FCC Test Report

Report No.:	RF170620C22-3
FCC ID:	Y6S-IOTADV
Test Model:	IoT Platform Advance
Series Model:	72201R Lumewave IoT Platform
Received Date:	Apr. 26, 2017
Test Date:	Jul. 03 ~ Aug. 31, 2017
Issued Date:	Sep. 07, 2017
Applicant:	Ionics EMS, Inc.
Address:	14 Mountain Drive, Light Industry and Science Park II, Brgy. La Mesa, Calamba, Laguna 4027, Philippines
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RF170620C22-3	Original release	Sep. 07, 2017

1 Certificate of Conformity

Product:	IOT PLATFORM
Brand:	Ionics, Lumewave
Test Model:	IoT Platform Advance
Series Model:	72201R Lumewave IoT Platform
Sample Status:	Engineering sample
Applicant:	Ionics EMS, Inc.
Test Date:	Jul. 03 ~ Aug. 31, 2017
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 : _____ , **Date:** Sep. 07, 2017
Pettie Chen / Senior Specialist

Approved by : _____ , **Date:** Sep. 07, 2017
Ken Liu / Senior 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 -7.88dB at 0.39739MHz.
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 -1.1dB at 1824.00MHz.
15.215	20dB Bandwidth Measurement	Pass	Meet the requirement of limit.

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	2.94 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.59 dB
	200MHz ~1000MHz	3.60 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	IOT PLATFORM
Brand	Ionics, Lumewave
Test Model	IoT Platform Advance
Series Model	72201R Lumewave IoT Platform
Model Difference	Refer to Note
Sample Status	Engineering sample
Power Supply Rating	9Vdc or 12Vdc (adapter)
Modulation Type	GFSK
Transfer Rate	50kbps
Operating Frequency	908MHz
Number of Channel	1
Antenna Type	PCB printed antenna with -2.91dBi gain
Antenna Connector	NA
Accessory Device	Adapter
Cable Supplied	NA

Note:

1. All models are listed as below.

Description	Sample 1	Sample 2
Brand	Ionics	Lumewave
Model	IoT Platform Advance	72201R Lumewave IoT Platform
Processor	NXP I.MX6 Dual Lite	NXP I.MX6 Dual Lite
Memory	2GB DDR3L SDRAM, 400 MHz	2GB DDR3L SDRAM, 400 MHz
Internal Storage	8GB eMMC	8GB eMMC
LAN	2 x Gigabit Ethernet	2 x Gigabit Ethernet
Button	1 x Hardware Reset Button	1 x Hardware Reset Button
	1 x Software Reset Button	1 x Software Reset Button
USB	2 x USB2.0 Port	2 x USB 2.0 Port
MicroSD	2 x microSD Card Port	2 x microSD Card Port
Audio	-	-
Debug	1 x Debug Console Port	1 x Debug Console Port
Debug LED	1 x Programming Port	1 x Programming Port
	6 x Status LED	6 x Status LED
Wi-Fi/BT	1 x 802.11 b/g/n 2.4 GHz / BT 2.1 +EDR, BT 4.0	1 x 802.11 b/g/n 2.4 GHz / BT 2.1 +EDR, BT 4.0
IEEE 802.15.4 Sub GHz	1 x 908 MHz Module	1 x 908 MHz Module
RFM900	1 x 915 MHz RFM900 Module	1 x 915 MHz RFM900 Module
Power Supply	Flypower PS30D120K2000UD	XP-Power ECL25US09-S
	12.0V, 2.0 A	9.0 V, 2.8A
	Tma= 40°C	Tma=70°C

2. The EUT consumes power from the following adapters

Adapter 1	
Brand	FLYPOWER
Model	PS30D120K2000UD
Input Power	100-240Vac~50/60Hz 800mA
Output Power	12.0Vdc / 2000mA
Power Line	1.5m power cable with one core

Adapter 2	
Brand	XP Power
Model	ECL25US09-S
Input Power	100-240Vac~0.8A 50/60Hz
Output Power	9Vdc / 2.8A
Power Line	AC: 0.7m non-shielded power cable without core DC: 0.25m non-shielded power cable without core

3. WLAN, BT and RFID technologies can transmit at same time.
4. 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

1 channel is provided to this EUT:

Channel	Freq. (MHz)
1	908.00

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	BM	
A	√	√	√	√	Power from adapter 1
B	-	√	√	-	Power from adapter 2

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **BM:** 20dB Bandwidth Measurement

Note:

1. The antenna had been pre-tested on the positioned of each 3 axis. The worst cases were found when positioned on X-plane.
2. "-": Means no effect.

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.

EUT CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A	1	1	GFSK

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.

EUT CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A, B	1	1	GFSK

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.

EUT CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A, B	1	1	GFSK

Bandedge Measurement:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

EUT CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A	1	1	GFSK

20dB Bandwidth Measurement:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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

EUT CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
A	1	1	GFSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25 deg. C, 66% RH	120Vac, 60Hz	James Yang
RE<1G	25 deg. C, 66% RH	120Vac, 60Hz	James Yang
BW	25 deg. C, 66% RH	120Vac, 60Hz	James Yang
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Luis Lee
BM	25 deg. C, 66% RH	120Vac, 60Hz	James Yang

3.3 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.	Notebook	DELL	D531	CN-0XM006-48643-81U-2610	QDS-BRCM1020	-
B.	Jig	NA	NA	NA	NA	-

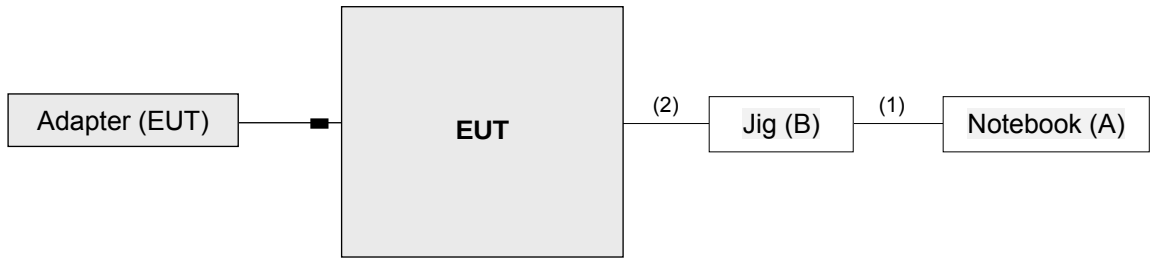
Note:

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

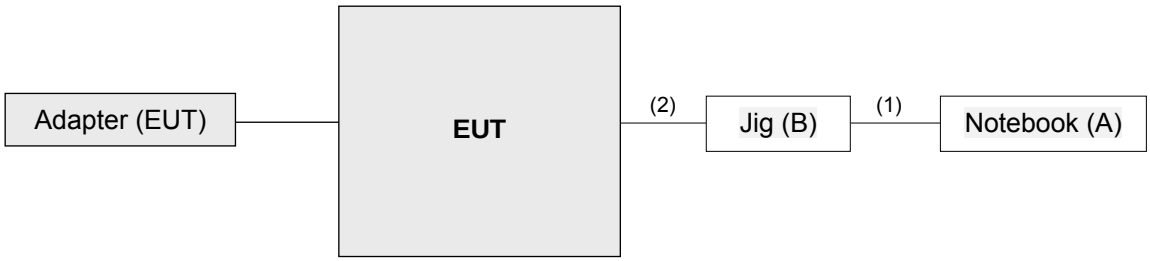
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Micro USB	1	0.6	Y	0	Provided by manufacturer
2.	Flat cable	1	0.2	N	0	Provided by manufacturer

3.3.1 Configuration of System under Test

Test Mode A



Test Mode B



3.4 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.

Note: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

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(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Mar. 27, 2017	Mar. 26, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Nov. 16, 2016	Nov. 15, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-148	Dec. 28, 2016	Dec. 27, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Dec. 27, 2016	Dec. 26, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 14, 2016	Dec. 13, 2017
Loop Antenna ETS-LINDGREN	3127-1880	00099260	Sep. 26, 2015	Sep. 27, 2017
Preamplifier Agilent	8449B	3008A01638	Feb. 22, 2017	Feb. 21, 2018
Preamplifier Agilent	8447D	2944A10638	Aug. 09, 2016	Aug. 08, 2017
			Aug. 08, 2017	Aug. 07, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-02 (248780+MY13377)	Aug. 09, 2016	Aug. 08, 2017
			Aug. 08, 2017	Aug. 07, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Aug. 09, 2016	Aug. 08, 2017
			Aug. 08, 2017	Aug. 07, 2018
RF signal cable Woken	8D-FB	Cable-CH9-01	Aug. 09, 2016	Aug. 08, 2017
			Aug. 01, 2017	Jul. 31, 2018
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower &Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
High Speed Peak Power Meter	ML2495A	1145013	Mar. 07, 2017	Mar. 06, 2018
Power Sensor	MA2411B	1126085	Mar. 07, 2017	Mar. 06, 2018

Note:
1. The calibration interval of the above test instruments is 12 or 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 9.
3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
5. The IC Site Registration No. is IC 7450F-9.

4.1.3 Test Procedures

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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:

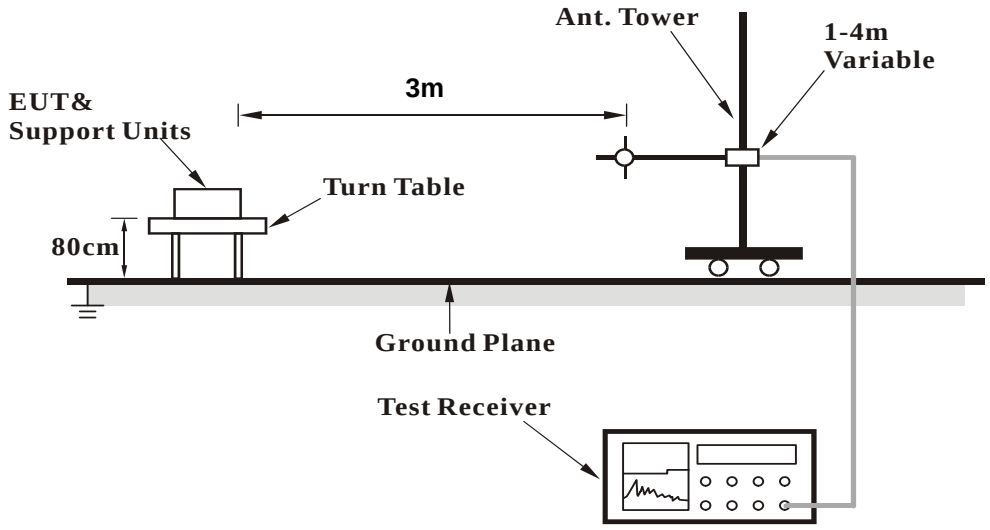
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

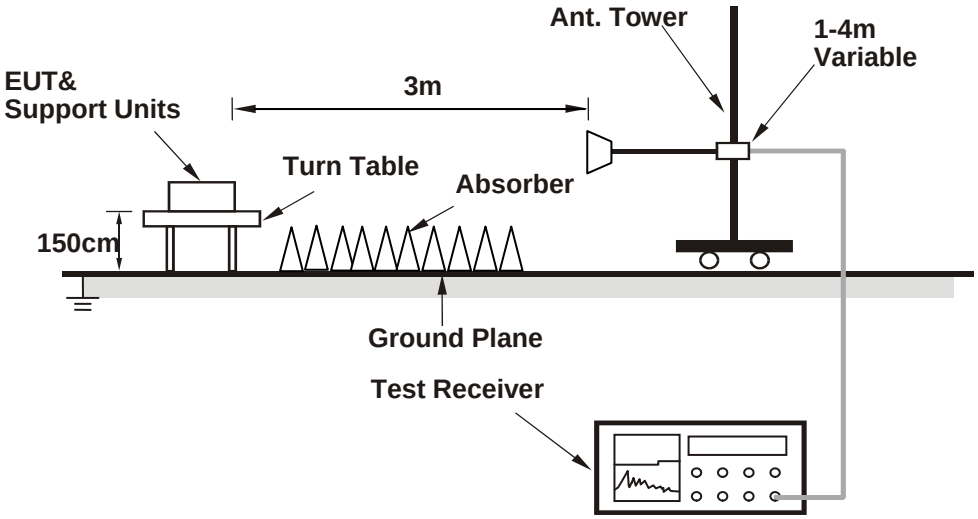
No deviation.

4.1.5 Test Set Up

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

a. Connected the EUT with the notebook and placed them on the testing table.
b. The notebook ran a test program to enable EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	30MHz ~ 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	*908.00	91.1 PK	114.0	-22.9	1.47 H	167	88.1	3.0
2	*908.00	90.9 AV	94.0	-3.1	1.47 H	167	87.9	3.0
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	*908.00	92.3 PK	114.0	-21.7	1.04 V	3	89.3	3.0
2	*908.00	92.1 AV	94.0	-1.9	1.04 V	3	89.1	3.0

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)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

Above 1GHz Data

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#1816.00	47.5 PK	74.0	-26.5	1.47 H	7	54.7	-7.2
2	#1816.00	44.3 AV	54.0	-9.7	1.47 H	7	51.5	-7.2
3	2724.00	49.8 PK	74.0	-24.2	1.69 H	316	53.4	-3.6
4	2724.00	46.0 AV	54.0	-8.0	1.69 H	316	49.6	-3.6
5	4540.00	48.1 PK	74.0	-25.9	1.00 H	350	47.2	0.9
6	4540.00	37.4 AV	54.0	-16.6	1.00 H	350	36.5	0.9
7	5448.00	49.7 PK	74.0	-24.3	1.00 H	45	47.0	2.7
8	5448.00	41.3 AV	54.0	-12.7	1.00 H	45	38.6	2.7
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	#1816.00	47.5 PK	74.0	-26.5	2.35 V	14	54.7	-7.2
2	#1816.00	43.8 AV	54.0	-10.2	2.35 V	14	51.0	-7.2
3	2724.00	50.6 PK	74.0	-23.4	2.42 V	340	54.2	-3.6
4	2724.00	47.3 AV	54.0	-6.7	2.42 V	340	50.9	-3.6
5	4540.00	48.1 PK	74.0	-25.9	1.62 V	55	47.2	0.9
6	4540.00	39.7 AV	54.0	-14.3	1.62 V	55	38.8	0.9
7	5448.00	50.0 PK	74.0	-24.0	1.23 V	348	47.3	2.7
8	5448.00	44.2 AV	54.0	-9.8	1.23 V	348	41.5	2.7

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

Below 1GHz worst-case data

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	A

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	88.20	37.9 QP	43.5	-5.6	1.49 H	75	57.1	-19.2
2	183.26	37.7 QP	43.5	-5.8	1.49 H	152	52.8	-15.1
3	264.74	39.6 QP	46.0	-6.4	1.00 H	184	53.1	-13.5
4	288.02	37.3 QP	46.0	-8.7	1.00 H	177	49.8	-12.5
5	600.36	40.4 QP	46.0	-5.6	1.49 H	205	47.9	-7.5
6	648.86	41.9 QP	46.0	-4.1	1.00 H	216	48.7	-6.8
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	28.05	33.3 QP	40.0	-6.7	1.00 V	178	48.8	-15.5
2	92.08	39.1 QP	43.5	-4.4	1.00 V	136	58.1	-19.0
3	159.98	37.1 QP	43.5	-6.4	1.00 V	346	50.4	-13.3
4	249.22	37.6 QP	46.0	-8.4	1.00 V	100	51.9	-14.3
5	600.36	37.5 QP	46.0	-8.5	1.49 V	184	45.0	-7.5
6	648.86	38.2 QP	46.0	-7.8	1.49 V	179	45.0	-6.8

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

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz	TEST MODE	B

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	94.02	37.8 QP	43.5	-5.7	1.50 H	75	56.6	-18.8
2	124.62	35.1 QP	43.5	-8.4	1.00 H	349	50.5	-15.4
3	239.52	42.5 QP	46.0	-3.5	1.01 H	138	57.2	-14.7
4	600.36	38.0 QP	46.0	-8.0	1.50 H	205	45.5	-7.5
5	648.86	43.0 QP	46.0	-3.0	1.50 H	218	49.8	-6.8
6	719.98	37.4 QP	46.0	-8.6	1.00 H	15	43.2	-5.8
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	34.11	31.4 QP	40.0	-8.6	1.00 V	196	46.4	-15.0
2	66.87	35.4 QP	40.0	-4.6	1.00 V	324	50.5	-15.1
3	95.96	41.1 QP	43.5	-2.4	1.49 V	188	59.6	-18.5
4	152.22	38.7 QP	43.5	-4.8	1.00 V	198	52.1	-13.4
5	600.36	37.2 QP	46.0	-8.8	1.49 V	181	44.7	-7.5
6	648.86	38.7 QP	46.0	-7.3	1.49 V	177	45.5	-6.8

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

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.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 21, 2016	Nov. 20, 2017
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Dec. 22, 2016	Dec. 21, 2017
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 10, 2017	Mar. 09, 2018
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100220	Nov. 08, 2016	Nov. 07, 2017
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

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

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

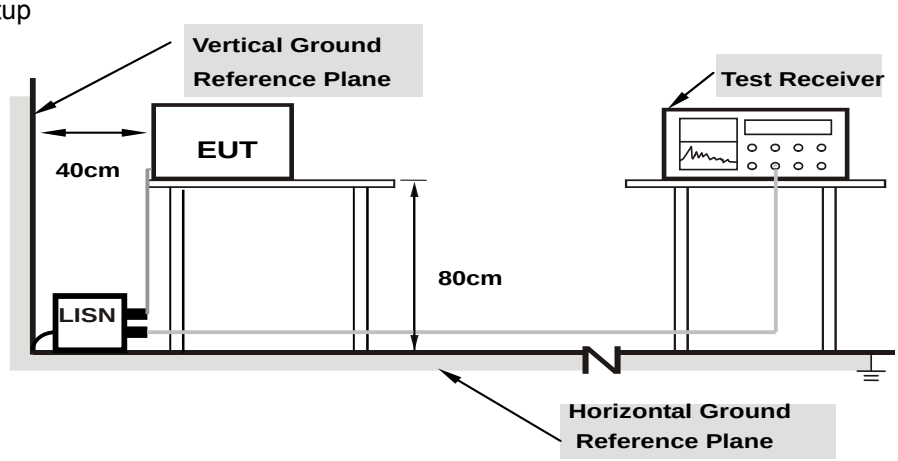
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

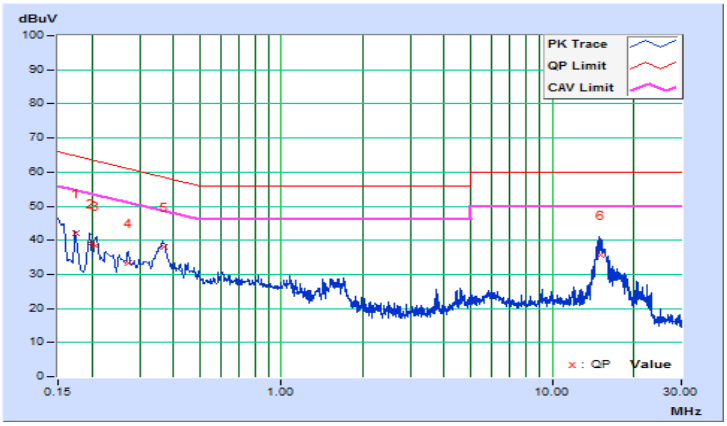
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	Channel 1	Test Mode	A

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17374	10.42	31.56	18.80	41.98	29.22	64.78	54.78	-22.80	-25.56
2	0.19717	10.43	28.74	19.81	39.17	30.24	63.73	53.73	-24.56	-23.49
3	0.20511	10.43	27.94	19.41	38.37	29.84	63.40	53.40	-25.03	-23.56
4	0.27120	10.46	22.81	15.25	33.27	25.71	61.08	51.08	-27.81	-25.37
5	0.36896	10.50	27.59	20.68	38.09	31.18	58.52	48.52	-20.43	-17.34
6	15.01582	11.16	24.49	13.43	35.65	24.59	60.00	50.00	-24.35	-25.41

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.

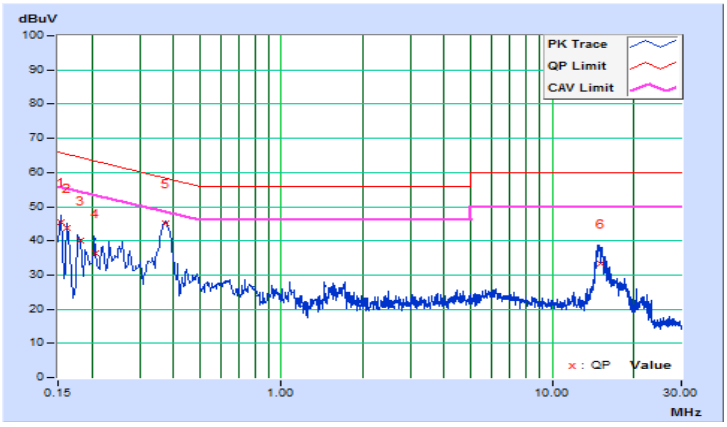


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	Channel 1	Test Mode	A

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.16	35.27	20.75	45.43	30.91	65.79	55.79	-20.36	-24.88
2	0.16096	10.16	33.59	18.80	43.75	28.96	65.41	55.41	-21.66	-26.45
3	0.18128	10.18	29.80	16.18	39.98	26.36	64.43	54.43	-24.45	-28.07
4	0.20511	10.20	26.31	16.43	36.51	26.63	63.40	53.40	-26.89	-26.77
5	0.37403	10.23	34.86	29.47	45.09	39.70	58.41	48.41	-13.32	-8.71
6	15.02364	10.84	22.61	10.92	33.45	21.76	60.00	50.00	-26.55	-28.24

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.

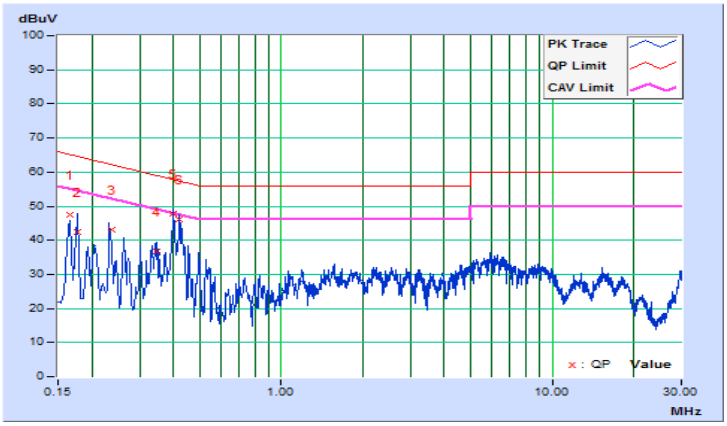


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	Channel 1	Test Mode	B

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16526	10.41	37.05	24.83	47.46	35.24	65.20	55.20	-17.74	-19.96
2	0.17605	10.42	32.11	15.53	42.53	25.95	64.67	54.67	-22.14	-28.72
3	0.23602	10.44	32.75	21.59	43.19	32.03	62.24	52.24	-19.05	-20.21
4	0.34560	10.49	26.11	13.02	36.60	23.51	59.07	49.07	-22.47	-25.56
5	**0.39739**	**10.51**	**37.23**	**29.52**	**47.74**	**40.03**	**57.91**	**47.91**	**-10.17**	**-7.88**
6	0.41780	10.51	35.64	17.07	46.15	27.58	57.49	47.49	-11.34	-19.91

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.

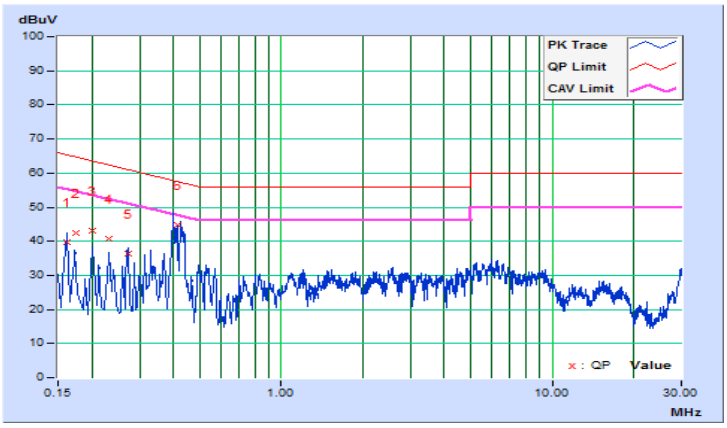


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	Channel 1	Test Mode	B

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16096	10.16	29.66	15.55	39.82	25.71	65.41	55.41	-25.59	-29.70
2	0.17374	10.18	32.24	16.69	42.42	26.87	64.78	54.78	-22.36	-27.91
3	0.19978	10.20	33.03	20.70	43.23	30.90	63.62	53.62	-20.39	-22.72
4	0.22972	10.20	30.54	18.29	40.74	28.49	62.46	52.46	-21.72	-23.97
5	0.27120	10.21	26.12	15.63	36.33	25.84	61.08	51.08	-24.75	-25.24
6	0.41233	10.23	34.63	17.96	44.86	28.19	57.60	47.60	-12.74	-19.41

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.

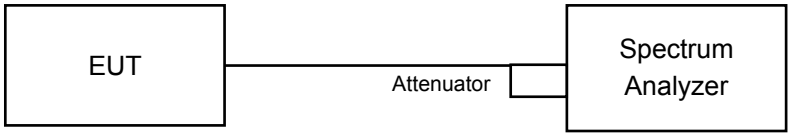


4.3 20dB Bandwidth Measurement

4.3.1 Limits of 20dB Bandwidth Measurement

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

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 Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.

d. Repeat above procedures until all frequencies measured were complete.

4.3.5 Deviation from Test Standard

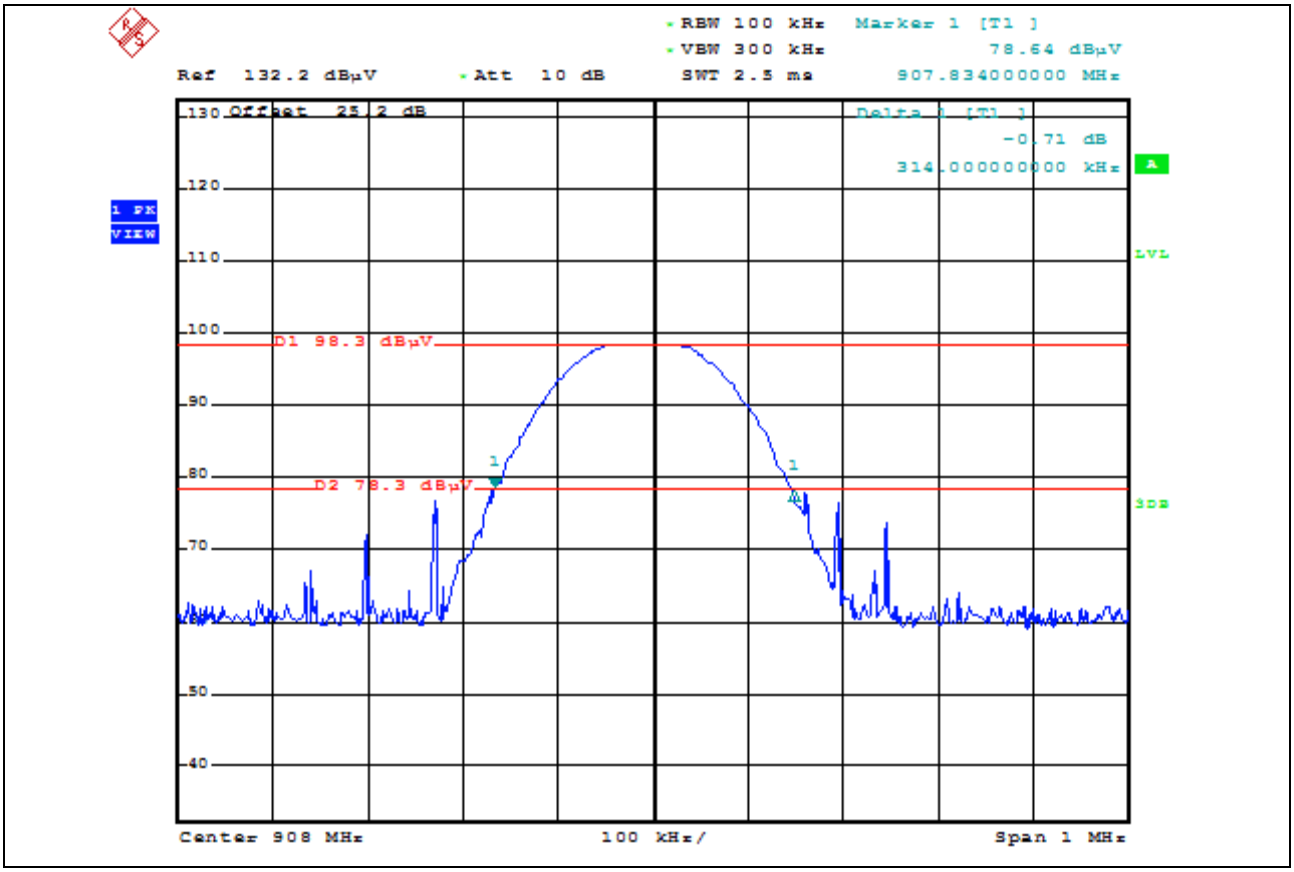
No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at channel frequencies individually.

4.3.7 Test Result

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Pass / Fail
1	908.00	0.314	Pass



5 Pictures of Test Arrangements

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

Appendix – Information on 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.

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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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