

FCC TEST REPORT

Product Name: Hybrid Full-Touch Handheld Computer

Trade Mark:



Model No.: HF550X

Add. Model No.: N/A

Report Number: 2208151076RFC-4

Test Standards: FCC 47 CFR Part 15 Subpart E

FCC ID: SS4HF550X

Test Result: PASS

Date of Issue: October 26, 2022

Prepared for:

Bluebird Inc.

3F, 115, Irwon-ro, Gangnam-gu, Seoul, Republic of Korea

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and
technology park, Longhua district, Shenzhen, China

TEL: +86-755-2823 0888

FAX: +86-755-2823 0886

Prepared by:

Kieron Luo
Project Engineer

Reviewed by:

Henry Lu
Assistant Manager

Approved by:

Kevin Liang
Assistant Manager

Date:

October 26, 2022

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

UTTR-RF-FCCPART15.407-V1.1

Version

Version No.	Date	Description
V1.0	October 26, 2022	Original



Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

UTTR-RF-FCCPART15.407-V1.1

CONTENTS

1. GENERAL INFORMATION	4
1.1 CLIENT INFORMATION	4
1.2 EUT INFORMATION	4
1.2.1 GENERAL DESCRIPTION OF EUT	4
1.2.2 DESCRIPTION OF ACCESSORIES.....	5
1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD	6
1.4 OTHER INFORMATION.....	7
1.5 DESCRIPTION OF SUPPORT UNITS	7
1.6 TEST LOCATION.....	7
1.7 TEST FACILITY.....	8
1.8 DEVIATION FROM STANDARDS	8
1.9 ABNORMALITIES FROM STANDARD CONDITIONS.....	8
1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER	8
1.11 MEASUREMENT UNCERTAINTY	8
2. TEST SUMMARY	9
3. EQUIPMENT LIST	10
4. TEST CONFIGURATION	11
4.1 ENVIRONMENTAL CONDITIONS FOR TESTING	11
4.1.1 NORMAL OR EXTREME TEST CONDITIONS	11
4.1.2 RECORD OF NORMAL ENVIRONMENT AND TEST SAMPLE	11
4.2 TEST CHANNELS	12
4.3 EUT TEST STATUS	12
4.4 PRE-SCAN.....	13
4.5 TEST SETUP	13
4.5.1 FOR RADIATED EMISSIONS TEST SETUP	13
4.5.2 FOR CONDUCTED EMISSIONS TEST SETUP	15
4.5.3 FOR CONDUCTED RF TEST SETUP	15
4.6 SYSTEM TEST CONFIGURATION.....	16
4.7 DUTY CYCLE	17
5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION	21
5.1 REFERENCE DOCUMENTS FOR TESTING	21
5.2 ANTENNA REQUIREMENT	21
5.3 26 DB BANDWIDTH	22
5.4 6 DB BANDWIDTH	39
5.5 MAXIMUM CONDUCTED OUTPUT POWER	45
5.6 PEAK POWER SPECTRAL DENSITY	49
5.7 RADIATED EMISSIONS AND BAND EDGE MEASUREMENT.....	73
5.8 DYNAMIC FREQUENCY SELECTION	121
5.9 AC POWER LINE CONDUCTED EMISSION	131
APPENDIX 1 PHOTOS OF TEST SETUP.....	134
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS.....	134

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Bluebird Inc.
Address of Applicant:	3F, 115, Irwon-ro, Gangnam-gu, Seoul, Republic of Korea
Manufacturer:	Bluebird Inc.
Address of Manufacturer:	3F, 115, Irwon-ro, Gangnam-gu, Seoul, Republic of Korea

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Hybrid Full-Touch Handheld Computer		
Model No.:	HF550X		
Add. Model No.:	N/A		
Trade Mark:			
DUT Stage:	Identical Prototype		
EUT Supports Function: (Provided by the customer)	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
		Bluetooth 5.1	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac
NFC:	13.553 MHz to 13.567 MHz		
Software Version:	R1.00 (Provided by the customer)		
Hardware Version:	0.5 (Provided by the customer)		
Sample Received Date:	August 15, 2022		
Sample Tested Date:	August 19, 2022 to September 21, 2022		
Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.			

1.2.2 Description of Accessories

Adapter	
Model No.:	KSA29B0500200D5
Input:	100-240 V~50/60 Hz 0.5A
Output:	5.0 V $\pm$ 2.0A
AC Cable:	N/A
DC Cable:	N/A

Battery	
Model No.:	BAT-400001
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.85 Vdc
Limited Charge Voltage:	4.4 Vdc
Rated Capacity:	4000 mAh

Cable	
Description:	USB Type-C Plug Cable
Connector:	USB Type-C / USB 3.0 Type A
Cable Type:	Shielded without ferrite
Length:	1 Meter

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com<http://www.uttlab.com>

UTTR-RF-FCCPART15.407-V1.1

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Bands:	5150 MHz to 5250 MHz (U-NII-1)	
	5250 MHz to 5350 MHz (U-NII-2A)	
	5470 MHz to 5725 MHz (U-NII-2C)	
	5 725 MHz to 5 850 MHz (U-NII-3)	
Frequency Ranges:	5180 MHz to 5240 MHz	
	5260 MHz to 5320 MHz	
	5500 MHz to 5700 MHz	
	5 745 MHz to 5 825 MHz	
Support Standards:	IEEE 802.11a/n/ac	
TPC Function:	Not Support	
DFS Operational mode:	Slave without radar Interference detection function	
Type of Modulation:	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK)	
	IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK)	
	IEEE 802.11ac: OFDM(256QAM, 64QAM, 16QAM, QPSK, BPSK)	
Channel Spacing:	IEEE 802.11a/n-HT20/ac-VHT20: 20 MHz	
	IEEE 802.11n-HT40/ac-VHT40: 40 MHz	
	IEEE 802.11ac-VHT80: 80 MHz	
Data Rate:	IEEE 802.11a: Up to 54 Mbps	
	IEEE 802.11n-HT20: Up to MCS15	
	IEEE 802.11n-HT40: Up to MCS15	
	IEEE 802.11ac-VHT20: Up to MCS8	
	IEEE 802.11ac-VHT40: Up to MCS9	
	IEEE 802.11ac-VHT80: Up to MCS9	
Number of Channels:	5150 MHz to 5250 MHz: 4 for IEEE 802.11a/n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40/ac-VHT40 1 for IEEE 802.11acVHT80	
	5250 MHz to 5350 MHz: 4 for IEEE 802.11a/n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40/ac-VHT40 1 for IEEE 802.11acVHT80	
	5470 MHz to 5725 MHz: 11 for IEEE 802.11a/n-HT20/ac-VHT20 5 for IEEE 802.11n-HT40/ac-VHT40 2 for IEEE 802.11ac-VHT80	
	5725 MHz to 5850 MHz: 5 for IEEE 802.11a/n-HT20/ac-VHT20 2 for IEEE 802.11n-HT40/ac-VHT40 1 for IEEE 802.11ac-VHT80	
Antenna Type:	Ant. 0	PIFA Antenna
	Ant. 1	PIFA Antenna
Antenna Gain: (Provided by the customer)	Ant. 0	5150 MHz to 5250 MHz: 0.32 dBi
		5250 MHz to 5350 MHz: 0.32 dBi
		5470 MHz to 5725 MHz: 1.46 dBi
		5725 MHz to 5850 MHz: -0.252 dBi
	Ant. 1	5150 MHz to 5250 MHz: 0.435 dBi
		5250 MHz to 5350 MHz: 0.435 dBi

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

UTTR-RF-FCCPART15.407-V1.1

Max. Conducted Avg. Power (dBm):			5470 MHz to 5725 MHz: 2.175 dBi			
			5725 MHz to 5850 MHz: 0.081 dBi			
	SISO_Ant. 0		U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11a:		15.81	15.61	15.63	15.58
	SISO_Ant. 1		U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11a:		14.41	14.48	14.91	14.71
	MIMO_Ant. 0+1		U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11n-HT20:		14.15	14.01	13.92	14.01
	IEEE 802.11n-HT40:		13.41	13.31	13.55	13.32
	IEEE 802.11ac-VHT20:		14.05	13.94	13.94	14.07
	IEEE 802.11ac-VHT40:		13.40	13.29	13.54	13.30
	IEEE 802.11ac-VHT80:		12.76	12.53	12.79	12.34
Normal Test Voltage:		3.85 Vdc and/or 120 Vac				

1.4 OTHER INFORMATION

None.

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	FCC ID	Supplied by
Notebook	DELL	Inspiron 5409	N/A	N/A	UnionTrust
Wireless Home Router	SAGEMCOM	FAST5280	N/A	VW3FAST5280	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.3 Meter	UnionTrust

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China, China 518109

Telephone: +86 (0) 755 2823 0888

Fax: +86 (0) 755 2823 0886

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

UTTR-RF-FCCPART15.407-V1.1

1.7 TEST FACILITY

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

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.2 dB
2	Conducted emission 150kHz-30MHz	±2.7 dB
3	Radiated emission 9kHz-30MHz	±4.7 dB
4	Radiated emission 30MHz-1GHz	±4.6 dB
5	Radiated emission 1GHz-18GHz	±4.4 dB
6	Radiated emission 18GHz-40GHz	±4.6 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart E Test Cases			
Test Item	Test Requirement	Test Method	Result
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203 FCC 47 CFR Part 15 Subpart C Section 15.407(a)(1) (2)	N/A	PASS
26 dB emission bandwidth	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(2)(5)	KDB 789033 D02 v02r01 Section C.1	PASS
6 dB bandwidth	FCC 47 CFR Part 15 Subpart E Section 15.407 (e)	KDB 789033 D02 v02r01 Section C.2	PASS
Maximum conducted output power	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)	KDB 789033 D02 v02r01 Section E.3.a (Method PM)	PASS
Peak Power Spectral Density	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)	KDB 789033 D02 v02r01 Section F	PASS
Radiated Emissions and Band Edge Measurement	FCC 47 CFR Part 15 Subpart E Section 15.407 (b)(1)(2)(3)(4)(6) FCC 47 CFR Part 15 Subpart C Section 15.209/205	KDB 789033 D02 v02r01 Section G.3, G.4, G.5, and G.6	PASS
Dynamic Frequency Selection	FCC 47 CFR Part 15 Subpart E Section 15.407 (h)	KDB 905462 D03 Client Without DFS New Rules v01r02	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart E Section 15.407 (b)(6) FCC 47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013, Section 6.2.	PASS

For Dynamic Frequency Selection

Test Case	Result
Channel Availability Check Time	N/A ¹
U-NII Detection Bandwidth	N/A ¹
Channel Closing Transmission Time	PASS
Channel Move Time	PASS
DFS Detection Threshold	N/A ¹
Non- Occupancy Period	N/A ¹
Note:	
1) The EUT is slave, NA In this whole report not applicable.	

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date	Cal. Due date
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	Euroshiedpn-CT001270-1317	22-Jan-2021	21-Jan-2024
☒	Receiver	R&S	ESIB26	100114	5-Nov-2021	4-Nov-2022
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	15-Apr-2022	14-Apr-2023
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	11-Nov-2021	10-Nov-2023
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	11-Nov-2021	10-Nov-2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	11-Nov-2021	10-Nov-2023
☒	Preamplifier	HP	8447F	2805A02960	5-Nov-2021	4-Nov-2022
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	17-Apr-2022	16-Apr-2024
☒	Pre-amplifier	ETS-LINDGREN	00118385	00201874	6-Nov-2021	5-Nov-2022
☐	Horn Antenna	ETS-LINDGREN	3116C	00200180	17-Apr-2022	16-Apr-2024
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	14-Nov-2020	13-Nov-2022
☒	Pre-amplifier	ETS-LINDGREN	00118384	00202652	17-Nov-2020	16-Nov-2022
☒	Band Rejection Filter (5150MHz~5880MHz)	Micro-Tronics	BRM50716	G186	6-Nov-2021	5-Nov-2022
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date	Cal. Due date
☒	Receiver	R&S	ESR7	101181	5-Nov-2021	4-Nov-2022
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	5-Nov-2021	4-Nov-2022
☒	LISN	R&S	ESH2-Z5	860014/024	5-Nov-2021	4-Nov-2022
☐	LISN	ETS-Lindgren	3816/2SH	00201088	5-Nov-2021	4-Nov-2022
☒	Test Software	Audix	e3	Software Version: 9 20151119i		

RF Conducted Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date	Cal. Due date
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	15-Apr-2022	14-Apr-2023
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	5-Nov-2021	4-Nov-2022
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	5-Nov-2021	4-Nov-2022
☐	EXG-B RF Analog Signal Generator	KEYSIGHT	N5171B	MY53051777	5-Nov-2021	4-Nov-2022
☒	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	5-Nov-2021	4-Nov-2022

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

UTTR-RF-FCCPART15.407-V1.1

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage	Relative Humidity (%)
NT/NV	+15 to +35	120V~60Hz or 240V~50Hz	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temp. (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
AC Power Line Conducted Emission	24.3	42.7	98.95	S20220815342-ZJA08/9	David Zhang
26 dB emission bandwidth	24.3	50	100.1	S20220815342-ZJA09/9	Hank Wu
Maximum conducted output power					
Peak Power Spectral Density					
6 dB bandwidth					
Dynamic Frequency Selection	25.2	50	100.6	S20220815342-ZJA08/9	Andy Lin
Radiated Emissions and Band Edge Measurement					

4.2 TEST CHANNELS

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11a IEEE 802.11n-HT20 IEEE 802.11ac-VHT20	5150 MHz to 5250 MHz	Channel 36	Channel 44	Channel 48
		5180 MHz	5220 MHz	5240 MHz
	5250 MHz to 5350 MHz	Channel 52	Channel 60	Channel 64
		5260 MHz	5300 MHz	5320 MHz
	5470 MHz to 5725 MHz	Channel 100	Channel 120	Channel 140
		5500 MHz	5600 MHz	5700 MHz
	5725 MHz to 5850 MHz	Channel 149	Channel 157	Channel 165
		5745 MHz	5785 MHz	5825 MHz
IEEE 802.11n-HT40 IEEE 802.11ac-VHT40	5150 MHz to 5250 MHz	Channel 38	--	Channel 46
		5190 MHz	--	5230 MHz
	5250 MHz to 5350 MHz	Channel 54	--	Channel 62
		5270 MHz	--	5310 MHz
	5470 MHz to 5725 MHz	Channel 102	Channel 118	Channel 134
		5510 MHz	5590 MHz	5670 MHz
	5725 MHz to 5850 MHz	Channel 151	--	Channel 159
		5755 MHz	--	5795 MHz
IEEE 802.11ac-VHT80	5150 MHz to 5250 MHz	--	Channel 42	--
		--	5210 MHz	--
	5250 MHz to 5350 MHz	--	Channel 58	--
		--	5290 MHz	--
	5470 MHz to 5725 MHz	Channel 106	--	Channel 122
		5530 MHz	--	5610 MHz
	5725 MHz to 5850 MHz	--	Channel 155	--
		--	5775 MHz	--

4.3 EUT TEST STATUS

Mode	Tx/Rx Function	Description
IEEE 802.11a/n/ac	1Tx/1Rx or 2Tx/2Rx	1. Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate.

Power Setting (Provided by the customer)						
Mode	U-NII-1/ U-NII-2A		U-NII-2C		U-NII-3	
	Antenna 0	Antenna 1	Antenna 0	Antenna 1	Antenna 0	Antenna 1
IEEE 802.11a	15	15	15	15	15	15
IEEE 802.11n-HT20 IEEE 802.11ac-VHT20	11	11	11	11	11	11
IEEE 802.11n-HT40 IEEE 802.11ac-VHT40	10	10	10	10	10	10
IEEE 802.11ac-VHT80	10	10	10	10	10	10

Test Software (Provided by the customer)
Test software name: QRCT4

4.4 PRE-SCAN

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Following data rate was (were) selected for the final test as listed below

Mode	Worst-case data rates
IEEE 802.11a	6 Mbps
IEEE 802.11n-HT20	MCS0
IEEE 802.11n-HT40	MCS0
IEEE 802.11ac-VHT20	MCS0
IEEE 802.11ac-VHT40	MCS0
IEEE 802.11ac-VHT80	MCS0

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

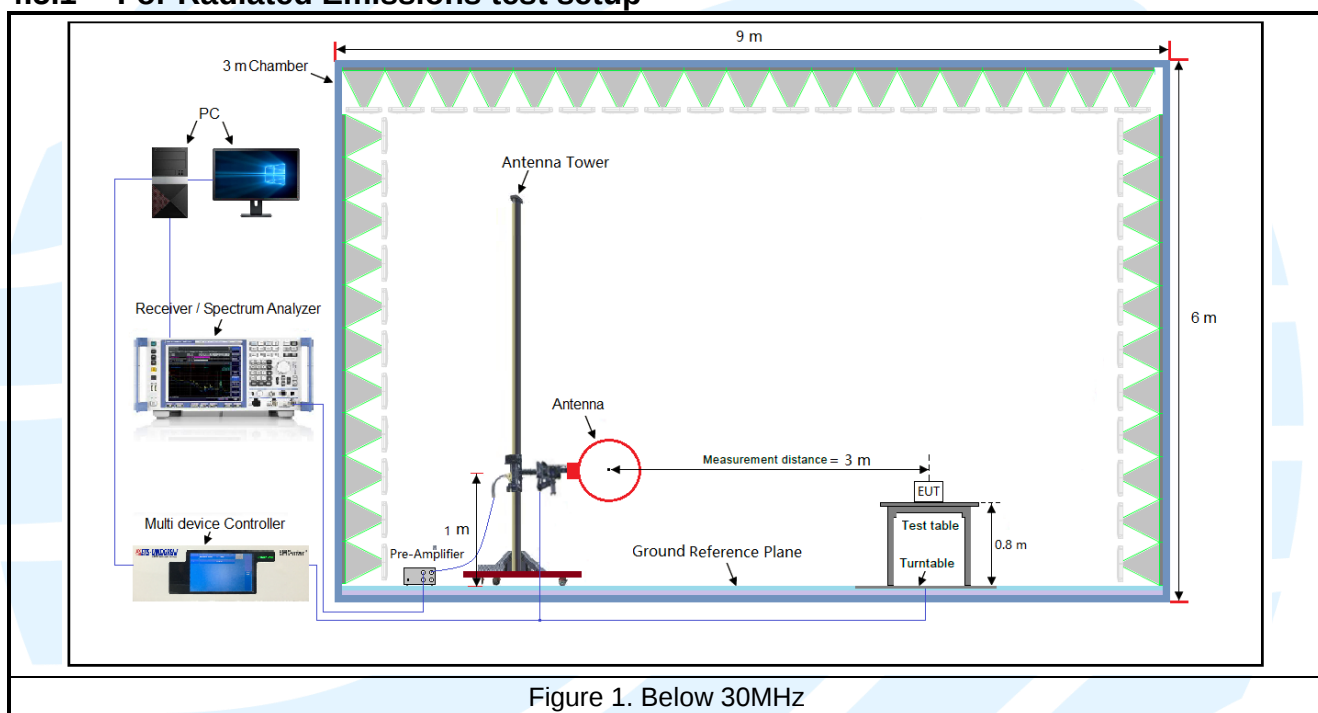
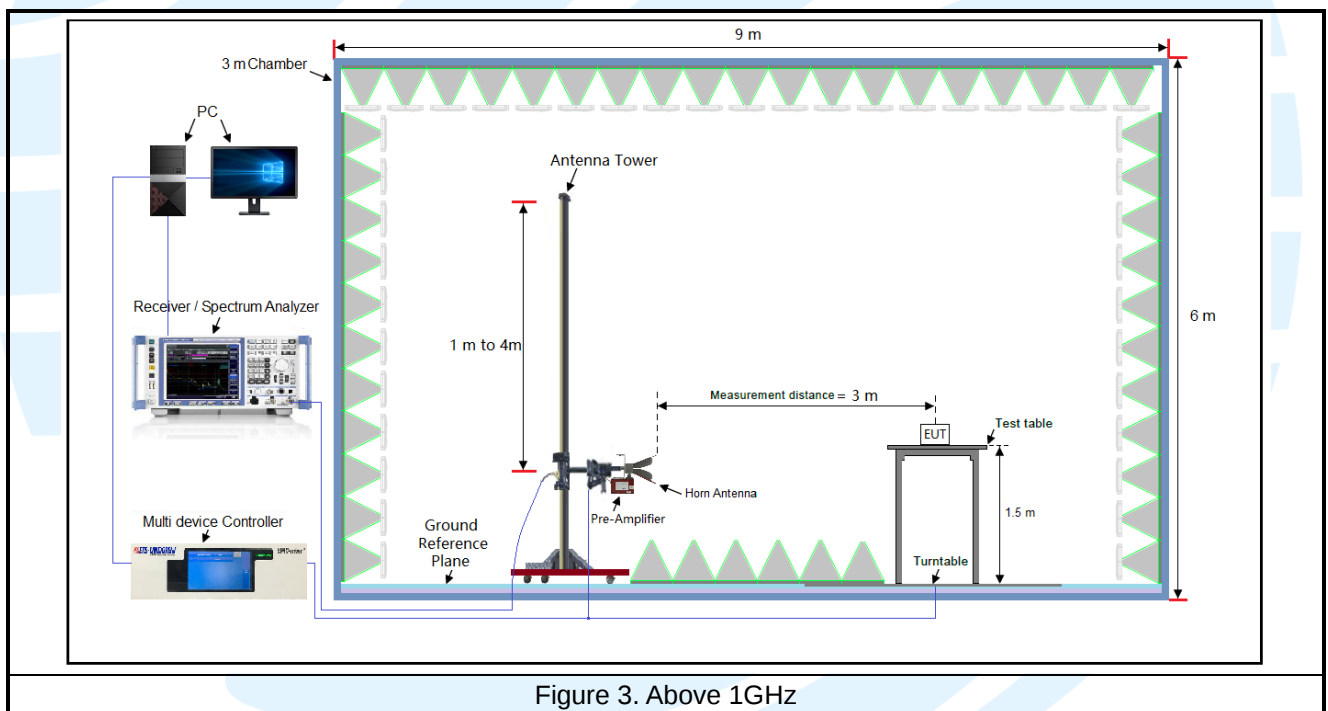
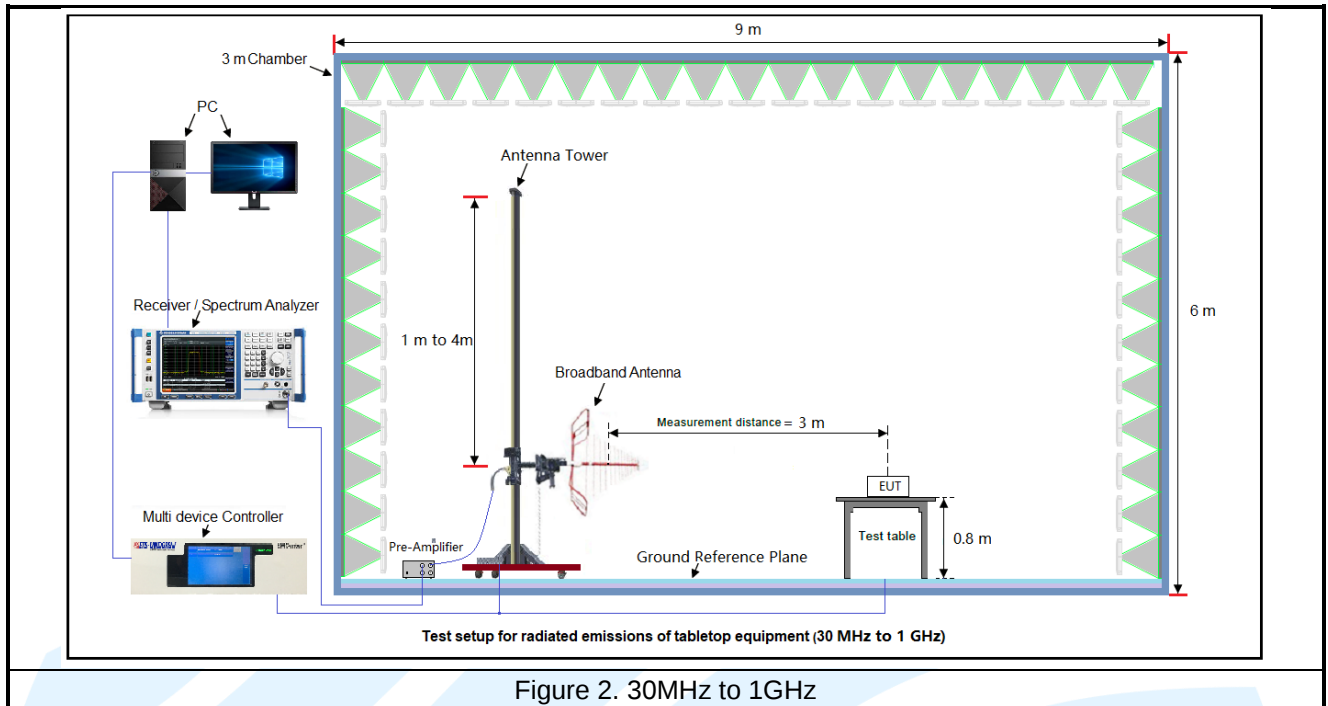
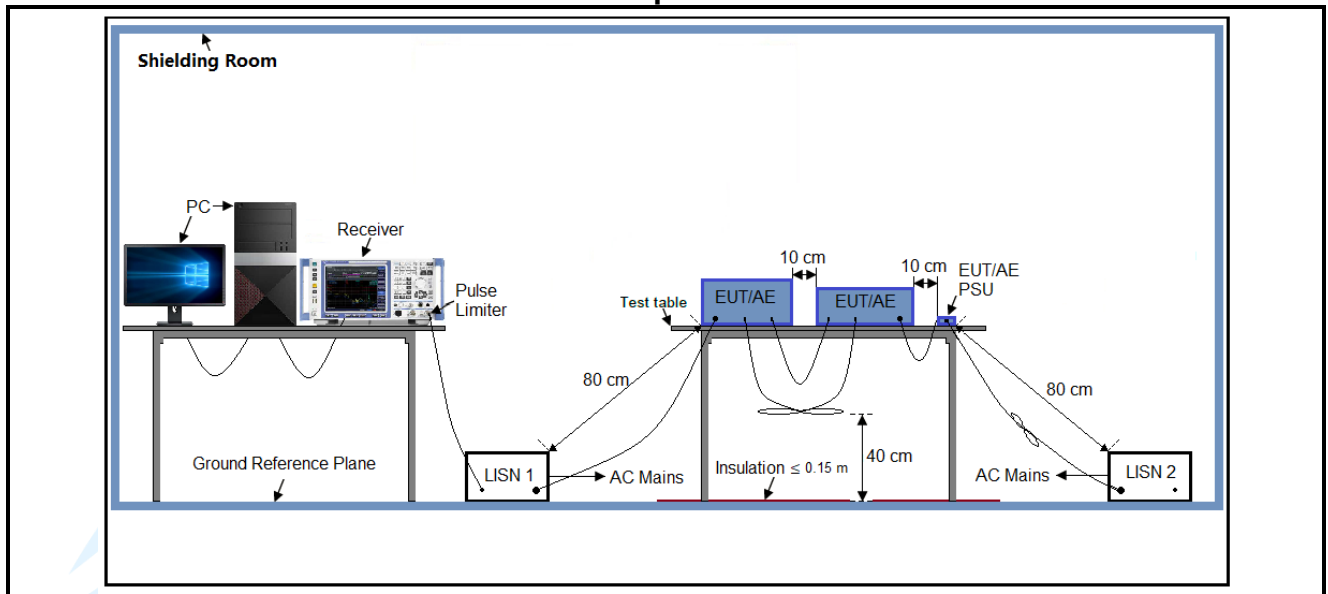


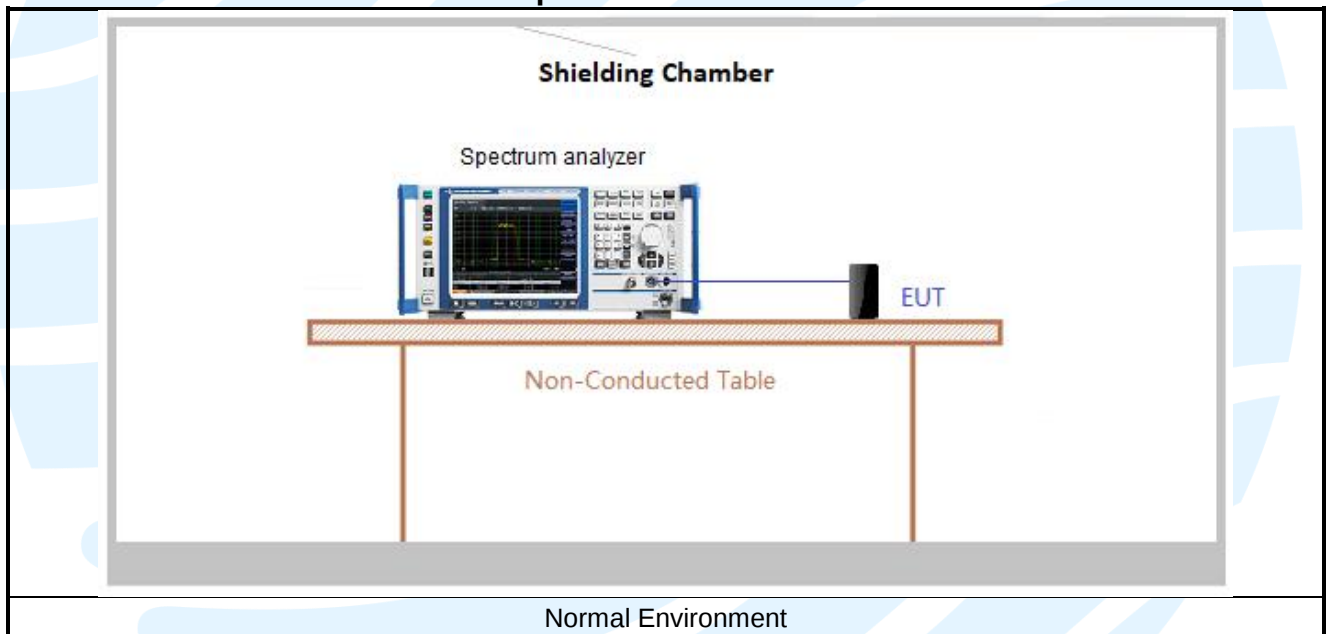
Figure 1. Below 30MHz



4.5.2 For Conducted Emissions test setup



4.5.3 For Conducted RF test setup



4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by 3.85V Battery. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in orientation.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.7 DUTY CYCLE

Test Procedure: ANSI C63.10-2013 Clause 12.2.

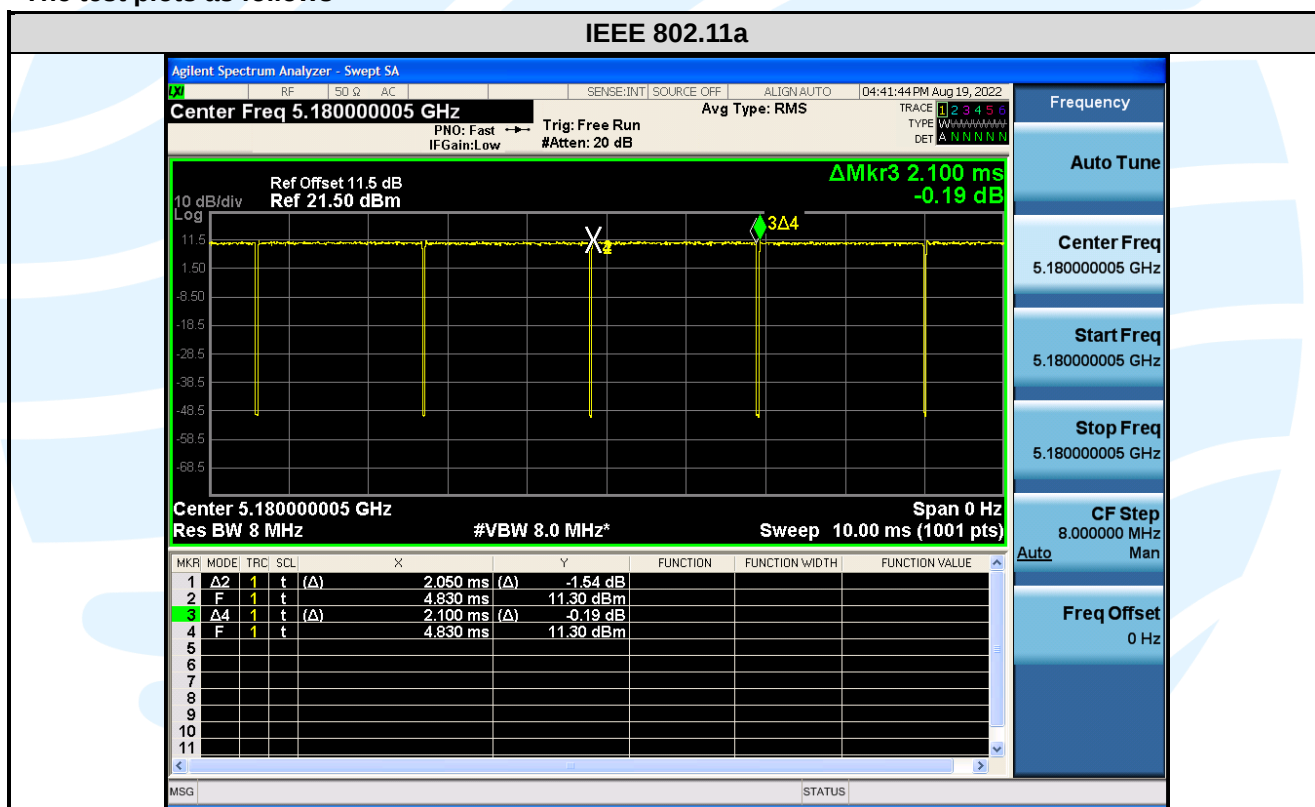
Test Results

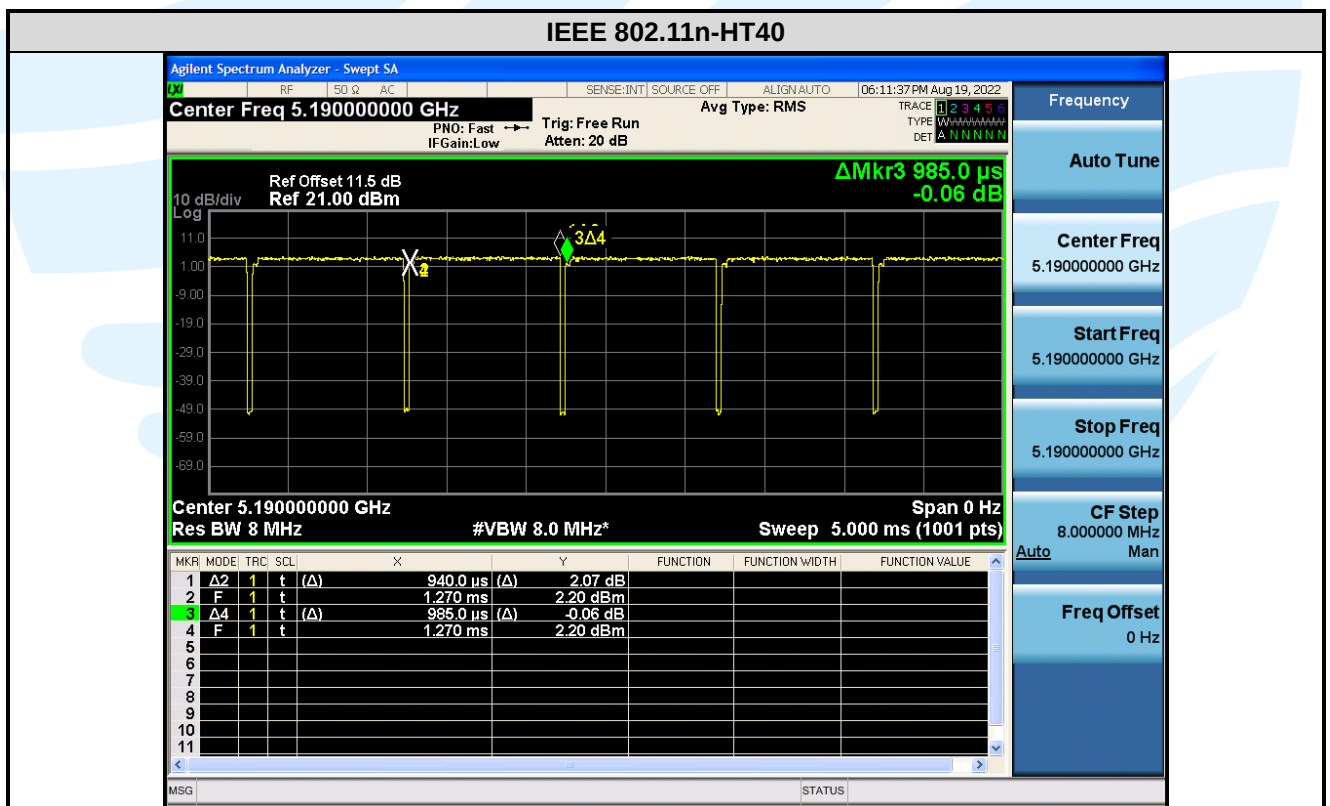
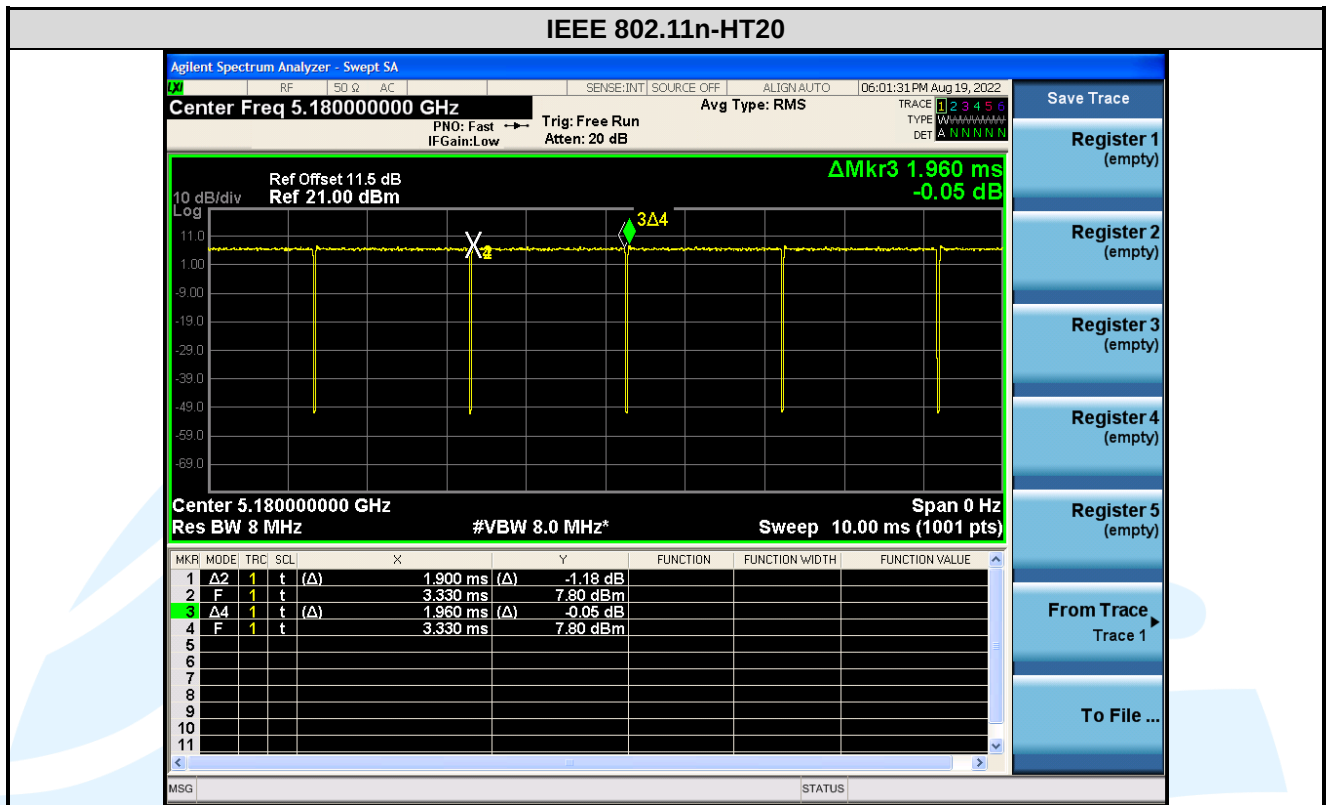
Mode	Data Rates	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/T Minimum VBW (kHz)
IEEE 802.11a	6 Mbps	2.050	2.100	0.98	97.62	0.10	0.49
IEEE 802.11n-HT20	MCS 0	1.900	1.960	0.97	96.94	0.14	0.53
IEEE 802.11n-HT40	MCS 0	0.940	0.985	0.95	95.43	0.20	1.06
IEEE 802.11ac-VHT20	MCS 0	1.920	1.970	0.97	97.46	0.11	0.52
IEEE 802.11ac-VHT40	MCS 0	0.940	0.985	0.95	95.43	0.20	1.06
IEEE 802.11ac-VHT80	MCS 0	0.462	0.501	0.92	92.22	0.35	2.16

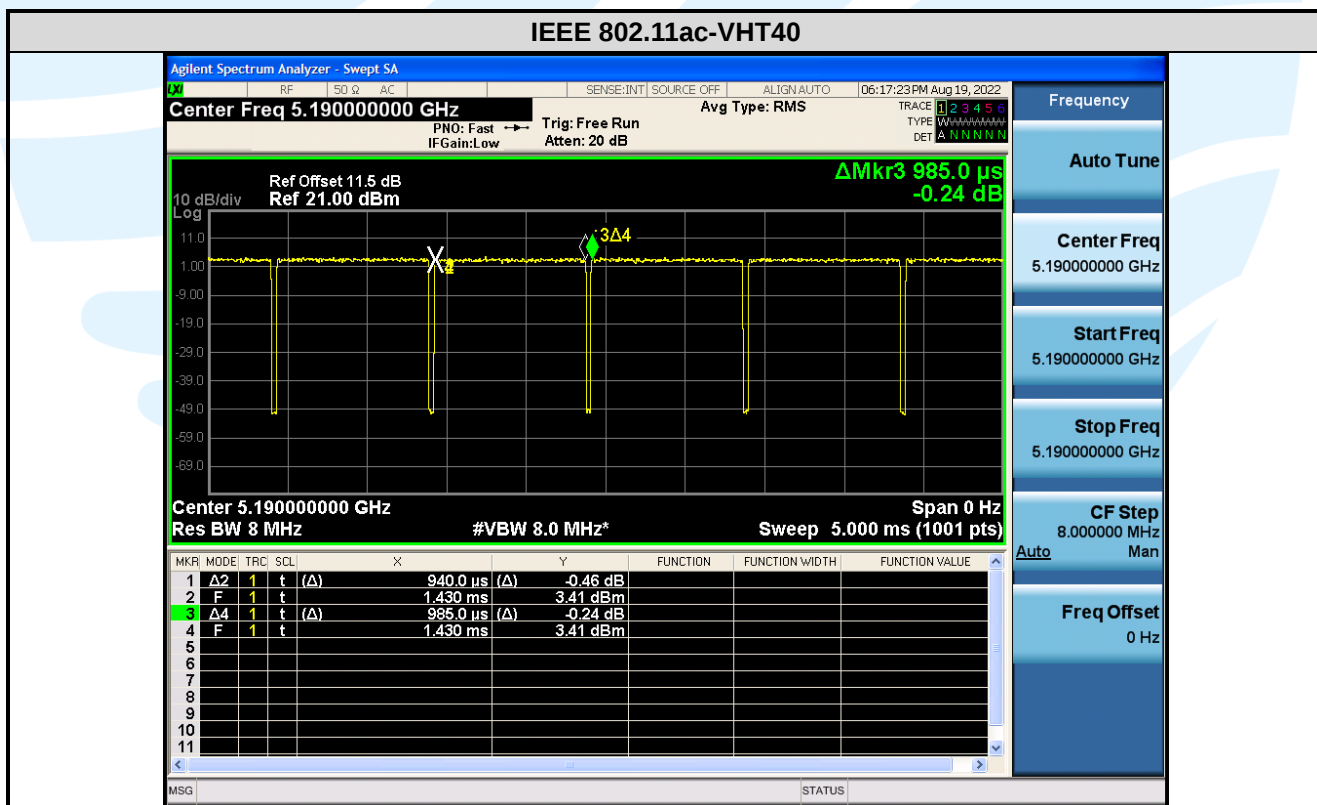
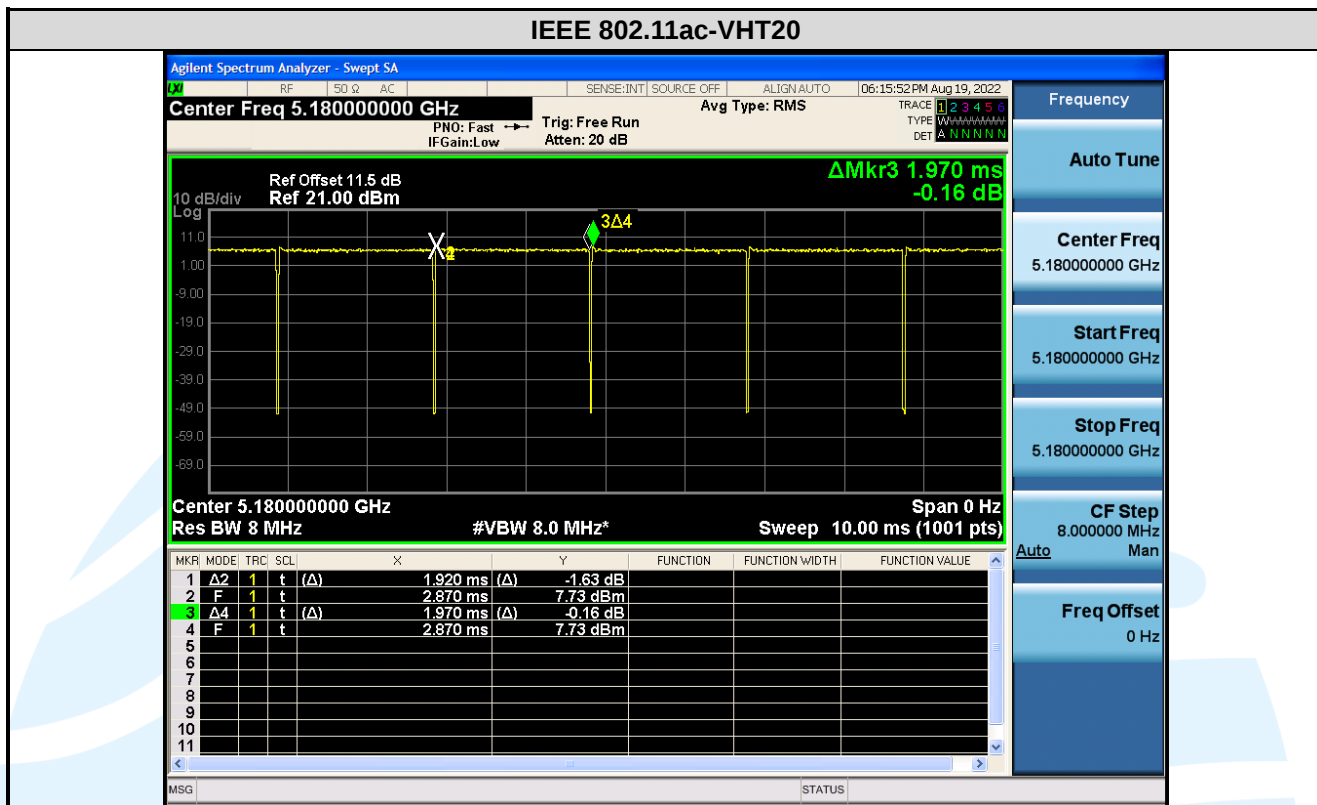
Remark:

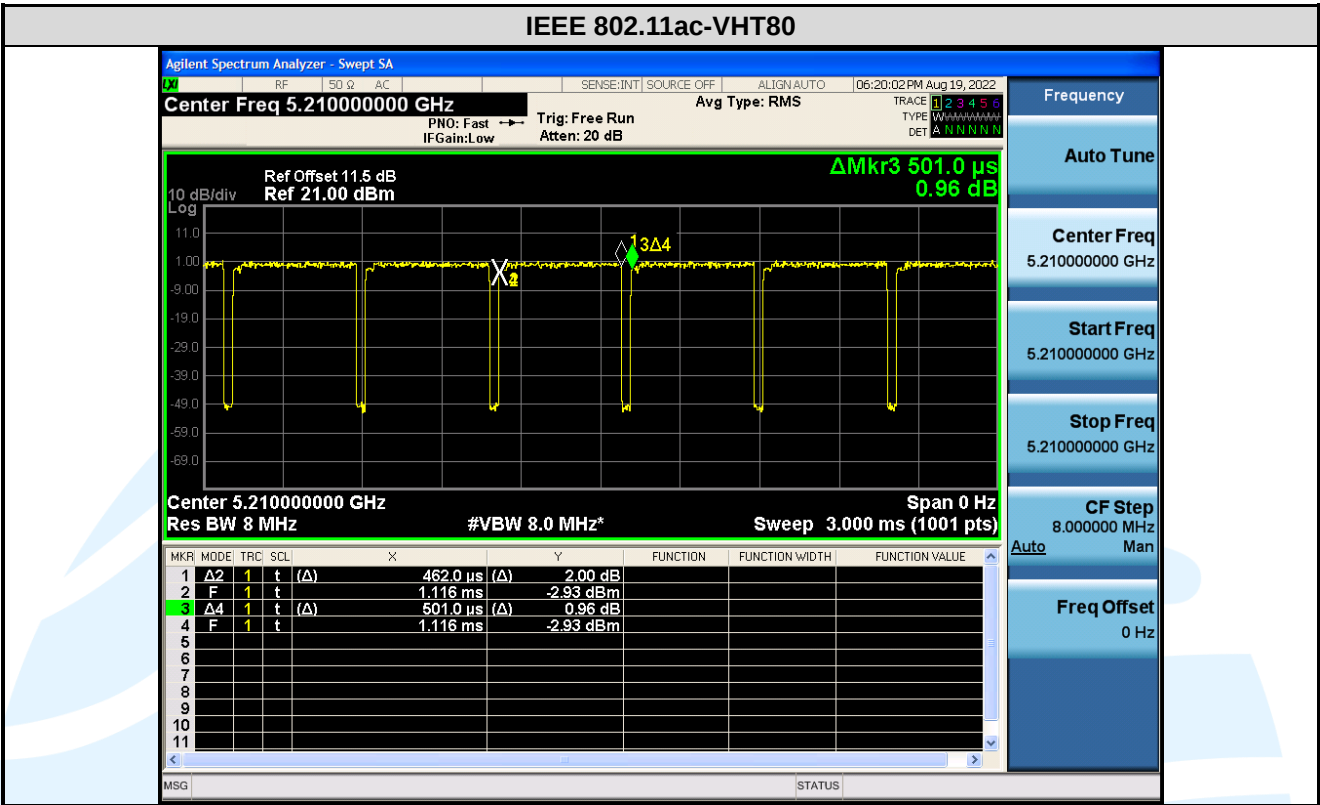
- 1) Duty cycle= On Time/ Period;
- 2) Duty Cycle factor = $10 * \log(1/ \text{Duty cycle})$

The test plots as follows









Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China
Tel: +86-755-28230888 Fax: +86-755-28230886 E-mail: info@uttlab.com <http://www.uttlab.com>
UTTR-RF-FCCPART15.407-V1.1

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
4	KDB 789033 D02 General UNII Test Procedures New Rules v02r01	Guidelines for compliance testing of unlicensed national information infrastructure (U-NII) device part 15, subpart E
5	KDB 905462 D06 802.11 Channel Plans New Rules v02	Operation in U-NII bands -802.11 channel PLAN(\$15.407)
6	KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02	Compliance measurement procedures for Unlicensed –National Information Infrastructure devices operates in the frequency bands 5250 MHz to 5350 MHz and 5470 MHz to 5725 MHz bands incorporating dynamic frequency selection
7	KDB 905462 D03 Client Without DFS New Rules v01r02	U-NII client devices without radar detection capability
8	KDB 662911 D01 Multiple Transmitter Output v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: 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, 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. 15.407(a)(1) (2) requirement: The conducted output power limit specified in paragraph (a) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (a) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power and the peak power spectral density shall be reduced by the by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
EUT Antenna: Both antenna in the interior of the equipment and no consideration of replacement. The transmit signals are correlated with each other and the antenna gain of both chains is completely consistent, the best case directional gain of the antenna is 1.83 dBi (See section 5.5).

5.326 DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart E Section 15.407 (a) (2)(5)

Test Method: KDB 789033 D02 v02r01 Section C.1

Limit: None; for reporting purposes only.

Test Procedure:

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum analyzer.

Spectrum analyzer according to the following Settings:

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

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

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

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

Test Results: Pass

Mode	Channel	26 dB Bandwidth (MHz)	
		Ant. 0	Ant. 1
IEEE 802.11a	36 (5180)	22.91	23.77
	44 (5220)	23.24	23.15
	48 (5240)	23.27	24.76
	52 (5260)	23.07	24.16
	60 (5300)	22.26	23.45
	64 (5320)	22.39	22.81
	100 (5500)	21.75	22.61
	120 (5600)	21.65	23.05
	140 (5700)	22.51	23.66
IEEE 802.11n-HT20	36 (5180)	21.49	23.22
	44 (5220)	21.31	22.99
	48 (5240)	21.99	22.11
	52 (5260)	22.82	22.16
	60 (5300)	23.34	22.73
	64 (5320)	21.94	23.00
	100 (5500)	21.51	23.31
	120 (5600)	21.72	23.28
	140 (5700)	22.00	22.80

Mode	Channel	26 dB Bandwidth (MHz)	
		Ant. 0	Ant. 1
IEEE 802.11n-HT40	38 (5190)	39.64	39.77
	46 (5230)	40.06	40.16
	54 (5270)	40.40	40.40
	62 (5310)	39.64	40.19
	102 (5510)	40.46	40.51
	118 (5590)	40.33	40.27
	134 (5670)	40.14	40.06
IEEE 802.11ac-VHT20	36 (5180)	22.40	23.52
	44 (5220)	22.34	22.91
	48 (5240)	21.95	23.26
	52 (5260)	22.77	23.42
	60 (5300)	22.59	22.56
	64 (5320)	22.48	23.10
	100 (5500)	21.85	22.06
	120 (5600)	22.65	23.43
	140 (5700)	22.62	22.27
IEEE 802.11ac-VHT40	38 (5190)	40.20	40.23
	46 (5230)	39.79	40.11
	54 (5270)	40.07	40.02
	62 (5310)	40.00	39.57
	102 (5510)	40.22	40.18
	118 (5590)	39.80	40.17
	134 (5670)	40.18	40.68
IEEE 802.11ac-VHT80	42 (5210)	81.69	81.50
	58 (5290)	80.93	81.30
	106 (5530)	81.70	81.76
	122 (5610)	81.55	81.48

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com
<http://www.uttlab.com>

UTTR-RF-FCCPART15.407-V1.1

IEEE 802.11a

Ant. 0

Ant. 1

Channel 36

Agilent Spectrum Analyzer - Occupied BW

Center Freq 5.180000000 GHz

Ref Offset 11.5 dB
Ref 30.00 dBm

10 dB/div
Log

Center 5.18 GHz
#Res BW 300 kHz
#VBW 910 kHz
Span 40 MHz
Sweep 1 ms

Occupied Bandwidth 16.530 MHz
Total Power 15.7 dBm
Transmit Freq Error 23.598 kHz
x dB Bandwidth 22.91 MHz

OBW Power 99.00 %
x dB -26.00 dB

Frequency
Center Freq 5.180000000 GHz
CF Step 4.000000 MHz
Auto
Man
Freq Offset 0 Hz

Agilent Spectrum Analyzer - Occupied BW

Center Freq 5.180000000 GHz

Ref Offset 11.5 dB
Ref 30.00 dBm

10 dB/div
Log

Center 5.18 GHz
#Res BW 300 kHz
#VBW 910 kHz
Span 40 MHz
Sweep 1 ms

Occupied Bandwidth 16.726 MHz
Total Power 21.0 dBm
Transmit Freq Error 43.404 kHz
x dB Bandwidth 23.77 MHz

OBW Power 99.00 %
x dB -26.00 dB

Frequency
Center Freq 5.180000000 GHz
CF Step 4.000000 MHz
Auto
Man
Freq Offset 0 Hz

Channel 44

Agilent Spectrum Analyzer - Occupied BW

Center Freq 5.220000000 GHz

Ref Offset 11.5 dB
Ref 30.00 dBm

10 dB/div
Log

Center 5.22 GHz
#Res BW 300 kHz
#VBW 910 kHz
Span 40 MHz
Sweep 1 ms

Occupied Bandwidth 16.584 MHz
Total Power 16.3 dBm
Transmit Freq Error 34.079 kHz
x dB Bandwidth 23.24 MHz

OBW Power 99.00 %
x dB -26.00 dB

Frequency
Center Freq 5.220000000 GHz
CF Step 4.000000 MHz
Auto
Man
Freq Offset 0 Hz

Agilent Spectrum Analyzer - Occupied BW

Center Freq 5.220000000 GHz

Ref Offset 11.5 dB
Ref 30.00 dBm

10 dB/div
Log

Center 5.22 GHz
#Res BW 300 kHz
#VBW 910 kHz
Span 40 MHz
Sweep 1 ms

Occupied Bandwidth 16.599 MHz
Total Power 19.2 dBm
Transmit Freq Error 42.859 kHz
x dB Bandwidth 23.15 MHz

OBW Power 99.00 %
x dB -26.00 dB

Frequency
Center Freq 5.220000000 GHz
CF Step 4.000000 MHz
Auto
Man
Freq Offset 0 Hz

Channel 48

Agilent Spectrum Analyzer - Occupied BW

Center Freq 5.240000000 GHz

Ref Offset 11.5 dB
Ref 30.00 dBm

10 dB/div
Log

Center 5.24 GHz
#Res BW 300 kHz
#VBW 910 kHz
Span 40 MHz
Sweep 1 ms

Occupied Bandwidth 16.564 MHz
Total Power 16.2 dBm
Transmit Freq Error 15.421 kHz
x dB Bandwidth 23.27 MHz

OBW Power 99.00 %
x dB -26.00 dB

Frequency
Center Freq 5.240000000 GHz
CF Step 4.000000 MHz
Auto
Man
Freq Offset 0 Hz

Agilent Spectrum Analyzer - Occupied BW

Center Freq 5.240000000 GHz

Ref Offset 11.5 dB
Ref 30.00 dBm

10 dB/div
Log

Center 5.24 GHz
#Res BW 300 kHz
#VBW 910 kHz
Span 40 MHz
Sweep 1 ms

Occupied Bandwidth 16.726 MHz
Total Power 19.8 dBm
Transmit Freq Error 37.374 kHz
x dB Bandwidth 24.76 MHz

OBW Power 99.00 %
x dB -26.00 dB

Frequency
Center Freq 5.240000000 GHz
CF Step 4.000000 MHz
Auto
Man
Freq Offset 0 Hz

