



Shenzhen Huaxia Testing Technology Co., Ltd

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

Telephone: +86-755-26648640

Fax: +86-755-26648637

Website: www.cqa-cert.com

Report Template Version: V04

Report Template Revision Date: 2018-07-06

FCC Test Report

Report No. : CQASZ20191001099E-01
Applicant: SHENZHEN HUBSAN TECHNOLOGY CO., LTD.
Address of Applicant: 13th Floor, Bldg 1C, Shenzhen Software Industry Base, Xuefu Road, Nanshan District, Shenzhen, China 518054
Equipment Under Test (EUT):
Product: Hubsan HT016P Transmitter
Model No.: HT016P
Brand Name: Hubsan
FCC ID: 2AN75-HT016PTX
Standards: 47 CFR Part 15, Subpart E
KDB 789033 D02 General UNII Test Procedures New Rules v02
KDB 558074 D01 Meas Guidance v05
Date of Receipt: 2019-11-01
Date of Test: 2019-11-01 to 2019-11-25
Date of Issue: 2019-11-25
Test Result : PASS*

*In the configuration tested, the EUT complied with the standards specified above

Tested By:

Tom Chen

(Tom chen)

Reviewed By:

Aaron Ma

(Aaron Ma)

Approved By:

Jack Ai

(Jack Ai)



1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20191001099E-01	Rev.01	Initial report	2019-11-25

2 Test Summary

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)	ANSI C63.10-2013	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	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	N/A
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
Frequency stability	FCC 47 CFR Part 15 Subpart E Section 15.407 (g)	ANSI C63.10-2013	PASS
Radiated Emissions and Band Edge Measurement	FCC 47 CFR Part 15 Subpart E Section 15.407 (b)(1)(2)(3)(5)(6)(7)(8) FCC 47 CFR Part 15 Subpart C Section 15.209/205	ANSI C63.10-2013	PASS
Dynamic Frequency Selection	FCC 47 CFR Part 15 Subpart E Section 15.407 (h)	KDB 905462 D03 Client Without DFS New Rules v01r02	N/A
Operation in the absence of information to the transmit	47 CFR Part 15 Subpart E Section 15.407 (c)	47 CFR Part 15 Subpart E	PASS

Note: N/A: In this whole report not application.

3 Contents

	Page
1 VERSION.....	2
2 TEST SUMMARY.....	3
3 CONTENTS.....	4
4 GENERAL INFORMATION.....	5
4.1 CLIENT INFORMATION.....	5
4.2 GENERAL DESCRIPTION OF EUT.....	5
4.3 TEST ENVIRONMENT AND MODE.....	7
4.4 DESCRIPTION OF SUPPORT UNITS.....	12
4.5 TEST LOCATION.....	12
4.6 TEST FACILITY.....	12
4.7 STATEMENT OF THE MEASUREMENT UNCERTAINTY.....	13
4.8 DEVIATION FROM STANDARDS.....	13
4.9 ABNORMALITIES FROM STANDARD CONDITIONS.....	13
4.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER.....	13
4.11 EQUIPMENT LIST.....	14
5 TEST RESULTS AND MEASUREMENT DATA.....	15
5.1 ANTENNA REQUIREMENT.....	15
5.2 CONDUCTED EMISSIONS.....	16
5.3 CONDUCTED AVERAGE OUTPUT POWER.....	20
5.4 6dB BANDWIDTH.....	22
5.5 POWER SPECTRAL DENSITY.....	27
5.6 FREQUENCY STABILITY.....	32
5.7 RADIATED SPURIOUS EMISSIONS.....	34
5.7.1 Radiated emission below 1GHz.....	37
5.7.2 Transmitter emission above 1GHz.....	39
5.8 RESTRICTED BANDS AROUND FUNDAMENTAL FREQUENCY.....	41
5.9 OPERATION IN THE ABSENCE OF INFORMATION TO THE TRANSMIT.....	45
6 PHOTOGRAPHS - EUT TEST SETUP.....	46
6.1 RADIATED SPURIOUS EMISSION.....	46
6.2 CONDUCTED EMISSION.....	47
7 PHOTOGRAPHS - EUT CONSTRUCTIONAL DETAILS.....	48

General Information

4.1 Client Information

Applicant:	SHENZHEN HUBSAN TECHNOLOGY CO., LTD.
Address of Applicant:	13th Floor, Bldg 1C, Shenzhen Software Industry Base, Xuefu Road, Nanshan District, Shenzhen, China 518054
Manufacturer:	SHENZHEN HUBSAN TECHNOLOGY CO., LTD.
Address of Manufacturer:	13th Floor, Bldg 1C, Shenzhen Software Industry Base, Xuefu Road, Nanshan District, Shenzhen, China 518054

4.2 General Description of EUT

Product Name:	Hubsan HT016P Transmitter
Model No.:	HT016P
Trade Mark:	Hubsan
Hardware version:	V1.0
Software version:	V1.0
Operation Frequency:	5725 ~ 5850 MHz
Channel Numbers:	5725 ~ 5850 MHz: 5 for 802.11a
Type of Modulation:	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK)
Channel Spacing:	IEEE 802.11a: 20 MHz
Sample Type:	☐ Mobile ☒ Portable ☐ Fix Location
Test Software of EUT:	Atheros Radio test 2(manufacturer declare)
Antenna Type:	Integral antenna
Antenna Gain:	ANT1: 3.0dBi ANT2: 3.0dBi
Power Supply:	Battery: 3.6V 2600 mAh Li-Po

Operation Frequency Each of Channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
For IEEE 802.11a/n-HT20 operation in the 5725 MHz to 5850 MHz band							
149	5745 MHz	153	5765 MHz	157	5785 MHz	161	5805 MHz
165	5825 MHz	--	--	--	--	--	--

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11a	5725 MHz to 5850 MHz	Channel 149	Channel 157	Channel 165
		5745 MHz	5785 MHz	5825 MHz

Note:

Software (RF test) provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.3 Test Environment and Mode

Operating Environment:		
Radiated Emissions:		
Temperature:	25.8 °C	
Humidity:	45 % RH	
Atmospheric Pressure:	1005 mbar	
Conducted Emissions:		
Temperature:	26.5 °C	
Humidity:	42 % RH	
Atmospheric Pressure:	1005 mbar	
Radio conducted item test (RF Conducted test room):		
Humidity:	42 % RH	
Atmospheric Pressure:	1005 mbar	
Test Condition	Temperature (°C)	Voltage (V)
TN/VN	+15 to +35	3.6
TL/VL	-20	3.4
TH/VL	50	3.4
TL/VH	-20	4.2
TH/VH	50	4.2

Remark:

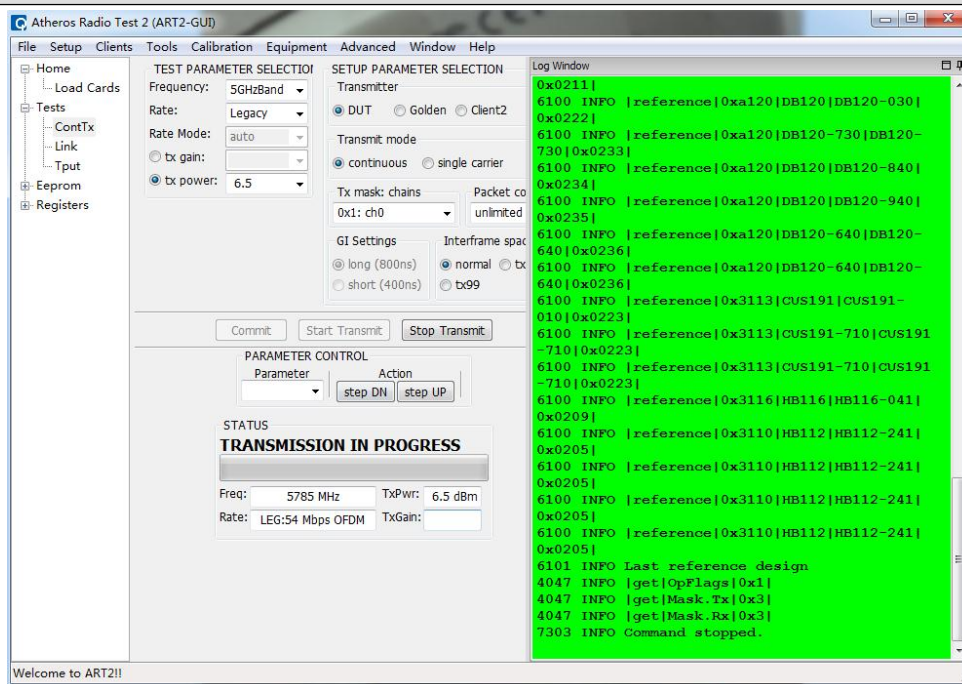
1)The EUT just work in such extreme temperature of -20 °C to 50 °C and the extreme voltage of 3.4 V to 4.2 V, so here the EUT is tested in the temperature of -20 °C to 50 °C and the voltage of 3.4 V to 4.2 V.

2VN: Normal Voltage; TN: Normal Temperature;

TL: Low Extreme Test Temperature; TH: High Extreme Test Temperature;

VL: Low Extreme Test Voltage; VH: High Extreme Test Voltage.

Run Software:



Operated Mode for Worst Duty Cycle:

Test Signal Duty Cycle(x)	Duty Cycle(x)	Average correction factor(dB)
IEEE802.11a_ANT1_5745MHz	78.03	1.08
IEEE802.11a_ANT1_5785MHz	78.03	1.08
IEEE802.11a_ANT1_5825MHz	78.61	1.05
IEEE802.11a_ANT2_5745MHz	78.61	1.05
IEEE802.11a_ANT2_5785MHz	78.03	1.08
IEEE802.11a_ANT2_5825MHz	78.03	1.08

Remark:

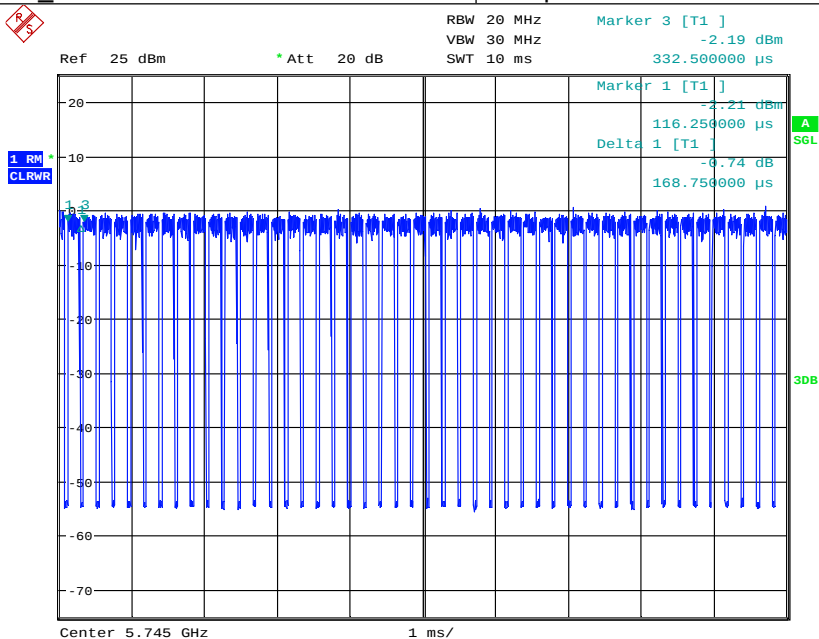
- 1) Duty cycle= On Time/ Period;
- 2) Duty Cycle factor = $10 * \log(1/ \text{Duty cycle})$;

Test plot as follows:

Test Case: Duty Cycle

Mode: 11a_ANT1_5745MHz

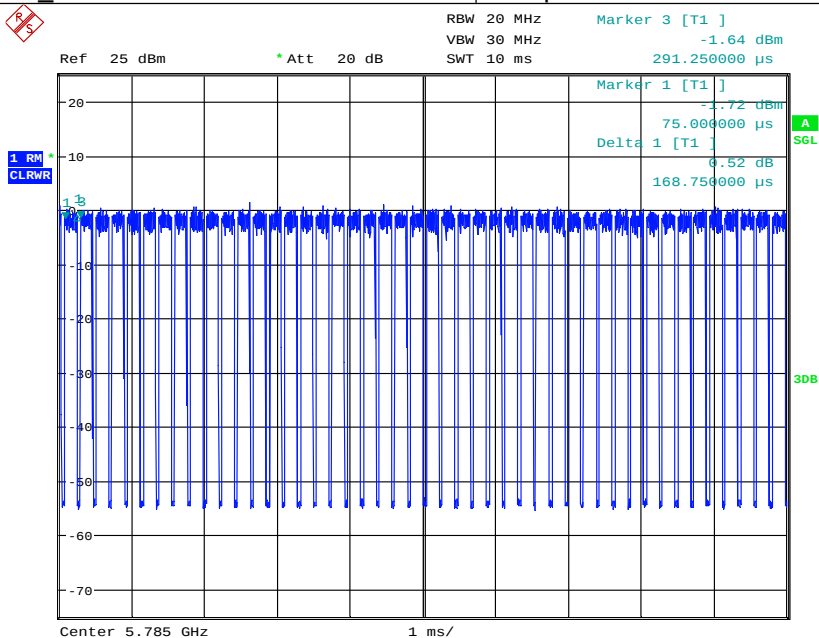
Temperature: TN



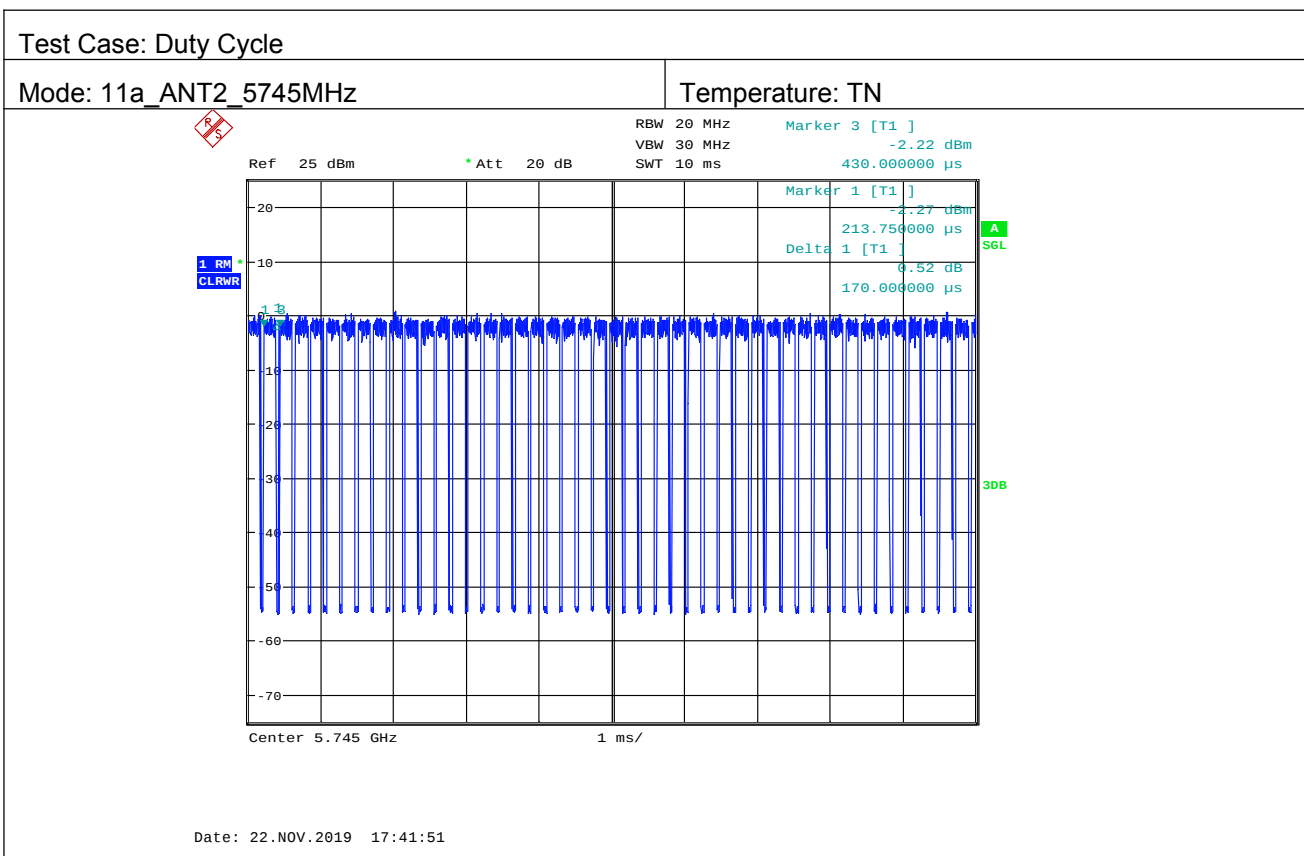
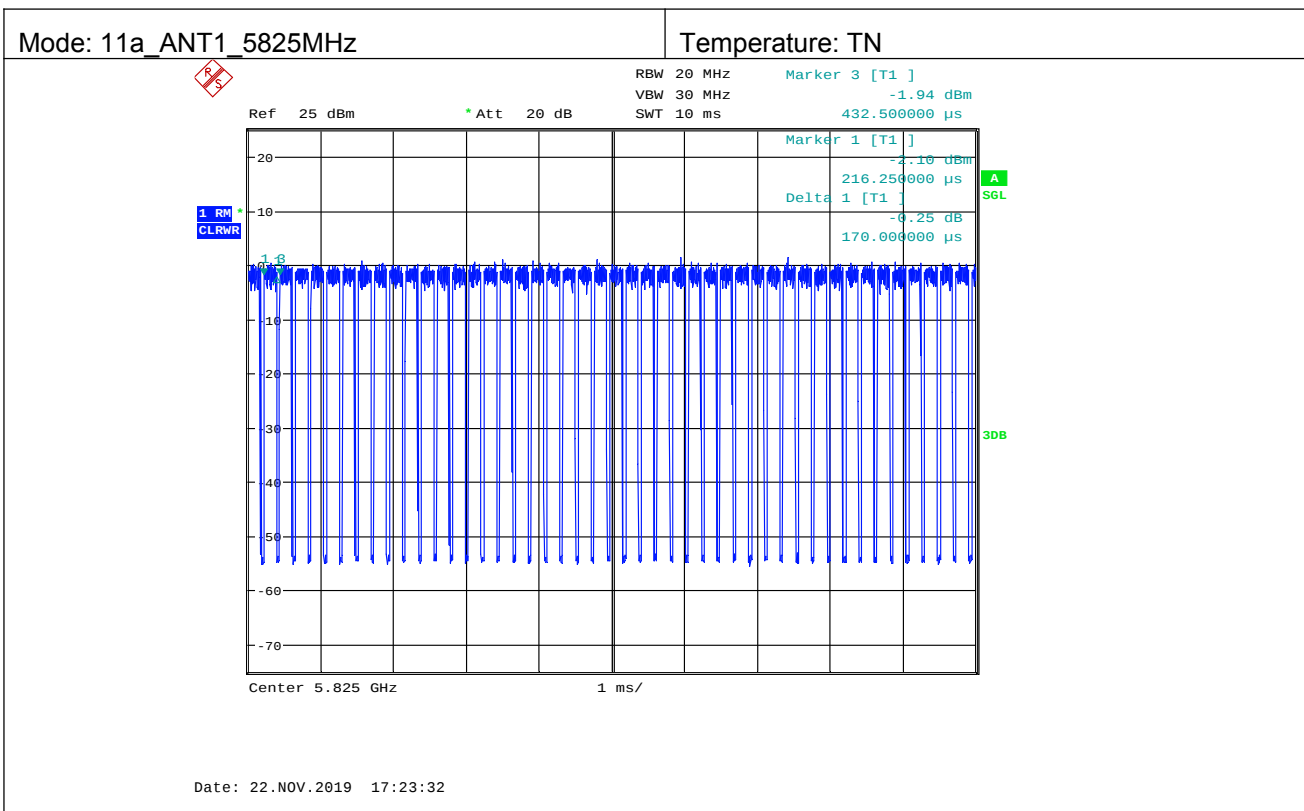
Date: 22.NOV.2019 17:14:27

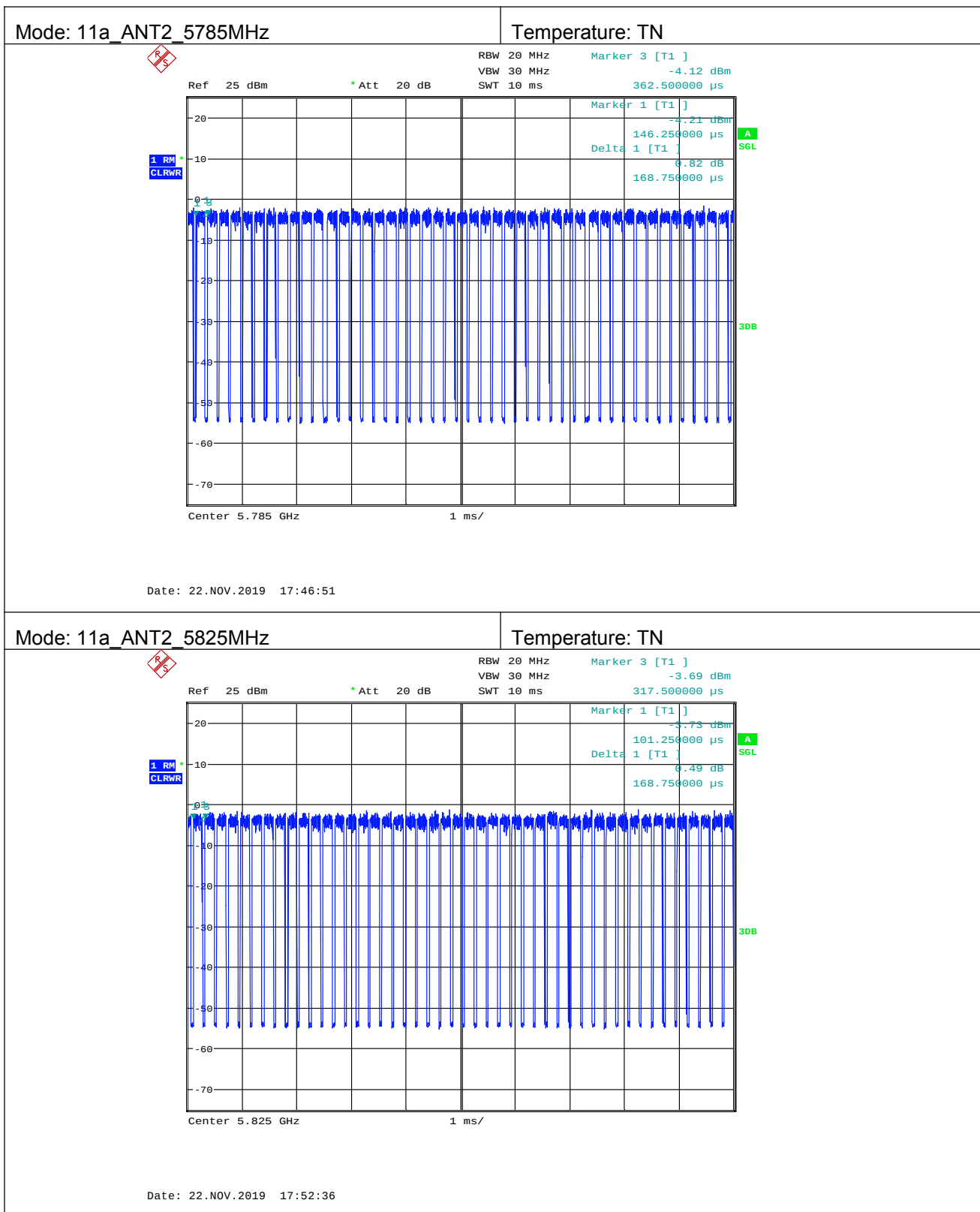
Mode: 11a_ANT1_5785MHz

Temperature: TN



Date: 22.NOV.2019 17:19:17





4.4 Description of Support Units

The EUT has been tested with associated equipment below.

1) Support equipment

Description	Manufacturer	Model No.	Remark	FCC certification
PC	Lenovo	ThinkPad E450c	FCC ID and DOC	CQA

2) Cable

Cable No.	Description	Manufacturer	Cable Type/Length	Supplied by
/	/	/	/	/

4.5 Test Location

Shenzhen Huaxia Testing Technology Co., Ltd.,

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua New District, Shenzhen, Guangdong, China

4.6 Test Facility

• A2LA (Certificate No. 4742.01)

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.

• FCC Registration No.: 522263

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.:522263

4.7 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 CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the **Shenzhen Huaxia 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 CQA laboratory is reported:

Test	Range	Uncertainty	Notes
Radiated Emission	Below 1GHz	5.12dB	(1)
Radiated Emission	Above 1GHz	4.60dB	(1)
Conducted Disturbance	0.15~30MHz	3.74dB	(1)

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

4.8 Deviation from Standards

None.

4.9 Abnormalities from Standard Conditions

None.

4.10 Other Information Requested by the Customer

None.

4.11 Equipment List

Test Equipment	Manufacturer	Model No.	Instrument No.	Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESR7	CQA-005	2019/10/25	2020/10/24
Spectrum analyzer	R&S	FSU26	CQA-038	2019/10/25	2020/10/24
Preamplifier	MITEQ	AMF-6D-02001800-29-20P	CQA-036	2019/10/25	2020/10/24
Loop antenna	Schwarzbeck	FMZB1516	CQA-060	2019/10/21	2020/10/20
Bilog Antenna	R&S	HL562	CQA-011	2019/9/26	2020/9/25
Horn Antenna	R&S	HF906	CQA-012	2019/9/26	2020/9/25
Horn Antenna	Schwarzbeck	BBHA 9170	CQA-088	2019/9/25	2020/9/24
Coaxial Cable (Above 1GHz)	CQA	N/A	C007	2019/9/26	2020/9/25
Coaxial Cable (Below 1GHz)	CQA	N/A	C013	2019/9/26	2020/9/25
Antenna Connector	CQA	RFC-01	CQA-080	2019/9/26	2020/9/25
Power Sensor	KEYSIGHT	U2021XA	CQA-30	2019/9/26	2020/9/25
N1918A Power Analysis Manager Power Panel	Agilent	N1918A	CQA-074	2019/9/26	2020/9/25
Power divider	MIDWEST	PWD-2533-02-SMA-79	CQA-067	2019/9/26	2020/9/25
EMI Test Receiver	R&S	ESR7	CQA-005	2019/10/25	2020/10/24
LISN	R&S	ENV216	CQA-003	2019/10/23	2020/10/22
Coaxial cable	CQA	N/A	CQA-C009	2019/9/26	2020/9/25
high-low temperature chamber	Auchno	OJN-9606	CQA-S003	2019/9/25	2020/9/24
DC power	KEYSIGHT	E3631A	CQA-028	2019/9/26	2020/9/25

Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

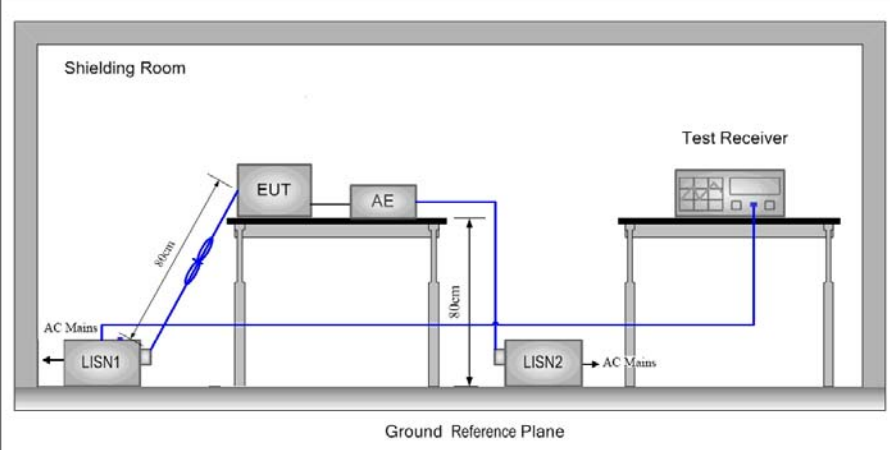
5 Test results and Measurement Data

5.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /407
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 (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
EUT Antenna:	
The antenna is internal antenna with ipex connector. The best case gain of the antenna is 3.0dBi. Note: These tow antennas does not transmit simultaneously.	

5.2 Conducted Emissions

Test Requirement:	47 CFR Part 15 Subpart C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	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 Procedure:	1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.		

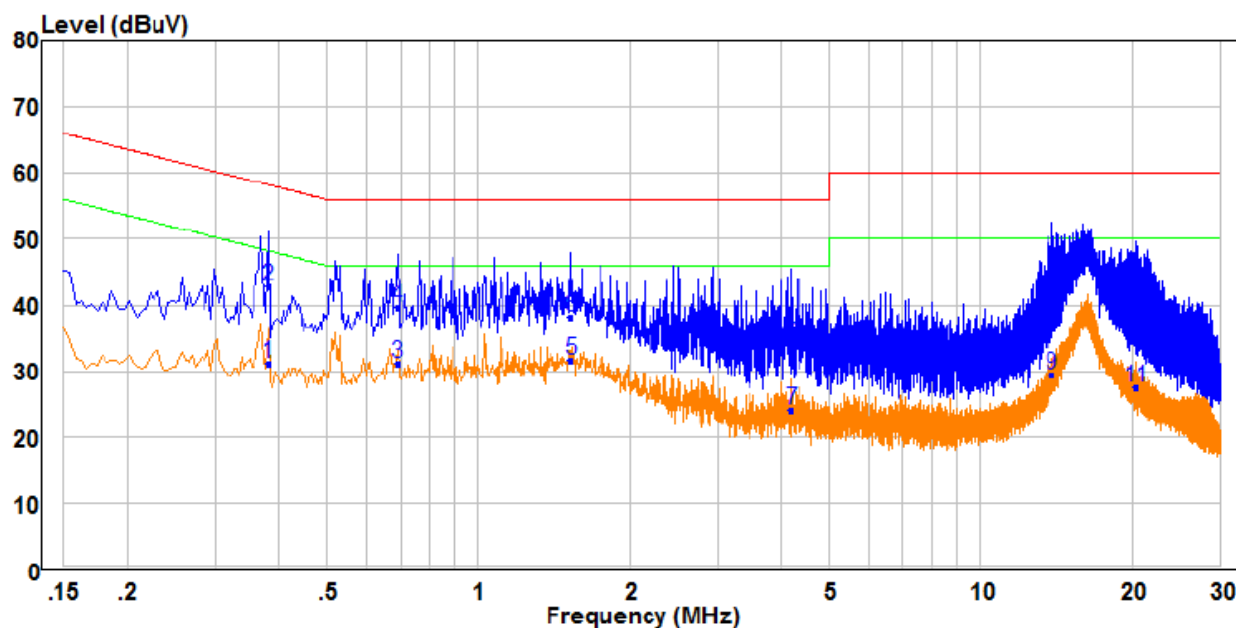
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel.
Final Test Mode:	Through Pre-scan, find the 6Mbps of rate of 802.11a_ANT1 at 149 channel is the worst case. Only the worst case is recorded in the report.
Test Voltage:	AC120V/60Hz
Test Results:	Pass

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

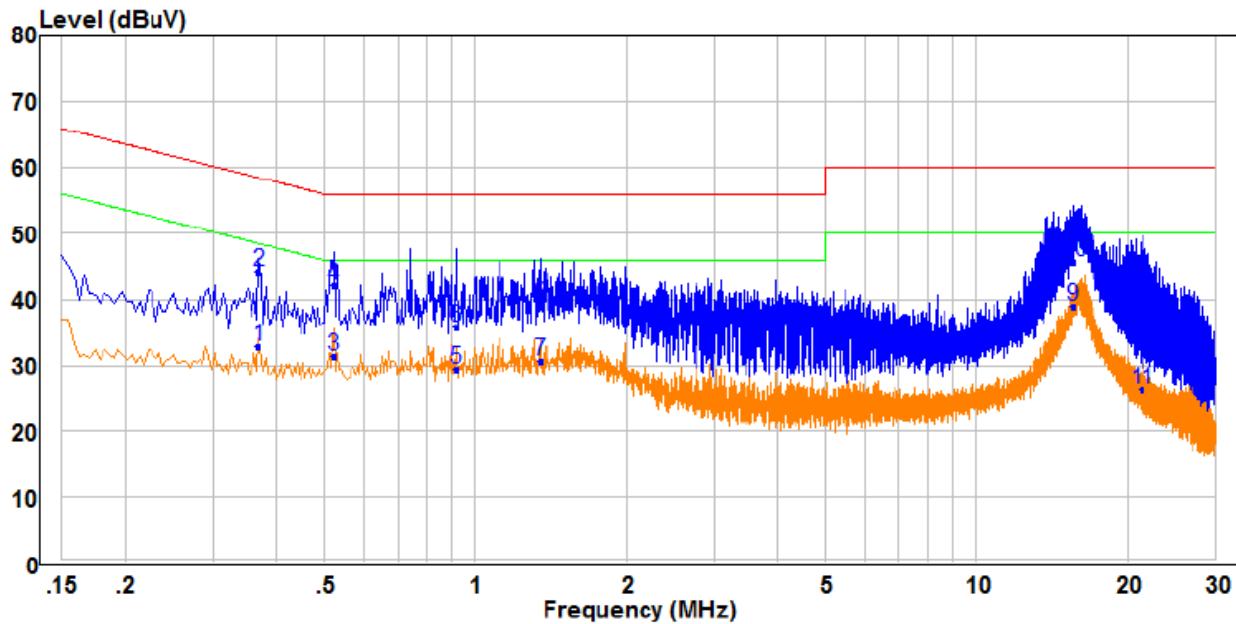
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live Line:



	Freq	Read	Factor	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.382	21.75	9.50	31.25	48.24	-16.99	Average	Line
2 QP	0.382	33.43	9.50	42.93	58.24	-15.31	QP	Line
3	0.690	21.20	9.85	31.05	46.00	-14.95	Average	Line
4	0.690	29.80	9.85	39.65	56.00	-16.35	QP	Line
5 PP	1.530	22.02	9.53	31.55	46.00	-14.45	Average	Line
6	1.530	28.64	9.53	38.17	56.00	-17.83	QP	Line
7	4.202	14.42	9.69	24.11	46.00	-21.89	Average	Line
8	4.202	24.29	9.69	33.98	56.00	-22.02	QP	Line
9	13.889	19.59	9.88	29.47	50.00	-20.53	Average	Line
10	13.889	30.72	9.88	40.60	60.00	-19.40	QP	Line
11	20.301	17.33	10.09	27.42	50.00	-22.58	Average	Line
12	20.301	28.52	10.09	38.61	60.00	-21.39	QP	Line

Neutral Line:

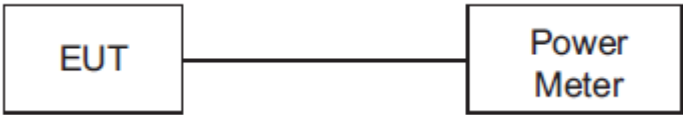


	Freq	Read	Factor	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.370	23.31	9.53	32.84	48.50	-15.66	Average	Neutral
2	0.370	34.68	9.53	44.21	58.50	-14.29	QP	Neutral
3	0.522	21.85	9.62	31.47	46.00	-14.53	Average	Neutral
4 QP	0.522	32.34	9.62	41.96	56.00	-14.04	QP	Neutral
5	0.918	19.65	9.75	29.40	46.00	-16.60	Average	Neutral
6	0.918	26.04	9.75	35.79	56.00	-20.21	QP	Neutral
7	1.346	20.92	9.72	30.64	46.00	-15.36	Average	Neutral
8	1.346	29.52	9.72	39.24	56.00	-16.76	QP	Neutral
9 PP	15.577	29.03	9.93	38.96	50.00	-11.04	Average	Neutral
10	15.577	35.84	9.93	45.77	60.00	-14.23	QP	Neutral
11	21.437	16.15	10.06	26.21	50.00	-23.79	Average	Neutral
12	21.437	28.31	10.06	38.37	60.00	-21.63	QP	Neutral

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

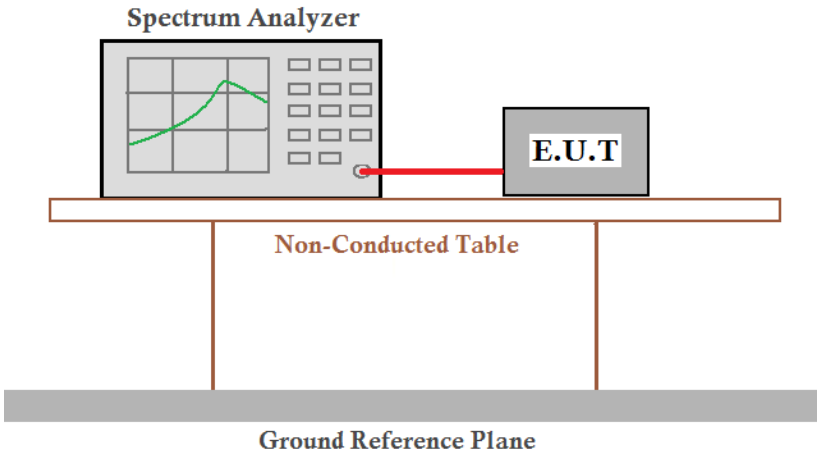
5.3 Conducted Average Output Power

Test Requirement:	47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)	
Test Method:	KDB 789033 D02 v02r01 Section E	
Test Setup:		
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates	
Final Test Mode:	Through Pre-scan, find the 6Mbps of rate is the worst case of 802.11a. Only the worst case is recorded in the report.	
Limit:	U-NII-1	24dBm
	U-NII-2A	24dBm
	U-NII-2C	24dBm
	U-NII-3	30dBm
Test Results:	Pass	

Measurement Data

Test Mode	Test Channel	Ant	Level [dBm]	10log(1/x) Factor [dB]	Power [dBm]	Limit [dBm]	Verdict
11A	5745	Ant1	6.26	1.08	7.34	30.00	PASS
11A	5785	Ant1	6.08	1.08	7.16	30.00	PASS
11A	5825	Ant1	6.18	1.05	7.23	30.00	PASS
11A	5745	Ant2	6.21	1.05	7.26	30.00	PASS
11A	5785	Ant2	6.03	1.08	7.11	30.00	PASS
11A	5825	Ant2	5.98	1.08	7.06	30.00	PASS

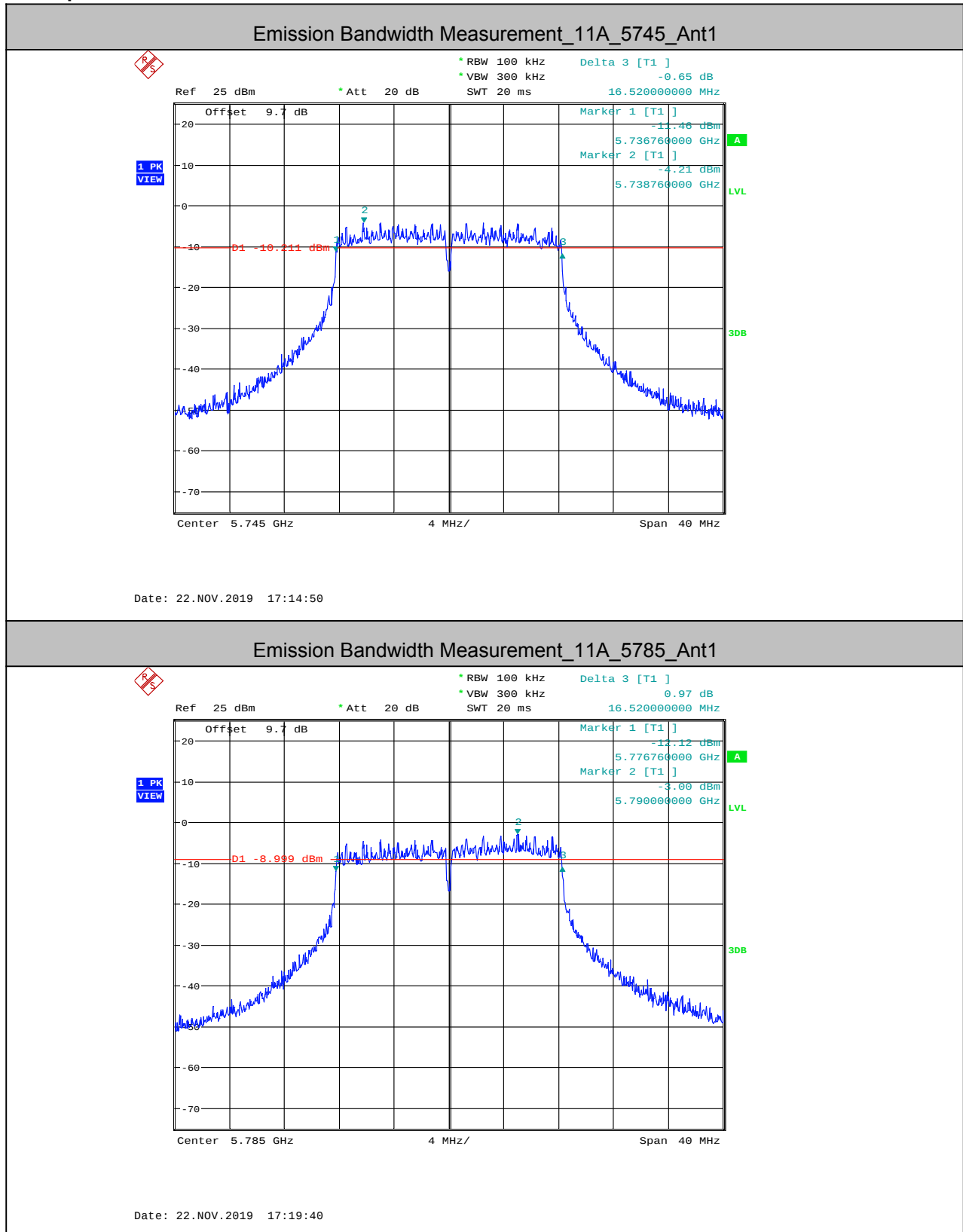
5.4 6dB Bandwidth

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.407 (e)
Test Method:	KDB 789033 D02 v02r01 Section C.2
Test Setup:	 The diagram illustrates the test setup. A Spectrum Analyzer, shown with a grid and a green signal trace, is connected to an E.U.T (Equipment Under Test) box by a red cable. Both the Spectrum Analyzer and the E.U.T are resting on a table labeled 'Non-Conducted Table'. Below this table is a thick grey bar representing the 'Ground Reference Plane'.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 6Mbps of rate is the worst case of 802.11a.
Limit:	≥ 500 kHz
Test Results:	Pass

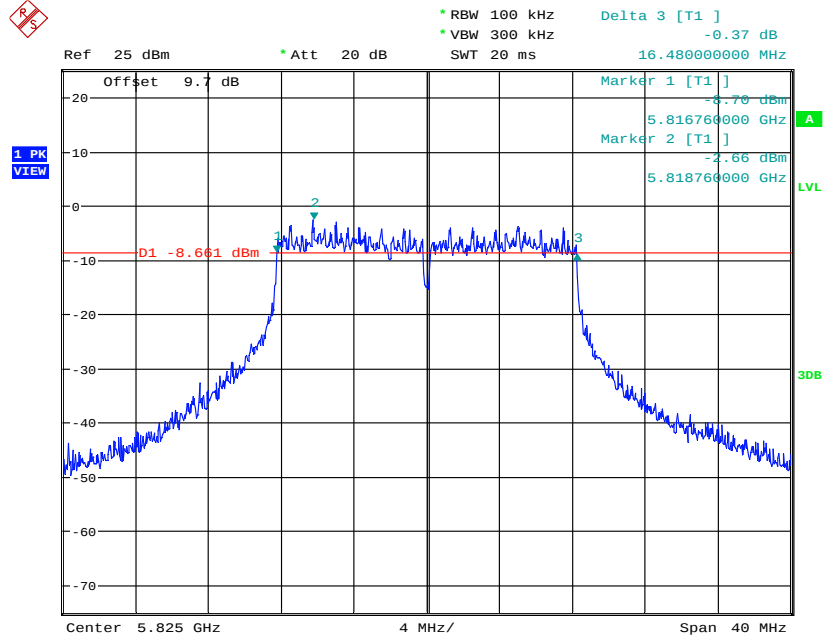
Measurement Data

Test Mode	Test Channel	Ant	EBW[MHz]	Limit[MHz]	Verdict
11A	5745	Ant1	16.520	0.5	PASS
11A	5785	Ant1	16.520	0.5	PASS
11A	5825	Ant1	16.480	0.5	PASS
11A	5745	Ant2	16.480	0.5	PASS
11A	5785	Ant2	16.440	0.5	PASS
11A	5825	Ant2	16.520	0.5	PASS

Test plot as follows:

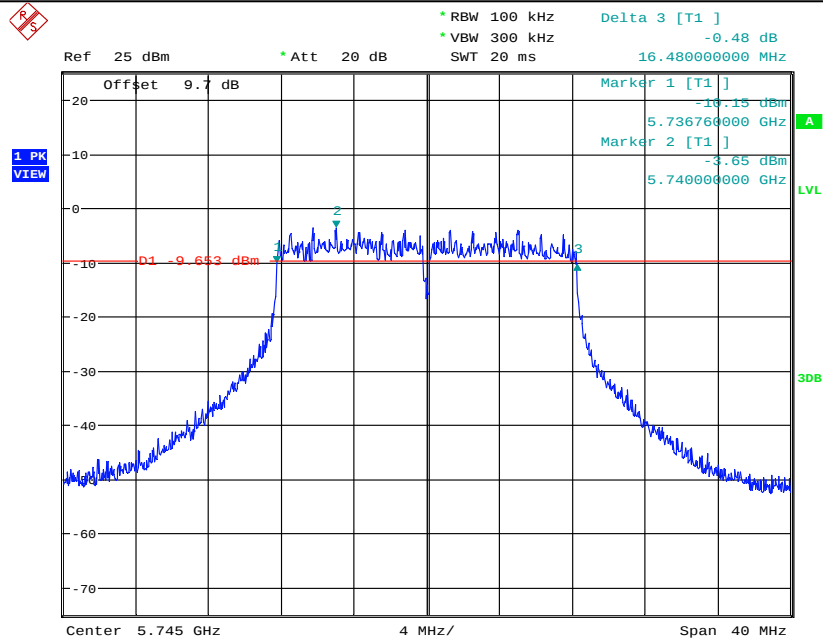


Emission Bandwidth Measurement_11A_5825_Ant1



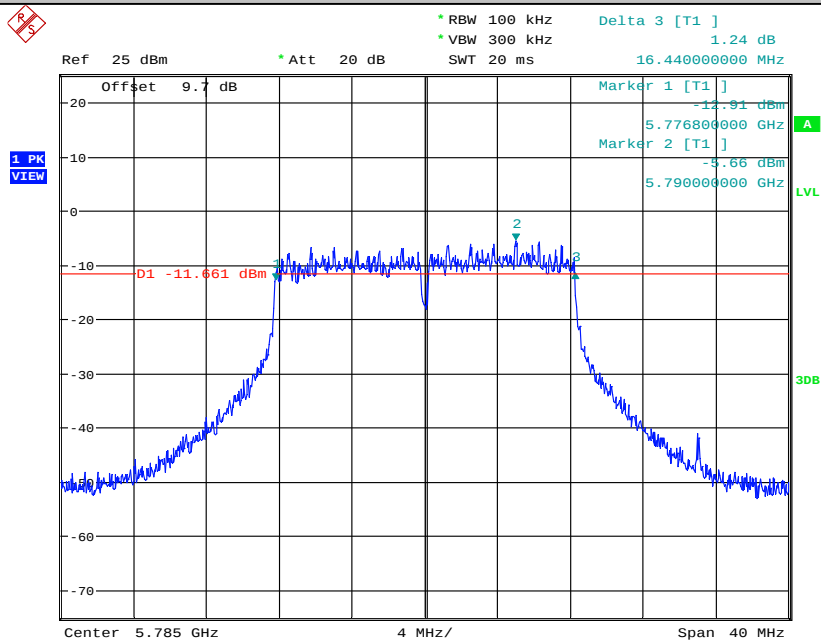
Date: 22.NOV.2019 17:23:54

Emission Bandwidth Measurement_11A_5745_Ant2



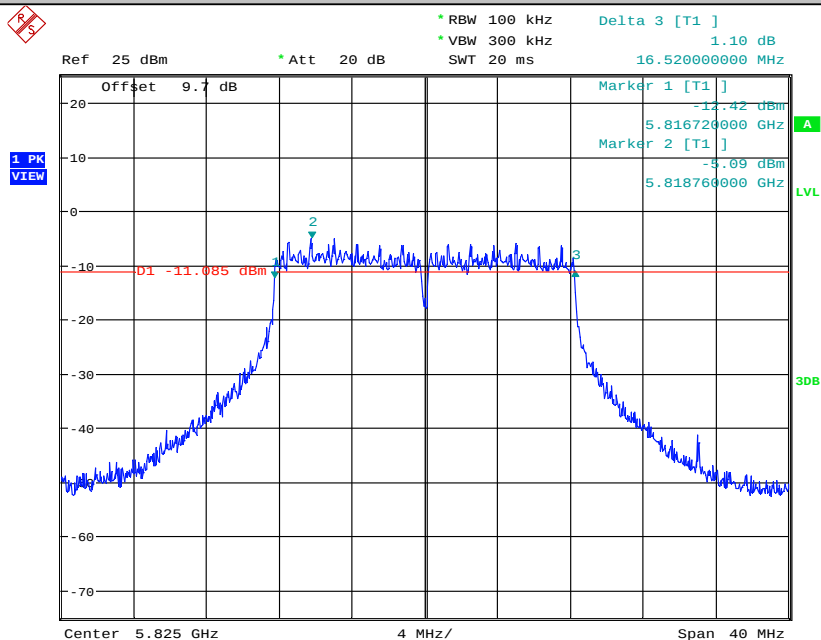
Date: 22.NOV.2019 17:42:13

Emission Bandwidth Measurement_11A_5785_Ant2



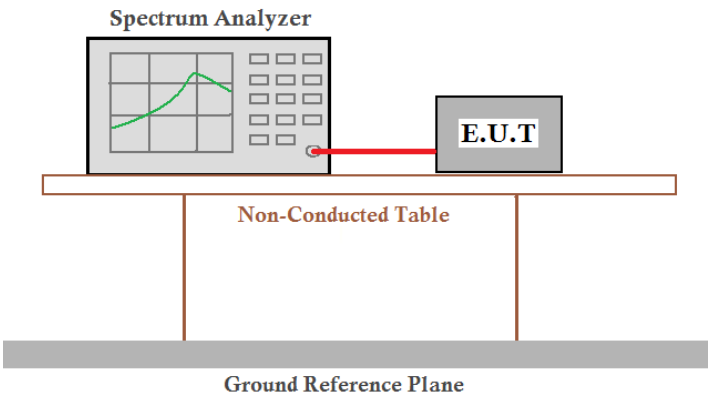
Date: 22.NOV.2019 17:47:14

Emission Bandwidth Measurement_11A_5825_Ant2



Date: 22.NOV.2019 17:52:59

5.5 Power Spectral Density

Test Requirement:	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)	
Test Method:	KDB 789033 D02 v02r01 Section F	
Test Setup:	 <i>Remark:</i> Offset the High-Frequency cable loss in the spectrum analyzer.	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates	
Final Test Mode:	Through Pre-scan, find the 6Mbps of rate is the worst case of 802.11a. Only the worst case is recorded in the report.	
Limit:	U-NII-1	11dBm/MHz
	U-NII-2A	11dBm/MHz
	U-NII-2C	11dBm/MHz
	U-NII-3	30dBm/500KHz
Test Results:	Pass	

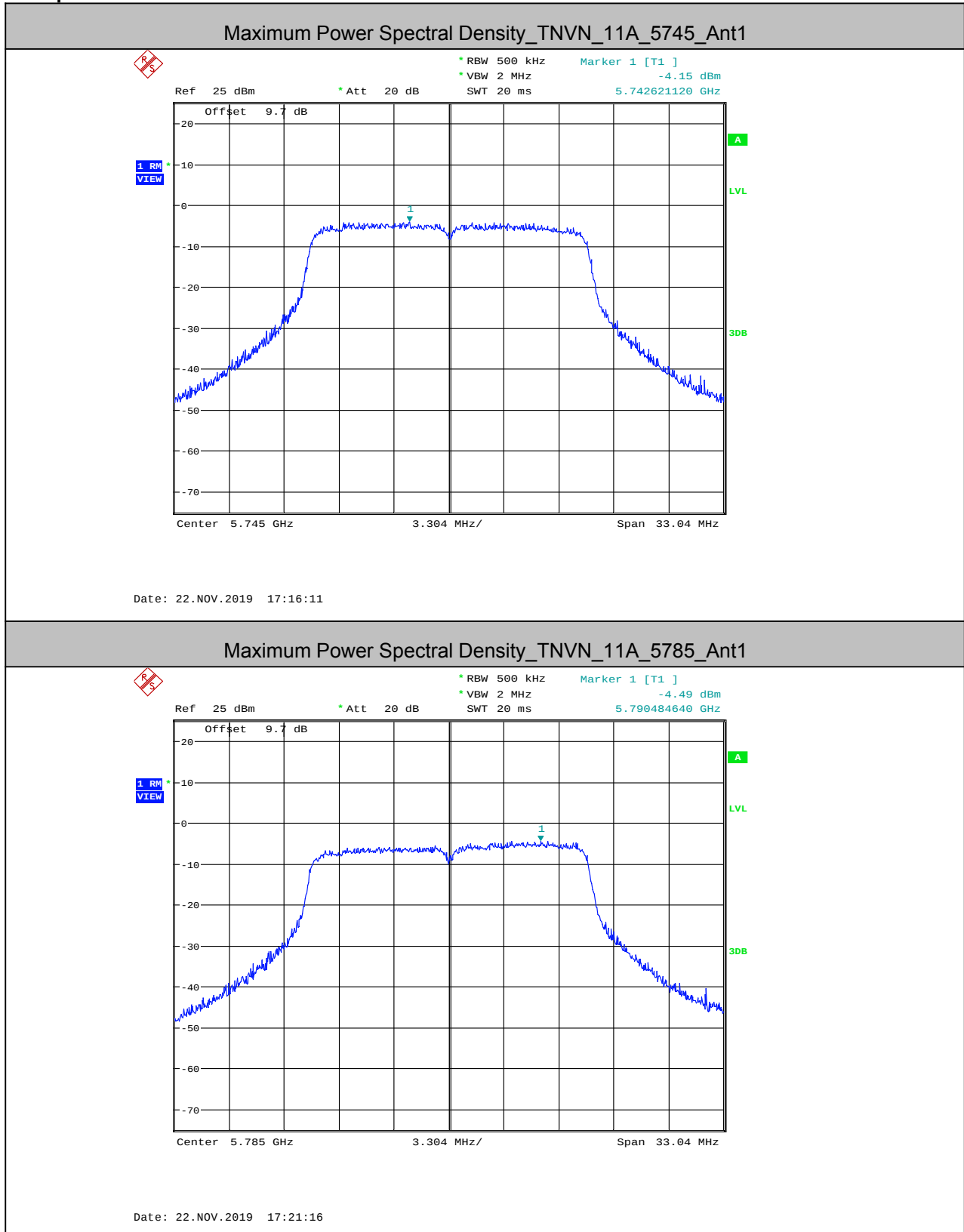
Measurement Data**For U-NII-3 Band:**

Test Mode	Test Channel	Ant	Level [dBm/500kHz]	10log(1/x) Factor[dB]	PSD [dBm/500kHz]	Limit [dBm/500kHz]	Verdict
11A	5745	Ant1	-4.15	1.08	-3.07	30.00	PASS
11A	5785	Ant1	-4.49	1.08	-3.41	30.00	PASS
11A	5825	Ant1	-5.17	1.05	-4.12	30.00	PASS
11A	5745	Ant2	-4.86	1.05	-3.81	30.00	PASS
11A	5785	Ant2	-5.94	1.08	-4.86	30.00	PASS
11A	5825	Ant2	-4.94	1.08	-3.86	30.00	PASS

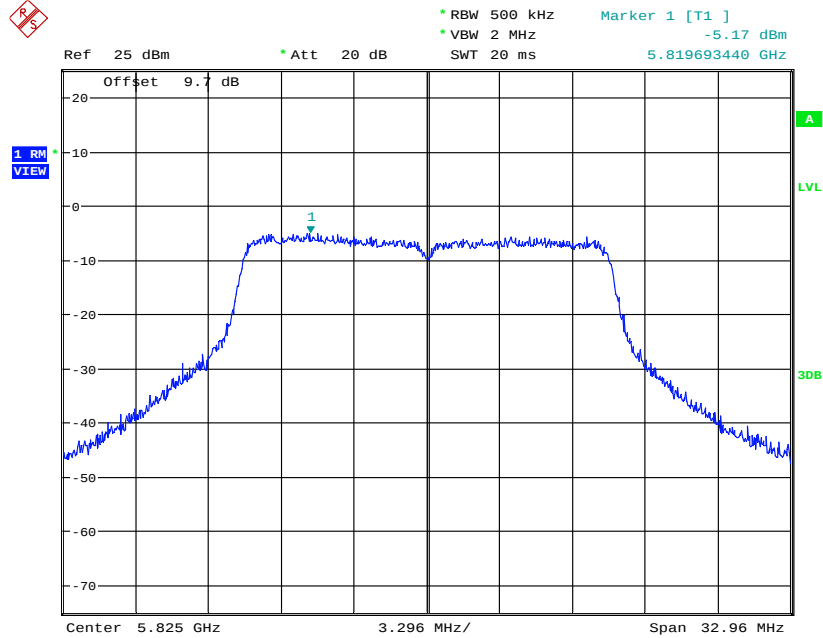
Remark:

PSD = Meas PSD + Duty Cycle Factor

Test plot as follows:

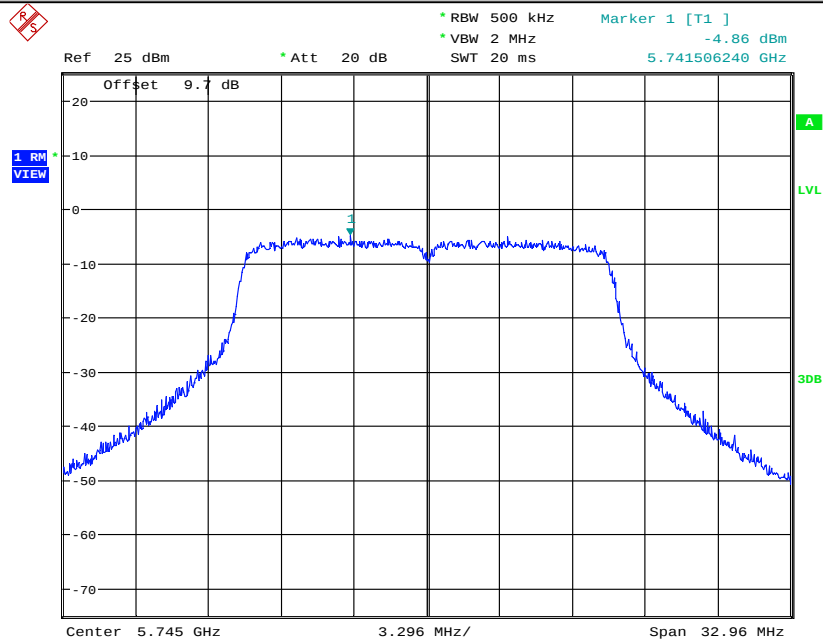


Maximum Power Spectral Density_TNVN_11A_5825_Ant1



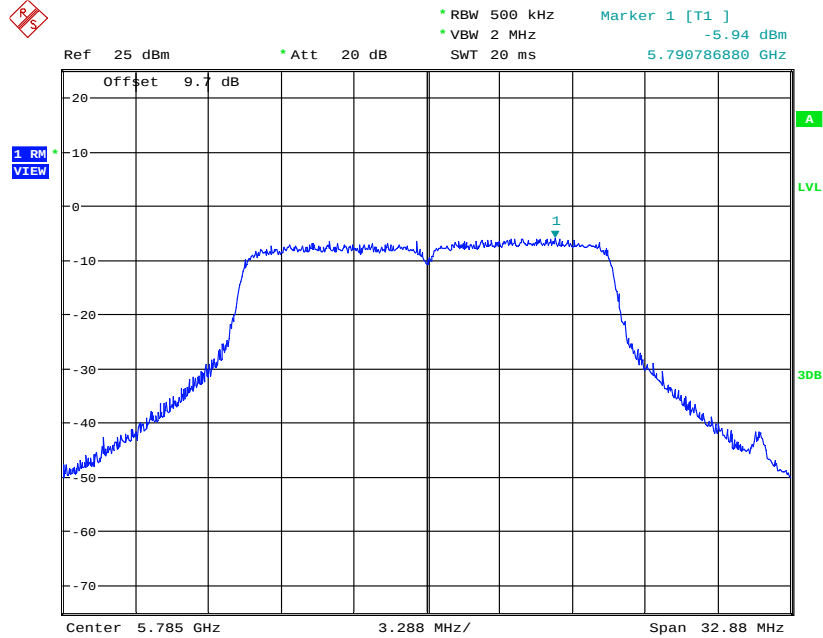
Date: 22.NOV.2019 17:25:19

Maximum Power Spectral Density_TNVN_11A_5745_Ant2



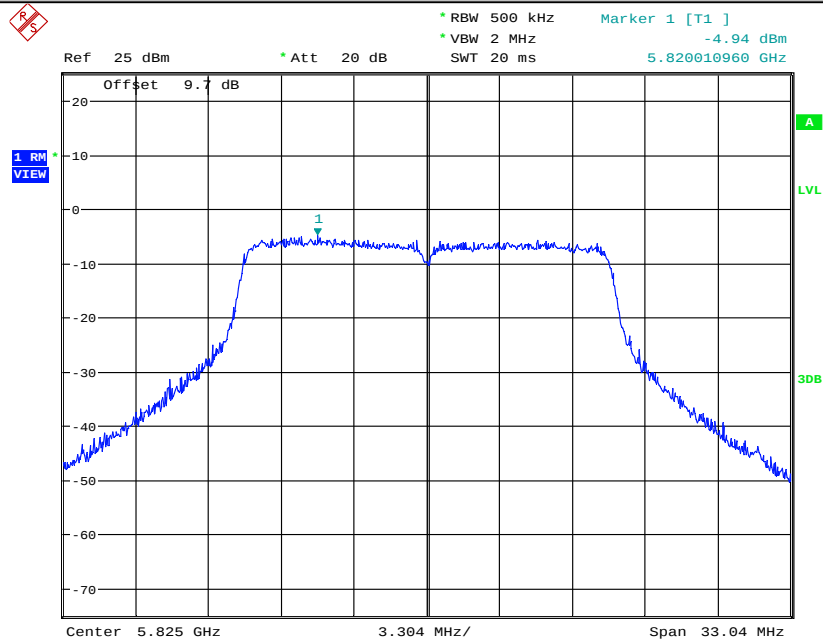
Date: 22.NOV.2019 17:44:09

Maximum Power Spectral Density_TNVN_11A_5785_Ant2



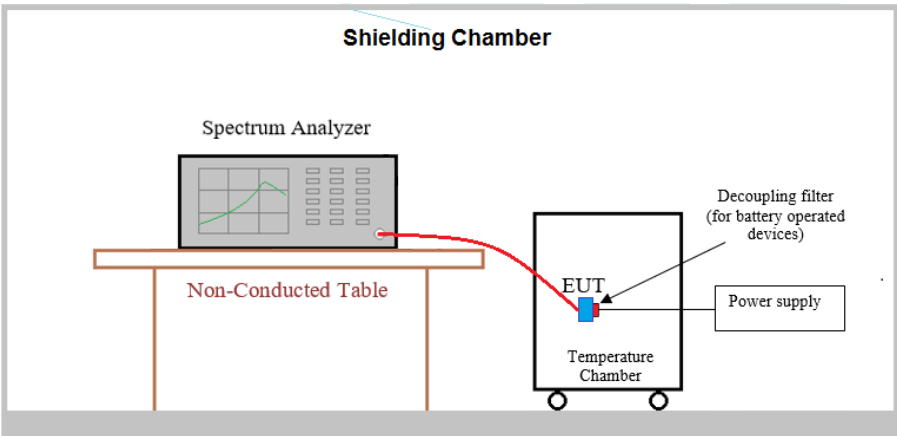
Date: 22.NOV.2019 17:48:38

Maximum Power Spectral Density_TNVN_11A_5825_Ant2



Date: 22.NOV.2019 17:54:22

5.6 Frequency Stability

Test Requirement:	FCC 47 CFR Part 15 Subpart E Section 15.407 (g)
Test Method:	ANSI C63.10-2013
Test Setup:	 <i>Remark:</i> Offset the High-Frequency cable loss in the spectrum analyzer.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 6Mbps of rate of 802.11a_ANT1 at lowest channel is the worst case. Only the worst case is recorded in the report.
Limit:	The frequency of the carrier signal shall be maintained within band of operation.
Test Results:	Pass

Measurement Data

Frequency Stability Versus Temp.			
Operating Frequency: 5745 MHz			
Temp (°C)	Volta ge	Measured Frequency (MHz)	Frequency Drift (ppm)
50	VN	5745.03	5.22193
40		5745.00	0.00000
30		5745.02	2.61097
20		5745.00	0.00000
10		5745.03	5.22193
0		5745.00	0.00000
-10		5745.00	0.00000
-20		5744.99	-2.61097

Frequency Stability Versus Temp.			
Operating Frequency: 5825 MHz			
Temp.	Volta ge	Measured Frequency (MHz)	Frequency Drift (ppm)
TN	VL	5744.99	-2.61097
	VN	5745.02	2.61097
	VH	5745.02	2.61097

5.7 Radiated Spurious Emissions

Test Requirement:	FCC 47 CFR Part 15 Subpart E Section 15.407 (b)(1)(2)(3)(5)(6)(7)(8) FCC 47 CFR Part 15 Subpart C Section 15.209/205				
Test Method:	KDB 789033 D02 v02r01 Section G.3, G.4, G.5, and G.6				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					

Test Setup:

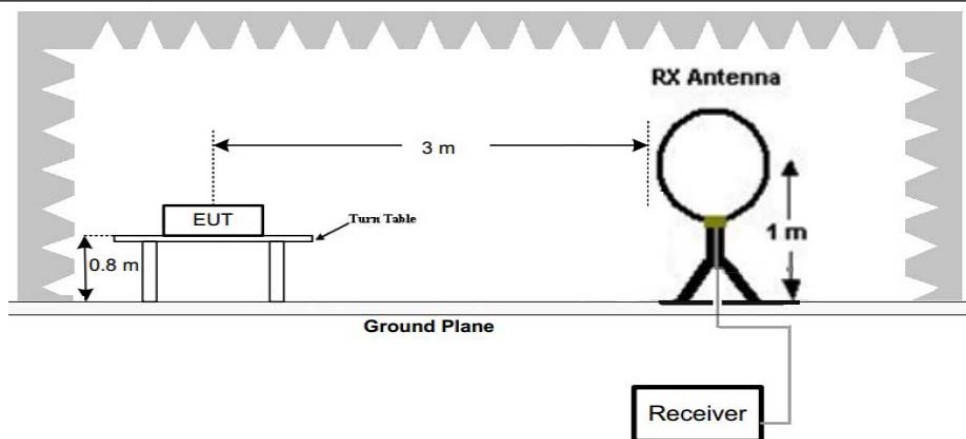


Figure 1. Below 30MHz

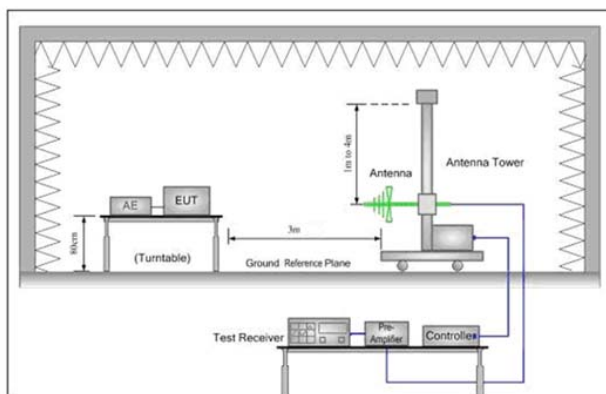


Figure 2. 30MHz to 1GHz

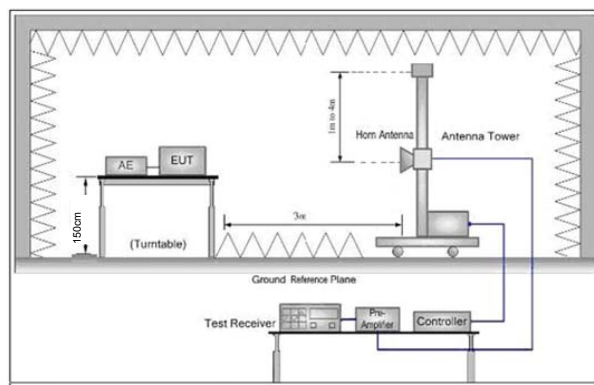


Figure 3. Above 1 GHz

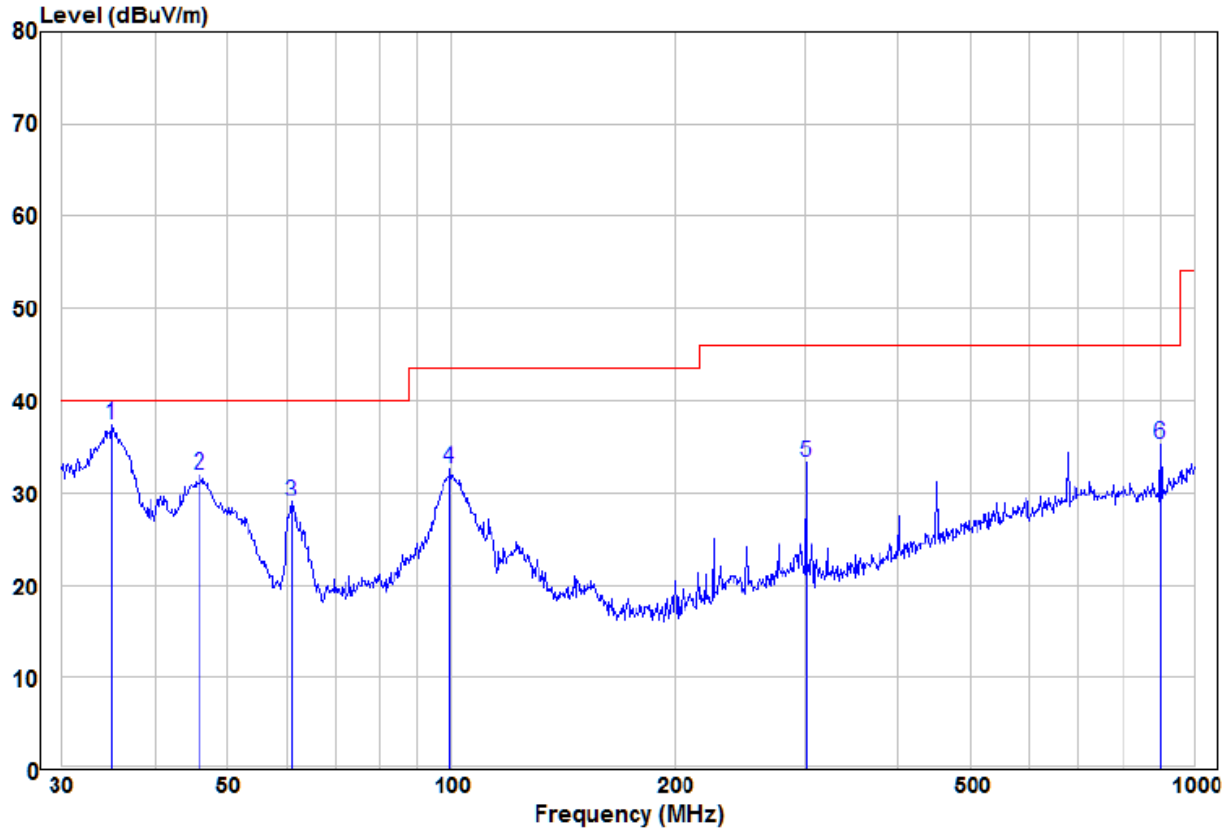
Test Procedure:

- a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
Note: For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

	d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. g. Test the EUT in the lowest channel, the middle channel, the Highest channel h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case. i. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Transmitting mode, Charge + Transmitting mode.
Final Test Mode:	Pretest the EUT at Transmitting mode and Charge + Transmitting mode, found the Charge + Transmitting mode which it is worse case. Through Pre-scan, find the 6Mbps of rate is the worst case of 802.11a. For below 1GHz, through Pre-scan, find the 6Mbps of rate of 802.11a at 149 channel is the worst case. Only the worst case is recorded in the report.
Test Results:	Pass

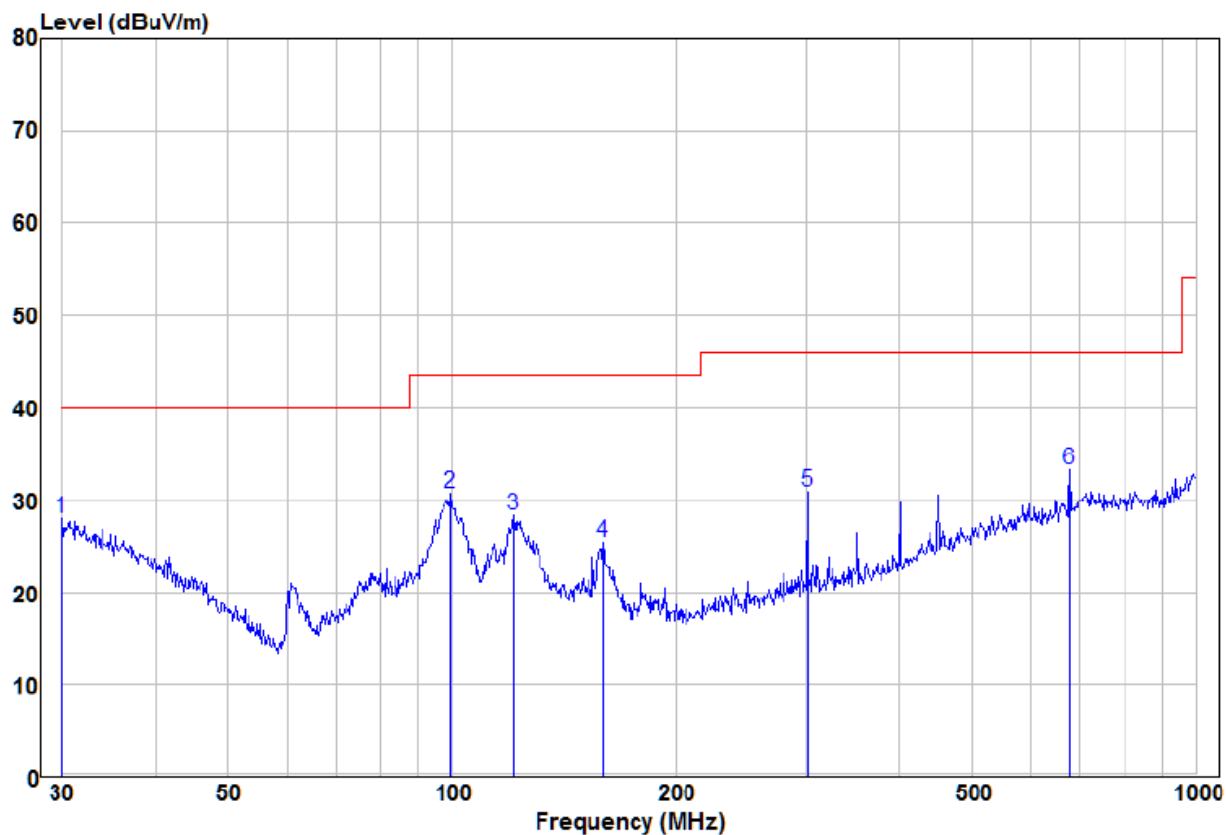
5.7.1 Radiated emission below 1GHz

30MHz~1GHz		
Test mode:	Transmitting	Vertical



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1 pp	35.00	20.72	16.60	37.32	40.00	-2.68	Peak	VERTICAL
2	46.02	20.52	11.36	31.88	40.00	-8.12	Peak	VERTICAL
3	60.92	23.68	5.30	28.98	40.00	-11.02	Peak	VERTICAL
4	99.88	21.93	10.64	32.57	43.50	-10.93	Peak	VERTICAL
5	300.37	21.46	11.74	33.20	46.00	-12.80	Peak	VERTICAL
6	900.15	15.05	20.34	35.39	46.00	-10.61	Peak	VERTICAL

Test mode:	Transmitting	Horizontal
------------	--------------	------------



		Read		Limit	Over		
	Freq	Level	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Pol/Phase
1	pp 30.00	9.49	18.41	27.90	40.00	-12.10	Peak
2	99.88	20.07	10.64	30.71	43.50	-12.79	Peak
3	121.12	17.60	10.66	28.26	43.50	-15.24	Peak
4	159.78	17.66	7.81	25.47	43.50	-18.03	Peak
5	300.37	19.06	11.74	30.80	46.00	-15.20	Peak
6	675.21	13.59	19.64	33.23	46.00	-12.77	Peak

5.7.2 Transmitter emission above 1GHz

Test mode:		802.11a_ANT1(6Mbps)		Test channel:		149	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
11490.000	47.43	2.42	49.85	74	-24.15	peak	H
11490.000	38.93	2.42	41.35	54	-12.65	AVG	H
17235.000	44.94	3.92	48.86	74	-25.14	peak	H
17235.000	37.07	3.92	40.99	54	-13.01	AVG	H
11490.000	46.95	2.42	49.37	74	-24.63	peak	V
11490.000	39.13	2.42	41.55	54	-12.45	AVG	V
17235.000	45.24	3.92	49.16	74	-24.84	peak	V
17235.000	37.33	3.92	41.25	54	-12.75	AVG	V

Test mode:		802.11a_ANT1(6Mbps)		Test channel:		157	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
11570.000	47.69	2.47	50.16	74	-23.84	peak	H
11570.000	39.58	2.47	42.05	54	-11.95	AVG	H
17355.000	46.39	3.96	50.35	74	-23.65	peak	H
17355.000	38.52	3.96	42.48	54	-11.52	AVG	H
11570.000	49.06	2.47	51.53	74	-22.47	peak	V
11570.000	40.51	2.47	42.98	54	-11.02	AVG	V
17355.000	46.53	3.96	50.49	74	-23.51	peak	V
17355.000	38.41	3.96	42.37	54	-11.63	AVG	V

Test mode:		802.11a_ANT1(6Mbps)		Test channel:		165	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
11650.000	48.8	2.55	51.35	74	-22.65	peak	H
11650.000	40.5	2.55	43.05	54	-10.95	AVG	H
17475.000	47.25	4.01	51.26	74	-22.74	peak	H
17475.000	39.74	4.01	43.75	54	-10.25	AVG	H
11650.000	48.97	2.55	51.52	74	-22.48	peak	V
11650.000	40.93	2.55	43.48	54	-10.52	AVG	V
17475.000	47.36	4.01	51.37	74	-22.63	peak	V
17475.000	39.14	4.01	43.15	54	-10.85	AVG	V

Remark:

- 1) The 6Mbps of rate of 802.11a_ANT1 is the worst case.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 3) Scan from 9kHz to 40GHz, The disturbance above 18GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

5.8 Restricted bands around fundamental frequency

Test Requirement:	FCC 47 CFR Part 15 Subpart E Section 15.407 (b)(4)(6) FCC 47 CFR Part 15 Subpart C Section 15.209/205		
Test Method:	KDB 789033 D02 v02r01 Section G.3, G.4, G.5, and G.6		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Applicable To	Limit	
	789033 D02 General U-NII Test Procedures New Rules v02r01	Field Strength at 3 m	
		PK: 74 (dBμV/m)	AV: 54 (dBμV/m)
	Applicable To	EIRP Limit	Equivalent Field Strength at 3 m
	FCC 47 CFR Part 15 Subpart E Section 6.2.1.2	PK: -27 (dBm/MHz)	PK: 74 (dBμV/m)
	FCC 47 CFR Part 15 Subpart E Section 6.2.2.2	PK: -27 (dBm/MHz)	PK: 74 (dBμV/m)
	FCC 47 CFR Part 15 Subpart E Section 6.2.3.2	PK: -27 (dBm/MHz)	PK: 68.2 (dBμV/m)
	FCC 47 CFR Part 15 Subpart E Section 6.2.4.2	27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;	PK: 68.2 (dBμV/m)
		15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;	
		10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges;	
		-27 dBm/MHz at	

	frequencies more than 75 MHz above or below the band edges.	
Note: (i) $EIRP = ((E \cdot d)^2) / 30$ where: • E is the field strength in V/m; • d is the measurement distance in meters; • EIRP is the equivalent isotropically radiated power in watts. (ii) Working in dB units, the above equation is equivalent to: $EIRP[dBm] = E[dB\mu V/m] + 20 \log(d[meters]) - 104.77$ (iii) Or, if d is 3 meters: $EIRP[dBm] = E[dB\mu V/m] - 95.2$		

Test Setup:

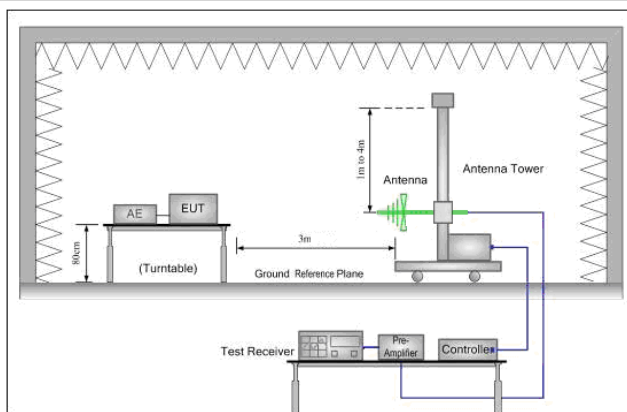


Figure 1. 30MHz to 1GHz

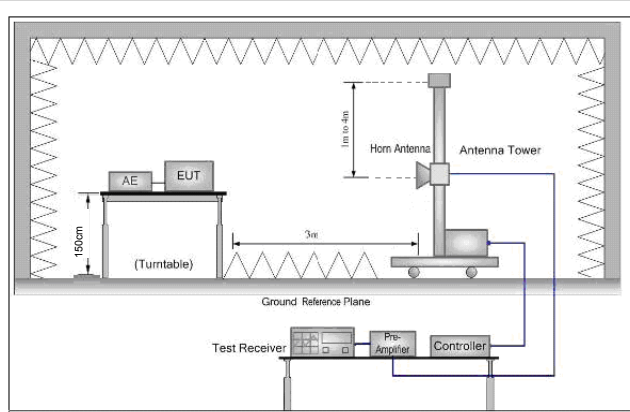


Figure 2. Above 1 GHz

Test Procedure:

- 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
 - 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- Note: For the radiated emission test above 1GHz:
- Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
 - The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
 - For each suspected emission, the EUT was arranged to its worst case and

		then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel g. Test the EUT in the lowest channel , the Highest channel h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case. i. Repeat above procedures until all frequencies measured was complete.
Exploratory Mode:	Test	Transmitting with all kind of modulations, data rates. Transmitting mode, Charge + Transmitting mode.
Final Test Mode:		Pretest the EUT at Transmitting mode and Charge + Transmitting mode, found the Charge + Transmitting mode which it is worse case. Through Pre-scan, find the 6Mbps of rate is the worst case of 802.11a. Only the worst case is recorded in the report.
Test Results:		Pass

Test data:

Worse case mode:		802.11a_ANT1(6Mbps)		Test channel:		149	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5650.00	56.38	-3.46	52.92	68.2	-15.28	peak	H
5745.25	97.96	-3.44	94.52	122.2	-27.68	peak	H
5650.00	58.43	-3.46	54.97	68.2	-13.23	peak	V
5745.81	93.45	-3.44	90.01	122.2	-32.19	peak	V

Worse case mode:		802.11a_ANT1 (6Mbps)		Test channel:		165	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5815.83	97.25	-3.42	93.83	122.2	-28.37	peak	H
5925.00	60.02	-3.41	56.61	68.2	-11.59	peak	H
5816.45	92.18	-3.42	88.76	122.2	-33.44	peak	V
5925.00	47.65	-3.41	44.24	68.2	-23.96	peak	V

Worse case mode:		802.11a_ANT2(6Mbps)		Test channel:		149	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5650.00	60.08	-3.46	56.62	68.2	-11.58	peak	H
5743.33	96.39	-3.44	92.95	122.2	-29.25	peak	H
5650.00	59.78	-3.46	56.32	68.2	-11.88	peak	V
5746.14	91.88	-3.44	88.44	122.2	-33.76	peak	V

Worse case mode:		802.11a_ANT2 (6Mbps)		Test channel:		165	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5814.74	99.52	-3.42	96.1	122.2	-26.1	peak	H
5925.00	60.41	-3.41	57	68.2	-11.2	peak	H
5817.95	90.53	-3.42	87.11	122.2	-35.09	peak	V
5925.00	47.04	-3.41	43.63	68.2	-24.57	peak	V

Note:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

5.9 Operation in the absence of information to the transmit

15.407(c) requirement:

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

Operation in the absence of information to the transmit

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

6 Photographs - EUT Test Setup

6.1 Radiated Spurious Emission

9KHz~30MHz:



30MHz~1GHz:



Above 1GHz:

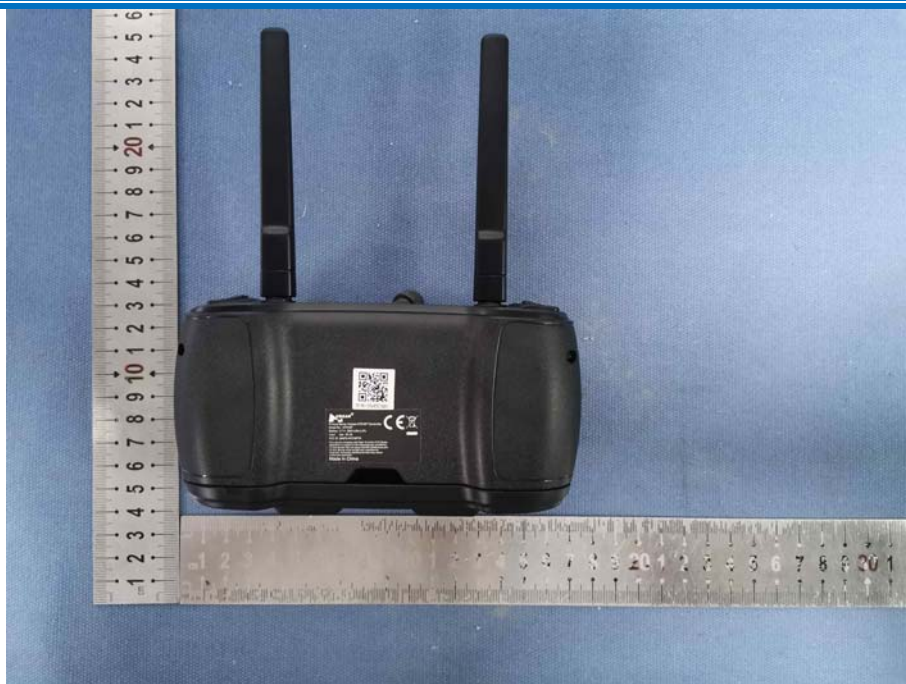


6.2 Conducted Emission



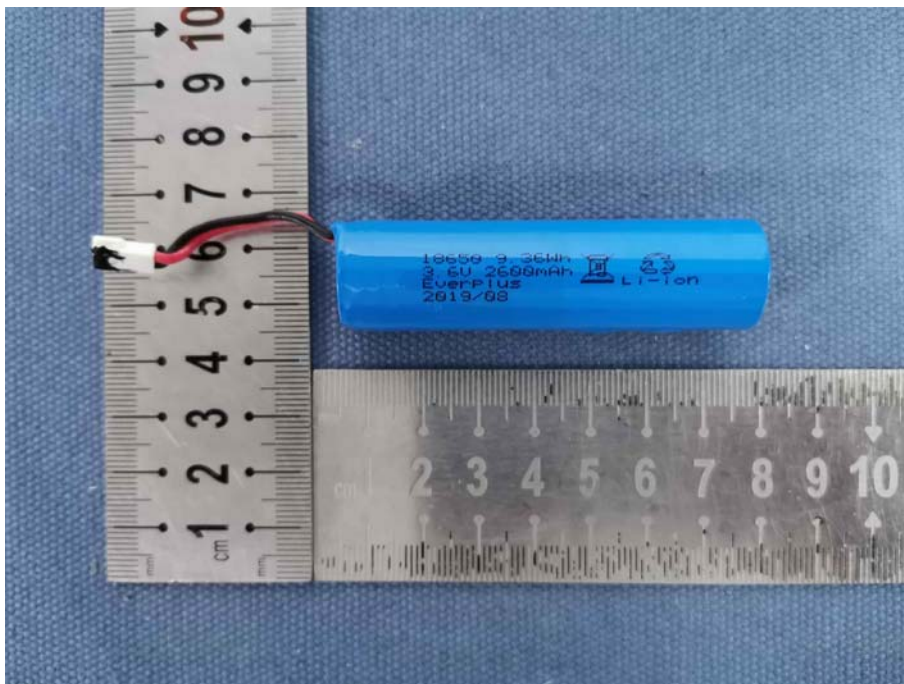
7 Photographs - EUT Constructional Details

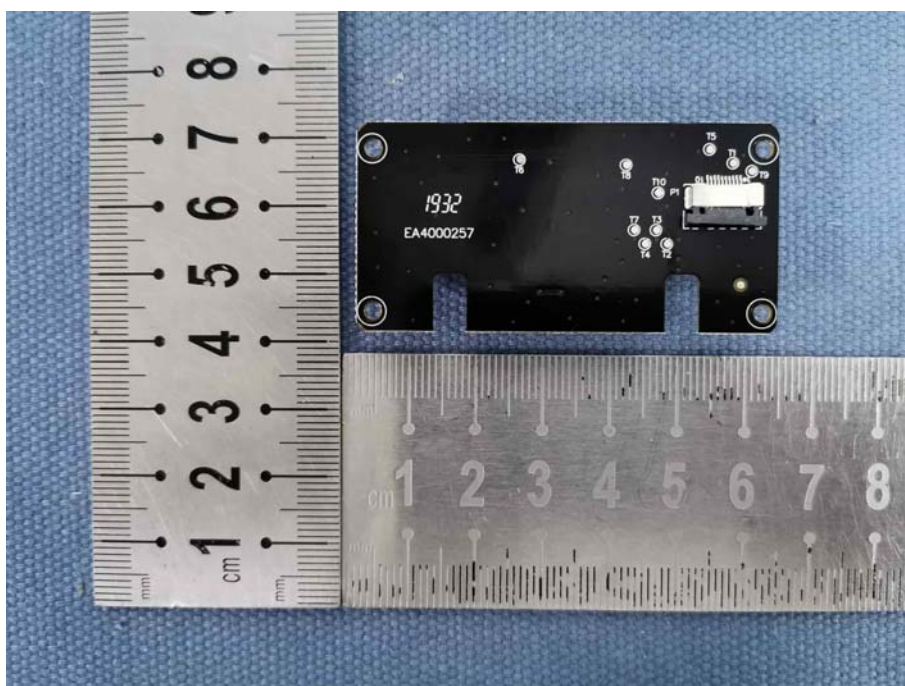
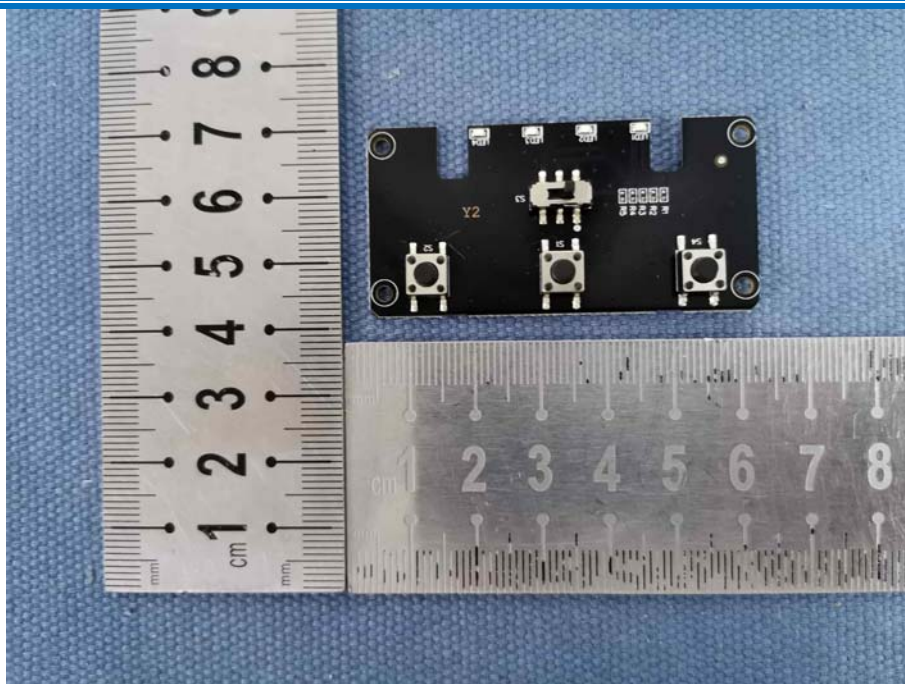


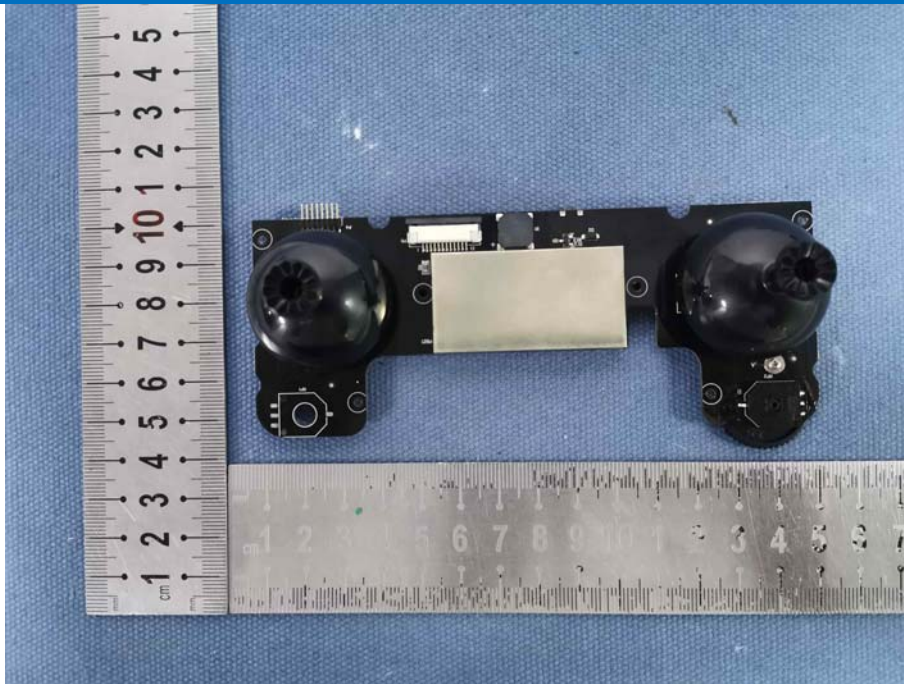


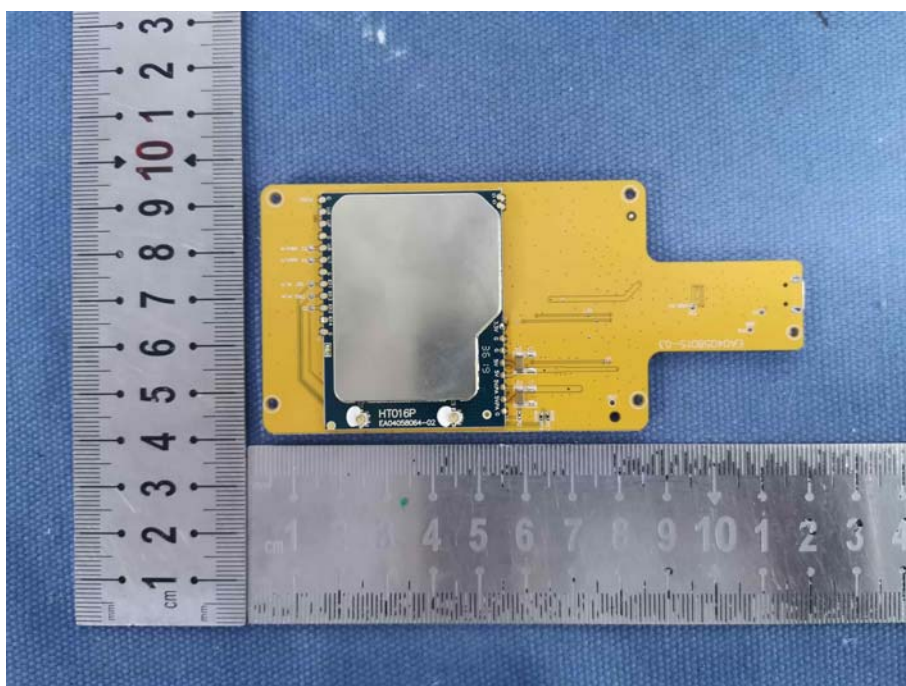
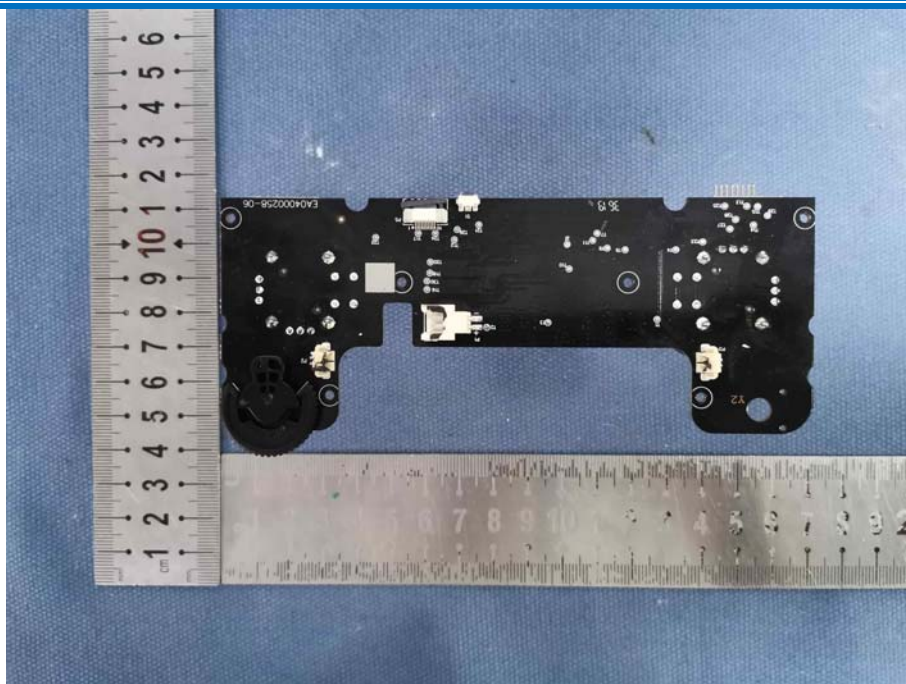


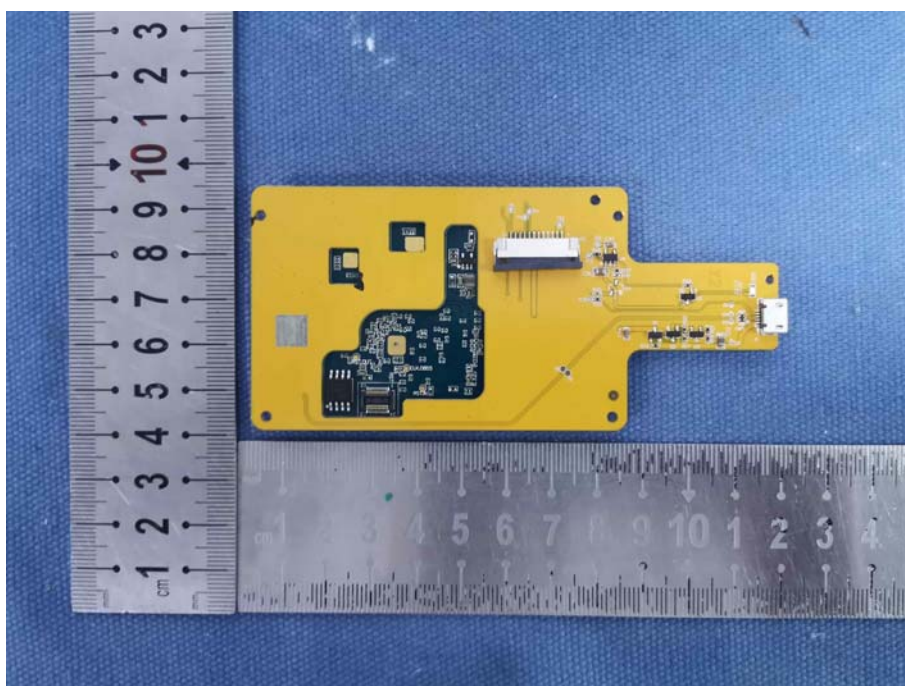
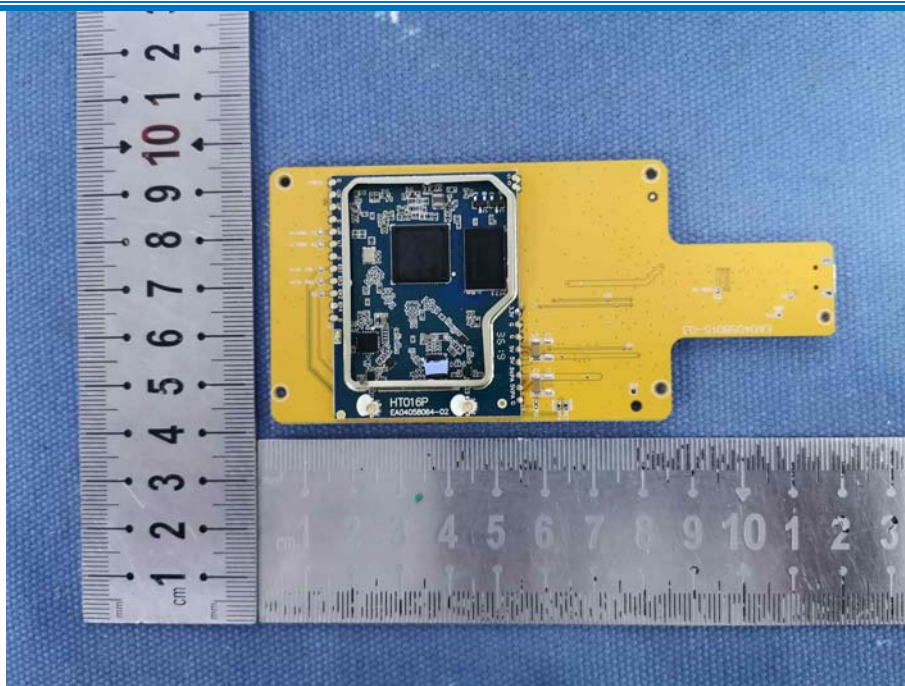














The End