

FCC 15.407 NII 5GHz Test Report

for

Duke Energy Business Services LLC

**526 S. Church St, Charlotte, North Carolina,
28202 United States**

Product Name : Duke Energy Gateway
Model Name : DK-GW001-A01-C001
Brand : DUKE ENERGY
FCC ID : 2AUYW-A010001

**Prepared by: : AUDIX Technology Corporation,
EMC Department**



The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the U.S. Government.

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APPENDIX A TEST DATA AND PLOTS

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TEST REPORT

Applicant : Duke Energy Business Services LLC
Manufacturer : Duke Energy Corporation
EUT Description
(1) Product : Duke Energy Gateway
(2) Model : DK-GW001-A01-C001
(3) Brand : DUKE ENERGY
(4) Power Supply: DC 5V

Applicable Standards:

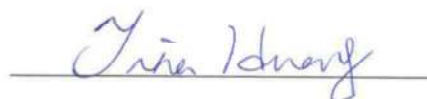
47CFR FCC Part 15 Subpart E
ANSI C63.10:2013
KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Audix Technology Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

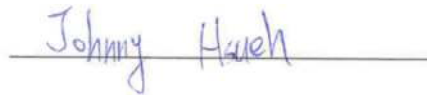
Date of Report: 2019. 12. 27

Reviewed by:



(Tina Huang/Administrator)

Approved by:



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1. REVISION RECORD OF TEST REPORT

Edition No	Issued Data	Revision Summary	Report Number
0	2019. 12. 27	Original Report	EM-F190517

2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	PASS
15.205/15.209	Radiated Band Edge and Radiated Spurious Emission	PASS
15.407(a)(5)/15.407(e)	26dB/6dB Bandwidth	PASS
15.407(a)	Maximum Output Power	PASS
15.407(b)	Conducted Spurious Emission	PASS
15.407(a)	Power Spectral Density	PASS
15.407	Frequency Stability	PASS
15.203	Antenna Requirement	Compliance
Note: The uncertainties value is not used in determining the result.		

3. GENERAL INFORMATION

3.1. Description of Application

Applicant	Duke Energy Business Services LLC 526 S. Church St, Charlotte, North Carolina, United States, 28202 United States
Manufacturer	Duke Energy Corporation 550 South Tryon Street Charlotte, NC 28202 United States
Product	Duke Energy Gateway
Model	DK-GW001-A01-C001
Brand	DUKE ENERGY

3.2. Description of EUT

Test Model	DK-GW001-A01-C001
Serial Number	N/A
Power Rating	DC 5V, 3A
Software Version	N/A
RF Features	WLAN: 802.11 a/b/g/n/ac Bluetooth: BT and BLE Zigbee Z-Wave
Transmit Type	WLAN: 1T1R Bluetooth: 1T1R Zigbee: 1T1R Z-Wave: 1T1R
Device Category	☐ Outdoor Access Point ☐ Fixed point-to-point Access Point ☐ Indoor Access Point ☒ Mobile and Portable client device
Sample Status	Mass production
Date of Receipt	2019. 11. 06
Date of Test	2019. 11.27 ~ 12. 27
Interface Ports of EUT	• One LAN Port • One USB Port • One DC Input Port
Accessories Supplied	• AC Adapter • Ethernet Cord

3.3. Antenna Information

WLAN/ZigBee/BT Antenna				
Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain(dBi)
RFA-DB1-AP609-70-100	ARISTOTLE.	PCB	2400-2500	3.73
			5150-5875	3.92

Z-Wave Antenna				
Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain(dBi)
RFA-ZW-AP856-100-R2	ARISTOTLE.	PCB	868-928	3.15

3.4. EUT Specifications Assessed in Current Report

Mode	UNII Band	Fundamental Range (MHz)	Channel Number
802.11a	NII-1	5180-5240	4
	NII-3	5745-5825	5
802.11n-HT20/ 802.11ac-VHT20	NII-1	5180-5240	4
	NII-3	5745-5825	5
802.11n-HT40/ 802.11ac-VHT40	NII-1	5190-5230	2
	NII-3	5755-5795	2
802.11ac-VHT80	NII-1	5210	1
	NII-3	5775	1

Mode	Modulation	Data Rate (Mbps)
802.11a	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 54
802.11n-HT20	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 72.2
802.11n-HT40		Up to 150
802.11ac-VHT20	OFDM (BPSK/QPSK/16QAM/64QAM/256QAM)	Up to 86.7
802.11ac-VHT40		Up to 200
802.11ac-VHT80		Up to 433.3

Channel List					
802.11a/802.11n-HT20/802.11ac-VHT20					
UNII Band	Channel Number	Frequency (MHz)	UNII Band	Channel Number	Frequency (MHz)
NII-1	36	5180	NII-3	149	5745
	40	5200		153	5765
	44	5220		157	5785
	48	5240		161	5805
				165	5825

Channel List					
802.11n-HT40/802.11ac-VHT40					
UNII Band	Channel Number	Frequency (MHz)	UNII Band	Channel Number	Frequency (MHz)
NII-1	38	5190	NII-3	151	5755
	46	5230		159	5795

Channel List					
802.11ac-VHT80					
UNII Band	Channel Number	Frequency (MHz)	UNII Band	Channel Number	Frequency (MHz)
NII-1	42	5210	NII-3	155	5775

Note Test modes are presented at section 3.6

3.5. Description of Key Components

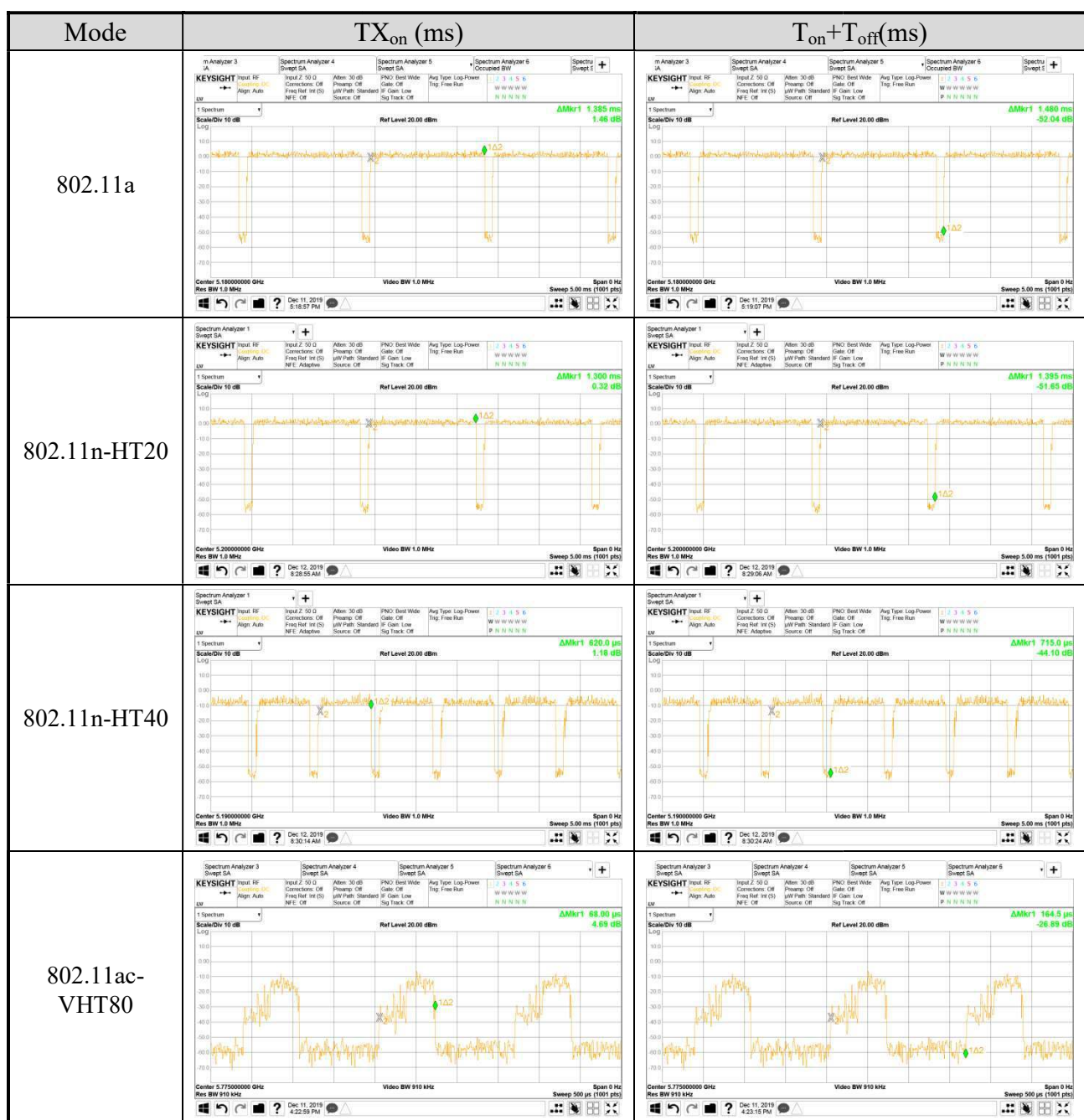
Item	Supplier	Model / Type	Character
CPU	Intel	E3805	1.33GHz
Storage (SSD)	Kingston.	EMMC16G-TB28	eMMC flash 16GB
Memory (RAM)	NANYA.	NT5CC256M16EP-EK	4GB DDR3
WLAN/BT Combo Card	AMPAK.	AP6255	---
Z-Wave Chip	SIGMA.	ZM5101A-CME3R	---
ZigBee Chip	Silicon Labs	EFR32MG1B232F256GM32-C0	---
Z-Wave Antenna	ARISTOTLE	RFA-ZW-AP856-100-R2	---
Wi-Fi/BT/ZigBee Antenna	ARISTOTLE	RFA-DB1-AP609-70-100	---
AC Adapter (Wall-mount, 2C)	SUNNY COMPUTER TECHNOLOGY CO., LTD	SYS1639-1505-W2	I/P: 100-240Vac, 50-60Hz, 1.0A O/P: 5Vdc, 3A 15W MAX
	DC Cable: Unshielded, Detachable, 1.4m		
Cable	Ethernet Cord: Unshielded, Detachable, 0.9m		

Remark: For more detailed features description, please refer to the manufacturer's specifications or the user manual.

3.6. Test Configuration

Mode	TX _{on} (ms)	1/ TX _{on} (kHz)	Duty Cycle (x)	Duty Cycle Factor [10log(1/x)] (dB)
802.11a	1.385	0.722	0.936	0.29
802.11n-HT20	1.300	0.769	0.932	0.31
802.11n-HT40	0.620	1.613	0.867	0.62
802.11ac-VHT80	0.068	14.706	0.413	3.84

Note: When duty cycle is less than 98% (0.98) that duty cycle factor 10log(1/x) is needed to add in conducted test items measured in average detector.



AC Conduction

Normal operation

Item		Mode	Data Rate	Test Channel
Radiated Test Case	Radiated Band Edge (NII-1) ^{Note1}	802.11a	6 Mbps	36
		802.11n-HT20	MCS0	36
		802.11n-HT40	MCS0	38
		802.11ac-VHT80	MCS0	42
	Radiated Band Edge (NII-3) ^{Note1}	802.11a	6 Mbps	149/157/165
		802.11n-HT20	MCS0	149/157/165
		802.11n-HT40	MCS0	151/159
		802.11ac-VHT80	MCS0	155
	Radiated Spurious Emission ^{Note1& 2}	802.11a	6 Mbps	48/149
		802.11n-HT20	MCS0	48/165
		802.11n-HT40	MCS0	46/151
		802.11ac-VHT80	MCS0	42/155

Item		Mode	Data Rate	Test Channel
Conducted Test Case	26dB/6dB Bandwidth	802.11a	6 Mbps	36/40/48/149/157/165
		802.11n-HT20	MCS0	36/40/48/149/157/165
		802.11n-HT40	MCS0	38/46/151/159
		802.11ac-VHT80	MCS0	42/155
	Maximum output power	802.11a	6 Mbps	36/40/48/149/157/165
		802.11n-HT20	MCS0	36/40/48/149/157/165
		802.11n-HT40	MCS0	38/46/151/159
		802.11ac-VHT80	MCS0	42/155
	Power spectral density	802.11a	6 Mbps	36/40/48/149/157/165
		802.11n-HT20	MCS0	36/40/48/149/157/165
		802.11n-HT40	MCS0	38/46/151/159
		802.11ac-VHT80	MCS0	42/155

Note 1: ☒ Mobile Device

☐ Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ☐ Lie ☐ Side ☐ Stand

Note 2: Low, mid, and high channels were measured, only the worst channel of each modulation was presented in this report.

3.7. Tested Supporting System List

3.7.1. Support Peripheral Unit

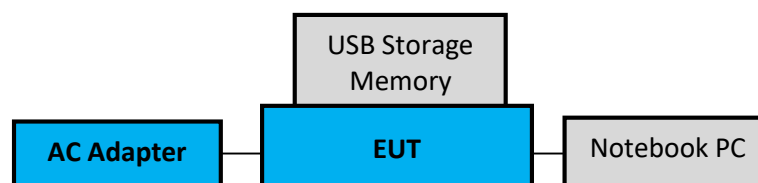
No.	Product	Brand	Model No.	Serial No.	Approval
1.	Notebook PC	hp	TPN-Q189	N/A	N/A
2.	USB Storage Memory (128GB)	SanDisk	N/A	N/A	N/A

3.7.2. Cable Lists

No.	Cable Description Of The Above Support Units
1.	AC Adapter: hp, M/N PPP-012C-S, DC Power Cord: Unshielded, Undetachable, 1.8m, Bonded a ferrite core AC Power Cord: Unshielded, Detachable, 1.0m
2.	USB Cable: Unshielded, Undetachable, 1.8m

3.8. Setup Configuration

3.8.1. EUT Configuration for Power Line & Radiated Emission



3.8.2. EUT Configuration for RF Conducted Test Items



3.9. Operating Condition of EUT

Test program “putty” is used for enabling EUT WLAN function under continues transmitting and choosing data rate/ channel.

3.10. Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2017 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	FCC OET Designation Number under APEC MRA by NCC is : TW1724 ISED CAB Identifier Number under APEC TEL MRA by NCC is TW1724 (1) No.8 Shielded Room (2) No.1 3m Semi Anechoic Chamber (3) Fully Anechoic Chamber

3.11.Measurement Uncertainty

Test Items/Facilities		Frequency Range	Uncertainty
Conduction Test		150kHz~30MHz	±3.50dB
Radiation Test	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.9dB
		200MHz-1000MHz, 3m, Horizontal	±4.3dB
		30MHz-200MHz, 3m, Vertical	±4.5dB
		200MHz-1000MHz, 3m, Vertical	±4.1dB
		1GHz-6GHz, 3m	±5.1dB
		6GHz-18GHz, 3m	±5.5dB
	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.7dB
		200MHz-1000MHz, 3m, Horizontal	±4.5dB
		30MHz-200MHz, 3m, Vertical	±4.3dB
		200MHz-1000MHz, 3m, Vertical	±4.1dB
	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.1dB
		200MHz-1000MHz, 3m, Horizontal	±4.4dB
		30MHz-200MHz, 3m, Vertical	±4.2dB
		200MHz-1000MHz, 3m, Vertical	±5.0dB
		1GHz-6GHz, 3m	±4.4dB
		6GHz-18GHz, 3m	±4.1dB
	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.0dB
		200MHz-1000MHz, 3m, Horizontal	±4.0dB
		30MHz-200MHz, 3m, Vertical	±4.2dB
		200MHz-1000MHz, 3m, Vertical	±4.4dB
		1GHz-6GHz, 3m	±4.3dB
		6GHz-18GHz, 3m	±4.6dB
	Fully Anechoic Chamber	30MHz~1000MHz	±4.7dB
		1GHz~18GHz	±5.3dB

Remark : Uncertainty = $ku_c(y)$

Test Items	Uncertainty
EmissionBandwidth	± 0.2kHz
Maximum output power	± 0.33dB
Power spectral density	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR3	101774	2019. 01. 23	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2019. 11. 13	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2018. 12. 19	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2019. 01. 12	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2019. 04. 20	1 Year
6.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.

4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2019. 09. 11	1 Year
2.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2019.05.06	1 Year
3.	Test Receiver	R & S	ESCS30	100338	2019. 06. 12	1 Year
4.	Amplifier	HP	8447D	2944A06305	2019. 01. 30	1 Year
5.	Amplifier	HP	8449B	3008A02678	2019. 03. 07	1 Year
6.	Amplifier	Keysight	83051A	MY53010042	2019. 08. 08	1 Year
7.	Bilog Antenna	TESEQ	CBL6112D	33821	2019. 01. 19	1 Year
8.	Loop Antenna	R&S	HFH2-Z2	891847/27	2017.12. 18	2 Years
9	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2019. 03. 13	1 Year
10.	Horn Antenna	COM-POWER	AH-840	101092	2019 .05. 14	1 Year
11.	5G Notch Filter	Microwave Circuits	N0452502	459775	2019. 05. 07	1 Year
12.	5G Notch Filter	Microwave Circuits	N0257881	459776	2019. 08. 21	1 Year
13.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2019. 02. 01	1 Year
14.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 104	RF CABLE-01	2019. 09. 20	1 Year
15.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	No.1 18-40GHz Cable	2019. 09.20	1 Year
16.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.1 3m A/C	2019. 04. 20	1 Year
17.	Digital Thermo-Hygro Meter	EVERY DAY	E-512	RF-02	2019. 04. 20	1 Year
18.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.
19.	Test Software	Audix	e3	V6.110601	N.C.R.	N.C.R.

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9020B-544	MY57120357	2019.01.17	1 Year
2.	Power Meter	Anritsu	ML2495A	1145008	2019. 11. 06	1 Year
3.	Power Sensor	Anritsu	MA2411B	1126096	2019. 11. 06	1 Year
4.	Digital Thermo-Hygro Meter	Shenzhen Datronn Electronics	KT-905	RF	2019. 04. 20	1 Year

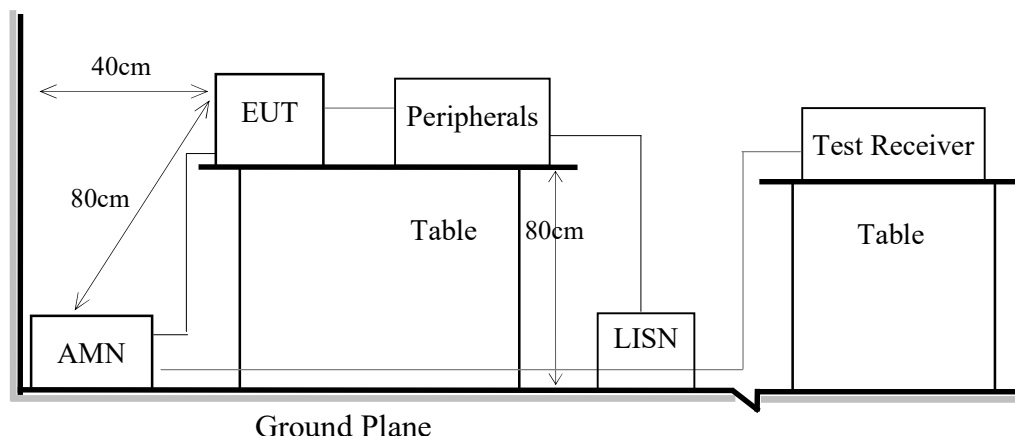
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.8

5.1.2. Shielded Room Setup Diagram



5.2. Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dB μ V	56 ~ 46 dB μ V
500kHz ~ 5MHz	56 dB μ V	46 dB μ V
5MHz ~ 30MHz	60 dB μ V	50 dB μ V

Remark1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.

2.: The lower limit applies to the band edges.

5.3. Test Procedure

- 5.3.1. To set up the EUT as indicated in ANSI C 63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.
- 5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).
- 5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.)
- 5.3.4. Checking frequency range from 150kHz to 30 MHz and record the emission which does not have 20 dB below limit.

5.4. Test Results

Please refer to Appendix A.

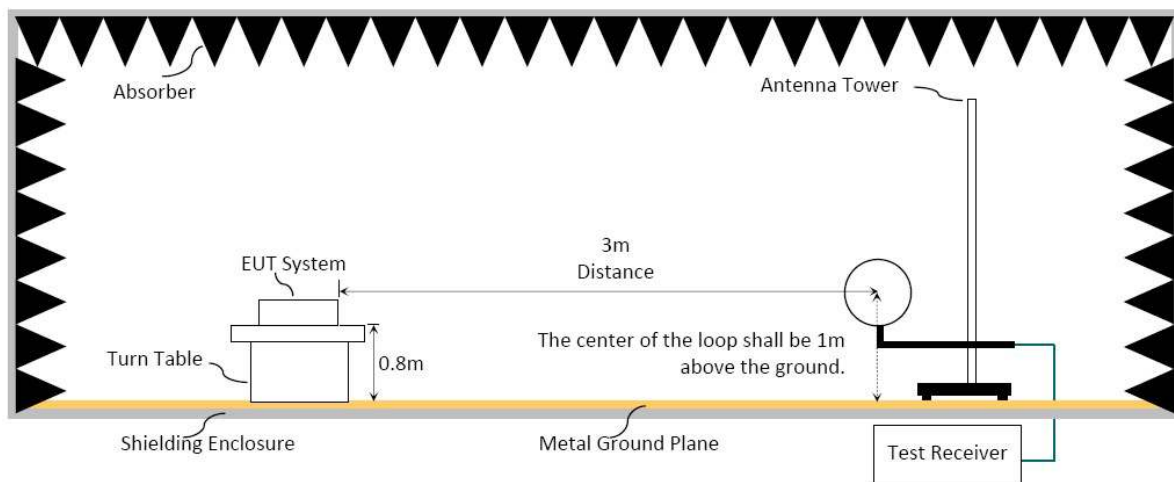
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

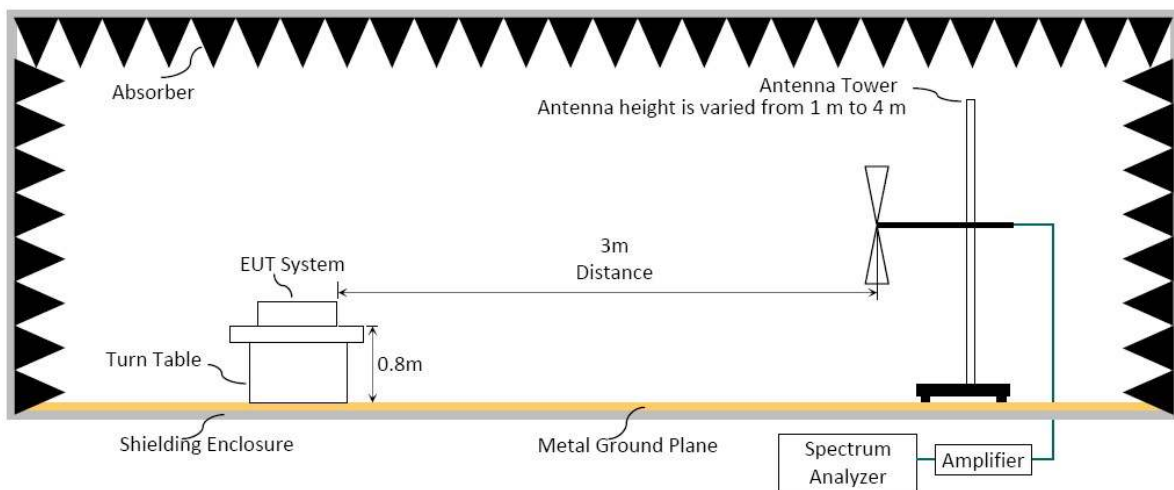
6.1.1. Block Diagram of EUT

Indicated as section 3.9

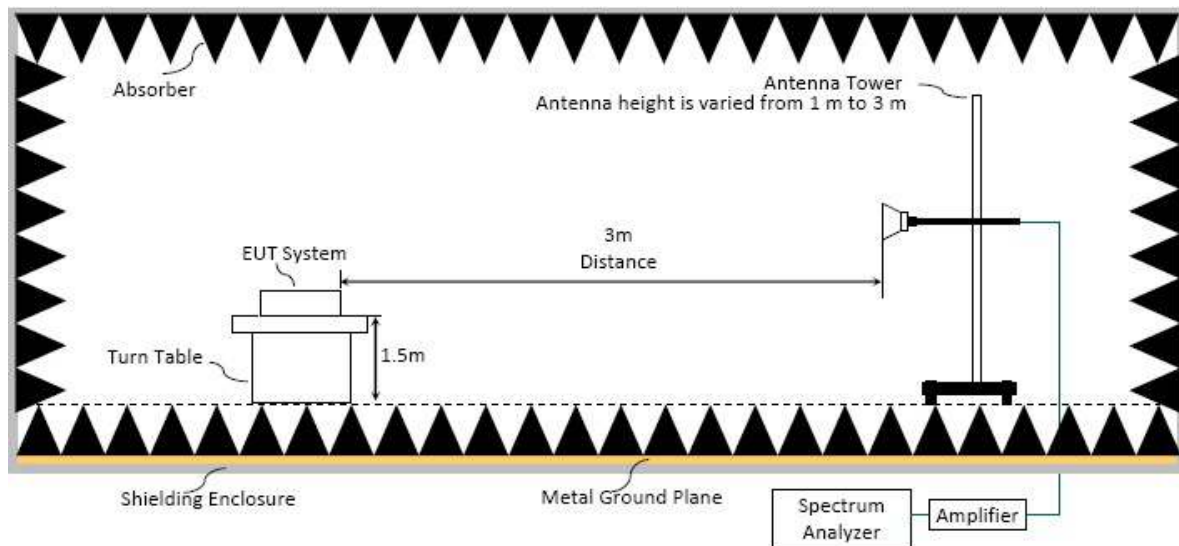
6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000MHz



6.1.4. Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

Radiated emissions fall in restricted bands, as defined in Section 15.205 must be in compliance with the radiated emission limits specified in 15.209 as below.

6.2.1. General Limit

Frequency (MHz)	Distance(m)	Limits	
		dBμV/m	μV/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

(2) The tighter limit applies to the edge between two frequency bands.

(3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

(4) Fundamental and emission fall within operation band are exempted from this section.

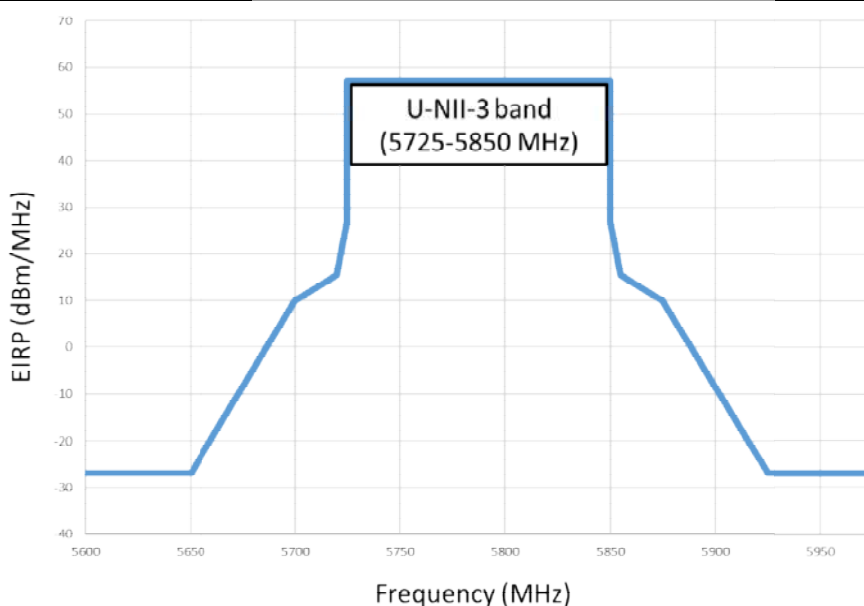
(5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.2.2. Limit for non-restricted frequency above 1 GHz

Frequency Band (MHz)	E.I.R.P. Limit	Field Strength Limit at 3 m
5150 to 5250	-27 dBm	68.2
5250 to 5350		68.2
5470 to 5725		68.2

Note: Field Strength at 3 m= E.I.R.P. + 95.2 dB

Frequency Band (MHz)	Field Strength Limit at 3 m	
5725 to 5850	☒	15.407(b)(4)(i) All emissions shall be limited to a level of 68.2 dBμV/m at 75 MHz or more above or below the band edge increasing linearly to 105.2dBμV/m 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 110.8 dBμV/m 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 68.2 dBμV/m at the band edge.
	☐	15.407(b)(4)(ii) ,compliance with the emission limits in § 15.247(d) Shall be at least 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power,. Attenuation below the general limits specified in §15.209(a) is not required. In addition,radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))



6.3. Test Procedure

Frequency Range 9kHz~30MHz:

The EUT setup on the turntable which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

- (1) RBW = 9kHz with peak and average detector.
- (2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

Frequency Range 30MHz ~ 40GHz:

The EUT setup on the turn table which has 80cm (for 30-1000MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m (for 30-1000MHz) or antenna varied from 1 m to 3 m (for above 1GHz) to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120KHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.

Note 1: When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required, otherwise using Q.P. for final measurement.

Note 2: When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Frequency above 1GHz to 10th harmonic(up to 40 GHz):

Peak Detector:

- (1) RBW = 1MHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.

Note: When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

Average Detector:**■ Option 1:**

(1) RBW = 1MHz

(2) VBW $\geq 1/T$.

Modulation Type	T (ms)	1/T (kHz)	VBW Setting(kHz)
802.11a	1.385	0.722	750Hz
802.11n-HT20	1.300	0.769	750Hz
802.11n-HT40	0.620	1.613	1.6kHz
802.11ac-VHT80	0.068	14.706	15kHz

N/A: 1/T is not implemented when duty cycle presented in section 3.6 is $\geq 98\%$.

(1) Detector = Peak.

(2) Sweep time = auto.

(3) Trace mode = max hold.

(4) Allow sweeps to continue until the trace stabilizes.

□ Option 2:

Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation**■** Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading

Meter Reading = Spectrum Analyzer Reading - Preamp factor

■ Average Emission Level = Antenna Factor + Cable Loss + Meter Reading

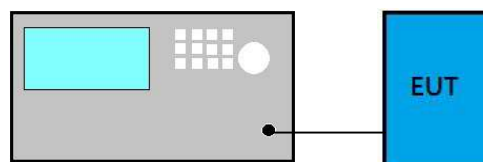
Meter Reading = Spectrum Analyzer Reading - Preamp factor

□ Average Emission Level = Peak Emission Level + DCCFDuty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.6.**□** ERP = Peak Emission Level - 95.2dB - 2.14dB**6.5. Test Results**

Please refer to Appendix A.

7. 26dB/6dB BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

Frequency Band (MHz)	Limit
5150 to 5250	Reference only
5250 to 5350	
5470 to 5725	
5725 to 5850	$\geq 500\text{kHz}$

7.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

■ Applicable to all bands except to 5725 MHz- 5850 MHz

- (1) Set RBW= 1% of the emission bandwidth
- (2) Set VBW > RBW
- (3) Detector = Peak
- (4) Trace mode = max hold
- (5) Setting channel bandwidth function x dB to -26 dB to record the final bandwidth.

■ 5725 MHz- 5850 MHz

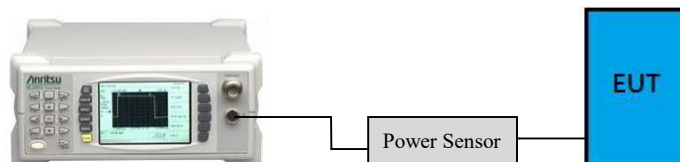
- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

7.4. Test Results

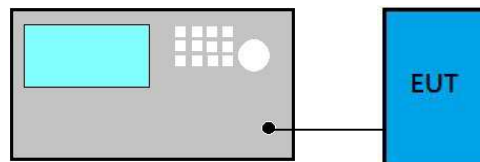
Please refer to Appendix A

8. MAXIMUM OUTPUT POWER

8.1. Block Diagram of Test Setup



- For 802.11ac-VHT80 mode only



8.2. Specification Limits

Frequency Band (MHz)	Category	Limit
5150 to 5250	Outdoor Access Point	1 W(30 dBm)/ Max e.i.r.p. ≤ 125 mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon
	Fixed point-to-point Access Point	1 W(30 dBm)
	Indoor Access Point	1 W(30 dBm)
	Mobile and Portable client device	250 mW(24 dBm)
5250 to 5350	N/A	250 mW or $11 \text{ dBm} + 10 \log B$ ^{Note 1}
5470 to 5725		250 mW or $11 \text{ dBm} + 10 \log B$ ^{Note 1}
5725 to 5850		1 W(30 dBm)

Note 1: B is the 26 dB emission bandwidth, which presented in section 7 and appendix A.1.

8.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

■ **Method AVGPM (Measurement using an RF average power meter):**

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.7 is < 98%.

■ **Method AVGSA-2 (Spectrum channel power) for 802.11ac-VHT80 mode only**

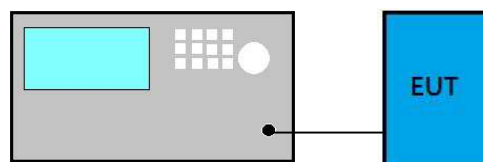
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 MHz
- (3) Set the video bandwidth (VBW) ≥ 3 MHz.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.
- (8) Duty cycle factor is added when duty cycle presented in section 3.7 is < 98%.

8.4. Test Results

Please refer to Appendix A

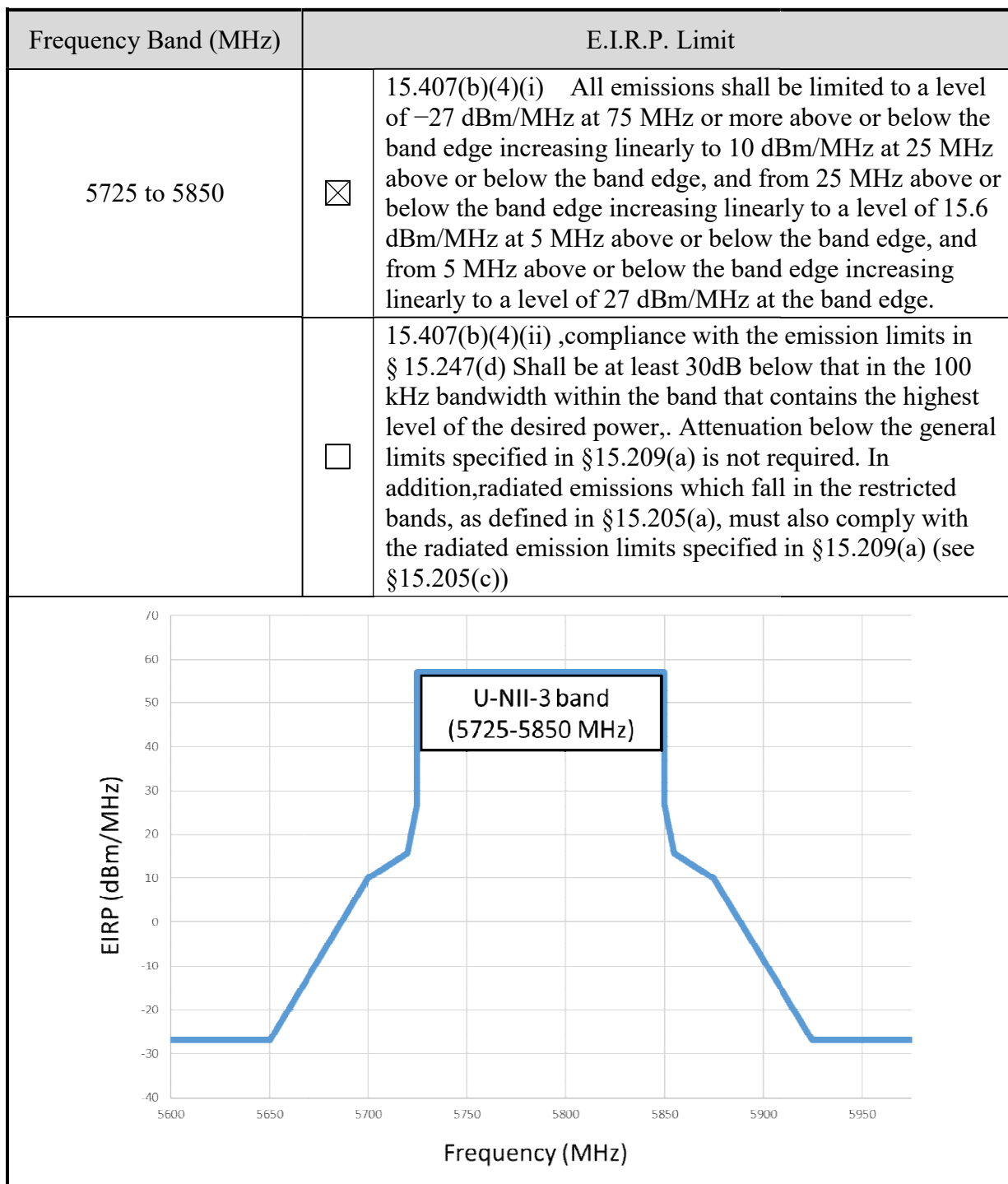
9. EMISSION LIMITATIONS MEASUREMENT

9.1. Block Diagram of Test Setup



9.2. Specification Limits

Frequency Band (MHz)	E.I.R.P. Limit
5150 to 5250	-27 dBm
5250 to 5350	
5470 to 5725	



9.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

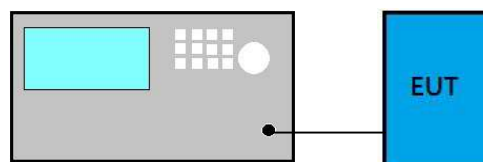
- (1) RBW = 1 MHz
- (2) VBW $\geq 3 \times$ RBW
- (3) Detector = Peak
- (4) Sweep time = auto
- (5) Trace mode = max hold
- (6) Allow sweeps to continue until the trace stabilizes.

9.4. Test Results

Please refer to Appendix A

10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

Frequency Band (MHz)	Category	Limit
5150 to 5250	Outdoor Access Point	17dBm/MHz
	Fixed point-to-point Access Point	
	Indoor Access Point	
	Mobile and Portable client device	11 dBm/MHz
5250 to 5350	N/A	11 dBm/MHz
5470 to 5725		11 dBm/MHz
5725 to 5850		30dBm/500 kHz

10.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

■ Method AVGSA-2 (Spectrum channel power)

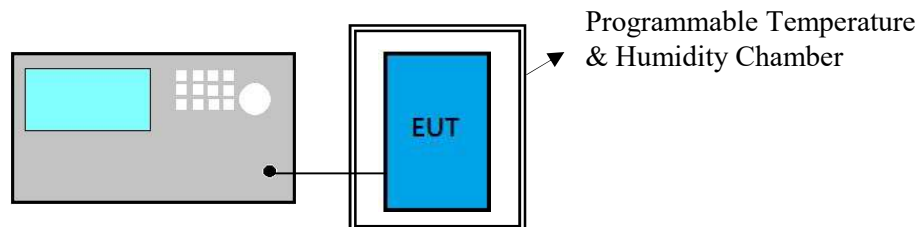
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 MHz
- (3) Set the video bandwidth (VBW) ≥ 3 MHz.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Use peak search function to find out the maximum power density.
- (8) Duty cycle factor is added when duty cycle presented in section 3.7 is $< 98\%$.

10.4. Test Results

Please refer to Appendix A

11. FREQUENCY STABILITY

11.1. Block Diagram of Test Setup



11.2. Specification Limits

NONE

11.3. Test Procedure

- (1) Frequency: Test frequency.
- (2) Span: enough to cover the complete power envelope
- (3) RBW: 1MHz(modulation ON) ; 10KHz(CW)
- (4) VBW: 1MHz(modulation ON) ; 10KHz(CW)
- (5) Detector Mode: Positive Peak
- (6) Indication mode: Max hold
- (7) Find the peak frequency and take calculate by the formula:
(Measurement Value-declaration frequency)/ declaration frequency)

11.4. Test Results

Please refer to Appendix A



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12. DEVIATION TO TEST SPECIFICATIONS

【NONE】



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APPDNDIX A

TEST DATA AND PLOTS

(Model: DK-GW001-A01-C001)

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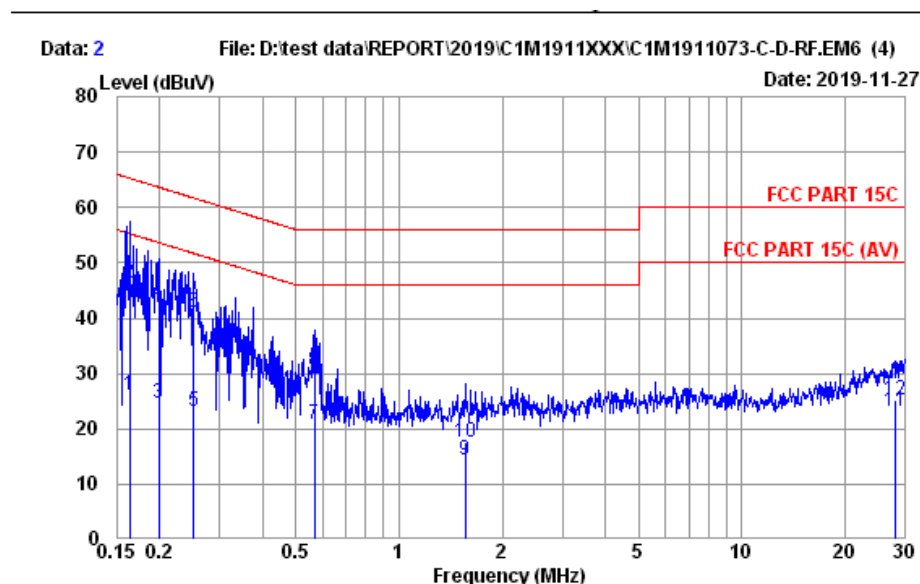
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A.1 CONDUCTED EMISSION

Test Phase	Neutral	Test Result	Pass
Test Voltage	AC 120V 60Hz (Via AC Adapter)		



Site no. : No.8 Shielded Room Data no. : 2
Condition : ENV4200 100169 LISN Phase : NEUTRAL
Limit : FCC PART 15C
Env. / Ins. : 25°C / 53% ESR3 (1774) Engineer : Chucky Chiu
EUT : DK-GW001-A01-C001
Power Rating : AC 120V/60Hz
Test Mode : Operating

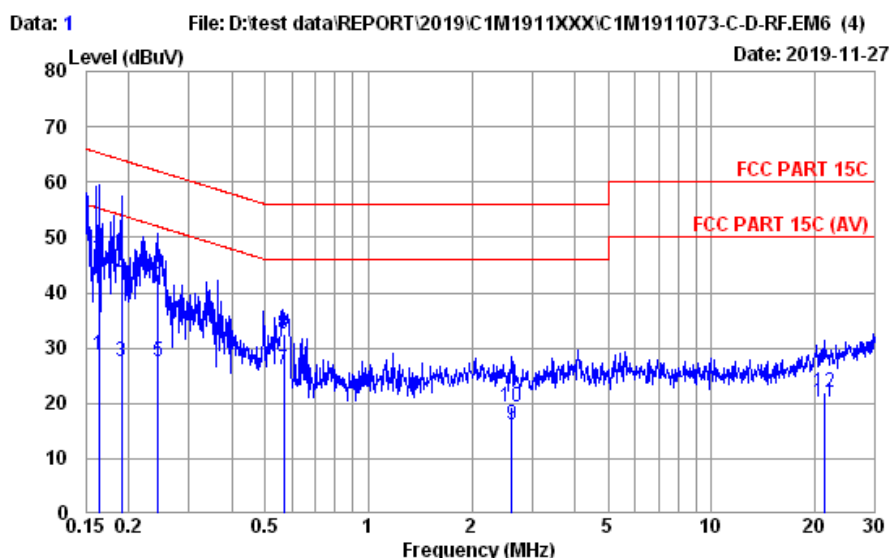
	AMN	Cable	Pulse	Emission					
	Freq.	Factor	Loss	Att.	Reading	Level	Limits	Margin	Remark
	(MHz)	(dB)	(dB)	(dB)	(dBμV)	(dBμV)	(dBμV)	(dB)	
1	0.163	10.68	0.04	9.86	5.40	25.98	55.30	29.32	Average
2	0.163	10.68	0.04	9.86	25.67	46.25	65.30	19.05	QP
3	0.199	10.62	0.04	9.86	4.17	24.69	53.67	28.98	Average
4	0.199	10.62	0.04	9.86	22.20	42.72	63.67	20.95	QP
5	0.252	10.58	0.04	9.86	2.72	23.20	51.69	28.49	Average
6	0.252	10.58	0.04	9.86	20.49	40.97	61.69	20.72	QP
7	0.567	10.48	0.04	9.86	0.49	20.87	46.00	25.13	Average
8	0.567	10.48	0.04	9.86	10.23	30.61	56.00	25.39	QP
9	1.560	10.50	0.06	9.86	-5.94	14.48	46.00	31.52	Average
10	1.560	10.50	0.06	9.86	-2.77	17.65	56.00	38.35	QP
11	28.003	15.79	0.24	10.00	-2.90	23.13	50.00	26.87	Average
12	28.003	15.79	0.24	10.00	-0.87	25.16	60.00	34.84	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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Fax: +886 2 26099303

Test Phase	Line	Test Result	Pass
Test Voltage	AC 120V 60Hz (Via AC Adapter)		



Site no. : No.8 Shielded Room Data no. : 1
Condition : ENV4200 100169 LISN Phase : LINE
Limit : FCC PART 15C
Env. / Ins. : 25°C / 53% ESR3 (1774) Engineer : Chucky Chiu
EUT : DK-GW001-A01-C001
Power Rating : AC 120V/60Hz
Test Mode : Operating

	AMN	Cable	Pulse		Emission				
Freq.	Factor	Loss	Att.	Reading	Level	Limits	Margin	Remark	
(MHz)	(dB)	(dB)	(dB)	(dBμV)	(dBμV)	(dBμV)	(dB)		
1	0.163	10.60	0.04	9.86	8.26	28.76	55.30	26.54	Average
2	0.163	10.60	0.04	9.86	25.64	46.14	65.30	19.16	QP
3	0.190	10.55	0.04	9.86	7.24	27.69	54.02	26.33	Average
4	0.190	10.55	0.04	9.86	22.75	43.20	64.02	20.82	QP
5	0.244	10.51	0.04	9.86	7.03	27.44	51.95	24.51	Average
6	0.244	10.51	0.04	9.86	22.83	43.24	61.95	18.71	QP
7	0.567	10.44	0.04	9.86	5.66	26.00	46.00	20.00	Average
8	0.567	10.44	0.04	9.86	12.27	32.61	56.00	23.39	QP
9	2.622	10.49	0.08	9.87	-4.38	16.06	46.00	29.94	Average
10	2.622	10.49	0.08	9.87	-1.07	19.37	56.00	36.63	QP
11	21.260	13.52	0.20	9.96	-3.60	20.08	50.00	29.92	Average
12	21.260	13.52	0.20	9.96	-1.77	21.91	60.00	38.09	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

A.2 RADIATED EMISSION

Test Date	2019/12/10	Temp./Hum.	21°C/55%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Sean Wang

A.2.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

A.2.1.2 Frequency Below 1 GHz

Mode	802.11a	UNII Band	NII-3
		Frequency	TX 5825MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
33.88	23.04	1.27	0.74	25.05	40.00	14.95	Peak
159.98	16.50	3.01	8.24	27.75	43.50	15.75	Peak
271.53	19.21	4.16	6.65	30.02	46.00	15.98	Peak
616.85	24.88	6.97	-0.40	31.45	46.00	14.55	Peak
900.09	27.31	8.45	0.02	35.78	46.00	10.22	Peak
1000.00	28.07	9.04	0.64	37.75	54.00	16.25	Peak

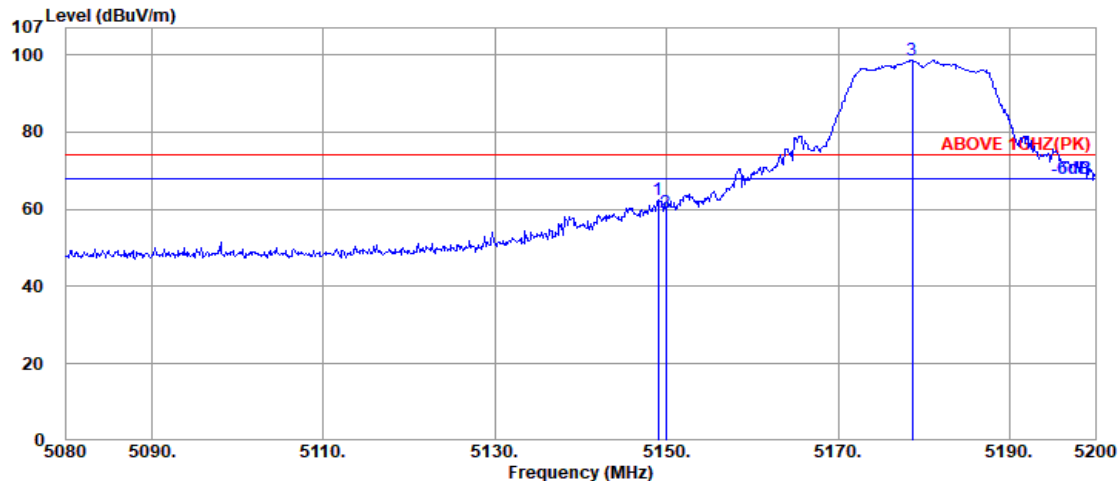
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
42.61	18.28	1.44	8.68	28.40	40.00	11.60	Peak
188.11	15.78	3.31	6.29	25.38	43.50	18.12	Peak
291.90	19.57	4.36	0.89	24.82	46.00	21.18	Peak
429.64	22.81	6.15	0.47	29.43	46.00	16.57	Peak
822.49	26.68	8.03	-1.01	33.70	46.00	12.30	Peak
967.99	27.84	8.86	0.56	37.26	54.00	16.74	Peak

A.2.1.3 Frequency Above 1 GHz to 10th harmonics

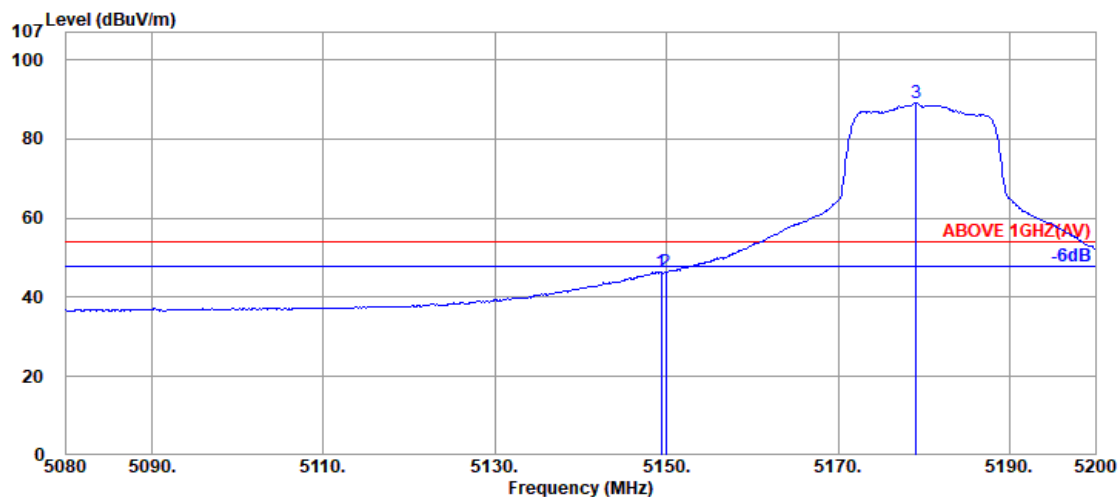
Band Edge:

Mode	802.11a	UNII Band	NII-1
		Frequency	TX 5180MHz



Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.00	34.70	10.36	17.54	62.60	74.00	11.40	Peak
5149.96	34.70	10.36	14.14	59.20	74.00	14.80	Peak
@ 5178.64	34.59	10.38	53.63	98.60	---	---	Peak

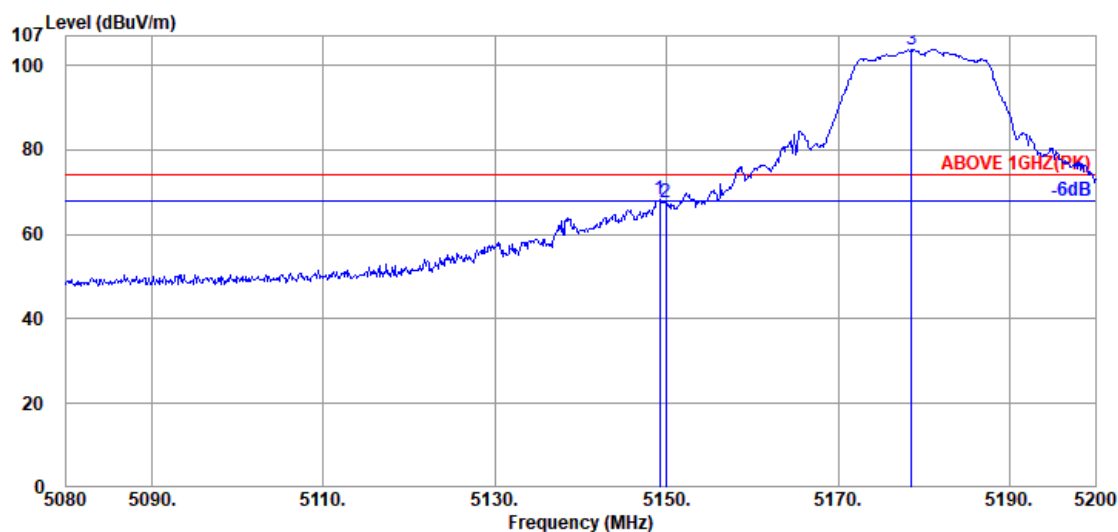


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.36	34.70	10.36	1.43	46.49	54.00	7.51	Average
5149.96	34.70	10.36	1.17	46.23	54.00	7.77	Average
@ 5179.12	34.58	10.38	44.10	89.06	---	---	Average

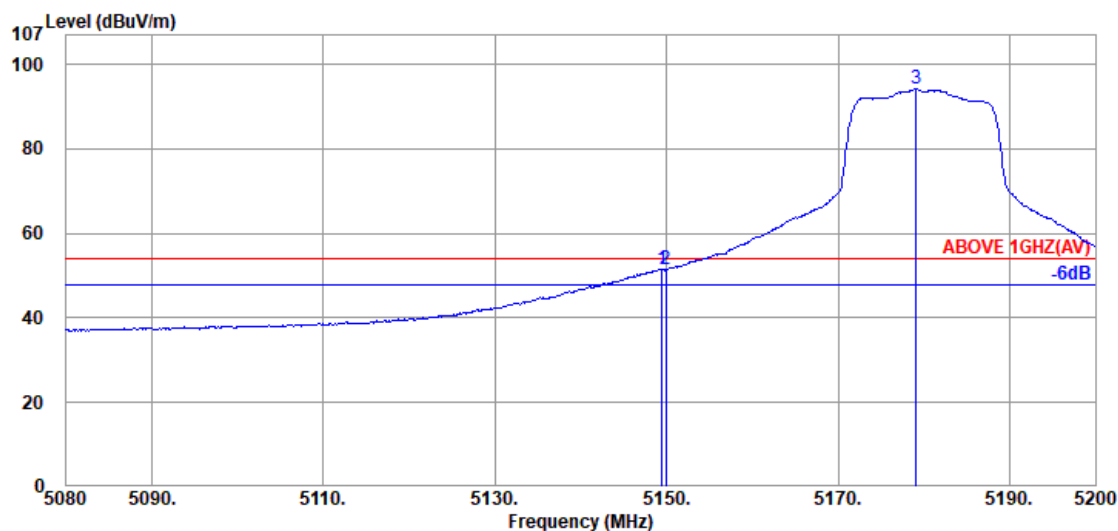
Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	802.11a	UNII Band	NII-1
		Frequency	TX 5180MHz



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.24	34.70	10.36	23.07	68.13	74.00	5.87	Peak
5149.96	34.70	10.36	22.47	67.53	74.00	6.47	Peak
@ 5178.52	34.59	10.38	58.92	103.89	---	---	Peak

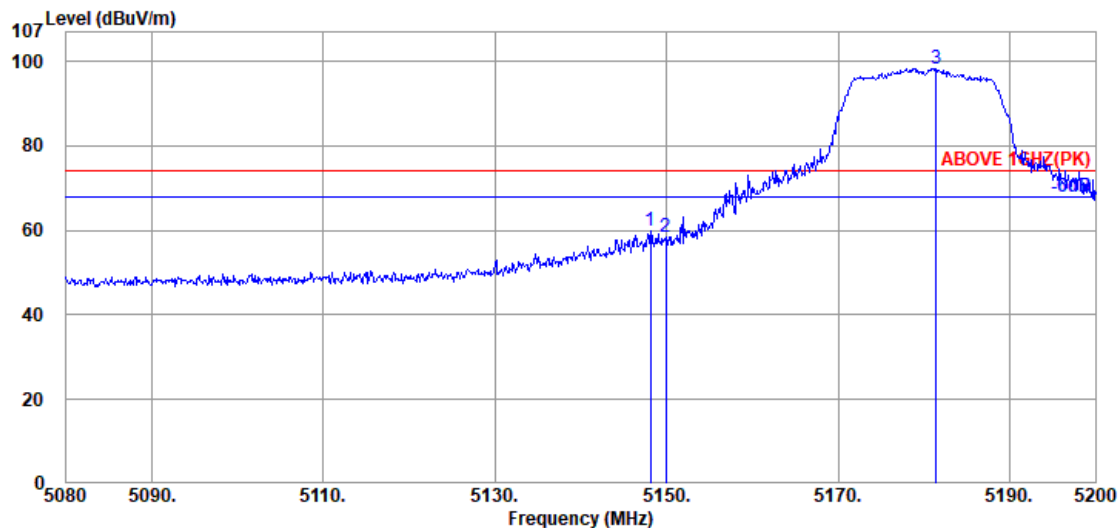


Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.48	34.70	10.36	6.60	51.66	54.00	2.34	Average
5149.96	34.70	10.36	6.46	51.52	54.00	2.48	Average
@ 5179.12	34.58	10.38	49.38	94.34	---	---	Average

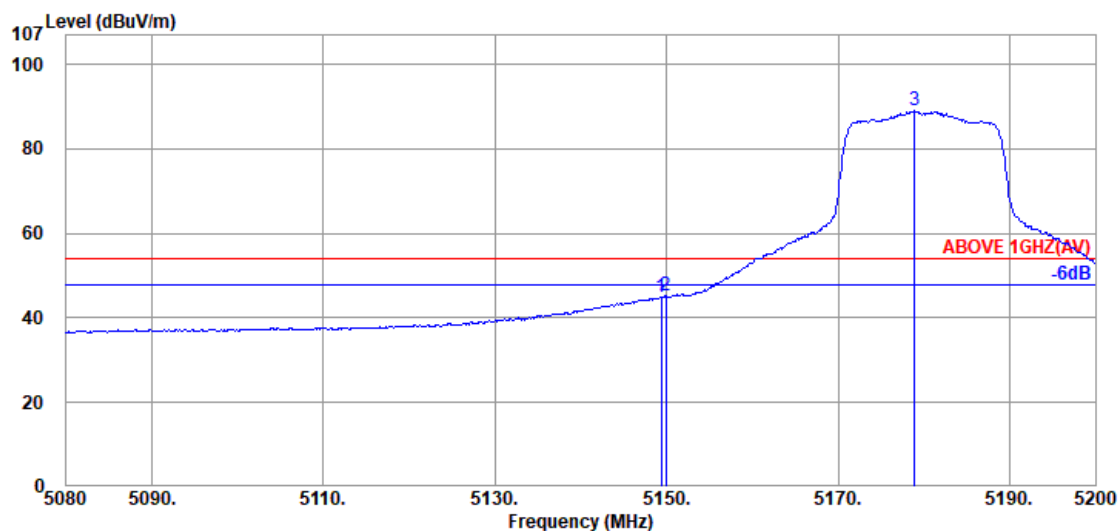
Remark: The "@" means fundamental frequency, it is ignored in this section.

Mode	802.11n-HT20	UNII Band	NII-1
		Frequency	TX 5180MHz



Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
	5148.16	34.69	10.36	14.75	59.80	74.00	14.20	Peak
	5149.96	34.70	10.36	13.30	58.36	74.00	15.64	Peak
@	5181.40	34.57	10.38	53.39	98.34	---	---	Peak

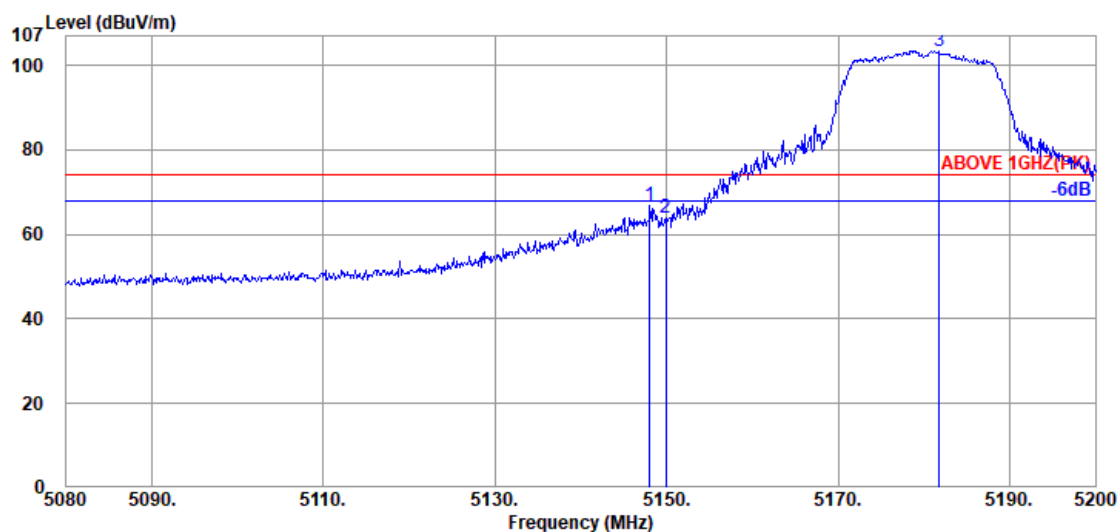


Antenna at Horizontal Polarization

	Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@	5149.36	34.70	10.36	-0.15	44.91	54.00	9.09	Average
	5149.96	34.70	10.36	0.16	45.22	54.00	8.78	Average
	5178.88	34.58	10.38	43.99	88.95	---	---	Average

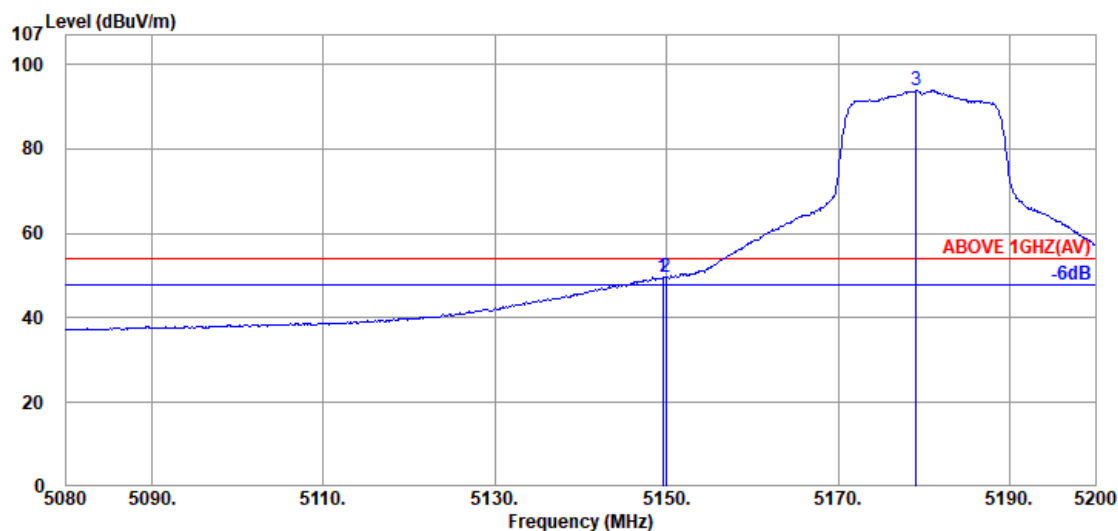
Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	802.11n-HT20	UNII Band	NII-1
		Frequency	TX 5180MHz



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5148.04	34.69	10.36	21.68	66.73	74.00	7.27	Peak
5149.96	34.70	10.36	18.86	63.92	74.00	10.08	Peak
@ 5181.76	34.57	10.38	58.51	103.46	---	---	Peak

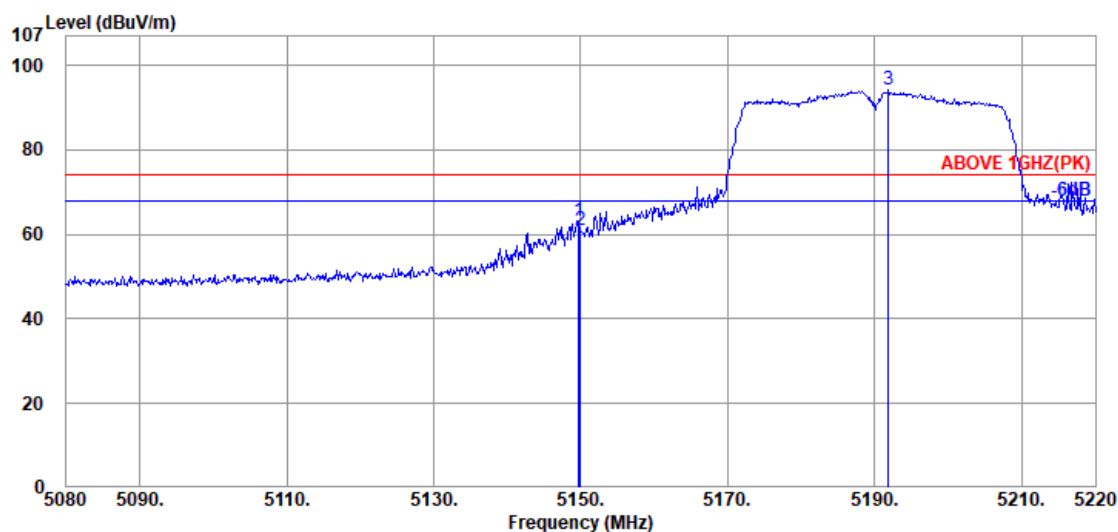


Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.60	34.70	10.36	4.50	49.56	54.00	4.44	Average
5149.96	34.70	10.36	4.64	49.70	54.00	4.30	Average
@ 5179.12	34.58	10.38	48.77	93.73	---	---	Average

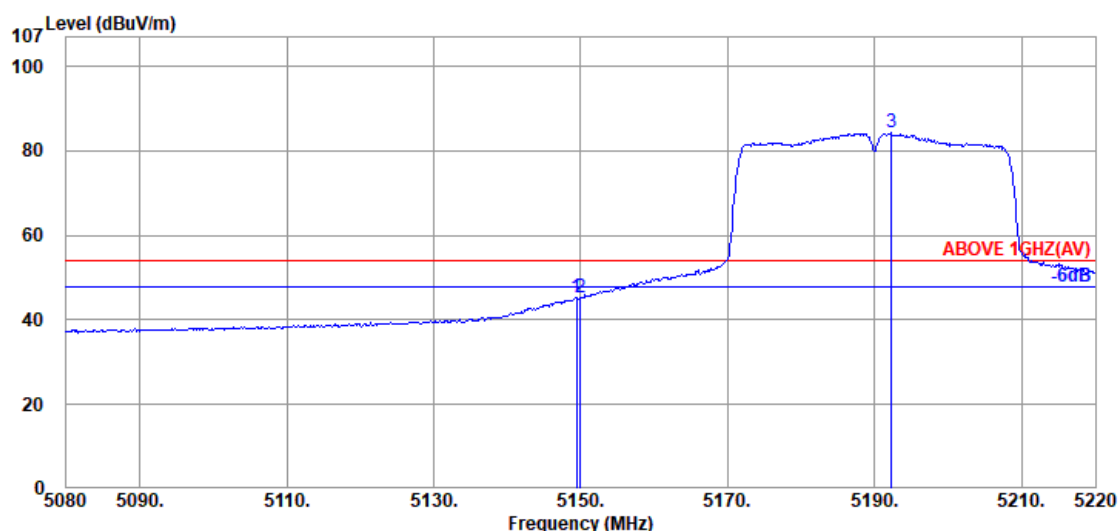
Remark: The "@" means fundamental frequency, it is ignored in this section.

Mode	802.11n-HT40	UNII Band	NII-1
		Frequency	TX 5190MHz



Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.72	34.70	10.36	18.20	63.26	74.00	10.74	Peak
5150.00	34.70	10.36	15.95	61.01	74.00	12.99	Peak
@ 5191.86	34.53	10.39	49.17	94.09	---	---	Peak

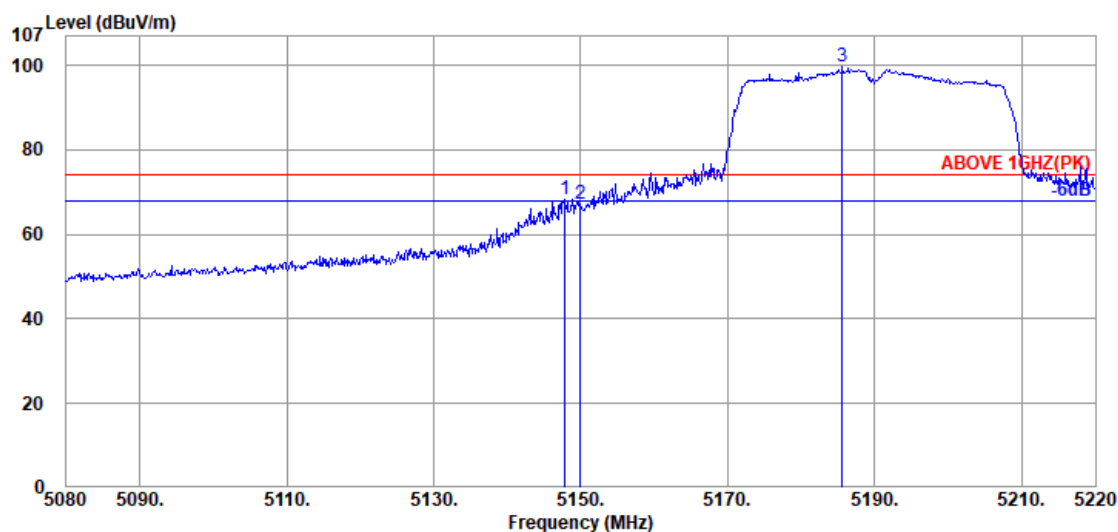


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.44	34.70	10.36	0.08	45.14	54.00	8.86	Average
5150.00	34.70	10.36	0.35	45.41	54.00	8.59	Average
@ 5192.28	34.53	10.39	39.29	84.21	---	---	Average

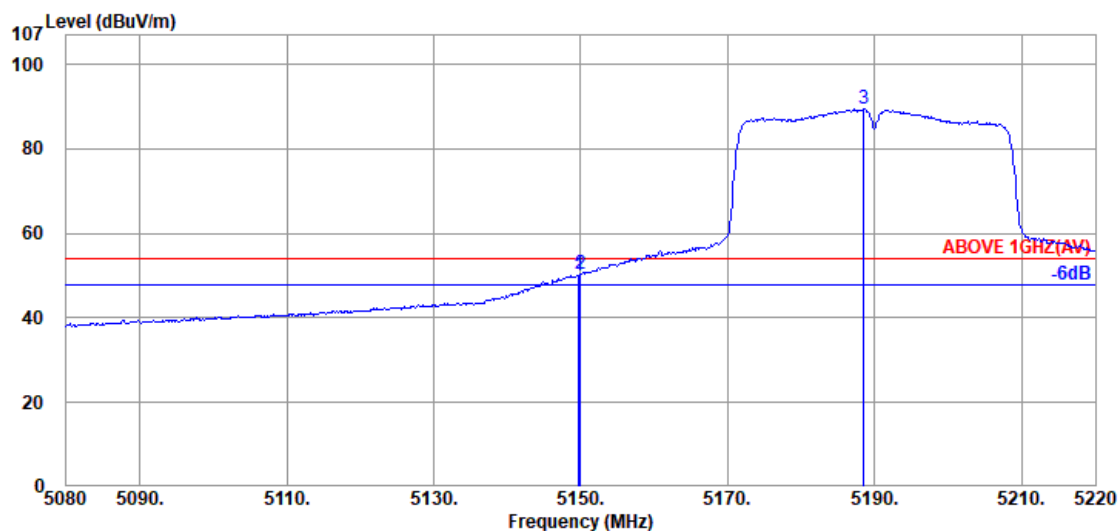
Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	802.11n-HT40	UNII Band	NII-1
		Frequency	TX 5190MHz



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5147.90	34.69	10.36	23.37	68.42	74.00	5.58	Peak
5150.00	34.70	10.36	22.14	67.20	74.00	6.80	Peak
@ 5185.56	34.56	10.38	54.74	99.68	---	---	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.72	34.70	10.36	5.11	50.17	54.00	3.83	Average
5150.00	34.70	10.36	5.28	50.34	54.00	3.66	Average
@ 5188.50	34.55	10.38	44.50	89.43	---	---	Average

Remark: The “@” means fundamental frequency, it is ignored in this section.

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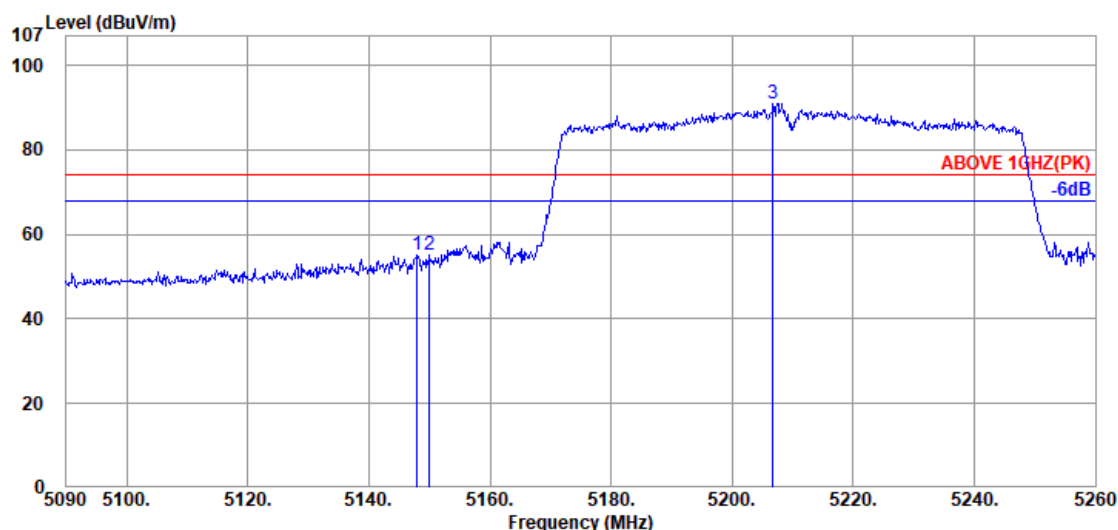
No. 53-11, Dingfu, Linkou, Dist.,

New Taipei City244, Taiwan

Tel: +886 2 26099301

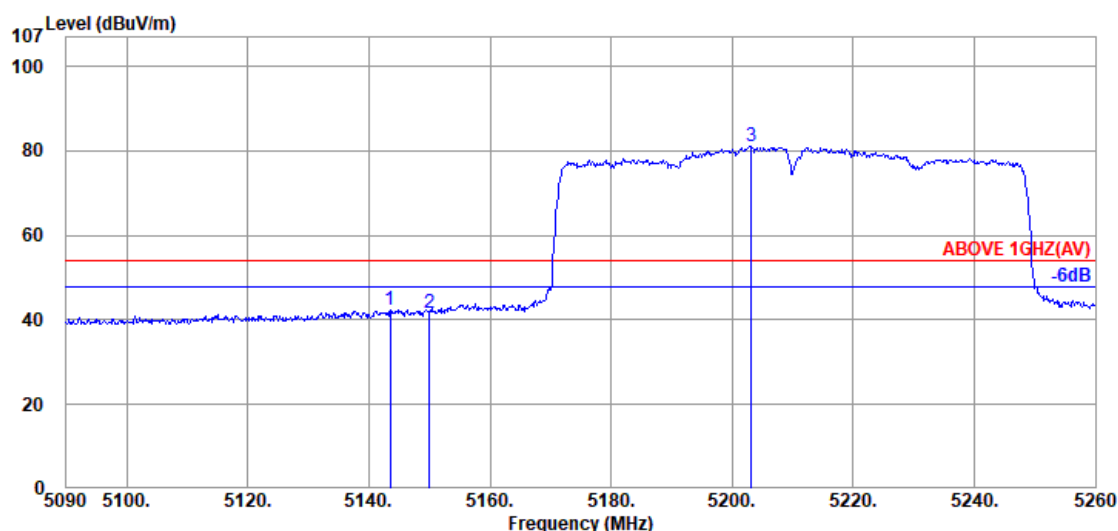
Fax: +886 2 26099303

Mode	802.11ac-VHT80	UNII Band	NII-1
		Frequency	TX 5210MHz



Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5147.97	34.69	10.36	10.08	55.13	74.00	18.87	Peak
5150.01	34.70	10.36	10.10	55.16	74.00	18.84	Peak
@ 5206.79	34.50	10.39	46.18	91.07	---	---	Peak

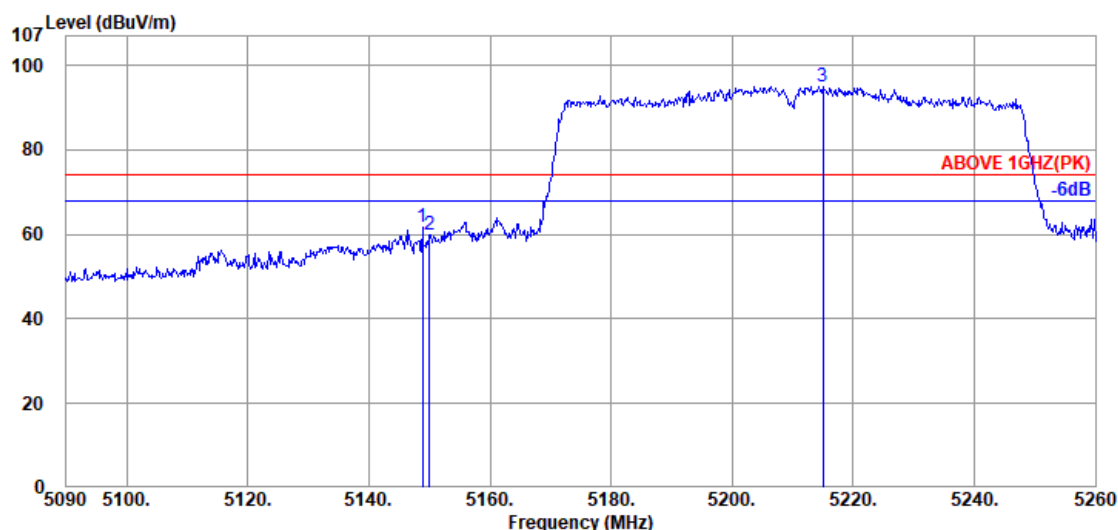


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5143.55	34.67	10.36	-2.75	42.28	54.00	11.72	Average
5150.01	34.70	10.36	-3.53	41.53	54.00	12.47	Average
@ 5203.22	34.50	10.39	36.07	80.96	---	---	Average

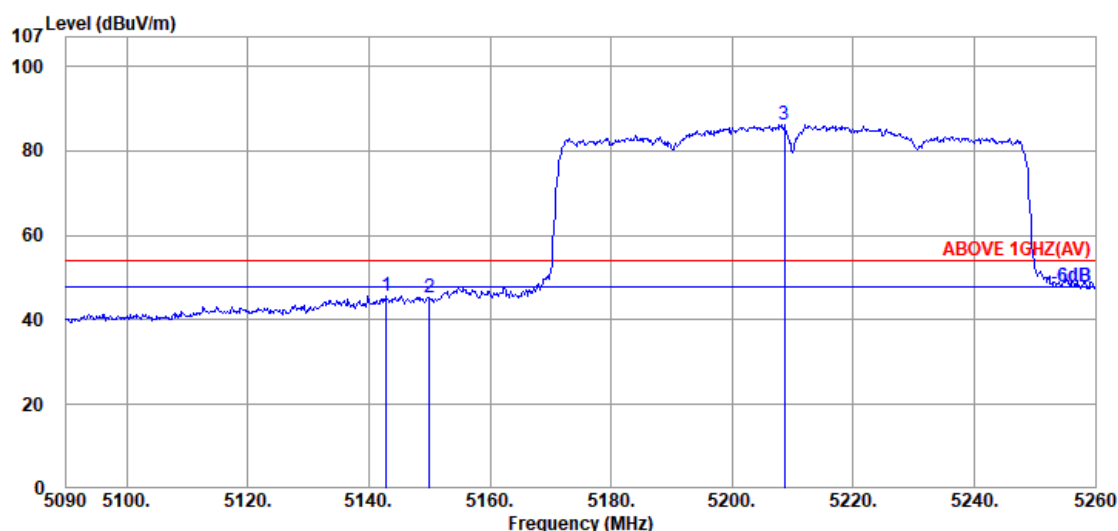
Remark: The "@" means fundamental frequency, it is ignored in this section.

Mode	802.11ac-VHT80	UNII Band	NII-1
		Frequency	TX 5210MHz



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5148.82	34.70	10.36	16.54	61.60	74.00	12.40	Peak
5150.01	34.70	10.36	14.89	59.95	74.00	14.05	Peak
@ 5214.95	34.50	10.40	50.23	95.13	---	---	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5142.87	34.67	10.36	0.76	45.79	54.00	8.21	Average
5150.01	34.70	10.36	0.21	45.27	54.00	8.73	Average
@ 5208.66	34.50	10.40	41.33	86.23	---	---	Average

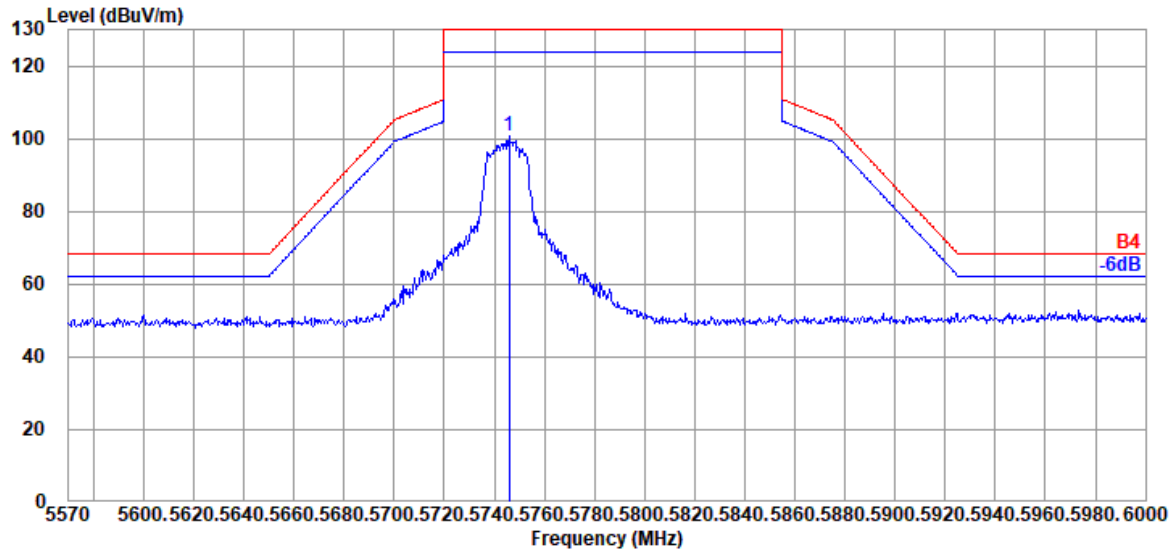
Remark: The “@” means fundamental frequency, it is ignored in this section.

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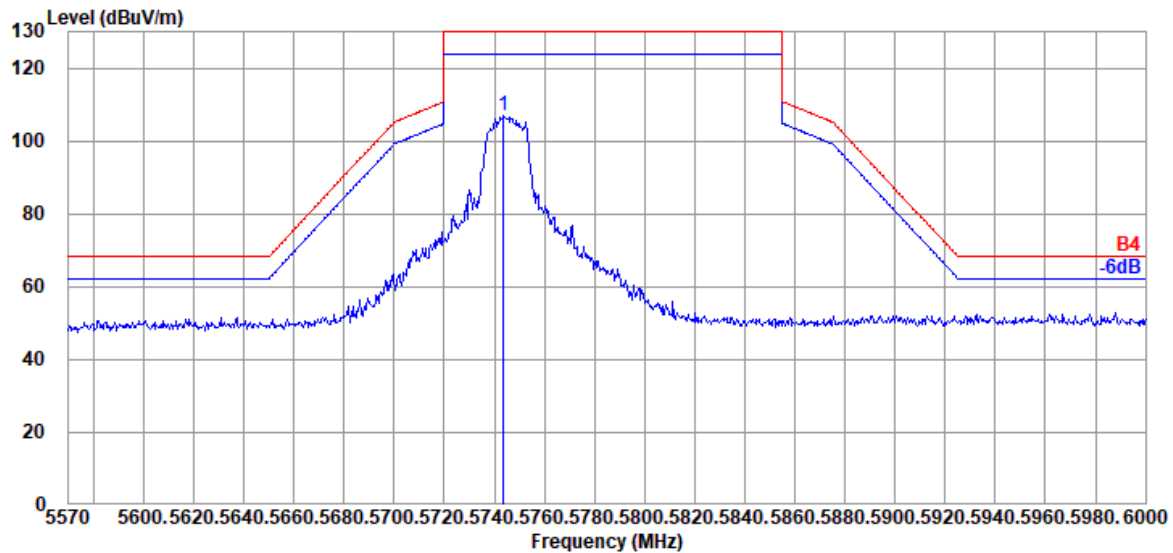
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Fax: +886 2 26099303

Mode	802.11a	UNII Band	NII-3
		Frequency	TX 5745MHz

Antenna at Horizontal Polarization



Antenna at Horizontal Polarization

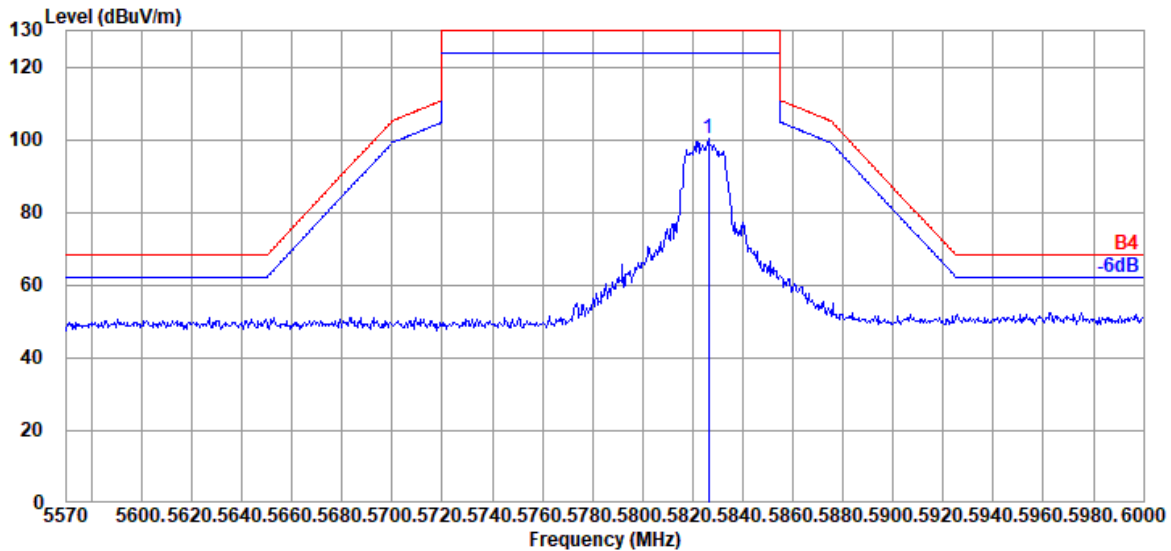


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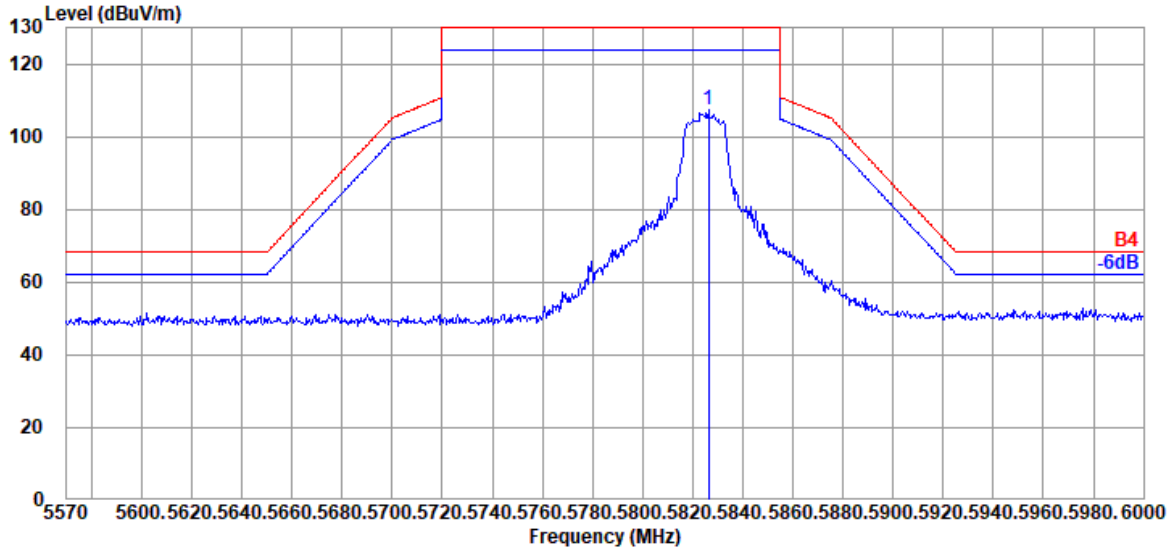
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Mode	802.11a	UNII Band	NII-3
		Frequency	TX 5825MHz

Antenna at Vertical Polarization



Antenna at Vertical Polarization

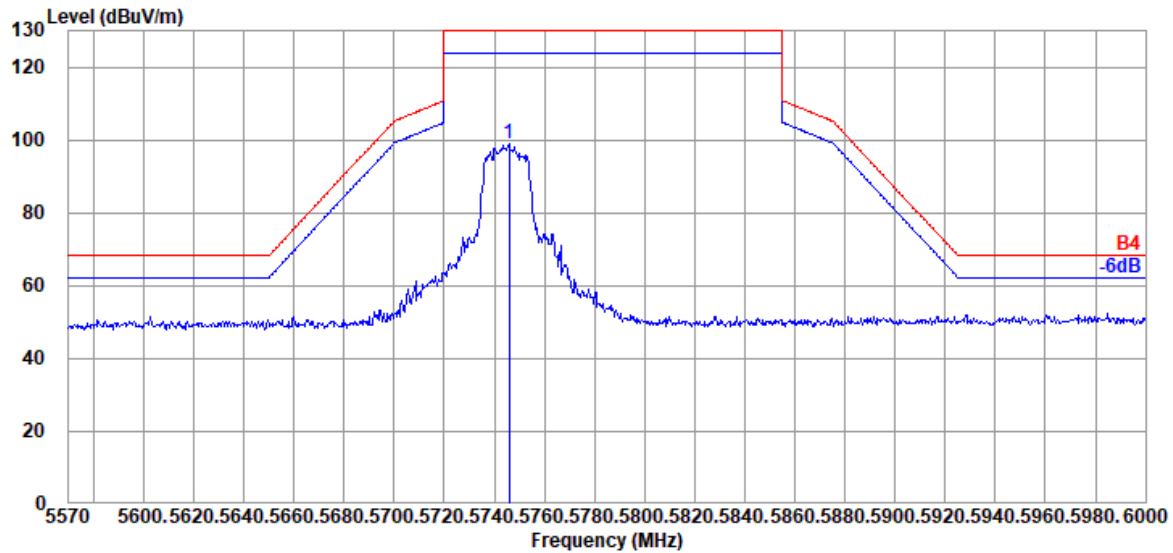


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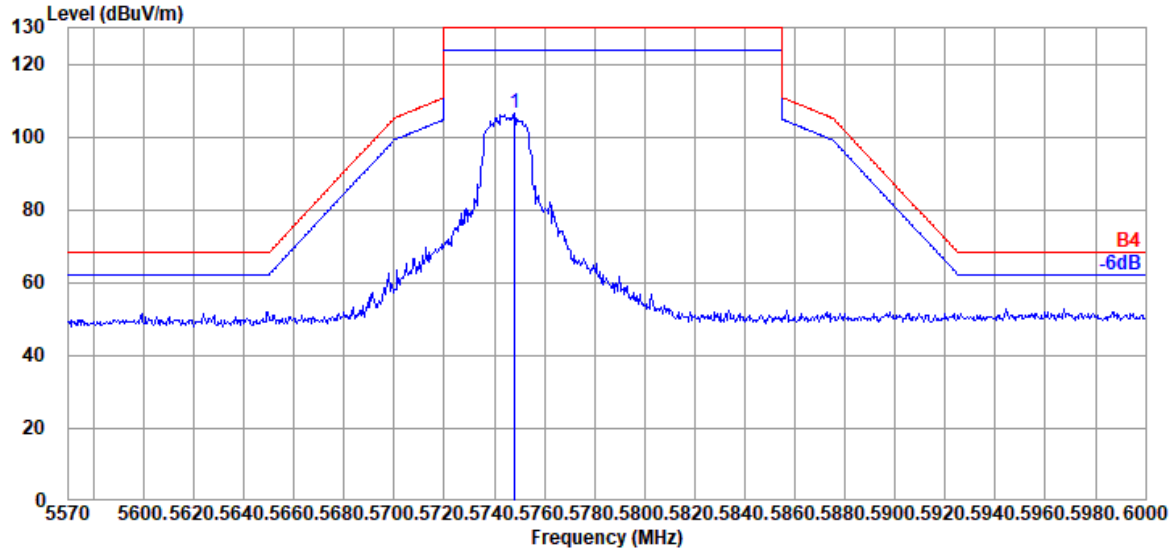
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Fax: +886 2 26099303

Mode	802.11n-HT20	UNII Band	NII-3
		Frequency	TX 5745MHz

Antenna at Horizontal Polarization



Antenna at Horizontal Polarization

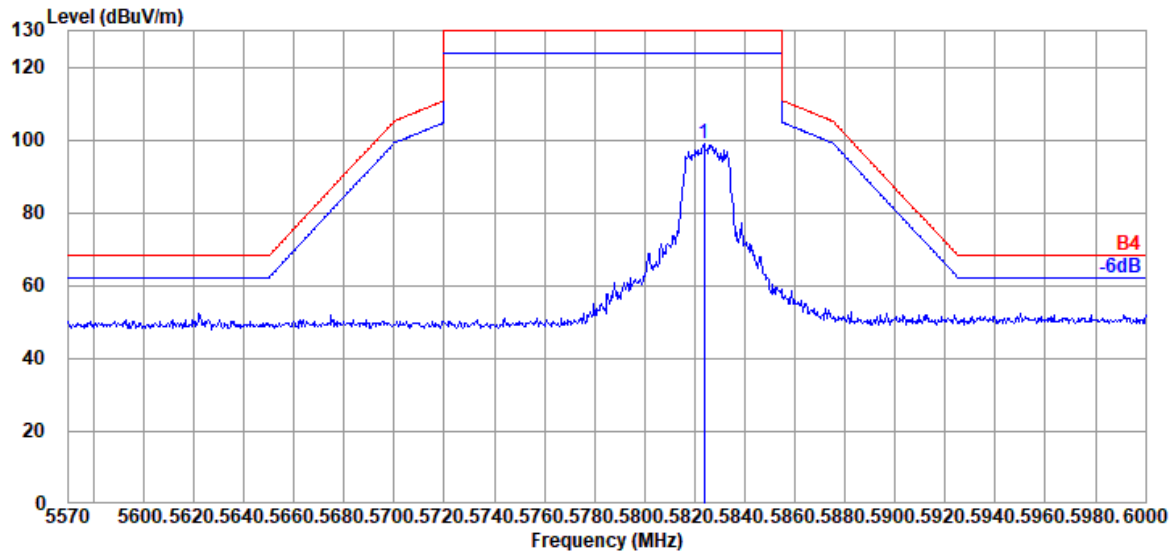


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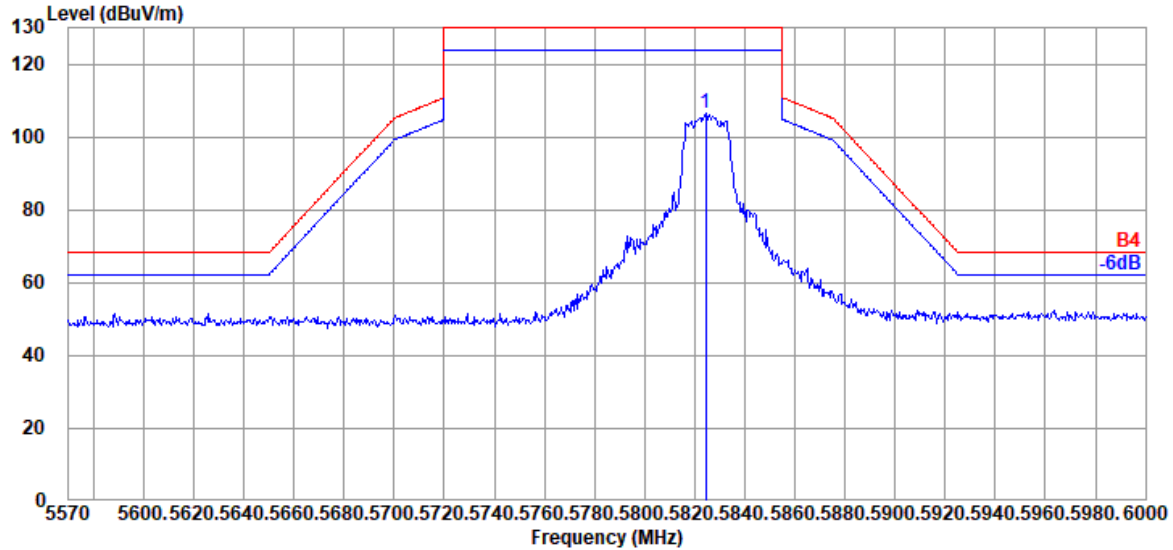
Tel: +886 2 26099301
Fax: +886 2 26099303

Mode	802.11n-HT20	UNII Band	NII-3
		Frequency	TX 5825MHz

Antenna at Vertical Polarization



Antenna at Vertical Polarization

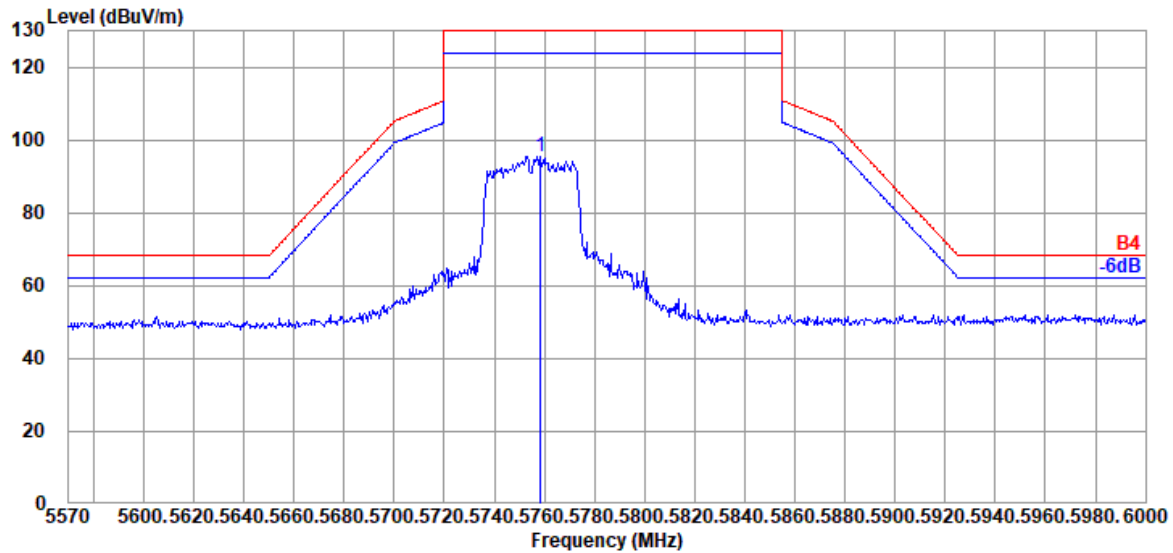


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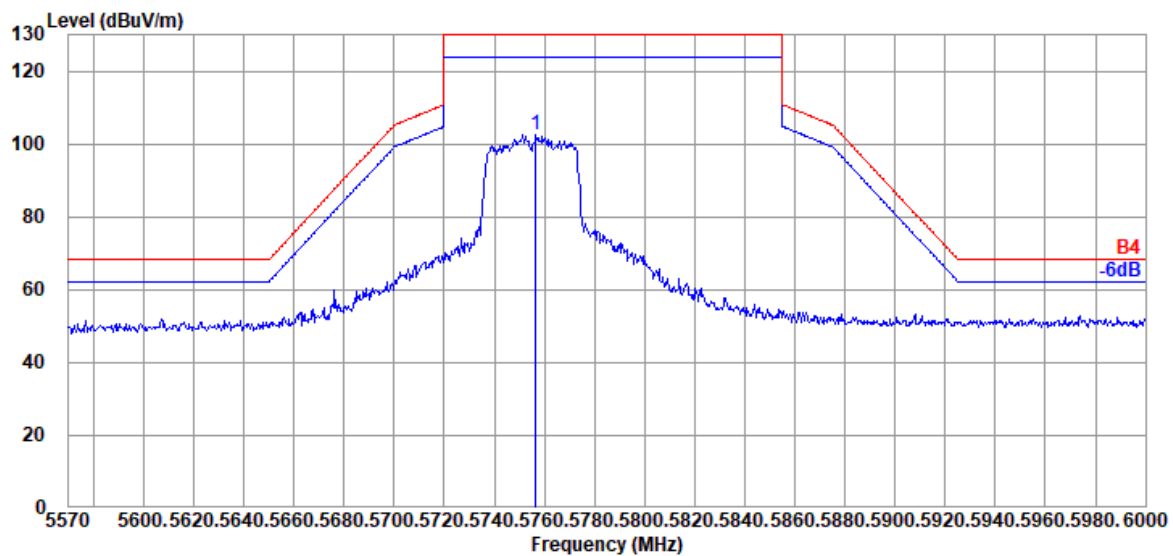
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Mode	802.11n-HT40	UNII Band	NII-3
		Frequency	TX 5755MHz

Antenna at Horizontal Polarization



Antenna at Vertical Polarization

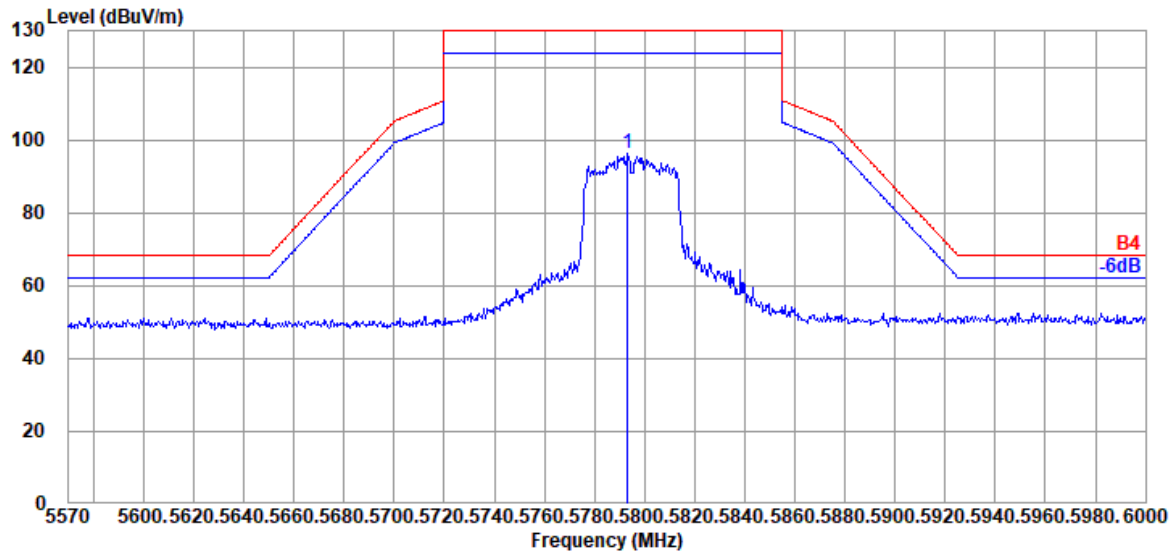


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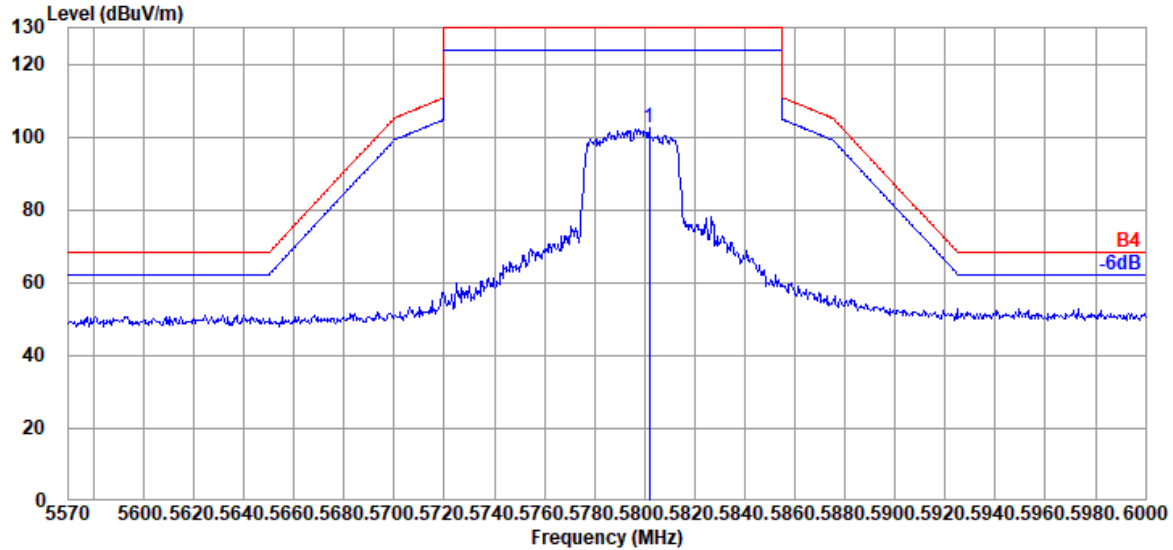
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Mode	802.11n-HT40	UNII Band	NII-3
		Frequency	TX 5795MHz

Antenna at Horizontal Polarization



Antenna at Vertical Polarization

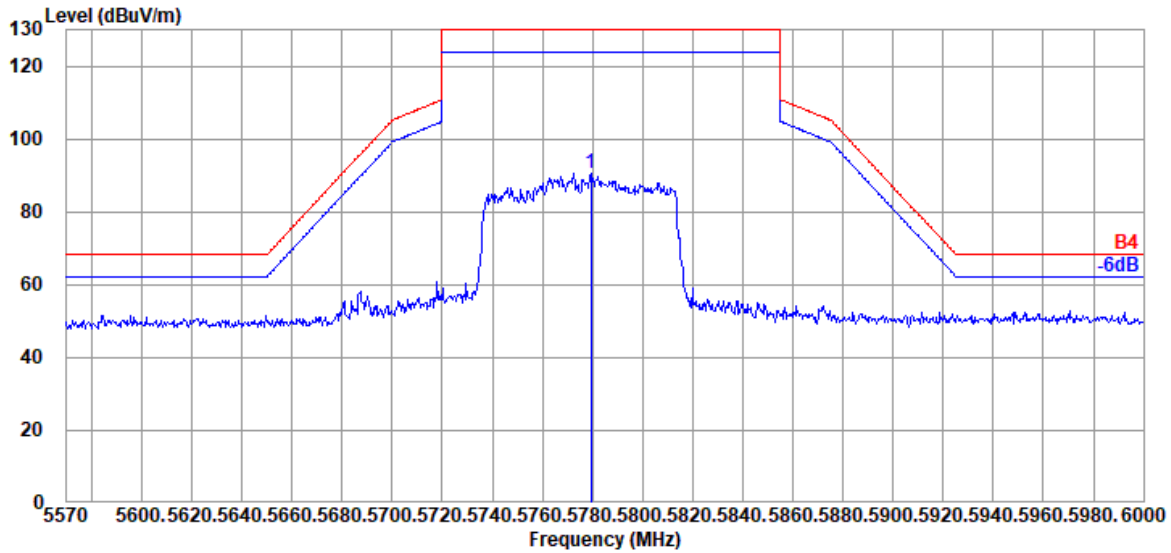


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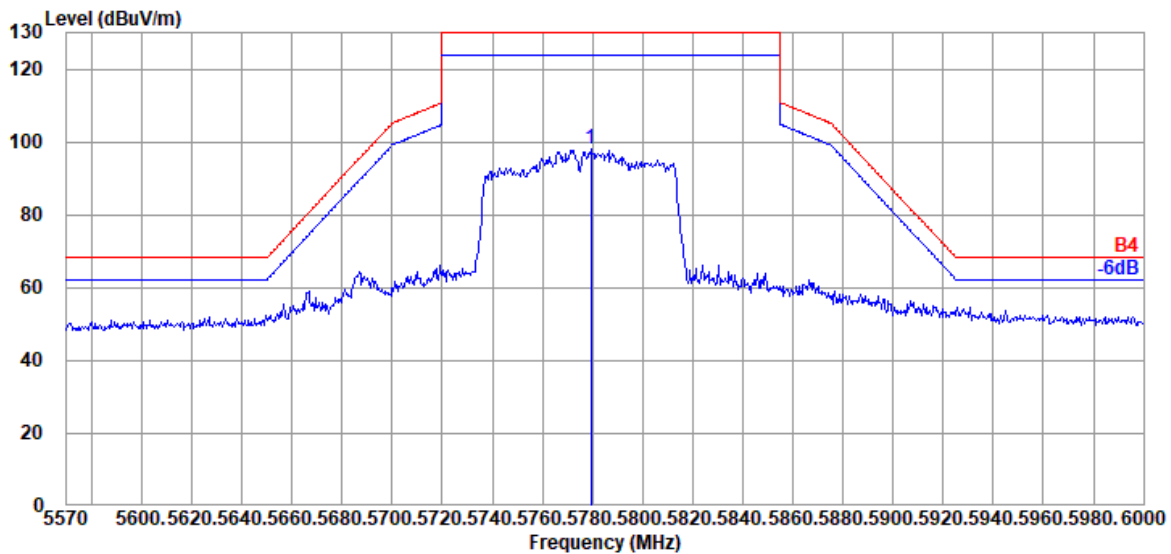
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Mode	802.11ac-VHT80	UNII Band	NII-3
		Frequency	TX 5775MHz

Antenna at Horizontal Polarization



Antenna at Vertical Polarization



A.2.2 Emissions outside the frequency band

The emissions (up to 40GHz) not reported for there is no emission be found.

Mode	802.11a	UNII Band	NII-1
		Frequency	TX 5240MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10480.00	37.78	14.82	-4.08	48.52	54.00	5.48	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10480.00	37.78	14.82	-4.13	48.47	54.00	5.53	Peak

Mode	802.11a	UNII Band	NII-3
		Frequency	TX 5745MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11490.00	38.32	15.47	-4.42	49.37	54.00	4.63	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11490.00	38.32	15.47	-4.99	48.80	54.00	5.20	Peak

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Mode	802.11n-HT20	UNII Band	NII-1
		Frequency	TX 5240MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
10480.00	37.78	14.82	-4.25	48.35	54.00	5.65	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
10480.00	37.78	14.82	-4.04	48.56	54.00	5.44	Peak

Mode	802.11n-HT20	UNII Band	NII-3
		Frequency	TX 5825MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
11650.00	0.00	0.00	49.42	49.42	54.00	4.58	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
11650.00	0.00	0.00	49.46	49.46	54.00	4.54	Peak

Mode	802.11n-HT40	UNII Band	NII-1
		Frequency	TX 5230MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
10460.00	37.76	14.80	-4.62	47.94	54.00	6.06	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
10460.00	37.76	14.80	-4.55	48.01	54.00	5.99	Peak

Mode	802.11n-HT40	UNII Band	NII-3
		Frequency	TX 5755MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
11510.00	38.32	15.49	-5.41	48.40	54.00	5.60	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
11510.00	38.32	15.49	-4.82	48.99	54.00	5.01	Peak

Mode	802.11ac-VHT80	UNII Band	NII-1
		Frequency	TX 5210MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
10420.00	37.72	14.78	-4.79	47.71	54.00	6.29	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
10420.00	37.72	14.78	-3.50	49.00	54.00	5.00	Peak

Mode	802.11ac-VHT80	UNII Band	NII-3
		Frequency	TX 5775MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
11550.00	38.40	15.52	-5.13	48.79	54.00	5.21	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
11550.00	38.40	15.52	-4.95	48.97	54.00	5.03	Peak

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A.2.3 Emissions in Non-restricted Frequency Bands

Pursuant to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 that emission levels below the 15.209 general radiated emissions limits is not required.

A.3 26dB/6dB BANDWIDTH

Test Date	2019/12/11~27	Temp./Hum.	20~22°C/54~63%
Cable Loss	0.8dB	Tested By	Sean Chang
Test Voltage	AC 120V 60Hz (Via AC Adapter)		

A.3.1 26dB/6dB Bandwidth Result

● For 26dB Bandwidth

Mode	UNII Band	Centre Frequency (MHz)	26dB Bandwidth (MHz)	Occupied (99%) Bandwidth (MHz) (Reference only)	Limit
802.11a	NII-1	5180	28.56	17.025	Reference only
		5200	28.92	17.028	
		5240	26.80	17.028	
802.11n-HT20	NII-1	5180	28.59	18.017	
		5200	28.09	17.935	
		5240	27.17	17.985	
802.11n-HT40	NII-1	5190	40.84	36.126	
		5230	40.01	36.189	
802.11ac-VHT80	NII-1	5210	80.37	75.526	

● For 6dB Bandwidth

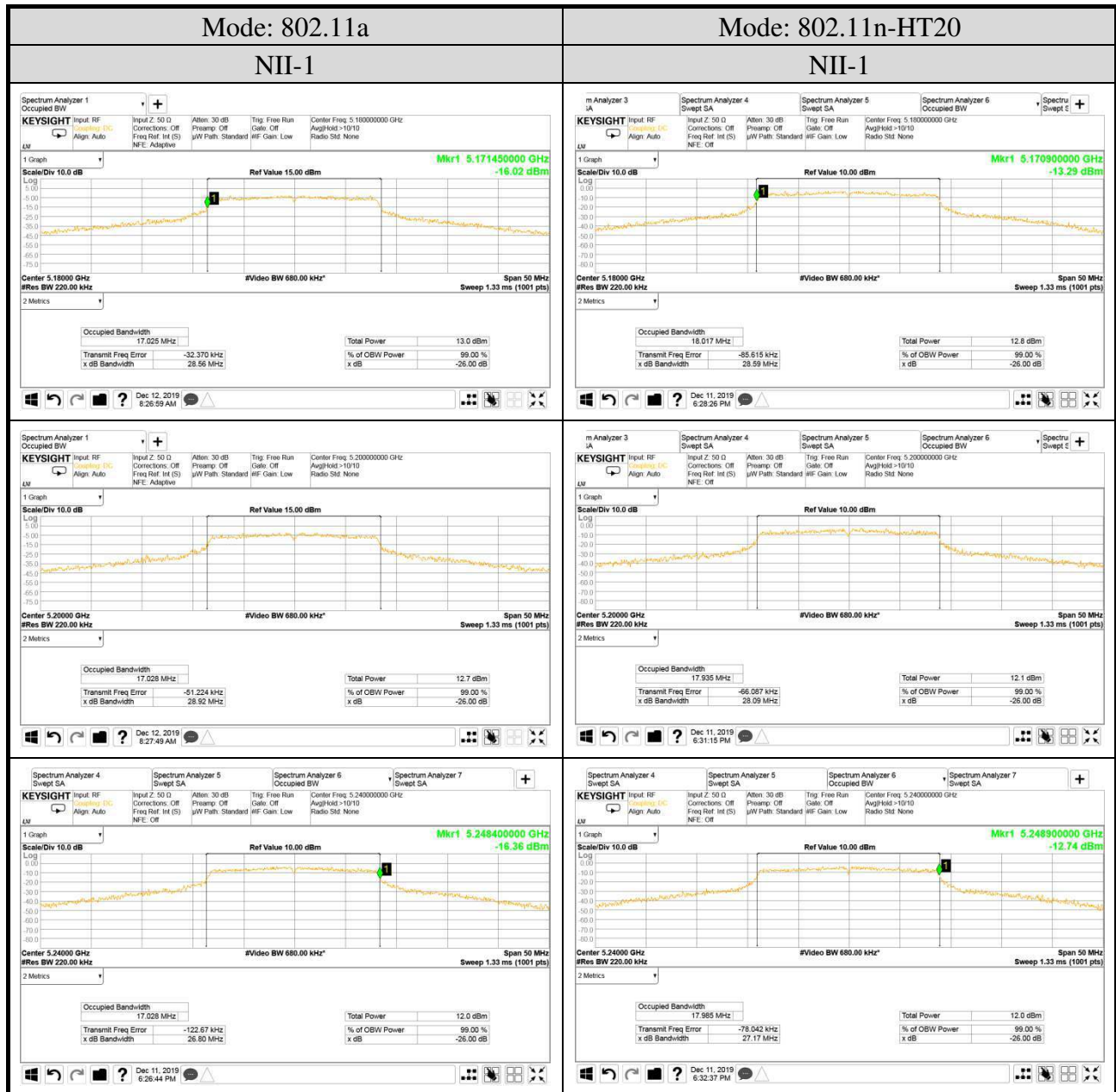
Mode	UNII Band	Centre Frequency (MHz)	6dB Bandwidth (MHz)	Occupied (99%) Bandwidth (MHz) (Reference only)	Limit
802.11a	NII-3	5745	16.36	16.780	≥ 500kHz
		5785	16.29	16.863	
		5825	16.31	16.690	
802.11n-HT20	NII-3	5745	16.99	17.784	
		5785	17.58	17.743	
		5825	17.62	17.745	
802.11n-HT40	NII-3	5755	35.44	36.173	
		5795	35.73	36.169	
802.11ac-VHT80	NII-3	5775	75.81	75.482	

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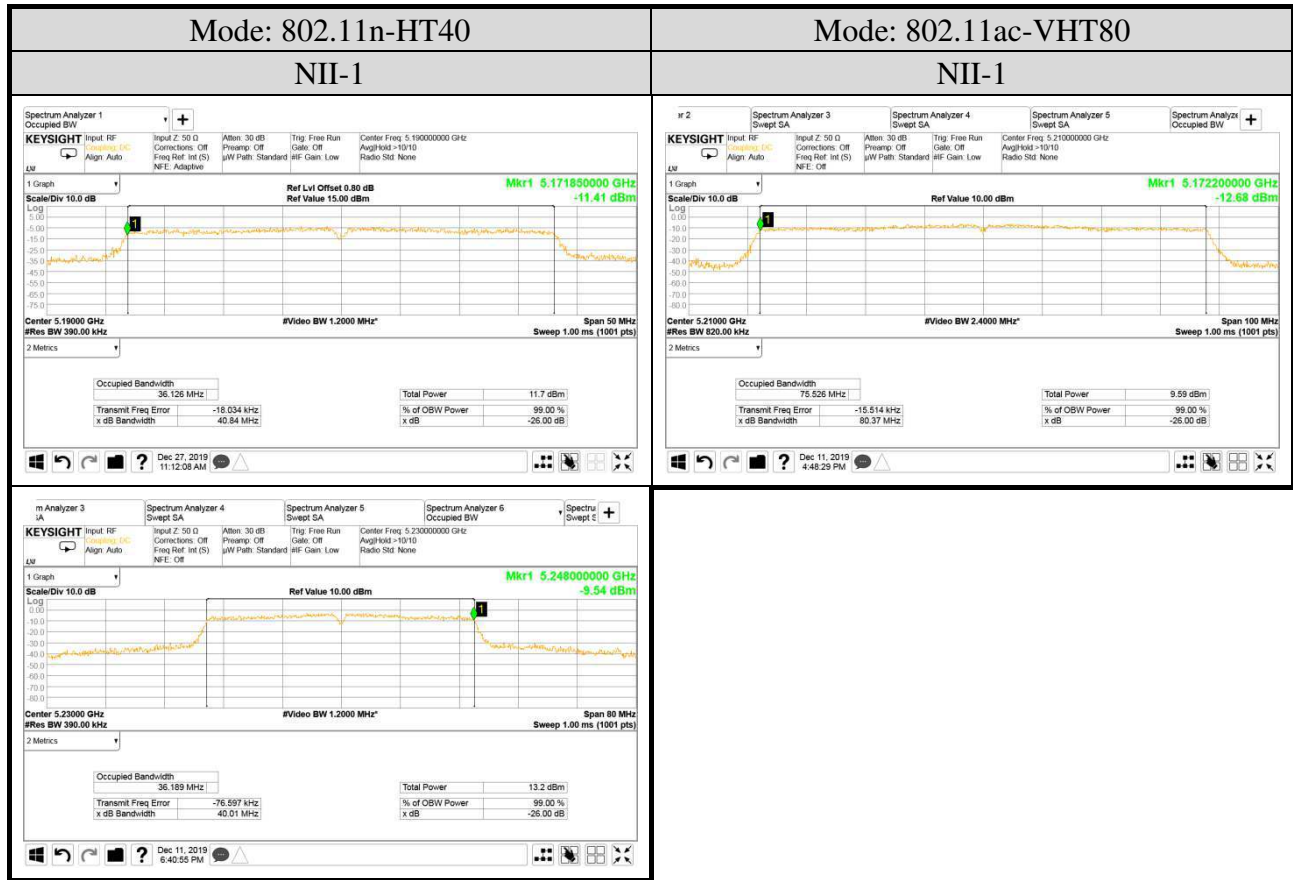
A.3.2 Measurement Plots

- For 26dB Bandwidth



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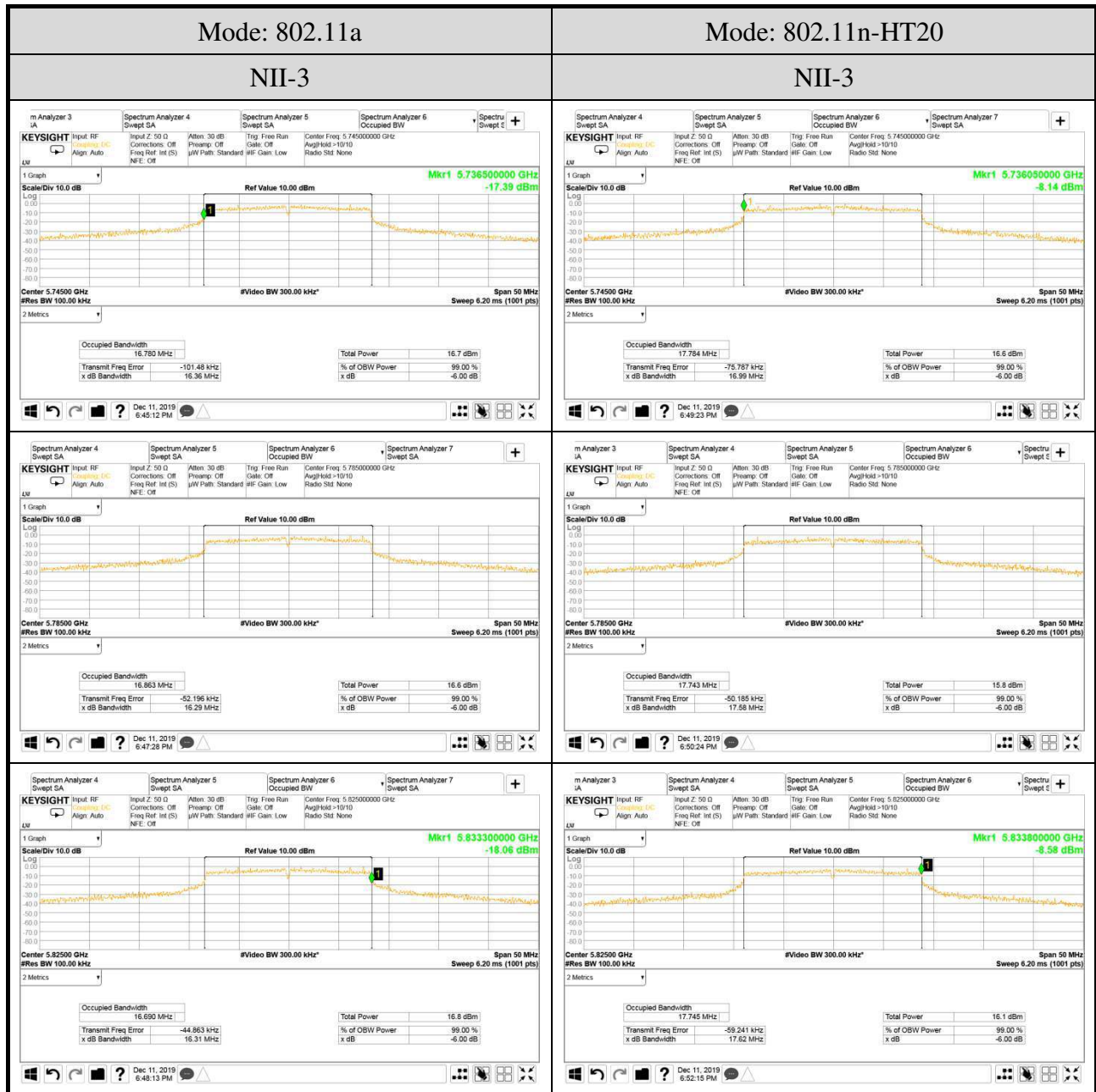
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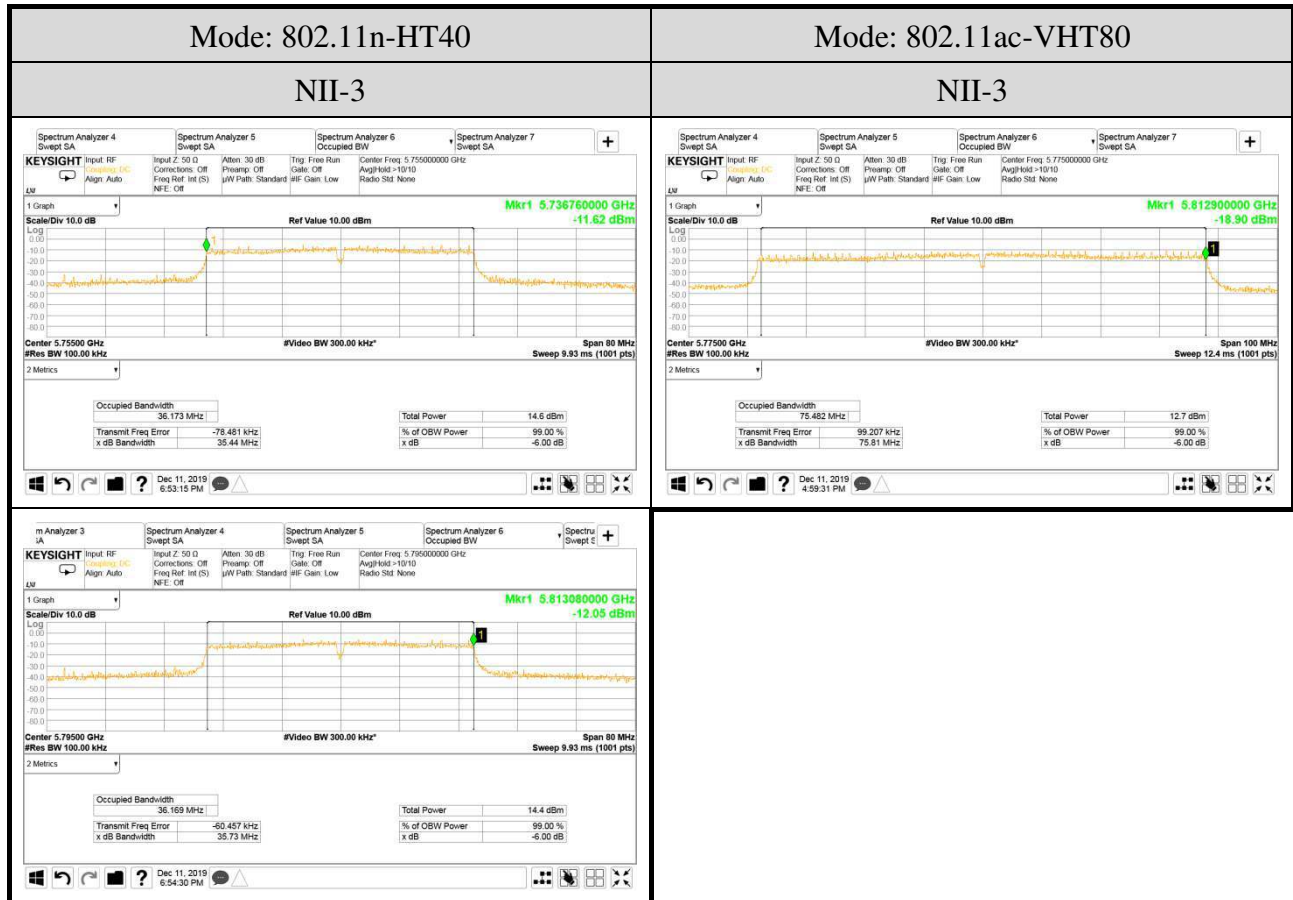
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● For 6dB Bandwidth



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A.4 MAXIMUM OUTPUT POWER

Test Date	2019/12/11~27	Temp./Hum.	20~22°C/54~63%
Cable Loss	0.8dB	Tested By	Sean Chang
Test Voltage	AC 120V 60Hz (Via AC Adapter)		

A.4.1 Average Output Power

Mode	UNII Band	Centre Frequency (MHz)	Average Output Power(dBm)	10log (1/X)	Max Average Output Power		Limit
					(dBm)	(W)	
802.11a	NII-1	5180	9.42	0.29	9.71	0.009	< 250 mW (24 dBm)
		5200	9.86		10.15	0.010	
		5240	10.05		10.34	0.011	
	NII-3	5745	12.46		12.75	0.019	
		5785	12.40		12.69	0.019	
		5825	12.52		12.81	0.019	

Mode	UNII Band	Centre Frequency (MHz)	Average Output Power(dBm)	10log (1/X)	Max Average Output Power		Limit
					(dBm)	(W)	
802.11n-HT20	NII-1	5180	9.14	0.31	9.45	0.009	< 250 mW (24 dBm)
		5200	9.22		9.53	0.009	
		5240	9.76		10.07	0.010	
	NII-3	5745	12.21		12.52	0.018	
		5785	12.14		12.45	0.018	
		5825	12.24		12.55	0.018	

Mode	UNII Band	Centre Frequency (MHz)	Average Output Power(dBm)	10log (1/X)	Max Average Output Power		Limit
					(dBm)	(W)	
802.11n-HT40	NII-1	5190	7.05	0.62	7.67	0.006	< 250 mW (24 dBm)
		5230	7.39		8.01	0.006	
	NII-3	5755	10.45		11.07	0.013	
		5795	10.28		10.90	0.012	

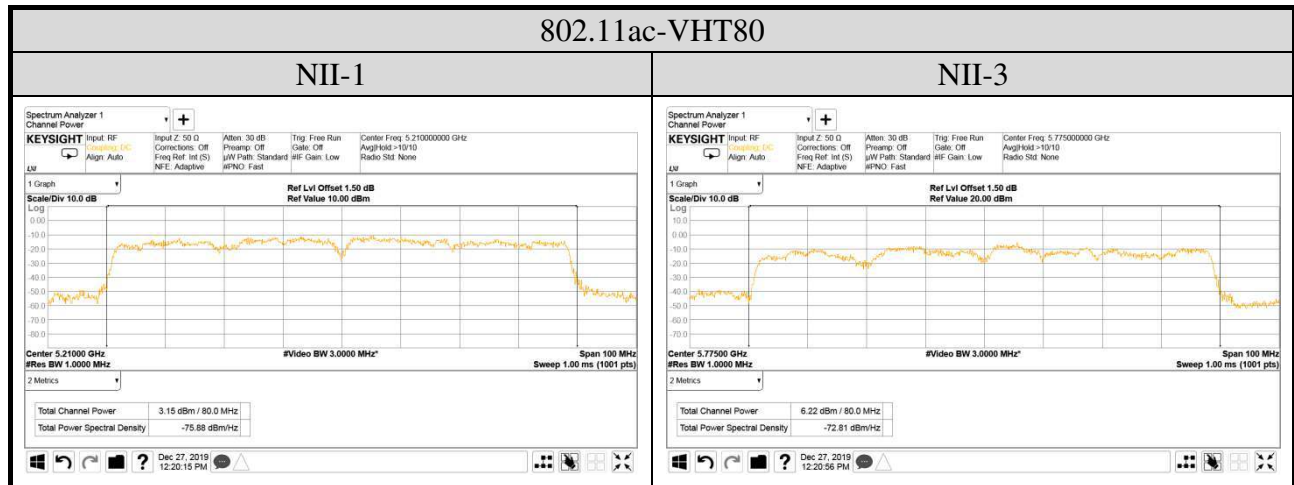
Mode	UNII Band	Centre Frequency (MHz)	Average Output Power(dBm)	10log (1/X)	Max Average Output Power		Limit
					(dBm)	(W)	
802.11ac-VHT80	NII-1	5210	3.15	3.84	6.99	0.005	< 250 mW (24 dBm)
	NII-3	5775	6.22		10.06	0.010	

Note: The results have been included cable loss.

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A.4.2 Measurement Plots



A.5 POWER SPECTRAL DENSITY

Test Date	2019/12/11	Temp./Hum.	22°C/63%
Cable Loss	1.5dB	Tested By	Sean Chang
Test Voltage	AC 120V 60Hz (Via AC Adapter)		
Simultaneous Factor 10 log(n)(Note: “n” is antenna number)		0	

A.5.1 Power Spectral Density Result

Mode	UNII Band	Centre Frequency (MHz)	Power Spectral Density (dBm)	Limit
802.11a	NII-1	5180	-0.509	11 dBm/MHz
		5200	0.250	
		5240	-1.538	
	NII-3 ^{Note2}	5745	1.850	30dBm/500 kHz
		5785	1.303	
		5825	1.608	
802.11n-HT20	NII-1	5180	-2.415	11 dBm/MHz
		5200	-1.981	
		5240	-1.574	
	NII-3 ^{Note2}	5745	1.378	30dBm/500 kHz
		5785	0.330	
		5825	0.639	
802.11n-HT40	NII-1	5190	-3.948	11 dBm/MHz
		5230	-3.466	
	NII-3 ^{Note2}	5755	-2.989	30dBm/500 kHz
		5795	-3.430	
802.11ac-VHT80	NII-1	5210	-7.884	11 dBm/MHz
	NII-3 ^{Note2}	5775	-6.403	30dBm/500 kHz

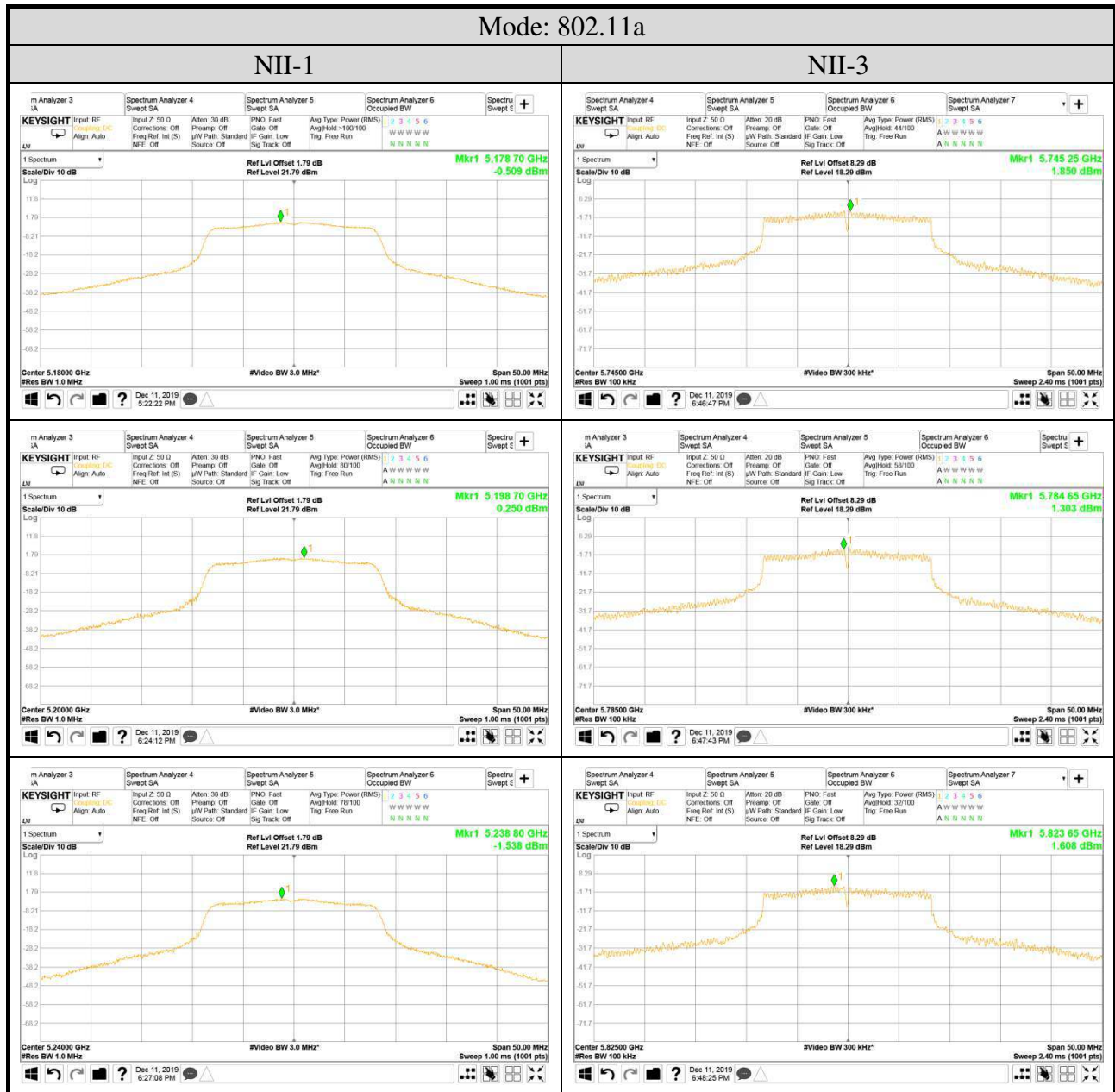
Note 1: All results have been included cable loss and Simultaneous Factor and correct duty factor.

Note 2: BWCF 6.99dB (100kHz converted to 500kHz) has been included in the test result.

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A.5.2 Measurement Plots



Mode: 802.11n-HT20

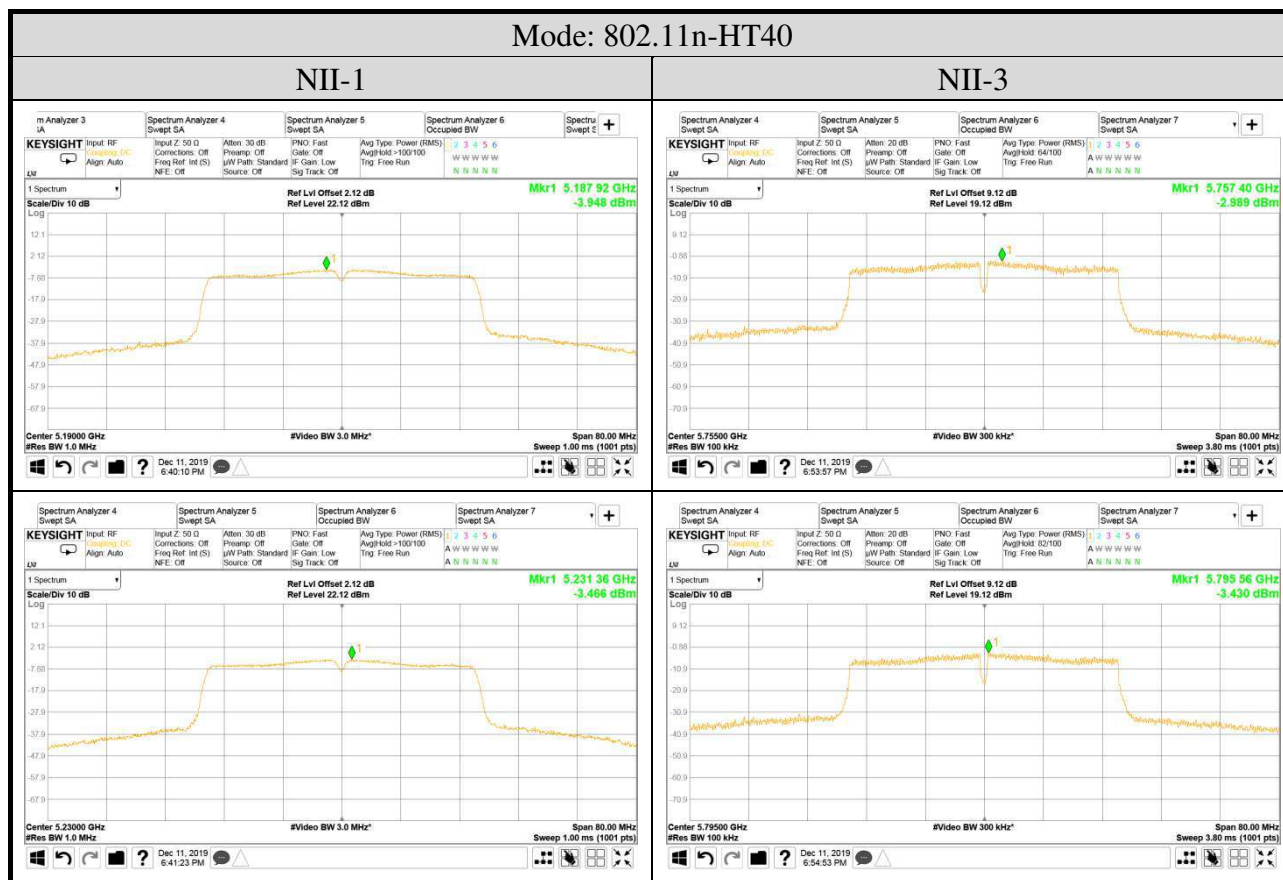
NII-1



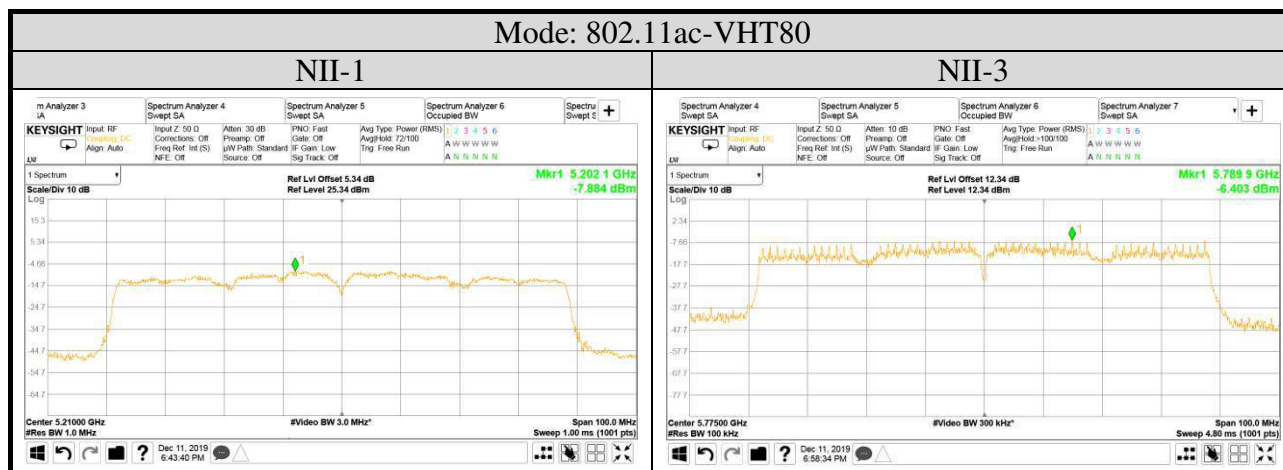
NII-3



Mode: 802.11n-HT40



Mode: 802.11ac-VHT80



A.6 FREQUENCY STABILITY

Test Date	2019/12/11	Temp./Hum.	22°C/63%
Cable Loss	1.5dB	Tested By	Sean Chang
Test Voltage	AC 120V 60Hz (Via AC Adapter)		

A.6.1 Frequency stability Result

Temperature (°C)	Voltage (Vac)	Centre Frequency (MHz)	Measurement Value (MHz)	Frequency Stability (ppm)
25	120	5180	5180.013	2.510
-30	102		5179.996	-0.772
	138		5179.989	-2.124
-20	102		5180.001	0.193
	138		5179.997	-0.579
-10	102		5179.982	-3.475
	138		5180.017	3.282
0	102		5180.010	1.931
	138		5180.009	1.737
10	102		5180.020	3.861
	138		5180.023	4.440
20	102		5179.994	-1.158
	138		5180.021	4.054
30	102		5179.994	-1.158
	138		5180.021	4.054
40	102		5179.983	-3.282
	138		5179.991	-1.737
50	102		5180.003	0.579
	138		5180.017	3.282



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APPENDIX B

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APPDNDIX B

TEST PHOTOGRAPHS

(Model: DK-GW001-A01-C001)