



FCC RADIO TEST REPORT

Applicant : Ubiquiti Networks, Inc.
Address : 685 Third Avenue, 27th Floor New York,
New York 10017 USA
Equipment : PowerBeam AC
Model No. : PBE-2AC-400
Trade Name : UBIQUITI
FCC ID. : SWX-PBE2ACN

I HEREBY CERTIFY THAT :

The sample was received on Aug. 24, 2017 and the testing was carried out on Aug. 31, 2017 at Cerpass Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of Cerpass Technology Corp., the test report shall not be reproduced except in full.

Approved by:

Mark Liao / Assistant Manager

Tested by:

Spree Yei / Engineer

Laboratory Accreditation:

Cerpass Technology Corporation Test Laboratory





CONTENTS

1.	Summary of Test Procedure and Test Results	5
1.1.	Applicable Standards	5
2.	Test Configuration of Equipment under Test	6
2.1.	Feature of Equipment.....	6
2.2.	Carrier Frequency of Channels	6
2.3.	Test Mode and Test Software	6
2.4.	Description of Test System.....	6
2.5.	General Information of Test.....	7
2.6.	Measurement Uncertainty	7
3.	Test Equipment and Ancillaries Used for Tests	8
4.	Antenna Requirements.....	9
4.1.	Antenna Construction and Directional Gain.....	9
5.	Test of AC Power Line Conducted Emission	10
5.1.	Test Limit	10
5.2.	Test Procedures	10
5.3.	Typical Test Setup	11
5.4.	Test Result and Data	12
5.5.	Test Photographs	14
6.	Test of Spurious Emission (Radiated)	15
6.1.	Test Limit	15
6.2.	Test Procedures	15
6.3.	Typical Test Setup	16
6.4.	Test Result and Data (9kHz ~ 30MHz).....	17
6.5.	Test Result and Data (30MHz ~ 1GHz).....	17
6.6.	Test Result and Data (1GHz ~ 40GHz).....	19
6.7.	Restricted Bands of Operation	25
6.8.	Test Photographs (30MHz ~ 1GHz).....	26
6.9.	Test Photographs (1GHz ~ 40GHz)	27
7.	On Time, Duty Cycle and Measurement methods	28
7.1.	Test Limit	28
7.2.	Test Procedure	28
7.3.	Test Setup Layout	28
7.4.	Test Result and Data	28
7.5.	Measurement Methods	28
8.	6dB Bandwidth	30
8.1.	Test Limit	30
8.2.	Test Procedure	30
8.3.	Test Setup Layout	30
8.4.	Test Result and Data	30
9.	Average Power	32
9.1.	Test Limit	32
9.2.	Test Procedure	32
9.3.	Test Setup Layout	32
9.4.	Test Result and Data	32



10. PPSPD	33
10.1. Test Limit	33
10.2. Test Procedure	35
10.3. Test Setup Layout	35
10.4. Test Result and Data	35
11. Frequency Stability	37
11.1. Test Procedure	37
11.2. Test Setup Layout	37
11.3. Test Result and Data	38
12. Automatically Discontinue Transmission	39
12.1. Limit of Automatically Discontinue Transmission	39
12.2. Test Result of Automatically Discontinue Transmission	39
13. Radio Frequency Exposure	40
13.1. Applicable Standards	40
13.2. EUT Specification	40
13.3. Test Results	41
13.4. Calculation	41
13.5. Maximum Permissible Exposure	41

History of this test report

[illegible]



1. Summary of Test Procedure and Test Results

1.1. Applicable Standards

ANSI C63.4:2014

ANSI C63.10:2013

FCC Rules and Regulations Part 15 Subpart E §15.407

First R&O 14-30

KDB662911

KDB789033

KDB644545

FCC Rule	Description of Test	Result
15.203	Antenna Requirement	Pass
15.207(a)	AC Power Line Conducted Emission	Pass
15.407(b) 15.209	Radiated Spurious Emission	Pass
15.407(a)	26 dB Occupied Bandwidth	N/A
15.407	6 dB Bandwidth	Pass
15.407 (a) & (a)(3)	Average Power	Pass
15.407(a)	Output and PPSD	Pass



2. Test Configuration of Equipment under Test

2.1. Feature of Equipment

Frequency Range	802.11n/ac: 2412-2462 MHz 802.11n: 5725MHz -5850MHz
Modulation Type	OFDM
Data Rate	2.4GHz 802.11n: MCS0 – MCS15, HT10/20/40 802.11ac: MCS0 – MCS9, VHT10/20/40 5GHz 802.11n: MCS0 – MCS7, HT20
Antenna Type/ gain	2.4G: Dish Antenna ANT A/B: 18dBi 5G: Internal Antenna ANT A: 2dBi

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. devices must be professionally installed ,Supply Point to Point & Point to multiple Point System

2.2. Carrier Frequency of Channels

Band 4: 5725MHz -5850MHz
802.11n HT20

Channel	Frequency(MHz)	Channel	Frequency(MHz)
*149	5745	161	5805
153	5765	*165	5825
*157	5785		

Note: Channels remarked * are selected to perform test.

2.3. Test Mode and Test Software

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.4.
- b. The complete test system included EUT for RF test.
- c. An executive program, " Art2_ver_3_11_2a" under WIN 8 was executed to transmit and receive data via WLAN.
- d. The following test mode was performed for the test:
Test Mode 1: 802.11n HT20 (MCS0)

2.4. Description of Test System

No support unit was used during testing.



2.5. General Information of Test

Test Site	Cerpass Technology Corporation Test Laboratory Address: No.10, Ln. 2, Lianfu St., Luzhu Dist., Taoyuan City 33848, Taiwan (R.O.C.) Tel:+886-3-3226-888 Fax:+886-3-3226-881 Address: No.68-1, Shihbachongsi, Shihding Township, New Taipei City 223, Taiwan, R.O.C. Tel: +886-2-2663-8582	
	FCC	TW1079, TW1061, 390316, 228391, 641184
	IC	4934E-1, 4934E-2
	VCCI	T-2205 for Telecommunication Test C-4663 for Conducted emission test R-4218, R-4399 for Radiated emission test G-812, G-813 for radiated disturbance above 1GHz
Frequency Range Investigated:	Conducted: from 150kHz to 30 MHz Radiation: from 30 MHz to 40,000MHz	
Test Distance:	The test distance of radiated emission from antenna to EUT is 3 M.	

2.6. Measurement Uncertainty

Measurement Item	Measurement Frequency	Polarization	Uncertainty
Conducted Emission	9 kHz ~ 30 MHz	Line / Neutral	±2.9076 dB
Radiated Emission	9 kHz ~ 25,000 MHz	Vertical / Horizontal	±0.948 dB
Spurious Emission (Conducted)	-	-	±4.011 dB
Maximum Peak and Average Output Power	-	-	±0.322 dB
Power Spectral Density	-	-	±0.322 dB
Bandwidth	-	-	74.224Hz



3. Test Equipment and Ancillaries Used for Tests

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
EMI Receiver	R&S	ESCI3	100443	2017/03/07	2018/03/06
LISN	Schwarzbeck	NSLK 8127	8127-568	2017/02/15	2018/02/14
Pulse Limiter	R&S	ESH3-Z2	101934	2017/02/14	2018/02/13
Bilog Antenna	Schwarzbeck	VULB9168	369	2017/03/15	2018/03/14
Active Loop Antenna	EMCO	6507	40855	2017/05/15	2018/05/14
Horn Antenna	EMCO	3115	31601	2016/09/05	2017/09/04
Horn Antenna	EMCO	3116	31970	2017/03/29	2018/03/28
EXA Signal Analyzer	KEYSIGHT	N9010A	MY54200207	2017/03/17	2018/03/16
Preamplifier	EM	EM330	60660	2017/02/25	2018/02/24
Preamplifier	EMC INSTRUMENTS	EMC051845SE	980333	2016/09/13	2017/09/12
Preamplifier	Agilent	8449B	3008A01954	2017/02/09	2018/02/08
Preamplifier	EMC INSTRUMENTS	EMC184045	980065	2016/11/04	2017/11/03
MXG MW Analog Signal Generator	KEYSIGHT	N5183A	MY50142931	2017/03/17	2018/03/16
Spectrum Analyzer	R&S	FSP40	100219	2017/07/01	2018/06/30
BLUETOOTH TESTER	R&S	CBT	101133	2017/03/10	2018/03/09
Attenuator	KEYSIGHT	8491B	MY39250703	2017/03/07	2018/03/06
Rotary Attenuator	Agilent	8495B	MY42146680	2017/03/13	2018/03/12
Temp & Humi chamber	T-MACHINE	TMJ-9712	T-12-040111	2016/09/05	2017/09/04
Series Power Meter	Anritsu	ML2495A	1224005	2017/03/01	2018/02/28
Power Sensor	Anritsu	MA2411B	1207295	2017/03/01	2018/02/28
Cable	HUBER SUHNER	SUCOFLEX 102	28422/2	2017/02/25	2018/02/24
Cable	HUBER SUHNER	SUCOFLEX 102	28418/2	2017/02/25	2018/02/24
Software	Farad	Ez-EMC	ver.ct3a1	N/A	N/A
Software	AUDIX	E3	V8.2014-8-6	N/A	N/A
Software	Keysight	N7607B Signal Studio	v2.0.0.1	N/A	N/A
Software	Keysight	Inservice MonitorUtility	N/A	N/A	N/A



4. Antenna Requirements

4.1. Antenna Construction and Directional Gain

Antenna Type	2.4G: Dish Antenna 5G: Internal Antenna
Antenna Gain	2.4G: ANT A/B: 18dBi 5G: ANT A: 2dBi

2412-2462MHz

For Power directional gain= G_{ant} = 18 dBi

For PSD directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / NANT]$
= 21.01(dBi)

5725MHz -5850MHz

For Power directional gain= G_{ant} = 2 dBi

For PSD directional gain = G_{ant} = 2 dBi



5. Test of AC Power Line Conducted Emission

5.1. Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz, according to the methods defined in ANSI C63.4-2014. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

Frequency (MHz)	Quasi Peak (dB μ V)	Average (dB μ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

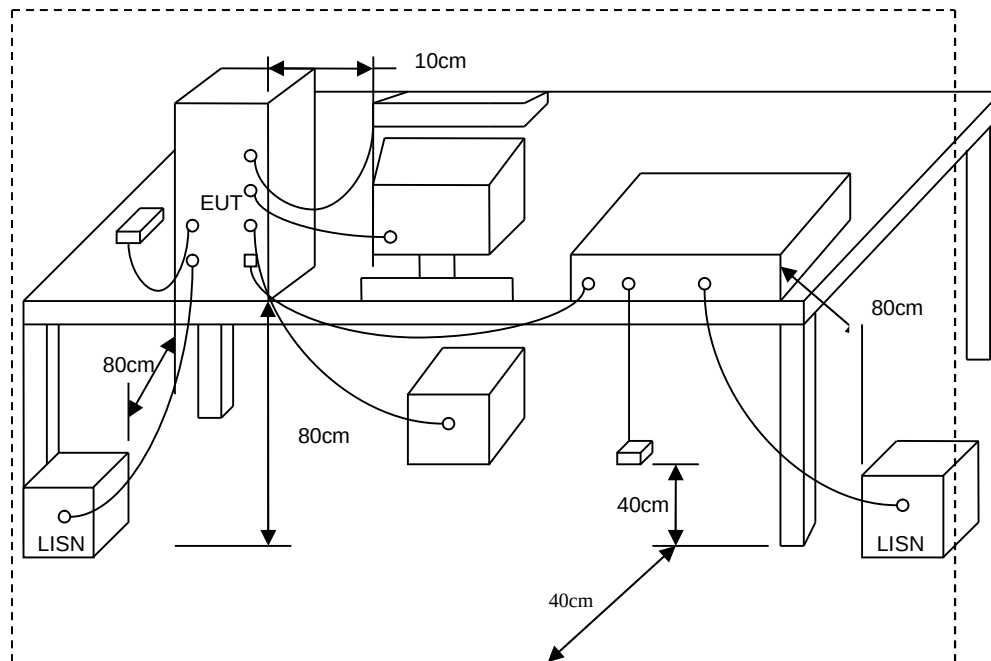
*Decreases with the logarithm of the frequency.

5.2. Test Procedures

- The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connecting to the other LISN.
- The LISN provides 50 ohm coupling impedance for the measuring instrument.
- The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.



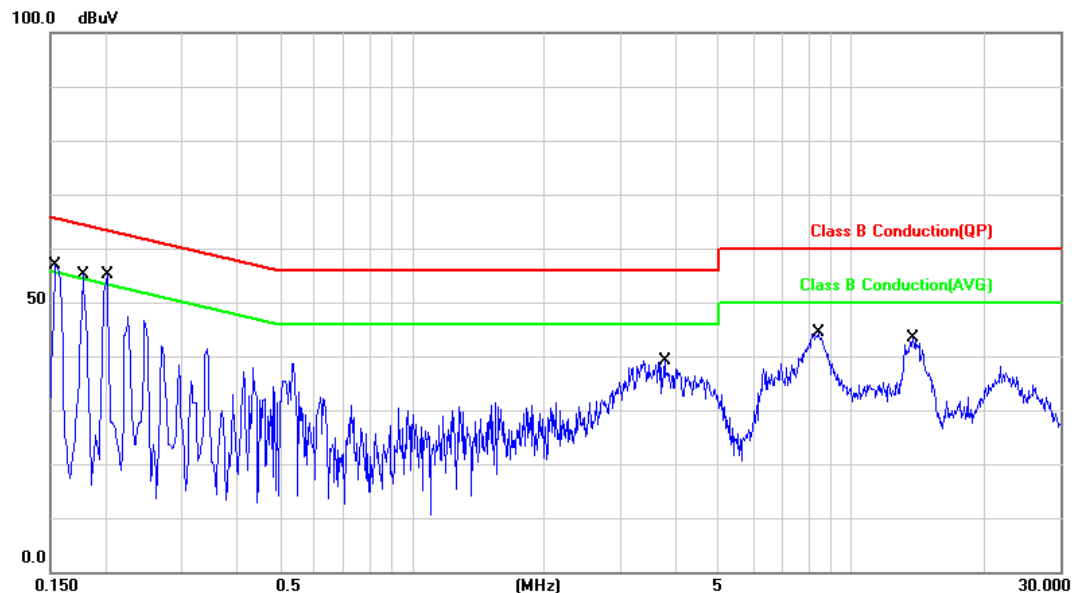
5.3. Typical Test Setup





5.4. Test Result and Data

Power	: PoE 24V	Pol/Phase	: LINE
Test Mode	: Mode 1, Band 4	Temperature	: 23 °C
Test date	: Aug. 31, 2017	Humidity	: 64 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1539	9.91	51.01	60.92	65.78	-4.86	QP	P
2	0.1539	9.91	32.97	42.88	55.78	-12.90	AVG	P
3	0.1780	9.91	38.53	48.44	64.57	-16.13	QP	P
4	0.1780	9.91	14.72	24.63	54.57	-29.94	AVG	P
5	0.2020	9.91	42.95	52.86	63.52	-10.66	QP	P
6	0.2020	9.91	25.26	35.17	53.52	-18.35	AVG	P
7	3.7700	10.13	23.11	33.24	56.00	-22.76	QP	P
8	3.7700	10.13	12.57	22.70	46.00	-23.30	AVG	P
9	8.4220	10.29	30.68	40.97	60.00	-19.03	QP	P
10	8.4220	10.29	22.62	32.91	50.00	-17.09	AVG	P
11	13.8500	10.44	28.83	39.27	60.00	-20.73	QP	P
12	13.8500	10.44	20.89	31.33	50.00	-18.67	AVG	P

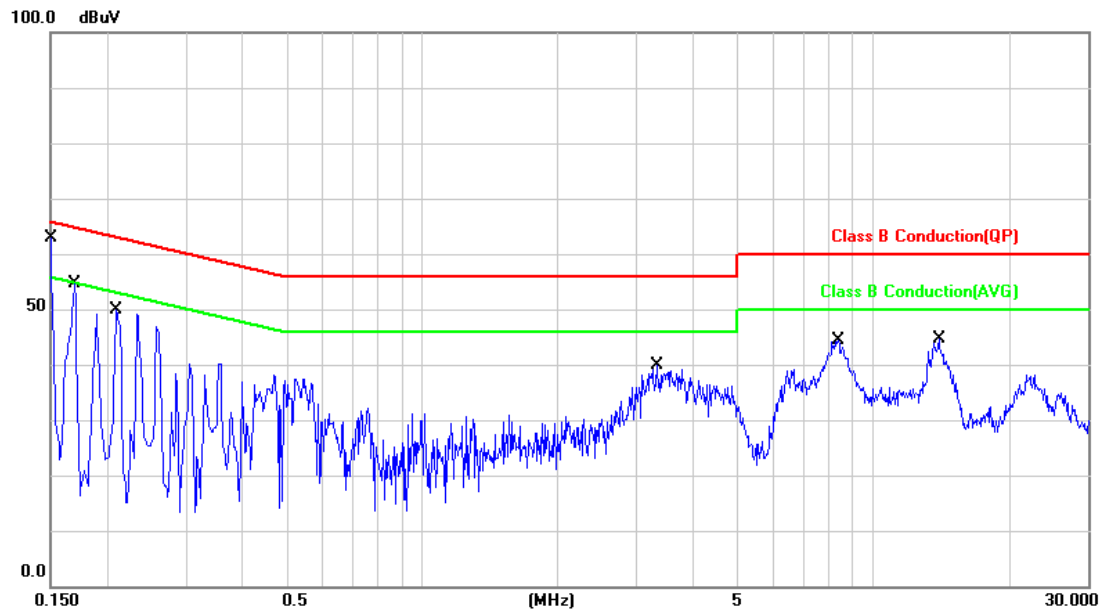
Note: Level = Reading + Factor

Margin = Level – Limit

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss+ Attenuator



Power	: PoE 24V	Pol/Phase	: NEUTRAL
Test Mode	: Mode 1, Band 4	Temperature	: 23 °C
Test date	: Aug. 31, 2017	Humidity	: 64 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1500	9.88	51.55	61.43	65.99	-4.56	QP	P
2	0.1500	9.88	34.56	44.44	55.99	-11.55	AVG	P
3	0.1700	9.88	40.21	50.09	64.96	-14.87	QP	P
4	0.1700	9.88	16.46	26.34	54.96	-28.62	AVG	P
5	0.2100	9.88	40.22	50.10	63.20	-13.10	QP	P
6	0.2100	9.88	19.81	29.69	53.20	-23.51	AVG	P
7	3.3220	10.06	26.40	36.46	56.00	-19.54	QP	P
8	3.3220	10.06	13.67	23.73	46.00	-22.27	AVG	P
9	8.3900	10.26	30.73	40.99	60.00	-19.01	QP	P
10	8.3900	10.26	22.65	32.91	50.00	-17.09	AVG	P
11	14.0300	10.44	29.98	40.42	60.00	-19.58	QP	P
12	14.0300	10.44	23.49	33.93	50.00	-16.07	AVG	P

Note: Level = Reading + Factor

Margin = Level – Limit

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss+ Attenuator



6. Test of Spurious Emission (Radiated)

6.1. Test Limit

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating 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 25MHz 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 27dBm/MHz at the band edge.
- (5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.
- (7) The provisions of §15.205 apply to intentional radiators operating under this section.
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

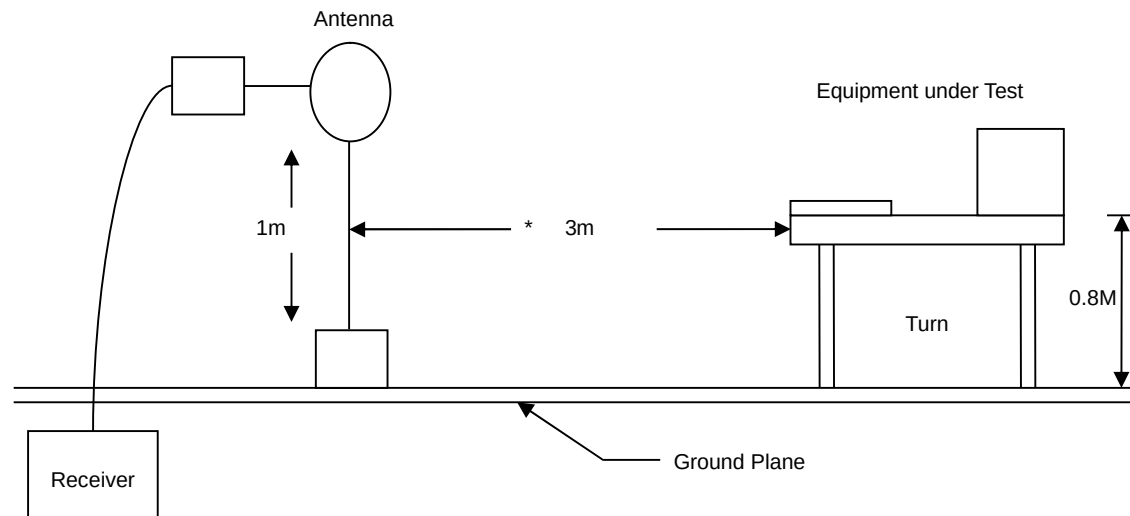
6.2. Test Procedures

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- i. "Cone of radiation" has been considered to be 3dB bandwidth of the measurement antenna.

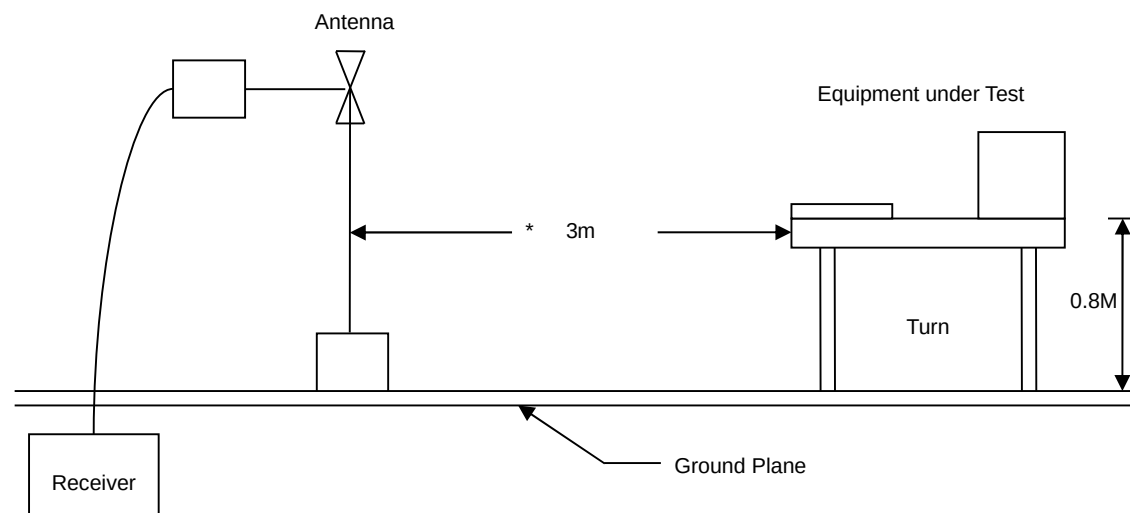


6.3. Typical Test Setup

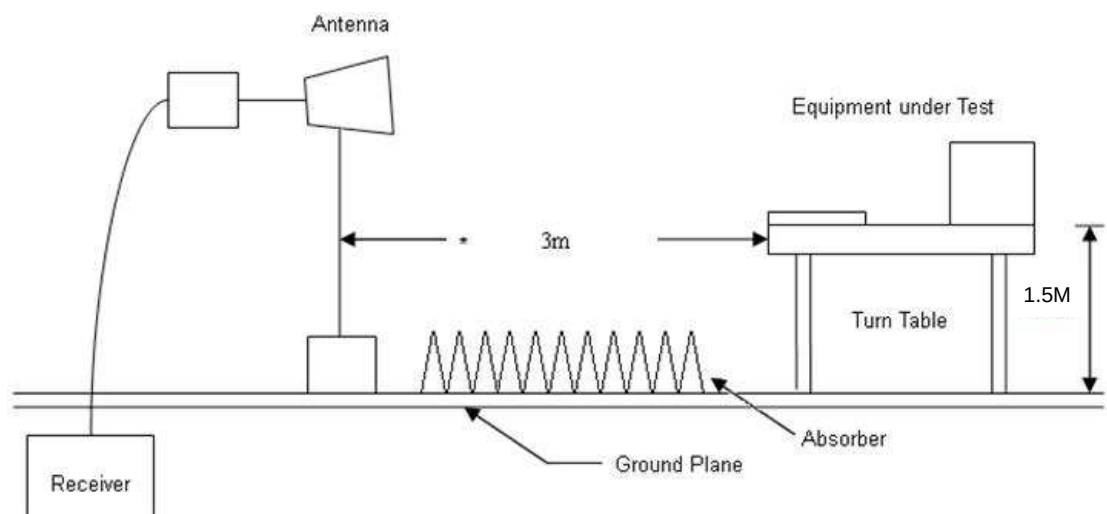
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup



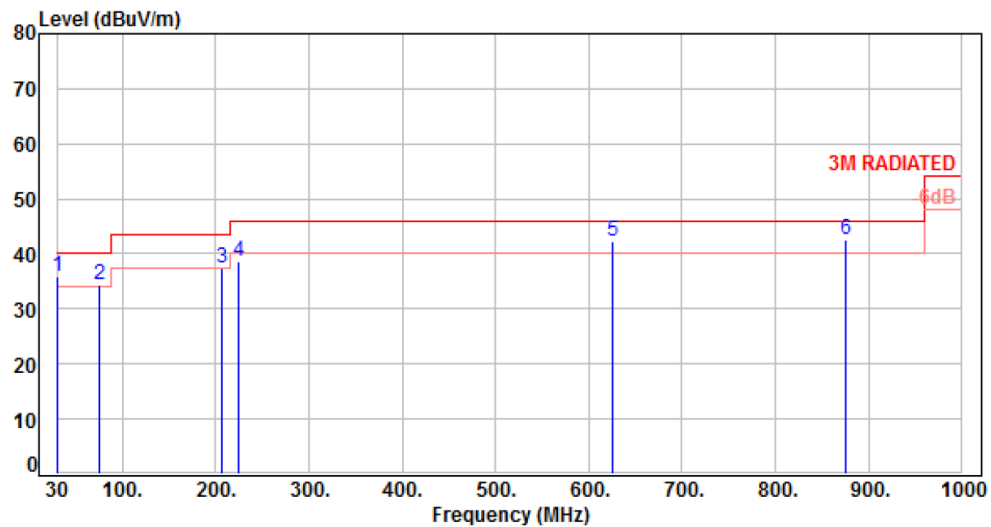


6.4. Test Result and Data (9kHz ~ 30MHz)

The 9kHz - 30MHz spurious emission is under limit 20dB more.

6.5. Test Result and Data (30MHz ~ 1GHz)

Power	: PoE 24V	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, Band 4	Temperature	: 23 °C
Test Date	: Aug. 30, 2017	Humidity	: 63 %

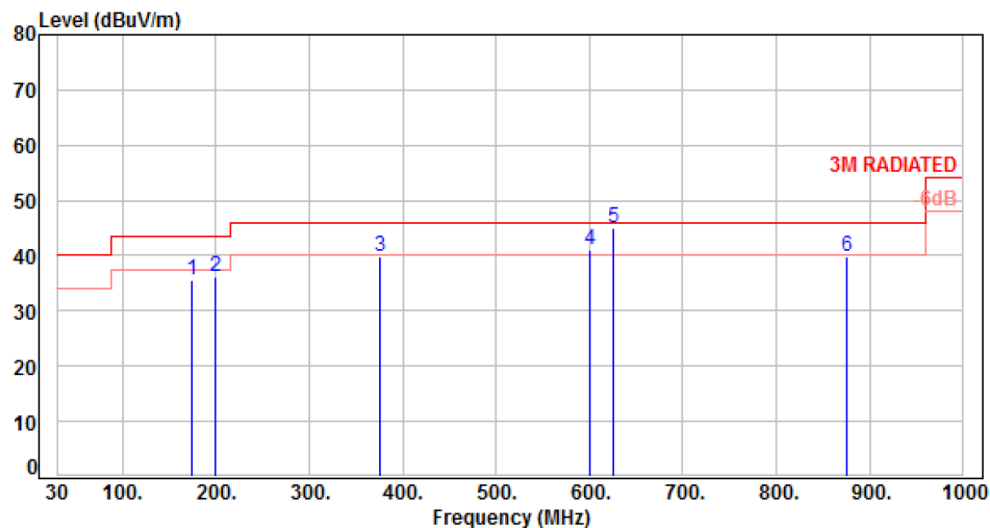


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	30.00	-11.20	47.12	35.92	40.00	-4.08	Peak	100	0	P
2	74.88	-13.87	48.28	34.41	40.00	-5.59	Peak	100	0	P
3	207.39	-13.07	50.63	37.56	43.50	-5.94	Peak	100	0	P
4	224.97	-12.85	51.35	38.50	46.00	-7.50	Peak	100	0	P
5	625.49	-2.37	44.72	42.35	46.00	-3.65	QP	100	251	P
6	875.55	1.44	41.03	42.47	46.00	-3.53	Peak	100	0	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: PoE 24V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, Band 4	Temperature	: 23 °C
Test Date	: Aug. 30, 2017	Humidity	: 63 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	174.79	-11.55	47.25	35.70	43.50	-7.80	Peak	100	0	P
2	199.87	-13.26	49.39	36.13	43.50	-7.37	Peak	100	0	P
3	375.21	-7.71	47.57	39.86	46.00	-6.14	Peak	100	0	P
4	600.25	-2.62	43.66	41.04	46.00	-4.96	Peak	100	0	P
5	625.58	-2.37	47.35	44.98	46.00	-1.02	QP	100	216	P
6	875.73	1.44	38.27	39.71	46.00	-6.29	Peak	100	0	P

Note: Level=Reading+Factor

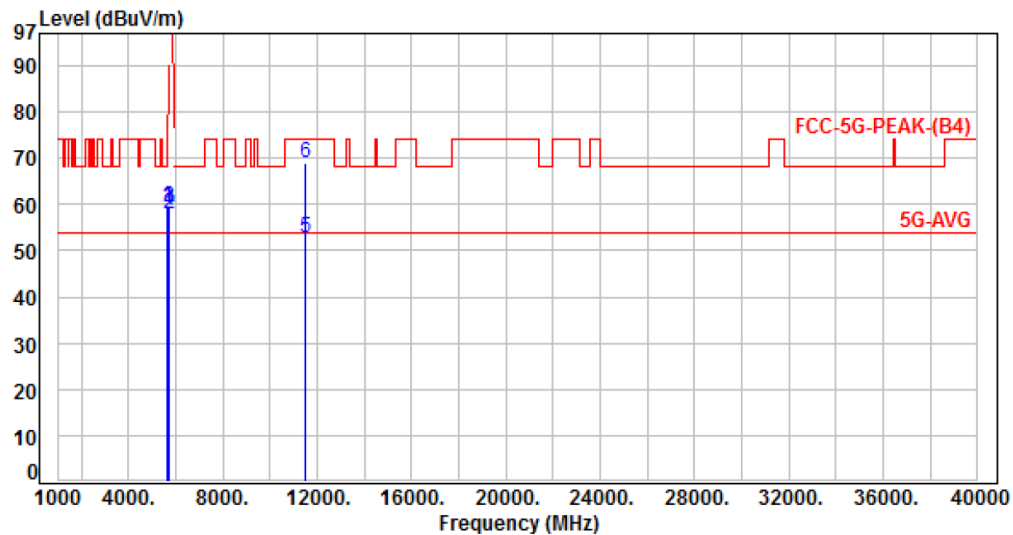
Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



6.6. Test Result and Data (1GHz ~ 40GHz)

Power	:	PoE 24V	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1, CH149	Temperature	:	23 °C
Test Date	:	Aug. 24, 2017	Humidity	:	60 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	5650.00	-12.09	71.45	59.36	68.20	-8.84	Peak	391	296	P
2	5700.00	-12.11	69.88	57.77	105.20	-47.43	Peak	391	296	P
3	5720.00	-12.12	71.45	59.33	110.80	-51.47	Peak	391	296	P
4	5725.00	-12.12	70.69	58.57	122.20	-63.63	Peak	391	296	P
5	11490.00	-6.25	59.04	52.79	54.00	-1.21	Average	126	3	P
6	11490.00	-6.25	75.23	68.98	74.00	-5.02	Peak	126	3	P

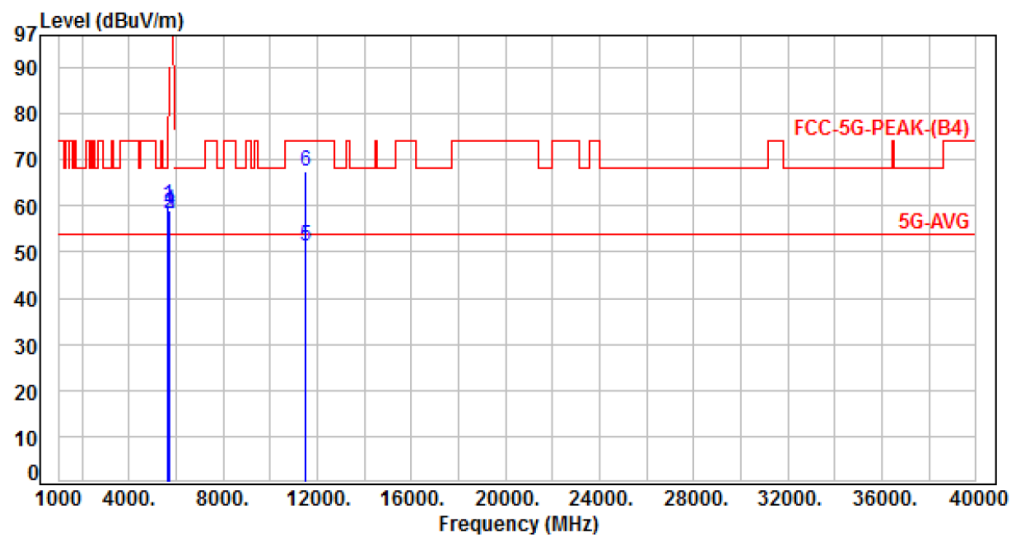
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: PoE 24V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH149	Temperature	: 23 °C
Test Date	: Aug. 24, 2017	Humidity	: 60 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	5650.00	-12.09	72.30	60.21	68.20	-7.99	Peak	136	5	P
2	5700.00	-12.11	70.44	58.33	105.20	-46.87	Peak	136	5	P
3	5720.00	-12.12	70.46	58.34	110.80	-52.46	Peak	136	5	P
4	5725.00	-12.12	71.15	59.03	122.20	-63.17	Peak	136	5	P
5	11490.00	-6.25	57.37	51.12	54.00	-2.88	Average	270	354	P
6	11490.00	-6.25	73.81	67.56	74.00	-6.44	Peak	270	354	P

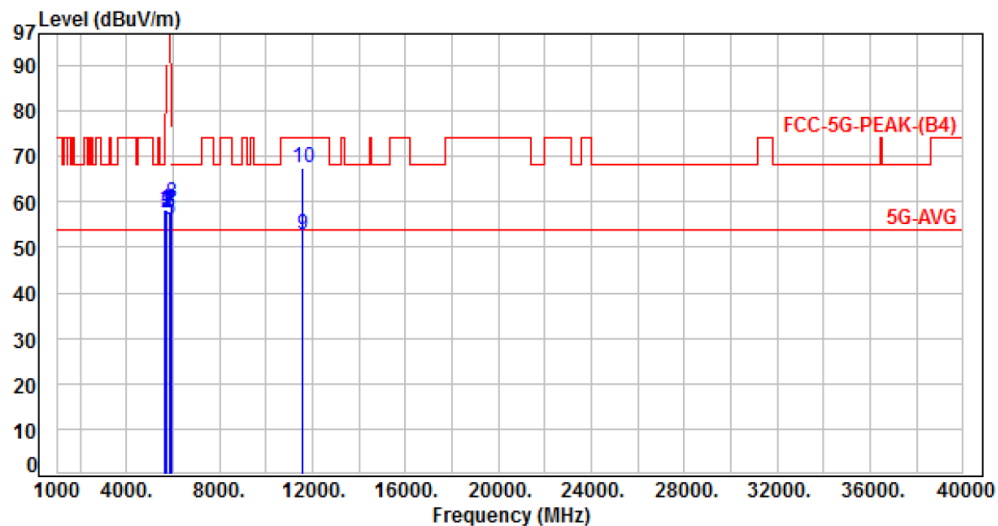
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: PoE 24V	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, CH157	Temperature	: 23 °C
Test Date	: Aug. 24, 2017	Humidity	: 60 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	5650.00	-12.09	70.53	58.44	68.20	-9.76	Peak	393	307	P
2	5700.00	-12.11	69.61	57.50	105.20	-47.70	Peak	393	307	P
3	5720.00	-12.12	70.02	57.90	110.80	-52.90	Peak	393	307	P
4	5725.00	-12.12	70.30	58.18	122.20	-64.02	Peak	393	307	P
5	5850.00	-12.16	68.21	56.05	122.20	-66.15	Peak	393	307	P
6	5855.00	-12.16	69.83	57.67	110.80	-53.13	Peak	393	307	P
7	5875.00	-12.17	70.01	57.84	105.20	-47.36	Peak	393	307	P
8	5925.00	-12.18	71.80	59.62	68.20	-8.58	Peak	393	307	P
9	11570.00	-6.23	59.01	52.78	54.00	-1.22	Average	201	1	P
10	11570.00	-6.23	73.78	67.55	74.00	-6.45	Peak	201	1	P

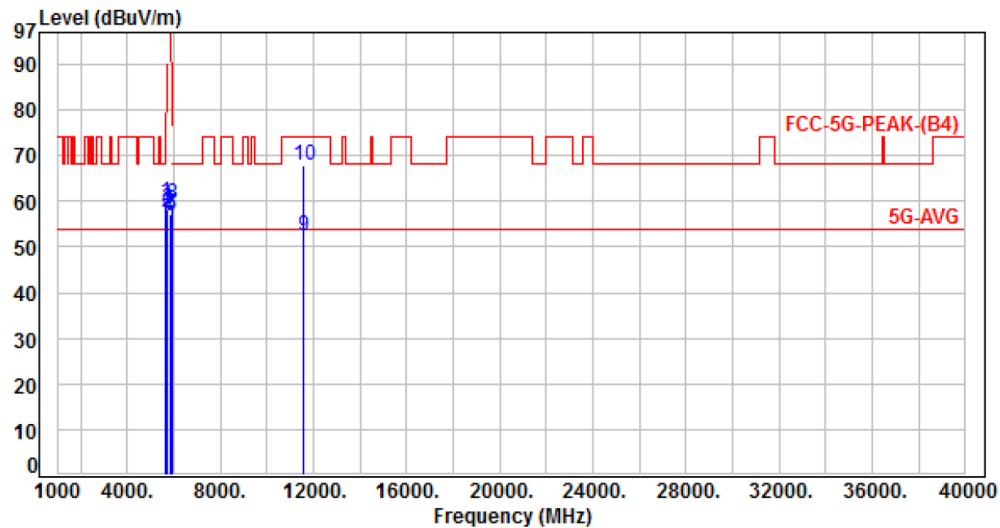
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: PoE 24V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH157	Temperature	: 23 °C
Test Date	: Aug. 24, 2017	Humidity	: 60 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	5650.00	-12.09	71.72	59.63	68.20	-8.57	Peak	106	13	P
2	5700.00	-12.11	69.80	57.69	105.20	-47.51	Peak	106	13	P
3	5720.00	-12.12	70.40	58.28	110.80	-52.52	Peak	106	13	P
4	5725.00	-12.12	70.30	58.18	122.20	-64.02	Peak	106	13	P
5	5850.00	-12.16	68.84	56.68	122.20	-65.52	Peak	106	13	P
6	5855.00	-12.16	69.49	57.33	110.80	-53.47	Peak	106	13	P
7	5875.00	-12.17	69.44	57.27	105.20	-47.93	Peak	106	13	P
8	5925.00	-12.18	71.60	59.42	68.20	-8.78	Peak	106	13	P
9	11570.00	-6.23	58.57	52.34	54.00	-1.66	Average	288	355	P
10	11570.00	-6.23	74.03	67.80	74.00	-6.20	Peak	288	355	P

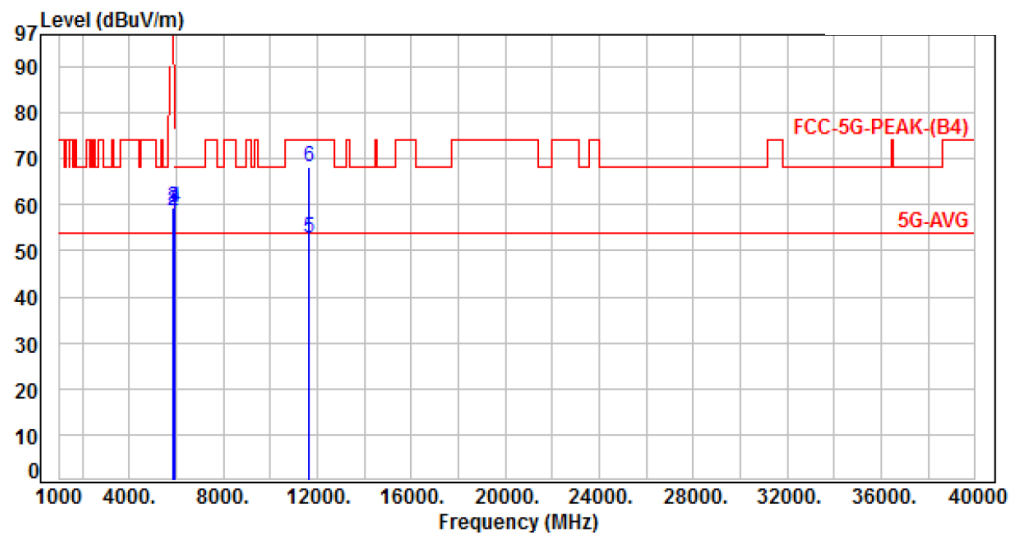
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: PoE 24V	Pol/Phase	: VERTICAL
Test Mode	: Mode 1, CH165	Temperature	: 23 °C
Test Date	: Aug. 24, 2017	Humidity	: 60 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	5850.00	-12.16	70.24	58.08	122.20	-64.12	Peak	388	317	P
2	5855.00	-12.16	70.77	58.61	110.80	-52.19	Peak	388	317	P
3	5875.00	-12.17	71.50	59.33	105.20	-45.87	Peak	388	317	P
4	5925.00	-12.18	71.65	59.47	68.20	-8.73	Peak	388	317	P
5	11650.00	-6.21	59.03	52.82	54.00	-1.18	Average	121	2	P
6	11650.00	-6.21	74.31	68.10	74.00	-5.90	Peak	121	2	P

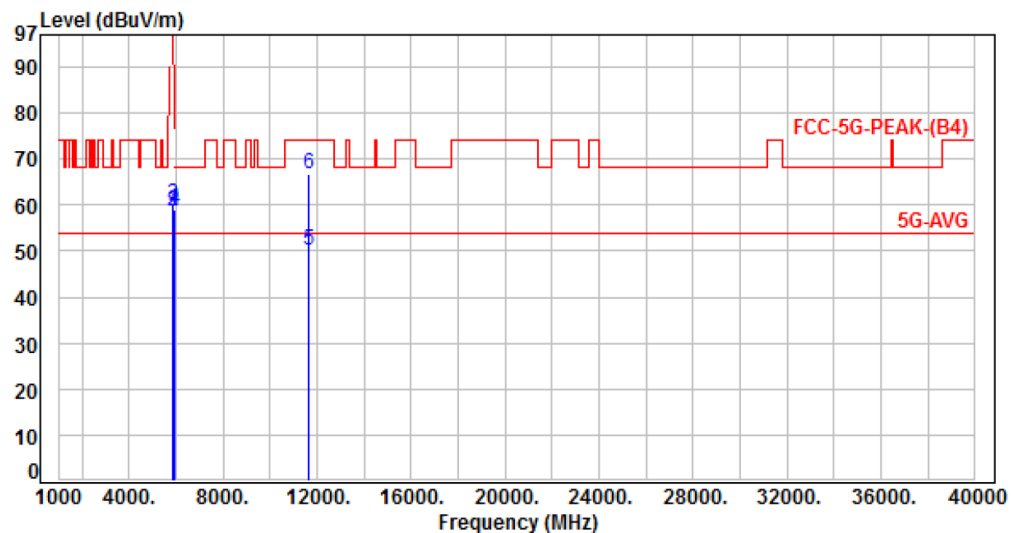
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: PoE 24V	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1, CH165	Temperature	: 23 °C
Test Date	: Aug. 24, 2017	Humidity	: 60 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	5850.00	-12.16	71.33	59.17	122.20	-63.03	Peak	140	7	P
2	5855.00	-12.16	70.95	58.79	110.80	-52.01	Peak	140	7	P
3	5875.00	-12.17	72.14	59.97	105.20	-45.23	Peak	140	7	P
4	5925.00	-12.18	71.28	59.10	68.20	-9.10	Peak	140	7	P
5	11650.00	-6.21	56.52	50.31	54.00	-3.69	Average	278	356	P
6	11650.00	-6.21	72.78	66.57	74.00	-7.43	Peak	278	356	P

Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



6.7. Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.09000 – 0.11000	16.42000 – 16.42300	399.9 – 410.0	4.500 – 5.150
0.49500 – 0.505**	16.69475 – 16.69525	608.0 – 614.0	5.350 – 5.460
2.17350 – 2.19050	16.80425 – 16.80475	960.0 – 1240.0	7.250 – 7.750
4.12500 – 4.12800	25.50000 – 25.67000	1300.0 – 1427.0	8.025 – 8.500
4.17725 – 4.17775	37.50000 – 38.25000	1435.0 – 1626.5	9.000 – 9.200
4.20725 – 4.20775	73.00000 – 74.60000	1645.5 – 1646.5	9.300 – 9.500
6.21500 – 6.21800	74.80000 – 75.20000	1660.0 – 1710.0	10.600 – 12.700
6.26775 – 6.26825	108.00000 – 121.94000	1718.8 – 1722.2	13.250 – 13.400
6.31175 – 6.31225	123.00000 – 138.00000	2200.0 – 2300.0	14.470 – 14.500
8.29100 – 8.29400	149.90000 – 150.05000	2310.0 – 2390.0	15.350 – 16.200
8.36200 – 8.36600	156.52475 – 156.52525	2483.5 – 2500.0	17.700 – 21.400
8.37625 – 8.38675	156.70000 – 156.90000	2655.0 – 2900.0	22.010 – 23.120
8.41425 – 8.41475	162.01250 – 167.17000	3260.0 – 3267.0	23.600 – 24.000
12.29000 – 12.29300	167.72000 – 173.20000	3332.0 – 3339.0	31.200 – 31.800
12.51975 – 12.52025	240.00000 – 285.00000	3345.8 – 3358.0	36.430 – 36.500
12.57675 – 12.57725	322.00000 – 335.40000	3600.0 – 4400.0	Above 38.6
13.36000 – 13.41000			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz



7. On Time, Duty Cycle and Measurement methods

7.1. Test Limit

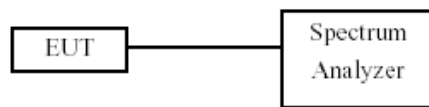
FCC §15.407

The minimum 6 dB bandwidth shall be at least 500 kHz.

7.2. Test Procedure

Reference to 789033 D02 General UNII Test Procedures New Rules v01: The transmitter output is connected to a spectrum analyzer with the RBW set to 100 kHz, the VBW $\geq 3 \times$ RBW, peak detector and max hold.

7.3. Test Setup Layout



7.4. Test Result and Data

Temperature: 22°C

Humidity: 64%

Test Date: Aug. 31, 2017

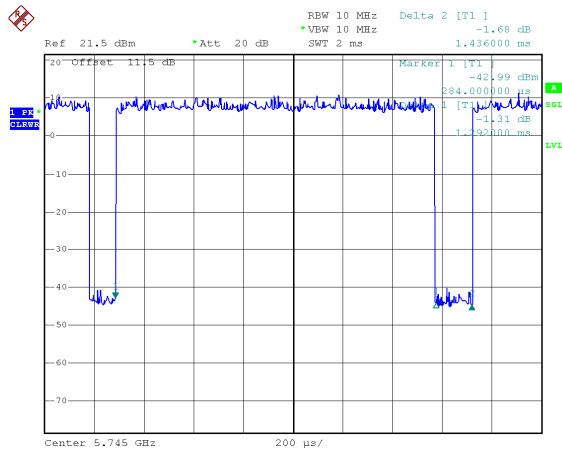
Modulation Type	On Time (msec)	Period Time (msec)	Duty Cycle (%)	1/T Minimum VBW(Hz)	Duty Cycle correction Factor (dB)
802.11n HT20	1.29	1.44	89.97%	773.99	0.46

7.5. Measurement Methods

26 dB and 6dB Emission BW	KDB 789033 D02 v01, Section C
99% Occupied BW	KDB 789033 D02 v01, Section D
Conducted Output Power	KDB 789033 D02 v01, Section E.2.d and E.3.b (Method PM-G)
Power Spectral Density	KDB 789033 D02 v01, Section F
Unwanted emissions in restricted bands	KDB 789033 D02 v01, Sections G and H
Unwanted emissions in non-restricted bands	KDB 789033 D02 v01, Sections G and H



Modulation Standard: 802.11n HT20





8. 6dB Bandwidth

8.1. Test Limit

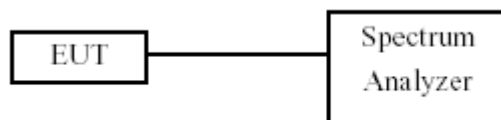
FCC §15.407

The minimum 6 dB bandwidth shall be at least 500 kHz.

8.2. Test Procedure

Reference to 789033 D02 General UNII Test Procedures New Rules v01: The transmitter output is connected to a spectrum analyzer with the RBW set to 100KHz, the VBW $\geq 3 \times$ RBW, peak detector and max hold.

8.3. Test Setup Layout



8.4. Test Result and Data

Temperature: 22°C

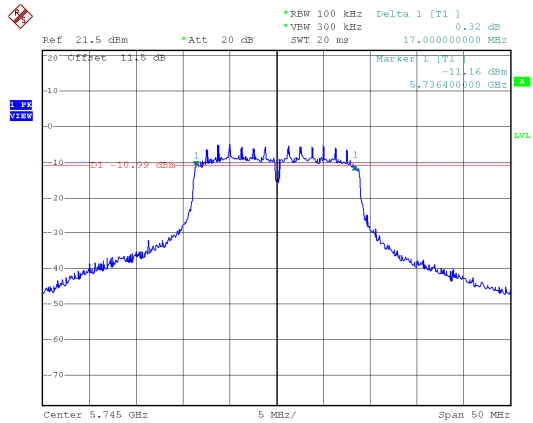
Humidity: 64%

Test Date: Aug. 31, 2017

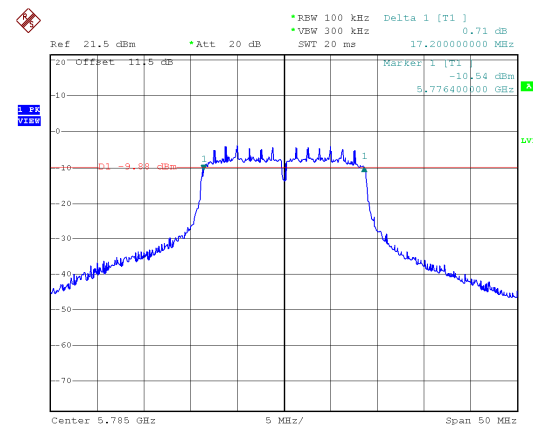
Modulation Type	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)
802.11n HT20	149	5745	17.00	0.50
	157	5785	17.20	0.50
	165	5825	17.10	0.50



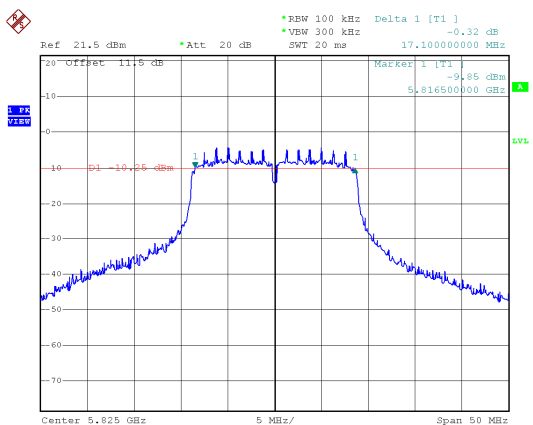
6dB Bandwidth
Modulation Standard: 802.11n HT20
CH149



CH157



CH165





9. Average Power

9.1. Test Limit

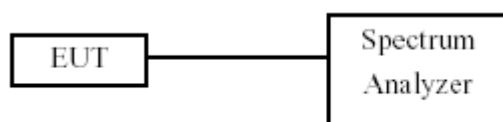
None; for reporting purposes only.

9.2. Test Procedure

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

9.3. Test Setup Layout



9.4. Test Result and Data

Temperature: 22°C

Humidity: 64%

Test Date: Aug. 31, 2017

Modulation Type	CH	Freq. (MHz)	Avg Power Output (dBm)	Total Power (dBm)	Total Power (mW)	Power Limit (dBm)
802.11n HT20	149	5745	5.6	5.60	3.63	30.00
	157	5785	7.4	7.40	5.50	30.00
	165	5825	7	7.00	5.01	30.00



10. PPSS

10.1. Test Limit

Output Power:

Frequency Band		Limit
☐	5.15~5.25GHz	
Operating Mode		
☐	Outdoor access point	The maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm) provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30degrees as measured from the horizon must not exceed 125 mW (21 dBm).
☐	Indoor access point	The maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm) provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
☐	Fixed point-to-point access points	The maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm). Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.
☐	Mobile and portable client devices	The maximum conducted output power over the frequency band of operation shall not exceed 250 mW (24dBm) provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



Frequency Band		Limit
☐	5.25-5.35 GHz	The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW (24dBm) or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
☐	5.470-5.725 GHz	
☒	5.725~5.85 GHz	The maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm). If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

PSD:

Frequency Band		Limit	
☐	5.15~5.25GHz		
	Operating Mode		
	☐	Outdoor access point	17 dBm/MHz
	☐	Indoor access point	17 dBm/MHz
	☐	Fixed point-to-point access points	17 dBm/MHz
	☐	Mobile and portable client devices	11 dBm/MHz
☐	5.725~5.85 GHz	11 dBm/MHz	
☐	5.470-5.725 GHz	11 dBm/MHz	
☒	5.725~5.85 GHz	30 dBm/500kHz	



10.2. Test Procedure

As an alternative to FCC KDB-789033, the EUT maximum conducted output power was Measured with an average power meter employing a video bandwidth greater than 6dB BW of the emission under test. Maximum conducted output power was read directly from the meter across all data rates, and across three channels within each sub-band. Special care was used to make sure that the EUT was transmitting in continuous mode. This method exceeds the limitations of FCC KDB-789033, and provides more accurate measurements.

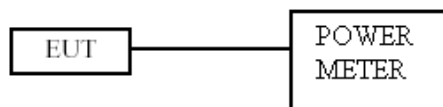
802.11an (BW $\leq$ 40MHz) Maximum conducted output power using KDB 789033 section E)3)b) Method PM-G (Measurement using a gated RF average power meter)

Note: the power meter have a video bandwidth that is greater than or equal to the measurement bandwidth, (Anritsu/ MA2411B video bandwidth: 65MHz)

802.11ac (BW=80MHz) Maximum conducted output power using KDB 789033 section E)2)b) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep).

When transmitted signals consist of two or more non-contiguous spectrum segments (e.g., 80+80 MHz mode) or when a single spectrum segment of a transmission crosses the boundary between two adjacent U-NII bands, KDB 644545 D01 section F) procedure is used for measurements.

10.3. Test Setup Layout



10.4. Test Result and Data

Temperature: 22°C

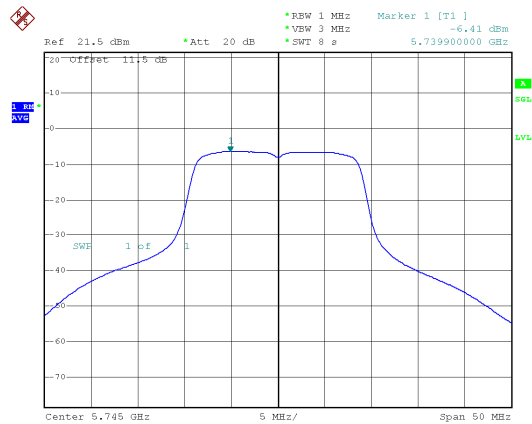
Humidity: 64%

Test Date: Aug. 31, 2017

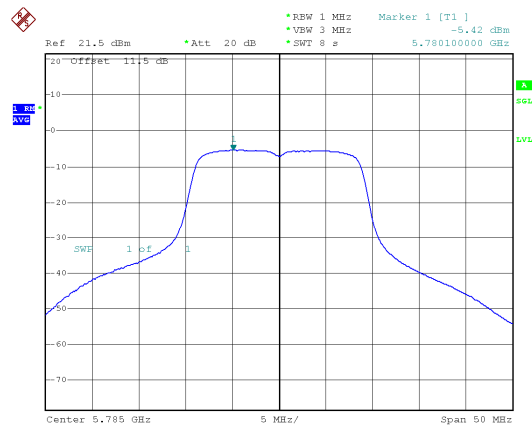
Modulation Type	CH	Freq. (MHz)	Meas PPSD (dBm/MHz)	Duty Cycle CF(dB)	10log(500KHz/ RBW) CF (dB)	Total Corr'd PPSD (dBm/MHz)	PPSD Limit (dBm/MHz)
802.11n HT20	149	5745	-6.41	0.46	-3.01	-8.96	30.00
	157	5785	-5.42	0.46	-3.01	-7.97	30.00
	165	5825	-5.40	0.46	-3.01	-7.95	30.00



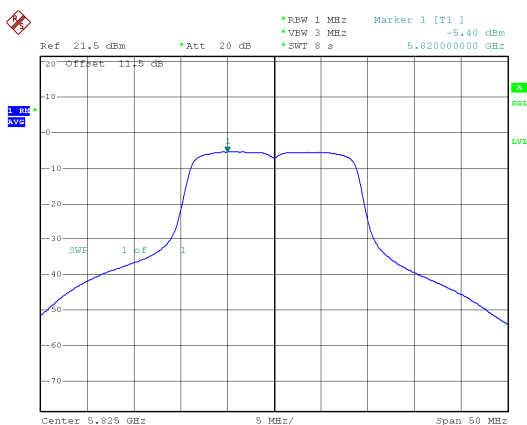
Modulation Standard: 802.11n HT20
CH149



CH157



CH165



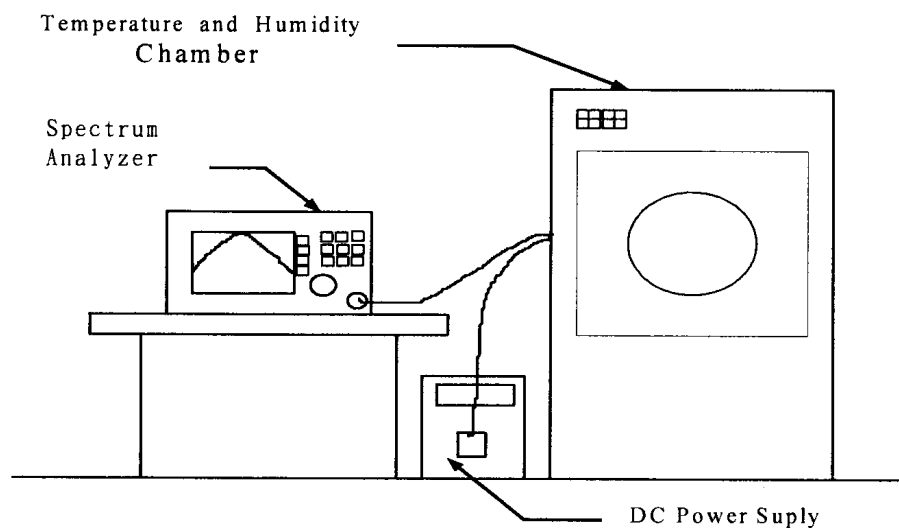


11. Frequency Stability

11.1. Test Procedure

1. The EUT was placed inside the Temperature and Humidity chamber.
2. The transmitter output was connected to spectrum analyzer.
3. Turn the EUT on and couple its output to a spectrum analyzer.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
6. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
7. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

11.2. Test Setup Layout



**11.3. Test Result and Data**

Temperature: 22°C

Humidity: 64%

Test Date: Aug. 31, 2017

Operating frequency: 5825 MHz							
Temp	Power supply	2 minute		5 minute		10 minute	
(°C)	(V)	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
70	93.5	5825.0056	0.000100	5825.0059	-0.001401	5825.0059	-0.000422
	110	5825.0821	0.001410	5825.0824	0.001491	5825.0819	0.000070
	126.5	5824.9389	-0.001053	5824.9394	-0.000568	5824.9398	-0.001232
60	93.5	5824.9234	0.000100	5824.9239	-0.001401	5824.9238	-0.000422
	110	5825.0225	0.001410	5825.0230	0.001491	5825.0231	0.000070
	126.5	5824.9066	-0.001053	5824.9060	-0.000568	5824.9064	-0.001232
50	93.5	5825.0058	0.000100	5824.9184	-0.001401	5824.9754	-0.000422
	110	5825.0822	0.001410	5825.0869	0.001491	5825.0041	0.000070
	126.5	5824.9387	-0.001053	5824.9669	-0.000568	5824.9282	-0.001232
40	93.5	5824.9230	-0.001322	5825.0302	0.000519	5824.9360	-0.001098
	110	5825.0225	0.000385	5824.9235	-0.001313	5825.0432	0.000742
	126.5	5824.9063	-0.001608	5824.9224	-0.001332	5824.9795	-0.000351
30	93.5	5825.0452	0.000776	5825.0100	0.000172	5825.0336	0.000577
	110	5825.0293	0.000502	5825.0936	0.001606	5825.0832	0.001428
	126.5	5825.0561	0.000963	5824.9932	-0.000116	5825.0898	0.001541
20	93.5	5825.0092	0.000158	5825.0275	0.000472	5825.0238	0.000409
	110	5825.0590	0.001013	5824.9656	-0.000590	5825.0740	0.001270
	126.5	5825.0475	0.000816	5825.0382	0.000656	5825.0359	0.000617
10	93.5	5825.0451	0.000775	5825.0670	0.001150	5825.0105	0.000179
	110	5825.0872	0.001497	5825.0570	0.000979	5824.9096	-0.001552
	126.5	5824.9851	-0.000256	5825.0379	0.000651	5824.9467	-0.000915
0	93.5	5824.9720	-0.000481	5824.9278	-0.001239	5825.0027	0.000047
	110	5825.0327	0.000561	5825.0033	0.000057	5824.9763	-0.000407
	126.5	5825.0572	0.000983	5825.0770	0.001322	5825.0891	0.001529
-10	93.5	5824.9514	-0.000835	5825.0944	0.001620	5824.9176	-0.001415
	110	5825.0789	0.001355	5825.0922	0.001582	5824.9659	-0.000586
	126.5	5824.9647	-0.000606	5824.9155	-0.001451	5825.0320	0.000549
-20	93.5	5824.9854	-0.000251	5825.0190	0.000327	5825.0882	0.001514
	110	5824.9728	-0.000467	5825.0299	0.000514	5824.9095	-0.001554
	126.5	5824.9386	-0.001053	5824.9616	-0.000659	5824.9473	-0.000904
-30	93.5	5824.9261	-0.001269	5825.0829	0.001424	5824.9496	-0.000865
	110	5825.0671	0.001151	5825.0355	0.000610	5825.0580	0.000995
	126.5	5825.0989	0.001698	5824.9857	-0.000245	5825.0360	0.000619
-40	93.5	5825.0455	-0.001269	5825.0457	0.001424	5825.0457	-0.000865
	110	5825.0293	0.001151	5825.0293	0.000610	5825.0296	0.000995
	126.5	5825.0563	0.001698	5825.0565	-0.000245	5825.0568	0.000619

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.



12. Automatically Discontinue Transmission

12.1.Limit of Automatically Discontinue Transmission

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

12.2.Test Result of Automatically Discontinue Transmission

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



13. Radio Frequency Exposure

13.1.Applicable Standards

The measurements shown in this test report were made in accordance with the procedures given in FCC Part 2 (Section 2.1091)

KDB 447498

13.2.EUT Specification

Frequency band (Operating)	☐ WLAN: 2412MHz ~ 2462MHz ☐ WLAN: 5150MHz ~ 5250MHz ☐ WLAN: 5250MHz ~ 5350MHz ☐ WLAN: 5470MHz ~ 5725MHz ☒ WLAN: 5725MHz ~ 5850MHz ☐ Bluetooth: 2402MHz ~ 2480MHz
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation)
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm ²) ☒ General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna diversity	☒ Single antenna ☐ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☐ Tx/Rx diversity
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A

Remark:

1. The maximum output power is 7.4dBm (5.01mW) at 5825MHz (with numeric 2 antenna gain.)
2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.
3. For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm² even if the calculation indicates that the power density would be larger.



13.3.Test Results

No non-compliance noted.

13.4.Calculation

$$\text{Given } E = \frac{\sqrt{30 \times P \times G}}{d} \quad \& \quad S = \frac{E^2}{3770}$$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770d^2}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) = d (m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \text{Equation 1}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

13.5.Maximum Permissible Exposure

Modulation Type	Frequency band (MHz)	Max. Conducted output power(dBm)	Antenna Gain(dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
11n HT20	5725-5850	7.40	2	28	0.0009	1