



Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street,
Bao'an District, Shenzhen, China

TEST REPORT

FCC PART 15 SUBPART E 15.407

Report Reference No.....: CTA25033100703

FCC ID.....: 2BHX3-TAA06

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Date of issue.....: Apr. 14, 2025

Testing Laboratory Name: Shenzhen CTA Testing Technology Co., Ltd.

Address.....: Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community,
Fuhai Street, Bao'an District, Shenzhen, China

Applicant's name.....: Shenzhen Trolink Technology Co., Ltd

Address: 5F, E Block, Fenda High-Tech Park, Sanwei, Hangcheng Steet, Bao'an,
Shenzhen, GD, China

Test specification

Standard: FCC Part 15 Subpart E 15.407

TRF Originator: Shenzhen CTA Testing Technology Co., Ltd.

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Test item description: Carplay Box

Trade Mark: N/A

Manufacturer: Shenzhen Trolink Technology Co., Ltd

Model/Type reference.....: TAA06

Modulation: OFDM

Frequency.....: From 5180MHz-5240MHz, 5745MHz-5825MHz

Rating: Input: 5V --- 1.0A

Result.....: PASS

Shenzhen CTA Testing Technology Co., Ltd.

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TEST REPORT

Equipment under Test : Carplay Box

Model /Type : TAA06

Listed Models : TAA01

Model difference : The PCB board, circuit, structure and internal of these models are the same, Only model number and appearance is different for these model.

Applicant : **Shenzhen Trolink Technology Co., Ltd**

Address : 5F, E Block, Fenda High-Tech Park, Sanwei, Hangcheng Steet, Bao'an, Shenzhen, GD, China

Manufacturer : **Shenzhen Trolink Technology Co., Ltd**

Address : 5F, E Block, Fenda High-Tech Park, Sanwei, Hangcheng Steet, Bao'an, Shenzhen, GD, China

Test Result:	PASS
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1 TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15 Subpart E](#)—Unlicensed National Information Infrastructure Devices

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices

[KDB789033 D02](#): General UNII Test Procedures New Rules v02r01

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Mar. 31, 2025
Testing commenced on	:	Mar. 31, 2025
Testing concluded on	:	Apr. 14, 2025

2.2 Product Description

Product Description:	Carplay Box			
Model:	TAA06			
Power supply:	Input: 5V --- 1.0A			
Hardware version:	V01			
Software version:	V01			
Testing sample ID:	CTA250331007-1# (Engineer sample) CTA250331007-2# (Normal sample)			
WIFI				
Supported type:	20MHz system	40MHz system	80MHz system	160MHz system
	802.11a 802.11n 802.11ac 802.11ax	802.11n 802.11ac 802.11ax	N/A	N/A
	5180MHz-5240MHz 5745MHz-5825MHz	5190MHz-5230MHz 5755MHz-5795MHz	N/A	N/A
	OFDM	OFDM	N/A	N/A
	9	4	N/A	N/A
Operation frequency:	20MHz	40MHz	N/A	N/A
Modulation:	PCB antenna			
Channel number:	2.27 dBi for 5180-5240MHz -2.45dBi for 5745-5825MHz			
Channel separation:				
Antenna type:				
Antenna gain:				

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	☐ 230V / 50 Hz	☐ 120V / 60Hz
		☐ 12 V DC	☐ 24 V DC
		☒ Other (Refer to section 2.2)	

2.4 Short description of the Equipment under Test (EUT)

This is a Carplay Box.

For more details, refer to the user's manual of the EUT.

Test Software Version	Tools software(ADB command)		
Frequency	5180 MHz	5220 MHz	5240 MHz
802.11a	14	14	14
802.11n20	14	14	14
802.11ac20	15	15	15
802.11ax20	15	15	15
Frequency	5190 MHz	/	5230 MHz
802.11n40	14	/	14
802.11ac40	14	/	14
802.11ax40	14	/	14

Test Software Version	Tools software(ADB command)		
Frequency	5745 MHz	5785 MHz	5825 MHz
802.11a	11	11	11
802.11n20	13	13	13
802.11ac20	11	11	11
802.11ax20	12	12	12
Frequency	5755 MHz	/	5795 MHz
802.11n40	12	/	12
802.11ac40	11	/	11
802.11ax40	11	/	11

2.5 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

○ - supplied by the manufacturer

● - supplied by the lab

● PC		Model: E470C Trade Mark: thinkpad
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2.6 EUT operation mode

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing.

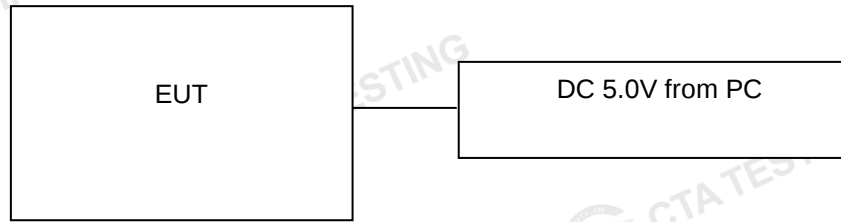
All test performed at the low, middle and high of operational frequency range of each mode.

Operation Frequency List WIFI on 5G Band:

Operating band	20MHz		40MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)
U-NII 1 (5150MHz-5250MHz)	36	5180	38	5190
	40	5200		
	44	5220	46	5230
	48	5240		
U-NII 3 (5725MHz-5850MHz)	149	5745	151	5755
	153	5765		
	157	5785	159	5795
	161	5805		
	165	5825	--	--

Note: The line display in grey is those Channels/Frequencies select to test in this report for each operation mode.

2.7 Block Diagram of Test Setup



2.8 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.

2.9 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

3.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 517856 Designation Number: CN1318

Shenzhen CTA Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6534.01

Shenzhen CTA Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

3.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Radiated Emission:

Temperature:	25 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

Conducted testing:

Temperature:	25 ° C
Humidity:	44 %
Atmospheric pressure:	950-1050mbar

AC Power Conducted Emission

Temperature:	24 ° C
Humidity:	44 %
Atmospheric pressure:	950-1050mbar

3.4 Test Description

FCC Requirement		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.407(a)	Emission Bandwidth(26dBm Bandwidth)	PASS ^{Note1}
FCC Part 15.407(e)	Minimum Emission Bandwidth(6dBm Bandwidth)	PASS ^{Note2}
FCC Part 15.407(a)	Maximum Conducted Output Power	PASS
FCC Part 15.407(a)	Peak Power Spectral Density	PASS
FCC Part 15.407(g)	Frequency Stability	PASS
FCC Part 15.407(b)	Undesirable emission	PASS
FCC Part 15.407(b)/15.205/15.209	Radiated Emissions	PASS
FCC Part 15.407(h)	Dynamic Frequency Selection	N/A ^{Note 3}
FCC Part 15.203/15.247(b)	Antenna Requirement	PASS

Note 1: Apply to U-NII 1 band.

Note 2: Apply to U-NII 3 band only.

Note 3: This device not work in DFS band.

Remark:

1. The measurement uncertainty is not included in the test result.
2. We tested all test mode and recorded worst case in report
3. RF Conducted test Offset= cable loss, For conducted spurious emission test, cable loss is the maximum value in the range of test.

Data Rate Used:

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate
Maximum Conducted Output Power	11a/OFDM	6 Mbps
Power Spectral Density		
Emission Bandwidth(26dBm Bandwidth)	11n(20MHz),11ac(20MHz),11ax(20MHz)/OFDM	MCS0
Minimum Emission Bandwidth(6dBm Bandwidth)		
Undesirable emission	11n(40MHz),11ac(40MHz),11ax(40MHz)/OFDM	MCS0
Frequency Stability		

3.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen CTA Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen CTA Testing Technology Co., Ltd. :

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	9KHz~30MHz	3.02 dB	(1)
Radiated Emission	30~1000MHz	4.06 dB	(1)

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Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)
Output Peak power	30MHz~18GHz	0.55 dB	(1)
Power spectral density	/	0.57 dB	(1)
Spectrum bandwidth	/	1.1%	(1)
Radiated spurious emission (30MHz-1GHz)	30~1000MHz	4.10 dB	(1)
Radiated spurious emission (1GHz-18GHz)	1~18GHz	4.32 dB	(1)
Radiated spurious emission (18GHz-40GHz)	18-40GHz	5.54 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2024/08/03	2025/08/02
LISN	R&S	ENV216	CTA-314	2024/08/03	2025/08/02
EMI Test Receiver	R&S	ESPI	CTA-307	2024/08/03	2025/08/02
EMI Test Receiver	R&S	ESCI	CTA-306	2024/08/03	2025/08/02
Spectrum Analyzer	Agilent	N9020A	CTA-301	2024/08/03	2025/08/02
Spectrum Analyzer	R&S	FSU	CTA-337	2024/08/03	2025/08/02
Vector Signal generator	Agilent	N5182A	CTA-305	2024/08/03	2025/08/02
Analog Signal Generator	R&S	SML03	CTA-304	2024/08/03	2025/08/02
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	R&S	CTA-302	2024/08/03	2025/08/02
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2024/08/03	2025/08/02
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2023/10/17	2026/10/16
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2023/10/13	2026/10/12
Loop Antenna	Zhinan	ZN30900C	CTA-311	2023/10/17	2026/10/16
Broadband Horn Antenna	A-INFOMW	LB-180500H-2.4F	CTA-336	2023/09/13	2026/09/12
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2024/08/03	2025/08/02
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2024/08/03	2025/08/02
Directional coupler	NARDA	4226-10	CTA-303	2024/08/03	2025/08/02
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2024/08/03	2025/08/02
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2024/08/03	2025/08/02
Automated filter bank	Tonscend	JS0806-F	CTA-404	2024/08/03	2025/08/02

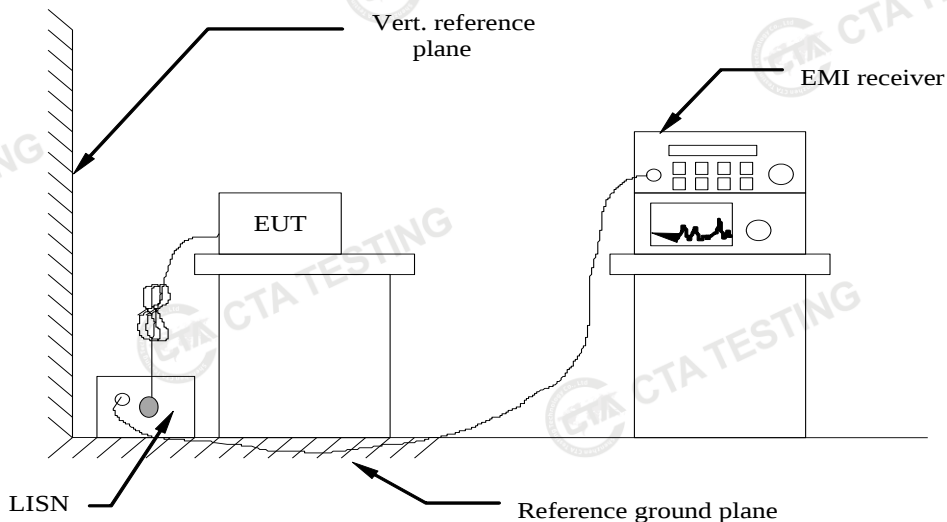
Power Sensor	Agilent	U2021XA	CTA-405	2024/08/03	2025/08/02
Amplifier	Schwarzbeck	BBV9719	CTA-406	2024/08/03	2025/08/02
Programmable Constant Temperature And Humidity Test Chamber	DONGGUAN JINGYU	HT-H-408	CTA-053	2024/08/03	2025/08/02

Test Equipment	Manufacturer	Model No.	Version number	Calibration Date	Calibration Due Date
EMI Test Software	Tonscend	TS@JS32-RE	5.0.0.2	N/A	N/A
EMI Test Software	Tonscend	TS@JS32-CE	5.0.0.1	N/A	N/A
RF Test Software	Tonscend	TS@JS1120-3	3.1.65	N/A	N/A
RF Test Software	Tonscend	TS@JS1120	3.1.46	N/A	N/A

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a Multi-System Scannerop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4 The EUT received power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

Frequency range (MHz)	Limit (dBuV)	
	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.

TEST RESULTS

Passed

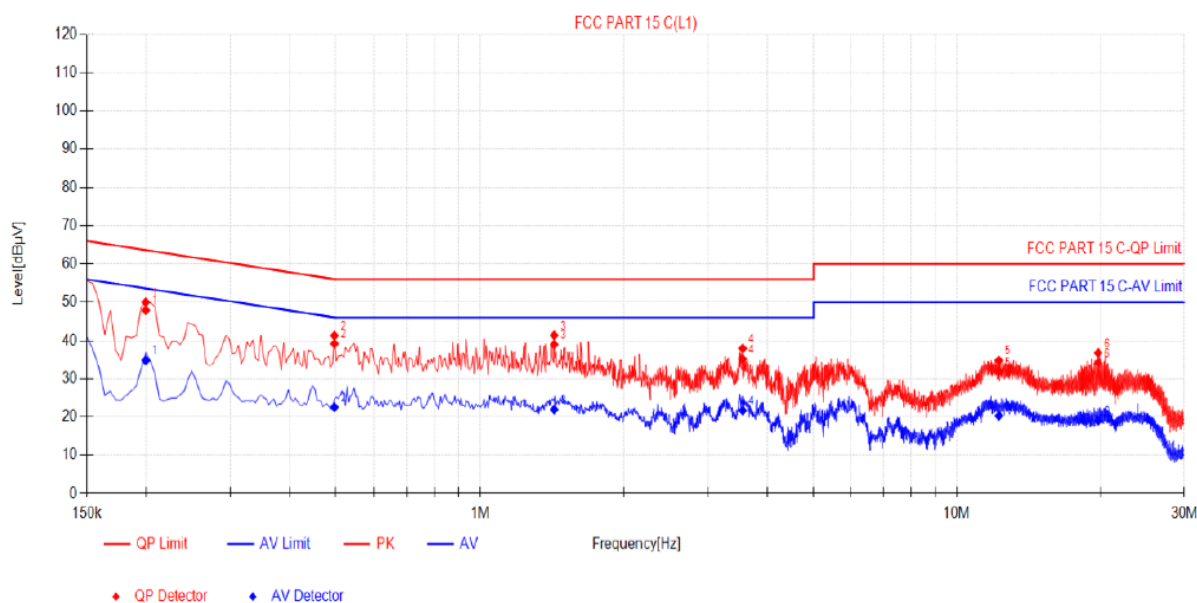
Please refer to the below test data:

Remark:

1. All modes of 802.11a/n/11ac/ax were test at Low, Middle, and High channel; only the worst result of a Middle Channel was reported as below:
2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:

5.2GWIFI:

Power supply:	DC 5.0V from PC AC 120V/60Hz	Polarization	L
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Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBμV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.1995	10.10	37.81	47.91	63.63	15.72	24.75	34.85	53.63	18.78	PASS
2	0.4965	10.01	29.18	39.19	56.06	16.87	12.46	22.47	46.06	23.59	PASS
3	1.428	9.90	29.08	38.98	56.00	17.02	11.95	21.85	46.00	24.15	PASS
4	3.552	9.96	25.28	35.24	56.00	20.76	11.64	21.60	46.00	24.40	PASS
5	12.246	10.28	21.64	31.92	60.00	28.08	9.94	20.22	50.00	29.78	PASS
6	19.7835	10.42	23.74	34.16	60.00	25.84	8.50	18.92	50.00	31.08	PASS

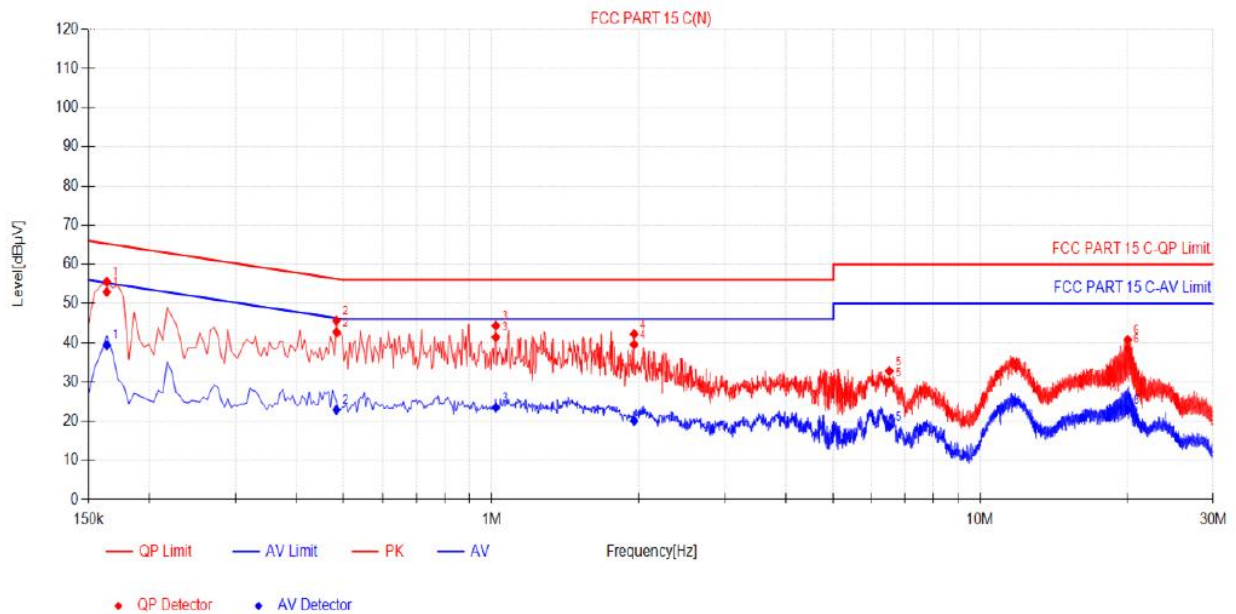
Note: 1). QP Value (dBμV) = QP Reading (dBμV) + Factor (dB)

2). Factor (dB) = insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin (dB) = QP Limit (dBμV) - QP Value (dBμV)

4). AVMargin (dB) = AV Limit (dBμV) - AV Value (dBμV)

Power supply:	DC 5.0V from PC AC 120V/60Hz	Polarization	N
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Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dB μV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.1635	10.05	42.90	52.95	65.28	12.33	29.35	39.40	55.28	15.88	PASS
2	0.483	10.00	32.70	42.70	56.29	13.59	12.89	22.89	46.29	23.40	PASS
3	1.0185	10.13	31.31	41.44	56.00	14.56	13.33	23.46	46.00	22.54	PASS
4	1.9545	10.19	29.37	39.56	56.00	16.44	9.88	20.07	46.00	25.93	PASS
5	6.5175	10.34	19.61	29.95	60.00	30.05	8.23	18.57	50.00	31.43	PASS
6	20.058	10.58	27.91	38.49	60.00	21.51	12.27	22.85	50.00	27.15	PASS

Note:1). QP Value (dBμV) = QP Reading (dBμV) + Factor (dB)

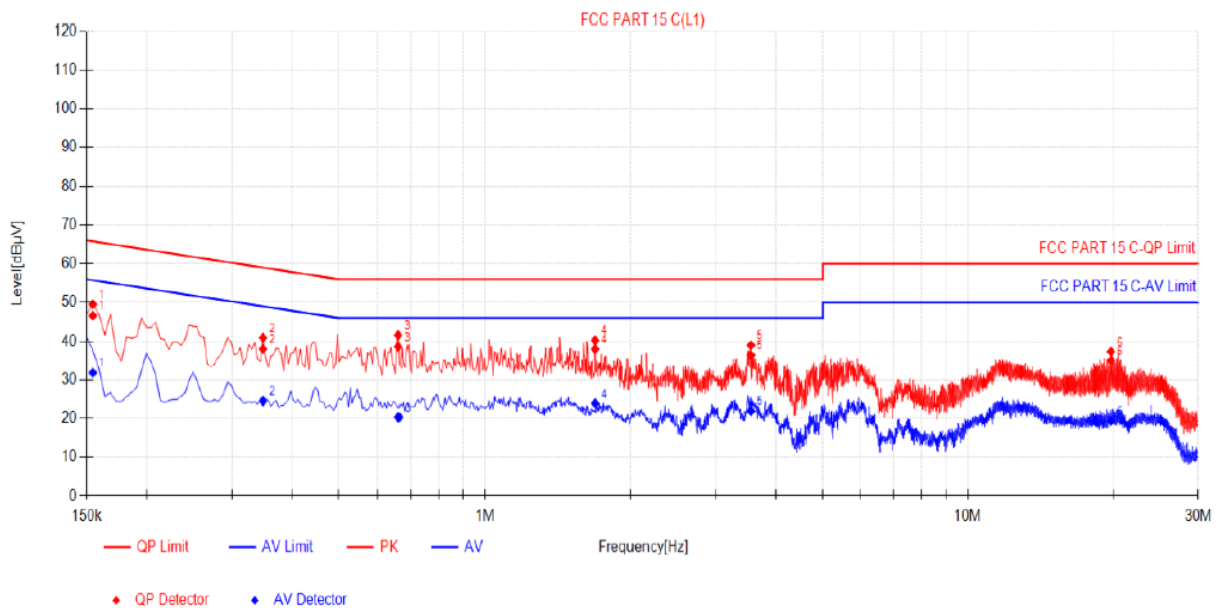
2). Factor (dB) = insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBμV) - QP Value (dBμV)

4). AVMargin(dB) = AV Limit (dBμV) - AV Value (dBμV)

5.8GWIFI:

Power supply:	DC 5.0V from PC AC 120V/60Hz	Polarization	L
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Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading [dB μV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.1545	9.89	36.71	46.60	65.75	19.15	21.88	31.77	55.75	23.98	PASS
2	0.348	9.87	28.11	37.98	59.01	21.03	14.51	24.38	49.01	24.63	PASS
3	0.663	9.96	28.66	38.62	56.00	17.38	10.31	20.27	46.00	25.73	PASS
4	1.689	9.91	28.06	37.97	56.00	18.03	13.93	23.84	46.00	22.16	PASS
5	3.552	9.96	26.45	36.41	56.00	19.59	11.87	21.83	46.00	24.17	PASS
6	19.7835	10.42	24.62	35.04	60.00	24.96	8.88	19.30	50.00	30.70	PASS

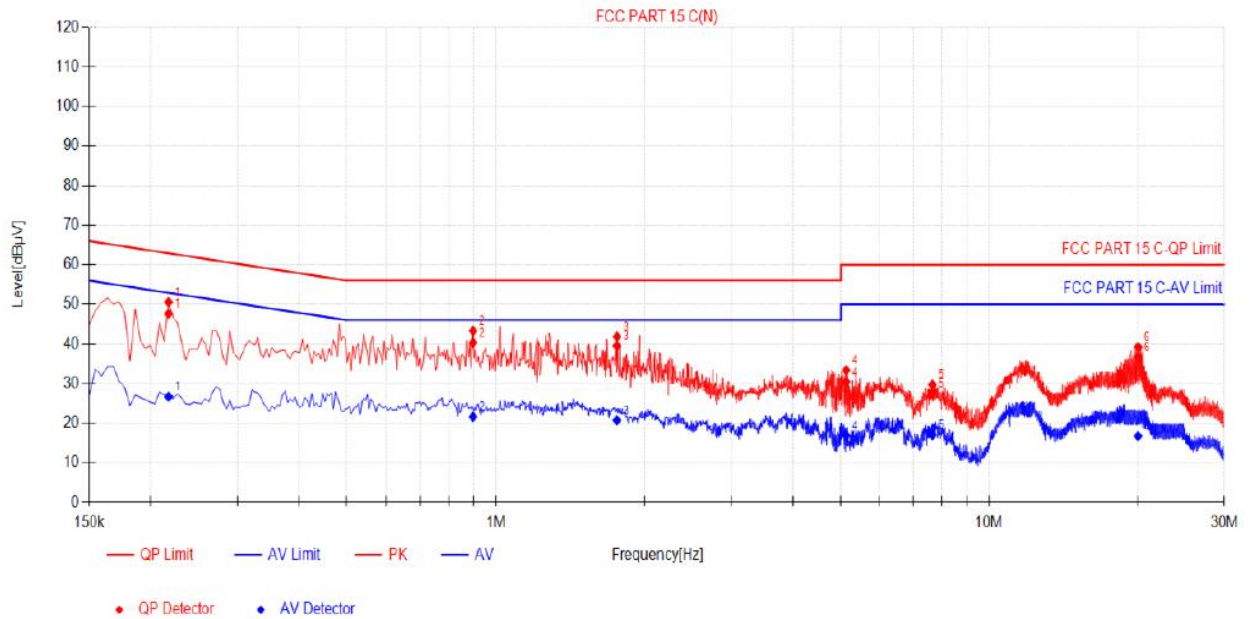
Note: 1). QP Value (dBμV) = QP Reading (dBμV) + Factor (dB)

2). Factor (dB) = insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin (dB) = QP Limit (dBμV) - QP Value (dBμV)

4). AVMargin (dB) = AV Limit (dBμV) - AV Value (dBμV)

Power supply:	DC 5.0V from PC AC 120V/60Hz	Polarization	N
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Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBμV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.2175	9.98	37.64	47.62	62.91	15.29	16.70	26.68	52.91	26.23	PASS
2	0.897	10.13	30.20	40.33	56.00	15.67	11.47	21.60	46.00	24.40	PASS
3	1.7565	10.16	29.39	39.55	56.00	16.45	10.55	20.71	46.00	25.29	PASS
4	5.127	10.10	20.36	30.46	60.00	29.54	6.82	16.92	50.00	33.08	PASS
5	7.6695	10.42	17.23	27.65	60.00	32.35	6.61	17.03	50.00	32.97	PASS
6	20.058	10.58	26.15	36.73	60.00	23.27	6.16	16.74	50.00	33.26	PASS

Note:1). QP Value (dBμV) = QP Reading (dBμV) + Factor (dB)

2). Factor (dB) = insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBμV) - QP Value (dBμV)

4). AVMargin(dB) = AV Limit (dBμV) - AV Value (dBμV)

4.2 Radiated and Conducted Unwanted Emissions

Limit

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 in the 5.725-5.85 GHz band: 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.

Undesirable emission limits

Requirement	Limit(EIRP)	Limit (Field strength at 3m) ^{Note1}
15.407(b)(1)	PK:-27(dBm/MHz)	PK:68.2(dBμV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)		

Note1: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts)}$$

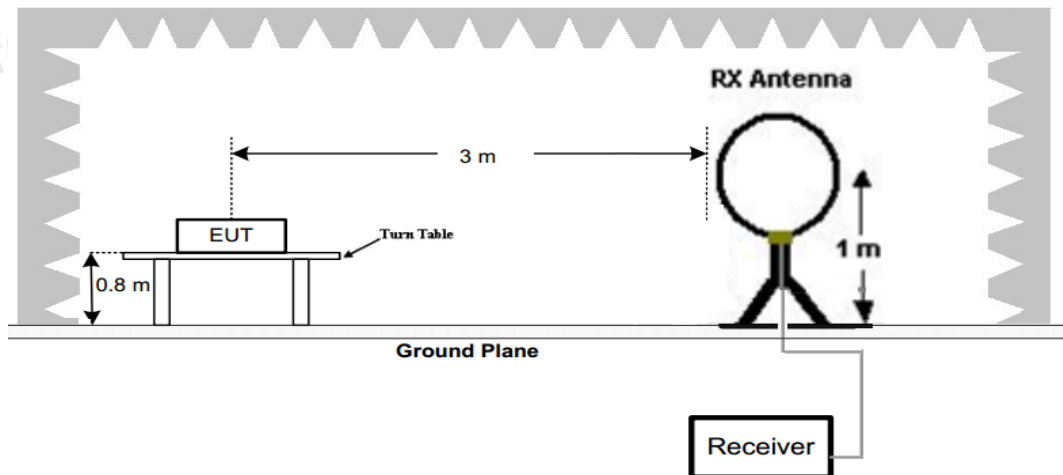
- (5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209
- (6) In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

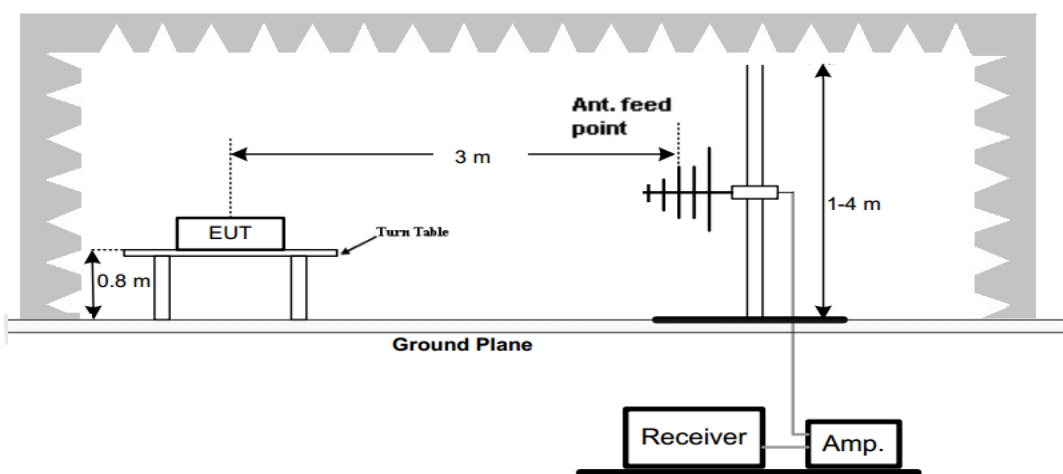
Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	$20\log(2400/F(\text{KHz}))+40\log(300/3)$	$2400/F(\text{KHz})$
0.49-1.705	3	$20\log(24000/F(\text{KHz}))+40\log(30/3)$	$24000/F(\text{KHz})$
1.705-30	3	$20\log(30)+40\log(30/3)$	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

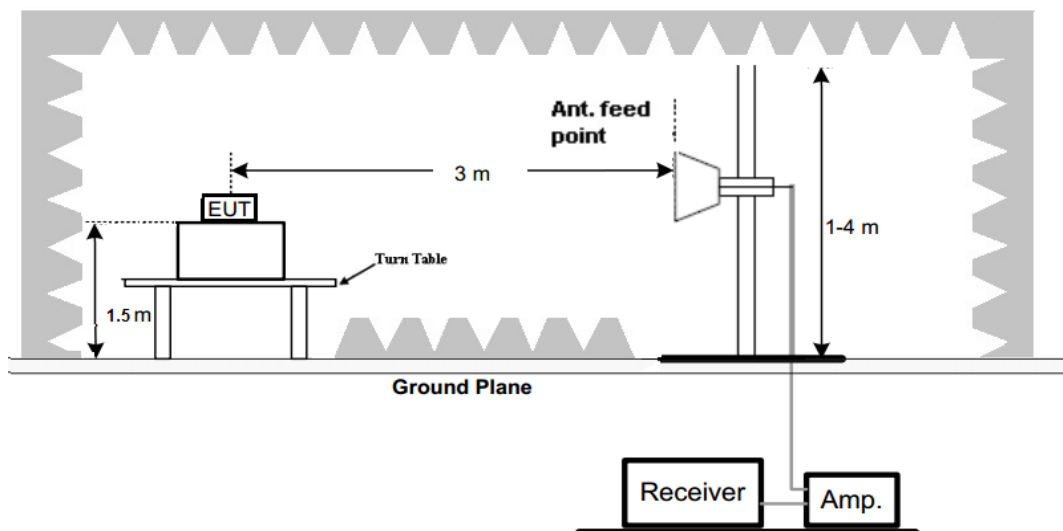
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz

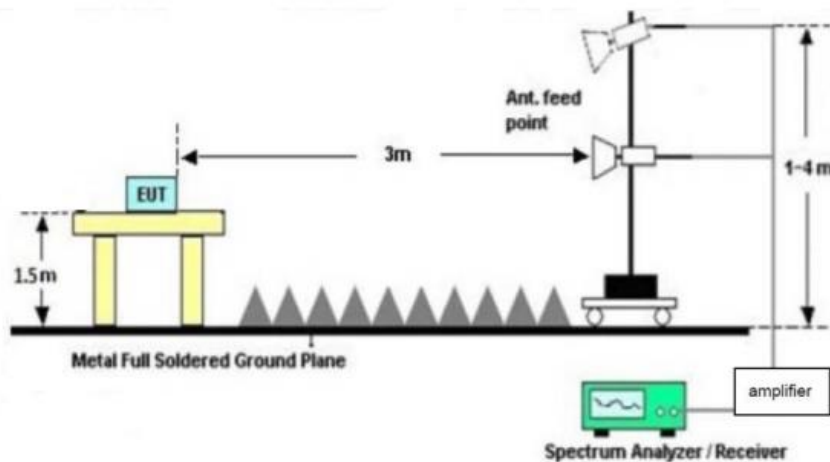


(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz





Test Procedure

- Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
- Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT
- And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- Repeat above procedures until all frequency measurements have been completed.
- Radiated emission test frequency band from 9KHz to 40GHz.
- The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Antenna	1

- Setting test receiver/spectrum as following table states:

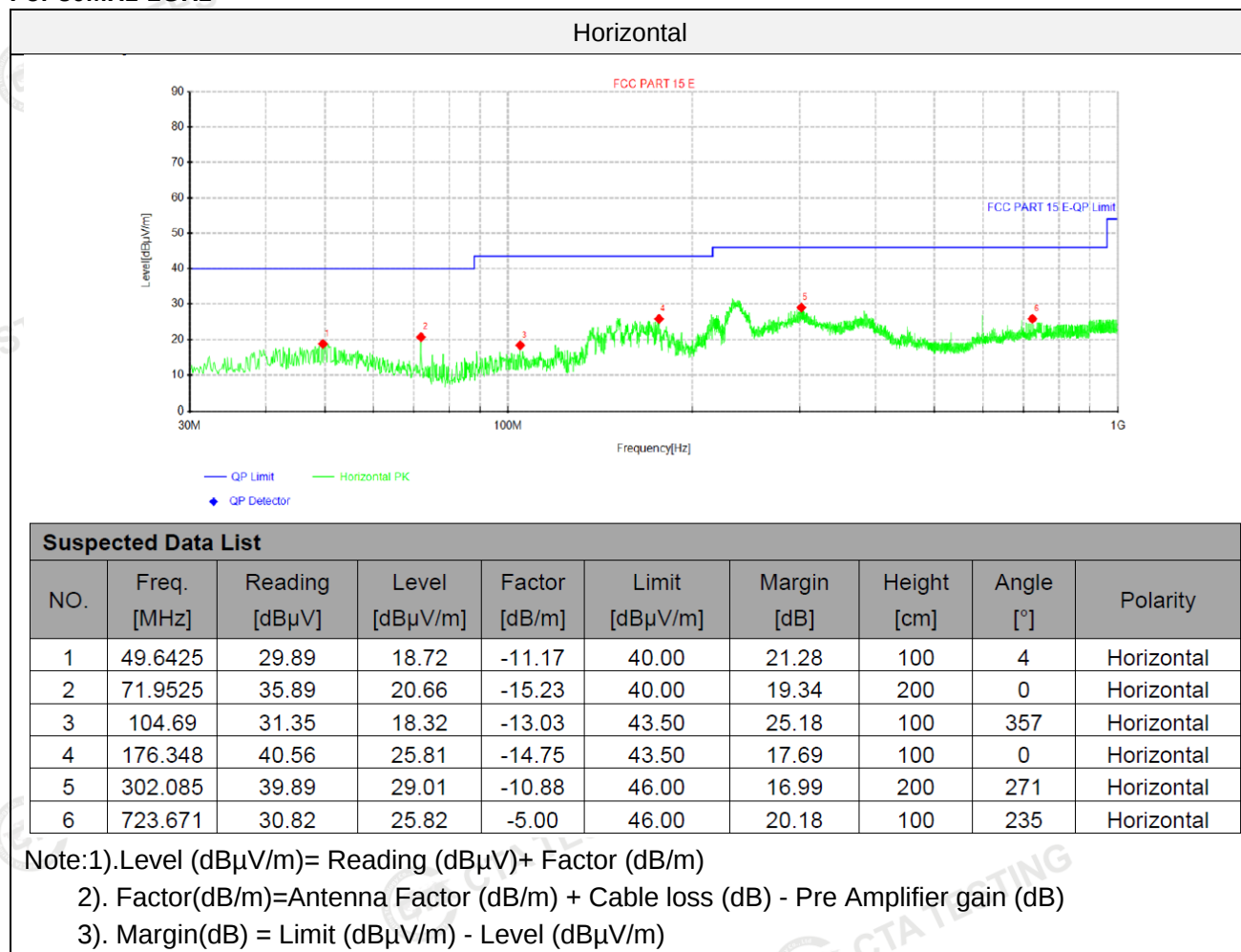
Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz, Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz, Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz, Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

TEST RESULTS

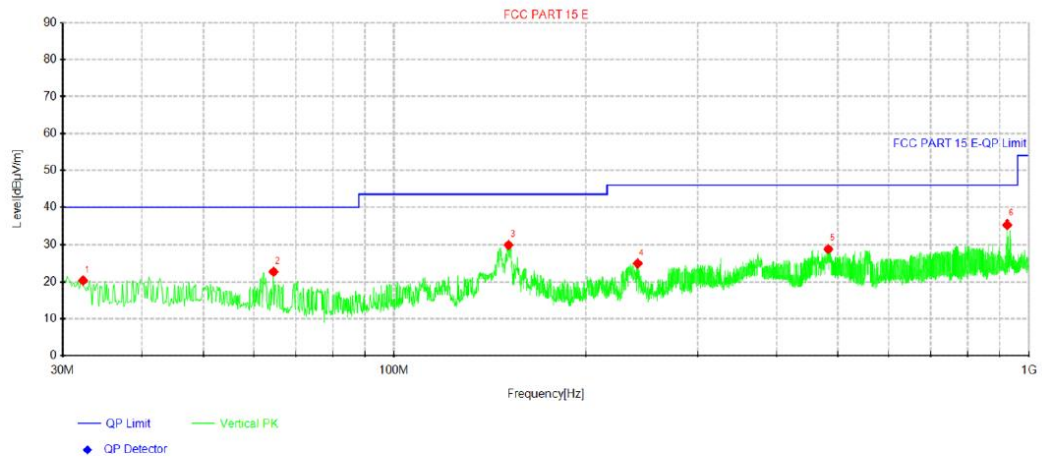
Remark:

- This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
- All modes of 802.11a/n/11ac/ax have been tested for below 1GHz test, only the worst case 802.11a low channel was recorded.
- All modes of 802.11a/n/11ac/ax have been tested for above 1GHz test, only the worst case 802.11a was recorded.
- Radiated emission test from 9 KHz to 40GHz harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

5.2G WIFI :
For 30MHz-1GHz



Vertical



Suspected Data List

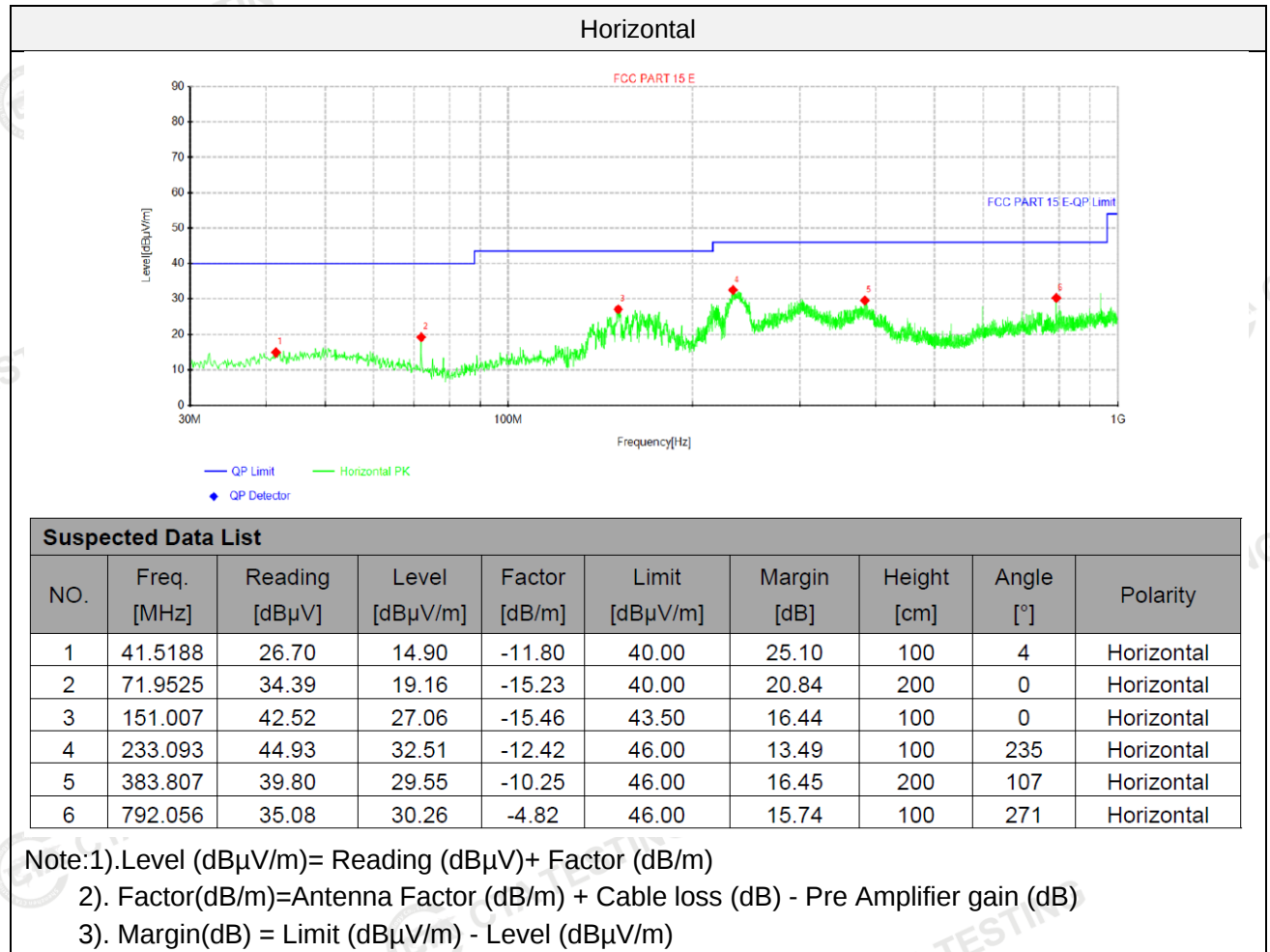
NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	32.3038	34.31	20.35	-13.96	40.00	19.65	100	261	Vertical
2	64.5562	36.61	22.75	-13.86	40.00	17.25	200	12	Vertical
3	151.007	45.47	30.01	-15.46	43.50	13.49	100	12	Vertical
4	241.46	37.31	24.99	-12.32	46.00	21.01	100	240	Vertical
5	482.626	38.20	28.89	-9.31	46.00	17.11	200	22	Vertical
6	924.218	37.76	35.43	-2.33	46.00	10.57	100	228	Vertical

Note:1). Level (dBμV/m) = Reading (dBμV) + Factor (dB/m)

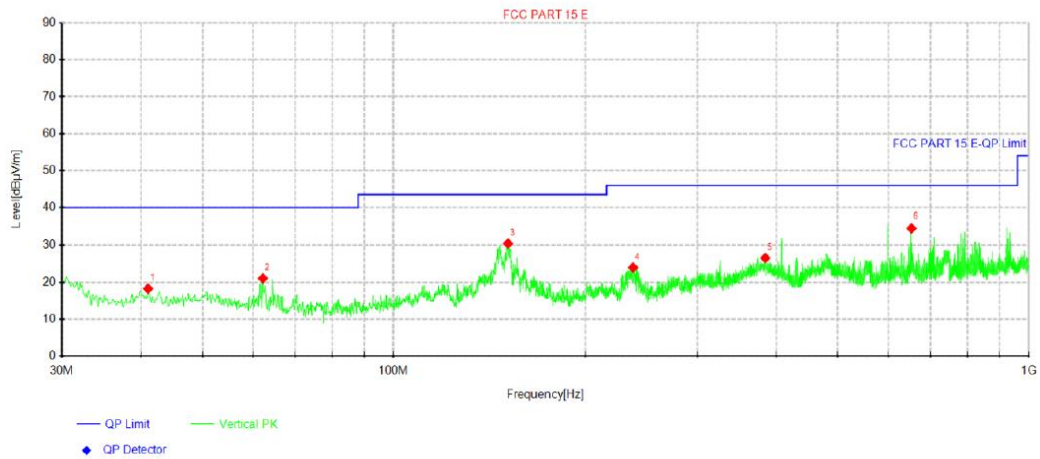
2). Factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin (dB) = Limit (dBμV/m) - Level (dBμV/m)

5.8G WIFI :
For 30MHz-1GHz



Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	41.0338	30.14	18.29	-11.85	40.00	21.71	100	273	Vertical
2	62.2525	34.34	21.03	-13.31	40.00	18.97	200	12	Vertical
3	151.007	45.97	30.51	-15.46	43.50	12.99	100	12	Vertical
4	237.822	36.36	23.99	-12.37	46.00	22.01	100	297	Vertical
5	384.171	36.81	26.57	-10.24	46.00	19.43	200	329	Vertical
6	653.346	40.04	34.60	-5.44	46.00	11.40	100	216	Vertical

Note:1). Level (dBμV/m) = Reading (dBμV) + Factor (dB/m)

2). Factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin (dB) = Limit (dBμV/m) - Level (dBμV/m)

For 1GHz to 40GHz

Note: All 802.11a / 802.11n/ac (HT20) /ax (HT20) /802.11n/ac (HT40) /ax (HT40) modes have been tested for above 1GHz test, only the worst case 802.11a was recorded.

U-NII 1 & 802.11a Mode (above 1GHz)

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5150.00	57.62	PK	H	68.30	10.68	61.05	33.04	5.45	41.92	-3.43
36.00	5150.00	48.80	AV	H	54.00	5.20	52.23	33.04	5.45	41.92	-3.43
(5180MHz)	10360.00	51.68	PK	H	68.30	16.62	48.01	38.83	10.12	45.28	3.67
	--	--	AV	H	--	--	--	--	--	--	--
44.00	10440.00	50.69	PK	H	68.30	17.61	47.01	38.85	10.13	45.3	3.68
(5220MHz)	--	--	AV	H	--	--	--	--	--	--	--
48.00	5350.50	47.84	PK	H	68.30	20.46	51.11	32.84	5.97	42.08	-3.27
(5240MHz)	10480.00	52.77	PK	H	68.30	15.53	49.03	38.89	10.19	45.34	3.74
	--	--	AV	V	--	--	--	--	--	--	--

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
	5150.00	56.53	PK	V	68.30	11.77	59.96	33.04	5.45	41.92	-3.43
36.00	5150.00	49.58	AV	V	54.00	4.42	53.01	33.04	5.45	41.92	-3.43
(5180MHz)	10360.00	51.87	PK	V	68.30	16.43	48.20	38.83	10.12	45.28	3.67
	--	--	--	V	--	--	--	--	--	--	--
44.00	10440.00	51.64	PK	V	68.30	16.66	47.96	38.85	10.13	45.3	3.68
(5220MHz)	--	--	--	V	--	--	--	--	--	--	--
48.00	5350.50	48.97	PK	V	68.30	19.33	52.24	32.84	5.97	42.08	-3.27
(5240MHz)	10480.00	52.69	PK	V	68.30	15.61	48.95	38.89	10.19	45.34	3.74
	--	--	--	V	--	--	--	--	--	--	--

U-NII 3 & 802.11a Mode (above 1GHz)

Tested	Frequency	Emission	Detector	Antenna	Limit	Margin	Raw	Antenna	Cable	Pre	Correction
Channel	(MHz)	Level	Mode	Pol	(dBuV/m)	(dB)	Value	Factor	Factor	amplifier	Factor
		(dBuV/m)					(dBuV)	(dB/m)	(dB)	(dB)	(dB/m)
	5650.00	39.89	PK	H	68.30	28.41	42.12	33.20	5.78	41.21	-2.23
	5700.00	41.80	PK	H	105.30	63.50	44.14	33.40	5.93	41.67	-2.34
	5720.00	43.17	PK	H	110.90	67.73	45.95	33.42	6.04	42.24	-2.78
	5725.00	42.42	PK	H	122.30	79.88	45.20	33.42	6.04	42.24	-2.78
149.00	5745.00	62.48	PK	H	122.30	59.82	65.26	33.42	6.04	42.24	-2.78
(5745MHz)	5850.00	45.65	PK	H	122.30	76.65	48.05	33.90	6.49	42.79	-2.40
	5855.00	45.71	PK	H	110.90	65.19	48.00	33.90	6.74	42.93	-2.29
	5875.00	46.12	PK	H	105.30	59.18	48.22	33.97	7.02	43.09	-2.10
	5925.00	46.25	PK	H	68.30	22.05	48.02	34.17	7.33	43.27	-1.77
149.00	11490.00	52.57	PK	H	68.30	15.73	48.09	39.02	10.91	45.45	4.48
(5745MHz)	--	--	AV	H	--	--	--	--	--	--	--
	5650.00	39.94	PK	H	68.30	28.36	42.17	33.20	5.78	41.21	-2.23
	5700.00	41.74	PK	H	105.30	63.56	44.08	33.40	5.93	41.67	-2.34
	5720.00	43.45	PK	H	110.90	67.45	46.23	33.42	6.04	42.24	-2.78
157.00	5785.00	61.36	PK	H	122.30	60.94	64.14	33.42	6.04	42.24	-2.78
(5785MHz)	5850.00	45.58	PK	H	122.30	76.72	47.98	33.90	6.49	42.79	-2.40
	5855.00	45.88	PK	H	110.90	65.02	48.17	33.90	6.74	42.93	-2.29
	5875.00	45.98	PK	H	105.30	59.32	48.08	33.97	7.02	43.09	-2.10
	5925.00	46.40	PK	H	68.30	21.90	48.17	34.17	7.33	43.27	-1.77
157.00	11570.00	52.55	PK	H	68.30	15.75	48.10	38.93	10.95	45.43	4.45
(5785MHz)	--	--	AV	H	--	--	--	--	--	--	--
	5650.00	39.84	PK	H	68.30	28.46	42.07	33.20	5.78	41.21	-2.23
	5700.00	41.73	PK	H	105.30	63.57	44.07	33.40	5.93	41.67	-2.34
	5720.00	43.46	PK	H	110.90	67.44	46.24	33.42	6.04	42.24	-2.78
165.00	5825.00	59.35	PK	H	122.30	62.95	62.13	33.42	6.04	42.24	-2.78
(5825MHz)	5850.00	45.74	PK	H	122.30	76.56	48.14	33.90	6.49	42.79	-2.40
	5855.00	45.83	PK	H	110.90	65.07	48.12	33.90	6.74	42.93	-2.29
	5875.00	45.91	PK	H	105.30	59.39	48.01	33.97	7.02	43.09	-2.10
	5925.00	46.21	PK	H	68.30	22.09	47.98	34.17	7.33	43.27	-1.77
165.00	11650.00	52.87	PK	H	68.30	15.43	48.29	38.83	11.16	45.41	4.58
(5825MHz)	--	--	AV	H	--	--	--	--	--	--	--

Tested	Frequency	Emission	Detector	Antenna	Limit	Margin	Raw	Antenna	Cable	Pre	Correction
Channel	(MHz)	Level	Mode	Pol	(dBuV/m)	(dB)	Value	Factor	Factor	amplifier	Factor
		(dBuV/m)					(dBuV)	(dB/m)	(dB)	(dB)	(dB/m)
	5650.00	39.71	PK	V	68.30	28.59	41.94	33.20	5.78	41.21	-2.23
	5700.00	41.78	PK	V	105.30	63.52	44.12	33.40	5.93	41.67	-2.34
	5720.00	42.28	PK	V	110.90	68.62	45.06	33.42	6.04	42.24	-2.78
	5725.00	41.40	PK	V	122.30	80.90	44.18	33.42	6.04	42.24	-2.78
149.00	5745.00	62.41	PK	V	122.30	59.89	65.19	33.42	6.04	42.24	-2.78
(5745MHz)	5850.00	47.69	PK	V	122.30	74.61	50.09	33.90	6.49	42.79	-2.40
	5855.00	45.92	PK	V	110.90	64.98	48.21	33.90	6.74	42.93	-2.29
	5875.00	45.96	PK	V	105.30	59.34	48.06	33.97	7.02	43.09	-2.10
	5925.00	46.46	PK	V	68.30	21.84	48.23	34.17	7.33	43.27	-1.77
149.00	11490.00	52.73	PK	V	68.30	15.57	48.25	39.02	10.91	45.45	4.48
(5745MHz)	--	--	AV	V	--	--	--	--	--	--	--
	5650.00	39.89	PK	V	68.30	28.41	42.12	33.20	5.78	41.21	-2.23
	5700.00	41.66	PK	V	105.30	63.64	44.00	33.40	5.93	41.67	-2.34
	5720.00	43.26	PK	V	110.90	67.64	46.04	33.42	6.04	42.24	-2.78
157.00	5785.00	62.41	PK	V	122.30	59.89	65.19	33.42	6.04	42.24	-2.78
(5785MHz)	5850.00	48.64	PK	V	122.30	73.66	51.04	33.90	6.49	42.79	-2.40
	5855.00	45.91	PK	V	110.90	64.99	48.20	33.90	6.74	42.93	-2.29
	5875.00	45.90	PK	V	105.30	59.40	48.00	33.97	7.02	43.09	-2.10
	5925.00	46.31	PK	V	68.30	21.99	48.08	34.17	7.33	43.27	-1.77
157.00	11570.00	53.61	PK	V	68.30	14.69	49.16	38.93	10.95	45.43	4.45
(5785MHz)	--	--	AV	V	--	--	--	--	--	--	--
	5650.00	38.83	PK	V	68.30	29.47	41.06	33.20	5.78	41.21	-2.23
	5700.00	41.75	PK	V	105.30	63.55	44.09	33.40	5.93	41.67	-2.34
	5720.00	43.45	PK	V	110.90	67.45	46.23	33.42	6.04	42.24	-2.78
165.00	5825.00	63.40	PK	V	122.30	58.90	66.18	33.42	6.04	42.24	-2.78
(5825MHz)	5850.00	45.70	PK	V	122.30	76.60	48.10	33.90	6.49	42.79	-2.40
	5855.00	45.84	PK	V	110.90	65.06	48.13	33.90	6.74	42.93	-2.29
	5875.00	46.09	PK	V	105.30	59.21	48.19	33.97	7.02	43.09	-2.10
	5925.00	46.46	PK	V	68.30	21.84	48.23	34.17	7.33	43.27	-1.77
165.00	11650.00	52.58	PK	V	68.30	15.72	48.00	38.83	11.16	45.41	4.58
(5825MHz)	--	--	AV	V	--	--	--	--	--	--	--

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
3. Margin value = Limit value - Emission level.
4. -- Mean the other emission levels were very low against the limit.
5. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
6. Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20, IEEE 802.11ac VHT40, IEEE 802.11ax VHT20, IEEE 802.11ax VHT40;

Conducted Emissions

Please refer to Appendix RF Test Data for 5GWIFI

Conducted Band Edge

Please refer to Appendix RF Test Data for 5GWIFI

4.3 Maximum Conducted Average Output Power

Limit

For the band 5.15-5.25 GHz.

- (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.
- (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.
- (iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.
- (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.

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.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

Test Configuration



Test Results

Please refer to Appendix RF Test Data for 5GWIFI

Total Output Average power(dBm)= Output Average power(dBm)+ Duty Factor(dB)

4.4 Power Spectral Density

Limit

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. ^{note1}

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. ^{note1}

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. ^{note1}

(2) For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. ^{note1}

(3) For the band 5.725 - 5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band. ^{note1, note2}

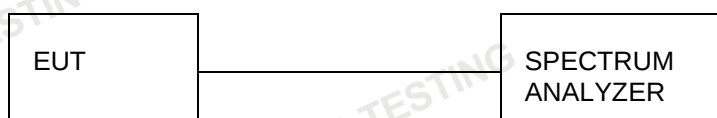
Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: 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.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 1MHz for U-NII 1, U-NII 2A, U-NII C band and 510KHz for U-NII 3 band.
3. Set the VBW $\geq 3 \times$ RBW.
4. Set the span to encompass the entire EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.

Test Configuration



Test Results

Please refer to Appendix RF Test Data for 5GWIFI

Total Power Spectral Density (dBm/MHz)= Power Spectral Density (dBm/MHz)+ Duty Factor (dB)

Remark: P.S.D(dBm/500KHz)= P.S.D(dBm/300KHz)+10 log (500 kHz/300KHz).

RBW factor = 10 log (500 KHz / 300 KHz) = 2.22 dB

4.5 Emission Bandwidth (26dB Bandwidth)

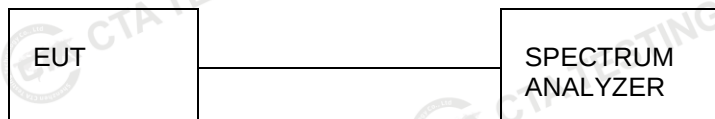
Limit

N/A

Test Procedure

1. Set resolution bandwidth (RBW) = approximately 1 % of the EBW.
2. Set the video bandwidth (VBW) > RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. 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 analyzer. Readjust RBW and repeat measurement as needed until the RBW / EBW ratio is approximately 1 %.

Test Configuration



Test Results

Please refer to Appendix RF Test Data for 5GWIFI

4.6 Minimum Emission Bandwidth (6dB Bandwidth)

Limit

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

Test Procedure

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth 3 x RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. 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.

Test Configuration



Test Results

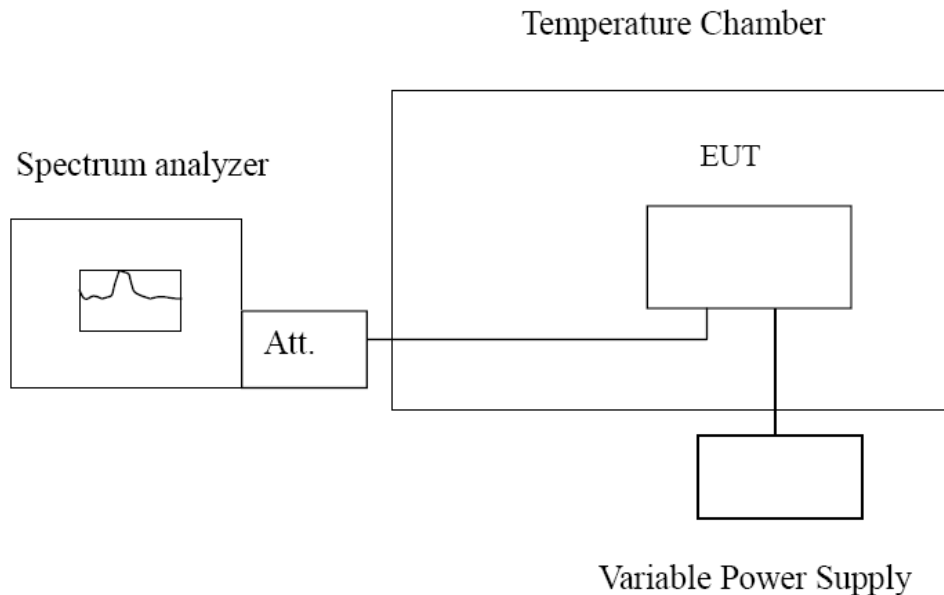
Please refer to Appendix RF Test Data for 5GWIFI

4.7 Frequency Stability

LIMIT

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.

TEST CONFIGURATION



TEST PROCEDURE

Frequency Stability under Temperature Variations:

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

Frequency Stability under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ($\pm 15\%$) and endpoint, record the maximum frequency change.

TEST RESULTS

Reference Frequency: 802.11ac channel=36 frequency=5180MHz				
Voltage (V)	Temperature (°C)	Frequency error		Limit (ppm)
		Hz	ppm	
DC 5.0	-30	110.63	0.021357	Within the band of operation
	-20	174.47	0.033681	
	-10	145.60	0.028108	
	0	146.65	0.028311	
	10	146.13	0.028210	
	20	99.61	0.019230	
	30	167.36	0.032309	
	40	129.57	0.025014	
	50	128.69	0.024844	
DC 5.5	25	195.83	0.037805	Pass
DC 4.5	25	118.75	0.022925	

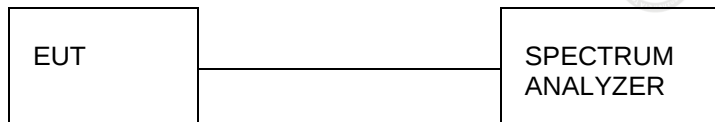
Reference Frequency: 802.11ac channel=149 frequency=5745MHz				
Voltage (V)	Temperature (°C)	Frequency error		Limit (ppm)
		Hz	ppm	
DC 5.0	-30	135.95	0.023664	Within the band of operation
	-20	129.51	0.022543	
	-10	167.16	0.029097	
	0	169.48	0.029500	
	10	136.51	0.023762	
	20	144.80	0.025205	
	30	116.71	0.020315	
	40	168.53	0.029335	
	50	160.52	0.027941	
DC 5.5	25	150.80	0.026249	Pass
DC 4.5	25	129.94	0.022618	

4.8 On Time and Duty Cycle

Standard Applicable

None; for reporting purpose only.

TEST CONFIGURATION



Test Procedures

- 1). Set the Centre frequency of the spectrum analyzer to the transmitting frequency;
- 2). Set the span=0MHz, RBW=8MHz, VBW=8MHz, Sweep time=5ms;
- 3). Detector = peak;
- 4). Trace mode = Single hold.

TEST RESULTS

Please refer to Appendix RF Test Data for 5GWIFI

5 Test Setup Photos of the EUT

Please refer to separated files for Test Setup Photos of the EUT.

6 Photos of the EUT

Please refer to separated files for External Photos & Internal Photos of the EUT.

***** End of Report *****