ACCREDITED
TESTING LABORATORY
CERTIFICATE # 4821.01

BACL
Bay Area Compliance Labs Corp.

FCC PART 15.407

TEST REPORT

For

Shenzhen HighGreat Innovation Technology Development Co., Ltd.

NO.6 Yuanlingzai Park, Henggang Town Longgang District Shenzhen City, Guangdong Province China

FCC ID: 2ALYRHG-F06

Report Type:	Product Type:
Original Report	MARK

Report Number:	RSZ180423011-00C
Report Date:	2018-06-19
Reviewed By:	Rocky Kang RF Engineer
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Shenzhen HighGreat Innovation Technology Development Co., Ltd.'s* product, model number: *HG-F06 (FCC ID: 2ALYRHG-F06)* or the "EUT" in this report is a *MARK,* which was measured approximately: 148 mm (L) x 73 mm (W) x 48 mm (H), rated with input voltage: DC 7.6 V.

Adapter Information:
Model: SOY-1200250US
Input: 100-240V ~ 50/60Hz 0.8A Max.
Output: 12V, 2.5A

**All measurement and test data in this report was gathered from production sample serial number: 1800656 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-04-23.*

Objective

This type approval report is prepared on behalf of *Shenzhen HighGreat Innovation Technology Development Co., Ltd.* in accordance with Part 2-Subpart J, Part 15-Subparts A and E of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart E, section 15.203, 15.205, 15.209 and 15.407 rules.

Related Submittal(s)/Grant(s)

Part 15.247 DTS submittal with FCC ID: 2ALYRHG-F06.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

And KDB 789033 D02 General UNII Test Procedures New Rules v02r01

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter	uncertainty
Occupied Channel Bandwidth	±5%
RF Output Power with Power meter	±0.5dB
RF conducted test with spectrum	±1.5dB
AC Power Lines Conducted Emissions	±1.95dB
All emissions, radiated	±4.88dB
Temperature	-30~60 ℃
Humidity	±6%
Supply voltages	±0.4%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 342867, the FCC Designation No. : CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode, which was provided by manufacturer.

The device support 802.11a/n20 modes.

For 5725-5850 MHz Band, 5 channels are provided to testing:

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

Channel 149, 157 and 165 were chosed for testing.

EUT Exercise Software

ADB command was used for wifi testing.

The device was tested with the worst case was performed as below:

Antenna 0 (or left Antenna):

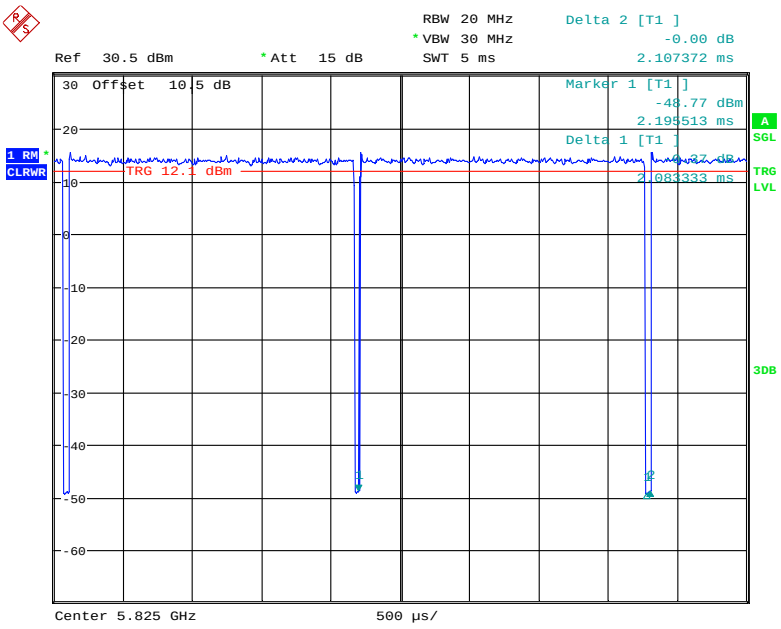
Mode	Data rate	Power level		
		Low channel	Middle channel	High channel
802.11a	6M	16	16	16
802.11n20	MCS0	16	16	17

Antenna 1 (or right Antenna):

Mode	Data rate	Power level		
		Low channel	Middle channel	High channel
802.11a	6M	17	17	17
802.11n20	MCS0	17	17	17

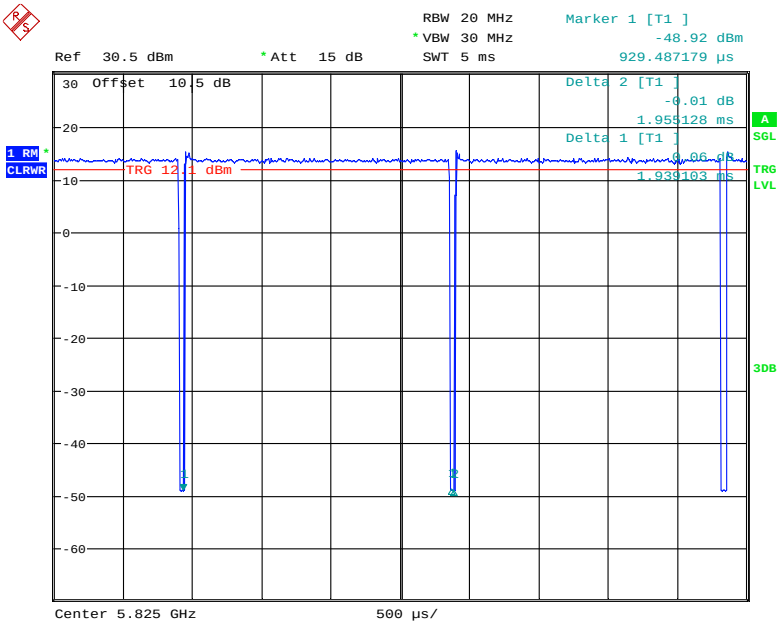
Duty cycle
Antenna 0:

802.11a Mode



Date: 4.MAY.2018 10:53:32

802.11n20 mode



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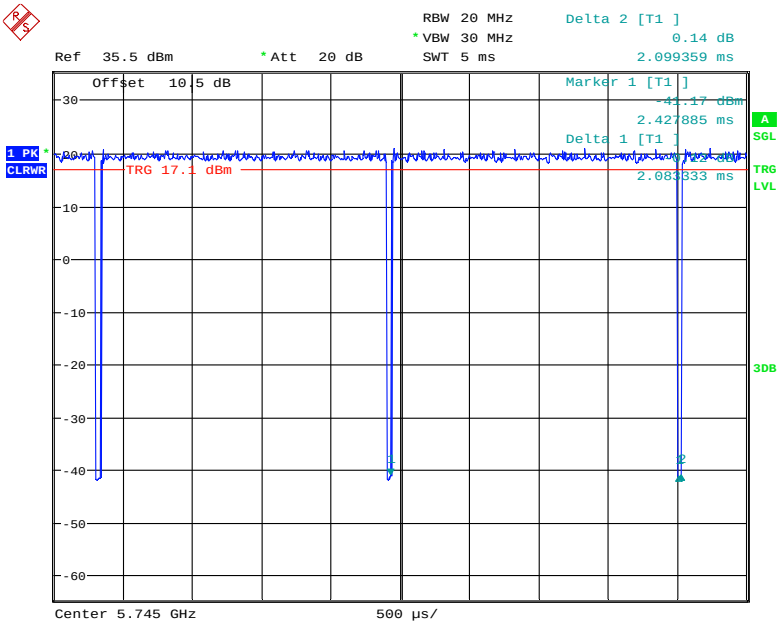
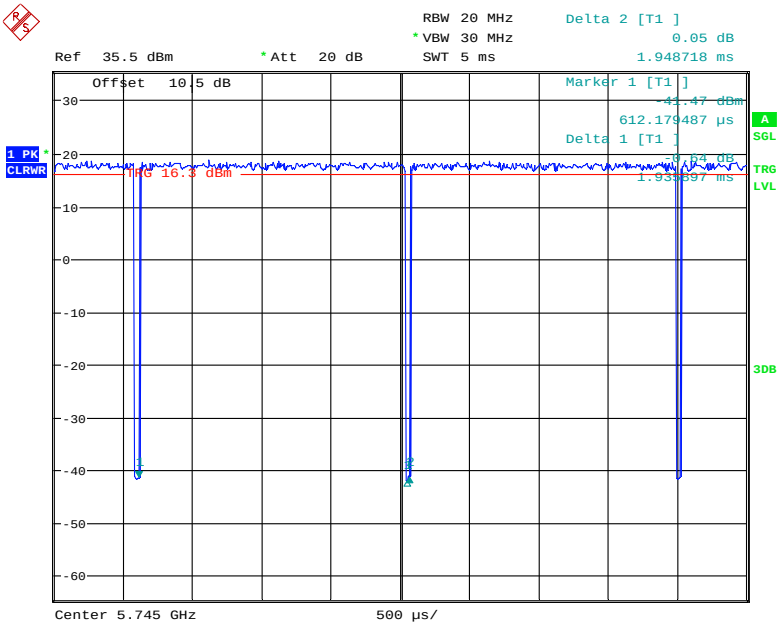
Antenna 1:

802.11a Mode



Date: 4.MAY.2018 16:17:47

802.11n20 mode



Date: 27.JUN.2018 18:02:39

Antenna 0:

Mode	Duty Cycle (%)	T(ms)	1/T(kHz)	VBW Setting	10log(1/ Duty Cycle)
802.11a	99	-	-	10Hz	-
802.11n20	99	-	-	10Hz	-

Antenna 1:

Mode	Duty Cycle (%)	T(ms)	1/T(kHz)	VBW Setting	10log(1/ Duty Cycle)
802.11a	99	-	-	10Hz	-
802.11n20	99	-	-	10Hz	-

Equipment Modifications

No modification was made to the EUT tested.

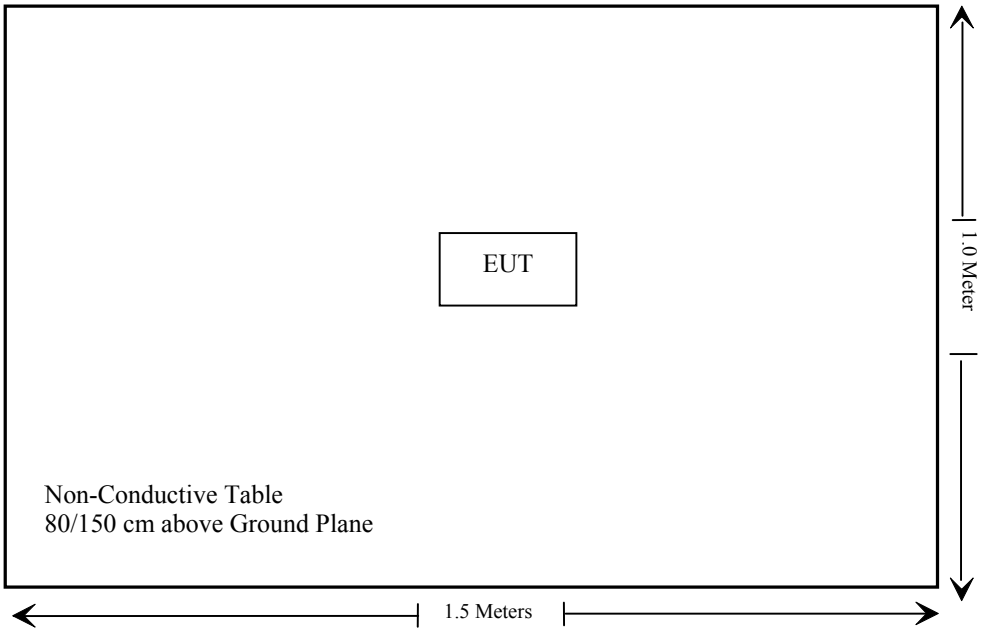
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 (b) (1) & §2.1091	MaximuM Permissible exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.407(b)(6)& §15.207(a)	Conducted Emissions	Not Applicable
§15.205& §15.209 &§15.407(b) (4),(6),(7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(b) (4)	Out Of Band Emission	Compliance
§15.407(e)	6dB Bandwidth	Compliance
§15.407(a) (3)	Conducted Transmitter Output Power	Compliance
§15.407 (a) (3)	Power Spectral Density	Compliance

Note:
Not Applicable: The EUT is powered by battery and the battery can be removed to a charger while it's charging

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
A.H.System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2018-04-24	2019-04-24
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2017-05-21	2018-05-21
HP	Amplifier	HP8447E	1937A01046	2017-11-19	2018-05-21
Agilent	Spectrum Analyzer	8564E	3943A01781	2018-01-04	2019-01-04
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	104PEA	218124002	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	RG-214	1	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	RG-214	2	2017-11-22	2018-05-22
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-04	2017-12-29	2020-12-28
Ducommun Technologies	Horn Antenna	ARH-2823-02	1007726-04	2017-12-29	2020-12-28
Ducommun Technologies	Pre-amplifier	ALN-22093530-01	991373-01	2017-08-03	2018-08-03
RF Conducted Test					
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2017-12-24	2018-12-24
Long Wei	DC Power Supply	TPR-6420D	398363	NCR	NCR
Agilent	Wideband Power Sensor	U2021XA	MY54250003	2018-03-21	2019-03-21
Ducommun technologies	RF Cable	RG-214	3	Each Time	
WEINSCHEL	10dB Attenuator	5324	AU 3842	Each Time	

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

§1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

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

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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Frequency (MHz)	Antenna Gain		Maximum Tune-up power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)			
5745-5825	2.56	1.80	20	100	20	0.04	1.0

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

2.4G & 5G WIFI can't transmit simultaneously.

Result: The device meets MPE requirement for Devices Used by the General Public at 20 cm distance.

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.407 (a), if the transmitting antennas of directional gain greater than 6dBi are used, the transmit power and power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

This product has two internal wifi antennas which were permanently attached and the antenna 0 with maximum gain 2.56 dBi and the antenna 1 with maximum gain 1.87dBi for 5.8G WIFI,fulfill the requirement of this section, and please refer to the EUT photos.

Result: Compliance.

§15.205 & §15.209 & §15.407(b) (4),(6),(7) – UNDESIRABLE EMISSION

Applicable Standard

FCC §15.407 (b) (4), (6), (7); §15.209; §15.205;

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(4) For transmitters operating in the 5.725-5.85 GHz band:
(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

As to transmitters operating in the 5.725-5.85 GHz band, the strictest limit was applied for undesirable emissions, performed as below:

1) For 25MHz-75 MHz above or below the band edge, a level of -27 dBm/MHz (68.2dBμV/m) was applied.
2) For 5MHz-25 MHz above or below the band edge, a level of 10 dBm/MHz (105.2dBμV/m) was applied.
2) For 0MHz-5 MHz above or below the band edge, a level of 15.6 dBm/MHz (110.8dBμV/m) was applied

According to ANSI C63.10-2013,9.4: For field strength measurements made at other than the distance at which the applicable limit is specified,extrapolate the measured field strength to the field strength at the distance specified by the limit using an inverse distance correction factor (20 dB/decade of distance). In some cases, a different distance correction factor may be required;

$$E_{\mathrm{SpecLimit}} = E_{\mathrm{Meas}} + 20\log\left(\frac{d_{\mathrm{Meas}}}{d_{\mathrm{SpecLimit}}}\right)$$

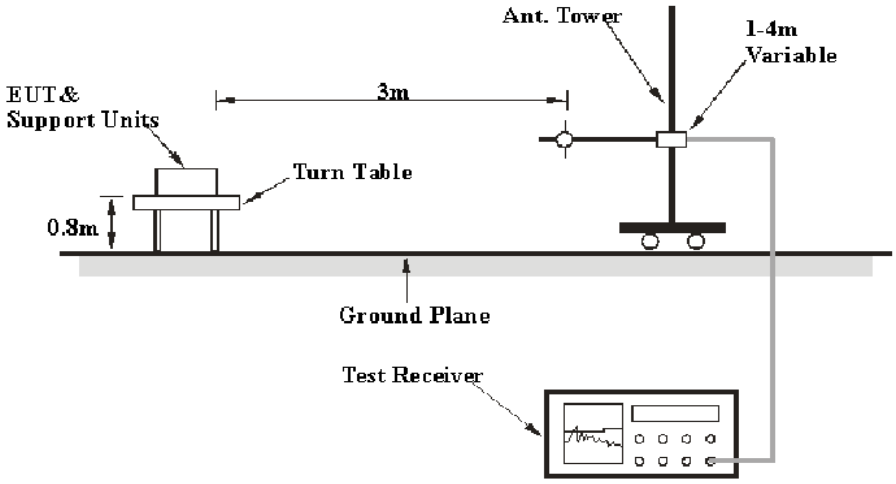
where

$E_{\mathrm{SpecLimit}}$	is the field strength of the emission at the distance specified by the limit, in dBμV/m
E_{Meas}	is the field strength of the emission at the measurement distance, in dBμV/m
d_{Meas}	is the measurement distance, in m
$d_{\mathrm{SpecLimit}}$	is the distance specified by the limit, in m

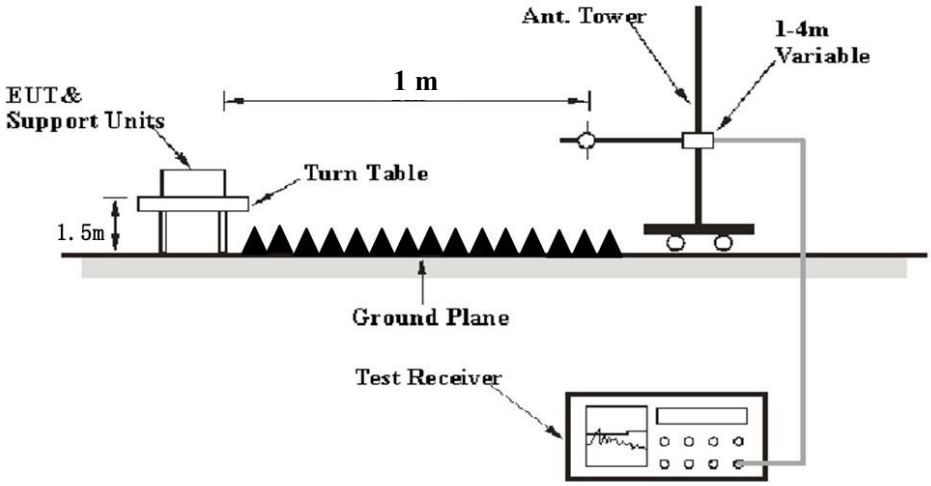
So the extrapolation factor of 1m is 20*log(1/3)= -9.5 dB

EUT Setup

Below 1 GHz:



Above 1 GHz:



The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC 15.209 and FCC 15.407 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1MHz	10 Hz Note 1	/	Ave.
	1MHz	＞1/T Note 2	/	Ave.

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

Test Procedure

Radiated Spurious Emission

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all the installation combinations.

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

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

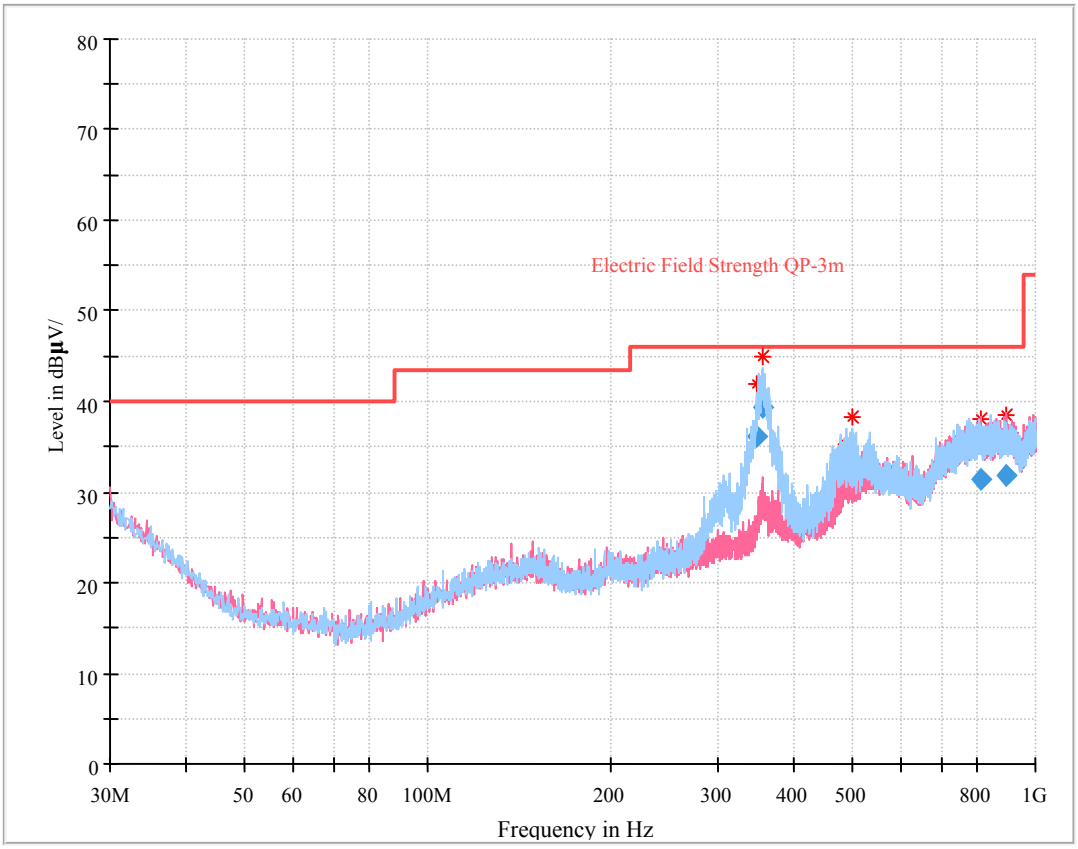
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nancy Wang on 2018-05-08.

EUT operation mode: Transmitting with two antennas simultaneously

30 MHz~1 GHz: (Worst case is 5825 MHz in 802.11n20 mode)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
348.659875	36.04	108.0	H	50.0	-1.9	46.00	9.96
354.871250	39.44	115.0	H	236.0	-1.7	46.00	6.56
487.321875	33.11	182.0	H	129.0	2.6	46.00	12.89
500.517875	31.45	206.0	H	144.0	3.4	46.00	14.55
811.751125	31.39	145.0	V	48.0	9.2	46.00	14.61
893.494125	31.74	393.0	V	193.0	10.1	46.00	14.26

1000 MHz ~ 40 GHz: (5725-5850 MHz)

802.11a mode:

Frequency (MHz)	Measurement		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Extrapolation Result (dBμV/m)	FCC Part 15.407/205/209	
	Reading (dBμV)	(PK/QP/Ave.)		Height (m)	Polar (H/V)				Limit (dBμV/m)	Margin (dB)
5745 MHz										
5745.00	72.55	PK	291	1.3	H	42.15	114.70	105.2	/	/
5745.00	60.80	Ave.	291	1.3	H	42.15	102.95	93.45	/	/
5745.00	72.76	PK	150	2.0	V	42.15	114.91	105.41	/	/
5745.00	60.85	Ave.	150	2.0	V	42.15	103.00	93.5	/	/
5724.39	46.04	PK	35	1.1	V	42.15	88.19	78.69	120.81	42.12
5718.45	38.27	PK	35	1.1	V	42.15	80.42	70.92	110.37	39.45
5689.37	28.03	PK	295	1.4	V	42.15	70.18	60.68	97.33	36.65
5860.22	27.59	PK	295	1.4	V	42.55	70.14	60.64	109.34	48.7
11490.00	47.59	PK	353	1.4	V	18.92	66.51	57.01	74	16.99
11490.00	33.06	Ave.	353	1.4	V	18.92	51.98	42.48	54	11.52
5785 MHz										
5785.00	72.71	PK	21	1.4	H	42.08	114.79	105.29	/	/
5785.00	60.64	Ave.	21	1.4	H	42.08	102.72	93.22	/	/
5785.00	75.56	PK	294	2.4	V	42.08	117.64	108.14	/	/
5785.00	63.51	Ave.	294	2.4	V	42.08	105.59	96.09	/	/
11570.00	51.76	PK	276	2.2	V	19.17	70.93	61.43	74	12.57
11570.00	37.01	Ave.	276	2.2	V	19.17	56.18	46.68	54	7.32
5825 MHz										
5825.00	71.26	PK	349	1.9	H	42.08	113.34	103.84	/	/
5825.00	59.03	Ave.	349	1.9	H	42.08	101.11	91.61	/	/
5825.00	74.51	PK	53	2.1	V	42.08	116.59	107.09	/	/
5825.00	62.29	Ave.	53	2.1	V	42.08	104.37	94.87	/	/
5850.75	34.18	PK	66	1.2	V	42.55	76.73	67.23	120.49	53.26
5862.24	30.53	PK	66	1.2	V	42.55	73.08	63.58	108.77	45.19
5879.05	28.77	PK	260	1.3	V	42.55	71.32	61.82	102.2	40.38
5715.55	27.63	PK	260	1.3	V	42.15	69.78	60.28	109.55	49.27
11650.00	50.42	PK	108	2.0	V	19.17	69.59	60.09	74	13.91
11650.00	36.78	Ave.	108	2.0	V	19.17	55.95	46.45	54	7.55

802.11n20 mode:

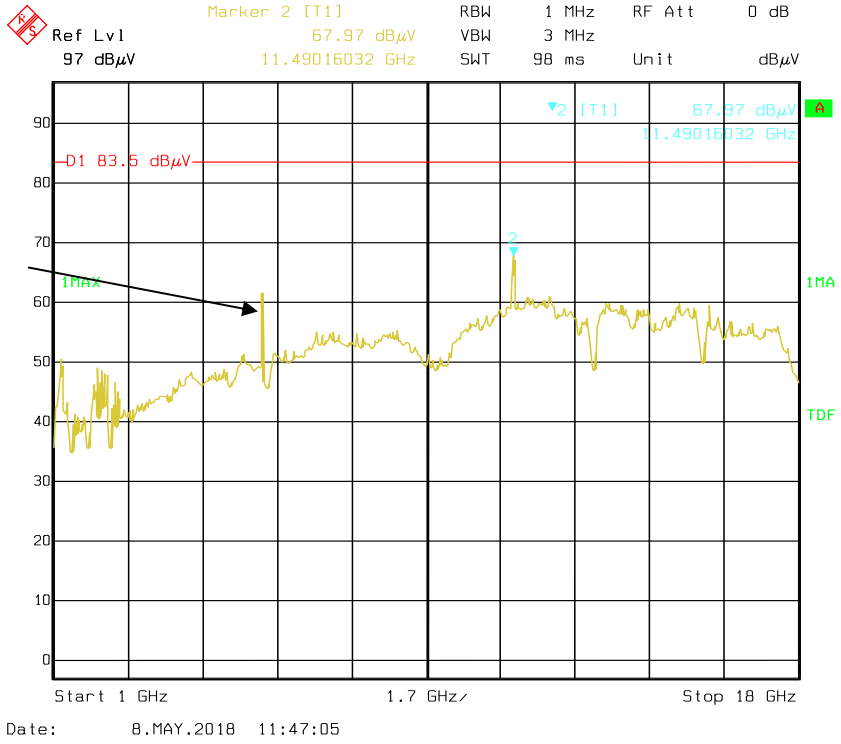
Frequency (MHz)	Measurement		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Extrapolation Result (dBμV/m)	FCC Part 15.407/205/209	
	Reading (dBμV)	(PK/QP/Ave.)		Height (m)	Polar (H/V)				Limit (dBμV/m)	Margin (dB)
5745 MHz										
5745.00	72.59	PK	15	1.9	H	42.15	114.74	105.24	/	/
5745.00	57.84	Ave.	15	1.9	H	42.15	99.99	90.49	/	/
5745.00	76.70	PK	179	2.5	V	42.15	118.85	109.35	/	/
5745.00	62.05	Ave.	179	2.5	V	42.15	104.20	94.7	/	/
5725.00	48.62	PK	219	1.7	V	42.15	90.77	81.27	122.2	40.93
5717.19	38.26	PK	219	1.7	V	42.15	80.41	70.91	110.01	39.1
5695.66	26.59	PK	128	1.1	V	42.15	68.74	59.24	101.99	42.75
5865.55	26.78	PK	128	1.1	V	42.55	69.33	59.83	107.85	48.02
11490.00	56.75	PK	338	1.5	V	18.92	75.67	66.17	74	7.83
11490.00	41.63	Ave.	338	1.5	V	18.92	60.55	51.05	54	2.95
5785 MHz										
5785.00	71.05	PK	279	2.4	H	42.08	113.13	103.63	/	/
5785.00	56.69	Ave.	279	2.4	H	42.08	98.77	89.27	/	/
5785.00	75.99	PK	36	1.1	V	42.08	118.07	108.57	/	/
5785.00	61.71	Ave.	36	1.1	V	42.08	103.79	94.29	/	/
11570.00	56.64	PK	140	1.9	V	19.17	75.81	66.31	74	7.69
11570.00	39.92	Ave.	140	1.9	V	19.17	59.09	49.59	54	4.41
5825 MHz										
5825.00	71.05	PK	353	1.2	H	42.08	113.13	103.63	/	/
5825.00	56.69	Ave.	353	1.2	H	42.08	98.77	89.27	/	/
5825.00	74.31	PK	48	2.3	V	42.08	116.39	106.89	/	/
5825.00	60.05	Ave.	48	2.3	V	42.08	102.13	92.63	/	/
5850.00	35.36	PK	347	2.4	V	42.55	77.91	68.41	122.2	53.79
5855.98	30.39	PK	347	2.4	V	42.55	72.94	63.44	110.53	47.09
5879.14	27.01	PK	339	2.2	V	42.55	69.56	60.06	102.14	42.08
5711.15	26.58	PK	339	2.2	V	42.15	68.73	59.23	108.32	49.09
11650.00	53.53	PK	228	1.9	V	19.17	72.70	63.2	74	10.8
11650.00	36.37	Ave.	228	1.9	V	19.17	55.54	46.04	54	7.96

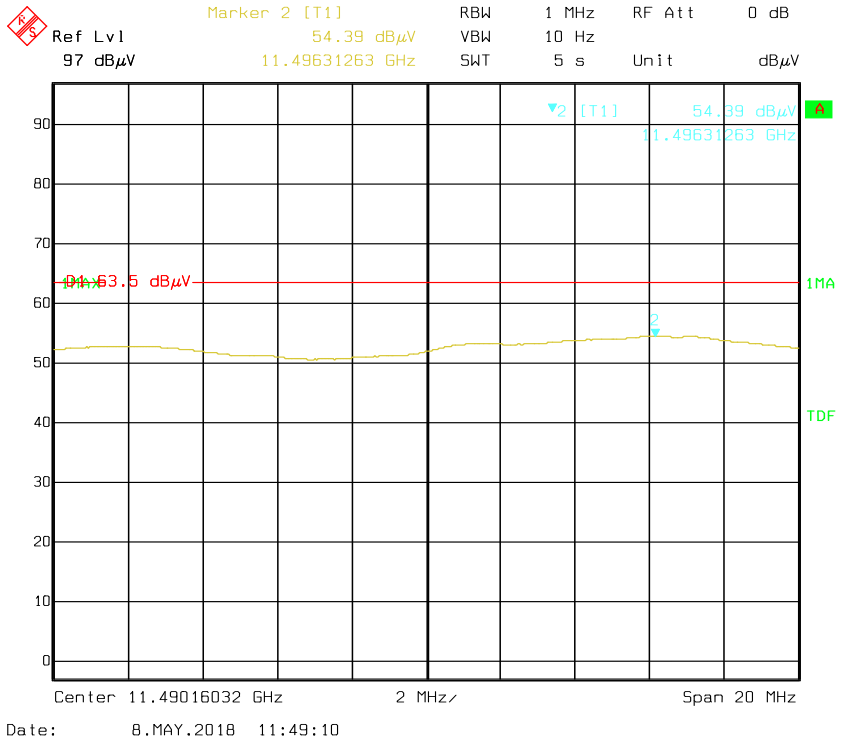
Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Margin = Limit- Corr. Amplitude
Spurious emissions more than 20 dB below the limit were not reported.

802.11n20 mode

Pre-scan for 1~18 GHz, H

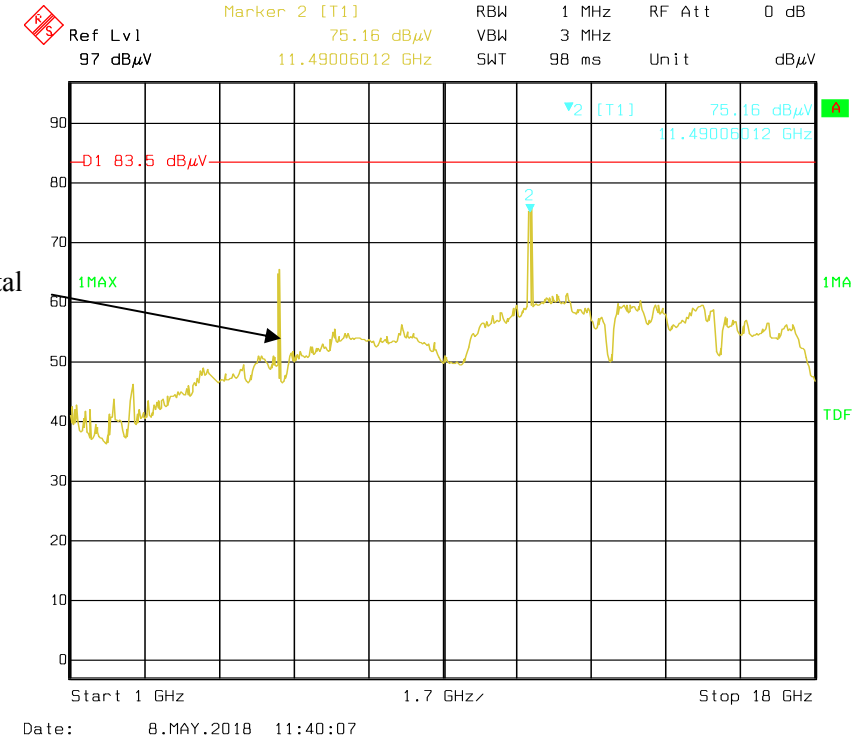
Fundamental

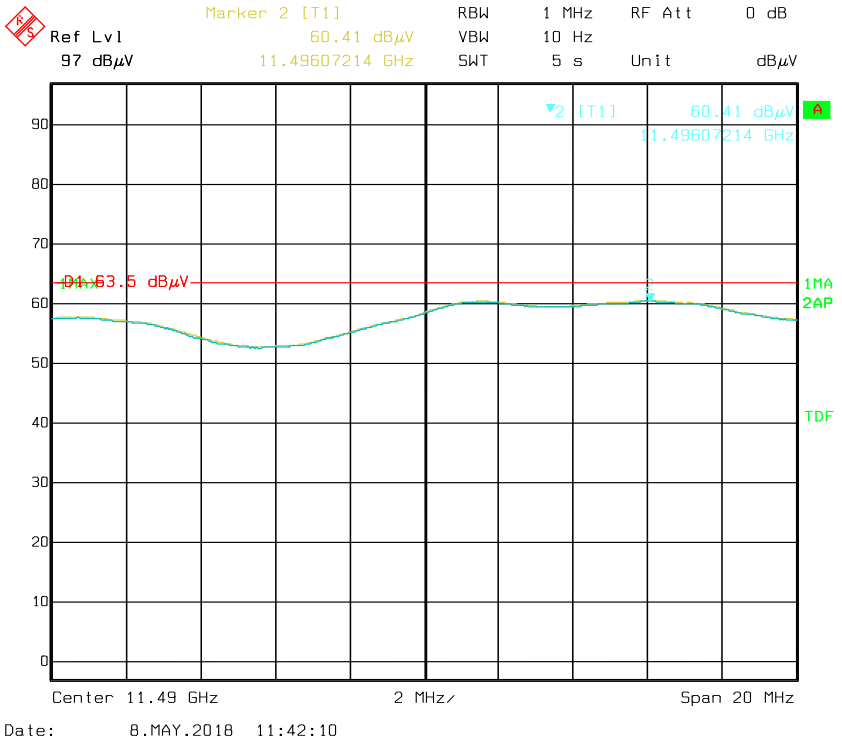




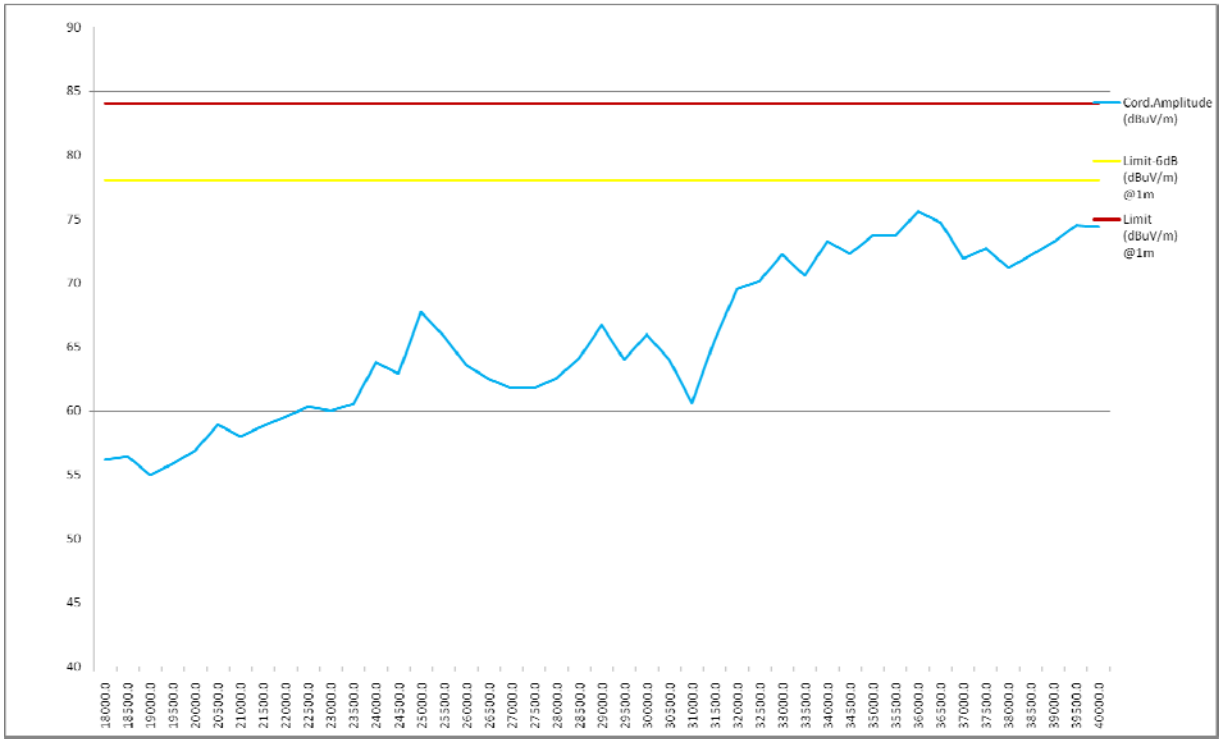
Pre-scan for 1~18 GHz, V

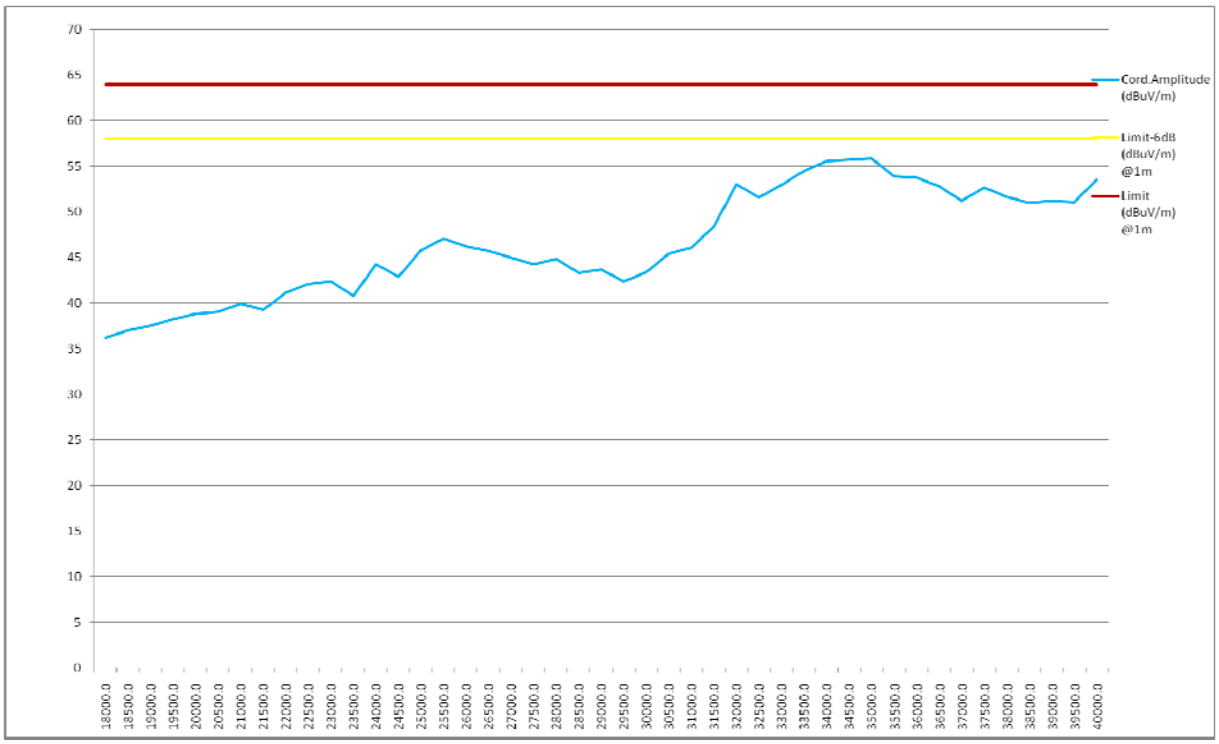
Fundamental



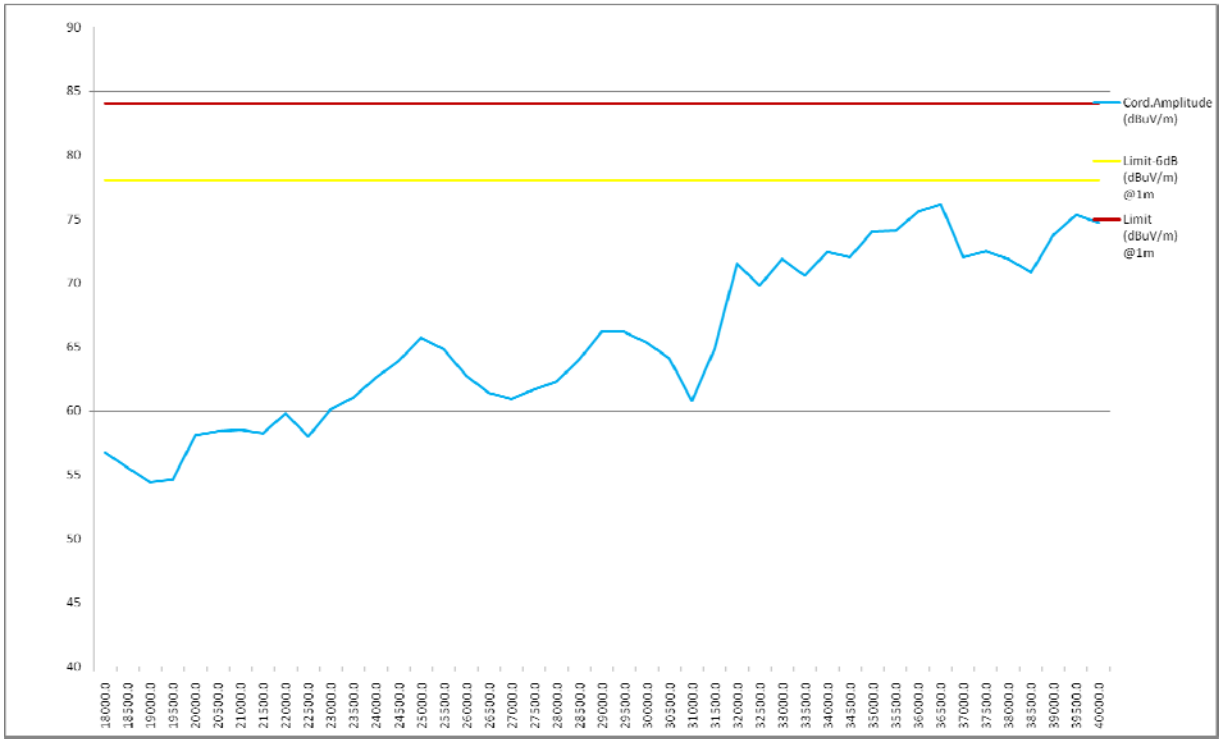


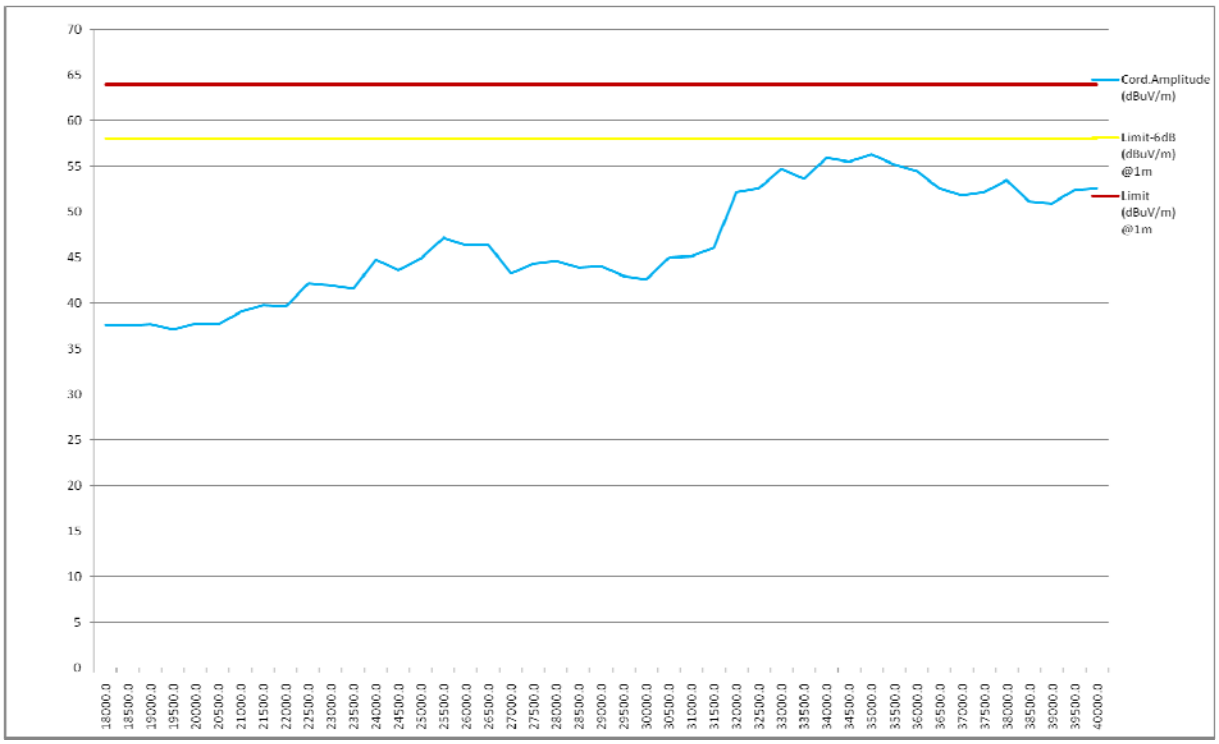
Above 18 GHz, H





Above 18 GHz, V





§15.407(b) (4) –OUT OF BAND EMISSION

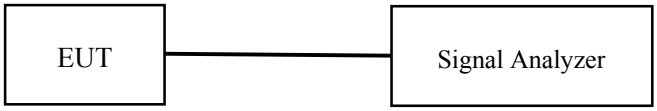
Applicable Standard

FCC §15.407 (b) (4);

For transmitters operating in the 5.725–5.825 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. The Resolution bandwidth is set to 1MHz, The Video bandwidth is set to ≥ 1MHz, report the peak value out of the oprating band.
3. Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

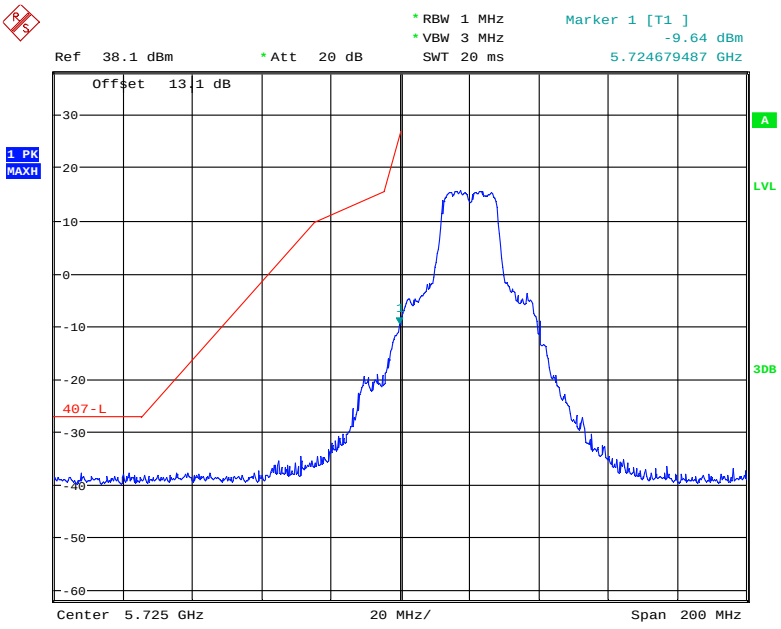
The testing was performed by Nancy Wang on 2018-05-04.

EUT operation mode: Transmitting

Note: The Max antenna gain had been added in the plots, the limit is EIRP.

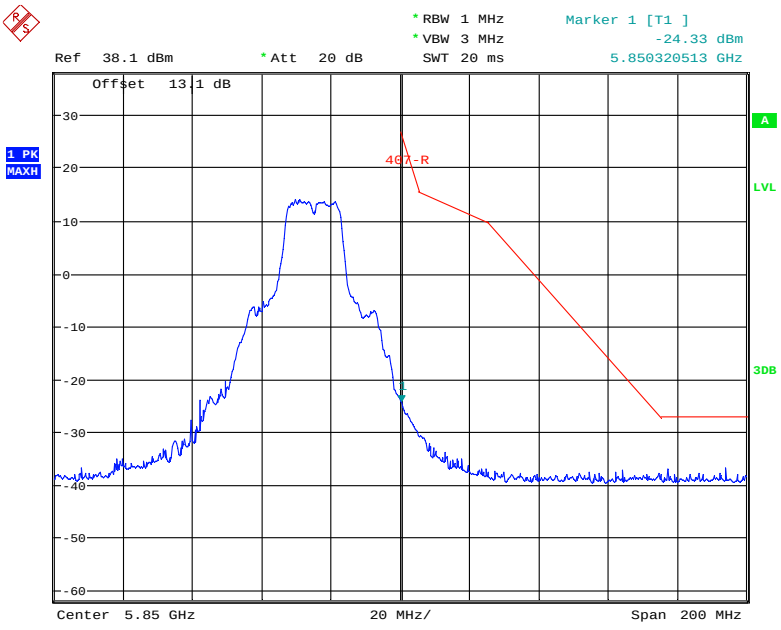
Antenna 0:

802.11a mode, Band Edge, Left Side



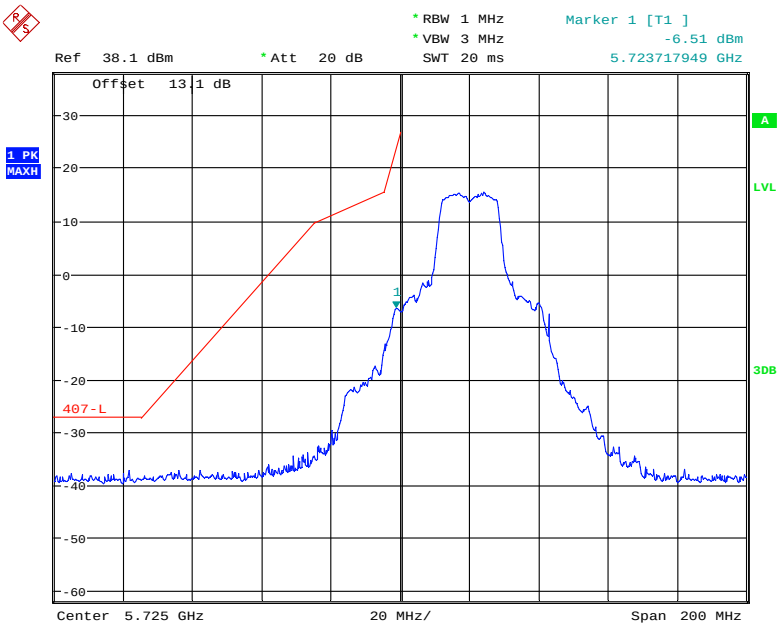
Date: 4.MAY.2018 17:02:16

802.11a mode, Band Edge, Right Side



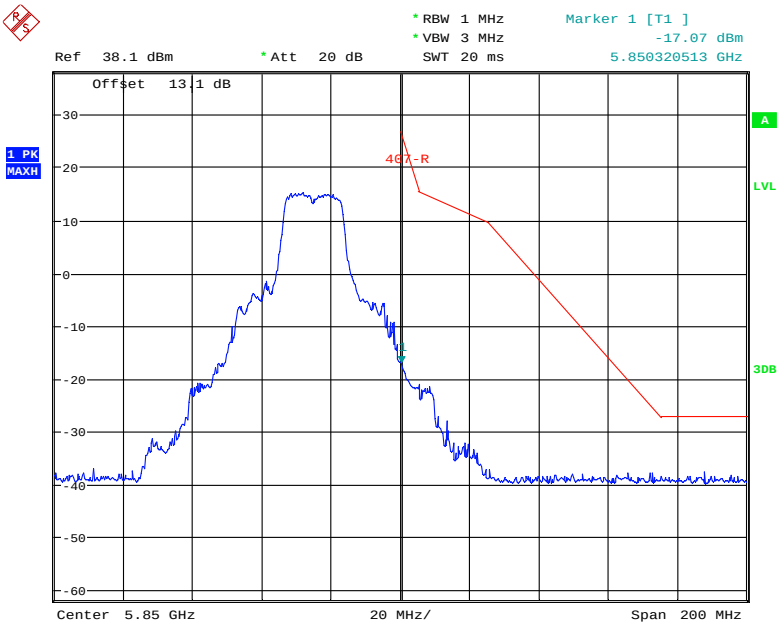
Date: 4.MAY.2018 16:57:29

802.11n20 mode, Band Edge, Left Side



Date: 4.MAY.2018 17:01:01

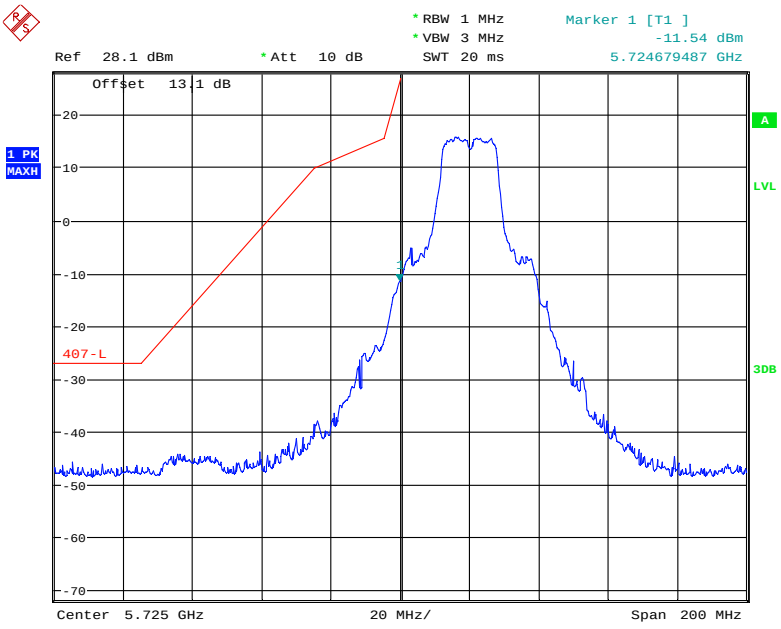
802.11n20 mode, Band Edge, Right Side



Date: 4.MAY.2018 16:58:45

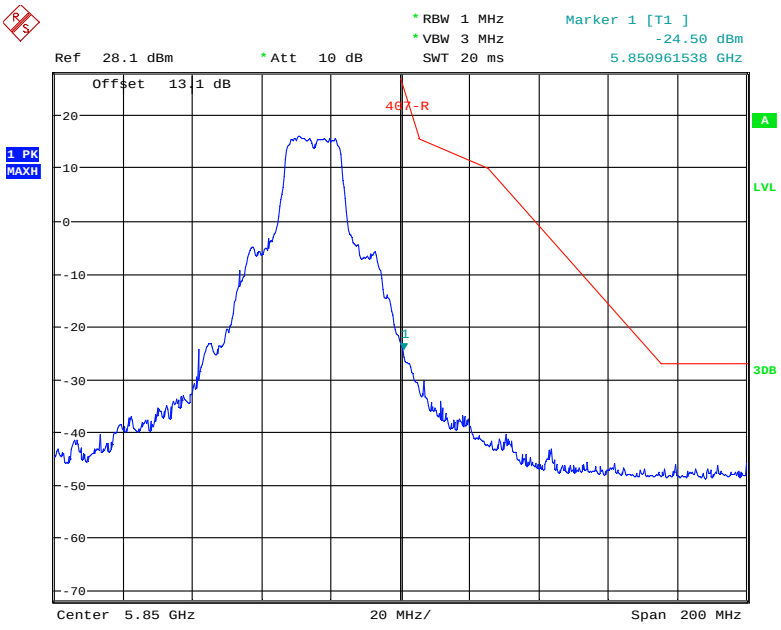
Antenna 1:

802.11a mode, Band Edge, Left Side



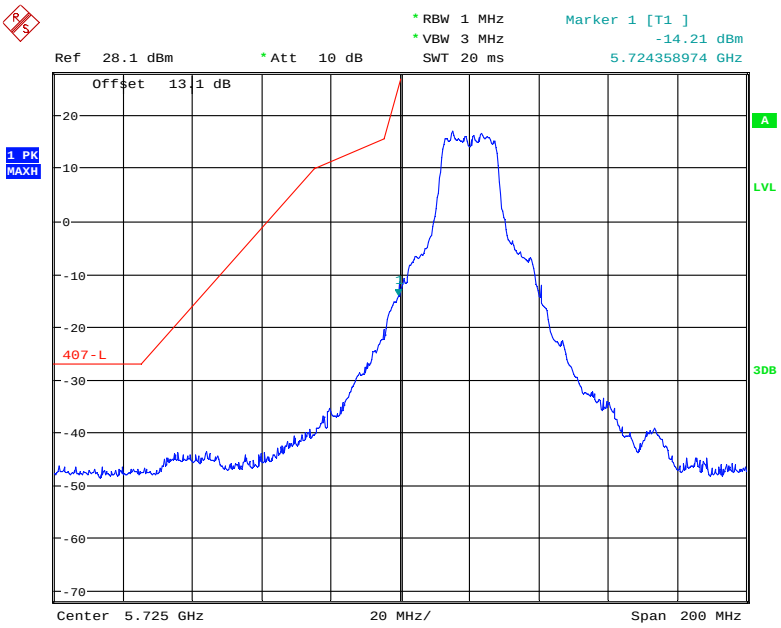
Date: 4.MAY.2018 16:00:08

802.11a mode, Band Edge, Right Side



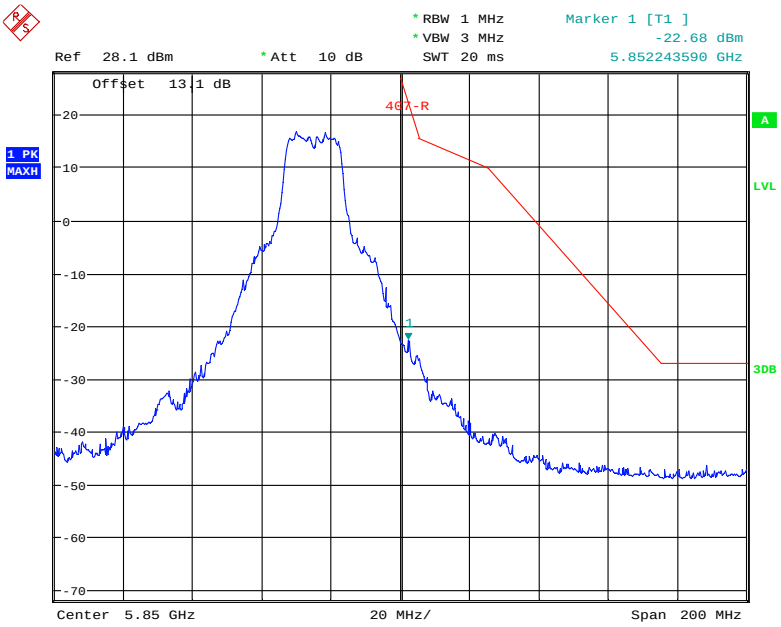
Date: 4.MAY.2018 16:02:26

802.11n20 mode, Band Edge, Left Side



Date: 4.MAY.2018 16:07:08

802.11n20 mode, Band Edge, Right Side



Date: 4.MAY.2018 16:05:23

Note：According the testing data, all the emissions was below the limit 3dB, so the two antennas transmit simultaneously result was pass.

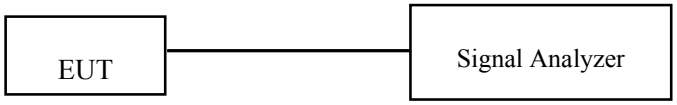
FCC §15.407(e) –6dB EMISSION BANDWIDTH

Applicable Standard

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

Test Procedure

1. Minimum Emission Bandwidth for the band 5.725-5.85 GHz
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.725-5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nancy Wang on 2018-05-03 and 2018-05-04.

EUT operation mode: Transmitting

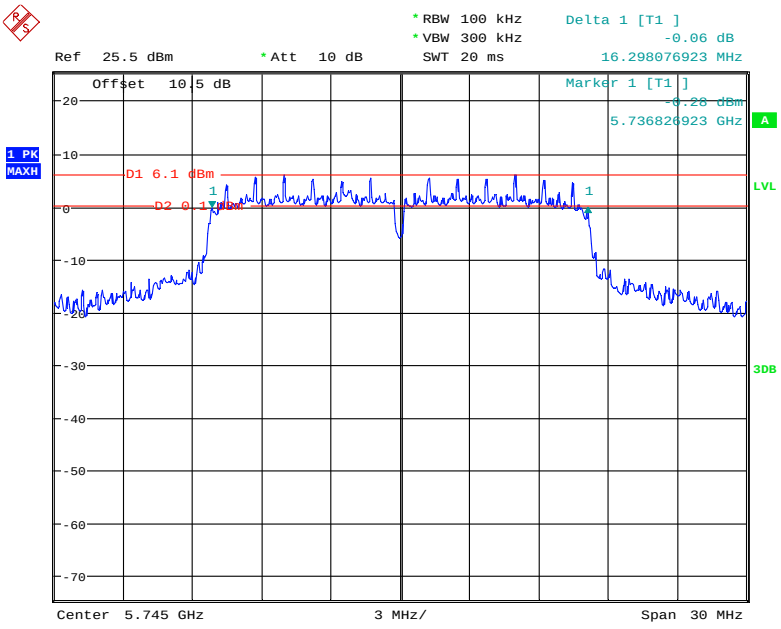
Test Result: Pass; please refer to the following tables and plots.

5725 MHz – 5850 MHz:

Frequency (MHz)	Antenna Port	6dB Bandwidth (MHz)	99% bandwidth (MHz)	Remark
802.11a				No transmitted signal in the 99% bandwidth extends into the U-NII-2C band
5745	0	16.30	21.41	
	1	16.30	17.82	
5785	0	16.11	21.03	
	1	16.11	17.76	
5825	0	16.37	21.03	
	1	16.37	18.52	
802.11n20				
5745	0	17.21	22.63	
	1	16.39	17.88	
5785	0	17.21	22.18	
	1	16.35	17.82	
5825	0	17.21	21.60	
	1	16.35	18.78	

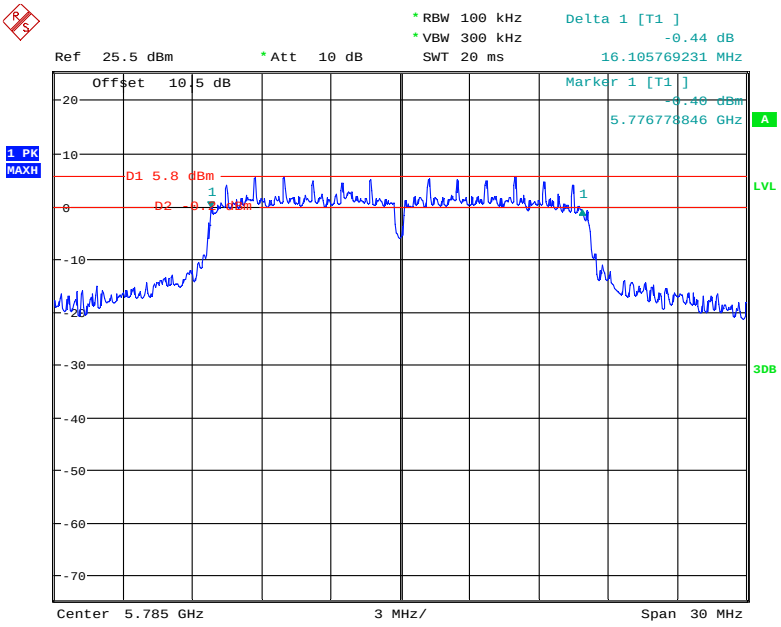
Antenna 0:

802.11a mode, 6dB Emission Bandwidth, 5745 MHz



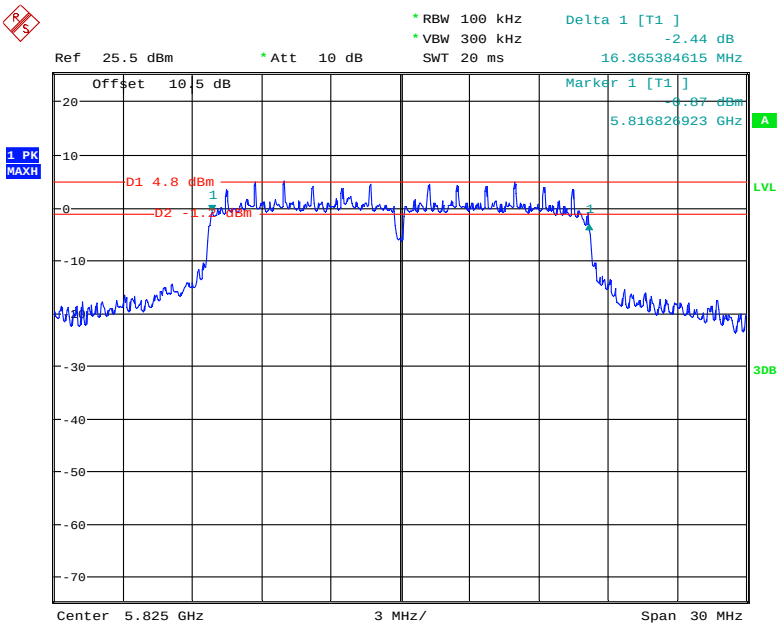
Date: 3.MAY.2018 17:33:43

802.11a mode, 6dB Emission Bandwidth, 5785 MHz



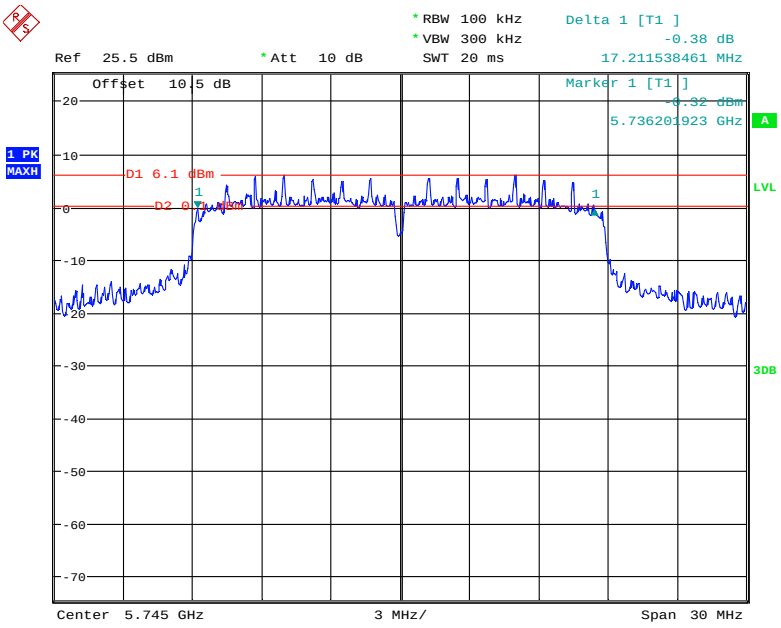
Date: 3.MAY.2018 17:35:55

802.11a mode, 6dB Emission Bandwidth, 5825 MHz



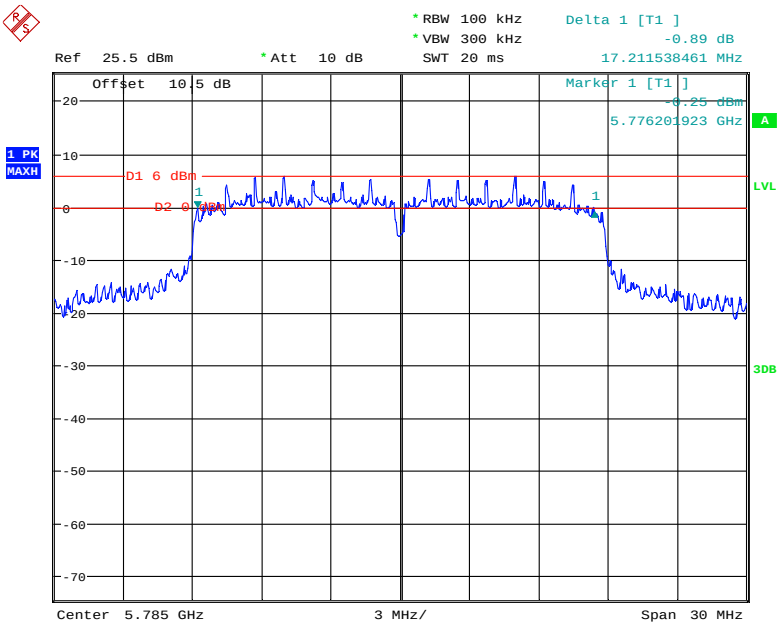
Date: 3.MAY.2018 17:38:16

802.11n20 mode, 6dB Emission Bandwidth, 5745 MHz



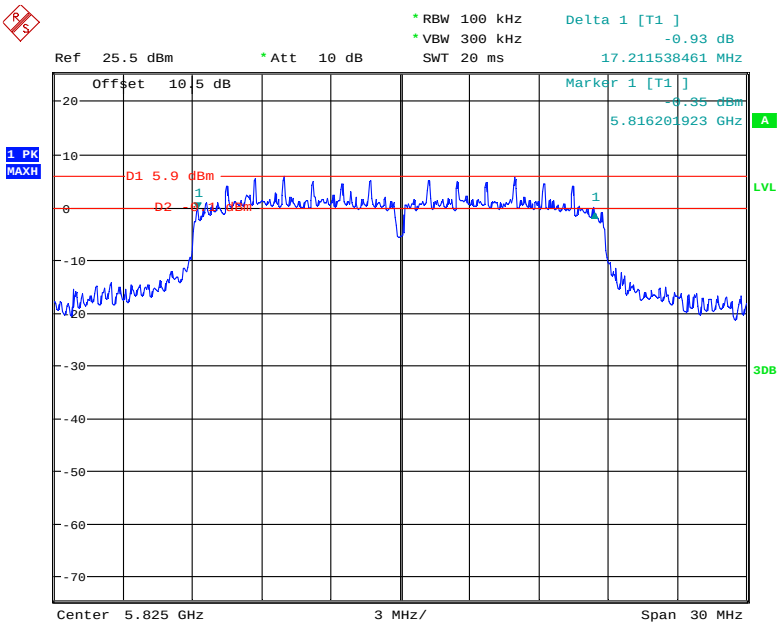
Date: 3.MAY.2018 17:31:27

802.11n20 mode, 6dB Emission Bandwidth, 5785 MHz



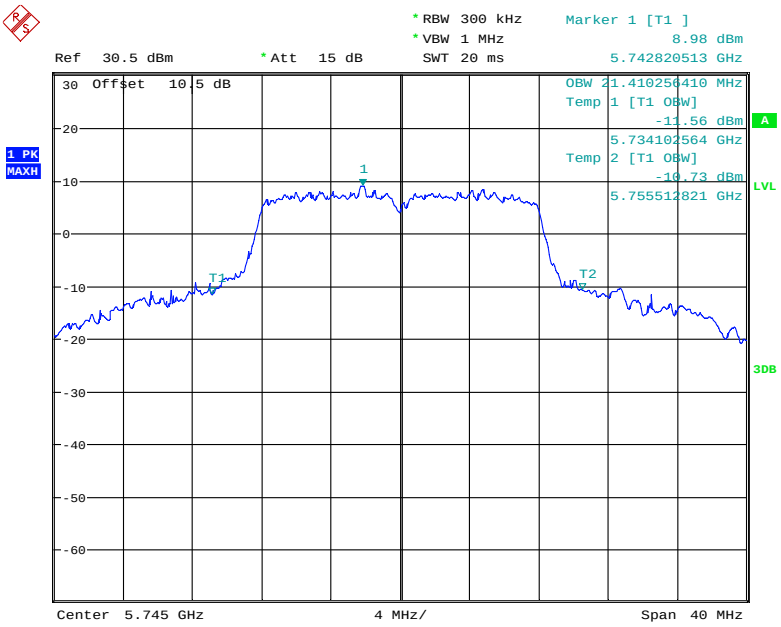
Date: 3.MAY.2018 17:29:11

802.11n20 mode, 6dB Emission Bandwidth, 5825 MHz

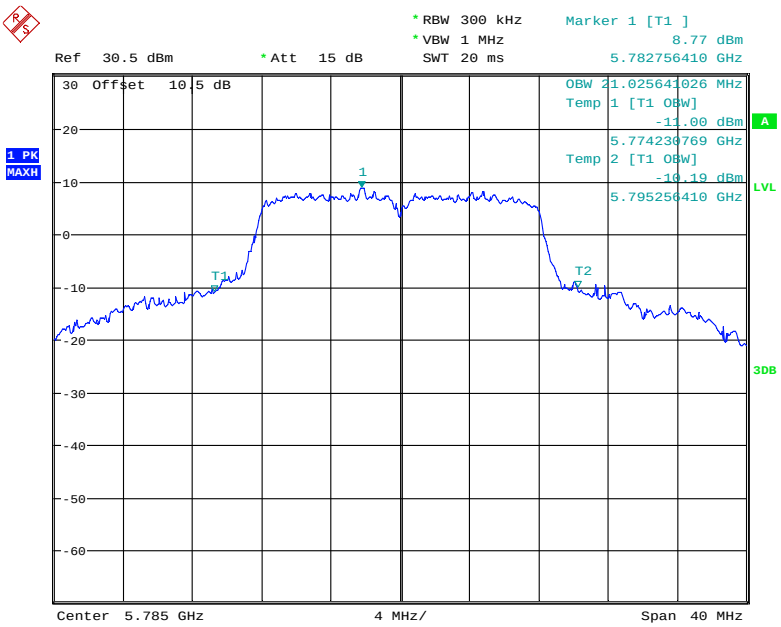


Date: 3.MAY.2018 17:25:17

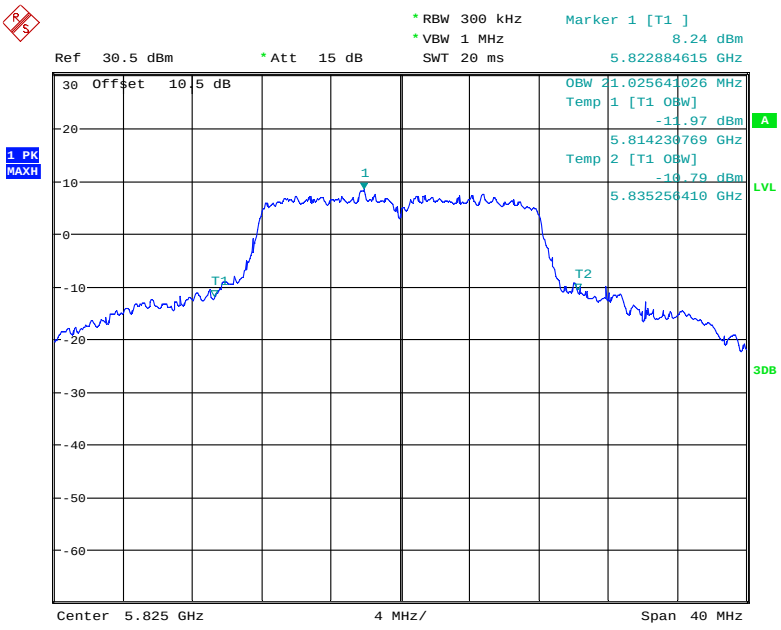
802.11a mode, 99% Occupied Bandwidth, 5745 MHz



802.11a mode, 99% Occupied Bandwidth, 5785 MHz

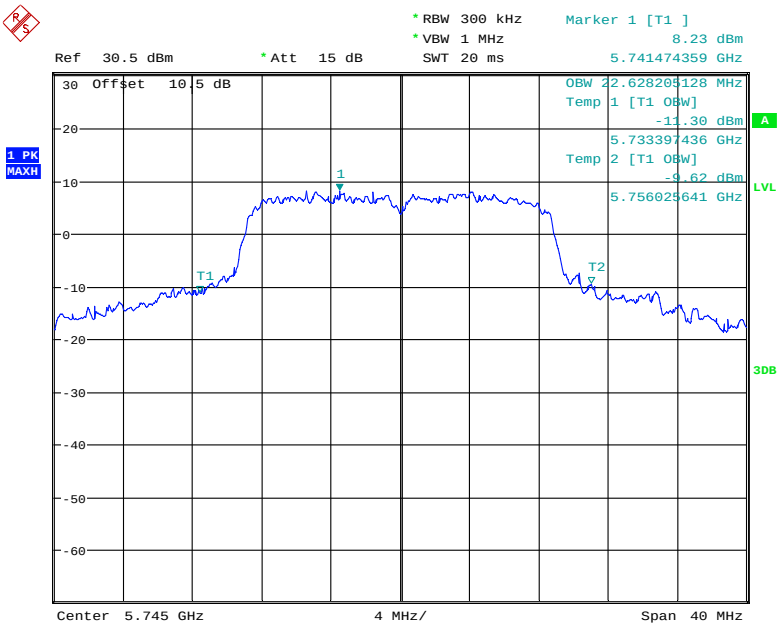


802.11a mode, 99% Occupied Bandwidth, 5825 MHz



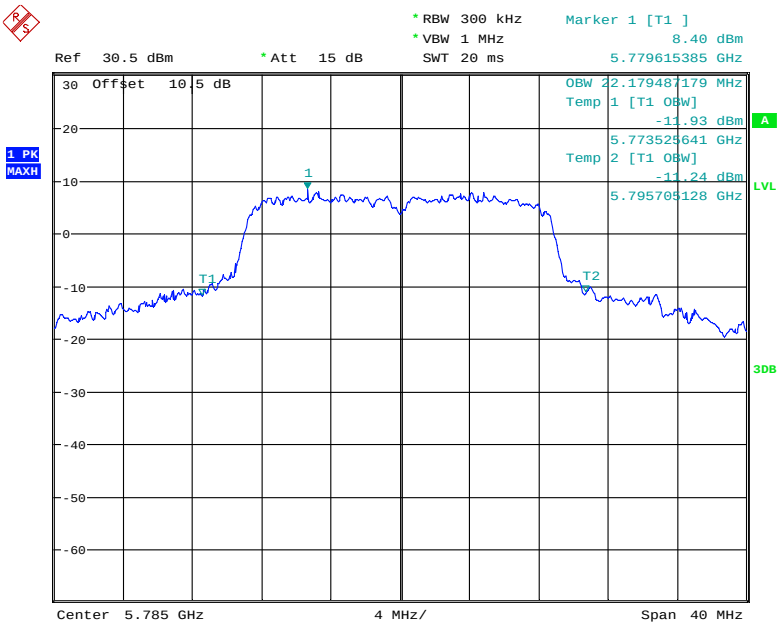
Date: 4.MAY.2018 09:54:47

802.11n20 mode, 99% Occupied Bandwidth, 5745 MHz



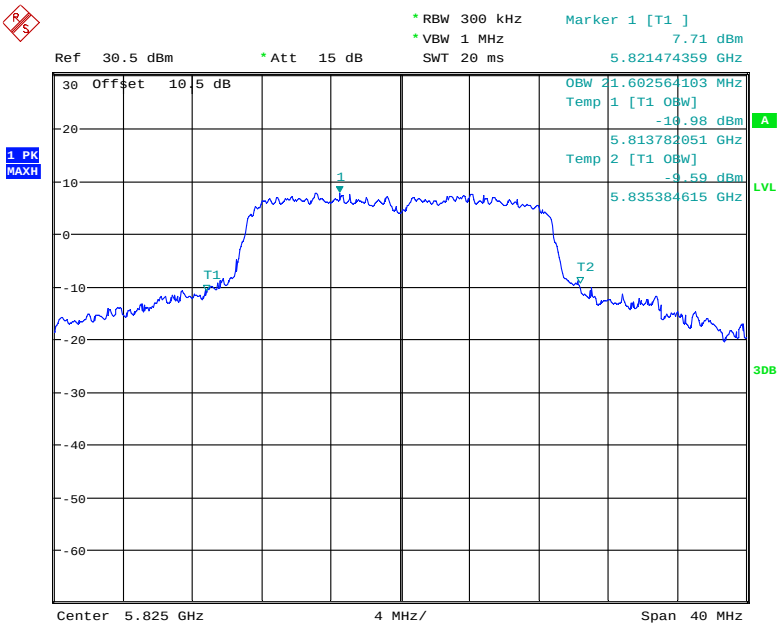
Date: 4.MAY.2018 10:16:49

802.11n20 mode, 99% Occupied Bandwidth, 5785 MHz



Date: 4.MAY.2018 10:18:38

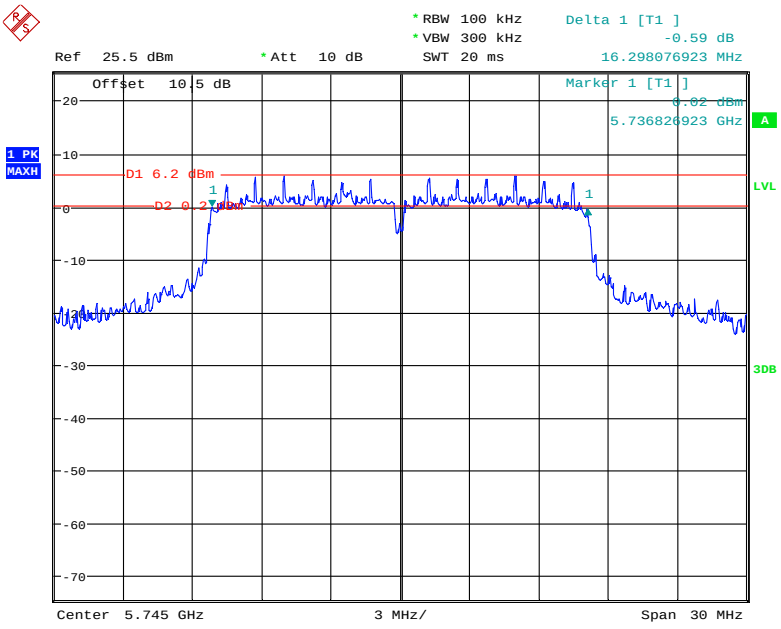
802.11n20 mode, 99% Occupied Bandwidth, 5825 MHz



Date: 4.MAY.2018 10:19:45

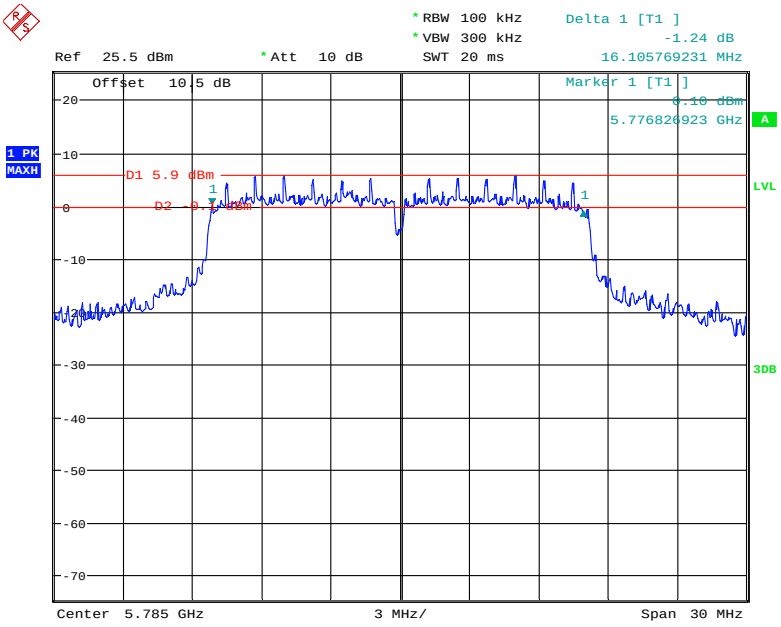
Antenna 1:

802.11a mode, 6dB Emission Bandwidth, 5745 MHz



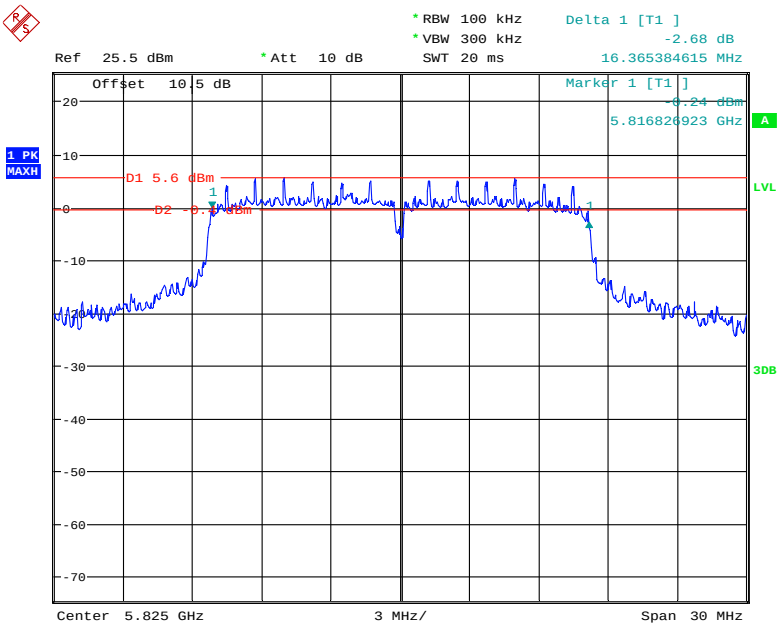
Date: 3.MAY.2018 17:44:48

802.11a mode, 6dB Emission Bandwidth, 5785 MHz



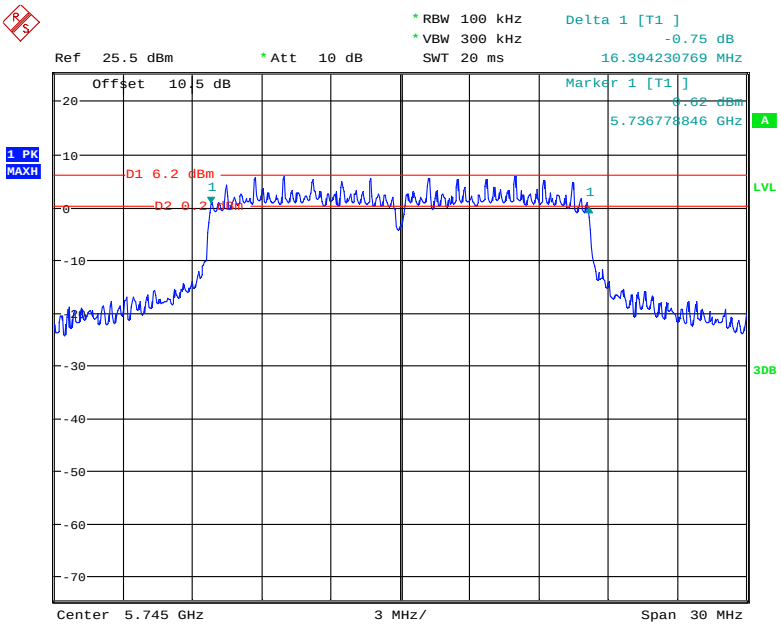
Date: 3.MAY.2018 17:42:58

802.11a mode, 6dB Emission Bandwidth, 5825 MHz



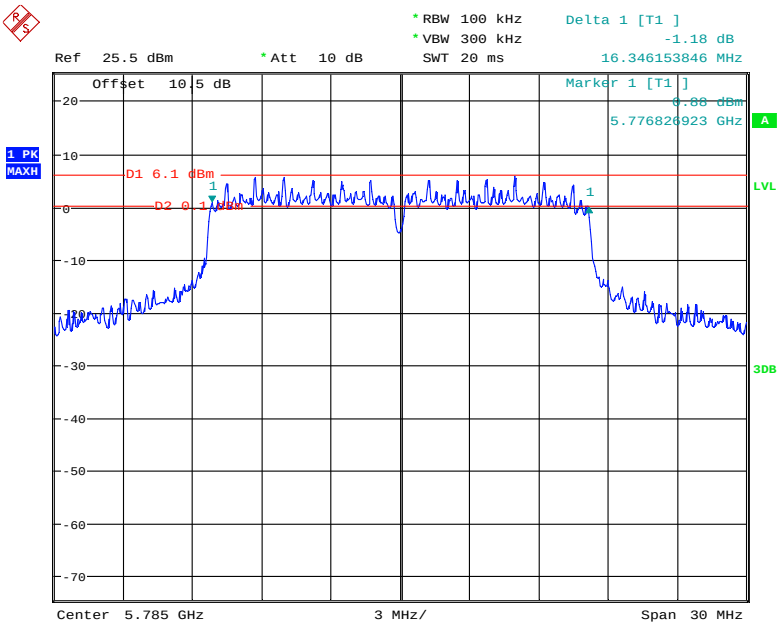
Date: 3.MAY.2018 17:40:54

802.11n20 mode, 6dB Emission Bandwidth, 5745 MHz



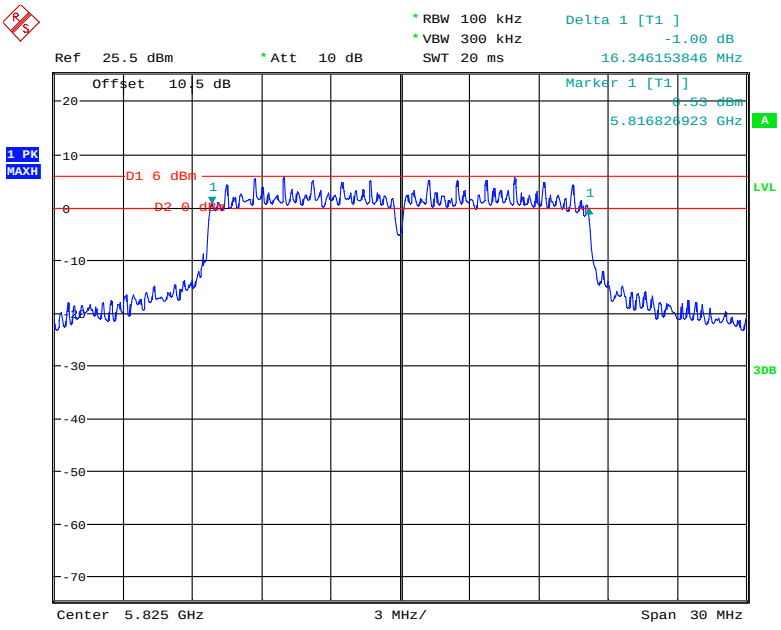
Date: 3.MAY.2018 17:46:24

802.11n20 mode, 6dB Emission Bandwidth, 5785 MHz



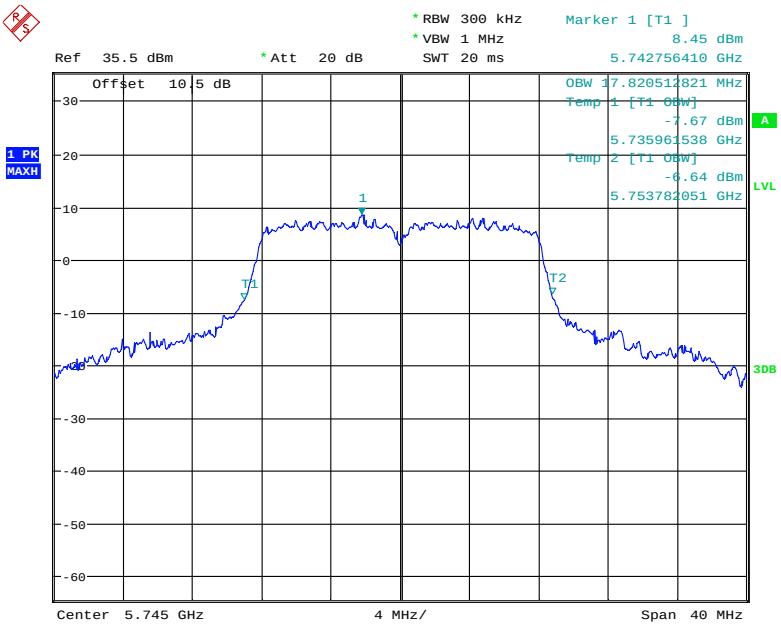
Date: 3.MAY.2018 17:48:32

802.11n20 mode, 6dB Emission Bandwidth, 5825 MHz



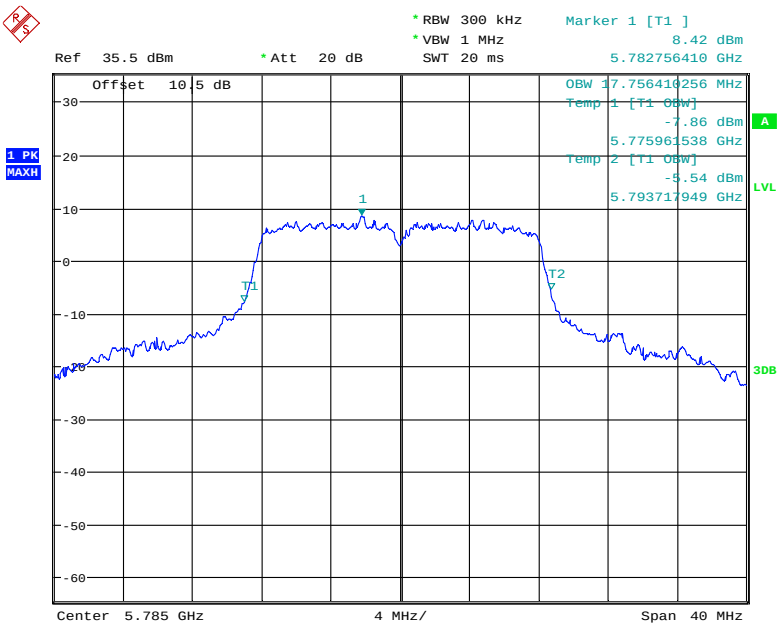
Date: 3.MAY.2018 17:50:13

802.11a mode, 99% Occupied Bandwidth, 5745 MHz



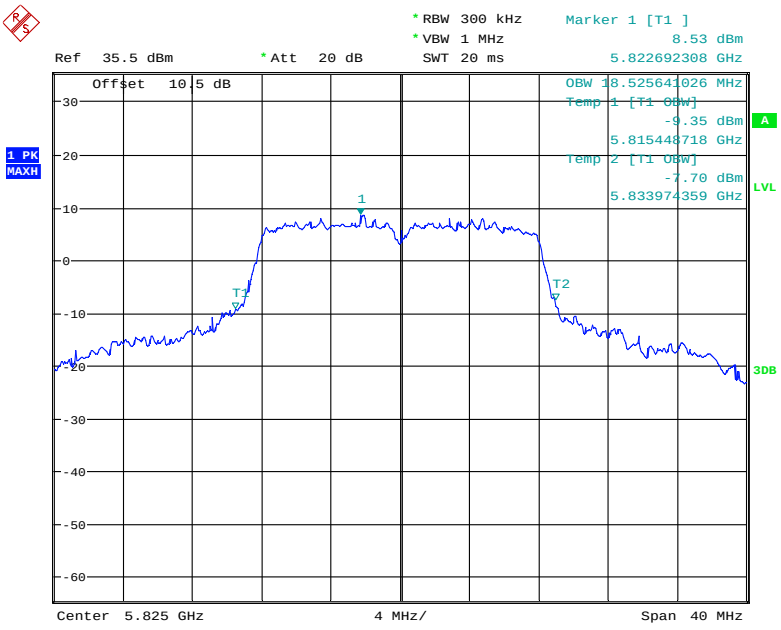
Date: 4.MAY.2018 14:23:36

802.11a mode, 99% Occupied Bandwidth, 5785 MHz



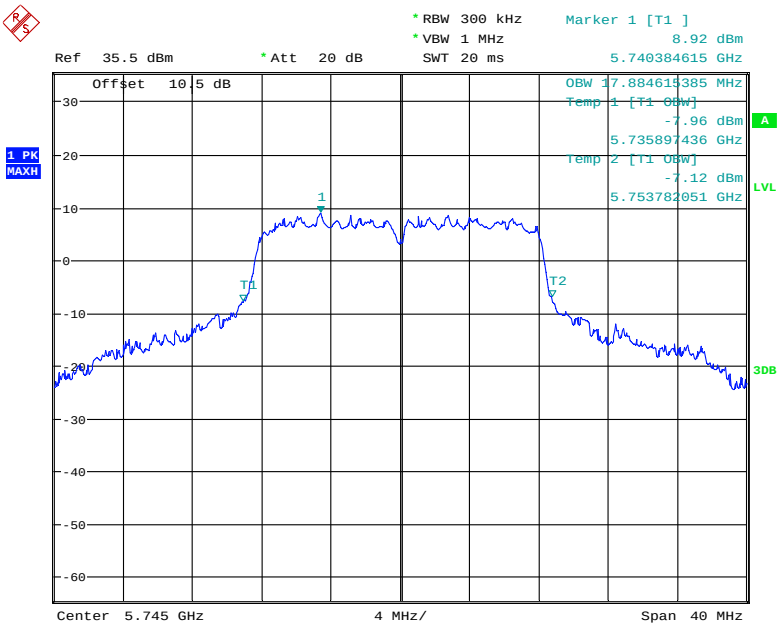
Date: 4.MAY.2018 14:22:29

802.11a mode, 99% Occupied Bandwidth, 5825 MHz



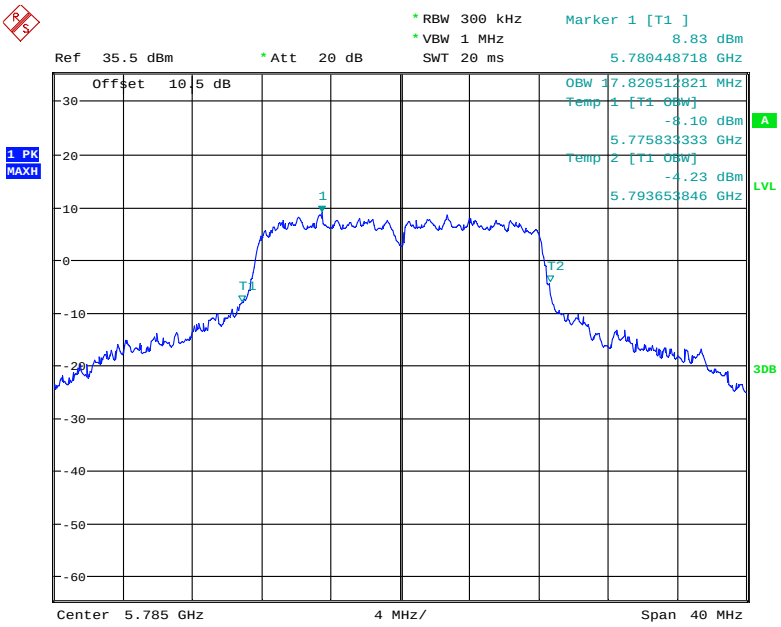
Date: 4.MAY.2018 14:24:40

802.11n20 mode, 99% Occupied Bandwidth, 5745 MHz

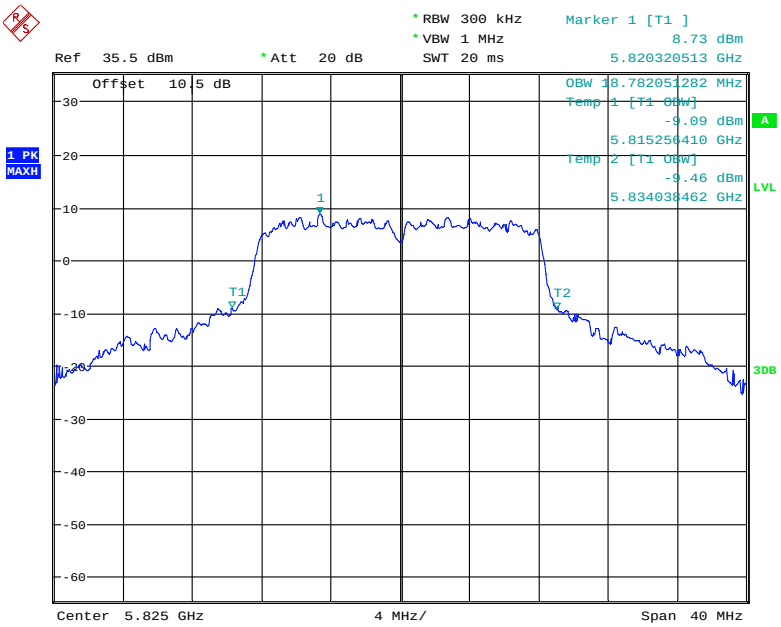


Date: 4.MAY.2018 14:29:33

802.11n20 mode, 99% Occupied Bandwidth, 5785 MHz



802.11n20 mode, 99% Occupied Bandwidth, 5825 MHz



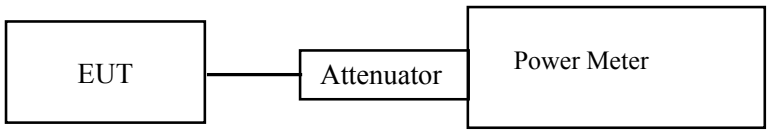
FCC §15.407(a) (3)– CONDUCTED TRANSMITTER OUTPUT POWER

Applicable Standard

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nancy Wang on 2018-05-03.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the following tables.

5725 MHz – 5850 MHz

Frequency (MHz)	Antenna Port	Average Output Power (dBm)	Total Output Power (dBm)	Limit (dBm)
802.11a				
5745	0	16.91	19.89	30
	1	16.84		
5785	0	16.74	19.79	
	1	16.82		
5825	0	15.95	19.35	
	1	16.69		
802.11n20				
5745	0	16.89	19.91	30
	1	16.91		
5785	0	16.72	19.79	
	1	16.83		
5825	0	16.62	19.72	
	1	16.80		

Note: This Device Emploies Cyclic Delay Diversity.
When determining reductions in conducted power limits, array gain is calculated as follows: As to this device, NANT $\leqslant$ 4, Array Gain = 0 dB.
Total directional gain (dBi) = gain of individual transmit antennas (dBi) + 0 (dB) =2.56dBi.

FCC §15.407(a) (3) - POWER SPECTRAL DENSITY

Applicable Standard

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Test Procedure

For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW $\geqslant$ 1/T, where T is defined in section II.B.l.a).
b) Set VBW $\geqslant$ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nancy Wang on 2018-05-04.

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EUT operation mode: Transmitting

Test Result: Pass

Please refer to the following tables and plots.

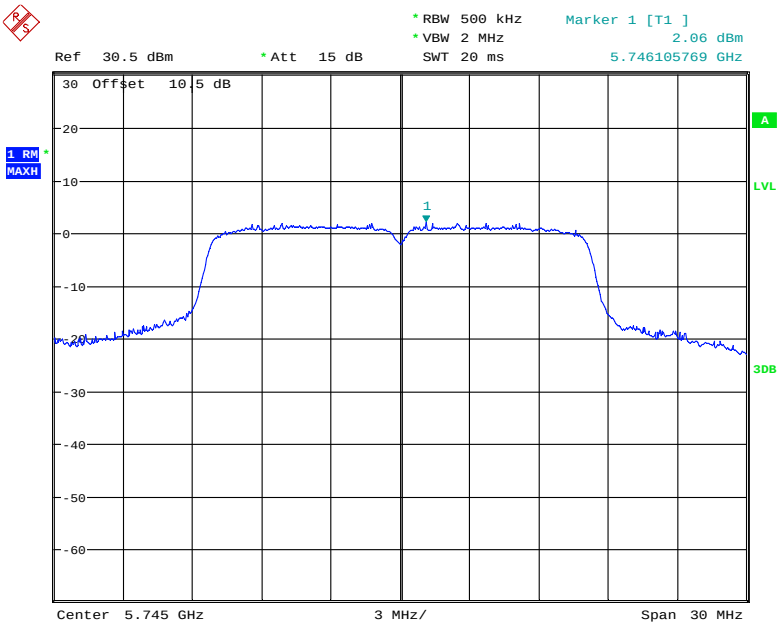
5725 MHz – 5850 MHz:

Frequency (MHz)	Antenna Port	Power Spectral Density (dBm/500kHz)	Total Power Spectral Density (dBm/500kHz)	Limit (dBm/500kHz)
802.11a				
5745	0	2.06	5.92	30
	1	3.61		
5785	0	2.12	6.05	
	1	3.80		
5825	0	1.22	5.34	
	1	3.21		
802.11n20				
5745	0	2.61	6.49	30
	1	4.22		
5785	0	2.08	6.23	
	1	4.14		
5825	0	4.12	7.01	
	1	3.87		

Note: This Device Emploies Cyclic Delay Diversity.
When determining reductions in power spectral density limits, array gain is calculated as follows:
Array gain = 10 log (N_{ANT}), where N_{ANT} is the number of transmit antennas.
Total directional gain (dBi) = gain of individual transmit antennas (dBi) +3.0 (dB) =5.56dBi.

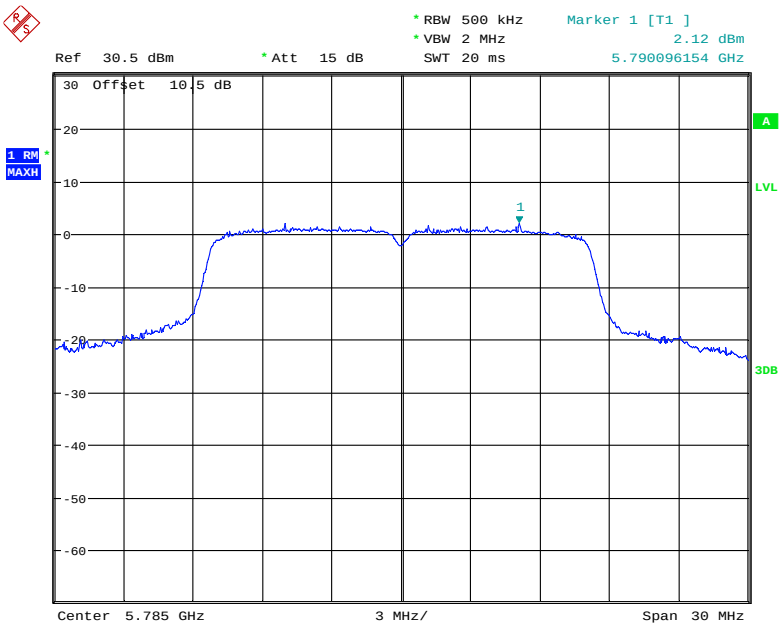
Antenna 0:

802.11a mode, Power Spectral Density, 5745 MHz



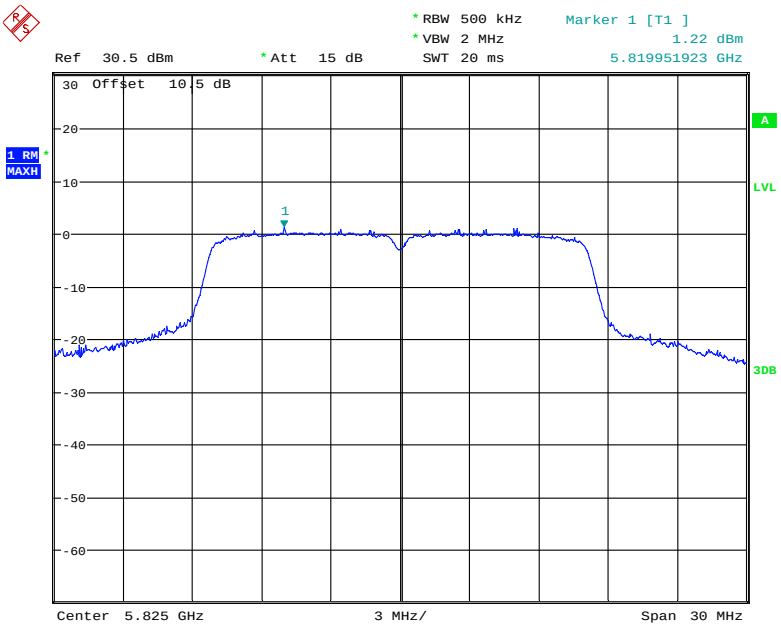
Date: 4.MAY.2018 10:41:31

802.11a mode, Power Spectral Density, 5785 MHz



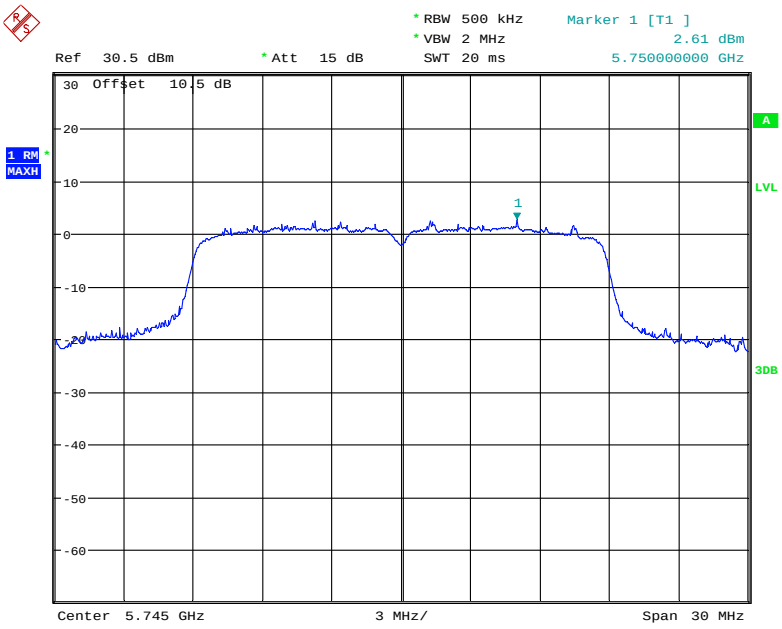
Date: 4.MAY.2018 10:42:18

802.11a mode, Power Spectral Density, 5825 MHz



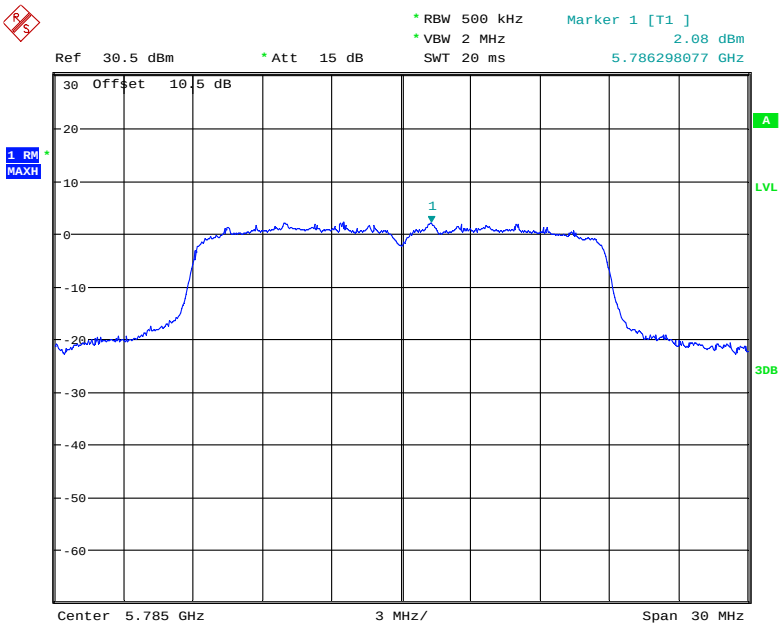
Date: 4.MAY.2018 10:43:04

802.11n20 mode, Power Spectral Density, 5745 MHz



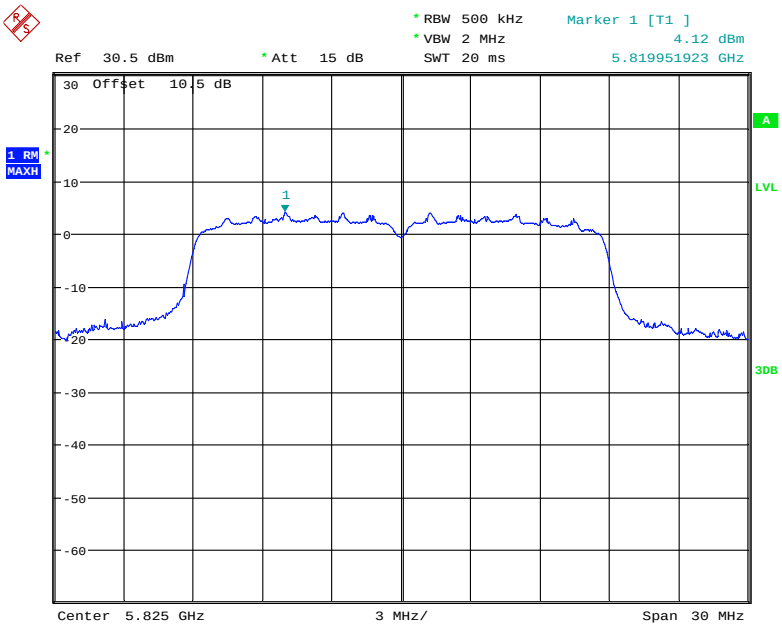
Date: 4.MAY.2018 10:40:51

802.11n20 mode, Power Spectral Density, 5785 MHz



Date: 4.MAY.2018 10:40:00

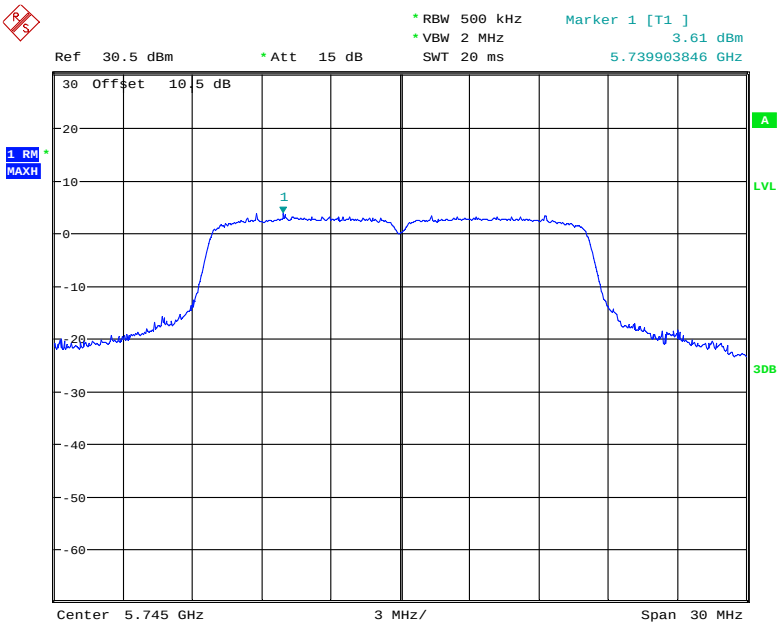
802.11n20 mode, Power Spectral Density, 5825 MHz



Date: 4.MAY.2018 10:33:59

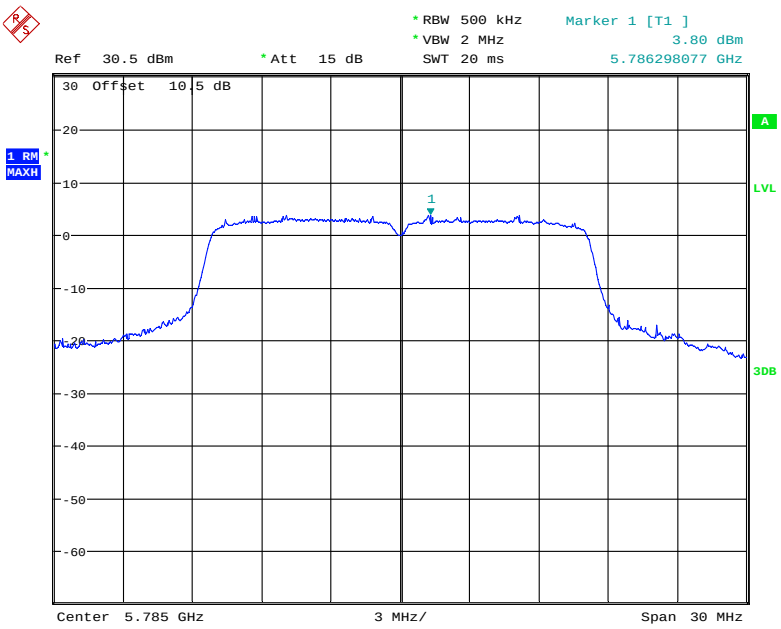
Antenna 1:

802.11a mode, Power Spectral Density, 5745 MHz



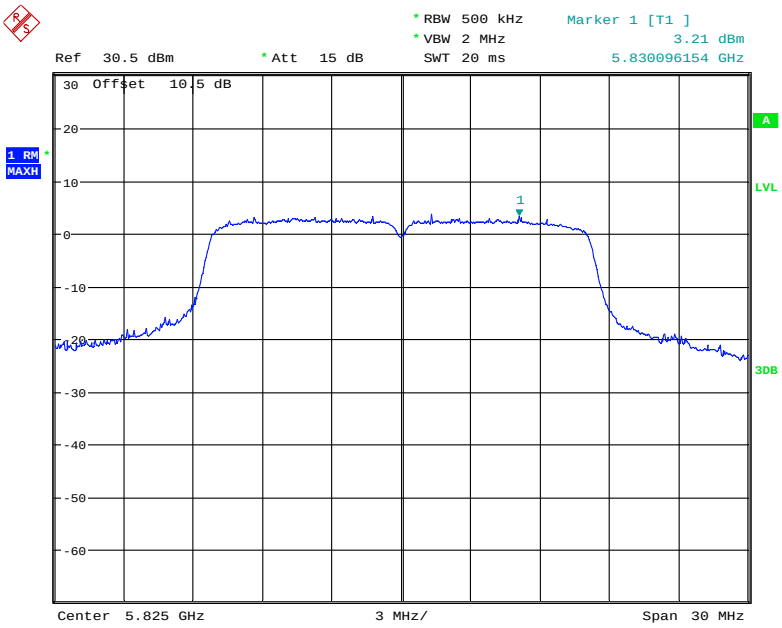
Date: 4.MAY.2018 14:52:09

802.11a mode, Power Spectral Density, 5785 MHz



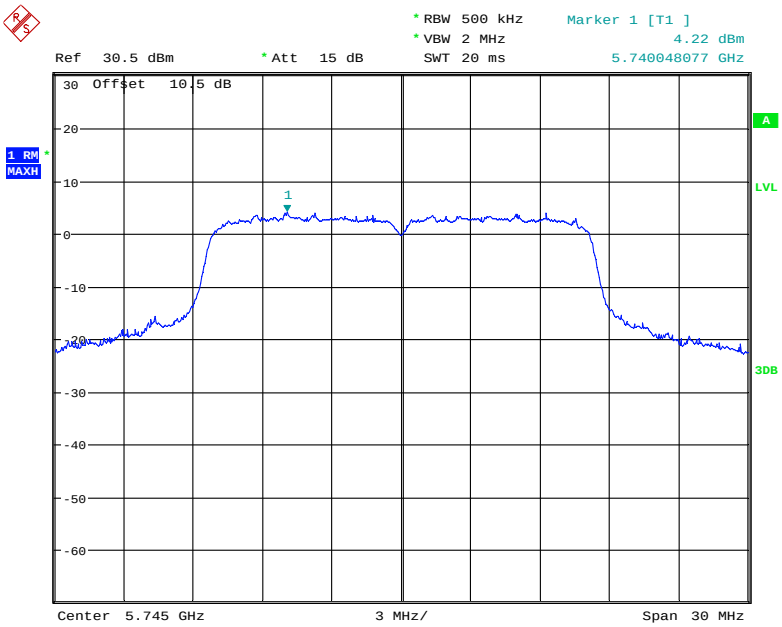
Date: 4.MAY.2018 14:53:45

802.11a mode, Power Spectral Density, 5825 MHz



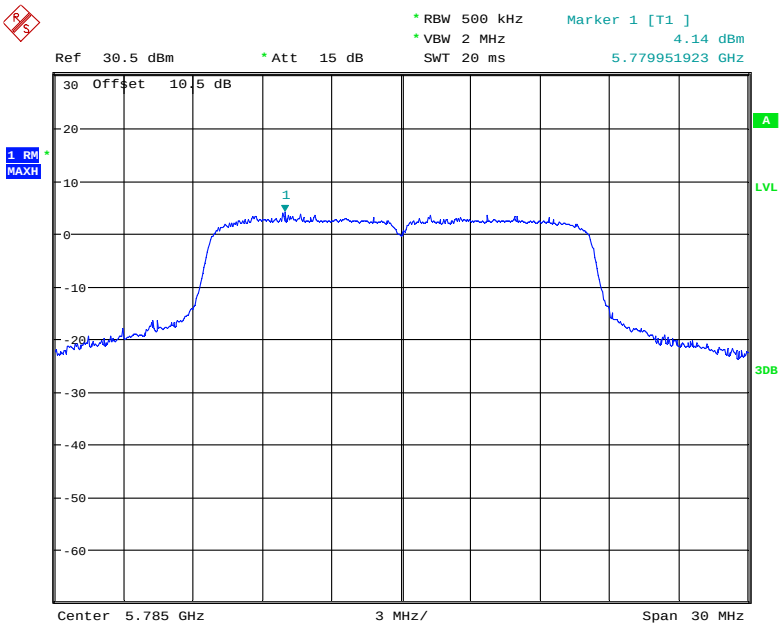
Date: 4.MAY.2018 14:58:43

802.11n20 mode, Power Spectral Density, 5745 MHz



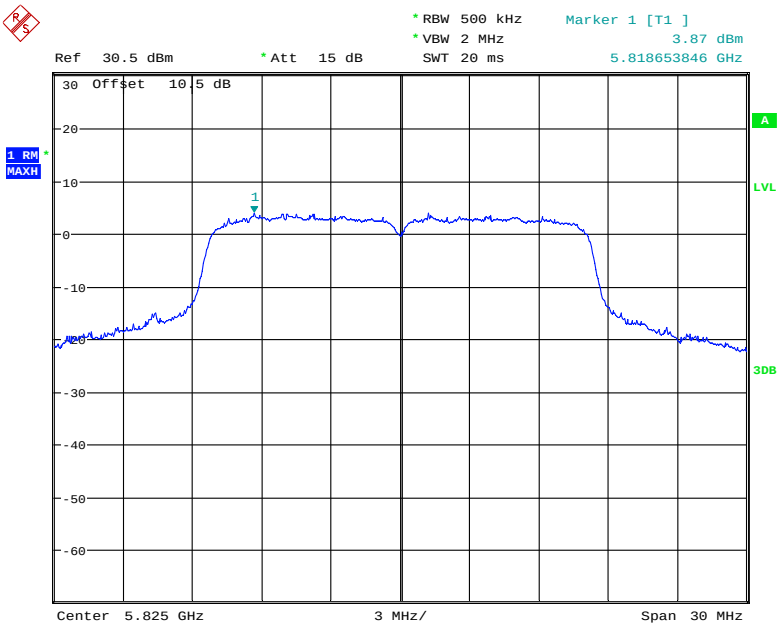
Date: 4.MAY.2018 15:01:51

802.11n20 mode, Power Spectral Density, 5785 MHz



Date: 4.MAY.2018 15:00:57

802.11n20 mode, Power Spectral Density, 5825 MHz



Date: 4.MAY.2018 15:00:09

******* END OF REPORT *******