

FCC RADIO TEST REPORT

FCC ID : IHDT56XN3
Equipment : Mobile Cellular Phone
Brand Name : Motorola
Model name : XT1965-3
Applicant : Motorola Mobility LLC
222 W,Merchandise Mart Plaza, Chicago IL
60654 USA
Manufacturer : Motorola Mobility LLC
222 W,Merchandise Mart Plaza, Chicago IL
60654 USA
Standard : FCC Part 15 Subpart E §15.407

The product was received on Sep. 04, 2018 and testing was started from Oct. 04, 2018 and completed on Oct. 09, 2018. We, SPORTON INTERNATIONAL INC., 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.



Approved by: Joseph Lin

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
FR890437-01F	01	Initial issue of report	Oct. 22, 2018

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.403 (i)	6dB & 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 3.08 dB at 30.270 MHz
-	15.207	AC Conducted Emission	Not Required	-
3.3	15.407 (c)	Automatically Discontinue Transmission	Pass	-
3.4	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. All the test cases were performed on original report which can be referred to Sporton Report Number FR890437F.				

Reviewed by: Wii Chang

Report Producer: Natasha Hsieh



1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Cellular Phone
Brand Name	Motorola
Model Name	XT1965-3
Sample 1	Dual SIM
Sample 2	Single SIM
FCC ID	IHDT56XN3
IMEI Code	Conducted : IMEI 1: 355575090010432 IMEI 2: 355575090010440 Radiation : IMEI 1: 355575090013295 IMEI 2: 355575090013303
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA/LTE/GNSS/NFC/FM WLAN 11b/g/n/ac HT20/VHT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
HW Version	DVT1B
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer.

Accessory List	
AC Adapter 1	Brand Name : Motorola
	Model Name : SC-31
	Manufacturer : Salom
AC Adapter 1	Brand Name : Motorola
	Model Name : SC-32
	Manufacturer : Salom
AC Adapter 1	Brand Name : Motorola
	Model Name : SC-33
	Manufacturer : Salom
AC Adapter 1	Brand Name : Motorola
	Model Name : SC-35
	Manufacturer : Salom
AC Adapter 2	Brand Name : Motorola
	Model Name : SC-31
	Manufacturer : Acbel
AC Adapter 2	Brand Name : Motorola
	Model Name : SC-32
	Manufacturer : Acbel
AC Adapter 2	Brand Name : Motorola
	Model Name : SC-33
	Manufacturer : Acbel
AC Adapter 2	Brand Name : Motorola
	Model Name : SC-35
	Manufacturer : Acbel
Battery	Brand Name : Motorola
	Model Name : JG40
	Manufacturer : Amperex
Earphone	Brand Name : Motorola
	Model Name : SH38C37773
	Manufacturer : Lyand
USB Cable 1	Brand Name : Cabletech
	Model Name : SC18C37157
USB Cable 2	Brand Name : Luxshare
	Model Name : SC18C37156
USB Cable 3	Brand Name : Saibao
	Model Name : SC18C37155

1.2 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	5745 MHz ~ 5825 MHz
Maximum Output Power	802.11a : 14.50 dBm / 0.0282 W 802.11n HT20 : 15.34 dBm / 0.0342 W 802.11n HT40 : 14.92 dBm / 0.0310 W 802.11ac VHT20 : 15.31 dBm / 0.0340 W 802.11ac VHT40 : 14.84 dBm / 0.0305 W 802.11ac VHT80 : 16.60 dBm / 0.0457 W
Antenna Type / Gain	Internal Antenna with gain -0.69 dBi
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

1.3 Modification of EUT

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

1.4 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, 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.
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.
	03CH15-HY

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

1.5 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

- 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: 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)
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

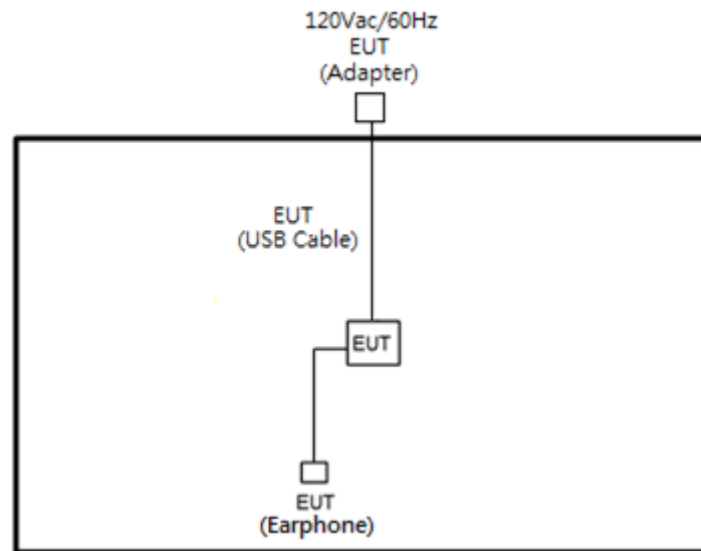
Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11n HT20	MCS0

Remark: For Radiated Test Cases, the tests were performed with Adapter 1, USB Cable 1 Type C and Sample 1

Ch. #		Band IV : 5725-5850 MHz
		802.11n HT20
L	Low	149
M	Middle	-
H	High	-

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

The RF test items, utility "QRCT" 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

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.

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

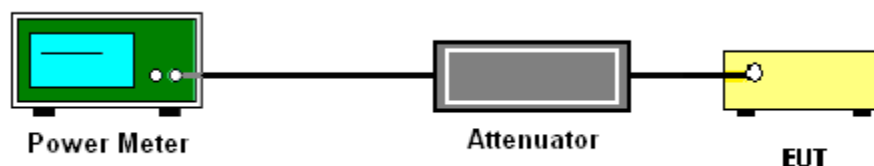
3.1.3 Test Procedures

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.

3.1.4 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 5.725-5.85 GHz band:

15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

- (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.

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

EIRP (dBm)	Field Strength at 3m (dB μ V/m)
- 27	68.3

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

- (i) Section 15.407(b)(1) to (b)(3) specify the unwanted emission limits 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.³
- (ii) Section 15.407(b)(4) specifies the unwanted emission limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are in terms of a Peak detector. An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the devices using the alternative limit.⁴

Note 3: An out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit.

Note 4: Only devices with antenna gains of 10 dBi or less may be approved using the emission limits specified in Section 15.247(d) till March 2, 2018; all other devices operating in this band must use the mask specified in Section 15.407(b)(4)(i).

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 \geq 3 MHz
- Detector = Peak
- Sweep time = auto
- Trace mode = max hold

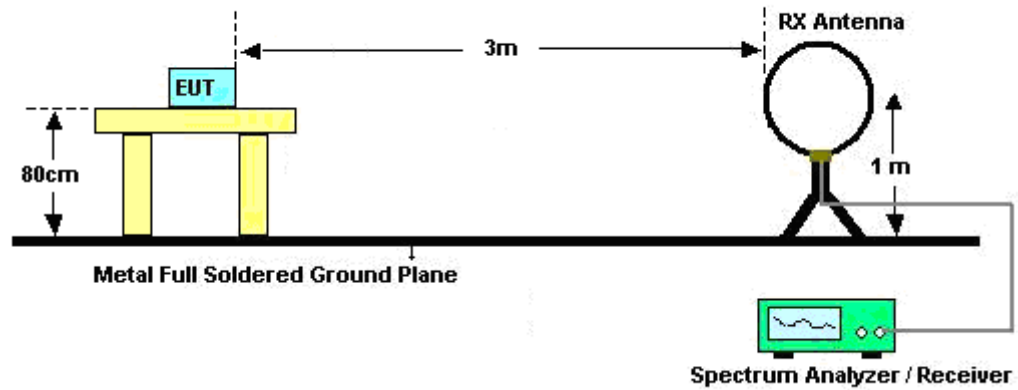


(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

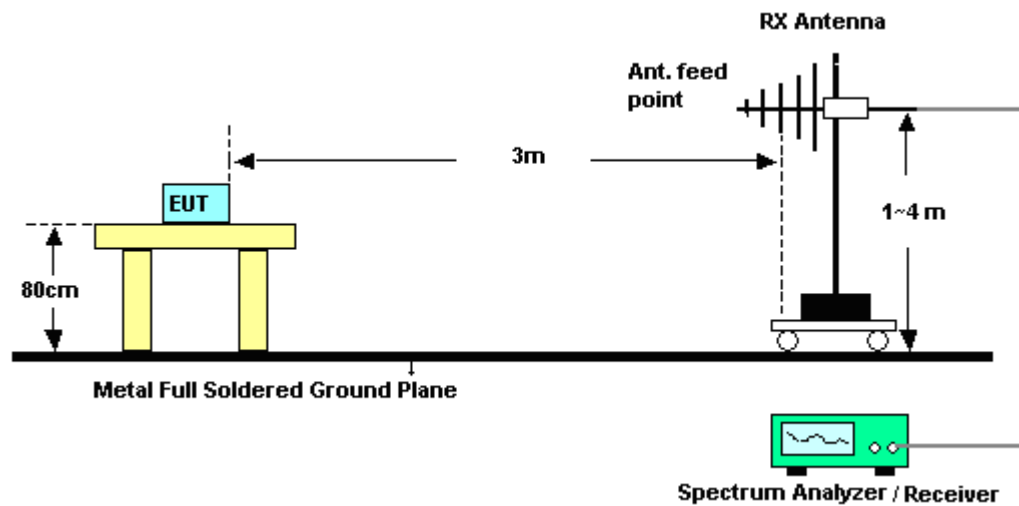
- $RBW = 1 \text{ MHz}$
 - $VBW = 10 \text{ Hz}$, when duty cycle is no less than 98 percent.
 - $VBW \geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested 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.

3.2.4 Test Setup

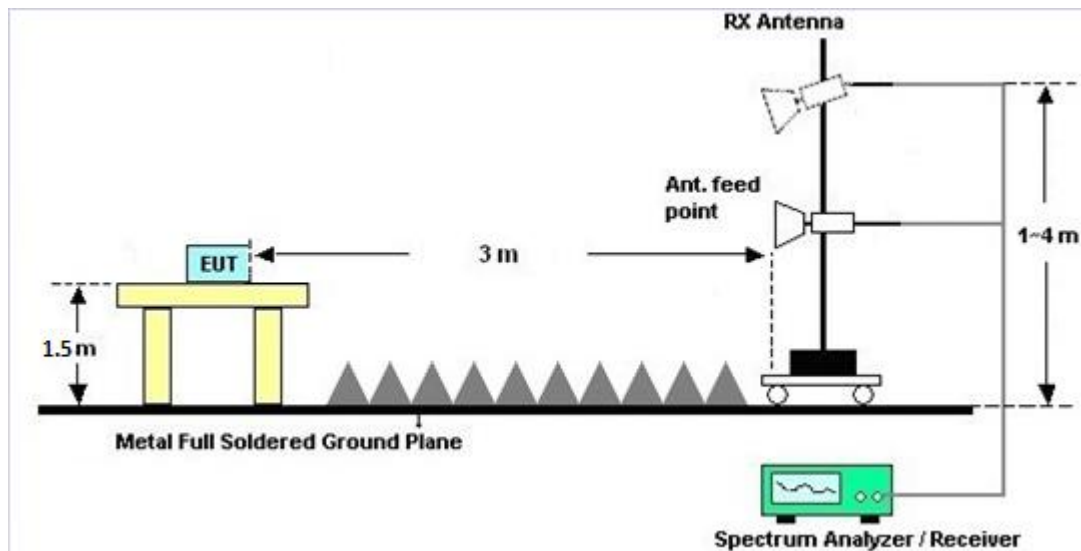
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.2.5 Test Results of Radiated 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 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 Unwanted Radiated Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix B and C.



3.3 Automatically Discontinue Transmission

3.3.1 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.

3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 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.



3.4 Antenna Requirements

3.4.1 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.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 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
Hygrometer	Testo	DTM-303A	TP157075	N/A	Mar. 06, 2018	Oct. 09, 2018	Mar. 05, 2019	Conducted (TH05-HY)
Power Meter	Anritsu	ML2495A	1132003	N/A	Aug. 16, 2018	Oct. 09, 2018	Aug. 15, 2019	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	1126017	300MHz~40GHz	Aug. 16, 2018	Oct. 09, 2018	Aug. 15, 2019	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100057	9kHz-40GHz	Nov. 21, 2017	Oct. 09, 2018	Nov. 20, 2018	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 07, 2017	Oct. 09, 2018	Nov. 06, 2018	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1300484	N/A	Mar. 01, 2018	Oct. 09, 2018	Feb. 28, 2019	Conducted (TH05-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Oct. 04, 2018~ Oct. 05, 2018	Nov. 22, 2018	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL6111D& 00800N1D0 1N-06	41912&05	30MHz to 1GHz	Jan. 10, 2018	Oct. 04, 2018~ Oct. 05, 2018	Jan. 09, 2019	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55- 303	1710001800 0550006	1GHz~18GHz	Jul. 10, 2018	Oct. 04, 2018~ Oct. 05, 2018	Jul. 09, 2019	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A (MXE)	MY5413008 5	20Hz ~ 8.4GHz	Oct. 31, 2017	Oct. 04, 2018~ Oct. 05, 2018	Oct. 30, 2018	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 16, 2017	Oct. 04, 2018~ Oct. 05, 2018	Oct. 15, 2018	Radiation (03CH15-HY)
Hygrometer	TECPEL	DTM-303B	TP162976	N/A	Oct. 12, 2017	Oct. 04, 2018~ Oct. 05, 2018	Oct. 11, 2018	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY5327019 5	1GHz~26.5GHz	Aug. 23, 2018	Oct. 04, 2018~ Oct. 05, 2018	Aug. 22, 2019	Radiation (03CH15-HY)
Spectrum Analyzer	Agilent	E4446A	MY5018013 6	3Hz~44GHz	Apr. 25, 2018	Oct. 04, 2018~ Oct. 05, 2018	Apr. 24, 2019	Radiation (03CH15-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Oct. 04, 2018~ Oct. 05, 2018	N/A	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Oct. 04, 2018~ Oct. 05, 2018	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Oct. 04, 2018~ Oct. 05, 2018	N/A	Radiation (03CH15-HY)
Amplifier	MITEQ	TTA1840-35- HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 16, 2018	Oct. 04, 2018~ Oct. 05, 2018	Jul. 15, 2019	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA91705 84	18GHz- 40GHz	Nov. 27, 2017	Oct. 04, 2018~ Oct. 05, 2018	Nov. 26, 2018	Radiation (03CH15-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Software	Audix	E3 6.2009-8-24(K5)	ARD-SPR-0 00185	N/A	N/A	Oct. 04, 2018~ Oct. 05, 2018	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY36980/4	30M-18G	Apr. 16, 2018	Oct. 04, 2018~ Oct. 05, 2018	Apr. 15, 2019	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9838/4	30M-18GHz	Apr. 16, 2018	Oct. 04, 2018~ Oct. 05, 2018	Apr. 15, 2019	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	MTJ	000000-MT1 8A-100D321 0	30M-18G	Apr. 16, 2018	Oct. 04, 2018~ Oct. 05, 2018	Apr. 15, 2019	Radiation (03CH15-HY)
Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Oct. 17, 2017	Oct. 04, 2018~ Oct. 05, 2018	Oct. 16, 2018	Radiation (03CH15-HY)
Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30M~40GHz	Oct. 17, 2017	Oct. 04, 2018~ Oct. 05, 2018	Oct. 16, 2018	Radiation (03CH15-HY)
Filter	Wainwright	WLKS1200- 8SS	SN3	1.2G Low Pass	Nov. 21, 2017	Oct. 04, 2018~ Oct. 05, 2018	Nov. 20, 2018	Radiation (03CH15-HY)
Filter	Wainwright	WLKS4500- 8SS	SN19	4.5G Low Pass	Mar. 22, 2018	Oct. 04, 2018~ Oct. 05, 2018	Mar. 21, 2019	Radiation (03CH15-HY)
Filter	Woken	WHKX8-527 2.5-6750-18 000-40ST	SN2	6.75G Highpass	Jul. 15, 2018	Oct. 04, 2018~ Oct. 05, 2018	Jul. 14, 2019	Radiation (03CH15-HY)

5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.20
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.50
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.20
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Appendix A. Test Result of Conducted Test Items

Test Engineer:	AnAn Wu	Temperature:	21~25	°C
Test Date:	2018/10/9	Relative Humidity:	51~54	%

TEST RESULTS DATA
Average Power Table

Band IV														
Mod.	Data Rate	N _{TX}	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	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	0.21	-	14.50	-		30.00	-	-0.69	-	Pass
11a	6Mbps	1	157	5785	0.21	-	14.30	-		30.00	-	-0.69	-	Pass
11a	6Mbps	1	165	5825	0.21	-	13.57	-		30.00	-	-0.69	-	Pass
HT20	MCS0	1	149	5745	0.23	-	15.34	-		30.00	-	-0.69	-	Pass
HT20	MCS0	1	157	5785	0.23	-	13.76	-		30.00	-	-0.69	-	Pass
HT20	MCS0	1	165	5825	0.23	-	12.67	-		30.00	-	-0.69	-	Pass
HT40	MCS0	1	151	5755	0.49	-	14.92	-		30.00	-	-0.69	-	Pass
HT40	MCS0	1	159	5795	0.49	-	14.55	-		30.00	-	-0.69	-	Pass
VHT20	MCS0	1	149	5745	0.27	-	15.31	-		30.00	-	-0.69	-	Pass
VHT20	MCS0	1	157	5785	0.27	-	13.73	-		30.00	-	-0.69	-	Pass
VHT20	MCS0	1	165	5825	0.27	-	12.64	-		30.00	-	-0.69	-	Pass
VHT40	MCS0	1	151	5755	0.49	-	14.84	-		30.00	-	-0.69	-	Pass
VHT40	MCS0	1	159	5795	0.49	-	14.52	-		30.00	-	-0.69	-	Pass
VHT80	MCS0	1	155	5775	0.50	-	16.60	-		30.00	-	-0.69	-	Pass



Appendix B. Radiated Spurious Emission

Test Engineer :	Watt Tseng	Temperature :	22~25°C
		Relative Humidity :	51~58%

Band 4 - 5725~5850MHz

WIFI 802.11n HT20 (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)
802.11n HT20 CH 149 5745MHz		5634.6	51.5	-16.7	68.2	40.34	32.17	9.21	30.22	100	63	P	H
		5698.4	54.72	-49.3	104.02	43.41	32.23	9.33	30.25	100	63	P	H
		5709.4	53.97	-53.86	107.83	42.63	32.25	9.35	30.26	100	63	P	H
		5725	54.78	-67.42	122.2	43.39	32.27	9.38	30.26	100	63	P	H
	*	5745	103.42	-	-	91.98	32.29	9.42	30.27	100	63	P	H
	*	5745	95.3	-	-	83.86	32.29	9.42	30.27	100	63	A	H
													H
													H
		5601.2	51.07	-17.13	68.2	39.99	32.12	9.15	30.19	107	223	P	V
		5692	55.35	-43.95	99.3	44.05	32.23	9.32	30.25	107	223	P	V
		5706.4	54.01	-52.98	106.99	42.67	32.25	9.35	30.26	107	223	P	V
		5721.6	55.4	-59.05	114.45	44.02	32.27	9.37	30.26	107	223	P	V
	*	5745	105.31	-	-	93.87	32.29	9.42	30.27	107	223	P	V
	*	5745	97.37	-	-	85.93	32.29	9.42	30.27	107	223	A	V
													V
													V



Band 4 5725~5850MHz
WIFI 802.11n HT20 (Harmonic @ 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)
802.11n HT20 CH 149 5745MHz		11490	56.86	-17.14	74	63.55	40.41	13.92	61.02	100	198	P	H
		11490	43.93	-10.07	54	50.62	40.41	13.92	61.02	100	198	A	H
		17235	49.7	-18.5	68.2	49.63	41.71	17.88	59.52	100	0	P	H
													H
		11490	62.2	-11.8	74	68.89	40.41	13.92	61.02	100	286	P	V
		11490	50.19	-3.81	54	56.88	40.41	13.92	61.02	100	286	A	V
		17235	50.16	-18.04	68.2	50.09	41.71	17.88	59.52	100	0	P	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 HT20 (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 HT20 LF		57.81	28.44	-11.56	40	47.91	12.17	0.92	32.61	-	-	P	H
		175.8	35.01	-8.49	43.5	50.41	15.35	1.6	32.55	-	-	P	H
		198.75	35.08	-8.42	43.5	50.75	14.99	1.7	32.54	100	0	P	H
		482	29.78	-16.22	46	35.73	23.91	2.59	32.55	-	-	P	H
		733.3	31.18	-14.82	46	32.4	27.89	3.17	32.4	-	-	P	H
		885.9	35.24	-10.76	46	34.12	29.18	3.5	31.77	-	-	P	H
													H
													H
													H
													H
													H
													H
		30.27	36.92	-3.08	40	44.68	24.22	0.67	32.65	100	0	P	V
		76.71	31.96	-8.04	40	50.25	13.15	1.06	32.59	-	-	P	V
		240.87	31.36	-14.64	46	43.22	18.69	1.86	32.54	-	-	P	V
		482	27.39	-18.61	46	33.34	23.91	2.59	32.55	-	-	P	V
		893.6	32.99	-13.01	46	31.69	29.31	3.51	31.73	-	-	P	V
		957.3	33.64	-12.36	46	29.83	31.12	3.65	31.22	-	-	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	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		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 C. Radiated Spurious Emission Plots

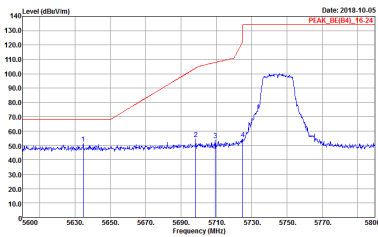
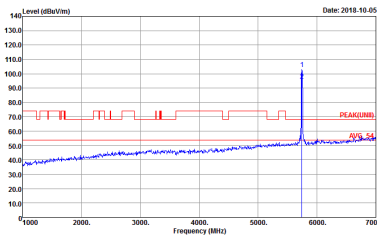
Test Engineer :	Watt Tseng	Temperature :	22~25°C
		Relative Humidity :	51~58%

Note symbol

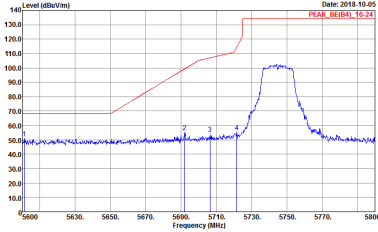
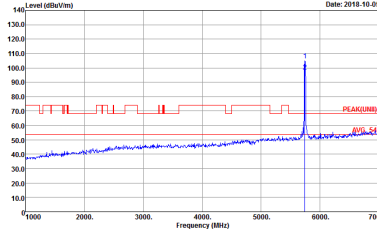
-L	Low channel location
-R	High channel location



Band 4 - 5725~5850MHz
WIFI 802.11n HT20 (Band Edge @ 3m)

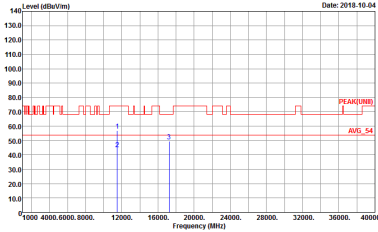
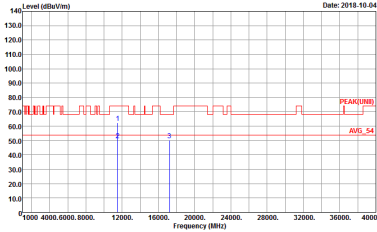
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11n HT20 CH149 5745MHz	
1	Horizontal	Fundamental
Peak	<div><p>Site : 03CH15-HY Condition : PEAK_85(94)_16-24 3m 91200_15_1620 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 890437-01 Mode : 3 Setting : 13.5</p></div>	<div><p>Site : 03CH15-HY Condition : PEAK(UNIT) 3m 91200_15_1620 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 890437-01 Mode : 3 Setting : 13.5</p></div>



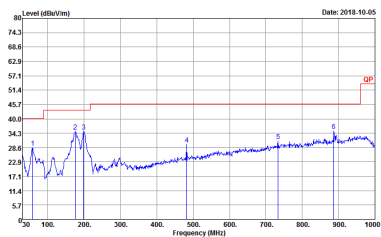
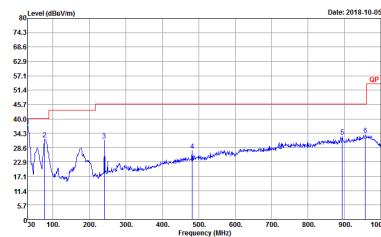
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11n HT20 CH149 5745MHz	
1	Vertical	Fundamental
Peak	<div><p>Site : 03CH15-11Y Condition : PEAK_BE(B4)_16-24 3m 91200_15_1620 VERTICAL Detector : Peak Project : 890437-01 Mode : 3 Setting : 13.5</p></div>	<div><p>Site : 03CH15-11Y Condition : PEAK(UNIT) 3m 91200_15_1620 VERTICAL Detector : Peak Project : 890437-01 Mode : 3 Setting : 13.5</p></div>



Band 4 - 5725~5850MHz
WIFI 802.11n HT20 (Harmonic @ 3m)

WIFI	Band 4 5725~5850MHz Harmonic @ 3m	
ANT	802.11n HT20 CH149 5745MHz	
1	Horizontal	Vertical
Peak Avg.	 <p>Site : 03CHI5-HY Condition : PEAK(UNIT) 3m 91200_15_1620 HORIZONTAL Detector : Peak Project : 890437 Mode : 3 Setting : 13.5</p>	 <p>Site : 03CHI5-HY Condition : PEAK(UNIT) 3m 91200_15_1620 VERTICAL Detector : Peak Project : 890437 Mode : 3 Setting : 13.5</p>

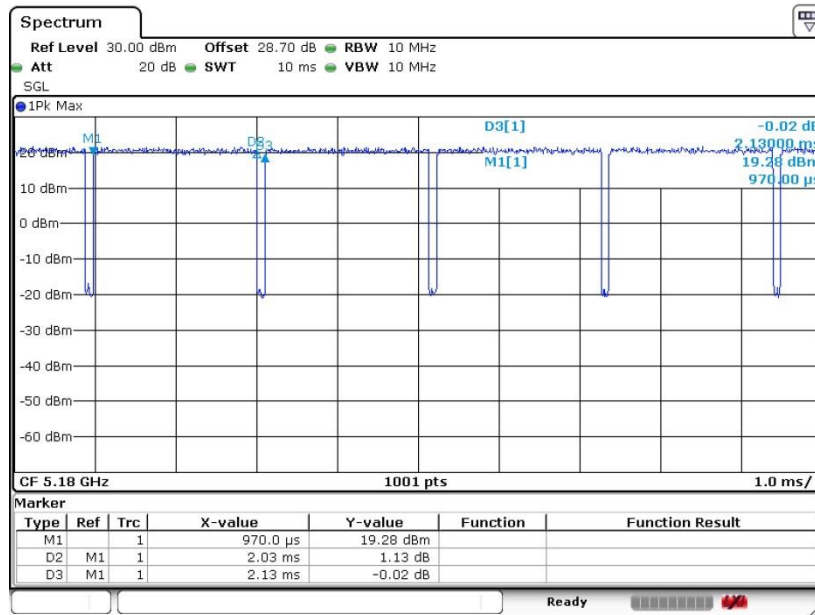
Emission below 1GHz
5GHz WIFI 802.11n HT20 (LF)

WIFI	5GHz 5725~5850MHz	
ANT	802.11n HT20 LF	
1	Horizontal	Vertical
QP / Peak	 <p> Site : 03CH15-HY Condition : QP 3m 81LO6_15_41912 HORIZONTAL Detector : Peak Project : 890437 Mode : 4 </p>	 <p> Site : 03CH15-HY Condition : QP 3m 81LO6_15_41912 VERTICAL Detector : Peak Project : 890437 Mode : 4 </p>

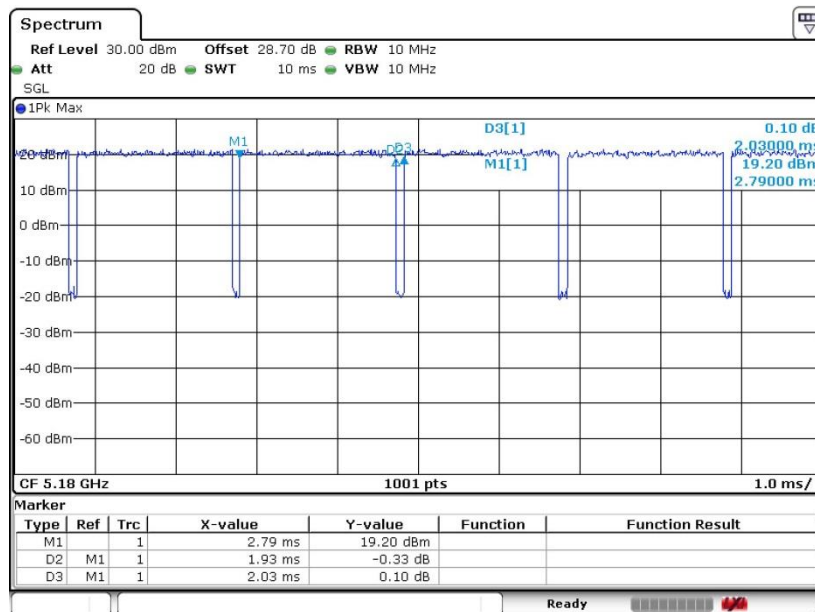


Appendix D. Duty Cycle Plots

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
802.11a	95.28	2020	0.495	1kHz	0.21
5GHz 802.11n HT20	94.95	1880	0.532	1kHz	0.23
5GHz 802.11n HT40	89.32	920	1.087	3kHz	0.49
5GHz 802.11ac VHT20	94.00	1880	0.532	1kHz	0.27
5GHz 802.11ac VHT40	89.42	930	1.075	3kHz	0.49
5GHz 802.11ac VHT80	89.16	740	1.351	3kHz	0.50

802.11a


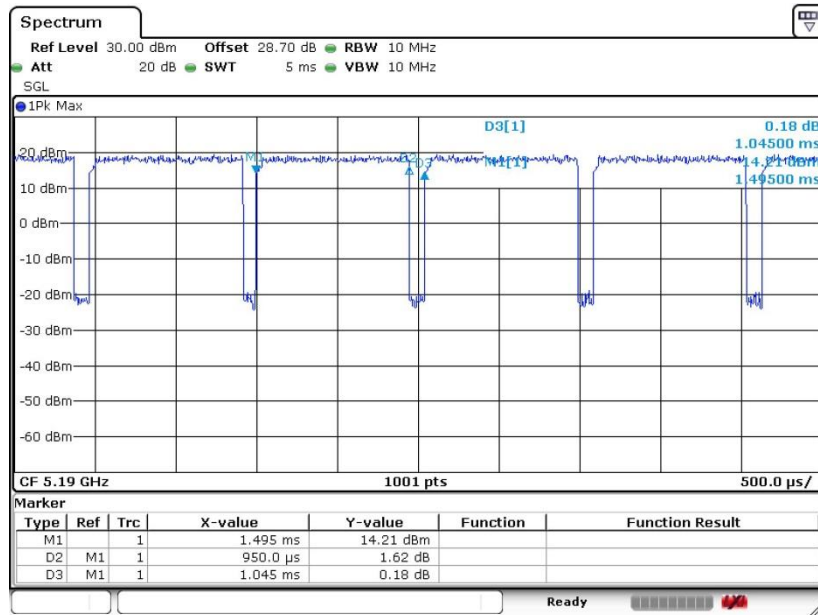
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802.11n HT20


Date: 12.SEP.2018 07:44:09

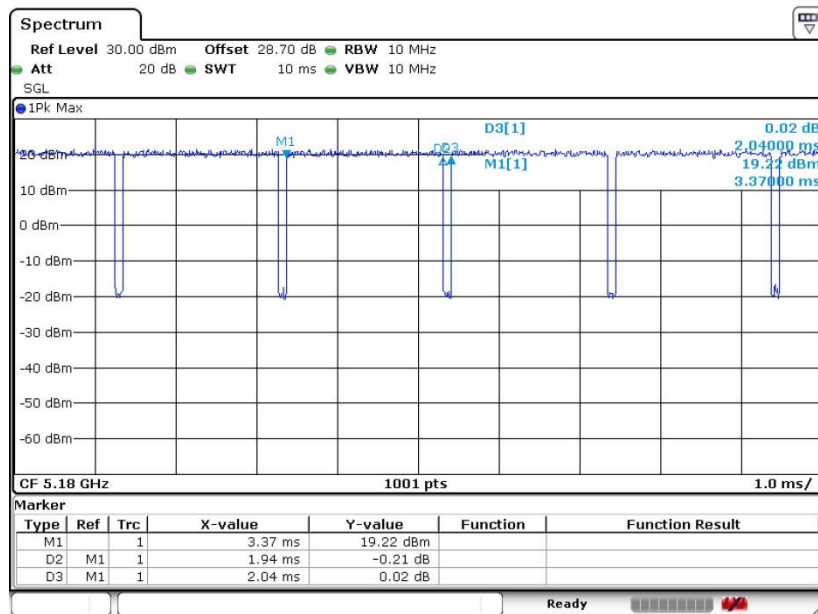


802.11n HT40



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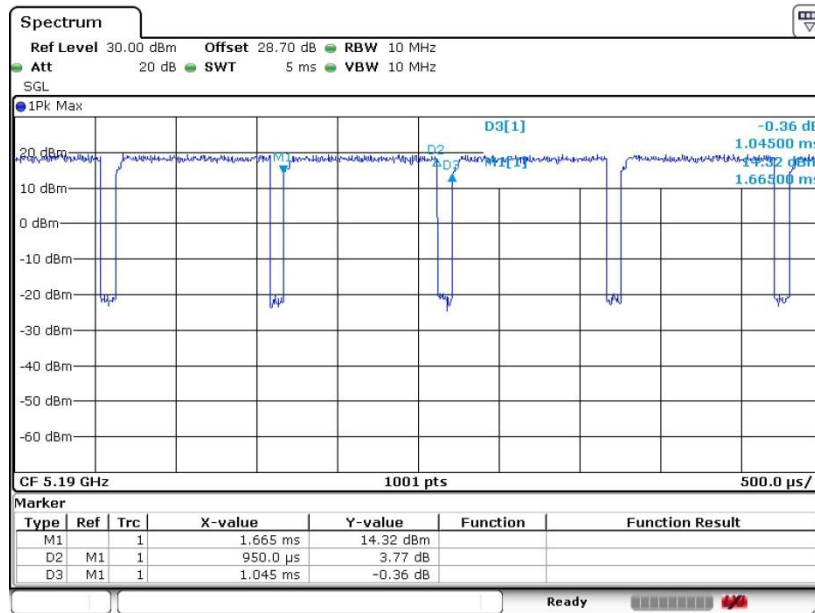
802.11ac VHT20



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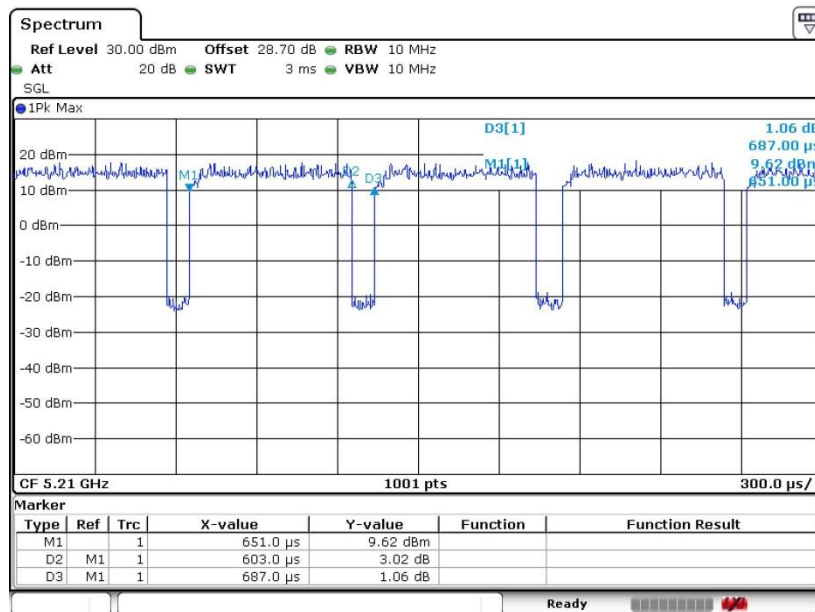


802.11ac VHT40



Date: 12.SEP.2018 07:08:52

802.11ac VHT80



Date: 12.SEP.2018 07:15:11

—THE END—