FCC Test Report

Report No.:	RF180704E02L
FCC ID:	UDX-60083010
Test Model:	MR56-HW
Received Date:	Sep. 24, 2019
Test Date:	Oct. 09 to 16, 2019
Issued Date:	Nov. 21, 2019
Applicant:	Cisco Systems, Inc.
Address:	170 West Tasman Drive, San Jose, CA 95134 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location :	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

Testing Laboratory
2022

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Release Control Record

Issue No.	Description	Date Issued
RF180704E02L	Original release.	Nov. 21, 2019

1 Certificate of Conformity

Product:	8x8 Wi-Fi 6 Access Point
Brand:	Cisco
Test Model:	MR56-HW
Sample Status:	ENGINEERING SAMPLE
Applicant:	Cisco Systems, Inc.
Test Date:	Oct. 09 to 16, 2019
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 EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** Nov. 21, 2019

Claire Kuan / Specialist

Approved by : _____ , **Date:** Nov. 21, 2019

Clark Lin / Technical Manager

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	Pass	Meet the requirement of limit. Minimum passing margin is -5.84dB at 29.23437MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -3.7dB at 2483.50MHz.
15.247(b)	Conducted power	Pass	Meet the requirement of limit.

Note:
1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. This is a supplementary report.

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	-	3.1 dB
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.8 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.0 dB
	30MHz ~ 1GHz	5.1 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.1 dB
	6GHz ~ 18GHz	5.0 dB
	18GHz ~ 40GHz	5.2 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	8x8 Wi-Fi 6 Access Point
Brand	Cisco
Test Model	MR56-HW
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	12Vdc from power adapter or 55Vdc from PoE
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT (20/40) mode in 2.4GHz 1024QAM for OFDMA in 11ax HE mode
Modulation Technology	DSSS, OFDM, OFDMA
Transfer Rate	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 600Mbps 802.11ac: up to 3466.7Mbps 802.11ax: up to 4803.9Mbps
Operating Frequency	**2.4GHz:** 2.412 ~ 2.462GHz **5GHz:** 5.18GHz ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.50 ~ 5.72GHz, 5.745GHz ~ 5.825GHz
Number of Channel	**2.4GHz:** 802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20): 11 802.11n (HT40), VHT40, 802.11ax (HE40): 7 **5GHz:** 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 25 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 12 802.11ac (VHT80), 802.11ax (HE80): 6 802.11ac (VHT80+80), 802.11ax (HE80+80): 1 set
Output Power	**2.4GHz:** **Non-Beamforming Mode:** **4TX:** 860.549mW **5.18 ~ 5.24GHz:** **Non-Beamforming Mode:** **8TX:** 399.767mW **5.26GHz ~ 5.32GHz:** **Non-Beamforming Mode:** **8TX:** 108.538mW **5.50 ~ 5.72GHz:** **Non-Beamforming Mode:** **8TX:** 124.83mW **5.745 ~ 5.825GHz:** **Non-Beamforming Mode:** **8TX:** 401.781mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1 (option)
Data Cable Supplied	NA

Note:

1. This is a supplementary report. The difference compared with the Report No.: RF180704E02 as the following infomatiion:
   - ◆ Changed the product name to 8x8 Wi-Fi 6 Access Point.
   - ◆ Changed the model name to MR56-HW.
   - ◆ Gen 2 chip revise Gen 1 chip's bug.
   - ◆ Upgrade software version.
   - ◆ Added one new POE for test (Refer to POE No.3 as below table).
2. According to above condition, only AC Power Conducted Emission / Radiated Emissions / Conducted power test items need to be performed. And all data were verified to meet the requirements.
3. The EUT has below radios as following table:

Radio 1	Radio 2	Radio 3	Radio 4
WLAN (2.4GHz)	WLAN (5GHz)	2.4GHz / 5GHz Scanning (only RX)	Bluetooth

4. Simultaneously transmission condition.

Condition	Technology		
1	WLAN (2.4GHz)	WLAN (5GHz)	Bluetooth
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.			

5. The EUT must be supplied with a power adapter or POE as following table:

Adapter (Option)			
No.	Brand	Model No.	Spec.
1	UMEC	MA-PWR-30W-US	Input: 100-240Vac, 0.8A, 50/60Hz Output: 12Vdc, 2.5A DC Output cable: Unshielded, 1.4m
2	Ktec	KSAS0361200250HU	Input: 100-240Vac, 1.0A, 50/60Hz Output: 12Vdc, 2.5A DC Output cable: Unshielded, 1.8m
POE (Only for test not for sale)			
No.	Brand	Model No.	Spec.
1	CISCO	MA-INJ-5	Input: 100-240Vac, 1.5A, 50-60Hz Output: 55Vdc, 0.63A
2	CISCO	MA-INJ-4	Input: 100-240Vac, 0.67A, 50/60Hz Output: 55Vdc, 0.6A
3	PHIHONG	POEA30U-1ATE	Input: 100-240VAC, 50/60Hz, 0.8A Output: 56V, 0.536A

Note:
1. From the above conditions, the conducted emissions, **POE No. 3** was selected as representative POE for the test and its data was recorded in this report.
2. From the above conditions, the radiated emissions worse case was found in **Adapter No. 2**. Therefore only the test data of the mode was recorded in this report.

6. The antennas provided to the EUT, please refer to the following table:

WLAN Directional gain table – 8TX			
Frequency range (GHz)	Directional Antenna Gain (dBi)	Antenna Type	Antenna Connector
5.15 ~ 5.25	9.29	PIFA	i-pex(MHF)
5.25 ~ 5.35	9.34		
5.47 ~ 5.725	8.88		
5.725 ~ 5.85	9.2		

WLAN Directional gain table – 4TX				
Frequency range (GHz)	Antenna Combine Type	Directional Antenna Gain (dBi)	Antenna Type	Antenna Connector
2.4 ~ 2.4835	Dual_1+Dual_2+Dual_3+Dual_4	5.43	PIFA	i-pex(MHF)
5.15 ~ 5.25	Single_1+Single_2+Single_3+Single_4	10.73		
5.25 ~ 5.35		10.71		
5.47 ~ 5.725		10.33		
5.725 ~ 5.85		10.68		

WLAN Directional gain table – 2TX				
Frequency range (GHz)	Antenna Combine Type	Directional Antenna Gain (dBi)	Antenna Type	Antenna Connector
2.4 ~ 2.4835	Dual_1+Dual_3	6.33	PIFA	i-pex(MHF)
5.15 ~ 5.25	Dual_2+Dual_3	8.47		
5.25 ~ 5.35		8.92		
5.47 ~ 5.725		8.16		
5.725 ~ 5.85		8.59		

Bluetooth antenna spec.			
Antenna Net Gain (dBi)	Frequency range (GHz)	Antenna Type	Antenna Connector
3.61	2.4~2.4835	PIFA	i-pex(MHF)
Note: More detailed information, please refer to operating description.			

7. The EUT incorporates a MIMO function.

2.4GHz Band		
MODULATION MODE	**TX & RX CONFIGURATION**	
802.11b	4TX	4RX
802.11g	4TX	4RX
802.11n (HT20)	4TX	4RX
802.11n (HT40)	4TX	4RX
VHT20	4TX	4RX
VHT40	4TX	4RX
802.11ax (HE20)	4TX	4RX
802.11ax (HE40)	4TX	4RX
5GHz Band		
MODULATION MODE	**TX & RX CONFIGURATION**	
802.11a	8TX	8RX
802.11n (HT20)	8TX	8RX
802.11n (HT40)	8TX	8RX
802.11ac (VHT20)	8TX	8RX
802.11ac (VHT40)	8TX	8RX
802.11ac (VHT80)	8TX	8RX
802.11ac (VHT80+VHT80)	4TX+4TX	4RX +4RX
802.11ax (HE20)	8TX	8RX
802.11ax (HE40)	8TX	8RX
802.11ax (HE80)	8TX	8RX
802.11ax (HE80+HE80)	4TX+4TX	4RX +4RX

Note:
1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.
2. The EUT support Beamforming and Non-Beamforming mode, therefore both mode were investigated and the worst case scenario was identified. The worst case data were presented in test report.

2.4GHz Scanning	
MODULATION MODE	**RX CONFIGURATION**
802.11b	1RX
802.11g	1RX
802.11n (HT20)	1RX
802.11n (HT40)	1RX
VHT20	1RX
VHT40	1RX
5GHz Scanning	
MODULATION MODE	**RX CONFIGURATION**
802.11a	1RX
802.11n (HT20)	1RX
802.11n (HT40)	1RX
802.11ac (VHT20)	1RX
802.11ac (VHT40)	1RX
802.11ac (VHT80)	1RX

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

3.2 Description of Test Modes

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

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

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

Channel	Frequency	Channel	Frequency
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	4TX (PLC: POE mode; RE: adapter mode)

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
APCM: Antenna Port Conducted Measurement

NOTE: 1. In the original test report, the EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane (below 1GHz) & Z-plane (above 1GHz)**.

Radiated Emission Test (Above 1GHz):

☒ Following channel(s) was (were) selected for the final test as listed below.

Non-Beamforming Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate Parameter
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1Mb/s

Radiated Emission Test (Below 1GHz):

☒ Following channel(s) was (were) selected for the final test as listed below.

Non-Beamforming Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate Parameter
802.11b	1 to 11	6	DSSS	DBPSK	1Mb/s

Power Line Conducted Emission Test:

☒ Following channel(s) was (were) selected for the final test as listed below.

Non-Beamforming Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate Parameter
802.11b	1 to 11	6	DSSS	DBPSK	1Mb/s

Antenna Port Conducted Measurement:

☒ Following channel(s) was (were) selected for the final test as listed below.

Non-Beamforming Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate Parameter
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1Mb/s

Test Condition:

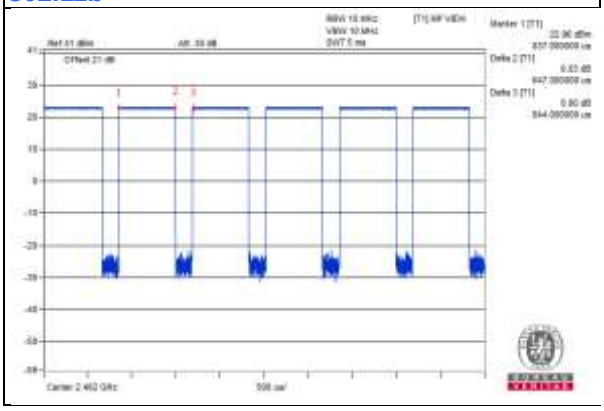
Applicable To	Environmental Conditions	Input Power (system)	Tested By
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Tom Yang
RE<1G	22deg. C, 68%RH	120Vac, 60Hz	Andy Ho
PLC	24deg. C, 75%RH	120Vac, 60Hz	Andy Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Tom Yang

3.3 Duty Cycle of Test Signal

If duty cycle of test signal is < 98%, duty factor shall be considered.

802.11b: Duty cycle = 0.647 ms/0.844 ms = 0.767, Duty factor = 10 * log (1/Duty cycle) = 1.15

802.11b



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab
B.	POE Adapter	PHIHONG	POEA30U-1ATE	NA	NA	Supplied by client

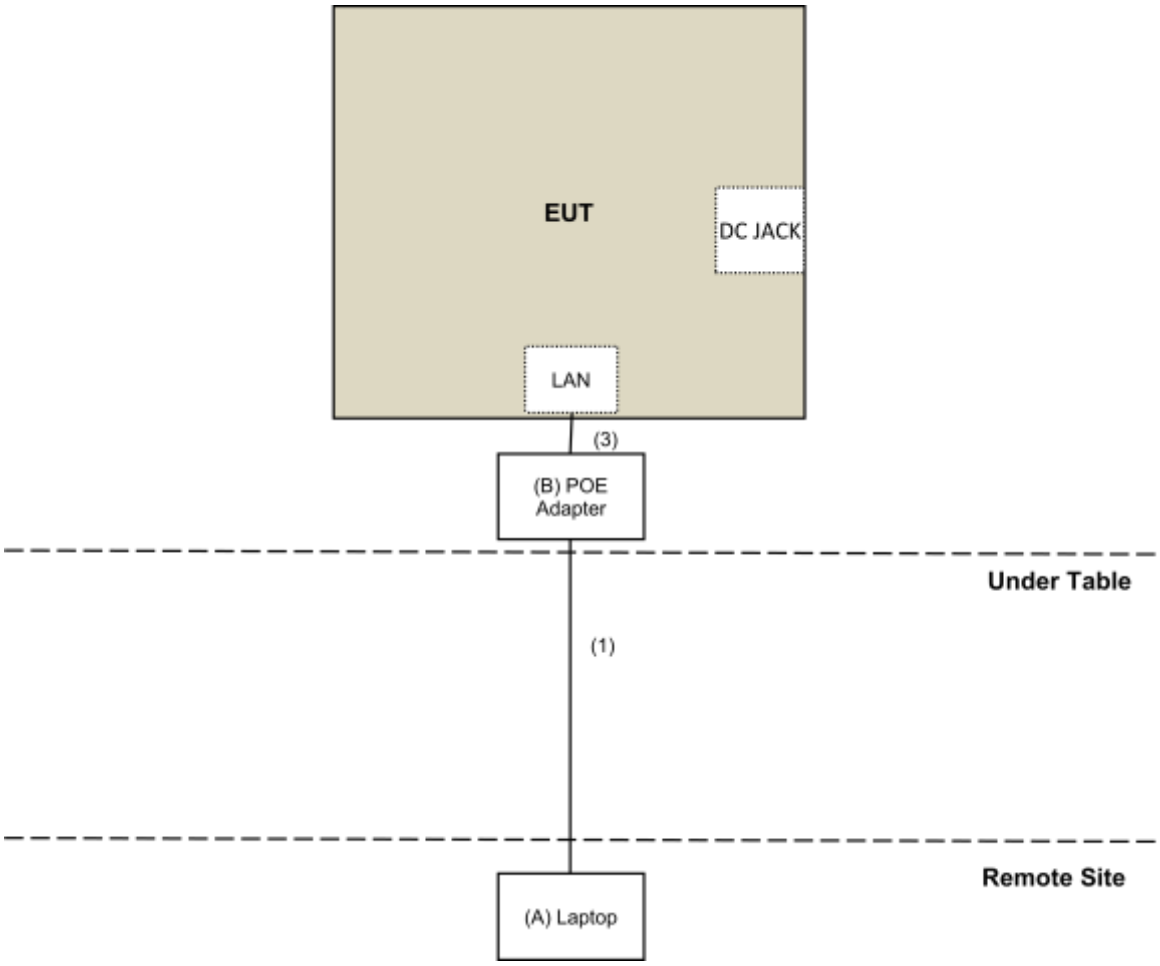
Note:

1. All power cords of the above support units are non-shielded (1.8m).

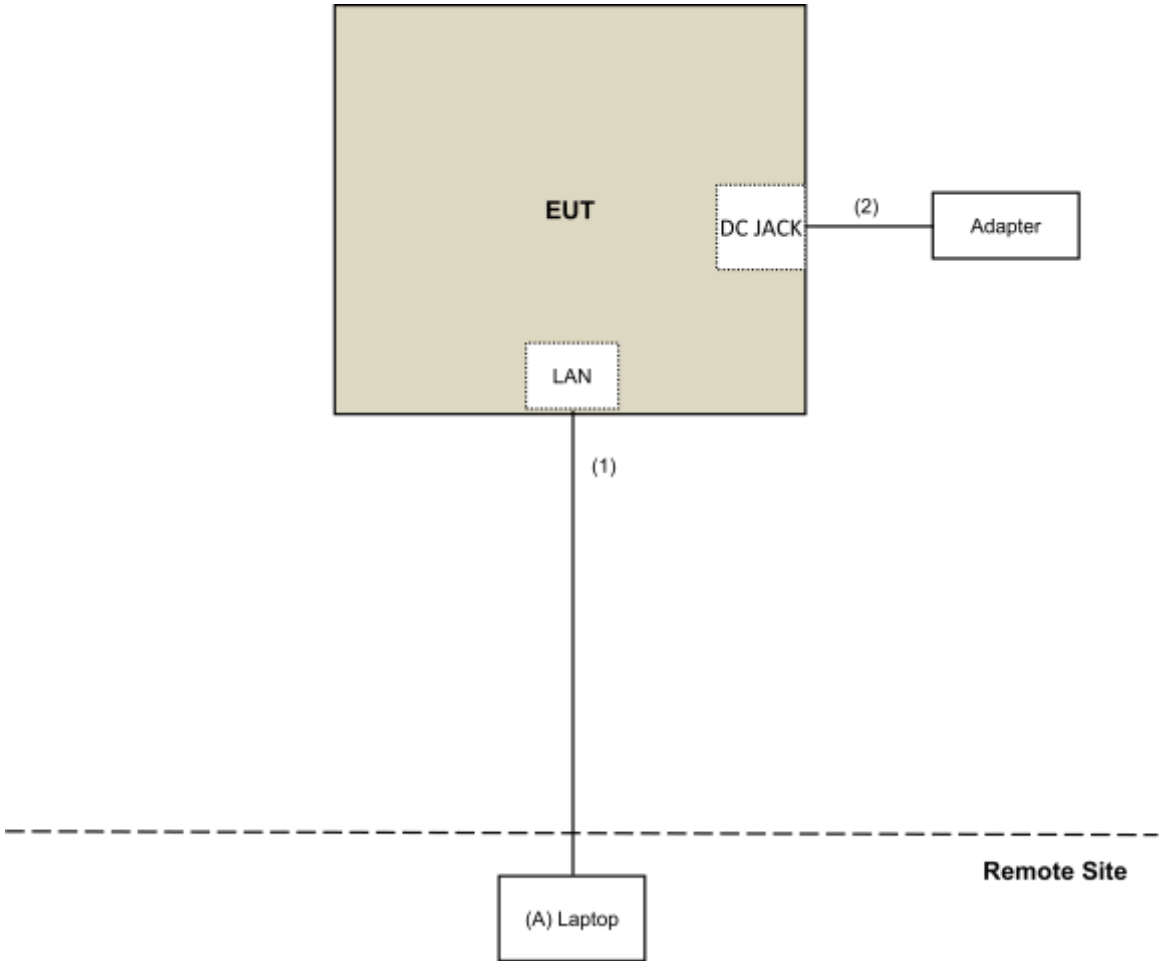
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ-45 Cable	1	10	No	0	Provided by Lab
2.	DC Cable	1	1.8	No	0	Supplied by client
3.	RJ-45 Cable	1	0.5	No	0	Provided by Lab

3.4.1 Configuration of System under Test

POE mode:



Adapter mode:



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)
KDB 558074 D01 15.247 Meas Guidance v05r02
KDB 662911 D01 Multiple Transmitter Output v02r01
ANSI C63.10-2013

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

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 30dB 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 1000MHz, 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 20dB under any condition of modulation.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	July 17, 2019	July 16, 2020
Pre-Amplifier EMCI	EMC001340	980142	May 30, 2019	May 29, 2020
Loop Antenna Electro-Metrics	EM-6879	264	Jan. 22, 2019	Jan. 21, 2020
RF Cable	NA	LOOPCAB-001	Jan. 14, 2019	Jan. 13, 2020
RF Cable	NA	LOOPCAB-002	Jan. 14, 2019	Jan. 13, 2020
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	Apr. 30, 2019	Apr. 29, 2020
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 22, 2018	Nov. 21, 2019
RF Cable	8D	966-3-1	Mar. 18, 2019	Mar. 17, 2020
RF Cable	8D	966-3-2	Mar. 18, 2019	Mar. 17, 2020
RF Cable	8D	966-3-3	Mar. 18, 2019	Mar. 17, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 26, 2019	Sep. 25, 2020
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC104-SM-SM-1200	160922	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC104-SM-SM-2000	180601	June 10, 2019	June 09, 2020
RF Cable	EMC104-SM-SM-6000	180602	June 10, 2019	June 09, 2020
Spectrum Analyzer Keysight	N9030A	MY54490679	July 17, 2019	July 16, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 28, 2019	Jan. 27, 2020
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 25, 2018	Nov. 24, 2019
RF Cable	EMC102-KM-KM-1200	160924	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC102-KM-KM-1200	160925	Jan. 28, 2019	Jan. 27, 2020
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Spectrum Analyzer R&S	FSV40	100964	June 04, 2019	June 03, 2020
Power meter Anritsu	ML2495A	1014008	May 13, 2019	May 12, 2020
Power sensor Anritsu	MA2411B	0917122	May 13, 2019	May 12, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020

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 966 Chamber No. 3.
3. Tested Date: Oct. 09 to 16, 2019

4.1.3 Test Procedures

For Radiated emission below 30MHz

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 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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 detects 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:

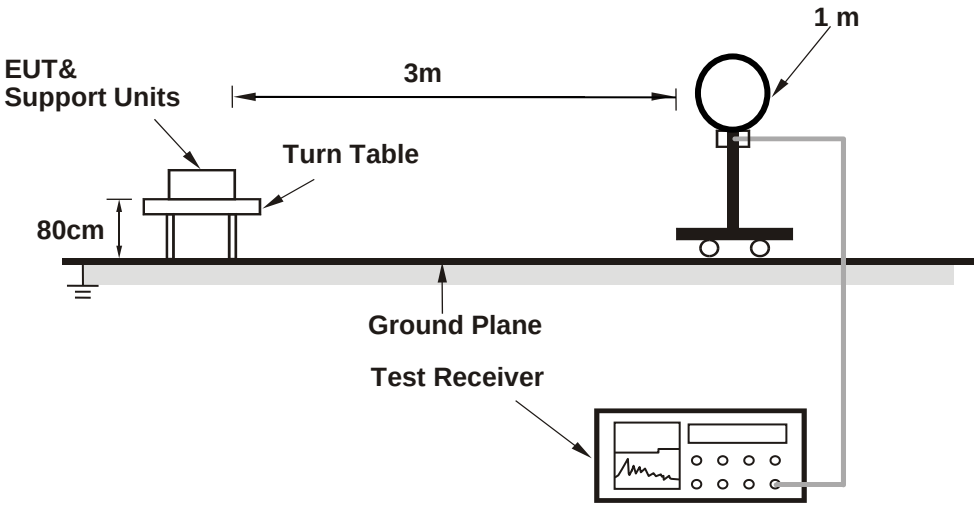
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

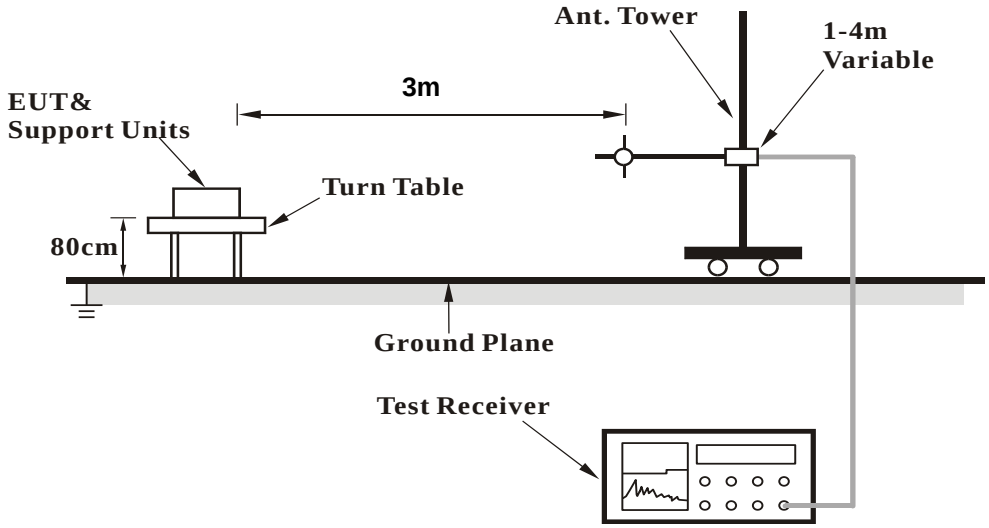
No deviation.

4.1.5 Test Setup

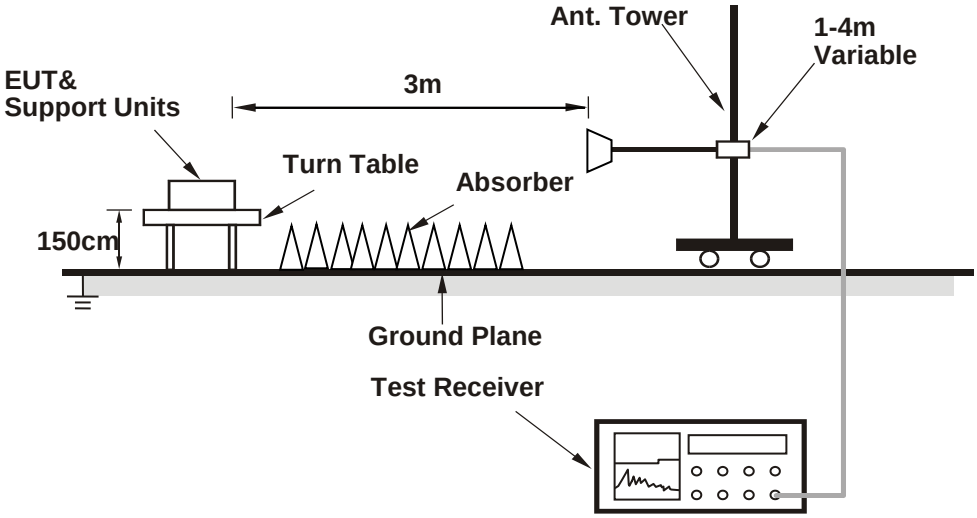
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

a. Connected the EUT with the Laptop which is placed on remote site.
b. Controlling software (QSPR (5.0-00161)) has been activated to set the EUT on specific status.

4.1.7 Test Results

Above 1GHz Data：

802.11b

CHANNEL	TX Channel 1	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	2390.00	57.3 PK	74.0	-16.7	1.42 H	235	59.3	-2.0
2	2390.00	49.7 AV	54.0	-4.3	1.42 H	235	51.7	-2.0
3	*2412.00	114.8 PK			1.42 H	235	116.8	-2.0
4	*2412.00	112.5 AV			1.42 H	235	114.5	-2.0
5	4824.00	40.3 PK	74.0	-33.7	1.24 H	213	38.0	2.3
6	4824.00	35.2 AV	54.0	-18.8	1.24 H	213	32.9	2.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	2390.00	56.7 PK	74.0	-17.3	2.76 V	159	58.7	-2.0
2	2390.00	46.8 AV	54.0	-7.2	2.76 V	159	48.8	-2.0
3	*2412.00	112.6 PK			2.76 V	159	114.6	-2.0
4	*2412.00	110.9 AV			2.76 V	159	112.9	-2.0
5	4824.00	43.7 PK	74.0	-30.3	1.54 V	155	41.4	2.3
6	4824.00	40.0 AV	54.0	-14.0	1.54 V	155	37.7	2.3

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	61.1 PK	74.0	-12.9	1.53 H	237	63.1	-2.0
2	2390.00	48.9 AV	54.0	-5.1	1.53 H	237	50.9	-2.0
3	*2437.00	117.2 PK			1.53 H	237	119.3	-2.1
4	*2437.00	114.9 AV			1.53 H	237	117.0	-2.1
5	2483.50	57.8 PK	74.0	-16.2	1.53 H	237	60.0	-2.2
6	2483.50	49.6 AV	54.0	-4.4	1.53 H	237	51.8	-2.2
7	4874.00	41.7 PK	74.0	-32.3	1.25 H	209	39.4	2.3
8	4874.00	37.5 AV	54.0	-16.5	1.25 H	209	35.2	2.3
9	7311.00	49.3 PK	74.0	-24.7	1.60 H	164	41.0	8.3
10	7311.00	46.2 AV	54.0	-7.8	1.60 H	164	37.9	8.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.8 PK	74.0	-16.2	2.70 V	169	59.8	-2.0
2	2390.00	45.3 AV	54.0	-8.7	2.70 V	169	47.3	-2.0
3	*2437.00	115.6 PK			2.70 V	169	117.7	-2.1
4	*2437.00	113.2 AV			2.70 V	169	115.3	-2.1
5	2483.50	54.5 PK	74.0	-19.5	2.70 V	169	56.7	-2.2
6	2483.50	46.1 AV	54.0	-7.9	2.70 V	169	48.3	-2.2
7	4874.00	45.7 PK	74.0	-28.3	1.22 V	5	43.4	2.3
8	4874.00	43.7 AV	54.0	-10.3	1.22 V	5	41.4	2.3
9	7311.00	50.9 PK	74.0	-23.1	2.67 V	3	42.6	8.3
10	7311.00	47.8 AV	54.0	-6.2	2.67 V	3	39.5	8.3

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	113.9 PK			1.17 H	237	116.1	-2.2
2	*2462.00	111.8 AV			1.17 H	237	114.0	-2.2
3	2483.50	58.3 PK	74.0	-15.7	1.17 H	237	60.5	-2.2
4	**2483.50**	**50.3 AV**	**54.0**	**-3.7**	**1.17 H**	**237**	**52.5**	**-2.2**
5	4924.00	41.2 PK	74.0	-32.8	1.25 H	205	38.7	2.5
6	4924.00	37.2 AV	54.0	-16.8	1.25 H	205	34.7	2.5
7	7386.00	49.1 PK	74.0	-24.9	1.66 H	170	40.8	8.3
8	7386.00	46.1 AV	54.0	-7.9	1.66 H	170	37.8	8.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	112.2 PK			2.73 V	166	114.4	-2.2
2	*2462.00	110.0 AV			2.73 V	166	112.2	-2.2
3	2483.50	55.9 PK	74.0	-18.1	2.73 V	166	58.1	-2.2
4	2483.50	47.7 AV	54.0	-6.3	2.73 V	166	49.9	-2.2
5	4924.00	43.6 PK	74.0	-30.4	1.57 V	360	41.1	2.5
6	4924.00	40.5 AV	54.0	-13.5	1.57 V	360	38.0	2.5
7	7386.00	42.1 PK	74.0	-31.9	1.57 V	170	33.8	8.3
8	7386.00	34.6 AV	54.0	-19.4	1.57 V	170	26.3	8.3

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

Below 1GHz Data:

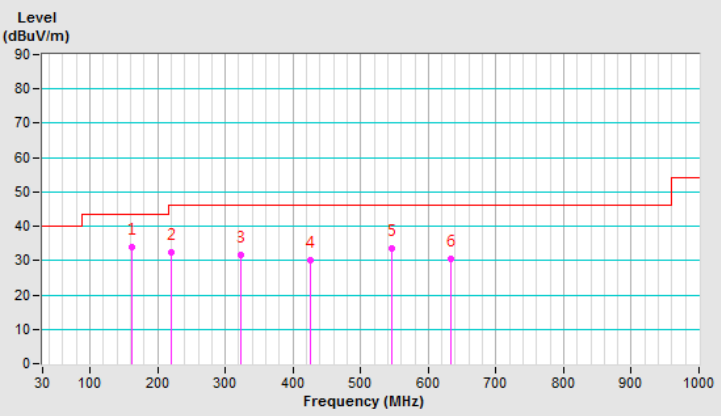
802.11b

CHANNEL	TX Channel 6	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	162.52	33.8 QP	43.5	-9.7	1.55 H	241	42.0	-8.2
2	219.50	32.4 QP	46.0	-13.6	1.65 H	302	42.2	-9.8
3	323.80	31.6 QP	46.0	-14.4	1.43 H	241	37.2	-5.6
4	425.15	30.2 QP	46.0	-15.8	1.65 H	301	33.7	-3.5
5	546.65	33.6 QP	46.0	-12.4	2.00 H	149	34.4	-0.8
6	633.13	30.5 QP	46.0	-15.5	2.05 H	298	28.9	1.6

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

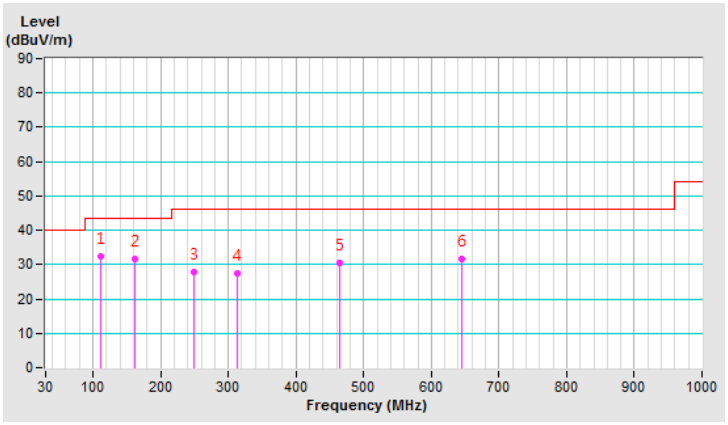


CHANNEL	TX Channel 6	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	111.49	32.4 QP	43.5	-11.1	1.00 V	142	43.0	-10.6
2	162.54	31.8 QP	43.5	-11.7	2.00 V	302	40.0	-8.2
3	249.96	27.9 QP	46.0	-18.1	1.55 V	298	36.3	-8.4
4	312.40	27.6 QP	46.0	-18.4	1.00 V	115	33.6	-6.0
5	464.89	30.6 QP	46.0	-15.4	1.00 V	142	33.1	-2.5
6	644.35	31.7 QP	46.0	-14.3	1.50 V	318	30.0	1.7

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Oct. 24, 2018	Oct. 23, 2019
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 22, 2018	Oct. 21, 2019
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 17, 2019	Mar. 16, 2020
50 ohms Terminator	N/A	3	Oct. 22, 2018	Oct. 21, 2019
RF Cable	5D-FB	COCCAB-001	Sep. 27, 2019	Sep. 26, 2020
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 14, 2019	Mar. 13, 2020
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
3. Tested Date: Oct. 16, 2019

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

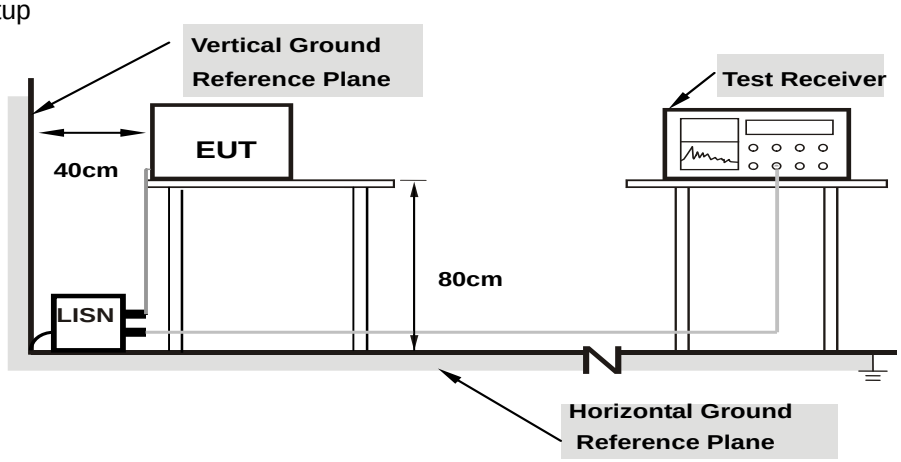
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

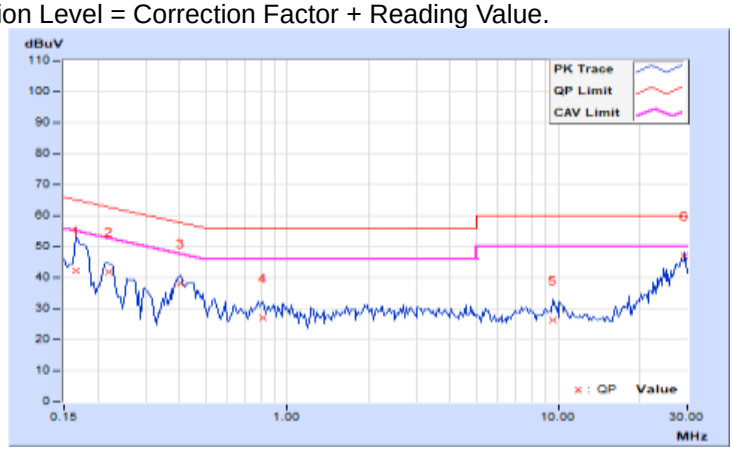
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16561	9.95	32.13	16.65	42.08	26.60	65.18	55.18	-23.10	-28.58
2	0.22030	9.96	31.83	22.41	41.79	32.37	62.81	52.81	-21.02	-20.44
3	0.40390	9.97	28.25	19.02	38.22	28.99	57.77	47.77	-19.55	-18.78
4	0.81796	10.00	17.03	7.76	27.03	17.76	56.00	46.00	-28.97	-28.24
5	9.55076	10.46	15.83	9.45	26.29	19.91	60.00	50.00	-33.71	-30.09
6	**29.23437**	**11.27**	**35.65**	**32.89**	**46.92**	**44.16**	**60.00**	**50.00**	**-13.08**	**-5.84**

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

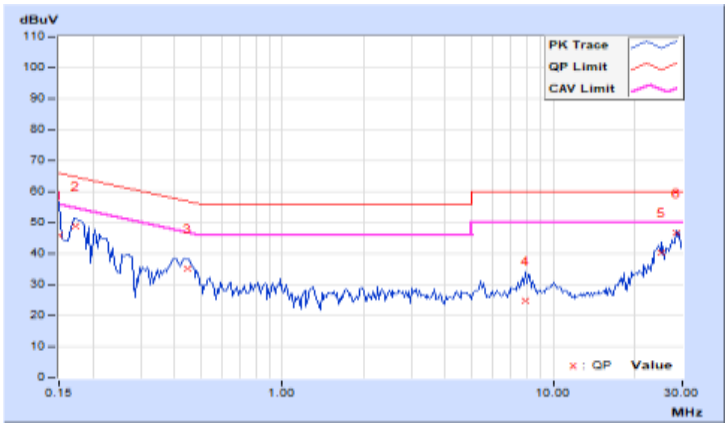


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.93	35.86	9.05	45.79	18.98	66.00	56.00	-20.21	-37.02
2	0.17343	9.93	39.06	28.32	48.99	38.25	64.79	54.79	-15.80	-16.54
3	0.44687	9.95	25.36	16.01	35.31	25.96	56.93	46.93	-21.62	-20.97
4	7.88670	10.28	14.65	8.49	24.93	18.77	60.00	50.00	-35.07	-31.23
5	25.23827	10.86	29.66	27.65	40.52	38.51	60.00	50.00	-19.48	-11.49
6	28.68749	10.91	35.79	32.96	46.70	43.87	60.00	50.00	-13.30	-6.13

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

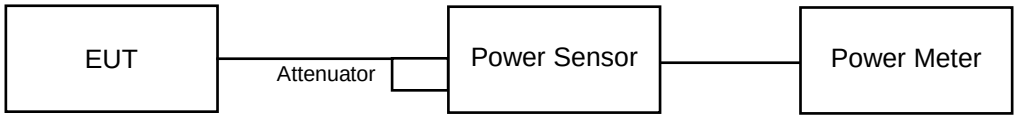
For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

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 $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

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 Test Procedures

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Results

Non-Beamforming Mode:

802.11b

Chan.	Chan. Freq. (MHz)	Average Power (dBm)				Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3				
1	2412	20.16	20.18	20.34	20.05	417.286	26.20	30.00	Pass
6	2437	23.48	23.01	23.52	23.28	860.549	29.35	30.00	Pass
11	2462	20.55	20.26	20.07	20.05	422.454	26.26	30.00	Pass

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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Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
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Fax: 886-3-6668323

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Email: service.adt@tw.bureauveritas.com
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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