

FCC Certification Test Report

Report No.: FC200611C02 R1

Test Model: MAX BR1 Mini Core

Series Model: MAX BR1 Mini Core LTE, MAX BR1 Mini Core LTEA, Pepwave MAX BR1 Mini Core, Pepwave MAX BR1 Mini Core LTE, Pepwave MAX BR1 Mini Core LTEA, Peplink MAX BR1 Mini Core, Peplink MAX BR1 Mini Core LTE, Peplink MAX BR1 Mini Core LTEA, MAX-BR1-MINI-LTE-US-T-M, MAX-BR1-MINI-LTEA-W-T-M, Pismo930 Lite
(refer to item 3.1 for more details)

FCC ID: U8G-P1930LITER4

Received Date: Jun. 11, 2020

Test Date: Jun. 17 ~ Jun. 18, 2020

Issued Date: Jul. 17, 2020

Applicant: PISMO LABS TECHNOLOGY LIMITED

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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 / 328930 / TW1050

Designation Number:



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Release Control Record

Issue No.	Description	Date Issued
FC200611C02	Original release.	Jun. 22, 2020
FC200611C02 R1	Revised test condition on Page.7 & 8	Jul. 17, 2020

1 Certificate of Conformity

Product: PEPWAVE / peplink Wireless Product

Brand: PEPWAVE / peplink

FCC ID: U8G-P1930LITER4

Test Model: MAX BR1 Mini Core

Series Model: MAX BR1 Mini Core LTE, MAX BR1 Mini Core LTEA, Pepwave MAX BR1 Mini Core, Pepwave MAX BR1 Mini Core LTE, Pepwave MAX BR1 Mini Core LTEA, Peplink MAX BR1 Mini Core, Peplink MAX BR1 Mini Core LTE, Peplink MAX BR1 Mini Core LTEA, MAX-BR1-MINI-LTE-US-T-M, MAX-BR1-MINI-LTEA-W-T-M, Pismo930 Lite (refer to item 3.1 for more details)

Sample Status: Prototype

Applicant: PISMO LABS TECHNOLOGY LIMITED

Test Date: Jun. 17 ~ Jun. 18, 2020

Standards: 47 CFR FCC Part 15, Subpart B, Class A
ICES-003:2016 Issue 6, updated Apr. 2019, Class A
ANSI C63.4:2014

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 : Christin Lee , **Date:** Jul. 17, 2020
Christin Lee / Specialist

Approved by : Mitch Jen , **Date:** Jul. 17, 2020
Mitch Jen / Assistant Manager

2 Summary of Test Results

FCC Clause	Test Item	Result/Remarks	Verdict
15.107	AC Power Line Conducted Emissions	Minimum passing Class A margin is -17.48 dB at 20.25800 MHz	Pass
15.109	Radiated Emissions up to 1 GHz	Minimum passing Class A margin is -6.71 dB at 43.48 MHz	Pass
	Radiated Emissions above 1 GHz	Minimum passing Class A margin is -21.34 dB at 6746.18 MHz	Pass

Note:

1. There is no deviation to the applied test methods and requirements covered by the scope of this report.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	4.14 dB
Radiated Emissions above 1 GHz	Above 1GHz	5.04 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 Description of EUT

Product	PEPWAVE / peplink Wireless Product
Brand	PEPWAVE / peplink
FCC ID	U8G-P1930LITER4
Test Model	MAX BR1 Mini Core
Series Model	MAX BR1 Mini Core LTE, MAX BR1 Mini Core LTEA, Pepwave MAX BR1 Mini Core, Pepwave MAX BR1 Mini Core LTE, Pepwave MAX BR1 Mini Core LTEA, Peplink MAX BR1 Mini Core, Peplink MAX BR1 Mini Core LTE, Peplink MAX BR1 Mini Core LTEA, MAX-BR1-MINI-LTE-US-T-M, MAX-BR1-MINI-LTEA-W-T-M, Pismo930 Lite
Model Difference	Refer to note
Sample Status	Prototype
Operating Software	N/A
Power Supply Rating	12Vdc from Adapter Passive PoE Input (WAN Port, 12Vdc-28Vdc) DC Jack/Terminal Block: 12Vdc-28Vdc
Accessory Device	Adapter
Data Cable Supplied	N/A

Note:

1. All models are listed as below. Model MAX BR1 Mini Core is the representative for final test.

Brand	Model	Description
PEPWAVE / peplink	MAX BR1 Mini Core	Main Test
	MAX BR1 Mini Core LTE, MAX BR1 Mini Core LTEA, Pepwave MAX BR1 Mini Core, Pepwave MAX BR1 Mini Core LTE, Pepwave MAX BR1 Mini Core LTEA, Peplink MAX BR1 Mini Core, Peplink MAX BR1 Mini Core LTE, Peplink MAX BR1 Mini Core LTEA, MAX-BR1-MINI-LTE-US-T-M, MAX-BR1-MINI-LTEA-W-T-M, Pismo930 Lite	Series Models is for market purpose

2. The EUT consumes power from the following Adapter.

Brand	DVE
Model	DSA-24PFM-12 FUS 120200
Input Power	100-240VAC, 0.8A,50-60Hz
Output Power	12Vdc / 2A
Power Line	1.45m non-shielded power cable without core attached on adapter

3. The EUT has three WWAN Modules for testing.

Module	Brand	Model	FCC ID
Integrated WWAN Module 1	Sierra	MC7455	N7NMC7455
Integrated WWAN Module 2	Telit	LE910C4-NF	R17LE910CXNF
Integrated WWAN Module 3	Telit	LE910NA-V2	R17LE910NAV2

3.2 Features of EUT

The tests reported herein were performed according to the method specified by PISMO LABS TECHNOLOGY LIMITED, for detailed feature description, please refer to the manufacturer's specifications or user's manual.

3.3 Operating Modes of EUT and Determination of Worst Case Operating Mode

The EUT consumes power from AC adapter of rating 100-240Vac, 50/60Hz or DC power supply of rating 12Vdc/28Vdc from POE.

For radiated emission test, the EUT has been pre-tested under the following test modes, and test mode 8 was the worst case for final test.

Mode	Test Condition
1	EUT + WWAN Module 2 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC IN with cable only + Adapter, 120Vac/60Hz
2	EUT + WWAN Module 2 + LTE Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC IN with cable only + Adapter, 120Vac/60Hz
3	EUT + WWAN Module 1 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC IN with cable only + Adapter, 120Vac/60Hz
4	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC IN with cable only + Adapter, 120Vac/60Hz
5	EUT + WWAN Module 3 + WCDMA Link (slot B) + LAN 100Mbps & WAN 100Mbps PING test + + DC IN with cable only + Adapter, 240Vac/60Hz
6	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC Power Supply, 12Vdc
7	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC Power Supply, 28Vdc
8	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps PING test + DC IN with cable only + WAN port PoE IN 100Mbps, 28Vdc

For conducted emission, the EUT has been pre-tested under following modes, and test mode 1, 3 were chosen for final test.

Mode	Test Condition
1	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC IN with cable only + Adapter, 120Vac/60Hz
2	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC IN with cable only + Adapter, 240Vac/60Hz
3	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC Power Supply, 12Vdc
4	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC Power Supply, 28Vdc

Test modes are presented in the report as below.

Mode	Test Condition
Conducted emission test	
A	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC IN with cable only + Adapter
B	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps & WAN 100Mbps PING test + DC Power Supply, 12Vdc
C	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps PING test + DC IN with cable only + WAN port PoE IN 100Mbps, 28Vdc
Radiated emission up to 1GHz test	
-	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps PING test + DC IN with cable only + WAN port PoE IN 100Mbps, 28Vdc
Radiated emission above 1GHz test	
-	EUT + WWAN Module 3 + WCDMA Link (slot A) + LAN 100Mbps PING test + DC IN with cable only + WAN port PoE IN 100Mbps, 28Vdc

3.4 Test Program Used and Operation Descriptions

- a. Placed the EUT on the test table.
- b. Prepared notebooks outside of test area to act as communication partners.
- c. The communication partners sent data to EUT via LAN & WAN by command "PING".
- d. EUT linked with radio communication analyzer through WWAN.

3.5 Primary Clock Frequencies of Internal Source

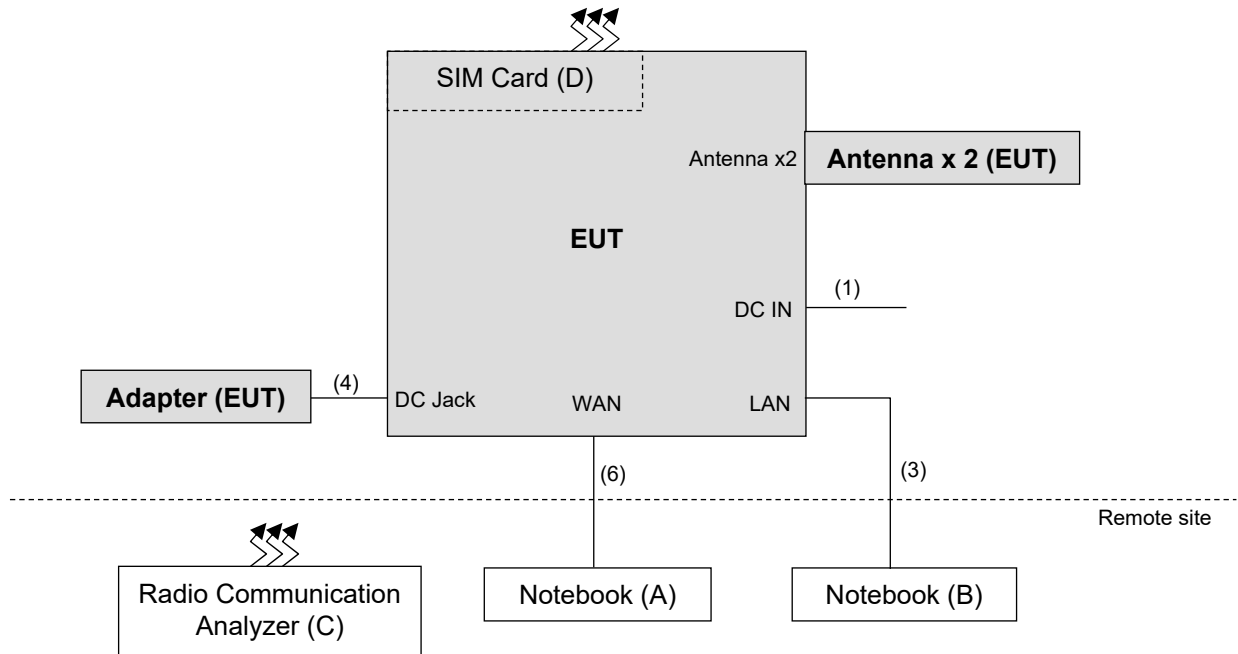
The highest frequency generated or used within the EUT or on which the EUT operates or tunes is 2.69GHz, provided by PISMO LABS TECHNOLOGY LIMITED, for detailed internal source, please refer to the manufacturer's specifications.

4 Configuration and Connections with EUT

4.1 Connection Diagram of EUT and Peripheral Devices

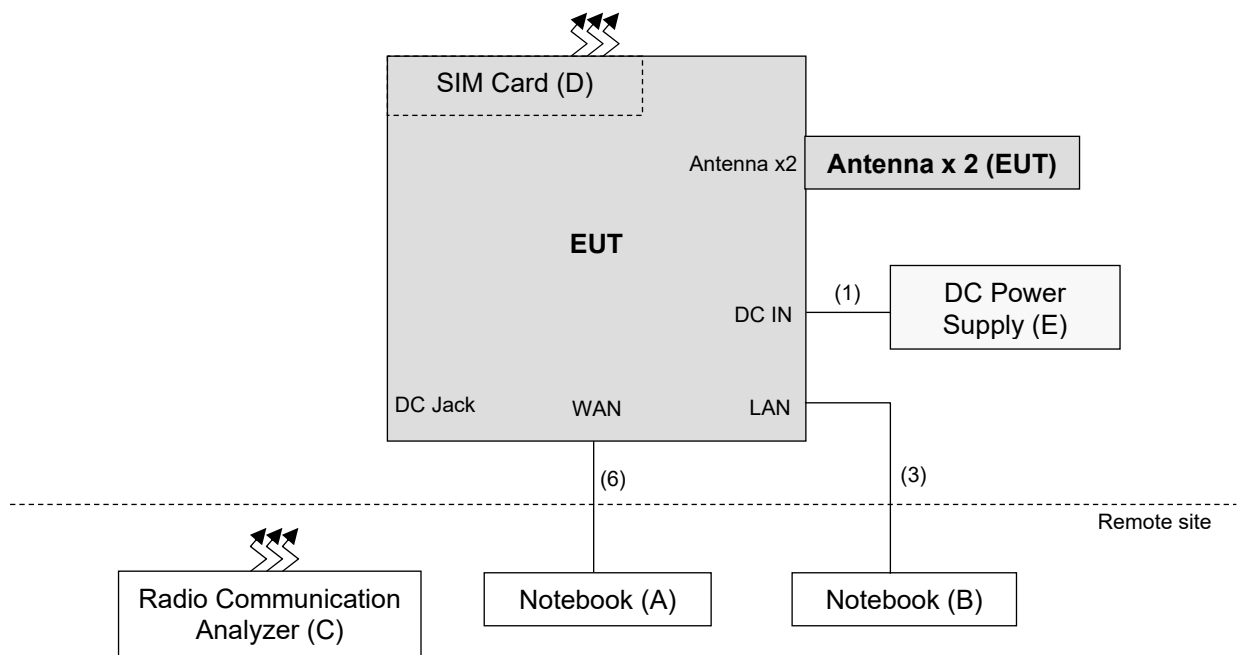
For Conducted emission test

Mode A (Adapter Mode)

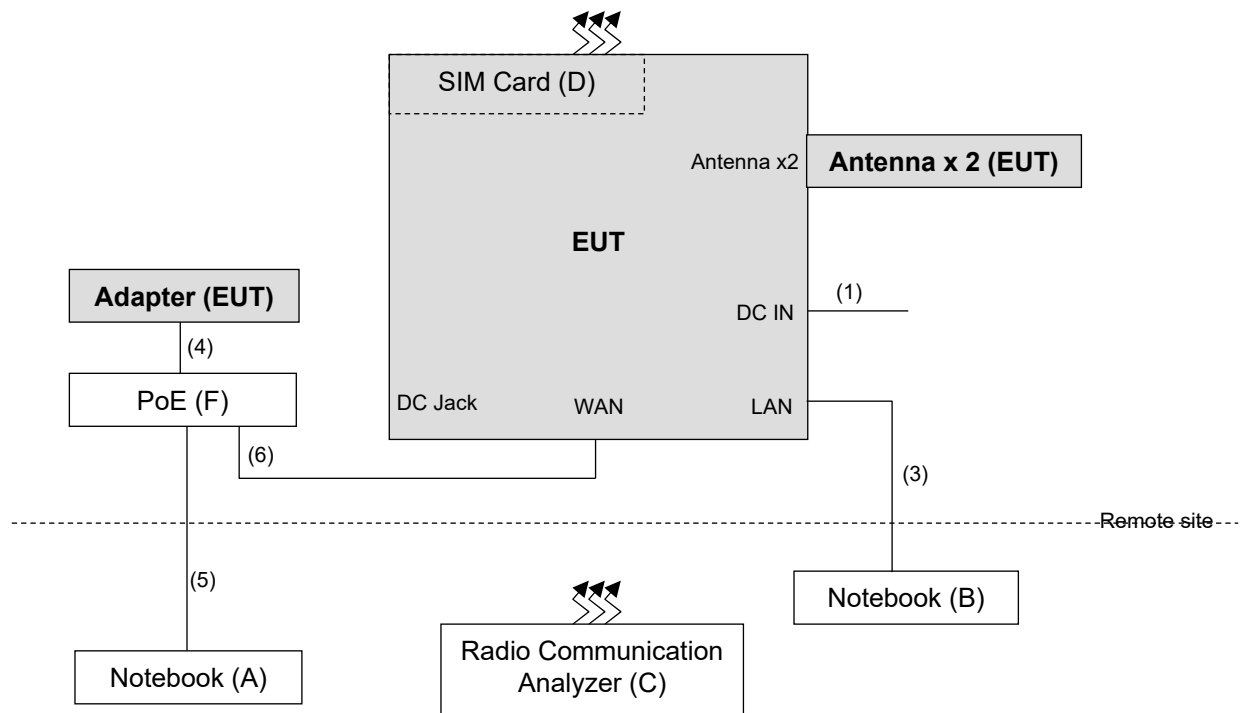


For Conducted emission test

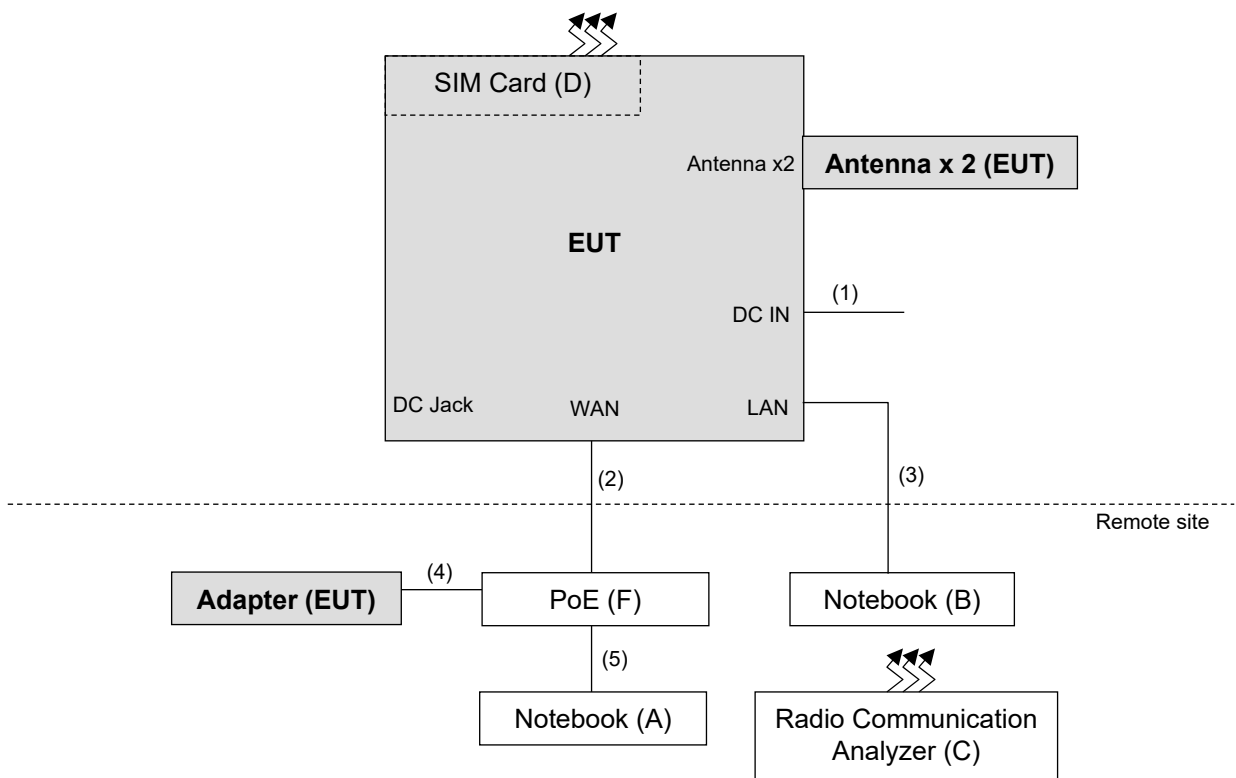
Mode B (DC mode)



For Conducted emission test
Mode C (PoE Mode)



For Radiated emission



4.2 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E6440	6QLNM32	FCC DoC Approved	-
B.	Notebook	Lenovo	S430	MP-2DBFW	PD92230BNHU	-
C.	Radio Communication Analyzer	Anritsu	MT8820C	6201010284	NA	-
D.	SIM Card	R&S	CMW-Z05	NA	NA	-
E.	DC Power Supply	TOP WARD	6603A	725906	NA	-
F.	PoE	PEPWAVE	ACW-102	NA	NA	Supply by client

Note:

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

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC cable	2	1	N	0	-
2.	LAN cable	1	10	N	0	Provided by Lab RJ45, Cat.5e
3.	LAN cable	1	10	N	0	Provided by Lab RJ45, Cat.5e
4.	DC cable	1	1.45	N	0	Attached on adpater
5.	LAN cable	1	1	N	0	Provided by Lab RJ45, Cat.5e
6.	LAN cable	1	3	N	0	Provided by Lab RJ45, Cat.5e

5 Conducted Emissions at Mains Ports

5.1 Limits

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

Notes: 1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases linearly with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

5.2 Test Instruments

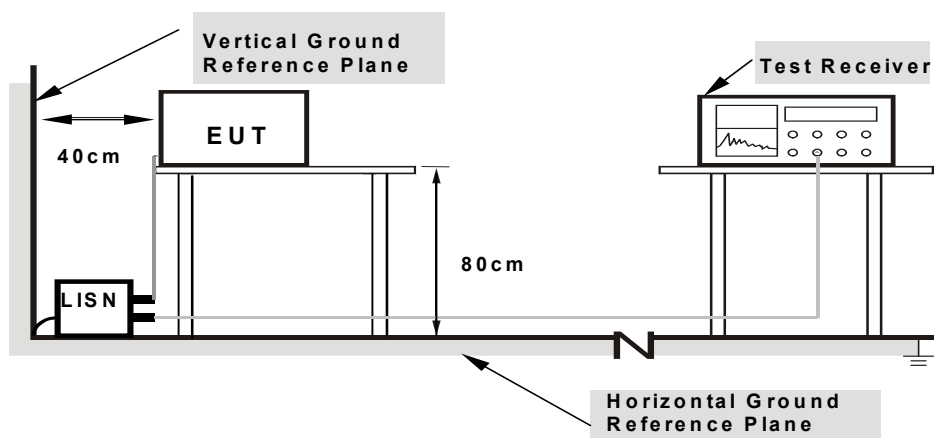
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 11, 2019	Dec. 10, 2020
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2019	Sep. 04, 2020
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 20, 2020	Feb. 19, 2021
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 22, 2019	Aug. 21, 2020
Software ADT	BV ADT_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 HwaYa Shielded Room 1 (Conduction 1).
 3. The VCCI Site Registration No. is C-12040.

5.3 Test Arrangement

- 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 test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

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.



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

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

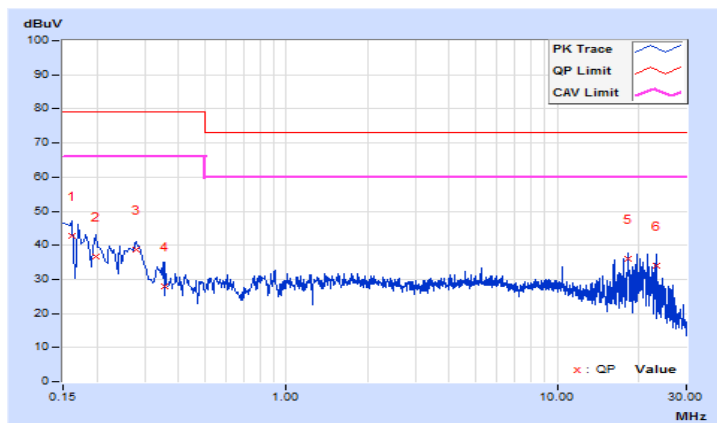
5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	26°C, 67%RH
Tested by	Rolan Zheng	Test Date	2020/6/18
Test Mode	A		

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	0.16190	9.80	33.08	17.01	42.88	26.81	79.00	66.00	-36.12	-39.19
2	0.19800	9.81	27.00	10.87	36.81	20.68	79.00	66.00	-42.19	-45.32
3	0.27786	9.83	28.93	21.27	38.76	31.10	79.00	66.00	-40.24	-34.90
4	0.35800	9.85	18.01	9.85	27.86	19.70	79.00	66.00	-51.14	-46.30
5	18.24200	10.23	25.82	25.05	36.05	35.28	73.00	60.00	-36.95	-24.72
6	23.13000	10.25	23.59	22.01	33.84	32.26	73.00	60.00	-39.16	-27.74

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

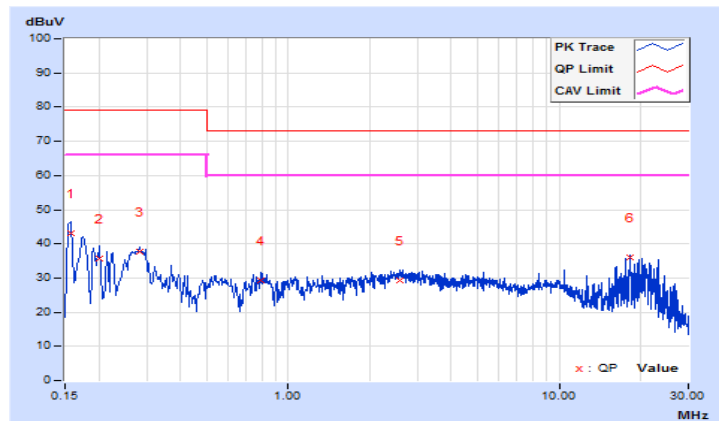


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	26°C, 67%RH
Tested by	Rolan Zheng	Test Date	2020/6/18
Test Mode	A		

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	0.15800	9.82	33.39	15.51	43.21	25.33	79.00	66.00	-35.79	-40.67
2	0.20200	9.81	25.72	9.65	35.53	19.46	79.00	66.00	-43.47	-46.54
3	0.28200	9.84	27.92	19.72	37.76	29.56	79.00	66.00	-41.24	-36.44
4	0.79000	9.93	19.26	12.01	29.19	21.94	73.00	60.00	-43.81	-38.06
5	2.59800	10.05	19.31	8.58	29.36	18.63	73.00	60.00	-43.64	-41.37
6	18.24320	10.34	25.64	24.68	35.98	35.02	73.00	60.00	-37.02	-24.98

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

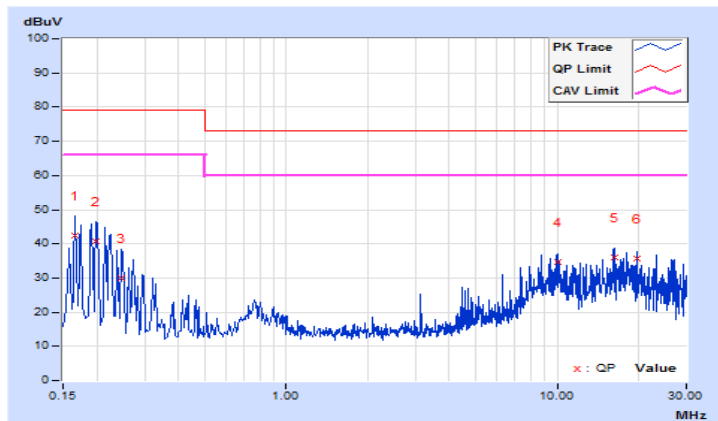


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz (Power Supply)	Environmental Conditions	26°C, 67%RH
Tested by	Rolan Zheng	Test Date	2020/6/18
Test Mode	B		

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	0.16600	9.80	32.65	5.68	42.45	15.48	79.00	66.00	-36.55	-50.52
2	0.19800	9.81	31.00	4.92	40.81	14.73	79.00	66.00	-38.19	-51.27
3	0.24600	9.82	20.30	0.59	30.12	10.41	79.00	66.00	-48.88	-55.59
4	10.06200	10.14	24.43	21.74	34.57	31.88	73.00	60.00	-38.43	-28.12
5	16.23000	10.21	25.83	21.70	36.04	31.91	73.00	60.00	-36.96	-28.09
6	19.71000	10.24	25.40	18.71	35.64	28.95	73.00	60.00	-37.36	-31.05

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

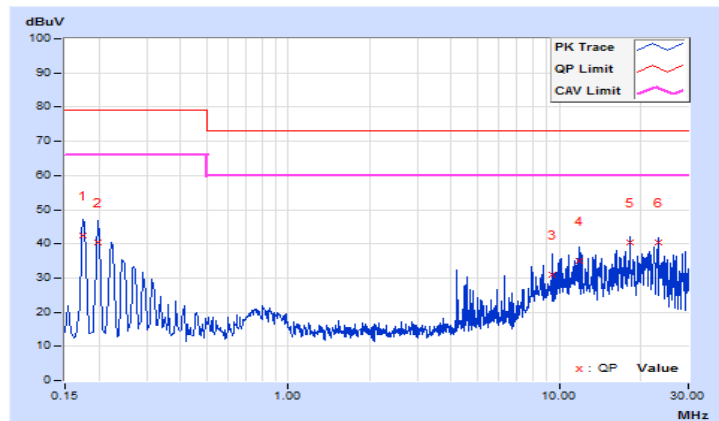


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz (Power Supply)	Environmental Conditions	26°C, 67%RH
Tested by	Rolan Zheng	Test Date	2020/6/18
Test Mode	B		

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	0.17400	9.82	32.67	5.25	42.49	15.07	79.00	66.00	-36.51	-50.93
2	0.19800	9.81	30.62	4.61	40.43	14.42	79.00	66.00	-38.57	-51.58
3	9.42200	10.20	20.86	12.33	31.06	22.53	73.00	60.00	-41.94	-37.47
4	11.89400	10.24	24.75	22.68	34.99	32.92	73.00	60.00	-38.01	-27.08
5	18.24200	10.34	29.92	24.55	40.26	34.89	73.00	60.00	-32.74	-25.11
6	23.13000	10.37	29.92	24.39	40.29	34.76	73.00	60.00	-32.71	-25.24

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

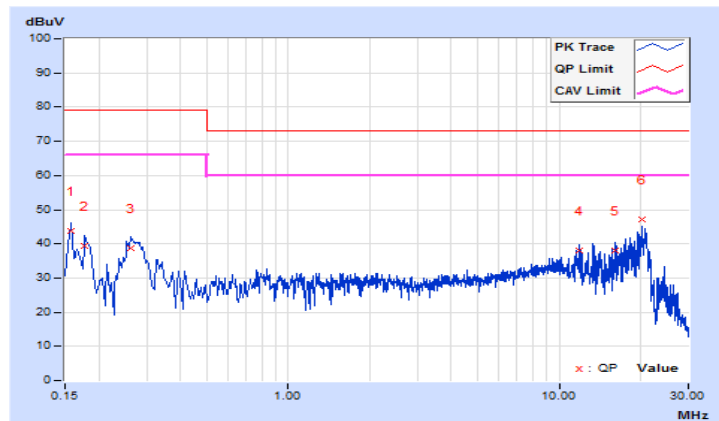


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz (PoE's Adpater)	Environmental Conditions	26°C, 67%RH
Tested by	Rolan Zheng	Test Date	2020/6/18
Test Mode	C		

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	0.15800	9.80	33.97	18.24	43.77	28.04	79.00	66.00	-35.23	-37.96
2	0.17800	9.81	29.45	13.48	39.26	23.29	79.00	66.00	-39.74	-42.71
3	0.26200	9.83	28.78	20.93	38.61	30.76	79.00	66.00	-40.39	-35.24
4	11.89400	10.16	28.04	24.47	38.20	34.63	73.00	60.00	-34.80	-25.37
5	16.17000	10.21	27.95	24.65	38.16	34.86	73.00	60.00	-34.84	-25.14
6	20.25800	10.24	36.81	32.28	47.05	42.52	73.00	60.00	-25.95	-17.48

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

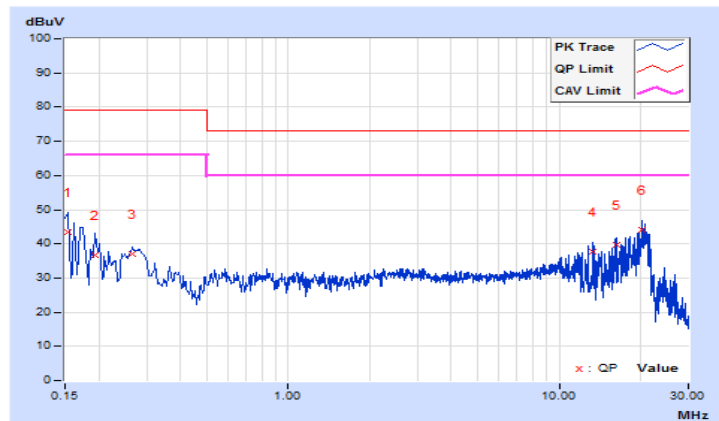


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz (PoE's Adpater)	Environmental Conditions	26°C, 67%RH
Tested by	Rolan Zheng	Test Date	2020/6/18
Test Mode	C		

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	0.15400	9.82	33.73	15.12	43.55	24.94	79.00	66.00	-35.45	-41.06
2	0.19400	9.81	27.04	9.24	36.85	19.05	79.00	66.00	-42.15	-46.95
3	0.26600	9.84	27.11	18.86	36.95	28.70	79.00	66.00	-42.05	-37.30
4	13.35800	10.27	27.60	25.09	37.87	35.36	73.00	60.00	-35.13	-24.64
5	16.22600	10.31	29.44	26.73	39.75	37.04	73.00	60.00	-33.25	-22.96
6	20.31800	10.36	33.69	29.04	44.05	39.40	73.00	60.00	-28.95	-20.60

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



6 Radiated Emissions up to 1 GHz

6.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dB μ V/m)				
Frequencies (MHz)	FCC 15B Class A	FCC 15B Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	39	29.5	40	30
88-216	43.5	33.1		
216-230	46.4	35.6		
230-960			47	37
960-1000	49.5	43.5		

Radiated Emissions Limits at 3 meters (dB μ V/m)				
Frequencies (MHz)	FCC 15B Class A	FCC 15B Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	49.5	40	50.5	40.5
88-216	54	43.5		
216-230	56.9	46		
230-960			57.5	47.5
960-1000	60	54		

- Notes:
1. The lower limit shall apply at the transition frequencies.
 2. Emission level (dB μ V/m) = 20 log Emission level (uV/m).
 3. QP detector shall be applied if not specified.

6.2 Test Instruments

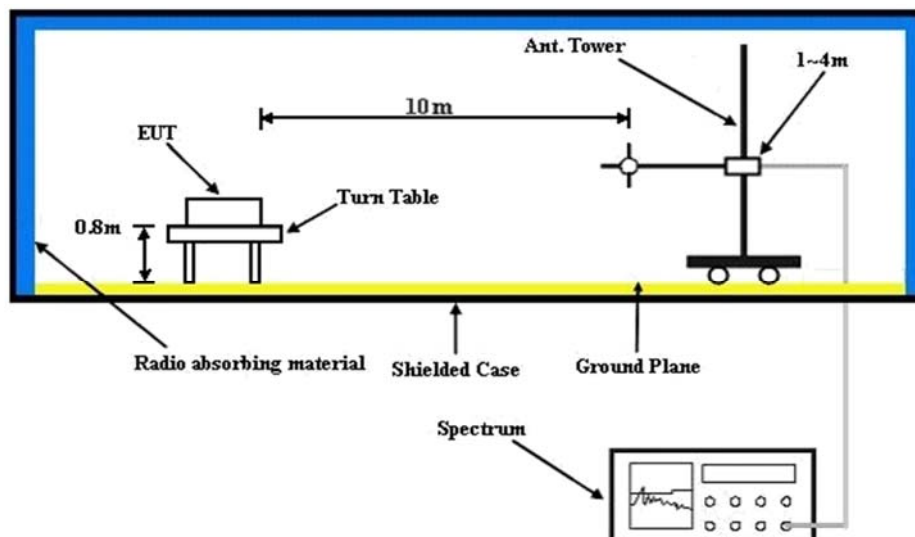
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ (V)	ESR	101240	Oct. 31, 2019	Oct. 30, 2020
Test Receiver ROHDE & SCHWARZ (H)	ESR	101264	Mar. 11, 2020	Mar. 10, 2021
BILOG Antenna SCHWARZBECK (V)	VULB9168	9168-148	Nov. 08, 2019	Nov. 07, 2020
BILOG Antenna SCHWARZBECK (H)	VULB9168	9168-156	Nov. 08, 2019	Nov. 07, 2020
Preamplifier Sonoma (V)	310N	352924	Jun. 08, 2020	Jun. 07, 2021
Preamplifier Sonoma (H)	310N	352923	Jun. 08, 2020	Jun. 07, 2021
RF signal cable (with 5dB PAD) Times (V)	LMR-600 (18M) +LMR-400 (7M)	CABLE-CH1 (VER) -01	Sep. 05, 2019	Sep. 04, 2020
RF signal cable (with 5dB PAD) Times (H)	LMR-600 (11.8M) +LMR-400 (7M)	CABLE-CH1 (HOR) -01	Sep. 05, 2019	Sep. 04, 2020
Software BV ADT	BV ADT_Radiated_ V8.7.08	NA	NA	NA
Antenna Tower (V)	MFA-440	9707	NA	NA
Antenna Tower (H)	MFA-440	970705	NA	NA
Turn Table	DS430	50303	NA	NA
Controller (V)	MF7802	074	NA	NA
Controller (H)	MF7802	08093	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 Chamber 1.
 3. The VCCI Site Registration No. is R-11893.

6.3 Test Arrangement

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited test facility. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna is a broadband antenna, and its height 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.
- 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.
- 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.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for quasi-peak detection (QP) at frequency below 1GHz.



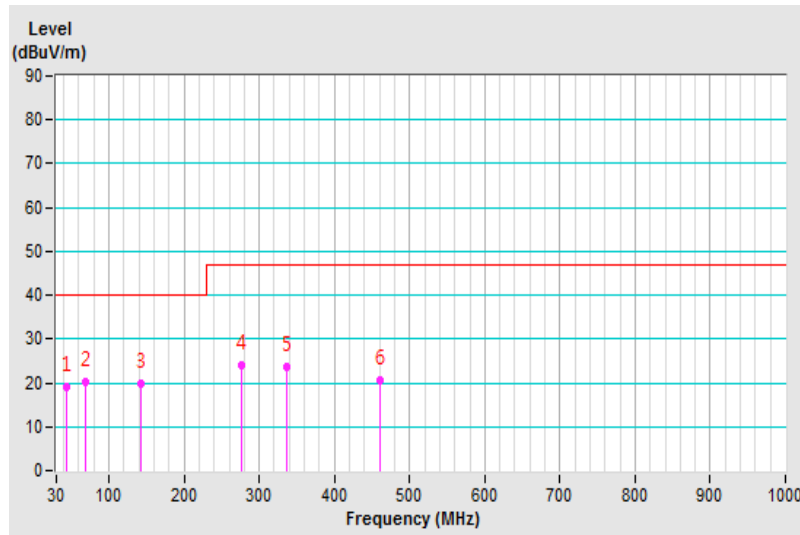
6.4 Test Results

Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Daniel Lin	Environmental Conditions	20°C, 62%RH
Test Date	2020/6/18		

Antenna Polarity & Test Distance : Horizontal at 10 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	43.77	19.04 QP	40.00	-20.96	2.50 H	286	32.58	-13.54
2	69.00	20.12 QP	40.00	-19.88	2.00 H	74	35.23	-15.11
3	143.30	19.83 QP	40.00	-20.17	3.50 H	270	33.37	-13.54
4	276.88	23.85 QP	47.00	-23.15	3.00 H	93	36.95	-13.10
5	335.66	23.67 QP	47.00	-23.33	2.50 H	90	35.43	-11.76
6	461.24	20.62 QP	47.00	-26.38	2.50 H	167	29.01	-8.39

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

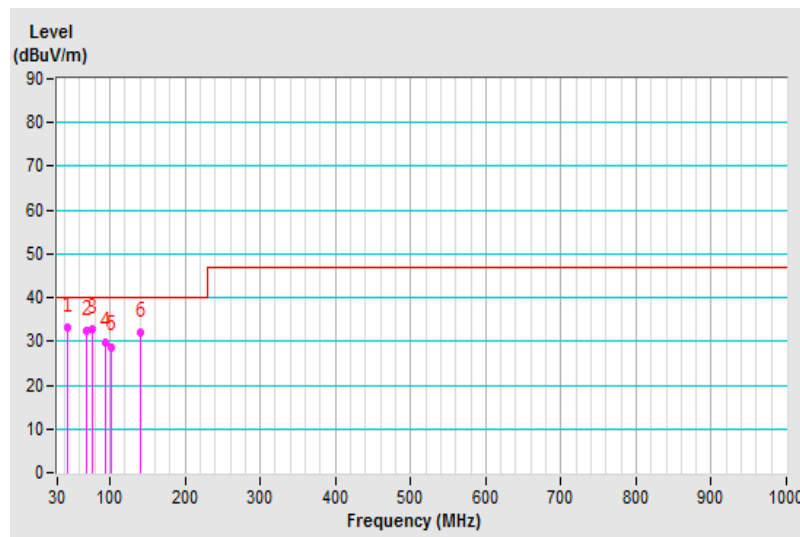


Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Tested by	Daniel Lin	Environmental Conditions	20°C, 62%RH
Test Date	2020/6/18		

Antenna Polarity & Test Distance : Vertical at 10 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	43.48	33.29 QP	40.00	-6.71	3.00 V	213	47.09	-13.80
2	69.00	32.27 QP	40.00	-7.73	2.00 V	50	47.85	-15.58
3	76.51	32.81 QP	40.00	-7.19	3.50 V	16	49.96	-17.15
4	94.36	29.71 QP	40.00	-10.29	1.50 V	192	48.65	-18.94
5	101.88	28.78 QP	40.00	-11.22	1.50 V	78	46.66	-17.88
6	141.17	32.02 QP	40.00	-7.98	1.00 V	306	46.03	-14.01

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



7 Radiated Emissions above 1 GHz

7.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dB μ V/m)				
Frequencies (MHz)	FCC 15B Class A	FCC 15B Class B	CISPR 22, Class A	CISPR 22, Class B
1000-3000	Avg: 49.5	Avg: 43.5	Not defined	Not defined
Above 3000	Peak: 69.5	Peak: 63.5	Not defined	Not defined

Radiated Emissions Limits at 3 meters (dB μ V/m)				
Frequencies (MHz)	FCC 15B Class A	FCC 15B Class B	CISPR 22, Class A	CISPR 22, Class B
1000-3000	Avg: 60	Avg: 54	Avg: 56 Peak: 76	Avg: 50 Peak: 70
Above 3000	Peak: 80	Peak: 74	Avg: 60 Peak: 80	Avg: 54 Peak: 74

- Notes:
1. The lower limit shall apply at the transition frequencies.
 2. Emission level (dB μ V/m) = 20 log Emission level (μ V/m).
 3. As shown in 15.35(b), 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.

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40GHz, whichever is lower

7.2 Test Instruments

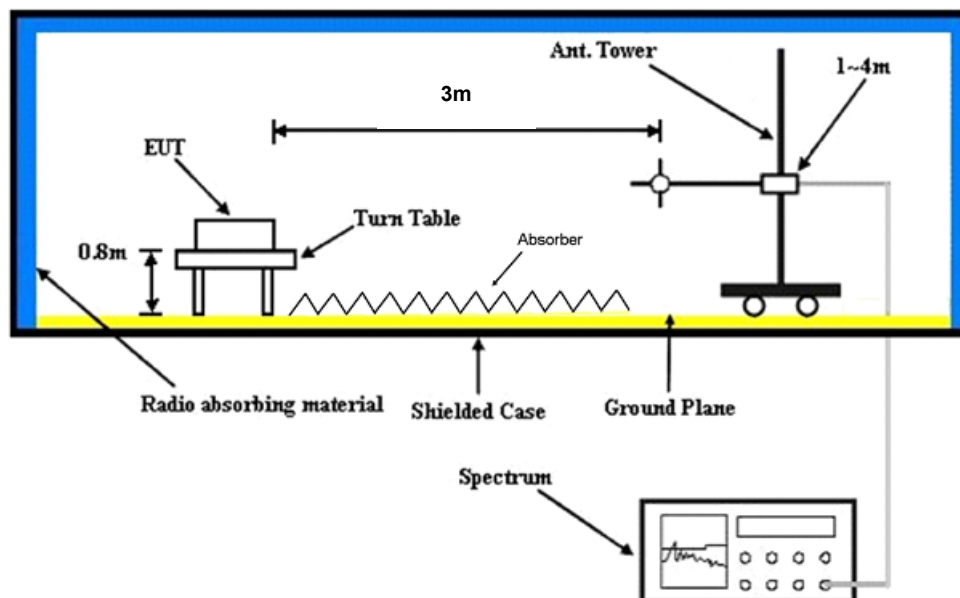
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ (Above 1GHz)	ESR7	101471	Mar. 11, 2020	Mar. 10, 2021
Spectrum Analyzer Agilent	E4446A	MY51100039	Sep. 05, 2019	Sep. 04, 2020
BILOG Antenna SCHWARZBECK	VULB9168	9168-149	Nov. 07, 2019	Nov. 06, 2020
RF signal cable (with 5dB PAD) Times	LMR-400 (18M)	CABLE-CH2-01	Mar. 23, 2020	Mar. 22, 2021
HORN Antenna (with 4dB PAD) SCHWARZBECK	BBHA 9120 D	9120D-405	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier Agilent (Above 1GHz)	8449B	3008A01961	Sep. 05, 2019	Sep. 04, 2020
Software BV ADT	BV ADT_Radiated_ V8.7.08	NA	NA	NA
Antenna Tower BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Controller BV ADT	SC100	SC93021702	NA	NA
BandPass Filter (2.4G) MICRO-TRONICS	BRM17690-01	003	Sep. 05, 2019	Sep. 04, 2020
BandPass Filter (5G) MICRO-TRONICS	BRM50716-01	G011	Sep. 05, 2019	Sep. 04, 2020
RF Coaxial Cable EMCI	EMC102-KM-KM-1000	170819	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable Rosnol	K1K50-UP0279-K1K50 -3000	181129-1	Oct. 08, 2019	Oct. 07, 2020
RF Coaxial Cable JUNFLON+EMC	JUNFLON+EMC104-S M-SM-6000	Cable-CH2-02(M WX3221308G003 +130710)	Jan. 18, 2020	Jan. 17, 2021
Fix tool for Boresight antenna	BAF-01	2	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 Chamber 2 (966 Chamber 1).
 3. The VCCI Site Registration No. is G-10018.

7.3 Test Arrangement

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- For frequency range 1GHz ~ 18GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The height of antenna can be varied from one meter to four meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The spectrum analyzer system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection (PK) at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.



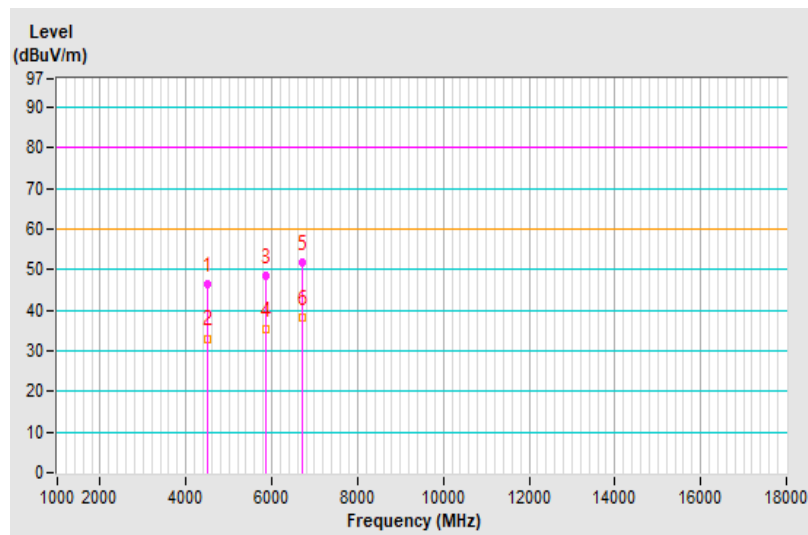
7.4 Test Results

Frequency Range	1GHz ~ 18GHz	Detector Function & Resolution Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Kai Chu	Environmental Conditions	22°C, 71%RH
Test Date	2020/6/17		

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	4509.25	46.27 PK	80.00	-33.73	1.79 H	58	40.81	5.46
2	4509.25	33.06 AV	60.00	-26.94	1.79 H	58	27.60	5.46
3	5848.68	48.57 PK	80.00	-31.43	1.65 H	72	39.37	9.20
4	5848.68	35.41 AV	60.00	-24.59	1.65 H	72	26.21	9.20
5	6706.72	51.68 PK	80.00	-28.32	1.91 H	354	39.97	11.71
6	6706.72	38.28 AV	60.00	-21.72	1.91 H	354	26.57	11.71

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

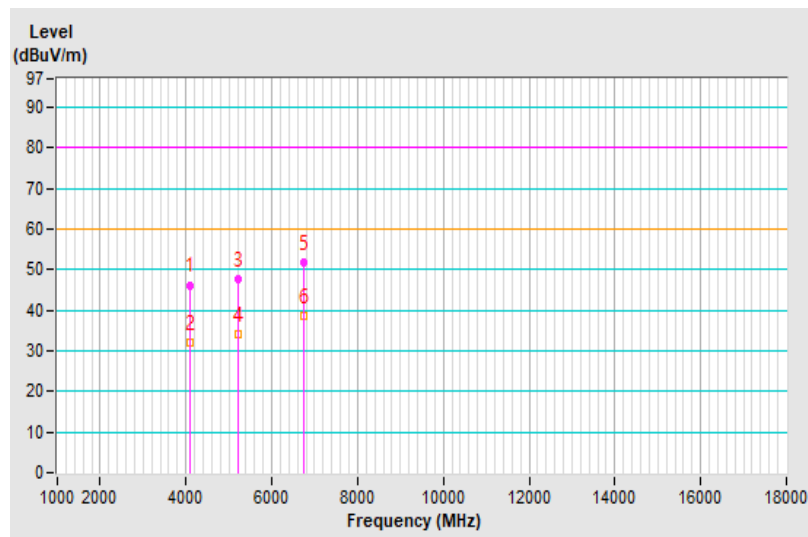


Frequency Range	1GHz ~ 18GHz	Detector Function & Resolution Bandwidth	Peak (PK) / Average (AV), 1MHz
Tested by	Kai Chu	Environmental Conditions	22°C, 71%RH
Test Date	2020/6/17		

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	4079.98	46.24 PK	80.00	-33.76	1.90 V	27	41.56	4.68
2	4079.98	32.00 AV	60.00	-28.00	1.90 V	27	27.32	4.68
3	5202.78	47.56 PK	80.00	-32.44	1.00 V	310	39.63	7.93
4	5202.78	34.07 AV	60.00	-25.93	1.00 V	310	26.14	7.93
5	6746.18	51.63 PK	80.00	-28.37	2.13 V	353	39.74	11.89
6	6746.18	38.66 AV	60.00	-21.34	2.13 V	353	26.77	11.89

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



8 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.

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

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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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