FCC RADIO TEST REPORT

FCC ID	:	**UZ7EC55BK**
Equipment	:	**Enterprise Computer**
Brand Name	:	**Zebra**
Model Name	:	**EC55BK**
Applicant	:	**Zebra Technologies Corporation** **1 Zebra Plaza, Holtsville, NY 11742**
Manufacturer	:	**Zebra Technologies Corporation** **1 Zebra Plaza, Holtsville, NY 11742**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Jul. 22, 2020 and testing was started from Sep. 23, 2020 and completed on Oct. 20, 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 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
FR070405C	01	Initial issue of report	Nov. 06, 2020

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	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	Under limit 1.27 dB at 2389.520 MHz
-	15.207	AC Conducted Emission	Not Required	-
3.3	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Note:

1. Not required means after assessing, test items are not necessary to carry out.
2. This is a variant report. The difference between EC55AK and EC55BK is the performance for cellular bands. The detail of similarity and difference can be found in Operation Description. All the test cases were performed on original report which can be referred to Sporton Report Number FR070401C as appendix E. 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: Celery Wei

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Enterprise Computer
Brand Name	Zebra
Model Name	EC55BK
FCC ID	UZ7EC55BK
EUT supports Radios application	GSM/WCDMA/HSPA/LTE/NFC/GNSS WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
HW Version	EV2
SW Version	Android version 10
FW Version	10-13-12.00-QG-U0D-PRD-HEL-04
MFD	02JUL20
EUT Stage	Engineering sample

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

Specification of Accessories				
AC Adapter	**Brand Name**	Zebra	**Part Number**	PWR-WUA5V15W0US
USB TYPE-C to TYPE-C cable	**Brand Name**	Zebra	**Part Number**	CBL-EC5X-USBC3A-01
Battery 1	**Brand Name**	Zebra	**Part Number**	BT-000424-00
Battery 2	**Brand Name**	Zebra	**Part Number**	BT-000424-08
Earphone 1	**Brand Name**	Zebra	**Part Number**	HDST-35MM-PTVP-01
Earphone 2	**Brand Name**	Zebra	**Part Number**	HS2100-OTH
USB TYPE C to 3.5mm audio connector	**Brand Name**	Symbol	**Part Number**	ADP-USBC-35MM1-01
3.5mm Jack 43"(1.1m) Standard Cable	**Brand Name**	Zebra	**Part Number**	CBL-HS2100-3MS1-01
Trigger Handle	**Brand Name**	Zebra	**Part Number**	TRG-EC5X-SNP1-01
Soft Holster	**Brand Name**	Zebra	**Part Number**	SG-EC5X-HLSTR1-01
Protective Boot	**Brand Name**	Zebra	**Part Number**	SG-EC5X-BOOT1-01

Sample list				
	Sample 1	**Sample 2**	**Sample 3**	**Sample 4**
Operating System	ANDROID	ANDROID	ANDROID	ANDROID
RAM	3GB	3GB	4GB	4GB
FLASH	32GB	32GB	64GB	64GB
Scanner	NO	SE4100	SE4100	SE4100
Front Camera	5MP	NO	5MP	5MP
Rear Camera	13MP	13MP	13MP	13MP
	MICRO SD	MICRO SD	MICRO SD	MICRO SD
	GMS	GMS	GMS	GMS
Back connector	NO I/O CONNECTOR	2-PIN	2-PIN	8-PIN
	ROW - Excludes China	ROW - Excludes China	ROW - Excludes China	ROW - Excludes China

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum Peak Output Power to antenna	**<Ant. 0>:** 802.11b : 20.15 dBm (0.1035 W) 802.11g : 22.07 dBm (0.1611 W) 802.11n HT20 : 22.43 dBm (0.1750 W) 802.11n HT40 : 22.04 dBm (0.1600 W) **<Ant. 1>:** 802.11b : 20.31 dBm (0.1074 W) 802.11g : 22.39 dBm (0.1734 W) 802.11n HT20 : 22.32 dBm (0.1706 W) 802.11n HT40 : 22.70 dBm (0.1862 W) **MIMO <Ant. 0 + 1>:** 802.11b : 23.29 dBm (0.2133 W) 802.11g : 25.02 dBm (0.3177 W) 802.11n HT20 : 25.15 dBm (0.3273 W) 802.11n HT40 : 24.77 dBm (0.2999 W)
Maximum Average Output Power to antenna	**<Ant. 0>:** 802.11b : 17.83 dBm (0.0607 W) 802.11g : 17.65 dBm (0.0582 W) 802.11n HT20 : 17.89 dBm (0.0615 W) 802.11n HT40 : 16.82 dBm (0.0481 W) **<Ant. 1>:** 802.11b : 17.87 dBm (0.0612 W) 802.11g : 17.86 dBm (0.0611 W) 802.11n HT20 : 17.75 dBm (0.0596 W) 802.11n HT40 : 17.18 dBm (0.0522 W) **MIMO <Ant. 0 + 1>:** 802.11b : 20.90 dBm (0.1230 W) 802.11g : 20.82 dBm (0.1208 W) 802.11n HT20 : 20.68 dBm (0.1169 W) 802.11n HT40 : 19.19 dBm (0.0830 W)
Antenna Type / Gain	**<Ant. 0>**: PIFA Antenna with gain 1.50 dBi **<Ant. 1>:** PIFA Antenna with gain 1.20 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)
Antenna Function Description	

	Ant. 0	Ant. 1
802.11 b/g/n	V	V
802.11 b/g/n MIMO	V	V

Note: MIMO Ant. 0+1 is a calculated result from sum of the power MIMO Ant. 0 and MIMO Ant. 1.

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, 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

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.**
	03CH16-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
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- 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. The TAF code is not including all the FCC KDB listed without accreditation.
3. 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 (1GHz 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)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

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**
802.11n HT40	**MCS0**

Ch. #	2400-2483.5 MHz		
	802.11b	802.11g	802.11n HT40
Low	-	-	03
Middle	-	-	-
High	11	11	09

Remark:

1. For radiation spurious emission, the final modulation and the worst data rate was reference the max RF conducted power.
2. For Radiated Test Cases, the tests were performed with Battery 1 and Sample 1.

<Ant. 0>

802.11b RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		1M
CH 01	2412	19.95
CH 06	2437	**20.15**
CH 11	2462	20.02

802.11g RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		6M
CH 01	2412	20.49
CH 06	2437	**22.07**
CH 11	2462	21.11

802.11n HT20 RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS 0
CH 01	2412	18.84
CH 06	2437	**22.43**
CH 11	2462	20.05

802.11n HT40 RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS 0
CH 03	2422	17.05
CH 06	2437	**22.04**
CH 09	2452	20.43

<Ant. 1>

802.11b RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		1M
CH 01	2412	20.29
CH 06	2437	**20.31**
CH 11	2462	20.14

802.11g RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		6M
CH 01	2412	22.18
CH 06	2437	**22.39**
CH 11	2462	21.87

802.11n HT20 RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS 0
CH 01	2412	21.40
CH 06	2437	**22.32**
CH 11	2462	21.94

802.11n HT40 RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS 0
CH 03	2422	21.52
CH 06	2437	**22.70**
CH 09	2452	22.25

MIMO <Ant. 0+1>

802.11b RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		1M
CH 01	2412	23.04
CH 06	2437	**23.29**
CH 11	2462	23.18

Channel	Frequency (MHz)	Data Rate (bps)
		6M
CH 01	2412	23.96
CH 06	2437	**25.02**
CH 11	2462	23.25

802.11n HT20 RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS0
CH 01	2412	21.36
CH 06	2437	**25.15**
CH 11	2462	22.34

802.11n HT40 RF Peak Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS0
CH 03	2422	20.39
CH 06	2437	**24.77**
CH 09	2452	22.89

<Ant. 0>

802.11b RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		1M
CH 01	2412	17.78
CH 06	2437	**17.83**
CH 11	2462	17.76

802.11g RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		6M
CH 01	2412	16.14
CH 06	2437	**17.65**
CH 11	2462	16.92

802.11n HT20 RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS 0
CH 01	2412	14.16
CH 06	2437	**17.89**
CH 11	2462	15.40

802.11n HT40 RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS 0
CH 03	2422	11.24
CH 06	2437	**16.82**
CH 09	2452	14.24

<Ant. 1>

802.11b RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		1M
CH 01	2412	17.83
CH 06	2437	**17.87**
CH 11	2462	17.77

802.11g RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		6M
CH 01	2412	17.83
CH 06	2437	**17.86**
CH 11	2462	17.65

802.11n HT20 RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS 0
CH 01	2412	16.73
CH 06	2437	**17.75**
CH 11	2462	17.46

802.11n HT40 RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS 0
CH 03	2422	15.33
CH 06	2437	**17.18**
CH 09	2452	16.31

MIMO <Ant. 0+1>

802.11b RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		1M
CH 01	2412	20.75
CH 06	2437	**20.90**
CH 11	2462	20.88

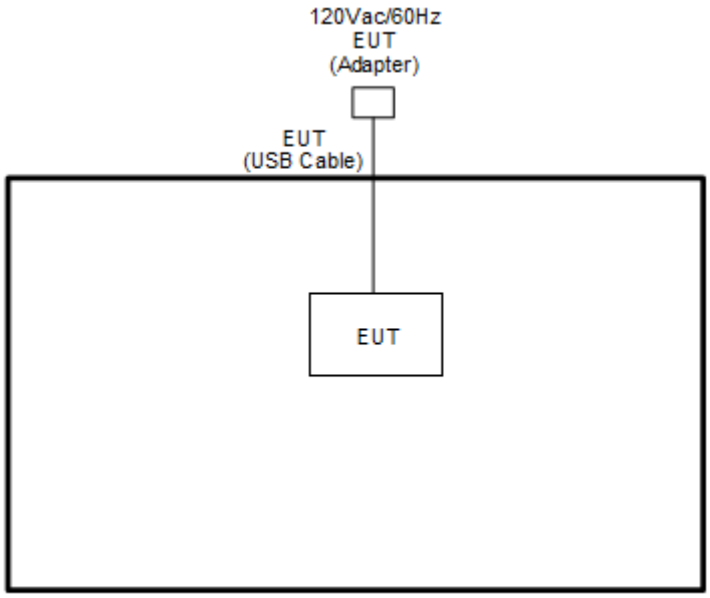
802.11g RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	Data Rate (bps)
		6M
CH 01	2412	19.72
CH 06	2437	**20.82**
CH 11	2462	18.60

802.11n HT20 RF Avg Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS0
CH 01	2412	16.56
CH 06	2437	**20.68**
CH 11	2462	17.47

802.11n HT40 RF Output Power (dBm)		
Power vs. Channel		
Channel	Frequency (MHz)	MCS Index
		MCS0
CH 03	2422	14.71
CH 06	2437	**19.19**
CH 09	2452	16.68

2.3 Connection Diagram of Test System

<WLAN Tx Mode>



2.4 EUT Operation Test Setup

The RF test items, utility “QRCT4.0” 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 output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak 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.

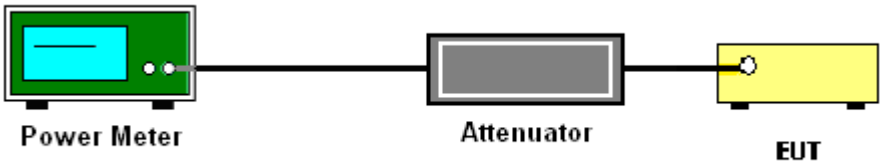
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. For Peak Power, the testing follows ANSI C63.10 Section 11.9.1.3 PKPM1
2. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
3. 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.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Measure the conducted output power and record the results in the test report.
6. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.1.4 Test Setup



3.1.5 Test Result of Peak Output Power

Test Engineer :	Kathy Chen	Temperature :	23.2℃
		Relative Humidity :	54.3%

2.4GHz Band Single Antenna																	
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	
11b	1Mbps	1	1	2412	19.95	20.29	-	30.00	30.00	1.50	1.20	21.45	21.49	36.00	36.00	Pass
11b	1Mbps	1	6	2437	20.15	20.31		30.00	30.00	1.50	1.20	21.65	21.51	36.00	36.00	Pass
11b	1Mbps	1	11	2462	20.02	20.14		30.00	30.00	1.50	1.20	21.52	21.34	36.00	36.00	Pass
11g	6Mbps	1	1	2412	20.49	22.18		30.00	30.00	1.50	1.20	21.99	23.38	36.00	36.00	Pass
11g	6Mbps	1	6	2437	22.07	22.39		30.00	30.00	1.50	1.20	23.57	23.59	36.00	36.00	Pass
11g	6Mbps	1	11	2462	21.11	21.87		30.00	30.00	1.50	1.20	22.61	23.07	36.00	36.00	Pass
HT20	MCS0	1	1	2412	18.84	21.40		30.00	30.00	1.50	1.20	20.34	22.60	36.00	36.00	Pass
HT20	MCS0	1	6	2437	22.43	22.32		30.00	30.00	1.50	1.20	23.93	23.52	36.00	36.00	Pass
HT20	MCS0	1	11	2462	20.05	21.94		30.00	30.00	1.50	1.20	21.55	23.14	36.00	36.00	Pass
HT40	MCS0	1	3	2422	17.05	21.52		30.00	30.00	1.50	1.20	18.55	22.72	36.00	36.00	Pass
HT40	MCS0	1	6	2437	22.04	22.70		30.00	30.00	1.50	1.20	23.54	23.90	36.00	36.00	Pass
HT40	MCS0	1	9	2452	20.43	22.25		30.00	30.00	1.50	1.20	21.93	23.45	36.00	36.00	Pass

2.4GHz Band MIMO																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	
11b	1Mbps	2	1	2412	19.85	20.21	23.04	30.00		1.50		24.54		36.00		Pass
11b	1Mbps	2	6	2437	20.28	20.28	23.29	30.00		1.50		24.79		36.00		Pass
11b	1Mbps	2	11	2462	19.99	20.34	23.18	30.00		1.50		24.68		36.00		Pass
11g	6Mbps	2	1	2412	20.67	21.21	23.96	30.00		1.50		25.46		36.00		Pass
11g	6Mbps	2	6	2437	21.87	22.15	25.02	30.00		1.50		26.52		36.00		Pass
11g	6Mbps	2	11	2462	19.99	20.48	23.25	30.00		1.50		24.75		36.00		Pass
HT20	MCS0	2	1	2412	18.38	18.31	21.36	30.00		1.50		22.86		36.00		Pass
HT20	MCS0	2	6	2437	21.88	22.38	25.15	30.00		1.50		26.65		36.00		Pass
HT20	MCS0	2	11	2462	19.06	19.59	22.34	30.00		1.50		23.84		36.00		Pass
HT40	MCS0	2	3	2422	17.38	17.38	20.39	30.00		1.50		21.89		36.00		Pass
HT40	MCS0	2	6	2437	21.64	21.88	24.77	30.00		1.50		26.27		36.00		Pass
HT40	MCS0	2	9	2452	19.95	19.80	22.89	30.00		1.50		24.39		36.00		Pass

3.1.6 Test Result of Average Output Power (Reporting Only)

Test Engineer :	Kathy Chen	Temperature :	23.2℃
		Relative Humidity :	54.3%

2.4GHz Band Single Antenna																	
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power with duty factor (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	
11b	1Mbps	1	1	2412	17.78	17.83	-	30.00	30.00	1.50	1.20	19.28	19.03	36.00	36.00	Pass
11b	1Mbps	1	6	2437	17.83	17.87		30.00	30.00	1.50	1.20	19.33	19.07	36.00	36.00	Pass
11b	1Mbps	1	11	2462	17.76	17.77		30.00	30.00	1.50	1.20	19.26	18.97	36.00	36.00	Pass
11g	6Mbps	1	1	2412	16.14	17.83		30.00	30.00	1.50	1.20	17.64	19.03	36.00	36.00	Pass
11g	6Mbps	1	6	2437	17.65	17.86		30.00	30.00	1.50	1.20	19.15	19.06	36.00	36.00	Pass
11g	6Mbps	1	11	2462	16.92	17.65		30.00	30.00	1.50	1.20	18.42	18.85	36.00	36.00	Pass
HT20	MCS0	1	1	2412	14.16	16.73		30.00	30.00	1.50	1.20	15.66	17.93	36.00	36.00	Pass
HT20	MCS0	1	6	2437	17.89	17.75		30.00	30.00	1.50	1.20	19.39	18.95	36.00	36.00	Pass
HT20	MCS0	1	11	2462	15.40	17.46		30.00	30.00	1.50	1.20	16.90	18.66	36.00	36.00	Pass
HT40	MCS0	1	3	2422	11.24	15.33		30.00	30.00	1.50	1.20	12.74	16.53	36.00	36.00	Pass
HT40	MCS0	1	6	2437	16.82	17.18		30.00	30.00	1.50	1.20	18.32	18.38	36.00	36.00	Pass
HT40	MCS0	1	9	2452	14.24	16.31		30.00	30.00	1.50	1.20	15.74	17.51	36.00	36.00	Pass

2.4GHz Band MIMO																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power with duty factor (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	
11b	1Mbps	2	1	2412	17.64	17.84	20.75	30.00		1.50		22.25		36.00		Pass
11b	1Mbps	2	6	2437	17.90	17.88	20.90	30.00		1.50		22.40		36.00		Pass
11b	1Mbps	2	11	2462	17.81	17.92	20.88	30.00		1.50		22.38		36.00		Pass
11g	6Mbps	2	1	2412	16.65	16.76	19.72	30.00		1.50		21.22		36.00		Pass
11g	6Mbps	2	6	2437	17.75	17.86	20.82	30.00		1.50		22.32		36.00		Pass
11g	6Mbps	2	11	2462	15.56	15.62	18.60	30.00		1.50		20.10		36.00		Pass
HT20	MCS0	2	1	2412	13.67	13.42	16.56	30.00		1.50		18.06		36.00		Pass
HT20	MCS0	2	6	2437	17.60	17.74	20.68	30.00		1.50		22.18		36.00		Pass
HT20	MCS0	2	11	2462	14.39	14.52	17.47	30.00		1.50		18.97		36.00		Pass
HT40	MCS0	2	3	2422	11.73	11.67	14.71	30.00		1.50		16.21		36.00		Pass
HT40	MCS0	2	6	2437	16.38	15.98	19.19	30.00		1.50		20.69		36.00		Pass
HT40	MCS0	2	9	2452	13.82	13.51	16.68	30.00		1.50		18.18		36.00		Pass

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

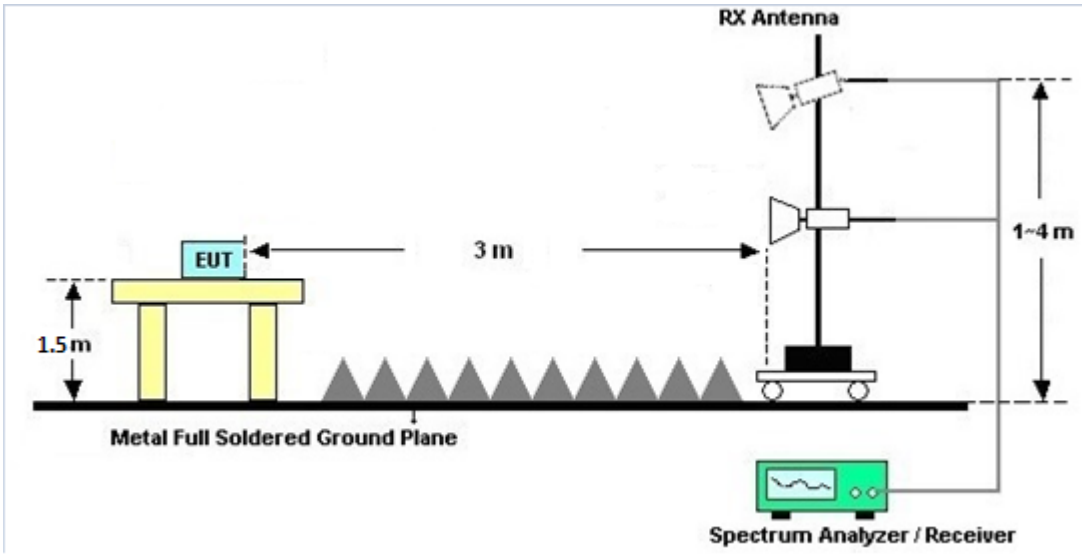
See list of measuring equipment of this test report.

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 0.8 meter for frequency below 1GHz and 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 A and B.

3.2.6 Duty Cycle

Please refer to Appendix C.

3.2.7 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix A and B.

3.3 Antenna Requirements

3.3.1 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.

3.3.2 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	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1212	1G~18GHz	May 20, 2019	Sep. 23, 2020	May 19, 2020	Radiation (03CH16-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800054001	1GHz~18GHz	Sep. 04, 2020	Sep. 23, 2020	Sep. 03, 2021	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz~26.5GHz	Dec. 11, 2019	Sep. 23, 2020	Dec.10, 2020	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A (MXE)	MY57290111	3Hz~26.5GHz	Dec. 05, 2019	Sep. 23, 2020	Dec. 04, 2020	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11680/4PE	NA	Aug. 29, 2020	Sep. 23, 2020	Aug. 28, 2021	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11688/4PE	NA	Aug. 29, 2020	Sep. 23, 2020	Aug. 28, 2021	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	EC-A5-300-5757	NA	Aug. 29, 2020	Sep. 23, 2020	Aug. 28, 2021	Radiation (03CH16-HY)
Hygrometer	TECPEL	DTM-303B	TP162965	N/A	Oct. 25, 2019	Sep. 23, 2020	Oct. 24, 2020	Radiation (03CH16-HY)
Software	Audix	E3 6.2009-8-24	RK-001136	N/A	N/A	Sep. 23, 2020	N/A	Radiation (03CH16-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Sep. 23, 2020	N/A	Radiation (03CH16-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Sep. 23, 2020	N/A	Radiation (03CH16-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Sep. 23, 2020	N/A	Radiation (03CH16-HY)
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 02, 2020	Oct. 20, 2020	Mar. 01, 2021	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO10	10MHz~6GHz	Dec. 23, 2019	Oct. 20, 2020	Dec. 22, 2020	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 15, 2019	Oct. 20, 2020	Nov. 14, 2020	Conducted (TH05-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW200302	N/A	Mar. 17, 2020	Oct. 20, 2020	Mar. 16, 2021	Conducted (TH05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.3**

Appendix A. Radiated Spurious Emission

Test Engineer :	Jacky Hung, Andy Yang and CR Liao	Temperature :	20~25°C
		Relative Humidity :	50~60%

2.4GHz 2400~2483.5MHz

WIFI 802.11b (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.
0		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 11 2462MHz	*	2462	112.85	-	-	96.46	27.58	18.62	29.81	107	150	P	H
	*	2462	109.64	-	-	93.25	27.58	18.62	29.81	107	150	A	H
		2486.88	60.65	-13.35	74	44.27	27.53	18.67	29.82	107	150	P	H
		2486.96	52.71	-1.29	54	36.33	27.53	18.67	29.82	107	150	A	H
													H
													H
	*	2462	106.85	-	-	90.46	27.58	18.62	29.81	274	350	P	V
	*	2462	103.72	-	-	87.33	27.58	18.62	29.81	274	350	A	V
		2487.08	58.51	-15.49	74	42.13	27.53	18.67	29.82	274	350	P	V
		2486.76	48.36	-5.64	54	31.98	27.53	18.67	29.82	274	350	A	V
													V
													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. 0	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 11 2462MHz		4924	38.72	-35.28	74	53.76	31.15	13.36	59.55	100	0	P	H
		7386	44.11	-29.89	74	50.68	36.33	16.36	59.26	100	0	P	H
													H
													H
		4924	41.05	-32.95	74	56.09	31.15	13.36	59.55	100	0	P	V
		7386	43.1	-30.9	74	49.67	36.33	16.36	59.26	100	0	P	V
													V
													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. 0	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 11 2462MHz	*	2462	109.72	-	-	93.33	27.58	18.62	29.81	105	148	P	H
	*	2462	102.4	-	-	86.01	27.58	18.62	29.81	105	148	A	H
		2484.24	64.53	-9.47	74	48.16	27.53	18.66	29.82	105	148	P	H
		2483.52	52.31	-1.69	54	35.94	27.53	18.66	29.82	105	148	A	H
													H
													H
	*	2462	105.36	-	-	88.97	27.58	18.62	29.81	276	351	P	V
	*	2462	97.84	-	-	81.45	27.58	18.62	29.81	276	351	A	V
		2484.28	61.26	-12.74	74	44.89	27.53	18.66	29.82	276	351	P	V
		2483.52	48.79	-5.21	54	32.42	27.53	18.66	29.82	276	351	A	V
													V
													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 (Harmonic @ 3m)

WIFI Ant. 0	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 11 2462MHz		4924	38.92	-35.08	74	53.96	31.15	13.36	59.55	100	0	P	H
		7386	43.83	-30.17	74	50.4	36.33	16.36	59.26	100	0	P	H
													H
													H
		4924	38.7	-35.3	74	53.74	31.15	13.36	59.55	100	0	P	V
		7386	43.39	-30.61	74	49.96	36.33	16.36	59.26	100	0	P	V
													V
													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 HT40 (Band Edge @ 3m)

WIFI Ant. 0	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 09 2452MHz		2362.36	57.55	-16.45	74	41.14	27.75	18.43	29.77	104	148	P	H
		2313.64	47.06	-6.94	54	30.6	27.87	18.34	29.75	104	148	A	H
	*	2452	105.75	-	-	89.36	27.6	18.6	29.81	104	148	P	H
	*	2452	97.69	-	-	81.3	27.6	18.6	29.81	104	148	A	H
		2483.5	61.3	-12.7	74	44.93	27.53	18.66	29.82	104	148	P	H
		2484.11	52.43	-1.57	54	36.06	27.53	18.66	29.82	104	148	A	H
		2320.08	57.81	-16.19	74	41.35	27.86	18.35	29.75	277	352	P	V
		2354.38	47.07	-6.93	54	30.64	27.78	18.42	29.77	277	352	A	V
	*	2452	99.7	-	-	83.31	27.6	18.6	29.81	277	352	P	V
	*	2452	92.34	-	-	75.95	27.6	18.6	29.81	277	352	A	V
		2485.72	59.06	-14.94	74	42.68	27.53	18.67	29.82	277	352	P	V
		2487.47	49.01	-4.99	54	32.63	27.53	18.67	29.82	277	352	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 HT40 (Harmonic @ 3m)

WIFI Ant. 0	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 09 2452MHz		4904	37.74	-36.26	74	52.81	31.11	13.36	59.54	100	0	P	H
		7356	43.53	-30.47	74	50.16	36.39	16.28	59.3	100	0	P	H
													H
													H
		4904	38.77	-35.23	74	53.84	31.11	13.36	59.54	100	0	P	V
		7356	44.79	-29.21	74	51.42	36.39	16.28	59.3	100	0	P	V
													V
													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 (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)
802.11b CH 11 2462MHz	*	2462	112.21	-	-	95.82	27.58	18.62	29.81	115	267	P	H
	*	2462	108.97	-	-	92.58	27.58	18.62	29.81	115	267	A	H
		2487.16	59.76	-14.24	74	43.38	27.53	18.67	29.82	115	267	P	H
		2486.4	51.3	-2.7	54	34.92	27.53	18.67	29.82	115	267	A	H
													H
													H
	*	2462	106.95	-	-	90.56	27.58	18.62	29.81	400	121	P	V
	*	2462	103.74	-	-	87.35	27.58	18.62	29.81	400	121	A	V
		2485.8	58.23	-15.77	74	41.85	27.53	18.67	29.82	400	121	P	V
		2486.24	47.16	-6.84	54	30.78	27.53	18.67	29.82	400	121	A	V
													V
													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. 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)
802.11b CH 11 2462MHz		4924	40.53	-33.47	74	55.57	31.15	13.36	59.55	100	0	P	H
		7386	43.99	-30.01	74	50.56	36.33	16.36	59.26	100	0	P	H
													H
													H
		4924	42.05	-31.95	74	57.09	31.15	13.36	59.55	100	0	P	V
		7386	43.77	-30.23	74	50.34	36.33	16.36	59.26	100	0	P	V
													V
													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. 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)
802.11g CH 11 2462MHz	*	2462	110.29	-	-	93.9	27.58	18.62	29.81	118	268	P	H
	*	2462	102.78	-	-	86.39	27.58	18.62	29.81	118	268	A	H
		2483.92	63.46	-10.54	74	47.09	27.53	18.66	29.82	118	268	P	H
		2483.52	52.71	-1.29	54	36.34	27.53	18.66	29.82	118	268	A	H
													H
													H
	*	2462	105.75	-	-	89.36	27.58	18.62	29.81	400	122	P	V
	*	2462	97.86	-	-	81.47	27.58	18.62	29.81	400	122	A	V
		2483.68	58.35	-15.65	74	41.98	27.53	18.66	29.82	400	122	P	V
		2483.52	48.27	-5.73	54	31.9	27.53	18.66	29.82	400	122	A	V
													V
													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 (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 11 2462MHz		4924	38.55	-35.45	74	53.59	31.15	13.36	59.55	100	0	P	H
		7386	42.92	-31.08	74	49.49	36.33	16.36	59.26	100	0	P	H
													H
													H
		4924	38.11	-35.89	74	53.15	31.15	13.36	59.55	100	0	P	V
		7386	43.69	-30.31	74	50.26	36.33	16.36	59.26	100	0	P	V
													V
													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 HT40 (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 HT40 CH 03 2422MHz		2389.24	60.54	-13.46	74	44.2	27.64	18.48	29.78	109	55	P	H
		2389.52	52.3	-1.7	54	35.96	27.64	18.48	29.78	109	55	A	H
	*	2422	104.71	-	-	88.37	27.6	18.54	29.8	109	55	P	H
	*	2422	96.94	-	-	80.6	27.6	18.54	29.8	109	55	A	H
		2486.7	57.83	-16.17	74	41.45	27.53	18.67	29.82	109	55	P	H
		2497.69	47.71	-6.29	54	31.35	27.5	18.69	29.83	109	55	A	H
		2387.98	59.27	-14.73	74	42.92	27.65	18.48	29.78	100	71	P	V
		2389.52	49.35	-4.65	54	33.01	27.64	18.48	29.78	100	71	A	V
	*	2422	99.77	-	-	83.43	27.6	18.54	29.8	100	71	P	V
	*	2422	92.04	-	-	75.7	27.6	18.54	29.8	100	71	A	V
		2487.19	56.77	-17.23	74	40.39	27.53	18.67	29.82	100	71	P	V
		2497.13	47.38	-6.62	54	31.01	27.51	18.69	29.83	100	71	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 HT40 (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 03 2422MHz		4844	37.65	-36.35	74	52.62	31.18	13.36	59.51	100	0	P	H
		7266	43.84	-30.16	74	50.86	36.36	16.05	59.43	100	0	P	H
													H
													H
		4844	38.15	-35.85	74	53.12	31.18	13.36	59.51	100	0	P	V
		7266	44.14	-29.86	74	51.16	36.36	16.05	59.43	100	0	P	V
													V
													V
													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 (Band Edge @ 3m)

WIFI Ant. 0+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)
802.11b CH 11 2462MHz	*	2462	114.13	-	-	97.74	27.58	18.62	29.81	100	275	P	H
	*	2462	111.13	-	-	94.74	27.58	18.62	29.81	100	275	A	H
		2488.84	60.81	-13.19	74	44.45	27.52	18.67	29.83	100	275	P	H
		2483.52	52.64	-1.36	54	36.27	27.53	18.66	29.82	100	275	A	H
													H
													H
	*	2462	110.07	-	-	93.68	27.58	18.62	29.81	400	100	P	V
	*	2462	107.02	-	-	90.63	27.58	18.62	29.81	400	100	A	V
		2483.68	59.49	-14.51	74	43.12	27.53	18.66	29.82	400	100	P	V
		2483.52	51.37	-2.63	54	35	27.53	18.66	29.82	400	100	A	V
													V
													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. 0+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)
802.11b CH 11 2462MHz		4924	41.63	-32.37	74	56.67	31.15	13.36	59.55	100	0	P	H
		7386	43.64	-30.36	74	50.21	36.33	16.36	59.26	100	0	P	H
													H
													H
		4924	44.06	-29.94	74	59.1	31.15	13.36	59.55	100	0	P	V
		7386	44.06	-29.94	74	50.63	36.33	16.36	59.26	100	0	P	V
													V
													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. 0+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)
802.11g CH 11 2462MHz	*	2462	111.71	-	-	95.32	27.58	18.62	29.81	100	296	P	H
	*	2462	104.19	-	-	87.8	27.58	18.62	29.81	100	296	A	H
		2484.4	63.57	-10.43	74	47.2	27.53	18.66	29.82	100	296	P	H
		2483.52	52.48	-1.52	54	36.11	27.53	18.66	29.82	100	296	A	H
													H
													H
	*	2462	107.21	-	-	90.82	27.58	18.62	29.81	400	127	P	V
	*	2462	99.78	-	-	83.39	27.58	18.62	29.81	400	127	A	V
		2484.84	59.05	-14.95	74	42.67	27.53	18.67	29.82	400	127	P	V
		2484.76	48.26	-5.74	54	31.88	27.53	18.67	29.82	400	127	A	V
													V
													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 (Harmonic @ 3m)

WIFI Ant. 0+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)
802.11g CH 11 2462MHz		4924	38.75	-35.25	74	53.79	31.15	13.36	59.55	100	0	P	H
		7386	43.57	-30.43	74	50.14	36.33	16.36	59.26	100	0	P	H
													H
													H
		4924	38.37	-35.63	74	53.41	31.15	13.36	59.55	100	0	P	V
		7386	43.84	-30.16	74	50.41	36.33	16.36	59.26	100	0	P	V
													V
													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 HT40 (Band Edge @ 3m)

WIFI Ant. 0+1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 03 2422MHz		2387.7	59.92	-14.08	74	43.57	27.65	18.48	29.78	133	210	P	H
		2389.52	52.73	-1.27	54	36.39	27.64	18.48	29.78	133	210	A	H
	*	2422	107.37	-	-	91.03	27.6	18.54	29.8	133	210	P	H
	*	2422	99.41	-	-	83.07	27.6	18.54	29.8	133	210	A	H
		2484.88	56.61	-17.39	74	40.23	27.53	18.67	29.82	133	210	P	H
		2483.62	47.47	-6.53	54	31.1	27.53	18.66	29.82	133	210	A	H
		2388.4	58.33	-15.67	74	41.98	27.65	18.48	29.78	322	22	P	V
		2389.52	49.93	-4.07	54	33.59	27.64	18.48	29.78	322	22	A	V
	*	2422	103.25	-	-	86.91	27.6	18.54	29.8	322	22	P	V
	*	2422	95.24	-	-	78.9	27.6	18.54	29.8	322	22	A	V
		2491.18	57.68	-16.32	74	41.31	27.52	18.68	29.83	322	22	P	V
		2490.13	47.2	-6.8	54	30.83	27.52	18.68	29.83	322	22	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 HT40 (Harmonic @ 3m)

WIFI Ant. 0+1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 03 2422MHz		4844	38.09	-35.91	74	53.06	31.18	13.36	59.51	100	0	P	H
		7266	43.57	-30.43	74	50.59	36.36	16.05	59.43	100	0	P	H
													H
													H
		4844	38.08	-35.92	74	53.05	31.18	13.36	59.51	100	0	P	V
		7266	43.91	-30.09	74	50.93	36.36	16.05	59.43	100	0	P	V
													V
													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 B. Radiated Spurious Emission Plots

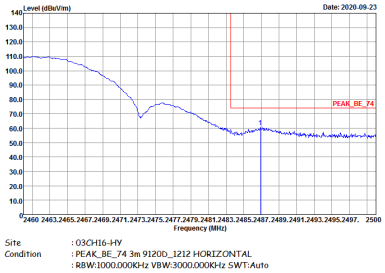
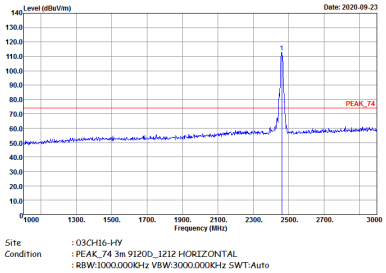
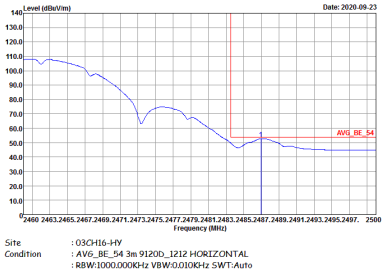
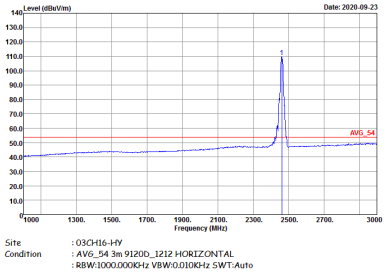
Test Engineer :	Jacky Hung, Andy Yang and CR Liao	**Temperature :**	20~25°C
		Relative Humidity :	50~60%

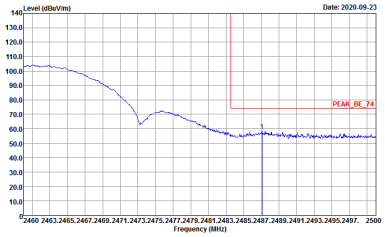
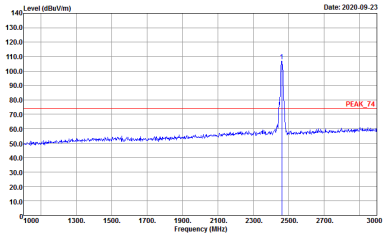
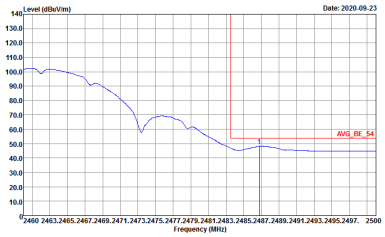
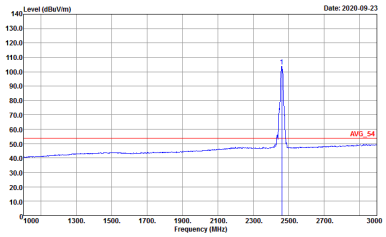
Note symbol

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

2.4GHz 2400~2483.5MHz

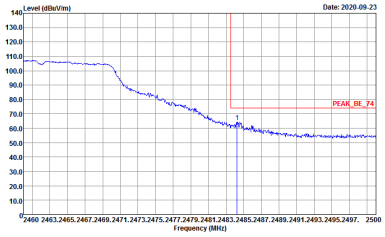
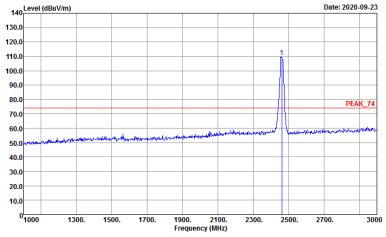
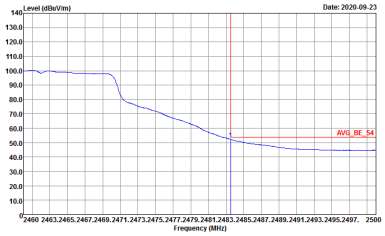
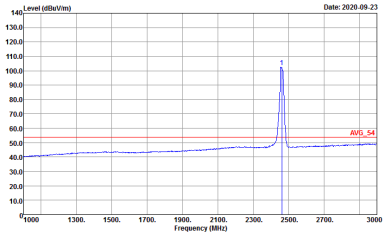
WIFI 802.11b (Band Edge @ 3m)

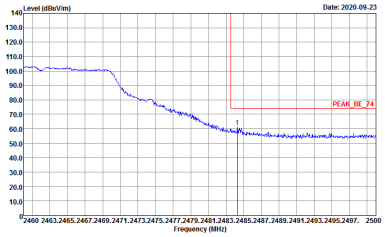
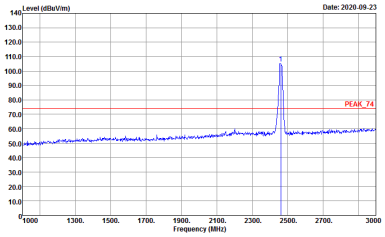
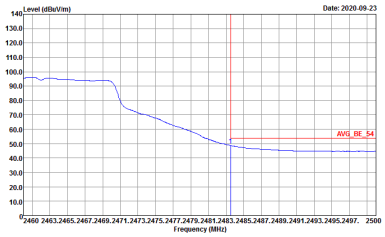
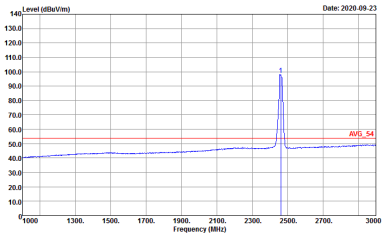
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
0	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
0	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

2.4GHz 2400~2483.5MHz

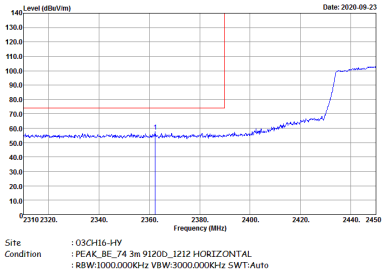
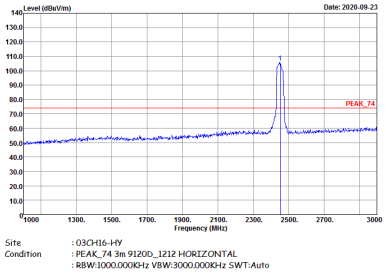
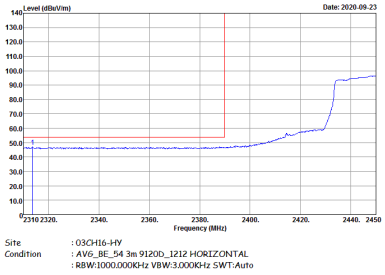
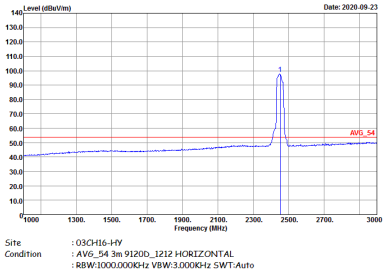
WIFI 802.11g (Band Edge @ 3m)

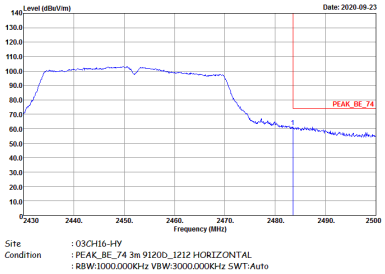
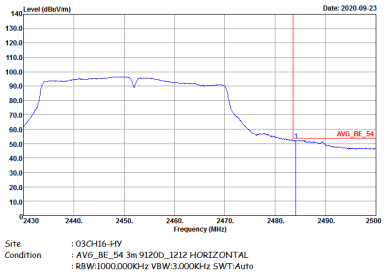
1WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
0	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1212 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1212 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1212 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 9120D_1212 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

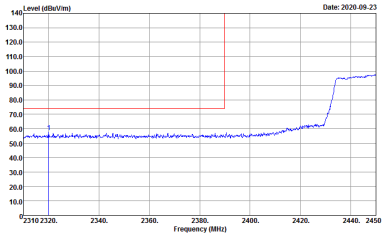
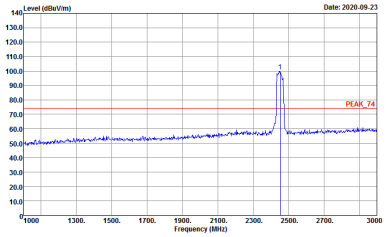
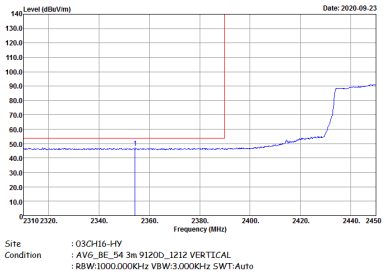
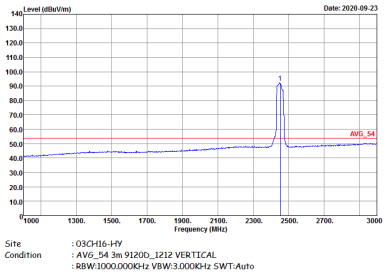
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
0	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

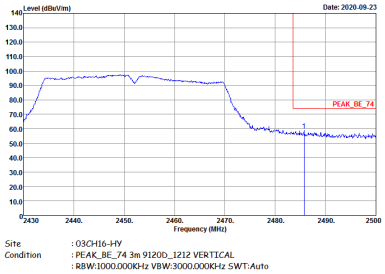
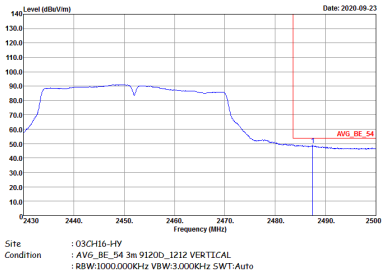
2.4GHz 2400~2483.5MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH09 2452MHz - L	
0	Horizontal	Fundamental
Peak		
Avg.		

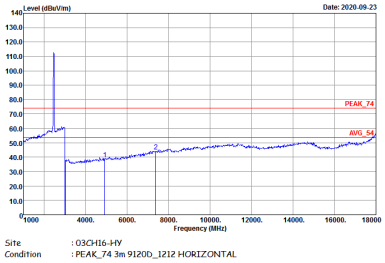
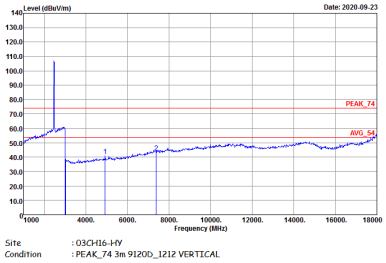
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH09 2452MHz - R	
0	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH09 2452MHz - L	
0	Vertical	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH09 2452MHz - R	
0	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

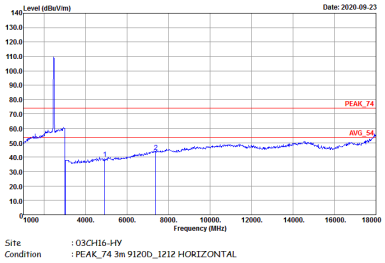
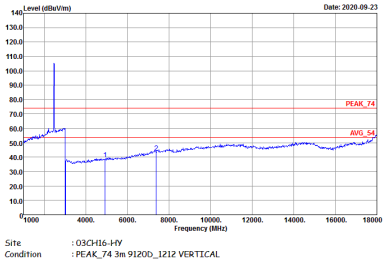
2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH11 2462MHz	
0	Horizontal	Vertical
Peak Avg.		

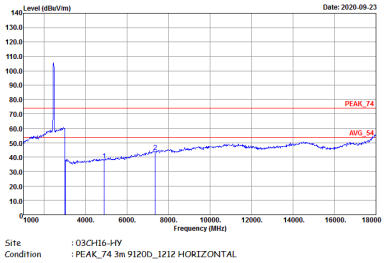
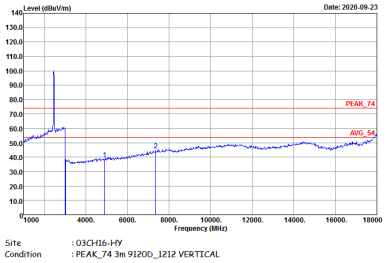
2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH11 2462MHz	
0	Horizontal	Vertical
Peak Avg.		

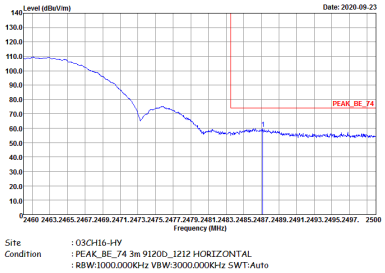
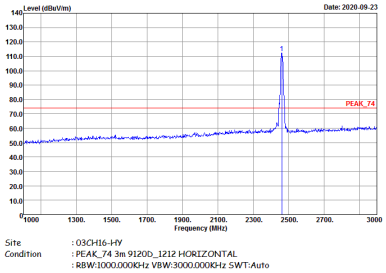
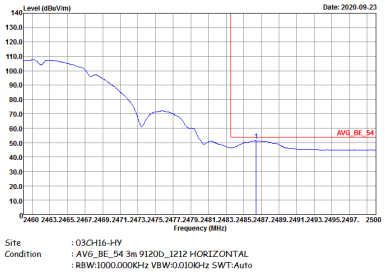
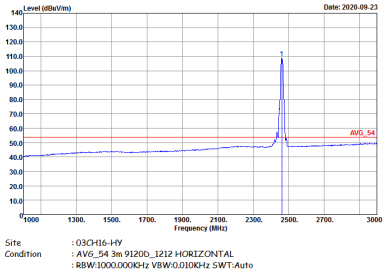
2.4GHz 2400~2483.5MHz

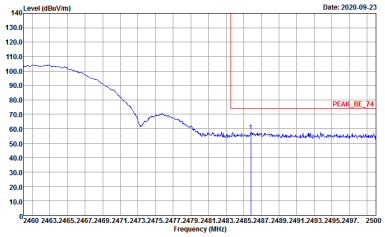
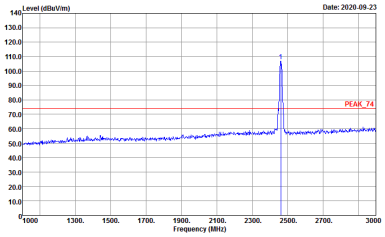
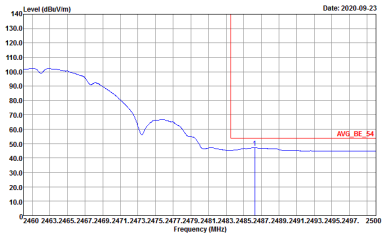
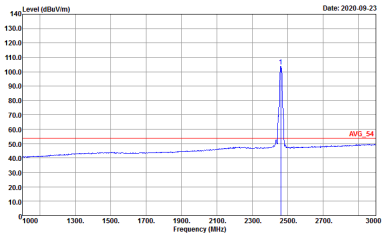
WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT40 CH09 2452MHz	
0	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

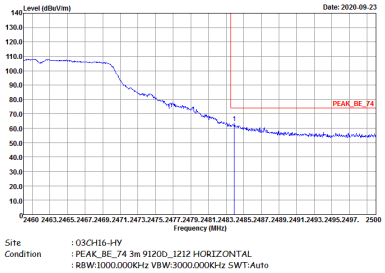
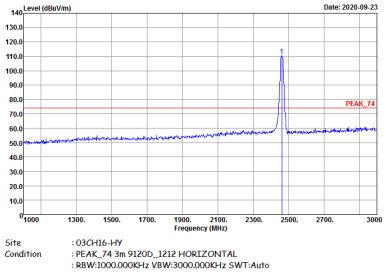
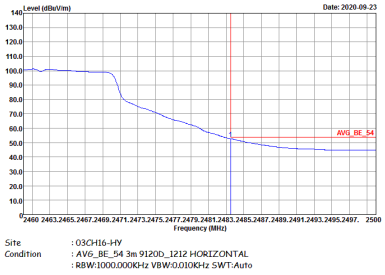
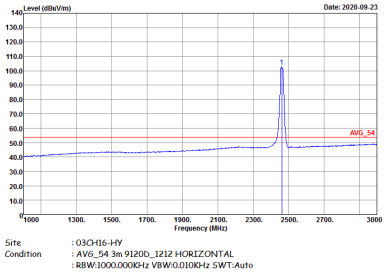
WIFI 802.11b (Band Edge @ 3m)

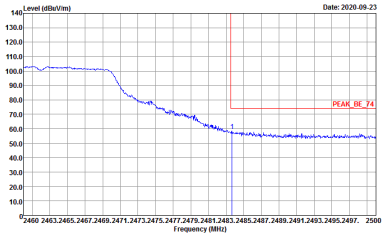
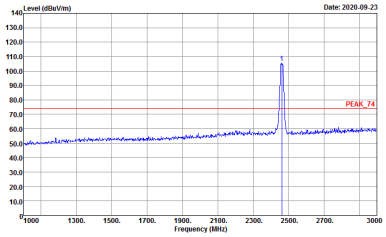
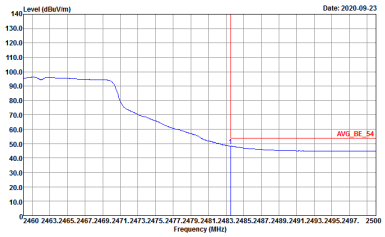
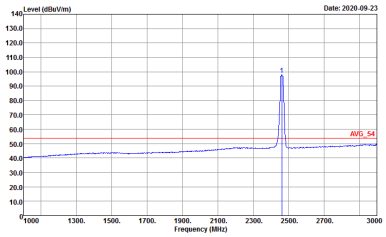
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

2.4GHz 2400~2483.5MHz

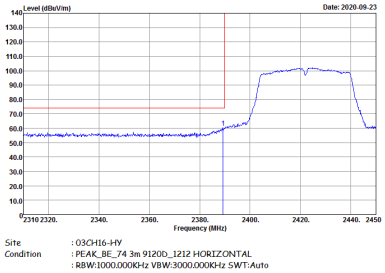
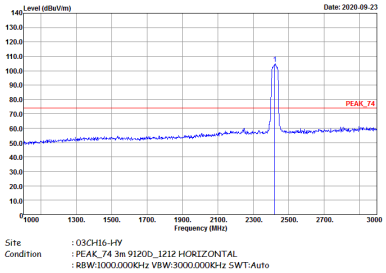
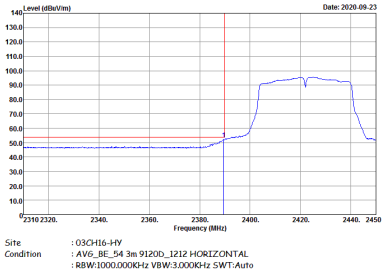
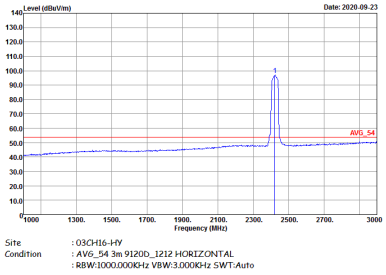
WIFI 802.11g (Band Edge @ 3m)

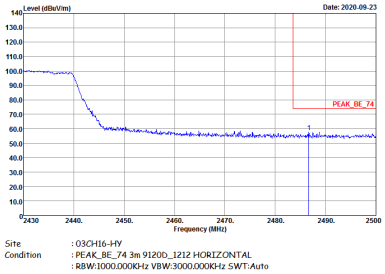
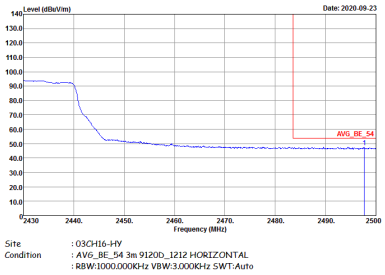
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

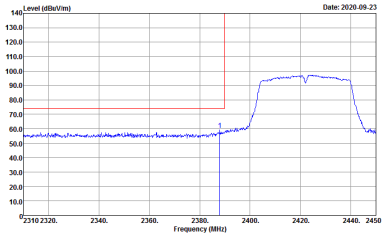
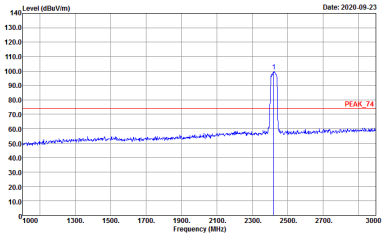
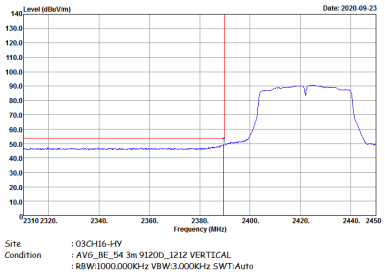
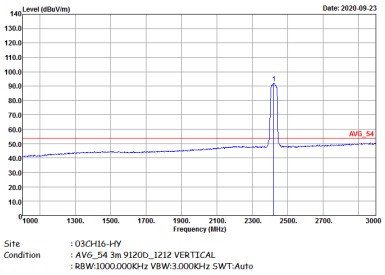
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

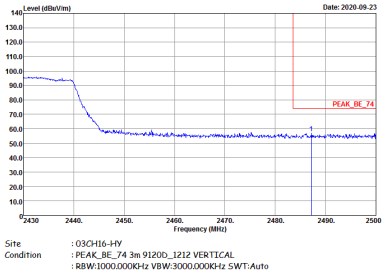
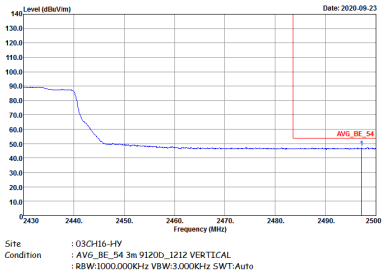
2.4GHz 2400~2483.5MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

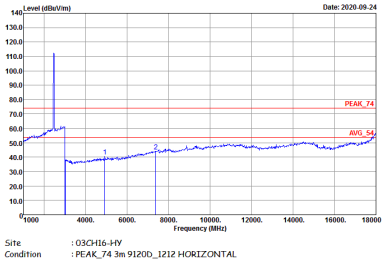
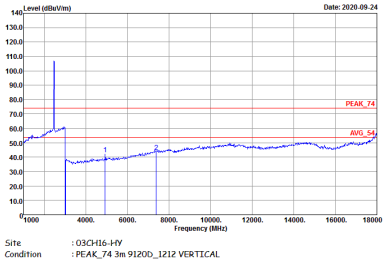
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - R	
1	Horizontal	Fundamental
Peak		Left Blank
Avg.		Left Blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

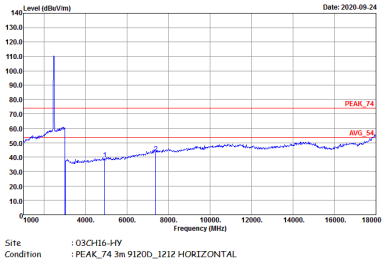
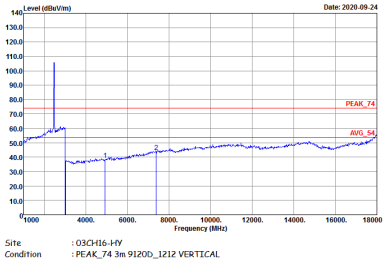
2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.		

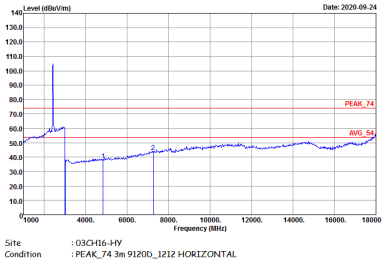
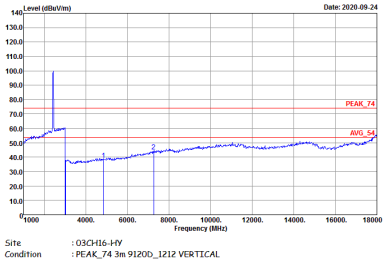
2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.		

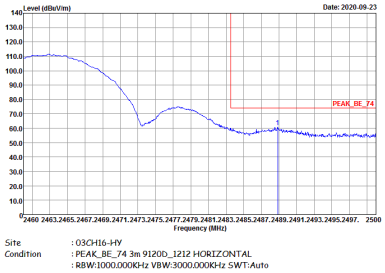
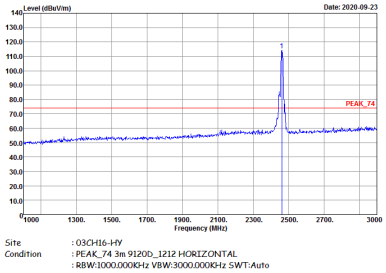
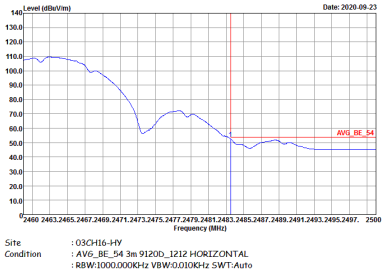
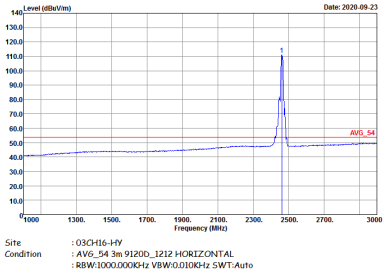
2.4GHz 2400~2483.5MHz

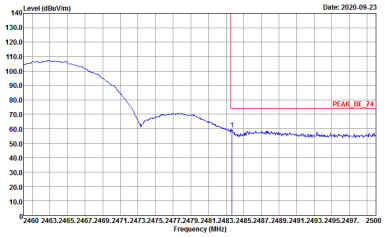
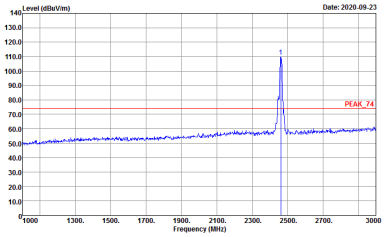
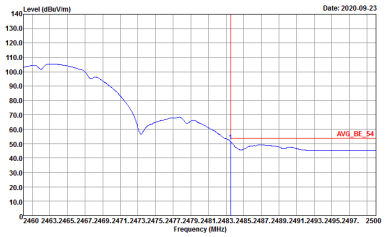
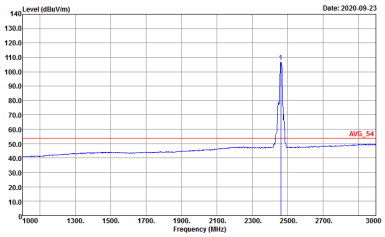
WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT40 CH03 2422MHz	
1	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

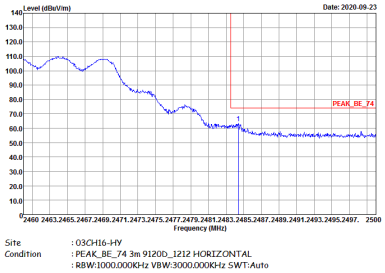
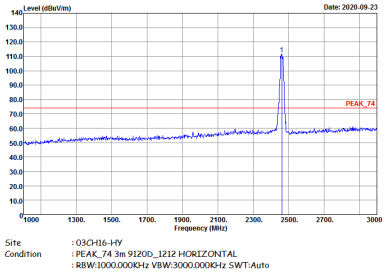
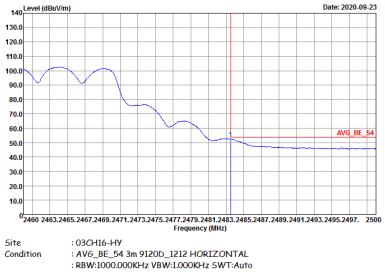
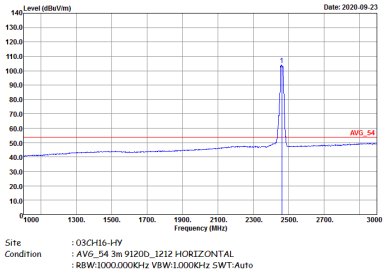
WIFI 802.11b (Band Edge @ 3m)

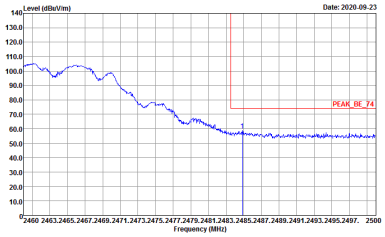
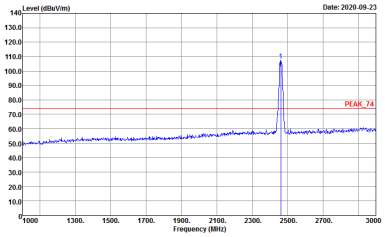
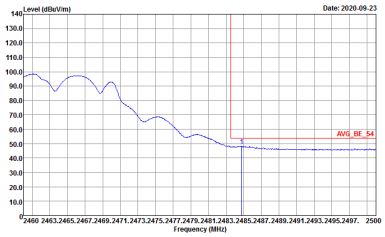
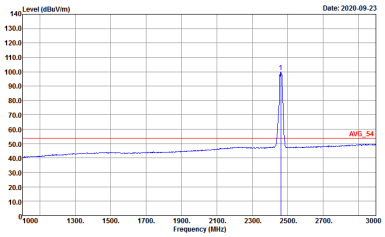
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
0+1	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
0+1	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

2.4GHz 2400~2483.5MHz

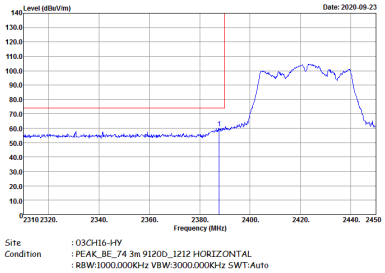
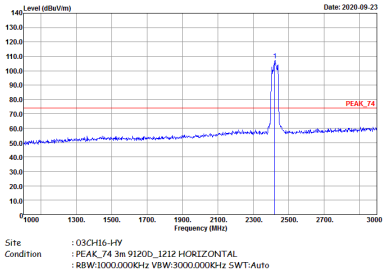
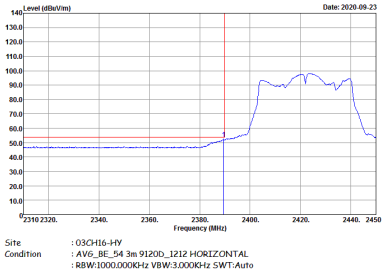
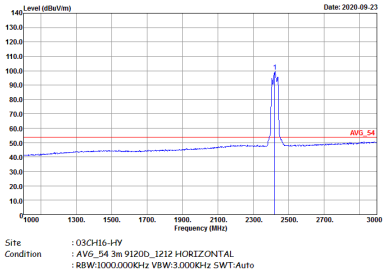
WIFI 802.11g (Band Edge @ 3m)

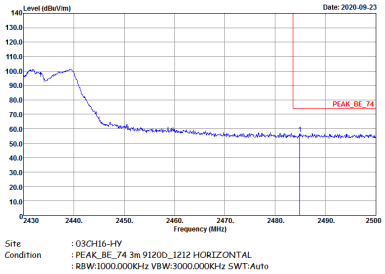
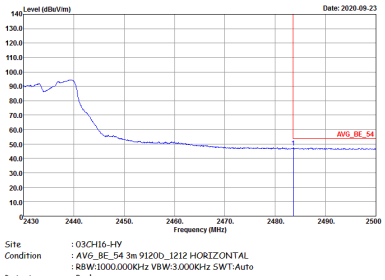
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
0+1	Horizontal	Fundamental
Peak		
Avg.		

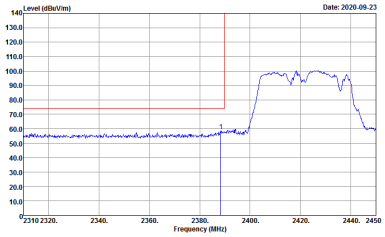
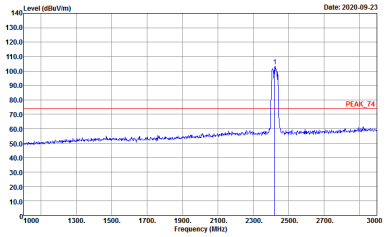
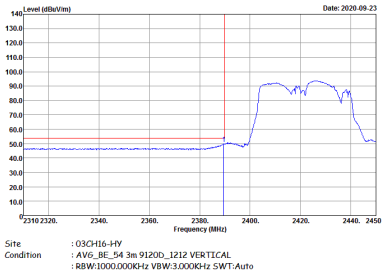
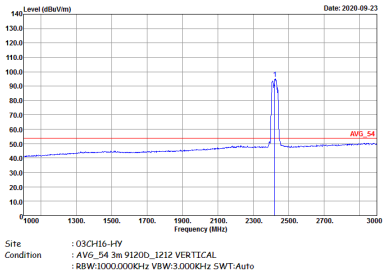
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
0+1	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 9120D_1212 VERTICAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto

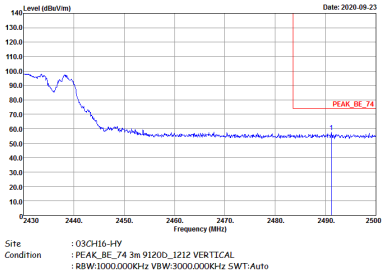
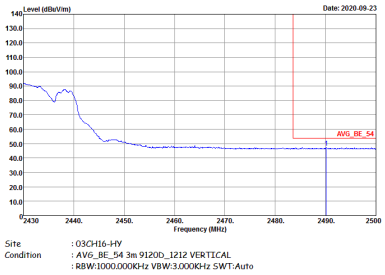
2.4GHz 2400~2483.5MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - L	
0+1	Horizontal	Fundamental
Peak		
Avg.		

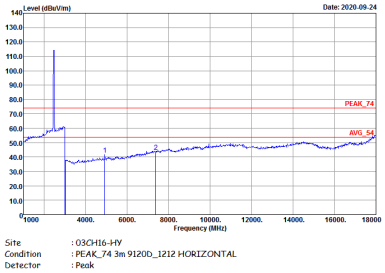
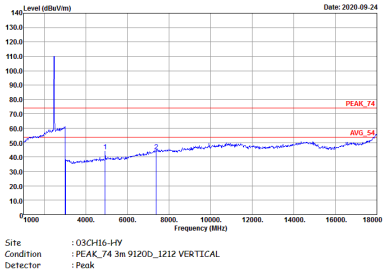
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - R	
0+1	Horizontal	Fundamental
Peak		Left Blank
Avg.		Left Blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - L	
0+1	Vertical	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - R	
0+1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

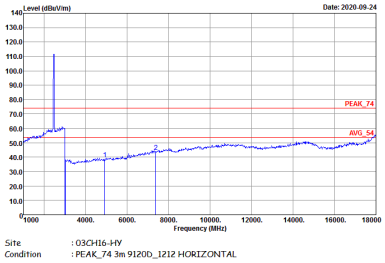
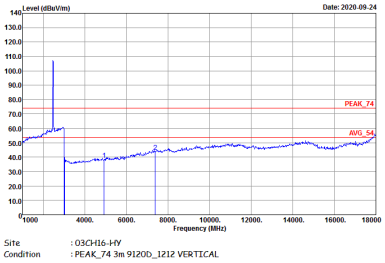
2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH11 2462MHz	
0+1	Horizontal	Vertical
Peak Avg.		

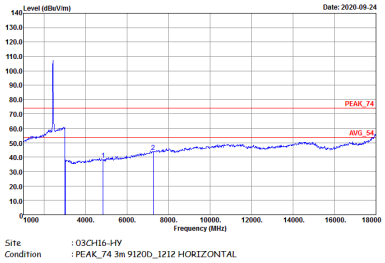
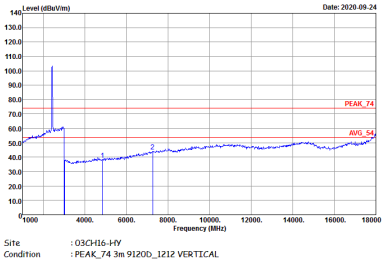
2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH11 2462MHz	
0+1	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT40 (Harmonic @ 3m)

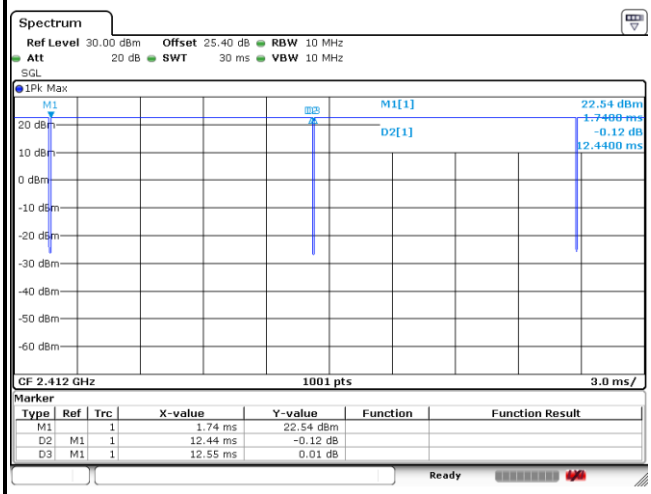
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT40 CH03 2422MHz	
0+1	Horizontal	Vertical
Peak Avg.		

Appendix C. Duty Cycle Plots

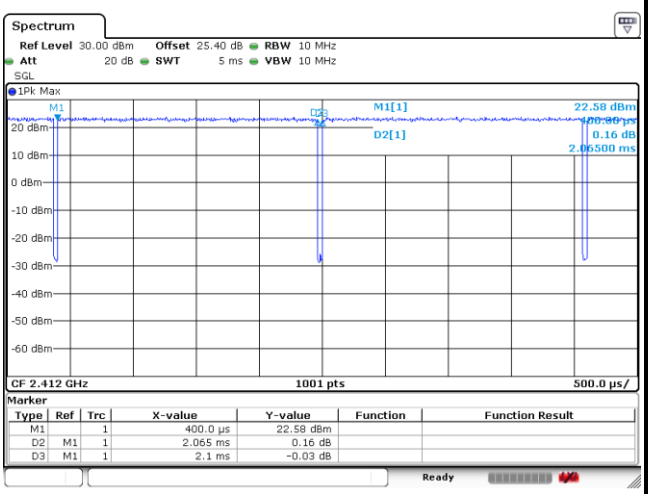
Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
0	802.11b	99.12	-	-	10Hz	0.04
1	802.11b	99.44	-	-	10Hz	0.02
0+1	802.11b for Ant 0	99.28	-	-	10Hz	0.03
0+1	802.11b for Ant 1	99.24	-	-	10Hz	0.03
0	802.11g	98.33	-	-	10Hz	0.07
1	802.11g	98.33	-	-	10Hz	0.07
0+1	802.11g for Ant 0	98.33	-	-	10Hz	0.07
0+1	802.11g for Ant 1	98.10	-	-	10Hz	0.08
0	2.4GHz 802.11n HT40	94.50	945	1.06	3kHz	0.25
1	2.4GHz 802.11n HT40	95.00	950	1.05	3kHz	0.22
0+1	2.4GHz 802.11n HT40 for Ant 0	94.50	945	1.06	3kHz	0.25
0+1	2.4GHz 802.11n HT40 for Ant 1	94.97	945	1.06	3kHz	0.22

<Ant. 0>

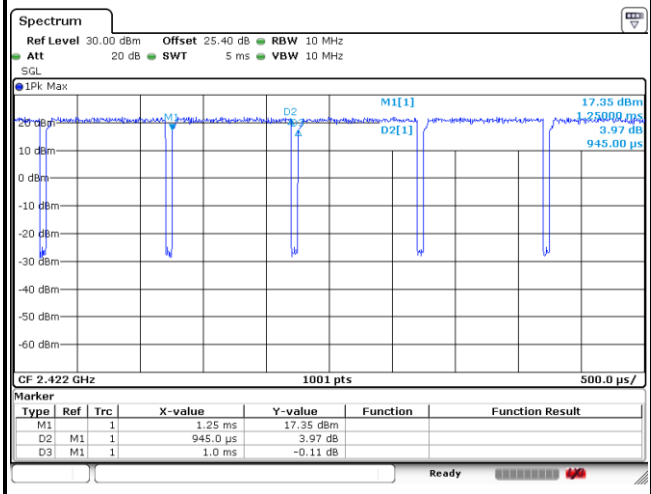
802.11b



802.11g



802.11n HT40



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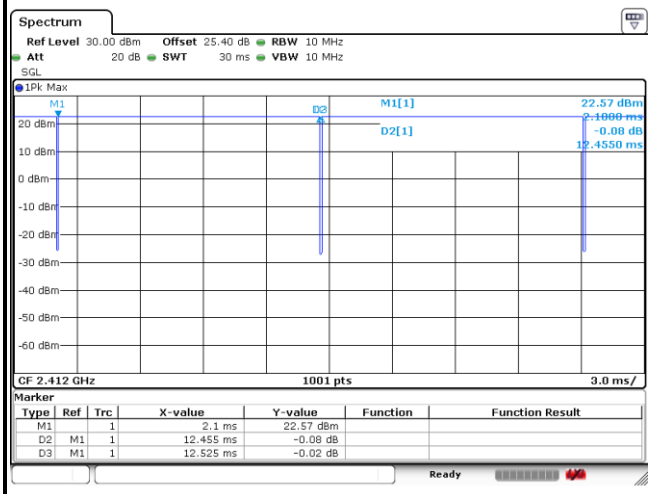
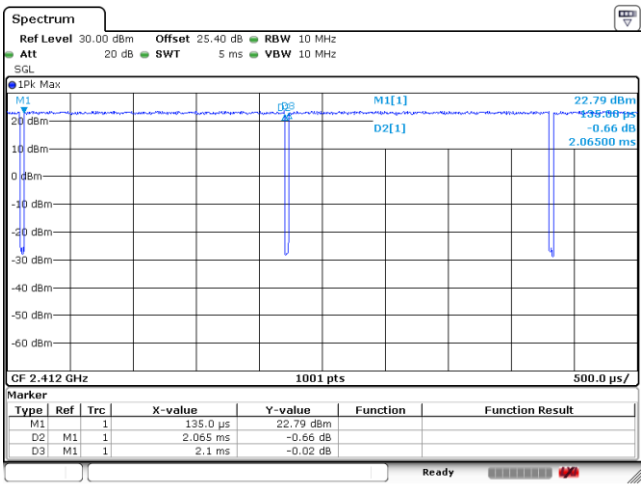
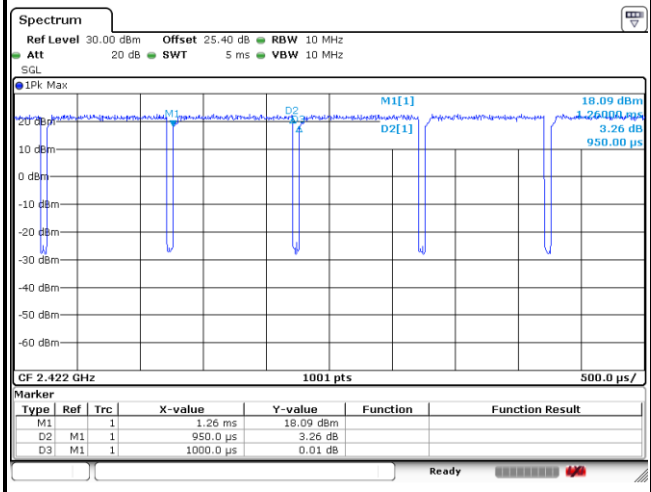
802.11b



802.11g

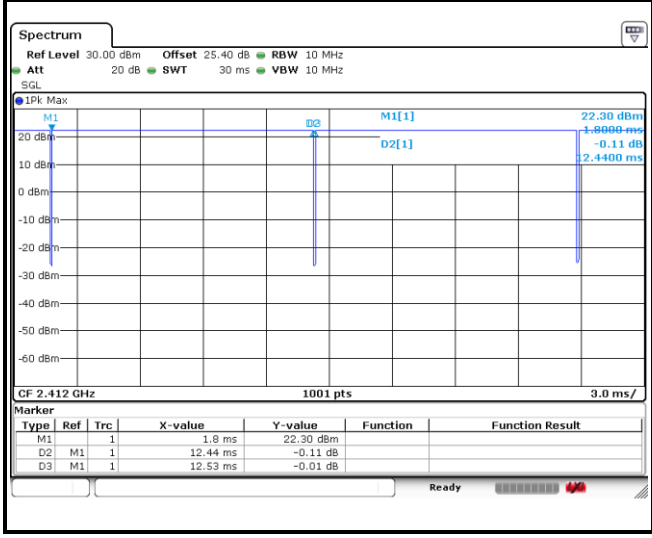


802.11n HT40

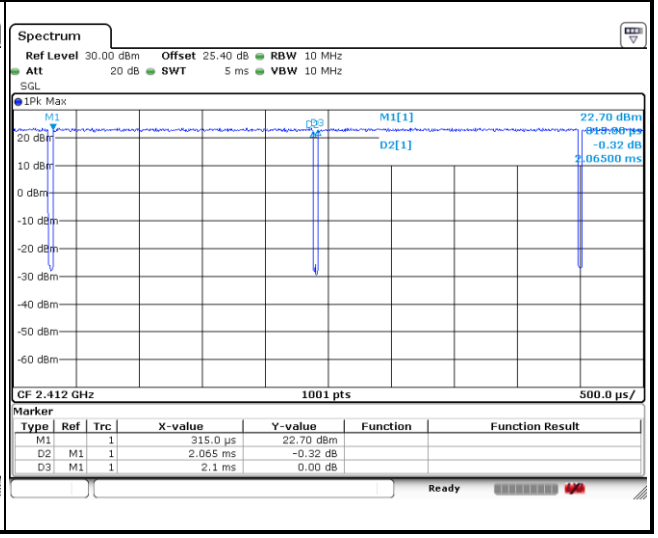


MIMO <Ant. 0>

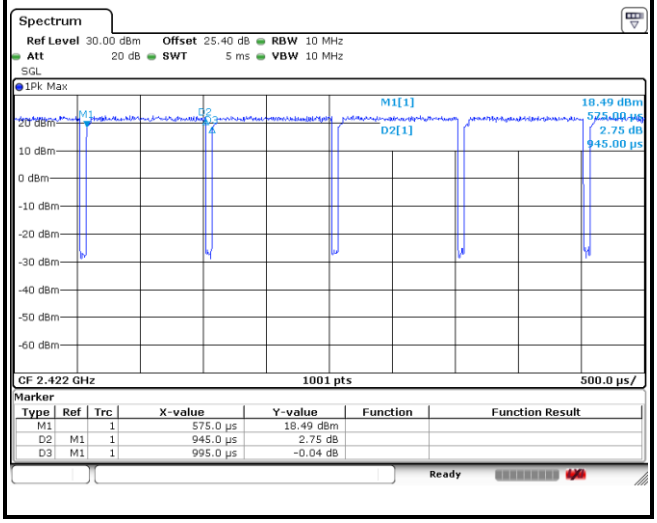
802.11b



802.11g

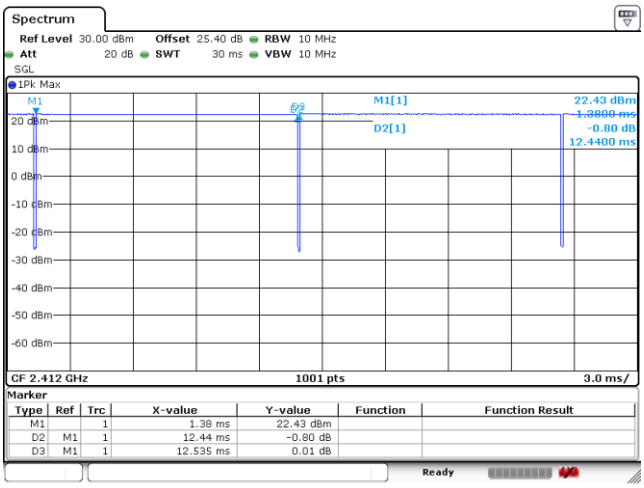


802.11n HT40

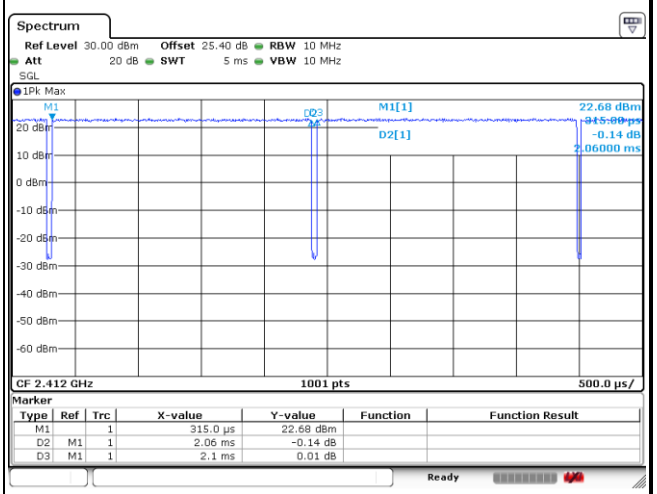


MIMO <Ant. 1>

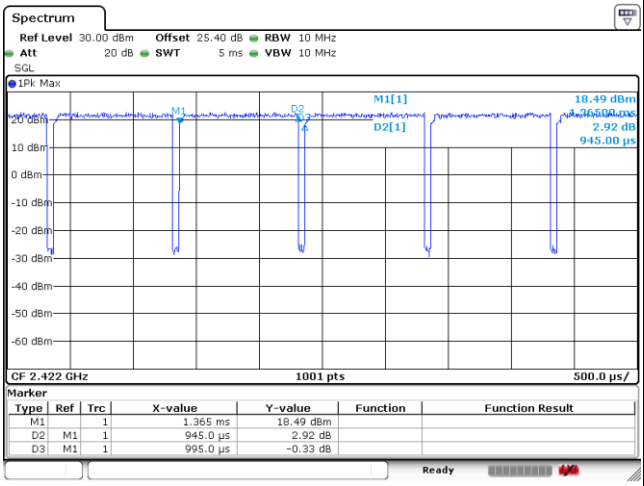
802.11b



802.11g



802.11n HT40



Appendix E. Original Report

Please refer to Sporton report number FR070401C as below.