FCC PART 15.407

TEST REPORT

For

Grandstream Networks, Inc.

126 Brookline Ave, 3rd Floor Boston, MA 02215, USA

FCC ID: YZZGWN7600

Report Type:	**Product Type:**
Class II Permissive Change	Wireless Access Point

Report Number: RSZ170328001-00BA1

Report Date: 2017-05-18

Reviewed By: Oscar Ye
Engineer

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Grandstream Networks, Inc.'s* product, model number: *GWN7600 (FCC ID: YZZGWN7600)* in this report was a *Wireless Access Point,* which was measured approximately: 18.0 cm (L) x18.0 cm (W) x 4.0 cm (H), rated with input voltage: DC 24 V from adapter or powered by POE supply.

**All measurement and test data in this report was gathered from production sample serial number: 1700516 (Assigned by BACL, Kunshan).The EUT supplied by the applicant was received on 2017-03-28.*

Objective

This type approval report is prepared on behalf of *Grandstream Networks, Inc.* in accordance with Part 2-Subpart J, Part 15-Subparts A, B 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, 15.207, 15.209 and 15.407 rules.

This is a CIIPC application of the device; the differences between the original device and the current one are as follows:

1. Changing the low channel power level (only for 5150-5250MHz).

For the change made to the device, the test item "Undesirable Emission& Restricted Bands", "Maximum Conducted Output Power" and "Power Spectral Density" was performed.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS and Part 15B JBP submissions with FCC ID: YZZGWN7600.

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

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

Measurement Uncertainty

Item		Uncertainty
RF conducted test with spectrum		±0.9dB
RF Output Power with Power meter		±0.5dB
Radiated emission	30MHz~1GHz	±5.91dB
	Above 1G	±4.92dB
Occupied Bandwidth		±0.5kHz
Temperature		±1.0℃
Humidity		±6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

EUT Exercise Software

Soft ware: “qrct.exe”

The test was tested with 100% duty cycle and the worst case was performed as below:

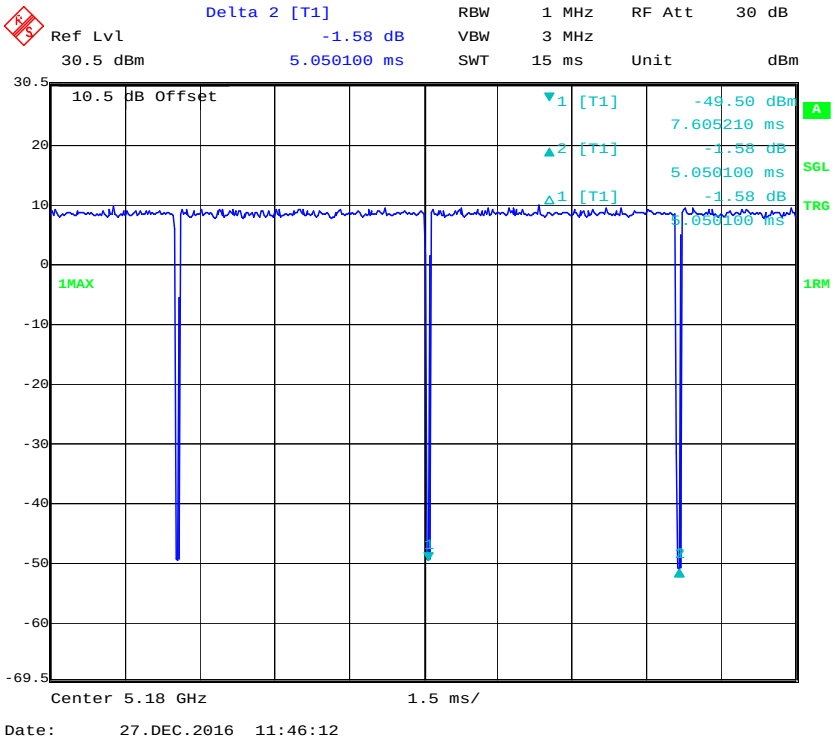
5150 MHz – 5250 MHz (low channel):

802.11n20: Rate MCS0, Power level: 17
802.11n40: Rate MCS0, Power level: 15
802.11ac20:Rate MCS0, Power level: 17
802.11ac40:Rate MCS0, Power level: 15
802.11ac80: Rate MCS0, Power level: 14

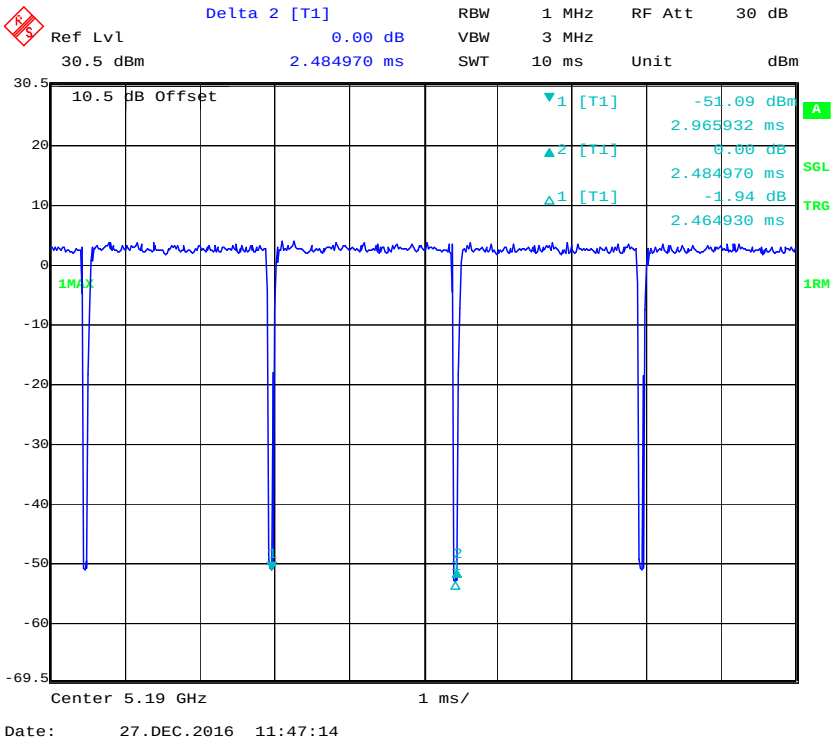
Duty cycle

5150 MHz – 5250 MHz:

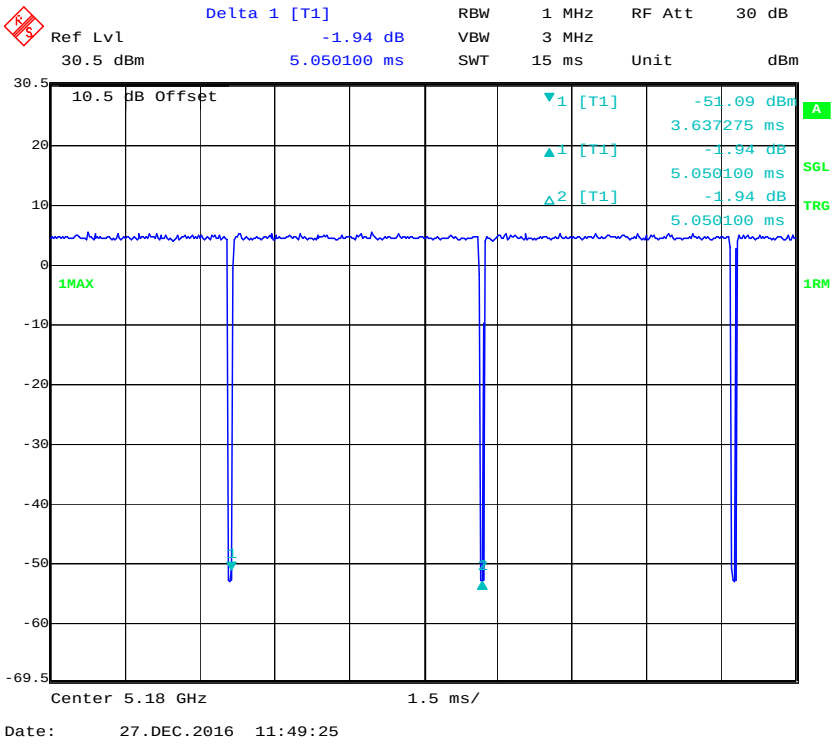
802.11n20 mode



802.11n40 Mode



802.11ac20 Mode



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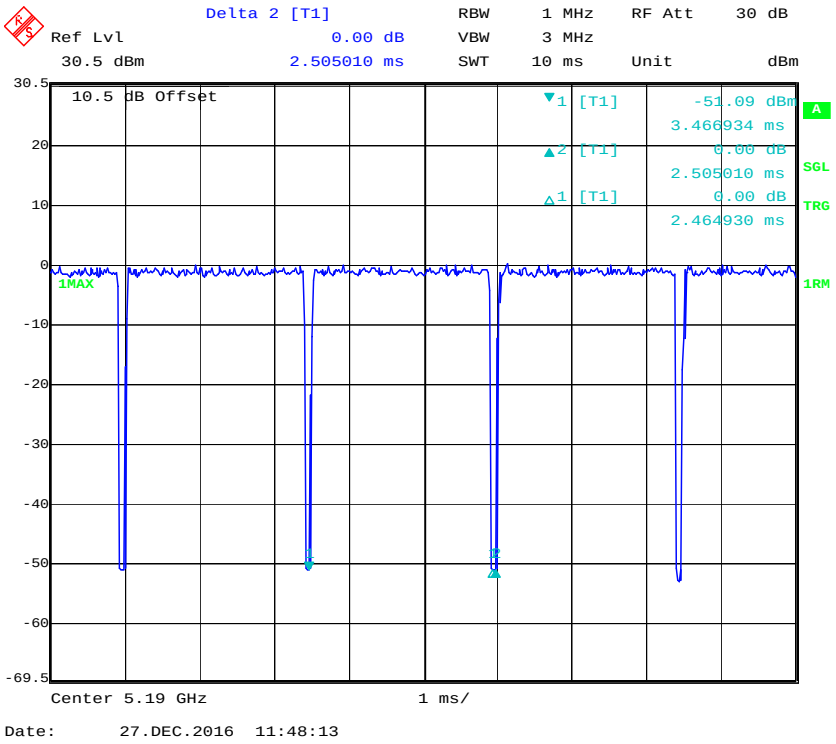
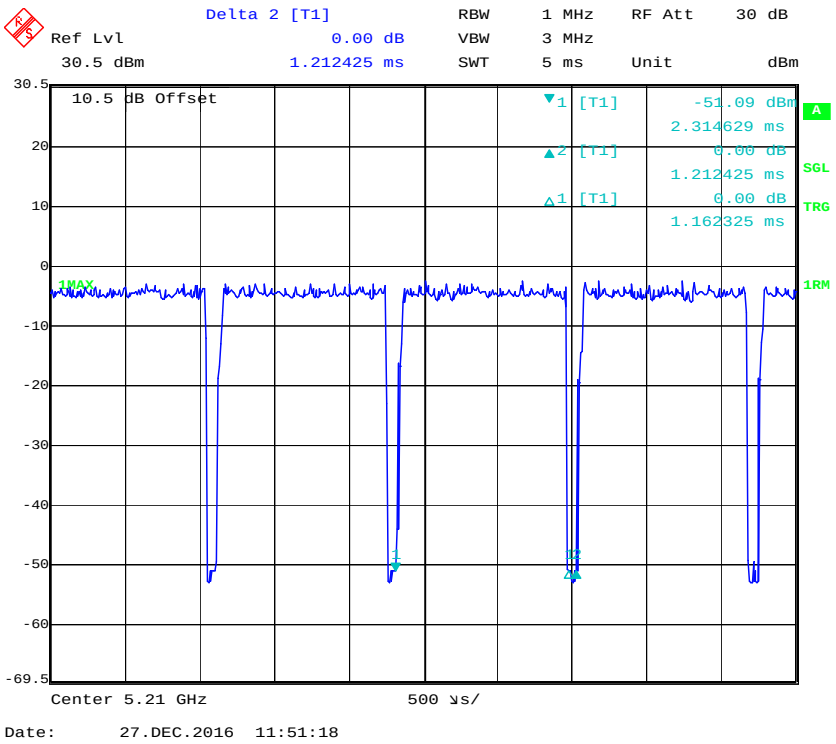


802.11ac80 Mode



Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	10log(1/x)
802.11n20	>98	-	-	10Hz	0
802.11n40	>98	-	-	10Hz	0
802.11ac20	>98	-	-	10Hz	0
802.11ac40	>98	-	-	10Hz	0
802.11ac80	96	1162	0.86	1kHz	0.18

Note: 5725-5825MHz band was used the same duty cycle to test.

Antenna system

This Device Emploies Cyclic Delay Diversity.

Total directional gain (dBi) = gain of individual transmit antennas (dBi) + array gain (dB),

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.

When determining reductions in conducted power limits, array gain is calculated as follows:

Array Gain = 0 dB for $N_{ANT} \leqslant 4$;
Array Gain = 0 dB for channel widths $\geqslant$ 40 MHz for any N_{ANT};
Array Gain = 3 dB for 20-MHz channel widths with $N_{ANT} \geqslant 5$.

Support Equipment List and Details

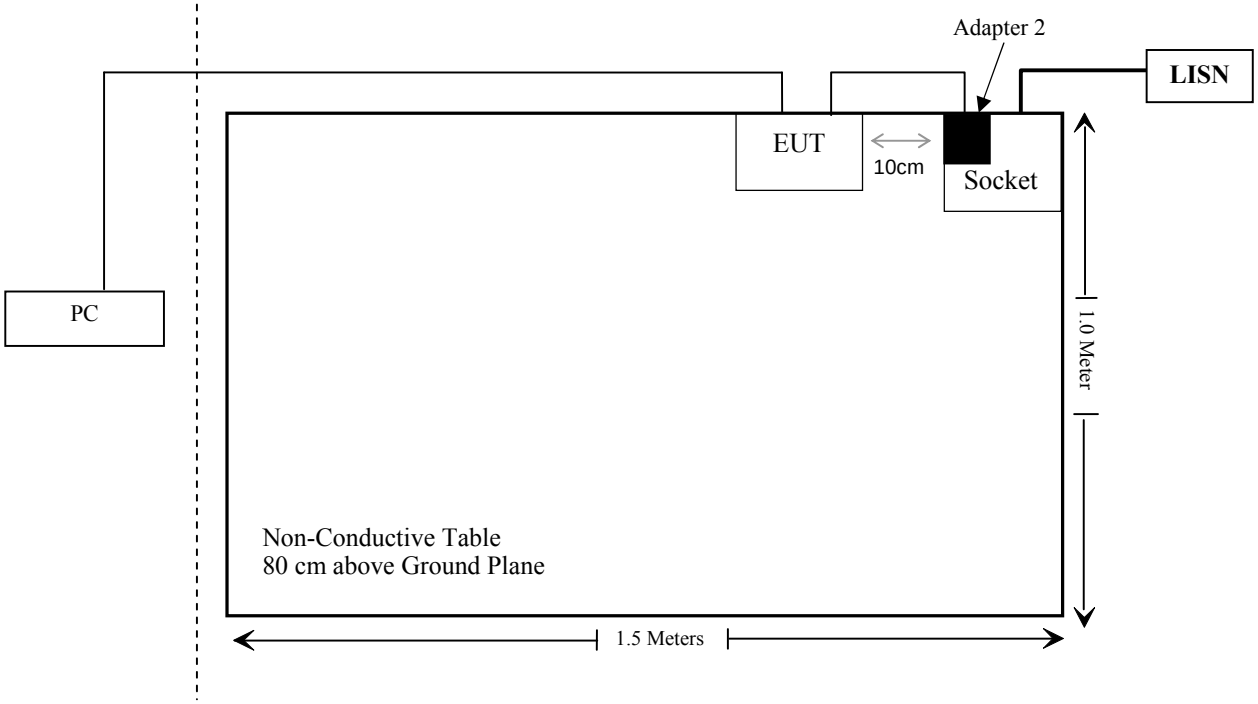
Manufacturer	Description	Model	Serial Number
Lenovo	Notebook	T400	R8-LXAXE 09/12
HUAWEI	POE	PoE35-54A	2102220369ARG6001801
NETGEAR	Adapter 1	DSA-0421S-50	330-10142-01
MASS POWER	Adapter 2	NBS24J240100VU	1604

External I/O Cable

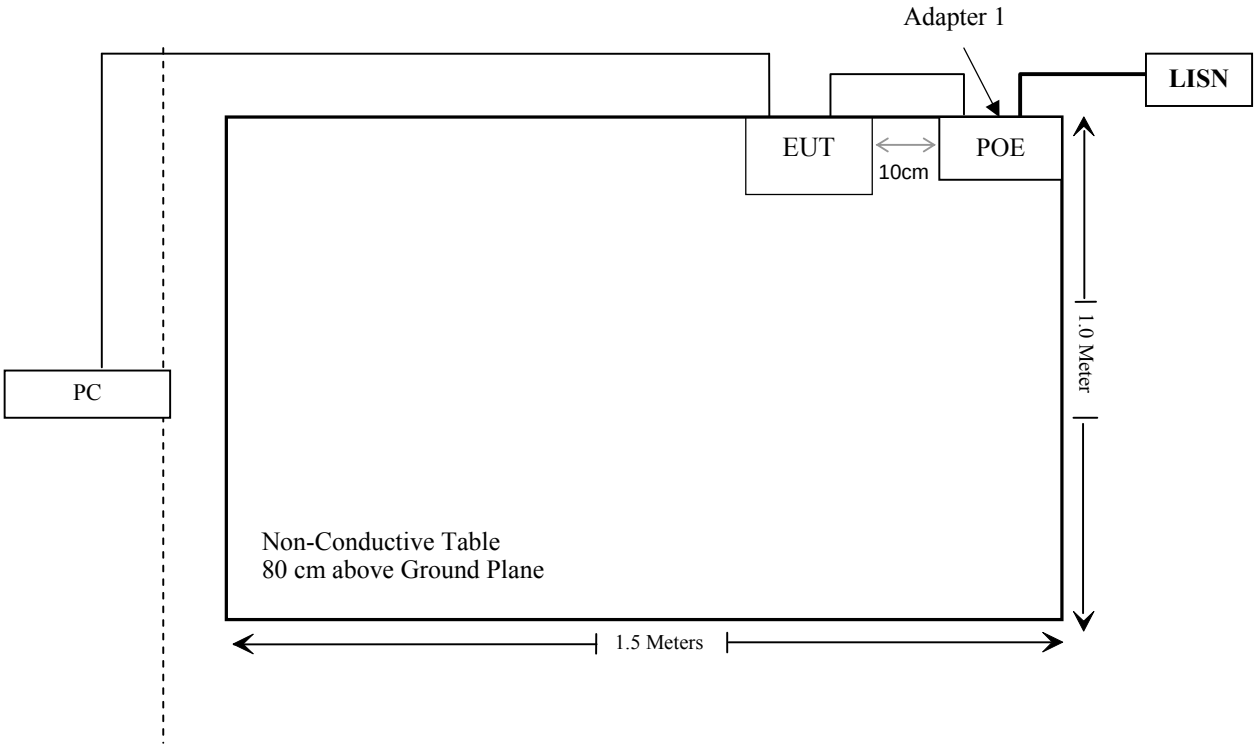
Cable Description	Length (m)	From Port	To
Un-shielding Un-detachable DC cable	0.8	POE	Adapter 1
Un-shielding detachable RJ45 cable	1.0	POE	EUT
Un-shielding detachable RJ45 cable	3.0	EUT	PC
Un-shielding detachable AC cable	0.9	Adapter 1	LISN
Un-shielding detachable AC cable	0.9	Adapter 2	LISN
Un-shielding Un-detachable DC cable	1.5	EUT	Adapter 2

Block Diagram of Test Setup

Powered by Adapter



Powered by POE



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.407 (f), §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.407(b)(6)& §15.207(a)	Conducted Emissions	Compliance*
§15.205& §15.209 &§15.407(b) (1),(4),(7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(a) (1),(5),(e)	26 dB Emission Bandwidth & 6dB Bandwidth	Compliance*
§15.407(a)(1),(3)	Conducted Transmitter Output Power	Compliance
§15.407 (a)(1),(3)	Power Spectral Density	Compliance

Compliance*: Please referred to FCC ID: **YZZGWN7600** granted on 2017-02-24, report No.: RSZ161216002-00B, which was tested by Simon Wang, Bay Area Compliance Laboratories Corp. (Kunshan).

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiation test					
Sonoma Instrunent	Amplifier	330	171377	2016-12-12	2017-12-12
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
EMCO	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-25
Rohde & Schwarz	FSV40 Signal Analyzer	FSV40	101116	2016-07-04	2017-07-03
ETS	Horn Antenna	3115	6229	2016-01-11	2019-01-10
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-12
RF Conducted test					
BACL	TS 8997 Cable-01	T-KS-EMC086	T-KS-EMC086	2016-12-09	2017-12-08
BACL	RF cable	KS-LAB-012	KS-LAB-012	2016-12-15	2017-12-14
WEINSCHEL	3dB Attenuator	5326	N/A	2016-06-18	2017-06-18
Rohde & Schwarz	FSV40 Signal Analyzer	FSV40	101116	2016-07-04	2017-07-03
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21

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

FCC §15.407 (f) & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to FCC §2.1091 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) 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;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
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);

Calculated Data (Worst Case):

Frequency (MHz)	**Antenna Gain**		**Max tune –up Conducted Power**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
	(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
5180-5240	3.0	2.0	23.00	199.53	20	0.08	1.0
5745-5825	3.0	2.0	22.50	177.83	20	0.07	1.0

Simultaneous transmitting consideration: (referring to the DTS report, the highest MPE for 2.4G band is $0.07mW/cm^2$)

The ratio=MPE_{DTS}/limit+MPE_{UNII}/limit=0.07+0.08=0.15＜1.0, simultaneous exposure is not required.

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 integrated antenna with maximum gain 3.0 dBi which were permanently attached, fulfill the requirement of this section, and please refer to the EUT photo.

Result: Compliance.

§15.205 & §15.209 & §15.407(B) (1),(4),(6),(7) – UNDESIRABLE EMISSION

Applicable Standard

FCC §15.407 (b) (1), (2), (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:
(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:
(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.

KDB 789033 D02 General UNII Test Procedures New Rulesv01r04, clause II.G 1 d),
(ii) E [dBμV/m] = EIRP [dBm] + 95.2, for d = 3 meters.

KDB 644545 D03 Guidance for IEEE 802 11ac New Rules v01 clause E.3)

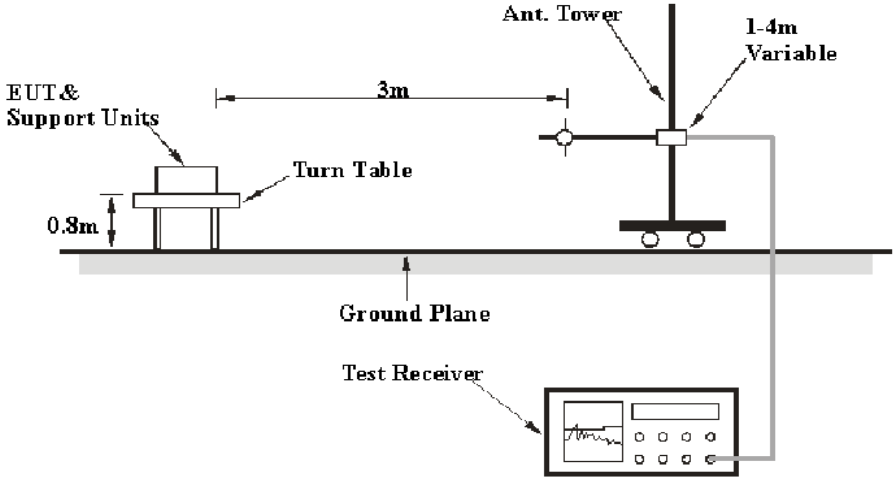
The general limit of -27 dBm EIRP (= 68 dBμV/m) is applied for unwanted emission of U-NII devices.
However, compliance with unwanted emissions in restricted bands may need to be considered, *e.g.,* some harmonics may land in the restricted bands below 5.15 GHz and above 5.35 GHz (refer
The general limit of -27 dBm EIRP (= 68 dBμV/m) is applied for unwanted emission of U-NII devices.
However, compliance with unwanted emissions in restricted bands may need to be considered, *e.g.,* some harmonics may land in the restricted bands below 5.15 GHz and above 5.35 GHz (refer to § 15.205 for restricted bands) that have average and peak limits specified in §§ 15.209 and 15.35(b), respectively.
Although the peak limit of 74 dBμV/m (20 dB above 54 dBμV/m) in the restricted band appears to be higher than 68 dBμV/m, the lower average limit of 54 dBμV/m in the restricted bands needs to be complied to

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

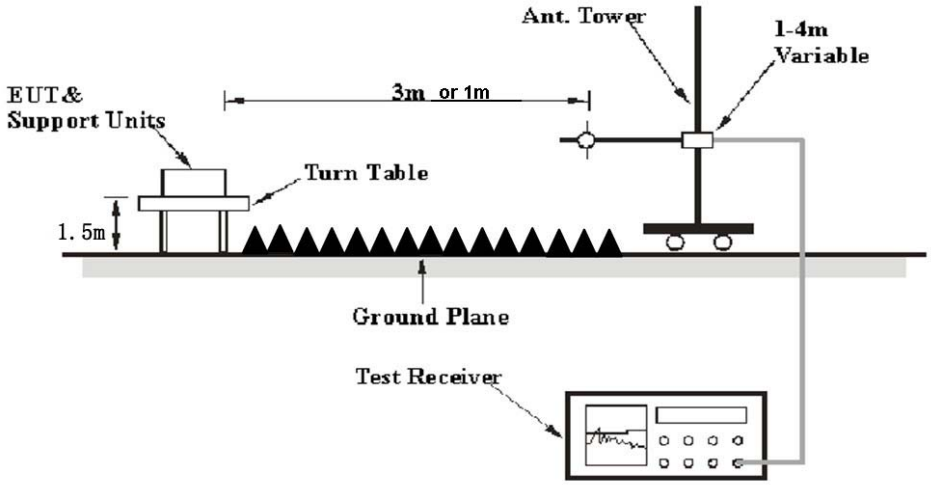
1) For 25MHz-75 MHz above or below the band edge, a level of −27 dBm/MHz (68.2dBμV/m) was applied.
2) For 5MHz-25 MHz above or below the band edge, a level of 10 dBm/MHz (105.2dBμV/m) was applied.
2) For 0MHz-5 MHz above or below the band edge, a level of 15.6 dBm/MHz (110.8dBμV/m) was applied.

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.

The adapter was connected to a 120 VAC/60 Hz power source,

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	Detector
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

During the radiated emission test, the adapter was connected to the AC floor outlet.

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.

According to KDB 789033, the limit is E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

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)= -9.54 dB

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:	27 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Layne Li on 2017-05-17.

EUT operation mode: Transmitting(worst case: simultaneous transmission for all the two transmitters)

30 MHz ~ 40 GHz: (5150-5250 MHz low channel)

802.11n20 mode:

(3m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
5180 MHz									
260.18	42.84	QP	301	1.5	H	-11.97	30.87	46	15.13
5180.00	118.97	PK	221	1.2	H	-6.19	112.78	/	/
5180.00	102.94	Ave.	221	1.2	H	-6.19	96.75	/	/
5180.00	111.69	PK	221	1.5	V	-6.19	105.5	/	/
5180.00	98.30	Ave.	221	1.5	V	-6.19	92.11	/	/
10360.00	40.82	PK	125	1.6	H	12.9	53.72	74	20.28
10360.00	26.26	Ave.	125	1.6	H	12.9	39.16	54	14.84

(1m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	Extrapolation result (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)				Limit (dBμV/m)	Margin (dB)
5180 MHz										
5146.19	69.28	PK	326	1.2	H	2.17	71.45	61.91	74	12.09
5146.19	54.74	Ave.	326	1.2	H	2.17	56.91	47.37	54	6.63
5144.78	75.31	PK	244	2.2	V	2.17	77.48	67.94	74	6.06
5144.78	58.65	Ave.	244	2.2	V	2.17	60.82	51.28	54	2.72

Note: the extrapolation factor of 1m is 20*log(1/3)= -9.54 dB

802.11ac20 mode:

(3m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
5180 MHz									
260.18	42.59	QP	99	1.3	H	-11.97	30.62	46	15.38
5180.00	108.48	PK	124	2.4	H	2.28	110.76	/	/
5180.00	96.34	Ave.	124	2.4	H	2.28	98.62	/	/
5180.00	104.22	PK	108	2.3	V	2.28	106.5	/	/
5180.00	93.01	Ave.	108	2.3	V	2.28	95.29	/	/
10360.00	40.84	PK	255	2.3	H	12.9	53.74	74	20.26
10360.00	25.83	Ave.	255	2.3	H	12.9	38.73	54	15.27

(1m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	Extrapolation result (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)				Limit (dBμV/m)	Margin (dB)
5180 MHz										
5074.48	68.78	PK	172	2.1	H	2.17	70.95	61.41	74	12.59
5074.48	54.89	Ave.	172	2.1	H	2.17	57.06	47.52	54	6.48
5144.98	75.13	PK	176	1.6	V	2.17	77.30	67.76	74	6.24
5144.98	59.08	Ave.	176	1.6	V	2.17	61.25	51.71	54	2.29

Note: the extrapolation factor of 1m is 20*log(1/3)= -9.54 dB

802.11n40 mode:

(3m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
5190 MHz									
260.18	42.96	QP	123	1.1	H	-11.97	30.99	46	15.01
5190.00	106.27	PK	124	2.4	H	2.28	108.55	/	/
5190.00	95.76	Ave.	124	2.4	H	2.28	98.04	/	/
5190.00	94.82	PK	108	2.3	V	2.28	97.10	/	/
5190.00	84.62	Ave.	108	2.3	V	2.28	86.90	/	/
10380.00	39.59	PK	357	1.8	H	12.9	52.49	74	21.51
10380.00	26.01	Ave.	357	1.8	H	12.9	38.91	54	15.09

(1m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	Extrapolation result (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)				Limit (dBμV/m)	Margin (dB)
5190 MHz										
5139.97	68.76	PK	284	1.1	H	2.17	70.93	61.39	74	12.61
5139.97	54.83	Ave.	284	1.1	H	2.17	57.00	47.46	54	6.54
5136.17	70.48	PK	265	1.6	V	2.17	72.65	63.11	74	10.89
5136.17	56.11	Ave.	265	1.6	V	2.17	58.28	48.74	54	5.26

Note: the extrapolation factor of 1m is 20*log(1/3)= -9.54 dB

802.11ac40 mode:

(3m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
5190 MHz									
260.18	42.56	QP	11	1.2	H	-11.97	30.59	46	15.41
5190.00	105.69	PK	356	1.0	H	2.28	107.97	/	/
5190.00	95.07	Ave.	356	1.0	H	2.28	97.35	/	/
5190.00	94.51	PK	65	1.7	V	2.28	96.79	/	/
5190.00	83.49	Ave.	65	1.7	V	2.28	85.77	/	/
10380.00	41.09	PK	118	2.2	H	12.9	53.99	74	20.01
10380.00	25.82	Ave.	118	2.2	H	12.9	38.72	54	15.28

(1m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	Extrapolation result (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)				Limit (dBμV/m)	Margin (dB)
5190 MHz										
5135.57	72.33	PK	75	2.1	H	2.17	74.50	64.96	74	9.04
5135.57	56.64	Ave.	75	2.1	H	2.17	58.81	49.27	54	4.73
5142.98	77.09	PK	197	2.0	V	2.17	79.26	69.72	74	4.28
5142.98	59.1	Ave.	197	2.0	V	2.17	61.27	51.73	54	2.27

Note: the extrapolation factor of 1m is 20*log(1/3)= -9.54 dB

802.11ac80 mode:

(3m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
5210 MHz									
260.18	42.66	QP	34	1.1	H	-11.97	30.69	46	15.31
5210.00	101.49	PK	33	1.9	H	2.28	103.77	/	/
5210.00	92.03	Ave.	33	1.9	H	2.28	94.31	/	/
5210.00	93.07	PK	137	2.4	V	2.28	95.35	/	/
5210.00	82.06	Ave.	137	2.4	V	2.28	84.34	/	/
10420.00	41.32	PK	270	1.3	H	12.9	54.22	74	19.78
10420.00	26.28	Ave.	270	1.3	H	12.9	39.18	54	14.82

(1m test distance)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	Extrapolation result (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)				Limit (dBμV/m)	Margin (dB)
5210 MHz										
5120.34	69.39	PK	345	1.8	H	2.17	71.56	62.02	74	11.98
5120.34	55.08	Ave.	345	1.8	H	2.17	57.25	47.71	54	6.29
5123.94	74.65	PK	246	1.2	V	2.17	76.82	67.28	74	6.72
5123.94	59.75	Ave.	246	1.2	V	2.17	61.92	52.38	54	1.62

Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Margin = Limit- Corr. Amplitude
The bandedge was tested all polarization , and the worst polarization data was recorded.
Spurious emissions more than 20 dB below the limit were not reported.
the extrapolation factor of 1m is 20*log(1/3)= -9.54 dB

FCC §15.407(a) (1) (3)– CONDUCTED TRANSMITTER OUTPUT POWER

Applicable Standard

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz 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.

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

Set span to encompass the entire EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(v) Manually set sweep time ≥ 10 * (number of points in sweep) * (symbol period of the transmitted signal), but not less than the automatic default sweep time.

(vi) Set detector = RMS.

(vii) The EUT shall be operated at 100 percent duty cycle.

(viii) Perform a single sweep.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Nefertari Xu on 2017-05-17.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the following tables and plots.

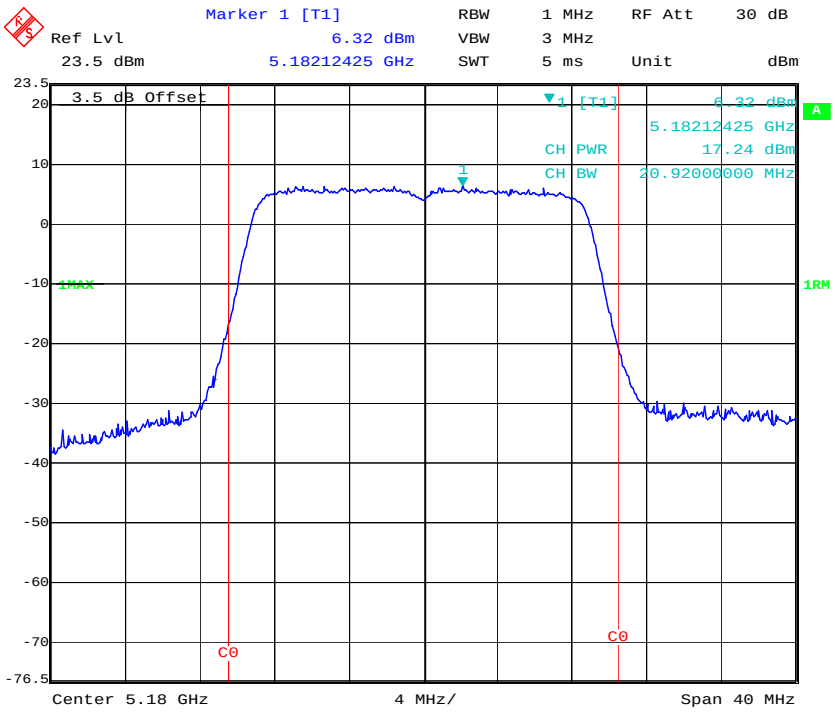
Note: This Device Emploies Cyclic Delay Diversity.
When determining reductions in conducted power limits, array gain is calculated as follows:
As to this device, $N_{ANT} \leq 4$, Array Gain = 0 dB.
Total directional gain (dBi) = gain of individual transmit antennas (dBi) + 0 (dB) =3dBi.

5150 MHz – 5250 MHz:

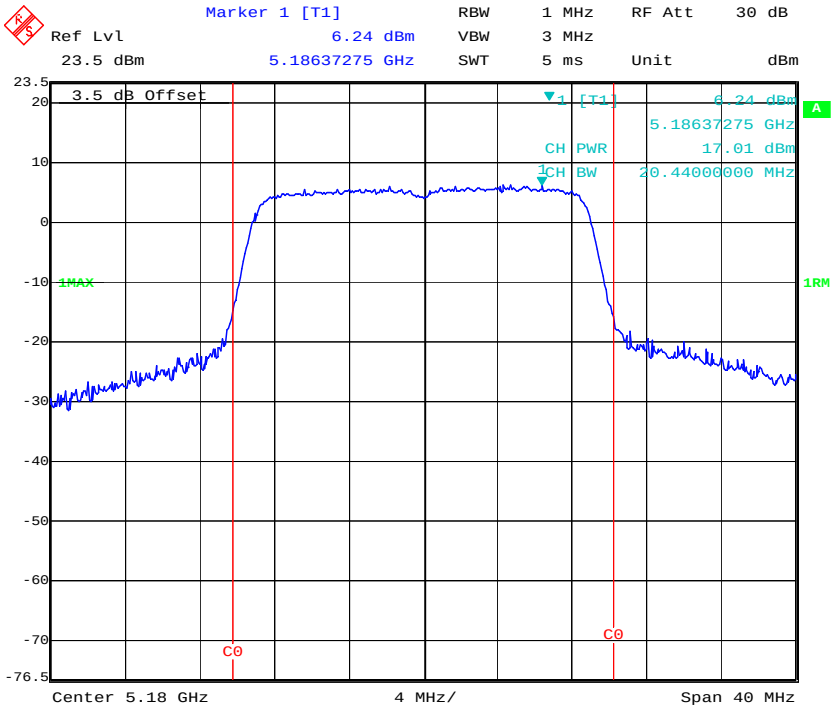
Frequency (MHz)	Antenna Port	Output Power (dBm)	Sum Output Power (dBm) Chain0+Chain1	Limit (dBm)
802.11n20				
5180	0	17.24	20.14	30
	1	17.01		
802.11n40				
5190	0	15.15	18.06	30
	1	14.95		

Frequency (MHz)	Antenna Port	Output Power (dBm)	Sum Output Power (dBm) Chain0+Chain1	Limit (dBm)
802.11ac20				
5180	0	17.06	20.05	30
	1	17.02		
802.11ac40				
5190	0	14.87	17.93	30
	1	14.97		
802.11ac80				
5210	0	14.14	17.12	30
	1	14.07		

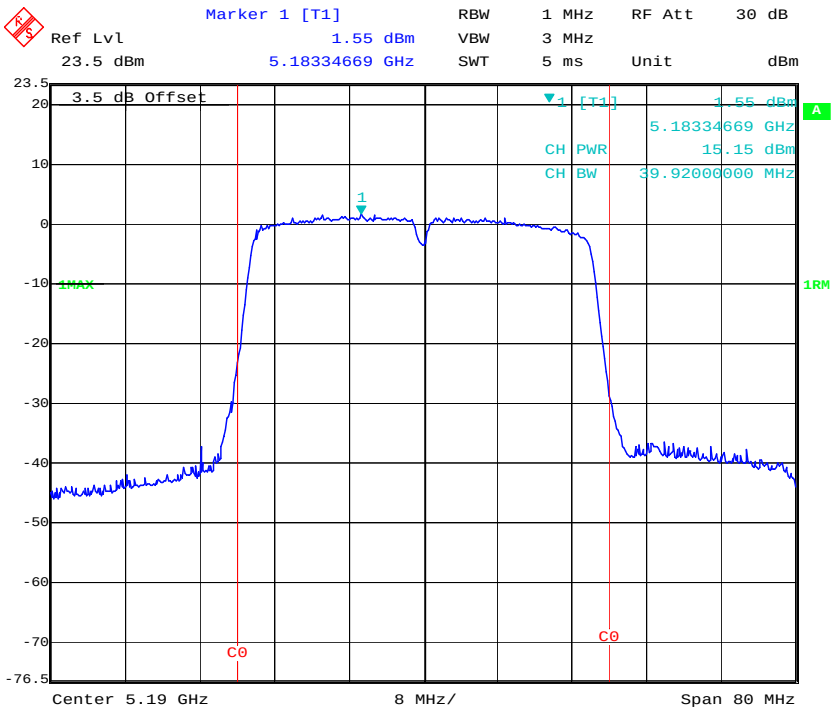
802.11n20 mode, RF Conducted Output Power, Antenn 0, 5180 MHz



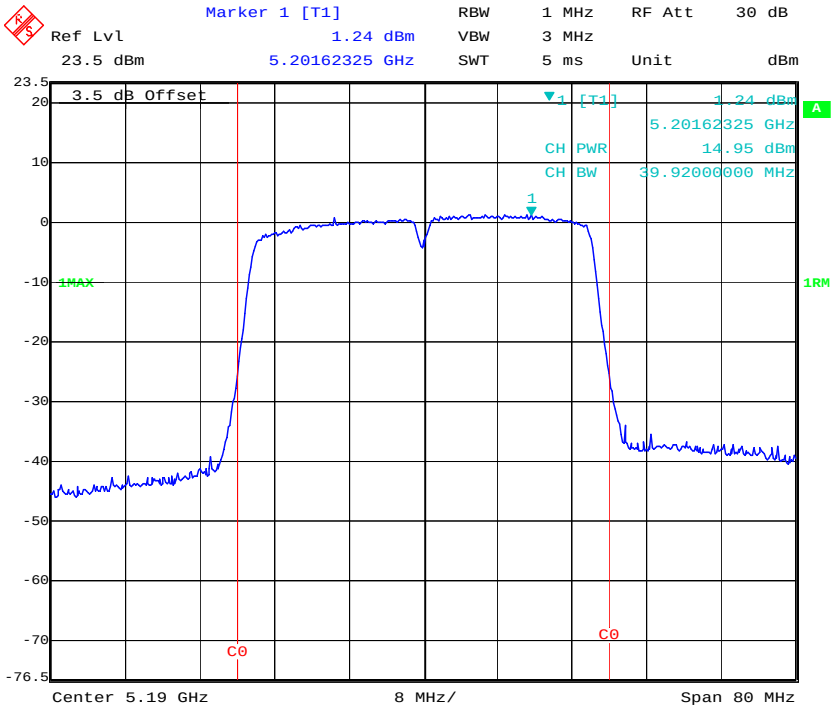
802.11n20 mode, RF Conducted Output Power, Antenn 1, 5180 MHz



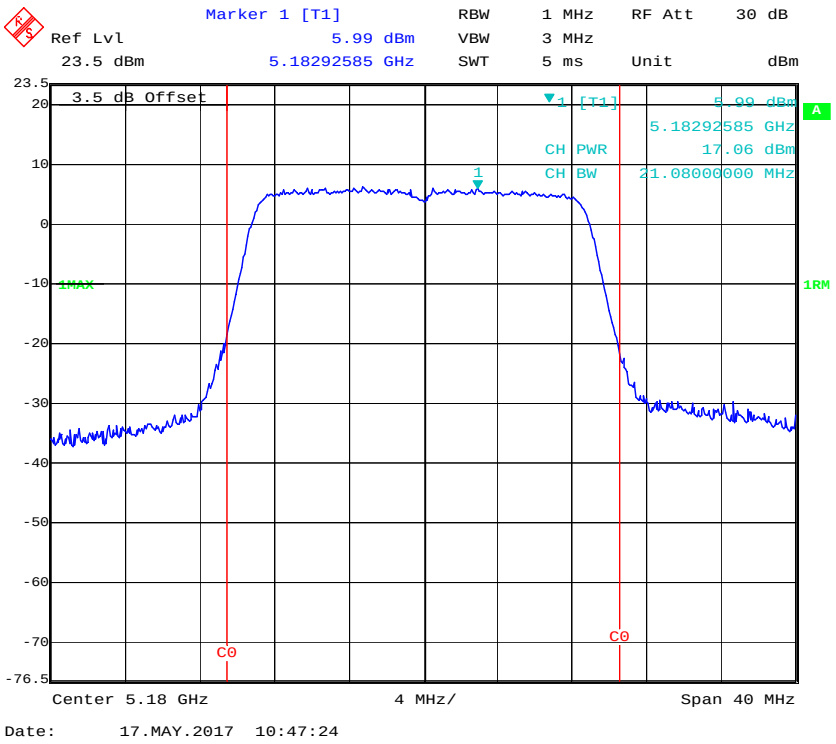
802.11n40 mode, RF Conducted Output Power, Antenn 0, 5190 MHz



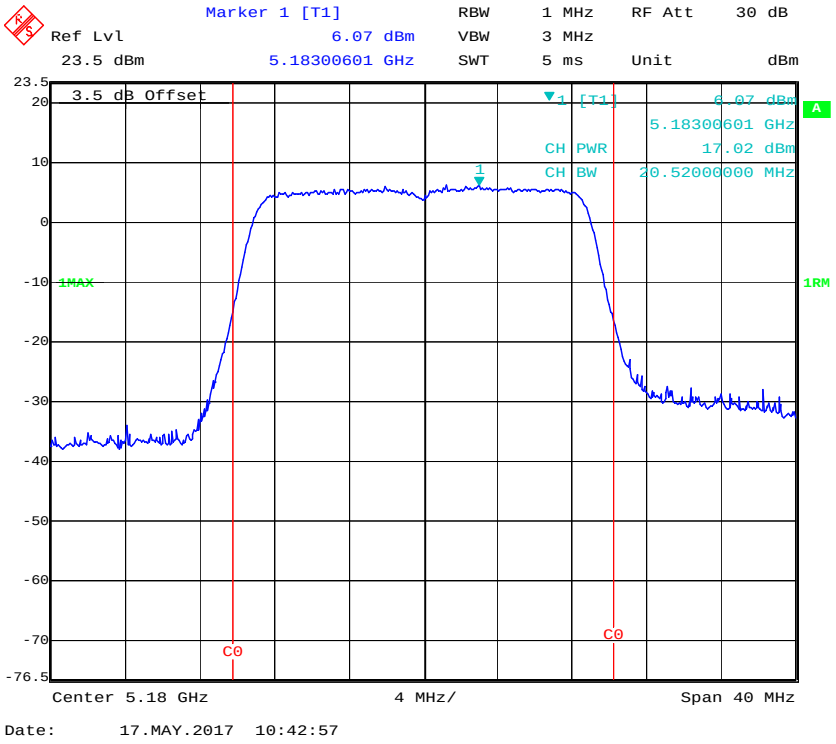
802.11n40 mode, RF Conducted Output Power, Antenn 1, 5190 MHz



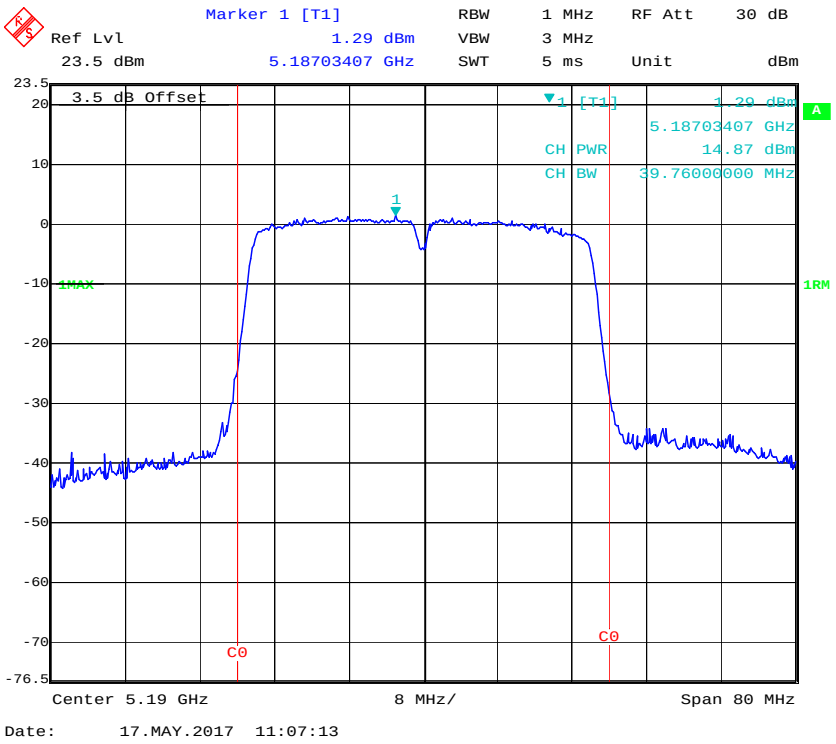
802.11ac20 mode, RF Conducted Output Power, Antenn 0, 5180 MHz



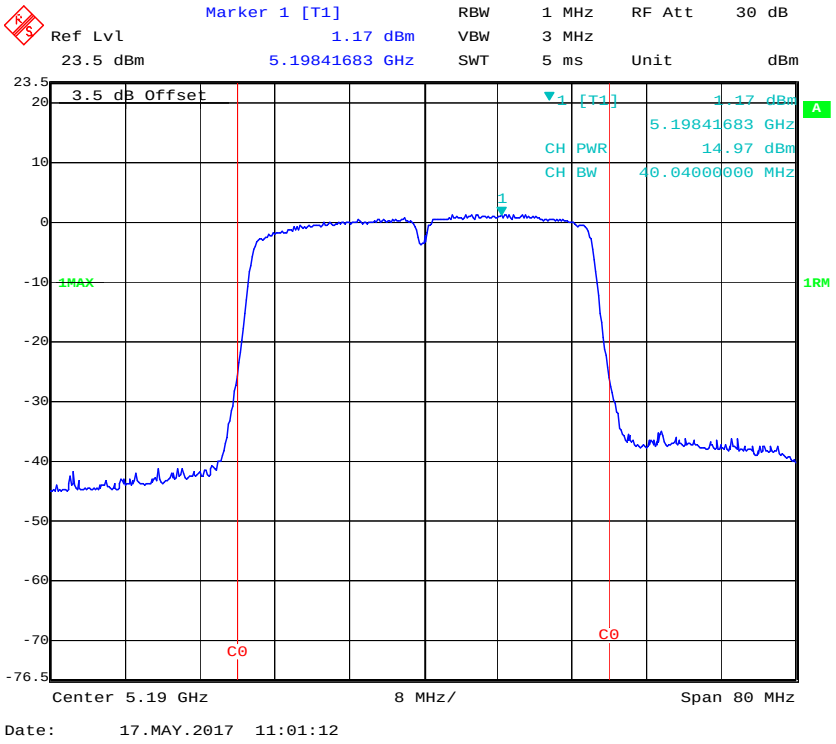
802.11ac20 mode, RF Conducted Output Power, Antenn 1, 5180 MHz



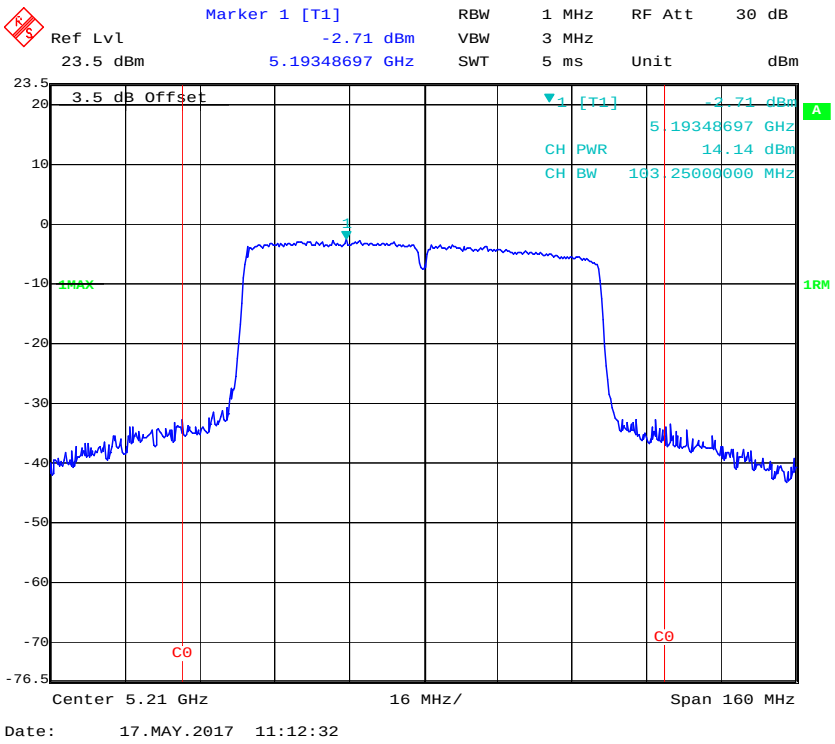
802.11ac40 mode, RF Conducted Output Power, Antenn 0, 5190 MHz



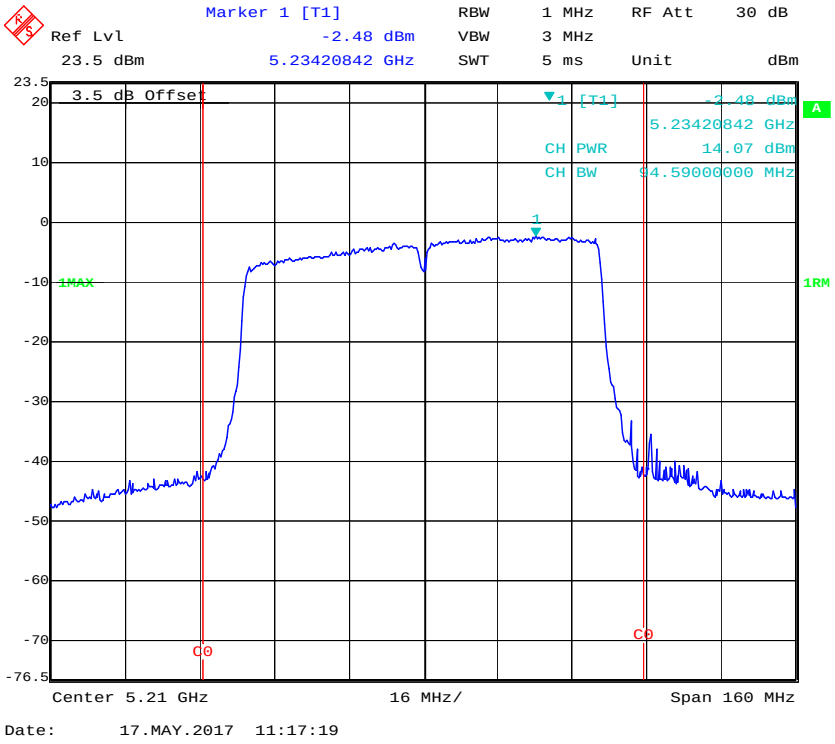
802.11ac40 mode, RF Conducted Output Power, Antenn 1, 5190 MHz



802.11ac80 mode, RF Conducted Output Power, Antenn 0, 5210 MHz



802.11ac80 mode, RF Conducted Output Power, Antenn 1, 5210 MHz



FCC §15.407(a) (1) (5) - POWER SPECTRAL DENSITY

Applicable Standard

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz 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.

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 bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). 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:	27 ℃
Relative Humidity:	47 %
ATM Pressure:	101.0 kPa

The testing was performed by Nefertari Xu on 2017-05-17.

EUT operation mode: Transmitting

Test Result: Pass

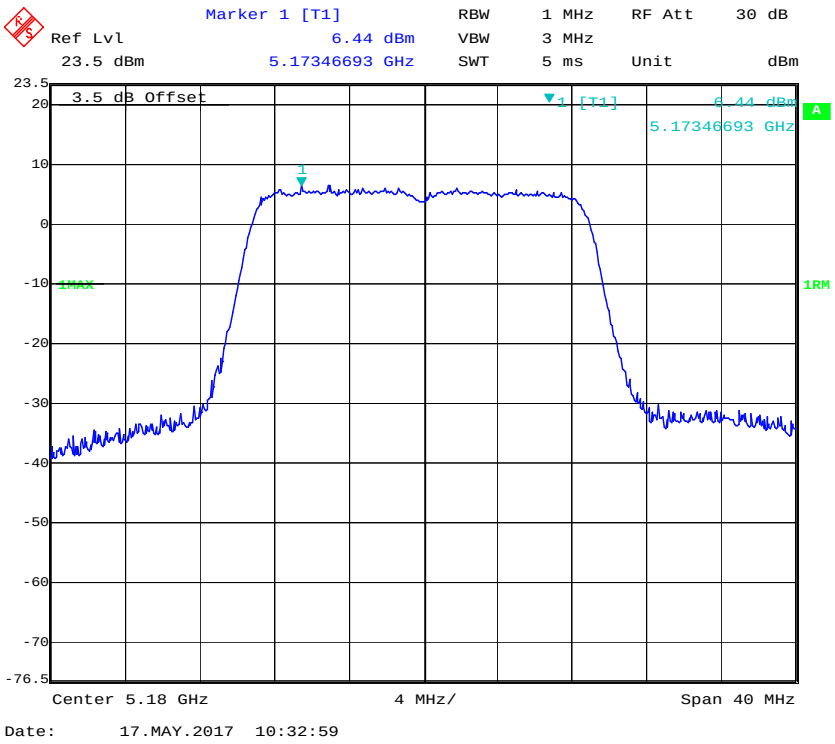
Please refer to the following tables and plots.

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) =6dBi.

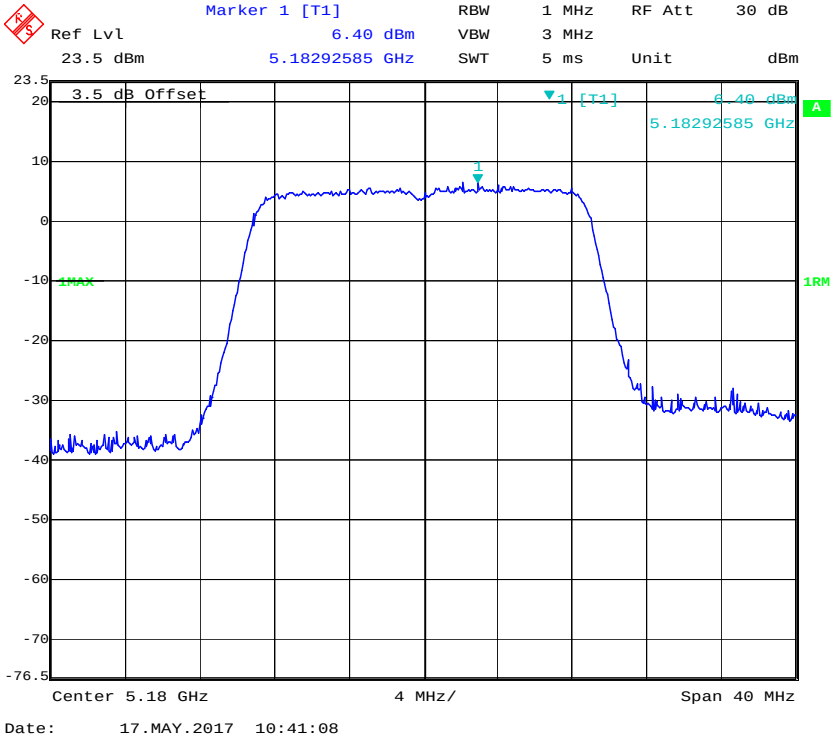
5150 MHz – 5250 MHz:

Frequency (MHz)	Antenna Port	Power Spectral Density (dBm/MHz)	Sum Power spectral density (dBm/MHz) Chain0+Chain1	Limit (dBm)
802.11n20				
5180	0	6.44	9.43	17
	1	6.40		
802.11n40				
5190	0	1.63	4.42	17
	1	1.17		
802.11ac20				
5180	0	6.06	9.05	17
	1	6.02		
802.11ac40				
5190	0	1.36	4.30	17
	1	1.22		
802.11ac80				
5210	0	-2.77	0.34	17
	1	-2.58		

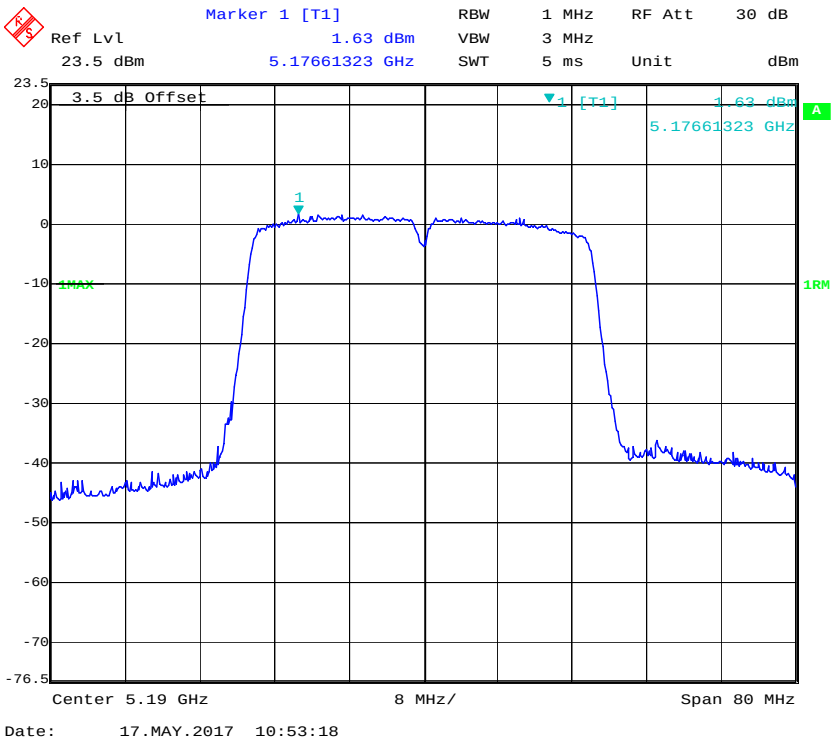
802.11n20 mode, Power Spectral Density, Antenn 0, 5180 MHz



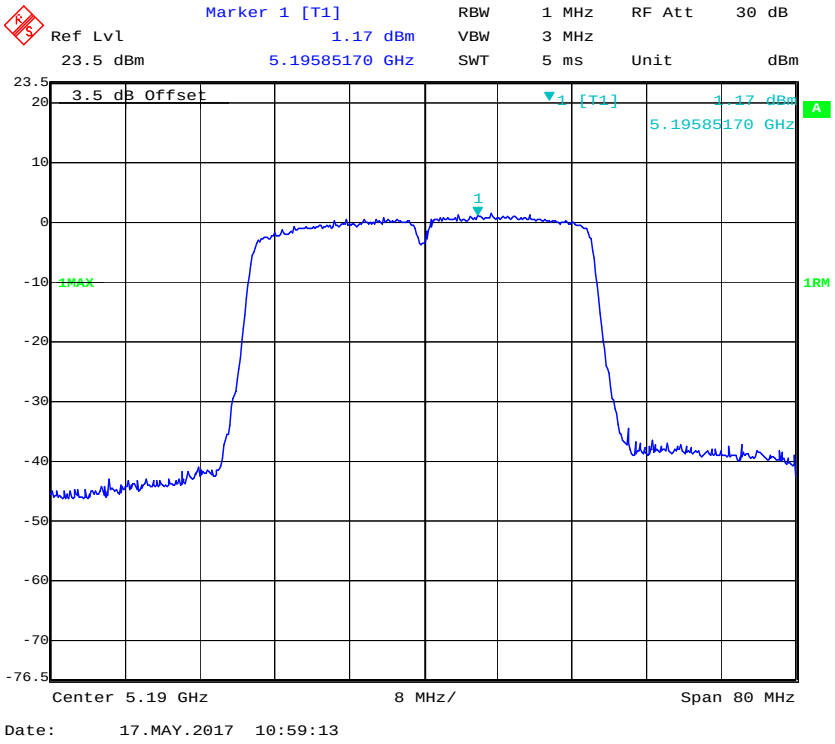
802.11n20 mode, Power Spectral Density, Antenn 1, 5180 MHz



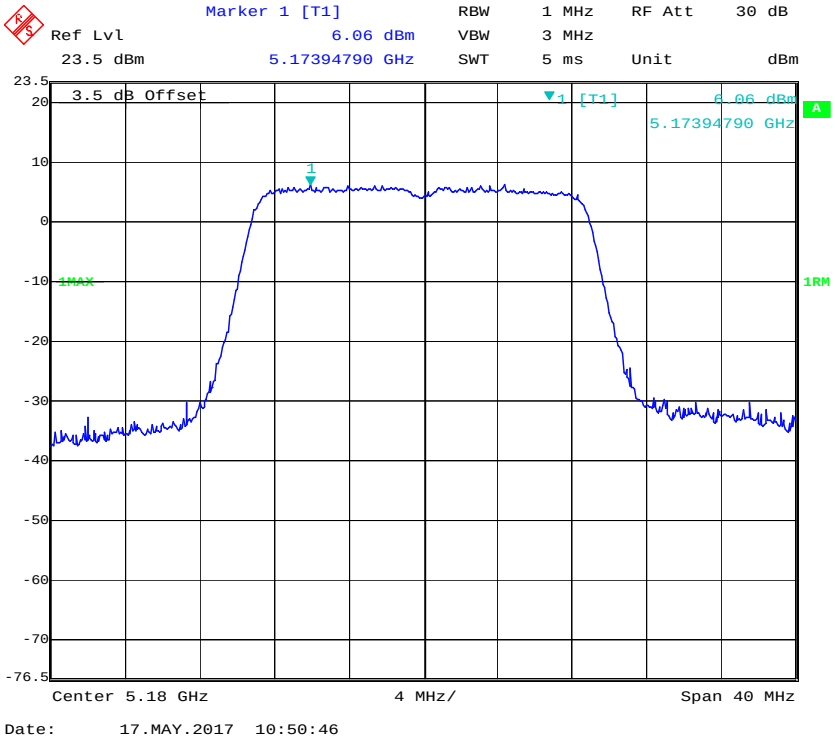
802.11n40 mode, Power Spectral Density, Antenn 0, 5190 MHz



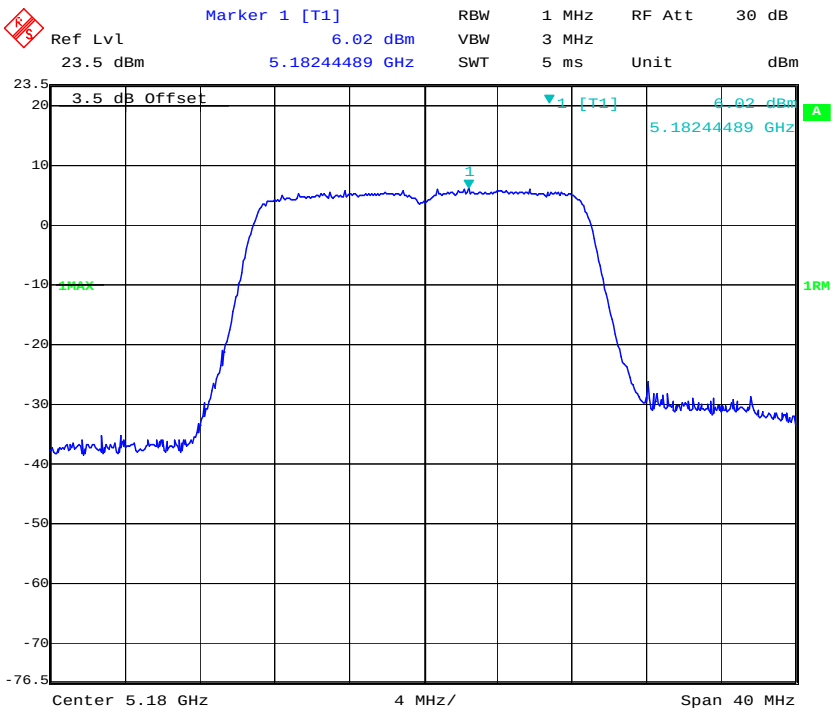
802.11n40 mode, Power Spectral Density, Antenn 1, 5190 MHz



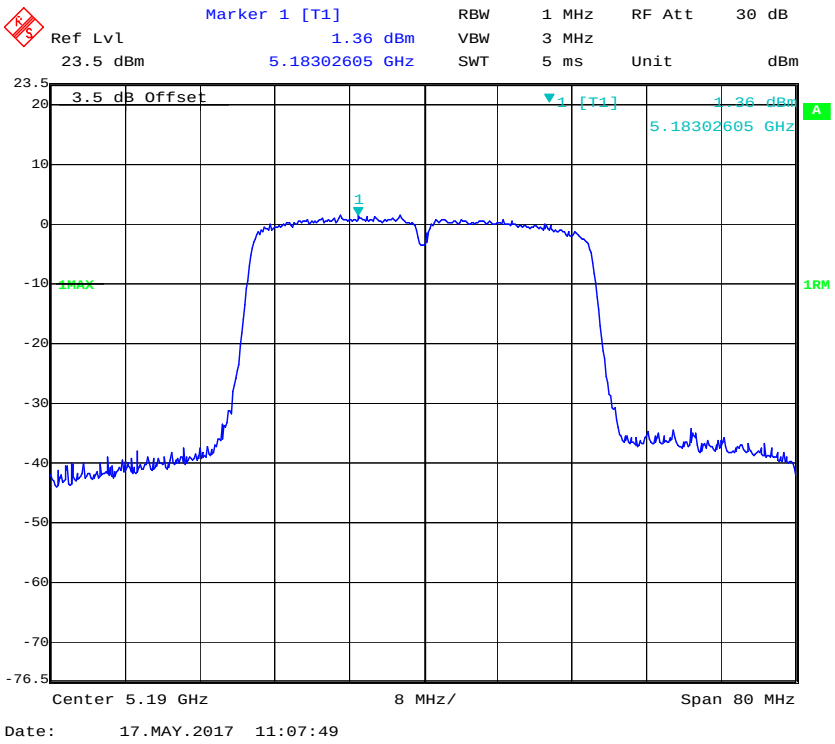
802.11ac20 mode, Power Spectral Density, Antenn 0, 5180 MHz



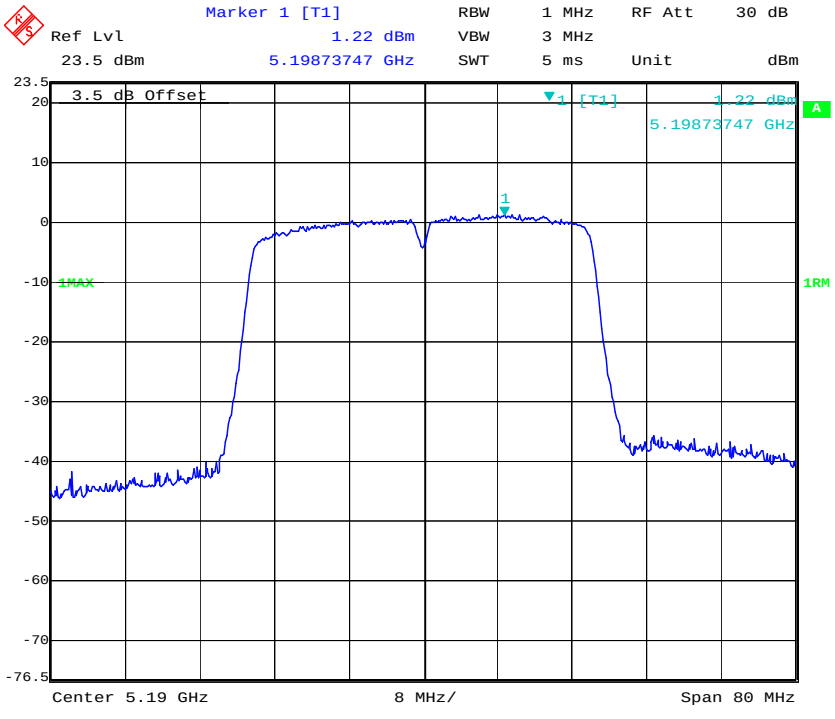
802. 11ac20 mode, Power Spectral Density, Antenn 1, 5180 MHz



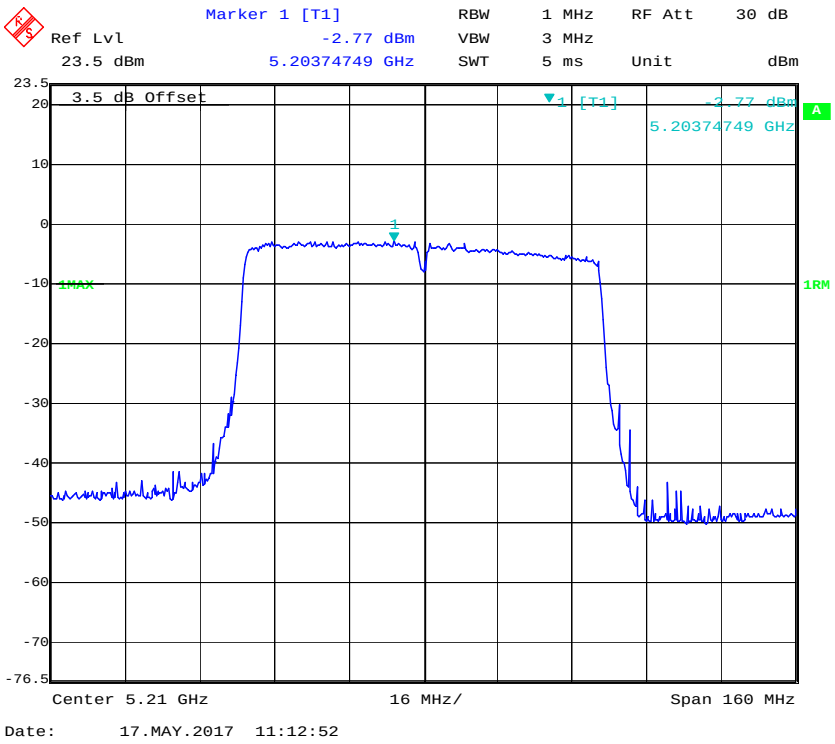
802. 11ac40 mode, Power Spectral Density, Antenn 0, 5190 MHz



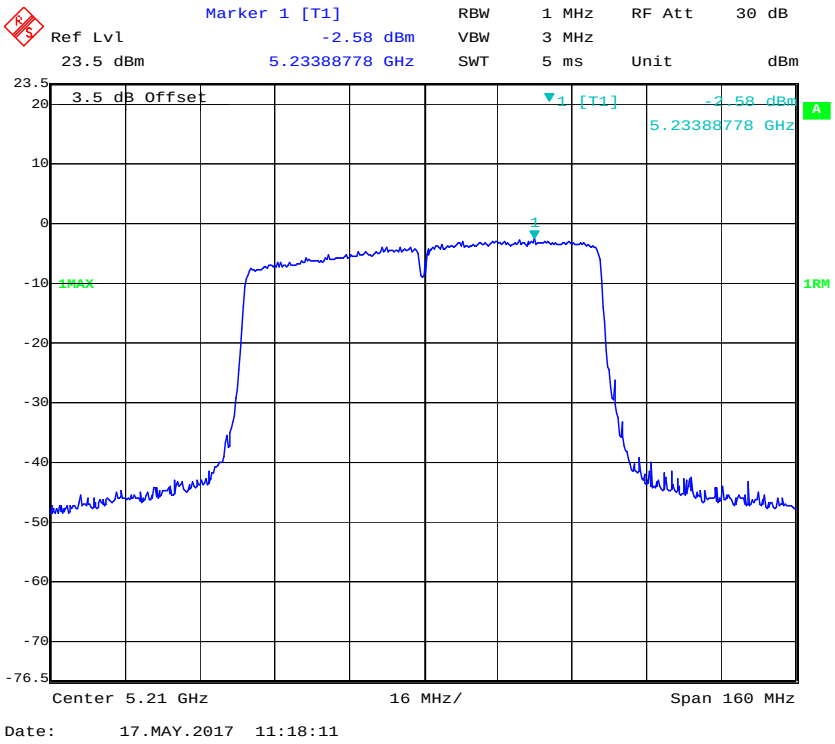
802. 11ac40 mode, Power Spectral Density, Antenn 1, 5190 MHz



802.11ac80 mode, Power Spectral Density, Antenn 0, 5210 MHz



802.11ac80 mode, Power Spectral Density, Antenn 1, 5210 MHz



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