FCC RADIO TEST REPORT

FCC ID	:	PU5-TP00139A
Equipment	:	Notebook Computer
Brand Name	:	Lenovo
Model Name	:	TP00139A
Applicant	:	Wistron Corporation 21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221,Taiwan
Manufacturer	:	Lenovo PC HK Limited. 23/F, Lincoln House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong, China
Standard	:	FCC Part 15 Subpart E §15.407

Equipment: Murata LBEE5QG2CX tested inside of Lenovo Notebook Computer.

The product was received on Nov. 08, 2021 and testing was performed from Jan. 14, 2022 to Feb. 17, 2022. We, Sporton International Inc. Wensan 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 from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory

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History of this test report

Report No.	Version	Description	Issue Date
FR1N0803F	01	Initial issue of report	Feb. 25, 2022
FR1N0803F	02	Revise Appendix A , Appendix B and Appendix C	Mar. 04, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.403(i) 15.407(a)(10)	26dB Emission Bandwidth	Not Required	-
-	2.1049	99% Occupied Bandwidth	Not Required	-
3.1	15.407(a)(8)	Maximum Conducted Output Power	Reporting only	-
3.1	15.407(a)(8)	Fundamental Maximum EIRP	Pass	-
-	15.407(a)(8)	Fundamental Power Spectral Density	Not Required	-
-	15.407(b)(6)	In-Band Emissions (Channel Mask)	Not Required	-
-	15.407(d)(6)	Contention Based Protocol	Not Required	-
3.2	15.407(b)	Unwanted Emissions	Pass	0.80 dB under the limit at 7125.020 MHz
-	15.207	AC Conducted Emission	Not Required	-
3.3	15.203 15.407(a)	Antenna Requirement	Pass	-

Note:

1. Not required means after assessing, test items are not necessary to carry out.

2. This is a variant report by removing WWAN function. All the test cases were performed on original report which can be referred to Sporton Report Number FR1D1645-01F. Based on the original report, the test cases were verified.

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
   It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sheng Kuo

Report Producer: Vivian Hsu

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00139A
FCC ID	PU5-TP00139A
Sample 1	EUT with INPAQ Antenna
Sample 2	EUT with WNC Antenna
EUT supports Radios application	WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80/VHT160 WLAN 11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer.
2. Equipment: Murata LBEE5QG2CX tested inside of Lenovo Notebook Computer.

Antenna Information			
Antenna 1	**Manufacturer**	INPAQ	
	Antenna Type	PIFA Antenna	PIFA Antenna
	Part number	025.901YK.0011	025.901YL.0011
	Peak gain (dbi)	Main Antenna :	Aux Antenna :
		WLAN (5G B5): 3.23 dBi WLAN (5G B6): 3.37 dBi WLAN (5G B7): 3.52 dBi WLAN (5G B8): 3.56 dBi	WLAN (5G B5): 3.29 dBi WLAN (5G B6): 3.29 dBi WLAN (5G B7): 3.45 dBi WLAN (5G B8): 3.57 dBi
Antenna 2	**Manufacturer**	WNC	
	Antenna Type	PIFA Antenna	PIFA Antenna
	Part number	025.901YK.0001	025.901YL.0001
	Peak gain (dbi)	Main Antenna :	Aux Antenna :
		WLAN (5G B5): 3.28 dBi WLAN (5G B6): 2.54 dBi WLAN (5G B7): 3.42 dBi WLAN (5G B8): 3.42 dBi	WLAN (5G B5): 3.33 dBi WLAN (5G B6): 3.47 dBi WLAN (5G B7): 3.71 dBi WLAN (5G B8): 3.71 dBi

Remark: The EUT's information above is declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Product Specification of Equipment Under Test

<table>
<tr><th colspan="2">Product Specification is subject to this standard</th></tr>
<tr><td>Tx/Rx Frequency Range</td><td>5925 MHz ~ 6425 MHz
6425 MHz ~ 6525 MHz
6525 MHz ~ 6875 MHz
6875 MHz ~ 7125 MHz</td></tr>
<tr><td>Maximum Output Power</td><td><5925 MHz ~ 6425 MHz>
MIMO <Chain 1+2>
802.11ax HE160: 11.51 dBm / 0.0142 W
<6425 MHz ~ 6525 MHz>
MIMO <Chain 1+2>
802.11ax HE160: 12.27 dBm / 0.0169 W
<6525 MHz ~ 6875 MHz>
MIMO <Chain 1+2>
802.11ax HE160: 11.56 dBm / 0.0143 W
<6875 MHz ~ 7125 MHz>
MIMO <Chain 1+2>
802.11ax HE160: 11.36 dBm / 0.0137 W</td></tr>
<tr><td>Type of Modulation</td><td>802.11a/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)
802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
802.11ax: OFDMA
(BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)</td></tr>
<tr><td>Antenna Function Description</td><td>
<table>
<tr><td></td><td>Chain 1</td><td>Chain 2</td></tr>
<tr><td>802.11 ax MIMO</td><td>V</td><td>V</td></tr>
</table>
</td></tr>
</table>

Remark:

1. MIMO <Chain 1+2> Directional Gain is a calculated result from MIMO Chain 1 and MIMO Chain 2. The formula used in calculation is documented in section 3.3.
2. Power of MIMO Chain 1 + Chain 2 is a calculated result from sum of the power MIMO Chain 1 and MIMO Chain 2.
3. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.3 Modification of EUT

No modifications made to the EUT during the testing.

1.4 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010
Test Site No.	**Sporton Site No.**
	TH05-HY, 03CH20-HY

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

FCC designation No.: TW3786

1.5 Applicable Standards

According to the specifications declared by 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 987594 D02 U-NII 6 GHz EMC Measurement v01
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

2.1 Carrier Frequency and Channel

BW 20M	**Channel**	1	5	9	13	17	21	25	29
	Freq. (MHz)	5955	5975	5995	6015	6035	6055	6075	6095
BW 40M	**Channel**	3		11		19		27	
	Freq. (MHz)	5965		6005		6045		6085	
BW 80M	**Channel**	7				23			
	Freq. (MHz)	5985				6065			
BW 160M	**Channel**	15							
	Freq. (MHz)	6025							

BW 20M	**Channel**	33	37	41	45	49	53	57	61
	Freq. (MHz)	6115	6135	6155	6175	6195	6215	6235	6255
BW 40M	**Channel**	35		43		51		59	
	Freq. (MHz)	6125		6165		6205		6245	
BW 80M	**Channel**	39				55			
	Freq. (MHz)	6145				6225			
BW 160M	**Channel**	47							
	Freq. (MHz)	6185							

BW 20M	Channel	65	69	73	77	81	85	89	93
	Freq. (MHz)	6275	6295	6315	6335	6355	6375	6395	6415
BW 40M	Channel	67		75		83		91	
	Freq. (MHz)	6285		6325		6365		6405	
BW 80M	Channel	71				87			
	Freq. (MHz)	6305				6385			
BW 160M	Channel	79							
	Freq. (MHz)	6345							

BW 20M	Channel	97	101	105	109	113	117	121	125
	Freq. (MHz)	6435	6455	6475	6495	6515	6535	6555	6575
BW 40M	Channel	99		107		115		123	
	Freq. (MHz)	6445		6485		6525		6565	
BW 80M	Channel	103				119			
	Freq. (MHz)	6465				6545			
BW 160M	Channel	111							
	Freq. (MHz)	6505							

BW 20M	Channel	129	133	137	141	145	149	153	157
	Freq. (MHz)	6595	6615	6635	6655	6675	6695	6715	6735
BW 40M	Channel	131		139		147		155	
	Freq. (MHz)	6605		6645		6685		6725	
BW 80M	Channel	135				151			
	Freq. (MHz)	6625				6705			
BW 160M	Channel	143							
	Freq. (MHz)	6665							

BW 20M	Channel	161	165	169	173	177	181	185	189
	Freq. (MHz)	6755	6775	6795	6815	6835	6855	6875	6895
BW 40M	Channel	163		171		179		187	
	Freq. (MHz)	6765		6805		6845		6885	
BW 80M	Channel	167				183			
	Freq. (MHz)	6785				6865			
BW 160M	Channel	175							
	Freq. (MHz)	6825							

BW 20M	Channel	193	197	201	205	209	213	217	221
	Freq. (MHz)	6915	6935	6955	6975	6995	7015	7035	7055
BW 40M	Channel	195		203		211		219	
	Freq. (MHz)	6925		6965		7005		7045	
BW 80M	Channel	199				215			
	Freq. (MHz)	6945				7025			
BW 160M	Channel	207							
	Freq. (MHz)	6985							

BW 20M	Channel	225	229
	Freq. (MHz)	7075	7095
BW 40M	Channel	227	
	Freq. (MHz)	7085	

BW 20M	Channel	233
	Freq. (MHz)	7115

2.2 Test Mode

The 802.11ax mode is investigated among different tones, full resource units (RU), partial resource units. The partial RU has no higher power than full RU's, thus the full RU is chosen as main test configuration.

The CDD mode is chosen as worst case configuration for all test cases due to higher power than SISO mode.

The final test modes consider the modulation and the worst data rates as shown in the table below.

MIMO Mode

Modulation	Data Rate
802.11ax HE160	MCS0

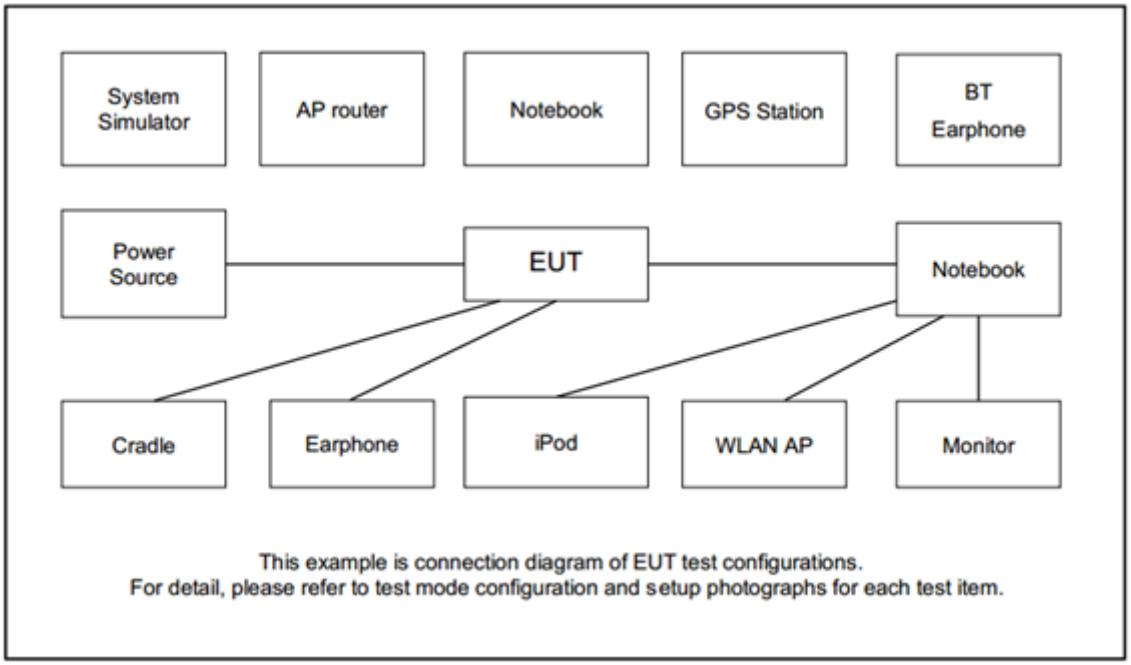
Ch. #		UNII-8 (6875-7125 MHz)
		802.11ax HE20
L	Low	-
M	Middle	-
H	High	233

Ch. #		UNII-5 (5925-6425 MHz)	UNII-6 (6425-6525 MHz)	UNII-7 (6525-6875 MHz)
		802.11ax HE160	802.11ax HE160	802.11ax HE160
L	Low	-	-	143
M	Middle	-		
H	High	079		
Straddle		-	111	-

Remark:

1. Based on ANSI C63.10 clause 5.6.2.2, b) Spurious emissions, measure the mode with the highest output power and the mode with highest output power spectral density for each modulation family.
2. For Radiated Test Cases, the tests were performed with Sample 2

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT v4.0.000194.0” 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 Maximum conducted Output Power and Fundamental Maximum EIRP Measurement

3.1.1 Limit of Fundamental Maximum EIRP

<FCC 14-30 CFR 15.407>

(a)(8) For client devices operating under the control of an indoor access point in the 5.925-7.125 GHz bands, the maximum e.i.r.p. over the frequency band of operation must not exceed 24 dBm.

3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

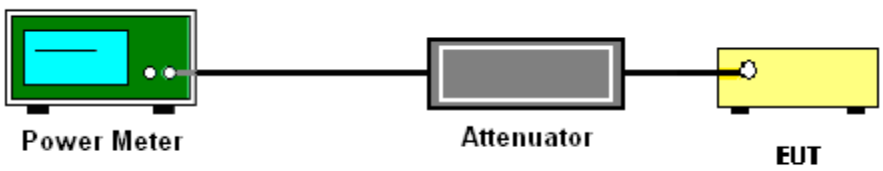
3.1.3 Test Procedures

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

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

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

Please refer to Appendix A.

3.2 Unwanted Emissions Measurement

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

3.2.1 Limit of Unwanted Emissions

(1) For transmitters operating within the 5.925-7.125 GHz band: Any emissions outside of the 5.925-7.125 GHz band must not exceed an e.i.r.p. of −27 dBm/MHz.

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27 (RMS)	68.3
- 7 (Peak)	88.3

According 987594 D02 U-NII 6GHz EMC Measurement v01 section G:
Unwanted emissions outside of restricted bands are measured with a RMS detector.
In addition, 15.35(b) applies where the peak emissions must be limited to no more than 20 dB above the average limit

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

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

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

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

3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

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

   (1) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

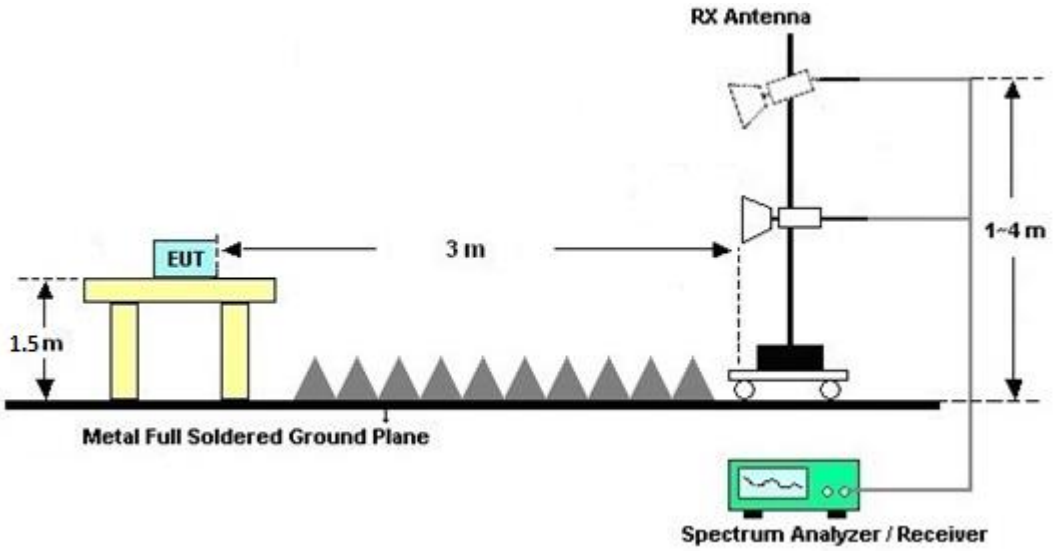
   (2) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - 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.

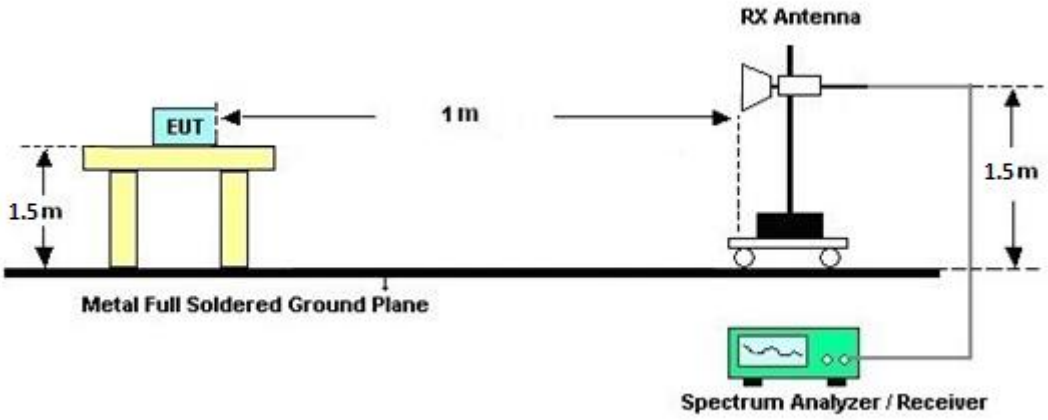
2. The EUT is placed on a turntable with 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT is set 3 meters away from the receiving antenna which is mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one 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 is 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. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-"..

3.2.4 Test Setup

For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.2.5 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.2.6 Duty Cycle

Please refer to Appendix D.

3.2.7 Test Result of Radiated Spurious Emissions

Please refer to Appendix B and C.

3.3 Antenna Requirements

3.3.1 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.2 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
EMI Test Receicver	Keysight	N9010B	MY60241055	10Hz~44GHz	Jul. 12, 2021	Feb. 14, 2022~ Feb. 17, 2022	Jul. 11, 2022	Radiation (03CH20-HY)
Preamplifier	COM-POWER	PAM-103	18020201	1MHz-1000MHz	Jan. 03, 2022	Feb. 14, 2022~ Feb. 17, 2022	Jan. 02, 2023	Radiation (03CH20-HY)
Amplifier	EMCI	EMC118A45SE	980792	N/A	Nov. 15, 2021	Feb. 14, 2022~ Feb. 17, 2022	Nov. 14, 2022	Radiation (03CH20-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	Jun. 22, 2021	Feb. 14, 2022~ Feb. 17, 2022	Jun. 21, 2022	Radiation (03CH20-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02294	1GHz~18GHz	Jun. 23, 2021	Feb. 14, 2022~ Feb. 17, 2022	Jun. 22, 2022	Radiation (03CH20-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	00991	18GHz-40GHz	May 12, 2021	Feb. 14, 2022~ Feb. 17, 2022	May 11, 2022	Radiation (03CH20-HY)
Hygrometer	TECPEL	DTM-303B	TP200728	N/A	Mar. 09, 2021	Feb. 14, 2022~ Feb. 17, 2022	Mar. 08, 2022	Radiation (03CH20-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	519229/2,804015/2,804027/2	N/A	Jan. 19, 2022	Feb. 14, 2022~ Feb. 17, 2022	Jan. 18, 2023	Radiation (03CH20-HY)
1.53GHz Low Pass Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN27	N/A	May 25, 2021	Feb. 14, 2022~ Feb. 17, 2022	May 24, 2022	Radiation (03CH20-HY)
Filter	Wainwright	WHKX8-6090-7000-18000-40SS	SN99	N/A	Nov. 04, 2021	Feb. 14, 2022~ Feb. 17, 2022	Nov. 03, 2022	Radiation (03CH20-HY)
Filter	Wainwright	WRCQV14-5425-5825-6525-6925-60SS	SN2	N/A	Jan. 07, 2022	Feb. 14, 2022~ Feb. 17, 2022	Jan. 06, 2023	Radiation (03CH20-HY)
Filter	Wainwright	WRCQV14-6025-6425-7125-7525-60SS	SN1	N/A	Jan. 07, 2022	Feb. 14, 2022~ Feb. 17, 2022	Jan. 06, 2023	Radiation (03CH20-HY)
Filter	Wainwright	WHW2-7100-10000-18000-40CC	SN3	N/A	May 25, 2021	Feb. 14, 2022~ Feb. 17, 2022	May 24, 2022	Radiation (03CH20-HY)
Software	Audix	E3 6.2009-8-24	RK-002156	N/A	N/A	Feb. 14, 2022~ Feb. 17, 2022	N/A	Radiation (03CH20-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Feb. 14, 2022~ Feb. 17, 2022	N/A	Radiation (03CH20-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Feb. 14, 2022~ Feb. 17, 2022	N/A	Radiation (03CH20-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Feb. 14, 2022~ Feb. 17, 2022	N/A	Radiation (03CH20-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 16, 2021	Jan. 14, 2022	Nov. 15, 2022	Conducted (TH05-HY)
Power Sensor	Raditeq	RPR3006W #010	RPR6W-2101002(NO:123)	10MHz~8GHz	Jan. 13, 2022	Jan. 14, 2022	Jan. 12, 2023	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 30, 2021	Jan. 14, 2022	Aug. 29, 2022	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100057	9kHz-40GHz	Dec. 30, 2021	Jan. 14, 2022	Dec. 29, 2022	Conducted (TH05-HY)
Switch Control Manframe	E-IUSTRUMENT	ETF-1405-0	EC1900067 (BOX7)	N/A	Aug. 12, 2021	Jan. 14, 2022	Aug. 11, 2022	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))	**5.2 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.7 dB**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Benny Ku	Temperature:	21~25	°C
Test Date:	2022/1/14	Relative Humidity:	51~54	%
Remark: For Conducted Test Items, Ant. 1 means Chain 1 (Aux.) and Ant. 2 means Chain 2 (Main).				

TEST RESULTS DATA
EIRP Power Table

FCC Band V MIMO												
Mod.	Data Rate	NTX	Freq. (MHz)	RU Config.	Conducted Power (dBm)			DG (dBi)		EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	SUM		
HE160	MCS0	2	6345	Full	8.50	8.50	11.51	3.33		14.84	24.00	Pass

TEST RESULTS DATA
EIRP Power Table

FCC Band VI straddle channel MIMO												
Mod.	Data Rate	NTX	Freq. (MHz)	RU Config.	Conducted Power (dBm)			DG (dBi)		EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	SUM		
HE160	MCS0	2	6505	Full	9.60	8.90	12.27	3.47		15.74	24.00	Pass

TEST RESULTS DATA
EIRP Power Table

FCC Band VII MIMO												
Mod.	Data Rate	NTX	Freq. (MHz)	RU Config.	Conducted Power (dBm)			DG (dBi)		EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	SUM		
HE160	MCS0	2	6665	Full	8.40	8.70	11.56	3.71		15.27	24.00	Pass

TEST RESULTS DATA
EIRP Power Table

Band VIII MIMO												
Mod.	Data Rate	NTX	Freq. (MHz)	RU Config.	Conducted Power (dBm)			DG (dBi)		EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	SUM		
HE160	MCS0	2	6985	Full	8.30	8.40	11.36	3.71		15.07	24.00	Pass

Appendix B. Radiated Spurious Emission

Test Engineer :	Bill Chang and JC Liang	**Temperature :**	20~25°C
		Relative Humidity :	50~60%

Remark: For Radiated Spurious Emission Test Items, Ant. 1 means Chain 1 (Aux.) and Ant. 2 means Chain 2 (Main).

Band 5 - 5925~6425MHz

WIFI 802.11ax HE160 Full (Harmonic @ 3m)

WIFI Ant. 1+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)
		12690	49.68	-24.32	74	32.68	39.48	20.74	43.22	100	110	P	H
		12690	41.54	-12.46	54	24.54	39.48	20.74	43.22	100	110	A	H
		13360	51.26	-22.74	74	33.16	39.92	21.34	43.16	-	-	P	H
		13360	42.12	-11.88	54	24.02	39.92	21.34	43.16	-	-	A	H
		15552	51.15	-22.85	74	35.09	37.94	22.89	44.77	-	-	P	H
		15552	41.1	-12.9	54	25.04	37.94	22.89	44.77	-	-	A	H
		17984	55.23	-18.77	74	34.73	41.69	24.27	45.46	-	-	P	H
		17984	45.91	-8.09	54	25.41	41.69	24.27	45.46	-	-	A	H
		19005	35.97	-38.03	74	38.24	38	14.93	55.2	-	-	P	H
		39582	52.74	-21.26	74	38.1	44.63	26.23	56.22	-	-	P	H
802.11ax		39582	43.08	-10.92	54	28.44	44.63	26.23	56.22	-	-	A	H
HE160 Full													H
CH 79		12690	50.35	-23.65	74	33.35	39.48	20.74	43.22	100	95	P	V
6345MHz		12690	42.58	-11.42	54	25.58	39.48	20.74	43.22	100	95	A	V
		13288	51.73	-22.27	74	33.8	39.79	21.29	43.15	-	-	P	V
		13288	42.65	-11.35	54	24.72	39.79	21.29	43.15	-	-	A	V
		15624	51.21	-22.79	74	35.19	37.78	22.94	44.7	-	-	P	V
		15624	41.13	-12.87	54	25.11	37.78	22.94	44.7	-	-	A	V
		17904	55.41	-18.59	74	35.46	41.13	24.22	45.4	-	-	P	V
		17904	45.4	-8.6	54	25.45	41.13	24.22	45.4	-	-	A	V
		19005	36.61	-37.39	74	38.88	38	14.93	55.2	-	-	P	V
		39428	52.28	-21.72	74	37.85	44.64	26.15	56.36	-	-	P	V
		39428	43.15	-10.85	54	28.72	44.64	26.15	56.36	-	-	A	V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.
4. The emission level close to 18GHz is checked that the average emission level is noise floor only.

Band 6 - 6425~6525MHz

WIFI 802.11ax HE160 Full (Harmonic @ 3m)

WIFI Ant. 1+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)
		10984	51.75	-22.25	74	35.51	38.72	19.18	41.66	-	-	P	H
		10984	41.17	-12.83	54	24.93	38.72	19.18	41.66	-	-	A	H
		13010	50.96	-37.24	88.2	33.29	39.69	21.08	43.1	-	-	P	H
		15696	51.04	-22.96	74	34.99	37.7	22.98	44.63	-	-	P	H
		15696	41.17	-12.83	54	25.12	37.7	22.98	44.63	-	-	A	H
		17984	55.26	-18.74	74	34.76	41.69	24.27	45.46	-	-	P	H
		17984	45.64	-8.36	54	25.14	41.69	24.27	45.46	-	-	A	H
		19515	37	-37	74	38.54	37.71	15.75	55	-	-	P	H
		39274	52.72	-21.28	74	38.62	44.52	26.06	56.48	-	-	P	H
		39274	42.93	-11.07	54	28.83	44.52	26.06	56.48	-	-	A	H
802.11ax													H
HE160 Full													H
CH 111		10816	51.5	-22.5	74	35.13	39.05	19.01	41.69	-	-	P	V
6505MHz		10816	41.25	-12.75	54	24.88	39.05	19.01	41.69	-	-	A	V
		13010	51.5	-36.7	88.2	33.83	39.69	21.08	43.1	-	-	P	V
		16120	51.62	-22.38	74	35.08	37.64	23.25	44.35	-	-	P	V
		16120	41.96	-12.04	54	25.42	37.64	23.25	44.35	-	-	A	V
		17992	55.26	-18.74	74	34.71	41.74	24.27	45.46	-	-	P	V
		17992	45.59	-8.41	54	25.04	41.74	24.27	45.46	-	-	A	V
		19515	36.53	-37.47	74	38.07	37.71	15.75	55	-	-	P	V
		39406	52.28	-21.72	74	37.91	44.62	26.13	56.38	-	-	P	V
		39406	42.98	-11.02	54	28.61	44.62	26.13	56.38	-	-	A	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.
4. The emission level close to 18GHz is checked that the average emission level is noise floor only.

Band 7 - 6525~6875MHz

WIFI 802.11ax HE160 Full (Harmonic @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		11440	51.09	-22.91	74	35.06	39.02	19.55	42.54	-	-	P	H
		13330	50.14	-23.86	74	32.12	39.86	21.32	43.16	151	228	P	H
		13330	42.35	-11.65	54	24.33	39.86	21.32	43.16	151	228	A	H
		15976	51.71	-22.29	74	35.34	37.55	23.18	44.36	-	-	P	H
		17984	55.53	-18.47	74	35.03	41.69	24.27	45.46	-	-	P	H
		19995	36.69	-37.31	74	37.56	37.51	16.52	54.9	-	-	P	H
		39560	51.79	-22.21	74	37.16	44.65	26.22	56.24	-	-	P	H
		39560	43.38	-10.62	54	28.75	44.65	26.22	56.24	-	-	A	H
													H
													H
802.11ax													H
HE160 Full													H
CH 143		10920	51.21	-22.79	74	34.98	38.78	19.12	41.67	-	-	P	V
6665MHz		13330	51.19	-22.81	74	33.17	39.86	21.32	43.16	148	128	P	V
		13330	42.24	-11.76	54	24.22	39.86	21.32	43.16	148	128	A	V
		15840	51.52	-22.48	74	35.52	37.4	23.09	44.49	-	-	P	V
		17944	54.99	-19.01	74	34.77	41.41	24.24	45.43	-	-	P	V
		19995	36.69	-37.31	74	37.56	37.51	16.52	54.9	-	-	P	V
		39582	52.18	-21.82	74	37.54	44.63	26.23	56.22	-	-	P	V
		39582	42.6	-11.4	54	27.96	44.63	26.23	56.22	-	-	A	V
													V
													V
													V
													V

Band 8 - 6875~7125MHz

WIFI 802.11ax HE20 Full (Band Edge @ 3m)

WIFI Ant. 1+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)
	*	7115	89.12	-	-	75.81	36.39	15.28	38.36	397	173	P	H
	*	7115	78.83	-	-	65.52	36.39	15.28	38.36	397	173	A	H
		7125.02	70.75	-17.45	88.2	57.39	36.45	15.28	38.37	397	173	P	H
		7125.02	65.67	-2.53	68.2	52.31	36.45	15.28	38.37	397	173	A	H
802.11ax													H
HE20 Full													H
CH 233	*	7115	91.51	-	-	78.2	36.39	15.28	38.36	183	208	P	V
7115MHz	*	7115	80.78	-	-	67.47	36.39	15.28	38.36	183	208	A	V
		7125.02	71.02	-17.18	88.2	57.66	36.45	15.28	38.37	183	208	P	V
		7125.02	67.4	-0.8	68.2	54.04	36.45	15.28	38.37	183	208	A	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

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+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 01 5955MHz		5925	55.45	-32.75	88.2	54.51	32.22	4.58	35.86	103	308	P	H
		5925	43.54	-24.66	68.2	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 @ 5925MHz:

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) – 88.2(dBμV/m)

= -32.75(dB)

For Average Limit @ 5925MHz:

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) – 68.2(dBμV/m)

= -24.66(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".

Appendix C. Radiated Spurious Emission Plots

Test Engineer :	Bill Chang and JC Liang	**Temperature :**	20~25°C
		Relative Humidity :	50~60%

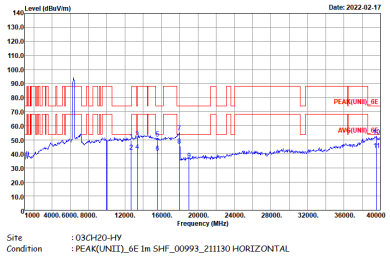
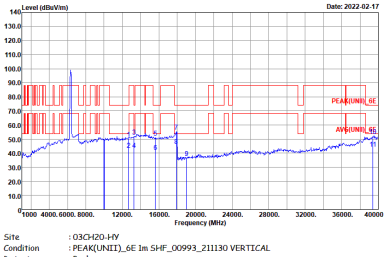
Remark: For Radiated Spurious Emission Test Items, Ant. 1 means Chain 1 (Aux.) and Ant. 2 means Chain 2 (Main).

Note symbol

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

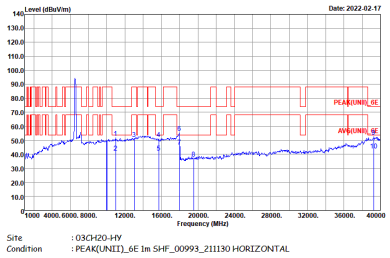
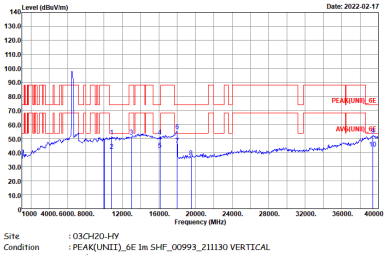
Band 5 - 5925~6425MHz

WIFI 802.11ax HE160 Full (Harmonic @ 3m)

WIFI	Band 5 5925~6425MHz Harmonic @ 3m	
ANT	802.11ax HE160 Full CH79 6345MHz	
1+2	Horizontal	Vertical
Peak Avg.		

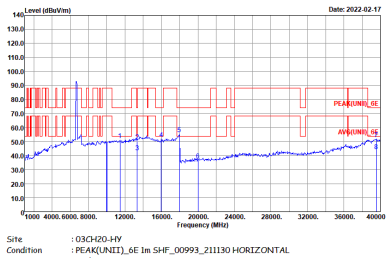
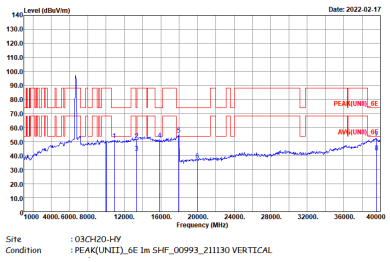
Band 6 - 6425~6525MHz

WIFI 802.11ax HE160 Full (Harmonic @ 3m)

WIFI	Band 6 6425~6525MHz Harmonic @ 3m	
ANT	802.11ax HE160 Full CH111 6505MHz	
1+2	Horizontal	Vertical
Peak Avg.		

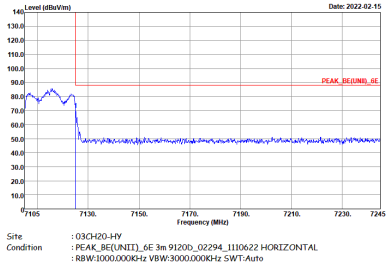
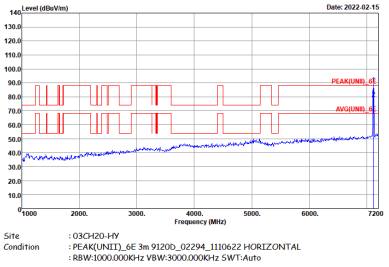
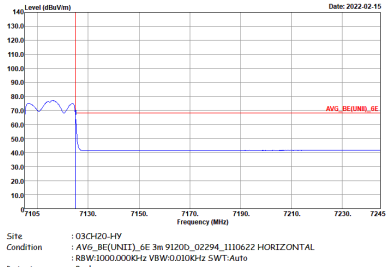
Band 7 - 6525~6875MHz

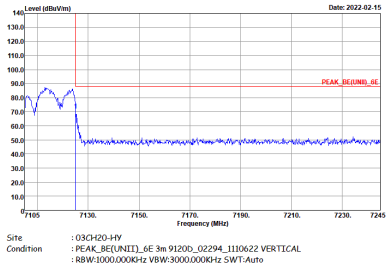
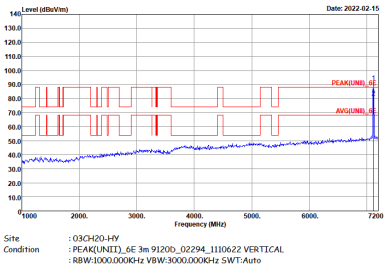
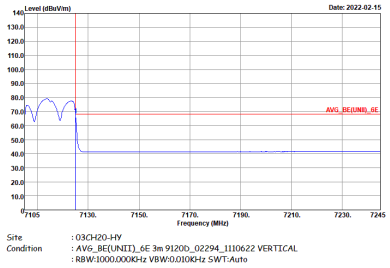
WIFI 802.11ax HE160 Full (Harmonic @ 3m)

WIFI	Band 7 6525~6875MHz Harmonic @ 3m	
ANT	802.11ax HE160 Full CH143 6665MHz	
1+2	Horizontal	Vertical
Peak Avg.		

Band 8 - 6875~7125MHz

WIFI 802.11ax HE20 Full (Band Edge @ 3m)

WIFI	Band 8 6875~7125MHz Band Edge @ 3m	
ANT	802.11ax HE20 Full CH233 7115MHz	
1+2	Horizontal	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 8 6875~7125MHz Band Edge @ 3m	
ANT	802.11ax HE20 Full CH233 7115MHz	
1+2	Vertical	Fundamental
Peak		
Avg.		Left blank

Appendix D. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
1+2	6GHz 802.11ax HE20 Full RU	100.00	-	-	10Hz
1+2	6GHz 802.11ax HE160 Full RU	100.00	-	-	10Hz

MIMO <Chain 1+2>

6GHz 802.11ax HE20 Full RU	6GHz 802.11ax HE160 Full RU