

FCC Test Report (Z-Wave)

(Spot Check)

Report No.: RF180830E03F-4

FCC ID: 2APLE18300398

Original FCC ID: 2APLE18300394

Test Model: VMB5000

Revision: Rev 5

Received Date: May 15, 2019

Test Date: May 20 to 27, 2019

Issued Date: June 12, 2019

Applicant: Arlo Technologies, Inc.

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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
RF180830E03F-4	Original release.	June 12, 2019

1 Certificate of Conformity

Product: Alro Gen5 Entry Hub

Brand: Arlo

Test Model: VMB5000

Revision: Rev 5

Sample Status: Pre Production Unit

Applicant: Arlo Technologies, Inc.

Test Date: May 20 to 27, 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:** June 12, 2019
Wendy Wu / Specialist

Approved by : May Chen , **Date:** June 12, 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 -13.61dB at 0.15000MHz.
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 908.40MHz.

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 (Z-Wave)

Product	Alro Gen5 Entry Hub
Brand	Arlo
Test Model	VMB5000
Revision	Rev 5
S/N	5GH2917EA29A4
Status of EUT	Pre Production Unit
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	NA

Note:

- Exhibit prepared for FCC Spot Check Verification report, the format, test items and amount of spot-check test data are decided by applicant's engineering judgment, for more details please refer to declaration letter exhibit.
- 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+5GHz band)	Z-Wave	Zigbee	Sub-GHz

3. Simultaneously transmission condition.

Condition	Technology				
1	WLAN 2.4GHz	WLAN 5GHz	Z-Wave	Zigbee	Sub-GHz

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

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

No.	Brand	Model No.	Spec.
1	Arlo	AD2076F10	Input: 100-120Vac, 0.56A, 50/60Hz Output: 12Vdc, 1.5A DC output cable (Unshielded, 1.8m)
2	Arlo	AD2067M20	Input: 100-240Vac, 1.0A, 50/60Hz Output: 12Vdc, 2.5A DC output cable (Unshielded, 1.8m)
3	Arlo	2ABB018F 1 NJ	Input: 100-120Vac, 0.6A, 50/60Hz Output: 12Vdc, 1.5A DC output cable (Unshielded, 1.8m)
4	Arlo	P030WM1251	Input: 100-240Vac, 1.0A, 50/60Hz Output: 12Vdc, 2.5A DC output cable (Unshielded, 1.8m)

Note: From the above models, the worst radiated emission and AC power conducted emission test was found in **Adapter 2**. Therefore only the test data of the modes were recorded in this report.

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

Sub-GHz							
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (MHz)	Antenna type	Connector type	
1	NA	902P00214N0	1.5	860~930	PIFA	NA	
Z-Wave							
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (MHz)	Antenna type	Connector type	
1	NA	902P00213N0	2.5	860~930	PIFA	NA	
Zigbee							
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type	
1	INPAQ TECHNOLOGY CO., LTD.	ACA-5036-A2-CC-S	3.5	2.4~2.4835	CHIP	NA	
WLAN							
Ant No.	Brand	Model	Antenna Net Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type	Cable Length (mm)
1	NA	9 07X01052X0	2.5	2.4~2.4835	Dipole	i-pex	75
			1.8	5.15~5.25			
			2	5.25~5.35			
			2.2	5.47~5.725			
			1.6	5.725~5.85			
2	NA	9 07X00747X19	2.5	2.4~2.4835	Dipole	i-pex	90
			2.2	5.15~5.25			
			1.2	5.25~5.35			
			3.2	5.47~5.725			
			3.5	5.725~5.85			

6. 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	1	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.

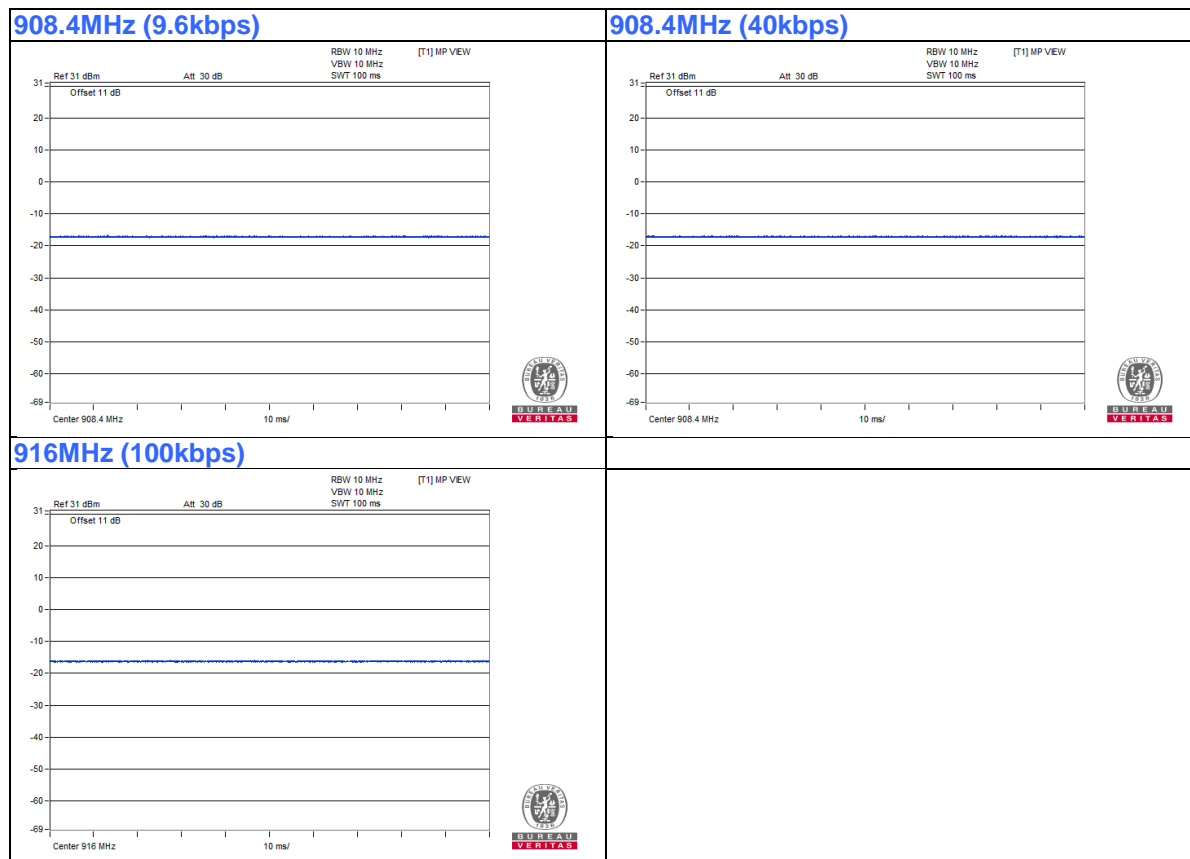
AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 3	1, 2, 3	FSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE \geq 1G	22deg. C, 67%RH	120Vac, 60Hz	Robert Cheng
RE $<$ 1G	23deg. C, 68%RH	120Vac, 60Hz	Ryan Du
PLC	25deg. C, 75%RH	120Vac, 60Hz	Andy Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Nelson Teng

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.

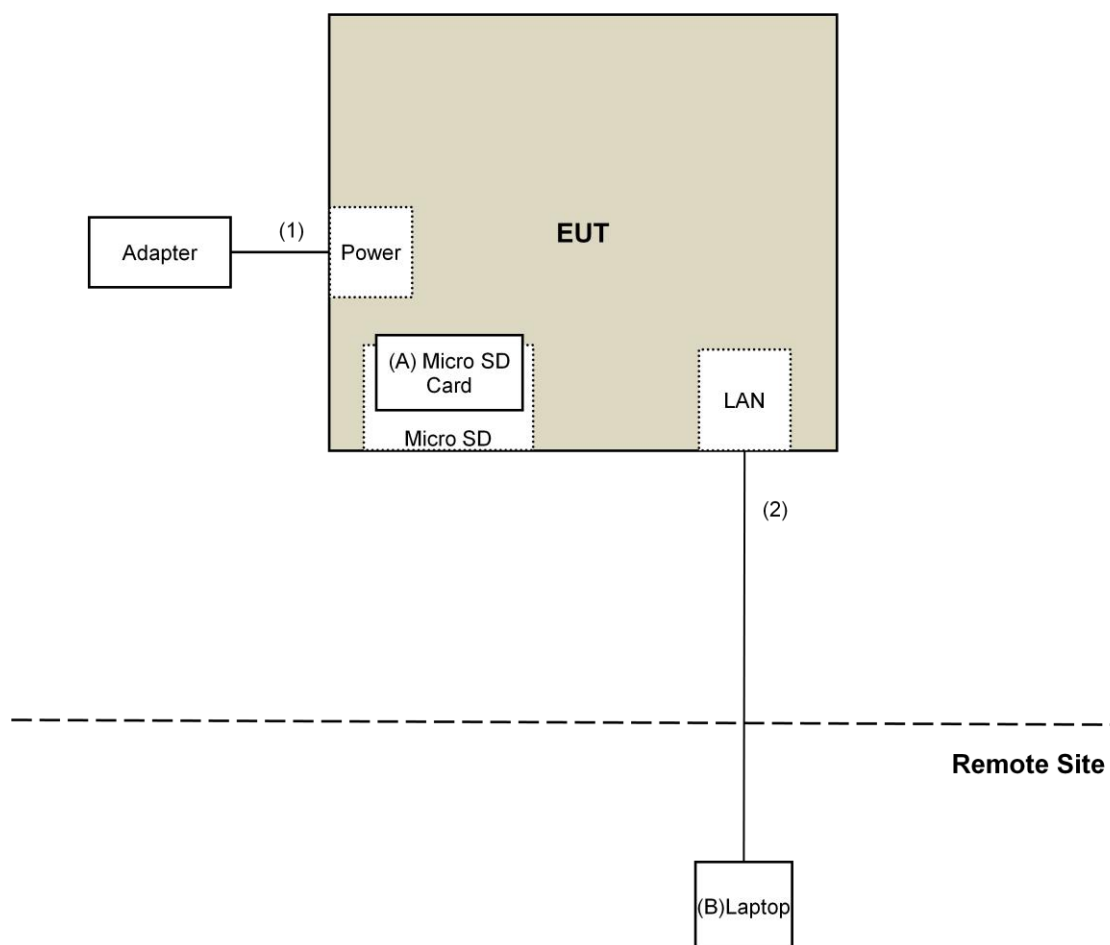
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	MicroSD Card	SanDisk	8GB	NA	NA	Provided by Lab
B.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab

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

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 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	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. 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

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: May 20 to 27, 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:

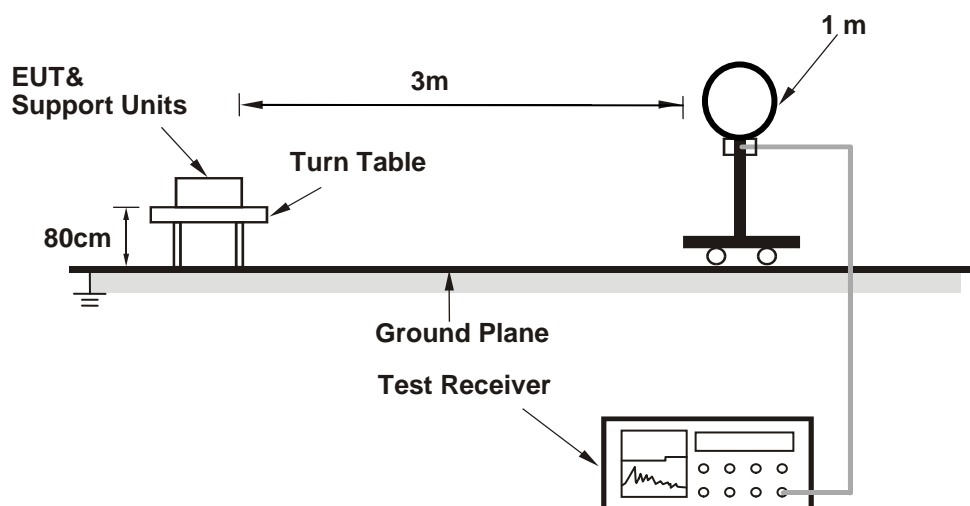
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

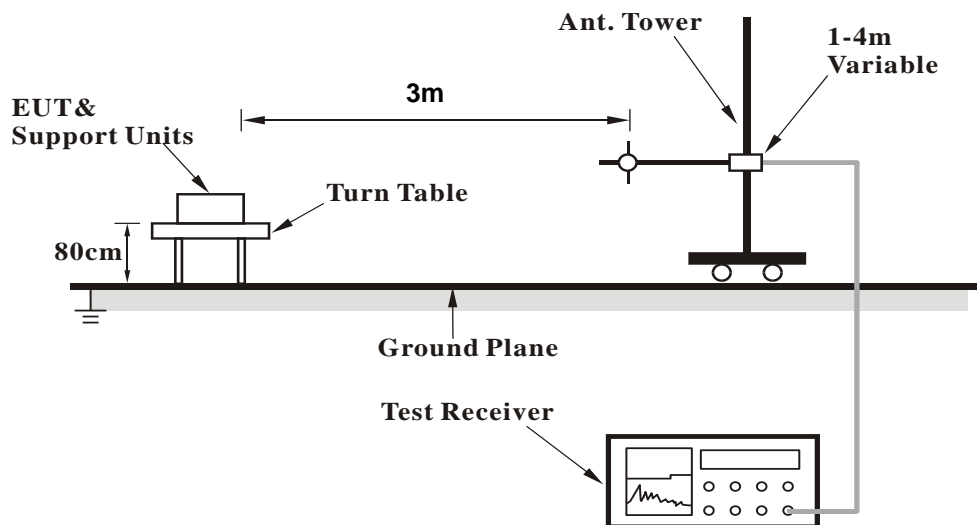
No deviation.

4.1.5 Test Setup

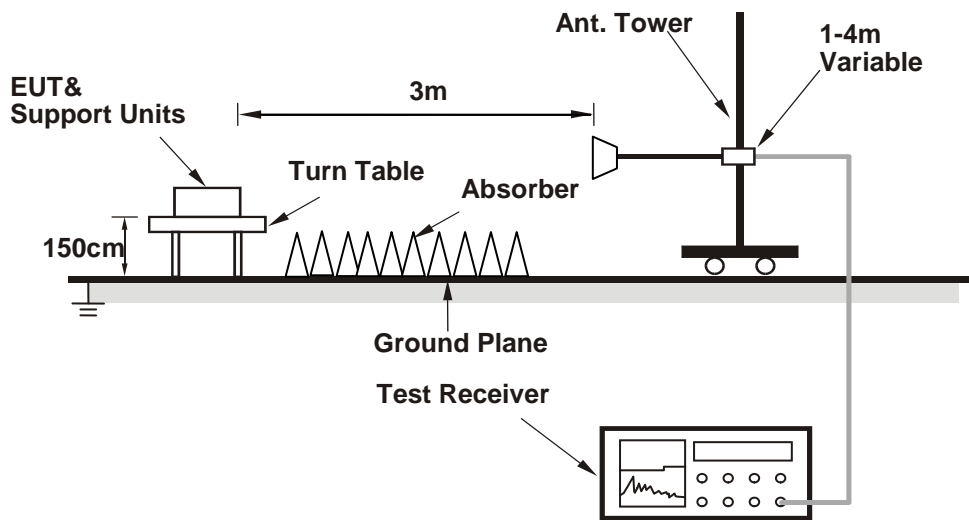
For Radiated emission below 30MHz



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 (Run teraturn paste TX command) has been activated to set the EUT on specific status.

4.1.7 Test Results

Above 1GHz Data:

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	41.9 PK	74.0	-32.1	1.49 H	185	46.6	-4.7
2	1816.80	28.8 AV	54.0	-25.2	1.49 H	185	33.5	-4.7
3	2725.20	44.0 PK	74.0	-30.0	1.47 H	199	45.6	-1.6
4	2725.20	31.8 AV	54.0	-22.2	1.47 H	199	33.4	-1.6
5	3633.60	46.0 PK	74.0	-28.0	1.59 H	214	46.2	-0.2
6	3633.60	33.5 AV	54.0	-20.5	1.59 H	214	33.7	-0.2
7	4542.00	46.9 PK	74.0	-27.1	1.60 H	185	45.4	1.5
8	4542.00	34.8 AV	54.0	-19.2	1.60 H	185	33.3	1.5
9	5450.40	48.6 PK	74.0	-25.4	1.48 H	177	45.4	3.2
10	5450.40	35.4 AV	54.0	-18.6	1.48 H	177	32.2	3.2
11	6358.80	49.8 PK	74.0	-24.2	1.49 H	237	44.8	5.0
12	6358.80	38.0 AV	54.0	-16.0	1.49 H	237	33.0	5.0
13	7267.20	53.4 PK	74.0	-20.6	1.55 H	196	45.2	8.2
14	7267.20	40.9 AV	54.0	-13.1	1.55 H	196	32.7	8.2
15	8175.60	53.6 PK	74.0	-20.4	1.65 H	226	44.7	8.9
16	8175.60	42.1 AV	54.0	-11.9	1.65 H	226	33.2	8.9
17	9084.00	53.8 PK	74.0	-20.2	1.53 H	359	44.0	9.8
18	9084.00	42.0 AV	54.0	-12.0	1.53 H	359	32.2	9.8

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	43.5 PK	74.0	-30.5	1.35 V	360	48.2	-4.7
2	1816.80	34.3 AV	54.0	-19.7	1.35 V	360	39.0	-4.7
3	2725.20	44.5 PK	74.0	-29.5	1.49 V	360	46.1	-1.6
4	2725.20	32.1 AV	54.0	-21.9	1.49 V	360	33.7	-1.6
5	3633.60	46.1 PK	74.0	-27.9	1.51 V	349	46.3	-0.2
6	3633.60	33.6 AV	54.0	-20.4	1.51 V	349	33.8	-0.2
7	4542.00	48.0 PK	74.0	-26.0	1.52 V	337	46.5	1.5
8	4542.00	35.6 AV	54.0	-18.4	1.52 V	337	34.1	1.5
9	5450.40	48.9 PK	74.0	-25.1	1.52 V	330	45.7	3.2
10	5450.40	35.9 AV	54.0	-18.1	1.52 V	330	32.7	3.2
11	6358.80	49.8 PK	74.0	-24.2	1.59 V	347	44.8	5.0
12	6358.80	37.5 AV	54.0	-16.5	1.59 V	347	32.5	5.0
13	7267.20	54.1 PK	74.0	-19.9	1.54 V	340	45.9	8.2
14	7267.20	40.9 AV	54.0	-13.1	1.54 V	340	32.7	8.2
15	8175.60	54.4 PK	74.0	-19.6	1.51 V	337	45.5	8.9
16	8175.60	42.4 AV	54.0	-11.6	1.51 V	337	33.5	8.9
17	9084.00	54.7 PK	74.0	-19.3	1.50 V	352	44.9	9.8
18	9084.00	42.6 AV	54.0	-11.4	1.50 V	352	32.8	9.8

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

CHANNEL	TX Channel 2	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	42.1 PK	74.0	-31.9	1.46 H	211	46.8	-4.7
2	1816.80	28.6 AV	54.0	-25.4	1.46 H	211	33.3	-4.7
3	2725.20	44.5 PK	74.0	-29.5	1.49 H	185	46.1	-1.6
4	2725.20	31.9 AV	54.0	-22.1	1.49 H	185	33.5	-1.6
5	3633.60	46.3 PK	74.0	-27.7	1.58 H	203	46.5	-0.2
6	3633.60	34.0 AV	54.0	-20.0	1.58 H	203	34.2	-0.2
7	4542.00	47.7 PK	74.0	-26.3	1.52 H	190	46.2	1.5
8	4542.00	35.3 AV	54.0	-18.7	1.52 H	190	33.8	1.5
9	5450.40	48.9 PK	74.0	-25.1	1.53 H	167	45.7	3.2
10	5450.40	36.0 AV	54.0	-18.0	1.53 H	167	32.8	3.2
11	6358.80	50.1 PK	74.0	-23.9	1.42 H	252	45.1	5.0
12	6358.80	38.0 AV	54.0	-16.0	1.42 H	252	33.0	5.0
13	7267.20	52.5 PK	74.0	-21.5	1.46 H	186	44.3	8.2
14	7267.20	40.4 AV	54.0	-13.6	1.46 H	186	32.2	8.2
15	8175.60	54.0 PK	74.0	-20.0	1.70 H	223	45.1	8.9
16	8175.60	42.4 AV	54.0	-11.6	1.70 H	223	33.5	8.9
17	9084.00	54.1 PK	74.0	-19.9	1.51 H	342	44.3	9.8
18	9084.00	42.5 AV	54.0	-11.5	1.51 H	342	32.7	9.8
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	1.27 V	360	47.2	-4.7
2	1816.80	33.6 AV	54.0	-20.4	1.27 V	360	38.3	-4.7
3	2725.20	44.1 PK	74.0	-29.9	1.44 V	360	45.7	-1.6
4	2725.20	31.9 AV	54.0	-22.1	1.44 V	360	33.5	-1.6
5	3633.60	45.9 PK	74.0	-28.1	1.58 V	351	46.1	-0.2
6	3633.60	33.2 AV	54.0	-20.8	1.58 V	351	33.4	-0.2
7	4542.00	47.6 PK	74.0	-26.4	1.56 V	334	46.1	1.5
8	4542.00	35.1 AV	54.0	-18.9	1.56 V	334	33.6	1.5
9	5450.40	49.3 PK	74.0	-24.7	1.49 V	342	46.1	3.2
10	5450.40	36.4 AV	54.0	-17.6	1.49 V	342	33.2	3.2
11	6358.80	49.7 PK	74.0	-24.3	1.57 V	349	44.7	5.0
12	6358.80	37.6 AV	54.0	-16.4	1.57 V	349	32.6	5.0
13	7267.20	54.4 PK	74.0	-19.6	1.46 V	325	46.2	8.2
14	7267.20	41.3 AV	54.0	-12.7	1.46 V	325	33.1	8.2
15	8175.60	54.3 PK	74.0	-19.7	1.58 V	357	45.4	8.9
16	8175.60	42.4 AV	54.0	-11.6	1.58 V	357	33.5	8.9
17	9084.00	55.3 PK	74.0	-18.7	1.56 V	352	45.5	9.8
18	9084.00	42.8 AV	54.0	-11.2	1.56 V	352	33.0	9.8

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

CHANNEL	TX Channel 3	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	42.6 PK	74.0	-31.4	1.46 H	208	47.2	-4.6
2	1832.00	29.2 AV	54.0	-24.8	1.46 H	208	33.8	-4.6
3	2748.00	44.4 PK	74.0	-29.6	1.58 H	184	46.0	-1.6
4	2748.00	32.3 AV	54.0	-21.7	1.58 H	184	33.9	-1.6
5	3664.00	45.1 PK	74.0	-28.9	1.59 H	209	45.3	-0.2
6	3664.00	33.0 AV	54.0	-21.0	1.59 H	209	33.2	-0.2
7	4580.00	47.4 PK	74.0	-26.6	1.52 H	201	45.7	1.7
8	4580.00	35.5 AV	54.0	-18.5	1.52 H	201	33.8	1.7
9	5496.00	48.9 PK	74.0	-25.1	1.51 H	159	45.8	3.1
10	5496.00	36.0 AV	54.0	-18.0	1.51 H	159	32.9	3.1
11	6412.00	49.4 PK	74.0	-24.6	1.48 H	254	44.0	5.4
12	6412.00	37.2 AV	54.0	-16.8	1.48 H	254	31.8	5.4
13	7328.00	53.3 PK	74.0	-20.7	1.49 H	193	45.3	8.0
14	7328.00	40.8 AV	54.0	-13.2	1.49 H	193	32.8	8.0
15	8244.00	53.8 PK	74.0	-20.2	1.61 H	235	45.2	8.6
16	8244.00	42.0 AV	54.0	-12.0	1.61 H	235	33.4	8.6
17	9160.00	53.7 PK	74.0	-20.3	1.50 H	360	43.7	10.0
18	9160.00	41.9 AV	54.0	-12.1	1.50 H	360	31.9	10.0
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	42.2 PK	74.0	-31.8	1.33 V	353	46.8	-4.6
2	1832.00	33.4 AV	54.0	-20.6	1.33 V	353	38.0	-4.6
3	2748.00	44.6 PK	74.0	-29.4	1.46 V	360	46.2	-1.6
4	2748.00	32.5 AV	54.0	-21.5	1.46 V	360	34.1	-1.6
5	3664.00	46.1 PK	74.0	-27.9	1.54 V	360	46.3	-0.2
6	3664.00	33.5 AV	54.0	-20.5	1.54 V	360	33.7	-0.2
7	4580.00	47.6 PK	74.0	-26.4	1.53 V	343	45.9	1.7
8	4580.00	34.7 AV	54.0	-19.3	1.53 V	343	33.0	1.7
9	5496.00	49.2 PK	74.0	-24.8	1.57 V	347	46.1	3.1
10	5496.00	36.2 AV	54.0	-17.8	1.57 V	347	33.1	3.1
11	6412.00	49.7 PK	74.0	-24.3	1.50 V	335	44.3	5.4
12	6412.00	37.4 AV	54.0	-16.6	1.50 V	335	32.0	5.4
13	7328.00	54.1 PK	74.0	-19.9	1.43 V	345	46.1	8.0
14	7328.00	41.4 AV	54.0	-12.6	1.43 V	345	33.4	8.0
15	8244.00	54.2 PK	74.0	-19.8	1.56 V	346	45.6	8.6
16	8244.00	42.3 AV	54.0	-11.7	1.56 V	346	33.7	8.6
17	9160.00	54.9 PK	74.0	-19.1	1.53 V	338	44.9	10.0
18	9160.00	42.9 AV	54.0	-11.1	1.53 V	338	32.9	10.0

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

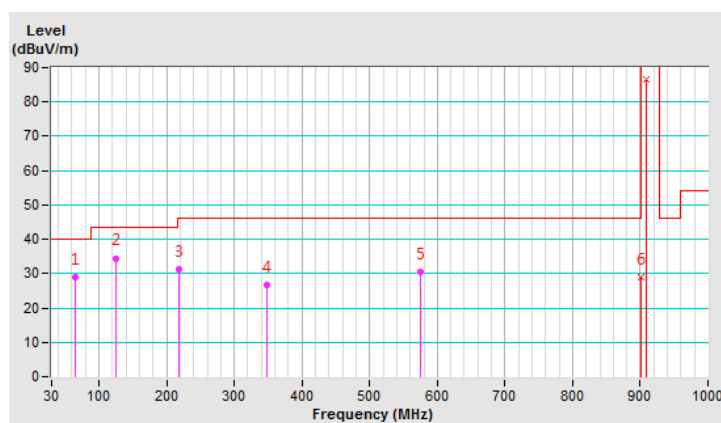
Below 1GHz Data:

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	64.58	28.9 QP	40.0	-11.1	3.00 H	271	38.4	-9.5
2	125.00	34.5 QP	43.5	-9.0	3.00 H	91	44.1	-9.6
3	218.01	31.3 QP	46.0	-14.7	1.50 H	231	41.1	-9.8
4	347.94	26.6 QP	46.0	-19.4	1.50 H	163	32.0	-5.4
5	574.85	30.5 QP	46.0	-15.5	2.00 H	16	30.4	0.1
6	902.00	29.1 QP	46.0	-16.9	1.02 H	341	23.2	5.9
7	908.40	86.6 QP	94.0	-7.4	1.02 H	341	80.5	6.1

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 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.

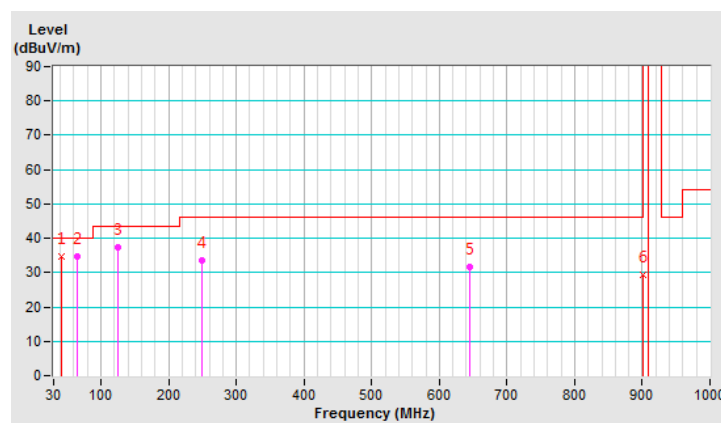


CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	41.62	34.7 QP	40.0	-5.3	1.02 V	3	43.7	-9.0
2	65.51	34.8 QP	40.0	-5.2	1.00 V	299	44.4	-9.6
3	125.00	37.3 QP	43.5	-6.2	1.00 V	261	46.9	-9.6
4	250.03	33.4 QP	46.0	-12.6	1.50 V	349	41.7	-8.3
5	644.24	31.8 QP	46.0	-14.2	1.00 V	192	30.1	1.7
6	902.00	29.2 QP	46.0	-16.8	1.13 V	163	23.3	5.9
7	*908.40	93.6 QP	94.0	-0.4	1.13 V	116	87.5	6.1

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 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.

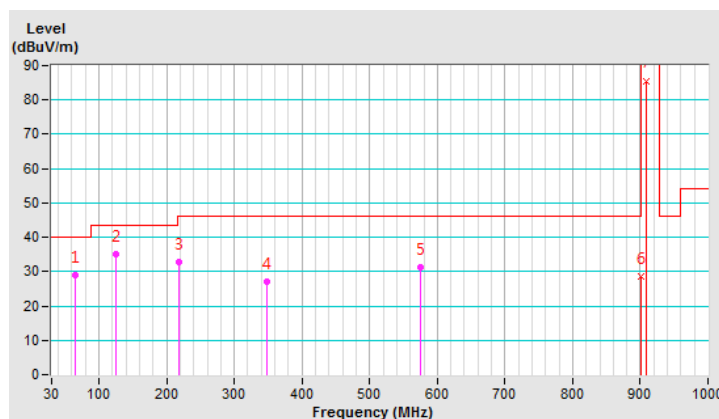


CHANNEL	TX Channel 2	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	64.59	29.1 QP	40.0	-10.9	2.50 H	156	38.6	-9.5
2	125.01	35.1 QP	43.5	-8.4	2.50 H	177	44.7	-9.6
3	218.00	32.8 QP	46.0	-13.2	2.00 H	316	42.6	-9.8
4	347.93	26.9 QP	46.0	-19.1	1.50 H	244	32.3	-5.4
5	574.99	31.3 QP	46.0	-14.7	2.00 H	236	31.2	0.1
6	902.00	28.5 QP	46.0	-17.5	1.02 H	341	22.6	5.9
7	908.40	85.6 QP	94.0	-8.4	1.02 H	356	79.5	6.1

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 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.

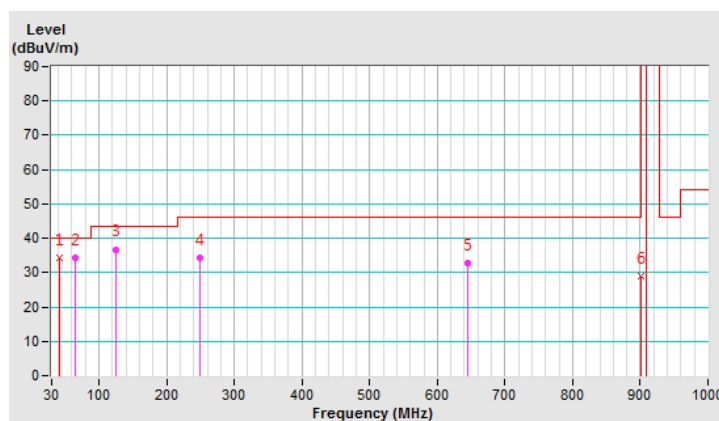


CHANNEL	TX Channel 2	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	41.62	34.3 QP	40.0	-5.7	1.00 V	26	43.3	-9.0
2	65.51	34.4 QP	40.0	-5.6	1.00 V	132	44.0	-9.6
3	125.00	36.8 QP	43.5	-6.7	1.10 V	245	46.4	-9.6
4	250.03	34.4 QP	46.0	-11.6	2.00 V	189	42.7	-8.3
5	644.24	32.7 QP	46.0	-13.3	1.50 V	169	31.0	1.7
6	902.00	29.0 QP	46.0	-17.0	1.10 V	123	23.1	5.9
7	*908.40	93.7 QP	94.0	-0.3	1.10 V	133	87.6	6.1

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 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.

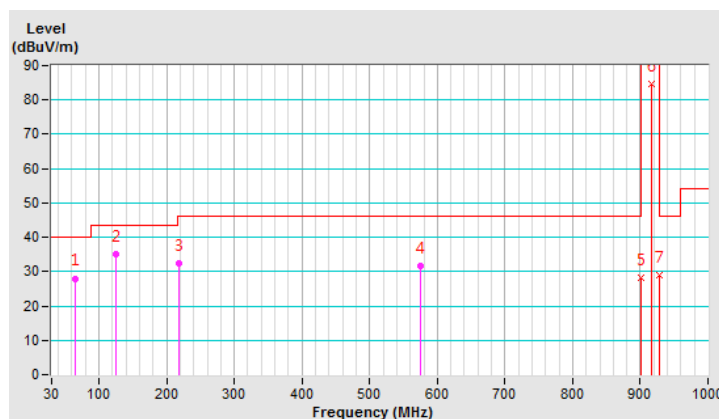


CHANNEL	TX Channel 3	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	64.59	28.0 QP	40.0	-12.0	2.50 H	152	37.5	-9.5
2	125.00	35.0 QP	43.5	-8.5	2.50 H	126	44.6	-9.6
3	218.01	32.5 QP	46.0	-13.5	1.50 H	216	42.3	-9.8
4	575.36	31.7 QP	46.0	-14.3	2.00 H	211	31.6	0.1
5	901.95	28.3 QP	46.0	-17.7	1.60 H	316	22.4	5.9
6	915.99	84.7 QP	94.0	-9.3	1.60 H	338	78.3	6.4
7	928.01	29.0 QP	46.0	-17.0	1.60 H	309	22.4	6.6

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.

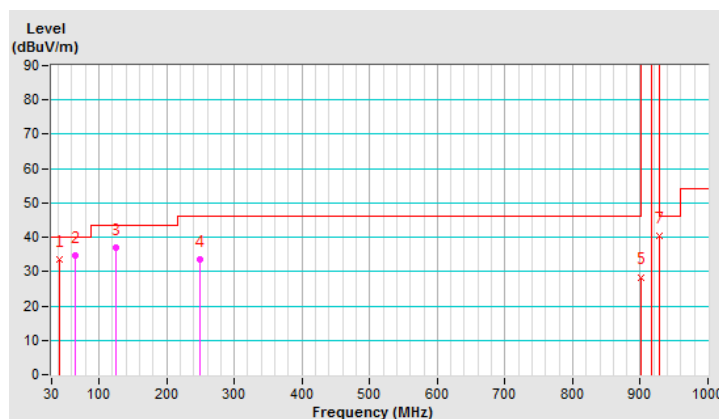


CHANNEL	TX Channel 3	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	41.41	33.6 QP	40.0	-6.4	1.00 V	24	42.6	-9.0
2	65.46	34.7 QP	40.0	-5.3	1.00 V	126	44.3	-9.6
3	124.99	37.1 QP	43.5	-6.4	1.00 V	162	46.8	-9.7
4	250.01	33.7 QP	46.0	-12.3	1.50 V	271	42.0	-8.3
5	901.99	28.4 QP	46.0	-17.6	1.08 V	124	22.5	5.9
6	916.01	93.6 QP	94.0	-0.4	1.08 V	136	87.2	6.4
7	928.00	40.5 QP	46.0	-5.5	1.08 V	13	33.9	6.6

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.



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: May 27, 2019

4.2.3 Test Procedures

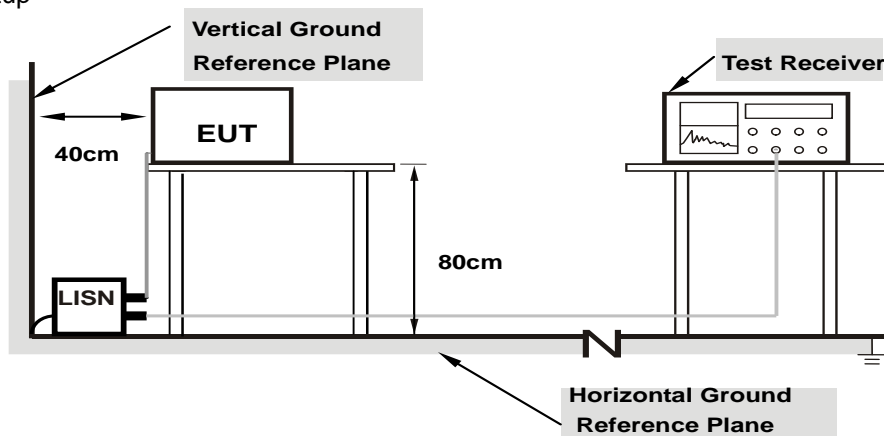
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

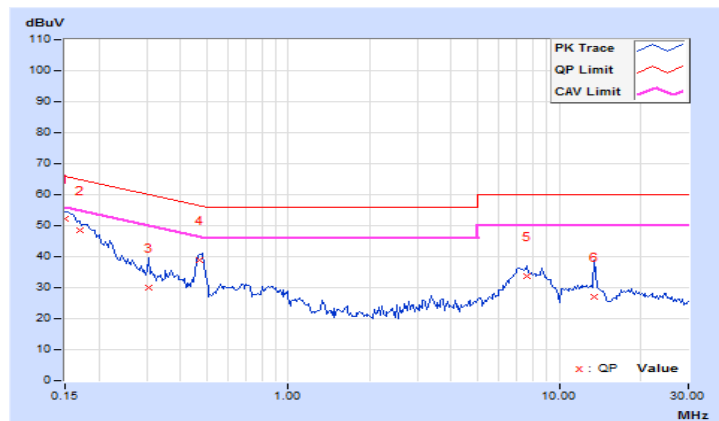
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.03	42.36	26.69	52.39	36.72	66.00	56.00	-13.61	-19.28
2	0.16953	10.04	38.56	21.20	48.60	31.24	64.98	54.98	-16.38	-23.74
3	0.30625	10.07	19.97	9.69	30.04	19.76	60.07	50.07	-30.03	-30.31
4	0.47031	10.09	28.69	21.39	38.78	31.48	56.51	46.51	-17.73	-15.03
5	7.61719	10.55	23.26	17.96	33.81	28.51	60.00	50.00	-26.19	-21.49
6	13.55859	10.93	16.04	10.40	26.97	21.33	60.00	50.00	-33.03	-28.67

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

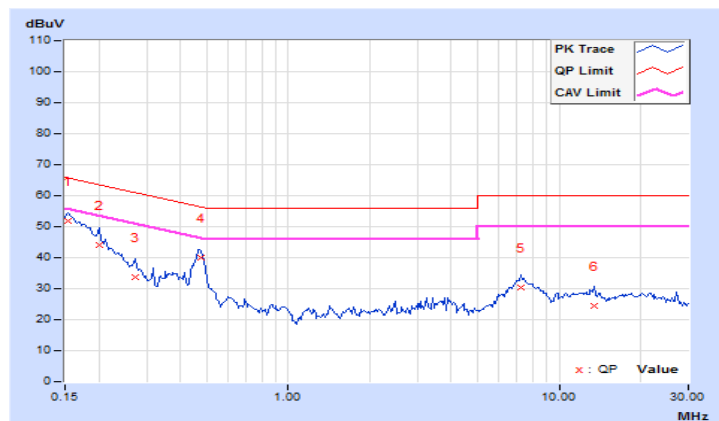


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.94	41.81	26.08	51.75	36.02	65.79	55.79	-14.04	-19.77
2	0.20078	9.95	34.29	19.21	44.24	29.16	63.58	53.58	-19.34	-24.42
3	0.27109	9.96	23.63	11.00	33.59	20.96	61.08	51.08	-27.49	-30.12
4	0.47422	9.98	30.20	21.41	40.18	31.39	56.44	46.44	-16.26	-15.05
5	7.25781	10.37	19.82	14.76	30.19	25.13	60.00	50.00	-29.81	-24.87
6	13.49609	10.74	13.66	7.32	24.40	18.06	60.00	50.00	-35.60	-31.94

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



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.

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

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