TEST REPORT

Reference No.	:	WTX23X02019626W001
FCC ID	:	2BABC-DWARF
Applicant	:	Tinyphoton Ltd.
Address	:	Room A708 Huibaojiang Building, No. 398 Minzhi Avenue, Shenzhen, China.
Manufacturer	:	The same as Applicant
Address	:	The same as Applicant
Product Name	:	DWARF II Smart Telescope
Model No.	:	CCT1D1D20101
Standards	:	FCC Part 15.407
Date of Receipt sample	:	2022-10-28
Date of Test	:	2022-10-29 to 2022-12-05; 2023-02-14 to 2023-03-15
Date of Issue	:	2023-03-15
Test Report Form No.	:	WTX_Part 15_407W
Test Result	:	**Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of approver.

Prepared By:

Waltek Testing Group (Shenzhen) Co., Ltd.

Address: 1/F., Room 101, Building 1, Hongwei Industrial Park, Liuxian 2nd Road,
Block 70 Bao'an District, Shenzhen, Guangdong, China

Tel.: +86-755-33663308 Fax.: +86-755-33663309 Email: sem@waltek.com.cn

Tested by:

Jack Huang

Jack Huang

Approved by:

Silin Chen

Silin Chen

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Rev.00	2023-03-15	Original
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

General Description of EUT	
Product Name:	DWARF II Smart Telescope
Trade Name:	DWARFLAB
Model No.:	CCT1D1D20101
Adding Model(s):	/
Rated Voltage:	USB DC 5V, DC 9V Battery DC 3.7V
Battery Capacity:	5600mAh
Power Adapter:	/
Software Version:	1.6.17
Hardware Version:	1.3.22
Note: The test data is gathered from a production sample, provided by the manufacturer.	

Technical Characteristics of EUT	
Support Standards:	802.11a, 802.11n(HT20) , 802.11n-HT40, 802.11ac-VHT80
Frequency Range:	5150-5250MHz, 5725-5850MHz
RF Output Power:	14.05dBm (Conducted)
Type of Modulation:	BPSK, QPSK,16QAM,64QAM, 256QAM
Type of Antenna:	FPC Antenna
Antenna Gain:	4.01dBi
Note: The Antenna Gain is provided by the customer and can affect the validity of results.	

1.2 Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.407: General technical requirements.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
KDB789033 D02 v02r01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-Nii) Devices Part 15, Subparte.

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 C63.10-2013, KDB789033 D02 v02r01 The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

1.4 Table for parameters of Test Software setting

Run commands and follow the instructions given by the manufacturer, you can start to test. 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.

Mode	Test Frequency (MHz)												
	NCB: 20MHz												
	5180	5200	5240	5260	5300	5320	5500	5580	5700	5720	5745	5785	5825
802.11a 6Mbps	-1	-1	-1	/	/	/	/	/	/	/	-1	-1	-1
802.11n-HT20 MCS0	-1	-1	-1	/	/	/	/	/	/	/	-1	-1	-1

Mode	NCB: 40MHz									
	5190	5230	5270	5310	5510	5550	5670	5710	5755	5795
802.11n-HT40 MCS0	-1	-1	/	/	/	/	/	/	-1	-1

Mode	NCB: 80MHz					
	5210	5290	5530	5610	5690	5775
802.11ac-VH80 MCS0/Nss2	-1	/	/	/	/	-1

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 Android were executed.

1.6 Test Facility

Address of the test laboratory

Laboratory: Waltek Testing Group (Shenzhen) Co., Ltd.

Address: 1/F., Room 101, Building 1, Hongwei Industrial Park, Liuxian 2nd Road, Block 70 Bao'an District, Shenzhen, Guangdong, China

FCC – Registration No.: 125990

Waltek Testing Group (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is mai ntained in our files. The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Waltek Testing Group (Shenzhen) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A and the CAB identifier is CN0057.

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, with a duty cycle equal to 100%, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11a	5180MHz,5200MHz,5240MHz, 5745MHz, 5785MHz,5825MHz
TM2	802.11n-HT20	5180MHz,5200MHz,5240MHz, 5745MHz, 5785MHz,5825MHz
TM3	802.11n-HT40	5190MHz,5230MHz, 5755MHz,5795MHz
TM4	802.11ac-VH80	5210MHz, 5775 MHz
Note: 802.11ac-VHT20, 802.11ac-VHT40 covered by 802.11n-HT20 and 802.11n-HT40.		

Test Conditions	
Temperature:	22~25 °C
Relative Humidity:	45~55 %.
ATM Pressure:	1019 mbar

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
USB Cable	1.20	Unshielded	Without Ferrite

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Mobile phone	HUAWEI	VOG-AL00	/
Notebook	Lenovo	E445	EB12648265
Adapter	Xiaomi	MDY-08-ES	/

1.8 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Power Spectral Density	Conducted	±1.8dB
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	9-150kHz ±3.74dB
		0.15-30MHz ±3.34dB
Transmitter Spurious Emissions	Radiated	30-200MHz ±4.52dB
		0.2-1GHz ±5.56dB
		1-6GHz ±3.84dB
		6-18GHz ±3.92dB

1.9 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
SEMT-1075	Communication Tester	Rohde & Schwarz	CMW500	148650	2022-03-22	2023-03-21
SEMT-1063	GSM Tester	Rohde & Schwarz	CMU200	114403	2022-03-22	2023-03-21
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2022-03-25	2023-03-24
SEMT-1079	Spectrum Analyzer	Agilent	N9020A	US47140102	2022-03-22	2023-03-21
SMET-1313	Spectrum Analyzer	Agilent	N9020A	MY54320548	2022-03-22	2023-03-21
SEMT-1080	Signal Generator	Agilent	83752A	3610A01453	2022-03-22	2023-03-21
SEMT-1081	Vector Signal Generator	Agilent	N5182A	MY47070202	2022-03-22	2023-03-21
SEMT-1028	Power Divider	Weinschel	1506A	PM204	2022-03-22	2023-03-21
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	/	/
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	/	/
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	/	/
SEMT-C004	Cable	Zheng DI	2M0RFC	/	/	/
SEMT-C005	Cable	Zheng DI	1M0RFC	/	/	/
SEMT-C006	Cable	Zheng DI	1M0RFC	/	/	/
☒Chamber A: Below 1GHz						
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2022-03-22	2023-03-21
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2022-03-22	2023-03-21
SEMT-1008	Amplifier	HP	8447F	2805A03475	2022-01-07	2023-01-06
					2022-12-30	2023-12-29
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2021-03-20	2023-03-19
SEMT-1068	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2021-03-20	2023-03-19
☒Chamber A: Above 1GHz						
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2022-03-22	2023-03-21
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2022-03-22	2023-03-21

SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2022-03-22	2023-03-21
SEMT-1042	Horn Antenna	ETS	3117	00086197	2021-03-19	2023-03-18
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2021-04-27	2023-04-26
SEMT-1216	Pre-amplifier	Schwarzbeck	BBV 9721	9721-031	2022-03-25	2023-03-24
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2022-03-22	2023-03-21
☐Chamber B:Below 1GHz						
SEMT-1068	Trilog Broadband Antenna	Schwarz beck	VULB9163(B)	9163-635	2021-04-09	2023-04-08
SEMT-1067	Amplifier	Agilent	8447D	2944A10179	2022-03-22	2023-03-21
SEMT-1066	EMI Test Receiver	Rohde & Schwarz	ESPI	101391	2022-03-22	2023-03-21
☐Chamber C:Below 1GHz						
SEMT-1319	EMI Test Receiver	Rohde & Schwarz	ESIB 26	100401	2022-01-07	2023-01-06
					2022-12-30	2023-12-29
SEMT-1343	Trilog Broadband Antenna	Schwarz beck	VULB 9168	1194	2021-05-28	2023-05-27
SEMT-1333	Amplifier	HP	8447F	2944A03869	2022-03-22	2023-03-21
☒Conducted Room 1#						
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2022-03-21	2023-03-20
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2022-03-25	2023-03-24
SEMT-1003	AC LISN	Schwarz beck	NSLK8126	8126-224	2022-03-22	2023-03-21
☐Conducted Room 2#						
SEMT-1334	EMI Test Receiver	Rohde & Schwarz	ESPI	101259	2022-03-22	2023-03-21
SEMT-1336	LISN	Rohde & Schwarz	ENV 216	100097	2022-03-22	2023-03-21

Software List			
Description	**Manufacturer**	**Model**	**Version**
EMI Test Software (Radiated Emission)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission)*	Farad	EZ-EMC	RA-03A1

*Remark: indicates software version used in the compliance certification testing.

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§15.203; §15.405	Antenna Requirement	Compliant
15.407 (c)	Automatically Discontinue Transmission	Compliant
§15.207; §15.407(b)(6)	Conducted Emission	Compliant
§15.407(a)(1),(2)	Power Spectral Density	Compliant
§15.407(e)	Emission Bandwidth and Occupied Bandwidth	Compliant
§15.407(a)(1),(2)	Maximum Conducted Output Power	Compliant
§15.407(b)(1),(2),(3),(4)	Undesirable emission	Compliant
§15.205; §15.407(b)(1),(2),(3)	Radiated Emission	Compliant
§15.407(g)	Frequency Stability	Compliant
§15.407(h)	Dynamic Frequency Selection (DFS)	Compliant

N/A: Not applicable.

3. Antenna Requirement

3.1 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.

3.2 Evaluation Information

This product has an FPC Antenna, fulfill the requirement of this section.

4. Automatically Discontinue Transmission

4.1 Standard Applicable

According to FCC Part 15.407(c), the device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

4.2 Summary of Test Results

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

5. Power Spectral Density

5.1 Standard Applicable

Section 15.407(a) Power limits:

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

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

(3) For the band 5.725-5.85GHz, 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 30dBm in any 500kHz band. If transmitting antennas of directional gain greater than 6dBi 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 6dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6dBi 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.

5.2 Test Procedure

According to 789033 D02 v02r01 General UNII Test Procedures New Rules v02, the following is the measurement procedure.
For devices operating in the bands 5.15-5.25GHz, 5.25-5.35GHz, and 5.47-5.725GHz, 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 5.725-5.85GHz, the rules specify a measurement bandwidth of 500kHz. Many spectrum analyzers do not have 500kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500kHz, “provided that the measured power is integrated over the full

reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1MHz, or 500kHz). If measurements are performed using a reduced resolution bandwidth (< 1MHz, or < 500kHz) and integrated over 1 MHz, or 500kHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.I.a).
b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500kHz) 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 10log(1MHz/RBW) to the measured result, whereas RBW (< 1MHz) 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 100kHz for the sections 5.c) and 5.d) above, since RBW=100kHZ is available on nearly all spectrum analyzers.

5.3 Summary of Test Results/Plots

Please refer to Appendix A

6. Emission Bandwidth and Occupied Bandwidth

6.1 Standard Applicable

According to 15.407(a) and (e):

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

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

(3) For the band 5.725-5.85GHz, 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 30dBm in any 500kHz band. If transmitting antennas of directional gain greater than 6dBi 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 6dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6dBi 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 5.725-5.85GHz band, the minimum 6dB bandwidth of U-NII devices shall be at least 500kHz.

6.2 Test Procedure

According to 789033 D02 v02r0r section C&D, 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 26dB 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 5.725-5.85GHz
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100kHz.
b) Set the video bandwidth (VBW) ≥ 3 × 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 6dB 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 ≥ 3 * 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.

6.3 Summary of Test Results/Plots

Please refer to Appendix B

7. Maximum Conducted Output Power

7.1 Standard Applicable

Section 15.407(a) Power limits:

(1) For the band 5.15-5.25GHz.
(iv) For mobile and portable client devices in the 5.15-5.25GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11dBm 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 6dBi.

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

(3) For the band 5.725-5.85GHz, 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 30dBm in any 500kHz band. If transmitting antennas of directional gain greater than 6dBi 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 6dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6dBi 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.

7.2 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 = 1MHz.

(iii) Set VBW ≥ 3MHz.

(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ 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 ≥ 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 1MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

7.3 Summary of Test Results/Plots

Please refer to Appendix C

8. Radiated Spurious Emissions

8.1 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:

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

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

(3) For transmitters operating in the 5.47-5.725GHz band: All emissions outside of the 5.47-5.725GHz band shall not exceed an e.i.r.p. of −27dBm/MHz.

(4) For transmitters operating in the 5.725-5.85GHz band:

(i) All emissions shall be limited to a level of −27dBm/MHz at 75MHz or more above or below the band edge increasing linearly to 10dBm/MHz at 25MHz above or below the band edge, and from 25MHz above or below the band edge increasing linearly to a level of 15.6dBm/MHz at 5MHz above or below the band edge, and from

5MHz above or below the band edge increasing linearly to a level of 27dBm/MHz at the band edge.

According to §15.407(b)(6), Unwanted emissions below 1GHz 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.

According to §15.407(b)(7), The provisions of §15.205 apply to intentional radiators operating under this section.

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If radiated measurements are performed, field strength is then converted to EIRP as follows:

EIRP = ((E*d)^2) / 30

where:

• E is the field strength in V/m;

• d is the measurement distance in meters;

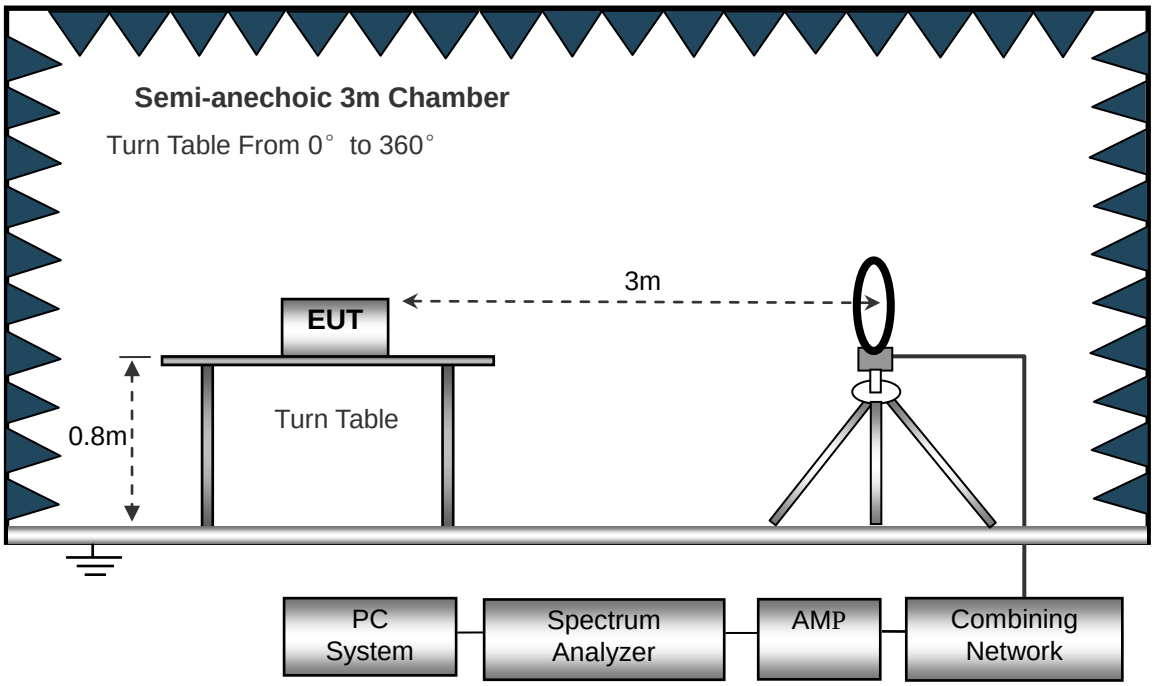
• EIRP is the equivalent isotropically radiated power in watts.

8.2 Test Procedure

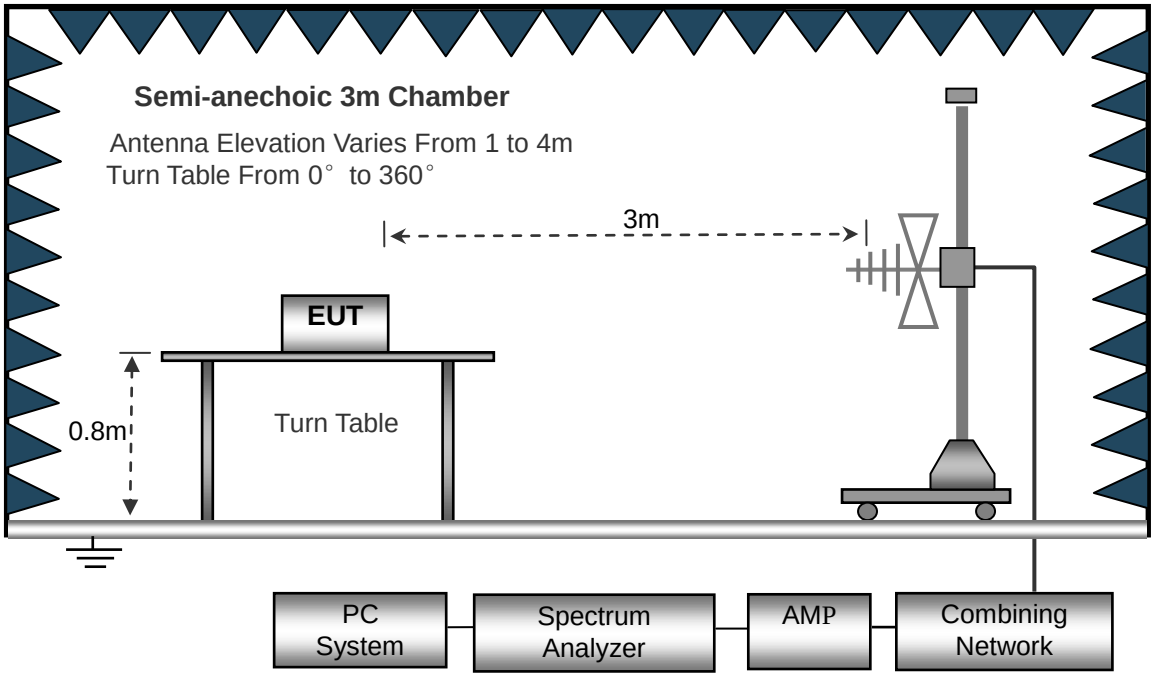
The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.407(b)(6) and FCC Part 15.209 Limit..

The external I/O cables were draped along the test table and formed a bundle 30 to 40cm long in the middle. The spacing between the peripherals was 10cm.

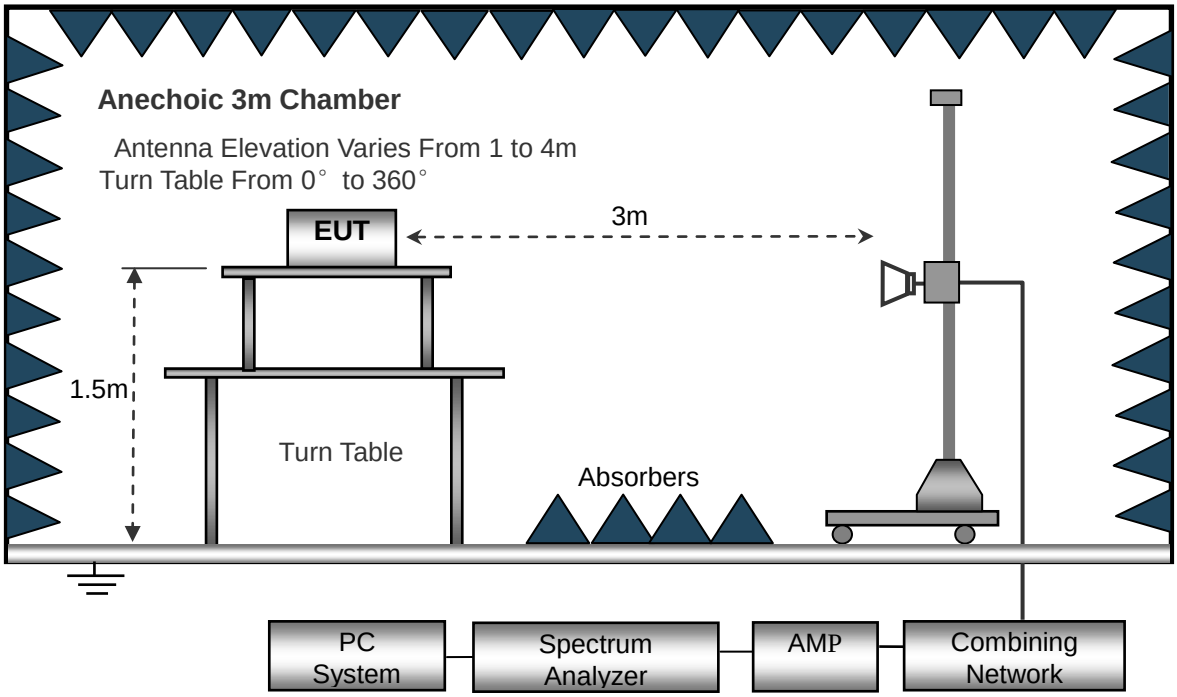
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30MHz to 1GHz.



The test setup for emission measurement above 1GHz.



8.3 Test Receiver Setup

During the radiated emission test for above 1GHz, the test receiver was set with the following configurations:

For peak detector:
RBW = 1000kHz, VBW = 3000kHz, Sweep Time = Auto

For average detector:
RBW = 1000kHz, VBW = 10Hz, Sweep Time = Auto

8.4 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:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

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

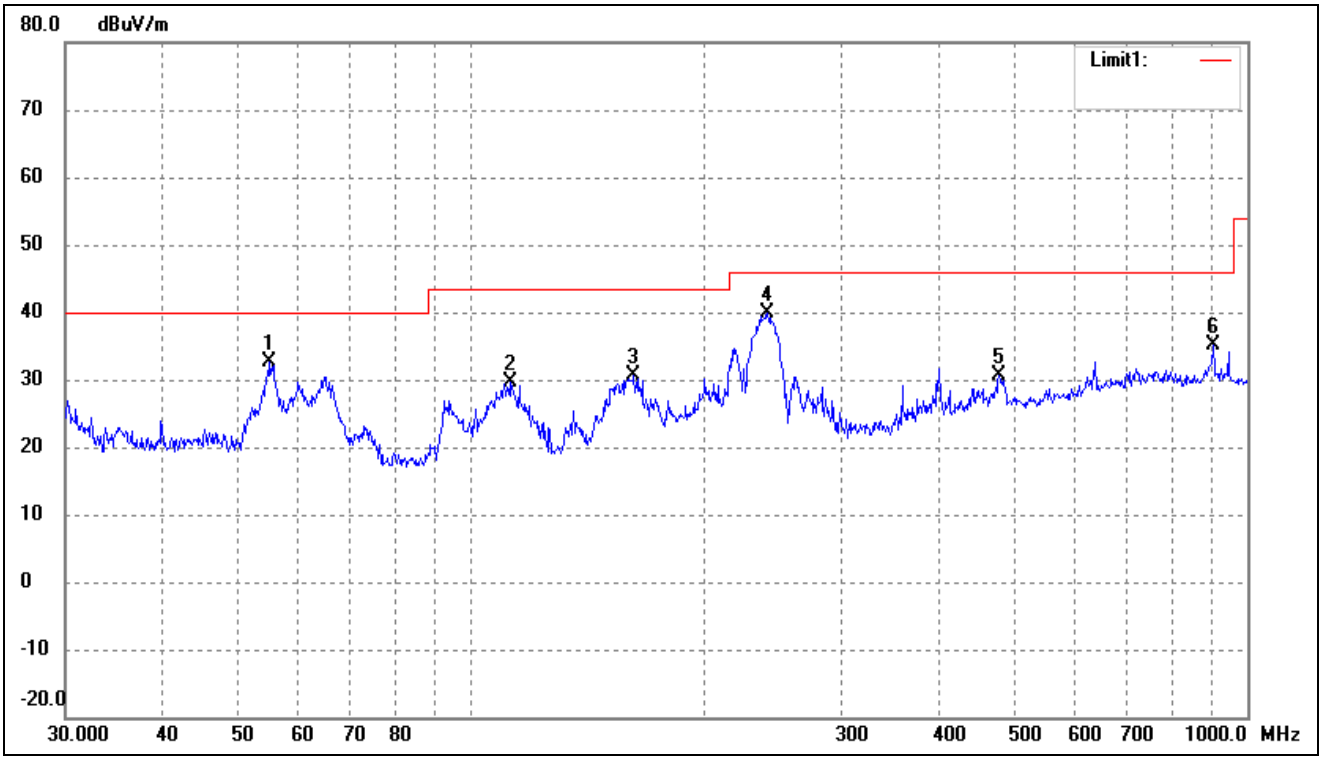
Margin = Corr. Ampl. – FCC Part 15 Limit

8.5 Summary of Test Results/Plots

Note: *this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*

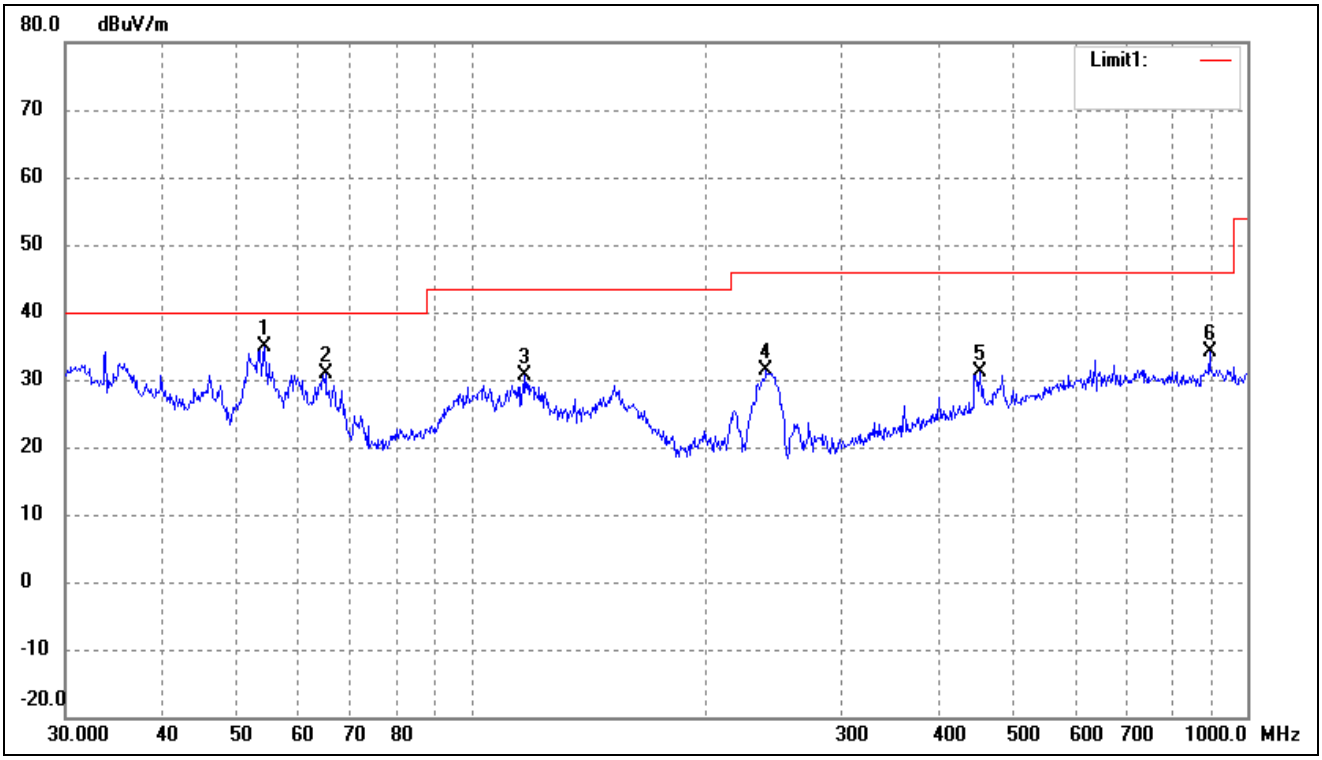
- Spurious Emission From 30MHz to 1GHz
- 5150-5250MHz

802.11a(Worst case)			
Test Channel	5180MHz	Polarity:	Horizontal



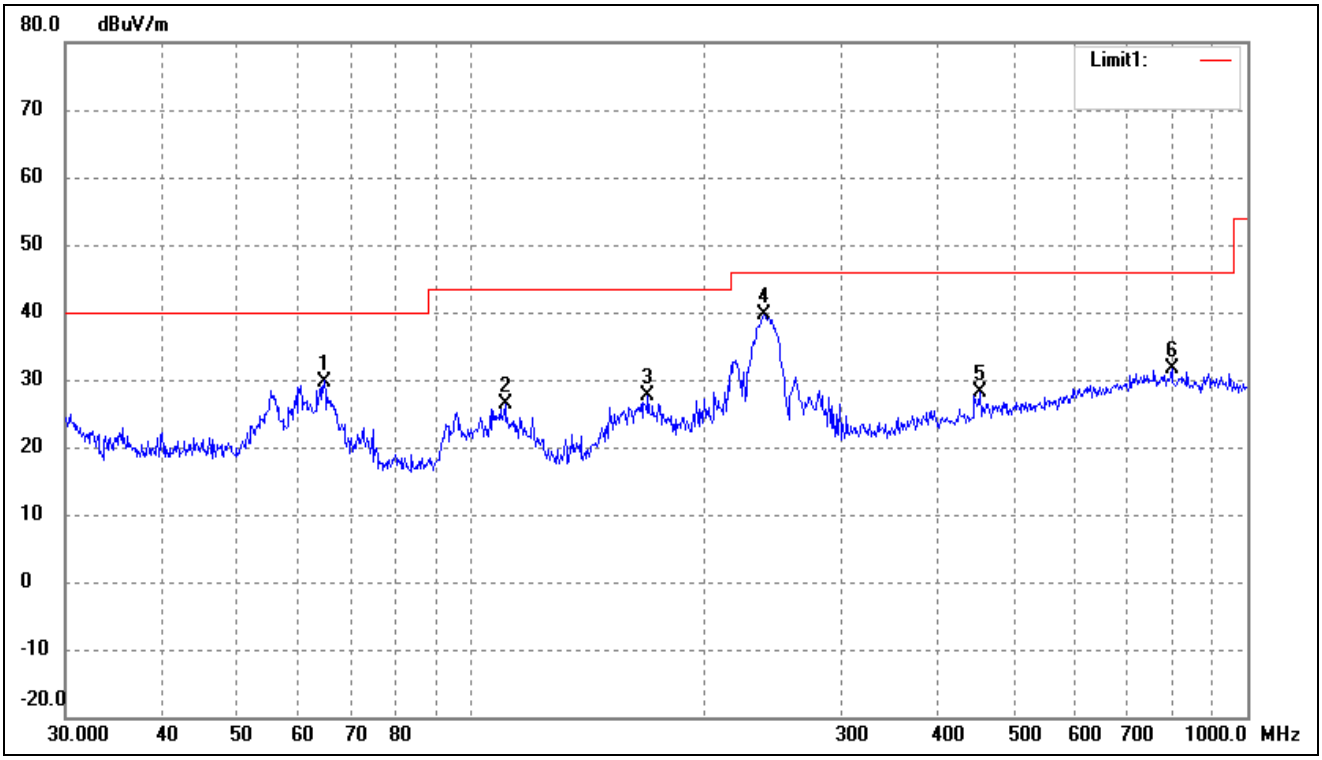
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	55.0274	39.64	-7.05	32.59	40.00	-7.41	--	--	peak
2	112.1305	38.05	-8.48	29.57	43.50	-13.93	--	--	peak
3	162.0414	42.37	-11.63	30.74	43.50	-12.76	--	--	peak
4	240.8304	48.12	-8.18	39.94	46.00	-6.06	--	--	peak
5	478.8456	32.29	-1.63	30.66	46.00	-15.34	--	--	peak
6	903.3094	32.27	2.86	35.13	46.00	-10.87	--	--	peak

802.11a(Worst case)			
Test Channel	5180MHz	Polarity:	Vertical



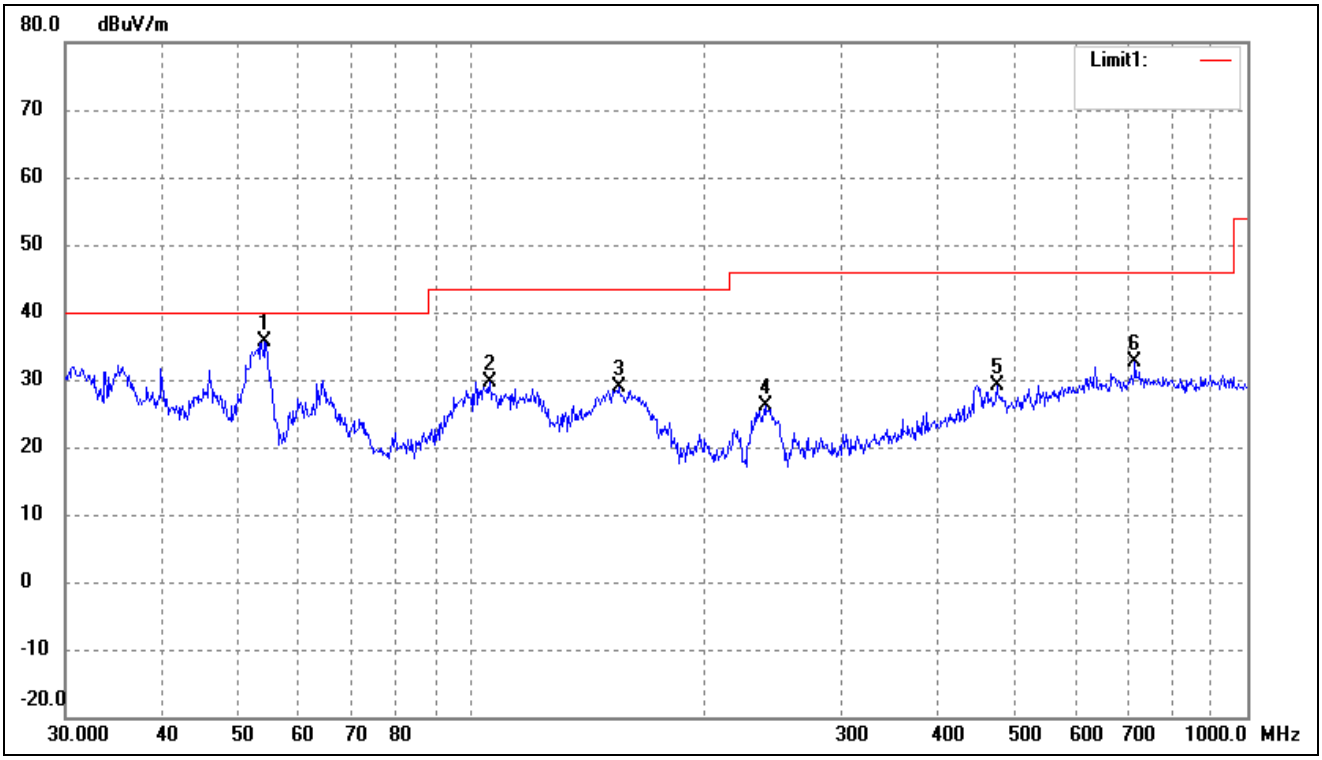
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	54.0711	41.85	-6.92	34.93	40.00	-5.07	--	--	peak
2	64.8865	39.54	-8.65	30.89	40.00	-9.11	--	--	peak
3	117.3603	39.46	-8.87	30.59	43.50	-12.91	--	--	peak
4	239.9874	39.60	-8.20	31.40	46.00	-14.60	--	--	peak
5	452.7197	33.52	-2.28	31.24	46.00	-14.76	--	--	peak
6	893.8567	31.33	2.85	34.18	46.00	-11.82	--	--	peak

802.11a(Worst case)			
Test Channel	5200MHz	Polarity:	Horizontal



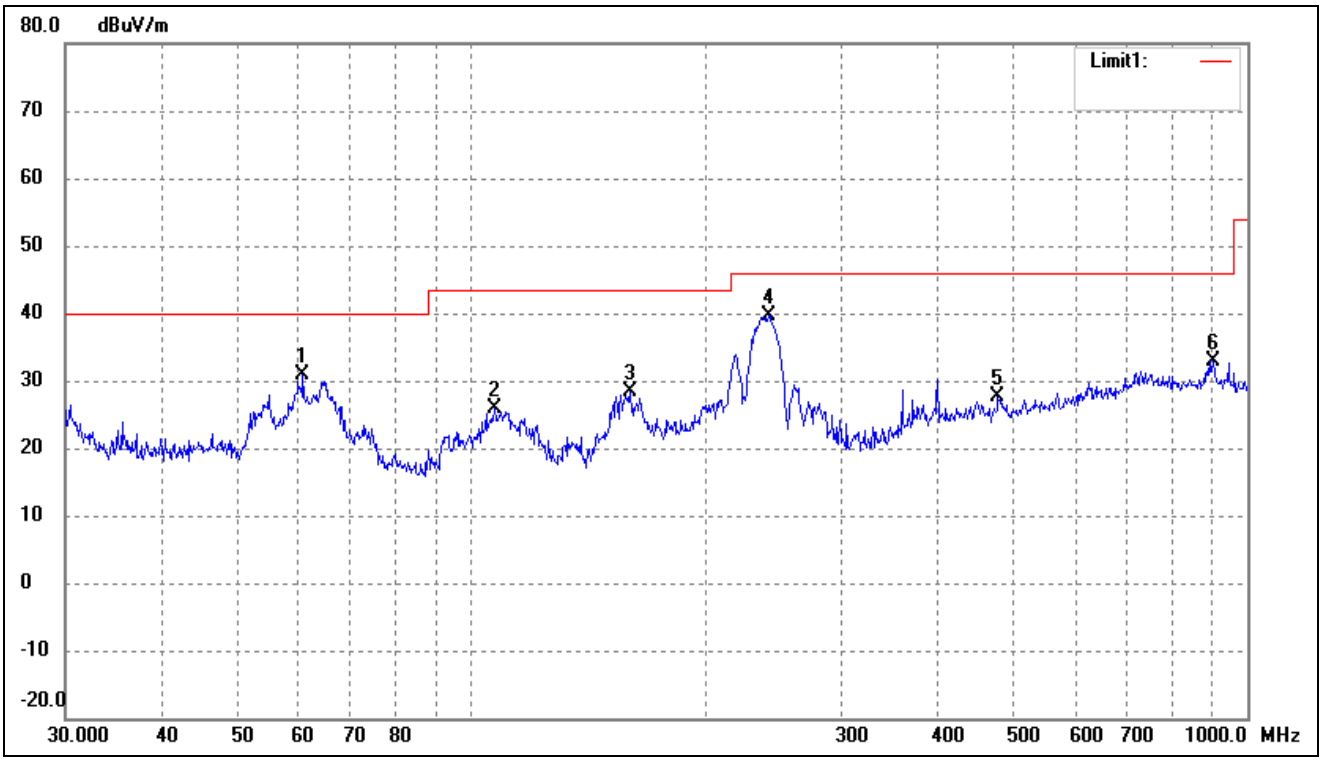
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	64.6594	38.36	-8.61	29.75	40.00	-10.25	--	--	peak
2	110.5687	34.68	-8.37	26.31	43.50	-17.19	--	--	peak
3	169.0054	38.84	-11.32	27.52	43.50	-15.98	--	--	peak
4	238.3102	47.86	-8.25	39.61	46.00	-6.39	--	--	peak
5	452.7197	30.35	-2.28	28.07	46.00	-17.93	--	--	peak
6	798.9797	29.44	2.23	31.67	46.00	-14.33	--	--	peak

802.11a(Worst case)			
Test Channel	5200MHz	Polarity:	Vertical



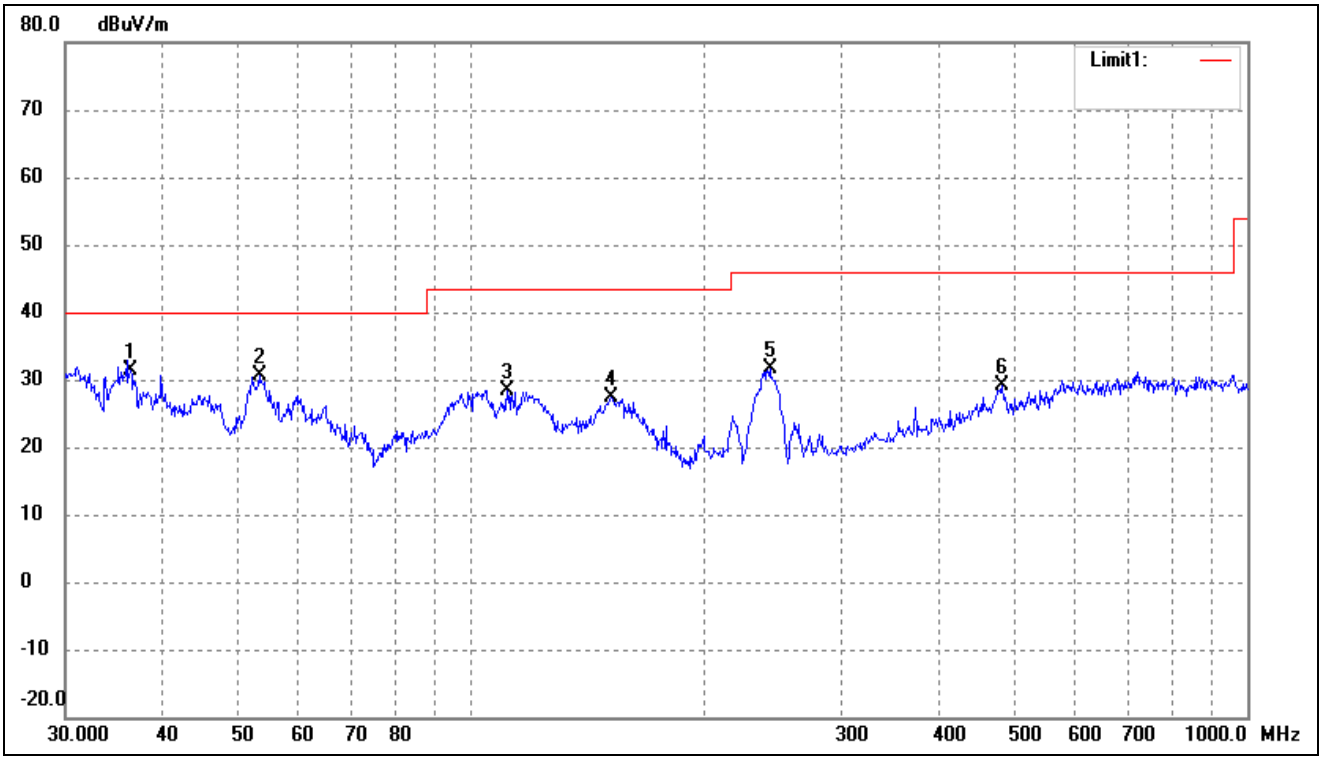
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	54.2610	42.61	-6.95	35.66	40.00	-4.34	--	--	peak
2	105.6415	37.76	-8.24	29.52	43.50	-13.98	--	--	peak
3	154.8204	40.80	-11.94	28.86	43.50	-14.64	--	--	peak
4	239.1473	34.24	-8.22	26.02	46.00	-19.98	--	--	peak
5	475.4991	30.88	-1.71	29.17	46.00	-16.83	--	--	peak
6	716.6820	30.76	1.75	32.51	46.00	-13.49	--	--	peak

802.11a(Worst case)			
Test Channel	5240MHz	Polarity:	Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	60.7044	38.84	-7.91	30.93	40.00	-9.07	--	--	peak
2	107.1337	34.16	-8.27	25.89	43.50	-17.61	--	--	peak
3	160.3456	40.16	-11.70	28.46	43.50	-15.04	--	--	peak
4	241.6763	47.82	-8.15	39.67	46.00	-6.33	--	--	peak
5	477.1694	29.30	-1.67	27.63	46.00	-18.37	--	--	peak
6	903.3094	29.96	2.86	32.82	46.00	-13.18	--	--	peak

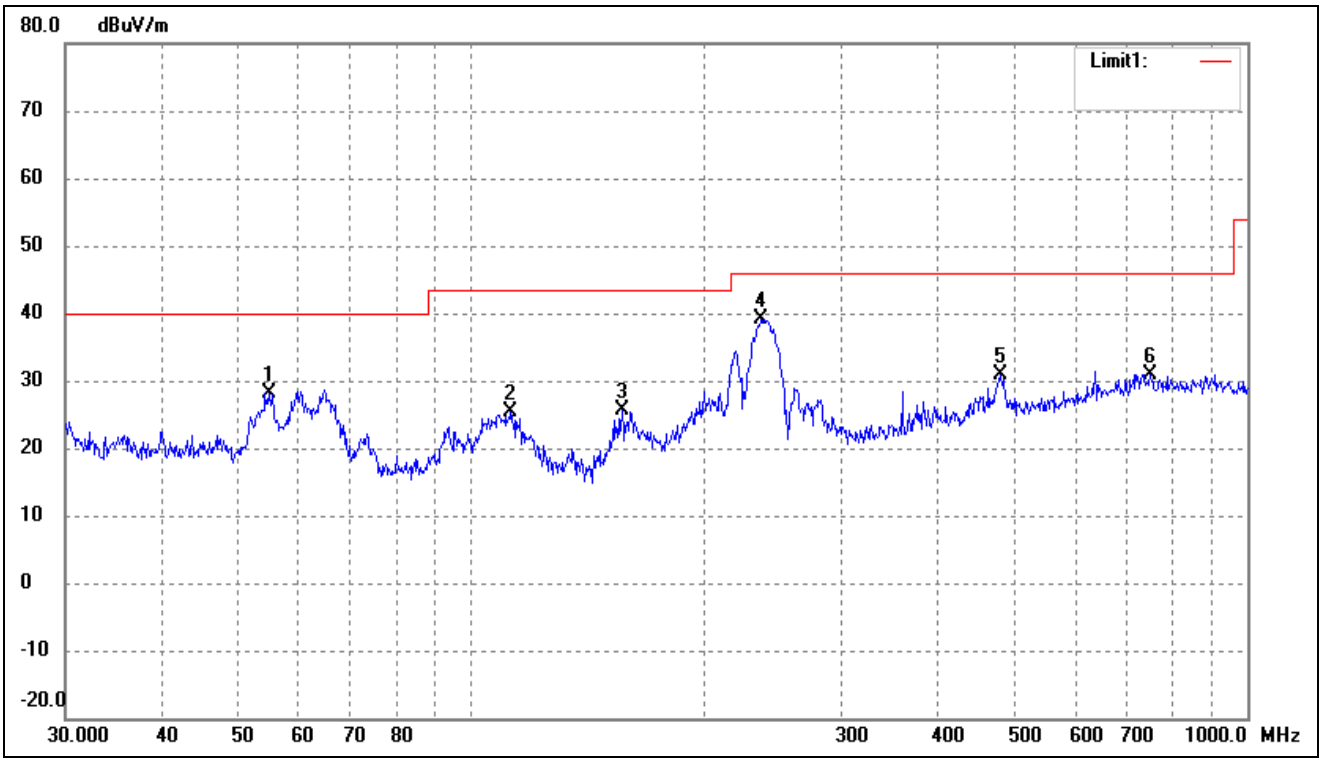
802.11a(Worst case)			
Test Channel	5240MHz	Polarity:	Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	36.3814	38.63	-7.22	31.41	40.00	-8.59	--	--	peak
2	53.3179	37.38	-6.81	30.57	40.00	-9.43	--	--	peak
3	111.3468	36.89	-8.42	28.47	43.50	-15.03	--	--	peak
4	151.5972	39.50	-12.08	27.42	43.50	-16.08	--	--	peak
5	242.5253	39.81	-8.14	31.67	46.00	-14.33	--	--	peak
6	482.2156	30.71	-1.54	29.17	46.00	-16.83	--	--	peak

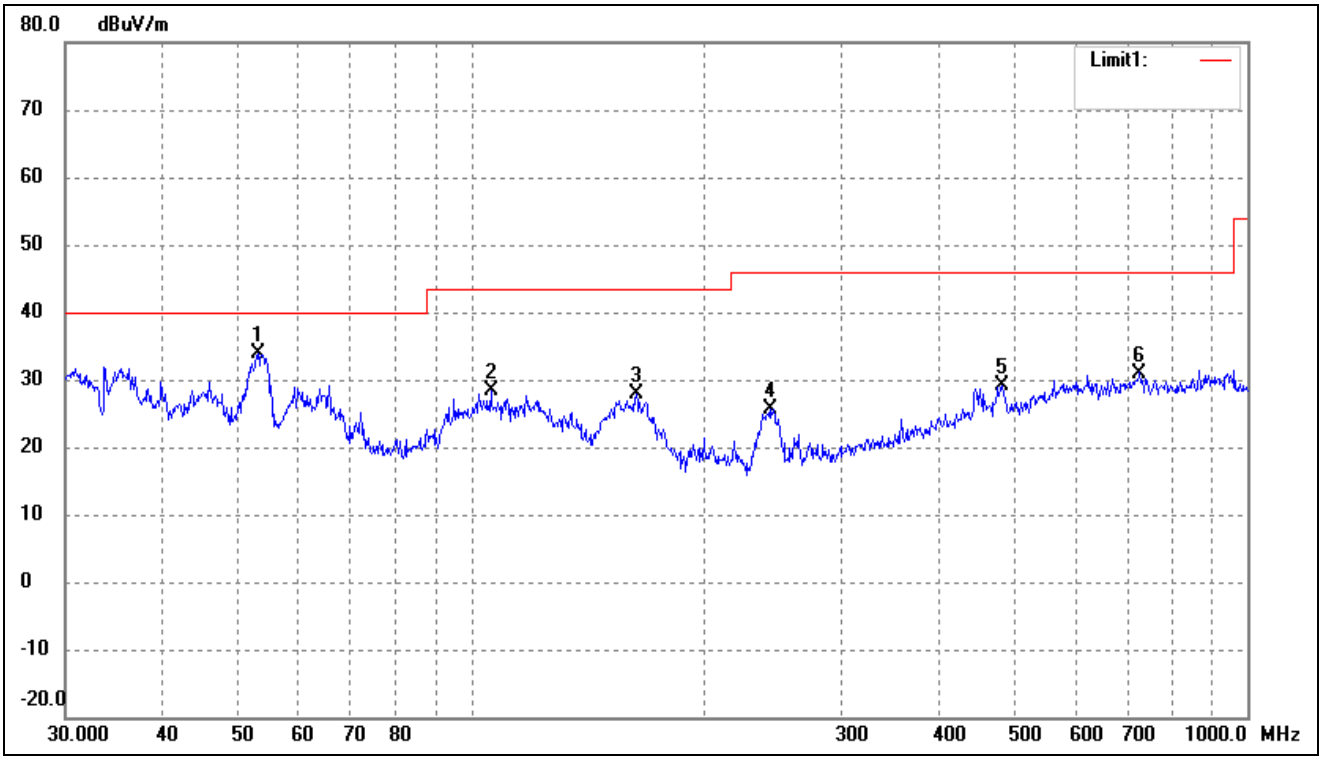
➢ 5725-5850MHz

802.11a(worst case)			
Test Channel	5745MHz	Polarity:	Horizontal



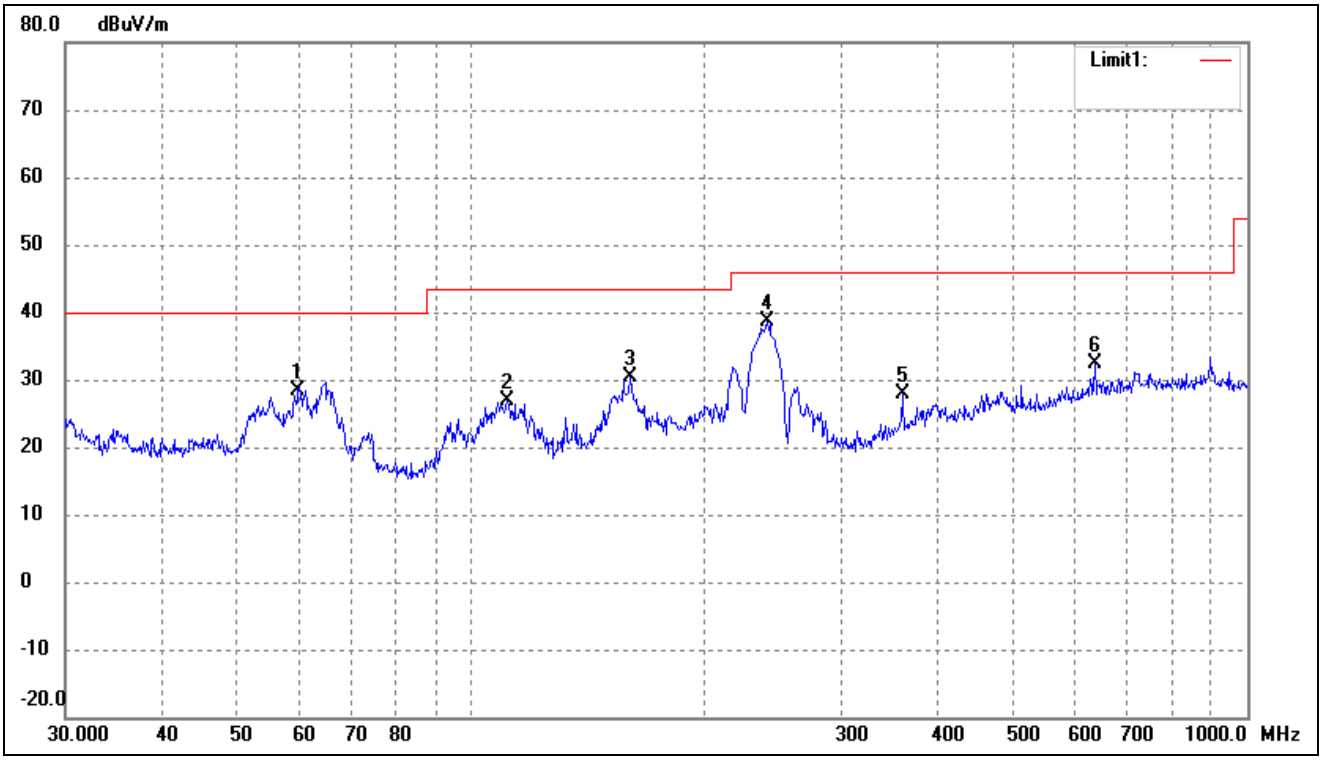
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	54.8348	35.23	-7.03	28.20	40.00	-11.80	--	--	peak
2	112.5244	33.79	-8.50	25.29	43.50	-18.21	--	--	peak
3	156.4578	37.58	-11.86	25.72	43.50	-17.78	--	--	peak
4	236.6447	47.39	-8.29	39.10	46.00	-6.90	--	--	peak
5	480.5276	32.34	-1.58	30.76	46.00	-15.24	--	--	peak
6	750.1083	29.05	1.91	30.96	46.00	-15.04	--	--	peak

802.11a(worst case)			
Test Channel	5745MHz	Polarity:	Vertical



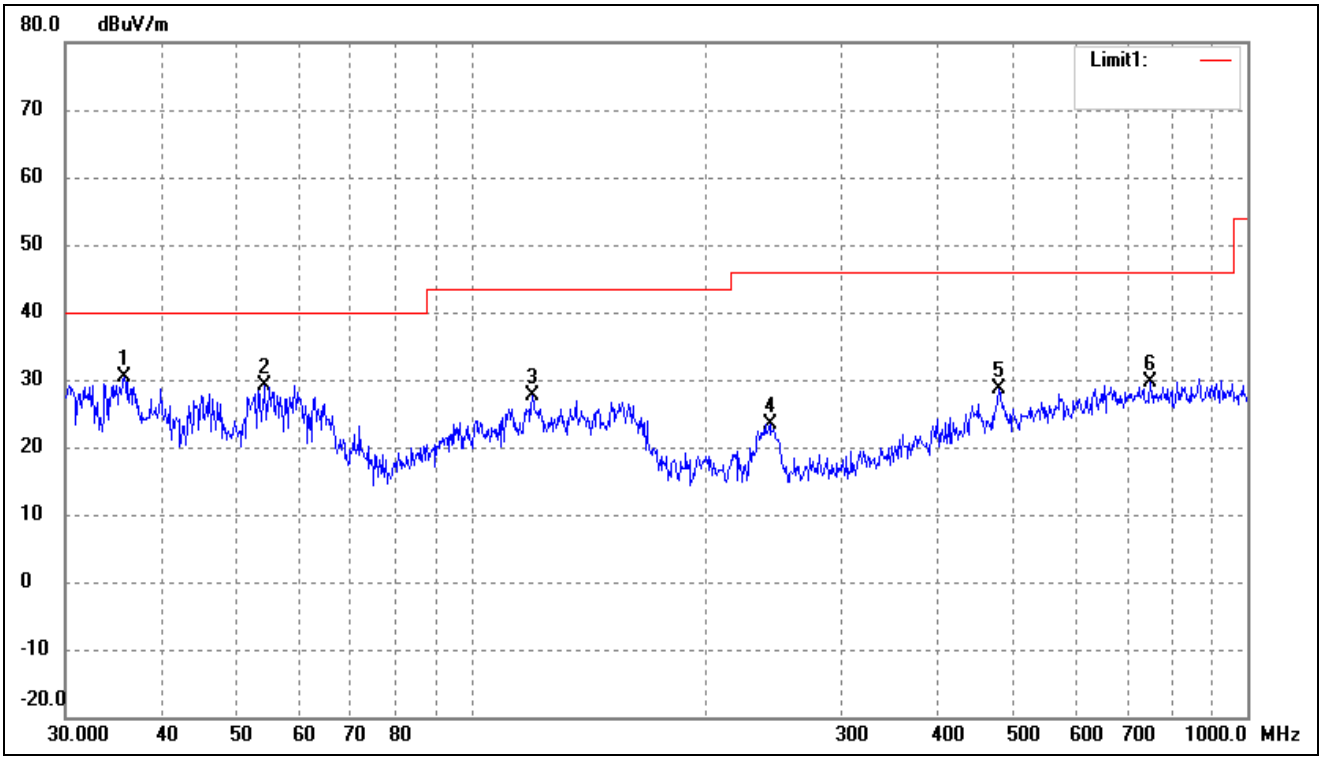
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	53.1313	40.66	-6.78	33.88	40.00	-6.12	--	--	peak
2	106.0126	36.65	-8.26	28.39	43.50	-15.11	--	--	peak
3	163.1818	39.51	-11.57	27.94	43.50	-15.56	--	--	peak
4	242.5253	33.85	-8.14	25.71	46.00	-20.29	--	--	peak
5	482.2156	30.59	-1.54	29.05	46.00	-16.95	--	--	peak
6	726.8052	29.20	1.80	31.00	46.00	-15.00	--	--	peak

802.11a(worst case)			
Test Channel	5785MHz	Polarity:	Horizontal



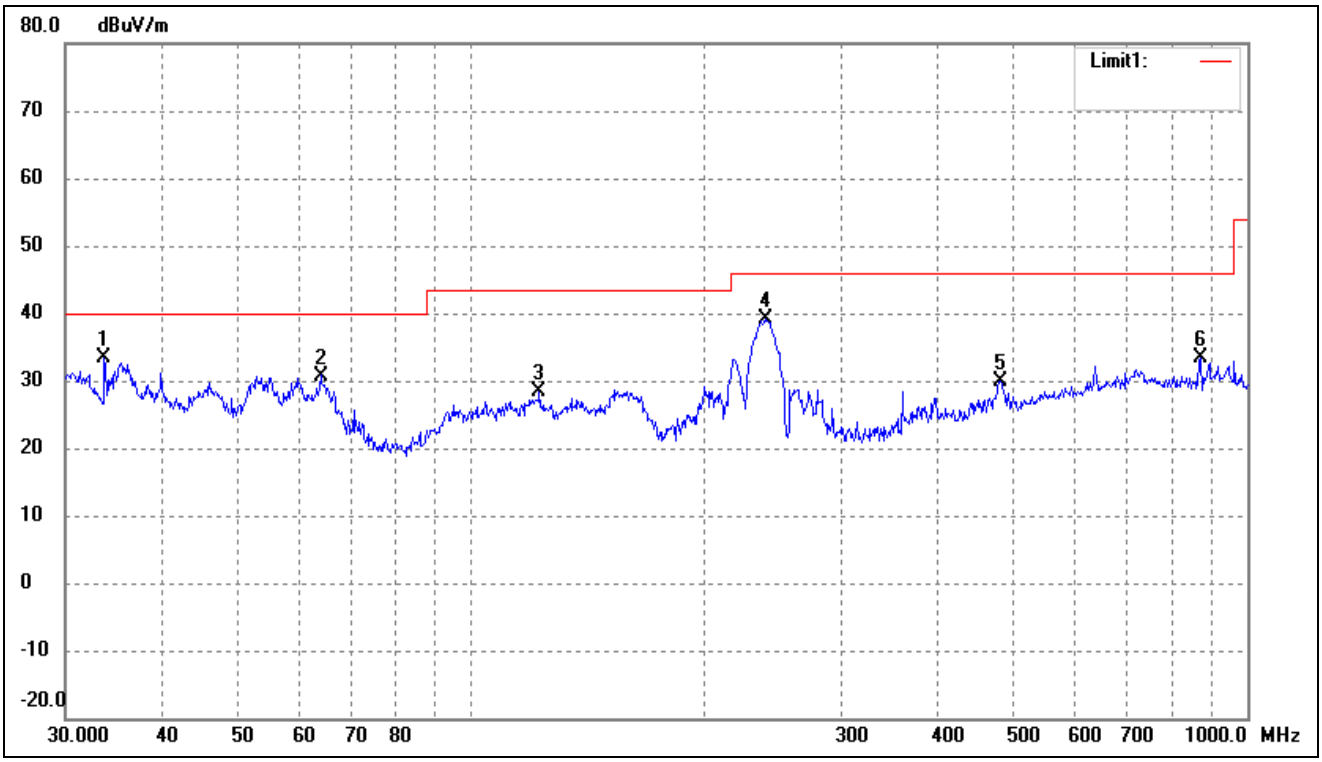
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	59.8588	36.21	-7.76	28.45	40.00	-11.55	--	--	peak
2	111.3468	35.42	-8.42	27.00	43.50	-16.50	--	--	peak
3	160.3456	42.06	-11.70	30.36	43.50	-13.14	--	--	peak
4	240.8304	46.71	-8.18	38.53	46.00	-7.47	--	--	peak
5	359.1860	32.66	-4.79	27.87	46.00	-18.13	--	--	peak
6	636.1340	31.47	0.94	32.41	46.00	-13.59	--	--	peak

802.11a(worst case)			
Test Channel	5785MHz	Polarity:	Vertical



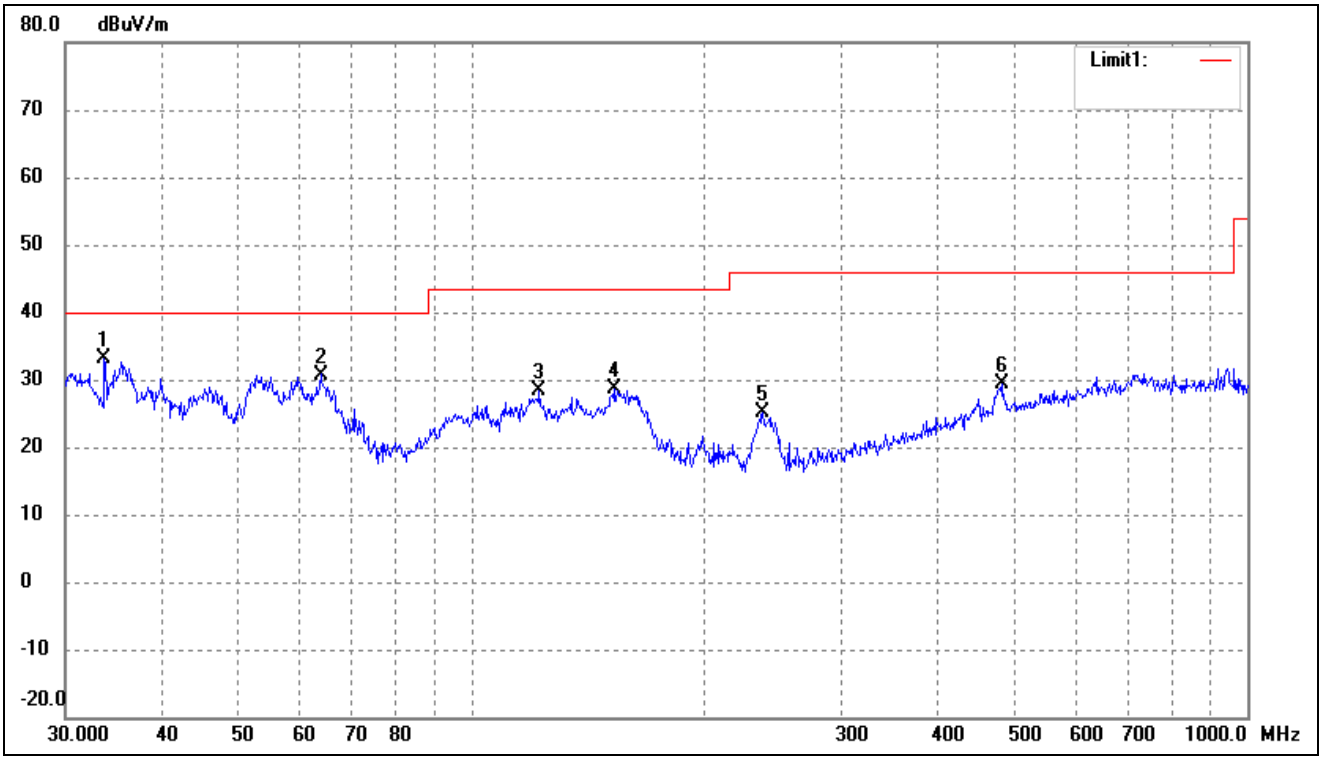
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	35.7490	37.67	-7.38	30.29	40.00	-9.71	--	--	peak
2	54.2610	36.11	-6.95	29.16	40.00	-10.84	--	--	peak
3	119.8556	36.74	-9.06	27.68	43.50	-15.82	--	--	peak
4	242.5253	31.57	-8.14	23.43	46.00	-22.57	--	--	peak
5	478.8456	30.22	-1.63	28.59	46.00	-17.41	--	--	peak
6	750.1083	27.66	1.91	29.57	46.00	-16.43	--	--	peak

802.11a(worst case)			
Test Channel	5825MHz	Polarity:	Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	33.6802	41.23	-7.88	33.35	40.00	-6.65	--	--	peak
2	63.9828	39.24	-8.49	30.75	40.00	-9.25	--	--	peak
3	122.4040	38.01	-9.52	28.49	43.50	-15.01	--	--	peak
4	239.1473	47.37	-8.22	39.15	46.00	-6.85	--	--	peak
5	480.5276	31.53	-1.58	29.95	46.00	-16.05	--	--	peak
6	869.1302	30.68	2.70	33.38	46.00	-12.62	--	--	peak

802.11a(worst case)			
Test Channel	5825MHz	Polarity:	Vertical

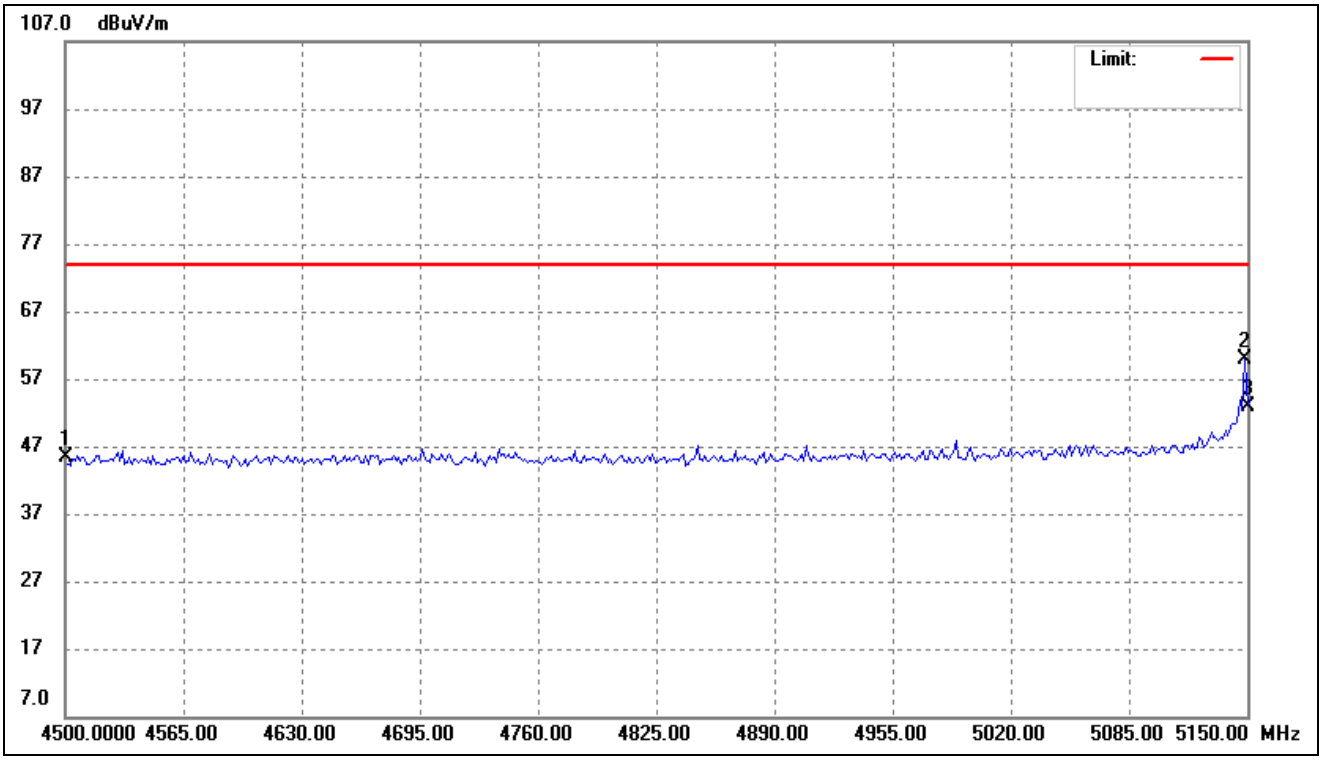


No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	33.6802	41.01	-7.88	33.13	40.00	-6.87	--	--	peak
2	63.9828	39.24	-8.49	30.75	40.00	-9.25	--	--	peak
3	122.4040	38.01	-9.52	28.49	43.50	-15.01	--	--	peak
4	153.2004	40.69	-12.00	28.69	43.50	-14.81	--	--	peak
5	237.4760	33.41	-8.26	25.15	46.00	-20.85	--	--	peak
6	482.2156	31.04	-1.54	29.50	46.00	-16.50	--	--	peak

Remark: '-'Means' the test Degree and Height are not recorded by the test software and only show the worst case in the test report.

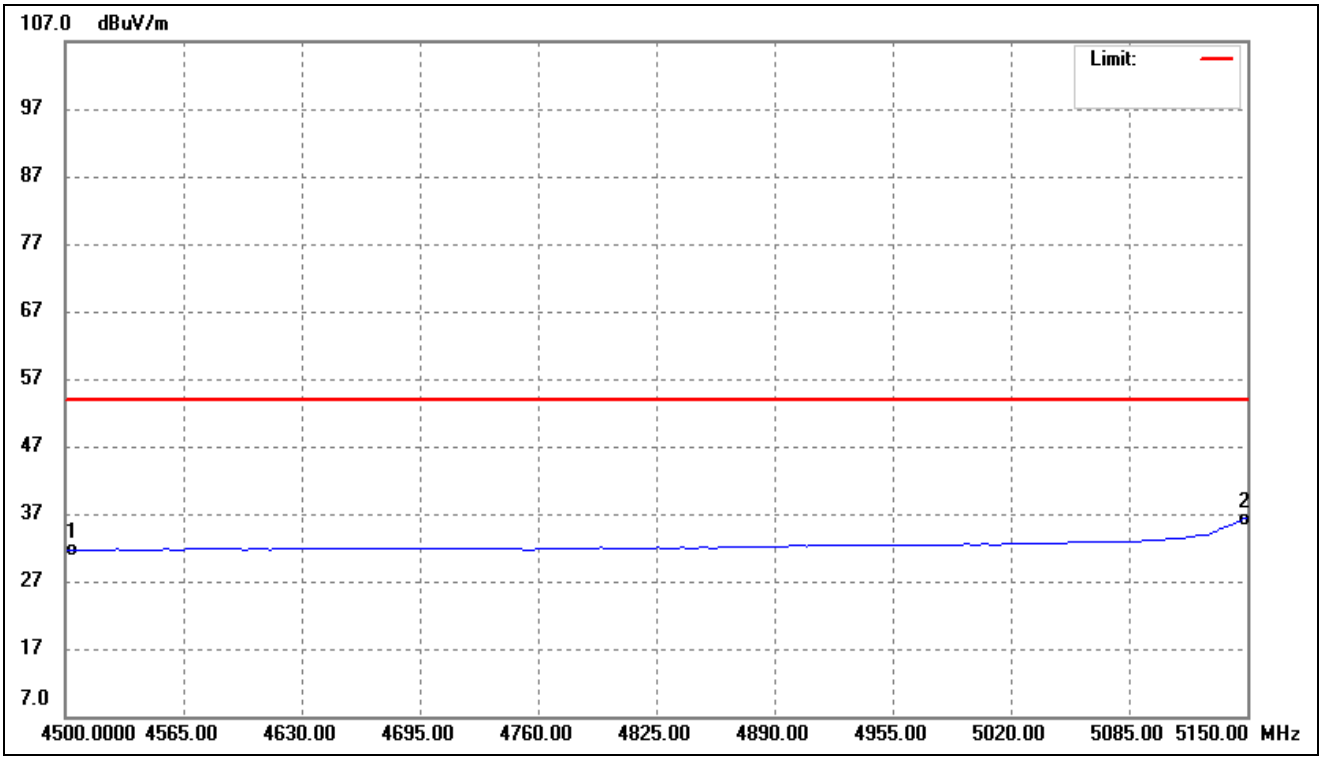
➢ Spurious Emission above 1GHz

802.11a- Restricted Bandedge (worst case)			
Test Channel	Band 4.5-5.15GHz	Polarity:	Horizontal (worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	4500.000	60.02	-14.70	45.32	74.00	-28.68	-	-	peak
2	5148.697	73.56	-13.72	59.84	74.00	-14.16	-	-	peak
3	5150.000	66.64	-13.72	52.92	74.00	-21.08	-	-	peak

802.11a- Restricted Bandedge			
Test Channel	Band 4.5-5.15GHz	Polarity:	Vertical(worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	4500.000	46.30	-14.70	31.60	54.00	-22.40	-	-	AVG
2	5150.000	49.85	-13.72	36.13	54.00	-17.87	-	-	AVG

Note: The Restricted Bandedge was tested in Horizontal /Vertical and the worst case position data was reported.

Remark: '-'Means' the test Degree and Height is not recorded by the test software and only show the worst case in the test report.

- For the frequency band 5.15-5.25GHz, 5.725-5.850GHz (802.11a)
- Harmonics And Spurious Emissions

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel (5180MHz)							
10360	55.56	7.11	62.67	74.00	-11.33	H	PK
15540	36.40	8.22	44.62	54.00	-9.38	H	AV
10360	58.26	7.11	65.37	74.00	-8.63	V	PK
15540	40.33	8.22	48.55	54.00	-5.45	V	AV
Middle Channel (5200MHz)							
10400	57.12	7.22	64.34	74.00	-9.66	H	PK
15600	34.40	8.67	43.07	54.00	-10.93	H	AV
10400	56.69	7.22	63.91	74.00	-10.09	V	PK
15600	38.80	8.67	47.47	54.00	-6.53	V	AV
High Channel (5240MHz)							
10480	56.97	7.69	64.66	74.00	-9.34	H	PK
15720	38.93	8.93	47.86	54.00	-6.14	H	AV
10480	58.09	7.69	65.78	74.00	-8.22	V	PK
15720	36.40	8.93	45.33	54.00	-8.67	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel (5745MHz)							
11490	55.41	9.45	64.86	74.00	-9.14	H	PK
17235	31.04	10.36	41.40	54.00	-12.60	H	AV
11490	55.33	9.45	64.78	74.00	-9.22	V	PK
17235	34.86	10.36	45.22	54.00	-8.78	V	AV
Middle Channel (5785MHz)							
11570	57.24	9.62	66.86	74.00	-7.14	H	PK
17355	35.81	10.67	46.48	54.00	-7.52	H	AV
11570	53.32	9.62	62.94	74.00	-11.06	V	PK
17355	35.66	10.67	46.33	54.00	-7.67	V	AV
High Channel (5825MHz)							
11650	53.77	9.84	63.61	74.00	-10.39	H	PK
17475	35.48	10.95	46.43	54.00	-7.57	H	AV
11650	55.97	9.84	65.81	74.00	-8.19	V	PK
17475	34.73	10.95	45.68	54.00	-8.32	V	AV

- Out of Band edge for 5150-5250MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-36.34	-27
Highest	Above 5350	-43.09	-27
Note: the data just list the worst cases			

- Out of Band edge for 5725-5850MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5650	-47.22	-27
	5650 to 5700	-33.39	-27 to -17
	5700 to 5720	-25.77	-17 to 15.6
	5720 to 5725	-17.44	15.6 to 27
Highest	5850 to 5855	-15.23	27 to 15.6
	5855 to 5875	-23.63	15.6 to -17
	5875 to 5925	-35.59	-17 to -27
	Above 5925	-39.37	-27
Note: the data just list the worst cases			

- For the frequency band 5.15-5.25GHz5.725-5.850GHz (802.11n HT20)
- Harmonics And Spurious Emissions

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel (5180MHz)							
10360	58.25	7.11	65.36	74.00	-8.64	H	PK
15540	39.55	8.22	47.77	54.00	-6.23	H	AV
10360	58.35	7.11	65.46	74.00	-8.54	V	PK
15540	38.53	8.22	46.75	54.00	-7.25	V	AV
Middle Channel (5200MHz)							
10400	56.57	7.22	63.79	74.00	-10.21	H	PK
15600	37.41	8.67	46.08	54.00	-7.92	H	AV
10400	58.10	7.22	65.32	74.00	-8.68	V	PK
15600	34.17	8.67	42.84	54.00	-11.16	V	AV
High Channel (5240MHz)							
10480	58.51	7.69	66.20	74.00	-7.80	H	PK
15720	33.47	8.93	42.40	54.00	-11.60	H	AV
10480	61.50	7.69	69.19	74.00	-4.81	V	PK
15720	37.06	8.93	45.99	54.00	-8.01	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel (5745MHz)							
11490	54.97	9.45	64.42	74.00	-9.58	H	PK
17235	35.88	10.36	46.24	54.00	-7.76	H	AV
11490	55.23	9.45	64.68	74.00	-9.32	V	PK
17235	34.32	10.36	44.68	54.00	-9.32	V	AV
Middle Channel (5785MHz)							
11570	60.84	9.62	70.46	74.00	-3.54	H	PK
17355	39.07	10.67	49.74	54.00	-4.26	H	AV
11570	58.85	9.62	68.47	74.00	-5.53	V	PK
17355	39.36	10.67	50.03	54.00	-3.97	V	AV
High Channel (5825MHz)							
11650	56.13	9.84	65.97	74.00	-8.03	H	PK
17475	35.82	10.95	46.77	54.00	-7.23	H	AV
11650	59.74	9.84	69.58	74.00	-4.42	V	PK
17475	34.30	10.95	45.25	54.00	-8.75	V	AV

- Out of Band edge 5150-5250MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-32.95	-27
Highest	Above 5350	-40.87	-27
Note: the data just list the worst cases			

- Out of Band edge for 5725-5850MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5650	-47.46	-27
	5650 to 5700	-33.13	-27 to -17
	5700 to 5720	-29.69	-17 to 15.6
	5720 to 5725	-17.80	15.6 to 27
Highest	5850 to 5855	-16.25	27 to 15.6
	5855 to 5875	-27.74	15.6 to -17
	5875 to 5925	-39.09	-17 to -27
	Above 5925	-40.86	-27
Note: the data just list the worst cases			

Note: this EUT was tested in the low, high channel and the worst case position data was reported.

- For the frequency band 5.15-5.25GHz, 5.725-5.850GHz (802.11n HT40)
- Harmonics And Spurious Emissions

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel (5190MHz)							
10380	58.88	7.25	66.13	74.00	-7.87	H	PK
15570	37.50	8.33	45.83	54.00	-8.17	H	AV
10380	57.70	7.25	64.95	74.00	-9.05	V	PK
15570	37.69	8.33	46.02	54.00	-7.98	V	AV
High Channel (5230MHz)							
10460	58.17	7.54	65.71	74.00	-8.29	H	PK
15690	36.97	8.86	45.83	54.00	-8.17	H	AV
10460	59.24	7.54	66.78	74.00	-7.22	V	PK
15690	41.35	8.86	50.21	54.00	-3.79	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel (5755MHz)							
11510	56.93	9.65	66.58	74.00	-7.42	H	PK
17265	34.67	10.87	45.54	54.00	-8.46	H	AV
11510	54.88	9.65	64.53	74.00	-9.47	V	PK
17265	35.89	10.87	46.76	54.00	-7.24	V	AV
High Channel (5795MHz)							
11590	57.60	9.81	67.41	74.00	-6.59	H	PK
17385	34.61	10.89	45.50	54.00	-8.50	H	AV
11590	56.55	9.81	66.36	74.00	-7.64	V	PK
17385	35.96	10.89	46.85	54.00	-7.15	V	AV

- Out of Band edge for 5150-5250MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-35.97	-27
Highest	Above 5350	-42.41	-27
Note: the data just list the worst cases			

- Out of Band edge for 5725-5850MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5650	-47.02	-27
	5650 to 5700	-35.43	-27 to -17
	5700 to 5720	-26.33	-17 to 15.6
	5720 to 5725	-16.04	15.6 to 27
Highest	5850 to 5855	-14.91	27 to 15.6
	5855 to 5875	-24.06	15.6 to -17
	5875 to 5925	-34.90	-17 to -27
	Above 5925	-38.23	-27
Note: the data just list the worst cases			

- For the frequency band 5.15-5.25GHz, 5.725-5.850GHz (802.11ac VH80)
- Harmonics And Spurious Emissions

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
5210MHz							
10420	57.16	7.33	64.49	74.00	-9.51	H	PK
15630	37.24	8.75	45.99	54.00	-8.01	H	AV
10420	56.46	7.33	63.79	74.00	-10.21	V	PK
15630	34.41	8.75	43.16	54.00	-10.84	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
5775MHz							
11550	54.62	9.54	64.16	74.00	-9.84	H	PK
17325	37.59	10.59	48.18	54.00	-5.82	H	AV
11550	56.11	9.54	65.65	74.00	-8.35	V	PK
17325	33.06	10.59	43.65	54.00	-10.35	V	AV

- Out of Band edge for 5150-5250MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5150	-39.33	-27
Highest	Above 5350	-34.26	-27
Note: the data just list the worst cases			

- Out of Band edge for 5725-5850MHz

Test CH.	Test Segment	Result	Limit
	MHz	dBm/MHz	dBm/MHz
Lowest	Below 5650	-45.64	-27
	5650 to 5700	-35.69	-27 to -17
	5700 to 5720	-24.14	-17 to 15.6
	5720 to 5725	-16.31	15.6 to 27
Highest	5850 to 5855	-15.49	27 to 15.6
	5855 to 5875	-25.09	15.6 to -17
	5875 to 5925	-37.33	-17 to -27
	Above 5925	-38.73	-27
Note: the data just list the worst cases			

Note: Testing is carried out with frequency rang 9kHz to 40Ghz, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

9. Frequency Stability

9.1 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.

9.2 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.

9.3 Summary of Test Results/Plots

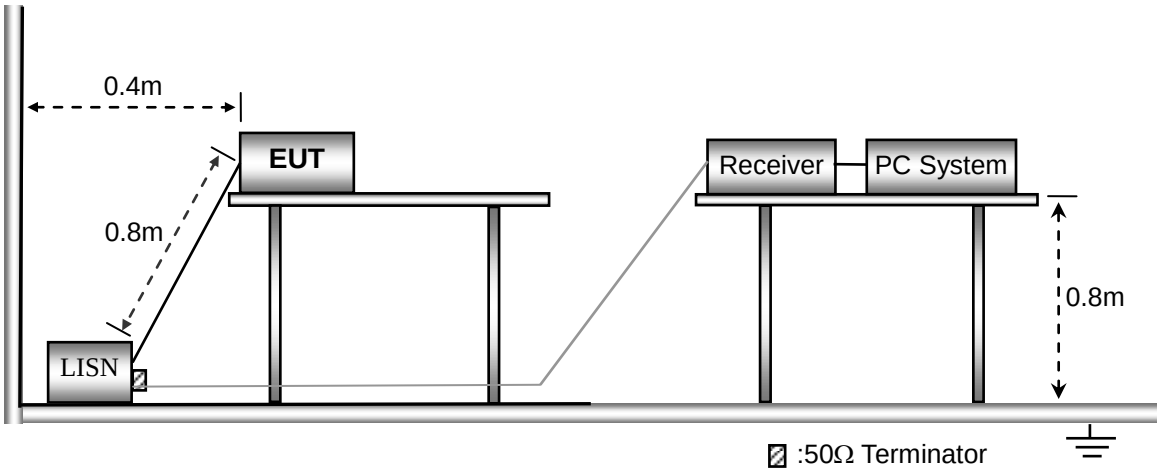
Please refer to Appendix D

10. Conducted Emissions

10.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement 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 40cm long in the middle. The spacing between the peripherals was 10cm.

10.2 Basic Test Setup Block Diagram



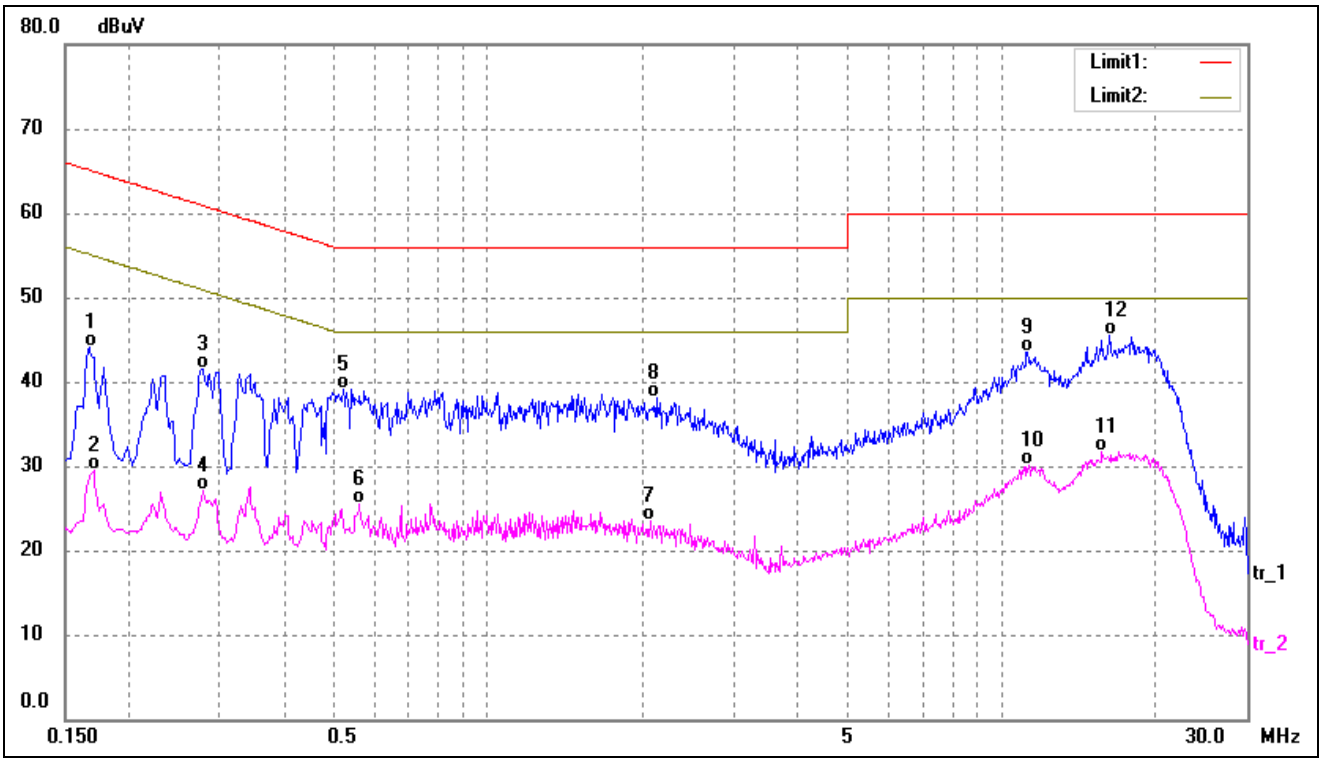
10.3 Test Receiver Setup

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

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

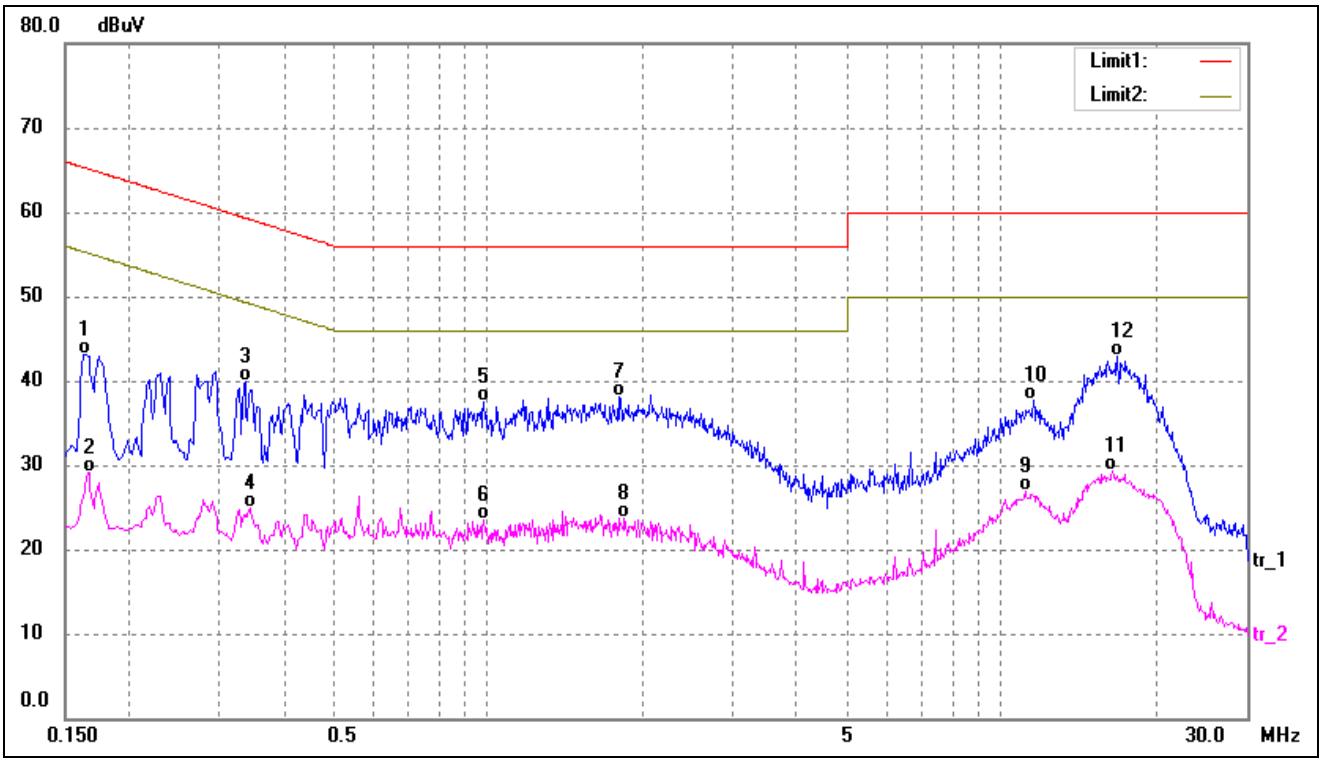
10.4 Summary of Test Results/Plots

Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1660	33.71	10.31	44.02	65.15	-21.13	QP
2	0.1700	19.21	10.31	29.52	54.96	-25.44	AVG
3	0.2779	31.22	10.25	41.47	60.88	-19.41	QP
4	0.2779	16.91	10.25	27.16	50.88	-23.72	AVG
5	0.5220	28.94	10.22	39.16	56.00	-16.84	QP
6	0.5620	15.34	10.21	25.55	46.00	-20.45	AVG
7	2.0700	13.27	10.25	23.52	46.00	-22.48	AVG
8	2.1220	27.87	10.25	38.12	56.00	-17.88	QP
9	11.1780	33.17	10.33	43.50	60.00	-16.50	QP
10	11.2739	19.71	10.32	30.03	50.00	-19.97	AVG
11	15.7100	21.40	10.25	31.65	50.00	-18.35	AVG
12*	16.1780	35.14	10.27	45.41	60.00	-14.59	QP

Test Mode	Communication	AC120V 60Hz	Polarity:	Line



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1620	32.75	10.31	43.06	65.36	-22.30	QP
2	0.1660	18.80	10.31	29.11	55.15	-26.04	AVG
3	0.3339	29.57	10.24	39.81	59.35	-19.54	QP
4	0.3420	14.76	10.23	24.99	49.15	-24.16	AVG
5	0.9820	27.41	10.14	37.55	56.00	-18.45	QP
6	0.9820	13.37	10.14	23.51	46.00	-22.49	AVG
7	1.7940	27.78	10.23	38.01	56.00	-17.99	QP
8	1.8420	13.47	10.23	23.70	46.00	-22.30	AVG
9	11.1180	16.51	10.33	26.84	50.00	-23.16	AVG
10	11.5180	27.40	10.32	37.72	60.00	-22.28	QP
11	16.4619	19.03	10.28	29.31	50.00	-20.69	AVG
12*	16.7700	32.55	10.29	42.84	60.00	-17.16	QP

APPENDIX SUMMARY

Project No.	WTX23X02019626W	Test Engineer	Timi Huang
Start date	2022/11/28	Finish date	2022/11/30
Temperature	23℃	Humidity	46%
RF specifications	U-NII		

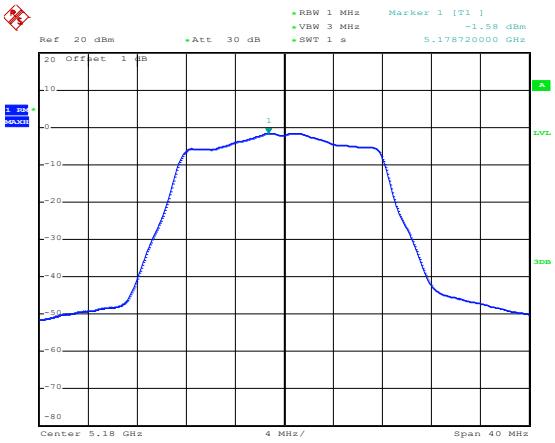
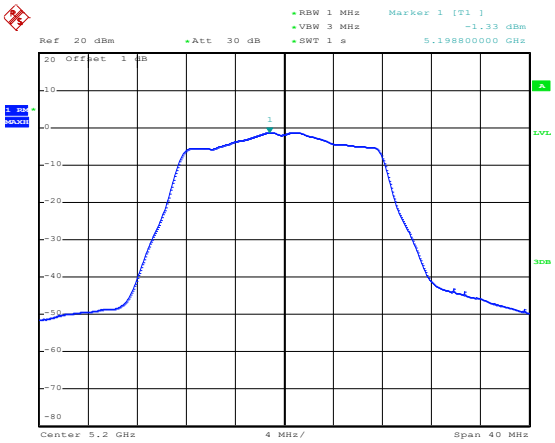
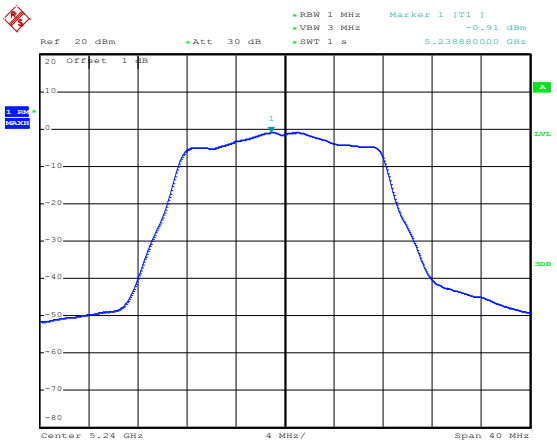
APPENDIX	Description of Test Item	Result
A	Power Spectral Density	Compliant
B	Emission Bandwidth and Occupied Bandwidth	Compliant
C	Maximum Conducted Output Power	Compliant
D	Frequency Stability	Compliant

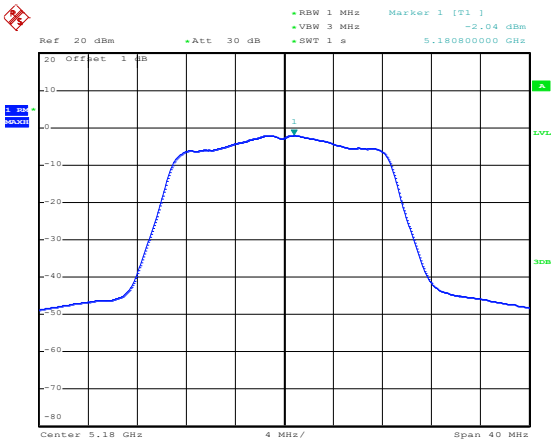
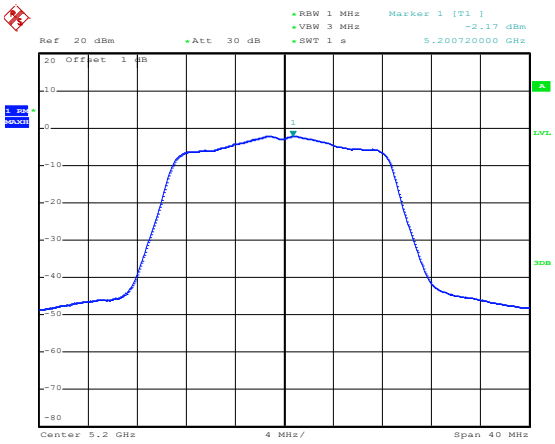
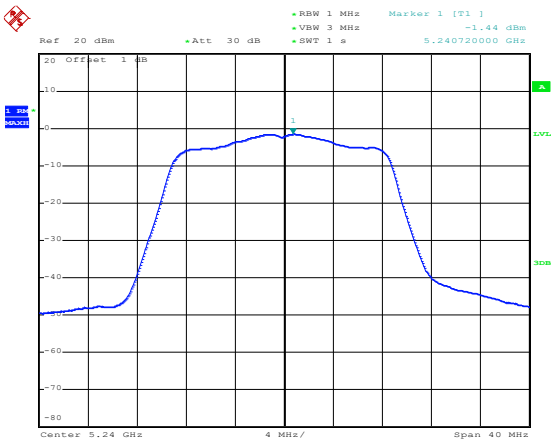
APPENDIX A

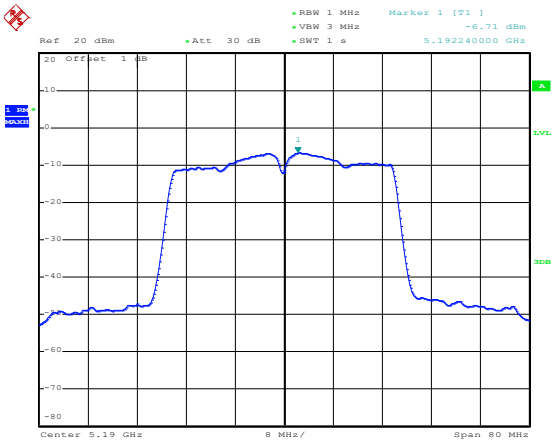
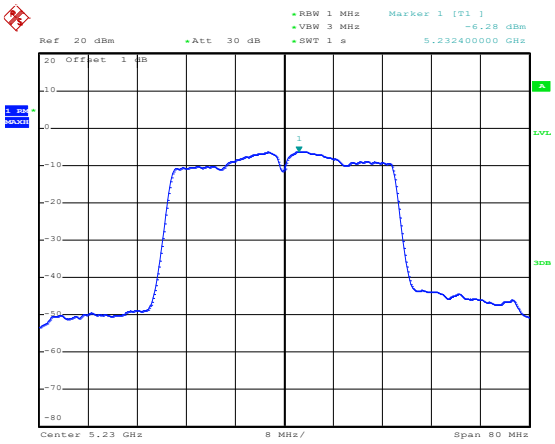
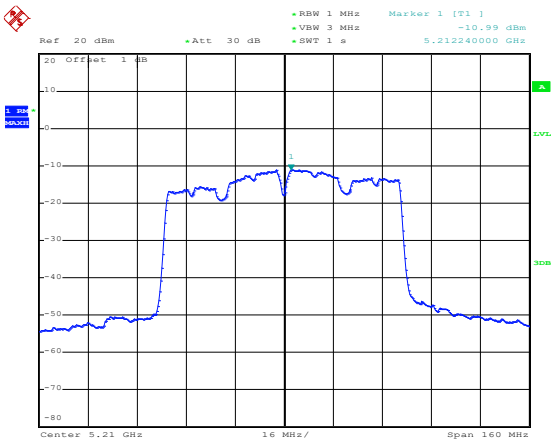
Power Spectral Density			
U-NII-1:5150-5250MHz			
Operating mode	Test Channel	Power Spectral Density dBm/MHz	Limit (dBm/MHz)
802.11a	5180	-1.58	11
	5200	-1.33	11
	5240	-0.91	11
802.11n-HT20	5180	-2.04	11
	5200	-2.17	11
	5240	-1.44	11
802.11n-HT40	5190	-6.71	11
	5230	-6.28	11
802.11ac-HT80	5210	-10.99	11

U-NII-3: 5725-5850MHz					
Operating mode	Test Channel	Power Spectral Density dBm/300kHz	Factor	Power Spectral Density* dBm/500kHz	Limit dBm/500kHz
802.11a	5745	-2.17	2.22	0.05	30
	5785	-1.52	2.22	0.70	30
	5825	-1.29	2.22	0.93	30
802.11n-HT20	5745	-3.89	2.22	-1.67	30
	5785	-3.09	2.22	-0.87	30
	5825	-2.85	2.22	-0.63	30
802.11n HT40	5755	-7.20	2.22	-4.98	30
	5795	-6.48	2.22	-4.26	30
802.11ac VH80	5775	-12.77	2.22	-10.55	30
*Note: Maximum PSD=PSD(dBm/300kHz)+10log(500kHz/300kHz)=2.22					

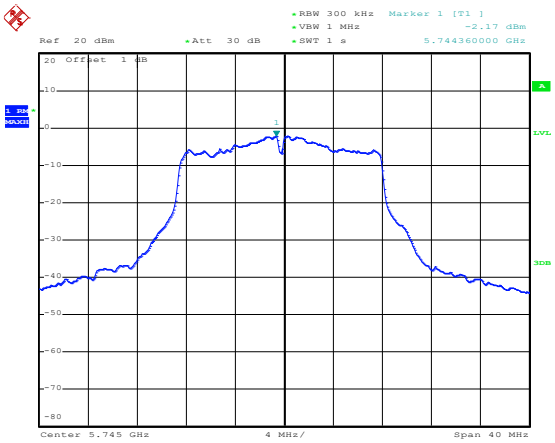
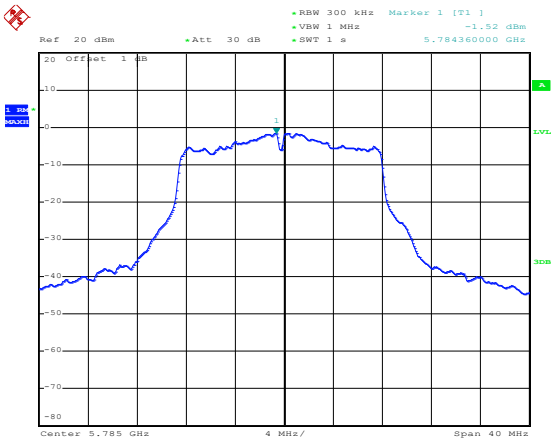
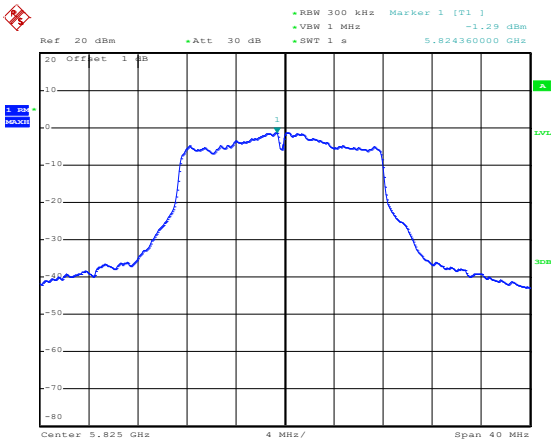
5150-5250MHz

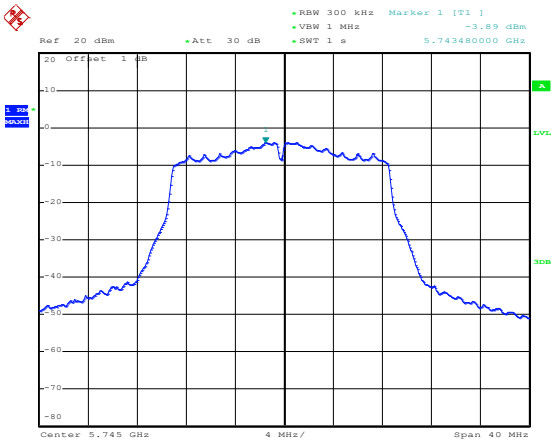
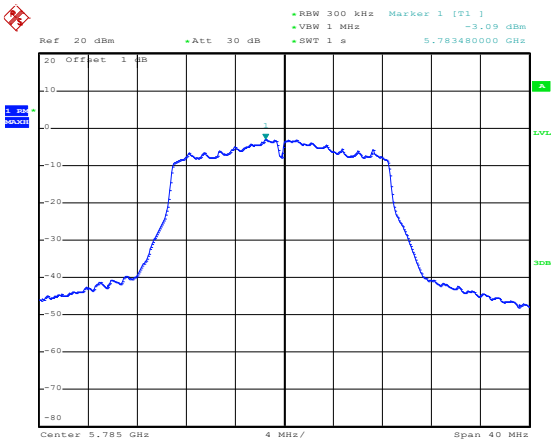
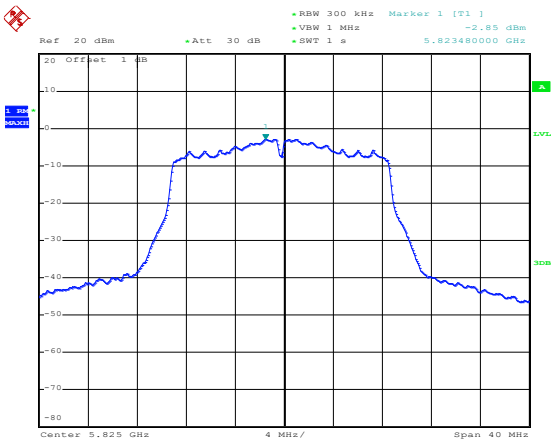
802.11a-Low	
802.11a-Middle	
802.11a-High	

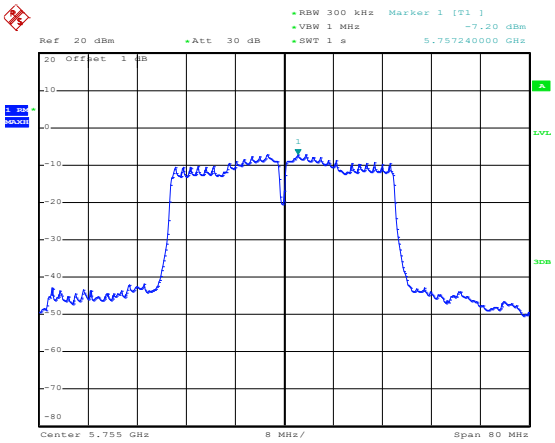
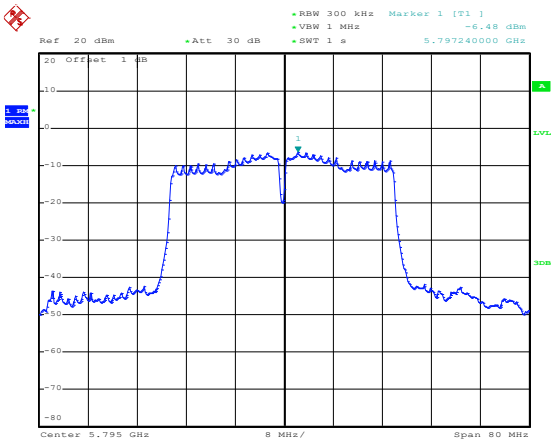
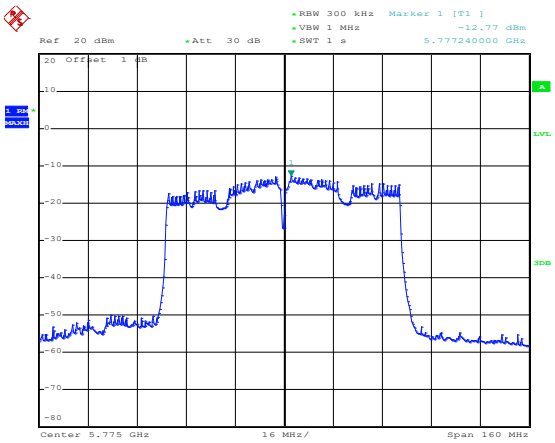
802.11n-HT20-Low	 Date: 28.NOV.2022 14:05:18
802.11n-HT20-Middle	 Date: 28.NOV.2022 14:06:28
802.11n-HT20-High	 Date: 28.NOV.2022 14:07:07

802.11n-HT40-Low	
802.11n-HT40-High	
802.11ac-HT80-Low	

5725-5850MHz

802.11a-Low	
802.11a-Middle	
802.11a-High	

802.11n-HT20-Low	 Date: 29.NOV.2022 13:22:10
802.11n-HT20-Middle	 Date: 29.NOV.2022 13:22:57
802.11n-HT20-High	 Date: 29.NOV.2022 13:23:32

802.11n-HT40-Low	 Date: 29.NOV.2022 13:24:08
802.11n-HT40-High	 Date: 29.NOV.2022 13:24:59
802.11ac-HT80-Low	 Date: 29.NOV.2022 13:17:16

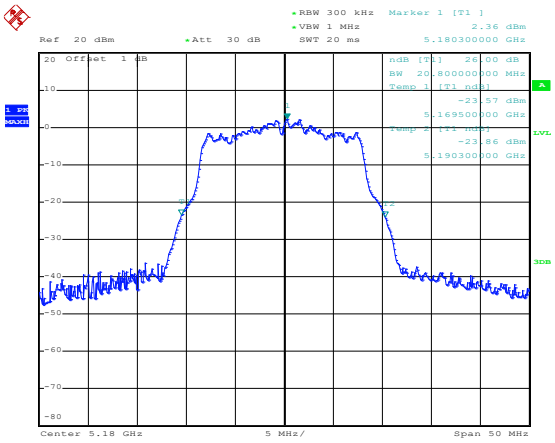
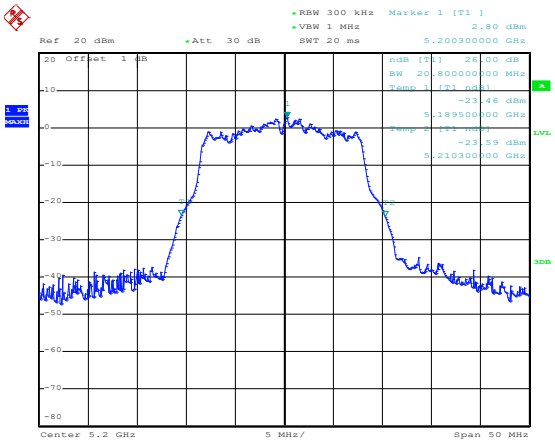
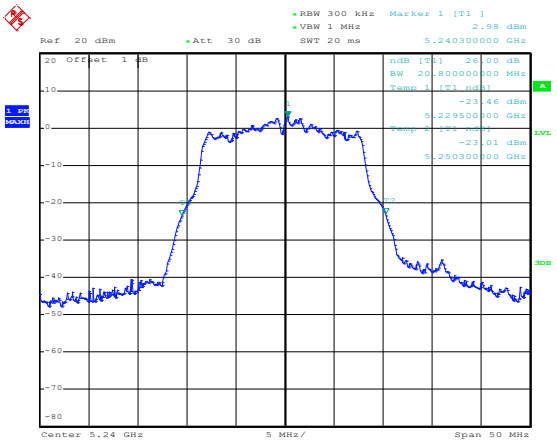
APPENDIX B

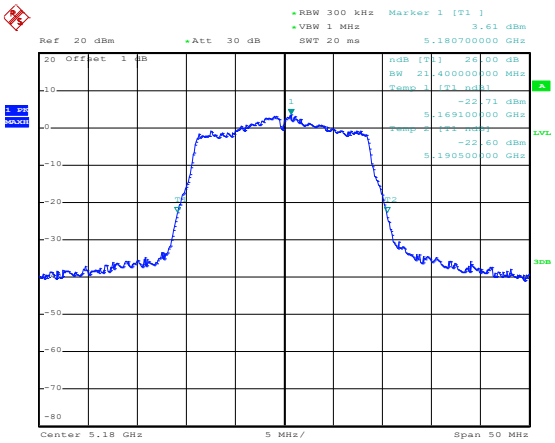
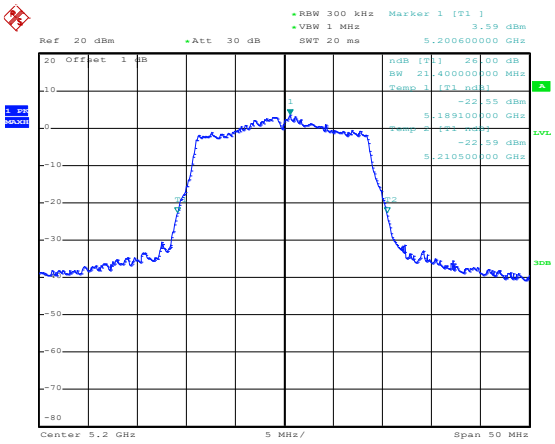
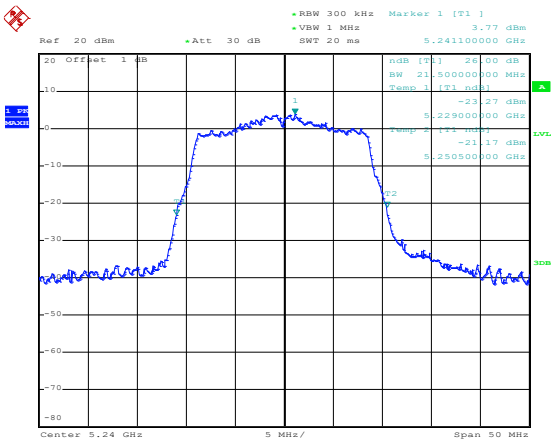
Emission Bandwidth and Occupied Bandwidth

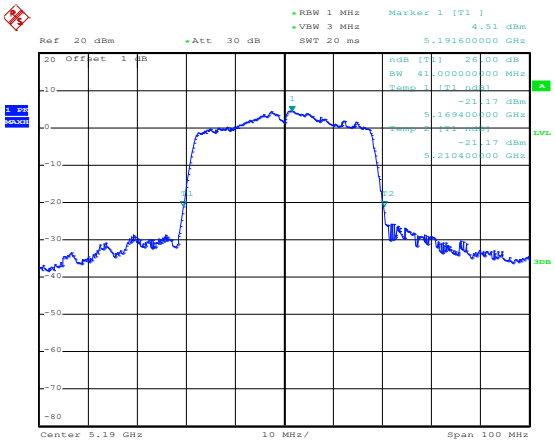
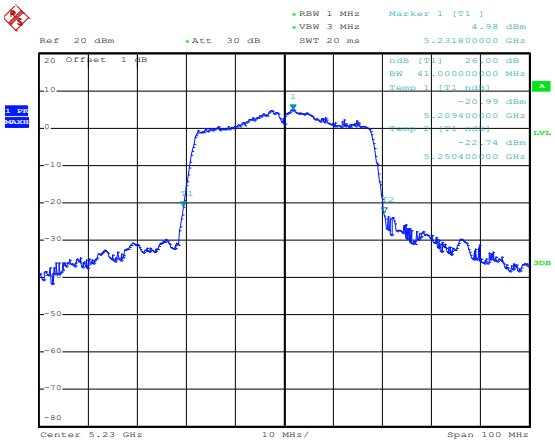
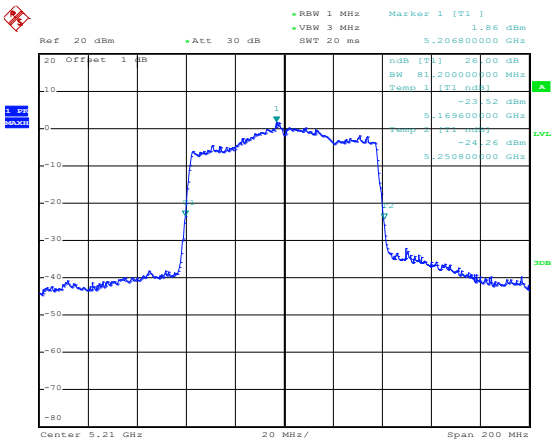
U-NII-1:5150-5250MHz				
Test Mode	**Test Channel MHz**	**26 dB Bandwidth MHz**	**99% Bandwidth MHz**	**Limit MHz**
802.11a	5180	20.80	16.60	Pass
	5200	20.80	16.60	Pass
	5240	20.80	16.60	Pass
802.11n-HT20	5180	21.40	18.00	Pass
	5200	21.40	17.90	Pass
	5240	21.50	18.00	Pass
802.11n-HT40	5190	41.00	36.60	Pass
	5230	41.00	36.60	Pass
802.11ac-HT80	5210	81.20	75.60	Pass

U-NII-3: 5725-5850MHz				
Test Mode	**Test Channel MHz**	**6 dB Bandwidth MHz**	**99% Bandwidth MHz**	**Limit MHz**
802.11a	5745	15.80	16.60	≥500
	5785	16.00	16.70	≥500
	5825	16.00	16.70	≥500
802.11n-HT20	5745	17.90	18.00	≥500
	5785	17.80	18.00	≥500
	5825	17.80	18.00	≥500
802.11n-HT40	5755	36.40	37.00	≥500
	5795	36.40	36.80	≥500
802.11ac VH80	5775	76.40	75.20	≥500

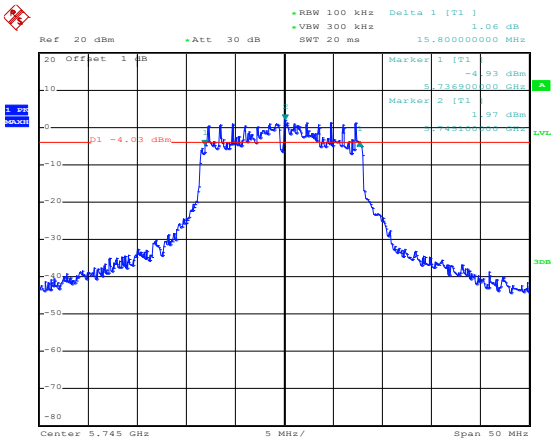
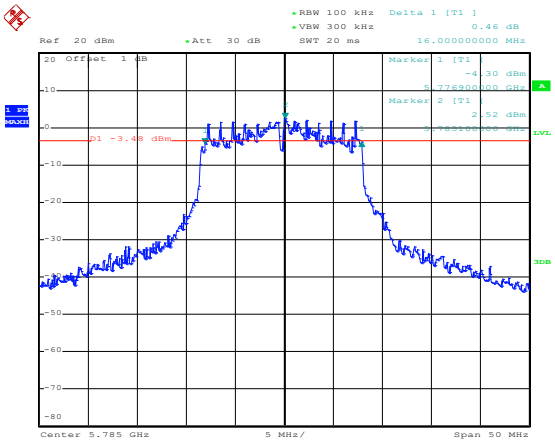
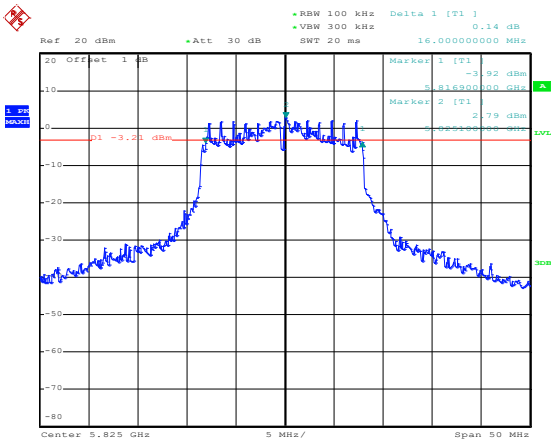
5150-5250MHz

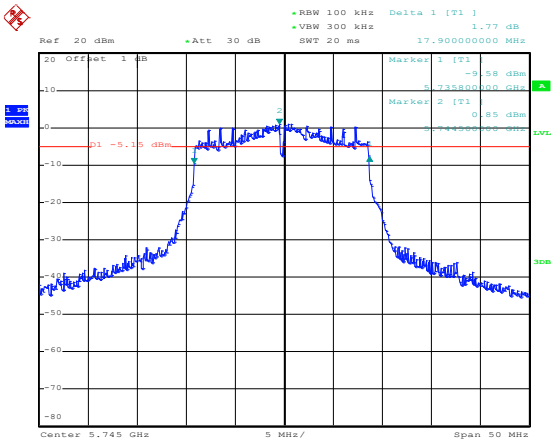
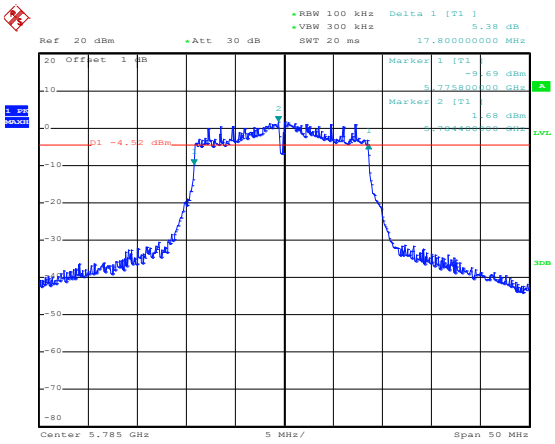
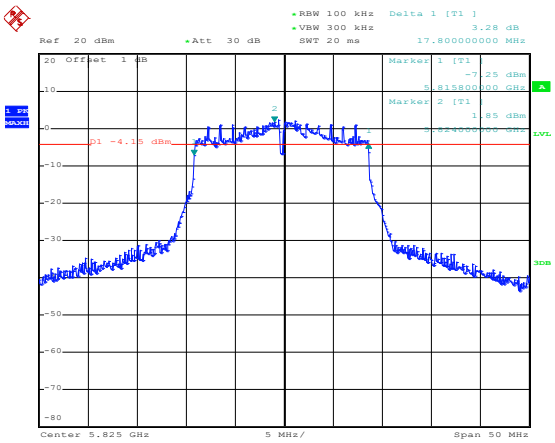
802.11a-Low	
802.11a-Middle	
802.11a-High	

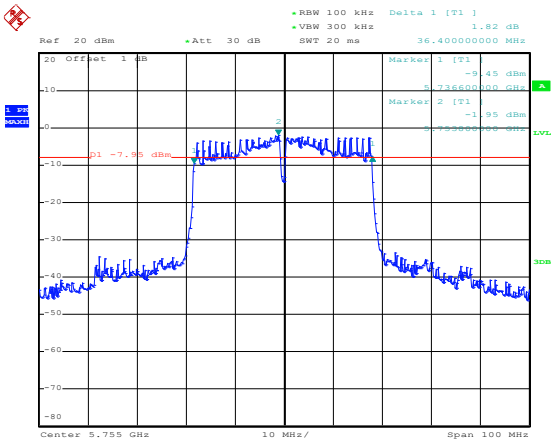
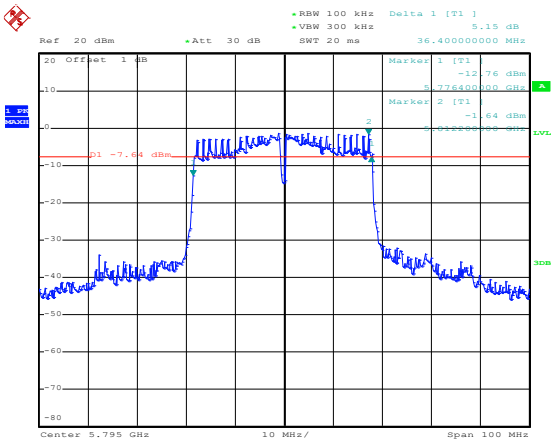
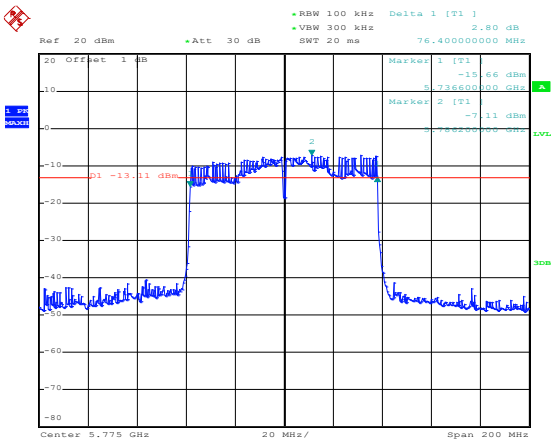
802.11n-HT20-Low	 Date: 28.NOV.2022 14:20:01
802.11n-HT20-Middle	 Date: 28.NOV.2022 14:20:55
802.11n-HT20-High	 Date: 28.NOV.2022 14:22:00

802.11n-HT40-Low	 Date: 28.NOV.2022 14:23:39
802.11n-HT40-High	 Date: 28.NOV.2022 14:24:28
802.11ac-HT80-Low	 Date: 28.NOV.2022 14:15:39

5725-5850MHz

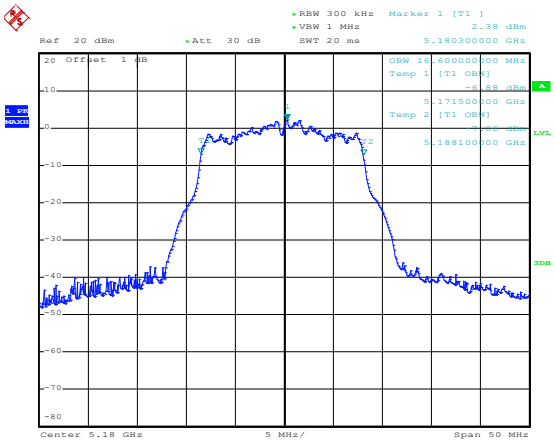
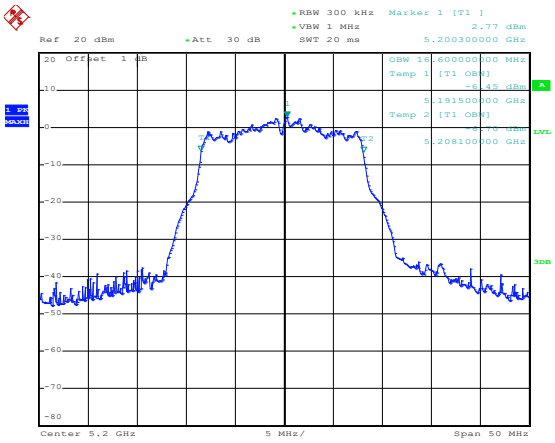
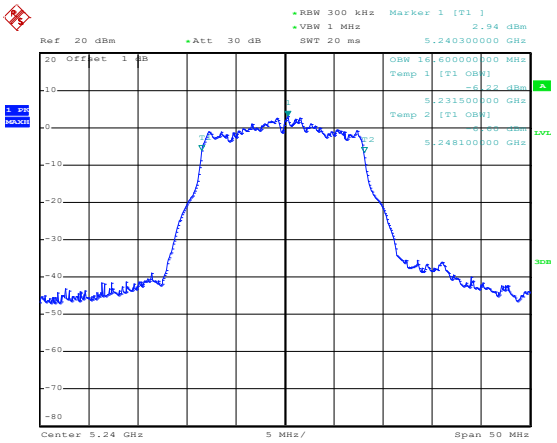
802.11a-Low	
802.11a-Middle	
802.11a-High	

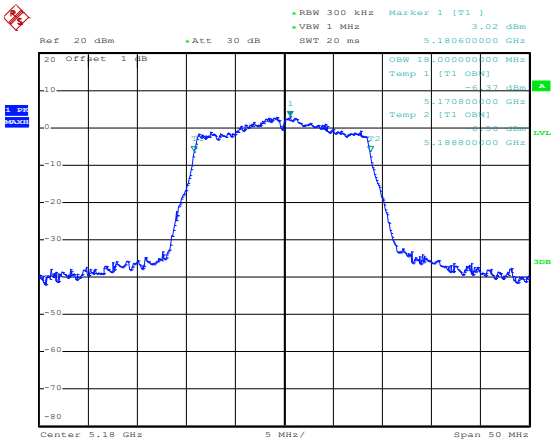
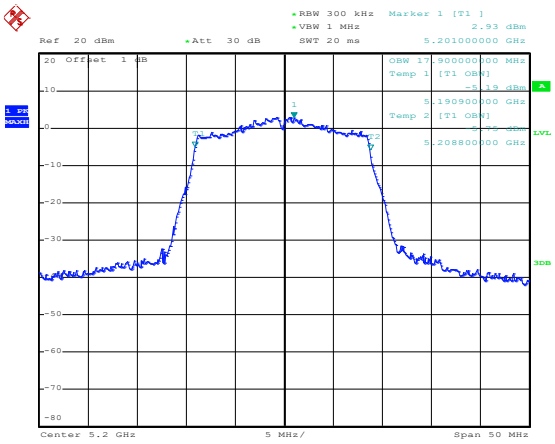
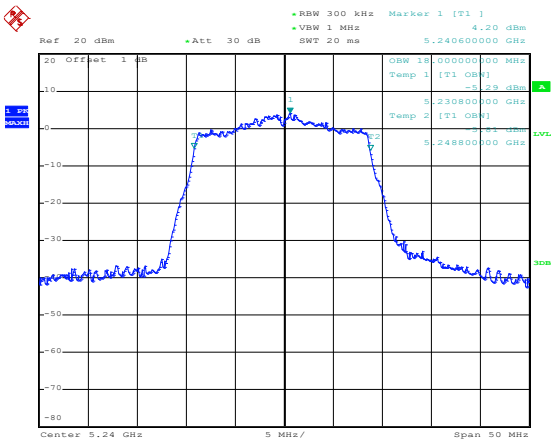
802.11n-HT20-Low	 Date: 28.NOV.2022 15:13:41
802.11n-HT20-Middle	 Date: 28.NOV.2022 15:15:38
802.11n-HT20-High	 Date: 28.NOV.2022 15:16:55

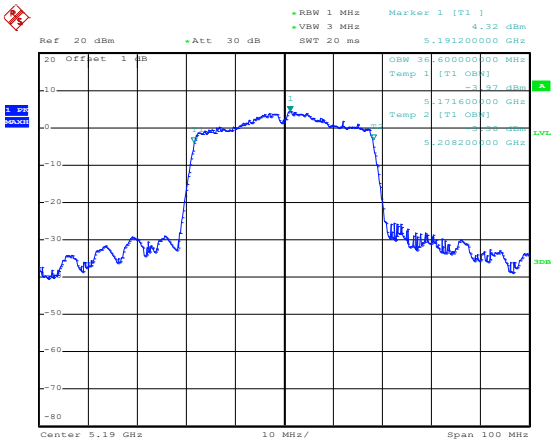
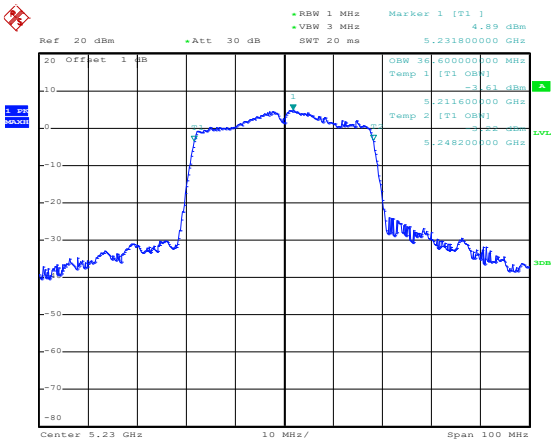
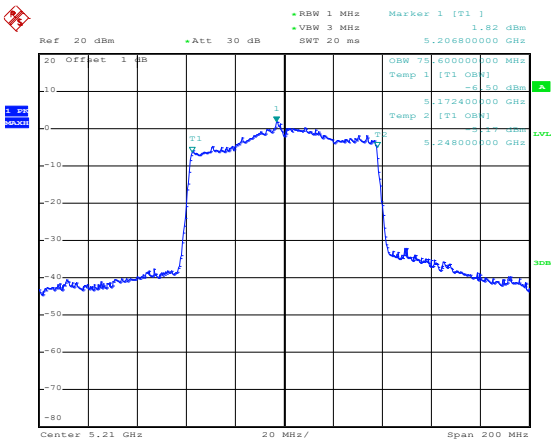
802.11n-HT40-Low	
802.11n-HT40-High	
802.11ac-HT80-Low	

99% BandwidthMHz

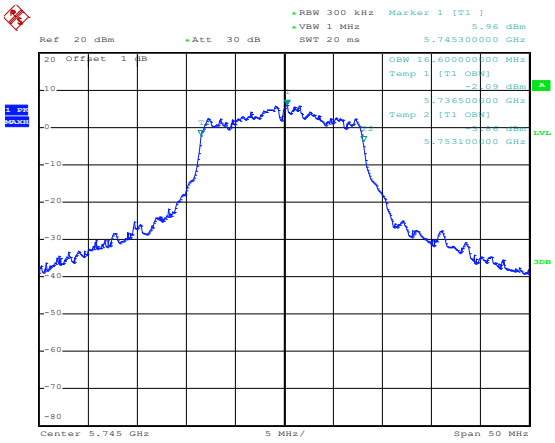
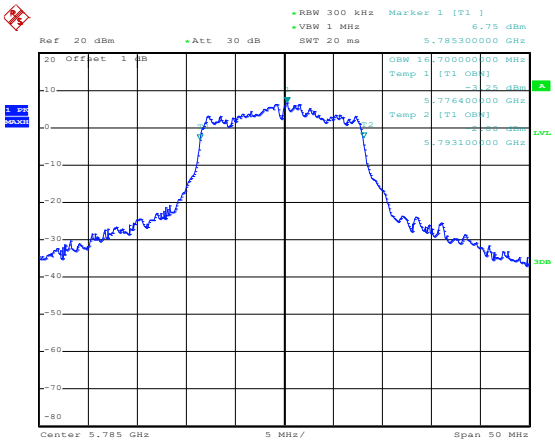
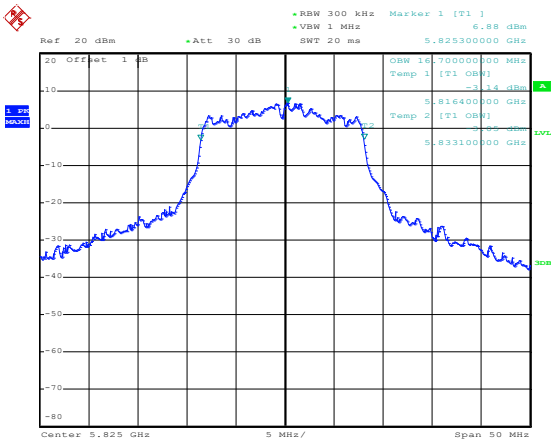
5150-5250MHz

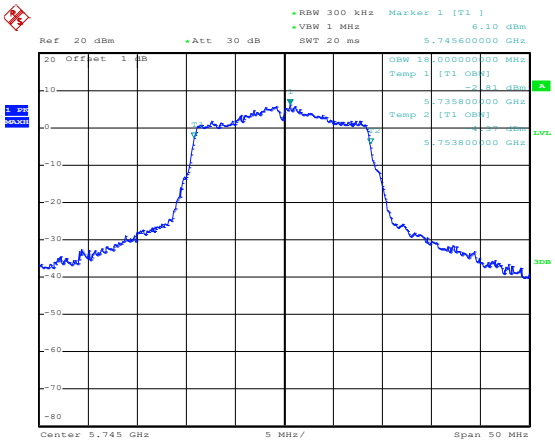
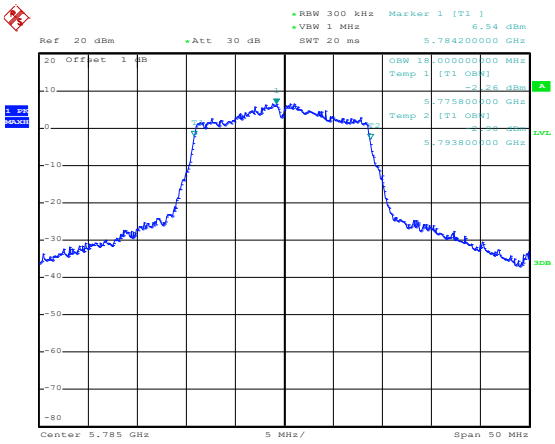
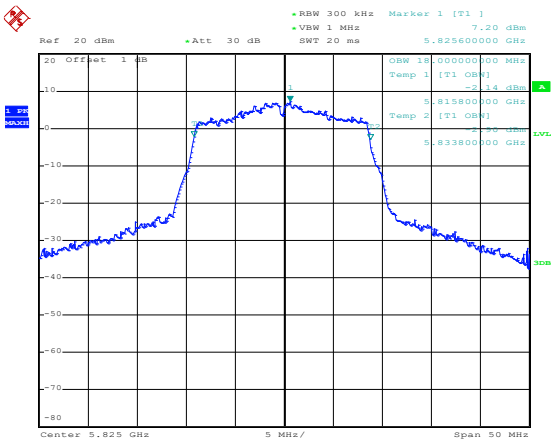
802.11a-Low	 Date: 28.NOV.2022 14:31:48
802.11a-Middle	 Date: 28.NOV.2022 14:32:24
802.11a-High	 Date: 28.NOV.2022 14:33:22

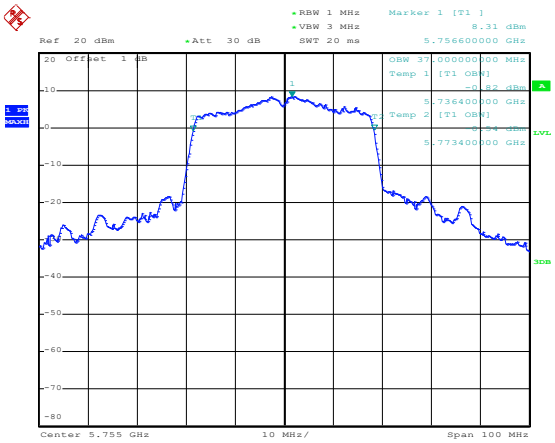
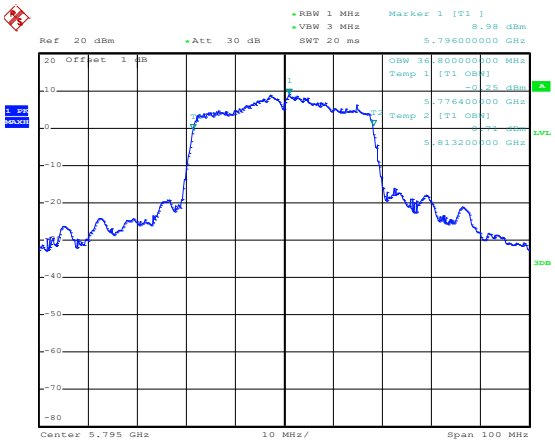
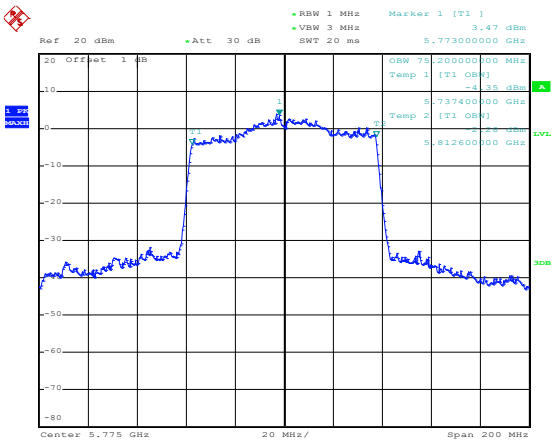
802.11n-HT20-Low	 Date: 28.NOV.2022 14:34:08
802.11n-HT20-Middle	 Date: 28.NOV.2022 14:35:08
802.11n-HT20-High	 Date: 28.NOV.2022 14:36:06

802.11n-HT40-Low	 Date: 28.NOV.2022 14:37:05
802.11n-HT40-High	 Date: 28.NOV.2022 14:38:06
802.11ac-HT80-Low	 Date: 28.NOV.2022 14:30:27

5725-5850MHz

802.11a-Low	 Date: 28.NOV.2022 14:44:16
802.11a-Middle	 Date: 28.NOV.2022 14:45:07
802.11a-High	 Date: 28.NOV.2022 14:46:24

802.11n-HT20-Low	 Date: 28.NOV.2022 14:47:39
802.11n-HT20-Middle	 Date: 28.NOV.2022 14:48:42
802.11n-HT20-High	 Date: 28.NOV.2022 14:50:00

802.11n-HT40-Low	
802.11n-HT40-High	
802.11ac-HT80-Low	

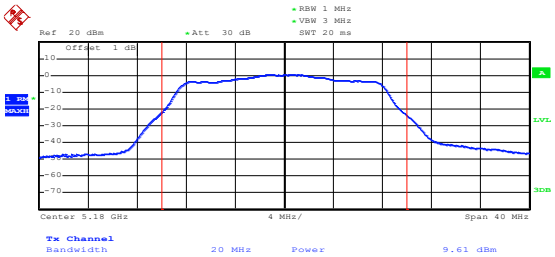
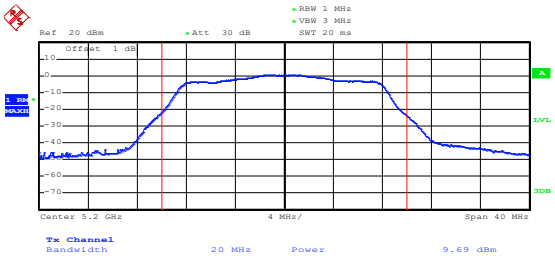
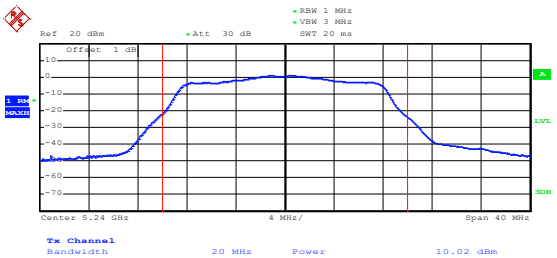
APPENDIX C

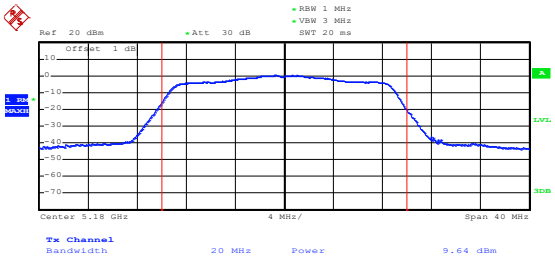
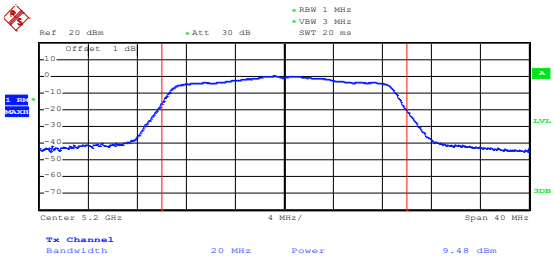
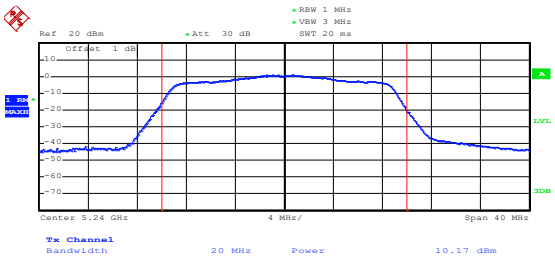
Maximum Conducted Output Power

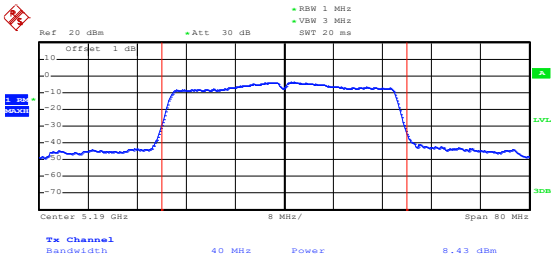
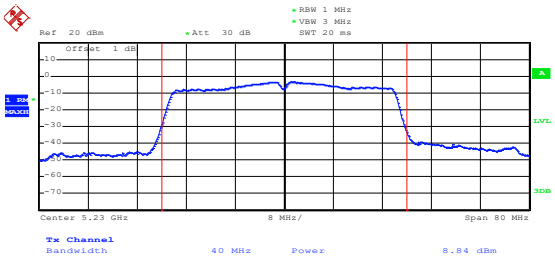
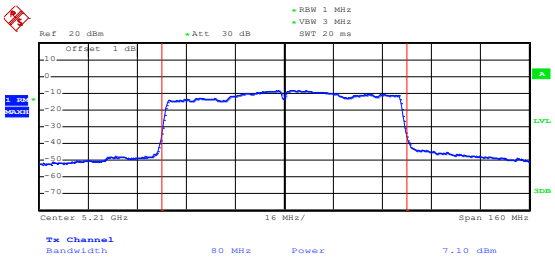
U-NII-1:5150-5250MHz			
Test mode	Frequency MHz	Output Power dBm	Limit dBm
802.11a	5180	9.61	23.98
	5200	9.69	23.98
	5240	10.02	23.98
802.11n-HT20	5180	9.64	23.98
	5200	9.48	23.98
	5240	10.17	23.98
802.11n-HT40	5190	8.43	23.98
	5230	8.84	23.98
802.11ac VH80	5210	7.10	23.98

U-NII-3: 5725-5850MHz			
Test mode	Frequency MHz	Output Power dBm	Limit dBm
802.11a	5745	13.32	30.00
	5785	13.77	30.00
	5825	14.05	30.00
802.11n-HT20	5745	12.29	30.00
	5785	12.86	30.00
	5825	13.19	30.00
802.11n-HT40	5755	12.47	30.00
	5795	13.03	30.00
802.11ac VH80	5775	9.72	30.00

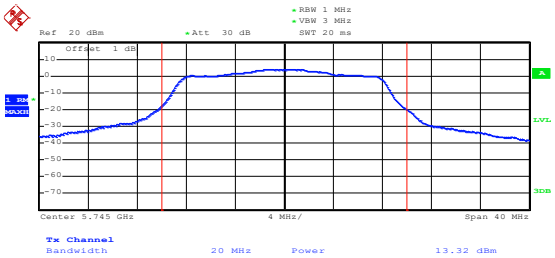
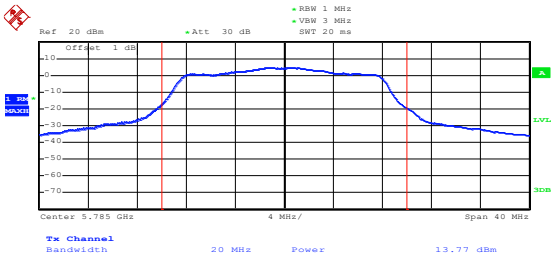
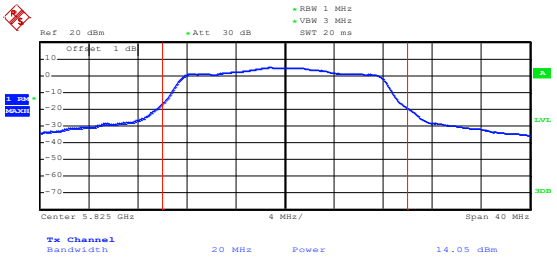
5150-5250MHz

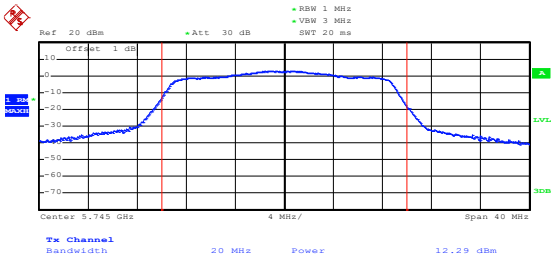
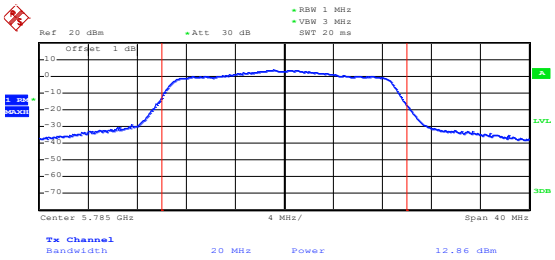
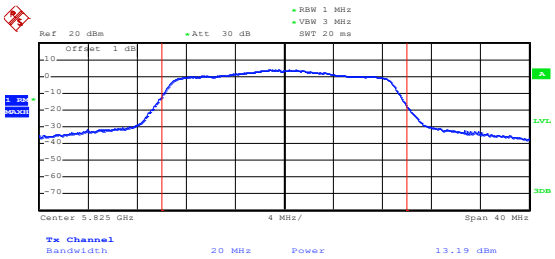
802.11a-Low	 Date: 28.NOV.2022 13:42:13
802.11a-Middle	 Date: 28.NOV.2022 13:43:14
802.11a-High	 Date: 28.NOV.2022 13:43:50

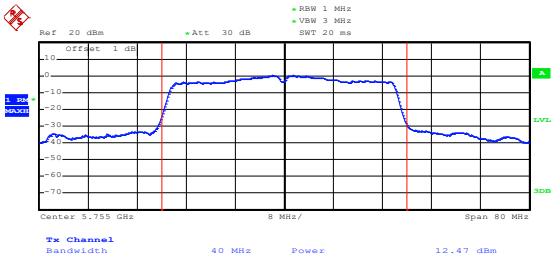
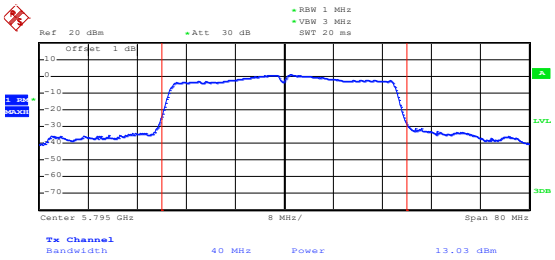
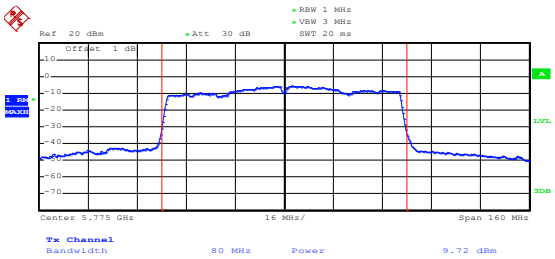
802.11n-HT20-Low	 Date: 28.NOV.2022 13:46:21
802.11n-HT20-Middle	 Date: 28.NOV.2022 13:47:09
802.11n-HT20-High	 Date: 28.NOV.2022 13:47:53

802.11n-HT40-Low	 Date: 28.NOV.2022 13:49:18
802.11n-HT40-High	 Date: 28.NOV.2022 13:50:07
802.11ac-HT80-Low	 Date: 28.NOV.2022 13:51:21

5725-5850MHz

802.11a-Low	 Date: 28.NOV.2022 15:33:07
802.11a-Middle	 Date: 28.NOV.2022 15:33:38
802.11a-High	 Date: 28.NOV.2022 15:34:26

802.11n-HT20-Low	 Date: 28.NOV.2022 15:35:14
802.11n-HT20-Middle	 Date: 28.NOV.2022 15:35:51
802.11n-HT20-High	 Date: 28.NOV.2022 15:36:24

802.11n-HT40-Low	 Date: 28.NOV.2022 15:37:19
802.11n-HT40-High	 Date: 28.NOV.2022 15:38:08
802.11ac-HT80-Low	 Date: 28.NOV.2022 15:31:26

APPENDIX D

Frequency Stability

U-NII-1:5150-5250MHz worst case at 802.11a middle channel				
Voltage(%)	Power(VDC)	TEMP(°C)	Freq.Dev(Hz)	Deviation
100%	3.7	-30	3002	0.5796
100%		-20	2997	0.5785
100%		-10	3006	0.5802
100%		0	3021	0.5833
100%		+10	3017	0.5824
100%		+20	3006	0.5803
100%		+30	2999	0.5790
100%		+40	3002	0.5796
100%		+50	3007	0.5806
Low Battery power	4.2	+20	3008	0.5806
High Battery power	3.5	+20	3000	0.5791

U-NII-1:5725-5850MHz worst case at 802.11a middle channel				
Voltage(%)	Power(VDC)	TEMP(°C)	Freq.Dev(Hz)	Deviation
100%	3.7	-30	3008	0.5236
100%		-20	3018	0.5253
100%		-10	2997	0.5217
100%		0	3010	0.5240
100%		+10	3015	0.5249
100%		+20	2999	0.5221
100%		+30	3004	0.5229
100%		+40	3010	0.5240
100%		+50	3003	0.5227
Low Battery power	4.2	+20	3009	0.5238
High Battery power	3.5	+20	3000	0.5223

APPENDIX PHOTOGRAPHS

Please refer to “ANNEX”

******* END OF REPORT *******