

Partial FCC Test Report

Report No.: RF191224C11

FCC ID: C3K1900

Test Model: 1900

**Contains Wi-Fi
Module Model No.:** 1900

Contains FCC ID: C3K1900

Received Date: Dec. 24, 2019

Test Date: Jan. 22, 2020 ~ Apr. 08, 2020

Issued Date: Apr. 13, 2020

Applicant: Microsoft Corporation

Address: One Microsoft Way Redmond, WA 98052-6399, U.S.A

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

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33383, Taiwan

**FCC Registration /
Designation Number:** 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RF191224C11	Original Release	Apr. 13, 2020

1 Certificate of Conformity

Product: Portable Computing Device

Brand: Microsoft

Test Model: 1900

Sample Status: Engineering Sample

Applicant: Microsoft Corporation

Test Date: Jan. 22, 2020 ~ Apr. 08, 2020

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Rona Chen, **Date:** Apr. 13, 2020
Rona Chen / Specialist

Approved by : Dylan Chiou, **Date:** Apr. 13, 2020
Dylan Chiou / Senior Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	N/A	Refer to Note
15.205 / 15.209 / 15.247(d)	Radiated Emissions Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -4.82 dB at 162.84 MHz.
	Conducted Band Edge Measurement	Pass	Meet the requirement of limit.
15.247(d)	Antenna Port Emission	N/A	Refer to Note
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to Note
---	Occupied Bandwidth Measurement	N/A	Refer to Note
15.247(b)	Conducted Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	N/A	Refer to Note
15.203	Antenna Requirement	N/A	Refer to Note

Note:

1. This report is issued as a partial report. The test item, test mode, and test method are in accordance with client's requirement. Only Radiated Emissions, Conducted Power and Conducted Band Edge test results were recorded in this report.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Portable Computing Device
Brand	Microsoft
Test Model	1900
FCC ID	C3K1900
Contains Wi-Fi Module Model No.	1900
Contains FCC ID	C3K1900
Status of EUT	Engineering Sample
Power Supply Rating	120 Vac (Adapter)
Modulation Type	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM for OFDMA
Modulation Technology	DSSS, OFDM, OFDMA
Transfer Rate	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to 360 Mbps 802.11ax: up to 573.5 Mbps
Operating Frequency	2412 ~ 2472 MHz
Number of Channel	13 for 802.11n (HT20) / (VHT20), 802.11ax (HE20) 9 for 802.11n (HT40) / (VHT40), 802.11ax (HE40)
Output Power	38.245 mW
Antenna Type	Refer to Note as below
Antenna Connector	N/A
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

- The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	TX Function
802.11b	1TX (SISO)
802.11g	1TX (SISO)
802.11n (HT20)	2TX (MIMO)
802.11n (HT40)	2TX (MIMO)
802.11n (VHT20)	2TX (MIMO)
802.11n (VHT40)	2TX (MIMO)
802.11ax (HE20)	2TX (MIMO)
802.11ax (HE40)	2TX (MIMO)

- The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter	Microsoft (Chicony)	1798	I/P: 100-240 Vac, 50-60 Hz, 1.5 A O/P: 15 Vdc, 6.33 A / 5 Vdc, 1.5 A 1.74m power cable w/o core
Top Battery	Simplo	G3HTA044H	7.5 Vdc
Base Battery	Simplo	G3HTA065H	11.36 Vdc

3. The antenna information is listed as below.

Ant. Type	Manufacturer	Parts Number	Antenna Gain (dBi)				
			2.4 GHz	5.15-5.25 GHz	5.25-5.35 GHz	5.47-5.725 GHz	5.725-5.85 GHz
PIFA	FIT	Main Antenna: 1415-07H50QS	1.83	3.17	3.30	3.56	3.02
		Aux. Antenna: 1415-07H10QS	2.05	3.36	3.25	2.29	2.64

4. Test Cable Loss is listed as below.

Frequency (MHz)	Mini lpx (dB)
2400	-0.84
2440	-0.99
2480	0.89

5. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

13 channels are provided for 802.11b, 802.11g, 802.11n (HT20) / (VHT20), 802.11ax (HE20):

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

9 channels are provided for 802.11n (HT40) / (VHT40), 802.11ax (HE40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	8	2447
4	2427	9	2452
5	2432	10	2457
6	2437	11	2462
7	2442		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To		Description
	RE	APCM	
-	√	√	-

Where **APCM**: Antenna Port Conducted Measurement **RE**: Radiated Emission

Radiated Emission Test:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11ax (HE20)	1 to 13	11, 12, 13	OFDMA	BPSK	MCS0
-	802.11n (HT40)	3 to 11	11	OFDM	BPSK	13.5
-	802.11ax (HE40)	3 to 11	11	OFDMA	BPSK	MCS0

* After the pretest, only the worst case channel was presented in the report.

Bandedge Measurement:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11ax (HE20)	1 to 13	11, 12, 13	OFDMA	BPSK	MCS0
-	802.11n (HT40)	3 to 11	11	OFDM	BPSK	13.5
-	802.11ax (HE40)	3 to 11	11	OFDMA	BPSK	MCS0

Antenna Port Conducted Measurement:

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11ax (HE20)	1 to 13	11, 12, 13	OFDMA	BPSK	MCS0
-	802.11n (HT40)	3 to 11	11	OFDM	BPSK	13.5
-	802.11ax (HE40)	3 to 11	11	OFDMA	BPSK	MCS0

* For above tests of 802.11ax Mode were tested on full bandwidth.

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
APCM	25 deg. C, 65 % RH	120 Vac, 60 Hz	Leo Tsai
RE	25 deg. C, 65 % RH	120 Vac, 60 Hz	Charles Hsiao, Harry Hsueh

3.3 Duty Cycle of Test Signal

802.11b: Duty cycle of test signal is $\geq 98\%$, duty factor is not required.

802.11g: Duty cycle = $2.08/2.135 = 0.97$, Duty factor = $10 * \log(1/0.97) = 0.11$

802.11n (HT20): Duty cycle of test signal is $\geq 98\%$, duty factor is not required.

802.11n (HT40): Duty cycle of test signal is $\geq 98\%$, duty factor is not required.

802.11ax (HE20): Duty cycle of test signal is $\geq 98\%$, duty factor is not required.

802.11ax (HE40): Duty cycle of test signal is $\geq 98\%$, duty factor is not required.



3.4 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test Standard:

FCC Part 15, Subpart C (15.247)

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 558074 D01 Meas Guidance v05r02

KDB 662911 D01 Multiple Transmitter Output v02r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (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:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent	N9038A	MY51210203	Mar. 18, 2019	Mar. 17, 2020
			Mar. 18, 2020	Mar. 17, 2021
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 12, 2019	Dec. 11, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSV40	100980	Apr. 23, 2019	Apr. 22, 2020
Broadband Horn Antenna SCHWARZBECK	BBHA 9170	148	Nov. 24, 2019	Nov. 23, 2020
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 24, 2019	Nov. 23, 2020
BILOG Antenna SCHWARZBECK	VULB 9168	9168-472	Nov. 08, 2019	Nov. 07, 2020
Fixed Attenuator WORKEN	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Preamplifier EMCI	EMC001340	980201	Oct. 14, 2019	Oct. 13, 2020
Preamplifier EMCI	EMC 012645	980115	Oct. 08, 2019	Oct. 07, 2020
Preamplifier EMCI	EMC 184045	980116	Oct. 08, 2019	Oct. 07, 2020
Preamplifier EMCI	EMC 330H	980112	Oct. 08, 2019	Oct. 07, 2020
Peak Power Analyzer KEYSIGHT	8990B	MY51000485	Jan. 14, 2020	Jan. 13, 2021
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55 190004/MY551900 07/MY55210005	Jul. 15, 2019	Jul 14, 2020
RF Coaxial Cable HUBER+SUHNNER	EMC104-SM-SM-8 000&3000	140811+170717	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM-1 000(140807)	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 08, 2019	Oct. 07, 2020
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Chamber 10.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.

For Radiated Emission above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

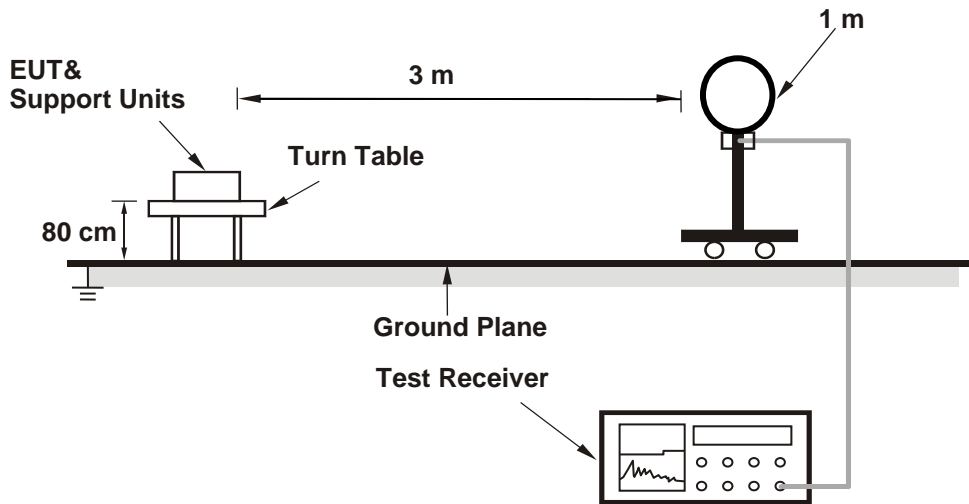
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle \geq 98 %) for Average detection (AV) at frequency above 1 GHz.
(11ax (HE20): RBW = 1 MHz, VBW = 3 kHz ; 11n (HT40): RBW = 1 MHz, VBW = 3 kHz ; 11ax (HE40): RBW = 1 MHz, VBW = 3 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

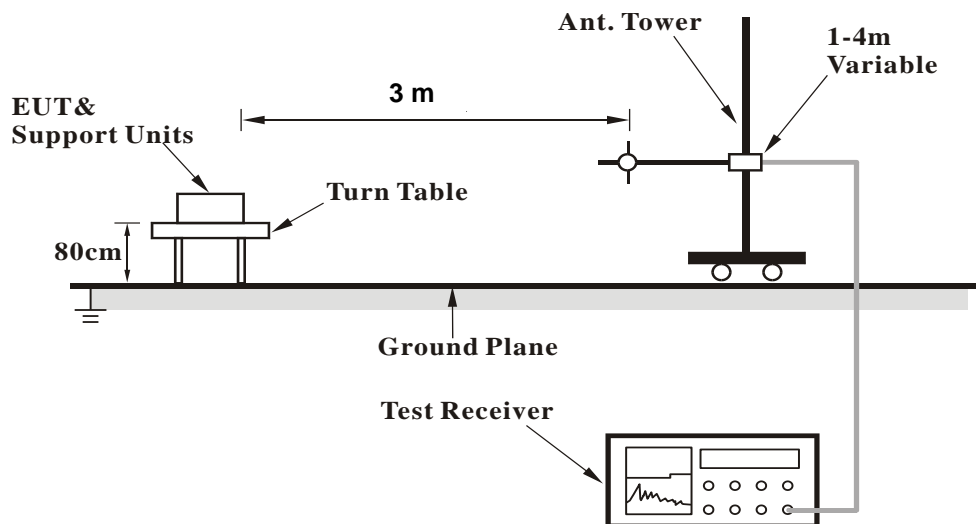
No deviation.

4.1.5 Test Set Up

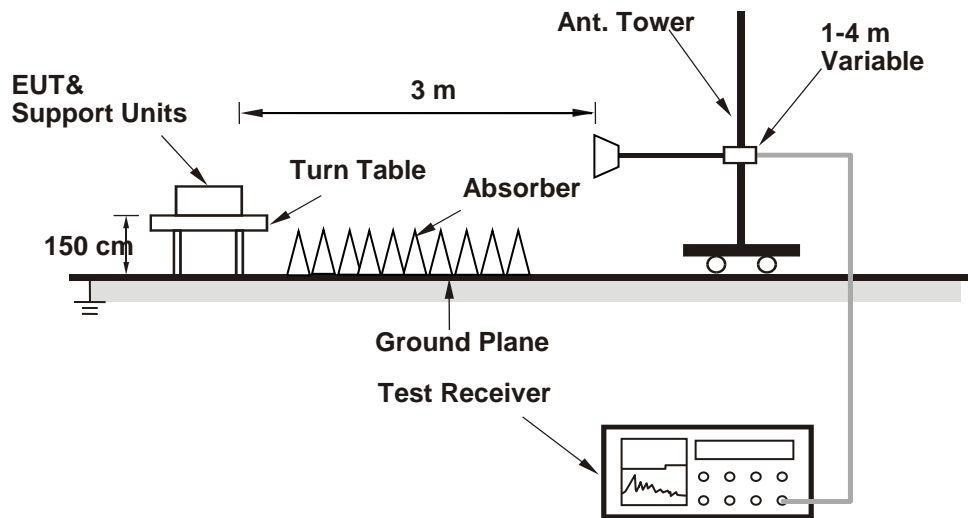
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

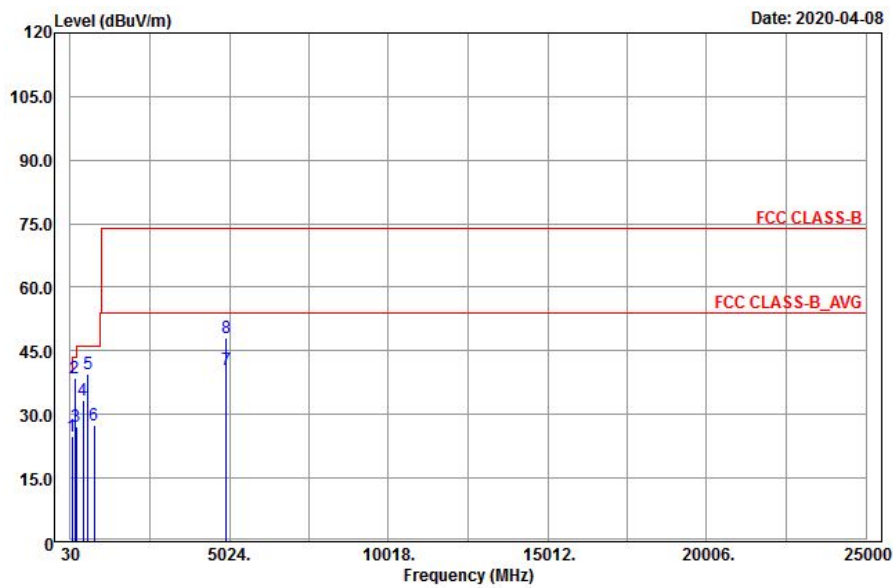
- a. Placed the EUT on a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

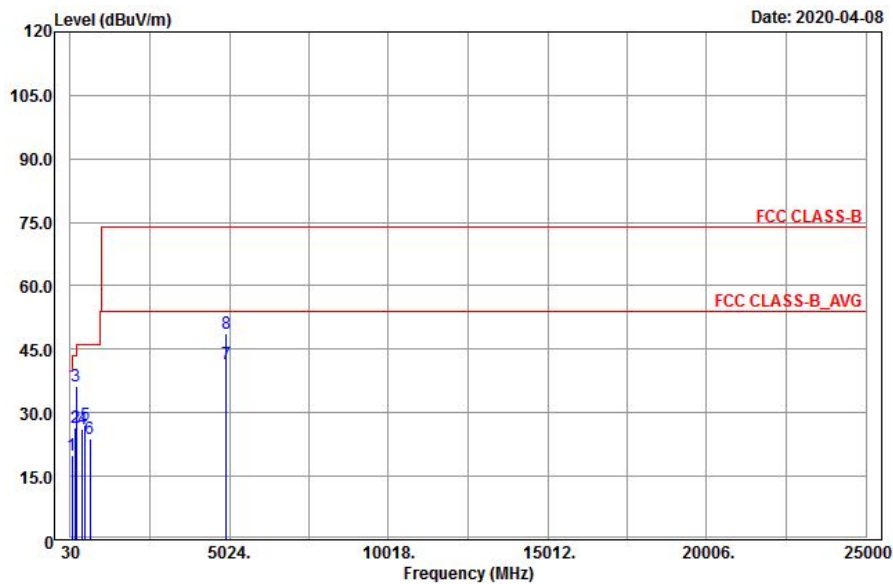
802.11ax (HE20)

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
75.36	24.78	46.01	-21.23	40	-15.22	125	173	Peak
162.84	38.68	59.21	-20.53	43.5	-4.82	139	336	Peak
223.59	27.03	44.69	-17.66	46	-18.97	108	112	Peak
437.2	33.33	46.76	-13.43	46	-12.67	150	172	Peak
576.5	39.46	50.48	-11.02	46	-6.54	107	322	Peak
778.1	27.49	35.63	-8.14	46	-18.51	196	0	Peak
4924	40.48	30.23	10.25	54	-13.52	142	168	Average
4924	48.09	37.84	10.25	74	-25.91	142	168	Peak

Antenna Polarity & Test Distance: Vertical at 3 m

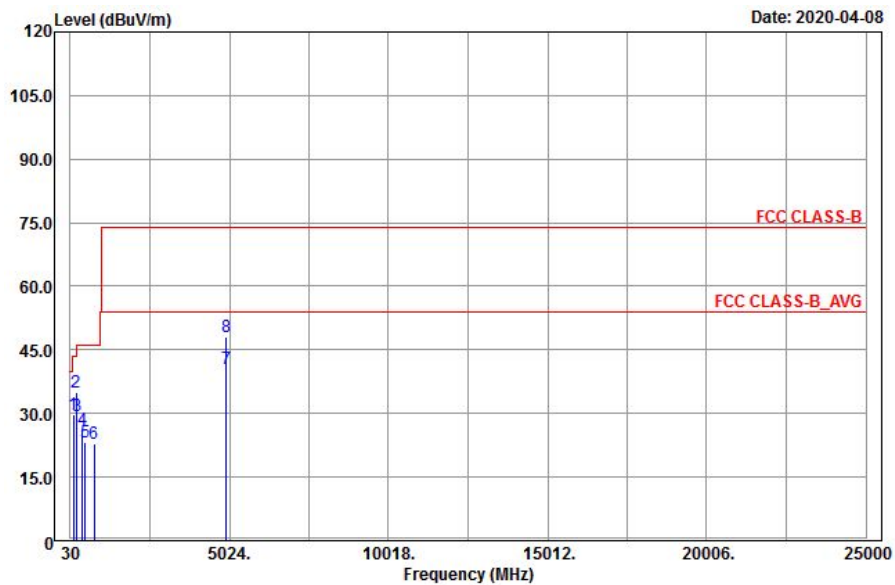
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
80.76	19.91	41.27	-21.36	40	-20.09	156	228	Peak
183.09	26.52	45.86	-19.34	43.5	-16.98	171	235	Peak
217.38	36.23	54.15	-17.92	46	-9.77	150	43	Peak
406.4	26.25	40.07	-13.82	46	-19.75	168	135	Peak
496.7	27.09	39.47	-12.38	46	-18.91	121	45	Peak
639.5	23.93	34.23	-10.3	46	-22.07	108	293	Peak
4924	41.5	31.25	10.25	54	-12.5	160	128	Average
4924	48.75	38.5	10.25	74	-25.25	160	128	Peak

Remarks:

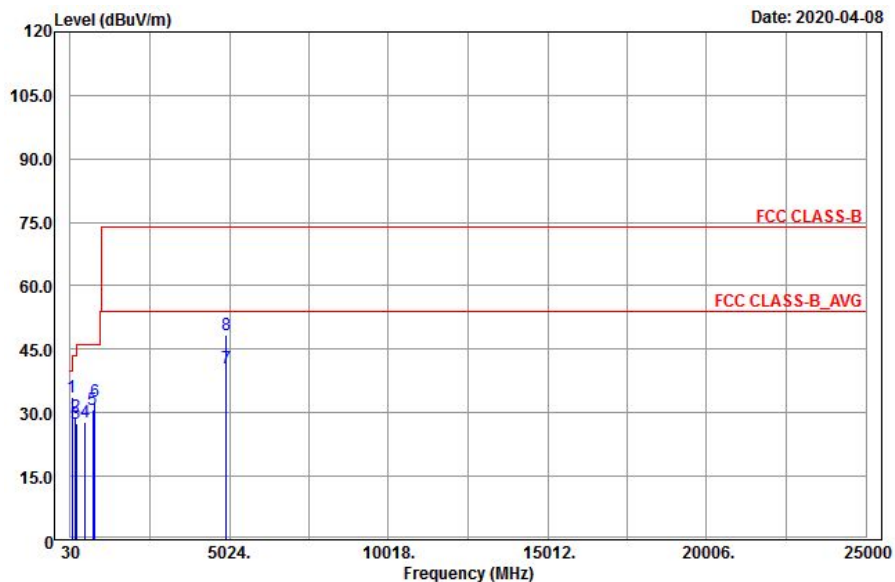
- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 12	Frequency Range	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
130.17	29.6	50.05	-20.45	43.5	-13.9	176	125	Peak
216.03	35.01	52.96	-17.95	46	-10.99	190	135	Peak
246.54	29.35	46.26	-16.91	46	-16.65	154	112	Peak
402.9	26.09	39.98	-13.89	46	-19.91	144	75	Peak
493.2	23.28	35.71	-12.43	46	-22.72	160	73	Peak
789.3	22.96	30.82	-7.86	46	-23.04	169	223	Peak
4934	40.49	30.23	10.26	54	-13.51	169	168	Average
4934	47.99	37.73	10.26	74	-26.01	169	168	Peak

Antenna Polarity & Test Distance: Vertical at 3 m

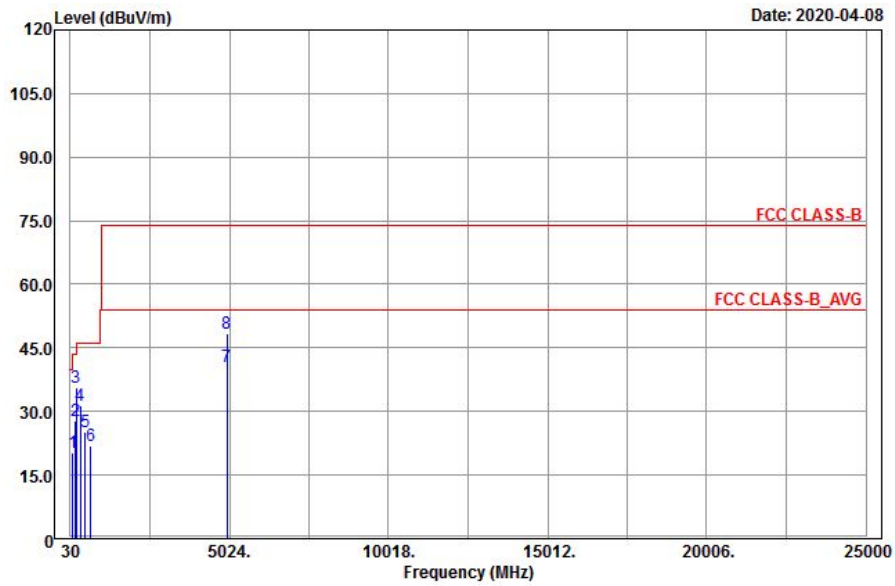
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
82.11	33.82	54.77	-20.95	40	-6.18	153	223	Peak
184.44	28.98	48.22	-19.24	43.5	-14.52	190	135	Peak
221.7	27.4	45.16	-17.76	46	-18.6	104	77	Peak
491.1	27.82	40.31	-12.49	46	-18.18	133	296	Peak
743.1	30.58	39.12	-8.54	46	-15.42	146	278	Peak
803.3	32.62	40.17	-7.55	46	-13.38	185	225	Peak
4934	40.49	30.23	10.26	54	-13.51	146	197	Average
4934	48.24	37.98	10.26	74	-25.76	146	197	Peak

Remarks:

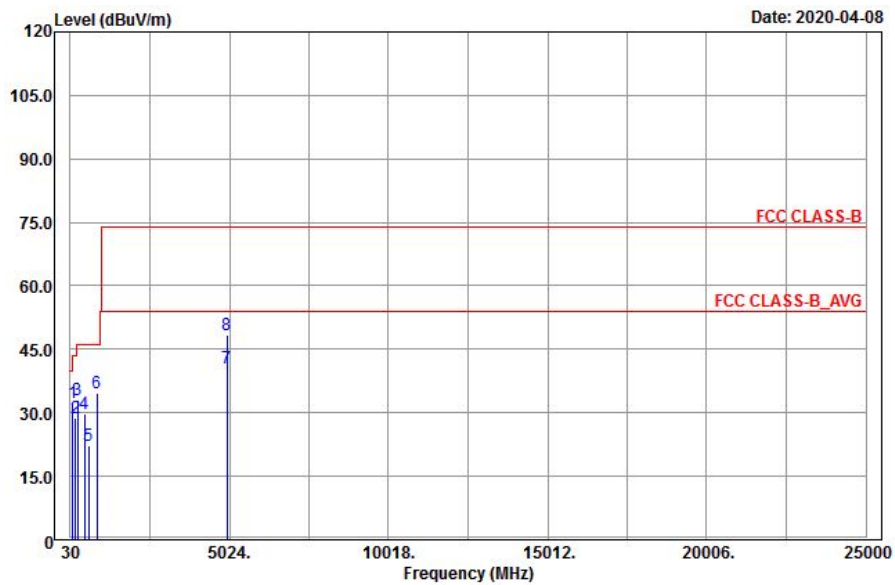
- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 13	Frequency Range	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
113.43	20.17	38.2	-18.03	43.5	-23.33	175	226	Peak
184.71	27.83	47.07	-19.24	43.5	-15.67	131	125	Peak
217.65	35.58	53.5	-17.92	46	-10.42	190	327	Peak
353.2	31.34	46.02	-14.68	46	-14.66	199	305	Peak
491.8	25.32	37.79	-12.47	46	-20.68	172	164	Peak
672.4	22.06	31.67	-9.61	46	-23.94	102	25	Peak
4944	40.68	30.33	10.35	54	-13.32	136	201	Average
4944	48.51	38.16	10.35	74	-25.49	136	201	Peak

Antenna Polarity & Test Distance: Vertical at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
108.84	32.46	49.92	-17.46	43.5	-11.04	190	336	Peak
184.44	28.86	48.1	-19.24	43.5	-14.64	111	38	Peak
247.35	32.98	49.87	-16.89	46	-13.02	154	127	Peak
479.2	29.71	42.43	-12.72	46	-16.29	189	234	Peak
615.7	22.1	32.45	-10.35	46	-23.9	112	45	Peak
871.9	34.6	40.91	-6.31	46	-11.4	120	143	Peak
4944	40.6	30.25	10.35	54	-13.4	187	196	Average
4944	48.24	37.89	10.35	74	-25.76	187	196	Peak

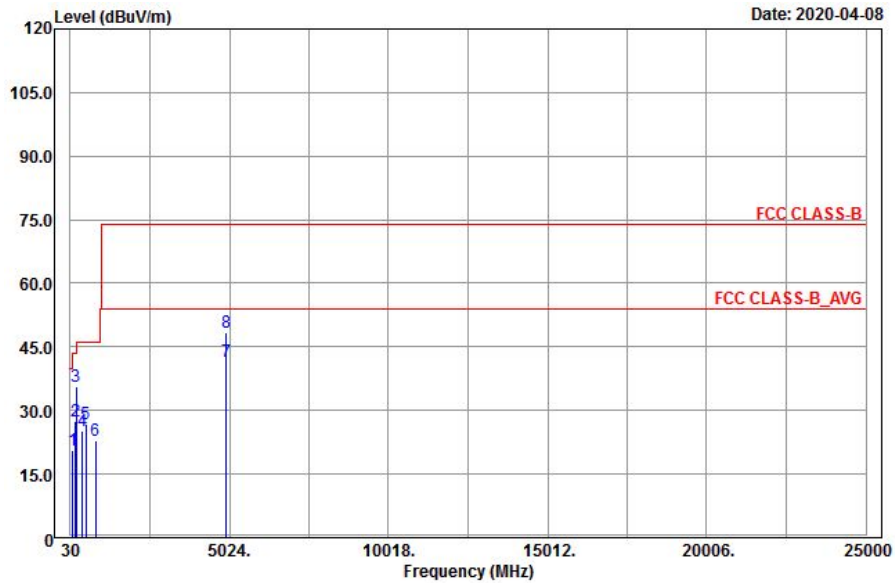
Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.

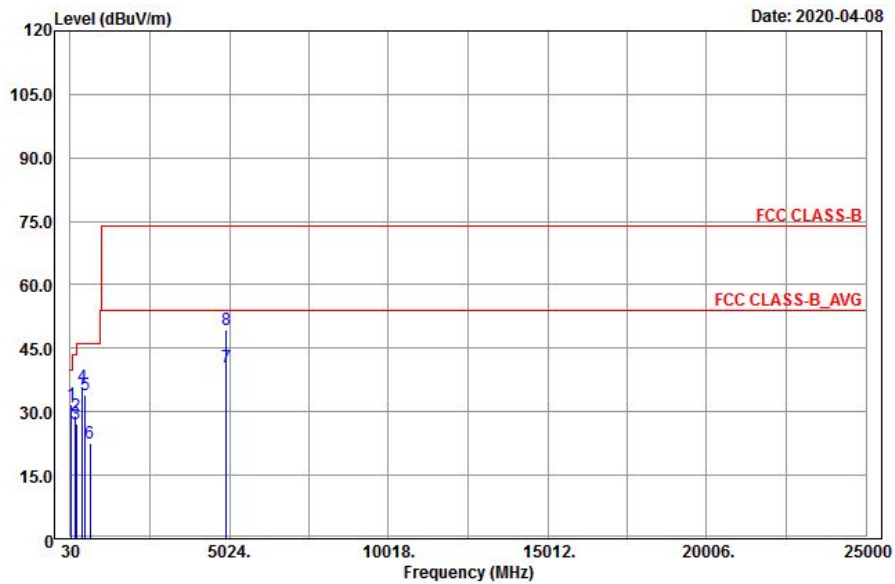
802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
116.67	20.56	39.08	-18.52	43.5	-22.94	167	115	Peak
184.17	27.6	46.84	-19.24	43.5	-15.9	134	186	Peak
217.11	35.51	53.43	-17.92	46	-10.49	120	312	Peak
409.9	25.15	38.9	-13.75	46	-20.85	165	114	Peak
512.1	26.93	39.12	-12.19	46	-19.07	177	64	Peak
827.8	23.04	30.21	-7.17	46	-22.96	196	283	Peak
4924	41.46	31.21	10.25	54	-12.54	162	135	Average
4924	48.38	38.13	10.25	74	-25.62	162	135	Peak

Antenna Polarity & Test Distance: Vertical at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
59.97	31.71	47.85	-16.14	40	-8.29	175	165	Peak
184.44	29.26	48.5	-19.24	43.5	-14.24	189	187	Peak
222.51	27	44.76	-17.76	46	-19	120	312	Peak
416.9	36.11	49.7	-13.59	46	-9.89	145	112	Peak
491.1	34.15	46.64	-12.49	46	-11.85	183	235	Peak
658.4	22.67	32.58	-9.91	46	-23.33	156	115	Peak
4924	40.48	30.23	10.25	54	-13.52	167	165	Average
4924	49.25	39	10.25	74	-24.75	167	165	Peak

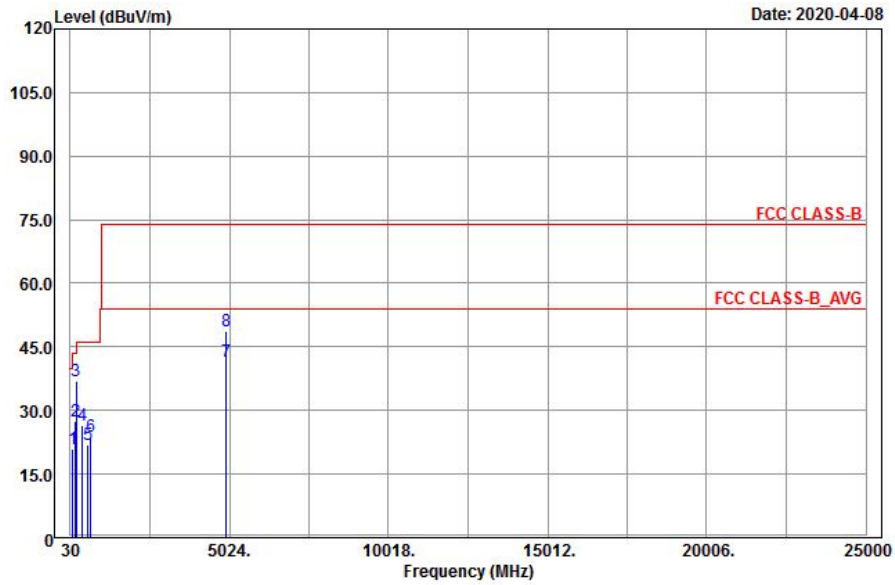
Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.

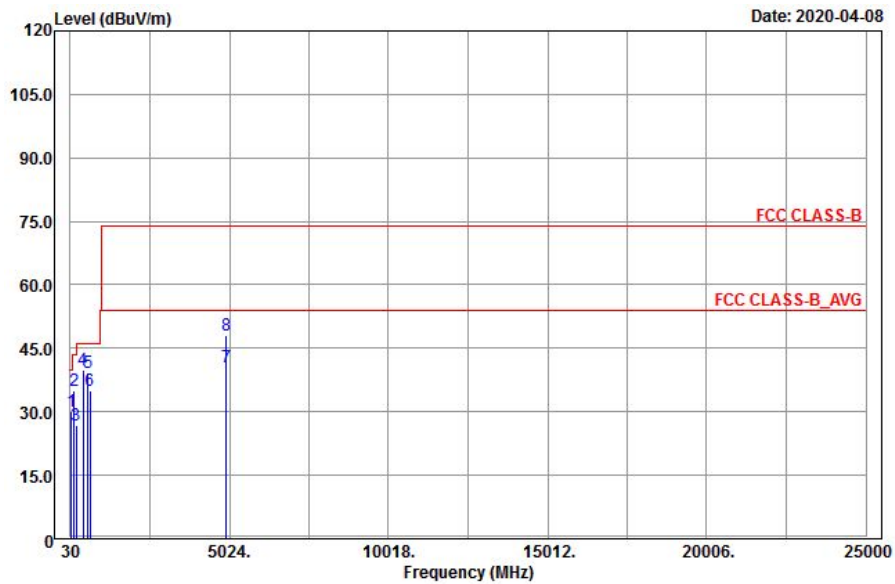
802.11ax (HE40)

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	30 MHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Charles Hsiao

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
115.05	20.95	39.23	-18.28	43.5	-22.55	146	205	Peak
191.73	27.35	45.93	-18.58	43.5	-16.15	159	134	Peak
217.11	37.06	54.98	-17.92	46	-8.94	180	122	Peak
405	26.58	40.42	-13.84	46	-19.42	108	68	Peak
579.3	22	32.94	-10.94	46	-24	170	125	Peak
668.2	23.74	33.41	-9.67	46	-22.26	186	134	Peak
4924	41.48	31.23	10.25	54	-12.52	142	102	Average
4924	48.87	38.62	10.25	74	-25.13	142	102	Peak

Antenna Polarity & Test Distance: Vertical at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
55.65	30.02	45.51	-15.49	40	-9.98	180	124	Peak
153.93	34.86	55.69	-20.83	43.5	-8.64	108	235	Peak
219.27	26.79	44.67	-17.88	46	-19.21	166	137	Peak
424.6	39.74	53.27	-13.53	46	-6.26	121	172	Peak
590.5	39.22	50.09	-10.87	46	-6.78	169	236	Peak
657.7	34.83	44.75	-9.92	46	-11.17	105	124	Peak
4924	40.48	30.23	10.25	54	-13.52	175	194	Average
4924	48.1	37.85	10.25	74	-25.9	175	194	Peak

Remarks:

- Emission Level = Read Level + Factor
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.

4.2 Conducted Output Power Measurement

4.2.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30 dBm)

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

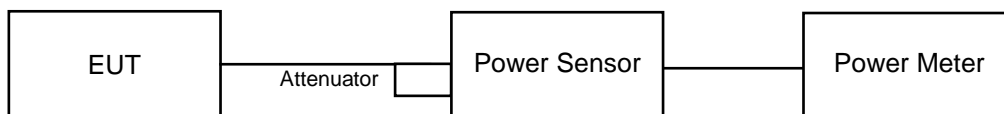
Array Gain = 0 dB (i.e., no array gain) for $NANT \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;

Array Gain = $5 \log(NANT/NSS)$ dB or 3 dB, whichever is less for 20 MHz channel widths with $NANT \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(NANT/NSS)$ dB.

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.2.7 Test Results

802.11ax (HE20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
11	2462	12.88	12.75	38.245	15.83	30	Pass
12	2467	11.72	11.66	29.515	14.70	30	Pass
13	2472	7.85	7.97	12.362	10.92	30	Pass

802.11n (HT40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
11	2462	7.26	7.48	10.919	10.38	30	Pass

802.11ax (HE40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
11	2462	7.43	7.49	11.144	10.47	30	Pass

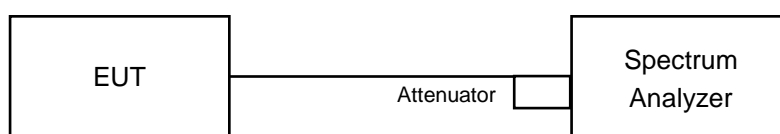
4.3 Conducted Bandedge Measurement

4.3.1 Limits of Conducted Bandedge Measurement

Radiated versus Conducted Measurement	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement
<p><u>For Radiated measurement:</u> The level of unwanted emissions was measured when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation)</p> <p><u>For Conducted measurement:</u> The level of unwanted emissions was measured as their power in a specified load (conducted spurious emissions).</p>	

Conducted Measurement Factor
<p>a. The composite gain will be used when signal support the correlated signal. (Composite gain = $3.62\text{dBi} + 10\log(2) = 6.63\text{dBi}$)</p> <p>b. For the out of band spurious the gain for the specific band may have been used rather than the highest gain across all bands.</p> <p>c. For the band edge the gain for the specific band may have been used.</p> <p>d. In restricted bands below 1000 MHz, add upper bound on ground plane reflection: For $f = 30 - 1000$ MHz, add 4.7 dB.</p> <p>Note: The conducted emission test was considered some factor to compute test result.</p>

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Deviation from Test Standard

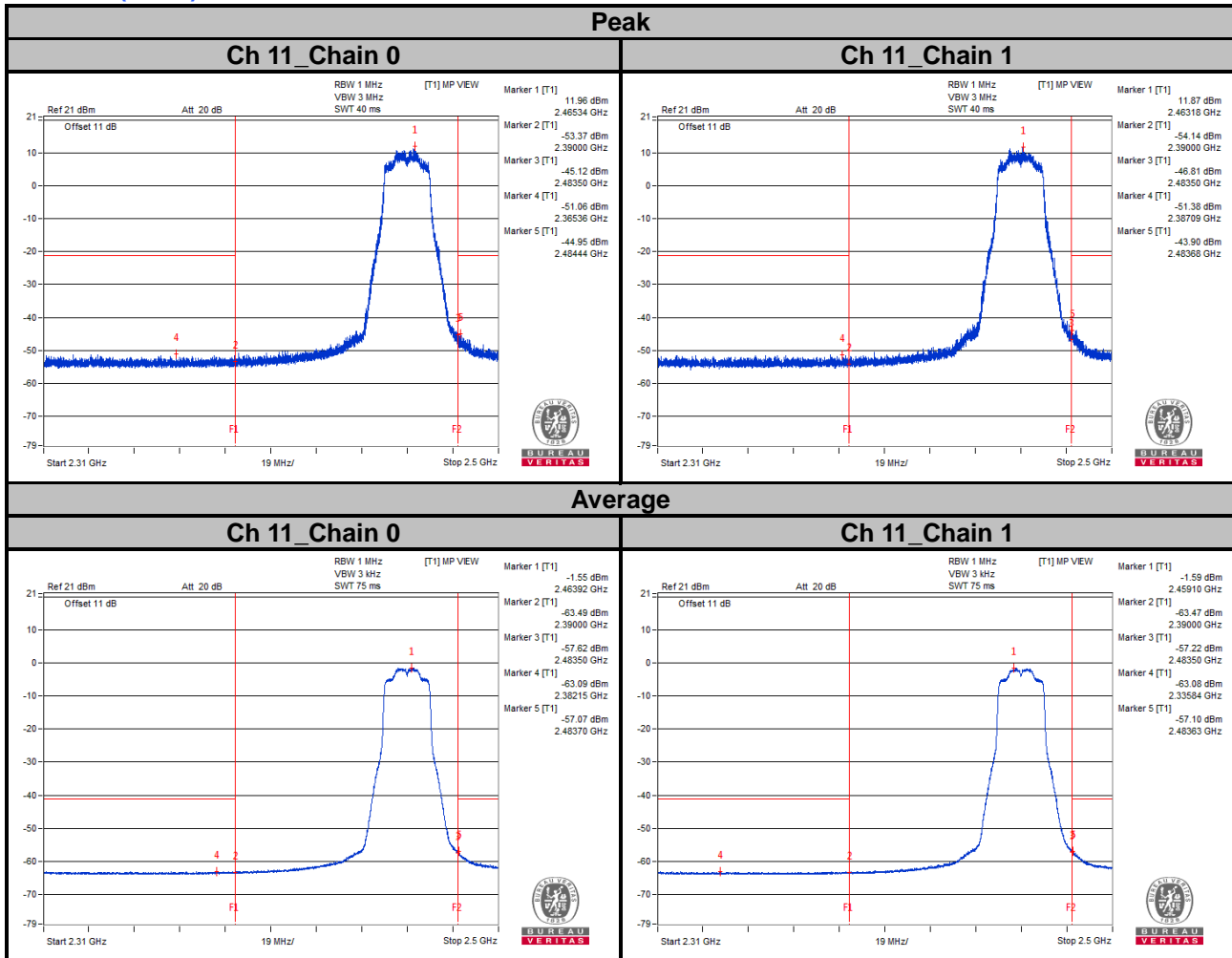
No deviation.

4.3.5 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

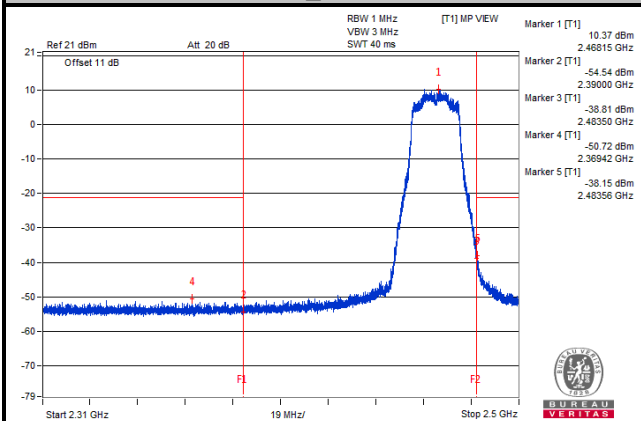
4.3.6 Test Results

802.11ax (HE20)

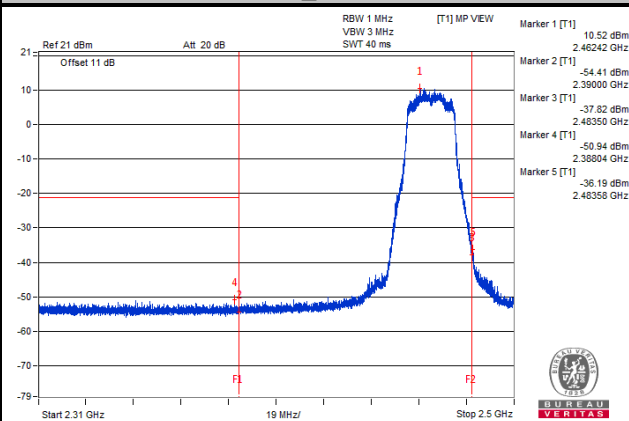


Peak

Ch 12_Chain 0

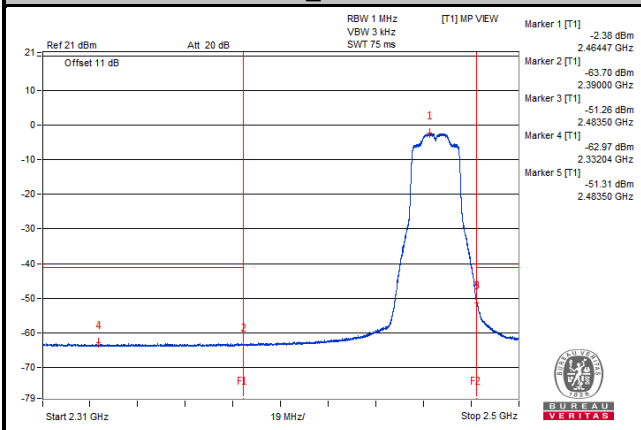


Ch 12_Chain 1

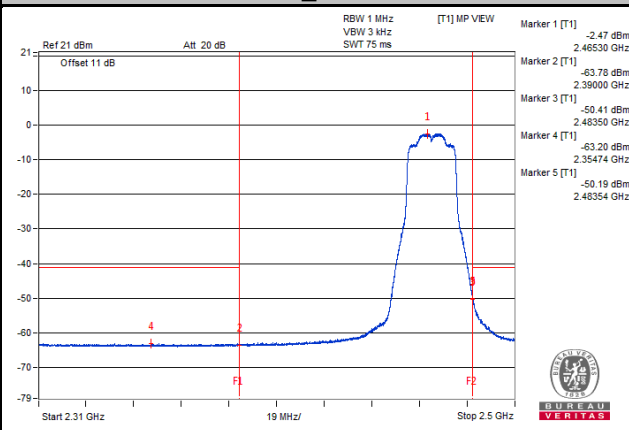


Average

Ch 12_Chain 0

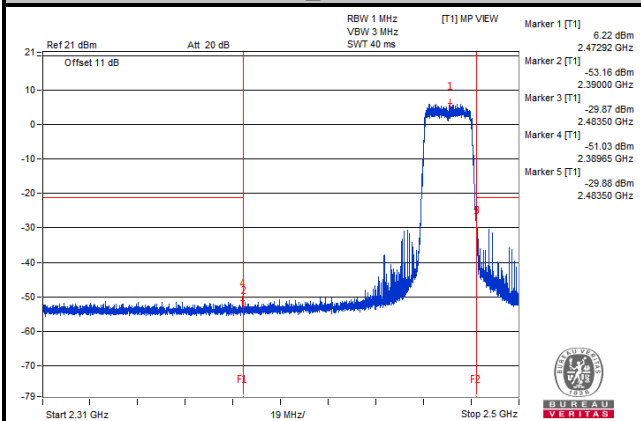


Ch 12_Chain 1

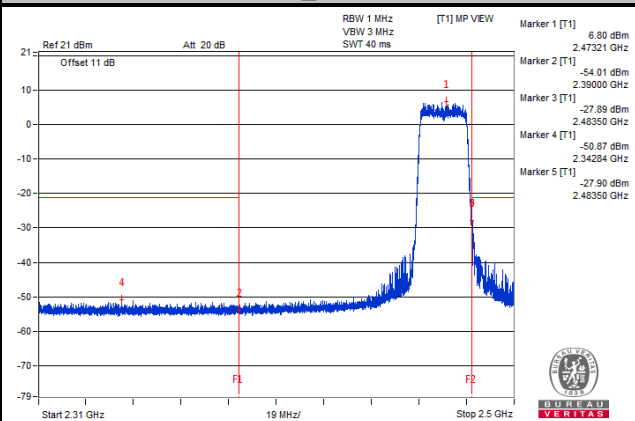


Peak

Ch 13_Chain 0

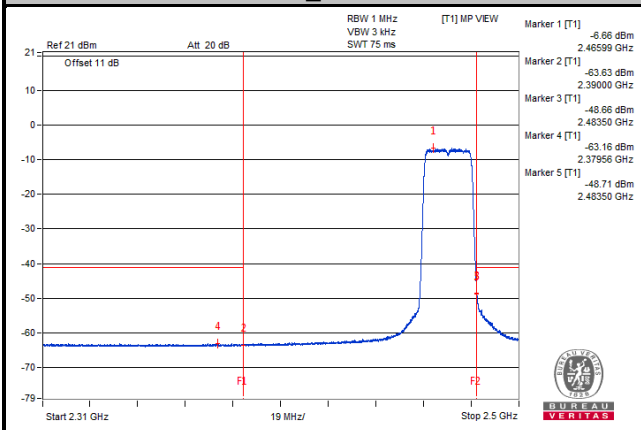


Ch 13_Chain 1

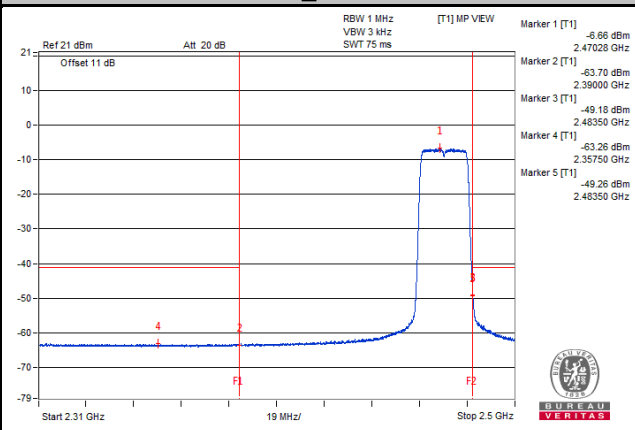


Average

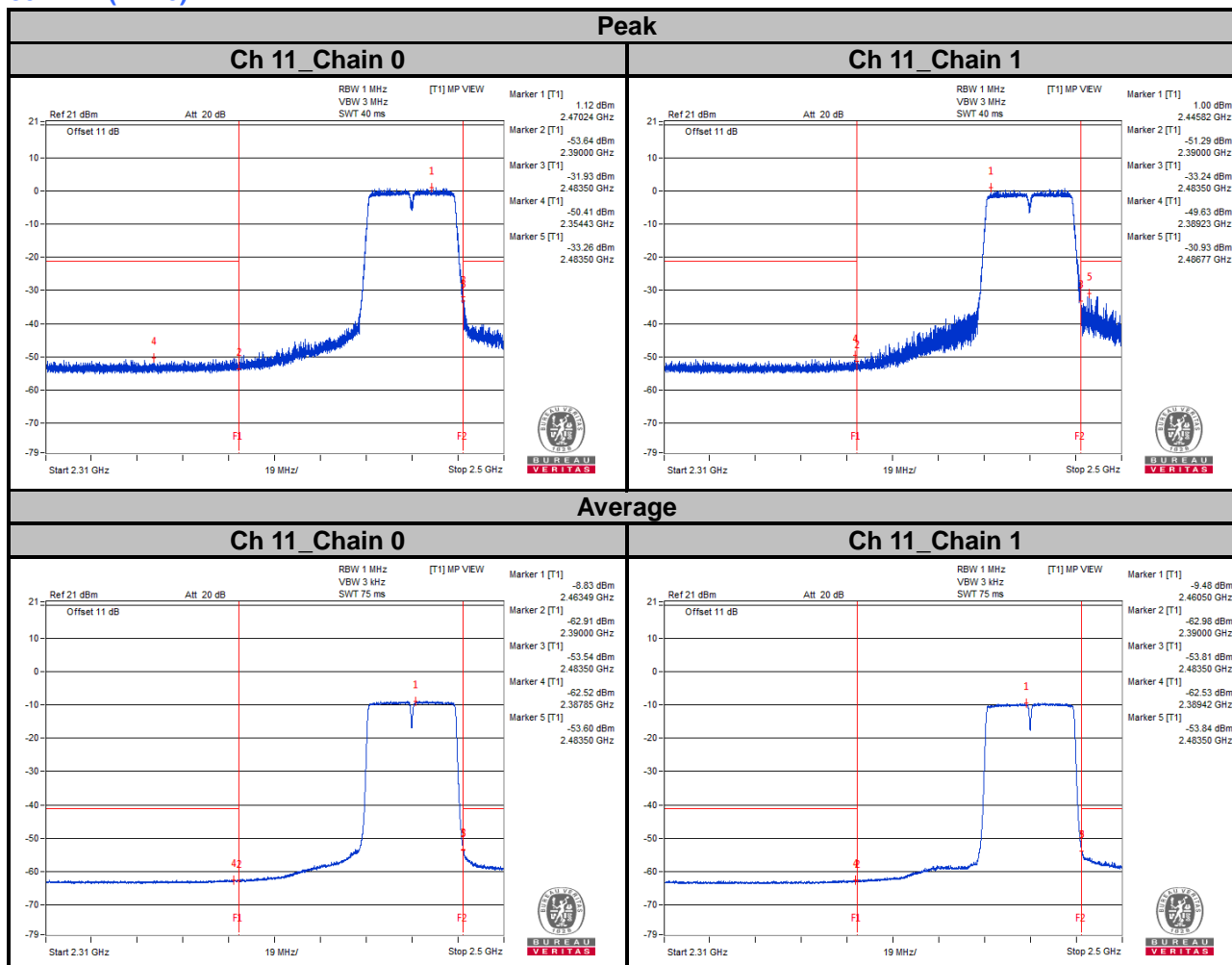
Ch 13_Chain 0



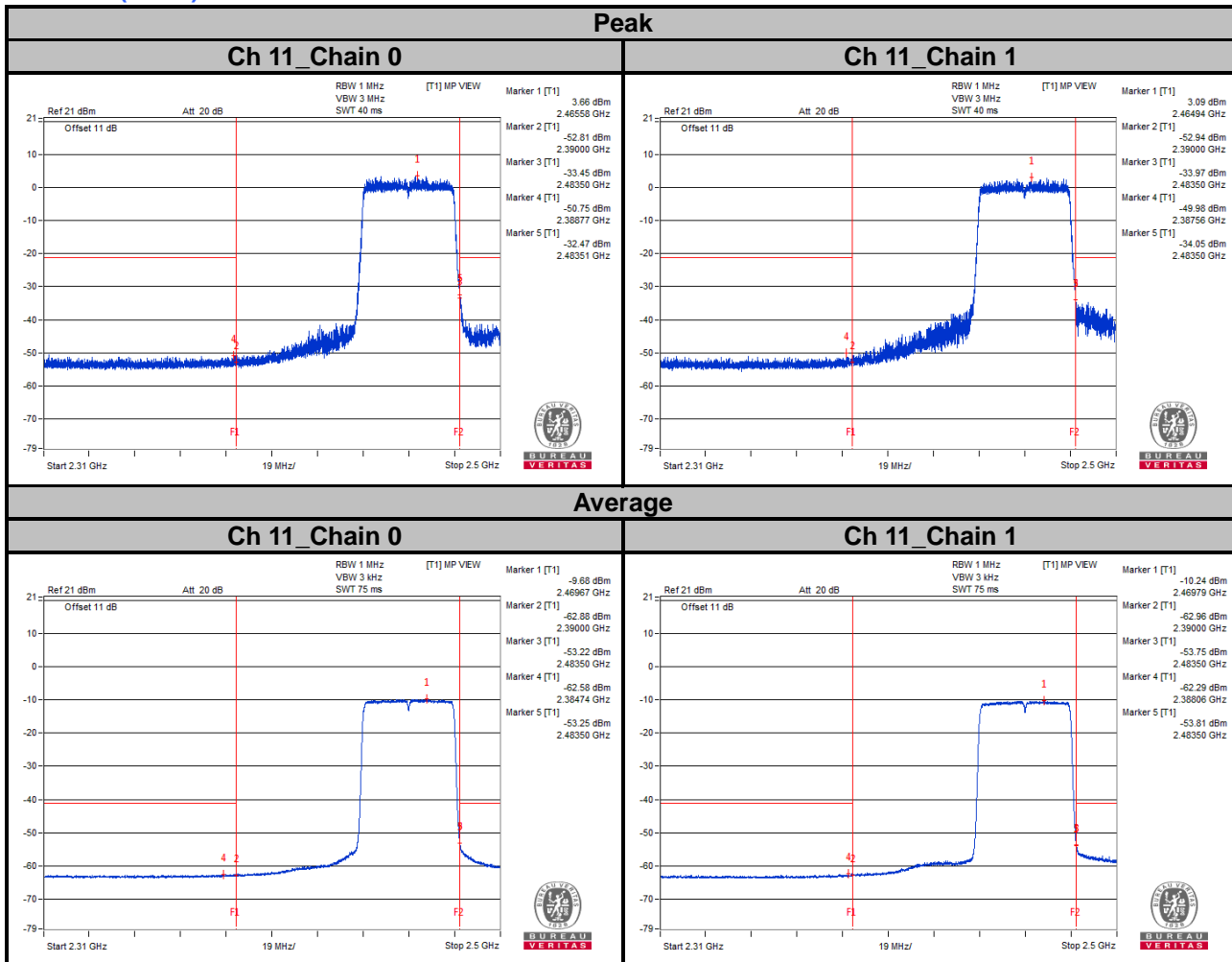
Ch 13_Chain 1



802.11n (HT40)



802.11ax (HE40)



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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