

## FCC Test Report (Z-Wave)

**Report No.:** RF190711E04-2

**FCC ID:** 2APLE18300399

**Test Model:** VMB4540

**PCBA Rev:** V005

**Received Date:** July 11, 2019

**Test Date:** July 22 to Aug. 02, 2019

**Issued Date:** Aug. 21, 2019

**Applicant:** Arlo Technologies, Inc.

**Address:** 2200 Faraday Ave. Suite 150, Carlsbad, CA 92008

**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



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

## Table of Contents

<b>Release Control Record .....</b>	<b>3</b>
<b>1 Certificate of Conformity .....</b>	<b>4</b>
<b>2 Summary of Test Results .....</b>	<b>5</b>
2.1 Measurement Uncertainty .....	5
2.2 Modification Record .....	5
<b>3 General Information .....</b>	<b>6</b>
3.1 General Description of EUT (Z-Wave) .....	6
3.2 Description of Test Modes .....	8
3.2.1 Test Mode Applicability and Tested Channel Detail .....	9
3.3 Duty Cycle of Test Signal .....	11
3.4 Description of Support Units .....	12
3.4.1 Configuration of System under Test .....	13
3.5 General Description of Applied Standards .....	14
<b>4 Test Types and Results .....</b>	<b>15</b>
4.1 Radiated Emission and Bandedge Measurement .....	15
4.1.1 Limits of Radiated Emission and Bandedge Measurement .....	15
4.1.2 Test Instruments .....	16
4.1.3 Test Procedures .....	17
4.1.4 Deviation from Test Standard .....	17
4.1.5 Test Setup .....	18
4.1.6 EUT Operating Conditions .....	19
4.1.7 Test Results .....	20
4.2 Conducted Emission Measurement .....	29
4.2.1 Limits of Conducted Emission Measurement .....	29
4.2.2 Test Instruments .....	29
4.2.3 Test Procedures .....	30
4.2.4 Deviation from Test Standard .....	30
4.2.5 Test Setup .....	30
4.2.6 EUT Operating Conditions .....	30
4.2.7 Test Results .....	31
4.3 20dB Bandwidth Measurement .....	33
4.3.1 Limits of 20dB Bandwidth Measurement .....	33
4.3.2 Test Instruments .....	33
4.3.3 Test Procedure .....	33
4.3.4 Test Setup .....	33
4.3.5 Deviation from Test Standard .....	33
4.3.6 EUT Operating Condition .....	33
4.3.7 Test Results .....	34
<b>5 Pictures of Test Arrangements .....</b>	<b>35</b>
<b>Appendix – Information of the Testing Laboratories .....</b>	<b>36</b>

### Release Control Record

Issue No.	Description	Date Issued
RF190711E04-2	Original release.	Aug. 21, 2019

## 1 Certificate of Conformity

**Product:** Arlo Pro 3 SmartHub

**Brand:** Arlo

**Test Model:** VMB4540

**PCBA Rev:** V005

**Sample Status:** ENGINEERING SAMPLE

**Applicant:** Arlo Technologies, Inc.

**Test Date:** July 22 to Aug. 02, 2019

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.249)  
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:** Aug. 21, 2019  
Wendy Wu / Specialist

**Approved by :** May Chen , **Date:** Aug. 21, 2019  
May Chen / Manager

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.249)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -13.98dB at 16.46484MHz.
15.209 15.249 15.249 (d)	Radiated Emission Test Band Edge Measurement Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209	PASS	Meet the requirement of limit. Minimum passing margin is -0.3dB at 908MHz.
15.215 (c)	20dB Bandwidth	PASS	Meet the requirement of limit
15.203	Antenna Requirement	PASS	No antenna connector is used.

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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.8 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	4.9 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.1 dB
	6GHz ~ 18GHz	4.9 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 (Z-Wave)

Product	Arlo Pro 3 SmartHub
Brand	Arlo
Test Model	VMB4540
PCBA Rev	V005
S/N	A081957BA0091
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	12Vdc from power adapter
Modulation Type	FSK
Transfer Rate	9.6/40/100 kbps
Operating Frequency	908.4 ~ 916MHz
Number of Channel	3
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x1
Data Cable Supplied	RJ45 cable x 1 (Unshielded, 1.8m)

Note:

- There are WLAN, Z-Wave, Zigbee and Sub-GHz technology used for the EUT. The EUT has below radios as following table:

Radio 1	Radio 2	Radio 3	Radio 4
WLAN 2.4GHz	Z-Wave	Zigbee	Sub-GHz

- Simultaneously transmission condition.

Condition	Technology			
1	WLAN 2.4GHz	Z-Wave	Zigbee	Sub-GHz

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

- The EUT must be supplied with a power adapter and following different models could be chosen as following table:

No.	Brand	Model No.	Spec.	Color
1	Arlo	2AAJ018F1	Input: 100-120Vac, 0.6A, 50/60Hz Output: 12V, 1.5A DC output cable (Unshielded, 1.8m)	Black/White
2	Arlo	2AAJ018FC	Input: 100-240Vac, 0.6A, 50/60Hz Output: 12V, 1.5A DC output cable (Unshielded, 1.8m)	Black/White
3	Arlo	AD2076F10	Input: 100-120Vac, 0.56A, 50/60Hz Output: 12V, 1.5A DC output cable (Unshielded, 1.8m)	Black/White

Note: From the above models, the worst radiated emission and AC power conducted emission test was found in **Adapter 3**. Therefore only the test data of the modes were recorded in this report.

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

WLAN					
Ant No.	Antenna Net Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type	Cable Length (mm)
1	2.8	2.4~2.4835	Dipole	i-pex (MHF)	65
2	2.5	2.4~2.4835	Dipole	i-pex (MHF)	85
Sub-GHz					
Ant No.	Antenna Gain (dBi)	Frequency rang (MHz)	Antenna type	Connector type	
1	1	860~930	PIFA	NA	
Z-Wave					
Ant No.	Antenna Gain (dBi)	Frequency rang (MHz)	Antenna type	Connector type	
1	1	860~930	PIFA	NA	
Zigbee					
Ant No.	Antenna Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type	
1	3	2.4~2.4835	Chip	NA	

5. 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

3 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	908.4 (9.6kbps)	3	916 (100kbps)
2	908.4 (40kbps)		



### 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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

#### **Radiated Emission Test (Above 1GHz):**

- ☒ 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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 3	1, 2, 3	FSK

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

- ☒ 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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 3	1, 2, 3	FSK

#### **Power Line Conducted 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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 3	3	FSK

#### **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.

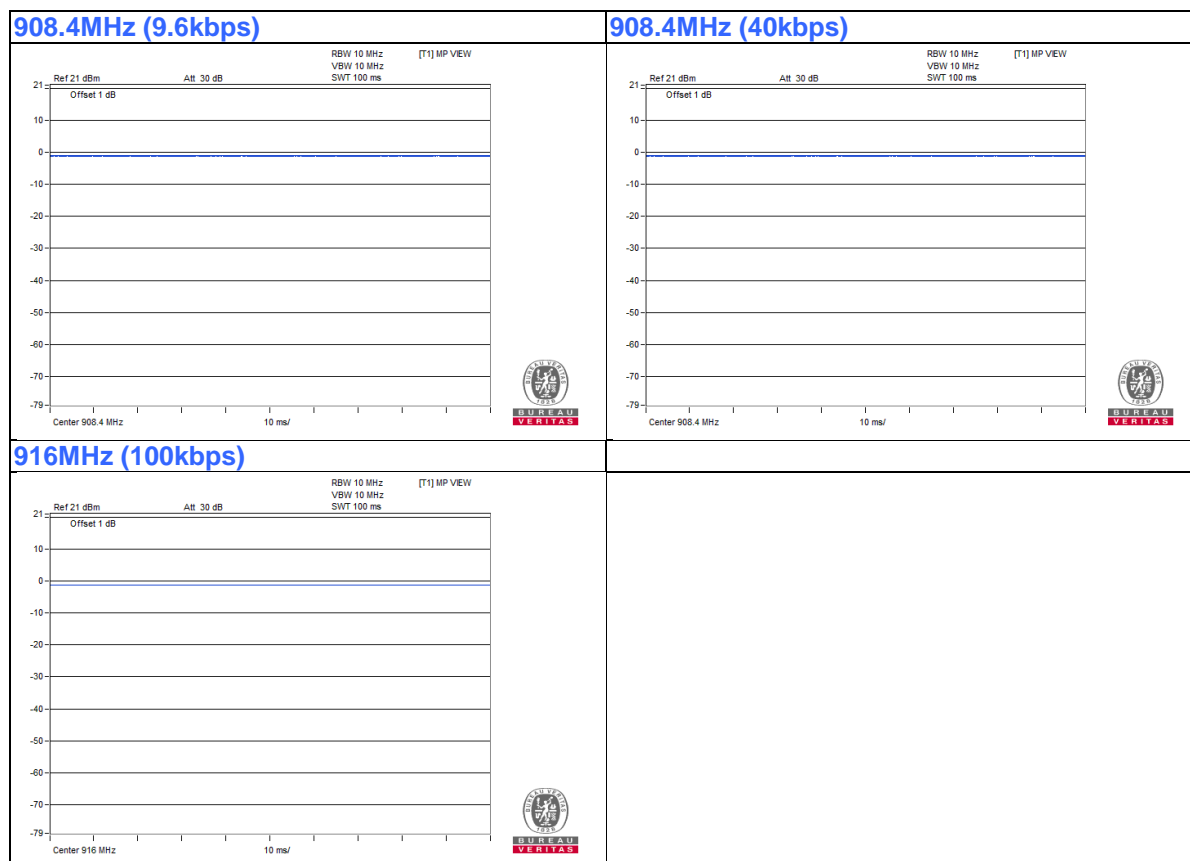
AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 3	1, 2, 3	FSK

**Test Condition:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE $\geq$ 1G	21deg. C, 70%RH	120Vac, 60Hz	Ryan Du
RE<1G	21deg. C, 70%RH	120Vac, 60Hz	Ryan Du
PLC	23deg. C, 76%RH	120Vac, 60Hz	Andy Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

### 3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100 %, duty factor is not required.



### 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.

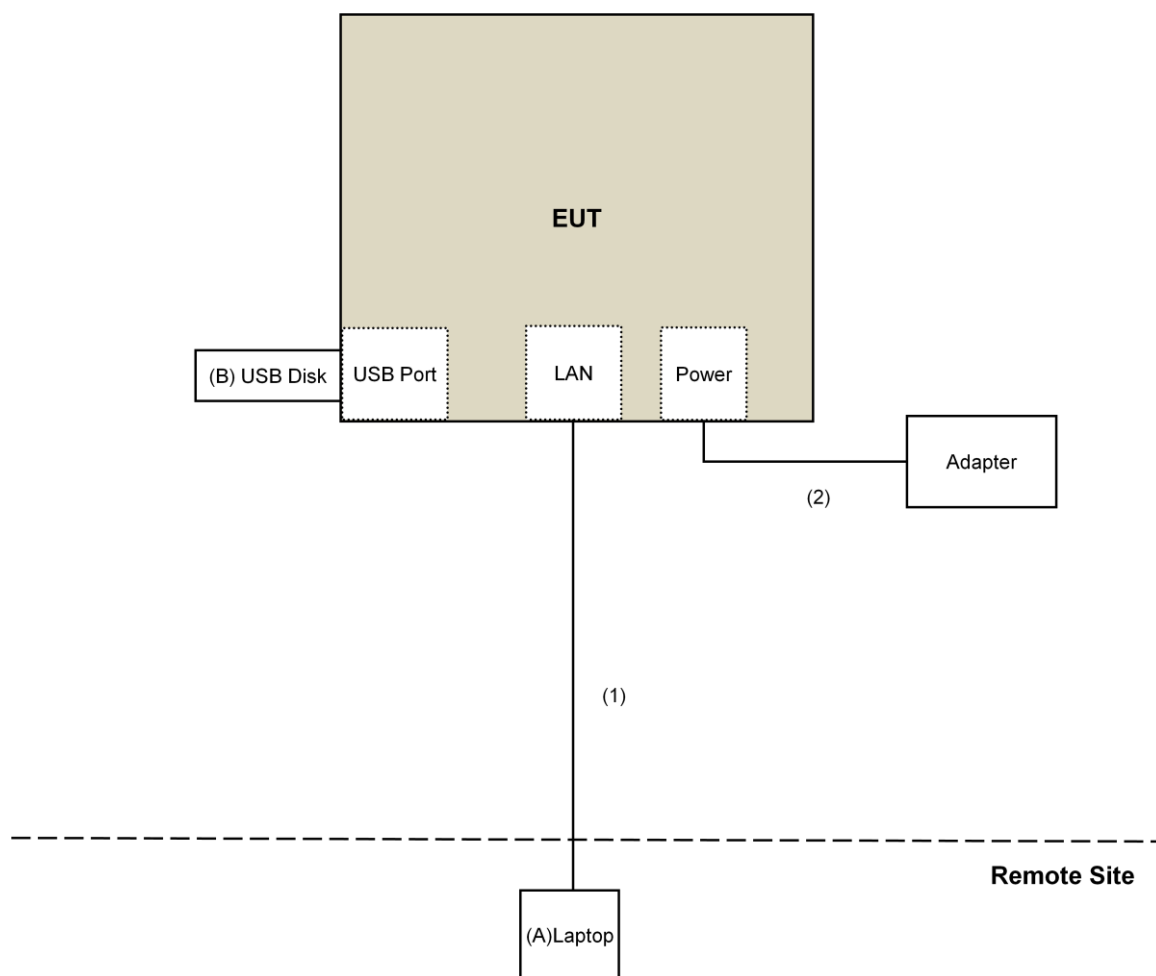
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	E6420	482T3R1	FCC DoC	Provided by Lab
B.	USB Disk	SanDisk	USB 3.0 Flash Drive	NA	NA	Provided by Lab

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.	RJ-45 Cable	1	10	No	0	Provided by Lab
2.	DC Cable	1	1.8	No	0	Supplied by client

### 3.4.1 Configuration of System under Test



### 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 (15.249)**

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

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 ~ 928 MHz	50	500
2400 ~ 2483.5 MHz	50	500
5725 ~ 5875 MHz	50	500
24 ~ 24.25 GHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits as below table, whichever is the lesser attenuation

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	$2400/F(\text{kHz})$	300
0.490 ~ 1.705	$24000/F(\text{kHz})$	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 Keysight	N9038A	MY54450088	July 03, 2019	July 02, 2020
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-01	Oct. 30, 2018	Oct. 29, 2019
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 22, 2018	Nov. 21, 2019
RF Cable	8D	966-4-1	Mar. 19, 2019	Mar. 18, 2020
RF Cable	8D	966-4-2	Mar. 19, 2019	Mar. 18, 2020
RF Cable	8D	966-4-3	Mar. 19, 2019	Mar. 18, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Sep. 27, 2018	Sep. 26, 2019
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCi	EMC12630SE	980385	Aug. 16, 2018	Aug. 15, 2019
RF Cable	EMC104-SM-SM-1200	160923	Jan. 28, 2019	Jan. 27, 2020
RF Cable	104 RF cable	131215	Jan. 10, 2019	Jan. 09, 2020
RF Cable	EMC104-SM-SM-6000	180418	May 03, 2019	May 02, 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
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	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. 4.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: July 22 to Aug. 02, 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:**

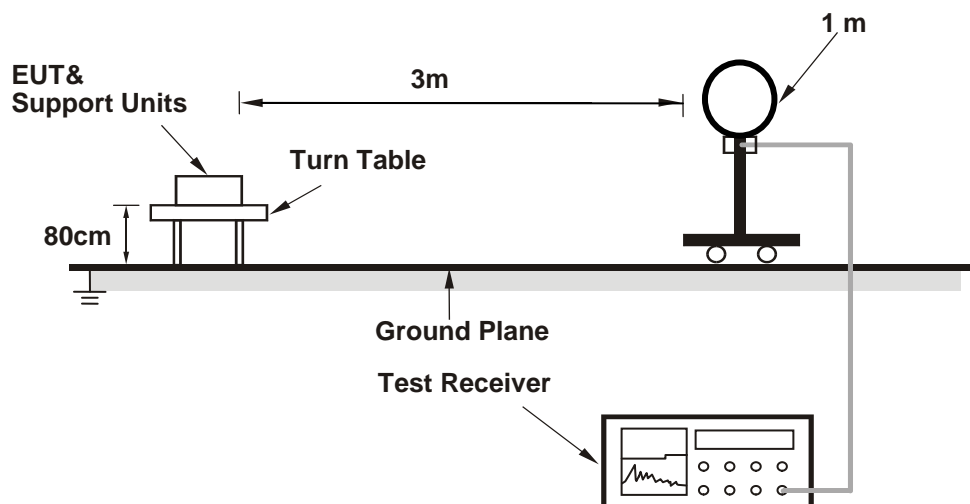
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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

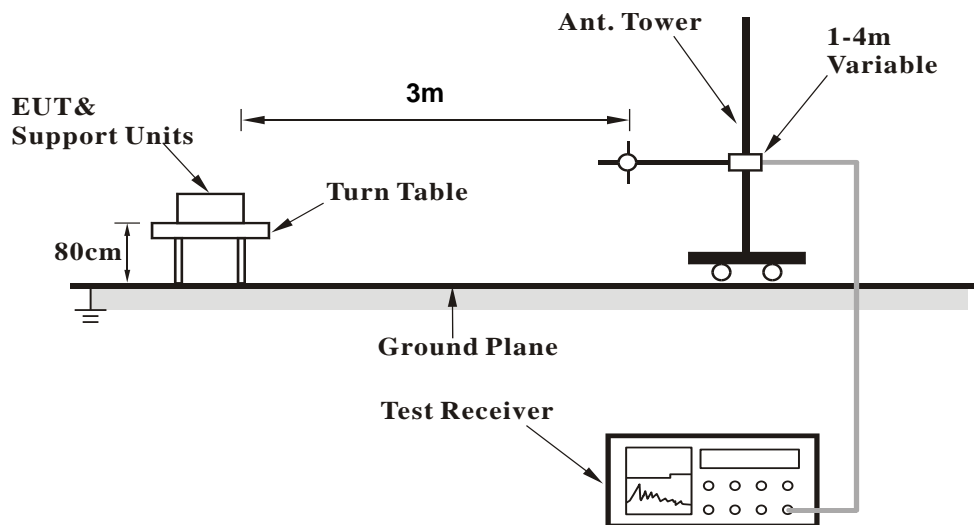
No deviation.

#### 4.1.5 Test Setup

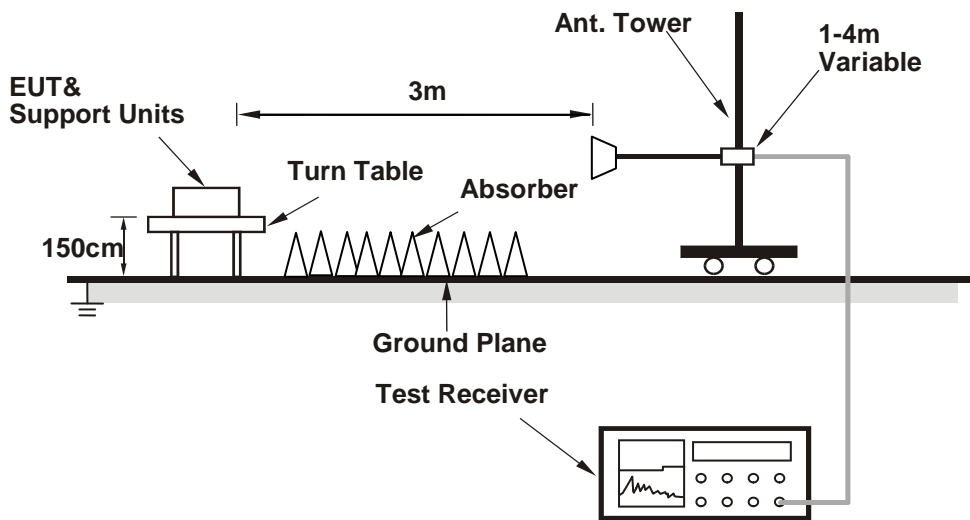
##### For Radiated emission below 30MHz



##### 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

- Connected the EUT with the Laptop which is placed on remote site.
- Controlling software (HyperTerminal paste 115200 Z-wave.txt) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

#### 4.1.7 Test Results

##### Above 1GHz Data:

<b>CHANNEL</b>	TX Channel 1	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 10GHz		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	#1816.80	42.7 PK	74.0	-31.3	2.21 H	147	46.8	-4.1
2	#1816.80	37.0 AV	54.0	-17.0	2.21 H	147	41.1	-4.1
3	2725.20	51.9 PK	74.0	-22.1	1.62 H	30	53.3	-1.4
4	2725.20	44.8 AV	54.0	-9.2	1.62 H	30	46.2	-1.4
5	3633.60	44.6 PK	74.0	-29.4	1.34 H	175	44.7	-0.1
6	3633.60	38.4 AV	54.0	-15.6	1.34 H	175	38.5	-0.1
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	#1816.80	41.6 PK	74.0	-32.4	3.32 V	216	45.7	-4.1
2	#1816.80	36.3 AV	54.0	-17.7	3.32 V	216	40.4	-4.1
3	2725.20	53.1 PK	74.0	-20.9	1.36 V	39	54.5	-1.4
4	2725.20	46.1 AV	54.0	-7.9	1.36 V	39	47.5	-1.4
5	3633.60	42.5 PK	74.0	-31.5	2.46 V	146	42.6	-0.1
6	3633.60	36.3 AV	54.0	-17.7	2.46 V	146	36.4	-0.1

##### 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. " # ": The radiated frequency is out of the restricted band.

<b>CHANNEL</b>	TX Channel 2	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 10GHz		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	1816.80	42.9 PK	74.0	-31.1	2.12 H	178	47.0	-4.1
2	1816.80	37.2 AV	54.0	-16.8	2.12 H	178	41.3	-4.1
3	2725.20	52.1 PK	74.0	-21.9	1.49 H	12	53.5	-1.4
4	2725.20	45.0 AV	54.0	-9.0	1.49 H	12	46.4	-1.4
5	3633.60	45.6 PK	74.0	-28.4	1.14 H	140	45.7	-0.1
6	3633.60	39.5 AV	54.0	-14.5	1.14 H	140	39.6	-0.1
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	1816.80	42.5 PK	74.0	-31.5	2.80 V	199	46.6	-4.1
2	1816.80	36.7 AV	54.0	-17.3	2.80 V	199	40.8	-4.1
3	2725.20	53.5 PK	74.0	-20.5	1.59 V	35	54.9	-1.4
4	2725.20	46.6 AV	54.0	-7.4	1.59 V	35	48.0	-1.4
5	3633.60	42.8 PK	74.0	-31.2	2.61 V	240	42.9	-0.1
6	3633.60	36.6 AV	54.0	-17.4	2.61 V	240	36.7	-0.1

**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.

<b>CHANNEL</b>	TX Channel 3	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 10GHz		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	1832.00	45.8 PK	74.0	-28.2	2.23 H	184	49.9	-4.1
2	1832.00	36.8 AV	54.0	-17.2	2.23 H	184	40.9	-4.1
3	2748.00	48.6 PK	74.0	-25.4	1.53 H	5	49.9	-1.3
4	2748.00	44.1 AV	54.0	-9.9	1.53 H	5	45.4	-1.3
5	3664.00	42.8 PK	74.0	-31.2	1.03 H	133	42.8	0.0
6	3664.00	35.9 AV	54.0	-18.1	1.03 H	133	35.9	0.0
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	1832.00	42.1 PK	74.0	-31.9	3.57 V	287	46.2	-4.1
2	1832.00	36.2 AV	54.0	-17.8	3.57 V	287	40.3	-4.1
3	2748.00	51.5 PK	74.0	-22.5	1.22 V	34	52.8	-1.3
4	2748.00	45.9 AV	54.0	-8.1	1.22 V	34	47.2	-1.3
5	3664.00	39.5 PK	74.0	-34.5	2.36 V	134	39.5	0.0
6	3664.00	32.6 AV	54.0	-21.4	2.36 V	134	32.6	0.0

**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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

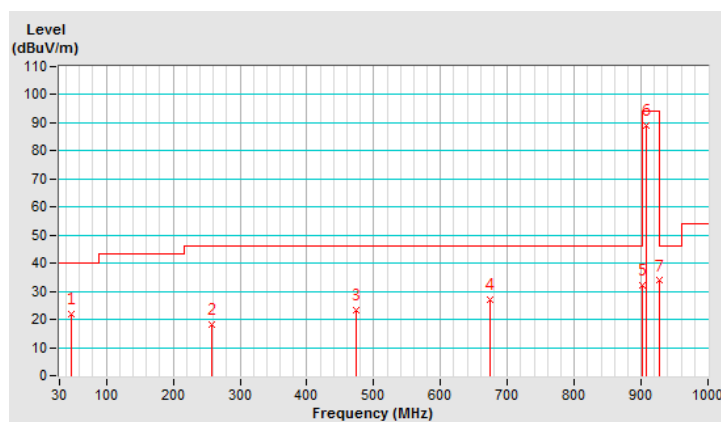
# Below 1GHz Data:

CHANNEL	TX Channel 1	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	48.36	22.0 QP	40.0	-18.0	1.42 H	88	30.1	-8.1
2	257.71	18.4 QP	46.0	-27.6	1.56 H	22	26.9	-8.5
3	473.09	23.2 QP	46.0	-22.8	1.51 H	86	25.4	-2.2
4	674.87	27.1 QP	46.0	-18.9	1.43 H	127	25.3	1.8
5	902.00	32.3 QP	46.0	-13.7	1.43 H	97	26.1	6.2
6	*908.40	89.0 QP	94.0	-5.0	1.43 H	97	82.8	6.2
7	928.00	33.9 QP	46.0	-12.1	1.43 H	97	27.2	6.7

## 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.
6. " \* ": Fundamental frequency.

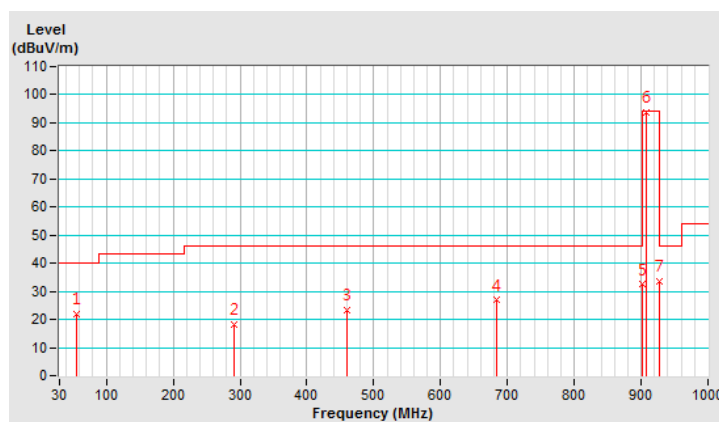


<b>CHANNEL</b>	TX Channel 1	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	9kHz ~ 1GHz		

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	55.61	22.0 QP	40.0	-18.0	1.39 V	88	30.3	-8.3
2	292.11	18.3 QP	46.0	-27.7	1.33 V	45	25.6	-7.3
3	459.32	23.3 QP	46.0	-22.7	1.35 V	66	25.8	-2.5
4	683.93	26.9 QP	46.0	-19.1	1.19 V	154	24.9	2.0
5	902.00	32.4 QP	46.0	-13.6	1.41 V	93	26.2	6.2
<b>6</b>	<b>*908.40</b>	<b>93.7 QP</b>	<b>94.0</b>	<b>-0.3</b>	<b>1.41 V</b>	<b>93</b>	<b>87.5</b>	<b>6.2</b>
7	928.00	33.7 QP	46.0	-12.3	1.41 V	93	27.0	6.7

#### 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.
6. " \* ": Fundamental frequency.



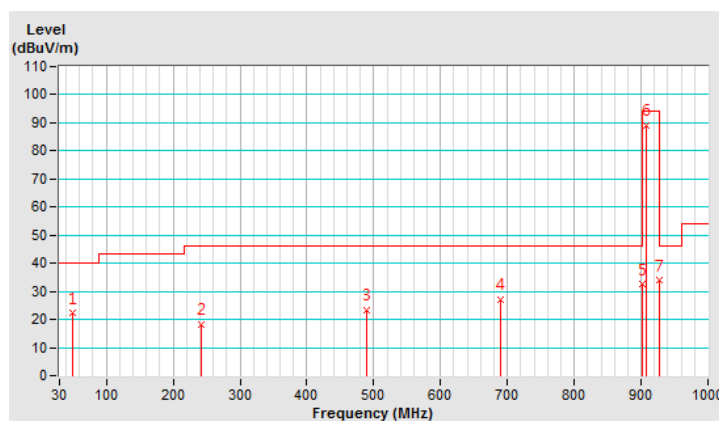


<b>CHANNEL</b>	TX Channel 2	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	9kHz ~ 1GHz		

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	50.36	22.2 QP	40.0	-17.8	1.63 H	235	30.3	-8.1
2	242.26	18.1 QP	46.0	-27.9	1.22 H	49	27.0	-8.9
3	489.21	23.3 QP	46.0	-22.7	1.63 H	119	25.3	-2.0
4	689.63	27.2 QP	46.0	-18.8	1.52 H	133	25.2	2.0
5	902.00	32.4 QP	46.0	-13.6	1.63 H	73	26.2	6.2
6	*908.40	89.1 QP	94.0	-4.9	1.63 H	73	82.9	6.2
7	928.00	33.8 QP	46.0	-12.2	1.63 H	73	27.1	6.7

#### 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.
6. " \* ": Fundamental frequency.

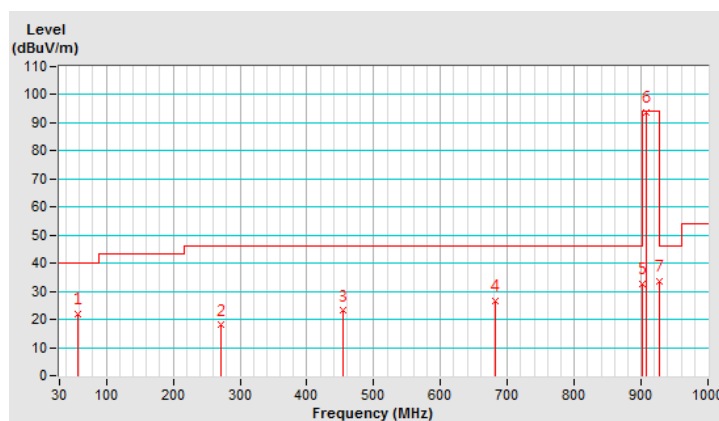


<b>CHANNEL</b>	TX Channel 2	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	9kHz ~ 1GHz		

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	58.05	22.1 QP	40.0	-17.9	1.03 V	155	30.6	-8.5
2	271.78	18.0 QP	46.0	-28.0	1.29 V	62	25.8	-7.8
3	453.60	23.1 QP	46.0	-22.9	1.39 V	44	25.6	-2.5
4	681.00	26.8 QP	46.0	-19.2	1.33 V	126	24.8	2.0
5	902.00	32.6 QP	46.0	-13.4	1.23 V	119	26.4	6.2
6	*908.40	93.6 QP	94.0	-0.4	1.23 V	119	87.4	6.2
7	928.00	33.6 QP	46.0	-12.4	1.23 V	119	26.9	6.7

#### 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.
6. " \* ": Fundamental frequency.

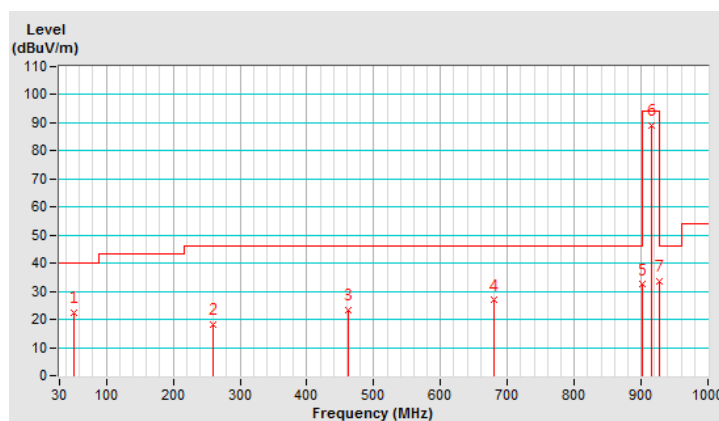


<b>CHANNEL</b>	TX Channel 3	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	9kHz ~ 1GHz		

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	52.44	22.3 QP	40.0	-17.7	1.16 H	199	30.5	-8.2
2	259.22	18.2 QP	46.0	-27.8	1.19 H	53	26.6	-8.4
3	462.20	23.2 QP	46.0	-22.8	1.47 H	100	25.7	-2.5
4	679.36	26.9 QP	46.0	-19.1	1.62 H	141	24.9	2.0
5	902.00	32.5 QP	46.0	-13.5	1.72 H	65	26.3	6.2
6	*916.00	89.2 QP	94.0	-4.8	1.72 H	65	82.8	6.4
7	928.00	33.7 QP	46.0	-12.3	1.72 H	65	27.0	6.7

#### 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.
5. " \* ": Fundamental frequency.

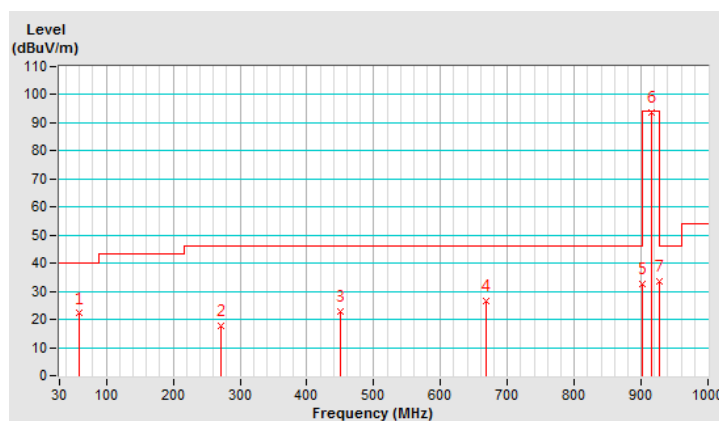


<b>CHANNEL</b>	TX Channel 3	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	9kHz ~ 1GHz		

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	58.60	22.2 QP	40.0	-17.8	1.00 V	163	30.8	-8.6
2	271.26	17.8 QP	46.0	-28.2	1.22 V	46	25.7	-7.9
3	450.71	22.9 QP	46.0	-23.1	1.33 V	29	25.4	-2.5
4	668.99	26.7 QP	46.0	-19.3	1.41 V	121	25.1	1.6
5	902.00	32.7 QP	46.0	-13.3	1.19 V	113	26.5	6.2
6	*916.00	93.7 QP	94.0	-0.3	1.19 V	113	87.3	6.4
7	928.00	33.5 QP	46.0	-12.5	1.19 V	113	26.8	6.7

#### 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.
5. " \* ": Fundamental frequency.



## 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. 28, 2018	Sep. 27, 2019
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: July 31, 2019

#### 4.2.3 Test Procedures

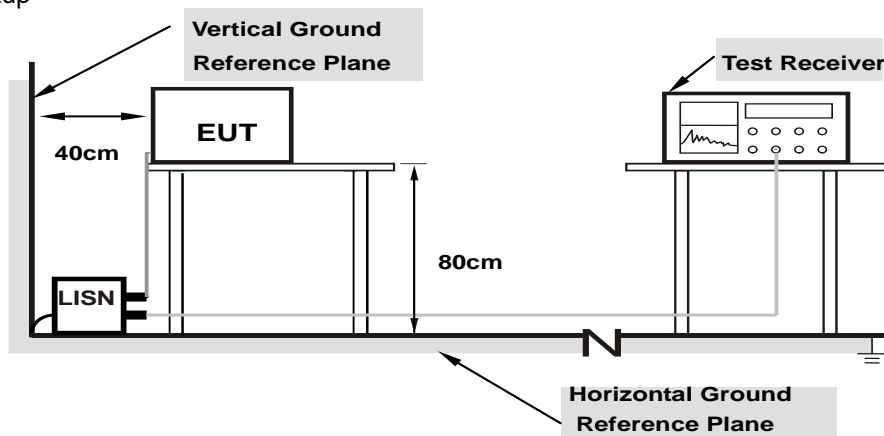
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

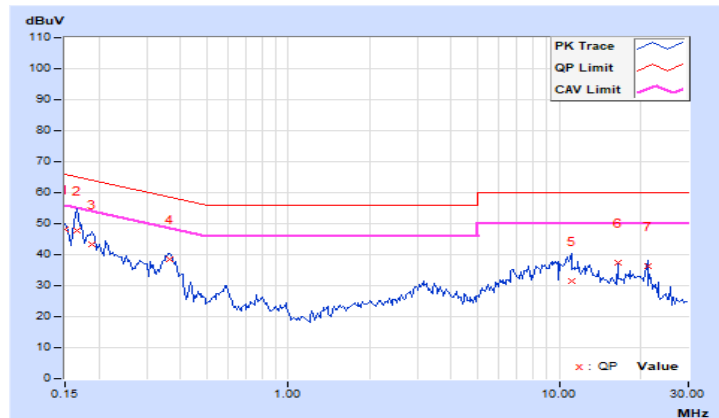
#### 4.2.7 Test Results

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

No	Freq. [MHz]	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.96	38.30	19.24	48.26	29.20	66.00	56.00	-17.74	-26.80
2	0.16562	9.97	37.81	23.57	47.78	33.54	65.18	55.18	-17.40	-21.64
3	0.18906	9.97	33.27	18.09	43.24	28.06	64.08	54.08	-20.84	-26.02
4	0.36484	9.98	28.38	23.32	38.36	33.30	58.62	48.62	-20.26	-15.32
5	11.08594	10.72	20.78	14.23	31.50	24.95	60.00	50.00	-28.50	-25.05
<b>6</b>	<b>16.46484</b>	<b>11.10</b>	<b>26.47</b>	<b>24.92</b>	<b>37.57</b>	<b>36.02</b>	<b>60.00</b>	<b>50.00</b>	<b>-22.43</b>	<b>-13.98</b>
7	21.17188	11.39	25.06	23.25	36.45	34.64	60.00	50.00	-23.55	-15.36

#### 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

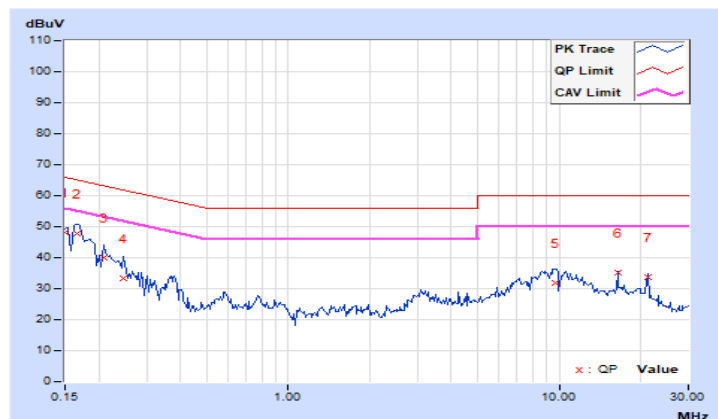


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.94	38.34	18.16	48.28	28.10	66.00	56.00	-17.72	-27.90
2	0.16562	9.95	37.83	23.19	47.78	33.14	65.18	55.18	-17.40	-22.04
3	0.20859	9.95	29.90	14.81	39.85	24.76	63.26	53.26	-23.41	-28.50
4	0.24766	9.95	23.55	9.52	33.50	19.47	61.84	51.84	-28.34	-32.37
5	9.63672	10.53	21.35	15.38	31.88	25.91	60.00	50.00	-28.12	-24.09
6	16.46484	10.90	24.36	22.82	35.26	33.72	60.00	50.00	-24.74	-16.28
7	21.17188	11.11	22.46	20.63	33.57	31.74	60.00	50.00	-26.43	-18.26

#### 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 20dB Bandwidth Measurement

#### 4.3.1 Limits of 20dB Bandwidth Measurement

The 20dB bandwidth shall be specified in operating frequency band.

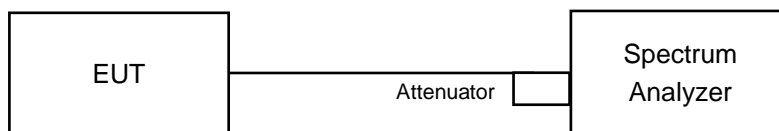
#### 4.3.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.3 Test Procedure

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3kHz RBW and 10kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

#### 4.3.4 Test Setup



#### 4.3.5 Deviation from Test Standard

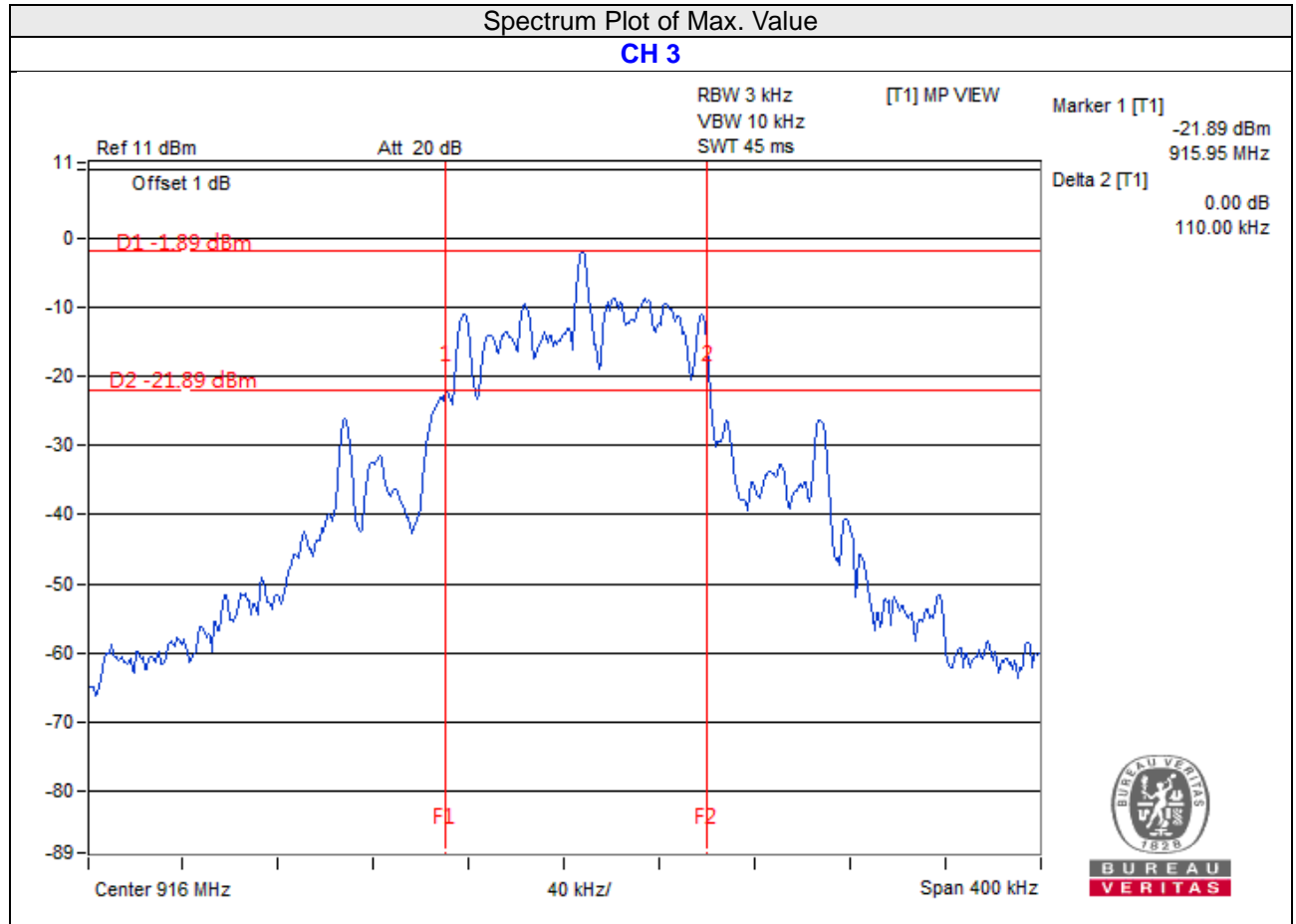
No deviation.

#### 4.3.6 EUT Operating Condition

Set the EUT under transmission condition continuously at specific channel frequency.

#### 4.3.7 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
1	908.4	0.08
2	908.4	0.08
3	916	0.11



## 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 accredited and approved according to ISO/IEC 17025.

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

**Lin Kou 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.

--- END ---