



中认信通

CHINA CERTIFICATION ICT CO., LTD (DONGGUAN)



TEST REPORT

Applicant: Heilongjiang Huida Technology Co., Ltd

Address: 6th floor,yitong building, No133 of xidazhi RD, nangang districition, ha'erbin city, heilongjiang province,China

FCC ID: 2BBNT3WWDZ-40-1B

Product Name: HD540Agricultural UAV

Standard(s): 47 CFR Part 15, Subpart E(15.407)

ANSI C63.10-2013

KDB 789033 D02 General U-NII Test Procedures New
Rules v02r01

The above equipment has been tested and found compliant with the requirement of the relative standards by China Certification ICT Co., Ltd (Dongguan)

Report Number: CR230634611-00A

Date Of Issue: 2023/7/11

Reviewed By: Calvin Chen

Title: RF Engineer

Reviewed By: Sun Zhong

Title: Manager

Test Laboratory: China Certification ICT Co., Ltd (Dongguan)

No. 113, Pingkang Road, Dalang Town, Dongguan,
Guangdong, China

Tel: +86-769-82016888

Test Facility

The Test site used by China Certification ICT Co., Ltd (Dongguan) to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 442868, the FCC Designation No. : CN1314.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0123.

Declarations

China Certification ICT Co., Ltd (Dongguan) is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

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CONTENTS

TEST FACILITY	2
DECLARATIONS.....	2
DOCUMENT REVISION HISTORY.....	5
1. GENERAL INFORMATION	6
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	6
1.2 DESCRIPTION OF TEST CONFIGURATION.....	8
1.2.1 EUT Operation Condition:	8
1.2.2 Support Equipment List and Details	8
1.2.3 Support Cable List and Details	9
1.2.4 Block Diagram of Test Setup	9
1.3 MEASUREMENT UNCERTAINTY	10
2. SUMMARY OF TEST RESULTS	11
3. REQUIREMENTS AND TEST PROCEDURES	12
3.1 AC LINE CONDUCTED EMISSIONS.....	12
3.1.1 Applicable Standard.....	12
3.1.2 EUT Setup.....	13
3.1.3 EMI Test Receiver Setup	13
3.1.4 Test Procedure	14
3.1.5 Corrected Amplitude & Margin Calculation.....	14
3.2 RADIATION SPURIOUS EMISSIONS.....	15
3.2.1 Applicable Standard.....	15
3.2.2 EUT Setup.....	16
3.2.3 EMI Test Receiver & Spectrum Analyzer Setup	16
3.2.4 Test Procedure	17
3.2.5 Corrected Amplitude & Margin Calculation.....	17
3.3 EMISSION BANDWIDTH:	18
3.3.1 Applicable Standard.....	18
3.3.2 EUT Setup.....	18
3.3.3 Test Procedure	18
3.4 MAXIMUM CONDUCTED OUTPUT POWER:	20
3.4.1 Applicable Standard.....	20
3.4.2 EUT Setup.....	20
3.4.3 Test Procedure	20
3.5 MAXIMUM POWER SPECTRAL DENSITY:	21
3.5.1 Applicable Standard.....	21
3.5.2 EUT Setup.....	21
3.5.3 Test Procedure	22
3.7 DUTY CYCLE:.....	23
3.7.1 EUT Setup.....	23
3.7.2 Test Procedure	23
3.8 ANTENNA REQUIREMENT.....	24

3.8.1 Applicable Standard.....	24
3.8.2 Judgment.....	24
4. Test DATA AND RESULTS.....	25
4.1 AC LINE CONDUCTED EMISSIONS.....	25
4.2 RADIATION SPURIOUS EMISSIONS.....	26
4.3 EMISSION BANDWIDTH:	40
4.4 MAXIMUM CONDUCTED OUTPUT POWER:	54
4.5 MAXIMUM POWER SPECTRAL DENSITY:	56
4.6 DUTY CYCLE:.....	64
5. RF EXPOSURE EVALUATION	67
5.1 APPLICABLE STANDARD.....	67
5.2 MEASUREMENT RESULT	68

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	CR230634611-00A	Original Report	2023/7/11

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

1.1.1 General:

EUT Name:	HD540Agricultural UAV
EUT Model:	3WWDZ-40.1B
Operation Frequency:	5180-5240 MHz (802.11a/n ht20/ac vht20) 5190-5230 MHz (802.11n ht40/ac vht40) 5210 MHz (802.11ac vht80) 5745-5825 MHz (802.11a/n ht20/ac vht20) 5755-5795 MHz (802.11n ht40/ac vht40) 5775 MHz (802.11ac vht80)
Maximum Average Output Power (Conducted):	12.26dBm (5150-5250 MHz) 12.02dBm (5725-5850 MHz)
Modulation Type:	802.11a/n/ac: OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM
Rated Input Voltage:	32Vdc from battery
Serial Number:	2709-3
EUT Received Date:	2023/6/20
EUT Received Status:	Good

1.1.2 Operation Frequency Detail:

For 802.11a/n ht20/ac vht20:

5150-5250MHz Band		5725-5850MHz Band	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	149	5745
40	5200	153	5765
44	5220	157	5785
48	5240	161	5805
/	/	165	5825
Per section 15.31(m), the below frequencies were performed the test as below:			
36	5180	149	5745
40	5200	157	5785
48	5240	165	5825

For 802.11n ht40/ac vht40:

5150-5250MHz Band		5725-5850MHz Band	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	151	5755
46	5230	159	5795
Per section 15.31(m), the below frequencies were performed the test as below:			
38	5190	151	5755
46	5230	159	5795

For 802.11ac vht80:

5150-5250MHz Band		5725-5850MHz Band	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	5210	155	5775
Per section 15.31(m), the below frequencies were performed the test as below:			
42	5210	155	5775

1.1.3 Antenna Information Detail ▲:

Antenna Type	input impedance (Ohm)	Frequency Range	Antenna Gain
FPC	50	5.10~5.30GHz	2.68 dBi
		5.70~5.90GHz	3.96 dBi

The Method of §15.203 Compliance:

- ☒ Antenna must be permanently attached to the unit.
☐ Antenna must use a unique type of connector to attach to the EUT.
☐ Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

1.1.4 Accessory Information:

Accessory Description	Manufacturer	Model
/	/	/

1.2 Description of Test Configuration

1.2.1 EUT Operation Condition:

EUT Operation Mode:			The system was configured for testing in Engineering Mode, which was provided by the manufacturer.	
Equipment Modifications:			No	
EUT Exercise Software:			RTL8852A MP Toolkit.exe	
The software was provided by manufacturer. The maximum power was configured as below, that was provided by the manufacturer ▲:				
5150-5250 MHz Band:				
Test Modes	Test Channels	Test Frequency (MHz)	Data rate	Power Level Setting
802.11a	Lowest	5180	6Mbps	100
	Middle	5200	6Mbps	100
	Highest	5240	6Mbps	100
802.11n ht20	Lowest	5180	MCS0	100
	Middle	5200	MCS0	100
	Highest	5240	MCS0	100
802.11n ht40	Lowest	5190	MCS0	100
	Highest	5230	MCS0	100
802.11ac vht80	Middle	5210	MCS0	100
5725-5850 MHz Band:				
Test Modes	Test Channels	Test Frequency (MHz)	Data rate	Power Level Setting
802.11a	Lowest	5745	6Mbps	80
	Middle	5785	6Mbps	76
	Highest	5825	6Mbps	74
802.11n ht20	Lowest	5745	MCS0	80
	Middle	5785	MCS0	75
	Highest	5825	MCS0	70
802.11n ht40	Lowest	5755	MCS0	80
	Highest	5795	MCS0	80
802.11ac vht80	Middle	5775	MCS0	78
Note: The system support 802.11a/n ht20/n ht40/ac vht20/vht40/vht80, the vht20/vht40 were reduced since the identical parameters with 802.11n ht20 and ht40. The above are the worst-case data rates, which are determined for each mode based upon investigations by measuring the average power and PSD across all data rates, bandwidths, and modulations.				

1.2.2 Support Equipment List and Details

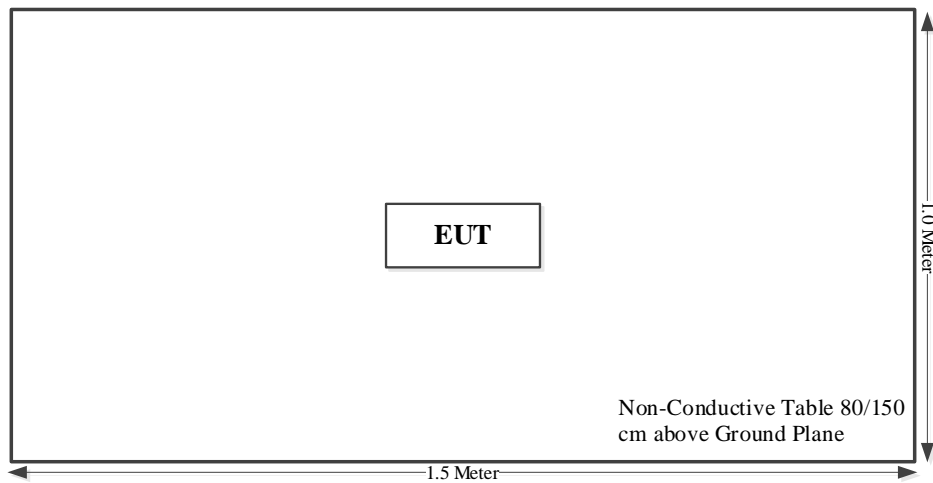
Manufacturer	Description	Model	Serial Number
/	/	/	/

1.2.3 Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
/	/	/	/	/	/

1.2.4 Block Diagram of Test Setup

Spurious Emissions :



Note: For above 1GHz test, the radio part and antenna are at a height of 1.5 meters above the ground

1.3 Measurement Uncertainty

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	$\pm 5\%$
RF output power, conducted	$\pm 0.61\text{dB}$
Power Spectral Density, conducted	$\pm 0.61\text{ dB}$
Unwanted Emissions, radiated	30M~200MHz: 4.15 dB, 200M~1GHz: 5.61 dB, 1G~6GHz: 5.14 dB, 6G~18GHz: 5.93 dB, 18G~26.5G: 5.47 dB, 26.5G~40G: 5.63 dB
Unwanted Emissions, conducted	$\pm 1.26\text{ dB}$
Temperature	$\pm 1^\circ\text{C}$
Humidity	$\pm 5\%$
DC and low frequency voltages	$\pm 0.4\%$
Duty Cycle	1%
AC Power Lines Conducted Emission	2.8 dB (150 kHz to 30 MHz)

2. SUMMARY OF TEST RESULTS

Standard(s) Section	Test Items	Result
§15.207(a)	AC line conducted emissions	Not Applicable
FCC §15.205& §15.209 & §15.407(b)	Radiated Spurious Emissions	Compliant
FCC §15.407(a) (e)	Emission Bandwidth	Compliant
FCC §15.407(a)	Maximum Conducted Output Power	Compliant
FCC §15.407 (a)	Power Spectral Density	Compliant
§15.203	Antenna Requirement	Compliant
§1.1310& §2.1091	RF Exposure Evaluation	Compliant

Note:

Not Applicable: Since the device was powered by Battery while operating, not applicable for this test item.

3. REQUIREMENTS AND TEST PROCEDURES

3.1 AC Line Conducted Emissions

3.1.1 Applicable Standard

FCC §15.207(a).

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that 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 the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current system containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 μ V within the frequency band 535-1705 kHz, as measured using a 50 μ H/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in §15.205, §15.209, §15.221, §15.223, or §15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

3.1.2 EUT Setup



Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter or EUT was connected to the main LISN with a 120 V/60 Hz AC power source.

3.1.3 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

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

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

3.1.4 Test Procedure

The frequency and amplitude of the six highest ac power-line conducted emissions relative to the limit, measured over all the current-carrying conductors of the EUT power cords, and the operating frequency or frequency to which the EUT is tuned (if appropriate), should be reported, unless such emissions are more than 20 dB below the limit. AC power-line conducted emissions measurements are to be separately carried out only on each of the phase (“hot”) line(s) and (if used) on the neutral line(s), but not on the ground [protective earth] line(s). If less than six emission frequencies are within 20 dB of the limit, then the noise level of the measuring instrument at representative frequencies should be reported. The specific conductor of the power-line cord for each of the reported emissions should be identified. Measure the six highest emissions with respect to the limit on each current-carrying conductor of each power cord associated with the EUT (but not the power cords of associated or peripheral equipment that are part of the test configuration). Then, report the six highest emissions with respect to the limit from among all the measurements identifying the frequency and specific current-carrying conductor identified with the emission. The six highest emissions should be reported for each of the current-carrying conductors, or the six highest emissions may be reported over all the current-carrying conductors.

3.1.5 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result = Reading + Factor

Factor = attenuation caused by cable loss + voltage division factor of AMN

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

3.2 Radiation Spurious Emissions

3.2.1 Applicable Standard

FCC §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 5.15-5.25 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.

(2) 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.

(3) 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.

(4) For transmitters operating solely in the 5.725-5.850 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.

(8) 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.

(9) 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.

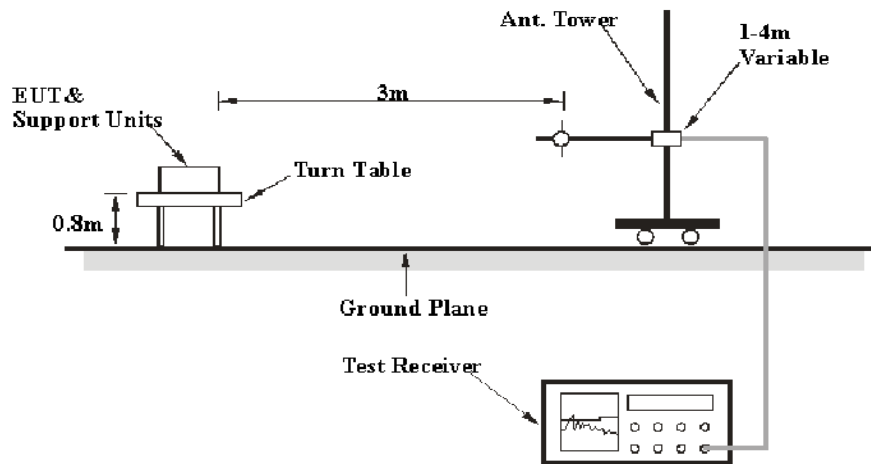
(10) The provisions of § 15.205 apply to intentional radiators operating under this section.

(11) 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.

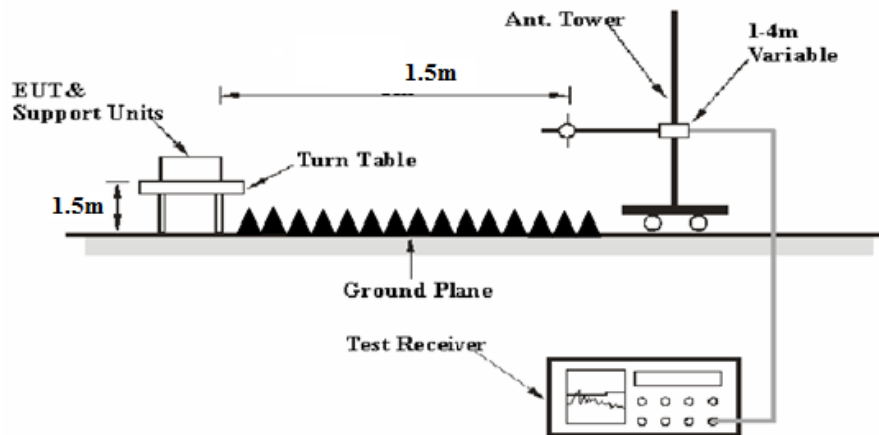
(c) The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signalling information or the use of repetitive codes used by certain digital technologies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

3.2.2 EUT Setup

Below 1GHz:



1-40 GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was FCC 15.209, FCC 15.407 limits.

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.

3.2.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30MHz-1000MHz:

Measurement	RBW	Video B/W	IF B/W
QP	120 kHz	300 kHz	120kHz

1GHz- 40GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
AV	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is minimum transmission duration

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

3.2.4 Test Procedure

During the radiated emission test, the adapter was connected to the first AC floor outlet.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1GHz, peak and Average detection modes for frequencies above 1GHz.

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, emission shall be computed as: $E [dB\mu V/m] = EIRP[dBm] + 95.2$, for $d = 3$ meters.

According to C63.10, the above 1G test result shall be extrapolated to the specified distance using an extrapolation Factor of 20dB/decade from 3m to 1.5m

Distance extrapolation Factor = $20 \log (\text{specific distance } [3m] / \text{test distance } [1.5m])$ dB = 6.02 dB

All emissions under the average limit and under the noise floor have not recorded in the report.

3.2.5 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Factor = Antenna Factor + Cable Loss- Amplifier Gain

For 30MHz-1GHz:

Result = Reading + Factor

For 1GHz-40GHz

Result = Reading + Factor-Distance extrapolation Factor

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

3.3 Emission Bandwidth:

3.3.1 Applicable Standard

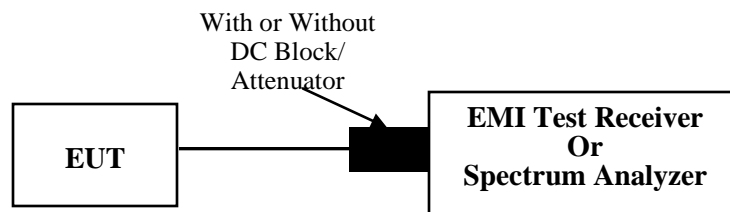
FCC §15.407 (a),(h)

(h)(2) Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems.

FCC §15.407 (e)

Within the 5.725-5.850 GHz and 5.850-5.895 GHz bands, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

3.3.2 EUT Setup



3.3.3 Test Procedure

26dB Emission Bandwidth:

According to ANSI C63.10-2013 Section 12.4.1

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

6 dB emission bandwidth:

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) ≥ 3 RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- 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 in this section. For devices that use channel aggregation refer to III.A and III.C for determining emission bandwidth.

99% Occupied Bandwidth:

According to ANSI C63.10-2013 Section 12.4.2&6.9.3

The 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.

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

- a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level. Specific guidance is given in 4.1.5.2.
- d) Step a) through step c) might require iteration to adjust within the specified range.
- e) 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.
- f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
- g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. 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% power bandwidth is the difference between these two frequencies.
- h) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

3.4 Maximum Conducted Output Power:

3.4.1 Applicable Standard

FCC §15.407(a) (1)(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.

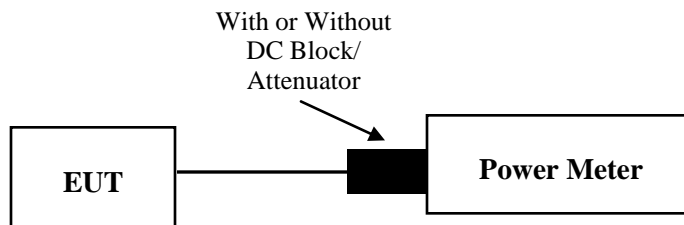
FCC §15.407(a) (2)

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.

FCC §15.407(a) (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.

3.4.2 EUT Setup



3.4.3 Test Procedure

According to ANSI C63.10-2013 Section 12.3.3.2

Method PM-G is measurement using a gated RF average power meter.

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Because the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

3.5 Maximum Power Spectral Density:

3.5.1 Applicable Standard

FCC §15.407(a) (1)(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.

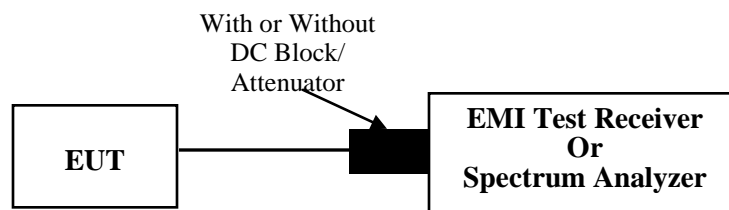
FCC §15.407(a) (2)

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.

FCC §15.407(a) (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.

3.5.2 EUT Setup



3.5.3 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Duty cycle $\geq 98\%$

KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Method SA-1 **Alternative** should be applied.

Duty cycle $< 98\%$, duty cycle variations are less than $\pm 2\%$

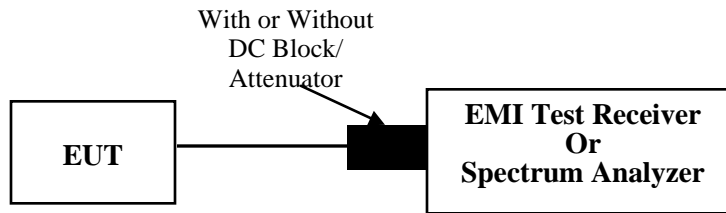
KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Method SA-2 **Alternative** should be applied.

Duty cycle $< 98\%$, duty cycle variations exceed $\pm 2\%$

KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Method SA-3 should be applied.

3.7 Duty Cycle:

3.7.1 EUT Setup



3.7.2 Test Procedure

According to ANSI C63.10-2013 Section 12.2

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:

- 1) Set the center frequency of the instrument to the center frequency of the transmission.
- 2) Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value.
- 3) Set $VBW \geq RBW$. Set detector = peak or average.
- 4) The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if $T \leq 16.7 \mu s$.)

3.8 Antenna Requirement

3.8.1 Applicable Standard

FCC §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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

3.8.2 Judgment

Result: Compliant. Please refer to the Antenna Information detail in Section 1.

4. Test DATA AND RESULTS

4.1 AC Line Conducted Emissions

Not Applicable, the device was powered by battery when operating.

4.2 Radiation Spurious Emissions

Serial Number:	2709-3	Test Date:	2023/6/30 ~2023/7/8
Test Site:	966-1,966-2	Test Mode:	Transmitting
Tester:	coco Tian,Carl Xue	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	26.1~27.4	Relative Humidity: (%)	60~70	ATM Pressure: (kPa)	99.9~100.5
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Test Equipment List and Details:

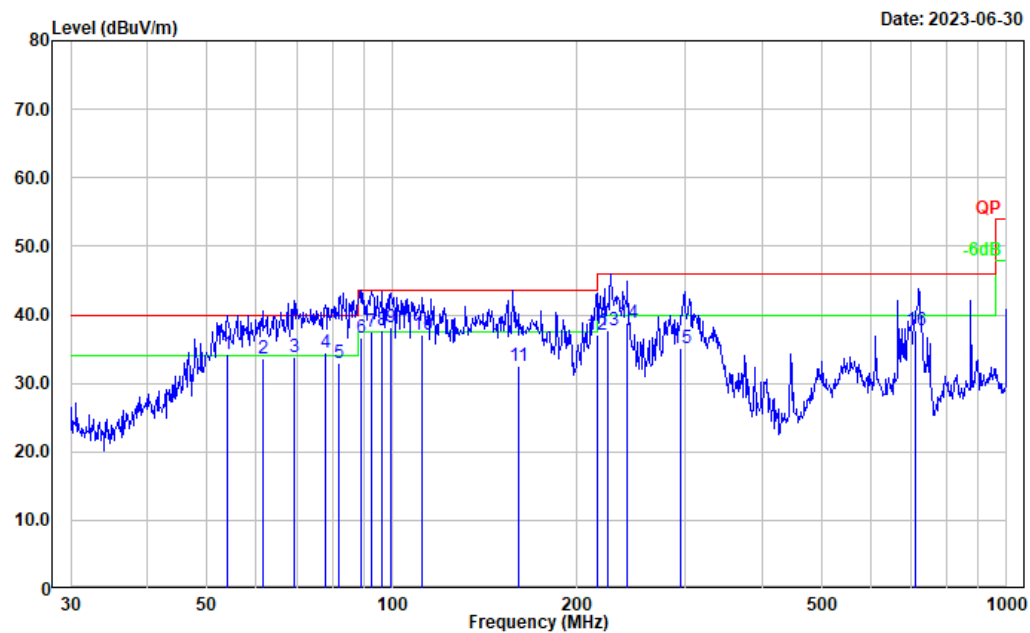
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB6	A082520-5	2020/10/19	2023/10/18
R&S	EMI Test Receiver	ESR3	102724	2022/07/15	2023/07/14
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0470-02	2022/07/17	2023/07/16
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0780-01	2022/07/17	2023/07/16
Sonoma	Amplifier	310N	186165	2022/07/17	2023/07/16
Audix	Test Software	E3	201021 (V9)	N/A	N/A
ETS-Lindgren	Horn Antenna	3115	9912-5985	2020/10/13	2023/10/12
R&S	Spectrum Analyzer	FSV40	101591	2022/07/15	2023/07/14
MICRO-COAX	Coaxial Cable	UFA210A-1-1200-70U300	217423-008	2022/08/07	2023/08/06
MICRO-COAX	Coaxial Cable	UFA210A-1-2362-300300	235780-001	2022/08/07	2023/08/06
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2022/11/09	2023/11/08
PASTERNAK	Horn Antenna	PE9852/2F-20	112002	2021/02/05	2024/02/04
Quinstar	Preamplifier	QLW-18405536-JO	15964001005	2022/09/16	2023/09/15
MICRO-COAX	Coaxial Cable	UFB142A-1-2362-200200	235772-001	2022/08/07	2023/08/06
E-Microwave	Band Rejection Filter	5150-5850MHz	OE01902423	2022/08/07	2023/08/06
Mini Circuits	High Pass Filter	VHF-6010+	31119	2022/08/07	2023/08/06
PASTERNAK	Horn Antenna	PE9850/2F-20	072001	2021/02/05	2024/02/04

* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data:

1) 30MHz-1GHz (802.11a 5200MHz)

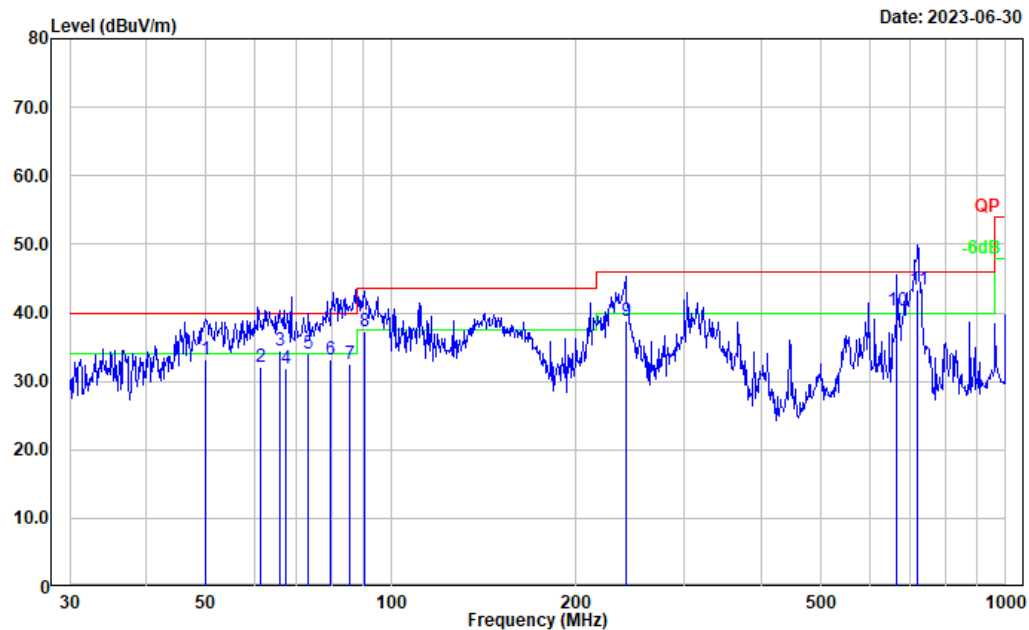
Test Mode: Transmitting
Polarization: horizontal
Note:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector

1	53.882	51.55	-17.26	34.29	40.00	5.71	QP
2	61.562	50.98	-17.30	33.68	40.00	6.32	QP
3	69.357	50.41	-16.56	33.85	40.00	6.15	QP
4	77.865	51.69	-17.25	34.44	40.00	5.56	QP
5	81.780	50.34	-17.36	32.98	40.00	7.02	QP
6	88.964	53.61	-17.00	36.61	43.50	6.89	QP
7	92.787	53.81	-16.22	37.59	43.50	5.91	QP
8	96.436	53.06	-15.23	37.83	43.50	5.67	QP
9	99.528	52.54	-14.43	38.11	43.50	5.39	QP
10	112.131	49.29	-12.15	37.14	43.50	6.36	QP
11	160.600	44.69	-12.12	32.57	43.50	10.93	QP
12	215.268	49.59	-12.61	36.98	43.50	6.52	QP
13	224.736	50.61	-12.86	37.75	46.00	8.25	QP
14	241.676	51.89	-13.00	38.89	46.00	7.11	QP
15	295.010	45.83	-10.77	35.06	46.00	10.94	QP
16	710.463	41.29	-3.47	37.82	46.00	8.18	QP

Test Mode: Transmitting
Polarization: vertical
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	49.881	50.33	-17.09	33.24	40.00	6.76	QP
2	61.383	49.42	-17.32	32.10	40.00	7.90	QP
3	65.803	51.39	-16.88	34.51	40.00	5.49	QP
4	67.507	48.54	-16.72	31.82	40.00	8.18	QP
5	73.359	50.84	-16.80	34.04	40.00	5.96	QP
6	79.460	50.60	-17.40	33.20	40.00	6.80	QP
7	85.699	49.63	-17.15	32.48	40.00	7.52	QP
8	90.537	54.06	-16.80	37.26	43.50	6.24	QP
9	240.830	51.85	-13.01	38.84	46.00	7.16	QP
10	665.804	44.48	-4.16	40.32	46.00	5.68	QP
11	719.200	46.75	-3.30	43.45	46.00	2.55	QP

2) 1GHz-40GHz:**5150-5250MHz****802.11a:**

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
Low Channel: 5180MHz							
5180.000	67.98	PK	H	38.68	100.64	N/A	N/A
5180.000	56.06	AV	H	38.68	88.72	N/A	N/A
5180.000	70.96	PK	V	38.68	103.62	N/A	N/A
5180.000	58.99	AV	V	38.68	91.65	N/A	N/A
5150.000	30.12	PK	V	38.64	62.74	74.00	11.26
5150.000	16.98	AV	V	38.64	49.60	54.00	4.40
10360.000	32.64	PK	V	19.18	45.80	68.20	22.40
15540.000	32.64	PK	V	22.44	49.06	74.00	24.94
15540.000	19.51	AV	V	22.44	35.93	54.00	18.07
Middle Channel: 5200 MHz							
5200.000	67.36	PK	H	38.70	100.04	N/A	N/A
5200.000	55.23	AV	H	38.70	87.91	N/A	N/A
5200.000	70.35	PK	V	38.70	103.03	N/A	N/A
5200.000	58.25	AV	V	38.70	90.93	N/A	N/A
10400.000	32.78	PK	V	19.16	45.92	68.20	22.28
15600.000	32.32	PK	V	22.41	48.71	74.00	25.29
15600.000	19.64	AV	V	22.41	36.03	54.00	17.97
High Channel: 5240 MHz							
5240.000	67.31	PK	H	38.85	100.14	N/A	N/A
5240.000	55.36	AV	H	38.85	88.19	N/A	N/A
5240.000	70.12	PK	V	38.85	102.95	N/A	N/A
5240.000	58.07	AV	V	38.85	90.90	N/A	N/A
5350.000	29.64	PK	V	39.03	62.65	74.00	11.35
5350.000	16.54	AV	V	39.03	49.55	54.00	4.45
10480.000	32.94	PK	V	18.86	45.78	68.20	22.42
15720.000	32.41	PK	V	22.28	48.67	74.00	25.33
15720.000	19.73	AV	V	22.28	35.99	54.00	18.01

802.11n ht20:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
Low Channel: 5180MHz							
5180.000	67.23	PK	H	38.68	99.89	N/A	N/A
5180.000	55.11	AV	H	38.68	87.77	N/A	N/A
5180.000	69.94	PK	V	38.68	102.60	N/A	N/A
5180.000	57.87	AV	V	38.68	90.53	N/A	N/A
5150.000	30.76	PK	V	38.64	63.38	74.00	10.62
5150.000	17.43	AV	V	38.64	50.05	54.00	3.95
10360.000	32.64	PK	V	19.18	45.80	68.20	22.40
15540.000	32.06	PK	V	22.44	48.48	74.00	25.52
15540.000	19.52	AV	V	22.44	35.94	54.00	18.06
Middle Channel: 5200 MHz							
5200.000	64.08	PK	H	38.70	96.76	N/A	N/A
5200.000	52.36	AV	H	38.70	85.04	N/A	N/A
5200.000	66.75	PK	V	38.70	99.43	N/A	N/A
5200.000	54.69	AV	V	38.70	87.37	N/A	N/A
10400.000	32.51	PK	V	19.16	45.65	68.20	22.55
15600.000	32.26	PK	V	22.41	48.65	74.00	25.35
15600.000	19.64	AV	V	22.41	36.03	54.00	17.97
High Channel: 5240 MHz							
5240.000	65.64	PK	H	38.85	98.47	N/A	N/A
5240.000	53.78	AV	H	38.85	86.61	N/A	N/A
5240.000	68.79	PK	V	38.85	101.62	N/A	N/A
5240.000	56.83	AV	V	38.85	89.66	N/A	N/A
5350.000	30.36	PK	V	39.03	63.37	74.00	10.63
5350.000	17.15	AV	V	39.03	50.16	54.00	3.84
10480.000	32.46	PK	V	18.86	45.30	68.20	22.90
15720.000	32.07	PK	V	22.28	48.33	74.00	25.67
15720.000	19.64	AV	V	22.28	35.90	54.00	18.10

802.11n ht40:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
Low Channel: 5190 MHz							
5190.000	63.04	PK	H	38.69	95.71	N/A	N/A
5190.000	51.35	AV	H	38.69	84.02	N/A	N/A
5190.000	65.89	PK	V	38.69	98.56	N/A	N/A
5190.000	53.47	AV	V	38.69	86.14	N/A	N/A
5150.000	31.25	PK	V	38.64	63.87	74.00	10.13
5150.000	18.02	AV	V	38.64	50.64	54.00	3.36
10380.000	32.49	PK	V	19.17	45.64	68.20	22.56
15570.000	32.58	PK	V	22.43	48.99	74.00	25.01
15570.000	19.67	AV	V	22.43	36.08	54.00	17.92
High Channel: 5230 MHz							
5230.000	64.28	PK	H	38.81	97.07	N/A	N/A
5230.000	52.12	AV	H	38.81	84.91	N/A	N/A
5230.000	67.45	PK	V	38.81	100.24	N/A	N/A
5230.000	52.16	AV	V	38.81	84.95	N/A	N/A
5350.000	29.64	PK	V	39.03	62.65	74.00	11.35
5350.000	16.35	AV	V	39.03	49.36	54.00	4.64
10460.000	32.71	PK	V	18.94	45.63	68.20	22.57
15690.000	32.33	PK	V	22.29	48.60	74.00	25.40
15690.000	19.61	AV	V	22.29	35.88	54.00	18.12

802.11ac vht80:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
5210.000	62.18	PK	H	38.74	94.90	N/A	N/A
5210.000	50.00	AV	H	38.74	82.72	N/A	N/A
5210.000	65.34	PK	V	38.74	98.06	N/A	N/A
5210.000	53.78	AV	V	38.74	86.50	N/A	N/A
5150.000	35.45	PK	V	38.64	68.07	74.00	5.93
5150.000	19.84	AV	V	38.64	52.46	54.00	1.54
5350.000	29.87	PK	V	39.03	62.88	74.00	11.12
5350.000	16.38	AV	V	39.03	49.39	54.00	4.61
10420.000	32.49	PK	V	19.09	45.56	68.20	22.64
15630.000	32.67	PK	V	22.37	49.02	74.00	24.98
15630.000	19.52	AV	V	22.37	35.87	54.00	18.13

Note:

Result = Reading + Factor- Distance extrapolation Factor

Distance extrapolation Factor = $20 \log (\text{specific distance [3m]}/\text{test distance [1.5m]})$ dB = 6.02 dB

5725-5850MHz:**802.11a:**

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
Low Channel: 5745MHz							
5745.000	65.34	PK	H	39.46	98.78	N/A	N/A
5745.000	52.01	AV	H	39.46	85.45	N/A	N/A
5745.000	68.15	PK	V	39.46	101.59	N/A	N/A
5745.000	54.91	AV	V	39.46	88.35	N/A	N/A
5725.000	33.87	PK	V	39.48	67.33	122.20	54.87
5720.000	32.49	PK	V	39.49	65.96	110.80	44.84
5700.000	31.28	PK	V	39.51	64.77	105.20	40.43
5650.000	30.05	PK	V	39.49	63.52	68.20	4.68
11490.000	31.33	PK	V	20.67	45.98	74.00	28.02
11490.000	18.41	AV	V	20.67	33.06	54.00	20.94
17235.000	32.55	PK	V	26.76	53.29	68.20	14.91
Middle Channel: 5785 MHz							
5785.000	65.27	PK	H	39.44	98.69	N/A	N/A
5785.000	51.96	AV	H	39.44	85.38	N/A	N/A
5785.000	68.09	PK	V	39.44	101.51	N/A	N/A
5785.000	54.90	AV	V	39.44	88.32	N/A	N/A
11570.000	31.75	PK	V	20.83	46.56	74.00	27.44
11570.000	18.67	AV	V	20.83	33.48	54.00	20.52
17355.000	32.50	PK	V	27.74	54.22	68.20	13.98
High Channel: 5825 MHz							
5825.000	65.75	PK	H	39.46	99.19	N/A	N/A
5825.000	52.43	AV	H	39.46	85.87	N/A	N/A
5825.000	68.03	PK	V	39.46	101.47	N/A	N/A
5825.000	54.79	AV	V	39.46	88.23	N/A	N/A
5850.000	33.94	PK	V	39.49	67.41	122.20	54.79
5855.000	32.61	PK	V	39.51	66.10	110.80	44.70
5875.000	30.19	PK	V	39.60	63.77	105.20	41.43
5925.000	29.96	PK	V	39.68	63.62	68.20	4.58
11650.000	31.62	PK	V	21.07	46.67	74.00	27.33
11650.000	18.58	AV	V	21.07	33.63	54.00	20.37
17475.000	32.87	PK	V	28.61	55.46	68.20	12.74

802.11n ht20:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
Low Channel: 5745MHz							
5745.000	63.78	PK	H	39.46	97.22	N/A	N/A
5745.000	51.35	AV	H	39.46	84.79	N/A	N/A
5745.000	66.45	PK	V	39.46	99.89	N/A	N/A
5745.000	54.37	AV	V	39.46	87.81	N/A	N/A
5725.000	33.46	PK	V	39.48	66.92	122.20	55.28
5720.000	32.41	PK	V	39.49	65.88	110.80	44.92
5700.000	30.15	PK	V	39.51	63.64	105.20	41.56
5650.000	29.89	PK	V	39.49	63.36	68.20	4.84
11490.000	31.69	PK	V	20.67	46.34	74.00	27.66
11490.000	18.76	AV	V	20.67	33.41	54.00	20.59
17235.000	32.47	PK	V	26.76	53.21	68.20	14.99
Middle Channel: 5785 MHz							
5785.000	62.75	PK	H	39.44	96.17	N/A	N/A
5785.000	50.07	AV	H	39.44	83.49	N/A	N/A
5785.000	65.89	PK	V	39.44	99.31	N/A	N/A
5785.000	53.76	AV	V	39.44	87.18	N/A	N/A
11570.000	31.25	PK	V	20.83	46.06	74.00	27.94
11570.000	18.31	AV	V	20.83	33.12	54.00	20.88
17355.000	32.52	PK	V	27.74	54.24	68.20	13.96
High Channel: 5825 MHz							
5825.000	62.31	PK	H	39.46	95.75	N/A	N/A
5825.000	49.97	AV	H	39.46	83.41	N/A	N/A
5825.000	65.21	PK	V	39.46	98.65	N/A	N/A
5825.000	52.45	AV	V	39.46	85.89	N/A	N/A
5850.000	33.16	PK	V	39.49	66.63	122.20	55.57
5855.000	31.76	PK	V	39.51	65.25	110.80	45.55
5875.000	30.46	PK	V	39.60	64.04	105.20	41.16
5925.000	29.91	PK	V	39.68	63.57	68.20	4.63
11650.000	31.49	PK	V	21.07	46.54	74.00	27.46
11650.000	18.37	AV	V	21.07	33.42	54.00	20.58
17475.000	32.61	PK	V	28.61	55.20	68.20	13.00

802.11n ht40:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
Low Channel: 5755 MHz							
5755.000	64.57	PK	H	39.45	98.00	N/A	N/A
5755.000	51.87	AV	H	39.45	85.30	N/A	N/A
5755.000	67.38	PK	V	39.45	100.81	N/A	N/A
5755.000	54.85	AV	V	39.45	88.28	N/A	N/A
5725.000	41.35	PK	V	39.48	74.81	122.20	47.39
5720.000	39.64	PK	V	39.49	73.11	110.80	37.69
5700.000	31.46	PK	V	39.51	64.95	105.20	40.25
5650.000	30.02	PK	V	39.49	63.49	68.20	4.71
11510.000	31.45	PK	V	20.67	46.10	74.00	27.90
11510.000	18.64	AV	V	20.67	33.29	54.00	20.71
17265.000	32.64	PK	V	26.94	53.56	68.20	14.64
High Channel: 5795 MHz							
5795.000	65.49	PK	H	39.43	98.90	N/A	N/A
5795.000	62.67	AV	H	39.43	96.08	N/A	N/A
5795.000	68.12	PK	V	39.43	101.53	N/A	N/A
5795.000	55.91	AV	V	39.43	89.32	N/A	N/A
5850.000	42.69	PK	V	39.49	76.16	122.20	46.04
5855.000	39.75	PK	V	39.51	73.24	110.80	37.56
5875.000	31.47	PK	V	39.60	65.05	105.20	40.15
5925.000	30.61	PK	V	39.68	64.27	68.20	3.93
11590.000	31.35	PK	V	20.88	46.21	74.00	27.79
11590.000	18.47	AV	V	20.88	33.33	54.00	20.67
17385.000	32.59	PK	V	28.07	54.64	68.20	13.56

802.11ac vht80:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
5775.000	62.35	PK	H	39.44	95.77	N/A	N/A
5775.000	50.03	AV	H	39.44	83.45	N/A	N/A
5775.000	64.89	PK	V	39.44	98.31	N/A	N/A
5775.000	52.76	AV	V	39.44	86.18	N/A	N/A
5725.000	41.95	PK	V	39.48	75.41	122.20	46.79
5720.000	40.56	PK	V	39.49	74.03	110.80	36.77
5700.000	37.07	PK	V	39.51	70.56	105.20	34.64
5650.000	29.25	PK	V	39.49	62.72	68.20	5.48
5850.000	38.95	PK	V	39.49	72.42	122.20	49.78
5855.000	37.76	PK	V	39.51	71.25	110.80	39.55
5875.000	32.66	PK	V	39.60	66.24	105.20	38.96
5925.000	30.15	PK	V	39.68	63.81	68.20	4.39
11550.000	31.69	PK	V	20.78	46.45	74.00	27.55
11550.000	18.75	AV	V	20.78	33.51	54.00	20.49
17325.000	32.19	PK	V	27.41	53.58	68.20	14.62

Note:

Result = Reading + Factor- Distance extrapolation Factor

Distance extrapolation Factor = $20 \log (\text{specific distance [3m]} / \text{test distance [1.5m]})$ dB = 6.02 dB

Worst Test plots for Band Edge Measurements (Radiated)

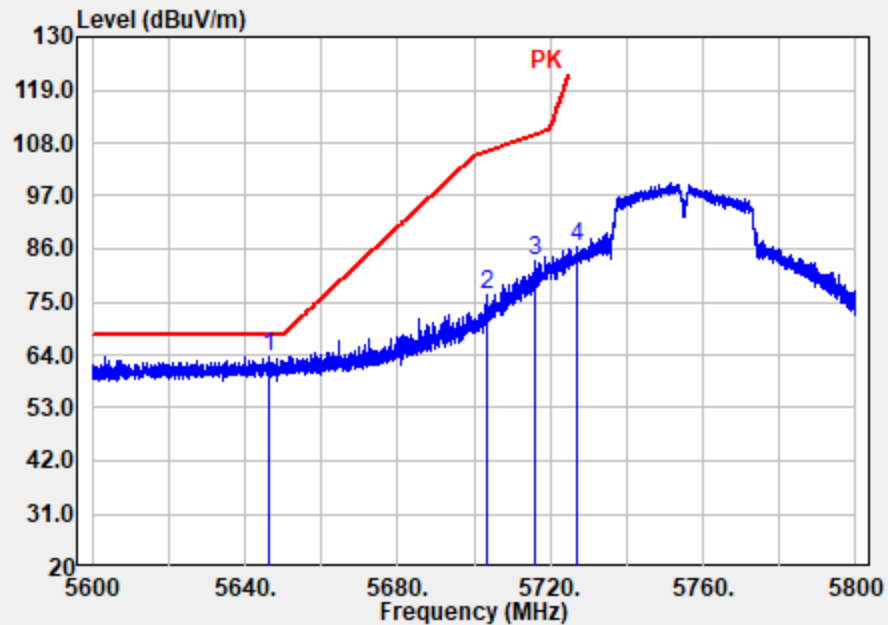
802.11n ht40

Test Channel:

5755MHz

Ant. Polar. :

Horizontal



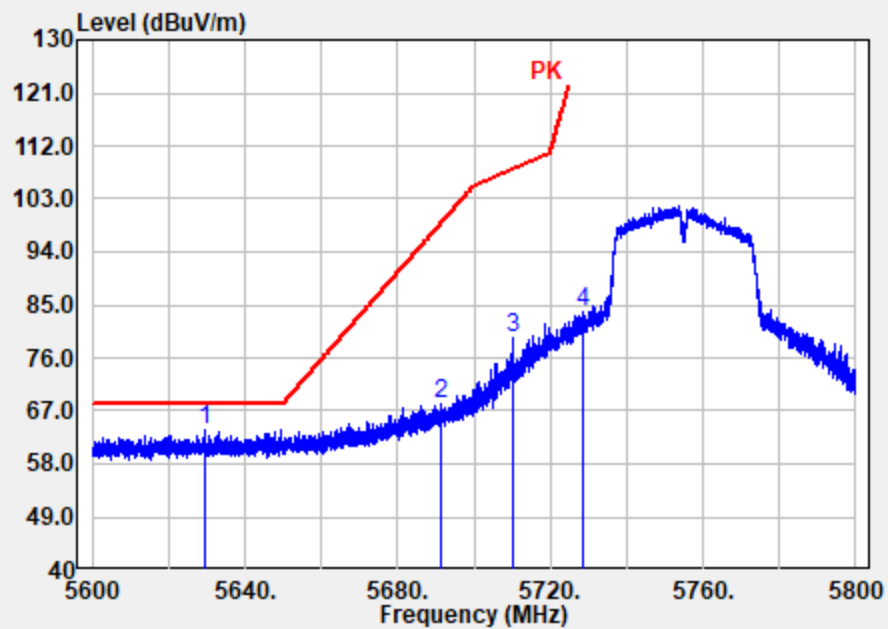
802.11n ht40

Test Channel:

5755MHz

Ant. Polar. :

Vertical



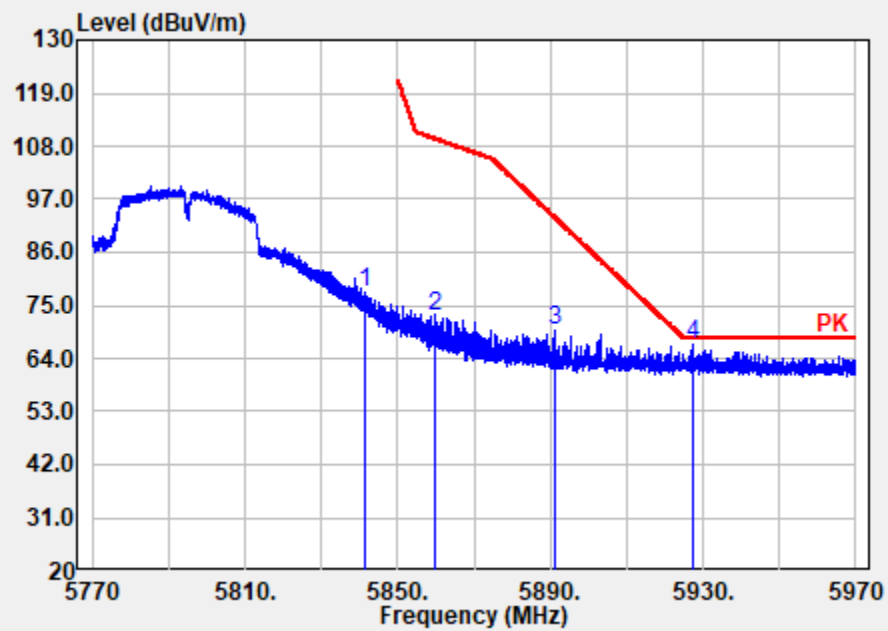
802.11n ht40

Test Channel:

5795MHz

Ant. Polar. :

Horizontal



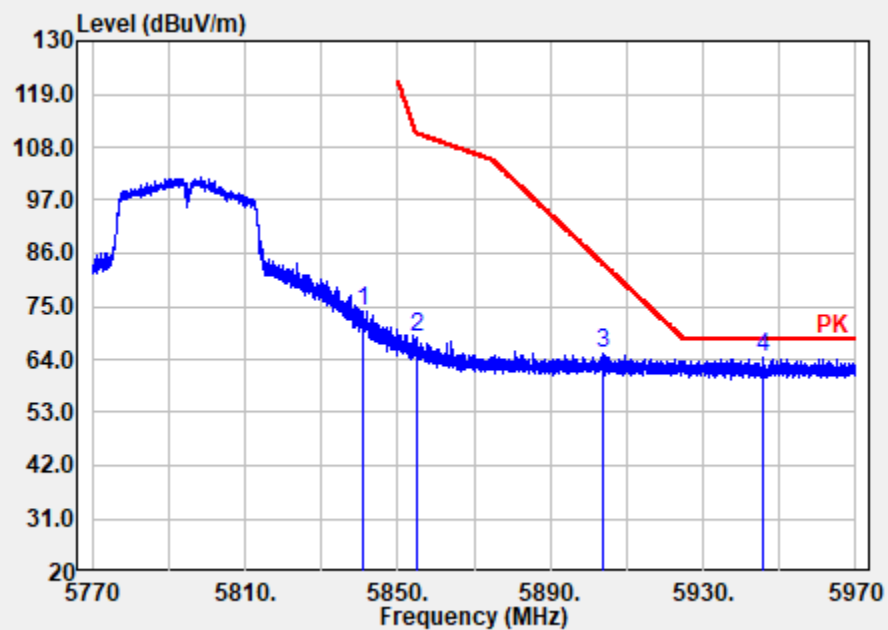
802.11n ht40

Test Channel:

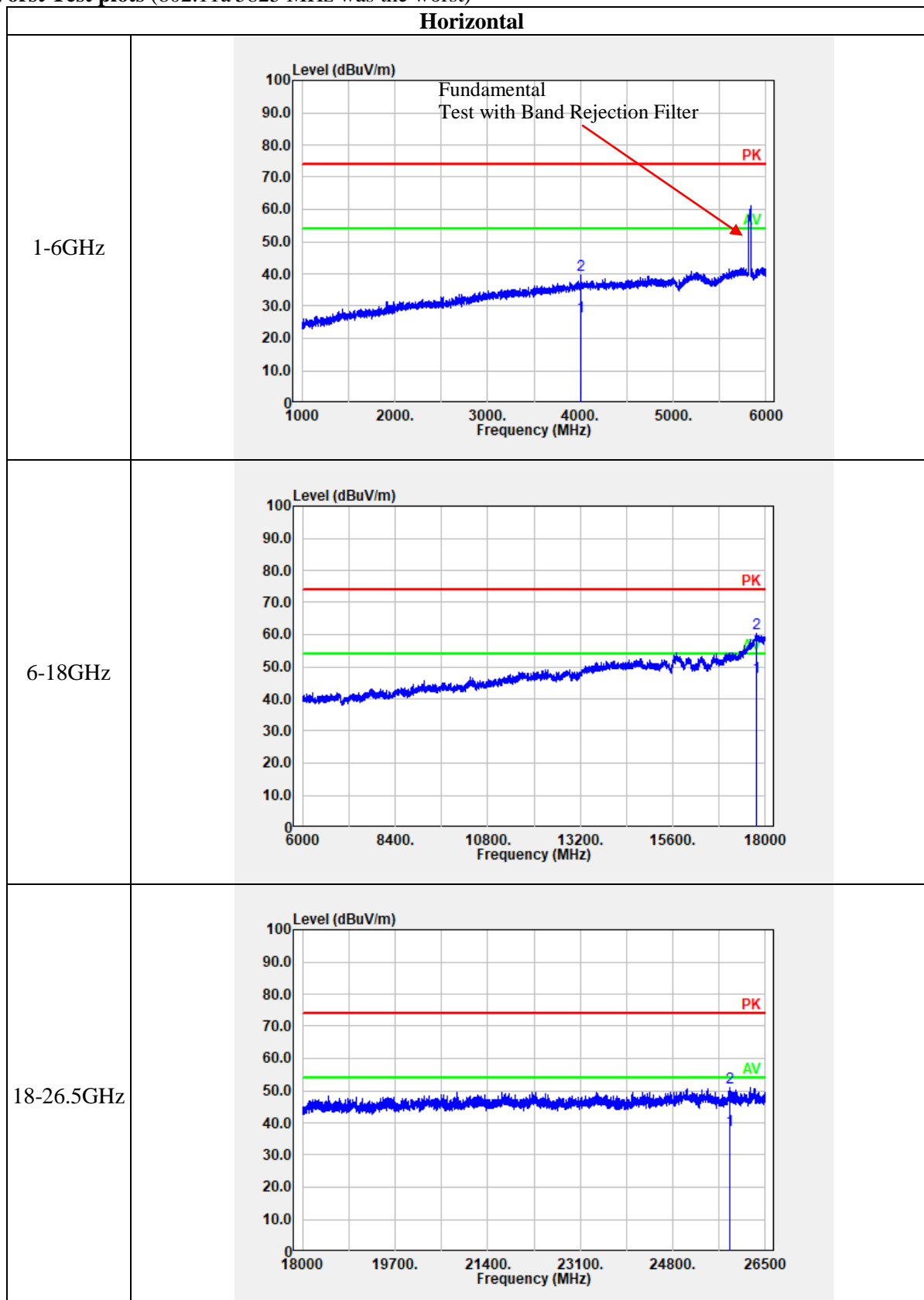
5795MHz

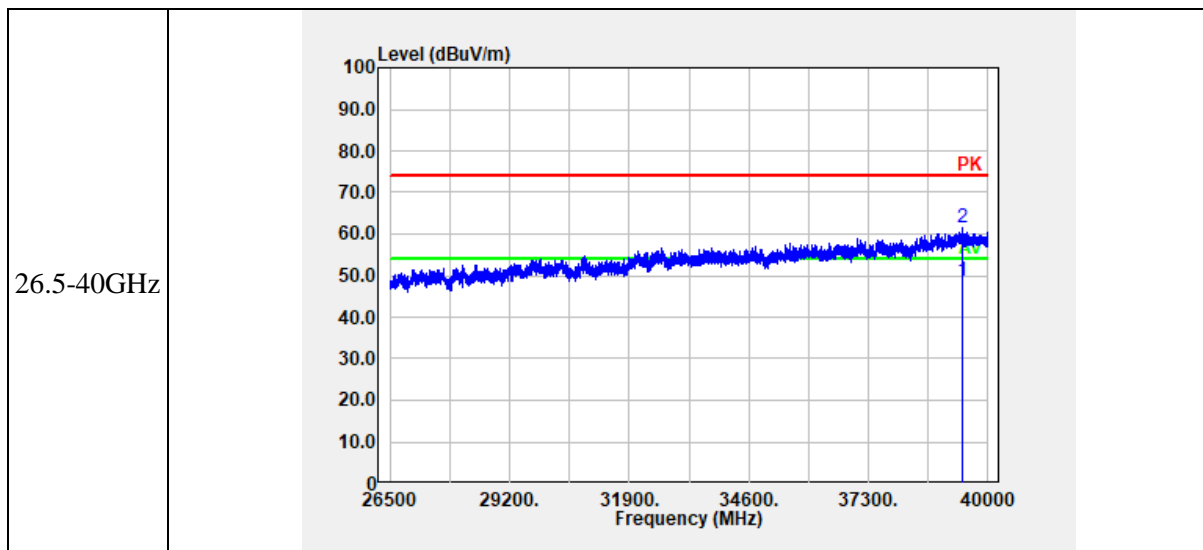
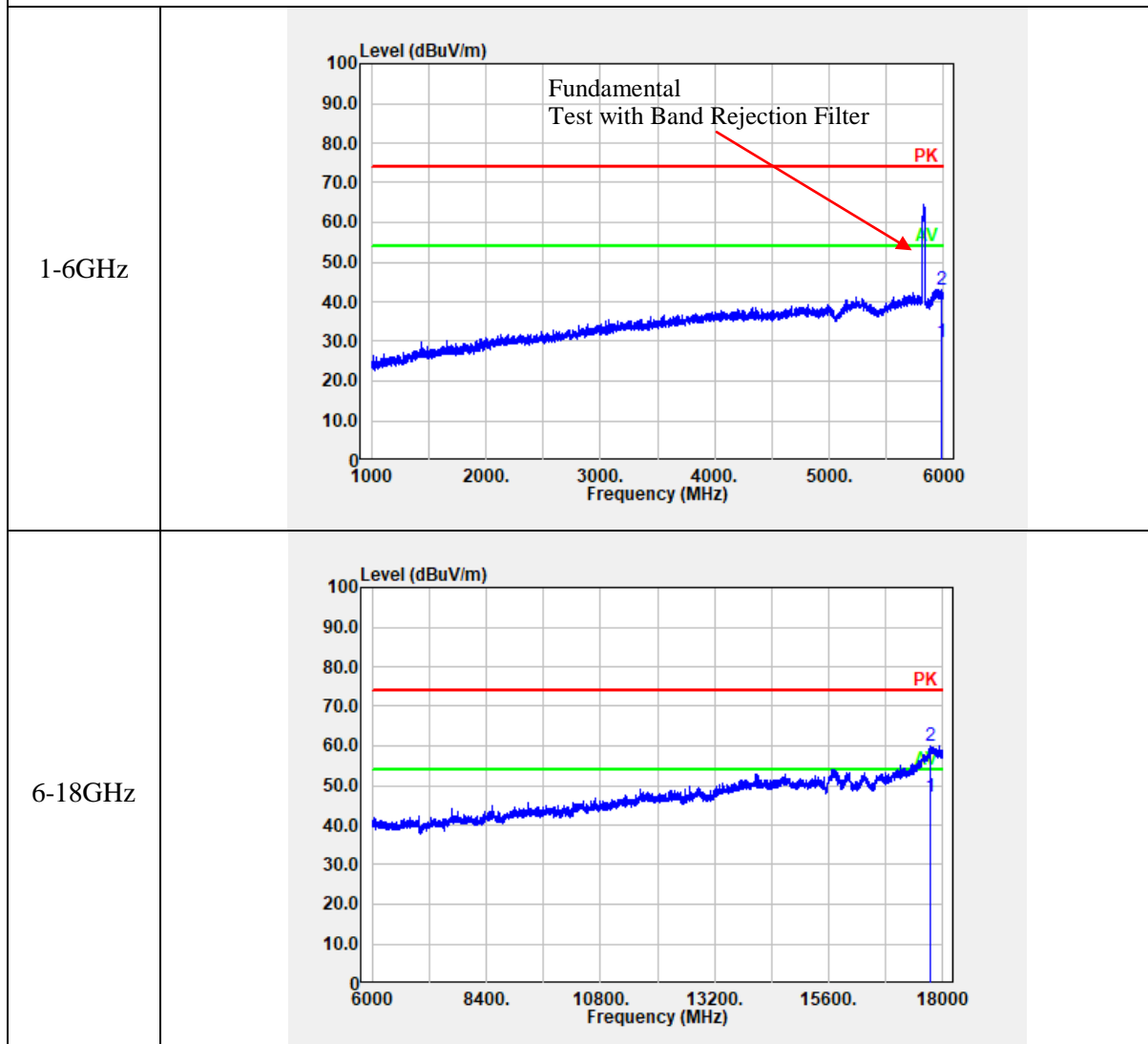
Ant. Polar. :

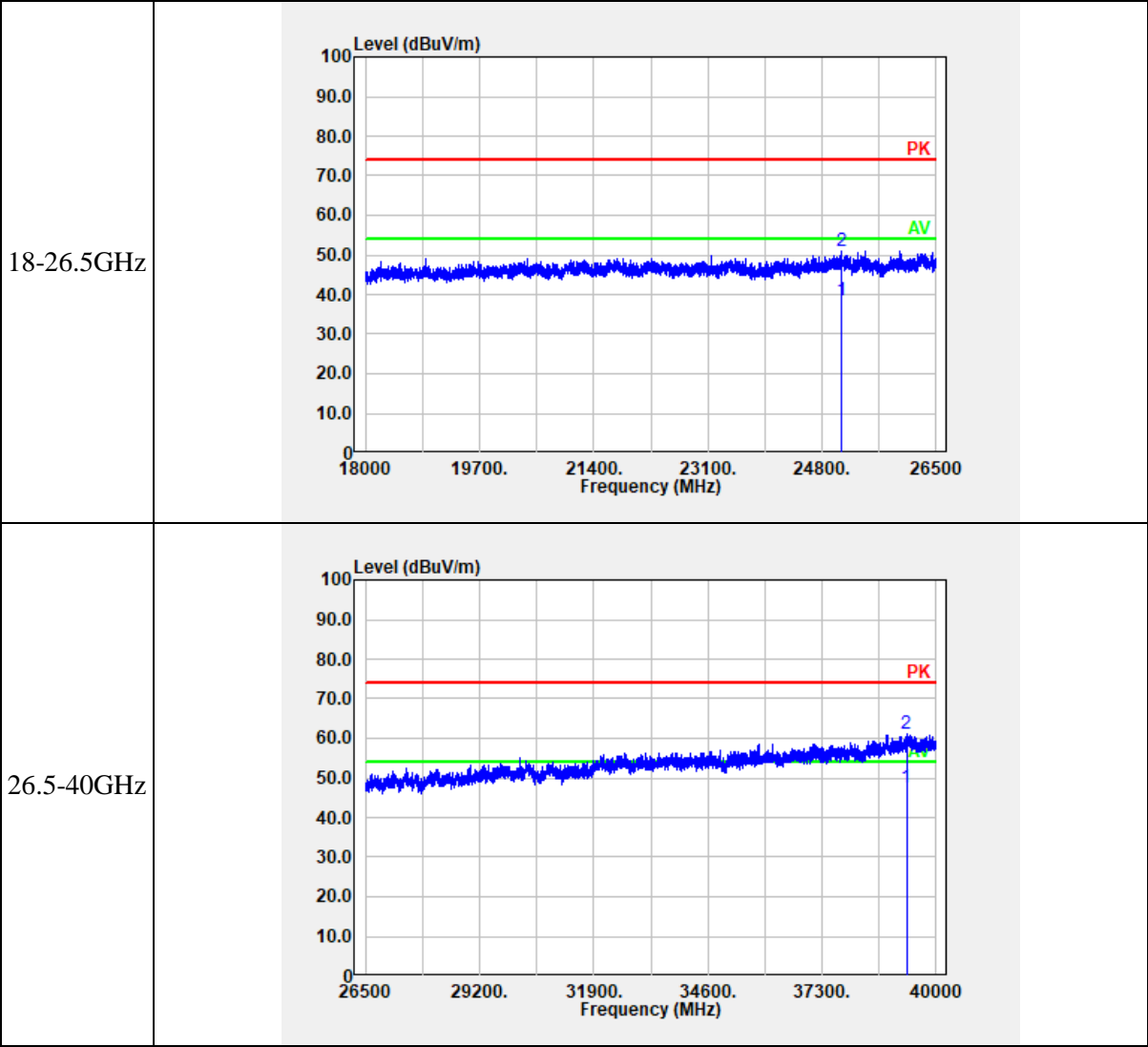
Vertical



Worst Test plots (802.11a 5825 MHz was the worst)



**Vertical**



4.3 Emission Bandwidth:

Serial Number:	2709-3	Test Date:	2023/7/6
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.9	Relative Humidity: (%)	60	ATM Pressure: (kPa)	100.2
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211001	Each time	N/A

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

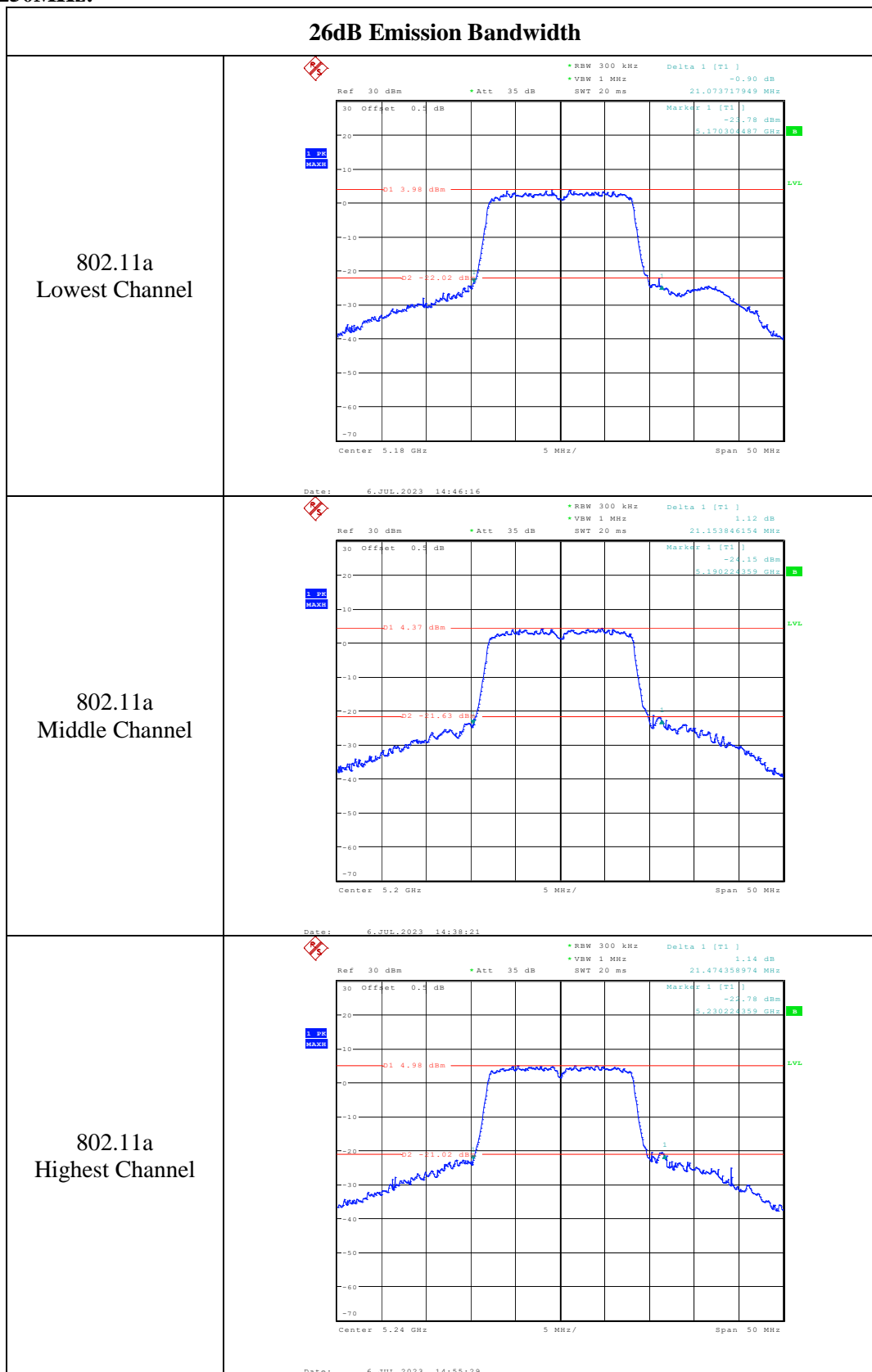
5150-5250 MHz:

Test Modes	Test Frequency (MHz)	26 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	5180	21.074	16.538
	5200	21.154	16.538
	5240	21.474	16.538
802.11n ht20	5180	25.321	17.692
	5200	22.596	17.692
	5240	24.359	17.692
802.11n ht40	5190	41.923	36.154
	5230	41.795	36.41
802.11ac vht80	5210	85.897	75.128
Note: the 99% Occupied Bandwidth have not fall into the band 5250-5350MHz, please refer to the test plots of 99% Occupied Bandwidth.			

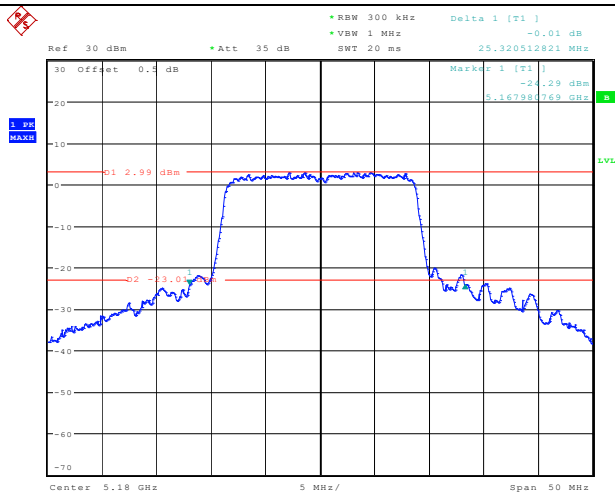
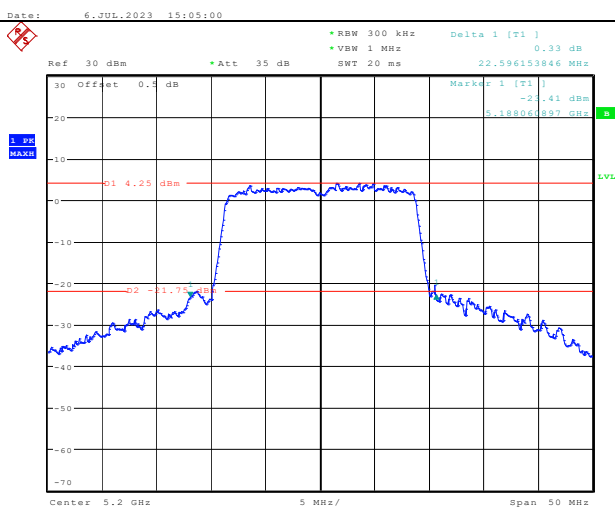
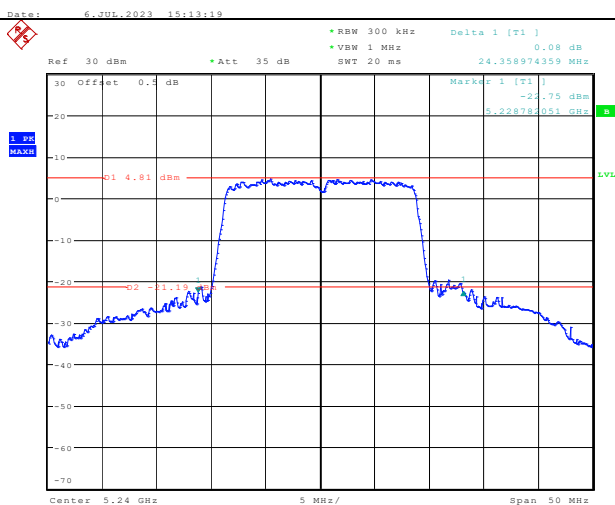
5725-5850 MHz:

Test Modes	Test Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	5745	16.474	18.782
	5785	16.474	19.295
	5825	16.474	19.423
802.11n ht20	5745	17.756	19.744
	5785	17.756	19.167
	5825	17.756	19.872
802.11n ht40	5755	35.897	38.846
	5795	35.513	39.872
802.11ac vht80	5775	75.897	77.949
Note: 6dB Emission Bandwidth Limit: ≥ 0.5 MHz the 99% Occupied Bandwidth have not fall into the band 5470-5725MHz, please refer to the test plots of 99% Occupied Bandwidth.			

5150-5250MHz:

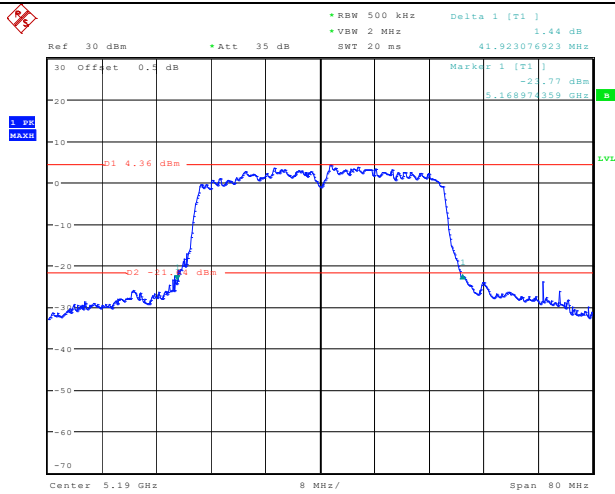
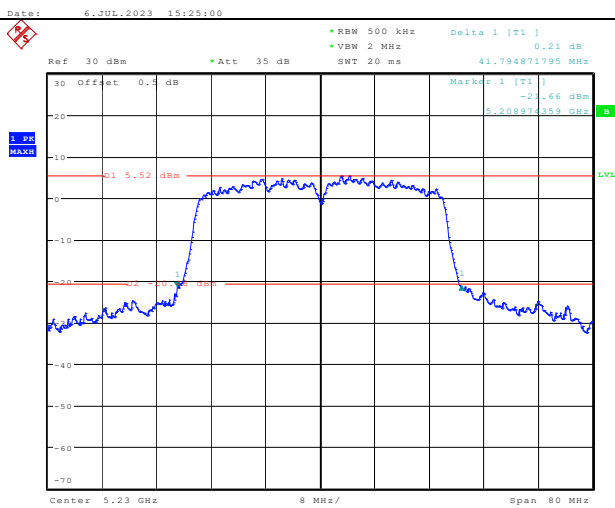
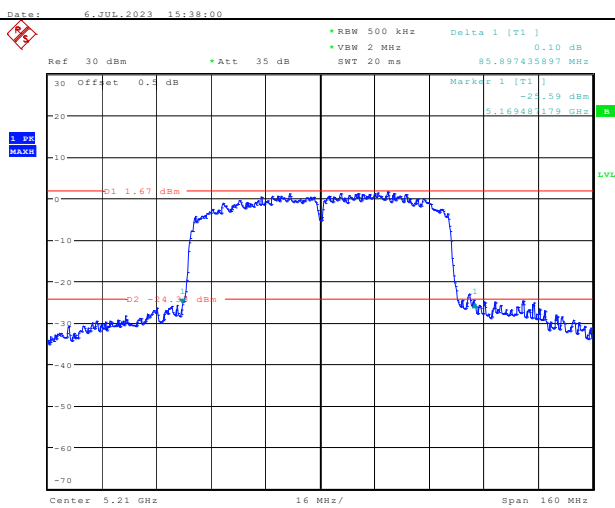


26dB Emission Bandwidth

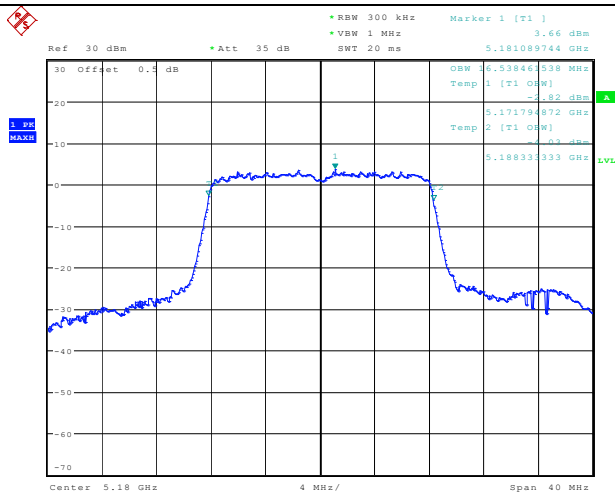
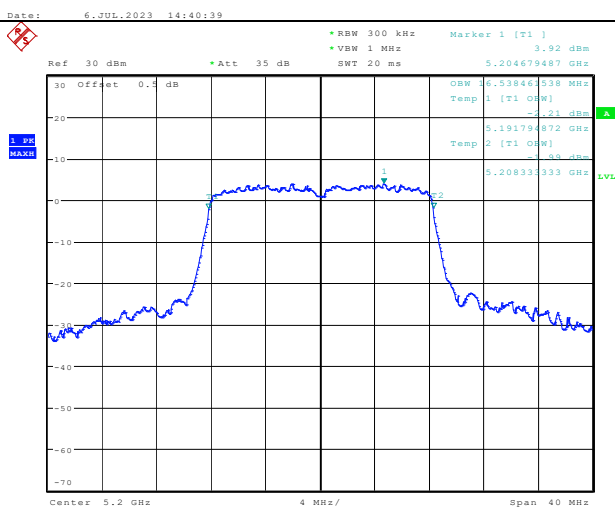
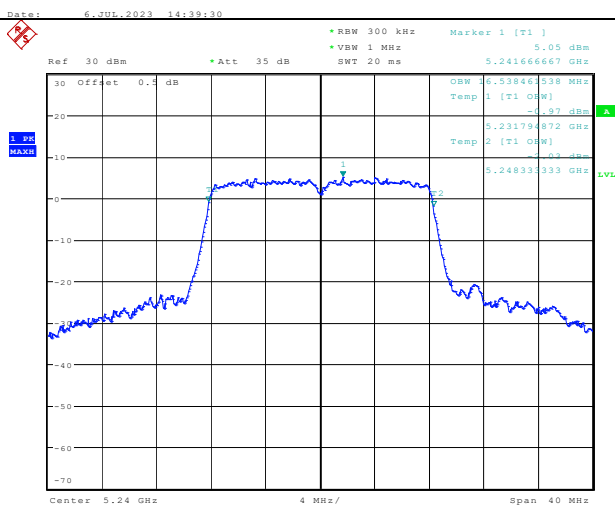
802.11n ht20
Lowest Channel802.11n ht20
Middle Channel802.11n ht20
Highest Channel

Date: 6_JUL_2023 15:34:22

26dB Emission Bandwidth

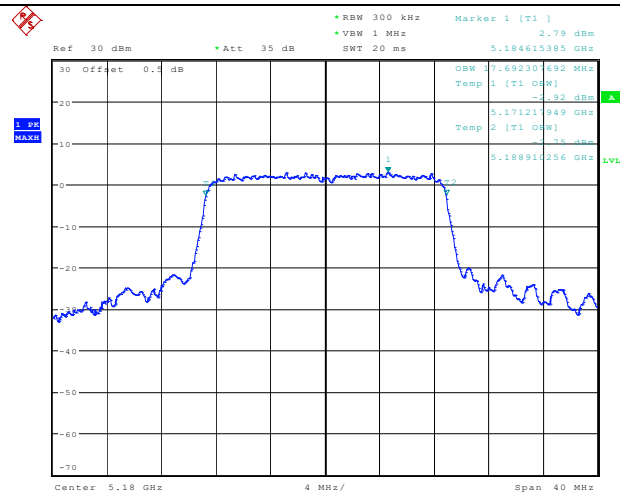
802.11n ht40
Lowest Channel802.11n ht40
Highest Channel802.11ac vht80
Middle Channel

99% Emission Bandwidth

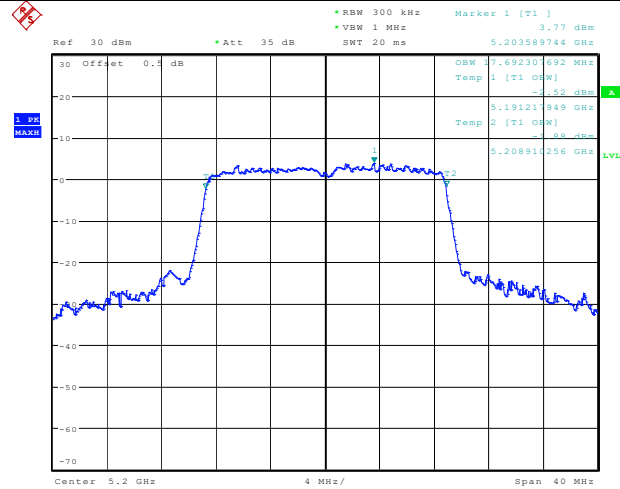
802.11a
Lowest Channel802.11a
Middle Channel802.11a
Highest Channel

Date: 6_JUL_2023 14:51:03

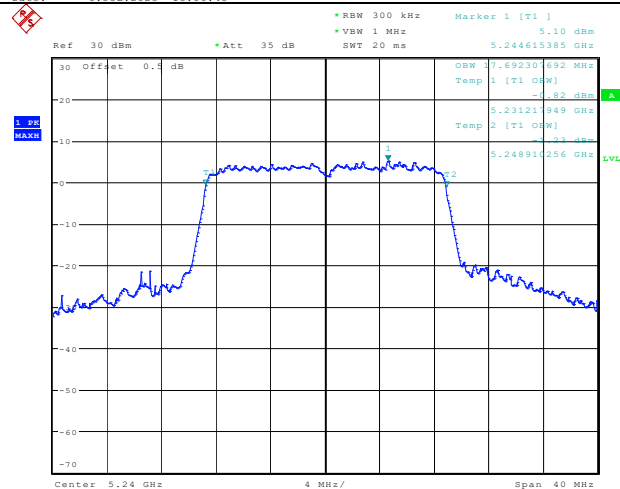
99% Emission Bandwidth

802.11n ht20
Lowest Channel

Date: 6_JUL_2023 14:59:21

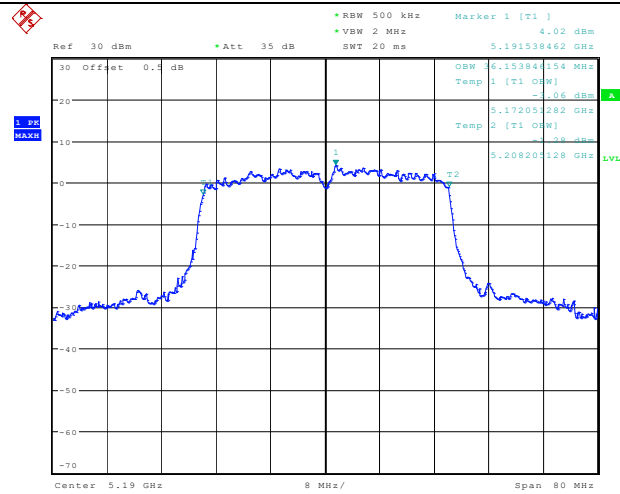
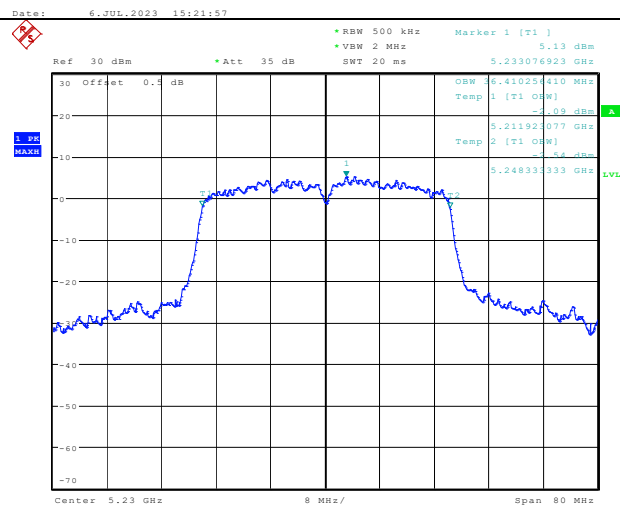
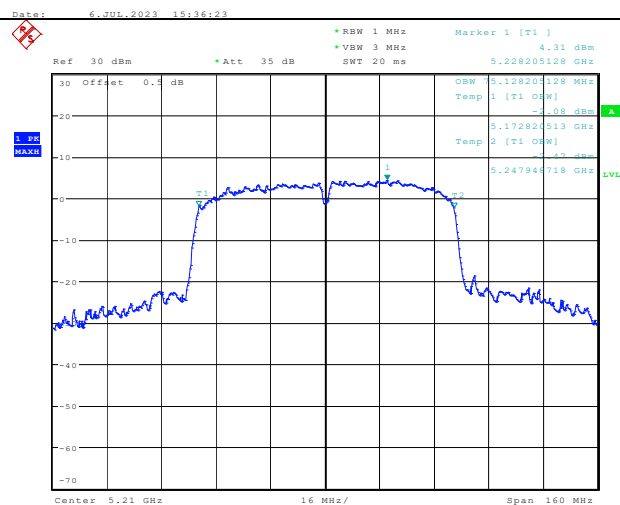
802.11n ht20
Middle Channel

Date: 6_JUL_2023 15:06:43

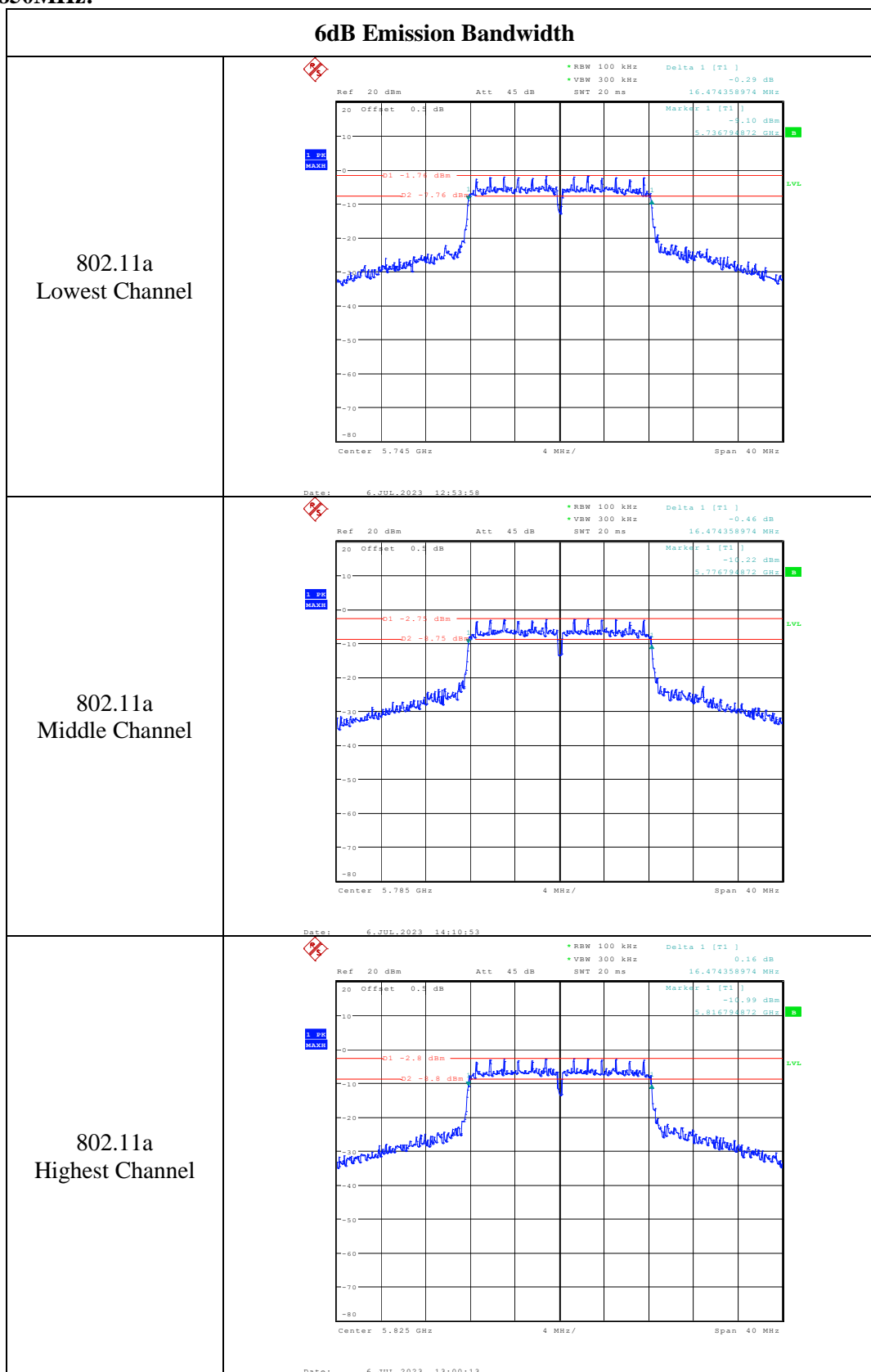
802.11n ht20
Highest Channel

Date: 6_JUL_2023 15:15:16

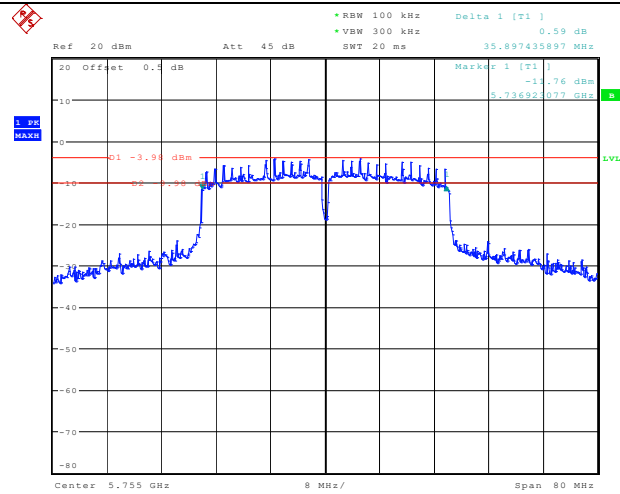
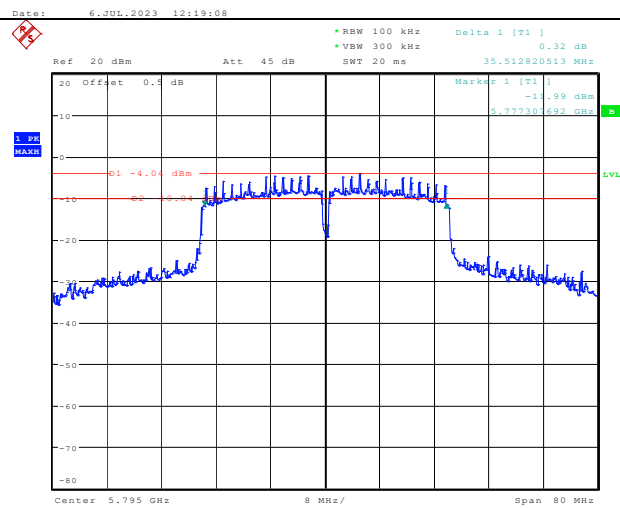
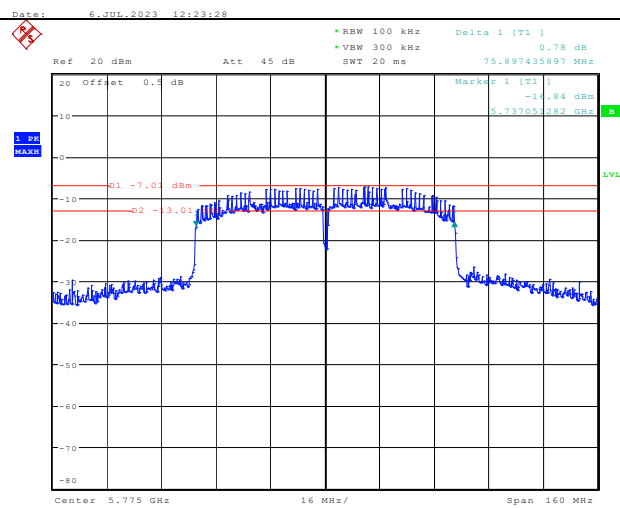
99% Emission Bandwidth

802.11n ht40
Lowest Channel802.11n ht40
Highest Channel802.11ac vht80
Middle Channel

5725-5850MHz:

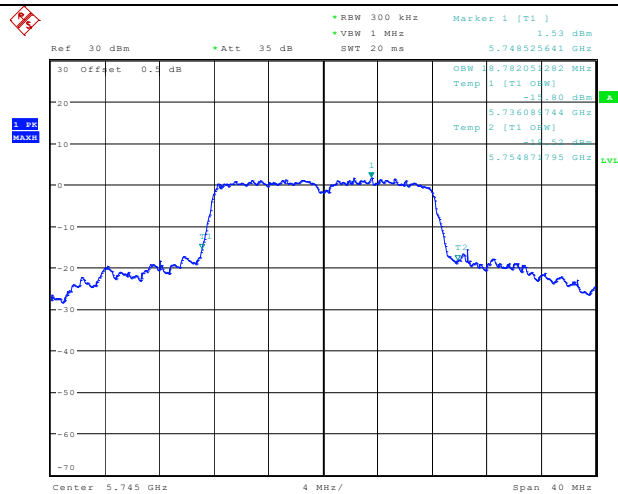
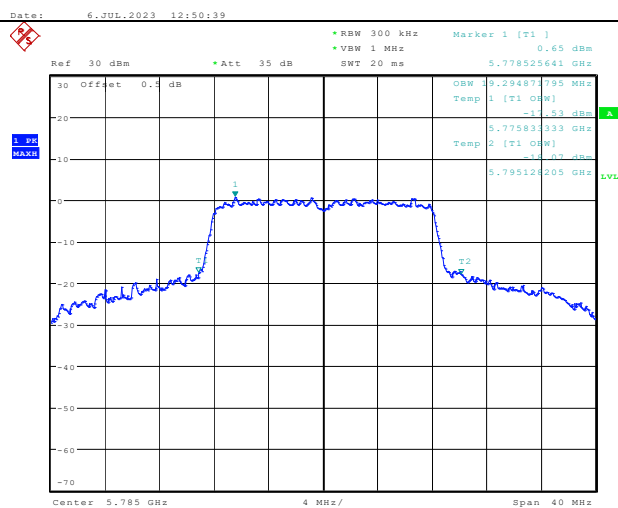
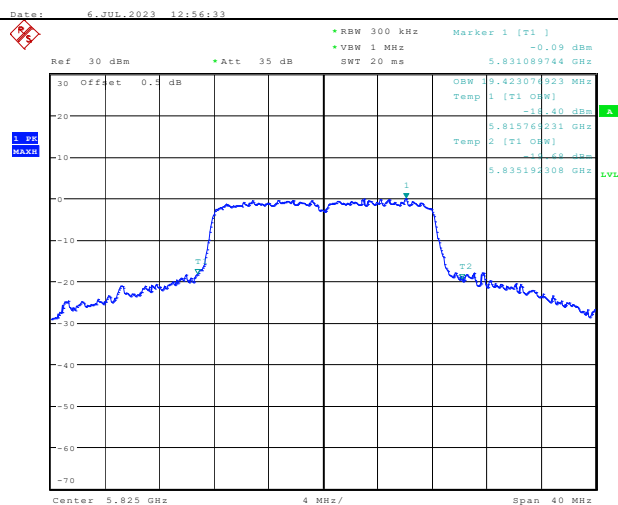


6dB Emission Bandwidth

802.11n ht40
Lowest Channel802.11n ht40
Highest Channel802.11ac vht80
Middle Channel

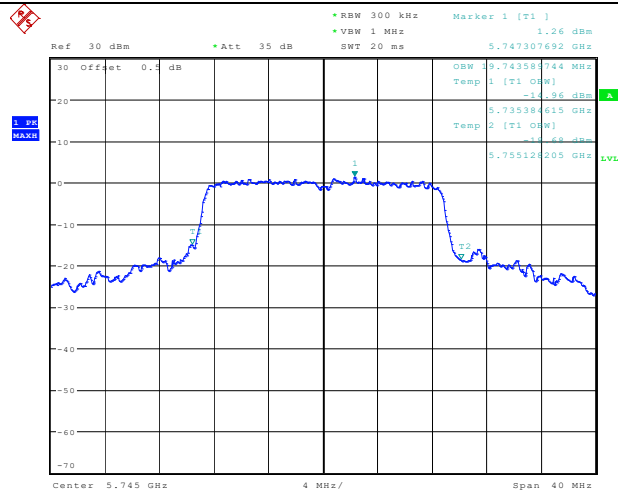
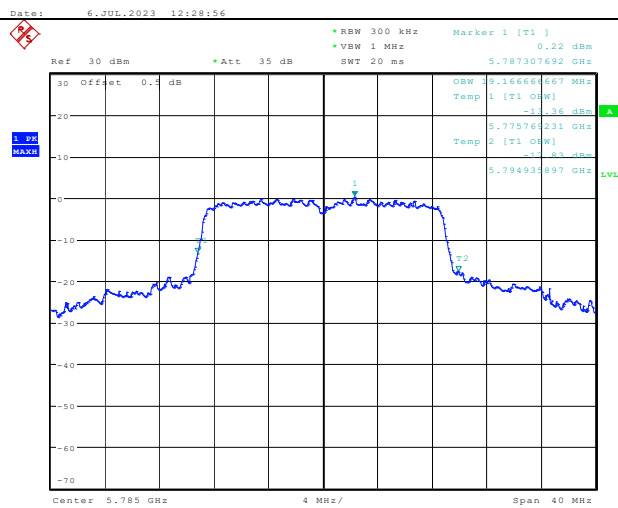
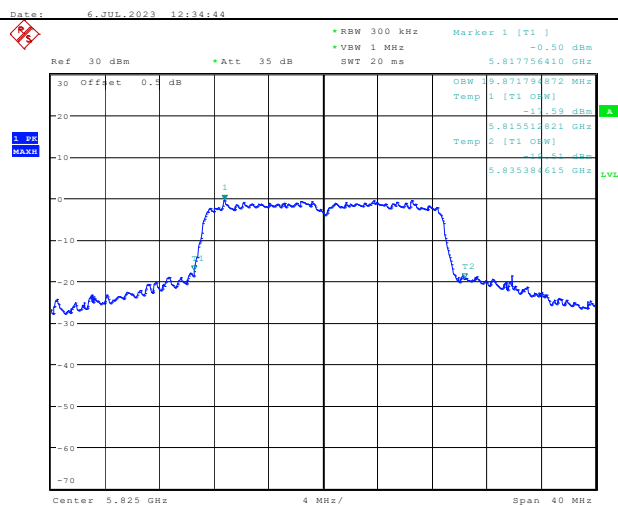
Date: 6 JUL 2023 11:58:57

99% Emission Bandwidth

802.11a
Lowest Channel802.11a
Middle Channel802.11a
Highest Channel

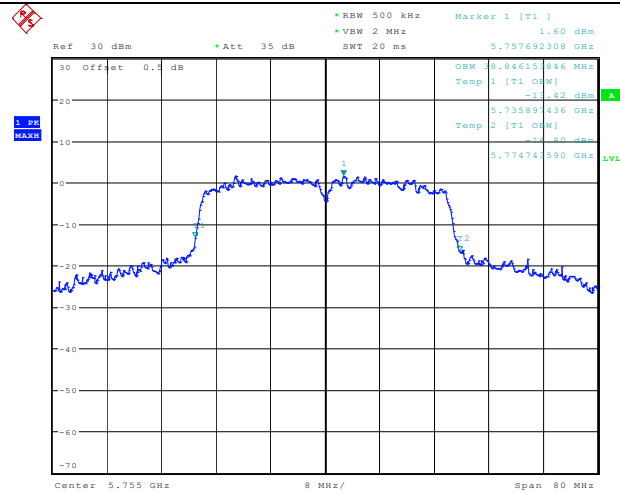
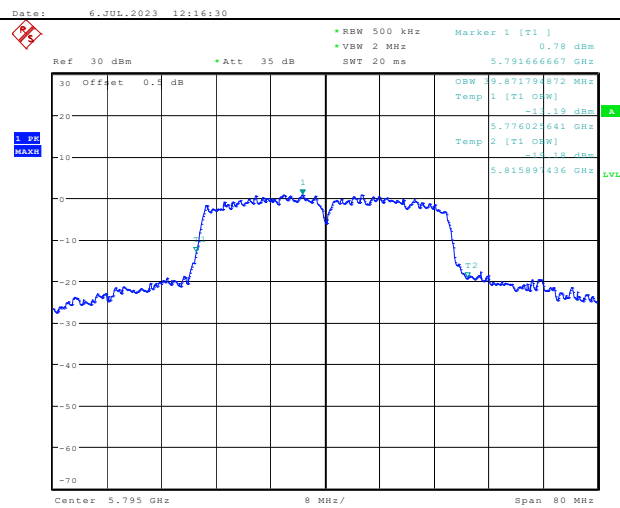
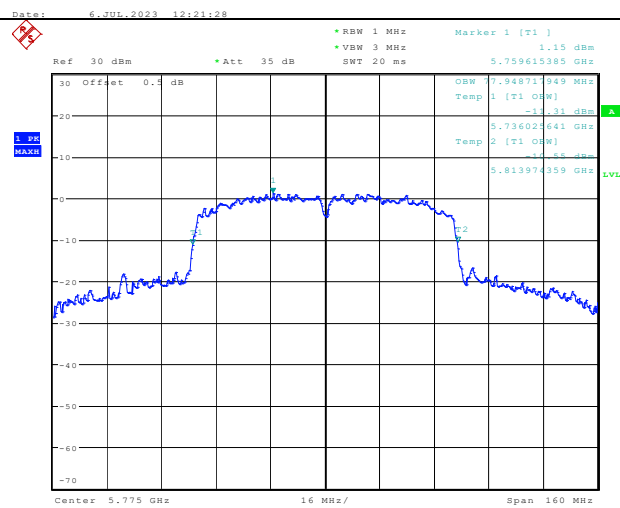
Date: 6 JUL 2023 12:59:03

99% Emission Bandwidth

802.11n ht20
Lowest Channel802.11n ht20
Middle Channel802.11n ht20
Highest Channel

Date: 6_JUL_2023 12:39:35

99% Emission Bandwidth

802.11n ht40
Lowest Channel802.11n ht40
Highest Channel802.11ac vht80
Middle Channel

4.4 Maximum Conducted Output Power:

Serial Number:	2709-3	Test Date:	2023/7/6
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.9	Relative Humidity: (%)	60	ATM Pressure: (kPa)	100.2
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	USB Wideband Power Sensor	U2021XA	MY54080015	2022/7/15	2023/7/14
zhuoxiang	Coaxial Cable	SMA-178	211001	Each time	N/A

* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data:

5150-5250 MHz:

Test Modes	Test Frequency (MHz)	Max. Conducted Average Output Power(dBm)	
		Result	Limit
802.11a	5180	12.04	24
	5200	12.26	24
	5240	12.18	24
802.11n ht20	5180	11.91	24
	5200	11.72	24
	5240	11.74	24
802.11n ht40	5190	11.43	24
	5230	11.88	24
802.11ac vht80	5210	10.66	24
Note: 1. The device is a client device. 2. Maximum antenna gain is 2.68dBi.			

5725-5850 MHz:

Test Modes	Test Frequency (MHz)	Max. Conducted Average Output Power(dBm)	
		Result	Limit
802.11a	5745	11.47	30
	5785	11.33	30
	5825	11.41	30
802.11n ht20	5745	11.54	30
	5785	11.47	30
	5825	10.95	30
802.11n ht40	5755	11.21	30
	5795	12.02	30
802.11ac vht80	5775	11.12	30
Note: 1. The device is a client device. 2. Maximum antenna gain is 3.96 dBi.			

4.5 Maximum power spectral density:

Serial Number:	2709-3	Test Date:	2023/7/6
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:					
Temperature: (°C)	25.9	Relative Humidity: (%)	60	ATM Pressure: (kPa)	100.2

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211001	Each time	N/A

* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data:

5150-5250 MHz:

Test Modes	Test Frequency (MHz)	Reading dBm/MHz)	Duty Cycle Factor (dB)	Maximum Power Spectral Density (dBm/MHz)	
				Result	Limit
802.11a	5180	-1.14	0.35	-0.79	11
	5200	-0.78	0.35	-0.43	11
	5240	1.04	0.35	1.39	11
802.11n ht20	5180	-1.65	0.34	-1.31	11
	5200	-1.31	0.34	-0.97	11
	5240	-0.51	0.34	-0.17	11
802.11n ht40	5190	-6.29	0.60	-5.69	11
	5230	-3.36	0.60	-2.76	11
802.11ac vht80	5210	-9.38	0.98	-8.40	11

Note:

- The device is a client device.
- Maximum antenna gain is 2.68 dBi.
- For PSD test, Duty cycle <98%, duty cycle variations are less than $\pm 2\%$
KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Method SA-2 was used for PSD test.
- For Duty cycle <98%, and Duty cycle be considered to be constant (variations are less than $\pm 2\%$), the duty cycle factor was added into the result.

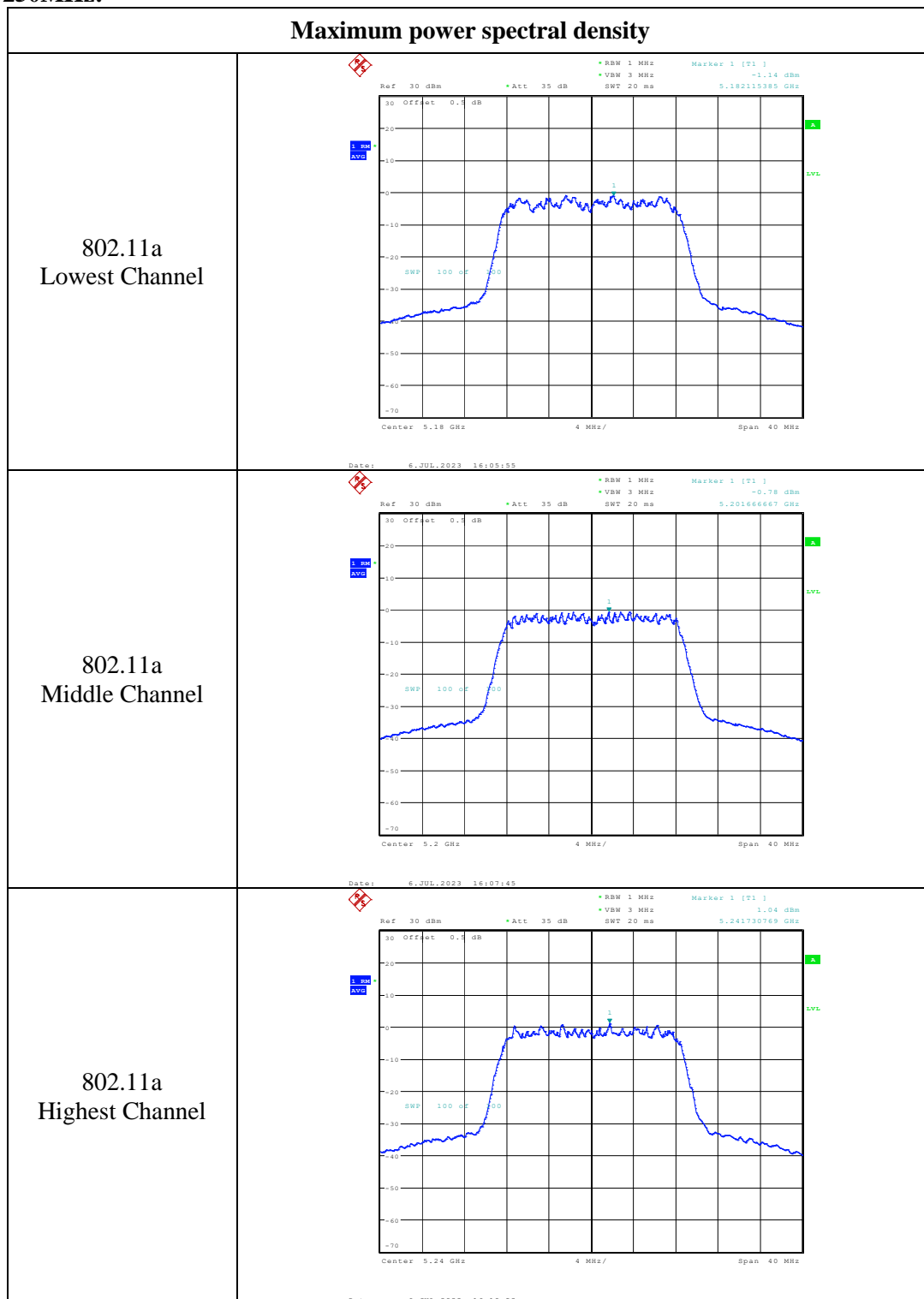
5725-5850 MHz:

Test Modes	Test Frequency(MHz)	Reading(dBm/500kHz)	Duty Cycle Factor(dB)	Maximum Power Spectral Density(dBm/500kHz)	
				Result	Limit
802.11a	5745	-6.07	0.35	-5.72	30
	5785	-7.35	0.35	-7.00	30
	5825	-7.49	0.35	-7.14	30
802.11n ht20	5745	-7.12	0.34	-6.78	30
	5785	-7.77	0.34	-7.43	30
	5825	-8.64	0.34	-8.30	30
802.11n ht40	5755	-11.06	0.60	-10.46	30
	5795	-11.02	0.60	-10.42	30
802.11ac vht80	5775	-14.96	0.98	-13.98	30

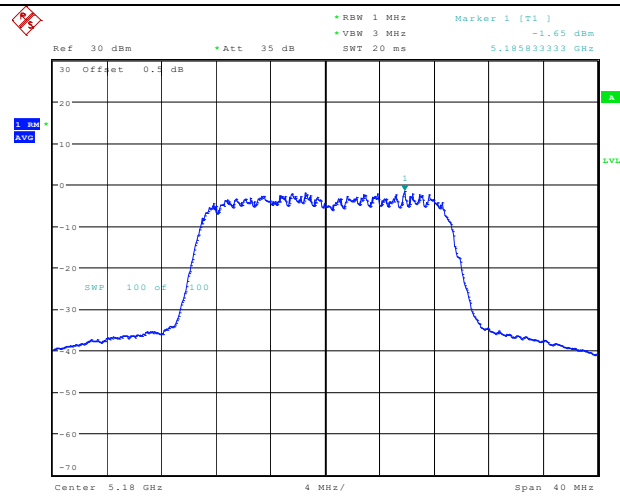
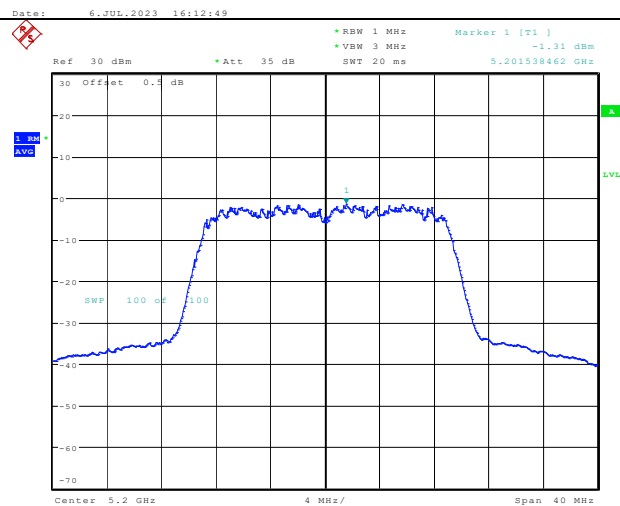
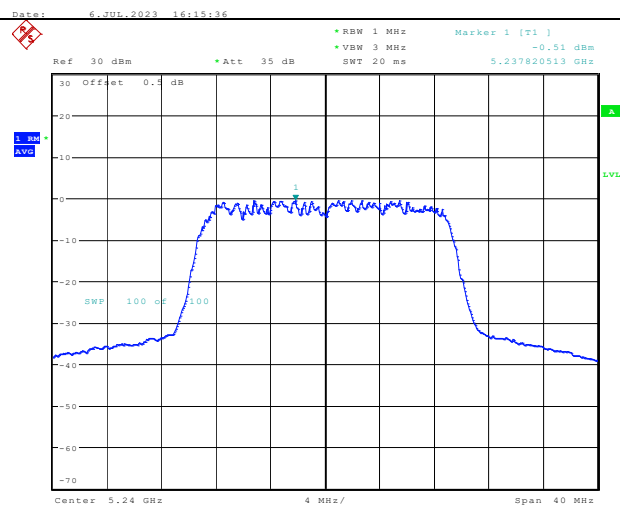
Note:

1. The device is a client device.
2. Maximum antenna gain is 3.96 dBi.
3. For PSD test, Duty cycle <98%, duty cycle variations are less than $\pm 2\%$
KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Method SA-2 was used for PSD test.
4. For Duty cycle <98%, and Duty cycle be considered to be constant (variations are less than $\pm 2\%$), the duty cycle factor was added into the result.

5150-5250MHz:

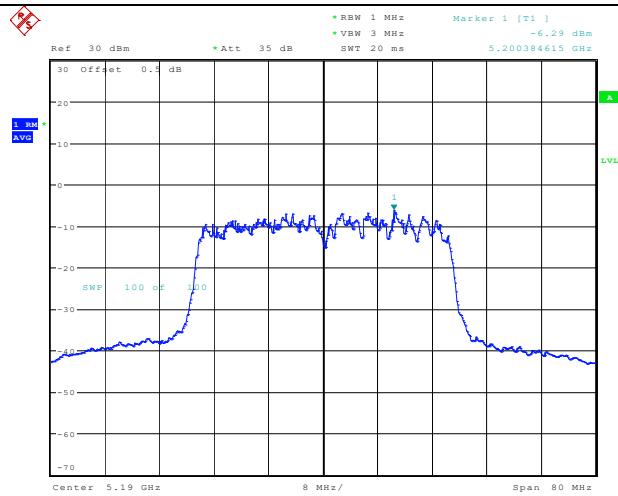
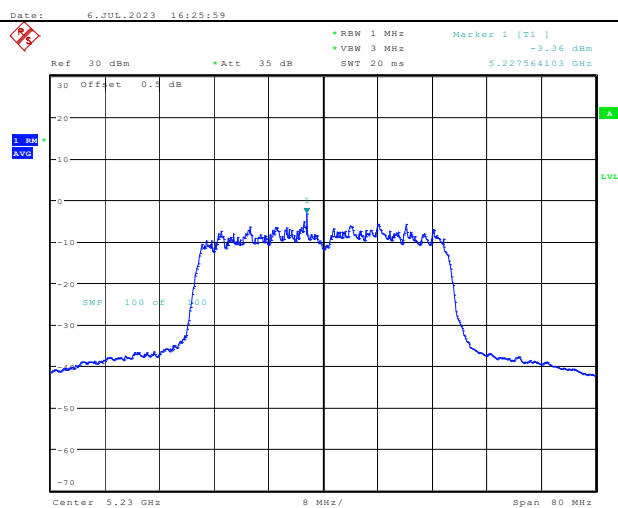
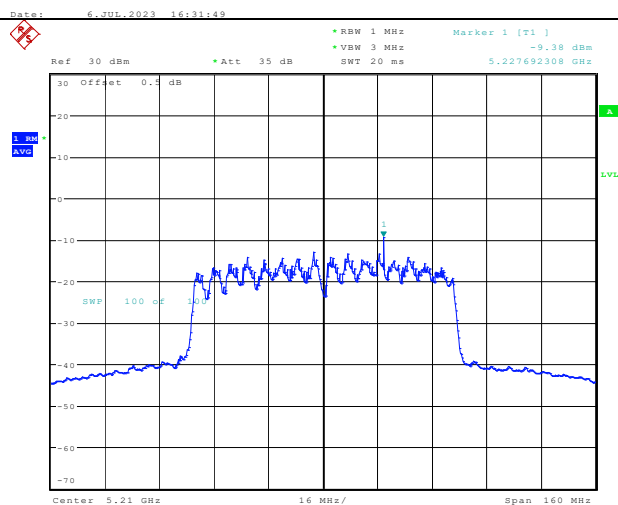


Maximum power spectral density

802.11n ht20
Lowest Channel802.11n ht20
Middle Channel802.11n ht20
Highest Channel

Date: 6 JUL 2023 16:17:49

Maximum power spectral density

802.11n ht40
Lowest Channel802.11n ht40
Highest Channel802.11ac vht80
Middle Channel

Maximum power spectral density

Ref 30 dBm •Att 35 dB SWT 20 ms 5.743782051 GHz

30 Offset 0.1 dB

1. MHz
AVG

Marker 1 (T1) -6.07 dBm
5.743782051 GHz

SWP 100 of 100

Center 5.745 GHz 4 MHz/ Span 40 MHz

Ref 30 dBm *Att 35 dB *RBW 500 kHz Marker 1 [T1] -7.35 dBm
 *VBW 2 MHz SWT 20 ms 5.78576923 GHz

30 Offset 0.3 dB
 20
 10
 0
 -10
 -20
 -30
 -40
 -50
 -60
 -70

1.9M
 AVG

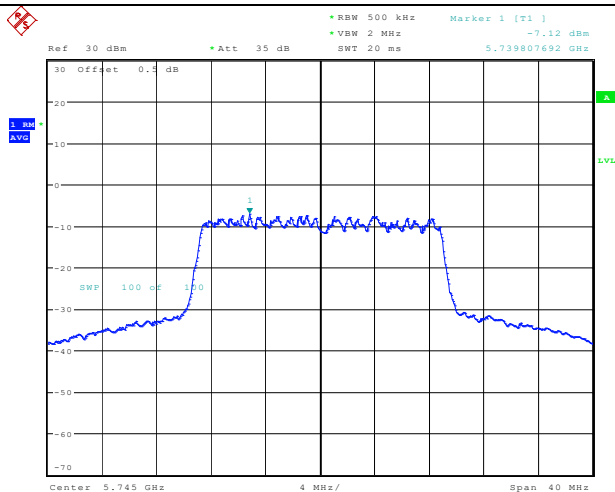
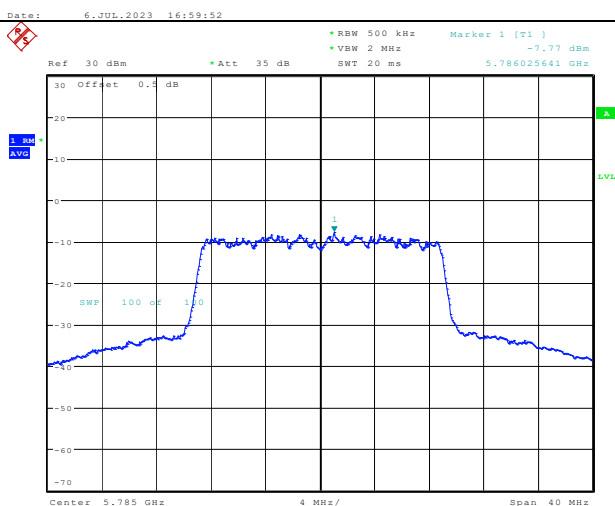
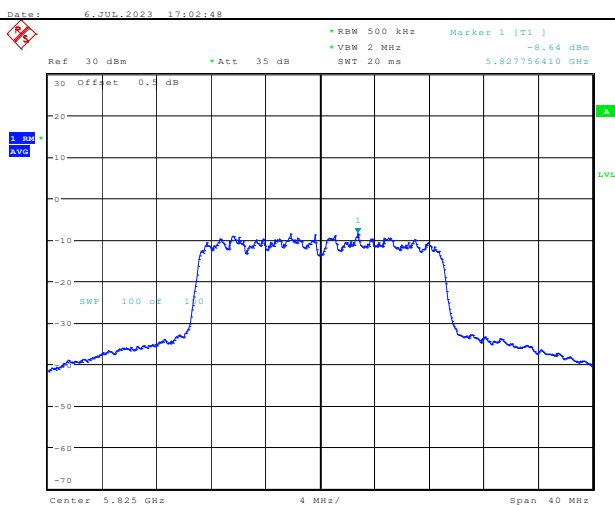
SWP 100 of 100

Center 5.785 GHz 4 MHz/ Span 40 MHz

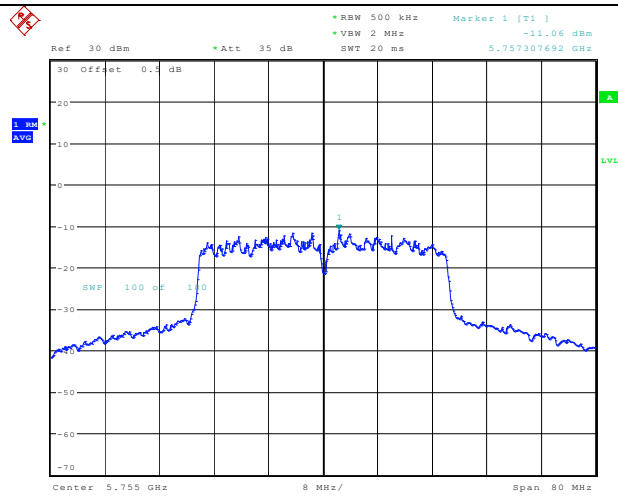
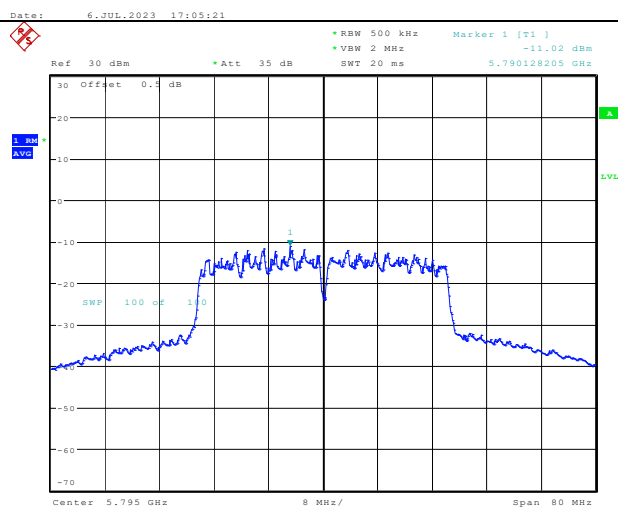
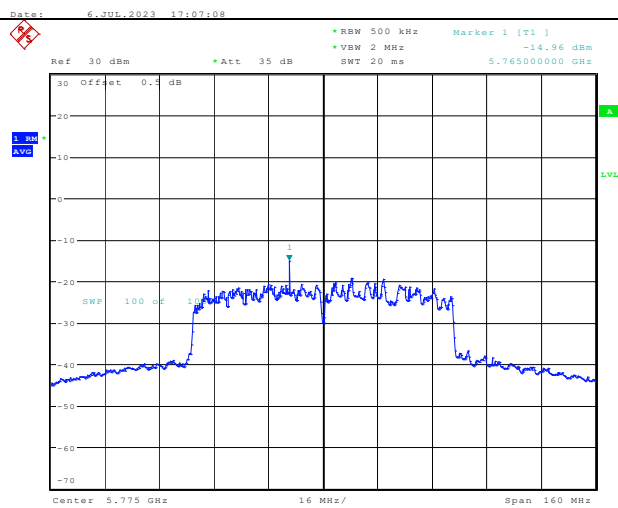
6.701 5825 16.44.55
 * RBW 500 kHz
 * VBW 2 MHz
 * Att 35 dB
 SWT 20 ms
 Ref 30 dBm
 Marker 1 [T1]
 -7.49 dBm
 5.824615385 GHz

30 Offset 0.1 dB
 1 RBW
 AVG
 SWP 100 dB 10
 Center 5.825 GHz
 Span 40 MHz

Maximum power spectral density

802.11n ht20
Lowest Channel802.11n ht20
Middle Channel802.11n ht20
Highest Channel

Maximum power spectral density

802.11n ht40
Lowest Channel802.11n ht40
Highest Channel802.11ac vht80
Middle Channel

4.6 Duty Cycle:

Serial Number:	2709-3	Test Date:	2023/7/6
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	N/A

Environmental Conditions:

Temperature: (°C)	25.9	Relative Humidity: (%)	60	ATM Pressure: (kPa)	100.2
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	100147	2023-03-31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211001	Each time	N/A

* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data:

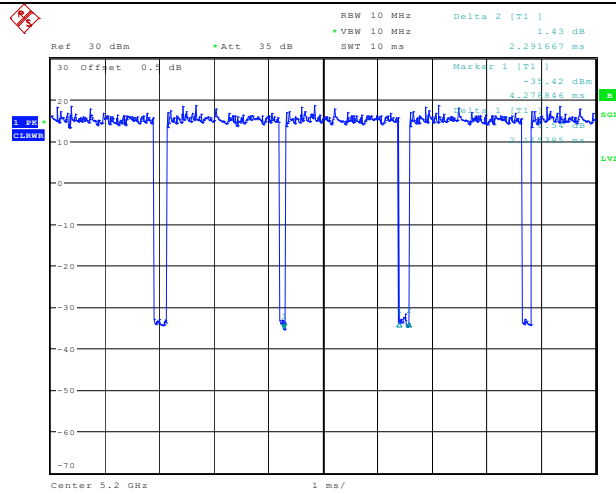
Test Modes	Ton (ms)	Ton+off (ms)	Duty cycle (%)	1/T (Hz)	Duty Cycle Factor (dB)
802.11a	2.115	2.292	92.28	473	0.35
802.11n ht20	1.955	2.115	92.43	512	0.34
802.11n ht40	0.873	1.002	87.13	1145	0.60
802.11ac vht80	0.433	0.543	79.74	2309	0.98

Note: For PSD test, Duty cycle <98%, duty cycle variations are less than $\pm 2\%$

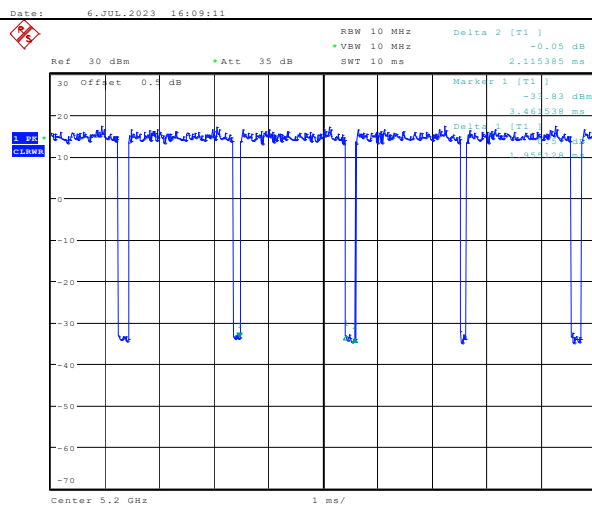
KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Method SA-2 should be applied.

Duty Cycle

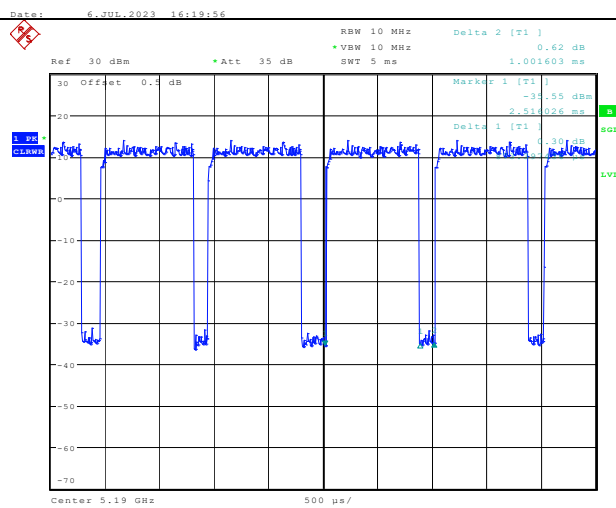
802.11a



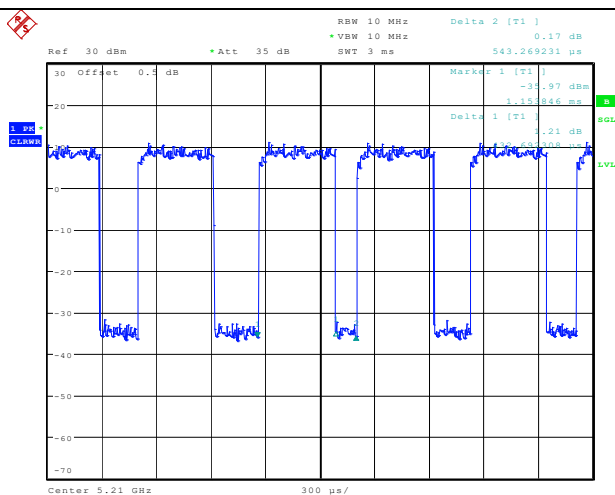
802.11n ht20



802.11n ht40



802.11ac vht80



Date: 6.JUL.2023 15:56:12

5. RF EXPOSURE EVALUATION

5.1 Applicable Standard

According to subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ³)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

5.2 Measurement Result

Mode	Frequency (MHz)	Antenna Gain		Conducted output power including Tune-up Tolerance		Evaluation Distance	Power Density	MPE Limit
		(dBi)	(numeric)	(dBm)	(mW)			
2.4GHz SRD	2405~2473	1.77	1.503	29	794.33	20	0.238	1
5.8GHz SRD	5731~5783	1.21	1.321	18	63.10	20	0.017	1
WLAN	5150~5250	2.68	1.854	13	19.95	20	0.007	1
WLAN	5725~5850	3.96	2.489	13	19.95	20	0.010	1

The WLAN and 2.4GHz SRD or 5.8GHz SRD can transmit simultaneously; 2.4GHz SRD or 5.8GHz SRD can't transmit simultaneously:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$$= S_{WLAN} / S_{limit-WLAN} + S_{2.4GHz\ SRD} / S_{limit-2.4GHz\ SRD}$$

$$= 0.010 / 1 + 0.238 / 1$$

$$= 0.248$$

$$< 1.0$$

Result: The device meets FCC MPE at **20 cm** distance

===== END OF REPORT =====