, Bao'an District, Shenzhen, Guangdong, 518052, People's Republic of China

FCC Test Firm Registration Number: 562200

Designation Number: CN1338

Tel: 400-882-9628

Fax: 86-755-26508703

1.7 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	IEEE 802.11a/n/ac(20)	5180MHz, 5200MHz, 5240MHz 5745MHz, 5785MHz, 5825MHz
TM2	IEEE 802.11n/ac(40)	5190MHz, 5230MHz 5755MHz, 5795MHz
TM3	IEEE 802.11ac(80)	5210MHz, 5775MHz
Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.		

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Core
Adapter Cable	1.45	Shielded	Without Core

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
USB cable	1.0	Unshielded	Without Ferrite

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	E10	/

1.8 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.9 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2025-10-25	2026-10-24
Spectrum Analyzer	R&S	FSP40	100550	2025-10-25	2026-10-24
Test Receiver	R&S	ESCI7	US47140102	2025-10-25	2026-10-24
Signal Generator	HP	83630B	3844A01028	2025-10-25	2026-10-24
Test Receiver	R&S	ESPI-3	100180	2025-10-25	2026-10-24
Amplifier	Agilent	8449B	4035A00116	2025-10-25	2026-10-24
Amplifier	HP	8447E	2945A02770	2025-10-25	2026-10-24
Signal Generator	IFR	2023A	202307/242	2025-10-25	2026-10-24
Broadband Antenna	SCHAFFNER	2774	2774	2025-10-25	2026-10-24
Biconical and log periodic antennas	ELECTRO-METRIC	EM-6917B-1	171	2025-10-25	2026-10-24
Horn Antenna	R&S	HF906	100253	2025-10-25	2026-10-24
Horn Antenna	EM	EM-6961	6462	2025-10-25	2026-10-24
LISN	R&S	ESH3-Z5	100196	2025-10-25	2026-10-24
LISN	COM-POWER	LI-115	02027	2025-10-25	2026-10-24
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2025-10-25	2026-10-24
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2025-10-25	2026-10-24
20dB Attenuator	ICPROBING	IATS1	BSL1003	2025-10-25	2026-10-24
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2025-10-25	2026-10-24
Power Meter	DARE	RPR3006W	15I00041SN O03	2025-10-25	2026-10-24
Loop Antenna	Schwarz beck	FMZB 1516	9773	2025-10-25	2026-10-24
Spectrum Analyzer	R&S	FSV40-N	CTA-344	2026-05-16	2027-05-15
Antenna Tower	SKET	BK-4AT-BS	N/A	N/A	N/A

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§15.203	Antenna Requirement	Compliant
§15.207	Conducted Emission	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.407(e)	Emission Bandwidth and Occupied Bandwidth	Compliant
§15.407	Maximum Conducted Output Power	Compliant
§15.407(b)	Conducted Spurious Emission	Compliant
§15.209;§15.407(b)	Radiated Emission	Compliant
§15.407(g)	Frequency Stability	Compliant
§15.407(h)	Dynamic Frequency Selection (DFS)	N/A

N/A: not applicable

3. RF Exposure

3.1 Standard Applicable

According to §1.1307 and §2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

This product has a FPC antenna(2.74dBi), fulfill the requirement of this section.

5. Conducted Emissions

5.1 Test Procedure

The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

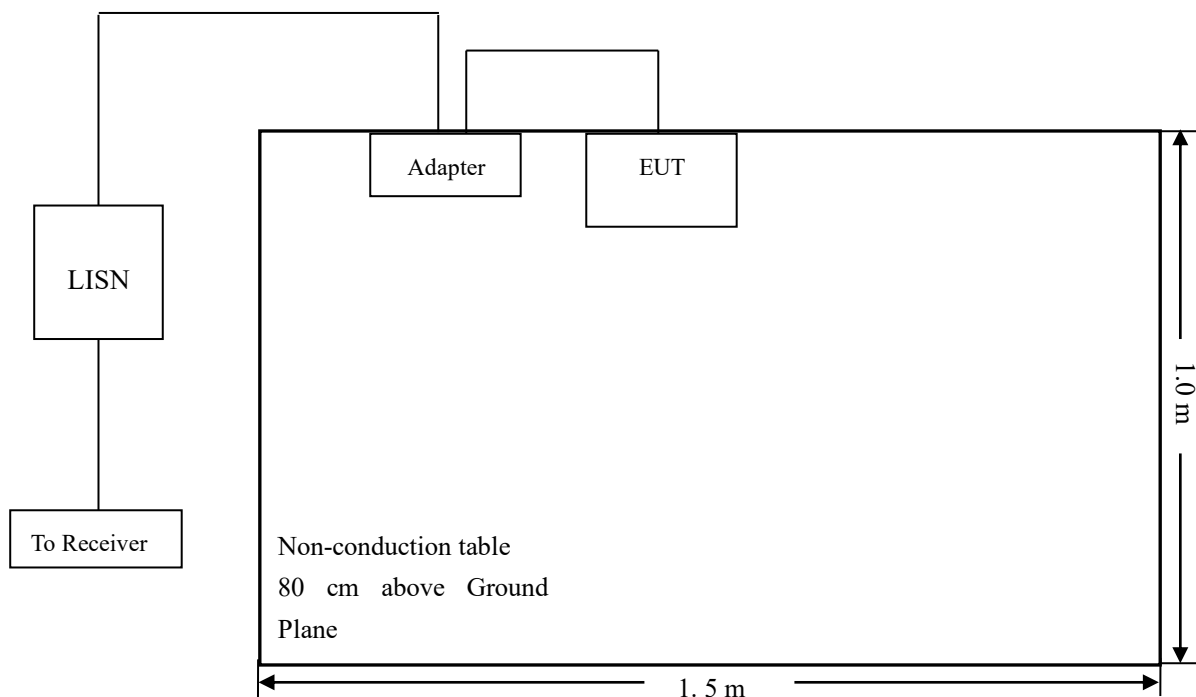
5.2 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

5.3 Basic Test Setup Block Diagram



5.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

5.5 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

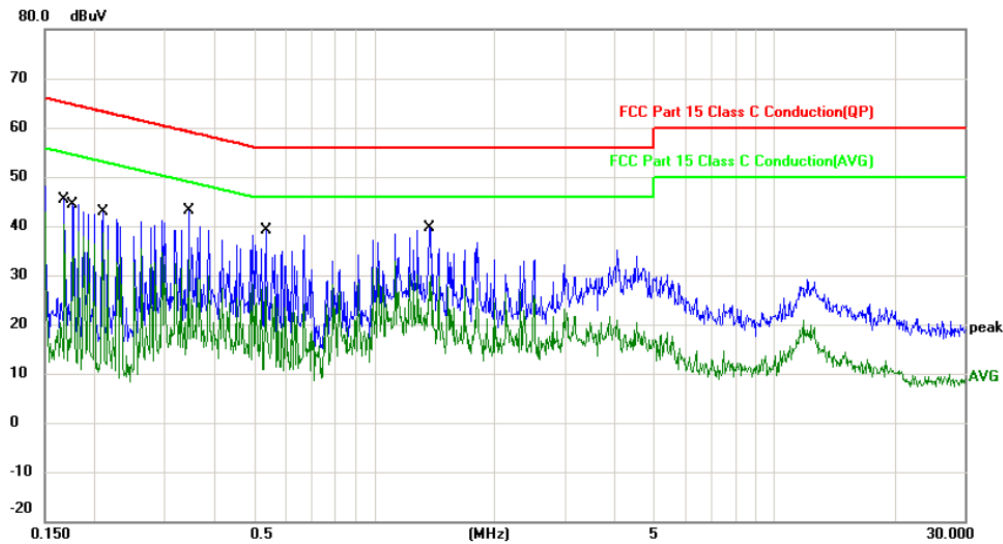
Start Frequency..... 150 kHz
Stop Frequency..... 30 MHz
Sweep Speed..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth 9 kHz
Quasi-Peak Adapter Mode Normal

5.6 Summary of Test Results/Plots

According to the data in section 3.8, the EUT complied with the FCC Part 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

Note: we are pre-scan all modes, the worst data is 5775MHz 802.11ac 80 mode.

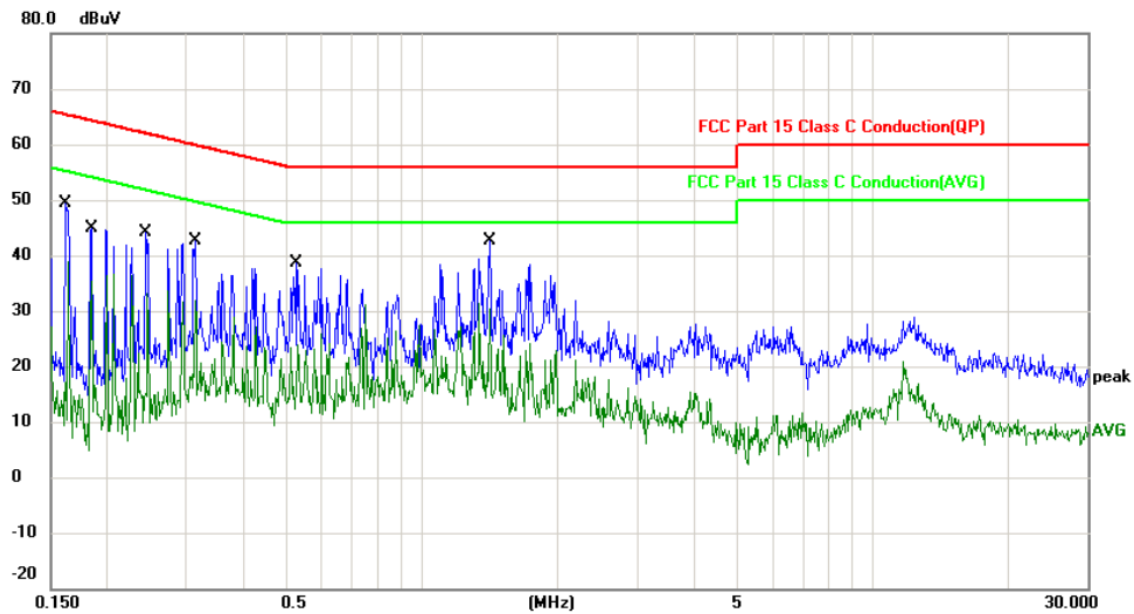
5.7 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data*EUT:* Solode*Tested Model:* TM3*Operating Condition:* Transmitting*Comment:* 100-240V 2.5A*Test Specification:* Neutral

No. Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	Detector
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.1676	45.17	0.26	45.43	65.07	-19.64	QP
2	0.1676	42.11	0.26	42.37	55.07	-12.70	AVG
3	0.1758	44.10	0.27	44.37	64.68	-20.31	QP
4	0.1758	41.55	0.27	41.82	54.68	-12.86	AVG
5	0.2094	42.58	0.29	42.87	63.23	-20.36	QP
6	0.2094	33.73	0.29	34.02	53.23	-19.21	AVG
7	0.3427	42.64	0.37	43.01	59.14	-16.13	QP
8 *	0.3427	40.77	0.37	41.14	49.14	-8.00	AVG
9	0.5350	38.67	0.44	39.11	56.00	-16.89	QP
10	0.5350	30.46	0.44	30.90	46.00	-15.10	AVG
11	1.3736	38.91	0.75	39.66	56.00	-16.34	QP
12	1.3736	28.63	0.75	29.38	46.00	-16.62	AVG

*:Maximum data x:Over limit !:over margin

Test Specification: Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1615	49.11	0.26	49.37	65.38	-16.01	QP
2		0.1615	39.54	0.26	39.80	55.38	-15.58	AVG
3		0.1844	44.64	0.27	44.91	64.28	-19.37	QP
4	*	0.1844	41.27	0.27	41.54	54.28	-12.74	AVG
5		0.2429	43.81	0.31	44.12	61.99	-17.87	QP
6		0.2429	35.09	0.31	35.40	51.99	-16.59	AVG
7		0.3133	42.29	0.35	42.64	59.88	-17.24	QP
8		0.3133	33.03	0.35	33.38	49.88	-16.50	AVG
9		0.5237	38.13	0.43	38.56	56.00	-17.44	QP
10		0.5237	30.64	0.43	31.07	46.00	-14.93	AVG
11		1.4107	41.91	0.74	42.65	56.00	-13.35	QP
12		1.4107	28.21	0.74	28.95	46.00	-17.05	AVG

*:Maximum data x:Over limit !:over margin

6. Power Spectral Density

6.1 Standard Applicable

Section 15.407(a) Power limits:

(1) (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) (i) For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output

power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(ii) For an indoor access point operating in the 5.850-5.895 GHz band, the maximum power spectral density must not exceed 20 dBm e.i.r.p. in any 1-megahertz band. In addition, the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm. Indoor access points operating on a channel that spans the 5.725-5.850 GHz and 5.850-5.895 GHz bands must not exceed an e.i.r.p. of 36 dBm.

(iii) For client devices operating under the control of an indoor access point in the 5.850-5.895 GHz band, the maximum power spectral density must not exceed 14 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm. Client devices operating on a channel that spans the 5.725-5.850 GHz and 5.850-5.895 GHz bands must not exceed an e.i.r.p. of 30 dBm.

(iv) For a subordinate device operating under the control of an indoor access point in the 5.850-5.895 GHz band, the maximum power spectral density must not exceed 20 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm.

(v) In the 5.850-5.895 GHz band, client devices must operate under the control of an indoor access point. In all cases, an exception exists for transmitting brief messages to an access point when attempting to join its network after detecting a signal that confirms that an access point is operating on a particular channel. Access points may connect to other access points. Client devices are prohibited from connecting directly to another client device.

Note to paragraph (a)(3):

The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.

(4) For a standard power access point and fixed client device operating in the 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum power spectral density must not exceed 23 dBm e.i.r.p. in any 1-megahertz band. In addition, the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm. For outdoor devices, the maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(5) For an indoor access point operating in the 5.925-7.125 GHz band, the maximum power spectral density must not exceed 5 dBm e.i.r.p. in any 1-megahertz band. In addition, the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm.

(6) For a subordinate device operating under the control of an indoor access point in the 5.925-7.125 GHz band, the maximum power spectral density must not exceed 5 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm.

(7) For a geofenced variable power access point operating in the 5.925-6.425 GHz or 6.525-6.875 GHz band, the maximum power spectral density must not exceed 11 dBm e.i.r.p. in any 1-megahertz band. In addition, the maximum e.i.r.p. over the frequency band of operation must not exceed 24 dBm.

(8) (i) For client devices, except for fixed client devices as defined in this subpart, operating under the control of a standard power access point in 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum power spectral density must not exceed 17 dBm e.i.r.p. in any 1-megahertz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm, and the device must limit its power to no more than 6 dB below its associated standard power access point's authorized transmit power.

- (ii) For client devices operating under the control of an indoor access point in the 5.925-7.125 GHz bands, the maximum power spectral density must not exceed -1 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 24 dBm.
- (iii) For client devices operating under the control of a geofenced variable power access point in the 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum power spectral density must not exceed 5 dBm e.i.r.p. in any 1-megahertz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 18 dBm, and the device must limit its power to no more than 6 dB below its associated geofenced variable power access point's authorized transmit power.
- (9) For very low power devices operating in the 5.925-7.125 GHz band, the maximum power spectral density must not exceed -5 dBm e.i.r.p. in any 1-megahertz band and the maximum e.i.r.p. must not exceed 14 dBm.
- (10) Access points operating under the provisions of paragraphs (a)(5), (6), (7) and (9) of this section must employ a permanently attached integrated antenna.
- (11) The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz.
- (12) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.
- (13) Power spectral density measurement: The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.895 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in all other bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

6.2 Test Procedure

According to 789033 D02 General UNII Test Procedures New Rules v02r01, the following is the measurement procedure.

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

- a) Set $RBW \geq 1/T$, where T is defined in section II.B.1.a).
- b) Set $VBW \geq 3$ RBW.
- c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500\text{kHz}/RBW)$ to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
- d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10\log(1\text{MHz}/RBW)$ to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHz is available on nearly all spectrum analyzers.

6.3 Environmental Conditions

Temperature:	20° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

6.4 Test Results/Plots

PASS

Please refer to Appendix A.5

7. Emission Bandwidth and Occupied Bandwidth

7.1 Standard Applicable

According to 15.407 (a) and (e)

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

7.2 Test Procedure

According to 789033 D02 v02r01, the following is the measurement procedure.

1. Emission Bandwidth (EBW)

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Measure the maximum width of the emission that is 26 dB down from the maximum 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%.

2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

D. 99 Percent Occupied Bandwidth

The 99-percent occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99-percent occupied bandwidth is required only as a condition for using the optional band-edge measurement techniques described in section II.G.3.d). Measurements of 99-percent occupied bandwidth may also optionally be used in lieu of the EBW to 789033 D02 v02r01 General UNII Test Procedures New Rules v01 define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in section II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW $\geq 3 \cdot$ RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

7.3 Environmental Conditions

Temperature:	24° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

7.4 Test Results/Plots

PASS

Please refer to Appendix A.4 and A.8

8. Maximum Conducted Output Power

8.1 Standard Applicable

Section 15.407(a) Power limits:

(1) (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) (i) For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz

band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(ii) For an indoor access point operating in the 5.850-5.895 GHz band, the maximum power spectral density must not exceed 20 dBm e.i.r.p. in any 1-megahertz band. In addition, the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm. Indoor access points operating on a channel that spans the 5.725-5.850 GHz and 5.850-5.895 GHz bands must not exceed an e.i.r.p. of 36 dBm.

(iii) For client devices operating under the control of an indoor access point in the 5.850-5.895 GHz band, the maximum power spectral density must not exceed 14 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm. Client devices operating on a channel that spans the 5.725-5.850 GHz and 5.850-5.895 GHz bands must not exceed an e.i.r.p. of 30 dBm.

(iv) For a subordinate device operating under the control of an indoor access point in the 5.850-5.895 GHz band, the maximum power spectral density must not exceed 20 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm.

(v) In the 5.850-5.895 GHz band, client devices must operate under the control of an indoor access point. In all cases, an exception exists for transmitting brief messages to an access point when attempting to join its network after detecting a signal that confirms that an access point is operating on a particular channel. Access points may connect to other access points. Client devices are prohibited from connecting directly to another client device.

Note to paragraph (a)(3):

The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.

(4) For a standard power access point and fixed client device operating in the 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum power spectral density must not exceed 23 dBm e.i.r.p. in any 1-megahertz band. In addition, the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm. For outdoor devices, the maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(5) For an indoor access point operating in the 5.925-7.125 GHz band, the maximum power spectral density must not exceed 5 dBm e.i.r.p. in any 1-megahertz band. In addition, the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm.

(6) For a subordinate device operating under the control of an indoor access point in the 5.925-7.125 GHz band, the maximum power spectral density must not exceed 5 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm.

(7) For a geofenced variable power access point operating in the 5.925-6.425 GHz or 6.525-6.875 GHz band, the maximum power spectral density must not exceed 11 dBm e.i.r.p. in any 1-megahertz band. In addition, the maximum e.i.r.p. over the frequency band of operation must not exceed 24 dBm.

(8) (i) For client devices, except for fixed client devices as defined in this subpart, operating under the control of a standard power access point in 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum power spectral density must not exceed 17 dBm e.i.r.p. in any 1-megahertz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm, and the device must limit its power to no more than 6 dB below its associated standard power access point's authorized transmit power.

- (ii) For client devices operating under the control of an indoor access point in the 5.925-7.125 GHz bands, the maximum power spectral density must not exceed -1 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 24 dBm.
- (iii) For client devices operating under the control of a geofenced variable power access point in the 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum power spectral density must not exceed 5 dBm e.i.r.p. in any 1-megahertz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 18 dBm, and the device must limit its power to no more than 6 dB below its associated geofenced variable power access point's authorized transmit power.
- (9) For very low power devices operating in the 5.925-7.125 GHz band, the maximum power spectral density must not exceed -5 dBm e.i.r.p. in any 1-megahertz band and the maximum e.i.r.p. must not exceed 14 dBm.
- (10) Access points operating under the provisions of paragraphs (a)(5), (6), (7) and (9) of this section must employ a permanently attached integrated antenna.
- (11) The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz.
- (12) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.
- (13) Power spectral density measurement: The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.895 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in all other bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

8.2 Test Procedure

According to KDB789033 D02 v02r01 section E, the following is the measurement procedure.

- (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- (ii) Set RBW = 1 MHz.
- (iii) Set VBW $\geq$ 3 MHz.
- (iv) Number of points in sweep $\geq$ 2 Span / RBW. (This ensures that bin-to-bin spacing is $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)
- (v) Sweep time = auto.
- (vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- (vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle $\geq$ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".
- (viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- (ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to

the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

8.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	65%
ATM Pressure:	1011 mbar

8.4 Summary of Test Results/Plots

PASS

Please refer to Appendix A.2

9. Emissions in Restricted Bands

9.1 Standard Applicable

According to §15.407 (b) Undesirable emission limits. Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (a) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (b) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (c) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (d) For transmitters operating in the 5.725-5.85 GHz band:
 - (i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
 - (ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.
- (e) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (f) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.
- (g) The provisions of §15.205 apply to intentional radiators operating under this section.
- (h) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

9.2 Test Procedure

According to KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section G: Unwanted Emission Measurement

- 1. Unwanted Emissions in the Restricted Bands
 - a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”
 - b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements below 1000 MHz.”
 - c) At frequencies above 1000 MHz, measurements performed using the peak and average measurement

procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.

- d) For conducted measurements above 1000 MHz, EIRP shall be computed as specified in section II.G.3.b) and then field strength shall be computed as follows (see KDB Publication 412172):
 - i) $E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$, where E = field strength and d = distance at which field strength limit is specified in the rules;
 - ii) $E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3$ meters
- e) For conducted measurements below 1000 MHz, the field strength shall be computed as specified in d), above, and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.

2. Unwanted Emissions that fall Outside of the Restricted Bands

- a) For all measurements, follow the requirements in section II.G.3. "General Requirements for Unwanted Emissions Measurements."
- b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. "Procedure for Unwanted Emissions Measurements below 1000 MHz."
- c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., "Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1000 MHz."
- d) Section 15.407(b) (1-3) specifies the unwanted emissions limit for the U-NII-1 and 2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz dBm/MHz peak emission limit.
- i) Section 15.407(b) (4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b) (4) (i). An alternative to the band emissions mask is specified in Section 15.407(b) (4) (ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.
- e) If radiated measurements are performed, field strength is then converted to EIRP as follows:
 - i) $\text{EIRP} = ((E \times d)^2) / 30$

Where:

- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotopically radiated power in watts;
- ii) Working in dB units, the above equation is equivalent to:
 $\text{EIRP} [\text{dBm}] = E [\text{dB}\mu\text{V/m}] + 20 \log(d [\text{meters}]) - 104.77$
- iii) Or, if d is 3 meters:
 $\text{EIRP} [\text{dBm}] = E [\text{dB}\mu\text{V/m}] - 95.23$

3) Radiated versus Conducted Measurements.

The unwanted emission limits in both the restricted and non-restricted bands are based on radiated measurements; however, as an alternative, antenna-port conducted measurements in conjunction with cabinet emissions tests will be permitted to demonstrate compliance provided that the following steps are performed:

- (i) Cabinet emissions measurements. A radiated test shall be performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna may be replaced by a termination matching the nominal impedance of the antenna.
- (ii) Impedance matching. Conducted tests shall be performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT.

(iii) EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater.³ However, for devices that operate in multiple bands using the same transmit antenna, the highest gain of the antenna within the operating band nearest to the out-of-band frequency being measured may be used in lieu of the overall highest gain when measuring emissions at frequencies within 20% of the absolute frequency at the nearest edge of that band, but in no case shall a value less than 2 dBi be selected.

(iv) EIRP adjustments for multiple outputs. For devices with multiple outputs occupying the same or overlapping frequency ranges in the same band (e.g., MIMO or beamforming devices), compute the total EIRP as follows:

- Compute EIRP for each output, as described in (iii), above.
- Follow the procedures specified in KDB Publication 662911 for summing emissions across the outputs or adjusting emission levels measured on individual outputs by $10 \log(NANT)$, where NANT is the number of outputs.
- Add the array gain term specified in KDB Publication 662911 for out-of-band and spurious signals.

(v) Direction of maximum emission.

For all radiated emissions tests, measurements shall correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

9.3 Environmental Conditions

Temperature:	21° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

9.4 Test Results/Plots

PASS

Please refer to Appendix A.6 and Appendix A.7

10. Radiated Spurious Emissions

10.1 Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz (68.2dBuV/m at 3m).

In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

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

10.2 Test Procedure

1) Sequence of testing 9 kHz to 30 MHz Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.0 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

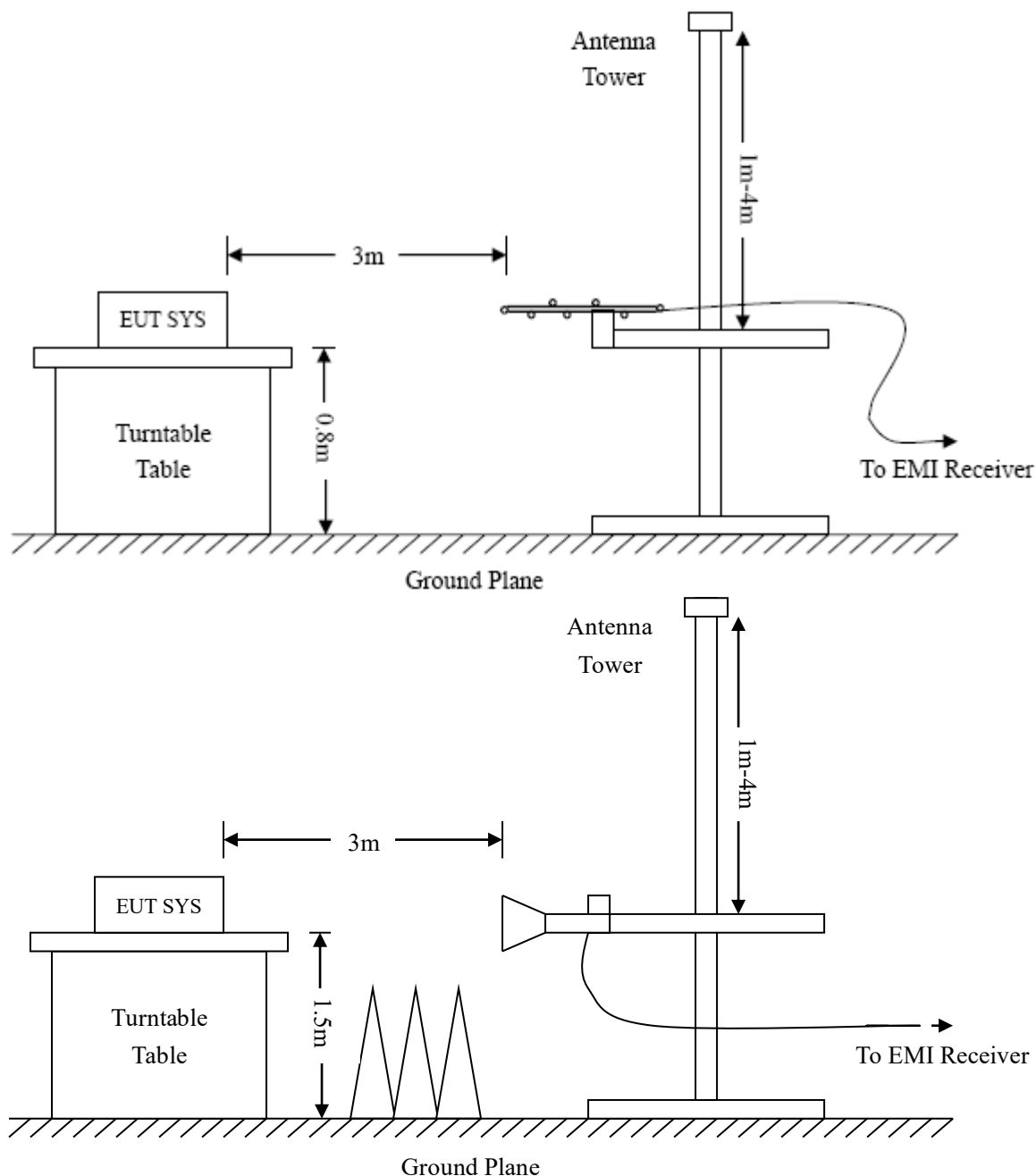
Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.



10.3 Test Receiver Setup

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10 th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

10.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

10.5 Environmental Conditions

Temperature:	22° C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

10.6 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.407(b)(6) standards, and had the worst margin of:

Between 9KHz – 30MHz

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o), the test result no need to reported.

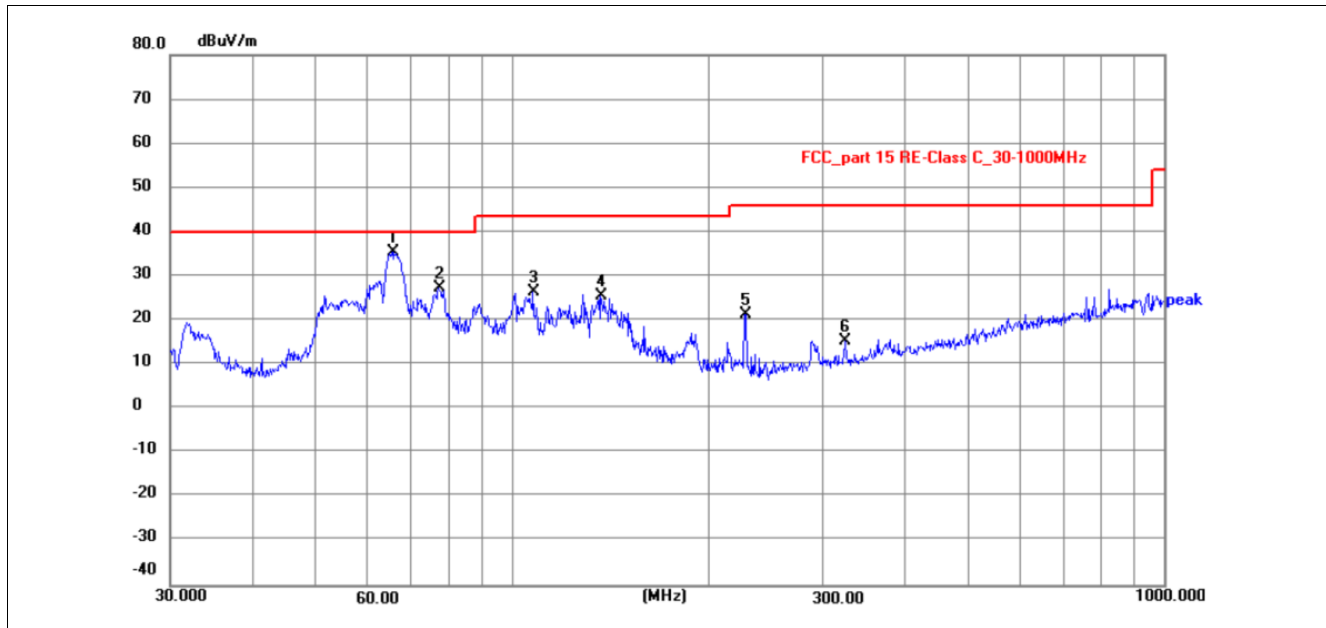
Note : All 802.11a/n/ac 20, 802.11n/ac 40, 802.11ac 80 modes have been tested for above 1GHz test, only the worst case 802.11ac 20) 5180Mhz was recorded. All 802.11a/n/ac 20, 802.11n/ac 40, 802.11ac 80 modes have been tested for above 1GHz test, only the worst case NII-1 802.11a and NII-3 802.11ac20 was recorded.

For 802.11a(CDD)

Spurious Emission From 30 MHz to 1 GHz

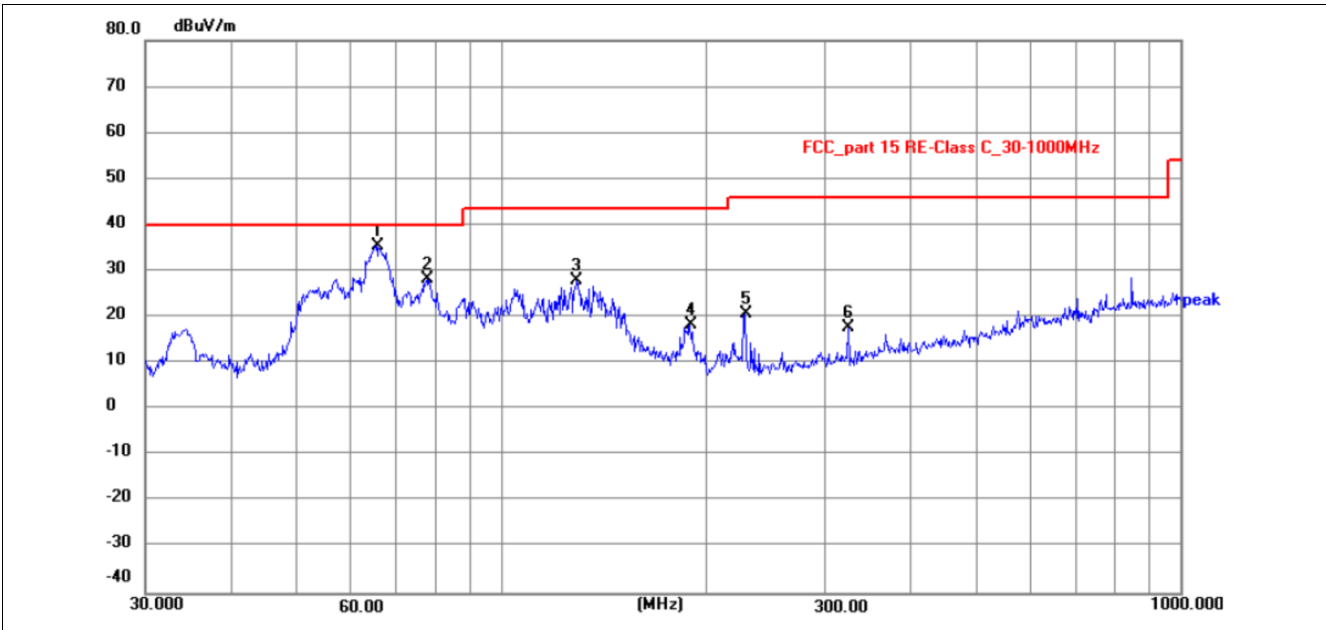
Test mode: Transmitting Channel 5180MHz

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	65.5727	53.48	-17.94	35.54	40.00	-4.46	peak
2	77.3212	47.37	-20.11	27.26	40.00	-12.74	peak
3	107.8877	45.56	-19.15	26.41	43.50	-17.09	peak
4	136.9391	42.41	-16.91	25.50	43.50	-18.00	peak
5	227.6906	40.18	-18.73	21.45	46.00	-24.55	peak
6	324.4560	30.36	-14.97	15.39	46.00	-30.61	peak

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	65.5727	53.29	-17.94	35.35	40.00	-4.65	peak
2	77.8654	48.57	-20.22	28.35	40.00	-11.65	peak
3	129.4677	45.24	-17.24	28.00	43.50	-15.50	peak
4	189.7385	37.05	-18.73	18.32	43.50	-25.18	peak
5	228.4904	39.53	-18.67	20.86	46.00	-25.14	peak
6	324.4560	32.63	-14.97	17.66	46.00	-28.34	peak

For 1GHz to 40GHz

802.11a(CDD)

Tested Channel	Frequency (MHz)	Emission Limit (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Read Value (dBuV)	Correction Factor (dB/m)
36 5180MHz	5150.00	55.00	PK	H	68.20	-13.20	52.01	2.99
	5150.00	48.52	AV	H	54.00	-5.48	45.53	2.99
	10360.00	47.21	PK	H	68.20	-20.99	40.05	7.16
	--	--	--	--	--	--	--	--
40 5200MHz	10400.00	45.64	PK	H	68.20	-22.56	38.35	7.29
	--	--	--	--	--	--	--	--
48 5240MHz	5350.50	37.46	PK	H	68.20	-30.74	34.42	3.04
	10480.00	35.68	PK	H	68.20	-32.52	28.33	7.35
	--	--	--	--	--	--	--	--
36 5180MHz	5150.00	56.12	PK	V	68.20	-12.08	53.13	2.99
	5150.00	48.31	AV	V	54.00	-5.69	45.32	2.99
	10360.00	47.20	PK	V	68.20	-21.00	40.04	7.16
	--	--	--	--	--	--	--	--
40 5200MHz	10400.00	42.41	PK	V	68.20	-25.79	35.12	7.29
	--	--	--	--	--	--	--	--
48 5240MHz	5350.50	36.07	PK	V	68.20	-32.13	33.03	3.04
	10480.00	35.78	PK	V	68.20	-32.42	28.43	7.35
	--	--	--	--	--	--	--	--

802.11ac20(MIMO)

Tested Channel	Frequency (MHz)	Emission Limit (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Read Value (dBuV)	Correction Factor (dB/m)
149 5745MHz	5720.00	65.03	PK	H	68.20	-3.17	62.04	4.80
	5720.00	53.12	AV	H	54.00	-0.88	50.13	4.80
	11490.00	47.18	PK	H	68.20	-21.02	40.02	9.00
	--	--	--	--	--	--	--	--
157 5785MHz	11570.00	42.42	PK	H	68.20	-25.78	35.13	9.32
	--	--	--	--	--	--	--	--
165 5825MHz	5855.00	35.09	PK	H	68.20	-33.11	32.05	5.15
	11650.00	33.57	PK	H	68.20	-34.63	26.22	9.45
	--	--	--	--	--	--	--	--
149 5745MHz	5720.00	55.13	PK	V	68.20	-13.07	52.14	4.80
	5720.00	43.11	AV	V	54.00	-10.89	40.12	4.80
	11490.00	40.38	PK	V	68.20	-27.82	33.22	9.00
	--	--	--	--	--	--	--	--
157 5785MHz	11570.00	37.31	PK	V	68.20	-30.89	30.02	9.32
	--	--	--	--	--	--	--	--
165 5825MHz	5855.00	29.36	PK	V	68.20	-38.84	26.32	5.15
	11650.00	28.48	PK	V	68.20	-39.72	21.13	9.45
	--	--	--	--	--	--	--	--

REMARKS:

1. Emission level (dBuV/m) = Read Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Emission level- Limit value.
4. -- Mean the other emission levels were very low against the limit.
5. RBW1MHz VBW3MHz Peak detector is for PK value; RBW1MHz VBW10Hz Peak detector is for AV value.

11. Frequency Stability

11.1 Standard Applicable

According to §15.407(g), Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

11.2 Test Procedure

According to §2.1055, the following test procedure was performed.

The Frequency Stability is measured directly with a Frequency Domain Analyzer. Frequency Deviation in ppm is calculated from the measured peak to peak value.

The Carrier Frequency Stability over Power Supply Voltage and over Temperature is measured with a Frequency Domain Analyzer in histogram mode

Temperature:	Supply Voltage
20°C	85-115% of declared nominal voltage
-30°C to +50°C	Normal

11.3 Environmental Conditions

Temperature:	20°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

11.4 Summary of Test Results/Plots

5150-5250MHz

802.11a

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	120	121	0.0231
40	120	118	0.0225
30	120	116	0.0221
20	120	124	0.0237
10	120	136	0.0260
0	120	141	0.0269
-10	120	133	0.0254
-20	120	128	0.0244
-30	120	144	0.0275

5725-5850MHz

802.11a

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	120	118	0.0208
40	120	124	0.0219
30	120	134	0.0237
20	120	125	0.0221
10	120	116	0.0205
0	120	147	0.0260
-10	120	157	0.0277
-20	120	184	0.0325
-30	120	164	0.0290

So, Frequency Stability Versus Input Voltage is:

5150-5250MHz

802.11a

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (V AC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	108	139	0.0265
	120	136	0.0260
	132	133	0.0254

5725-5850MHz

802.11a

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	108	147	0.0260
	120	154	0.0296
	132	186	0.0357

12. On Time and Duty Cycle

12.1 Standard requirement

None; for reporting purpose only

12.2 Test Procedure

- a) Set RBW = 1000 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.

12.3 Environmental Conditions

Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

12.4 Summary of Test Results/Plots

Please refer to Appendix A.1

14. -26dB Occupied Bandwidth Measurement

14.1 Standard requirement

No restriction limits. But resolution bandwidth within band edge measurement is 1% of the 99% occupied bandwidth.

14.2 Test Procedure

- a) Set RBW = 1%~5% OBW; VBW $\geq$ 3*RBW
- b) The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
- c) Measured the spectrum width with power higher than 26dB below carrier.

14.3 Environmental Conditions

Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

14.4 Summary of Test Results/Plots

PASS

Please refer to Appendix A.3

END OF REPORT *****