FCC RADIO TEST REPORT

FCC ID	:	**2ATUQ-6698**
Equipment	:	**Tablet**
Model Name	:	**K72LL4**
Applicant	:	**Mangled Horses LLC** **225 Wilmington-West Chester Pike, Suite 202, Chadds Ford, PA 19317**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Nov. 12, 2019 and testing was started from Nov. 12, 2019 and completed on Jan. 16, 2020. 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
FR982217-02C	01	Initial issue of report	Jan. 10, 2020
FR982217-02C	02	Add the description of worst mode in section 2.2	Jan. 17, 2020
FR982217-02C	03	Adding conducted output power.	Jan. 21, 2020
FR982217-02C	04	Add the near view of Radiated Emission in setup photo	Jan. 23, 2020

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)
-	15.247(a)(2)	6dB Bandwidth	Not Required
-	2.1049	99% Occupied Bandwidth	Not Required
3.1	15.247(b)	Power Output Measurement	Pass
-	15.247(e)	Power Spectral Density	Not Required
-	15.247(d)	Conducted Band Edges	Not Required
		Conducted Spurious Emission	Not Required
3.2	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass
3.3	15.207	AC Conducted Emission	Pass
3.4	15.203 & 15.247(b)	Antenna Requirement	Pass

Remark:

1. Not required means after assessing, test items are not necessary to carry out, which is covered by previous report.
2. This is a variant report by removing WPC function. All the test cases were performed on original report which can be referred to Sporton Report Number FR982217-01C. Based on the original report, the test cases were 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: Vivian Hsu

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Tablet
Model Name	K72LL4
FCC ID	2ATUQ-6698
EUT supports Radios application	WLAN 11b/g/n HT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE

1.2 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2472 MHz
Maximum (Average) Output Power to antenna	**<Ant. 1>** 802.11b : 15.30 dBm (0.0339 W) 802.11n HT20 : 14.00 dBm (0.0251 W) **<Ant. 2>** 802.11b : 15.10 dBm (0.0324 W) 802.11g : 14.00 dBm (0.0251 W) 802.11n HT20 : 13.90 dBm (0.0245 W)
Antenna Type / Gain	**<Ant. 1>** IFA Antenna Type with gain 2.8 dBi **<Ant. 2>** Monopole Antenna type with gain 2.8 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.3 Modification of EUT

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

1.4 Testing Location

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory	
Test Site Location	No.52, 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.**	
	CO05-HY	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.**
	03CH15-HY

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

FCC designation No.: TW1190 and TW0007

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 C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- 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 (1 GHz 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 (Ant. 1: Y plane ; Ant. 2: X plane) were recorded in this report.

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)
2400-2483.5 MHz	1	2412	8	2447
	2	2417	9	2452
	3	2422	10	2457
	4	2427	11	2462
	5	2432	12	2467
	6	2437	13	2472
	7	2442		

2.2 Test Mode

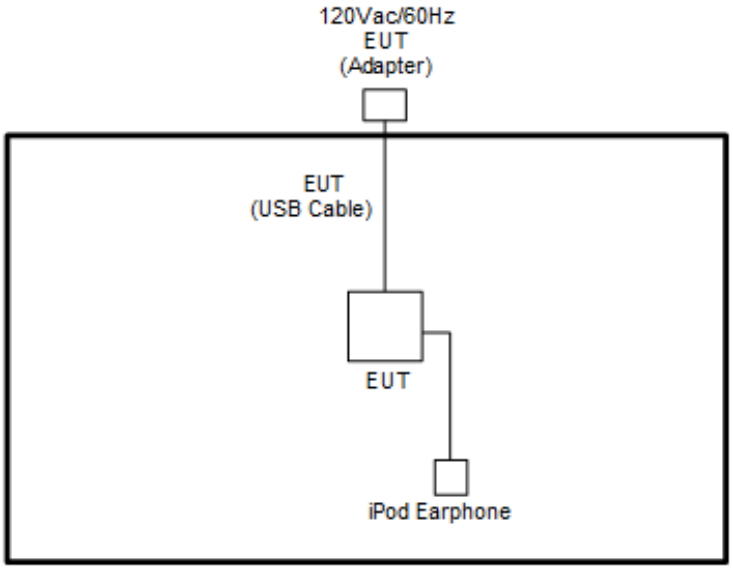
Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11b	**1 Mbps**
802.11g	**6 Mbps**
802.11n HT20	**MCS0**

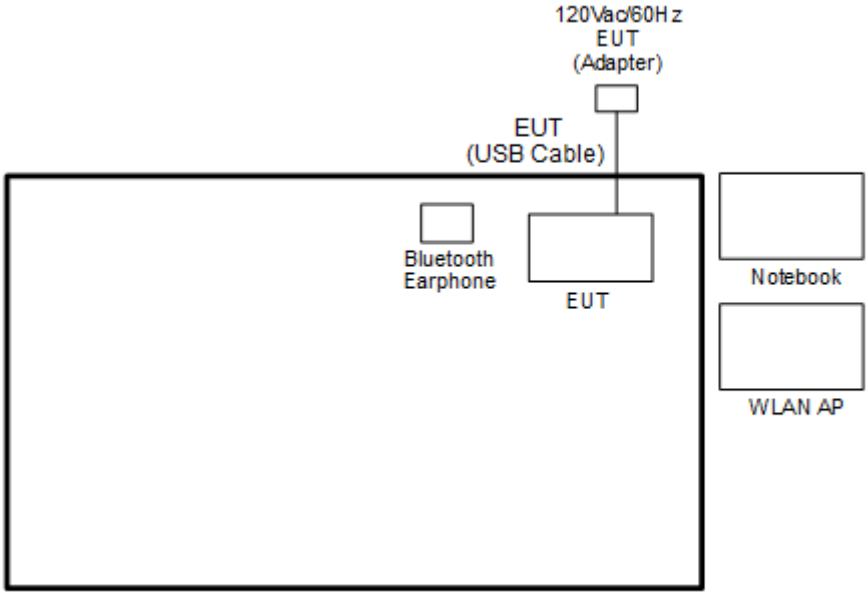
Test Cases	
AC Conducted Emission	Mode 1 : WLAN (2.4GHz) Link + Bluetooth Link + Play MPEG4 from SD Card + USB Cable (Charging from AP16) + MicroSD card
Remark: The AC Conducted Emission test case has leveraged from the worst mode of Part 15B AC Conducted Emission.	

2.3 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Lenovo	L570	N/A	N/A	N/A
2.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A
3.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
4.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
5.	NOTE BOOK	Dell	Latitude E3400	FCC DoC	N/A	AC I/P：Unshielded, 1.2m DC O/P：Shielded, 1.8m
6.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “CMD” 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 Output Power Measurement

3.1.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for average output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the average output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

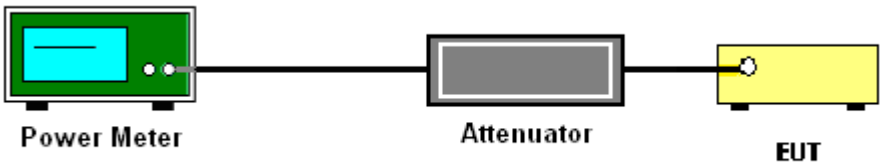
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of Average Output Power

Please refer to Appendix A.

3.2 Radiated Band Edges and Spurious Emission Measurement

3.2.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.2.2 Measuring Instruments

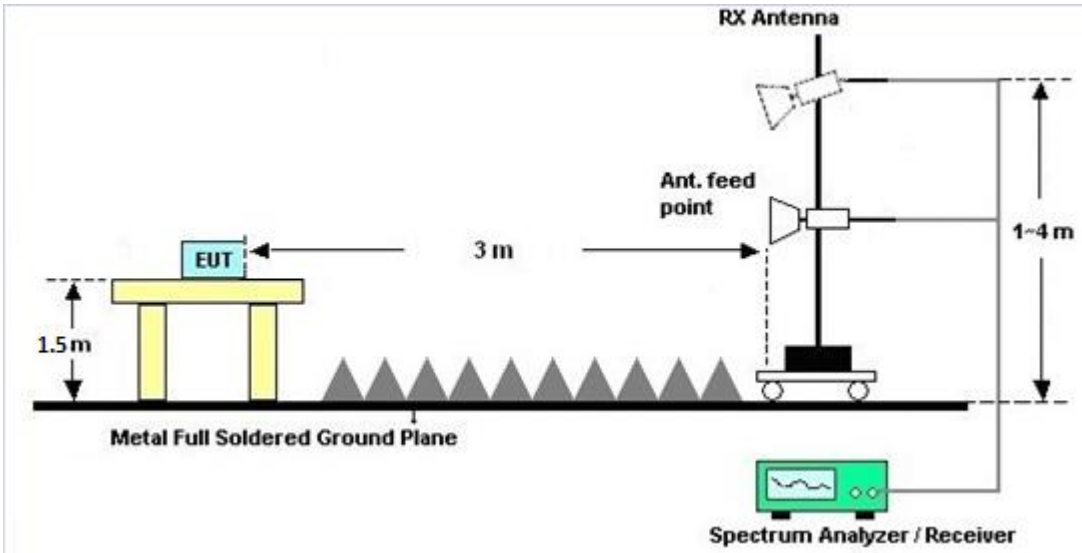
See list of measuring equipment of this test report.

3.2.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. 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. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. 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.
7. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - 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.

3.2.4 Test Setup

For radiated emissions above 1GHz



3.2.5 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.2.6 Duty Cycle

Please refer to Appendix E.

3.2.7 Test Result of Radiated Spurious Emission

Please refer to Appendix C and D.

3.3 AC Conducted Emission Measurement

3.3.1 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 (dBμV)	
	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.

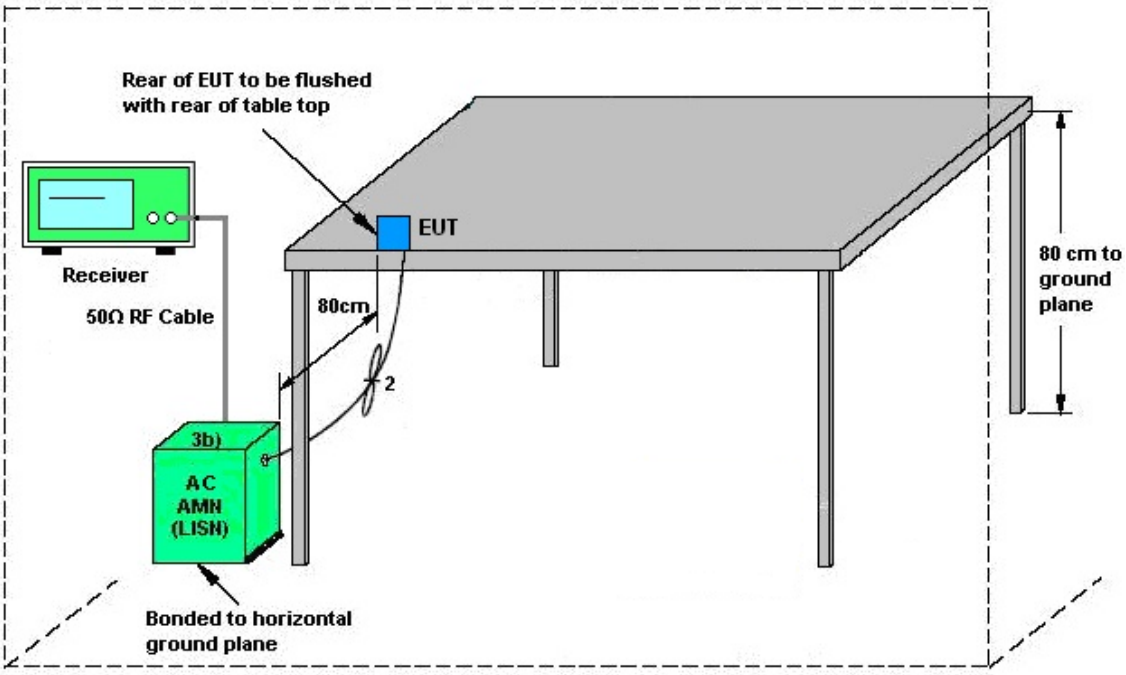
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it 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.

3.3.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.3.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.4 Antenna Requirements

3.4.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached Antenna or of an Antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

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
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 06, 2018	Nov. 12, 2019 ~ Nov. 27, 2019	Dec. 05, 2019	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-2114	1-18GHz	Jul. 31, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	Jul. 30, 2020	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Dec. 05, 2018	Nov. 12, 2019 ~ Nov. 27, 2019	Dec. 04, 2019	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800055007	1GHz~18GHz	Apr. 01, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	May 31, 2020	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY53270195	1GHz~26.5GHz	Aug. 23, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	Aug. 22, 2020	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY55420170	20MHz~8.4GHz	Mar. 08, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	Mar. 07, 2020	Radiation (03CH15-HY
EMI Test Receiver	Rohde & Schwarz	ESU26	100390	20Hz~26.5GHz	Dec. 27, 2018	Nov. 12, 2019 ~ Nov. 27, 2019	Dec. 26, 2019	Radiation (03CH15-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Nov. 12, 2019 ~ Nov. 27, 2019	N/A	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Nov. 12, 2019 ~ Nov. 27, 2019	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Nov. 12, 2019 ~ Nov. 27, 2019	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24(k5)	RK-000451	N/A	N/A	Nov. 12, 2019 ~ Nov. 27, 2019	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY36980/4	30M-18G	Apr. 15, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	Apr. 14, 2020	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9838/4PE	30M-18G	Apr. 15, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	Apr. 14, 2020	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY802430/4	30M~18GHz	May 13, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	May 12, 2020	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz-40GHz	Feb. 26, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	Feb. 25, 2020	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz-40GHz	Feb. 26, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	Feb. 25, 2020	Radiation (03CH15-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN2	3GHz High Pass Filter	Jul. 17, 2019	Nov. 12, 2019 ~ Nov. 27, 2019	Jul. 14, 2020	Radiation (03CH15-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jan. 07, 2020	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 15, 2019	Jan. 07, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Mar. 19, 2019	Jan. 07, 2020	Mar. 18, 2020	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 15, 2019	Jan. 07, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Jan. 07, 2020	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 02, 2020	Jan. 07, 2020	Jan. 01, 2021	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 02, 2020	Jan. 07, 2020	Jan. 01, 2021	Conduction (CO05-HY)
Hygrometer	Testo	608-H2	41410069	N/A	Jun. 17, 2019	Jan. 16, 2020	Jun. 16, 2020	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO10	10MHz~6GHz	Dec. 23, 2019	Jan. 16, 2020	Dec. 22 2020	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Jul. 15, 2019	Jan. 16, 2020	Jul. 14, 2020	Conducted (TH05-HY)
Switch Control Manframe	E-IUSTRUMENT	ETF-1405-0	EC1900067	N/A	Aug. 15, 2019	Jan. 16, 2020	Aug. 14, 2020	Conducted (TH05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.0

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.4

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Luffy Lin	Temperature:	21~25	°C
Test Date:	2020/1/16	Relative Humidity:	51~54	%

Report Number : FR982217-02C

TEST RESULTS DATA
Average Output Power

2.4GHz Band Single Antenna																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant1	Ant2	SUM	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	
11b	1Mbps	1	1	2412	-	15.10	-	-	30.00	2.80	2.80	-	17.90	-	36.00	Pass
11b	1Mbps	1	6	2437	15.30	-		30.00	-	2.80	2.80	18.10	-	36.00	-	Pass
11g	6Mbps	1	1	2412	-	14.00		-	30.00	2.80	2.80	-	16.80	-	36.00	Pass
HT20	MCS0	1	1	2412	14.00	-		30.00	-	2.80	2.80	16.80	-	36.00	-	Pass
HT20	MCS0	1	11	2462	13.70	13.90		30.00	30.00	2.80	2.80	16.50	16.70	36.00	36.00	Pass

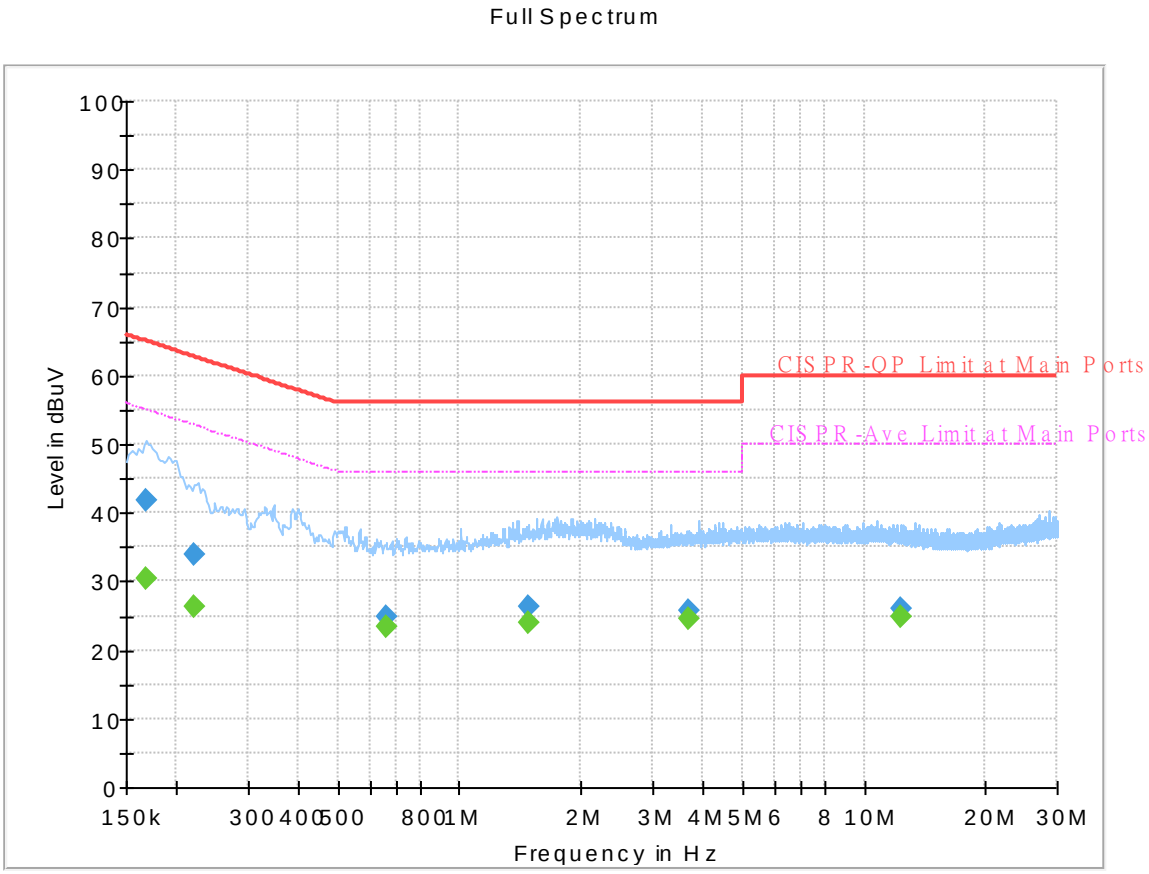
Note: Measured power (dBm) has offset with cable loss.

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Tom Lee & Howard Huang	**Temperature :**	22~25℃
		Relative Humidity :	45~53%

EUT Information

Report NO :	982217-02
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

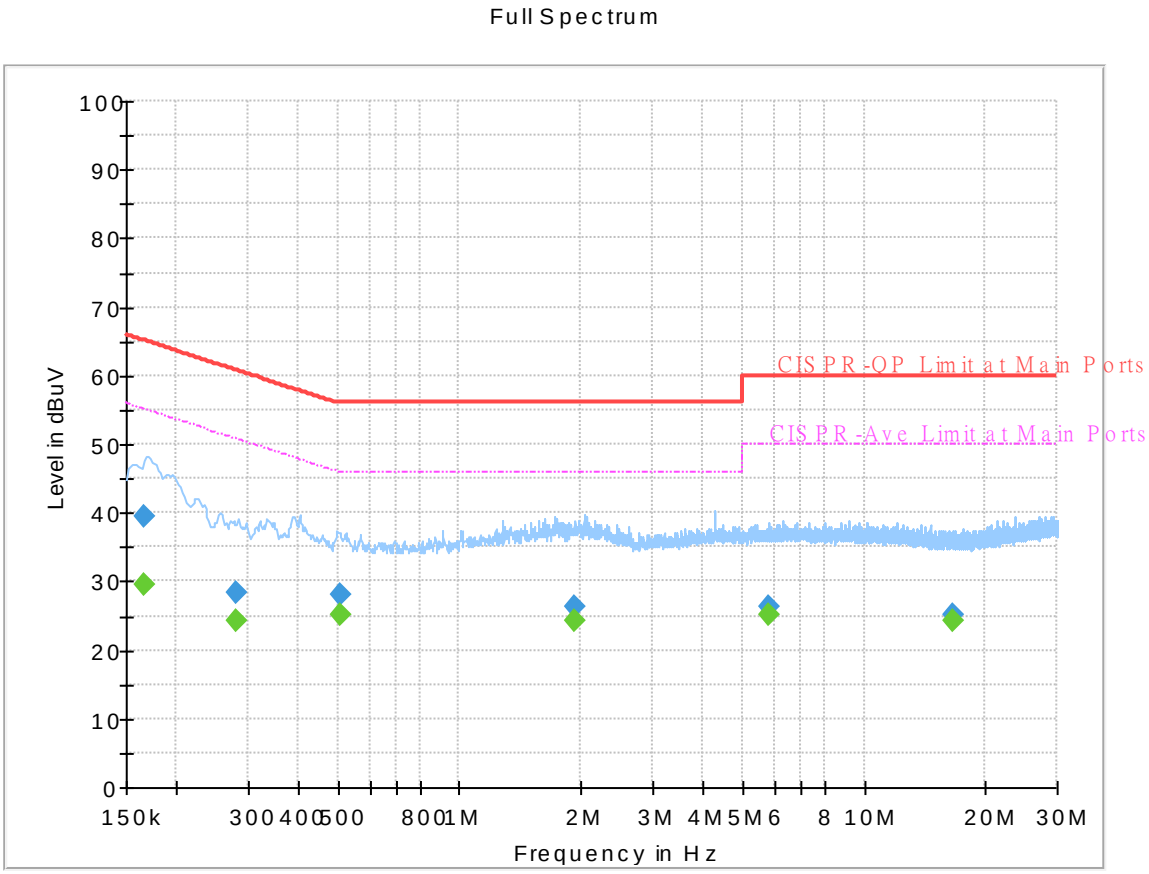


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.167550	---	30.50	55.08	24.58	L1	OFF	19.5
0.167550	41.71	---	65.08	23.37	L1	OFF	19.5
0.220290	---	26.26	52.81	26.55	L1	OFF	19.5
0.220290	33.85	---	62.81	28.96	L1	OFF	19.5
0.663000	---	23.28	46.00	22.72	L1	OFF	19.5
0.663000	24.98	---	56.00	31.02	L1	OFF	19.5
1.475250	---	23.83	46.00	22.17	L1	OFF	19.6
1.475250	26.17	---	56.00	29.83	L1	OFF	19.6
3.703290	---	24.59	46.00	21.41	L1	OFF	19.7
3.703290	25.78	---	56.00	30.22	L1	OFF	19.7
12.267780	---	24.94	50.00	25.06	L1	OFF	20.1
12.267780	25.98	---	60.00	34.02	L1	OFF	20.1

EUT Information

Report NO :	982217-02
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.167100	---	29.44	55.10	25.66	N	OFF	19.6
0.167100	39.39	---	65.10	25.71	N	OFF	19.6
0.280500	---	24.17	50.80	26.63	N	OFF	19.6
0.280500	28.27	---	60.80	32.53	N	OFF	19.6
0.509280	---	25.15	46.00	20.85	N	OFF	19.6
0.509280	28.10	---	56.00	27.90	N	OFF	19.6
1.933710	---	24.14	46.00	21.86	N	OFF	19.6
1.933710	26.35	---	56.00	29.65	N	OFF	19.6
5.794710	---	25.16	50.00	24.84	N	OFF	19.8
5.794710	26.29	---	60.00	33.71	N	OFF	19.8
16.526850	---	24.25	50.00	25.75	N	OFF	20.2
16.526850	25.23	---	60.00	34.77	N	OFF	20.2

Appendix C. Radiated Spurious Emission

Test Engineer :	Bigshow Wang	Temperature :	24.2 ~ 24.8°C
		Relative Humidity :	55 ~ 64%

2.4GHz 2400~2483.5MHz

WIFI 802.11b (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)
802.11b CH 06 2437MHz		4874	46.34	-27.66	74	64.42	31.45	9.64	59.17	100	0	P	H
		7311	44.61	-29.39	74	55.32	36.78	11.69	59.18	100	0	P	H
		4874	46.54	-27.46	74	64.62	31.45	9.64	59.17	100	0	P	V
		7311	45.13	-28.87	74	55.84	36.78	11.69	59.18	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (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 HT20 CH 01 2412MHz		2389.485	63.43	-10.57	74	50.6	27.82	16.16	31.15	339	122	P	H
		2390	50.69	-3.31	54	37.86	27.82	16.16	31.15	339	122	A	H
	*	2412	108.02	-	-	95.17	27.8	16.18	31.13	339	122	P	H
	*	2412	100.49	-	-	87.64	27.8	16.18	31.13	339	122	A	H
		2389.695	62.91	-11.09	74	50.08	27.82	16.16	31.15	100	104	P	V
		2390	48.72	-5.28	54	35.89	27.82	16.16	31.15	100	104	A	V
	*	2412	105.93	-	-	93.08	27.8	16.18	31.13	100	104	P	V
	*	2412	98.56	-	-	85.71	27.8	16.18	31.13	100	104	A	V
802.11n HT20 CH 11 2462MHz	*	2462	106.13	-	-	93.23	27.78	16.23	31.11	359	128	P	H
	*	2462	98.32	-	-	85.42	27.78	16.23	31.11	359	128	A	H
		2483.56	59.7	-14.3	74	46.82	27.73	16.25	31.1	359	128	P	H
		2483.52	47.19	-6.81	54	34.31	27.73	16.25	31.1	359	128	A	H
	*	2462	104.99	-	-	92.09	27.78	16.23	31.11	100	91	P	V
	*	2462	97.48	-	-	84.58	27.78	16.23	31.11	100	91	A	V
		2484.08	59.59	-14.41	74	46.71	27.73	16.25	31.1	100	91	P	V
		2483.52	46.17	-7.83	54	33.29	27.73	16.25	31.1	100	91	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 2	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)
802.11b CH 01 2412MHz		4824	49.07	-24.93	74	67.2	31.4	9.63	59.16	100	0	P	H
		4824	46.09	-27.91	74	64.22	31.4	9.63	59.16	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Band Edge @ 3m)

WIFI Ant. 2	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)
802.11g CH 01 2412MHz		2389.17	55.11	-18.89	74	42.28	27.82	16.16	31.15	367	295	P	H
		2390	45.19	-8.81	54	32.36	27.82	16.16	31.15	367	295	A	H
	*	2412	105.39	-	-	92.54	27.8	16.18	31.13	367	295	P	H
	*	2412	98.03	-	-	85.18	27.8	16.18	31.13	367	295	A	H
		2390	59.01	-14.99	74	46.18	27.82	16.16	31.15	382	226	P	V
		2390	46.05	-7.95	54	33.22	27.82	16.16	31.15	382	226	A	V
	*	2412	105.42	-	-	92.57	27.8	16.18	31.13	382	226	P	V
	*	2412	97.81	-	-	84.96	27.8	16.18	31.13	382	226	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI Ant. 2	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 HT20 CH 11 2462MHz	*	2462	104.42	-	-	91.52	27.78	16.23	31.11	357	295	P	H
	*	2462	96.95	-	-	84.05	27.78	16.23	31.11	357	295	A	H
		2483.52	64.47	-9.53	74	51.59	27.73	16.25	31.1	357	295	P	H
		2483.52	47.09	-6.91	54	34.21	27.73	16.25	31.1	357	295	A	H
	*	2462	104.44	-	-	91.54	27.78	16.23	31.11	366	221	P	V
	*	2462	97.12	-	-	84.22	27.78	16.23	31.11	366	221	A	V
		2483.64	60.46	-13.54	74	47.58	27.73	16.25	31.1	366	221	P	V
		2483.52	46.57	-7.43	54	33.69	27.73	16.25	31.1	366	221	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average 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 D. Radiated Spurious Emission Plots

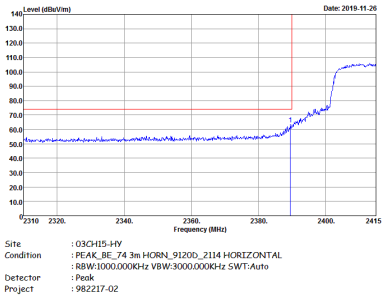
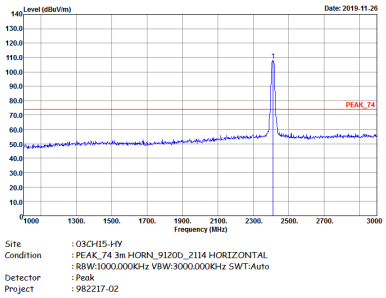
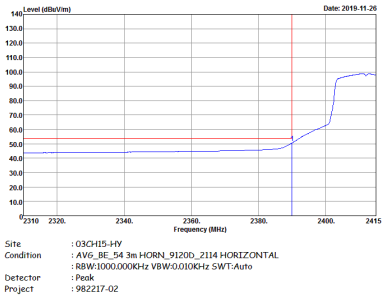
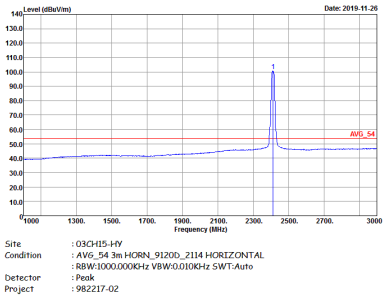
Test Engineer :	Bigshow Wang	**Temperature :**	24.2 ~ 24.8°C
		Relative Humidity :	55 ~ 64%

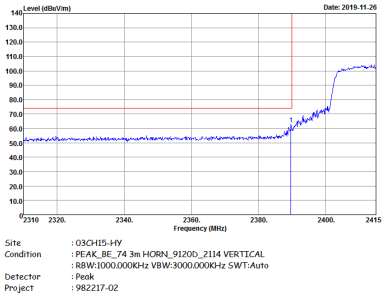
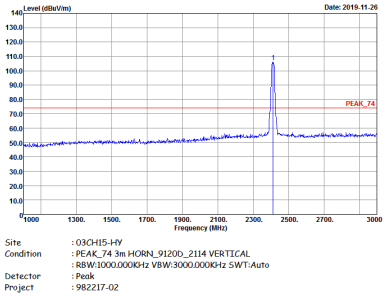
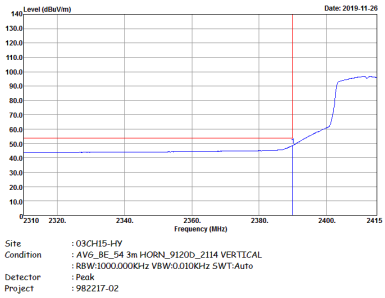
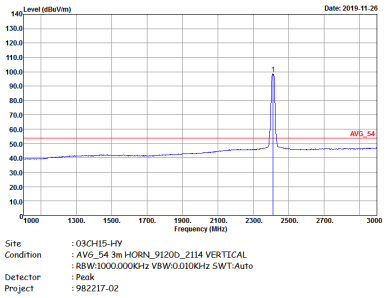
Note symbol

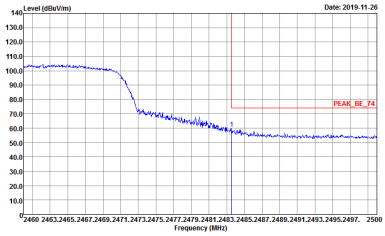
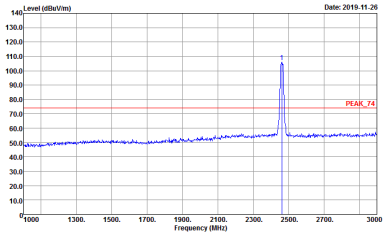
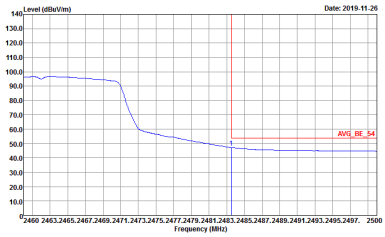
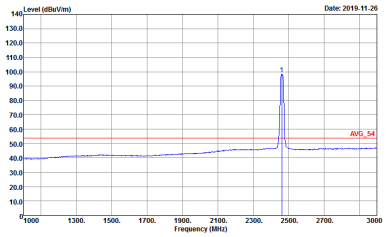
-L	**Low channel location**
-R	**High channel location**

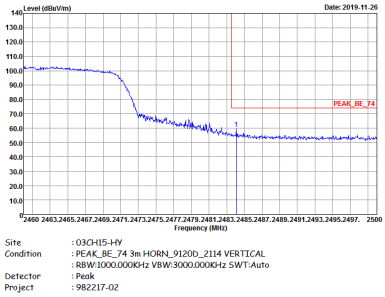
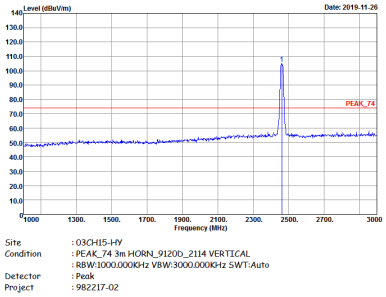
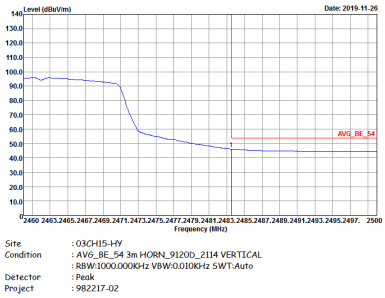
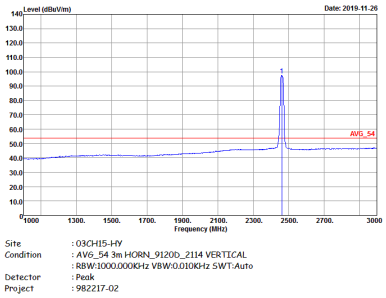
2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

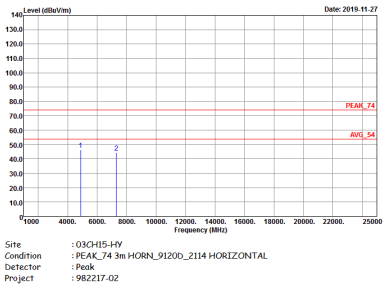
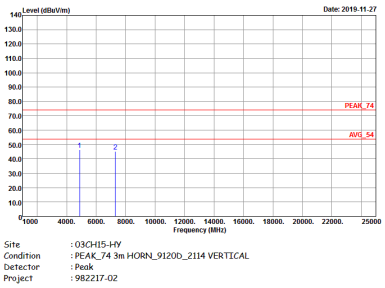
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m HORN_9120D_2114 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 982217-02	 Site : 03CH15-HY Condition : PEAK_74 3m HORN_9120D_2114 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 982217-02
Avg.	 Site : 03CH15-HY Condition : AVG_BE_54 3m HORN_9120D_2114 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 982217-02	 Site : 03CH15-HY Condition : AVG_54 3m HORN_9120D_2114 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 982217-02

WIFI	2.4GHz 2400~2483.5MHz Fundamental @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

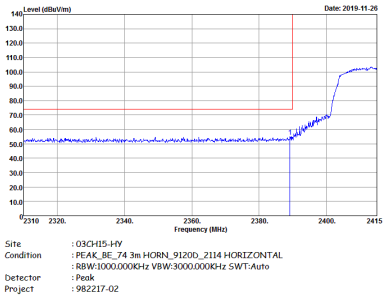
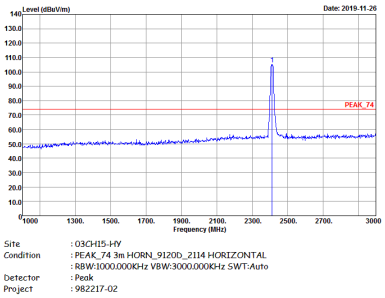
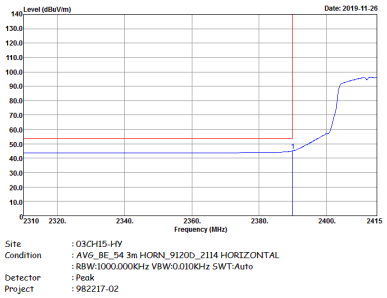
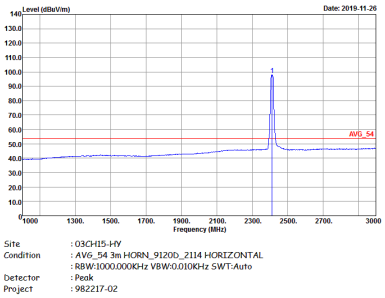
2.4GHz 2400~2483.5MHz

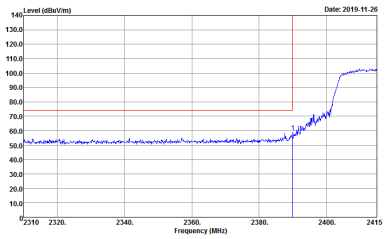
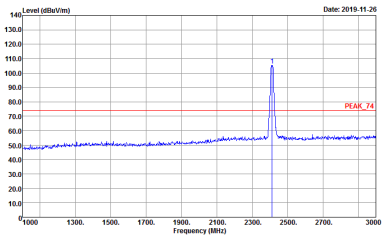
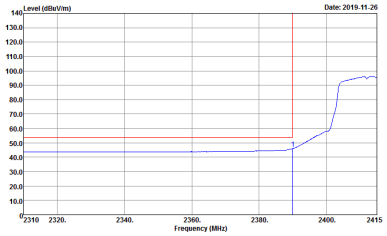
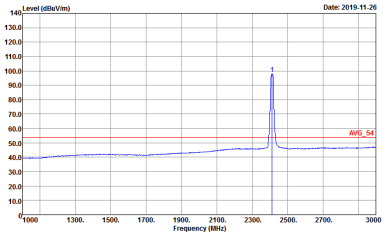
WIFI 802.11b (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

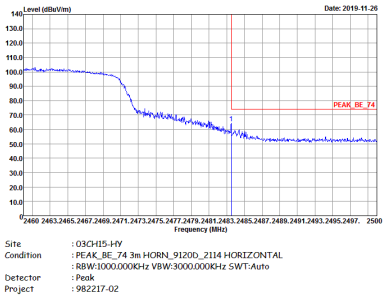
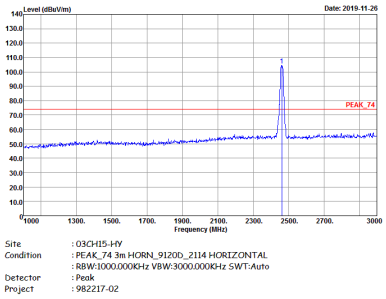
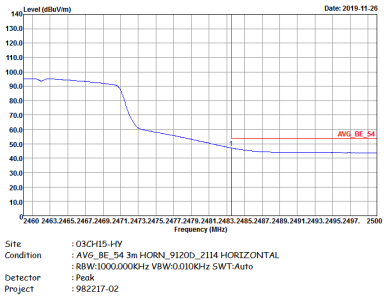
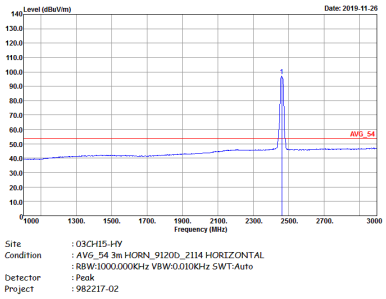
WIFI 802.11g (Band Edge @ 3m)

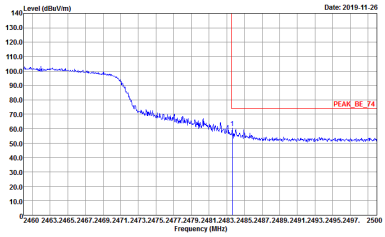
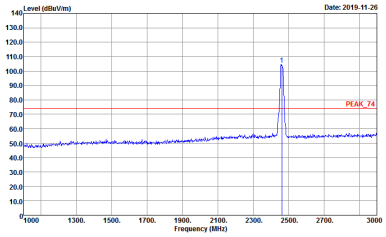
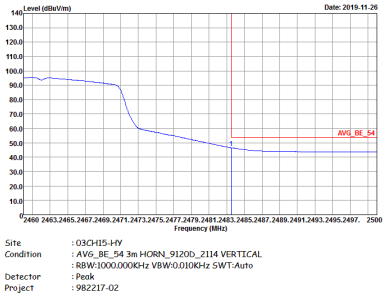
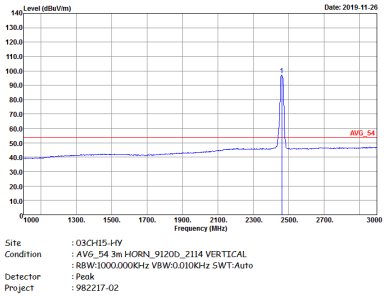
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
2	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
2	Vertical	Fundamental
Peak	 Site : 03CH15-HY Condition : PEAK_BE_74 3m HORN_9120D_2114 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 982217-02	 Site : 03CH15-HY Condition : PEAK_74 3m HORN_9120D_2114 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 982217-02
Avg.	 Site : 03CH15-HY Condition : AVG_BE_54 3m HORN_9120D_2114 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 982217-02	 Site : 03CH15-HY Condition : AVG_54 3m HORN_9120D_2114 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 982217-02

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
2	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Fundamental @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
2	Vertical	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

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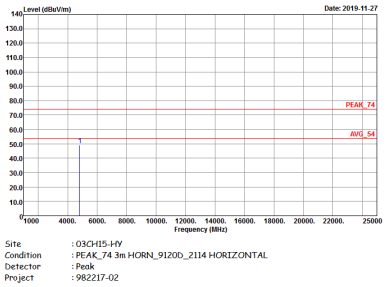
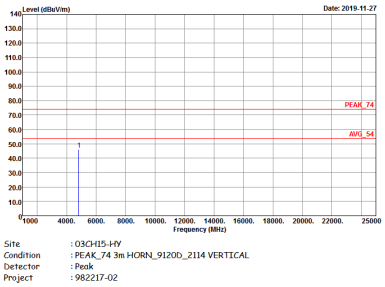
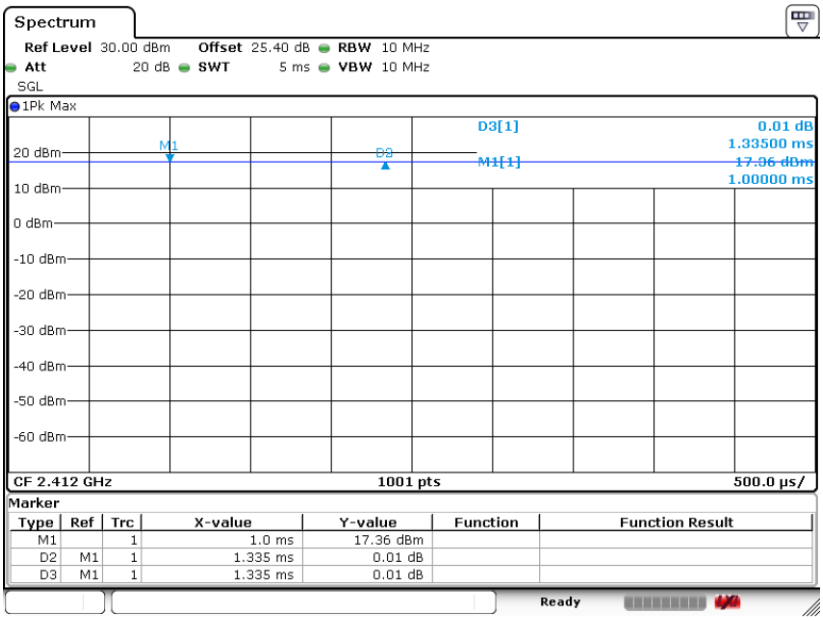
ANT	802.11b CH01 2412MHz	
2	Horizontal	Vertical
Peak Avg.		

Appendix E. Duty Cycle Plots

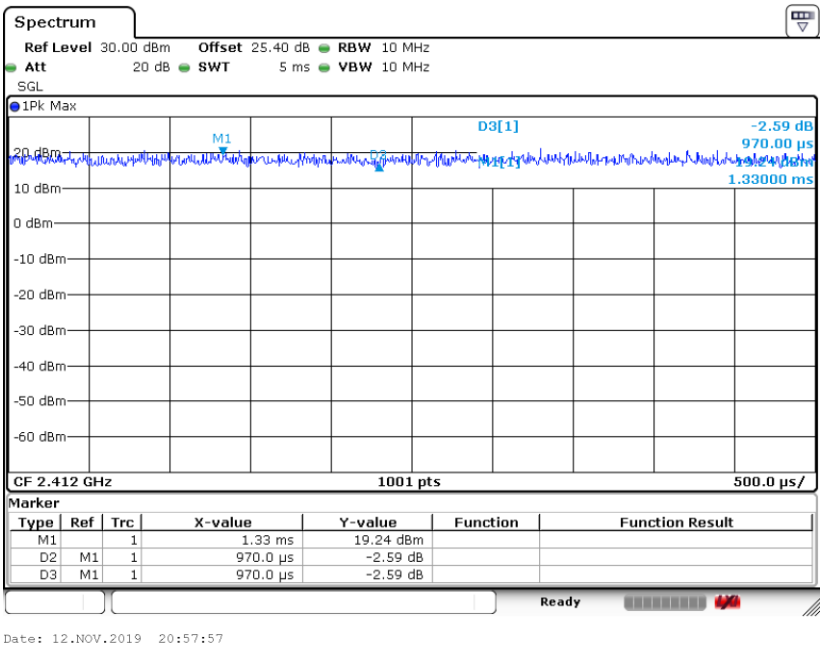
Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
1	802.11b	100	-	-	10Hz	0.00
2	802.11b	100	-	-	10Hz	0.00
2	802.11g	100	-	-	10Hz	0.00
1	2.4GHz 802.11n HT20	100	-	-	10Hz	0.00
2	2.4GHz 802.11n HT20	100	-	-	10Hz	0.00

<Ant. 1>

802.11b

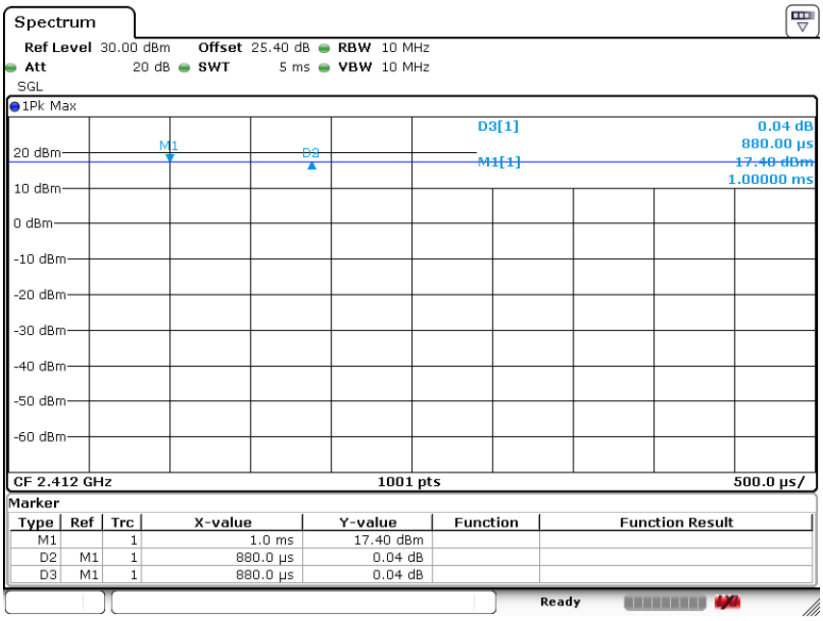


802.11n HT20



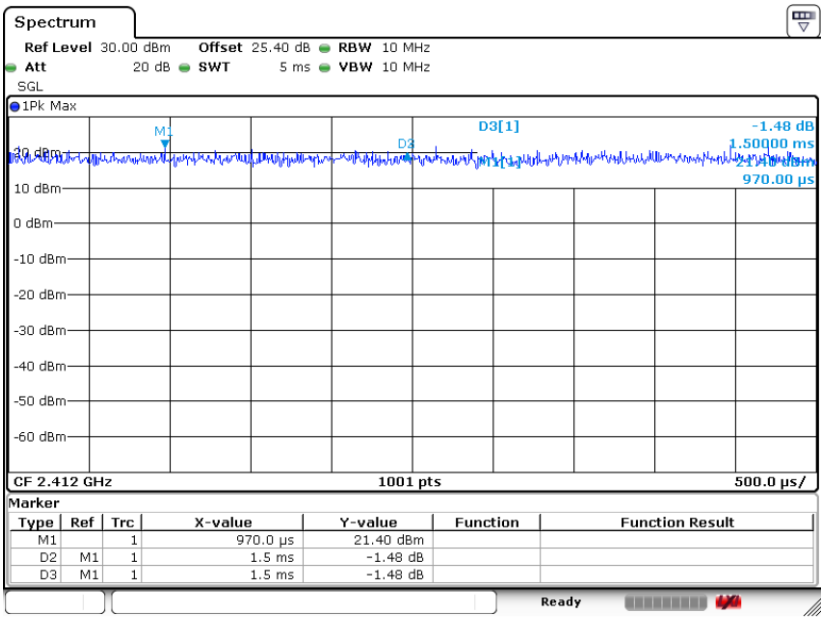
<Ant. 2>

802.11b



Date: 12.NOV.2019 00:43:15

802.11g



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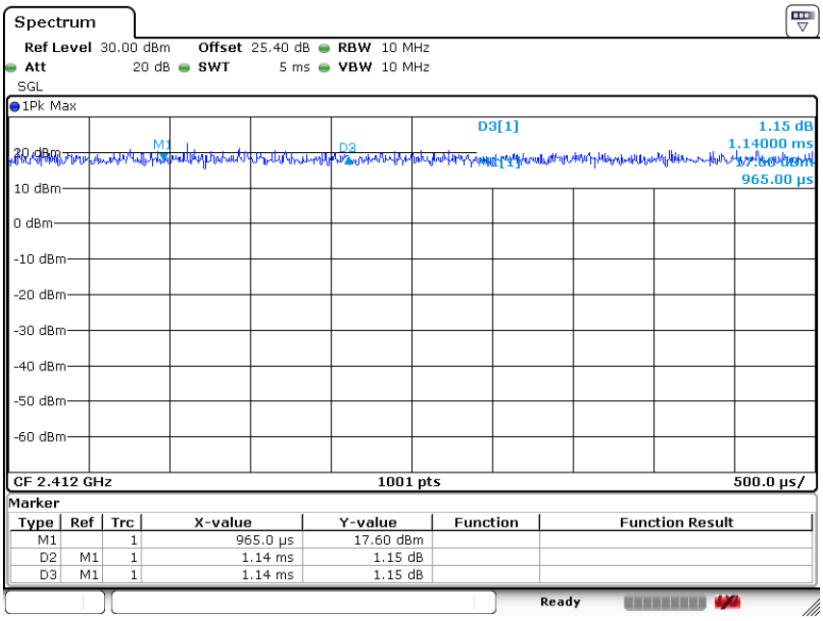
802.11n HT20



Date: 12.NOV.2019 21:13:05

———THE END———