FCC CO-LOCATION TEST REPORT

FCC ID	:	**S9GT750**
Equipment	:	**Access point**
Brand Name	:	**RUCKUS**
Model Name	:	**T750**
Applicant	:	**Ruckus Wireless Inc. 350 W. Java Dr., Sunnyvale CA 94089 USA**
Manufacturer	:	**Ruckus Wireless Inc. 350 W. Java Dr., Sunnyvale CA 94089 USA**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Jun. 21, 2019 and testing was started from Sep. 02, 2019 and completed on Jan. 08, 2020. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (USA) Inc., the test report shall not be reproduced except in full.

Approved by: Ken Chen

Sporton International (USA) Inc.
1175 Montague Expressway, Milpitas, CA 95035

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History of this test report

Report No.	Version	Description	Issued Date
FR190621001-01B	01	Initial issue of report	Jan. 14, 2020

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.407(b)	Unwanted Emissions	Pass	Under limit 2.24 dB at 5370.000 MHz
3.2	15.203 15.407(a)	Antenna Requirement	Pass	-

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.

1 General Description

1.1 Product Feature of Equipment Under Test

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

Product Specification subjective to this standard	
Antenna Type	WLAN: <Ant. 1> Omni Antenna <Ant. 2> Omni Antenna <Ant. 3> Omni Antenna <Ant. 4> Omni Antenna Bluetooth: Omni Antenna Zigbee: Omni Antenna

1.2 Modification of EUT

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

1.3 Testing Location

Test Site	Sporton International (USA) Inc.
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300
Test Site No.	**Sporton Site No.**
	03CH02-CA

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

1.4 Applicable Standards

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

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

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

2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

2.1 Carrier Frequency and Channel

5150-5250MHz 802.11ax HE80		5250-5350MHz 802.11ax HE80		5470-5725 MHz 802.11ax HE80			
Channel	**Freq. (MHz)**	**Channel**	**Freq. (MHz)**	**Channel**	**Freq. (MHz)**	**Channel**	**Freq. (MHz)**
42	5210	58	5290	106	5530	122	5610

2.2 Test Mode

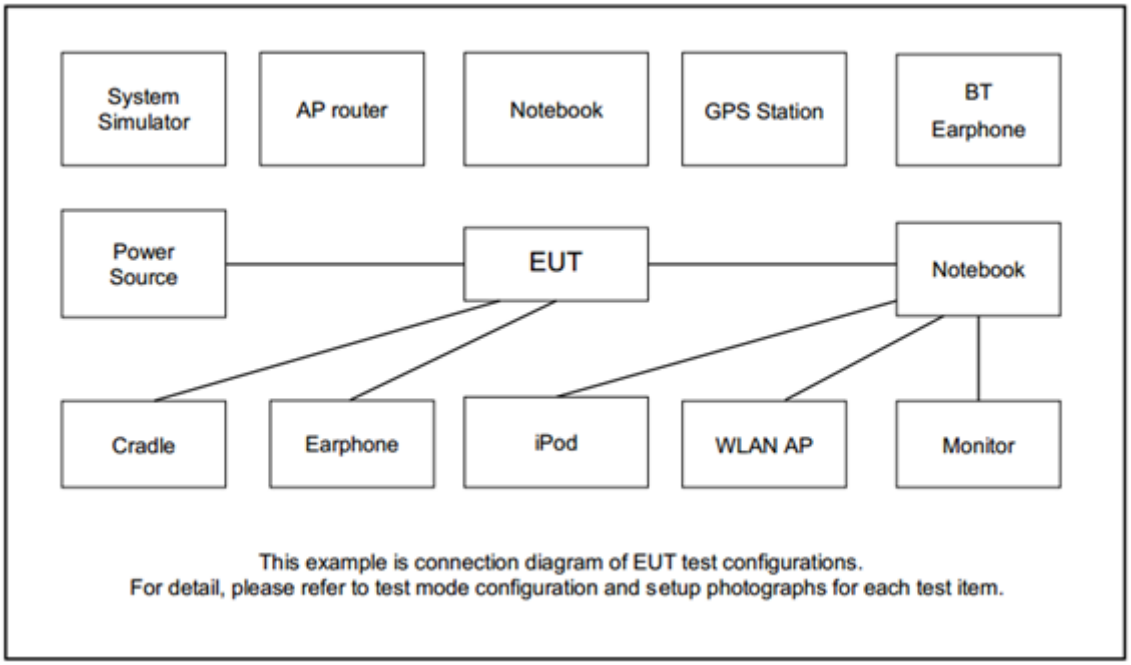
Final test modes are considering the modulation and worse data rates as below table.

<Co-Location>

Modulation	Data Rate
5GHz 802.11ax HE80 + 5GHz 802.11ax HE80	**MCS0 + MCS0**

Remark: The testing for co-transit mode subjects to intermodulation signal which is based on customer's requirement.

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Laptop	HP	15t-cu000	PD97265NG	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility “Putty v0.6” 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 Unwanted Emissions Measurement

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

3.1.1 Limit of Unwanted Emissions

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

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

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

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

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

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

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

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

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules **v02r01**. Section G) Unwanted emissions measurement.

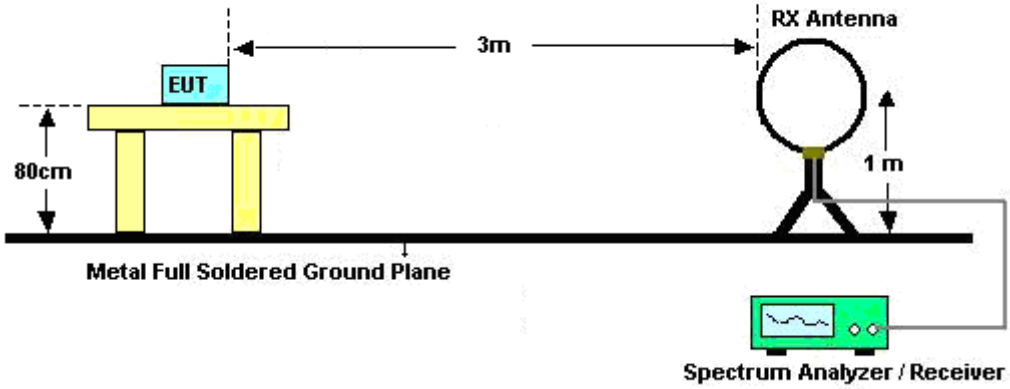
   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

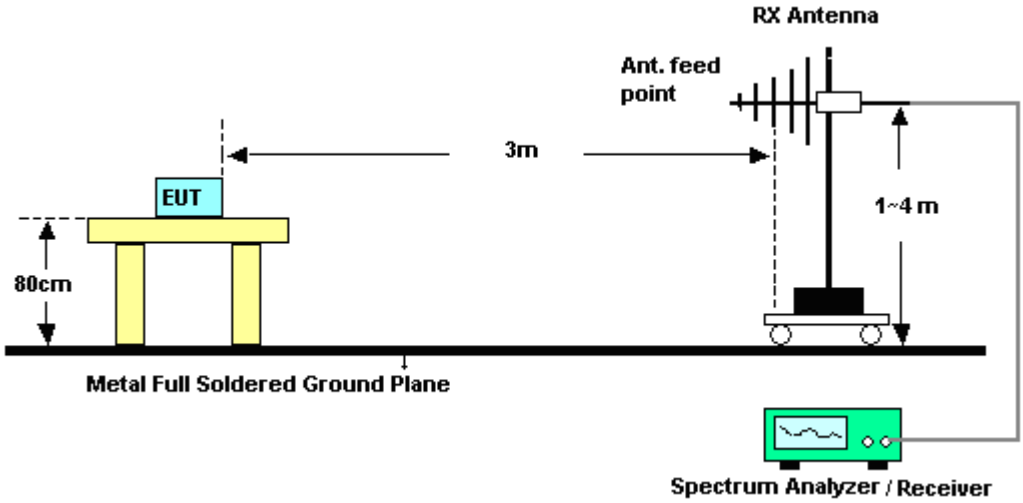
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.1.4 Test Setup

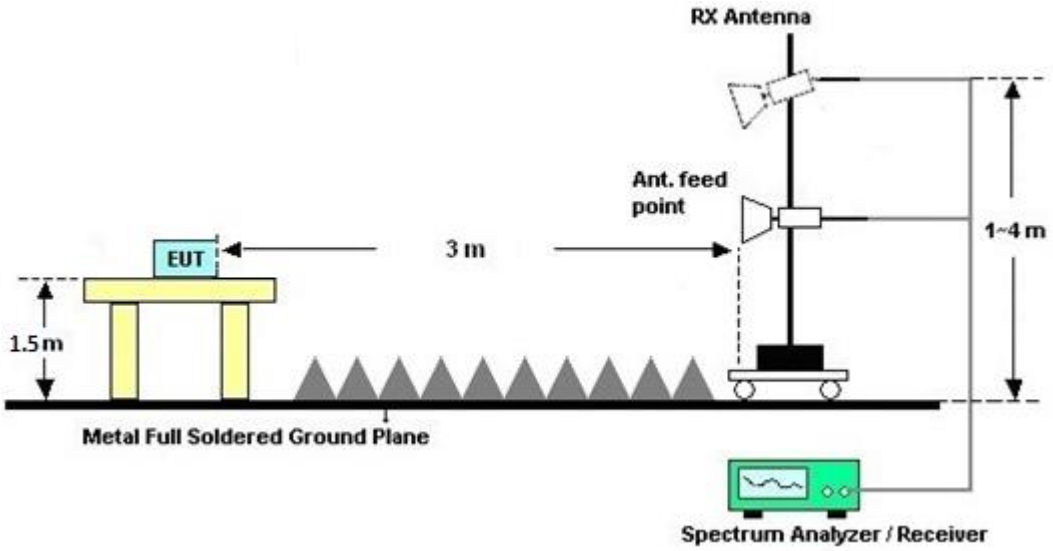
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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

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

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

3.1.7 Duty Cycle

Please refer to Appendix C.

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

Please refer to Appendix A and B.

3.2 Antenna Requirements

3.2.1 Standard Applicable

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

3.2.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.2.3 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
Bilog Antenna	TESEQ	6111D	50392	30MHz~1GHz	May 15, 2019	Sep. 02, 2019~ Jan. 08, 2020	May 14, 2020	Radiation (03CH02-CA)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	BBHA917000842	18GHz~40GHz	Jul. 23. 2019	Jan. 08, 2020	Jul. 22. 2020	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	01894	1GHz~18GHz	Jul. 22, 2019	Sep. 02, 2019~ Sep. 03, 2019	Jul. 21, 2020	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	01895	1GHz~18GHz	Aug. 20, 2019	Jan. 08, 2020	Aug. 19, 2020	Radiation (03CH02-CA)
Amplifier	SONOMA	310N	372240	N/A	Aug. 13, 2019	Sep. 02, 2019~ Jan. 08, 2020	Aug. 12, 2020	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270323	1GHz~26.5GHz	Sep. 11, 2018	Sep. 02, 2019~ Sep. 03, 2019	Sep. 10, 2019	Radiation (03CH02-CA)
Preamplifier	EMEC	EMC18G40G	060726	18G-40G	Aug. 01. 2019	Jan. 08, 2020	Jul. 31. 2020	Radiation (03CH02-CA)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800055007	1GHz~18GHz	Apr. 01, 2019	Sep. 02, 2019~ Jan. 08, 2020	Mar. 31, 2020	Radiation (03CH02-CA)
EMI Test Receiver	R&S	ESU26	100049	20Hz~26.5GHz	Jul. 31, 2019	Sep. 02, 2019~ Jan. 08, 2020	Jul. 30, 2020	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200-1272-11000-40SS	SN2	1.2G Low Pass	Aug. 02, 2019	Sep. 02, 2019~ Sep. 03, 2019	Aug. 01, 2020	Radiation (03CH02-CA)
Notch Filter	Wainwright	WRCJV12-5120-5150-5350-5380-40SS	SN14	Notch Filter	Aug. 02, 2019	Sep. 02, 2019~ Sep. 03, 2019	Aug. 01, 2020	Radiation (03CH02-CA)
Notch Filter	Wainwright	WRCJV12-5695-5725-5850-5880-40SS	SN18	Notch Filter	Aug. 02, 2019	Sep. 02, 2019~ Sep. 03, 2019	Aug. 01, 2020	Radiation (03CH02-CA)
Notch Filter	Wainwright	WRCJV16-5440-5470-5725-5755-40SS	SN20	Notch Filter	Aug. 02, 2019	Sep. 02, 2019~ Sep. 03, 2019	Aug. 01, 2020	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Sep. 02, 2019~ Jan. 08, 2020	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Sep. 02, 2019~ Jan. 08, 2020	N/A	Radiation (03CH02-CA)
Spectrum Analyzer	Keysight	N9010A	MY57420221	10Hz~44GHz	Sep. 11, 2019	Jan. 08, 2020	Sep. 10, 2020	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Jul. 25, 2019	Jan. 08, 2020	Jul. 24, 2020	Radiation (03CH02-CA)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Jan. 08, 2020	N/A	Radiation (03CH02-CA)
Software	Audix	E3	E3 6.2009-8-24d Sporton	N/A	N/A	Jan. 08, 2020	N/A	Radiation (03CH02-CA)
Filter	Wainwright	WHKX12-1080-1200-15000-60ST	SN7	1.2G Low Pass	Aug. 02, 2019	Jan. 08, 2020	Aug. 01, 2020	Radiation (03CH02-CA)
Filter	Wainwright	WHKX8-5872.5-6750-18000-40ST	SN8	6.75 Highpass	Aug. 02, 2019	Jan. 08, 2020	Aug. 01, 2020	Radiation (03CH02-CA)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.4**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.5**

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

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

Appendix A. Radiated Spurious Emission

Test Engineer :	Hao Syu and J.C. Liang	Temperature :	23~26°C
		Relative Humidity :	42~51%

11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58

WIFI 802.11ax HE80 (Band Edge @ 3m)

WIFI	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)
802.11ax HE80 CH 42 5210MHz		5150	60.34	-13.66	74	47.66	31.62	10.99	29.93	283	106	P	H
		5147.94	49.57	-4.43	54	36.89	31.62	10.99	29.93	283	106	A	H
	*	5210	108.42	-	-	95.52	31.67	11.15	29.92	283	106	P	H
	*	5210	95.77	-	-	82.87	31.67	11.15	29.92	283	106	A	H
		5350.8	61.36	-12.64	74	48.16	31.78	11.33	29.91	283	106	P	H
		5369.84	50.37	-3.63	54	37.13	31.8	11.35	29.91	283	106	A	H
		5146.12	59.39	-14.61	74	46.5	31.84	10.98	29.93	263	328	P	V
		5149.5	48.54	-5.46	54	35.64	31.84	10.99	29.93	263	328	A	V
	*	5210	110.81	-	-	97.7	31.88	11.15	29.92	263	328	P	V
	*	5210	97.86	-	-	84.75	31.88	11.15	29.92	263	328	A	V
		5350.52	60.35	-13.65	74	46.97	31.96	11.33	29.91	263	328	P	V
		5351.36	48.71	-5.29	54	35.33	31.96	11.33	29.91	263	328	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

WIFI 802.11ax HE80 (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11ax HE80 CH 58 5290MHz		5147.9	60.36	-13.64	74	47.68	31.62	10.99	29.93	232	111	P	H
		5149.6	49.51	-4.49	54	36.83	31.62	10.99	29.93	232	111	A	H
	*	5290	106.61	-	-	93.55	31.73	11.25	29.92	232	111	P	H
	*	5290	93.94	-	-	80.88	31.73	11.25	29.92	232	111	A	H
		5352	62.24	-11.76	74	49.04	31.78	11.33	29.91	232	111	P	H
		5370	51.76	-2.24	54	38.52	31.8	11.35	29.91	232	111	A	H
		5147.22	58.19	-15.81	74	45.3	31.84	10.98	29.93	301	201	P	V
		5148.92	46.25	-7.75	54	33.35	31.84	10.99	29.93	301	201	A	V
	*	5290	108.99	-	-	95.74	31.92	11.25	29.92	301	201	P	V
	*	5290	96.63	-	-	83.38	31.92	11.25	29.92	301	201	A	V
		5350.56	60.34	-13.66	74	46.96	31.96	11.33	29.91	301	201	P	V
		5351.28	49.59	-4.41	54	36.21	31.96	11.33	29.91	301	201	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Co-location mode (Harmonic @ 3m)

Co-location	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Co-location mode		10420	47.41	-20.79	68.2	52.17	39.59	16.56	60.91	100	0	P	H
		10580	47.47	-20.73	68.2	52.21	39.81	16.65	61.2	100	0	P	H
		15630	47.26	-26.74	74	50.32	38.34	20.04	61.44	100	0	P	H
		15870	46.96	-27.04	74	50.08	37.86	20.18	61.16	100	0	P	H
		10420	47.36	-20.84	68.2	52.11	39.6	16.56	60.91	100	0	P	V
		10580	48.34	-19.86	68.2	53.05	39.84	16.65	61.2	100	0	P	V
		15630	47.96	-26.04	74	50.8	38.56	20.04	61.44	100	0	P	V
		15870	46.06	-27.94	74	48.89	38.15	20.18	61.16	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 3 - 5470~5725MHz

WIFI 802.11ax HE80 CH106 + HE80 CH 122 (Band Edge @ 3m)

WIFI Ant.	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)
802.11ax HE80 CH 106 5530MHz		5458.24	56.65	-17.35	74	43.29	31.83	11.43	29.9	347	70	P	H
		5460.4	56.46	-11.74	68.2	43.09	31.84	11.43	29.9	347	70	P	H
		5450.08	50.33	-3.67	54	36.98	31.82	11.43	29.9	347	70	A	H
	*	5530	106.09	-	-	92.59	31.93	11.48	29.91	347	70	P	H
	*	5530	97.22	-	-	83.72	31.93	11.48	29.91	347	70	A	H
		5742.635	51.67	-16.53	68.2	37.75	32.15	11.75	29.98	347	70	P	H
		5458.24	55.27	-18.73	74	41.83	31.91	11.43	29.9	320	125	P	V
		5462.32	55.6	-12.6	68.2	42.15	31.92	11.43	29.9	320	125	P	V
		5450.08	47.3	-6.7	54	33.89	31.88	11.43	29.9	320	125	A	V
	*	5530	109.49	-	-	95.88	32.04	11.48	29.91	320	125	P	V
	*	5530	99.19	-	-	85.58	32.04	11.48	29.91	320	125	A	V
		5752.4	52.8	-15.4	68.2	38.79	32.23	11.77	29.99	320	125	P	V
802.11ax HE80 CH 122 5610MHz		5449.6	55.03	-18.97	74	41.69	31.82	11.42	29.9	319	221	P	H
		5463.52	55.22	-12.98	68.2	41.85	31.84	11.43	29.9	319	221	P	H
		5450.08	50.82	-3.18	54	37.47	31.82	11.43	29.9	319	221	A	H
	*	5610	104.35	-	-	90.85	31.89	11.55	29.94	319	221	P	H
	*	5610	96.35	-	-	82.85	31.89	11.55	29.94	319	221	A	H
		5761.85	53.43	-14.77	68.2	39.41	32.23	11.78	29.99	319	221	P	H
		5429.92	53.74	-20.26	74	40.41	31.83	11.41	29.91	322	209	P	V
		5463.76	53.69	-14.51	68.2	40.24	31.92	11.43	29.9	322	209	P	V
		5450.08	47.95	-6.05	54	34.54	31.88	11.43	29.9	322	209	A	V
	*	5610	108.37	-	-	94.78	31.98	11.55	29.94	322	209	P	V
	*	5610	98.8	-	-	85.21	31.98	11.55	29.94	322	209	A	V
		5726.885	53.05	-15.15	68.2	39.18	32.12	11.73	29.98	322	209	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

WIFI 802.11ax HE80 + HE80 (LF @ 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)
WIFI 802.11ax HE80 + HE80 LF		49.4	31.19	-8.81	40	47.88	14.5	1.25	32.44	-	-	P	H
		82.38	33.5	-6.5	40	50.61	13.78	1.56	32.45	100	0	P	H
		108.57	32.89	-10.61	43.5	46.65	16.96	1.7	32.42	-	-	P	H
		138.64	24.07	-19.43	43.5	36.8	17.64	2.05	32.42	-	-	P	H
		787.57	30.38	-15.62	46	29.89	28.15	4.57	32.23	-	-	P	H
		942.77	32.89	-13.11	46	28.54	30.61	5	31.26	-	-	P	H
													H
													H
													H
													H
													H
													H
		83.35	28.47	-11.53	40	45.39	13.94	1.59	32.45	100	0	P	V
		111.48	30.54	-12.96	43.5	44.09	17.15	1.72	32.42	-	-	P	V
		131.85	29.95	-13.55	43.5	42.74	17.7	1.94	32.43	-	-	P	V
		347.19	25.07	-20.93	46	34.22	20.39	2.9	32.44	-	-	P	V
		873.9	31.48	-14.52	46	29.3	29.12	4.88	31.82	-	-	P	V
		959.26	33.07	-12.93	46	28.09	30.99	5.08	31.09	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

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

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

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		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

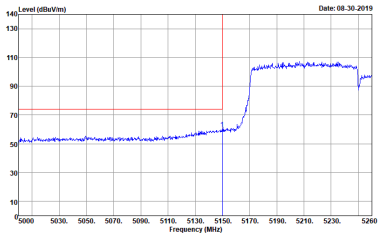
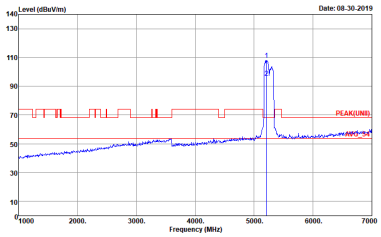
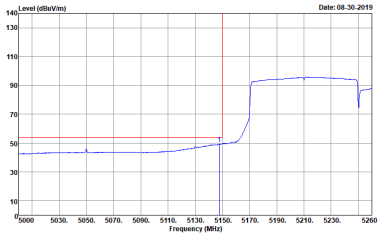
Test Engineer :	Hao Syu and J.C. Liang	**Temperature :**	23~26°C
		Relative Humidity :	42~51%

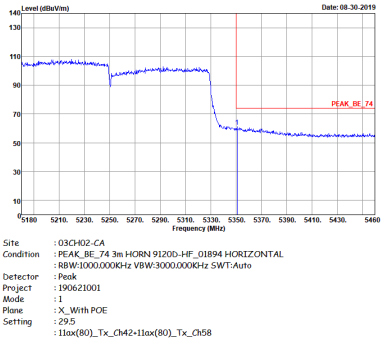
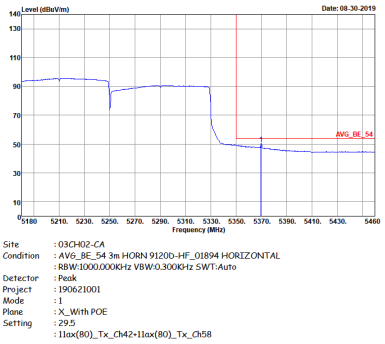
Note symbol

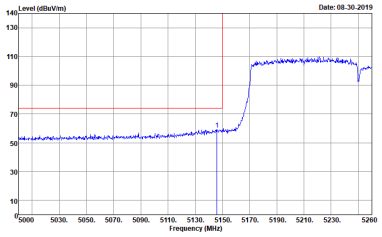
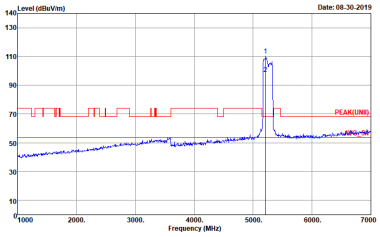
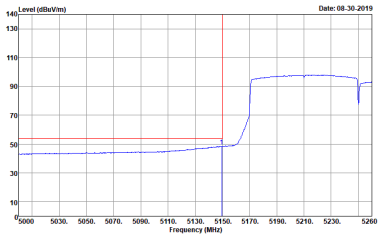
-L	**Low channel location**
-R	**High channel location**

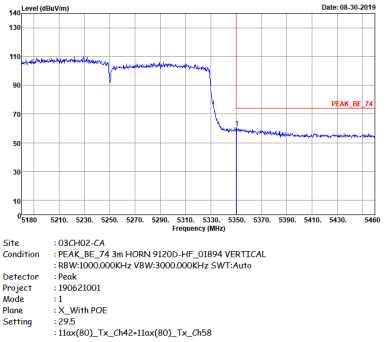
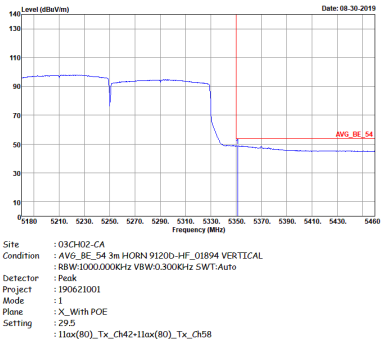
11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58

WIFI 802.11ax HE80 (Band Edge @ 3m)

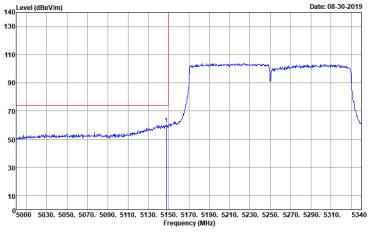
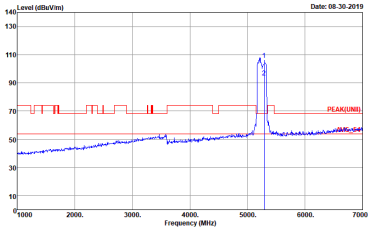
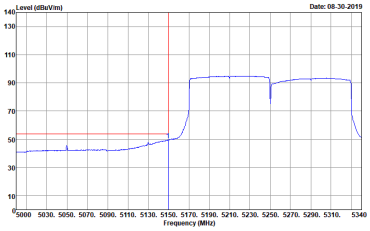
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
	802.11ax HE80 CH42 5210MHz - L	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58	 Site : 03CH02-CA Condition : PEAK(UNII) 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58
Avg.	 Site : 03CH02-CA Condition : AV6_BE_54 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58	Left blank

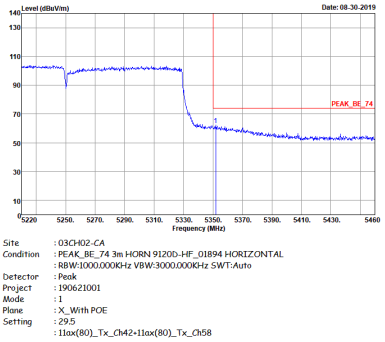
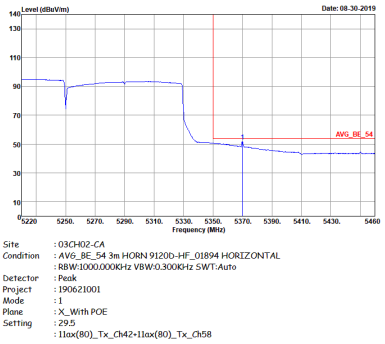
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
	802.11ax HE80 CH42 5210MHz - R	
	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

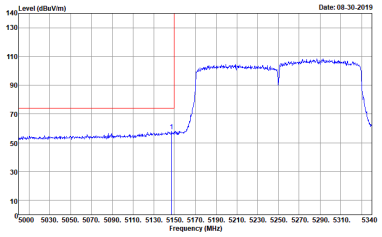
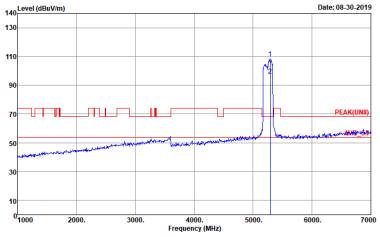
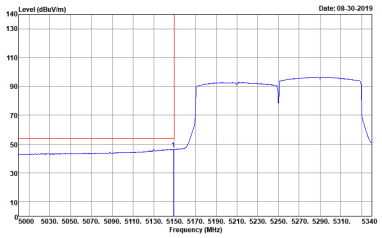
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
	802.11ax HE80 CH42 5210MHz - L	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58	 Site : 03CH02-CA Condition : PEAK(UNII) 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58
Avg	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58	Left blank

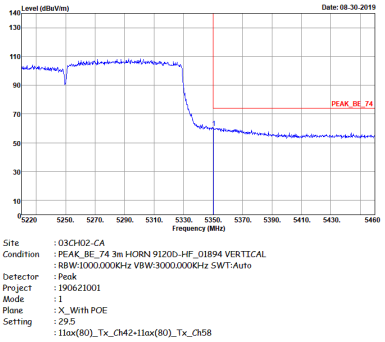
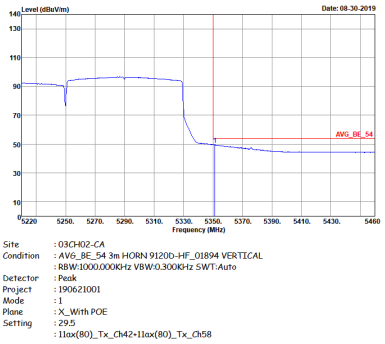
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
	802.11ax HE80 CH42 5210MHz - R	
	Vertical	Fundamental
Peak		Left blank
Avg		Left blank

WIFI 802.11ax VHT80 (Band Edge @ 3m)

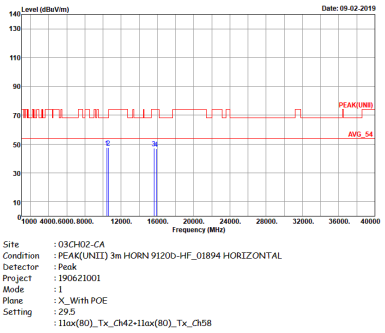
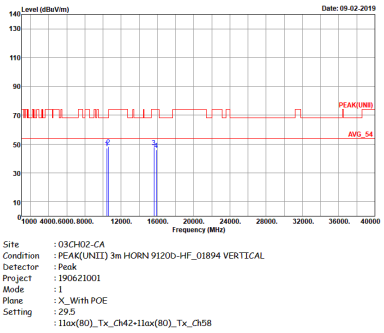
WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
	802.11ax HE80 CH58 5290MHz - L	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58	 Site : 03CH02-CA Condition : PEAK(UNII) 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58	Left blank

WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
	802.11ax HE80 CH58 5290MHz - R	
	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
	802.11ax HE80 CH58 5290MHz - L	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58	 Site : 03CH02-CA Condition : PEAK(UNII) 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58	Left blank

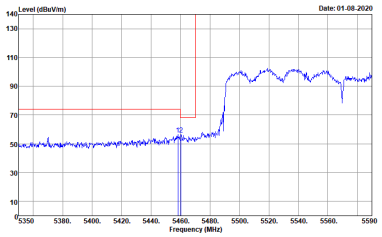
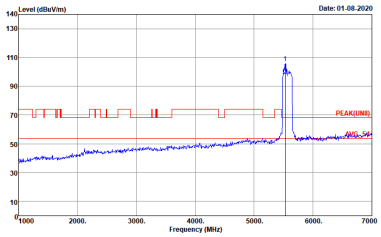
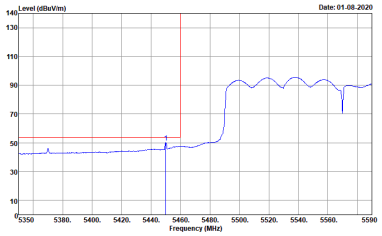
WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
	802.11ax HE80 CH58 5290MHz - R	
	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

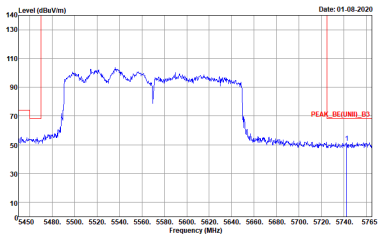
Co-location mode (Harmonic @ 3m)

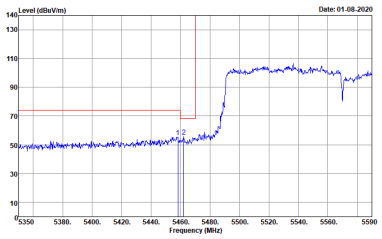
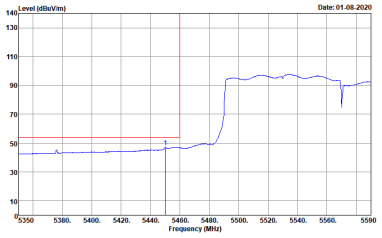
	Co-location mode Harmonic @ 3m	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH02-CA Condition : PEAK(UNII) 3m HORN 9120D-HF_01894 HORIZONTAL Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58	 Site : 03CH02-CA Condition : PEAK(UNII) 3m HORN 9120D-HF_01894 VERTICAL Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch42+11ax(80)_Tx_Ch58

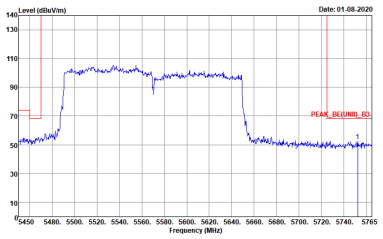
Band 3 - 5470~5725MHz

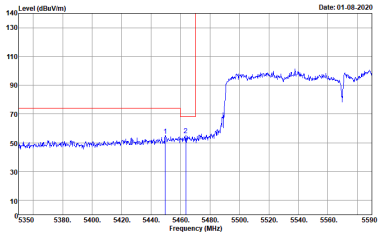
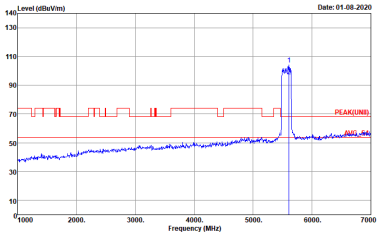
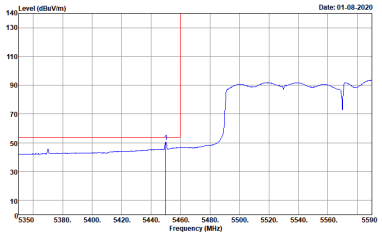
WIFI 802.11ax HE80 Ch106+HE80 Ch122 (Band Edge @ 3m)

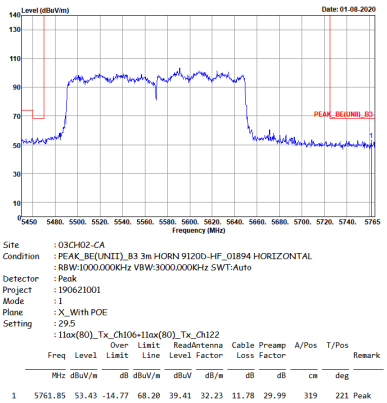
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 CH106 5530MHz - L	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE(UNII)_B3 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 5458.24 56.65 -17.35 74.00 43.29 31.83 11.43 29.90 347 70 Peak 2 5460.40 56.46 -11.74 68.20 43.09 31.84 11.43 29.90 347 70 Peak	 Site : 03CH02-CA Condition : PEAK(UNII) 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 * 5530.00 106.09 37.89 68.20 92.59 31.93 11.48 29.91 347 70 Peak 2 * 5530.00 97.22 43.22 54.00 83.72 31.93 11.48 29.91 347 70 Average
Avg.	 Site : 03CH02-CA Condition : AVG_BE(UNII)_B3 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 5450.08 50.33 -3.67 54.00 36.98 31.82 11.43 29.90 347 70 Average	Left blank

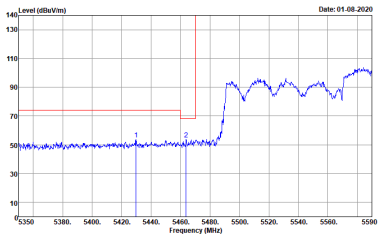
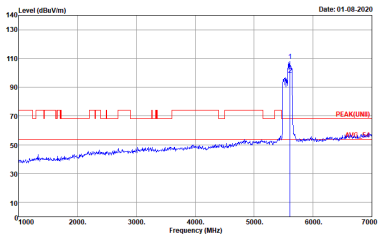
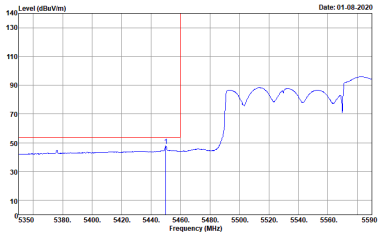
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 CH106 5530MHz - R	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE(UNII)_B3 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 5742.64 51.67 -16.53 68.20 37.75 32.15 11.75 29.98 347 70 Peak	Left blank
Avg.		Left blank

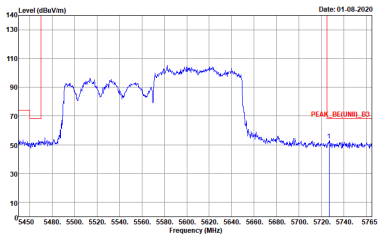
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 CH106 5530MHz - L	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE(UNII)_B3 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 5458.24 55.27 -18.73 74.00 41.83 31.91 11.43 29.90 320 125 Peak 2 5462.32 55.60 -12.60 68.20 42.15 31.92 11.43 29.90 320 125 Peak	
Avg.	 Site : 03CH02-CA Condition : AV6_BE(UNII)_B3 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 5450.08 47.30 -6.70 54.00 33.89 31.88 11.43 29.90 320 125 Average	Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 CH106 5530MHz - R	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE(UNII)_B3 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 5752.40 52.80 -15.40 68.20 38.79 32.23 11.77 29.99 320 125 Peak	Left blank
Avg.		Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 CH122 5610MHz - L	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE(UNII)_B3 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 5449.60 55.03 -18.97 74.00 41.69 31.82 11.42 29.90 319 221 Peak 2 5463.52 55.22 -12.98 68.20 41.85 31.84 11.43 29.90 319 221 Peak	 Site : 03CH02-CA Condition : PEAK(UNII) 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 * 5610.00 104.35 36.15 68.20 90.85 31.89 11.55 29.94 319 221 Peak 2 * 5610.00 96.35 42.35 54.00 82.85 31.89 11.55 29.94 319 221 Average
Avg.	 Site : 03CH02-CA Condition : AVG_BE(UNII)_B3 3m HORN 9120D-HF_01894 HORIZONTAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 5450.08 50.82 -3.18 54.00 37.47 31.82 11.43 29.90 319 221 Average	Left blank

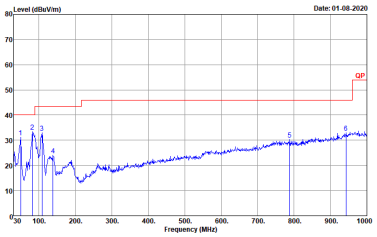
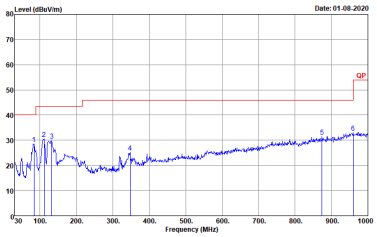
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 CH122 5610MHz - R	
	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 CH122 5610MHz - L	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE(UNII)_B3 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 1 5429.92 53.74 -20.26 74.00 40.41 31.83 11.41 29.91 322 209 Peak 2 5463.76 53.69 -14.51 68.20 40.24 31.92 11.43 29.90 322 209 Peak	 Site : 03CH02-CA Condition : PEAK(UNII) 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 1 * 5610.00 108.37 40.17 68.20 94.78 31.98 11.55 29.94 322 209 Peak 2 * 5610.00 98.80 44.80 54.00 85.21 31.98 11.55 29.94 322 209 Average
Avg.	 Site : 03CH02-CA Condition : AVG_BE(UNII)_B3 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 1 5450.08 47.95 -6.05 54.00 34.54 31.88 11.43 29.90 322 209 Average	Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ax HE80 CH122 5610MHz - R	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE(UNII)_B3 3m HORN 9120D-HF_01894 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190621001 Mode : 1 Plane : X_With POE Setting : 29.5 : 11ax(80)_Tx_Ch106+11ax(80)_Tx_Ch122 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor Factor A/Pos T/Pos Remark MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 5726.89 53.05 -15.15 68.20 39.18 32.12 11.73 29.98 322 209 Peak	Left blank
Avg.		Left blank

Emission below 1GHz

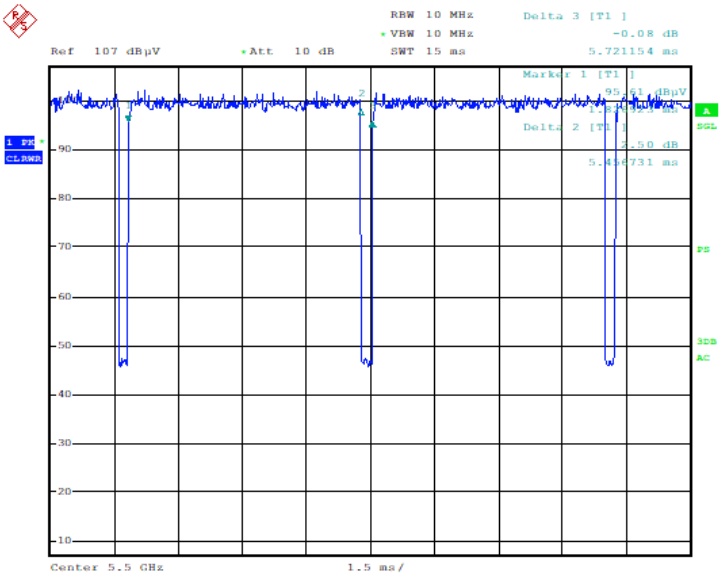
5GHz WIFI 802.11ax HE80 + HE80 (LF)

WIFI	5GHz WIFI	
ANT	802.11ax HE80+HE80 LF	
	Horizontal	Vertical
QP / Peak	 Site : 03CH02-CA Condition : QP 3m BILOG 6111D-LF_50392 HORIZONTAL Detector : Peak Project : 190621001 Mode : 2 1 49.40 31.19 -8.81 40.00 47.88 14.50 1.08 32.44 --- --- Peak 2 82.38 33.50 -6.50 40.00 50.61 13.78 1.44 32.45 100 0 Peak 3 108.57 32.89 -10.61 43.50 46.65 16.96 1.61 32.42 --- --- Peak 4 138.64 24.07 -19.43 43.50 36.80 17.64 1.80 32.42 --- --- Peak 5 787.57 30.38 -15.62 46.00 29.89 28.15 4.23 32.23 --- --- Peak 6 942.77 32.89 -13.11 46.00 28.54 30.61 4.57 31.26 --- --- Peak	 Site : 03CH02-CA Condition : QP 3m BILOG 6111D-LF_50392 VERTICAL Detector : Peak Project : 190621001 Mode : 2 1 83.35 28.47 -11.53 40.00 45.39 13.94 1.46 32.45 100 0 Peak 2 111.48 30.54 -12.96 43.50 44.09 17.15 1.64 32.42 --- --- Peak 3 131.85 29.95 -13.55 43.50 42.74 17.70 1.77 32.43 --- --- Peak 4 347.19 25.07 -20.93 46.00 34.22 20.39 2.84 32.44 --- --- Peak 5 873.90 31.48 -14.52 46.00 29.30 29.12 4.46 31.82 --- --- Peak 6 959.26 33.07 -12.93 46.00 28.09 30.99 4.61 31.09 --- --- Peak

Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor (dB)
1+2+3+4	5GHz 802.11ax HE80	95.38	5456	0.18	300Hz	0.21

WLAN 5GHz 802.11ax HE80



Date: 25.JAN.2003 21:23:54