

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 15, Subpart E (Section 15.407)

Report No.: RFBEIH-WTW-P23060517-2

FCC ID: 2BBDG-CHPU-NS-A01

Product: Canopy Hub

Brand: CANOPY

Model No.: CHPU-NS-A01

Received Date: 2023/6/20

Test Date: 2023/6/30 ~ 2023/7/27

Issued Date: 2023/8/11

Applicant: SNTNL LLC

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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FCC Registration / 198487 / TW2021

Designation Number:

Approved by:

Jeremy Lin

Date:

2023/8/11

Jeremy Lin / Project Engineer

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Prepared by : Annie Chang / Senior Specialist

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Table of Contents

Release Control Record	4
1 Certificate.....	5
2 Summary of Test Results	6
2.1 Measurement Uncertainty	6
2.2 Supplementary Information	6
3 General Information	7
3.1 General Description of EUT	7
3.2 Antenna Description of EUT	7
3.3 Channel List.....	8
3.4 Test Mode Applicability and Tested Channel Detail.....	9
3.5 Duty Cycle of Test Signal.....	10
3.6 Test Program Used and Operation Descriptions	11
3.7 Connection Diagram of EUT and Peripheral Devices	11
3.8 Configuration of Peripheral Devices and Cable Connections	11
4 Test Instruments	12
4.1 RF Output Power.....	12
4.2 Power Spectral Density	12
4.3 6 dB Bandwidth	12
4.4 Occupied Bandwidth.....	12
4.5 Frequency Stability	12
4.6 Unwanted Emissions below 1 GHz	13
4.7 Unwanted Emissions above 1 GHz.....	14
5 Limits of Test Items.....	15
5.1 RF Output Power.....	15
5.2 Power Spectral Density	15
5.3 6 dB Bandwidth	15
5.4 Occupied Bandwidth.....	15
5.5 Frequency Stability	15
5.6 Unwanted Emissions below 1 GHz	16
5.7 Unwanted Emissions above 1 GHz.....	17
6 Test Arrangements.....	18
6.1 RF Output Power.....	18
6.1.1 Test Setup	18
6.1.2 Test Procedure.....	18
6.2 Power Spectral Density	18
6.2.1 Test Setup	18
6.2.2 Test Procedure.....	18
6.3 6 dB Bandwidth	19
6.3.1 Test Setup	19
6.3.2 Test Procedure.....	19
6.4 Occupied Bandwidth.....	19
6.4.1 Test Setup	19
6.4.2 Test Procedure.....	19
6.5 Frequency Stability	20
6.5.1 Test Setup	20
6.5.2 Test Procedure.....	20
6.6 Unwanted Emissions below 1 GHz	21
6.6.1 Test Setup	21
6.6.2 Test Procedure.....	22
6.7 Unwanted Emissions above 1 GHz.....	23
6.7.1 Test Setup	23
6.7.2 Test Procedure.....	23
7 Test Results of Test Item	24

7.1	RF Output Power.....	24
7.2	Power Spectral Density	25
7.3	6 dB Bandwidth	27
7.4	Occupied Bandwidth.....	28
7.5	Frequency Stability	30
7.6	Unwanted Emissions below 1 GHz	32
7.7	Unwanted Emissions above 1 GHz.....	34
8	Pictures of Test Arrangements	52
9	Information of the Testing Laboratories	53

Release Control Record

Issue No.	Description	Date Issued
RFBEIH-WTW-P23060517-2	Original release.	2023/8/11

1 Certificate

Product: Canopy Hub

Brand: CANOPY

Test Model: CHPU-NS-A01

Sample Status: Engineering sample

Applicant: SNTNL LLC

Test Date: 2023/6/30 ~ 2023/7/27

Standard: 47 CFR FCC Part 15, Subpart E (Section 15.407)

Measurement ANSI C63.10-2013

procedure: KDB 789033 D02 General UNII Test Procedure New Rules v02r01

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
Clause	Test Item	Result	Remark
15.407(a)(2)	26 dB Bandwidth	N/A	For U-NII-2A U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.
15.407(a)(1) 15.407(a)(3)	RF Output Power	Pass	Meet the requirement of limit.
15.407(a)(1) 15.407(a)(3)	Power Spectral Density	Pass	Meet the requirement of limit.
15.407(e)	6 dB Bandwidth	Pass	Meet the requirement of limit. (U-NII-3 Band only)
---	Occupied Bandwidth	-	Reference only.
15.407(g)	Frequency Stability	Pass	Meet the requirement of limit.
15.407(b)(9)	AC Power Conducted Emissions	N/A	Power supply is 12Vdc from battery.
15.407(b)(9)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -7.7 dB at 34.22 MHz
15.407(b) (1/10) 15.407(b) (4(i)/10)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -1.0 dB at 5150.00 MHz
15.203	Antenna Requirement	Pass	Antenna connector is ipex not a standard connector.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Specification	Expanded Uncertainty (k=2) (±)
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	2.38 dB
	30 MHz ~ 1 GHz	5.7 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 6 GHz	4.83 dB
	6 GHz ~ 18 GHz	5.37 dB
	18 GHz ~ 40 GHz	5.24 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Canopy Hub
Brand	CANOPY
Test Model	CHPU-NS-A01
Status of EUT	Engineering sample
Power Supply Rating	12.8Vdc from internal battery or 12-24Vdc from Car battery
Modulation Type	64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	OFDM
Transfer Rate	Up to 72.2 Mbps
Operating Frequency	5.18 GHz ~ 5.24 GHz, 5.745 GHz ~ 5.825 GHz
Number of Channel	802.11a, 802.11n (HT20): 9
Output Power	5.18 GHz ~ 5.24 GHz : 107.647 mW (20.32 dBm) 5.745 GHz ~ 5.825 GHz : 145.211 mW (21.62 dBm)
EUT Category	Client device

Note:

1. There are Bluetooth, WLAN (2.4 GHz & 5 GHz) and WWAN technologies used for the EUT.
2. Simultaneously transmission condition.

Condition	Technology	
1	WLAN (5 GHz)	Bluetooth
2	WLAN (2.4 GHz)	Bluetooth
3	WWAN (LTE Band 12)	Bluetooth

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Gain (dBi)	Antenna Type	Connector Type
4.09	PIFA	ipex

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

2. The EUT incorporates SISO function:

5 GHz Band		
Modulation Mode	TX & RX Configuration	
802.11a	1TX	1RX
802.11n (HT20)	1TX	1RX

3.3 Channel List

FOR 5180 ~ 5240 MHz

4 channels are provided for 802.11a, 802.11n (HT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

FOR 5745 ~ 5825 MHz:

5 channels are provided for 802.11a, 802.11n (HT20):

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

3.4 Test Mode Applicability and Tested Channel Detail

Pre-Scan:	1. EUT can be used in the following ways: XYZ 3-axis. Pre-scan in these ways and find the worst case as a representative test condition. 2. For Unwanted Emission below/ above 1 GHz has Input 12V=5A / Input 24V=2.5A of power supply. Pre-scan these modes and find the worst case as a representative test condition.
Worst Case:	1. X/ Y/ Z Worst Condition: X Axis for Unwanted Emission above 1GHz and Unwanted Emission below 1GHz. 2. For Unwanted Emission below/above 1 GHz Input 12V=5A is the worst case of power supply.

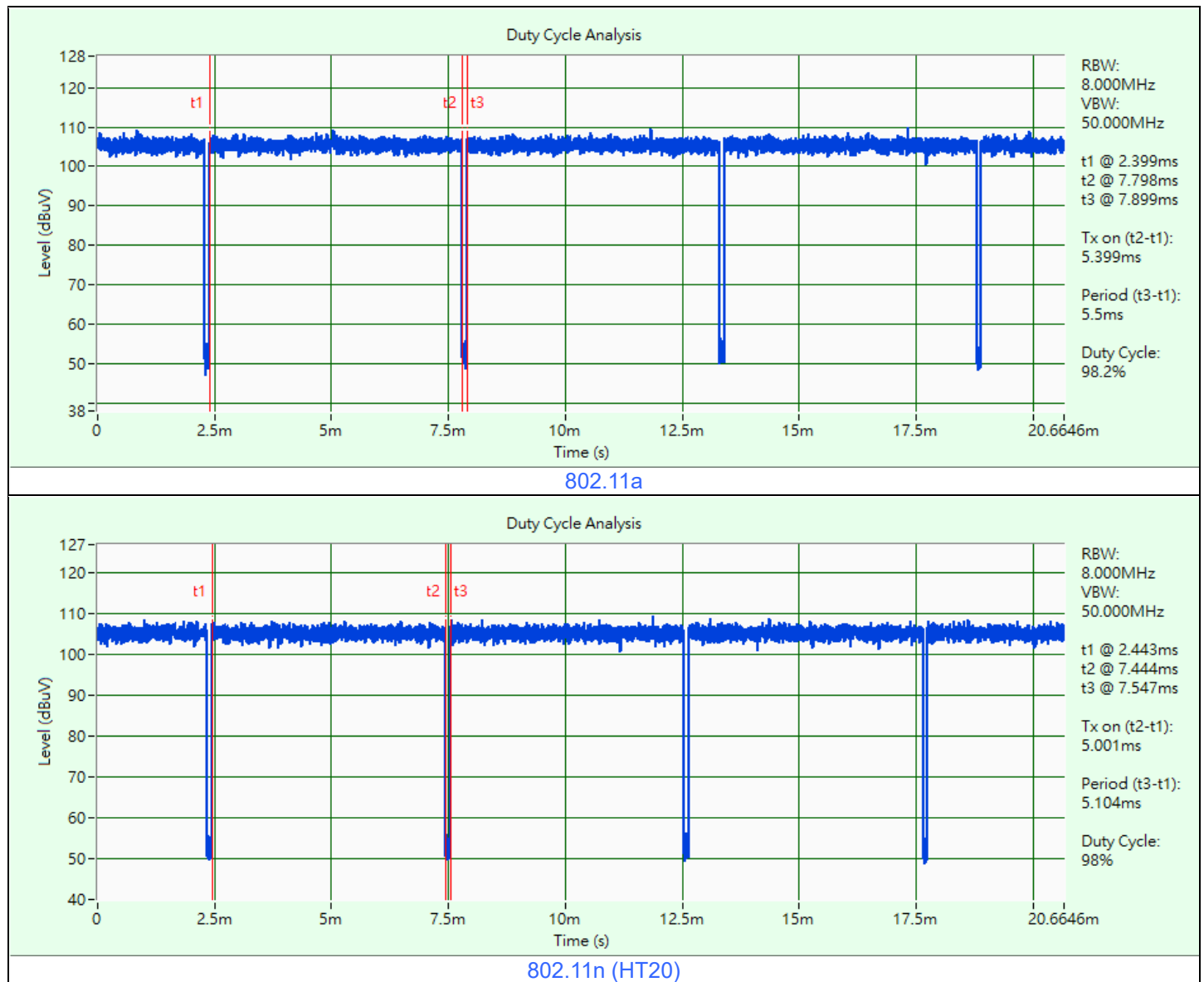
Following channel(s) was (were) selected for the final test as listed below:

Test Item	Mode	Tested Channel	Modulation	Data Rate Parameter
RF Output Power / Power Spectral Density	802.11a	36, 40, 48, 149, 157, 165	BPSK	6Mb/s
	802.11n (HT20)	36, 40, 48, 149, 157, 165	BPSK	MCS0
6 dB Bandwidth	802.11a	149, 157, 165	BPSK	6Mb/s
	802.11n (HT20)	149, 157, 165	BPSK	MCS0
Occupied Bandwidth	802.11a	36, 40, 48, 149, 157, 165	BPSK	6Mb/s
	802.11n (HT20)	36, 40, 48, 149, 157, 165	BPSK	MCS0
Frequency Stability	802.11a	36	unmodulated	-
Unwanted Emissions below 1 GHz	802.11n (HT20)	157	BPSK	MCS0
Unwanted Emissions above 1 GHz	802.11a	36, 40, 48, 149, 157, 165	BPSK	6Mb/s
	802.11n (HT20)	36, 40, 48, 149, 157, 165	BPSK	MCS0

3.5 Duty Cycle of Test Signal

802.11a: Duty cycle = 5.399 ms / 5.5 ms x 100% = 98.2%

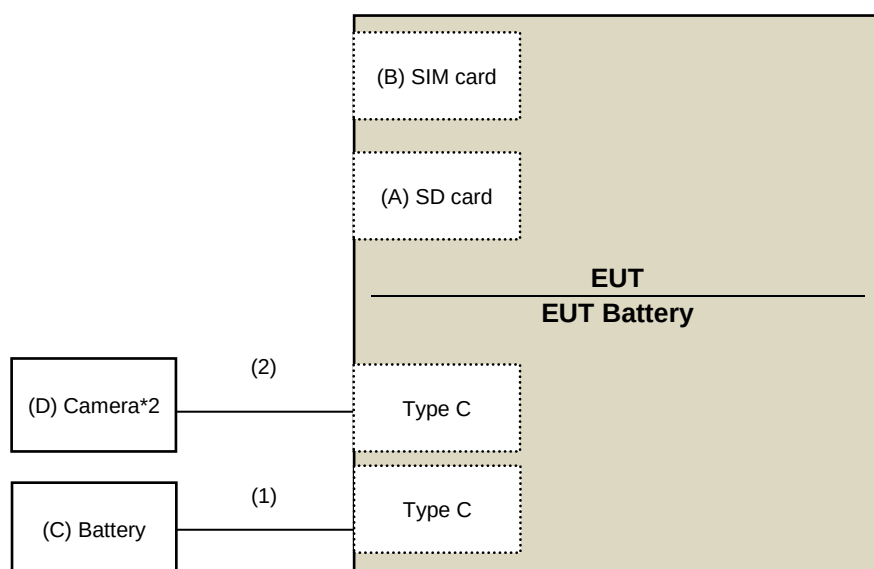
802.11n (HT20): Duty cycle = 5.001 ms / 5.104 ms x 100% = 98.0%



3.6 Test Program Used and Operation Descriptions

Controlling software (teraterm v4.80) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

3.7 Connection Diagram of EUT and Peripheral Devices



3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	SD card	SanDisk	256G	N/A	N/A	Provided by Lab
B	SIM card	N/A	N/A	N/A	N/A	Provided by Lab
C	Battery	GS	GG20LH2	N/A	N/A	Provided by Lab
D	Camera*2	CANOPY	CSSU-TS-A01	N/A	N/A	Supplied by applicant

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	Battery DC cable	1	3	Y	0	Supplied by applicant
2	Type C cable	2	2.9	N	0	Supplied by applicant

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 RF Output Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Power Meter Anritsu	ML2495A	0842014	2023/5/5	2024/5/4
Pulse Power Sensor Anritsu	MA2411B	0738404	2023/5/5	2024/5/4
PXA Signal Analyzer Keysight	N9030A	MY54490260	2023/7/13	2024/7/12
Signal Analyzer R&S	FSV40	101042	2022/9/5	2023/9/4
		101544	2023/5/9	2024/5/8
Temperature & Humidity Chamber Terchy	MHU-225AU	920409	2023/6/26	2024/6/25
True RMS Multimeter FLUKE	179	89610322	2022/10/3	2023/10/2
USB Wideband Power Sensor Keysight	U2021XA	U2021XA_001	2023/6/6	2024/6/5

Notes:

1. The test was performed in LK - Oven
2. Tested Date: 2023/7/27

4.2 Power Spectral Density

Refer to section 4.1 to get information of the instruments.

4.3 6 dB Bandwidth

Refer to section 4.1 to get information of the instruments.

4.4 Occupied Bandwidth

Refer to section 4.1 to get information of the instruments.

4.5 Frequency Stability

Refer to section 4.1 to get information of the instruments.

4.6 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
* Loop Antenna EMCI	LPA600	270	2021/9/2	2023/9/1
Bi_Log Antenna Schwarzbeck	VULB 9168	137	2022/10/21	2023/10/20
Coupling / Decoupling Network Schwarzbeck	CDNE-M2	00097	2023/5/25	2024/5/24
	CDNE-M3	00091	2023/5/25	2024/5/24
MXE EMI Receiver Agilent	N9038A	MY51210129	2023/3/24	2024/3/23
		MY51210137	2023/6/5	2024/6/4
Preamplifier EMCI	EMC001340	980269	2023/6/27	2024/6/26
Preamplifier HP	8447D	2432A03504	2023/2/16	2024/2/15
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	2023/6/27	2024/6/26
Signal Analyzer R&S	FSV40	101544	2023/5/9	2024/5/8
Software BVADT	Radiated_V7.7.1.1.1	N/A	N/A	N/A
	Radiated_V8.7.08	N/A	N/A	N/A
Tower ADT	AT100	0306	N/A	N/A
Turn Table ADT	TT100	0306	N/A	N/A

Notes:

1. * The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA
2. The test was performed in Linkou 966 Chamber 6 (CH 6).
3. Tested Date: 2023/7/3

4.7 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Band Pass Filter Micro-Tronics	BRM17690	005	2023/5/25	2024/5/24
Boresight antenna tower fixture BV	BAF-02	6	N/A	N/A
High Pass Filter Wainwright	WHK 3.1/18G-10SS	SN 8	2023/5/25	2024/5/24
Horn Antenna EMCO	3115	00028257	2022/11/13	2023/11/12
Horn Antenna ETS-Lindgren	3117-PA	00215857	2022/11/13	2023/11/12
Horn Antenna Schwarzbeck	BBHA 9170	212	2022/10/20	2023/10/19
MXE EMI Receiver Agilent	N9038A	MY51210129	2023/3/24	2024/3/23
		MY51210137	2023/6/5	2024/6/4
Notch Filter Micro-Tronics	BRC50703-01	010	2023/5/25	2024/5/24
Preamplifier EMCI	EMC0126545	980076	2023/2/16	2024/2/15
	EMC184045B	980175	2022/9/3	2023/9/2
		980235	2023/2/16	2024/2/15
Preamplifier HP	8449B	3008A01201	2023/2/16	2024/2/15
RF Coaxial Cable EM	EM102-KMKM-3.5+1M	EM102-KMKM-3.5+1M-01	2022/7/7	2023/7/6
RF Coaxial Cable EMCI	EMC104	190801	2022/7/7	2023/7/6
		190804	2022/7/7	2023/7/6
RF Coaxial Cable HUBER+SUHNER	SF-104	Cable-CH6-01	2022/7/7	2023/7/6
Signal Analyzer R&S	FSV40	101042	2022/9/5	2023/9/4
		101544	2023/5/9	2024/5/8
Software BVADT	Radiated_V7.7.1.1.1	N/A	N/A	N/A
	Radiated_V8.7.08	N/A	N/A	N/A
Tower ADT	AT100	0306	N/A	N/A
Turn Table ADT	TT100	0306	N/A	N/A

Notes:

1. The test was performed in Linkou 966 Chamber 6 (CH 6).
2. Tested Date: 2023/6/30 ~ 2023/7/1

5 Limits of Test Items

5.1 RF Output Power

Operation Band	EUT Category	Limit
U-NII-1	Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p $\leq$ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
	Fixed point-to-point Access Point	1 Watt (30 dBm)
	Indoor Access Point	1 Watt (30 dBm)
	Mobile and Portable client device	250mW (24 dBm)

Operation Band	Limit
U-NII-3	1 Watt (30 dBm)

5.2 Power Spectral Density

Operation Band	EUT Category	Limit
U-NII-1	Outdoor Access Point	17 dBm/MHz
	Fixed point-to-point Access Point	
	Indoor Access Point	
	Mobile and Portable client device	11 dBm/MHz

Operation Band	Limit
U-NII-3	30 dBm/500 kHz

5.3 6 dB Bandwidth

Within the 5.725-5.850 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.4 Occupied Bandwidth

The results are for reference only.

5.5 Frequency Stability

The frequency of the carrier signal shall be maintained within band of operation.

5.6 Unwanted Emissions below 1 GHz

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

5.7 Unwanted Emissions above 1 GHz

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
Above 960	500	3

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Limits of unwanted emission out of the restricted bands

Applicable To	Limit	
789033 D02 General UNII Test Procedure New Rules v02r01	Field Strength at 3 m	
	PK: 74 (dBμV/m)	AV: 54 (dBμV/m)

For transmitters operating in the 5.15-5.25 GHz band:

Applicable To	EIRP Limit	Equivalent Field Strength at 3 m
15.407(b)(1)	PK: -27 (dBm/MHz)	PK: 68.2 (dBμV/m)

For transmitters operating in the 5.725-5.850 GHz band:

Applicable To	EIRP Limit	Equivalent Field Strength at 3 m
15.407(b)(4)(i)	PK: -27 (dBm/MHz) ^{*1} PK: 10 (dBm/MHz) ^{*2} PK: 15.6 (dBm/MHz) ^{*3} PK: 27 (dBm/MHz) ^{*4}	PK: 68.2 (dBμV/m) ^{*1} PK: 105.2 (dBμV/m) ^{*2} PK: 110.8 (dBμV/m) ^{*3} PK: 122.2 (dBμV/m) ^{*4}

^{*1} beyond 75 MHz or more above of the band edge.

^{*2} below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.

^{*3} below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.

^{*4} from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

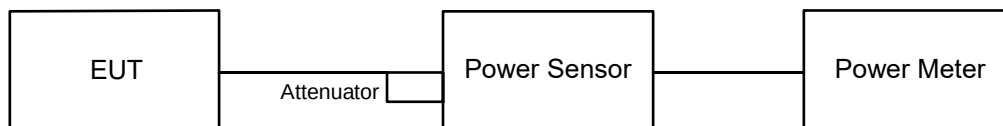
Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts).}$$

6 Test Arrangements

6.1 RF Output Power

6.1.1 Test Setup

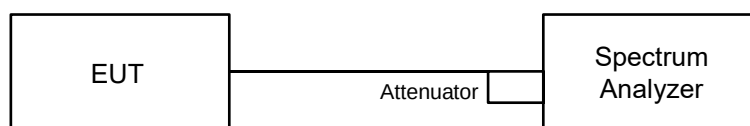


6.1.2 Test Procedure

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst and set the detector to average. Duty factor is not added to measured value.

6.2 Power Spectral Density

6.2.1 Test Setup



6.2.2 Test Procedure

For specified measurement bandwidth 1 MHz:

Method SA-1

- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 1 MHz, Set VBW $\geq$ 3 MHz, Detector = RMS
- Sweep points $\geq [2 \times \text{span} / \text{RBW}]$. (This gives bin-to-bin spacing $\leq \text{RBW} / 2$, so that narrowband signals are not lost between frequency bins.)
- Sweep time = auto, trigger set to "free run".
- Trace average at least 100 traces in power averaging mode.
- Record the max value

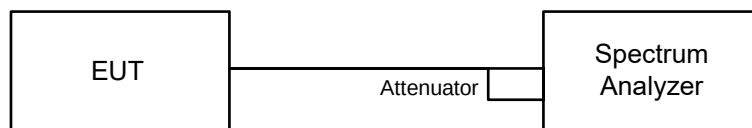
For specified measurement bandwidth 500 kHz:

Method SA-1

- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz, Set VBW $\geq$ 1 MHz, Detector = RMS
- Scale the observed power level to an equivalent value in 500 kHz by adjusting (increasing) the measured power by a bandwidth correction factor (BWCF) where $\text{BWCF} = 10\log(500 \text{ kHz}/300 \text{ kHz})$
- Sweep points $\geq [2 \times \text{span} / \text{RBW}]$. (This gives bin-to-bin spacing $\leq \text{RBW} / 2$, so that narrowband signals are not lost between frequency bins.)
- Sweep time = auto, trigger set to "free run".
- Trace average at least 100 traces in power averaging mode.
- Record the max value

6.3 6 dB Bandwidth

6.3.1 Test Setup

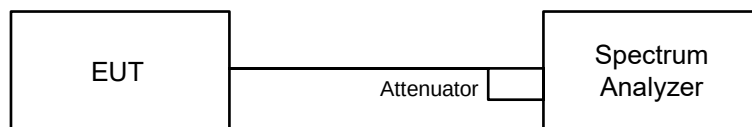


6.3.2 Test Procedure

- Set resolution bandwidth (RBW) = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.4 Occupied Bandwidth

6.4.1 Test Setup

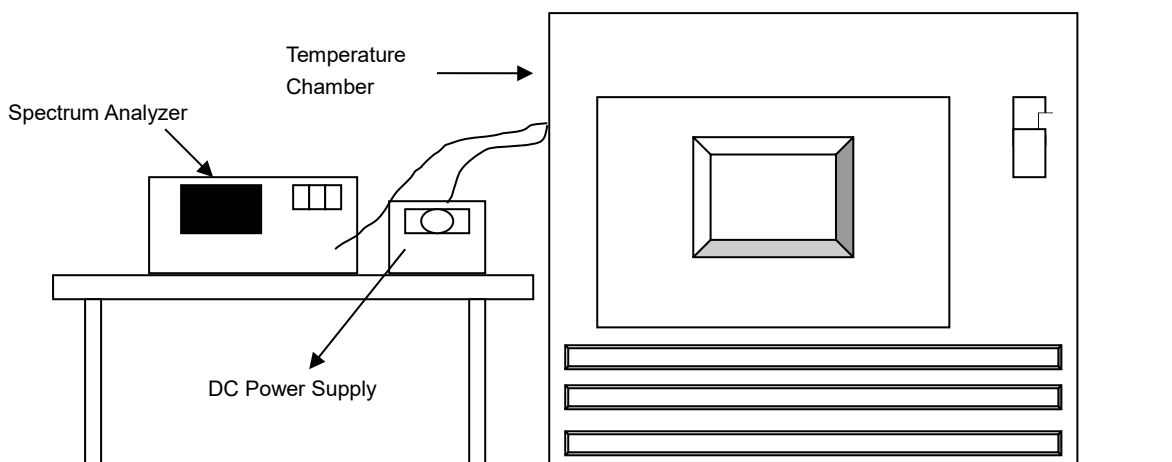


6.4.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to Sampling. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean power of a given emission.

6.5 Frequency Stability

6.5.1 Test Setup



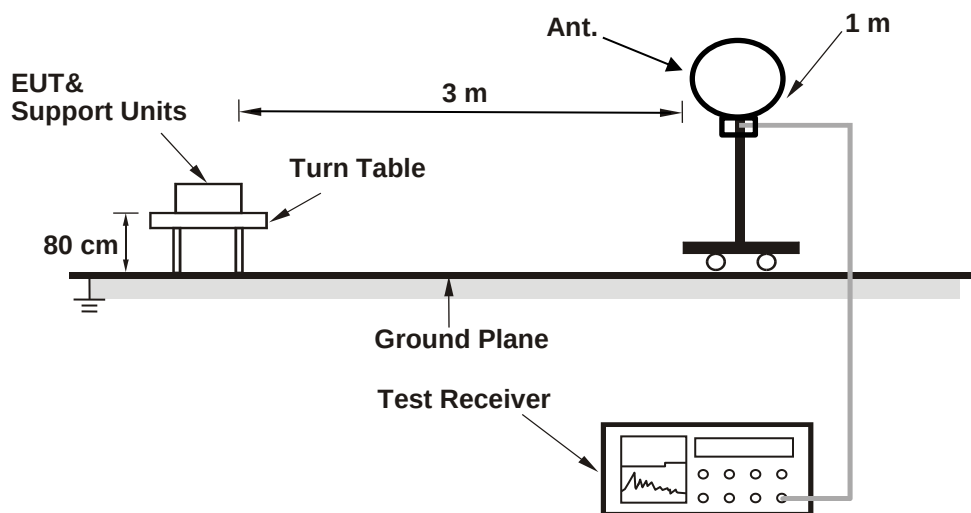
6.5.2 Test Procedure

- The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
- Turn the EUT on and couple its output to a spectrum analyzer.
- Turn the EUT off and set the chamber to the highest temperature specified.
- Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 Minutes.
- Repeat step (d) with the temperature chamber set to the next desired temperature until measurements down to the lowest specified temperature have been completed.
- The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 Minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

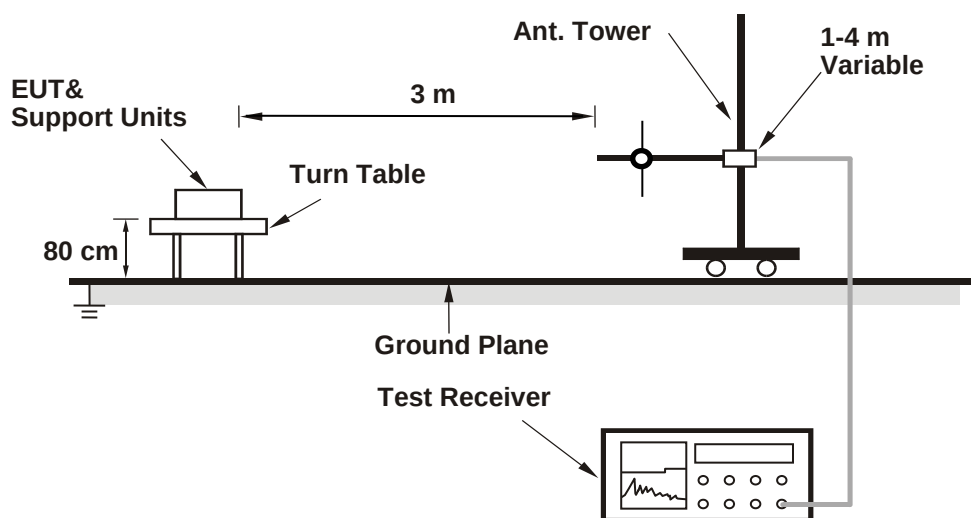
6.6 Unwanted Emissions below 1 GHz

6.6.1 Test Setup

For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.6.2 Test Procedure

For Radiated emission below 30 MHz

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode, except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

Notes:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
- All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission above 30 MHz

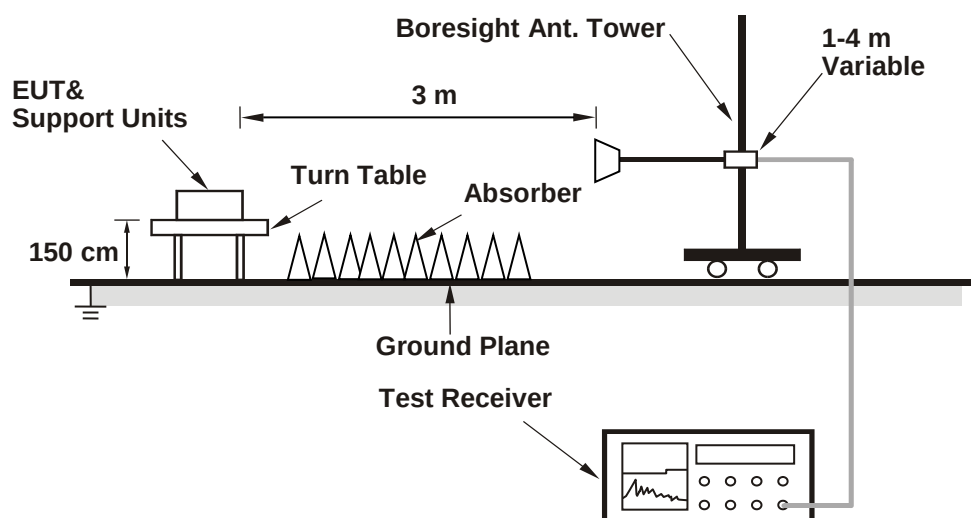
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Quasi-peak(QP) detect function, Average(AV) detect function, Peak(PK) detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

Notes:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP), Average detection (AV), Peak detection (PK) at frequency (30MHz to 1 GHz).
- All modes of operation were investigated and the worst-case emissions are reported.

6.7 Unwanted Emissions above 1 GHz

6.7.1 Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.7.2 Test Procedure

- The EUT was placed on the top of a rotating table 1.5 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Notes:

- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz.
- For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10 Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1 GHz.
- All modes of operation were investigated and the worst-case emissions are reported.

7 Test Results of Test Item

7.1 RF Output Power

Input Power:	12 Vdc	Environmental Conditions:	25°C, 76% RH	Tested By:	Dalen Dai
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802.11a

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
36	5180	44.361	16.47	24	Pass
40	5200	107.647	20.32	24	Pass
48	5240	85.704	19.33	24	Pass
149	5745	137.721	21.39	30	Pass
157	5785	142.561	21.54	30	Pass
165	5825	134.276	21.28	30	Pass

Notes:

1. For U-NII-1, the antenna gain is 4.09 dBi < 6 dBi, so the output power limit shall not be reduced.
2. For U-NII-3, the antenna gain is 4.09 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11n (HT20)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
36	5180	35.645	15.52	24	Pass
40	5200	85.901	19.34	24	Pass
48	5240	76.384	18.83	24	Pass
149	5745	142.889	21.55	30	Pass
157	5785	145.211	21.62	30	Pass
165	5825	133.968	21.27	30	Pass

Notes:

1. For U-NII-1, the antenna gain is 4.09 dBi < 6 dBi, so the output power limit shall not be reduced.
2. For U-NII-3, the antenna gain is 4.09 dBi < 6 dBi, so the output power limit shall not be reduced.

7.2 Power Spectral Density

Input Power:	12 Vdc	Environmental Conditions:	25°C, 76% RH	Tested By:	Dalen Dai
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802.11a

Chan.	Chan. Freq. (MHz)	PSD (dBm/MHz)	Max. PSD Limit (dBm/MHz)	Test Result
36	5180	2.06	11	Pass
40	5200	5.91	11	Pass
48	5240	4.97	11	Pass

Note: For U-NII-1, the antenna gain is 4.09 dBi < 6dBi, so the power density limit shall not be reduced.

802.11n (HT20)

Chan.	Chan. Freq. (MHz)	PSD (dBm/MHz)	Max. PSD Limit (dBm/MHz)	Test Result
36	5180	1.53	11	Pass
40	5200	4.60	11	Pass
48	5240	4.41	11	Pass

Note: For U-NII-1, the antenna gain is 4.09 dBi < 6dBi, so the power density limit shall not be reduced.

802.11a

Channel	Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	PSD Limit (dBm/500kHz)	Test Result
149	5745	-1.59	0.63	30	Pass
157	5785	-1.88	0.34	30	Pass
165	5825	-2.27	-0.05	30	Pass

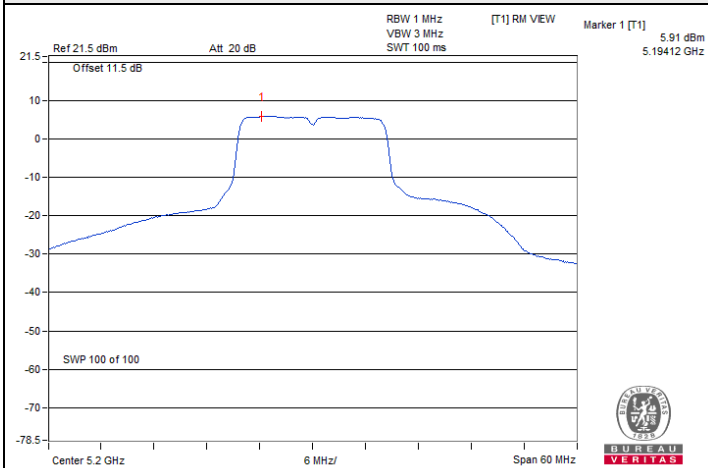
Note: For U-NII-3, the antenna gain is 4.09 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11n (HT20)

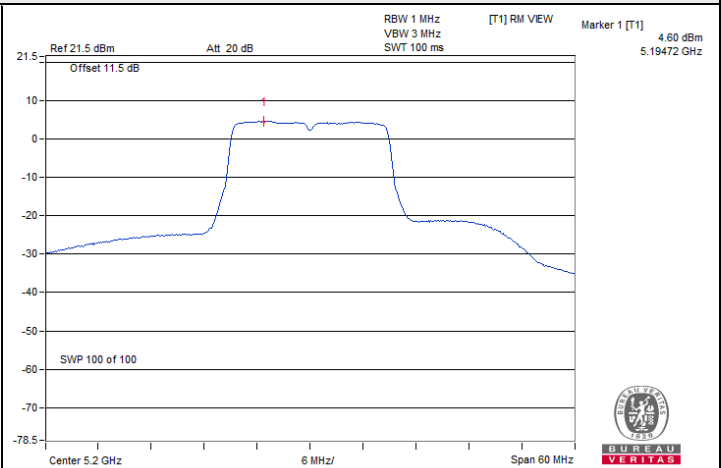
Channel	Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	PSD Limit (dBm/500kHz)	Test Result
149	5745	-1.77	0.45	30	Pass
157	5785	-2.18	0.04	30	Pass
165	5825	-2.49	-0.27	30	Pass

Note: For U-NII-3, the antenna gain is 4.09 dBi < 6 dBi, so the power density limit shall not be reduced.

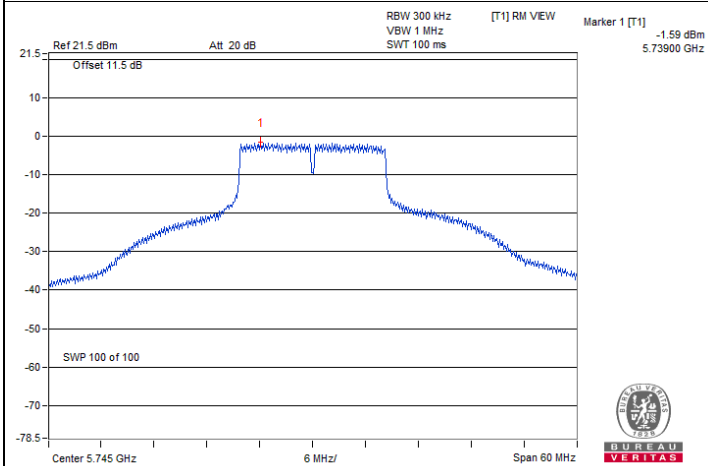
Spectrum Plot of Maximum Value



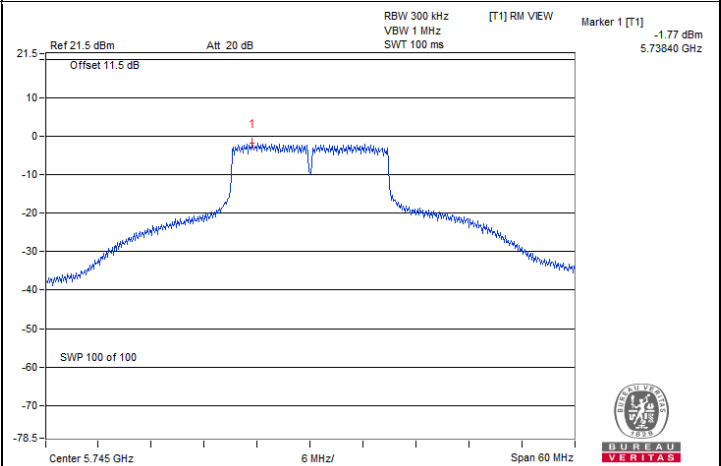
802.11a : CH 40



802.11n (HT20) : CH 40



802.11a : CH 149



802.11n (HT20) : CH 149

7.3 6 dB Bandwidth

Input Power:	12 Vdc	Environmental Conditions:	25°C, 76% RH	Tested By:	Dalen Dai
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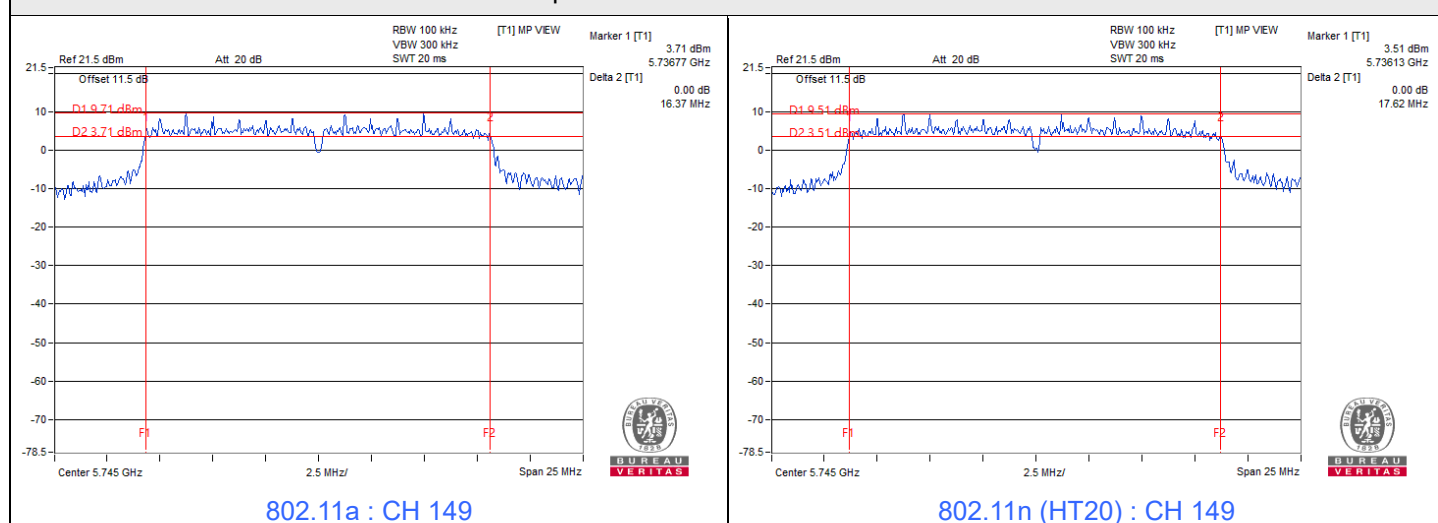
802.11a

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
149	5745	16.37	0.5	Pass
157	5785	16.39	0.5	Pass
165	5825	16.39	0.5	Pass

802.11n (HT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
149	5745	17.62	0.5	Pass
157	5785	17.63	0.5	Pass
165	5825	17.62	0.5	Pass

Spectrum Plot of Minimum Value



7.4 Occupied Bandwidth

Input Power:	12 Vdc	Environmental Conditions:	25°C, 76% RH	Tested By:	Dalen Dai
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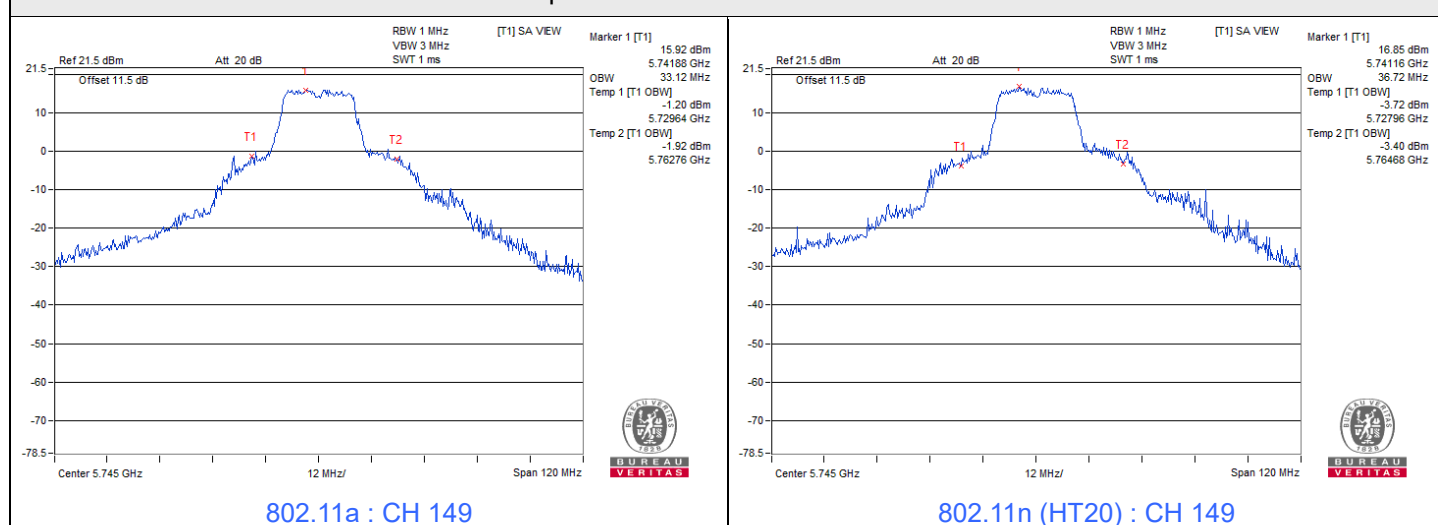
802.11a

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	17.4
40	5200	23.76
48	5240	18.84
149	5745	33.12
157	5785	32.64
165	5825	29.52

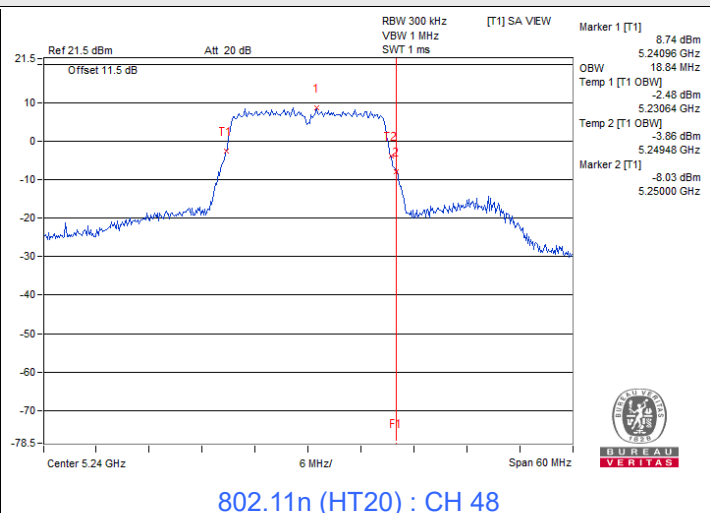
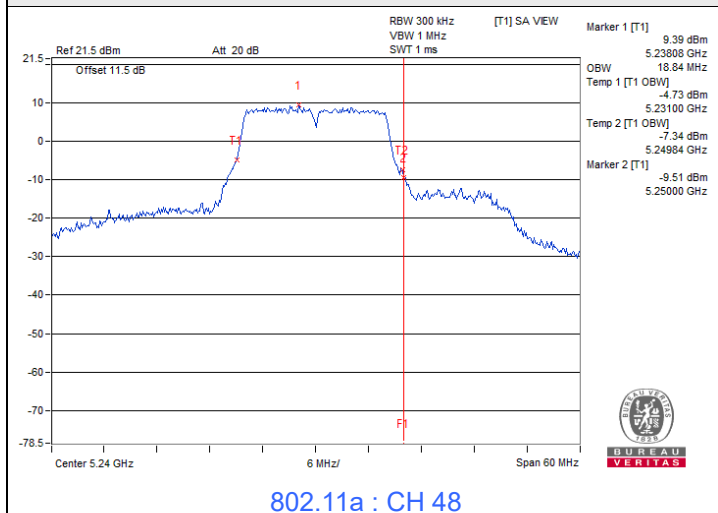
802.11n (HT20)

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	18.12
40	5200	18.96
48	5240	18.84
149	5745	36.72
157	5785	36.24
165	5825	33.6

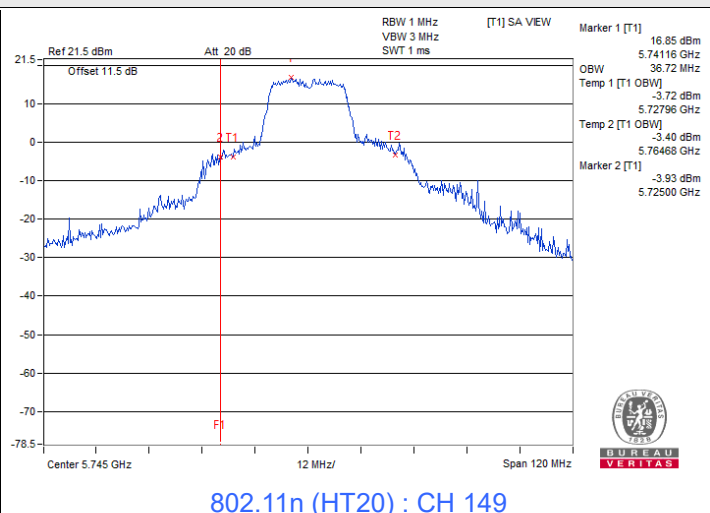
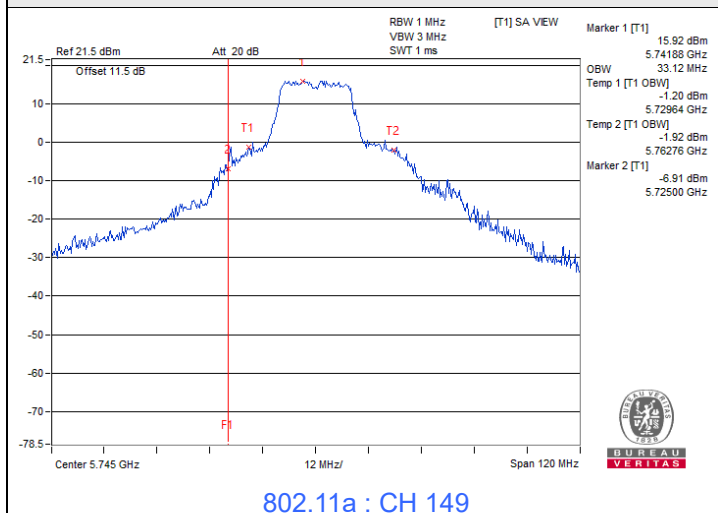
Spectrum Plot of Maximum Value



Spectrum Plot for nearby DFS band (DFS is required, if 99% OCP straddle into U-NII-2A)



Spectrum Plot for nearby DFS band (DFS is required, if 99% OCP straddle into U-NII-2C)



7.5 Frequency Stability

Input Power:	12 Vdc	Environmental Conditions:	25°C, 76% RH	Tested By:	Dalen Dai
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802.11a

Frequency Stability Versus Temperature									
Operating Frequency: 5180 MHz									
Temp. (°C)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result
65	12	5180.0144	Pass	5180.0133	Pass	5180.0153	Pass	5180.0144	Pass
60	12	5180.0007	Pass	5180.0018	Pass	5180	Pass	5180	Pass
50	12	5179.9913	Pass	5179.994	Pass	5179.991	Pass	5179.9923	Pass
40	12	5180.0026	Pass	5180.0043	Pass	5180.0029	Pass	5180.0033	Pass
30	12	5180.0195	Pass	5180.0192	Pass	5180.0186	Pass	5180.0205	Pass
20	12	5180.012	Pass	5180.0153	Pass	5180.0125	Pass	5180.0131	Pass
10	12	5179.9918	Pass	5179.9921	Pass	5179.9936	Pass	5179.9906	Pass
0	12	5179.9921	Pass	5179.9931	Pass	5179.9926	Pass	5179.9904	Pass
-10	12	5180.001	Pass	5179.9978	Pass	5179.9997	Pass	5179.9992	Pass
-20	12	5179.9912	Pass	5179.9869	Pass	5179.9869	Pass	5179.9868	Pass
-30	12	5179.9836	Pass	5179.9829	Pass	5179.9836	Pass	5179.9814	Pass

Frequency Stability Versus Voltage									
Operating Frequency: 5180 MHz									
Temp. (°C)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result
20	13.8	5180.017	Pass	5180.0186	Pass	5180.0138	Pass	5180.0155	Pass
	12	5180.012	Pass	5180.0153	Pass	5180.0125	Pass	5180.0131	Pass
	10.2	5180.0072	Pass	5180.0088	Pass	5180.008	Pass	5180.0064	Pass

Input Power:	24 Vdc	Environmental Conditions:	25°C, 76% RH	Tested By:	Dalen Dai
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802.11a

Frequency Stability Versus Temperature									
Operating Frequency: 5180 MHz									
Temp. (°C)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result
65	24	5180.0171	Pass	5180.0139	Pass	5180.0168	Pass	5180.0172	Pass
60	24	5179.9805	Pass	5179.9826	Pass	5179.9787	Pass	5179.9826	Pass
50	24	5179.9971	Pass	5179.9993	Pass	5180.0006	Pass	5179.9982	Pass
40	24	5180.0177	Pass	5180.0215	Pass	5180.0167	Pass	5180.0193	Pass
30	24	5179.9736	Pass	5179.973	Pass	5179.9748	Pass	5179.9745	Pass
20	24	5180.0169	Pass	5180.0194	Pass	5180.0186	Pass	5180.0182	Pass
10	24	5180.0102	Pass	5180.0116	Pass	5180.0138	Pass	5180.0125	Pass
0	24	5180.0091	Pass	5180.0085	Pass	5180.0115	Pass	5180.0117	Pass
-10	24	5179.9901	Pass	5179.9907	Pass	5179.9915	Pass	5179.9904	Pass
-20	24	5179.9822	Pass	5179.9823	Pass	5179.9821	Pass	5179.9826	Pass
-30	24	5180.0215	Pass	5180.017	Pass	5180.02	Pass	5180.0213	Pass

Frequency Stability Versus Voltage									
Operating Frequency: 5180 MHz									
Temp. (°C)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result
20	27.6	5180.0251	Pass	5180.0254	Pass	5180.0257	Pass	5180.0249	Pass
	24	5180.0169	Pass	5180.0194	Pass	5180.0186	Pass	5180.0182	Pass
	20.4	5180.0186	Pass	5180.0231	Pass	5180.0215	Pass	5180.0197	Pass

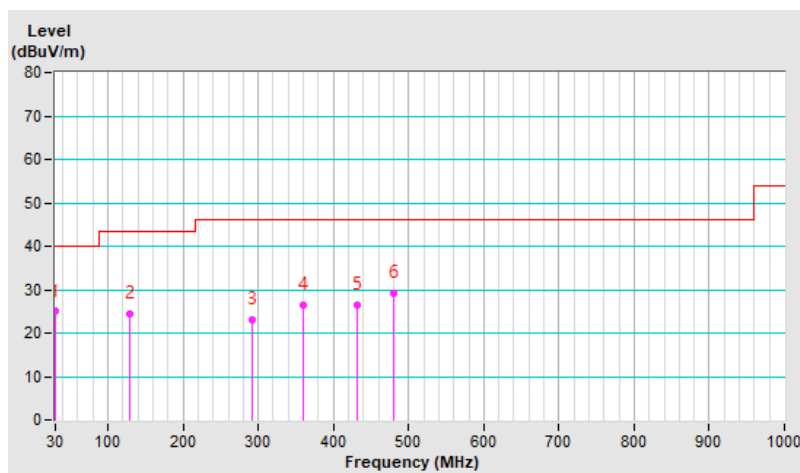
7.6 Unwanted Emissions below 1 GHz

RF Mode	802.11n (HT20)	Channel	CH 157 : 5785 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	12 Vdc	Environmental Conditions	22°C, 67% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	30.58	25.0 QP	40.0	-15.0	1.27 H	49	35.6	-10.6
2	129.28	24.4 QP	43.5	-19.1	1.83 H	82	34.3	-9.9
3	291.42	23.2 QP	46.0	-22.8	1.37 H	120	29.6	-6.4
4	359.99	26.5 QP	46.0	-19.5	1.96 H	89	31.5	-5.0
5	431.97	26.4 QP	46.0	-19.6	1.14 H	39	29.4	-3.0
6	479.98	29.1 QP	46.0	-16.9	1.70 H	15	31.2	-2.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

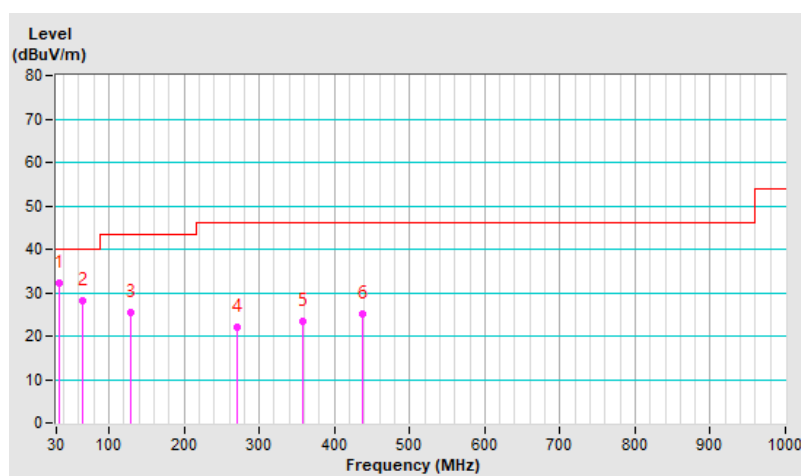


RF Mode	802.11n (HT20)	Channel	CH 157 : 5785 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	12 Vdc	Environmental Conditions	22°C, 67% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	34.22	32.3 QP	40.0	-7.7	1.32 V	158	42.6	-10.3
2	64.10	28.2 QP	40.0	-11.8	1.24 V	78	38.1	-9.9
3	129.81	25.5 QP	43.5	-18.0	1.40 V	148	35.3	-9.8
4	270.51	22.2 QP	46.0	-23.8	1.16 V	360	29.2	-7.0
5	357.96	23.5 QP	46.0	-22.5	1.57 V	153	28.5	-5.0
6	436.96	25.2 QP	46.0	-20.8	1.85 V	19	28.1	-2.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.



7.7 Unwanted Emissions above 1 GHz

RF Mode	802.11a	Channel	CH 36 : 5180 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	72.4 PK	74.0	-1.6	2.09 H	66	59.1	13.3
2	5150.00	51.5 AV	54.0	-2.5	2.09 H	66	38.2	13.3
3	*5180.00	110.1 PK			2.09 H	66	96.7	13.4
4	*5180.00	100.0 AV			2.09 H	66	86.6	13.4
5	#10360.00	63.1 PK	68.2	-5.1	2.61 H	72	39.1	24.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	71.6 PK	74.0	-2.4	3.30 V	123	58.3	13.3
2	5150.00	51.3 AV	54.0	-2.7	3.30 V	123	38.0	13.3
3	*5180.00	109.5 PK			3.30 V	123	96.1	13.4
4	*5180.00	99.4 AV			3.30 V	123	86.0	13.4
5	#10360.00	62.4 PK	68.2	-5.8	3.03 V	156	38.4	24.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	802.11a	Channel	CH 40 : 5200 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	72.7 PK	74.0	-1.3	2.43 H	40	59.4	13.3
2	5150.00	51.7 AV	54.0	-2.3	2.43 H	40	38.4	13.3
3	*5200.00	115.1 PK			2.43 H	40	101.5	13.6
4	*5200.00	105.1 AV			2.43 H	40	91.5	13.6
5	#10400.00	64.0 PK	68.2	-4.2	3.95 H	46	39.9	24.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	72.3 PK	74.0	-1.7	3.64 V	97	59.0	13.3
2	5150.00	51.2 AV	54.0	-2.8	3.64 V	97	37.9	13.3
3	*5200.00	113.6 PK			3.64 V	97	100.0	13.6
4	*5200.00	103.3 AV			3.64 V	97	89.7	13.6
5	#10400.00	63.3 PK	68.2	-4.9	3.37 V	182	39.2	24.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	802.11a	Channel	CH 48 : 5240 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5240.00	117.2 PK			2.39 H	39	103.4	13.8
2	*5240.00	106.4 AV			2.39 H	39	92.6	13.8
3	5350.00	59.4 PK	74.0	-14.6	2.39 H	39	45.1	14.3
4	5350.00	44.4 AV	54.0	-9.6	2.39 H	39	30.1	14.3
5	#10480.00	64.2 PK	68.2	-4.0	3.91 H	47	40.0	24.2
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5240.00	116.3 PK			3.60 V	96	102.5	13.8
2	*5240.00	105.7 AV			3.60 V	96	91.9	13.8
3	5350.00	59.1 PK	74.0	-14.9	3.60 V	96	44.8	14.3
4	5350.00	44.0 AV	54.0	-10.0	3.60 V	96	29.7	14.3
5	#10480.00	63.5 PK	68.2	-4.7	3.33 V	129	39.3	24.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # " : The radiated frequency is out of the restricted band.

RF Mode	802.11a	Channel	CH 149 : 5745 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5648.00	58.1 PK	68.2	-10.1	2.41 H	34	44.3	13.8
2	*5745.00	114.6 PK			2.41 H	34	100.8	13.8
3	*5745.00	104.2 AV			2.41 H	34	90.4	13.8
4	#5958.40	56.1 PK	68.2	-12.1	2.41 H	34	41.6	14.5
5	11490.00	63.7 PK	74.0	-10.3	2.93 H	40	36.1	27.6
6	11490.00	50.3 AV	54.0	-3.7	2.93 H	40	22.7	27.6
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5646.80	58.2 PK	88.2	-30.0	2.98 V	91	44.4	13.8
2	*5745.00	113.7 PK			2.98 V	91	99.9	13.8
3	*5745.00	103.2 AV			2.98 V	91	89.4	13.8
4	#5986.00	56.8 PK	68.2	-11.4	2.98 V	91	42.3	14.5
5	11490.00	63.0 PK	74.0	-11.0	2.71 V	124	35.4	27.6
6	11490.00	49.6 AV	54.0	-4.4	2.71 V	124	22.0	27.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # " : The radiated frequency is out of the restricted band.

RF Mode	802.11a	Channel	CH 157 : 5785 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5629.60	55.3 PK	68.2	-12.9	2.29 H	36	41.4	13.9
2	*5785.00	114.4 PK			2.29 H	36	100.7	13.7
3	*5785.00	104.0 AV			2.29 H	36	90.3	13.7
4	#5946.00	56.6 PK	68.2	-11.6	2.29 H	36	42.2	14.4
5	11570.00	63.4 PK	74.0	-10.6	3.05 H	42	36.0	27.4
6	11570.00	50.0 AV	54.0	-4.0	3.05 H	42	22.6	27.4
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5625.20	55.1 PK	68.2	-13.1	2.86 V	89	41.2	13.9
2	*5785.00	113.5 PK			2.86 V	89	99.8	13.7
3	*5785.00	103.2 AV			2.86 V	89	89.5	13.7
4	#5929.60	56.9 PK	68.2	-11.3	2.86 V	89	42.6	14.3
5	11570.00	62.7 PK	74.0	-11.3	2.59 V	122	35.3	27.4
6	11570.00	49.4 AV	54.0	-4.6	2.59 V	122	22.0	27.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # " : The radiated frequency is out of the restricted band.

RF Mode	802.11a	Channel	CH 165 : 5825 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5633.60	54.7 PK	68.2	-13.5	2.27 H	34	40.8	13.9
2	*5825.00	115.0 PK			2.27 H	34	101.1	13.9
3	*5825.00	104.7 AV			2.27 H	34	90.8	13.9
4	#5926.00	57.9 PK	68.2	-10.3	2.27 H	34	43.6	14.3
5	11650.00	64.1 PK	74.0	-9.9	3.03 H	40	36.4	27.7
6	11650.00	50.7 AV	54.0	-3.3	3.03 H	40	23.0	27.7
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5625.60	55.0 PK	68.2	-13.2	2.84 V	92	41.1	13.9
2	*5825.00	113.8 PK			2.84 V	92	99.9	13.9
3	*5825.00	103.4 AV			2.84 V	92	89.5	13.9
4	#5926.80	57.7 PK	68.2	-10.5	2.84 V	92	43.4	14.3
5	11650.00	63.4 PK	74.0	-10.6	2.57 V	125	35.7	27.7
6	11650.00	50.0 AV	54.0	-4.0	2.57 V	125	22.3	27.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # " : The radiated frequency is out of the restricted band.

RF Mode	802.11n (HT20)	Channel	CH 36 : 5180 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	73.0 PK	74.0	-1.0	2.09 H	65	59.7	13.3
2	5150.00	51.9 AV	54.0	-2.1	2.09 H	65	38.6	13.3
3	*5180.00	110.3 PK			2.09 H	65	96.9	13.4
4	*5180.00	99.4 AV			2.09 H	65	86.0	13.4
5	#10360.00	63.2 PK	68.2	-5.0	2.62 H	71	39.2	24.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	72.6 PK	74.0	-1.4	3.29 V	124	59.3	13.3
2	5150.00	51.5 AV	54.0	-2.5	3.29 V	124	38.2	13.3
3	*5180.00	109.7 PK			3.29 V	124	96.3	13.4
4	*5180.00	98.9 AV			3.29 V	124	85.5	13.4
5	#10360.00	62.5 PK	68.2	-5.7	3.02 V	155	38.5	24.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	802.11n (HT20)	Channel	CH 40 : 5200 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	73.0 PK	74.0	-1.0	2.43 H	39	59.7	13.3
2	5150.00	50.0 AV	54.0	-4.0	2.43 H	39	36.7	13.3
3	*5200.00	115.1 PK			2.43 H	39	101.5	13.6
4	*5200.00	104.0 AV			2.43 H	39	90.4	13.6
5	#10400.00	64.0 PK	68.2	-4.2	2.95 H	45	39.9	24.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	72.5 PK	74.0	-1.5	2.96 V	100	59.2	13.3
2	5150.00	49.5 AV	54.0	-4.5	2.96 V	100	36.2	13.3
3	*5200.00	114.3 PK			2.96 V	100	100.7	13.6
4	*5200.00	103.5 AV			2.96 V	100	89.9	13.6
5	#10400.00	63.3 PK	68.2	-4.9	2.69 V	133	39.2	24.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	802.11n (HT20)	Channel	CH 48 : 5240 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5240.00	117.3 PK			2.39 H	39	103.5	13.8
2	*5240.00	105.8 AV			2.39 H	39	92.0	13.8
3	5350.00	60.6 PK	74.0	-13.4	2.39 H	39	46.3	14.3
4	5350.00	43.2 AV	54.0	-10.8	2.39 H	39	28.9	14.3
5	#10480.00	63.1 PK	68.2	-5.1	2.90 H	44	38.9	24.2
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5240.00	116.0 PK			2.99 V	151	102.2	13.8
2	*5240.00	104.8 AV			2.99 V	151	91.0	13.8
3	5350.00	60.2 PK	74.0	-13.8	2.99 V	151	45.9	14.3
4	5350.00	42.8 AV	54.0	-11.2	2.99 V	151	28.5	14.3
5	#10480.00	62.4 PK	68.2	-5.8	2.72 V	184	38.2	24.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	802.11n (HT20)	Channel	CH 149 : 5745 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5648.80	65.1 PK	68.2	-3.1	2.41 H	33	51.3	13.8
2	*5745.00	115.2 PK			2.41 H	33	101.4	13.8
3	*5745.00	104.2 AV			2.41 H	33	90.4	13.8
4	#5929.60	56.4 PK	68.2	-11.8	2.41 H	33	42.1	14.3
5	11490.00	64.3 PK	74.0	-9.7	2.92 H	39	36.7	27.6
6	11490.00	50.9 AV	54.0	-3.1	2.92 H	39	23.3	27.6
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5649.20	64.3 PK	68.2	-3.9	2.97 V	90	50.5	13.8
2	*5745.00	114.3 PK			2.97 V	90	100.5	13.8
3	*5745.00	103.6 AV			2.97 V	90	89.8	13.8
4	#5978.00	56.5 PK	68.2	-11.7	2.97 V	90	42.0	14.5
5	11490.00	63.6 PK	74.0	-10.4	2.72 V	123	36.0	27.6
6	11490.00	50.2 AV	54.0	-3.8	2.72 V	123	22.6	27.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # " : The radiated frequency is out of the restricted band.

RF Mode	802.11n (HT20)	Channel	CH 157 : 5785 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5645.20	55.6 PK	68.2	-12.6	2.29 H	32	41.8	13.8
2	*5785.00	115.4 PK			2.29 H	32	101.7	13.7
3	*5785.00	104.4 AV			2.29 H	32	90.7	13.7
4	#5926.40	57.3 PK	68.2	-10.9	2.29 H	32	43.0	14.3
5	11570.00	64.4 PK	74.0	-9.6	2.80 H	38	37.0	27.4
6	11570.00	51.0 AV	54.0	-3.0	2.80 H	38	23.6	27.4
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5641.20	55.3 PK	68.2	-12.9	2.86 V	89	41.5	13.8
2	*5785.00	114.4 PK			2.86 V	89	100.7	13.7
3	*5785.00	103.2 AV			2.86 V	89	89.5	13.7
4	#5992.40	56.8 PK	68.2	-11.4	2.86 V	89	42.3	14.5
5	11570.00	63.7 PK	74.0	-10.3	2.59 V	126	36.3	27.4
6	11570.00	50.3 AV	54.0	-3.7	2.59 V	126	22.9	27.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # " : The radiated frequency is out of the restricted band.

RF Mode	802.11n (HT20)	Channel	CH 165 : 5825 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
Input Power	12 Vdc	Environmental Conditions	18.1°C, 65.2% RH
Tested By	Jed Wu		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5602.80	55.0 PK	68.2	-13.2	2.37 H	32	41.1	13.9
2	*5825.00	116.1 PK			2.37 H	32	102.2	13.9
3	*5825.00	105.1 AV			2.37 H	32	91.2	13.9
4	#5926.80	62.5 PK	68.2	-5.7	2.37 H	32	48.2	14.3
5	11650.00	65.2 PK	74.0	-8.8	2.88 H	37	37.5	27.7
6	11650.00	51.8 AV	54.0	-2.2	2.88 H	37	24.1	27.7
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5637.60	55.3 PK	68.2	-12.9	2.94 V	93	41.5	13.8
2	*5825.00	114.6 PK			2.94 V	93	100.7	13.9
3	*5825.00	103.7 AV			2.94 V	93	89.8	13.9
4	#5930.40	62.0 PK	68.2	-6.2	2.94 V	93	47.6	14.4
5	11650.00	64.5 PK	74.0	-9.5	2.67 V	122	36.8	27.7
6	11650.00	51.1 AV	54.0	-2.9	2.67 V	122	23.4	27.7

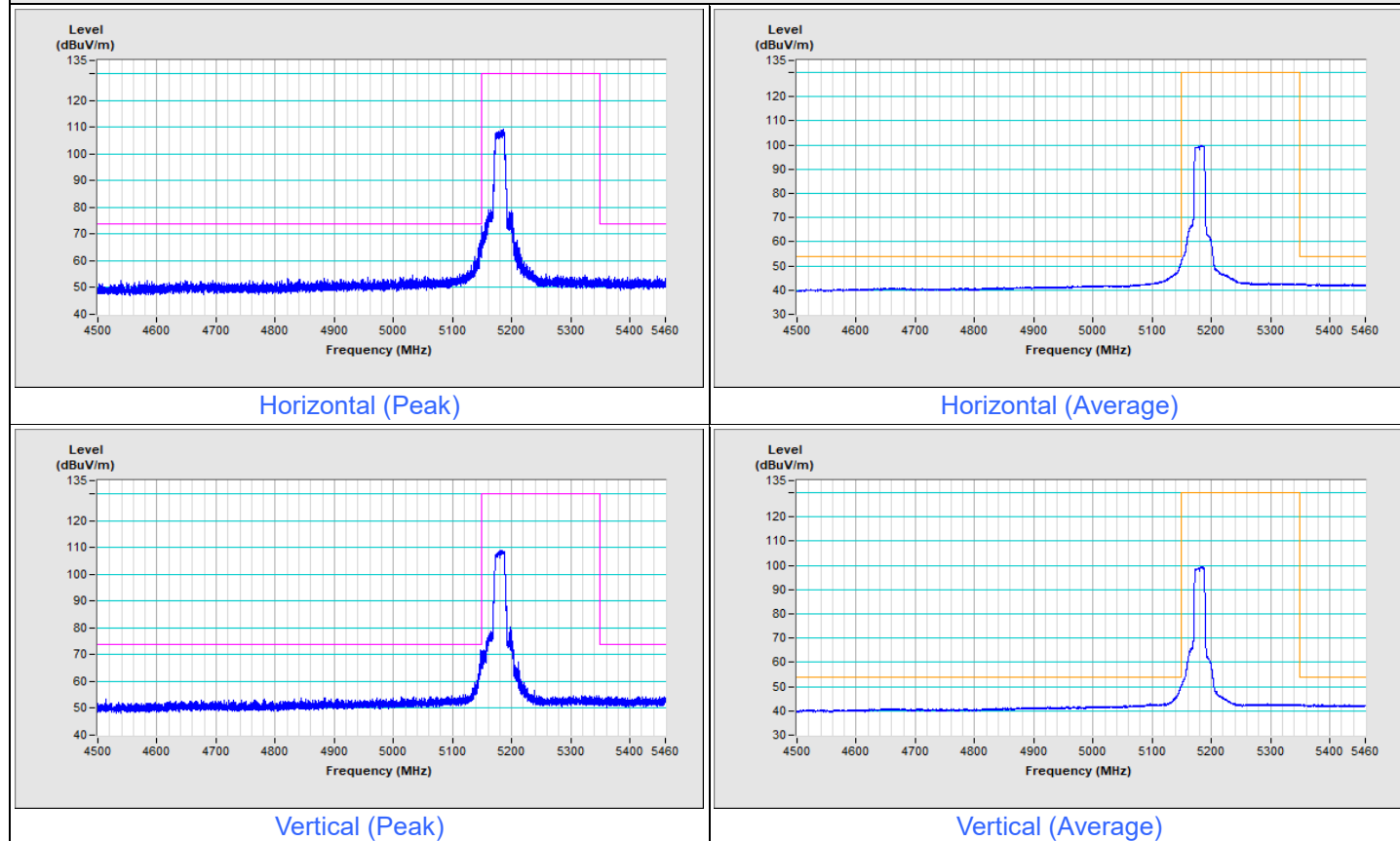
Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency, the limit was restricted at the RF Output Power.
6. " # " : The radiated frequency is out of the restricted band.

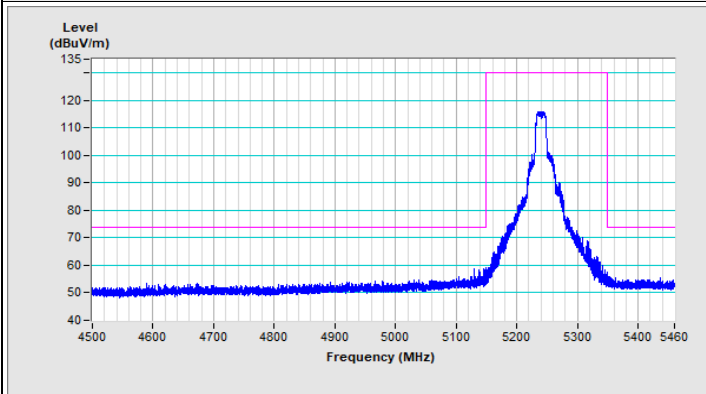
Plot of Band Edge

Frequency Range	4.5 GHz ~ 5.46 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
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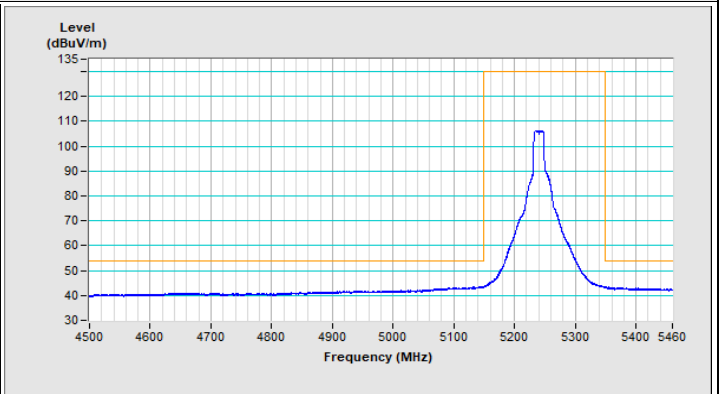
802.11a Channel 36



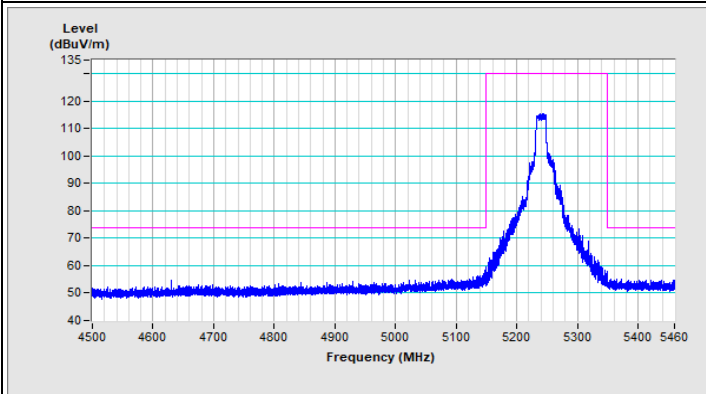
802.11a Channel 48



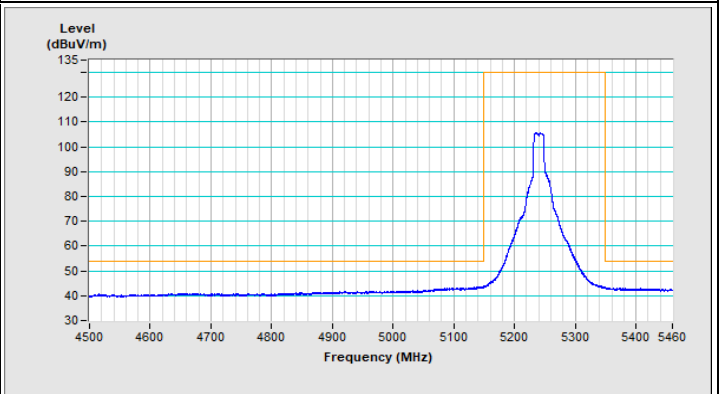
Horizontal (Peak)



Horizontal (Average)



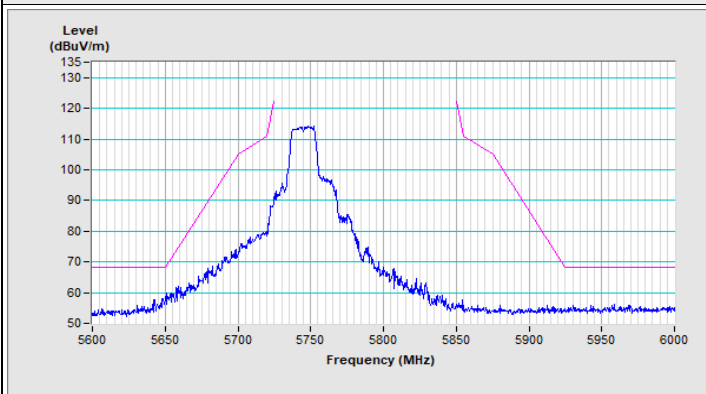
Vertical (Peak)



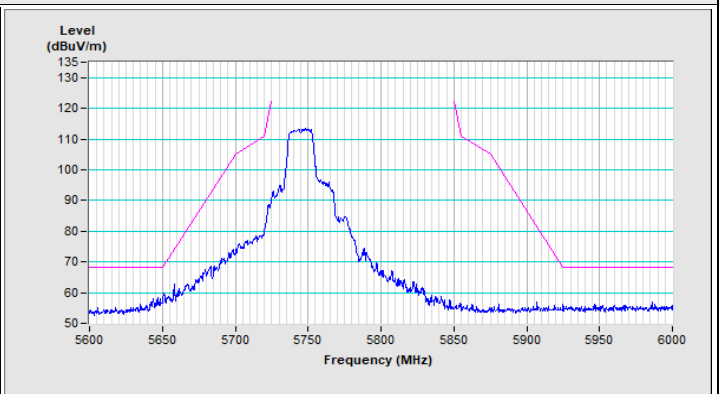
Vertical (Average)

Frequency Range	5.6 GHz ~ 6 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak
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802.11a Channel 149

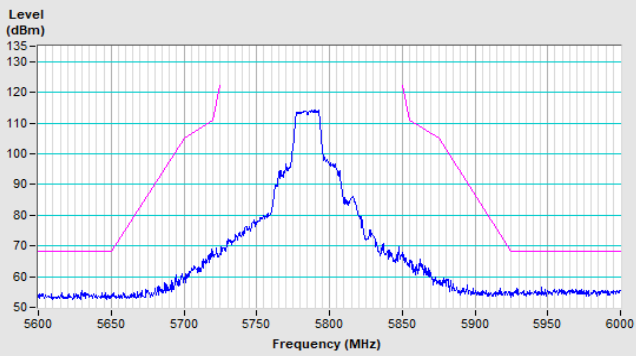


Horizontal (Peak)

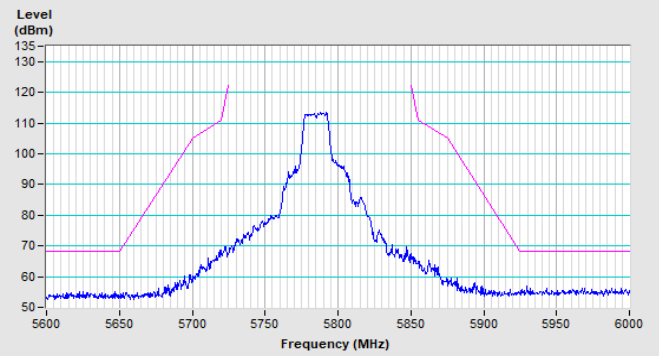


Vertical (Peak)

802.11a Channel 157

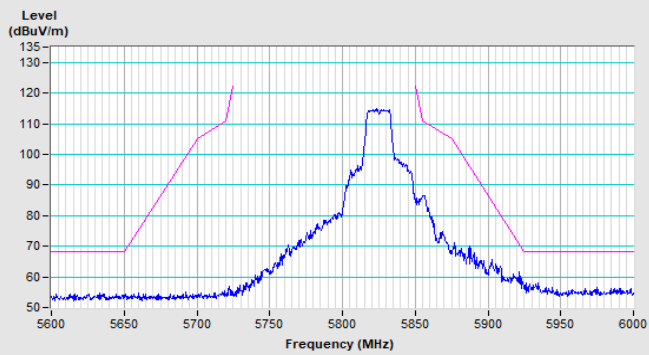


Horizontal (Peak)

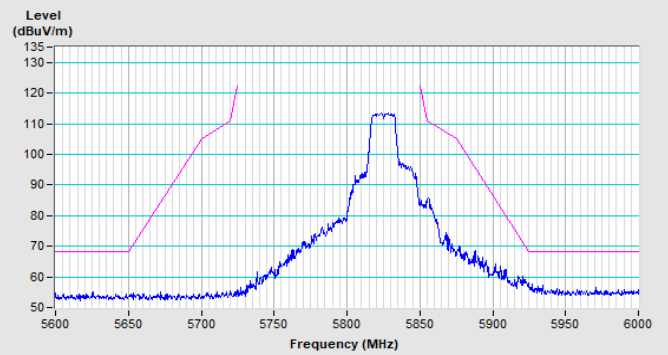


Vertical (Peak)

802.11a Channel 165



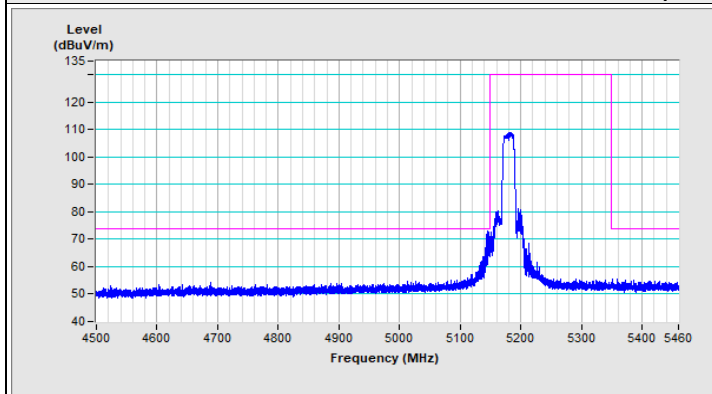
Horizontal (Peak)



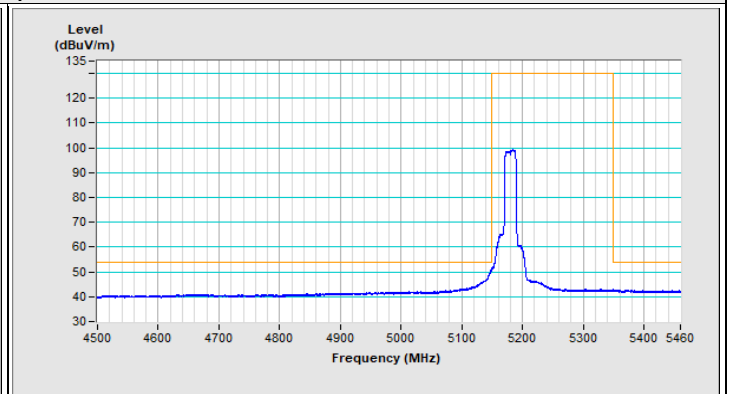
Vertical (Peak)

Frequency Range	4.5 GHz ~ 5.46 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=10 Hz, DET=Peak
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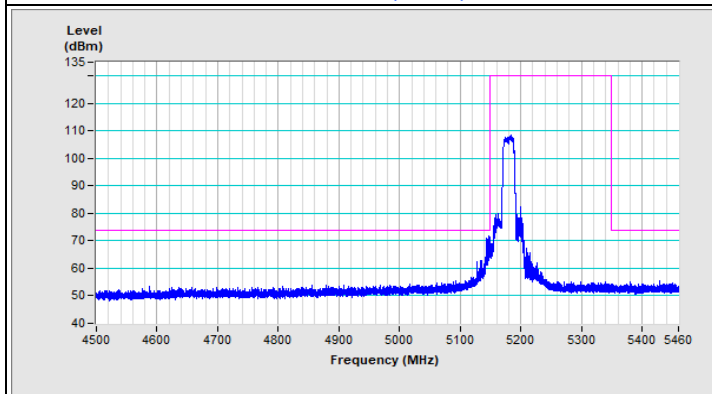
802.11n (HT20) Channel 36



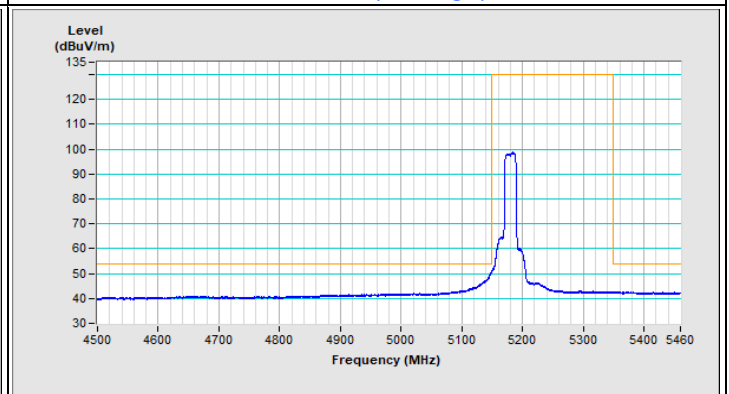
Horizontal (Peak)



Horizontal (Average)

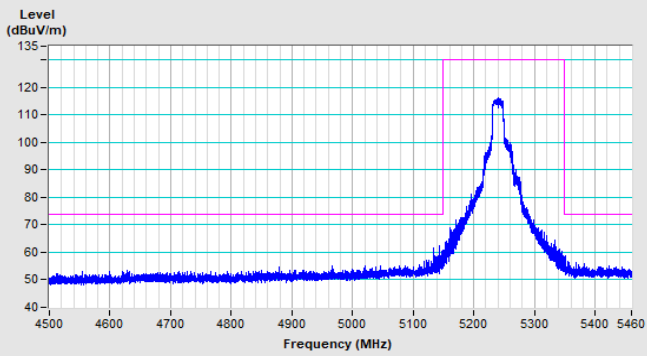


Vertical (Peak)

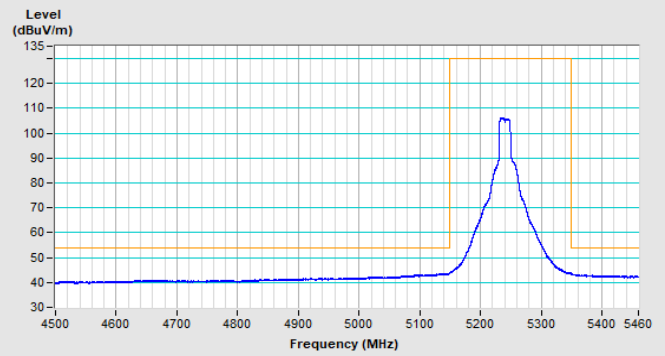


Vertical (Average)

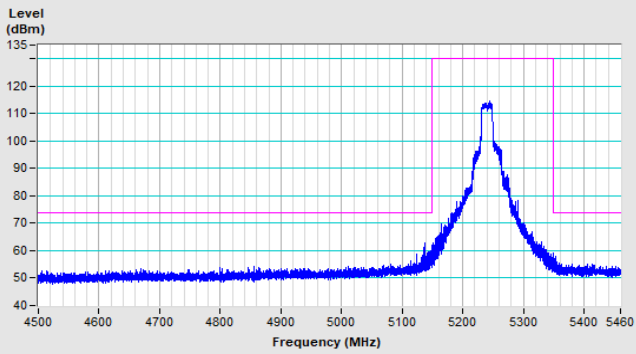
802.11n (HT20) Channel 48



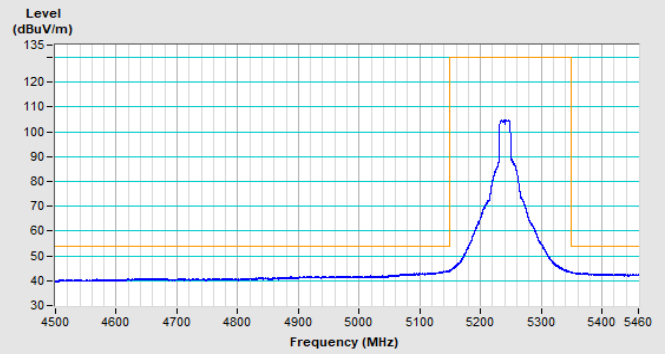
Horizontal (Peak)



Horizontal (Average)



Vertical (Peak)



Vertical (Average)

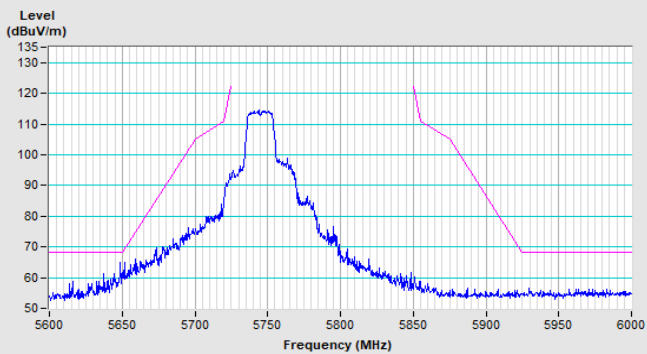
Frequency Range

5.6 GHz ~ 6 GHz

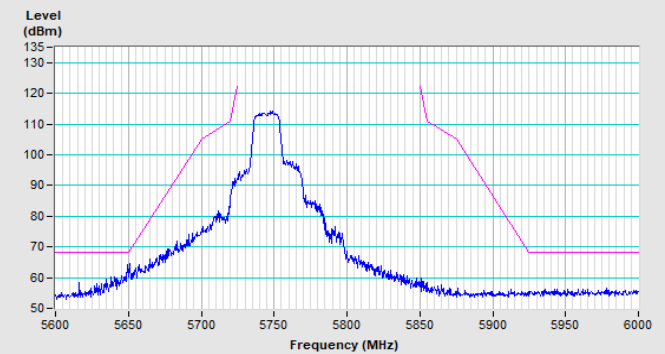
Detector Function &
Bandwidth

PK: RB=1 MHz, VB=3 MHz, DET=Peak

802.11n (HT20) Channel 149

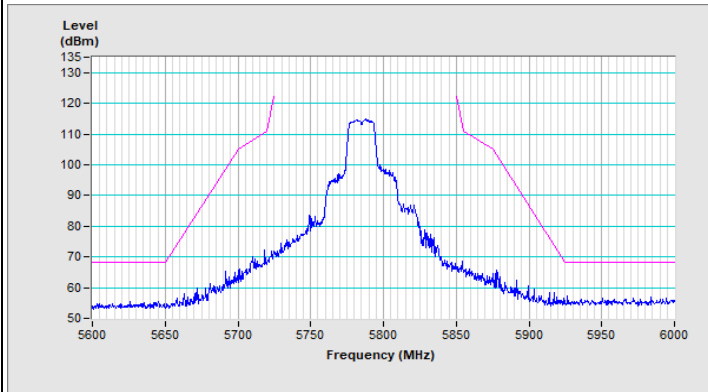


Horizontal (Peak)

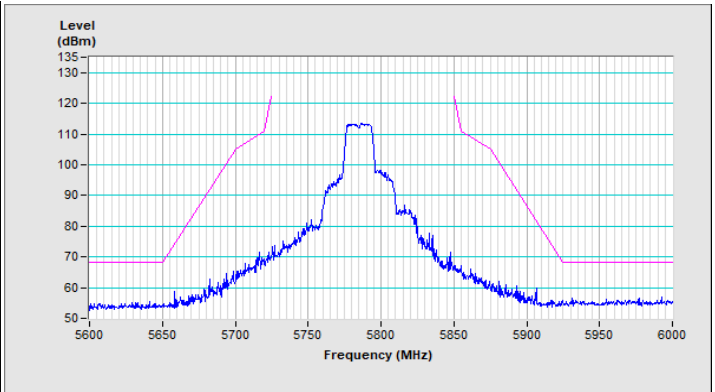


Vertical (Peak)

802.11n (HT20) Channel 157

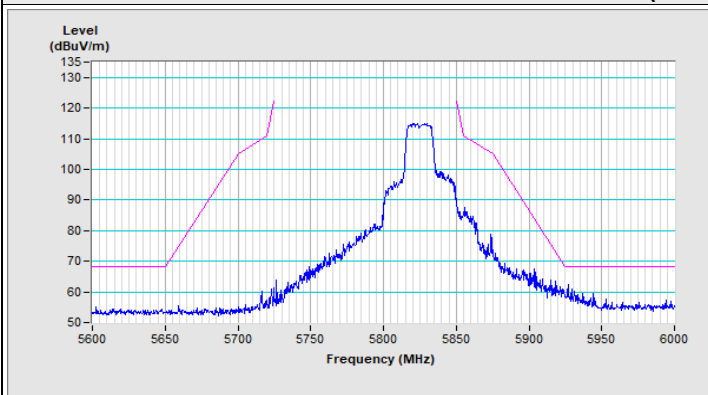


Horizontal (Peak)

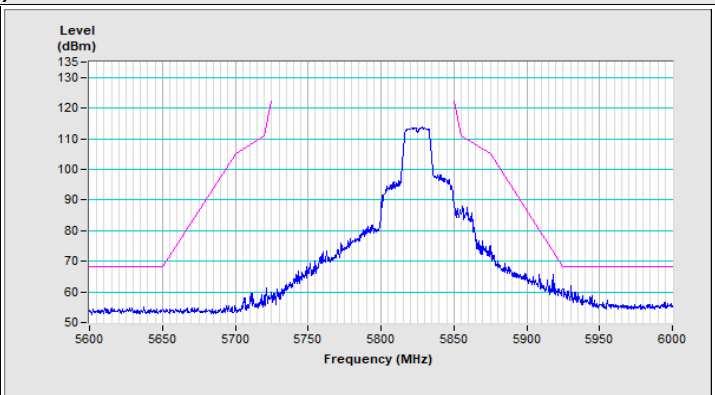


Vertical (Peak)

802.11n (HT20) Channel 165



Horizontal (Peak)



Vertical (Peak)

8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

9 Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: <http://ee.bureauveritas.com.tw>

The address and road map of all our labs can be found in our web site also.

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