FCC RADIO TEST REPORT

FCC ID	:	**APYHRO00277**
Equipment	:	**Smart phone**
Brand Name	:	**SHARP**
Applicant	:	**SHARP CORPORATION** **2-13-1, Hachihonmatsu-lida,** **Higashi-hiroshima-shi,Hiroshima pref.** **739-0192, Japan**
Manufacturer	:	**SHARP CORPORATION** **1 Takumi-Cho, Sakai-Ku, Sakai-Shi,** **Osaka 590-8522, Japan**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Sep. 02, 2019 and testing was started from Sep. 20, 2019 and completed on Sep. 26, 2019. We, SPORTON INTERNATIONAL INC., EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in 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 variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

SPORTON INTERNATIONAL 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	Issued Date
FR990231D	01	Initial issue of report	Oct. 02, 2019
FR990231D	02	Add the description of Sample difference	Oct. 09, 2019

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.403(i)	26dB Bandwidth	Not Required	-
-	2.1049	99% Occupied Bandwidth	Not Required	-
3.1	15.407(a)	Maximum Conducted Output Power	Pass	-
-	15.407(a)	Power Spectral Density	Not Required	-
3.2	15.407(b)	Unwanted Emissions	Pass	Under limit 3.07 dB at 5149.600 MHz
-	15.207	AC Conducted Emission	Not Required	-
-	15.407(c)	Automatically Discontinue Transmission	Not Required	-
3.3	15.203 15.407(a)	Antenna Requirement	Pass	-

Remark:

1. Not required means after assessing, test items are not necessary to carry out.
2. This is a variant report which can be referred Product Equality Declaration. All the test cases were performed on original report which can be referred to Sporton Report Number FR971613E. Based on the original report, the test case was verified.

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Ann Lee

1 General Description

1.1 Product Feature of Equipment Under Test

GSM/WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n/ac and GNSS

Product Specification subjective to this standard	
Sample 1	1st vender parts
Sample 2	2nd vender parts
Antenna Type	WWAN: ILA & IFA Antenna WLAN: IFA Antenna Bluetooth: IFA Antenna GPS/Glonass/BDS/Galileo : ILA Antenna

Remark:

1. All test items were performed with Sample 1.

2. The difference between Sample 1 & Sample 2 is their suppliers of memory, battery, vibe motor components.

1.2 Modification of EUT

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

1.3 Testing Location

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	TH05-HY

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

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
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.

FCC designation No.: TW1190 and TW0007

1.4 Applicable Standards

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

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

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: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5150-5250 MHz Band 1 (U-NII-1)	36	5180	44	5220
	38*	5190	46*	5230
	40	5200	48	5240
	42#	5210		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5250-5350 MHz Band 2 (U-NII-2A)	52	5260	60	5300
	54*	5270	62*	5310
	56	5280	64	5320
	58#	5290		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5470-5725 MHz Band 3 (U-NII-2C)	100	5500	112	5560
	102*	5510	116	5580
	104	5520	132	5660
	106#	5530	134*	5670
	108	5540	136	5680
	110*	5550	140	5700

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.

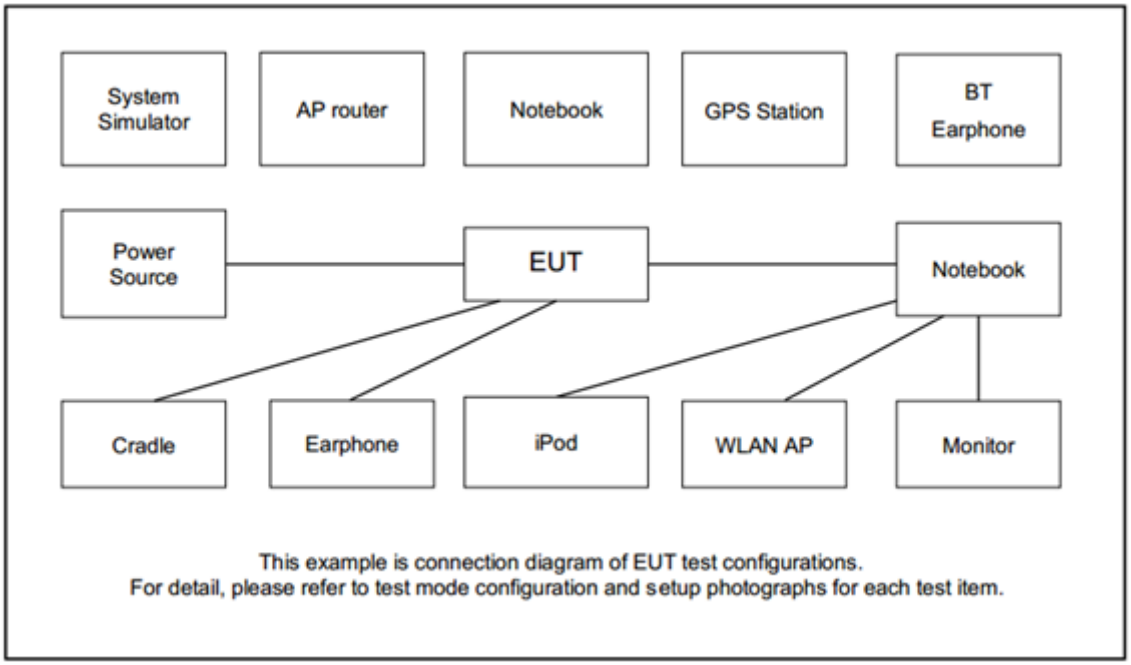
2.2 Test Mode

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	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

Ch. #		Band I：5150-5250 MHz	Band II：5250-5350 MHz	Band III：5470-5725MHz
		802.11ac VHT80	802.11ac VHT80	802.11ac VHT80
L	Low	-	-	106
M	Middle	42	58	-
H	High	-	-	-

2.3 Connection Diagram of Test System



2.4 Table for Supporting Units

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Earphone	SHARP	RPHOEA007AFZZ	N/A	Unshielded, 1.2 m	N/A
2.	Adapter	SHARP	SH-AC05	N/A	N/A	Unshielded, 1.5 m

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT 4.0-00108” 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.

3 Test Result

3.1 Maximum Conducted Output Power Measurement

3.1.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For the 5.15–5.25 GHz bands:

■ For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW. For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

For the 5.25–5.725 GHz bands:

■ The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz.

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.

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

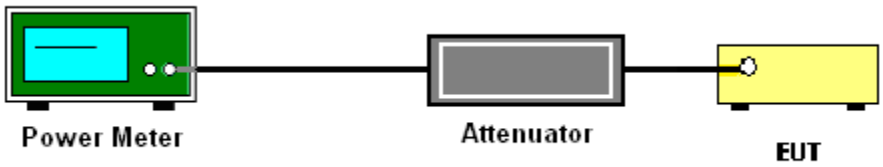
3.1.3 Test Procedures

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

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

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit at its maximum power control level.
3. Measure the average power of the transmitter
4. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

3.1.4 Test Setup



3.1.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

3.2 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.2.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5600 MHz and 5650-5725MHz band: all emissions outside of the 5470-5600 MHz and 5650-5725MHz band shall not exceed an EIRP of -27 dBm/MHz.

(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.

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

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

(3) KDB789033 D02 v02r01 G)2)c)

(i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of −27 dBm/MHz.

(ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 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 ≥ 3 MHz
- Detector = Peak
- Sweep time = auto
- Trace mode = max hold

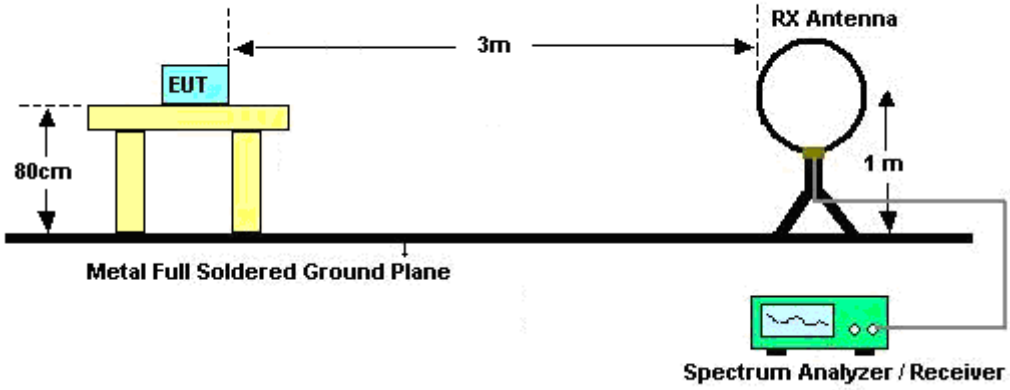
(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

- RBW = 1 MHz
- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW ≥ 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.

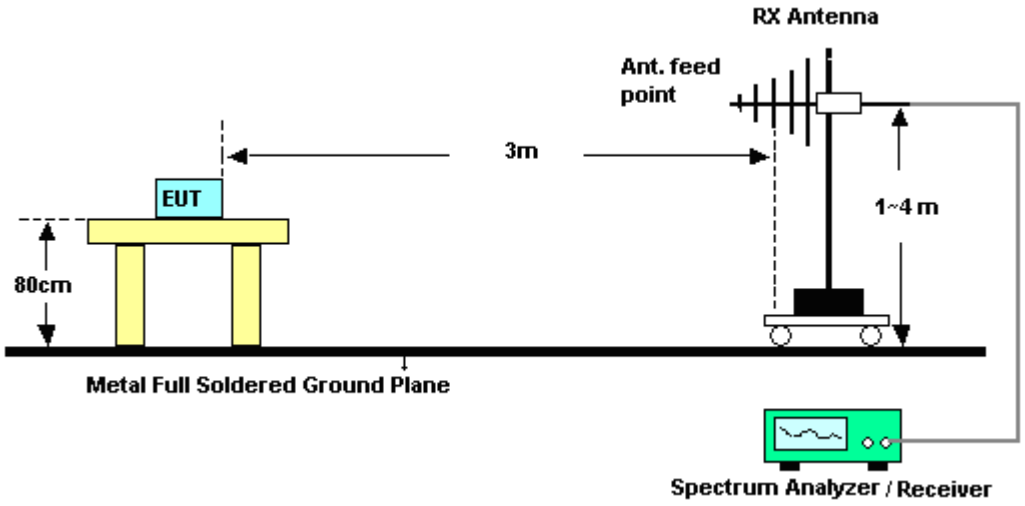
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband 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.

3.2.4 Test Setup

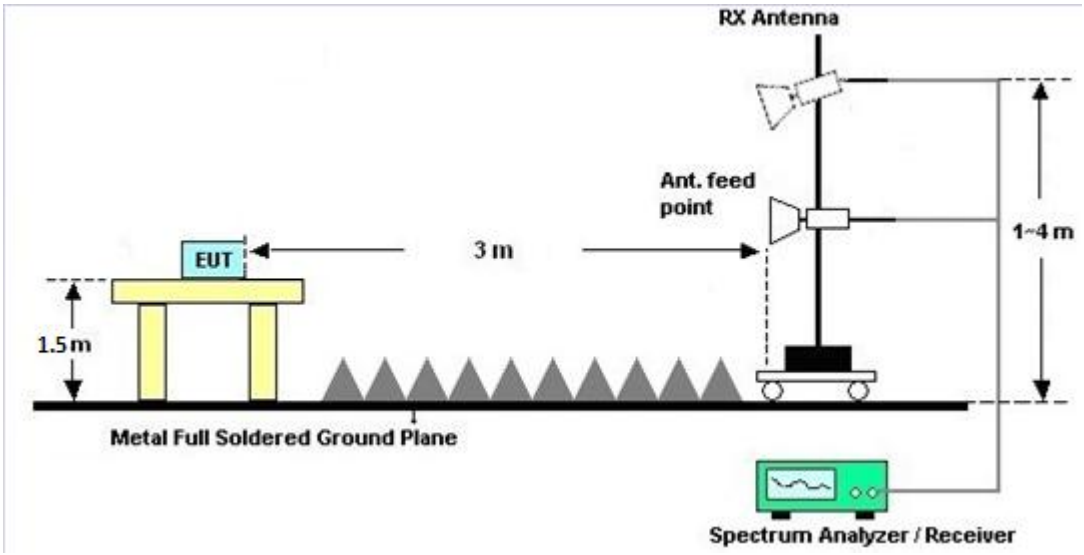
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.2.5 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 was not reported.

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.2.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.

3.3 Antenna Requirements

3.3.1 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.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.3 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.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Sensor	DARE	RPR3006W	13I00030SNO32	9kHz~6GHz	Dec. 03, 2018	Sep. 20, 2019~ Sep. 26, 2019	Dec. 02, 2019	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 13, 2018	Sep. 20, 2019~ Sep. 26, 2019	Nov. 12, 2019	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1208382	N/A	Mar. 27, 2019	Sep. 20, 2019~ Sep. 26, 2019	Mar. 26, 2020	Conducted (TH05-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 06, 2018	Sep. 22, 2019~ Sep. 26, 2019	Dec. 05, 2019	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 04, 2018	Sep. 22, 2019~ Sep. 26, 2019	Dec. 03, 2019	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 13, 2018	Sep. 22, 2019~ Sep. 26, 2019	Oct. 12, 2019	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 30, 2018	Sep. 22, 2019~ Sep. 26, 2019	Oct. 29, 2019	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 22, 2018	Sep. 22, 2019~ Sep. 26, 2019	Nov. 21, 2019	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 14, 2018	Sep. 22, 2019~ Sep. 26, 2019	Nov. 13, 2020	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 19, 2018	Sep. 22, 2019~ Sep. 26, 2019	Oct. 18, 2019	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Sep. 22, 2019~ Sep. 26, 2019	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Sep. 22, 2019~ Sep. 26, 2019	N/A	Radiation (03CH11-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 20, 2019	Sep. 22, 2019~ Sep. 26, 2019	May 19, 2020	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Dec. 05, 2018	Sep. 22, 2019~ Sep. 26, 2019	Dec. 04, 2019	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY55420170	20MHz~8.4GHz	Mar. 08, 2019	Sep. 22, 2019~ Sep. 26, 2019	Mar. 07, 2020	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-001042	N/A	N/A	Sep. 22, 2019~ Sep. 26, 2019	N/A	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz-30MHz	Mar. 13, 2019	Sep. 22, 2019~ Sep. 26, 2019	Mar. 12, 2020	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 13, 2019	Sep. 22, 2019~ Sep. 26, 2019	Mar. 12, 2020	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	30M-18G	Mar. 13, 2019	Sep. 22, 2019~ Sep. 26, 2019	Mar. 12, 2020	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz-40GHz	Mar. 13, 2019	Sep. 22, 2019~ Sep. 26, 2019	Mar. 12, 2020	Radiation (03CH11-HY)
Filter	Wainwright	WLJ4-1000-1530-6000-40ST	SN4	1.53GHz Low Pass Filter	Jul. 04, 2019	Sep. 22, 2019~ Sep. 26, 2019	Jul. 03, 2020	Radiation (03CH11-HY)
Filter	Wainwright	WHKX8-5872.5-6750-18000-40ST	SN5	6.75GHz High Pass	Mar. 13, 2019	Sep. 22, 2019~ Sep. 26, 2019	Mar. 12, 2020	Radiation (03CH11-HY)

5 Uncertainty of Evaluation

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**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

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

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Richard Qiu	Temperature:	21~25	°C
Test Date:	2019/9/20~2019/9/26	Relative Humidity:	51~54	%
TX Tool		TX Tool Version		

TEST RESULTS DATA
Average Power Table

FCC Band I													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	36	5180	11.60	-		24.00	-	0.80	-		Pass
11a	6Mbps	1	44	5220	11.60	-		24.00	-	0.80	-		Pass
11a	6Mbps	1	48	5240	11.80	-		24.00	-	0.80	-		Pass
HT20	MCS0	1	36	5180	11.60	-		24.00	-	0.80	-		Pass
HT20	MCS0	1	44	5220	11.60	-		24.00	-	0.80	-		Pass
HT20	MCS0	1	48	5240	11.80	-		24.00	-	0.80	-		Pass
HT40	MCS0	1	38	5190	11.80	-		24.00	-	0.80	-		Pass
HT40	MCS0	1	46	5230	11.80	-		24.00	-	0.80	-		Pass
VHT20	MCS0	1	36	5180	11.70	-		24.00	-	0.80	-		Pass
VHT20	MCS0	1	44	5220	11.70	-		24.00	-	0.80	-		Pass
VHT20	MCS0	1	48	5240	11.90	-		24.00	-	0.80	-		Pass
VHT40	MCS0	1	38	5190	11.90	-		24.00	-	0.80	-		Pass
VHT40	MCS0	1	46	5230	11.90	-		24.00	-	0.80	-		Pass
VHT80	MCS0	1	42	5210	11.80	-		24.00	-	0.80	-		Pass

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TEST RESULTS DATA
Average Power Table

FCC Band II													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		EIRP Power Limit (dBm)	Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	52	5260	11.60	-		23.98	-	0.80	-	26.99	Pass
11a	6Mbps	1	60	5300	11.70	-		23.98	-	0.80	-	26.99	Pass
11a	6Mbps	1	64	5320	11.70	-		23.98	-	0.80	-	26.99	Pass
HT20	MCS0	1	52	5260	11.80	-		23.98	-	0.80	-	26.99	Pass
HT20	MCS0	1	60	5300	11.80	-		23.98	-	0.80	-	26.99	Pass
HT20	MCS0	1	64	5320	11.70	-		23.98	-	0.80	-	26.99	Pass
HT40	MCS0	1	54	5270	11.60	-		23.98	-	0.80	-	26.99	Pass
HT40	MCS0	1	62	5310	11.80	-		23.98	-	0.80	-	26.99	Pass
VHT20	MCS0	1	52	5260	11.90	-		23.98	-	0.80	-	26.99	Pass
VHT20	MCS0	1	60	5300	11.90	-		23.98	-	0.80	-	26.99	Pass
VHT20	MCS0	1	64	5320	11.80	-		23.98	-	0.80	-	26.99	Pass
VHT40	MCS0	1	54	5270	11.70	-		23.98	-	0.80	-	26.99	Pass
VHT40	MCS0	1	62	5310	11.90	-		23.98	-	0.80	-	26.99	Pass
VHT80	MCS0	1	58	5290	11.30	-		23.98	-	0.80	-	26.99	Pass

Report Number : FR990231D

TEST RESULTS DATA
Average Power Table

FCC Band III													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		EIRP Power Limit (dBm)	Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	100	5500	11.80	-		23.98	-	-0.70	-	26.99	Pass
11a	6Mbps	1	116	5580	11.80	-		23.98	-	-0.70	-	26.99	Pass
11a	6Mbps	1	140	5700	11.70	-		23.98	-	-0.70	-	26.99	Pass
HT20	MCS0	1	100	5500	11.80	-		23.98	-	-0.70	-	26.99	Pass
HT20	MCS0	1	116	5580	11.80	-		23.98	-	-0.70	-	26.99	Pass
HT20	MCS0	1	140	5700	11.70	-		23.98	-	-0.70	-	26.99	Pass
HT40	MCS0	1	102	5510	11.70	-		23.98	-	-0.70	-	26.99	Pass
HT40	MCS0	1	110	5550	11.80	-		23.98	-	-0.70	-	26.99	Pass
HT40	MCS0	1	134	5670	11.80	-		23.98	-	-0.70	-	26.99	Pass
VHT20	MCS0	1	100	5500	11.90	-		23.98	-	-0.70	-	26.99	Pass
VHT20	MCS0	1	116	5580	11.90	-		23.98	-	-0.70	-	26.99	Pass
VHT20	MCS0	1	140	5700	11.80	-		23.98	-	-0.70	-	26.99	Pass
VHT40	MCS0	1	102	5510	11.80	-		23.98	-	-0.70	-	26.99	Pass
VHT40	MCS0	1	110	5550	11.90	-		23.98	-	-0.70	-	26.99	Pass
VHT40	MCS0	1	134	5670	11.90	-		23.98	-	-0.70	-	26.99	Pass
VHT80	MCS0	1	106	5530	11.90	-		23.98	-	-0.70	-	26.99	Pass

Appendix B. Radiated Spurious Emission

Test Engineer :	Watt Tseng, Fu Chen, Troye Hsieh	Temperature :	21.5~26.8°C
		Relative Humidity :	48.5~69.3%

Band 1 - 5150~5250MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11ac VHT80 CH 42 5210MHz		5137.7	56.37	-17.63	74	47.59	31.88	10.02	33.12	301	342	P	H
		5149.6	50.93	-3.07	54	42.12	31.9	10.03	33.12	301	342	A	H
	*	5210	95.21	-	-	86.68	31.56	10.09	33.12	301	342	P	H
	*	5210	87.05	-	-	78.52	31.56	10.09	33.12	301	342	A	H
		5430.88	50.35	-23.65	74	41.6	31.66	10.2	33.11	301	342	P	H
		5449.08	40.77	-13.23	54	31.95	31.7	10.23	33.11	301	342	A	H
		5143.48	57.29	-16.71	74	48.49	31.89	10.03	33.12	330	118	P	V
		5149.6	50.38	-3.62	54	41.57	31.9	10.03	33.12	330	118	A	V
	*	5210	96.34	-	-	87.81	31.56	10.09	33.12	330	118	P	V
	*	5210	88.19	-	-	79.66	31.56	10.09	33.12	330	118	A	V
		5451.16	48.75	-25.25	74	39.93	31.7	10.23	33.11	330	118	P	V
		5458.96	40.98	-13.02	54	32.11	31.74	10.24	33.11	330	118	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (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)
		10420	46.85	-21.35	68.2	47.69	39.7	16.39	56.93	100	0	P	H
		15630	45.72	-28.28	74	43.8	37.85	20.6	56.53	100	0	P	H
802.11ac													H
VHT80													H
CH 42		10420	46.04	-22.16	68.2	46.88	39.7	16.39	56.93	100	0	P	V
5210MHz		15630	45.58	-28.42	74	43.66	37.85	20.6	56.53	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 2 - 5250~5350MHz

WIFI 802.11ac VHT80 (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)
		5134.1	50.3	-23.7	74	41.53	31.87	10.02	33.12	293	341	P	H
		5077.4	42.48	-11.52	54	33.93	31.71	9.96	33.12	293	341	A	H
	*	5290	94.46	-	-	86.13	31.32	10.12	33.11	293	341	P	H
	*	5290	86.58	-	-	78.25	31.32	10.12	33.11	293	341	A	H
802.11ac		5350.08	56.1	-17.9	74	47.77	31.3	10.14	33.11	293	341	P	H
VHT80		5350.8	47	-7	54	38.67	31.3	10.14	33.11	293	341	A	H
CH 58		5124.5	49.7	-24.3	74	40.96	31.85	10.01	33.12	382	113	P	V
5290MHz		5137.1	42.09	-11.91	54	33.32	31.87	10.02	33.12	382	113	A	V
	*	5290	95.79	-	-	87.46	31.32	10.12	33.11	382	113	P	V
	*	5290	87.66	-	-	79.33	31.32	10.12	33.11	382	113	A	V
		5363.28	55.05	-18.95	74	46.64	31.38	10.14	33.11	382	113	P	V
		5350.32	47.13	-6.87	54	38.8	31.3	10.14	33.11	382	113	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 2 5250~5350MHz

WIFI 802.11ac VHT80 (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)
		10580	44.93	-23.27	68.2	45.56	39.7	16.5	56.83	100	0	P	H
		15870	44.11	-29.89	74	42.48	37.32	20.55	56.24	100	0	P	H
802.11ac													H
VHT80													H
CH 58		10580	44.65	-23.55	68.2	45.28	39.7	16.5	56.83	100	0	P	V
5290MHz		15870	44.13	-29.87	74	42.5	37.32	20.55	56.24	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 3 - 5470~5725MHz

WIFI 802.11ac VHT80 (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)
		5458.72	58.5	-15.5	74	49.64	31.73	10.24	33.11	269	337	P	H
		5468.08	59.36	-8.84	68.2	50.44	31.77	10.26	33.11	269	337	P	H
		5459.92	49.75	-4.25	54	40.88	31.74	10.24	33.11	269	337	A	H
	*	5530	94.91	-	-	85.84	31.84	10.35	33.12	269	337	P	H
802.11ac	*	5530	86.79	-	-	77.72	31.84	10.35	33.12	269	337	A	H
VHT80		5748.62	49.93	-18.27	68.2	40.48	32.1	10.54	33.19	269	337	P	H
CH 106		5459.92	58.17	-15.83	74	49.3	31.74	10.24	33.11	368	117	P	V
5530MHz		5468.32	59.77	-8.43	68.2	50.85	31.77	10.26	33.11	368	117	P	V
		5458	49.29	-4.71	54	40.43	31.73	10.24	33.11	368	117	A	V
	*	5530	95.75	-	-	86.68	31.84	10.35	33.12	368	117	P	V
	*	5530	87.62	-	-	78.55	31.84	10.35	33.12	368	117	A	V
		5756.18	49.9	-18.3	68.2	40.43	32.11	10.55	33.19	368	117	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 3 5470~5725MHz

WIFI 802.11ac VHT80 (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)
		11060	46.94	-27.06	74	46.8	39.76	16.85	56.47	100	0	P	H
		16590	46.49	-21.71	68.2	42.07	38.88	21.31	55.77	100	0	P	H
802.11ac													H
VHT80													H
CH 106		11060	46.67	-27.33	74	46.53	39.76	16.85	56.47	100	0	P	V
5530MHz		16590	46.37	-21.83	68.2	41.95	38.88	21.31	55.77	100	0	P	V
													V
													V

Remark	
	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.

Emission below 1GHz

WIFI 802.11ac VHT80 (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)
802.11ac VHT80 LF		30	24.71	-15.29	40	32.31	24.01	0.77	32.38	-	-	P	H
		40.67	22.86	-17.14	40	35.67	18.7	0.86	32.37	-	-	P	H
		54.25	19.81	-20.19	40	38.87	12.31	1	32.37	-	-	P	H
		923.37	32.17	-13.83	46	29.79	29.24	4.27	31.13	-	-	P	H
		936.95	32.55	-13.45	46	29.46	29.8	4.3	31.01	-	-	P	H
		947.62	34.35	-11.65	46	30.49	30.43	4.34	30.91	100	0	P	H
													H
													H
													H
													H
													H
													H
		40.67	33.86	-6.14	40	46.67	18.7	0.86	32.37	100	0	P	V
		54.25	29.79	-10.21	40	48.85	12.31	1	32.37	-	-	P	V
		73.65	27.25	-12.75	40	46.01	12.4	1.19	32.35	-	-	P	V
		923.37	32.81	-13.19	46	30.43	29.24	4.27	31.13	-	-	P	V
		943.74	33.5	-12.5	46	29.93	30.19	4.33	30.95	-	-	P	V
		955.38	33.51	-12.49	46	29.19	30.81	4.35	30.84	-	-	P	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	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

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 CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		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 C. Radiated Spurious Emission Plots

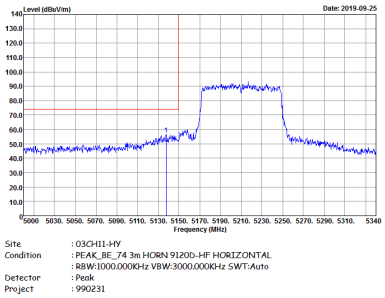
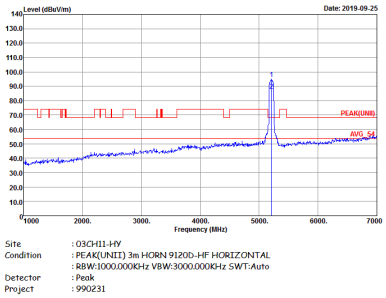
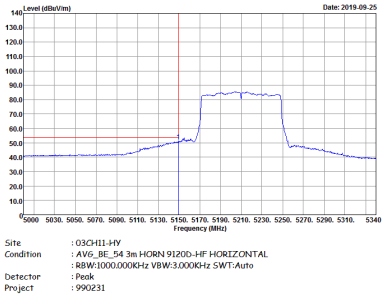
Test Engineer :	Watt Tseng, Fu Chen, Troye Hsieh	**Temperature :**	21.5~26.8°C
		Relative Humidity :	48.5~69.3%

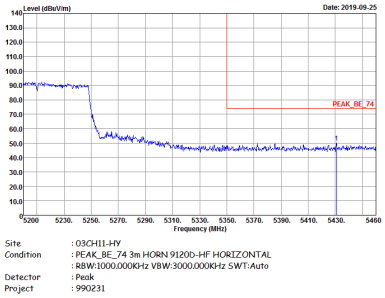
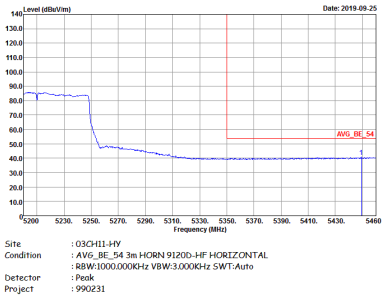
Note symbol

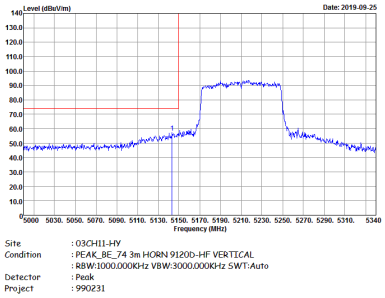
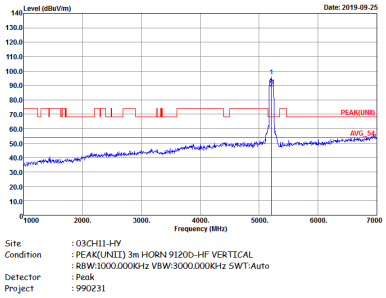
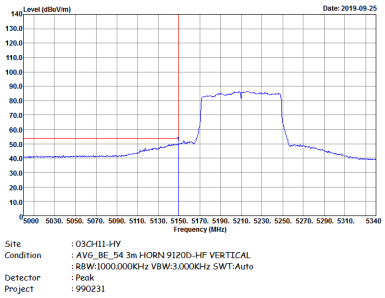
-L	**Low channel location**
-R	**High channel location**

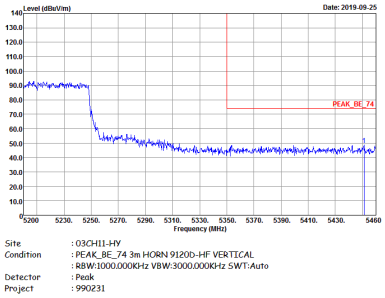
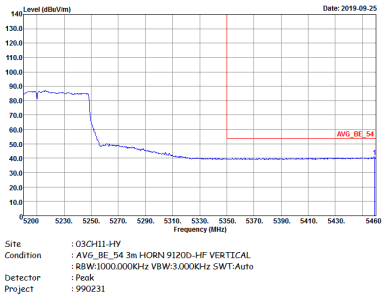
Band 1 - 5150~5250MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

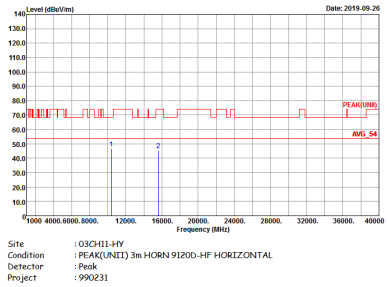
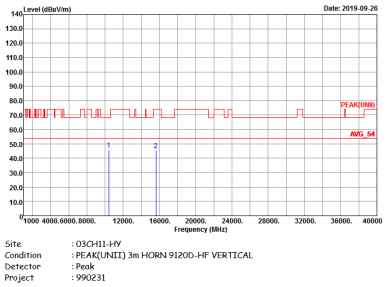
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

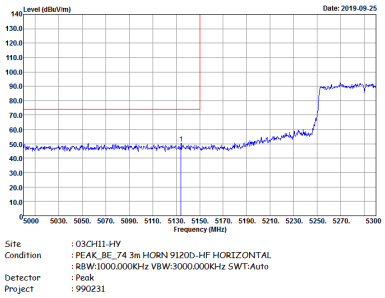
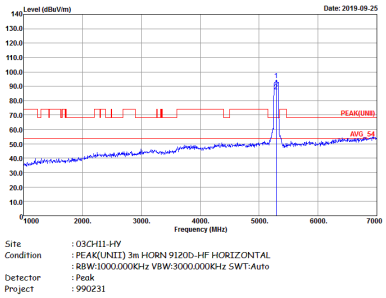
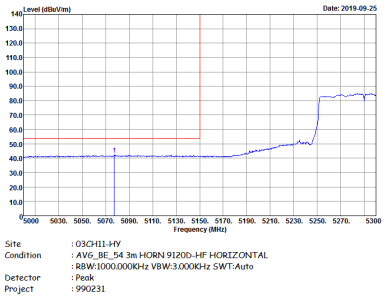
Band 1 - 5150~5250MHz

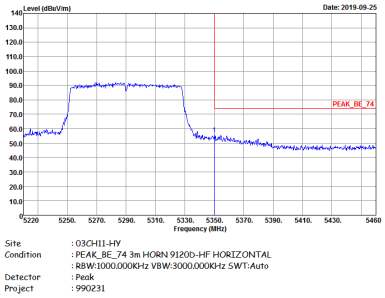
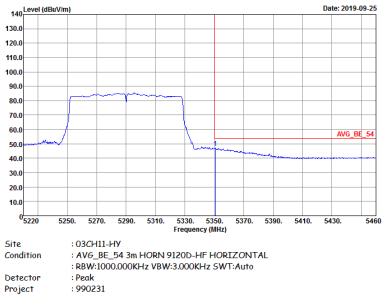
WIFI 802.11ac VHT80 (Harmonic @ 3m)

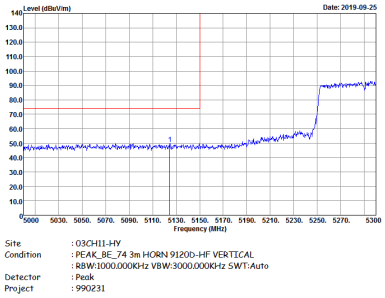
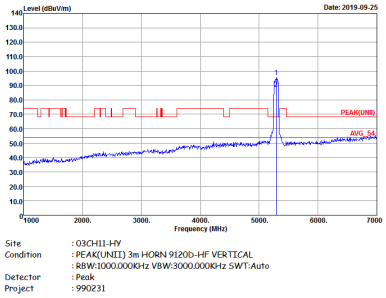
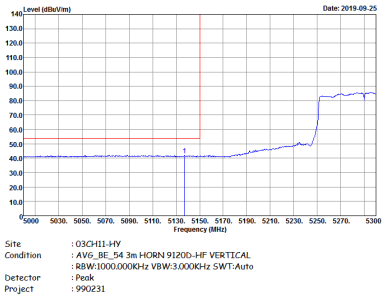
WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz	
1	Horizontal	Vertical
Peak Avg.		

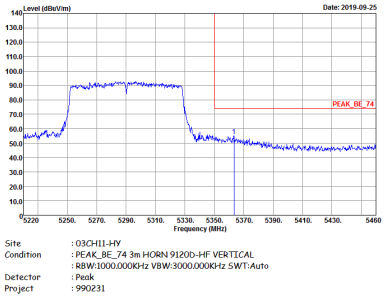
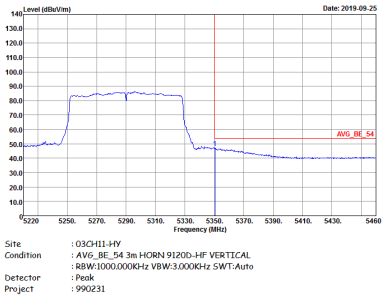
Band 2 - 5250~5350MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

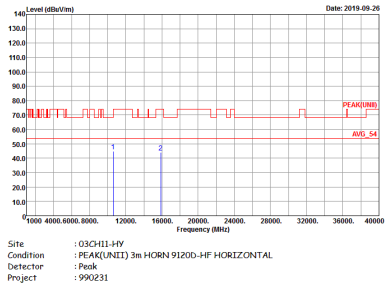
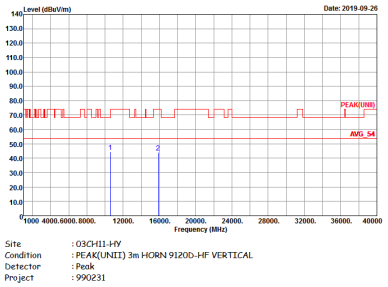
WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

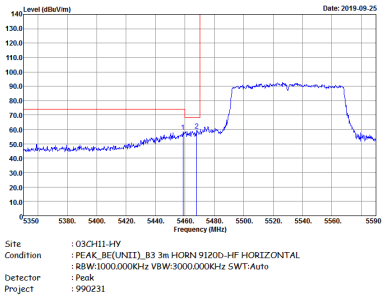
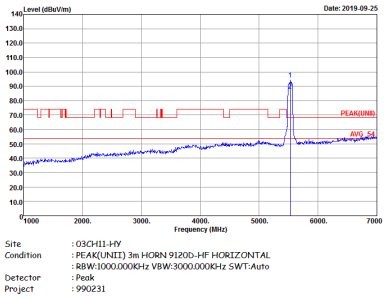
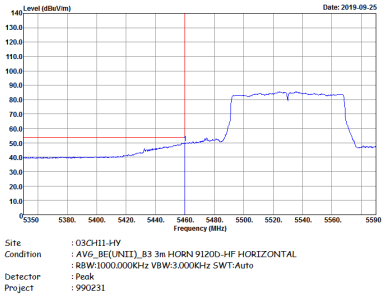
Band 2 - 5250~5350MHz

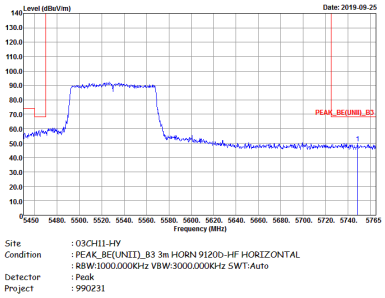
WIFI 802.11ac VHT80 (Harmonic @ 3m)

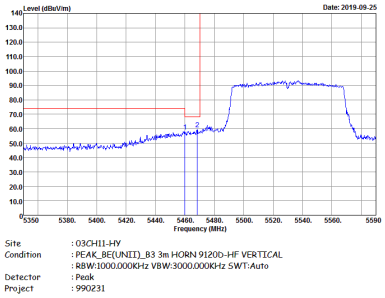
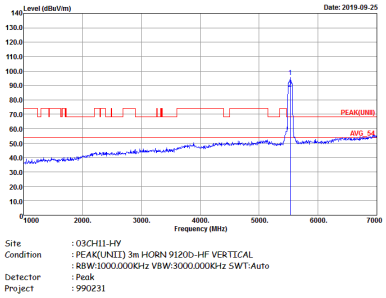
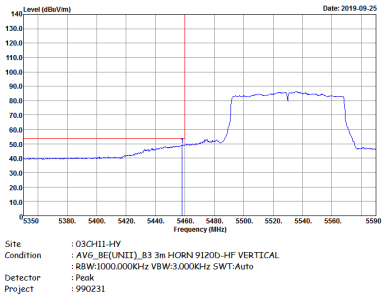
WIFI	Band 2 5250~5350MHz Harmonic @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz	
1	Horizontal	Vertical
Peak Avg.		

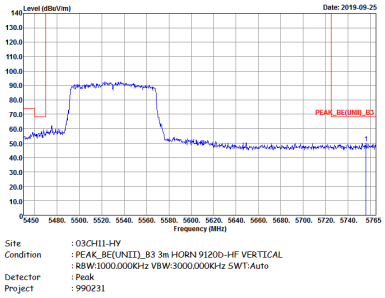
Band 3 - 5470~5725MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

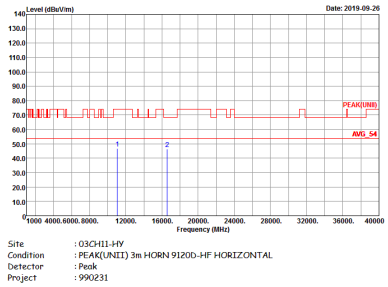
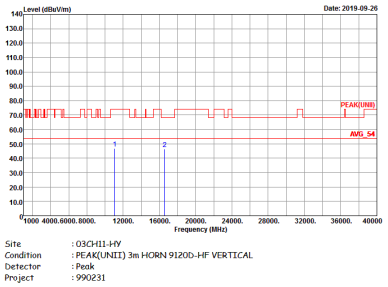
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz - R	
1	Horizontal	Fundamental
Peak		Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz - R	
1	Vertical	Fundamental
Peak		Left blank

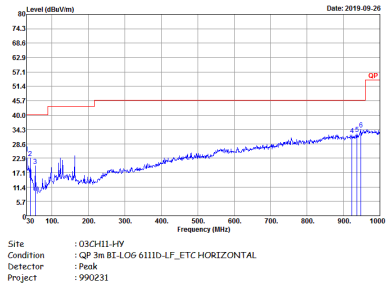
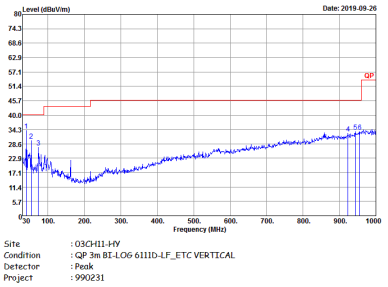
Band 3 - 5470~5725MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI	Band 3 5470~5725MHz Harmonic @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz	
1	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

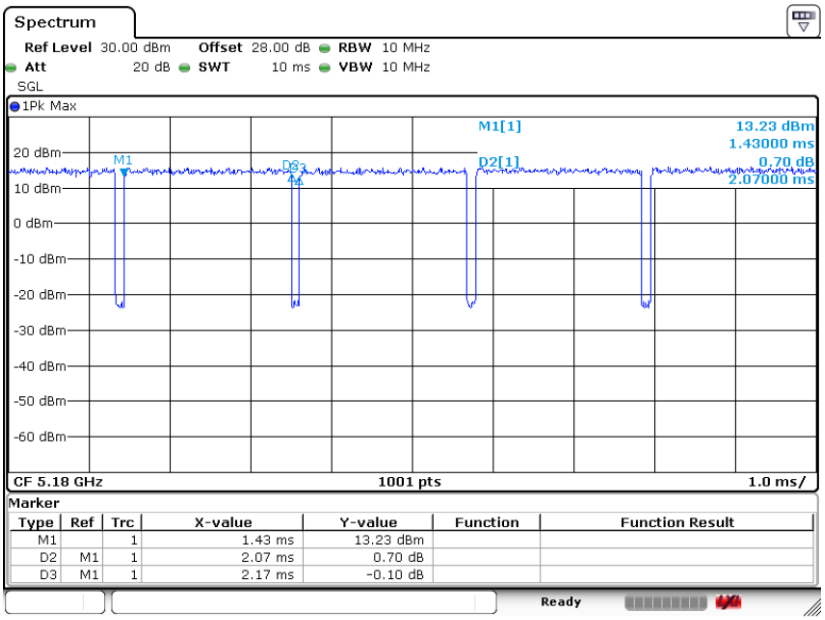
5GHz WIFI 802.11ac VHT80 (LF)

WIFI	5GHz WIFI	
ANT	802.11ac VHT80 LF	
1	Horizontal	Vertical
QP / Peak		

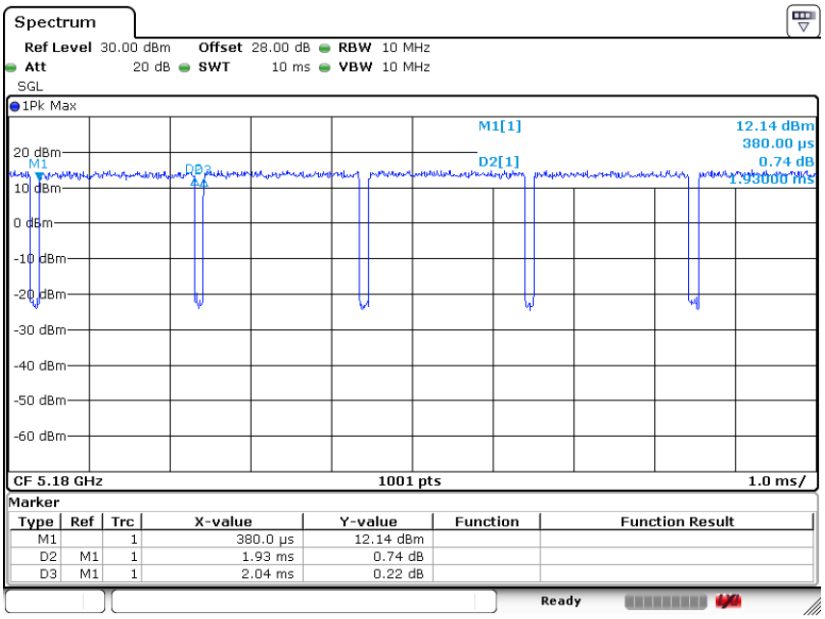
Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
802.11a	95.39	2070	0.48	1kHz	0.20
5GHz 802.11n HT20	94.61	1930	0.52	1kHz	0.24
5GHz 802.11n HT40	90.91	950	1.05	3kHz	0.41
5GHz 802.11ac VHT20	95.10	1940	0.52	1kHz	0.22
5GHz 802.11ac VHT40	89.62	950	1.05	3kHz	0.48
5GHz 802.11ac VHT80	88.89	736	1.36	3kHz	0.51

802.11a



802.11n HT20



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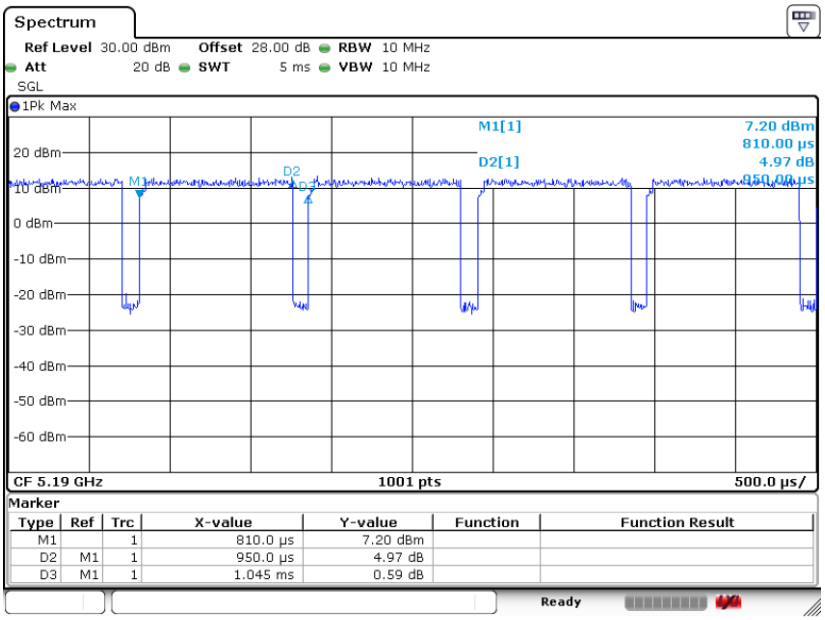
802.11n HT40



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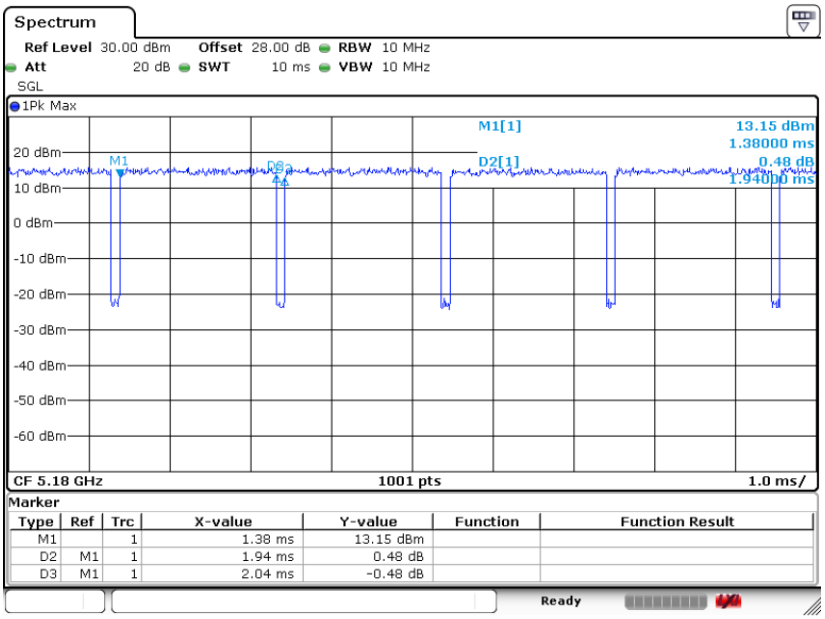
802.11ac VHT20



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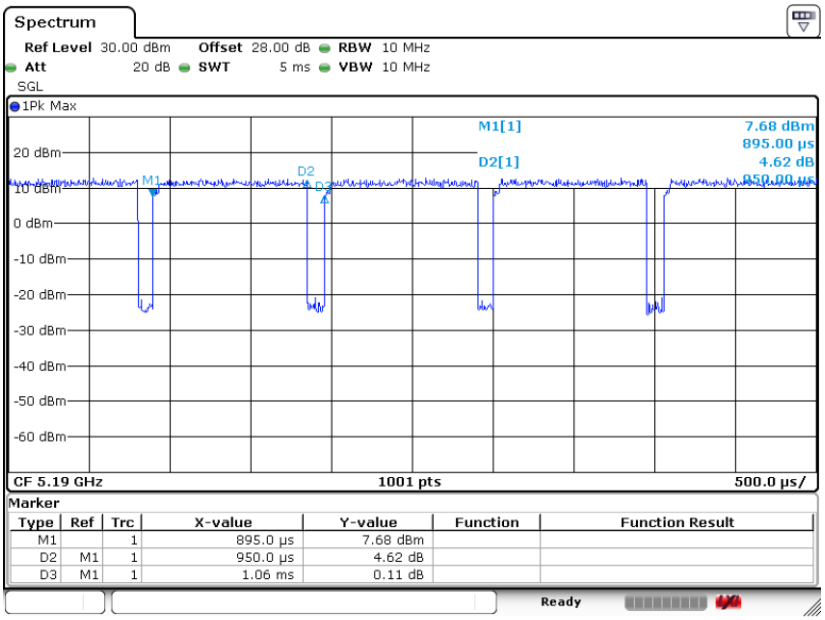
802.11ac VHT40



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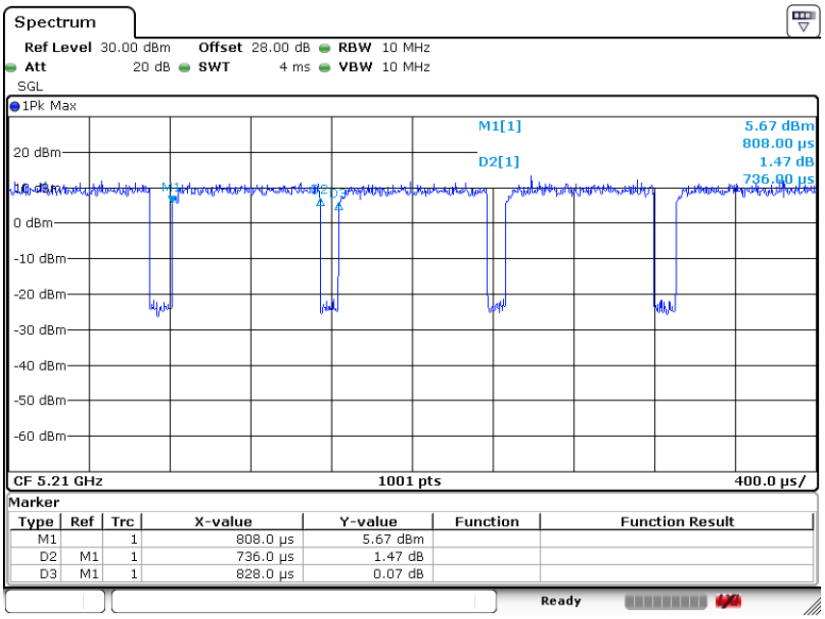
802.11ac VHT80



Date: 20.SEP.2019 17:46:48