



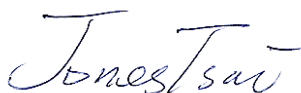
NCC RADIO TEST REPORT

Equipment : 無線音箱
Brand Name : Marshall
Model Name : WOBURN MULTI-ROOM
Applicant : 百滋國際股份有限公司
台北市松山區寶清街 17 號 5 樓之 1
Manufacturer : Zound Industries International AB
Room 411-412, 4th Floor, Main Building, No. 99 Qiao
Cheng East Road, Nanshan District, Shenzhen City, China
Standard : NCC LP0002 (2018-01-10)

The product was received on May 09, 2018, and testing was started from Jun. 12, 2018 and completed on Jul. 04, 2018. We, SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in NCC LP0002 (2018-01-10) and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Jones Tsai

SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issue Date
TR850937E	01	Initial issue of report	Jul. 10, 2018

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	LP0002 4.7.3 4.7.5	6dB, 26dB and 99% Occupied Bandwidth	Pass	-
3.2	LP0002 4.7.3	Maximum Conducted Output Power	Pass	-
3.3	LP0002 4.7.3	Power Spectral Density	Pass	-
3.4	LP0002 4.7.4	Unwanted Emissions	Pass	Under limit 7.07 dB at 5617.750 MHz
3.5	LP0002 2.11	Receiver Radiated Emission	Pass	Under limit 6.31 dB at 35.130 MHz
3.6	LP0002 2.3	AC Conducted Emission	Pass	Under limit 13.83 dB at 0.191 MHz
3.7	LP0002 4.7.6	Automatically Discontinue Transmission	Pass	-
3.8	LP0002 2.2 4.7.8	Antenna Requirement	Pass	-
3.9	LP0002 2.2 5.20.2	Maximum Power Density	Pass	-

Reviewed by: Joseph Lin
Report Producer: Yuping Lin

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, and Wi-Fi 5GHz 802.11a/n/ac.

Product Specification subjective to this standard	
Antenna Type	WLAN: FPCB Antenna Bluetooth: FPCB Antenna

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 and TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	Sporton Site No.	
	TH05-HY	CO05-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Dist, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855	
Test Site No.	Sporton Site No.	
	03CH11-HY	

Note: The test site complies with ANSI C63.4 2014 requirement.



1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ NCC LP0002 (2018-01-10)
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01
- ♦ ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5725-5850 MHz Band 4 (U-NII-3)	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155 [#]	5775	165	5825

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40.
2. The above Frequency and Channel in "[#]" were 802.11ac VHT80.

2.2 Test Mode

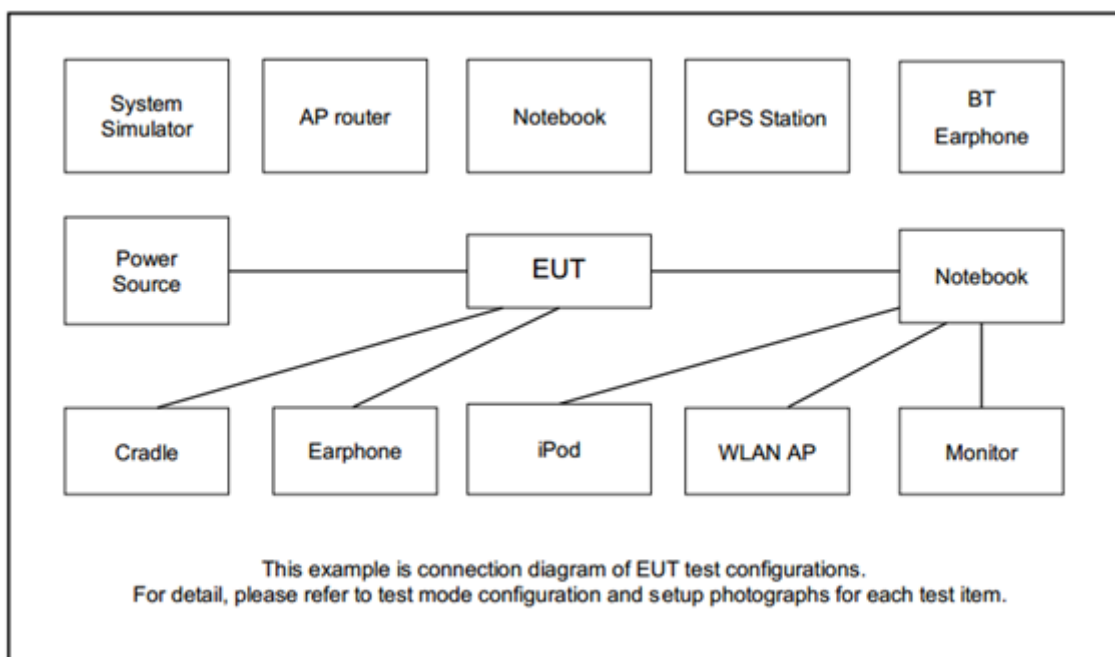
Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20 (Covered by HT20)	MCS0
802.11ac VHT40 (Covered by HT40)	MCS0
802.11ac VHT80	MCS0

Test Cases	
AC Conducted Emission	Mode 1: Bluetooth Link + AUX In (Load with iPod) + RCA In (Load with iPod) + Phone Play MP3 via Bluetooth Function + Power Cord Mode 2: WLAN (2.4GHz) Link + AUX In (Load with iPod) + RCA In (Load with iPod) + Phone Play MP3 via WLAN (2.4GHz) Function + Power Cord Mode 3: WLAN (5GHz) Link + AUX In (Load with iPod) + RCA In (Load with iPod) + Phone Play MP3 via WLAN (5GHz) Function + Power Cord Mode 4: Bluetooth Idle + AUX In (Load with iPod) + RCA In (Load with iPod) + Power Cord Mode 5: WLAN (2.4GHz) Idle + AUX In (Load with iPod) + RCA In (Load with iPod) + Power Cord Mode 6: WLAN (5GHz) Idle + AUX In (Load with iPod) + RCA In (Load with iPod) + Power Cord
Receiver Radiated Emission	Mode 1 : WLAN (5GHz) Idle + Power Cord
Remark: The worst case of conducted emission is mode 2; only the test data of it was reported.	

Ch. #		Band IV : 5725-5850 MHz			
		802.11a	802.11n HT20	802.11n HT40	802.11ac VHT80
L	Low	149	149	151	-
M	Middle	157	157	-	155
H	High	165	165	159	-

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8m
2.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
3.	iPhone	Apple	A1687	BCG-E2944A	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “Putty” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)}\end{aligned}$$

3 Test Result

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

3.1.1 Description of 6dB and 26dB and 99% Occupied Bandwidth

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

26dB and 99% Occupied bandwidth are reporting only.

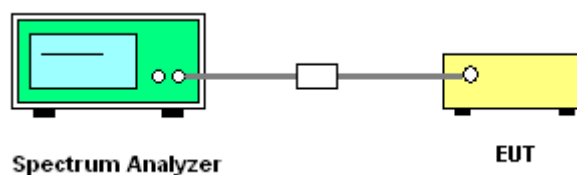
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

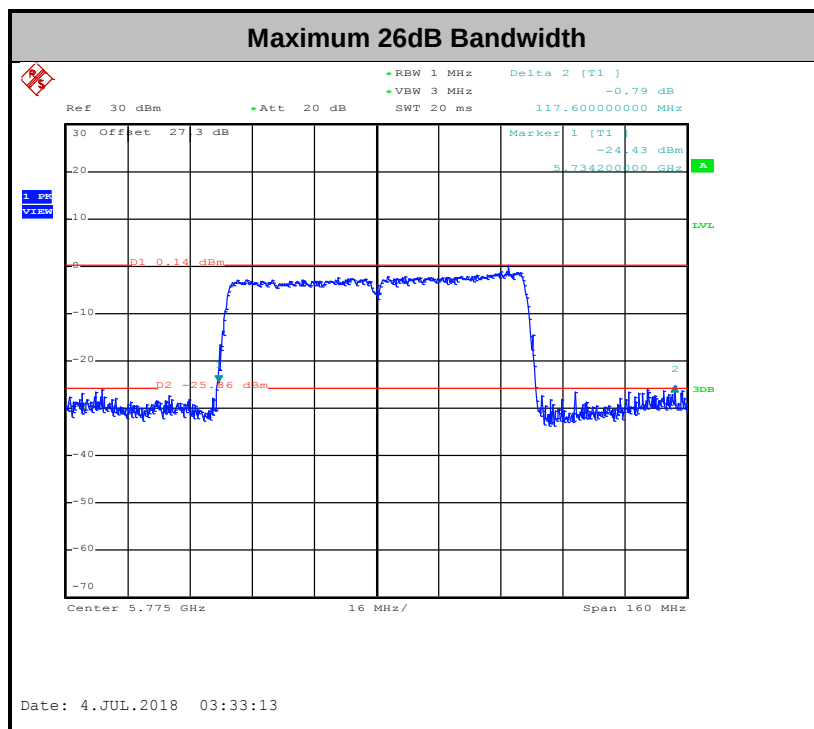
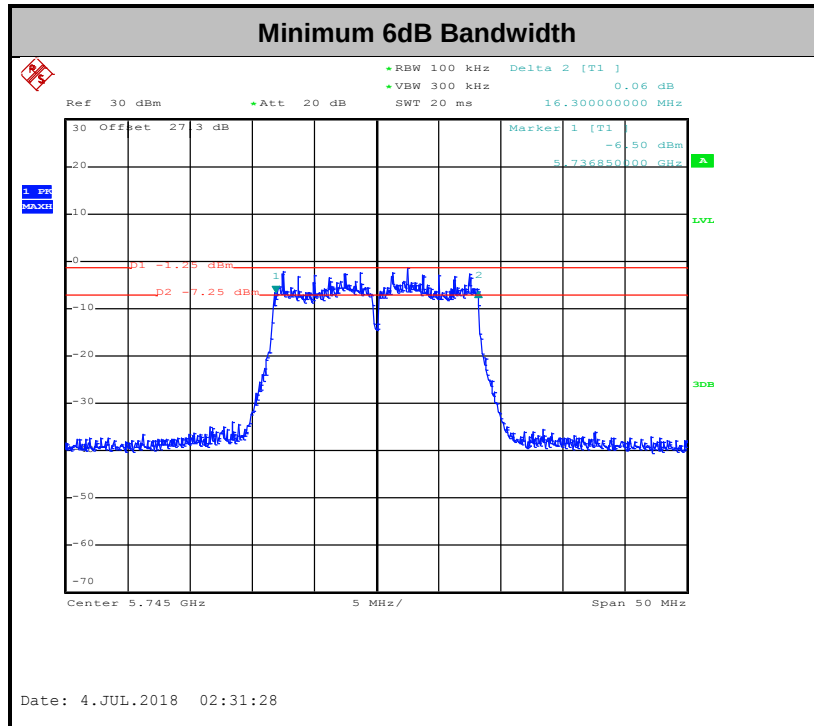
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section C) Emission bandwidth for the band 5.725-5.85GHz
2. Set RBW = 100kHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 6 dB down from the peak of the emission.
7. Measure and record the results in the test report.

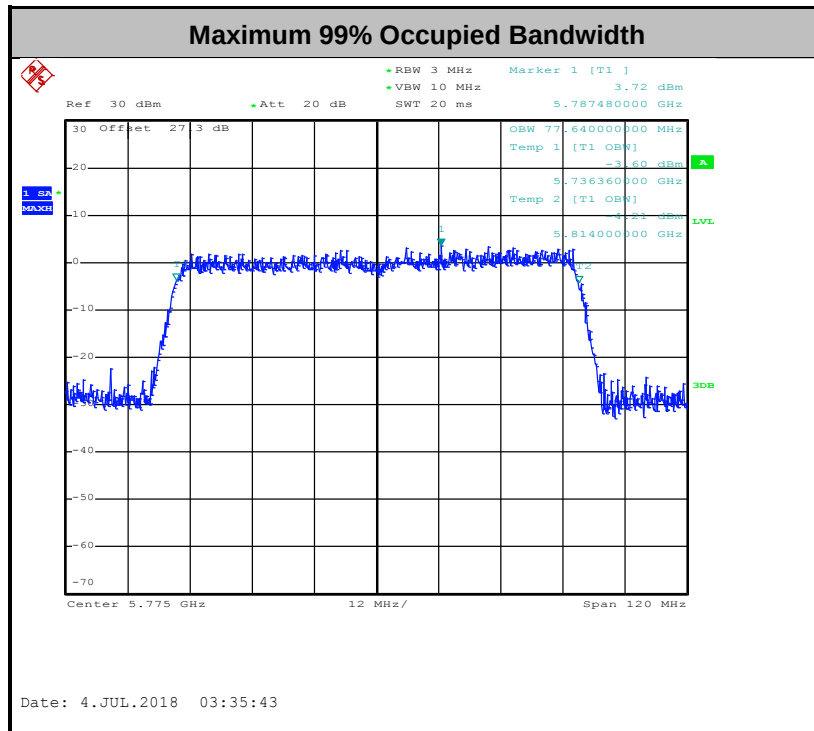
3.1.4 Test Setup



3.1.5 Test Result of 6dB and 26dB and 99% Occupied Bandwidth

Please refer to Appendix A.





Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

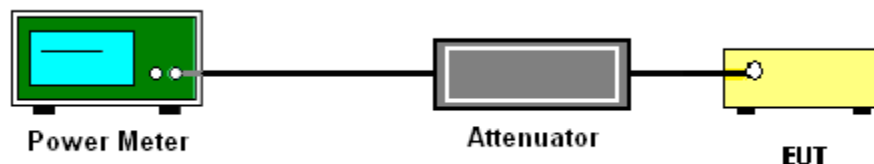
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, $10 \log(1/x)$, where x is the duty cycle.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section F) Maximum power spectral density.

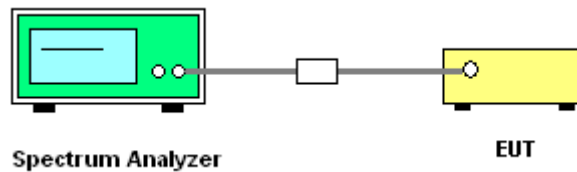
Method SA-2

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz.
- Set VBW $\geq$ 1 MHz.
- Number of points in sweep $\geq$ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add $10 \log(500\text{kHz}/\text{RBW})$ to the test result.
- Add $10 \log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add $10 \log(1/0.25) = 6$ dB if the duty cycle is 25 percent.

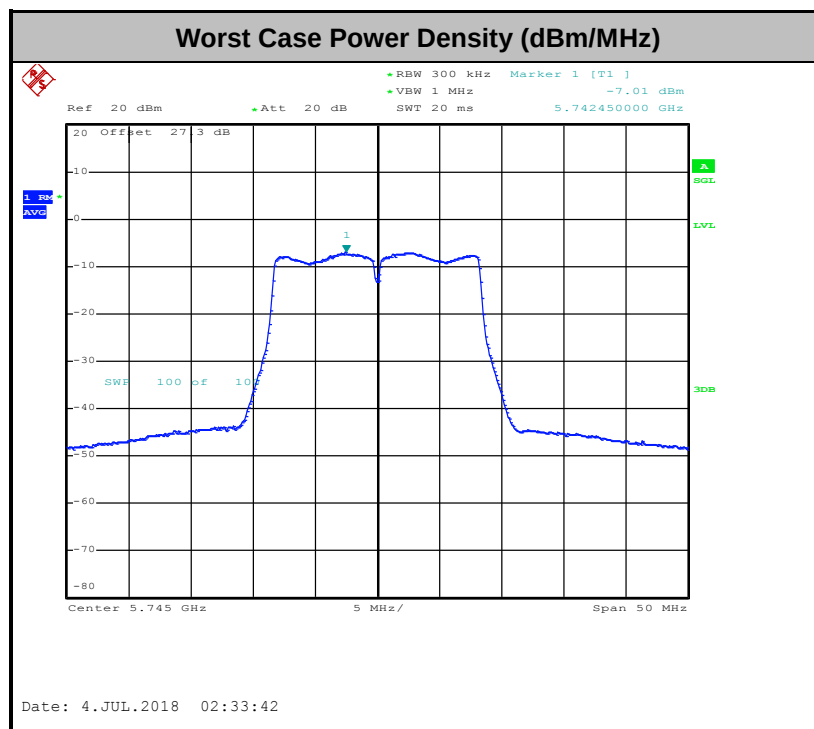
1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
2. Each plot has already offset with cable loss, and attenuator loss. Measure the PSD and record it.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



3.4 Unwanted Emissions Measurement

3.4.1 Limit of Unwanted Emissions

- (1) For transmitters operating in the 5.725-5.85 GHz band:

All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

- (2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency (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

Note: The following formula is used to convert the EIRP to field strength.

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

EIRP (dBm)	Field Strength at 3m (dBμV/m)
-17	78.3
- 27	68.3

- (3) ANSI C63.10-2013 clause 12.7.3 note 97

As specified by regulatory requirements, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit. However, an out-of-band emission that complies with both the average and peak general regulatory limits is not required to satisfy the peak emission limit.

3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

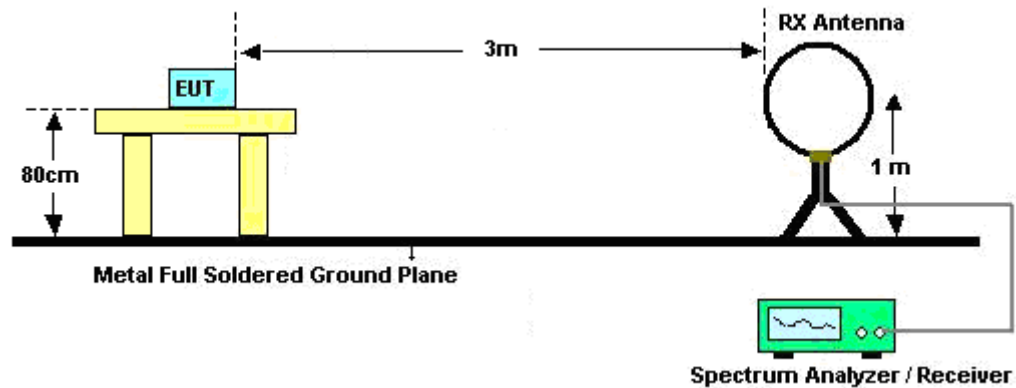
3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW $\geq$ 3 MHz
 - Detector = Peak
 - Sweep time = auto
 - Trace mode = max hold
 - (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
 - RBW = 1 MHz
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.

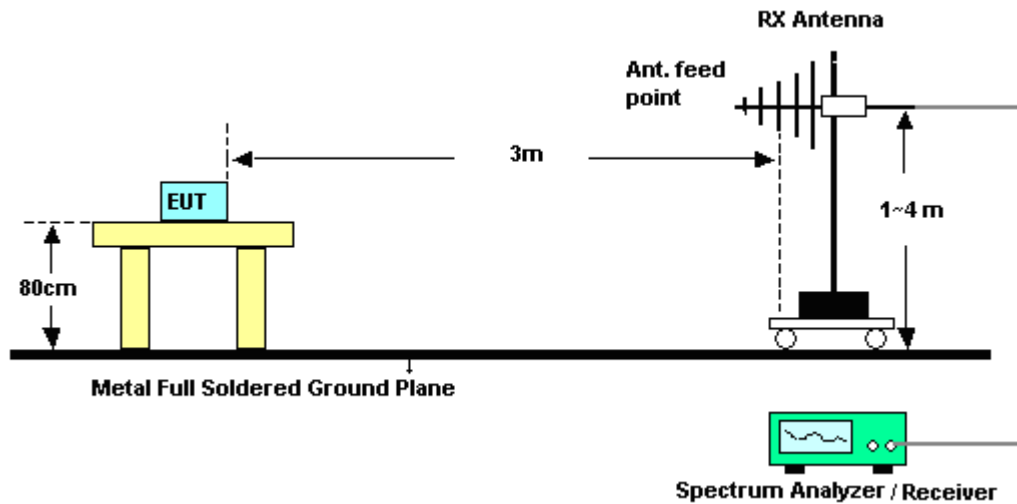
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.4.4 Test Setup

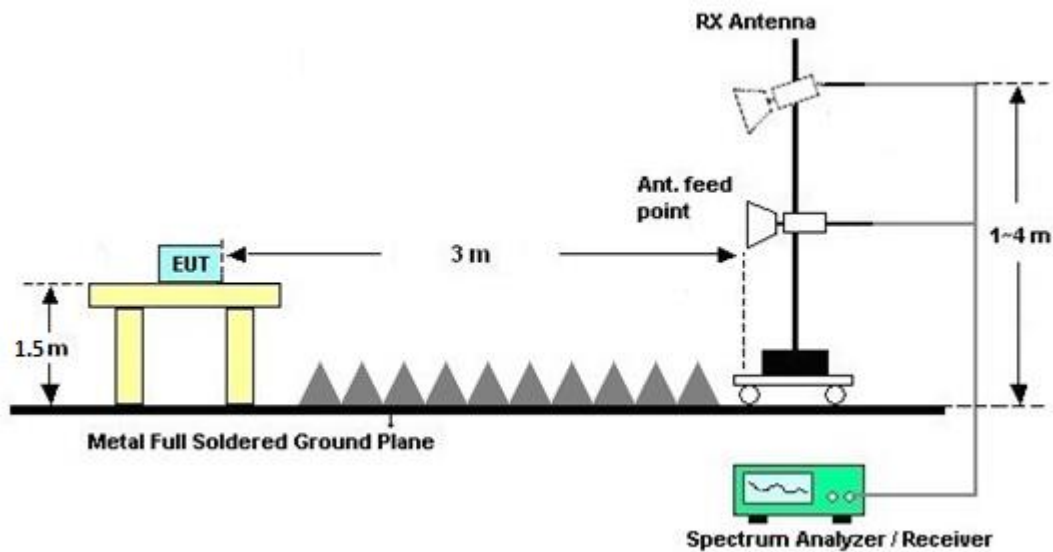
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 5.13 was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.4.7 Duty Cycle

Please refer to Appendix E.

3.4.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.5 Test of Receiver Radiated Emission Measurement

3.5.1 Limit of Receiver Radiated Emission

Frequency (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

3.5.2 Measuring Instruments

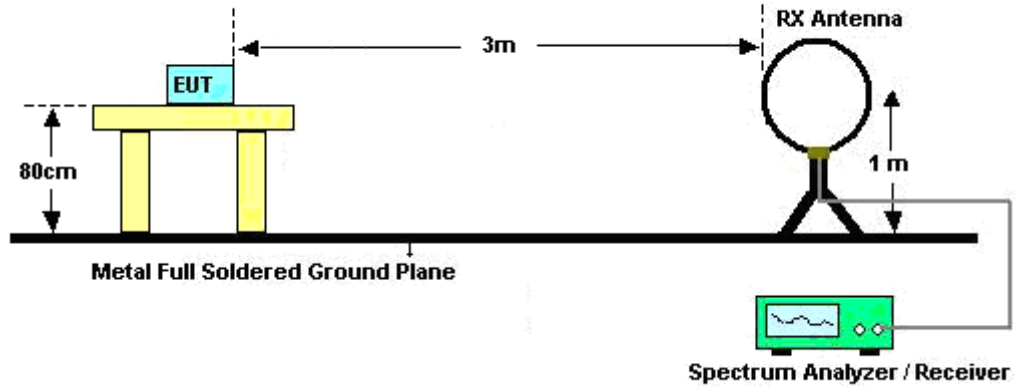
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

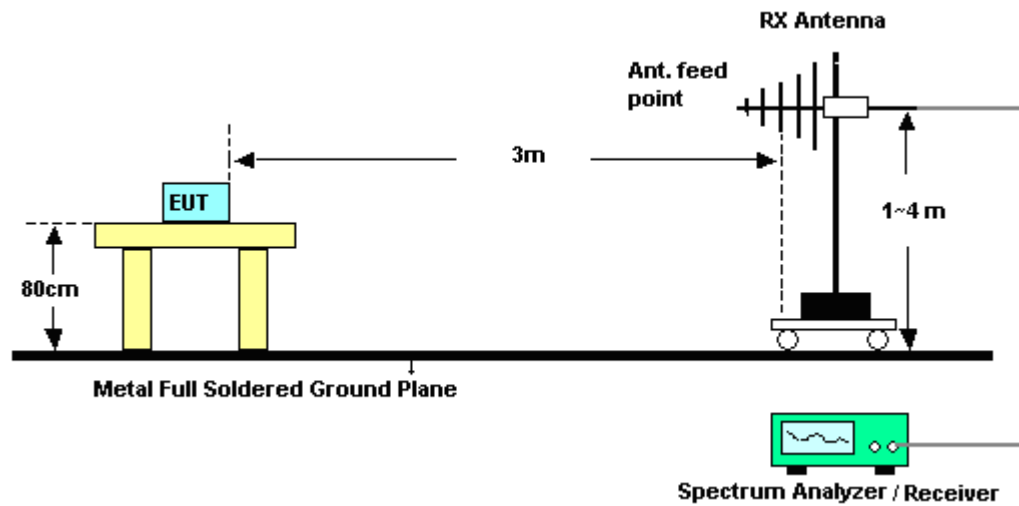
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
8. Emission level (dBμV/m) = 20 log Emission level (μV/m)
9. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

3.5.4 Test Setup

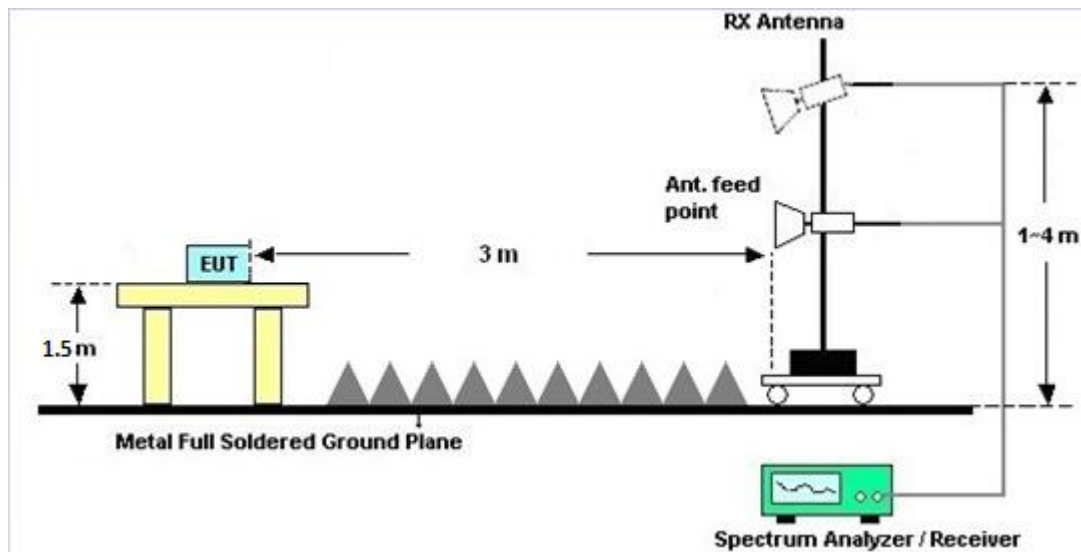
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.5.5 Test Result of Receiver Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 5.13 was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.5.6 Test Result of Receiver Radiated Spurious Emission (30MHz ~ 5th Harmonic)

Please refer to Appendix D.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

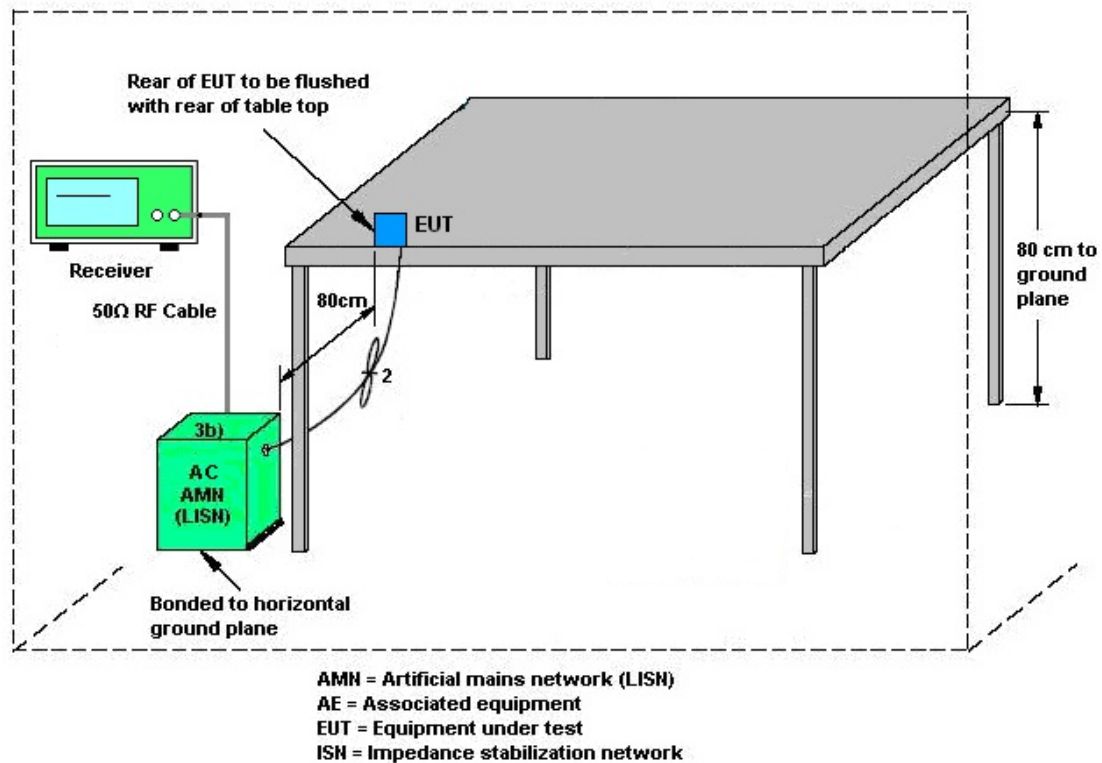
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Automatically Discontinue Transmission

3.7.1 Limit of Automatically Discontinue Transmission

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

3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.7.3 Test Result of Automatically Discontinue Transmission

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

3.8 Antenna Requirements

3.8.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.8.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.8.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

3.9 Maximum Power Density

3.9.1 RF Exposure Limit Introduction

According to NCC LP0002, the criteria listed in Table shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §5.20.2.1 and §5.20.2.2.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

3.9.2 Standalone Power Density Calculation

Please refer to Appendix A.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Meter	Anritsu	ML2495A	0932001	N/A	Sep. 26, 2017	Jun. 12, 2018~ Jul. 04, 2018	Sep. 25, 2018	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	0846202	300MHz~40GHz	Sep. 26, 2017	Jun. 12, 2018~ Jul. 04, 2018	Sep. 25, 2018	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9kHz ~ 30GHz	Nov. 13, 2017	Jun. 12, 2018~ Jul. 04, 2018	Nov. 12, 2018	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1300484	N/A	Mar. 01, 2018	Jun. 12, 2018~ Jul. 04, 2018	Feb. 28, 2019	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jun. 12, 2018	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	3.6GHz	Dec. 08, 2017	Jun. 12, 2018	Dec. 07, 2018	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 30, 2017	Jun. 12, 2018	Nov. 29, 2018	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Jun. 12, 2018	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 03, 2018	Jun. 12, 2018	Jan. 02, 2019	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 03, 2018	Jun. 12, 2018	Jan. 02, 2019	Conduction (CO05-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Jun. 16, 2018~ Jun. 22, 2018	Nov. 22, 2018	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 14, 2017	Jun. 16, 2018~ Jun. 22, 2018	Oct. 13, 2018	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 16, 2017	Jun. 16, 2018~ Jun. 22, 2018	Oct. 15, 2018	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 27, 2017	Jun. 16, 2018~ Jun. 22, 2018	Nov. 26, 2018	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Jan. 16, 2018	Jun. 16, 2018~ Jun. 22, 2018	Jan. 15, 2019	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-303K	1710001800054002	1GHz~18GHz	Apr. 17, 2018	Jun. 16, 2018~ Jun. 22, 2018	Apr. 16, 2019	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Jan. 16, 2018	Jun. 16, 2018~ Jun. 22, 2018	Jan. 15, 2020	Radiation (03CH11-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	Jun. 16, 2018~ Jun. 22, 2018	Jul. 17, 2018	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 19, 2017	Jun. 16, 2018~ Jun. 22, 2018	Oct. 18, 2018	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Jun. 16, 2018~ Jun. 22, 2018	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Jun. 16, 2018~ Jun. 22, 2018	N/A	Radiation (03CH11-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4	9K-30M	Mar. 20, 2018	Jun. 16, 2018~ Jun. 22, 2018	Mar. 19, 2019	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4	30M-18G	Mar. 15, 2018	Jun. 16, 2018~ Jun. 22, 2018	Mar. 14, 2019	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2589/2	30M-18G	Mar. 15, 2018	Jun. 16, 2018~ Jun. 22, 2018	Mar. 14, 2019	Radiation (03CH11-HY)
Filter	Wainwright	WHKX8-5872. 5-6750-18000 -40ST	SN3	6.75GHz High Pass	Sep. 18, 2017	Jun. 16, 2018~ Jun. 22, 2018	Sep. 17, 2018	Radiation (03CH11-HY)
Filter	Wainwright	WLK4-1000-1 530-8000-40S S	SN11	1G Low Pass	Sep. 18, 2017	Jun. 16, 2018~ Jun. 22, 2018	Sep. 17, 2018	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-00104 2	N/A	N/A	Jun. 16, 2018~ Jun. 22, 2018	N/A	Radiation (03CH11-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.7
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.2
---	-----

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.5
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.2
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Appendix A. Test Result of Conducted Test Items

Test Engineer:	Shiang Wang/Shiming Liu	Temperature:	21~25	°C
Test Date:	2018/6/12~2018/7/4	Relative Humidity:	51~54	%

Maximum Power Density				
Max. Power	Gain	EIRP	20 cm PSD	PSD Limit
8.61	4.30	12.91	0.004	1.0
dBm	dBi	dBm	mW/cm ²	mW/cm ²

TEST RESULTS DATA
6dB and 26dB EBW and 99% OBW

Band IV												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)		26dB Bandwidth (MHz)		6 dB Bandwidth (MHz)		6 dB Bandwidth Min. Limit (MHz)	Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	149	5745	16.70	-	21.30	-	16.30	-	0.5	Pass
11a	6Mbps	1	157	5785	16.75	-	21.15	-	16.30	-	0.5	Pass
11a	6Mbps	1	165	5825	16.80	-	21.30	-	16.30	-	0.5	Pass
HT20	MCS0	1	149	5745	17.70	-	21.65	-	17.30	-	0.5	Pass
HT20	MCS0	1	157	5785	17.75	-	21.70	-	17.50	-	0.5	Pass
HT20	MCS0	1	165	5825	17.70	-	21.60	-	17.30	-	0.5	Pass
HT40	MCS0	1	151	5755	36.40	-	41.94	-	35.40	-	0.5	Pass
HT40	MCS0	1	159	5795	36.50	-	57.06	-	35.28	-	0.5	Pass
VHT80	MCS0	1	155	5775	77.64	-	117.60	-	76.16	-	0.5	Pass

TEST RESULTS DATA
Average Power Table

Band IV													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)		FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	0.08	-	8.61	-	30.00	-	4.30	-	Pass
11a	6Mbps	1	157	5785	0.08	-	8.10	-	30.00	-	4.30	-	Pass
11a	6Mbps	1	165	5825	0.08	-	8.35	-	30.00	-	4.30	-	Pass
HT20	MCS0	1	149	5745	0.06	-	7.59	-	30.00	-	4.30	-	Pass
HT20	MCS0	1	157	5785	0.06	-	7.90	-	30.00	-	4.30	-	Pass
HT20	MCS0	1	165	5825	0.06	-	7.44	-	30.00	-	4.30	-	Pass
HT40	MCS0	1	151	5755	0.13	-	7.88	-	30.00	-	4.30	-	Pass
HT40	MCS0	1	159	5795	0.13	-	8.07	-	30.00	-	4.30	-	Pass
VHT20	MCS0	1	149	5745	0.08	-	7.42	-	30.00	-	4.30	-	Pass
VHT20	MCS0	1	157	5785	0.08	-	7.89	-	30.00	-	4.30	-	Pass
VHT20	MCS0	1	165	5825	0.08	-	7.43	-	30.00	-	4.30	-	Pass
VHT40	MCS0	1	151	5755	0.13	-	7.64	-	30.00	-	4.30	-	Pass
VHT40	MCS0	1	159	5795	0.13	-	7.03	-	30.00	-	4.30	-	Pass
VHT80	MCS0	1	155	5775	0.28	-	8.07	-	30.00	-	4.30	-	Pass

TEST RESULTS DATA
Power Spectral Density

Band IV															
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		10log (500kHz /RBW) Factor (dB)		Average Power Density (dBm/500kHz)		Average PSD Limit (dBm/500kHz)		DG (dBi)		Pass /Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	0.08	-	2.22	-	-4.71	-	30.00	-	4.30	-	Pass
11a	6Mbps	1	157	5785	0.08	-	2.22	-	-5.66	-	30.00	-	4.30	-	Pass
11a	6Mbps	1	165	5825	0.08	-	2.22	-	-4.93	-	30.00	-	4.30	-	Pass
HT20	MCS0	1	149	5745	0.06	-	2.22	-	-6.67	-	30.00	-	4.30	-	Pass
HT20	MCS0	1	157	5785	0.06	-	2.22	-	-6.94	-	30.00	-	4.30	-	Pass
HT20	MCS0	1	165	5825	0.06	-	2.22	-	-7.16	-	30.00	-	4.30	-	Pass
HT40	MCS0	1	151	5755	0.13	-	2.22	-	-9.56	-	30.00	-	4.30	-	Pass
HT40	MCS0	1	159	5795	0.13	-	2.22	-	-9.18	-	30.00	-	4.30	-	Pass
VHT80	MCS0	1	155	5775	0.28	-	2.22	-	-12.17	-	30.00	-	4.30	-	Pass

Note: PSD Sum = Max PSD(Ant. 1, Ant. 2) + 10 log (n)



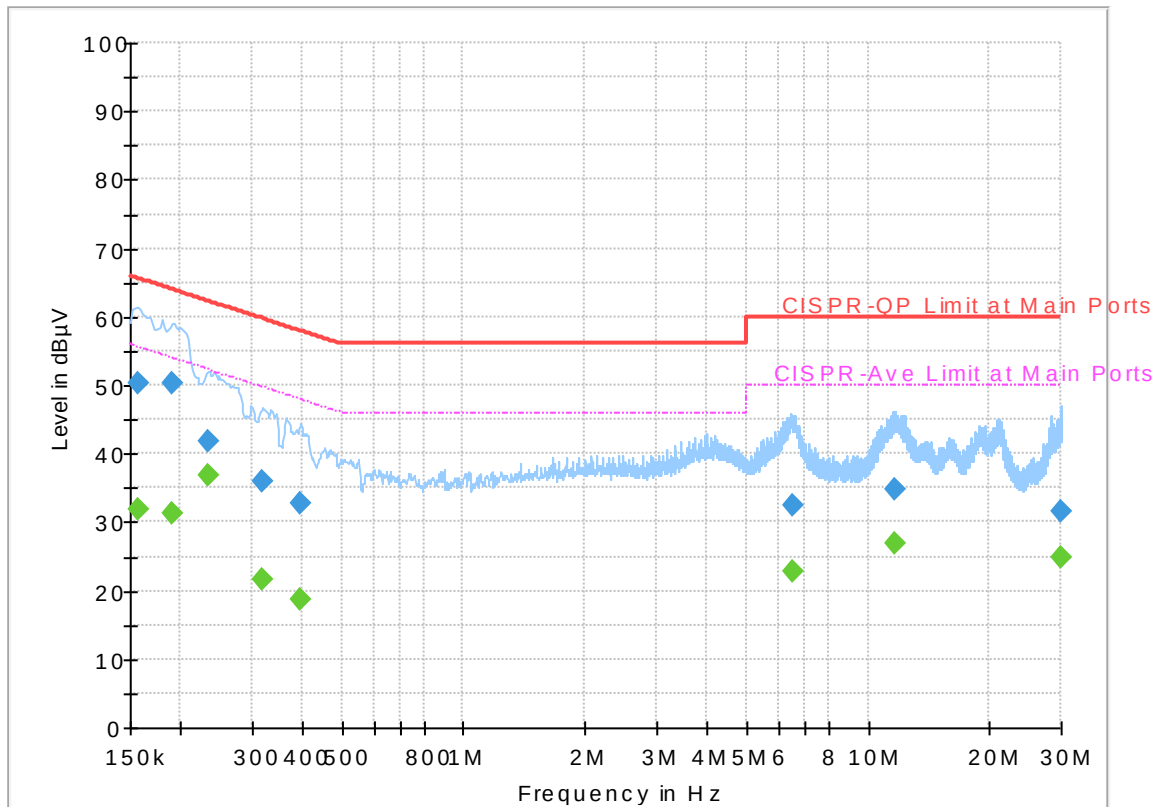
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Kai-Chun Chu	Temperature :	25~27°C
		Relative Humidity :	50~52%

EUT Information

Report NO : 850937
Test Mode : Mode 2
Test Voltage : 110Vac/60Hz
Phase : Line

Full Spectrum



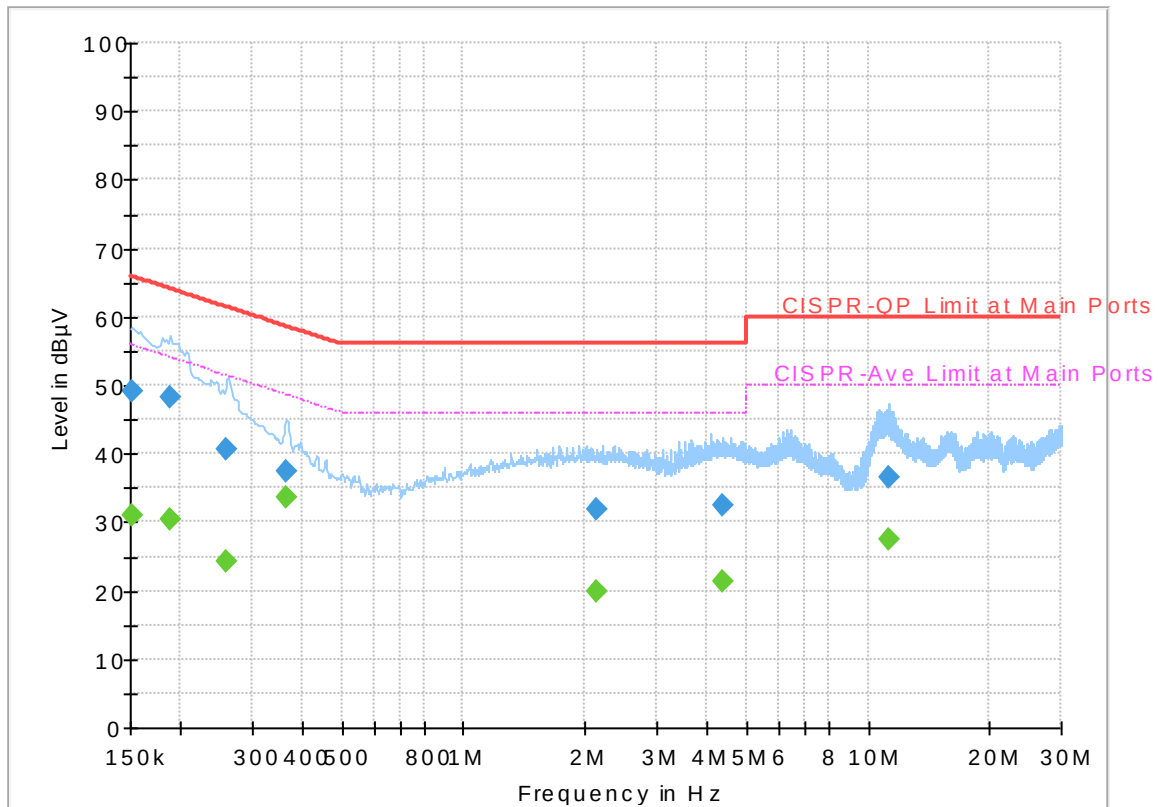
Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.156750	---	31.87	55.63	23.76	L1	OFF	19.5
0.156750	50.44	---	65.63	15.19	L1	OFF	19.5
0.190500	---	31.35	54.02	22.67	L1	OFF	19.5
0.190500	50.19	---	64.02	13.83	L1	OFF	19.5
0.233250	---	36.71	52.33	15.62	L1	OFF	19.5
0.233250	41.91	---	62.33	20.42	L1	OFF	19.5
0.318750	---	21.50	49.74	28.24	L1	OFF	19.5
0.318750	35.97	---	59.74	23.77	L1	OFF	19.5
0.395250	---	18.58	47.95	29.37	L1	OFF	19.5
0.395250	32.72	---	57.95	25.23	L1	OFF	19.5
6.481500	---	22.89	50.00	27.11	L1	OFF	19.6
6.481500	32.59	---	60.00	27.41	L1	OFF	19.6
11.625000	---	26.82	50.00	23.18	L1	OFF	19.7
11.625000	34.84	---	60.00	25.16	L1	OFF	19.7
29.971500	---	24.85	50.00	25.15	L1	OFF	19.8
29.971500	31.54	---	60.00	28.46	L1	OFF	19.8

EUT Information

Report NO : 850937
 Test Mode : Mode 2
 Test Voltage : 110Vac/60Hz
 Phase : Neutral

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	30.92	55.88	24.96	N	OFF	19.5
0.152250	49.18	---	65.88	16.70	N	OFF	19.5
0.188250	---	30.47	54.11	23.64	N	OFF	19.5
0.188250	48.18	---	64.11	15.93	N	OFF	19.5
0.260250	---	24.29	51.42	27.13	N	OFF	19.5
0.260250	40.70	---	61.42	20.72	N	OFF	19.5
0.366000	---	33.50	48.59	15.09	N	OFF	19.5
0.366000	37.56	---	58.59	21.03	N	OFF	19.5
2.141250	---	19.78	46.00	26.22	N	OFF	19.4
2.141250	31.89	---	56.00	24.11	N	OFF	19.4
4.353000	---	21.49	46.00	24.51	N	OFF	19.6
4.353000	32.35	---	56.00	23.65	N	OFF	19.6
11.235750	---	27.63	50.00	22.37	N	OFF	19.7
11.235750	36.47	---	60.00	23.53	N	OFF	19.7



Appendix C. Radiated Spurious Emission

Test Engineer :	Hao Hsuand Ken Wu	Temperature :	22~25°C
		Relative Humidity :	50~55%

Band 4 - 5725~5850MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 149 5745MHz		5601	49.47	-18.73	68.2	40.7	32.29	9.55	33.07	400	128	P	H
		5672.2	50.61	-34.06	84.67	41.63	32.41	9.68	33.11	400	128	P	H
		5717.2	52.68	-57.34	110.02	43.53	32.47	9.81	33.13	400	128	P	H
		5722.8	57.21	-59.97	117.18	48.03	32.5	9.81	33.13	400	128	P	H
	*	5745	99.89	-	-	90.63	32.53	9.88	33.15	400	128	P	H
	*	5745	92.56	-	-	83.3	32.53	9.88	33.15	400	128	A	H
													H
													H
		5642	48.6	-19.6	68.2	39.74	32.35	9.61	33.1	164	232	P	V
		5673.2	52.55	-32.86	85.41	43.57	32.41	9.68	33.11	164	232	P	V
		5717.2	57.23	-52.79	110.02	48.08	32.47	9.81	33.13	164	232	P	V
		5724.8	64.3	-57.44	121.74	55.12	32.5	9.81	33.13	164	232	P	V
	*	5745	106.84	-	-	97.58	32.53	9.88	33.15	164	232	P	V
	*	5745	99.39	-	-	90.13	32.53	9.88	33.15	164	232	A	V
													V
													V



WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 157 5785MHz		5626	48.75	-19.45	68.2	39.96	32.32	9.55	33.08	394	126	P	H
		5680.5	49.01	-41.8	90.81	39.97	32.41	9.75	33.12	394	126	P	H
		5702.5	48.93	-56.97	105.9	39.83	32.47	9.75	33.12	394	126	P	H
		5720.5	47.68	-64.26	111.94	38.5	32.5	9.81	33.13	394	126	P	H
	*	5785	99.8	-	-	90.36	32.6	10.01	33.17	394	126	P	H
	*	5785	91.95	-	-	82.51	32.6	10.01	33.17	394	126	A	H
		5855	48.02	-62.78	110.8	38.44	32.75	10.02	33.19	394	126	P	H
		5866	49.4	-58.32	107.72	39.84	32.75	10.02	33.21	394	126	P	H
		5884.75	49.76	-48.2	97.96	40.18	32.78	10.02	33.22	394	126	P	H
		5927	49.76	-18.44	68.2	40.09	32.88	10.02	33.23	394	126	P	H
													H
													H
		5627.75	49.47	-18.73	68.2	40.62	32.32	9.61	33.08	156	235	P	V
		5688.25	49.3	-47.23	96.53	40.23	32.44	9.75	33.12	156	235	P	V
		5707.75	51.24	-56.13	107.37	42.09	32.47	9.81	33.13	156	235	P	V
		5721.5	49.05	-65.17	114.22	39.87	32.5	9.81	33.13	156	235	P	V
	*	5785	105.32	-	-	95.88	32.6	10.01	33.17	156	235	P	V
	*	5785	97.9	-	-	88.46	32.6	10.01	33.17	156	235	A	V
		5852.5	49.72	-66.78	116.5	40.17	32.72	10.02	33.19	156	235	P	V
		5857.25	51	-59.17	110.17	41.42	32.75	10.02	33.19	156	235	P	V
		5876.5	50.99	-53.1	104.09	41.4	32.78	10.02	33.21	156	235	P	V
		5935.75	50.21	-17.99	68.2	40.55	32.88	10.02	33.24	156	235	P	V
													V
													V



WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 165 5825MHz	*	5825	100.73	-	-	91.2	32.69	10.02	33.18	389	128	P	H
	*	5825	93.2	-	-	83.67	32.69	10.02	33.18	389	128	A	H
		5850	54.35	-67.85	122.2	44.8	32.72	10.02	33.19	389	128	P	H
		5855.4	50.49	-60.2	110.69	40.91	32.75	10.02	33.19	389	128	P	H
		5897.8	49.77	-38.52	88.29	40.16	32.81	10.02	33.22	389	128	P	H
		5925.4	50.29	-17.91	68.2	40.62	32.88	10.02	33.23	389	128	P	H
													H
													H
	*	5825	105.87	-	-	96.34	32.69	10.02	33.18	164	232	P	V
	*	5825	98.32	-	-	88.79	32.69	10.02	33.18	164	232	A	V
		5850.8	54.27	-66.11	120.38	44.72	32.72	10.02	33.19	164	232	P	V
		5856	53.54	-56.98	110.52	43.96	32.75	10.02	33.19	164	232	P	V
		5900.4	52.39	-33.97	86.36	42.78	32.81	10.02	33.22	164	232	P	V
		5933.6	49.84	-18.36	68.2	40.17	32.88	10.02	33.23	164	232	P	V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 149 5745MHz		11490	47.1	-26.9	74	52.98	40	15.72	61.6	100	0	P	H
		17235	47.05	-21.15	68.2	42.7	40.54	19.6	55.79	100	0	P	H
													H
													H
		11490	45.42	-28.58	74	51.3	40	15.72	61.6	100	0	P	V
		17235	47.3	-20.9	68.2	42.95	40.54	19.6	55.79	100	0	P	V
													V
													V
802.11a CH 157 5785MHz		11570	45.38	-28.62	74	51.5	39.86	15.77	61.75	100	0	P	H
		17355	46.72	-21.48	68.2	41.61	40.96	19.68	55.53	100	0	P	H
													H
													H
		11570	45.85	-28.15	74	51.97	39.86	15.77	61.75	100	0	P	V
		17355	46.68	-21.52	68.2	41.57	40.96	19.68	55.53	100	0	P	V
													V
													V
802.11a CH 165 5825MHz		11650	45.57	-28.43	74	51.91	39.72	15.84	61.9	100	0	P	H
		17475	48.15	-20.05	68.2	42.29	41.38	19.75	55.27	100	0	P	H
													H
													H
		11650	45.93	-28.07	74	52.27	39.72	15.84	61.9	100	0	P	V
		17475	48.23	-19.97	68.2	42.37	41.38	19.75	55.27	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 151 5755MHz		5642.75	49.84	-18.36	68.2	40.98	32.35	9.61	33.1	392	128	P	H
		5681.5	50.88	-40.67	91.55	41.84	32.41	9.75	33.12	392	128	P	H
		5714.5	57.2	-52.06	109.26	48.05	32.47	9.81	33.13	392	128	P	H
		5724.5	60.04	-61.02	121.06	50.86	32.5	9.81	33.13	392	128	P	H
	*	5755	96.07	-	-	86.77	32.57	9.88	33.15	392	128	P	H
	*	5755	87.3	-	-	78	32.57	9.88	33.15	392	128	A	H
		5854.75	48.51	-62.86	111.37	38.93	32.75	10.02	33.19	392	128	P	H
		5859.5	48.3	-61.24	109.54	38.74	32.75	10.02	33.21	392	128	P	H
		5883.25	49.1	-49.97	99.07	39.52	32.78	10.02	33.22	392	128	P	H
		5937	50.24	-17.96	68.2	40.58	32.88	10.02	33.24	392	128	P	H
													H
													H
		5610.25	51.29	-16.91	68.2	42.53	32.29	9.55	33.08	167	233	P	V
		5700	56.79	-48.41	105.2	47.72	32.44	9.75	33.12	167	233	P	V
		5719	67.38	-43.14	110.52	58.2	32.5	9.81	33.13	167	233	P	V
		5723.75	67.66	-51.69	119.35	58.48	32.5	9.81	33.13	167	233	P	V
	*	5755	102.61	-	-	93.31	32.57	9.88	33.15	167	233	P	V
	*	5755	93.95	-	-	84.65	32.57	9.88	33.15	167	233	A	V
		5851.5	49.09	-69.69	118.78	39.54	32.72	10.02	33.19	167	233	P	V
		5855.5	50.94	-59.72	110.66	41.36	32.75	10.02	33.19	167	233	P	V
		5917	51.24	-22.86	74.1	41.61	32.84	10.02	33.23	167	233	P	V
		5925.75	48.96	-19.24	68.2	39.29	32.88	10.02	33.23	167	233	P	V
													V
													V

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 159 5795MHz		5605	48.66	-19.54	68.2	39.9	32.29	9.55	33.08	391	129	P	H
		5653.75	48.5	-22.49	70.99	39.54	32.38	9.68	33.1	391	129	P	H
		5717	49.55	-60.41	109.96	40.4	32.47	9.81	33.13	391	129	P	H
		5722	48.35	-67.01	115.36	39.17	32.5	9.81	33.13	391	129	P	H
	*	5795	95.67	-	-	86.2	32.63	10.01	33.17	391	129	P	H
	*	5795	87.22	-	-	77.75	32.63	10.01	33.17	391	129	A	H
		5854.5	49.09	-62.85	111.94	39.51	32.75	10.02	33.19	391	129	P	H
		5861.5	51.6	-57.38	108.98	42.04	32.75	10.02	33.21	391	129	P	H
		5897	48.85	-40.03	88.88	39.24	32.81	10.02	33.22	391	129	P	H
		5936.5	49.92	-18.28	68.2	40.26	32.88	10.02	33.24	391	129	P	H
													H
													H
		5643.5	49.54	-18.66	68.2	40.68	32.35	9.61	33.1	169	233	P	V
		5699.5	50.83	-54	104.83	41.76	32.44	9.75	33.12	169	233	P	V
		5718.75	52.51	-57.94	110.45	43.33	32.5	9.81	33.13	169	233	P	V
		5723.75	53.29	-66.06	119.35	44.11	32.5	9.81	33.13	169	233	P	V
	*	5795	101.99	-	-	92.52	32.63	10.01	33.17	169	233	P	V
	*	5795	93.42	-	-	83.95	32.63	10.01	33.17	169	233	A	V
		5852.75	53.09	-62.84	115.93	43.54	32.72	10.02	33.19	169	233	P	V
		5861.5	55.7	-53.28	108.98	46.14	32.75	10.02	33.21	169	233	P	V
	5876.75	52.33	-51.57	103.9	42.74	32.78	10.02	33.21	169	233	P	V	
	5933	49.69	-18.51	68.2	40.02	32.88	10.02	33.23	169	233	P	V	
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz
WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 155 5775MHz		5629	58.06	-10.14	68.2	49.23	32.32	9.61	33.1	391	131	P	H
		5689	64.06	-33.03	97.09	54.99	32.44	9.75	33.12	391	131	P	H
		5710.5	66.07	-42.07	108.14	56.92	32.47	9.81	33.13	391	131	P	H
		5721.25	62.18	-51.47	113.65	53	32.5	9.81	33.13	391	131	P	H
	*	5775	93.4	-	-	84.01	32.6	9.95	33.16	391	131	P	H
	*	5775	85.05	-	-	75.66	32.6	9.95	33.16	391	131	A	H
		5852.25	63.42	-53.65	117.07	53.87	32.72	10.02	33.19	391	131	P	H
		5859.5	61.22	-48.32	109.54	51.66	32.75	10.02	33.21	391	131	P	H
		5921.75	55.45	-15.15	70.6	45.78	32.88	10.02	33.23	391	131	P	H
		5943.75	51.71	-16.49	68.2	42.02	32.91	10.02	33.24	391	131	P	H
													H
													H
		5617.75	61.13	-7.07	68.2	52.34	32.32	9.55	33.08	164	233	P	V
		5684.25	72.56	-21.02	93.58	63.49	32.44	9.75	33.12	164	233	P	V
		5718.25	73.7	-36.61	110.31	64.52	32.5	9.81	33.13	164	233	P	V
		5722	72.84	-42.52	115.36	63.66	32.5	9.81	33.13	164	233	P	V
	*	5775	99.68	-	-	90.29	32.6	9.95	33.16	164	233	P	V
	*	5775	91.02	-	-	81.63	32.6	9.95	33.16	164	233	A	V
		5851	71.24	-48.68	119.92	61.69	32.72	10.02	33.19	164	233	P	V
		5862.25	67.26	-41.51	108.77	57.7	32.75	10.02	33.21	164	233	P	V
		5889.75	60.8	-33.45	94.25	51.19	32.81	10.02	33.22	164	233	P	V
		5933.75	55.07	-13.13	68.2	45.4	32.88	10.02	33.23	164	233	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

5GHz WIFI 802.11n HT40 (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
5GHz 802.11n HT40 LF		122.88	31.28	-12.22	43.5	44.93	17.26	1.55	32.46	-	-	P	H
		221.16	36.35	-9.65	46	51.78	15.18	1.78	32.39	100	0	P	H
		270.3	32.57	-13.43	46	43.59	19.19	2.17	32.38	-	-	P	H
		319.6	32.59	-13.41	46	43.33	19.23	2.39	32.36	-	-	P	H
		417.6	34.38	-11.62	46	41.61	22.43	2.68	32.34	-	-	P	H
		931.4	33.15	-12.85	46	30.8	29.73	3.99	31.37	-	-	P	H
													H
													H
													H
													H
													H
													H
		44.58	32.7	-7.3	40	47.62	16.55	1.02	32.49	100	0	P	V
		122.88	31.98	-11.52	43.5	45.63	17.26	1.55	32.46	-	-	P	V
		221.16	32.6	-13.4	46	48.03	15.18	1.78	32.39	-	-	P	V
		417.6	32.9	-13.1	46	40.13	22.43	2.68	32.34	-	-	P	V
		565.3	29.82	-16.18	46	33.24	25.89	3.12	32.43	-	-	P	V
		857.9	31.32	-14.68	46	30.39	28.99	3.82	31.88	-	-	P	V
													V
													V
													V
													V
													V
													V
												V	
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	Peak or Average
H/V	Horizontal or Vertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)
 = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
 = 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)
 = 55.45 (dBμV/m)
2. Over Limit(dB)
 = Level(dBμV/m) – Limit Line(dBμV/m)
 = 55.45(dBμV/m) – 74(dBμV/m)
 = -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)
 = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
 = 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)
 = 43.54 (dBμV/m)
2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)
 = 43.54(dBμV/m) – 54(dBμV/m)
 = -10.46(dB)

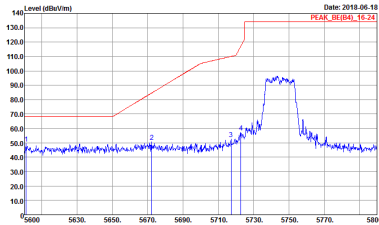
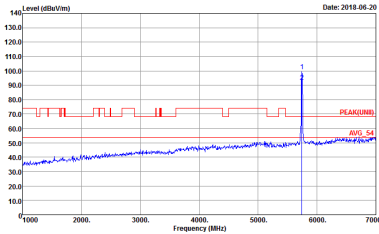
Both peak and average measured complies with the limit line, so test result is “PASS”.

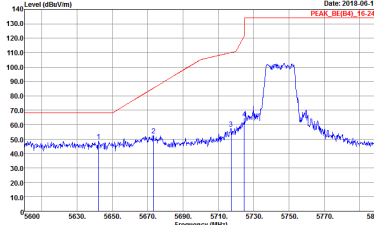
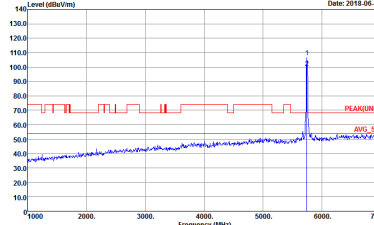
Appendix D. Radiated Spurious Emission Plots

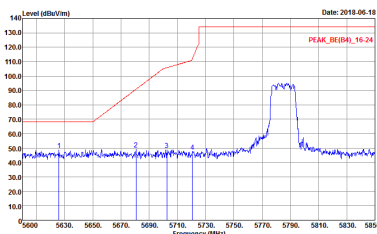
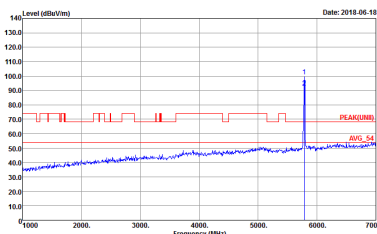
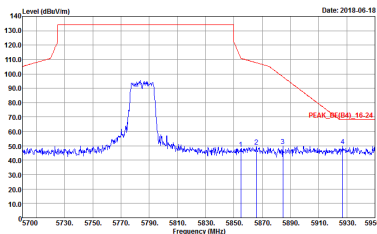
Test Engineer :	Hao Hsuand Ken Wu	Temperature :	22~25°C
		Relative Humidity :	50~55%

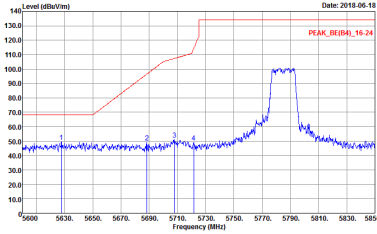
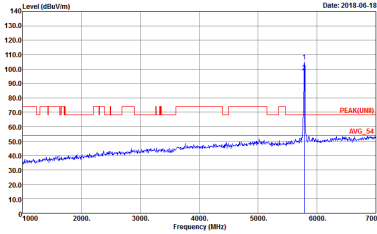
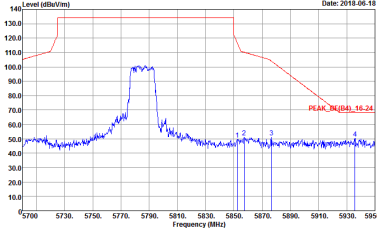
Band 4 - 5725~5850MHz

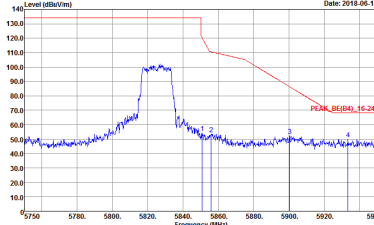
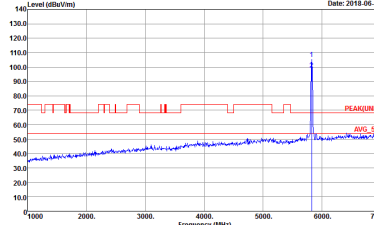
WIFI 802.11a (Band Edge @ 3m)

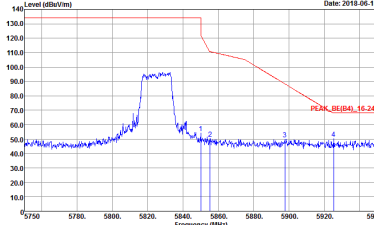
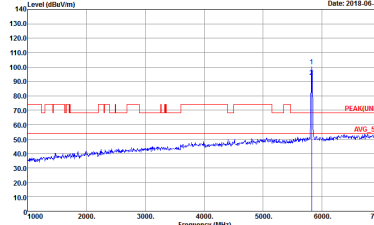
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH149 5745MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 9120D-HF HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNIT) 3m HORN 9120D-HF HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 850937

WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH149 5745MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_850937_15-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK_850937_15-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937

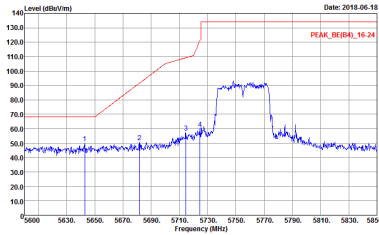
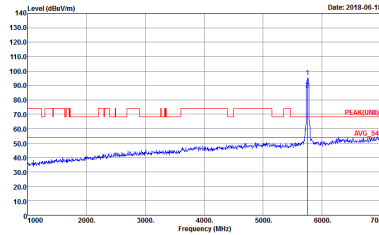
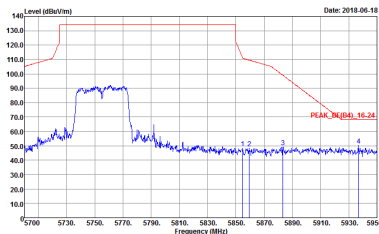
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH157 5785MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak Project : 850937
	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak Project : 850937	Left blank

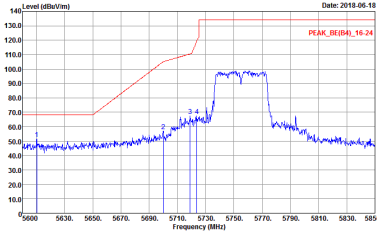
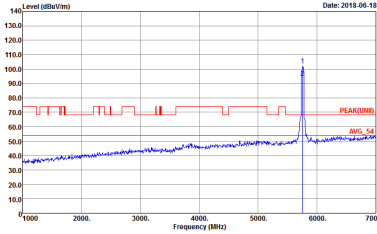
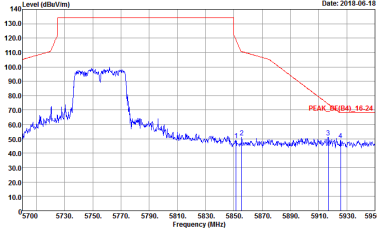
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH157 5785MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(84)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNII) 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937
	 Site : 03CH11-HY Condition : PEAK_BE(84)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	Left blank

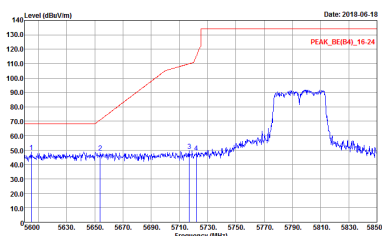
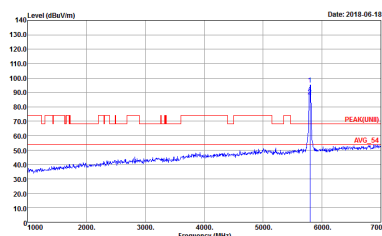
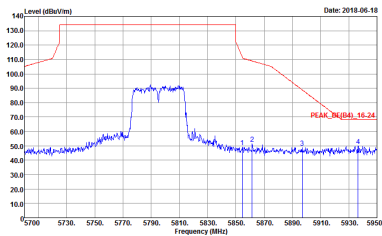
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH165 5825MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(84)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNII) 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937

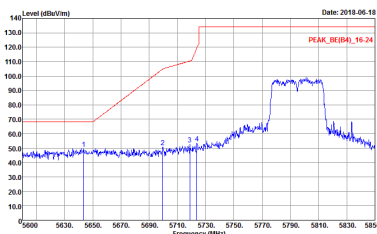
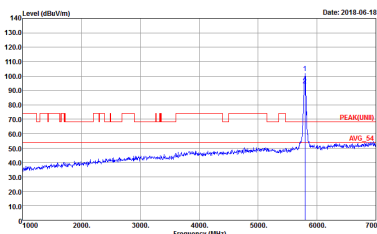
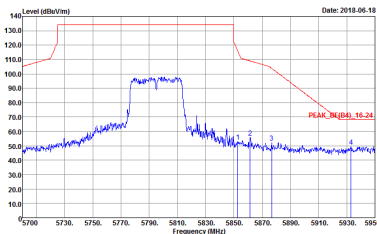
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH165 5825MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(84)_16-24 3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNII)_3m HORN 9120D-HF HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937

Band 4 5725~5850MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

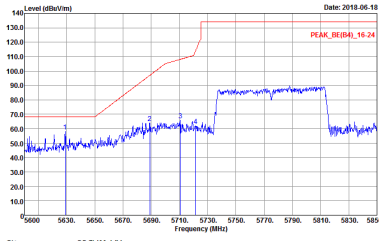
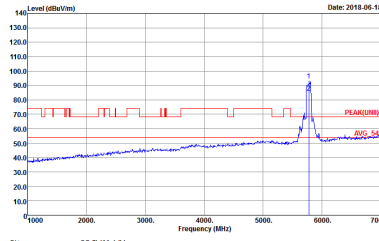
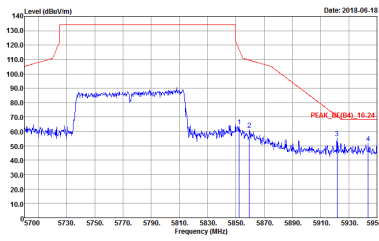
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11n HT40 CH151 5755MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK_UN(B4)_16-24 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 850937
	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 850937	Left blank

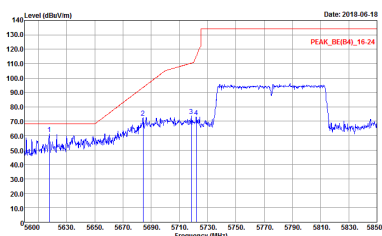
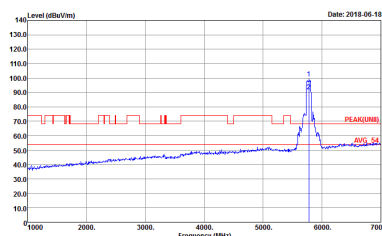
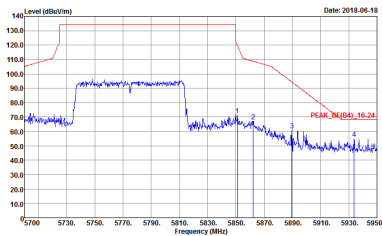
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11n HT40 CH151 5755MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK_FU(B4)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937
Peak	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	Left blank

WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11n HT40 CH159 5795MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(84)_16-24 3m HORN 91200-HF HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak : 850937	 Site : 03CH11-HY Condition : PEAK(UNII) 3m HORN 91200-HF HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak : 850937
Peak	 Site : 03CH11-HY Condition : PEAK_BE(84)_16-24 3m HORN 91200-HF HORIZONTAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak : 850937	Left blank

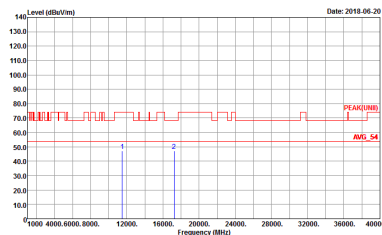
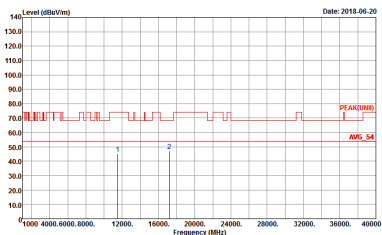
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11n HT40 CH159 5795MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNII) 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937
	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	Left blank

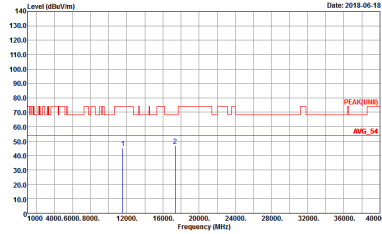
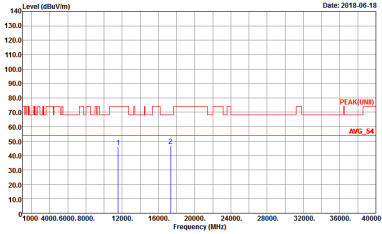
Band 4 5725~5850MHz
WIFI 802.11ac VHT80 (Band Edge @ 3m)

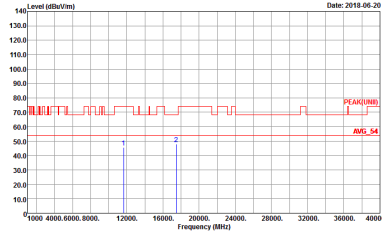
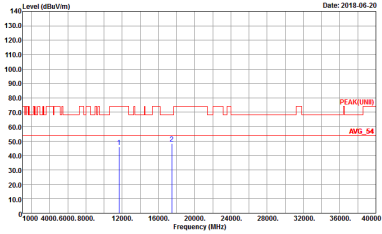
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH155 5775MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNIT) 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 850937
	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 850937	Left blank

WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH155 5775MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNII) 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937
	 Site : 03CH11-HY Condition : PEAK_BE(B4)_16-24 3m HORN 91200-HF VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 850937	Left blank

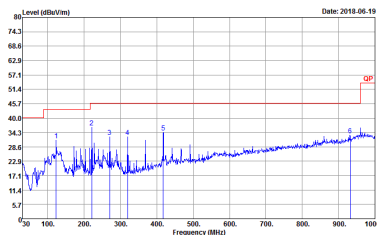
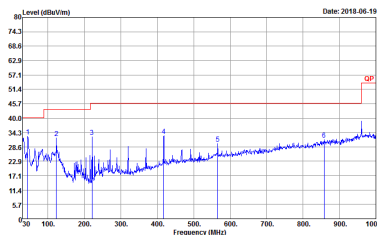
Band 4 - 5725~5850MHz
WIFI 802.11a (Harmonic @ 3m)

WIFI	Band 4 5725~5850MHz Harmonic @ 3m	
ANT	802.11a CH149 5745MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK(UNII) 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNII) 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 850937

WIFI	Band 4 5725~5850MHz Harmonic @ 3m	
ANT	802.11a CH157 5785MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK(UNB) 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNB) 3m HORN 91200-HF VERTICAL Detector : Peak Project : 850937

WIFI	Band 4 5725~5850MHz Harmonic @ 3m	
ANT	802.11a CH165 5825MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK(UNB) 3m HORN 91200-HF HORIZONTAL Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : PEAK(UNB) 3m HORN 91200-HF VERTICAL Detector : Peak Project : 850937

Emission below 1GHz
5GHz WIFI 802.11n HT40 (LF)

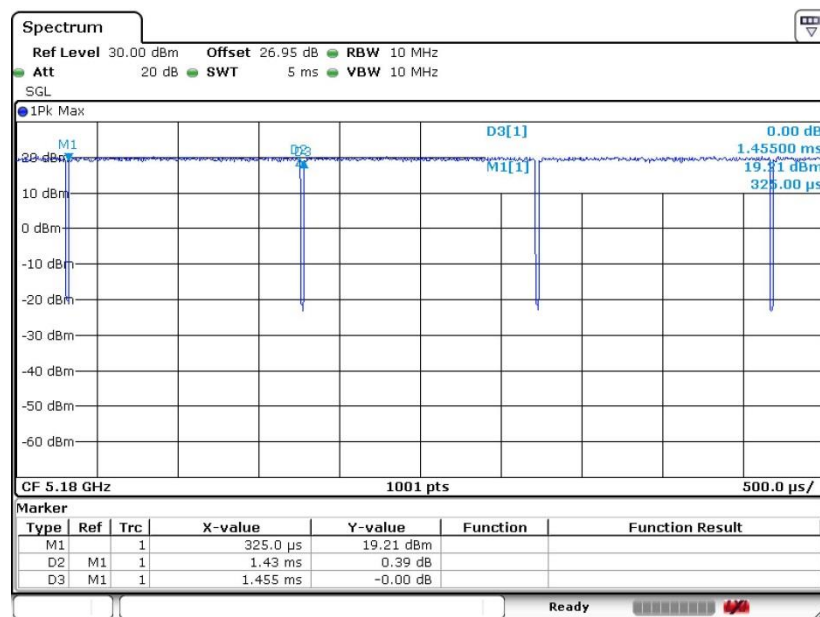
WIFI	5GHz 5725~5850MHz	
ANT	802.11n HT40 LF	
1	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HY Condition : QP 3m BT-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 850937	 Site : 03CH11-HY Condition : QP 3m BT-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 850937



Appendix E. Duty Cycle Plots

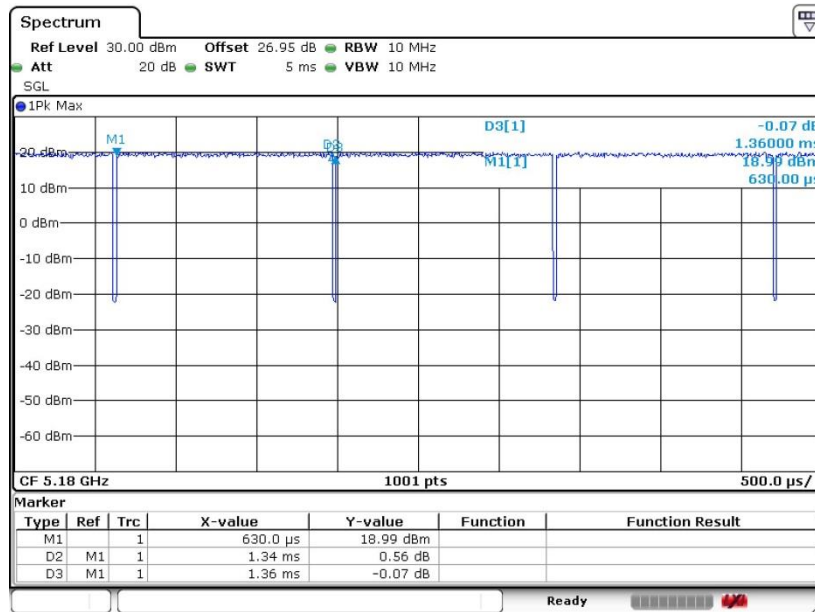
Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor (dB)
802.11a	98.28	-	-	10Hz	0.08
5GHz 802.11n HT20	98.53	-	-	10Hz	0.06
5GHz 802.11n HT40	96.94	666.00	1.50	3kHz	0.13
5GHz 802.11ac VHT20	98.18	-	-	10Hz	0.08
5GHz 802.11ac VHT40	96.97	672.00	1.49	3kHz	0.13
5GHz 802.11ac VHT80	93.79	332.00	3.01	10kHz	0.28

802.11a



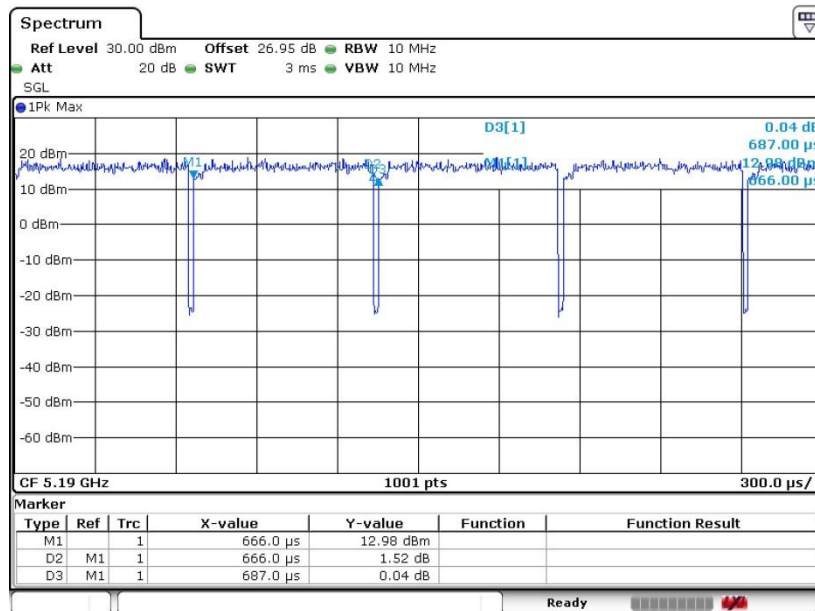
Date: 12 JUN 2018 20:08:25

802.11n HT20



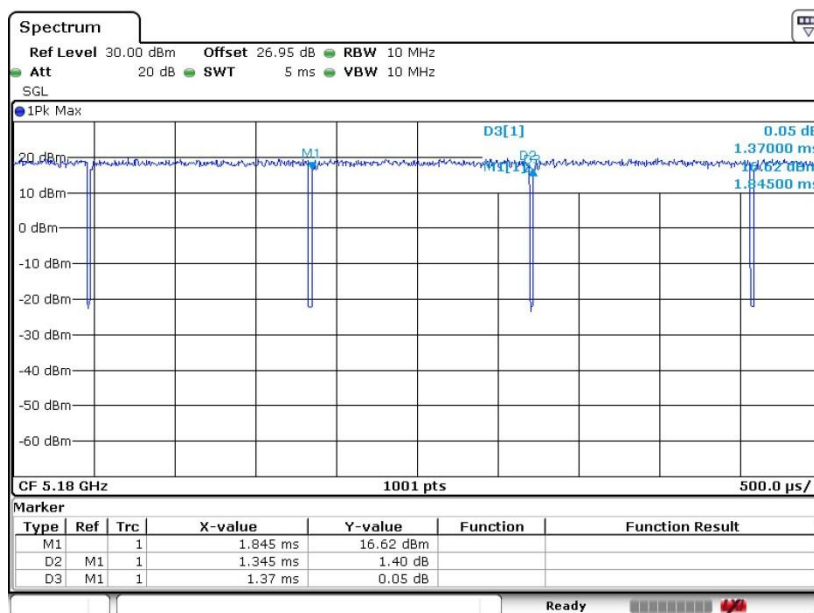
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802.11n HT40



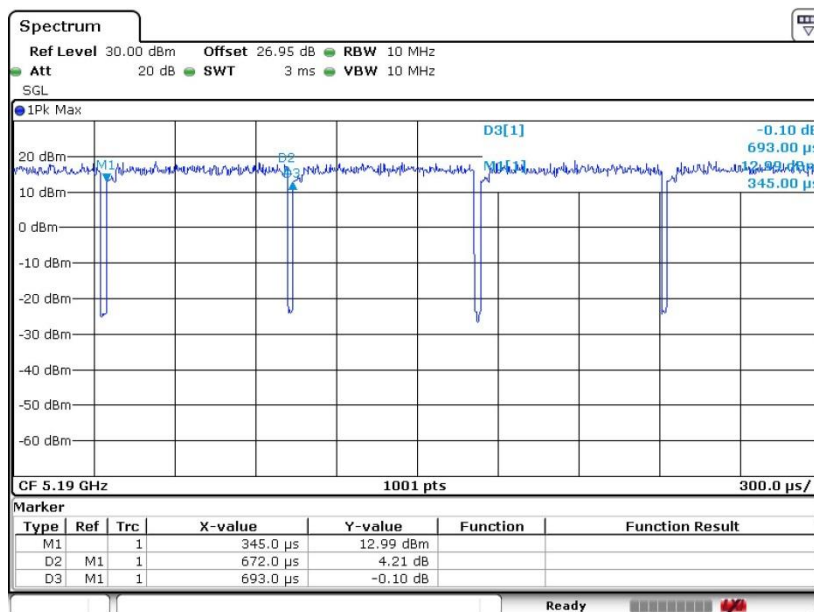
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802.11ac VHT20



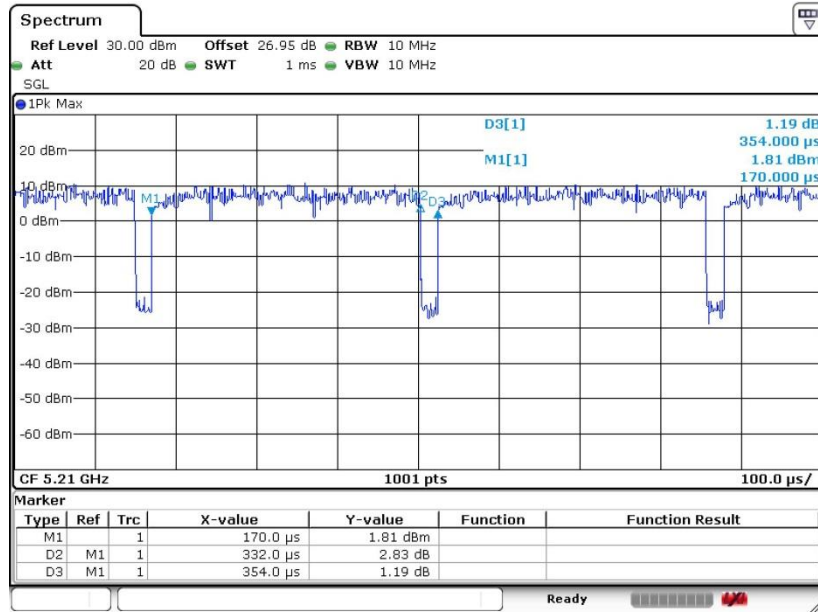
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802.11ac VHT40



Date: 12.JUN.2018 22:04:25

802.11ac VHT80



Date: 12.JUN.2018 22:18:21