

FCC Test Report (Z-Wave)

Report No.: RFBEIH-WTW-P21070244-8

FCC ID: P27-IG515

Test Model: IG515-4G

Received Date: 2021/7/8

Test Date: 2021/9/24 ~ 2021/9/27

Issued Date: 2021/11/29

Applicant: Sercomm Corp.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

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**FCC Registration /
Designation Number:** 198487 / TW2021



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Release Control Record

Issue No.	Description	Date Issued
RFBEIH-WTW-P21070244-8	Original release.	2021/11/29

1 Certificate of Conformity

Product: Gateway

Brand: Sercomm

Test Model: IG515-4G

Sample Status: Engineering sample

Applicant: Sercomm Corp.

Test Date: 2021/9/24 ~ 2021/9/27

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 RF characteristics under the conditions specified in this report.

Prepared by : Annie Chang, **Date:** 2021/11/29
Annie Chang / Senior Specialist

Approved by : Jeremy Lin, **Date:** 2021/11/29
Jeremy Lin / Project Engineer

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 -19.16dB at 0.16172MHz.
15.215	Channel Bandwidth Measurement	N/A	Refer to Note 2 below
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 -4.55dB at 33.78MHz.
15.203	Antenna Requirement	Pass	Antenna connector is I-PEX not a standard connector.

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. Test items: AC Power Conducted Emission and Radiated Emissions below 1GHz were performed for this addendum. The others testing data refer to original test report.
3. N/A: Not Applicable

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.00 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.38 dB
	30MHz ~ 1GHz	5.70 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Gateway
Brand	Sercomm
Test Model	IG515-4G
Status of EUT	Engineering sample
Power Supply Rating	12Vdc from adapter or 7.5Vdc from battery
Modulation Type	FSK
Operating Frequency	908.4MHz, 916.0MHz
Number of Channel	2
Antenna Type	Ant. 3: PIFA antenna with 2.7dBi gain
Antenna Connector	I-PEX
Accessory Device	Adapter
Cable Supplied	N/A

Note:

- This report is prepared for FCC class II permissive change. This report is issued as a supplementary report to BV CPS report no. RF200709D02-8. The difference compared with original report is listed as below, therefore only Conducted Emission and Radiated Emissions (below 1GHz) tests were performed for this addendum.
 - ✧ Adding new HW, Buzzer, Tamper & Pairing button
 - ✧ Adding new battery source (Main source: Simpo: Model: Sercomm NA50X_NA502S, 2nd source: FUJI: Model: IG55)
 - ✧ Cancel the large shell of the original report.
- 2.4GHz & 5GHz WLAN technologies cannot transmit at same time.
WCDMA & LTE technologies cannot transmit at same time.
WLAN, WWAN, Bluetooth, Zigbee & Z-Wave technologies can transmit at same time.
- The EUT was pre-tested with the following modes:
 - ✧ Operating Mode (EUT + Battery)
 - ✧ Operating + Charging Mode (EUT + Adapter)
 The worst emission level was found when the EUT tested under **Operating + Charging Mode (EUT + Adapter)**, therefore, only its test data was recorded in this report.
- The EUT uses following adapter or battery.

Item	Adapter	Battery
Brand	APD	FUJI
Model	WB-24J12FU	IG55
AC I/P Rating	100-240V, 50/60Hz, 0.7A	-
DC O/P Rating	12V, 2A	7.2V, 3100mAh, 22.32Wh
Power cord	AC 2 Pin, Non-shielded DC cable (1.5m)	-

- The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.
- 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

2 channels are provided to this EUT:

Channel	Frequency	Channel	Frequency
1	908.4MHz	2	916.0MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE \geq 1G	RE<1G	PLC	APCM	
-	Note 2	√	√	Note 2	Operating + Charging Mode (EUT + Adapter)

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

NOTE: 1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.
 2. Test items: Conducted Emission and Radiated Emissions below 1GHz were performed for this addendum. The others testing data refer to original test report.

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 Configure Mode	Available Channel	Tested Channel	Modulation Type
-	1 to 2	1	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.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
-	1 to 2	1	FSK

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE<1G	28deg. C, 72%RH	120Vac, 60Hz	Jed Wu
PLC	25deg. C, 75%RH	120Vac, 60Hz	Ian Chang

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 PC	ASUS	PU401L	E9NXXBC002007372	NA	Provided by Lab

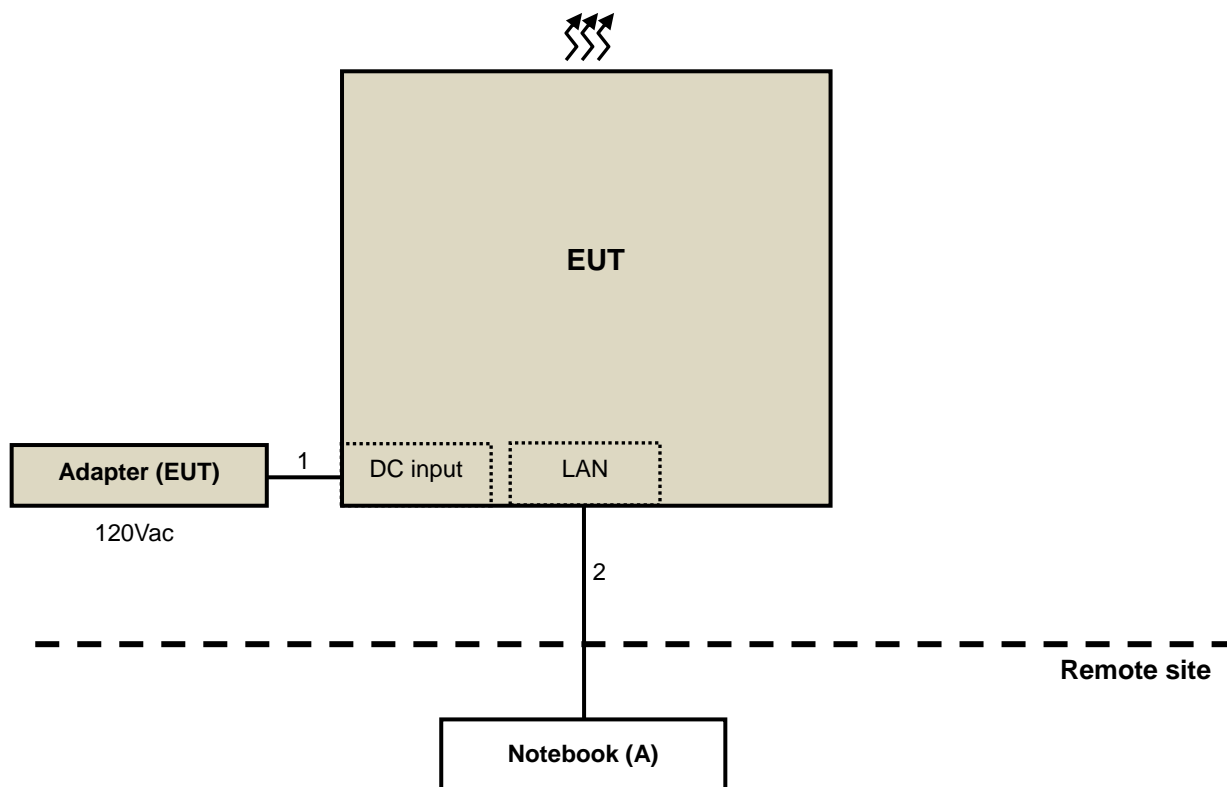
Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as communication partners to transfer data.

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/ No)	Cores (Qty.)	Remarks
1.	DC cable	1	1.5	N	0	Supplied by client
2.	LAN cable	1	10	N	0	Provided by Lab (RJ45, Cat.5e)

Note: The core(s) is(are) originally attached to the cable(s).

3.3.1 Configuration of System under Test



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.

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
Pre_Amplifier EMCI	EMC001340	980269	2021/6/29	2022/6/28
LOOP ANTENNA EMCI	LPA600	270	2021/9/2	2023/9/1
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	2021/7/13	2022/7/12
Pre_Amplifier HP	8447D	2432A03504	2021/2/18	2022/2/17
Bi-log Broadband Antenna Schwarzbeck	VULB9168	139	2020/11/6	2021/11/5
Attenuator Mini-Circuits	UNAT-5+	PAD-CH6-01	2021/7/13	2022/7/12
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	2021/7/13	2022/7/12

- NOTE:**
1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in LK - 966 chamber 1
 3. Tested Date: 2021/9/24

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: 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:

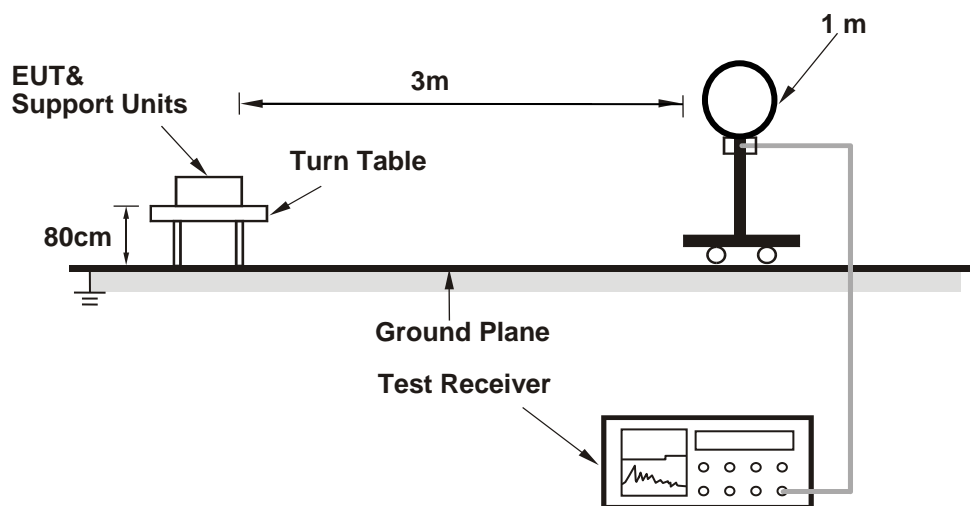
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

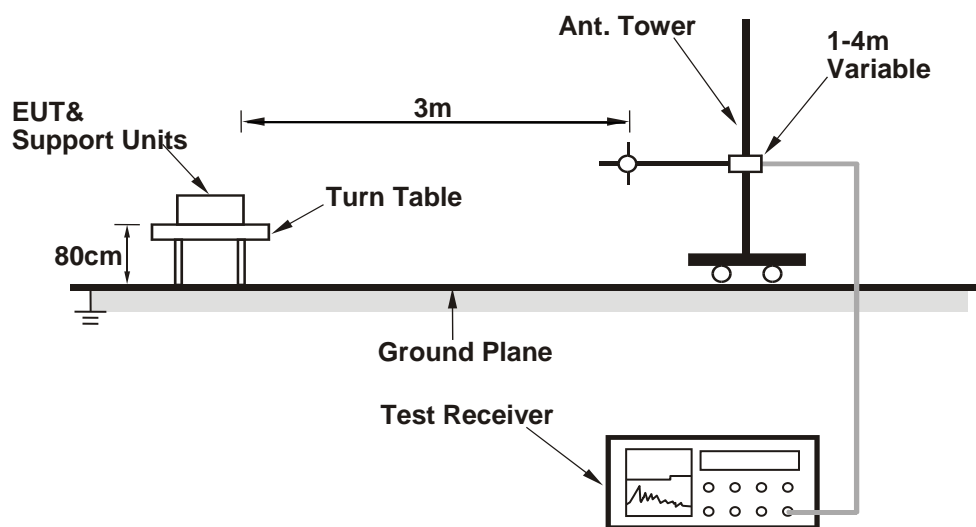
No deviation.

4.1.5 Test Set Up

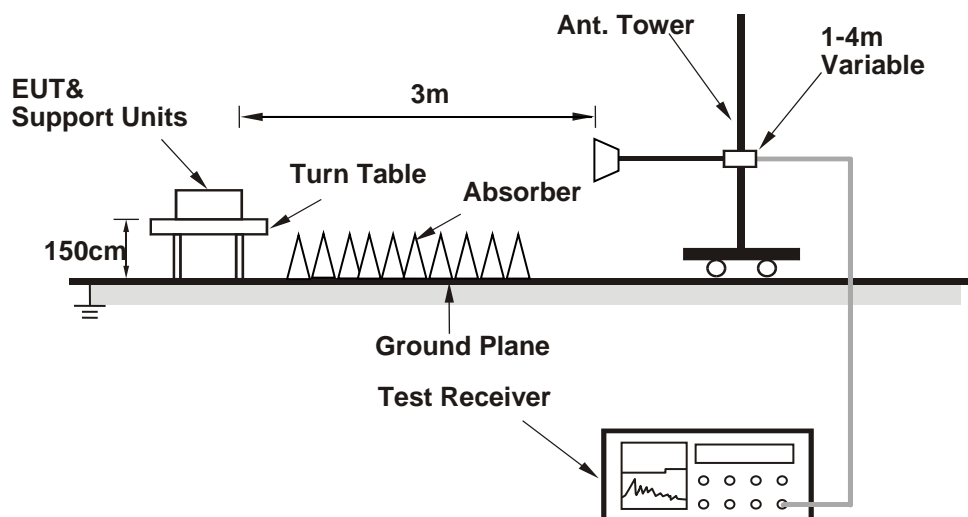
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Prepared notebook to act as communication partner and placed it outside of testing area.
- The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the system in full functions.

4.1.7 Test Results

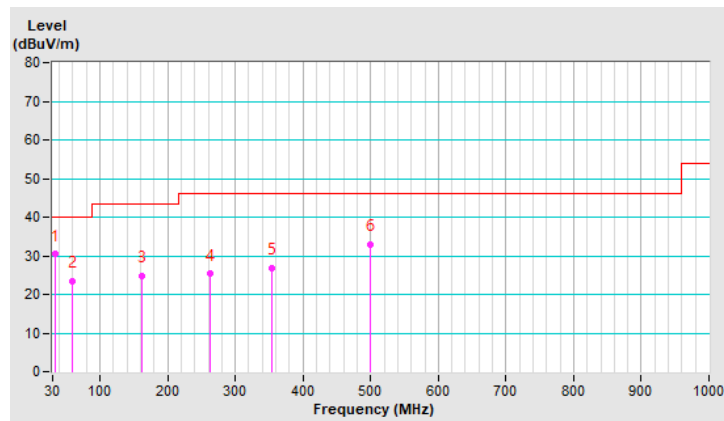
Below 1GHz Data:

RF Mode	TX Z-wave	Channel	CH 1 : 908.4 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	33.59	30.39 QP	40.00	-9.61	2.35 H	61	38.92	-8.53
2	58.57	23.42 QP	40.00	-16.58	2.06 H	12	30.74	-7.32
3	161.39	24.89 QP	43.50	-18.61	2.11 H	260	31.06	-6.17
4	262.17	25.33 QP	46.00	-20.67	2.48 H	46	31.12	-5.79
5	353.79	26.77 QP	46.00	-19.23	1.14 H	360	29.83	-3.06
6	500.06	32.93 QP	46.00	-13.07	1.38 H	229	32.93	0.00

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.

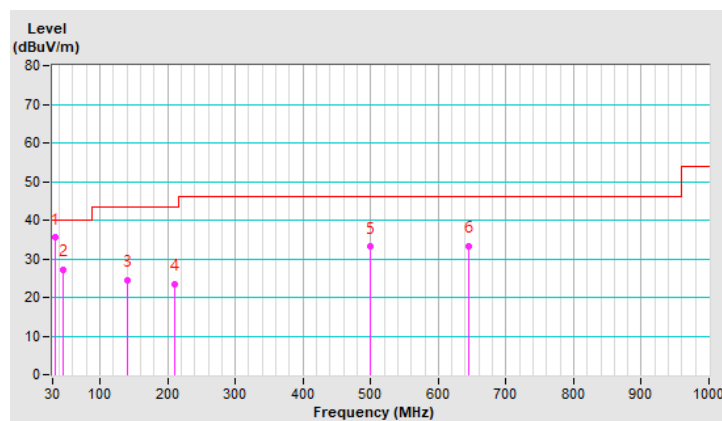


RF Mode	TX Z-wave	Channel	CH 1 : 908.4 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	33.78	35.45 QP	40.00	-4.55	2.36 V	205	43.97	-8.52
2	46.34	27.15 QP	40.00	-12.85	2.03 V	360	34.12	-6.97
3	141.06	24.44 QP	43.50	-19.06	1.75 V	88	31.22	-6.78
4	209.98	23.46 QP	43.50	-20.04	1.96 V	322	31.93	-8.47
5	500.01	33.13 QP	46.00	-12.87	1.25 V	143	33.13	0.00
6	644.88	33.28 QP	46.00	-12.72	2.18 V	336	30.03	3.25

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	838251/021	2020/11/3	2021/11/2
LISN R&S	ENV216	101197	2021/6/23	2022/6/22
LISN R&S	ENV216	101195	2021/5/25	2022/5/24
LISN SCHWARZBECK	NNLK8129	8129229	2021/5/20	2022/5/19
DC LISN SCHWARZBECK	NNLK 8121	8121-808	2021/4/18	2022/4/17
LISN SCHWARZBECK	NNLK 8121	8121-731	2021/4/28	2022/4/27
LISN R&S	ENV216	101196	2021/4/26	2022/4/25
LISN EMCO	3825/2	9504-2359	2021/7/27	2022/7/26
LISN R&S	ESH3-Z6	844950/018	2021/7/25	2022/7/24
LISN EMCO	3825/2	9204-1964	2021/5/19	2022/5/18
DC LISN R&S	ESH3-Z6	100219	2021/7/25	2022/7/24
Coupling/Dcoupling Network SCHWARZBECK	CDNE-M2	00097	2021/5/6	2022/5/5
Coupling/Dcoupling Network SCHWARZBECK	CDNE-M3	00091	2021/5/6	2022/5/5
Coupling/Dcoupling Network TESEQ	CDN A201A	44601	2020/12/27	2021/12/26
RF Coaxial Cable Commate	5D-FB	Cable-CO3-01	2021/9/15	2022/9/14
Attenuator STI	STI02-2200-10	NO.3	2020/10/23	2021/10/22
50 ohms Terminator LYNICS	0900510	E1-01-300	2021/1/27	2022/1/26
50 ohms Terminator LYNICS	0900510	E1-01-301	2021/1/27	2022/1/26
Isolation Transformer Erika Fiedler	D-65396	017	2021/9/9	2022/9/8
Software BVADT	Cond_V7.3.7.4	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 Linkou Conduction03

3. Tested Date: 2021/9/27

4.2.3 Test Procedure

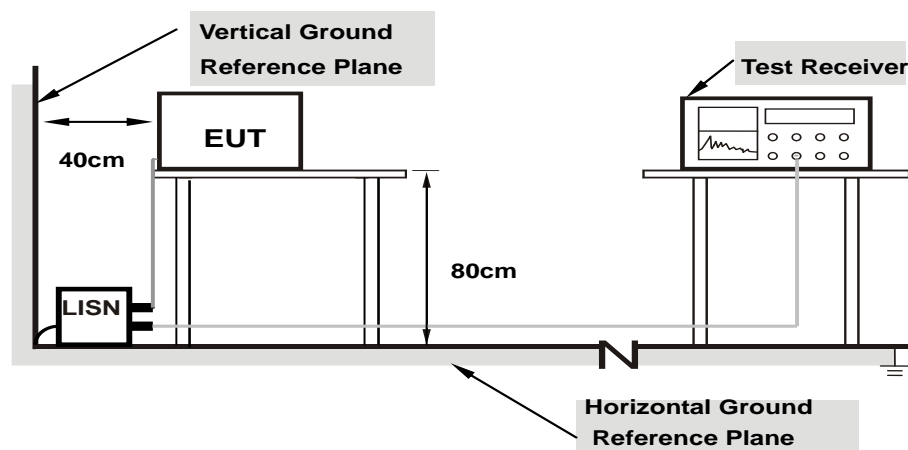
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

Same as Item 4.1.6.

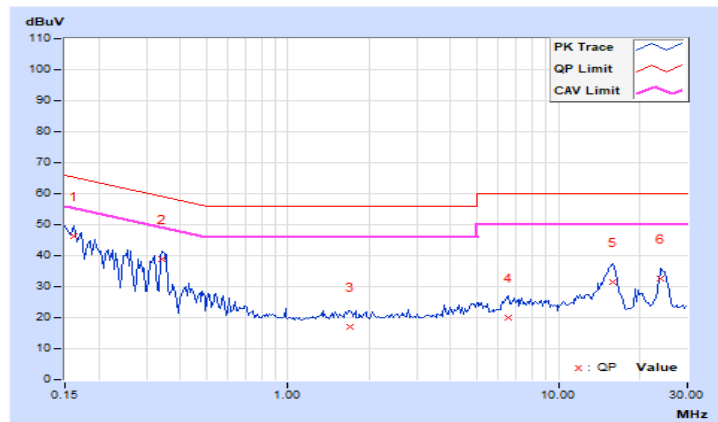
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
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Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	9.83	36.39	24.85	46.22	34.68	65.38	55.38	-19.16	-20.70
2	0.34141	9.86	28.91	19.52	38.77	29.38	59.17	49.17	-20.40	-19.79
3	1.69922	10.00	6.98	1.16	16.98	11.16	56.00	46.00	-39.02	-34.84
4	6.50391	10.16	9.66	1.68	19.82	11.84	60.00	50.00	-40.18	-38.16
5	15.81250	10.29	21.23	13.71	31.52	24.00	60.00	50.00	-28.48	-26.00
6	23.97266	10.32	22.13	16.43	32.45	26.75	60.00	50.00	-27.55	-23.25

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

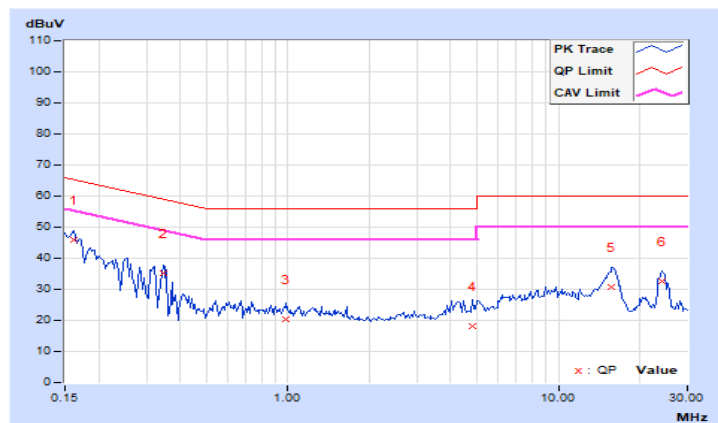


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
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Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	9.80	36.19	24.33	45.99	34.13	65.38	55.38	-19.39	-21.25
2	0.34531	9.82	25.23	18.64	35.05	28.46	59.07	49.07	-24.02	-20.61
3	0.98594	9.86	10.63	3.87	20.49	13.73	56.00	46.00	-35.51	-32.27
4	4.80859	10.10	8.14	1.82	18.24	11.92	56.00	46.00	-37.76	-34.08
5	15.74609	10.29	20.60	12.76	30.89	23.05	60.00	50.00	-29.11	-26.95
6	24.26563	10.36	22.10	18.33	32.46	28.69	60.00	50.00	-27.54	-21.31

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 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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