

## Supplemental “Transmit Simultaneously” Test Report

**Report No.:** RF190103E03-5

**FCC ID:** COF-WMBACBM25

**Test Model:** WM-BAC-BM-25

**Received Date:** Jan. 03, 2019

**Test Date:** Mar. 14 to 15, 2019

**Issued Date:** Mar. 22, 2019

**Applicant:** UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

**Address:** 141, Lane 351, Sec. 1, Taiping Road., Tsautuen, Nantou 54261, Taiwan

**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 R.O.C.

**Test Location:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,  
Taiwan R.O.C.

**FCC Registration /  
Designation Number:** 723255 / TW2022



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### Release Control Record

Issue No.	Description	Date Issued
RF190103E03-5	Original release.	Mar. 22, 2019

## 1 Certificate of Conformity

**Product:** 802.11a/b/g/n/ac + BT 4.1 Module

**Brand:** USI

**Test Model:** WM-BAC-BM-25

**Sample Status:** ENGINEERING SAMPLE

**Applicant:** UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

**Test Date:** Mar. 14 to 15, 2019

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)

47 CFR FCC Part 15, Subpart E (Section 15.407)

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** Wendy Wu, **Date:** Mar. 22, 2019  
Wendy Wu / Specialist  
**Approved by :** May Chen, **Date:** Mar. 22, 2019  
May Chen / Manager

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C, E (SECTION 15.247, 15.407)			
FCC Clause	Test Item	Result	Remarks
15.207 15.407(b)(6)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -22.27dB at 18.24219MHz.
15.205 / 15.209 / 15.247(d) 15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -3.0dB at 11590.00MHz.

Note:

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) ( $\pm$ )
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.8 dB
Radiated Emissions up to 1 GHz	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	802.11a/b/g/n/ac + BT 4.1 Module
Brand	USI
Test Model	WM-BAC-BM-25
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 3.6V from host equipment
Modulation Type	<b>WLAN:</b> CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only <b>BT-EDR:</b> GFSK, $\pi/4$ -DQPSK, 8DPSK <b>BT-LE:</b> GFSK
Modulation Technology	<b>WLAN:</b> DSSS, OFDM <b>BT-EDR:</b> FHSS <b>BT-LE:</b> DTS
Operating Frequency	<b>WLAN:</b> <b>2.4GHz:</b> 2.412 ~ 2.462GHz <b>5GHz:</b> 5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.50 ~ 5.70GHz, 5.745 ~ 5.825GHz <b>BT-EDR:</b> 2402MHz ~ 2480MHz <b>BT-LE:</b> 2402MHz ~ 2480MHz
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. There are WLAN and Bluetooth technology used for the EUT.
2. Simultaneously transmission condition.

Condition	Technology	
1	WLAN (2.4GHz)	Bluetooth
2	WLAN (5GHz)	Bluetooth

**Note:** The emission of the simultaneous operation has been evaluated and no non-compliance was found.

3. The antenna provided to the EUT, please refer to the following table:

Antenna No.	Brand	Model	Ant. Net Gain (dBi)	Frequency range (GHz)	Antenna Type	Connector Type
1	YANGO	ANT3216A063R2455A	1.59	2.4~2.4835	Ceramic Chip Antenna	None
			2.23	5.15~5.85		

4. The EUT incorporates a SISO function.

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

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.

### 3.1.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	OB	
1	√	√	√	√	WLAN 2.4GHz + Bluetooth
2	√	√	√	√	WLAN 5GHz + Bluetooth

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz

**RE<1G**: Radiated Emission below 1GHz

**PLC**: Power Line Conducted Emission

**OB**: Conducted Out-Band Emission Measurement

#### NOTE:

- The EUT's antenna 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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11g + BT-EDR	1 to 11	6	OFDM	BPSK
	0 to 78	39	FHSS	GFSK
802.11ac (VHT40) + BT-EDR	38 to 46 54 to 62 102 to 134 151 to 159	159	OFDM	BPSK
	0 to 78	39	FHSS	GFSK

#### Radiated Emission Test (Below 1GHz):

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11g + BT-EDR	1 to 11	6	OFDM	BPSK
	0 to 78	39	FHSS	GFSK
802.11ac (VHT40) + BT-EDR	38 to 46 54 to 62 102 to 134 151 to 159	159	OFDM	BPSK
	0 to 78	39	FHSS	GFSK



**Power Line Conducted Emission Test:**
☒ Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11g + BT-EDR	1 to 11	6	OFDM	BPSK
	0 to 78	39	FHSS	GFSK
802.11ac (VHT40) + BT-EDR	38 to 46 54 to 62 102 to 134 151 to 159	159	OFDM	BPSK
	0 to 78	39	FHSS	GFSK

**Conducted Out-Band Emission Measurement:**
☒ Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11g + BT-EDR	1 to 11	6	OFDM	BPSK
	0 to 78	39	FHSS	GFSK
802.11ac (VHT40) + BT-EDR	38 to 46 54 to 62 102 to 134 151 to 159	159	OFDM	BPSK
	0 to 78	39	FHSS	GFSK

**Test Condition:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE $\geq$ 1G	25deg. C, 65%RH	120Vac, 60Hz	Frank Chuang
RE $<$ 1G	25deg. C, 65%RH	120Vac, 60Hz	Frank Chuang
PLC	25deg. C, 68%RH	120Vac, 60Hz	Frank Chuang
OB	21deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

### 3.2 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.	Test Tool	NA	NA	NA	NA	Supplied by client
B.	DC POWER SUPPLY	GOOD WILL INSTRUMENT CO., LTD	GPC-3030D	E847076	NA	Provided by Lab

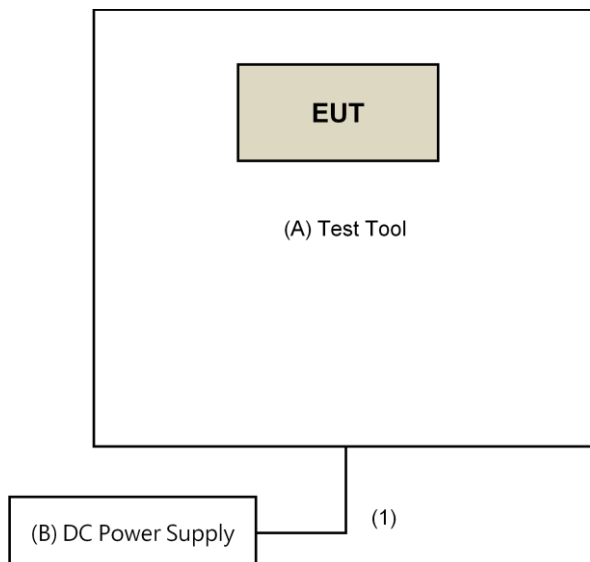
Note:

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

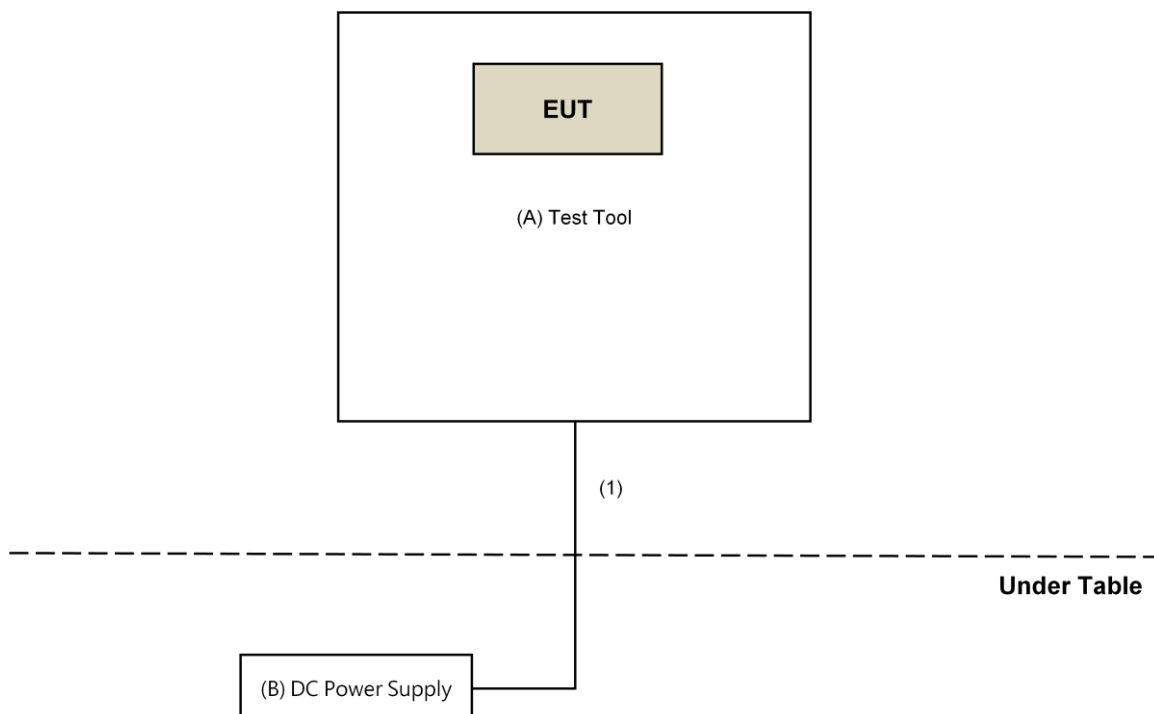
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.8	No	0	Provided by Lab

### 3.2.1 Configuration of System under Test

#### For Conducted Emissions test:



#### For other test:



## 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.

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:**

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 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.

Limits of unwanted emission out of the restricted bands

Applicable To			Limit	
789033 D02 General UNII Test Procedure New Rules v02r01			Field Strength at 3m	
			PK:74 (dBµV/m)	AV:54 (dBµV/m)
Frequency Band	Applicable To		EIRP Limit	Equivalent Field Strength at 3m
5150~5250 MHz	15.407(b)(1)		PK:-27 (dBm/MHz)	PK:68.2(dBµV/m)
5250~5350 MHz	15.407(b)(2)			
5470~5725 MHz	15.407(b)(3)			
5725~5850 MHz	<input checked="" type="checkbox"/>	15.407(b)(4)(i)	PK:-27 (dBm/MHz) <sup>*1</sup> PK:10 (dBm/MHz) <sup>*2</sup> PK:15.6 (dBm/MHz) <sup>*3</sup> PK:27 (dBm/MHz) <sup>*4</sup>	PK: 68.2(dBµV/m) <sup>*1</sup> PK:105.2 (dBµV/m) <sup>*2</sup> PK: 110.8(dBµV/m) <sup>*3</sup> PK:122.2 (dBµV/m) <sup>*4</sup>
	<input type="checkbox"/>	15.407(b)(4)(ii)	Emission limits in section 15.247(d)	
<sup>*1</sup> beyond 75 MHz or more above of the band edge.			<sup>*2</sup> below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.	
<sup>*3</sup> below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.			<sup>*4</sup> from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.	

**Note:**

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

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

#### 4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	July 12, 2018	July 11, 2019
Pre-Amplifier EMCI	EMC001340	980142	Jan. 25, 2019	Jan. 24, 2020
Loop Antenna Electro-Metrics	EM-6879	269	Sep. 07, 2018	Sep. 06, 2019
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	May 05, 2018	May 04, 2019
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 22, 2018	Nov. 21, 2019
RF Cable	8D	966-3-1	Mar. 20, 2018	Mar. 19, 2019
RF Cable	8D	966-3-2	Mar. 20, 2018	Mar. 19, 2019
RF Cable	8D	966-3-3	Mar. 20, 2018	Mar. 19, 2019
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 27, 2018	Sep. 26, 2019
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 12, 2018	June 11, 2019
RF Cable	EMC104-SM-SM-6000	180602	June 12, 2018	June 11, 2019
Spectrum Analyzer Keysight	N9030A	MY54490679	July 23, 2018	July 22, 2019
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 20, 2018	June 19, 2019
Power meter Anritsu	ML2495A	1014008	May 09, 2018	May 08, 2019
Power sensor Anritsu	MA2411B	0917122	May 09, 2018	May 08, 2019
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 16, 2018	Apr. 15, 2019

#### 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. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: Mar. 14 to 15, 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 detect 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:**

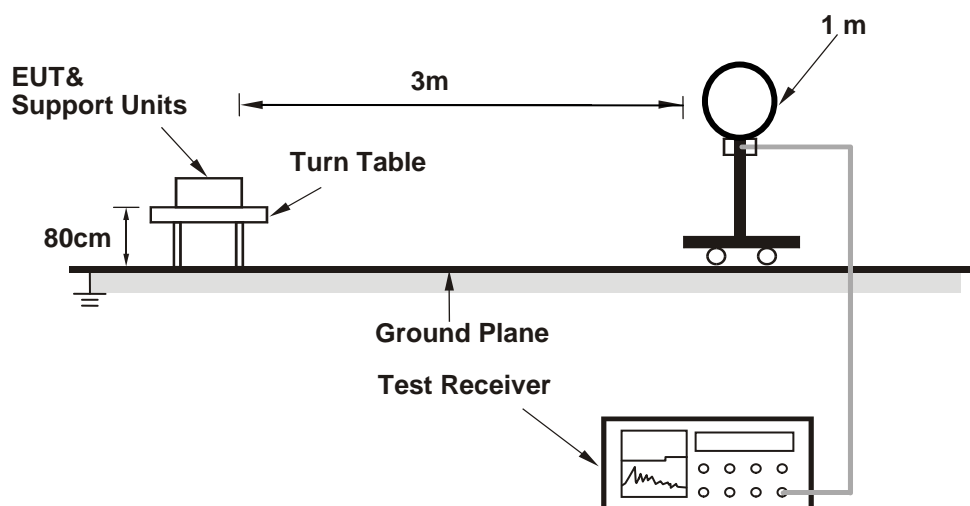
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle  $< 98\%$ ) or 10Hz (Duty cycle  $\geq 98\%$ ) 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

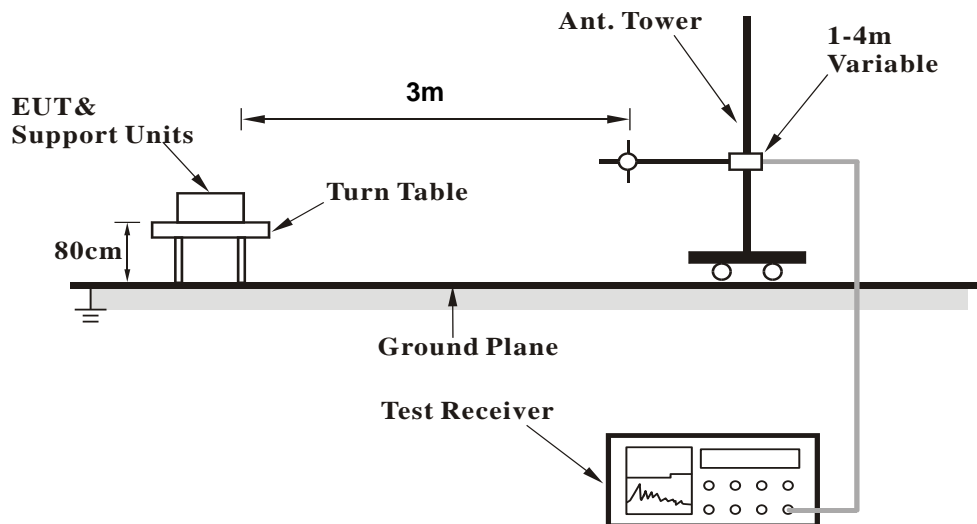
No deviation.

#### 4.1.5 Test Setup

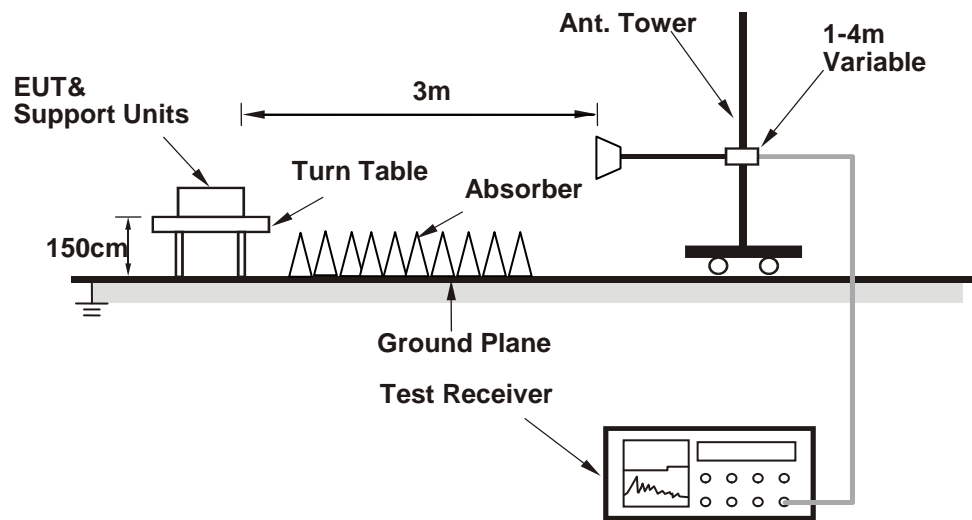
##### For Radiated emission below 30MHz



##### 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

- Placed the EUT on the testing table.
- Controlling software (sh use Test scripts.sh) has been activated to set the EUT on specific status.



#### 4.1.7 Test Results (Mdoe 1)

##### Above 1GHz Data

<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz	<b>DETECTOR FUNCTION</b>	Peak (PK) 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	4874.00	40.9 PK	74.0	-33.1	1.09 H	162	38.8	2.1
2	4874.00	29.8 AV	54.0	-24.2	1.09 H	162	27.7	2.1
3	4882.00	48.0 PK	74.0	-26.0	1.60 H	193	45.9	2.1
4	4882.00	43.1 AV	54.0	-10.9	1.60 H	193	41.0	2.1
5	7311.00	42.9 PK	74.0	-31.1	2.23 H	183	34.9	8.0
6	7311.00	32.7 AV	54.0	-21.3	2.23 H	183	24.7	8.0
7	7323.00	42.4 PK	74.0	-31.6	1.30 H	168	34.4	8.0
8	7323.00	32.9 AV	54.0	-21.1	1.30 H	168	24.9	8.0
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	4874.00	46.1 PK	74.0	-27.9	2.12 V	137	44.0	2.1
2	4874.00	36.4 AV	54.0	-17.6	2.12 V	137	34.3	2.1
3	4882.00	44.0 PK	74.0	-30.0	1.76 V	342	41.9	2.1
4	4882.00	39.4 AV	54.0	-14.6	1.76 V	342	37.3	2.1
5	7311.00	42.7 PK	74.0	-31.3	1.25 V	160	34.7	8.0
6	7311.00	32.9 AV	54.0	-21.1	1.25 V	160	24.9	8.0
7	7323.00	42.3 PK	74.0	-31.7	1.58 V	342	34.3	8.0
8	7323.00	32.7 AV	54.0	-21.3	1.58 V	342	24.7	8.0

#### 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

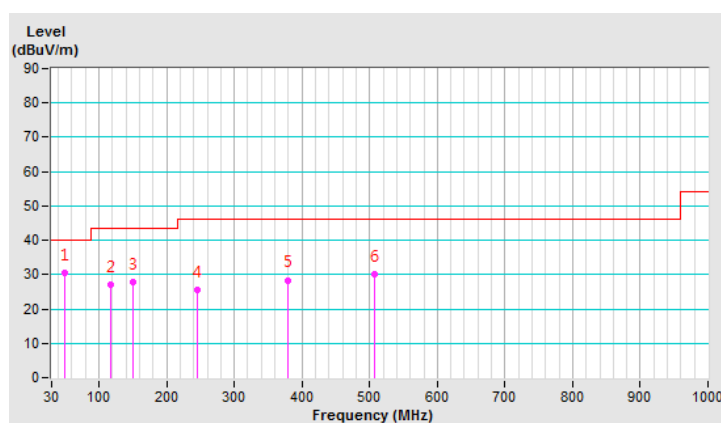
# Below 1GHz Data:

<b>FREQUENCY RANGE</b>	9kHz ~ 1GHz	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
------------------------	-------------	--------------------------	-----------------

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	48.92	30.5 QP	40.0	-9.5	1.00 H	243	39.4	-8.9
2	117.09	27.2 QP	43.5	-16.3	1.00 H	206	37.6	-10.4
3	150.86	27.7 QP	43.5	-15.8	1.00 H	87	35.7	-8.0
4	246.14	25.4 QP	46.0	-20.6	2.00 H	360	34.5	-9.1
5	378.29	28.4 QP	46.0	-17.6	1.50 H	308	33.5	-5.1
6	506.93	30.0 QP	46.0	-16.0	1.00 H	114	31.8	-1.8

## 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 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.

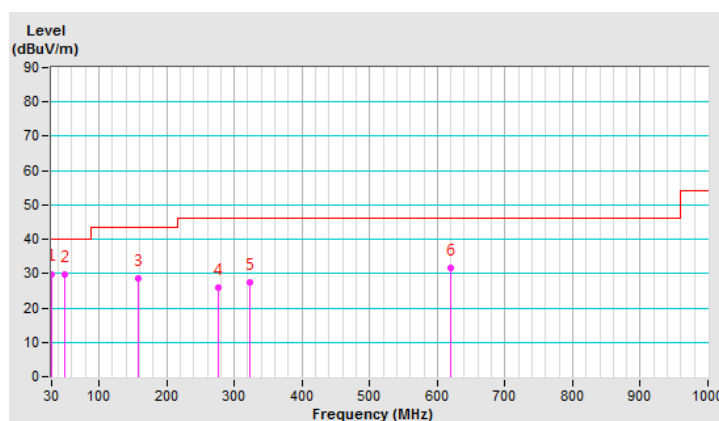


<b>FREQUENCY RANGE</b>	9kHz ~ 1GHz	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
------------------------	-------------	--------------------------	-----------------

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	30.22	29.9 QP	40.0	-10.1	1.50 V	323	39.6	-9.7
2	49.98	29.8 QP	40.0	-10.2	2.00 V	360	38.7	-8.9
3	157.51	28.6 QP	43.5	-14.9	1.00 V	215	36.8	-8.2
4	276.55	25.9 QP	46.0	-20.1	1.50 V	5	33.8	-7.9
5	322.82	27.3 QP	46.0	-18.7	1.00 V	50	33.6	-6.3
6	619.86	31.5 QP	46.0	-14.5	1.00 V	212	31.0	0.5

#### 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 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.



#### 4.1.8 Test Results (Mdoe 2)

##### Above 1GHz Data

<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz	<b>DETECTOR FUNCTION</b>	Peak (PK) Average (AV)
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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	4882.00	48.0 PK	74.0	-26.0	1.60 H	193	45.9	2.1
2	4882.00	43.1 AV	54.0	-10.9	1.60 H	193	41.0	2.1
3	7323.00	42.4 PK	74.0	-31.6	1.30 H	168	34.4	8.0
4	7323.00	32.9 AV	54.0	-21.1	1.30 H	168	24.9	8.0
5	11590.00	61.6 PK	74.0	-12.4	1.94 H	102	48.8	12.8
6	<b>11590.00</b>	<b>51.0 AV</b>	<b>54.0</b>	<b>-3.0</b>	<b>1.94 H</b>	<b>102</b>	<b>38.2</b>	<b>12.8</b>
7	17385.00	52.9 PK	68.2	-15.3	2.80 H	34	36.0	16.9
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	4882.00	44.0 PK	74.0	-30.0	1.76 V	342	41.9	2.1
2	4882.00	39.4 AV	54.0	-14.6	1.76 V	342	37.3	2.1
3	7323.00	42.3 PK	74.0	-31.7	1.58 V	342	34.3	8.0
4	7323.00	32.7 AV	54.0	-21.3	1.58 V	342	24.7	8.0
5	11590.00	57.4 PK	74.0	-16.6	1.24 V	148	44.6	12.8
6	11590.00	45.8 AV	54.0	-8.2	1.24 V	148	33.0	12.8
7	17385.00	54.7 PK	68.2	-13.5	1.69 V	253	37.8	16.9

#### 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

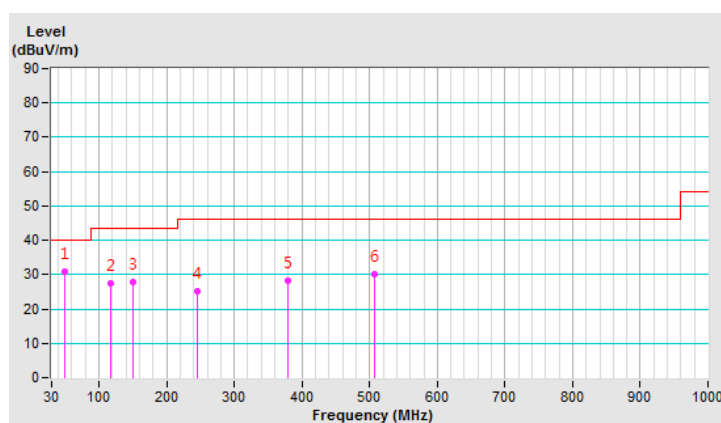
# Below 1GHz Data:

<b>FREQUENCY RANGE</b>	9kHz ~ 1GHz	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
------------------------	-------------	--------------------------	-----------------

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	48.90	30.7 QP	40.0	-9.3	1.50 H	245	39.6	-8.9
2	117.12	27.4 QP	43.5	-16.1	1.00 H	176	37.8	-10.4
3	150.89	27.9 QP	43.5	-15.6	1.50 H	57	35.9	-8.0
4	246.12	25.2 QP	46.0	-20.8	1.00 H	330	34.3	-9.1
5	378.27	28.2 QP	46.0	-17.8	1.50 H	288	33.3	-5.1
6	506.95	30.2 QP	46.0	-15.8	1.50 H	164	32.0	-1.8

## 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 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.

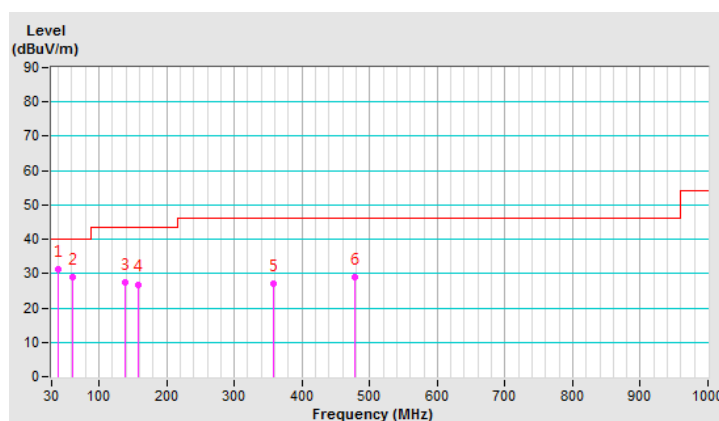


<b>FREQUENCY RANGE</b>	9kHz ~ 1GHz	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
------------------------	-------------	--------------------------	-----------------

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	38.95	31.2 QP	40.0	-8.8	1.50 V	222	40.7	-9.5
2	60.94	28.9 QP	40.0	-11.1	1.00 V	269	38.3	-9.4
3	138.13	27.5 QP	43.5	-16.0	1.50 V	78	36.1	-8.6
4	157.53	26.9 QP	43.5	-16.6	1.00 V	0	35.1	-8.2
5	358.49	26.9 QP	46.0	-19.1	2.00 V	360	32.7	-5.8
6	477.70	28.9 QP	46.0	-17.1	2.00 V	2	31.7	-2.8

#### 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 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	ENV216	100072	June 04, 2018	June 03, 2019
50 ohms Terminator	N/A	3	Oct. 22, 2018	Oct. 21, 2019
RF Cable	5D-FB	COCCAB-001	Sep. 28, 2018	Sep. 27, 2019
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 16, 2018	Mar. 15, 2019
Software BVADT	BVADT_Conc_ 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: Mar. 15, 2019

#### 4.2.3 Test Procedures

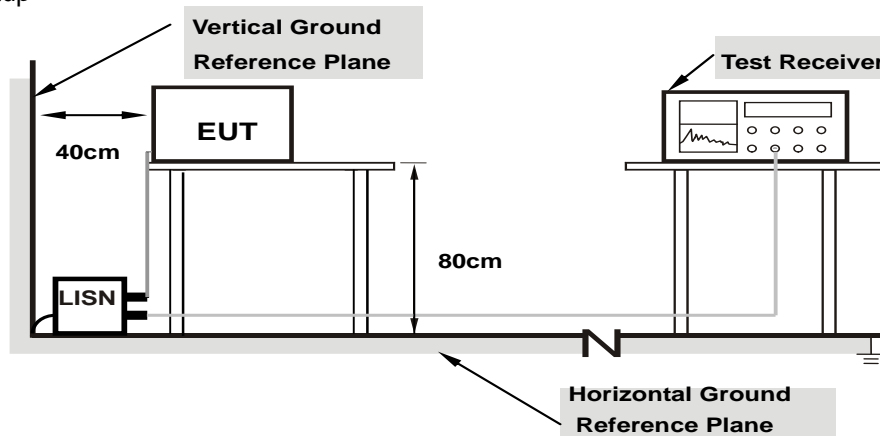
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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



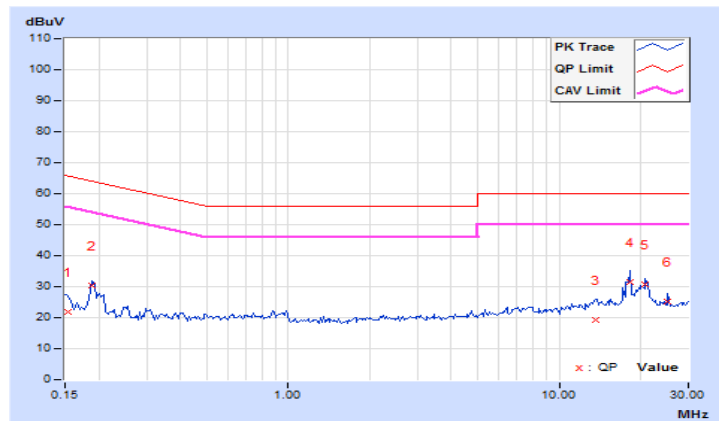
#### 4.2.7 Test Results (Mode 1)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.02	11.98	7.18	22.00	17.20	65.79	55.79	-43.79	-38.59
2	0.18906	10.04	20.19	10.83	30.23	20.87	64.08	54.08	-33.85	-33.21
3	13.65234	10.73	8.68	3.37	19.41	14.10	60.00	50.00	-40.59	-35.90
<b>4</b>	<b>18.24219</b>	<b>10.98</b>	<b>20.65</b>	<b>16.75</b>	<b>31.63</b>	<b>27.73</b>	<b>60.00</b>	<b>50.00</b>	<b>-28.37</b>	<b>-22.27</b>
5	20.86328	11.08	19.70	11.89	30.78	22.97	60.00	50.00	-29.22	-27.03
6	25.23047	11.15	14.00	13.32	25.15	24.47	60.00	50.00	-34.85	-25.53

#### 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

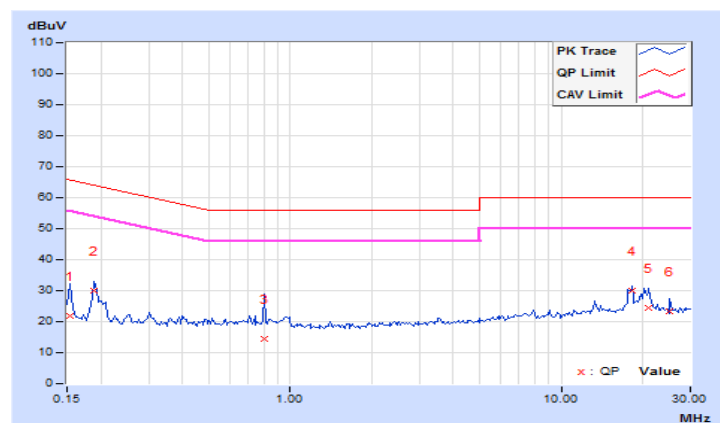


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.93	11.98	7.16	21.91	17.09	65.79	55.79	-43.88	-38.70
2	0.18906	9.94	20.24	10.77	30.18	20.71	64.08	54.08	-33.90	-33.37
3	0.80625	9.98	4.61	0.87	14.59	10.85	56.00	46.00	-41.41	-35.15
4	18.24219	10.78	19.17	15.43	29.95	26.21	60.00	50.00	-30.05	-23.79
5	21.01172	10.88	13.62	7.86	24.50	18.74	60.00	50.00	-35.50	-31.26
6	25.22656	10.92	12.54	11.70	23.46	22.62	60.00	50.00	-36.54	-27.38

**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



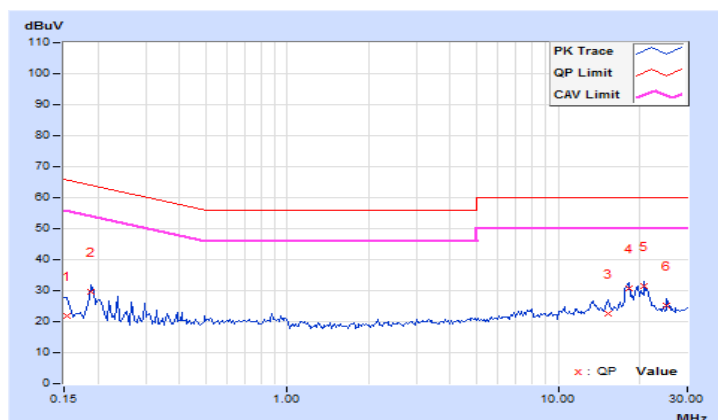
#### 4.2.8 Test Results (Mode 2)

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

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.02	11.72	6.80	21.74	16.82	65.79	55.79	-44.05	-38.97
2	0.18906	10.04	19.64	10.52	29.68	20.56	64.08	54.08	-34.40	-33.52
3	15.26953	10.81	11.67	3.28	22.48	14.09	60.00	50.00	-37.52	-35.91
4	18.24609	10.98	19.71	16.09	30.69	27.07	60.00	50.00	-29.31	-22.93
5	20.86328	11.08	20.50	12.99	31.58	24.07	60.00	50.00	-28.42	-25.93
6	25.23047	11.15	14.17	13.28	25.32	24.43	60.00	50.00	-34.68	-25.57

#### 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

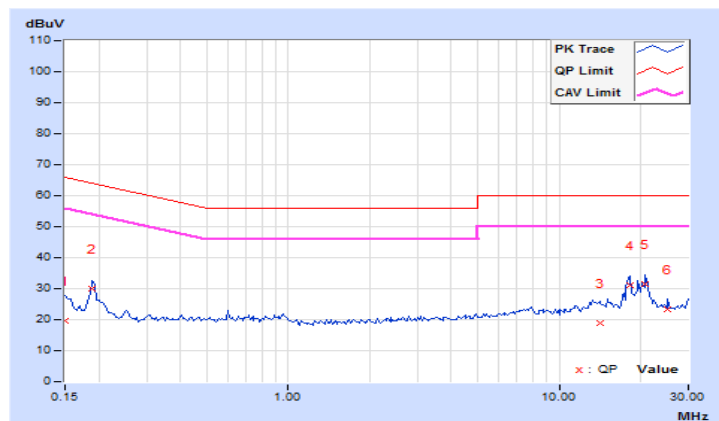


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.93	9.62	2.49	19.55	12.42	66.00	56.00	-46.45	-43.58
2	0.18906	9.94	20.16	10.22	30.10	20.16	64.08	54.08	-33.98	-33.92
3	14.09375	10.58	8.24	1.83	18.82	12.41	60.00	50.00	-41.18	-37.59
4	18.24219	10.78	20.29	16.45	31.07	27.23	60.00	50.00	-28.93	-22.77
5	20.86328	10.88	20.60	12.53	31.48	23.41	60.00	50.00	-28.52	-26.59
6	25.23047	10.92	12.40	11.44	23.32	22.36	60.00	50.00	-36.68	-27.64

**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

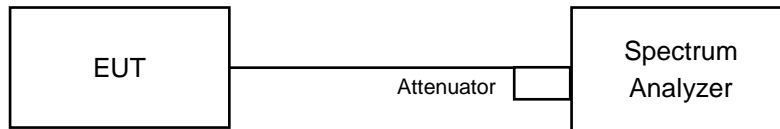


### 4.3 Conducted Out of Band Emission Measurement

#### 4.3.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

#### 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

##### MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

##### MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

#### 4.3.5 Deviation from Test Standard

No deviation.

#### 4.3.6 EUT Operating Conditions

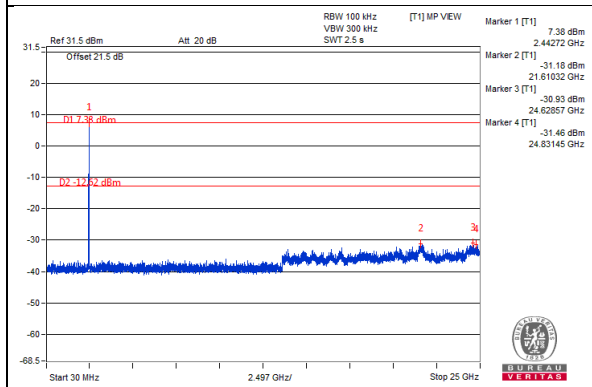
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### 4.3.7 Test Results

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

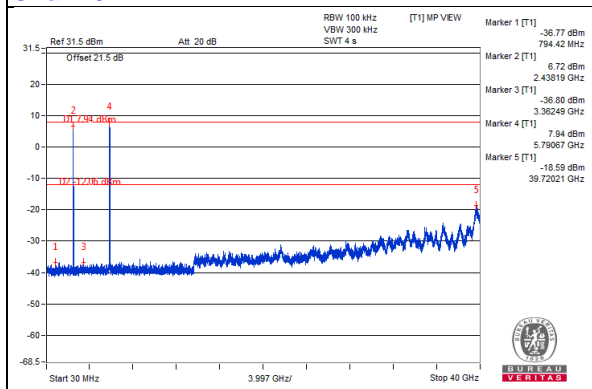
## 2.4GHz\_802.11g CH6 + BT-EDR CH39

### Chain 0



## 5GHz\_802.11ac(VHT40) CH159 + BT-EDR CH39

### Chain 0



## 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:

**Linko EMC/RF Lab**

Tel: 886-2-26052180

Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab**

Tel: 886-3-6668565

Fax: 886-3-6668323

**Hwa Ya EMC/RF/Safety Lab**

Tel: 886-3-3183232

Fax: 886-3-3270892

**Email:** [service.adt@tw.bureauveritas.com](mailto:service.adt@tw.bureauveritas.com)

**Web Site:** [www.bureauveritas-adt.com](http://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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