FCC Test Report (Z-wave)

Report No.:	RF161201C02-4
FCC ID:	G95-MGM0110VZN
Equipment Name:	LTE Router
Trade Name:	technicolor
Model Number:	MBHA10
Product Code:	DSLMVZ011GM
Received Date:	Dec. 01, 2016
Test Date:	Dec. 01, 2016 to Jan. 10, 2017
Issued Date:	Mar. 08, 2017
Applicant:	Technicolor Connected Home USA LLC
Address:	5030 Sugarloaf Parkway Building Lawrenceville Georgia United States 30044
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.

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Release Control Record

Issue No.	Description	Date Issued
RF161201C02-4	Original release.	Mar. 08, 2017

1 Certificate of Conformity

Equipment Name:	LTE Router
Trade Name:	technicolor
Test Model:	MBHA10
Product Code:	DSLMVZ011GM
Sample Status:	Product Unit
Applicant:	Technicolor Connected Home USA LLC
Test Date:	Dec. 01, 2016 to Jan. 10, 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:** Mar. 08, 2017

Claire Kuan / Specialist

Approved by : _____ , **Date:** Mar. 08, 2017

May Chen / Manager

2 Summary of Test Results

Applied Standard: 47 CFR FCC Part 15 Subpart C (15.249)					
Section	**Ref. Std. Clause**	**Description**	**Measured**	**Limit**	**Result**
3.9	15.203	Antenna Requirements	-	-	PASS
4.1	15.207	AC Power Conducted Emission	Margin is -9.06dB at 0.15000MHz.	-	PASS
4.2	15.209 15.249(a)/(d)	Band Edge and Fundamental Emissions	Margin is -0.1dB at 908.40MHz.	-	PASS
4.3	15.209 15.249(a)/(d)	Radiated Emissions	Margin is -0.9dB at 6358.80MHz.	-	PASS
4.4	15.215(c)	Emission Bandwidth	0.32MHz	-	PASS

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	1.83 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.36 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.47 dB
	6GHz ~ 18GHz	3.75 dB
	18GHz ~ 40GHz	3.30 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 Basic Description of Equipment Under Test (Z-Wave)

Items	Description			
Equipment Name	LTE Router			
Trade Name	technicolor			
Model Number	MBHA10			
Product Code	DSLMVZ011GM			
FCC ID	G95-MGM0110VZN			
Power Type	From power adapter			
Antenna	Refer section 3.10			
EUT Stage	■	Product Unit	□	Pre-Sample
Operating Band and Conducted Output Power	902~928MHz		■	Z-Wave : 5.12 dBm
Product Type	For IEEE 802.15.4 : Z-wave(1TX, 1RX)			
Nominal Bandwidth	0.32MHz			
Modulation	FSK			
Data Rate (kbps)	Z-Wave : 40kbps			
I/O Ports	LAN Port x 1 RJ31 Port x 1 FXS Port x 1 SIM Port x1 Console Port x 1 (For engineer debug use only)			
Hardware Version	FGR1			
Software Version	16.4.7446-3130000-20161220230657-aa636a7383f23e65d07560e3fbe49cd6cbed2ce0			

3.2 Accessories

Li-ion Battery:

Model	BP-MGM0110
Manufacturer	GETAC TECHNOLOGY CORP.
Rating	3.7V, 2500mAh / 9.25Wh

Power supply:

Model	WAE002
P/N	DSL37544940
Manufacturer	AcBel
Input	100/240Vac , 50/60Hz , 0.7A
Output	12Vdc , 2A
DC power cord	1.5m

3.3 Feature of Equipment Under Test

Please refer to user manual.

3.4 Information Provided by the Manufacturer

Interface Availability

Interface / Model	DC 12Vdc	RJ31-X Alarm	Ethernet 10/100 Mbps	FXS	SIM	Zigbee	Z-Wave	BT	GPS	LTE (4G)	WLAN 802.11a/b/g/n/ac (2.4GHz 2*2) (5GHz 2*2 ac)
MBHA10	● (2A)	● (1 port)	● (1 port)	● (1 port)	● (1 port)	●	●	●	●	●	●

● : Equipped

○ : Not Equipped

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.

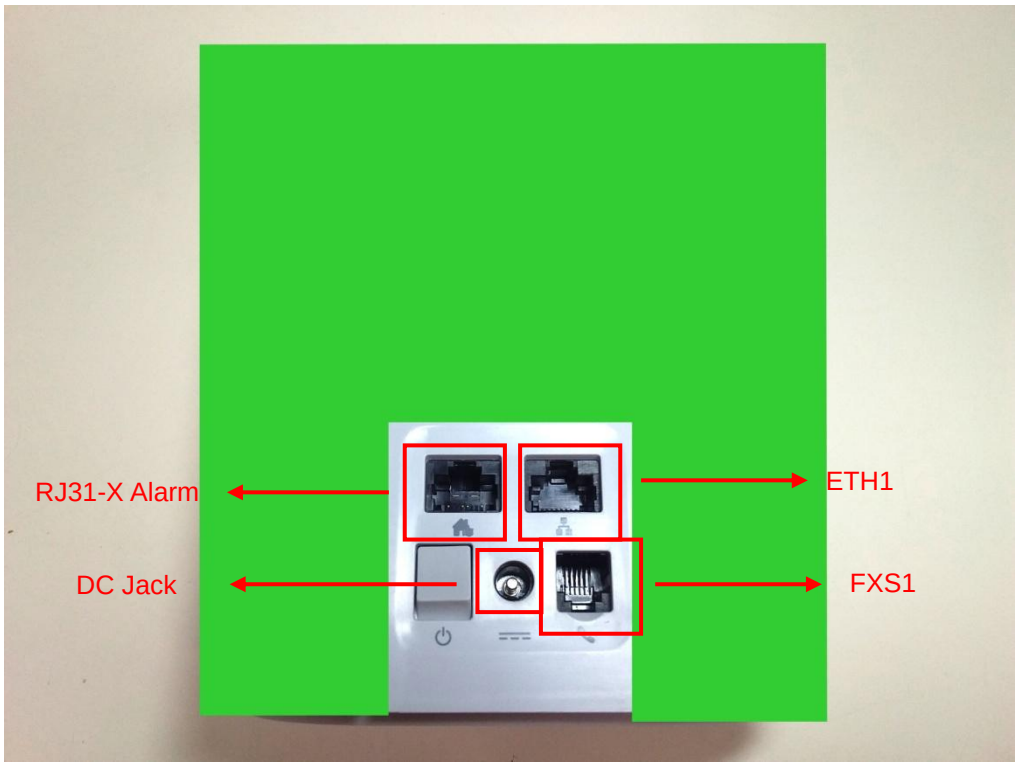
NOTE: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

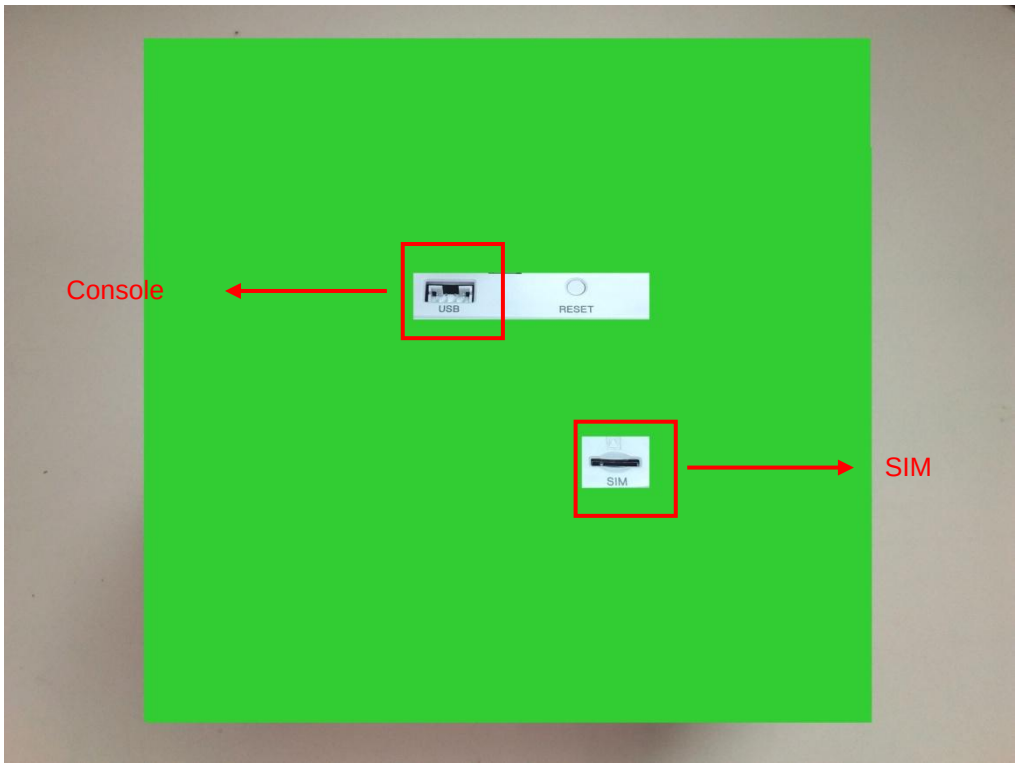
3.6 Cabling Attached to the Equipment

Cable and Interconnection

Interface	Cable Type	Cable Length Delivered with the Modem	"Real Life" Cable Length that can be Attached to this Type of Interface	Cable Length to be used for Testing	Internal/ External Connection
ETH1	UTP Cat 5	1 meter	> 10 meter	10 meter	Internal
RJ31-X Alarm	UTP Cat 3	1 meter	> 10 meter	10 meter	Internal
FXS1	UTP Cat 3	1 meter	> 10 meter	10 meter flat cable	Internal
AC power	-	-	-	-	External

3.7 Panel Drawing





3.8 Transmit Operating Mode

Transmit Operating Mode		Transmit Muitiple Antennas	
■	Operating mode 1 (single antenna)	■	1TX

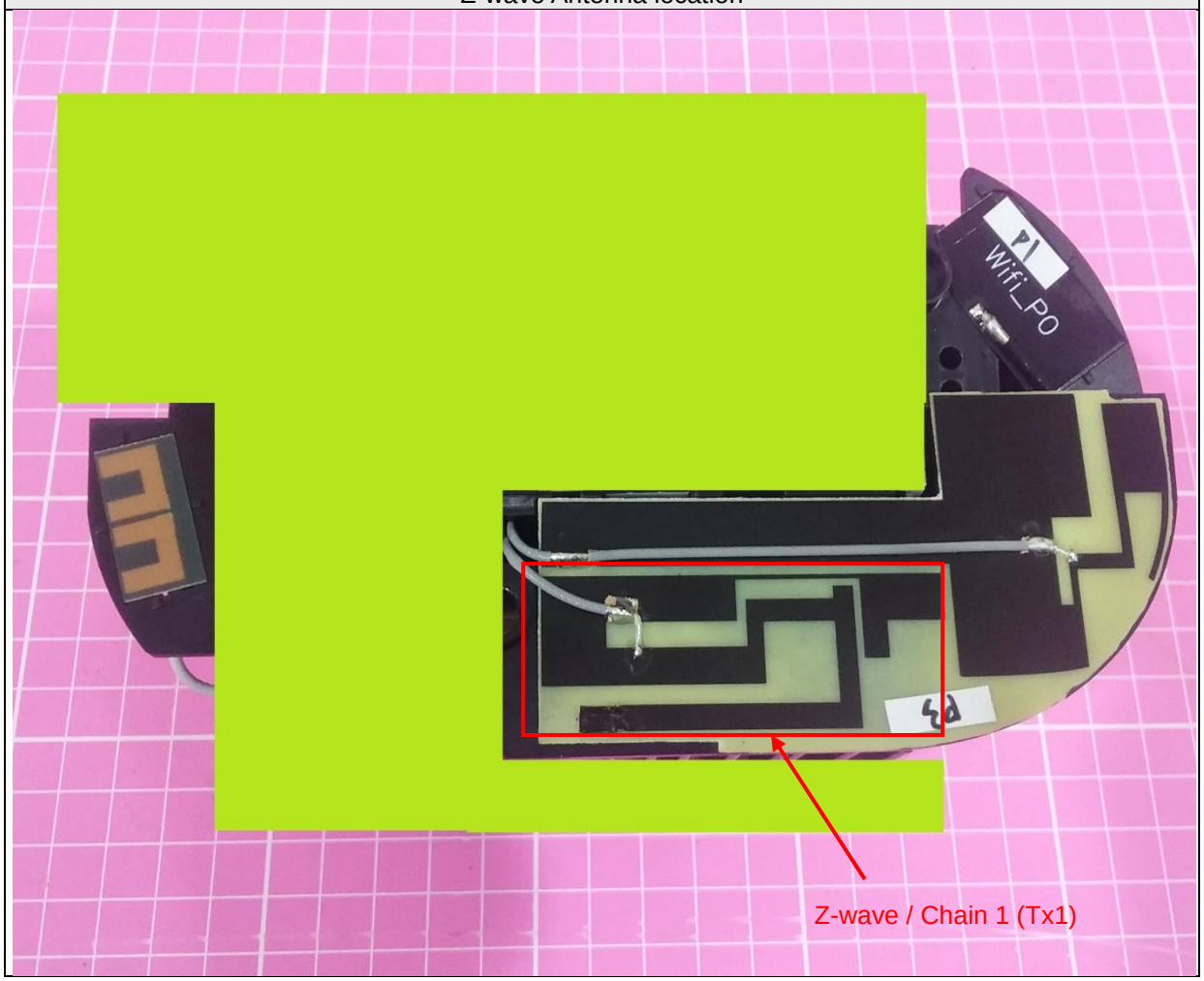
3.9 Antenna Requirements

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

3.10 Antenna Information

Antenna Information					
Ant.	**Brand**	**Model No.**	**Antenna Type**	**Connector**	**Cable Length**
Z-wave	**INPAQ**	**WA-P-DAG1-03-001**	**PCB Antenna**	**I-PEX**	**115 mm**

Z-wave Antenna location



Frequency	Antenna Gain (dBi)
	Ant. 1 (Cn10)
908.4MHz	**0.34**

3.11 Table for Carrier Frequency

Frequency Band	Channel No.	Frequency
902~928 MHz	1	908.4 MHz

3.12 Table for Test Modes

Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Channel	Data Rate	Antenna
AC Power Line Conducted Emissions	1	40kbps	1
Band Edge and Fundamental Emissions	1	40kbps	1
Radiated Emission Test	1	40kbps	1
Emission Bandwidth	1	40kbps	1

3.13 Parameters of Test Software Setting

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

The Power Setting Parameter					
Test Software Version	gbnt-a_16.4.7400-3130000-20161205221903-b70a41bfe166cc2641e406fc8321b480517a6eb3				
Worst Modulation Mode	**Number of Transmit Chains (NTX)**	**Frequency (MHz)**	**Maximum Output Power (dBm)**	**Power Setting**	**Data Rate**
Z-wave	1TX	908.4	5.12	40	40kbps

Note: Maximum Output Power (dBm) value is measured by the power meter average sensor, for reference only.

3.14 Testing Location Information

Test Site Location					
Address	(1) E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.				
TEL	886-3-6668565				
FAX	886-3-6668323				
Test Site No.	**Site Category**	**Location**	**FCC Reg. No.**	**IC Reg. No.**	**VCCI Reg. No**
Conduction 1	Conduction	Hsinchu	-	-	-
Chamber 3	966 Chamber	Hsinchu	147459	20331-1	-
Oven 2	Oven	Hsinchu	-	-	-

3.15 EUT Diagram and Support Equipment

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.

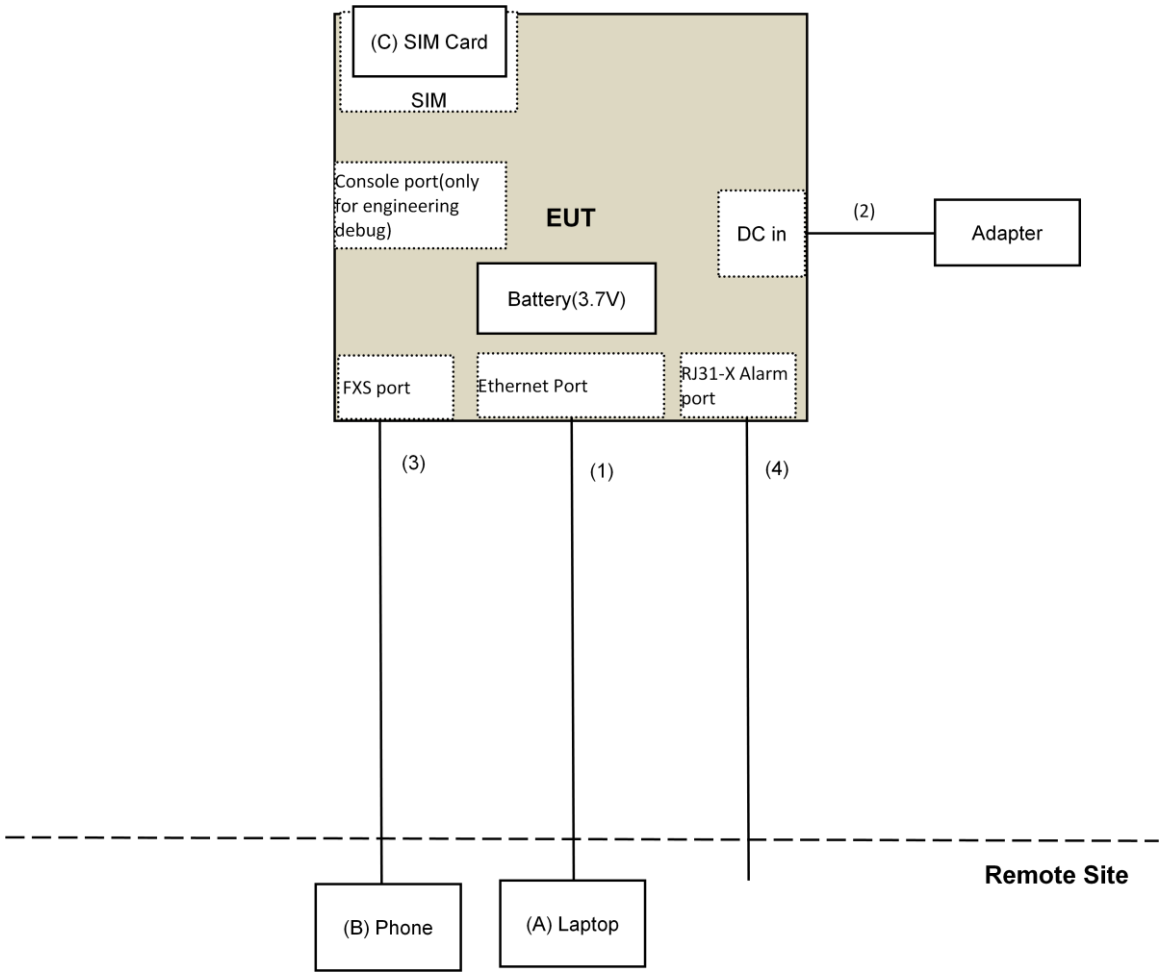
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	E6440	F9LYQ32	FCC DoC	Provided by Lab
B.	Phone	WONDER	WD-303	8C17DA02763	NA	Provided by Lab
C.	SIM Card	R&S	CRT-Z3	NA	NA	Provided by Lab

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.)	Internal/external connection	Remarks
1.	RJ-45 Cable	1	10	No	0	External	Provided by Lab
2.	DC Cable	1	1.8	No	0	Internal	Supplied by client
3.	RJ-11 Cable	1	10	No	0	External	Provided by Lab
4.	RJ-31 Cable	1	10	No	0	External	Provided by Lab

EUT Diagram


(C) SIM Card
SIM
Console port(only for engineering debug)
EUT
DC in
(2)
Adapter
Battery(3.7V)
FXS port
Ethernet Port
RJ31-X Alarm port
(3)
(1)
(4)
Remote Site
(B) Phone
(A) Laptop

4 Test Types and Results

4.1 AC Power Conducted Emissions Measurement

4.1.1 Limit

For this product which is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

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

4.1.2 Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver

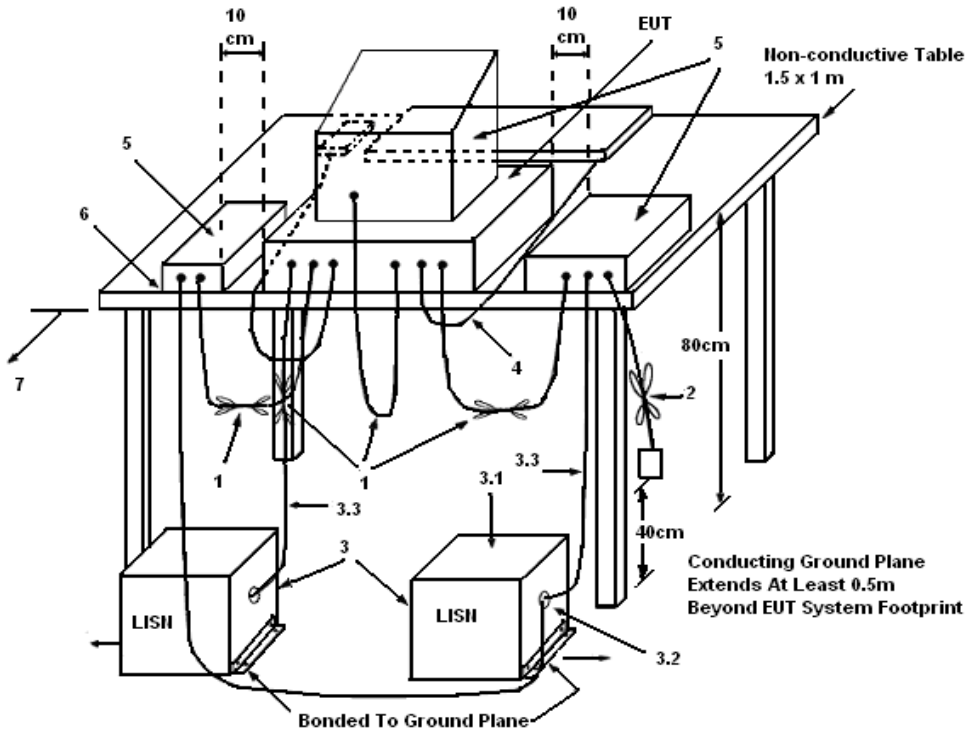
Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.1.3 Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

4.1.4 Test Setup Layout

Test Setup



1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
2. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
3. EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, reference ground plane.
   3.1 All other equipment powered from additional LISN(s).
   3.2 Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
   3.3 LISN at least 80 cm from nearest part of EUT chassis.
4. Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.
5. Non-EUT components of EUT system being tested.
6. Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.
   Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

4.1.5 Test Deviation

There are no deviations with the original standard.

4.1.6 EUT Operating during Test

The EUT was placed on the test table and programmed in normal function.

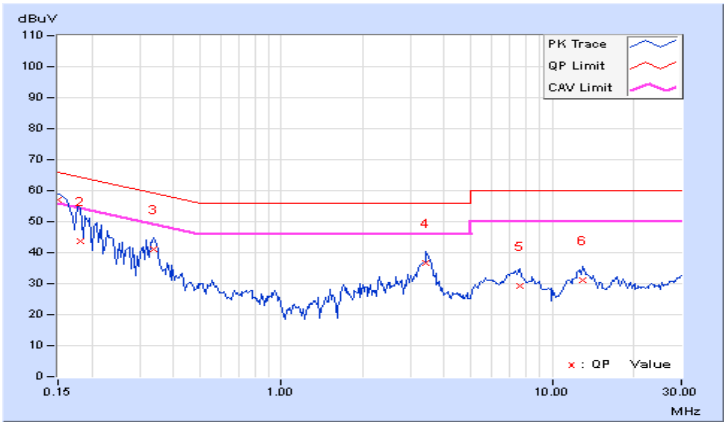
4.1.7 Test Results of AC Power Conducted Emissions

Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	**Environmental Conditions**	25℃, 75%RH
Tested by	Andy Ho		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	**0.15000**	**10.20**	**46.74**	**32.65**	**56.94**	**42.85**	**66.00**	**56.00**	**-9.06**	**-13.15**
2	0.18125	10.20	33.67	13.12	43.87	23.32	64.43	54.43	-20.56	-31.11
3	0.33750	10.23	31.03	22.11	41.26	32.34	59.26	49.26	-18.00	-16.92
4	3.43750	10.30	26.25	20.65	36.55	30.95	56.00	46.00	-19.45	-15.05
5	7.60938	10.56	18.72	13.06	29.28	23.62	60.00	50.00	-30.72	-26.38
6	12.91406	11.06	20.00	14.58	31.06	25.64	60.00	50.00	-28.94	-24.36

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

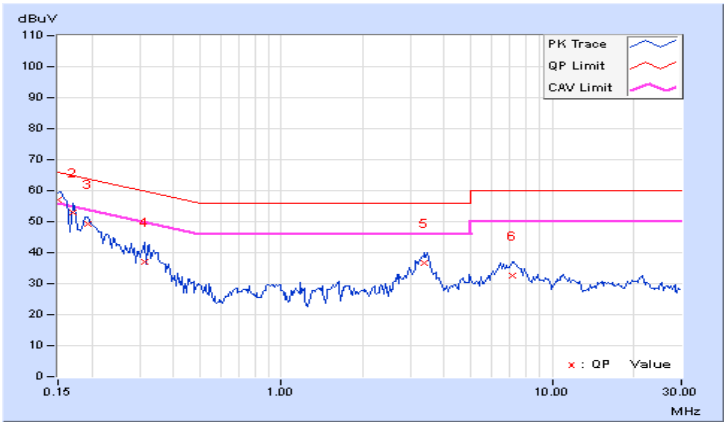


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	**Environmental Conditions**	25℃, 75%RH
Tested by	Andy Ho		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15000	10.19	46.72	33.02	56.91	43.21	66.00	56.00	-9.09	-12.79
2	0.16953	10.18	42.91	24.69	53.09	34.87	64.98	54.98	-11.89	-20.11
3	0.19297	10.17	39.11	27.25	49.28	37.42	63.91	53.91	-14.63	-16.49
4	0.31406	10.21	26.82	15.27	37.03	25.48	59.86	49.86	-22.83	-24.38
5	3.37891	10.25	26.56	20.96	36.81	31.21	56.00	46.00	-19.19	-14.79
6	7.11328	10.43	22.26	16.99	32.69	27.42	60.00	50.00	-27.31	-22.58

Remarks:

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



4.2 Band Edge and Fundamental Emissions Measurement

4.2.1 Limit

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.

4.2.2 Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of receiver.

Receiver Parameter	Setting
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.2.3 Test Procedure

1 Configure the EUT according to ANSI C63.10. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) above the ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.

2 Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

3 The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.

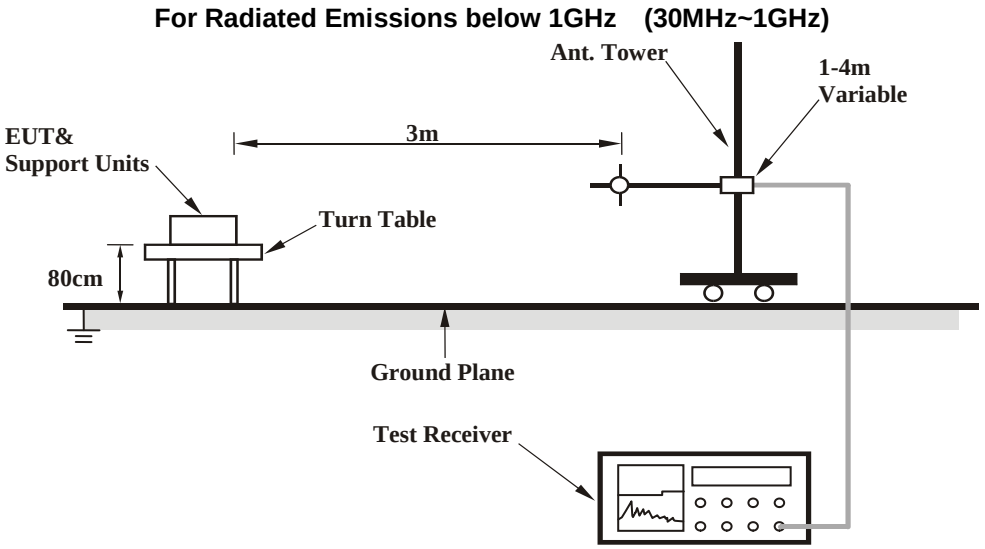
4 For each suspected emissions, the antenna tower was scan (from 1 m to 4 m) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.

5 Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode

6 If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.

4.2.4 Test Setup Layout

Setup



4.2.5 Test Deviation

There are no deviations with the original standard.

4.2.6 EUT Operating Conditions

The EUT was programmed to be in continuously transmitting mode.

4.2.7 Test Results

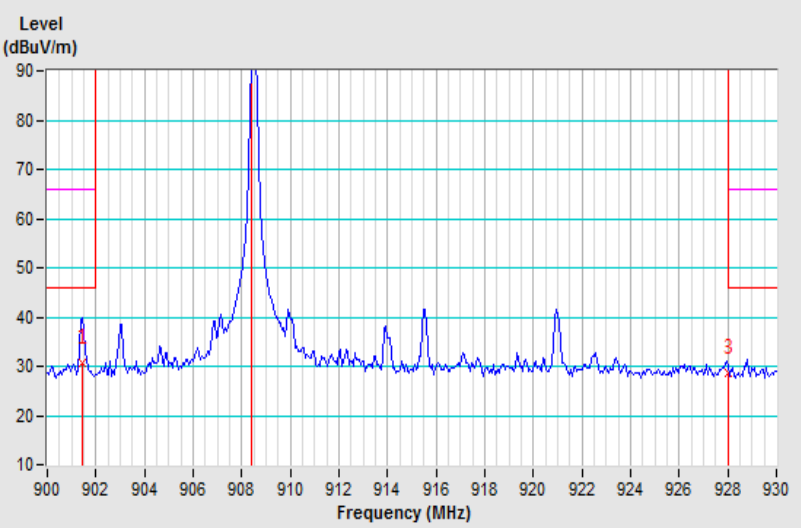
Temperature	23°C	Humidity	69%
Test Engineer	Gary Cheng		

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	901.44	30.60 QP	46.00	-15.40	1.49 H	290	26.20	4.40
2	***908.40**	**93.90 QP**	**94.00**	**-0.10**	**1.49 H**	**290**	**89.30**	**4.60**
3	928.00	28.80 QP	46.00	-17.20	1.49 H	290	24.00	4.80

Remarks:

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

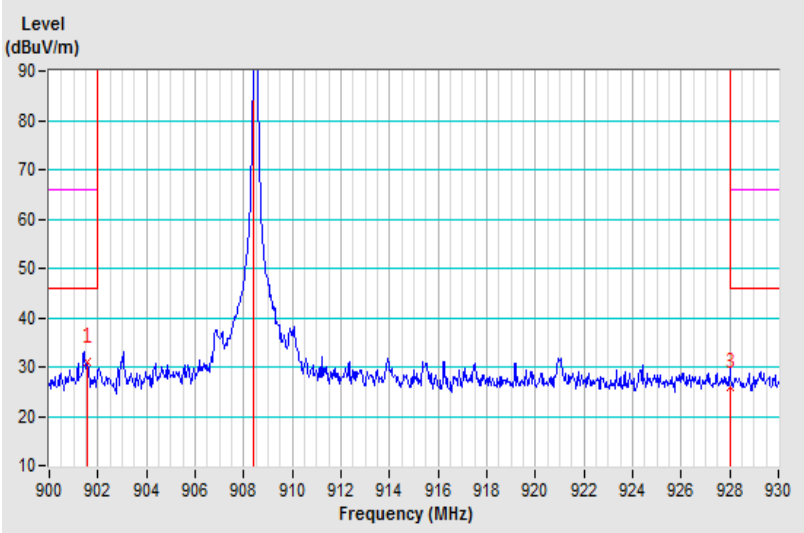


CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	901.55	31.10 QP	46.00	-14.90	1.04 V	157	26.70	4.40
2	*908.40	91.00 QP	94.00	-3.00	1.04 V	157	86.40	4.60
3	928.03	26.00 QP	46.00	-20.00	1.04 V	157	21.20	4.80

Remarks:

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



4.3 Radiated Emissions Measurement

4.3.1 Limit

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.

4.3.2 Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW	1MHz / 3MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.3.3 Test Procedure

1 Configure the EUT according to ANSI C63.10. 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. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.

2 Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

3 The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.

4 For each suspected emissions, the antenna tower was scan (from 1 m to 4 m) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.

5 Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode

6 If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.

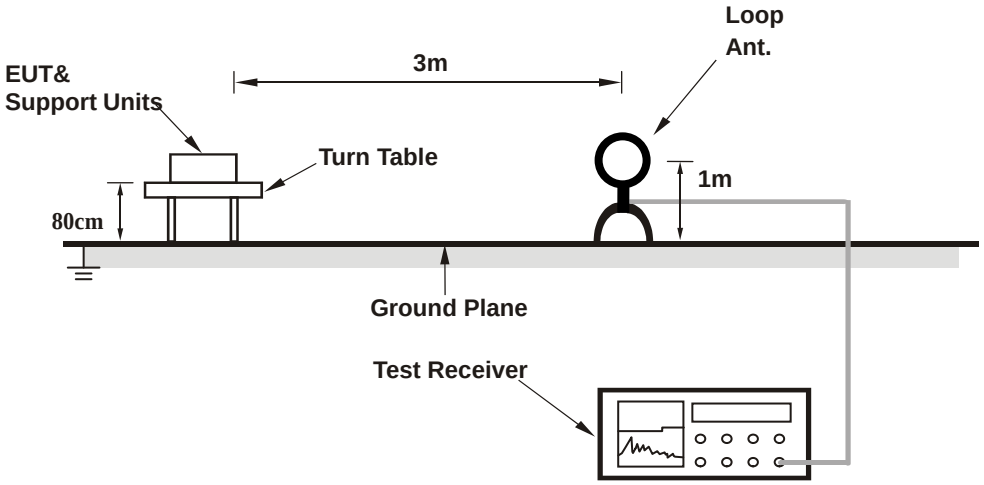
7 For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

8 As the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

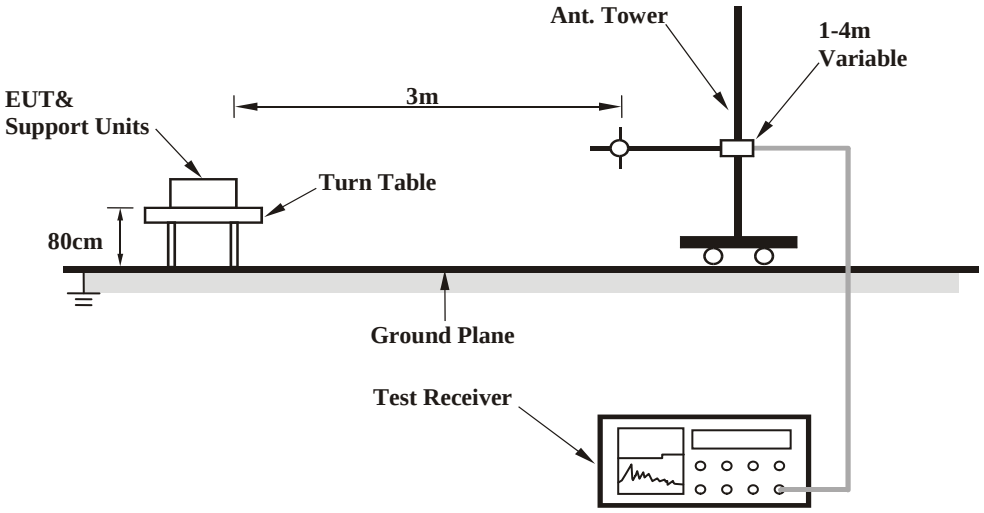
4.3.4 Test Setup Layout

Setup

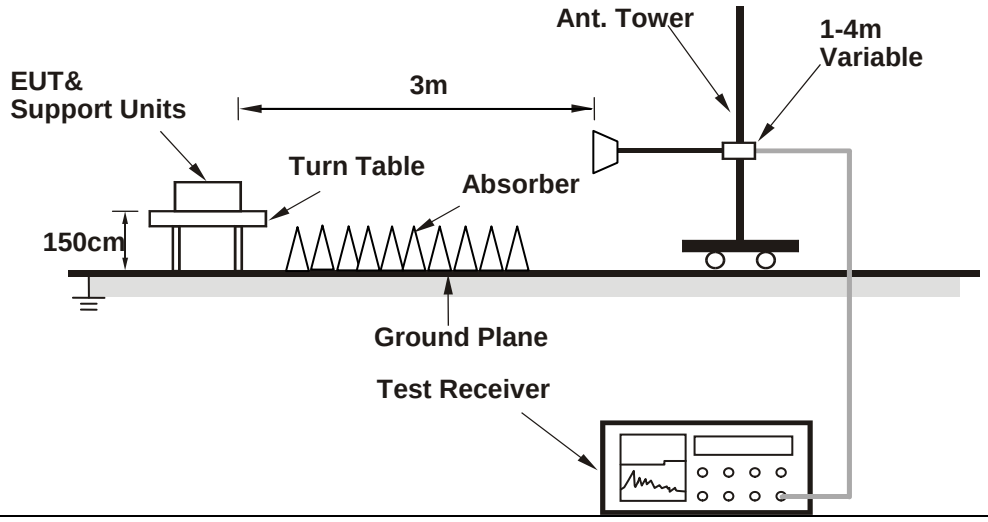
For Radiated Emissions below 1GHz (9kHz~30MHz)



For Radiated Emissions below 1GHz (30MHz~1GHz)



For Radiated Emissions above 1GHz



4.3.5 Test Deviation

There are no deviations with the original standard.

4.3.6 EUT Operating Conditions

The EUT was programmed to be in continuously transmitting mode.

4.3.7 Test Results of Radiated Emissions

Temperature	23°C	**Humidity**	70%
Test Engineer	Gary Cheng		

Radiated Emissions Range 9kHz~30MHz

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

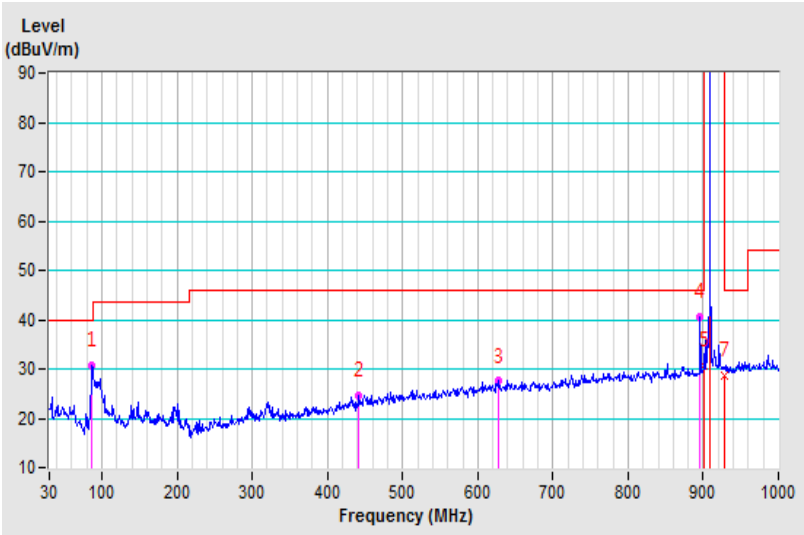
Radiated Emissions Range 30MHz~1GHz

CHANNEL	TX Channel 1	**DETECTOR FUNCTION**	Quasi-Peak (QP)
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	87.13	30.60 QP	40.00	-9.40	2.00 H	246	44.60	-14.00
2	442.06	24.60 QP	46.00	-21.40	1.50 H	37	28.00	-3.40
3	627.57	27.50 QP	46.00	-18.50	1.50 H	124	27.10	0.40
4	895.75	40.60 QP	46.00	-5.40	2.00 H	228	36.30	4.30
5	901.44	30.60 QP	46.00	-15.40	1.49 H	290	26.20	4.40
6	***908.40**	**93.90 QP**	**94.00**	**-0.10**	**1.49 H**	**290**	**89.30**	**4.60**
7	928.00	28.80 QP	46.00	-17.20	1.49 H	290	24.00	4.80

Remarks:

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

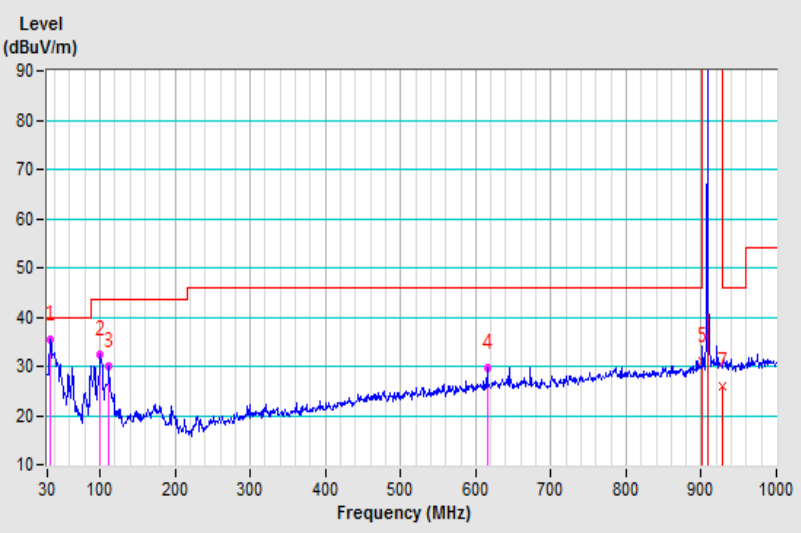


CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

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	34.70	35.60 QP	40.00	-4.40	1.00 V	236	45.20	-9.60
2	100.16	32.30 QP	43.50	-11.20	1.00 V	39	45.20	-12.90
3	112.09	30.00 QP	43.50	-13.50	1.50 V	0	41.30	-11.30
4	615.69	29.60 QP	46.00	-16.40	1.00 V	128	29.40	0.20
5	901.55	31.10 QP	46.00	-14.90	1.04 V	157	26.70	4.40
6	*908.40	91.00 QP	94.00	-3.00	1.04 V	157	86.40	4.60
7	928.03	26.00 QP	46.00	-20.00	1.04 V	157	21.20	4.80

Remarks:

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



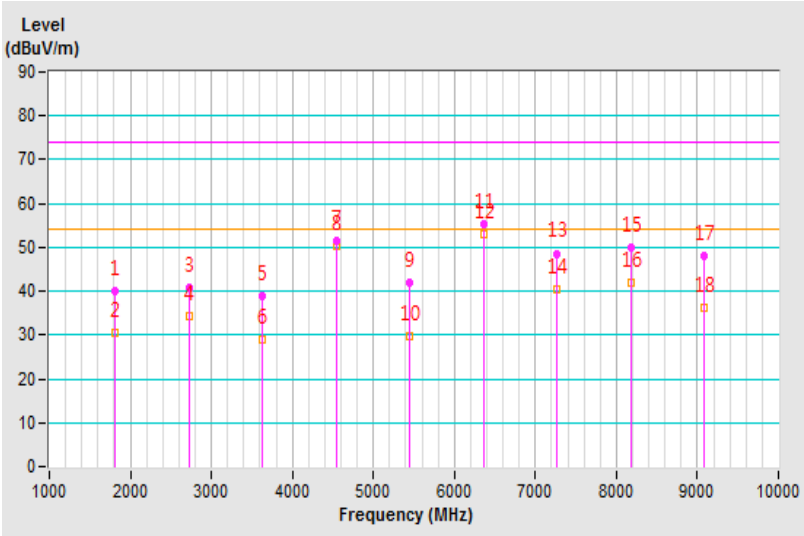
Radiated Emission Range 1GHz~10th Harmonic

CHANNEL	TX Channel 1	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 10GHz		

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	40.10 PK	74.00	-33.90	2.38 H	188	46.30	-6.20
2	1816.80	30.50 AV	54.00	-23.50	2.38 H	188	36.70	-6.20
3	2725.20	40.90 PK	74.00	-33.10	1.83 H	345	44.10	-3.20
4	2725.20	34.20 AV	54.00	-19.80	1.83 H	345	37.40	-3.20
5	3633.60	38.80 PK	74.00	-35.20	1.88 H	185	39.90	-1.10
6	3633.60	29.10 AV	54.00	-24.90	1.88 H	185	30.20	-1.10
7	4542.00	51.60 PK	74.00	-22.40	2.53 H	174	49.90	1.70
8	4542.00	50.20 AV	54.00	-3.80	2.53 H	174	48.50	1.70
9	5450.40	41.90 PK	74.00	-32.10	1.76 H	238	38.20	3.70
10	5450.40	29.80 AV	54.00	-24.20	1.76 H	238	26.10	3.70
11	6358.80	55.20 PK	74.00	-18.80	1.70 H	72	49.30	5.90
12	6358.80	53.10 AV	54.00	-0.90	1.70 H	72	47.20	5.90
13	7267.20	48.60 PK	74.00	-25.40	2.31 H	297	39.80	8.80
14	7267.20	40.30 AV	54.00	-13.70	2.31 H	297	31.50	8.80
15	8175.60	50.00 PK	74.00	-24.00	1.76 H	303	39.90	10.10
16	8175.60	42.00 AV	54.00	-12.00	1.76 H	303	31.90	10.10
17	9084.00	47.90 PK	74.00	-26.10	1.75 H	244	37.10	10.80
18	9084.00	36.10 AV	54.00	-17.90	1.75 H	244	25.30	10.80

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

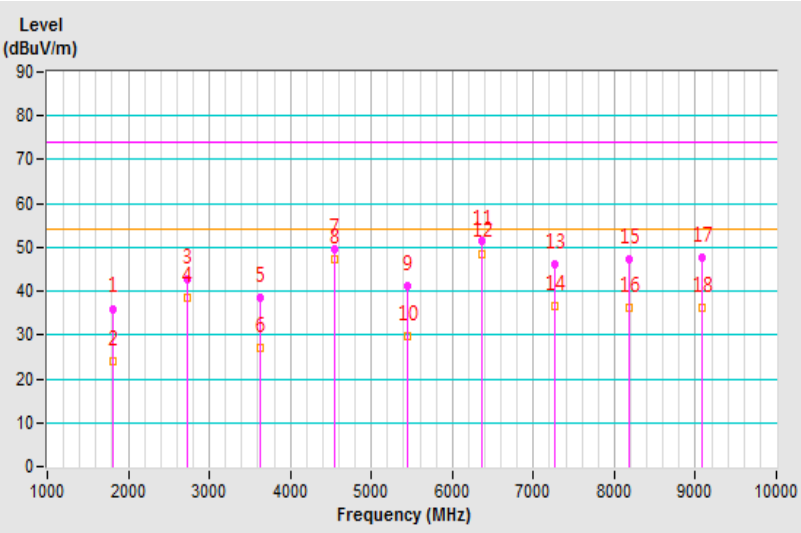


CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 10GHz		

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	36.00 PK	74.00	-38.00	1.75 V	242	42.20	-6.20
2	1816.80	23.90 AV	54.00	-30.10	1.75 V	242	30.10	-6.20
3	2725.20	42.60 PK	74.00	-31.40	2.56 V	344	45.80	-3.20
4	2725.20	38.40 AV	54.00	-15.60	2.56 V	344	41.60	-3.20
5	3633.60	38.60 PK	74.00	-35.40	1.58 V	342	39.70	-1.10
6	3633.60	27.10 AV	54.00	-26.90	1.58 V	342	28.20	-1.10
7	4542.00	49.50 PK	74.00	-24.50	3.94 V	142	47.80	1.70
8	4542.00	47.30 AV	54.00	-6.70	3.94 V	142	45.60	1.70
9	5450.40	41.00 PK	74.00	-33.00	1.57 V	242	37.30	3.70
10	5450.40	29.80 AV	54.00	-24.20	1.57 V	242	26.10	3.70
11	6358.80	51.50 PK	74.00	-22.50	3.92 V	22	45.60	5.90
12	6358.80	48.60 AV	54.00	-5.40	3.92 V	22	42.70	5.90
13	7267.20	46.00 PK	74.00	-28.00	1.28 V	334	37.20	8.80
14	7267.20	36.70 AV	54.00	-17.30	1.28 V	334	27.90	8.80
15	8175.60	47.20 PK	74.00	-26.80	1.78 V	242	37.10	10.10
16	8175.60	36.10 AV	54.00	-17.90	1.78 V	242	26.00	10.10
17	9084.00	47.50 PK	74.00	-26.50	1.78 V	248	36.70	10.80
18	9084.00	36.10 AV	54.00	-17.90	1.78 V	248	25.30	10.80

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



4.4 Emission Bandwidth Measurement

4.4.1 Limits

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (902~928MHz).

4.4.2 Measuring Instruments and Setting

The following table is the setting of the Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> 20dB Bandwidth
RBW	100KHz
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto couple

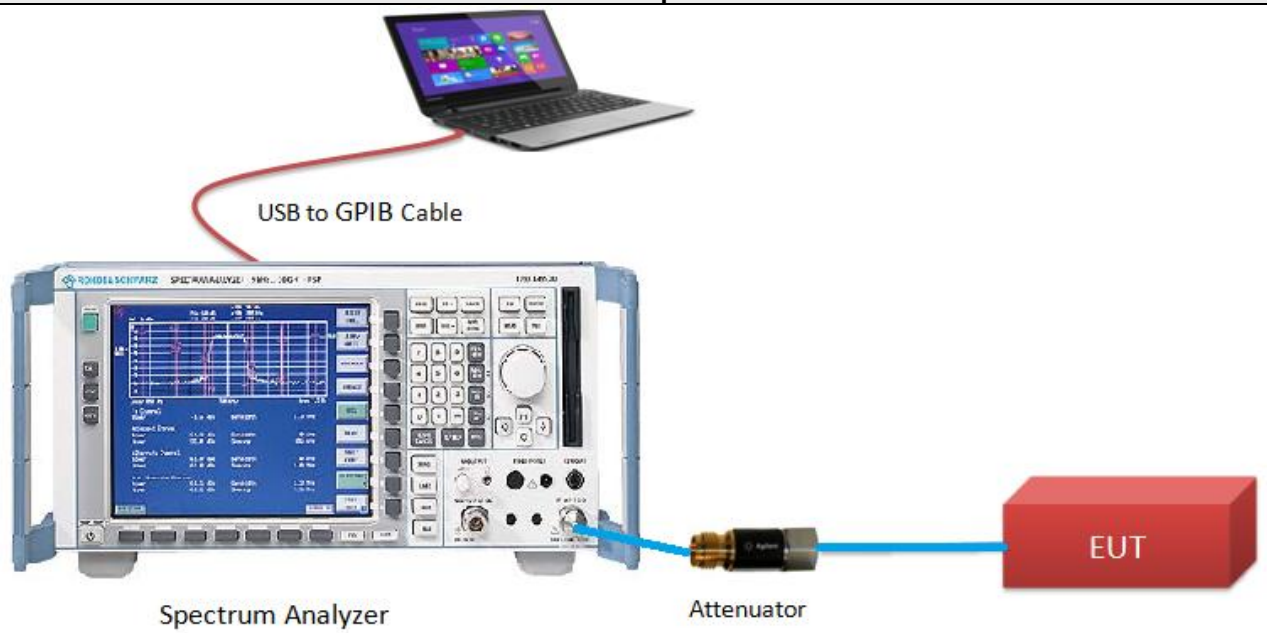
4.4.3 Test Procedure

1 The transmitter output (antenna port) was connected to the spectrum analyzer in peak, Max hold mode.

2 For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier frequency. Peak reading was taken; two markers were set 20 dB below the maximum level on the right and the left side of the emission.

3 The 20 dB bandwidth is the frequency difference between the two markers

4.4.4 Test Setup

Setup


4.4.5 Test Deviation

There are no deviations with the original standard.

4.4.6 EUT Operating Conditions

The EUT was programmed to be in continuously transmitting mode.

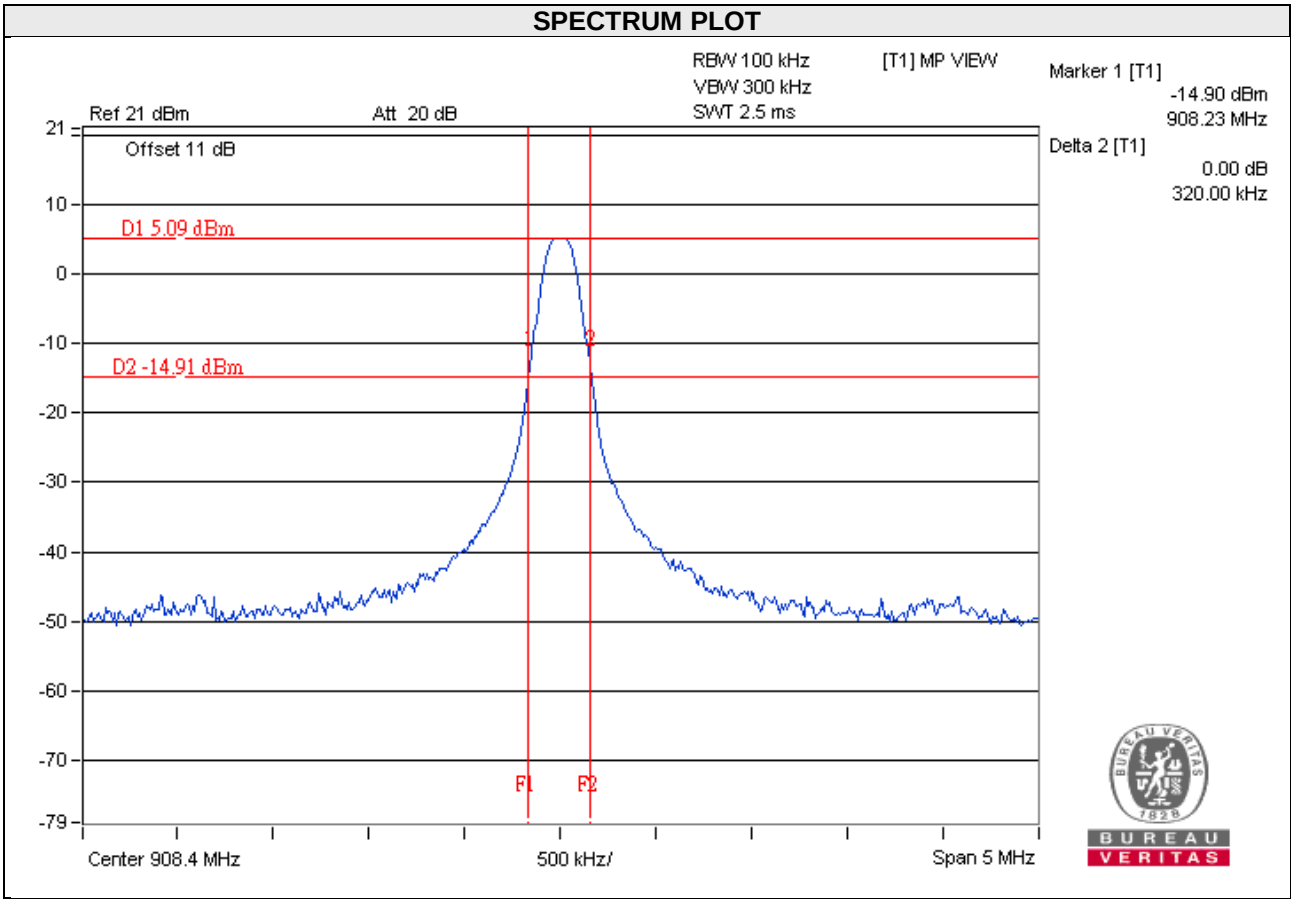
4.4.7 Test Results of Emission Bandwidth

Temperature	20°C	**Humidity**	62%
Test Engineer	Anderson Chen		

Z-Wave

CHANNEL	FREQUENCY (MHz)	EMISSION BANDWIDTH (kHz)	Frequency Low>902MHz	Frequency High<928MHz	PASS / FAIL
1	908.4	320	908.23	908.55	PASS

SPECTRUM PLOT



4.5 List of Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Oct. 24, 2016	Oct. 23, 2017
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 26, 2016	Oct. 25, 2017
RF Cable	5D-FB	COCCAB-001	Sep. 30, 2016	Sep. 29, 2017
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	June 20, 2016	June 19, 2017
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 Shielded Room No. 1.
3. Tested Date: Dec. 01, 2016

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 18, 2016	Aug. 17, 2017
Pre-Amplifier(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2014	Dec. 15, 2016
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 18, 2016	Jan. 17, 2017
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-05	May 07, 2016	May 06, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-156	Jan. 04, 2016	Jan. 03, 2017
RF Cable	8D	966-3-1 966-3-2 966-3-3	Apr. 02, 2016	Apr. 01, 2017
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Oct. 05, 2016	Oct. 04, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Jan. 20, 2016	Jan. 19, 2017
Pre-Amplifier Agilent	8449B	3008A02465	Apr. 05, 2016	Apr. 04, 2017
RF Cable	EMC104-SM-SM-2000 EMC104-SM-SM-5000 EMC104-SM-SM-5000	150317 150321 150322	Mar. 30, 2016	Mar. 29, 2017
Spectrum Analyzer Keysight	N9030A	MY54490520	July 29, 2016	July 28, 2017
Pre-Amplifier EMCI	EMC184045	980143	Jan. 15, 2016	Jan. 14, 2017
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Jan. 08, 2016	Jan. 07, 2017
RF Cable	SUCOFLEX 102	36432/2 36433/2	Jan. 16, 2016	Jan. 15, 2017
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

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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 3.
4. The FCC Site Registration No. is 147459
5. The CANADA Site Registration No. is 20331-1
6. Tested Date: Dec. 13 to 14, 2016

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	100964	June 28, 2016	June 27, 2017
Spectrum Analyzer Agilent	E4446A	MY48250253	Dec. 21, 2016	Dec. 20, 2017
Power meter Anritsu	ML2495A	1014008	May 05, 2016	May 04, 2017
Power sensor Anritsu	MA2411B	0917122	May 05, 2016	May 04, 2017
AC Power Source Extech Electronics	6205	1440452	NA	NA
Temperature & Humidity Chamber Giant Force	GTH-150-40-SP-AR	MAA0812-008	Jan. 15, 2016	Jan. 14, 2017
DC Power Supply Topward	6603D	795558	NA	NA
Digital Multimeter FLUKE	87III	73680266	Nov. 10, 2016	Nov. 09, 2017
ESG Vector signal generator Agilent	E4438C	MY45094468/005 506 602 UK6 UNJ	Nov. 25, 2016	Nov. 24, 2017
Mech Switch Absorptive Mini-Circuits	MSP4TA-18+	0140	Mar. 19, 2016	Mar. 18, 2017
FXD ATTEN Mini-Circuits	BW-S3W2+	MN71981	Mar. 19, 2016	Mar. 18, 2017
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA

NOTE: 1. The test was performed in Oven room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: Jan. 10, 2017

Appendix A. 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.

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

Linko EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

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