

FCC Radio Test Report

FCC ID: QISVOG-LX9**This report concerns: Class II Permissive Change**

Project No. : 2003C225
Equipment : Smart Phone
Brand Name : HUAWEI
Test Model : VOG-L29
Series Model : VOG-L09
Applicant : Huawei Technologies Co., Ltd.
Address : Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
Manufacturer : Huawei Technologies Co., Ltd.
Address : Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
Date of Receipt : Mar. 30, 2020
Date of Test : Mar. 31, 2020 ~ May 06, 2020
Issued Date : May 06, 2020
Report Version : R01
Test Sample : Engineering Sample No.: DG20200407232 for conducted, DG20200407233 for radiated.
Standard(s) : FCC Part15, Subpart C (15.247)
ANSI C63.10-2013
FCC KDB 558074 D01 15.247 Meas Guidance v05r02

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

Chay . Cai
Prepared by : Chay Cai

Ethan Ma
Approved by : Ethan Ma



Certificate #5123.02

Add: No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.

Tel: +86-769-8318-3000

Web: www.newbtl.com

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, A2LA, or any agency of the U.S. Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

Table of Contents	Page
REPORT ISSUED HISTORY	6
1 . SUMMARY OF TEST RESULTS	7
1.1 TEST FACILITY	8
1.2 MEASUREMENT UNCERTAINTY	8
1.3 TEST ENVIRONMENT CONDITIONS	9
2 . GENERAL INFORMATION	10
2.1 GENERAL DESCRIPTION OF EUT	10
2.2 DESCRIPTION OF TEST MODES	13
2.3 PARAMETERS OF TEST SOFTWARE	14
2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	15
2.5 SUPPORT UNITS	15
3 . AC POWER LINE CONDUCTED EMISSIONS TEST	16
3.1 LIMIT	16
3.2 TEST PROCEDURE	16
3.3 DEVIATION FROM TEST STANDARD	16
3.4 TEST SETUP	17
3.5 EUT OPERATING CONDITIONS	17
3.6 TEST RESULTS	17
4 . RADIATED EMISSION TEST	18
4.1 LIMIT	18
4.2 TEST PROCEDURE	19
4.3 DEVIATION FROM TEST STANDARD	19
4.4 TEST SETUP	20
4.5 EUT OPERATING CONDITIONS	22
4.6 TEST RESULTS - 9 KHZ TO 30 MHZ	22
4.7 TEST RESULTS - 30 MHZ TO 1000 MHZ	22
4.8 TEST RESULTS - ABOVE 1000 MHZ	22
5 . NUMBER OF HOPPING FREQUENCY	23
5.1 LIMIT	23
5.2 TEST PROCEDURE	23
5.3 DEVIATION FROM STANDARD	23
5.4 TEST SETUP	23
5.5 EUT OPERATION CONDITIONS	23

Table of Contents	Page
5.6 TEST RESULTS	23
6 . AVERAGE TIME OF OCCUPANCY	24
6.1 LIMIT	24
6.2 TEST PROCEDURE	24
6.3 DEVIATION FROM STANDARD	24
6.4 TEST SETUP	24
6.5 EUT OPERATION CONDITIONS	24
6.6 TEST RESULTS	24
7 . HOPPING CHANNEL SEPARATION MEASUREMENT	25
7.1 LIMIT	25
7.2 TEST PROCEDURE	25
7.3 DEVIATION FROM STANDARD	25
7.4 TEST SETUP	25
7.5 EUT OPERATION CONDITIONS	25
7.6 TEST RESULTS	25
8 . BANDWIDTH TEST	26
8.1 LIMIT	26
8.2 TEST PROCEDURE	26
8.3 DEVIATION FROM STANDARD	26
8.4 TEST SETUP	26
8.5 EUT OPERATION CONDITIONS	26
8.6 TEST RESULTS	26
9 . MAXIMUM OUTPUT POWER TEST	27
9.1 LIMIT	27
9.2 TEST PROCEDURE	27
9.3 DEVIATION FROM STANDARD	27
9.4 TEST SETUP	27
9.5 EUT OPERATION CONDITIONS	27
9.6 TEST RESULTS	27
10 . CONDUCTED SPURIOUS EMISSION	28
10.1 LIMIT	28
10.2 TEST PROCEDURE	28
10.3 DEVIATION FROM STANDARD	28
10.4 TEST SETUP	28

Table of Contents	Page
10.5 EUT OPERATION CONDITIONS	28
10.6 TEST RESULTS	28
11 . MEASUREMENT INSTRUMENTS LIST	29
12 . EUT TEST PHOTO	31
APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS	36
APPENDIX B - RADIATED EMISSION - 9 KHZ-30 MHZ	39
APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1000 MHZ	44
APPENDIX D - RADIATED EMISSION - ABOVE 1000 MHZ	47
APPENDIX E - NUMBER OF HOPPING FREQUENCY	168
APPENDIX F - AVERAGE TIME OF OCCUPANCY	172
APPENDIX G - HOPPING CHANNEL SEPARATION MEASUREMENT	178
APPENDIX H - BANDWIDTH	182
APPENDIX I - MAXIMUM OUTPUT POWER	186
APPENDIX J - CONDUCTED SPURIOUS EMISSION	193

REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Compared with original report (SYBH(Z-RF)20181224014002-2003), Model VOG-L29 added BT UHD function by upgrade software. So all the test items for BT UHD are evaluated and recorded.	Apr. 30, 2020
R01	Updated the data of Appendix F.	May 06, 2020

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC Part15, Subpart C (15.247)				
Standard(s) Section	Test Item	Test Result	Judgment	Remark
15.207	AC Power Line Conducted Emissions	APPENDIX A	PASS	-----
15.247(d) 15.205(a) 15.209(a)	Radiated Emission	APPENDIX B APPENDIX C APPENDIX D	PASS	-----
15.247 (a)(1)(iii)	Number of Hopping Frequency	APPENDIX E	PASS	-----
15.247 (a)(1)(iii)	Average Time Of Occupancy	APPENDIX F	PASS	-----
15.247(a)(1)	Hopping Channel Separation	APPENDIX G	PASS	-----
15.247(a)(1)	Bandwidth	APPENDIX H	PASS	-----
15.247(a)(1)	Maximum Output Power	APPENDIX I	PASS	-----
15.247(d)	Conducted Spurious Emission	APPENDIX J	PASS	-----
15.203	Antenna Requirement	-----	PASS	Note(2)

Note:

- (1) "N/A" denotes test is not applicable in this test report
- (2) The device what use a permanently attached antenna were considered sufficient to comply with the provisions of 15.203.

1.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China
 BTL's Test Firm Registration Number for FCC: 357015
 BTL's Designation Number for FCC: CN1240

1.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))
 The BTL measurement uncertainty as below table:

A. AC power line conducted emissions test:

Test Site	Method	Measurement Frequency Range	U, (dB)
DG-C02	CISPR	150kHz ~ 30MHz	2.60

B. Radiated emissions test:

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
DG-CB03	CISPR	9kHz ~ 30MHz	V	3.79
		9kHz ~ 30MHz	H	3.57
		30MHz ~ 200MHz	V	4.88
		30MHz ~ 200MHz	H	4.14
		200MHz ~ 1,000MHz	V	4.62
		200MHz ~ 1,000MHz	H	4.80
		1GHz ~ 6GHz	-	4.58
		6GHz ~ 18GHz	-	5.18
		18GHz ~ 26.5GHz	-	3.80
		26.5GHz ~ 40GHz	-	4.30

C. Other Measurement:

Test Item	Uncertainty
Conducted Spurious Emission	2.67 dB
Hopping Channel Separation	53.46 MHz
Output Power	0.95 dB
Number of Hopping Frequency	53.46 MHz
Temperature	0.08 °C
Humidity	1.5%

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By
AC Power Line Conducted Emissions	25°C	55%	AC 120V/60Hz	Sheldon Ou
Radiated Emissions-9K-30MHz	25°C	60%	AC 120V/60Hz	Sheldon Ou
Radiated Emissions-30 MHz to 1GHz	24°C	68%	AC 120V/60Hz	Sheldon Ou
Radiated Emissions-Above 1000 MHz	24°C	68%	AC 120V/60Hz	Sheldon Ou
Number of Hopping Frequency	25°C	60%	DC 3.82V	Hayden Chen
Average Time Of Occupancy	25°C	60%	DC 3.82V	Hayden Chen
Hopping Channel Separation	25°C	60%	DC 3.82V	Hayden Chen
Bandwidth	25°C	60%	DC 3.82V	Hayden Chen
Maximum Output Power	25°C	60%	DC 3.82V	Hayden Chen
Conducted Spurious Emission	25°C	60%	DC 3.82V	Hayden Chen

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Smart Phone
Brand Name	HUAWEI
Test Model	VOG-L29
Series Model	VOG-L09
Model Difference(s)	The only difference between VOG-L29 and VOG-L09 is that VOG-L09 deletes into single SIM card by software. Other parts of the two models are the same.
Hardware Version	HL2VOGUEM
Software Version	10.1.0.122(C432E19R2P5)
Power Source	1# DC voltage supplied from AC/DC adapter. 2# Supplied from battery. 3# Supplied from USB port.
Power Rating	1# I/P: 100-240V ~50/60Hz, 1.2A O/P: 5V $\overline{\text{---}}$ 2A OR 9V $\overline{\text{---}}$ 2A OR 10V $\overline{\text{---}}$ 4A 2# DC 3.82V, 4100mAh 3# DC 5V
Operation Frequency	2404 MHz ~ 2478 MHz
Modulation Type	UHD 1M GFSK (1Mbps) UHD 2M GFSK (2Mbps)
Transfer Rate	UHD 2M $\pi/4$ -DQPSK (4Mbps) UHD 2M 8DPSK (6Mbps) UHD 4M $\pi/4$ -DQPSK (8Mbps)
Modulation Technology	FHSS
Max. Output Power _Normal Power	UHD 1M GFSK: 6.55dBm (0.0045W) UHD 2M GFSK: 6.58dBm (0.0045W) UHD 2M $\pi/4$ -DQPSK: 9.26dBm (0.0084W) UHD 2M 8DPSK: 9.68dBm (0.0093W) UHD 4M $\pi/4$ -DQPSK: 8.95dBm (0.0079W)
Max. Output Power _High Power	UHD 1M GFSK: 14.77dBm (0.0300W) UHD 2M GFSK: 14.68dBm (0.0294W) UHD 2M $\pi/4$ -DQPSK: 16.81dBm (0.0480W) UHD 2M 8DPSK: 17.13dBm (0.0516W) UHD 4M $\pi/4$ -DQPSK: 16.41dBm (0.0438W)

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. Channel List:

For UHD 1M GFSK, UHD 2M GFSK, UHD 2M $\pi/4$ -DQPSK, UHD 2M 8DPSK Mode			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2404	21	2446
01	2406	22	2448
02	2408	23	2450
03	2410	24	2452
04	2412	25	2454
05	2414	26	2456
06	2416	27	2458
07	2418	28	2460
08	2420	29	2462
09	2422	30	2464
10	2424	31	2466
-	-	32	2468
12	2428	33	2470
13	2430	34	2472
14	2432	35	2474
15	2434	36	2476
16	2436	37	2478
17	2438	-	-
18	2440	-	-
19	2442	-	-
20	2444	-	-

For UHD 4M $\pi/4$ -DQPSK Mode			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2404	20	2444
02	2408	22	2448
04	2412	24	2452
06	2416	26	2456
08	2420	28	2460
10	2424	30	2464
12	2428	32	2468
14	2432	34	2472
16	2436	36	2476
18	2440	-	-

3. Table for Filed Antenna:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Internal	N/A	-1.4

4. The EUT contains following accessory devices:

Items	Trademark / Manufacturer / Factory	Model Name	Description
Adapter	Huawei Technologies Co., Ltd.	HW-100400A00 HW-100400U00 HW-100400E00 HW-100400B00 HW-100400B01 HW-100400U01 HW-100400E01 HW-100400A01	I/P: 100-240V ~50/60Hz, 1.2A O/P: 5V $\equiv$ 2A OR 9V $\equiv$ 2A OR 10V $\equiv$ 4A
Battery	Huawei Technologies Co., Ltd. (Manufacturer: SCUD / Desay)	HB486486ECW	Rated capacity: 4100mAh Nominal Voltage: +3.82V Charging Voltage: +4.4V
Earphone	Jiangxi Lianchuang Hongsheng Electronic Co., LTD	MEND1632B729000	/
	GoerTek Inc.	Windy-C	
	Boluo County Quancheng Electronic Co., Ltd	1331-3301-6001-TC-296	
	Foster Electric Co.,(GuangZhou)LTD.Sales Dep.	618017	
USB Cable	Ningbo Broad Telecommunication Co., Ltd	WA0009	/
	LUXSHARE Precision Industry Co., Ltd.	L99UC117-CS-H	
	HUIZHOU DEHONG TECHNOLOGY CO.,LTD.	330-50465	
Wireless charging case	Huawei Technologies Co., Ltd.	CP60 (S/N: 2155030353C8B027778)	Wireless charging power: 10W max Connector rating: 5A max

Note:

- 1) HW-100400E00 has same board with UK/AU, HW-100400B00 has same board with EU/AU, HW-100400A00 has same board with UK/EU.
- 2) HW-100400A01, HW-100400E01, HW-100400B01 and HW-100400U01 have same board with each other.
- 3) HW-100400U00 has different board.

2.2 DESCRIPTION OF TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Pretest Mode	Description
Mode 1	TX Mode NOTE (1)
Mode 2	TX Mode Channel 00_UHD 2M $\pi/4$ -DQPSK

Following mode(s) was (were) found to be the worst case(s) and selected for the final test.

AC Power Line Conducted Emissions	
Final Test Mode	Description
Mode 2	TX Mode Channel 00_UHD 2M $\pi/4$ -DQPSK

Radiated emissions test - Below 1GHz	
Final Test Mode	Description
Mode 2	TX Mode Channel 00_UHD 2M $\pi/4$ -DQPSK

Radiated emissions test - Above 1GHz	
Final Test Mode	Description
Mode 1	TX Mode NOTE (1)

Conducted test	
Final Test Mode	Description
Mode 1	TX Mode NOTE (1)

Note:

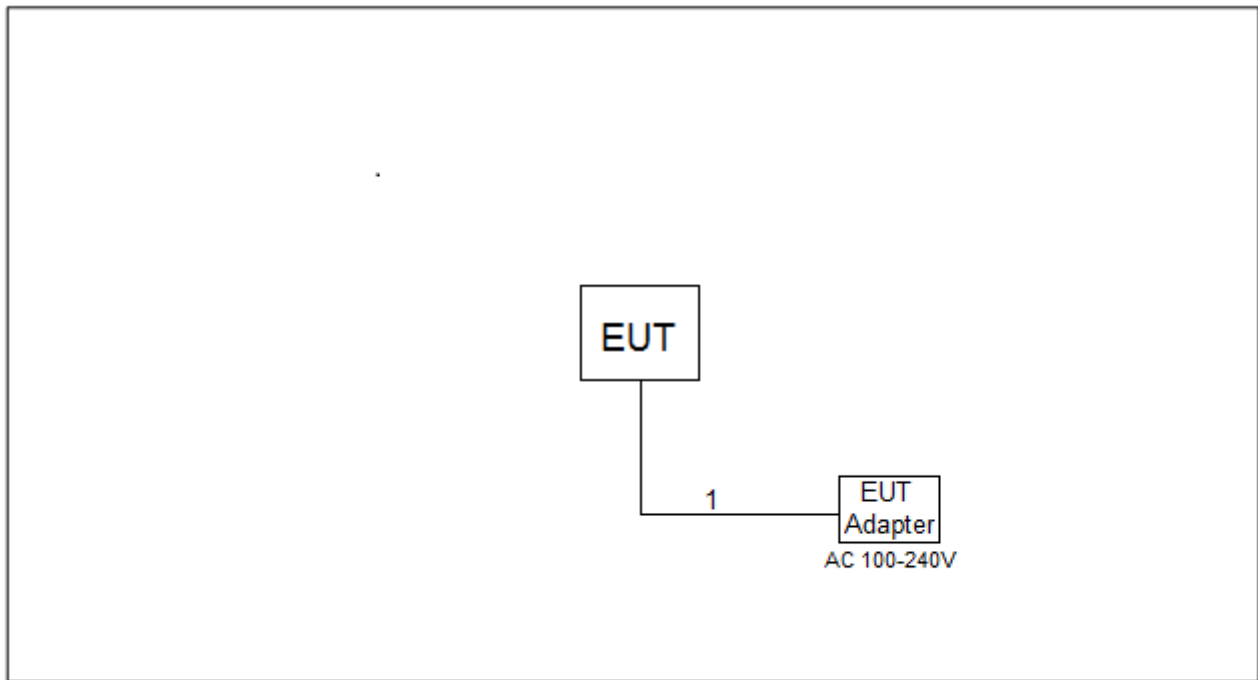
- (1) The measurements are performed at the high, middle, low available channels.
- (2) The EUT is considered a portable unit, it was pre-tested on the positioned of each 3 axis. The worst case was found positioned on Y-plane. Therefore only the test data of this Y-plane was used for radiated emission measurement test.
- (3) For radiated spurious emissions below 1 GHz test, all adapters had been pre-tested and in this report only recorded the worst case.
- (4) For radiated spurious emissions below 1 GHz test, the UHD 2M $\pi/4$ -DQPSK mode channel 00 is found to be the worst case and recorded.
- (5) The measurements for Maximum Output Power were tested for Normal Power and High Power, the worst case were High Power, only worst case was documented for other test items.

2.3 PARAMETERS OF TEST SOFTWARE

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 power parameters of FHSS

Test Software	N/A
Frequency (MHz)	Hopping Mode
Power Parameters (1Mbps)	N/A
Power Parameters (2Mbps)	N/A
Power Parameters (4Mbps)	N/A
Power Parameters (6Mbps)	N/A
Power Parameters (8Mbps)	N/A

2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



2.5 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.
-	-	-	-	-

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	USB Cable	YES	NO	1m

3. AC POWER LINE CONDUCTED EMISSIONS TEST

3.1 LIMIT

Frequency of Emission (MHz)	Limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

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

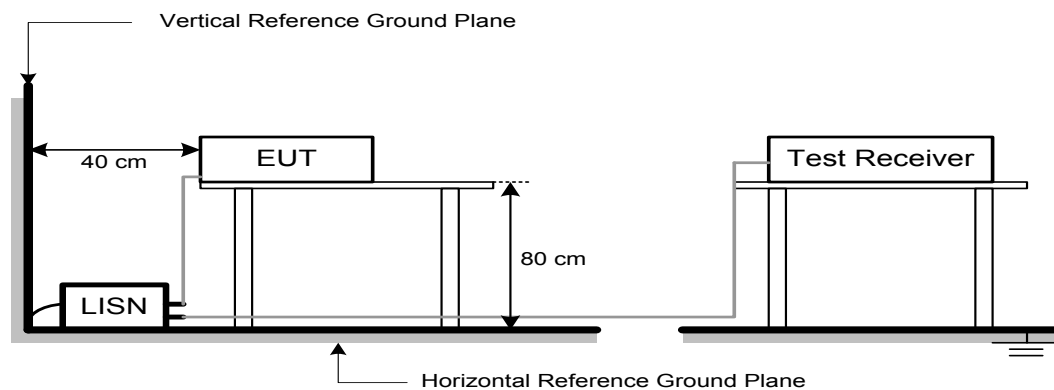
3.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. 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.
- c. 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.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3 DEVIATION FROM TEST STANDARD

No deviation

3.4 TEST SETUP



3.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical function (as a customer would normally use it), EUT was programmed to be in continuously transmitting data or hopping on mode.

3.6 TEST RESULTS

Please refer to the APPENDIX A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of 『Note』 . If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform in this case, a “**” marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150 kHz to 30 MHz.

4. RADIATED EMISSION TEST

4.1 LIMIT

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (9 kHz-1000 MHz)

Frequency (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

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000 MHz)

Frequency (MHz)	Band edge/ Harmonic at 3m (dBμV/m)		Harmonic at 1.5m (dBμV/m)	
	Peak	Average	Peak	Average
Above 1000	74	54	80 (Note 4)	60 (Note 4)

Note:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4)

$$FS_{\text{limit}} = FS_{\text{max}} - 20 \log \left(\frac{d_{\text{limit}}}{d_{\text{measure}}} \right)$$

$$20 \log d_{\text{limit}}/d_{\text{measure}} = 20 \log 3/1.5 = 6 \text{ dB.}$$

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	RBW 1 MHz VBW 3 MHz peak detector for Pk value RMS detector for AV value

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9 kHz~90 kHz for PK/AVG detector
Start ~ Stop Frequency	90 kHz~110 kHz for QP detector
Start ~ Stop Frequency	110 kHz~490 kHz for PK/AVG detector
Start ~ Stop Frequency	490 kHz~30 MHz for QP detector
Start ~ Stop Frequency	30 MHz~1000 MHz for QP detector

4.2 TEST PROCEDURE

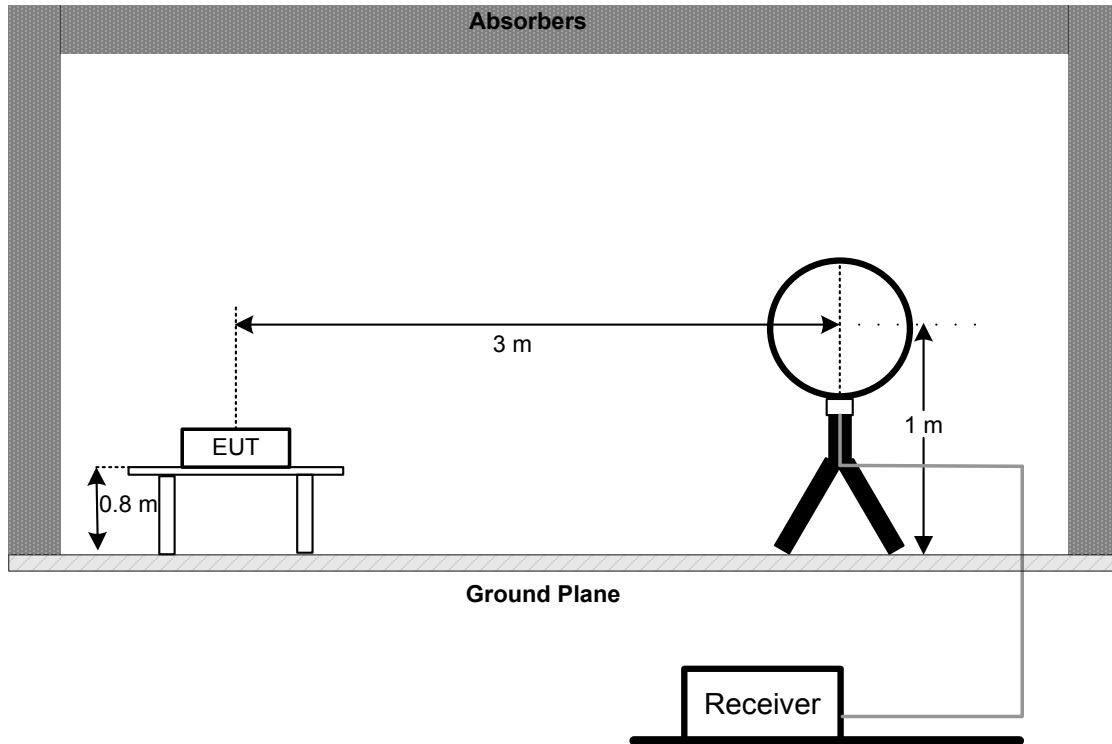
- The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1 GHz)
- The measuring distance of 3 m or 1.5m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; the height of the test antenna shall vary between 1 m to 4 m. 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 find the maximum reading (used Bore sight function).
- The 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.
- The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
(below 1 GHz)
- All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1 GHz)
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.3 DEVIATION FROM TEST STANDARD

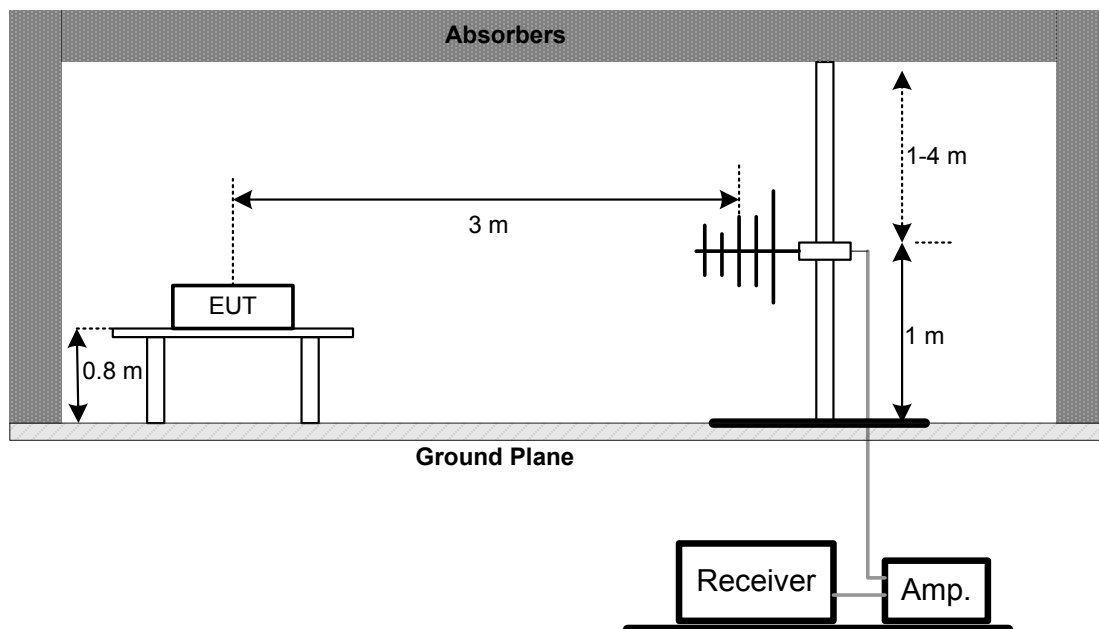
No deviation

4.4 TEST SETUP

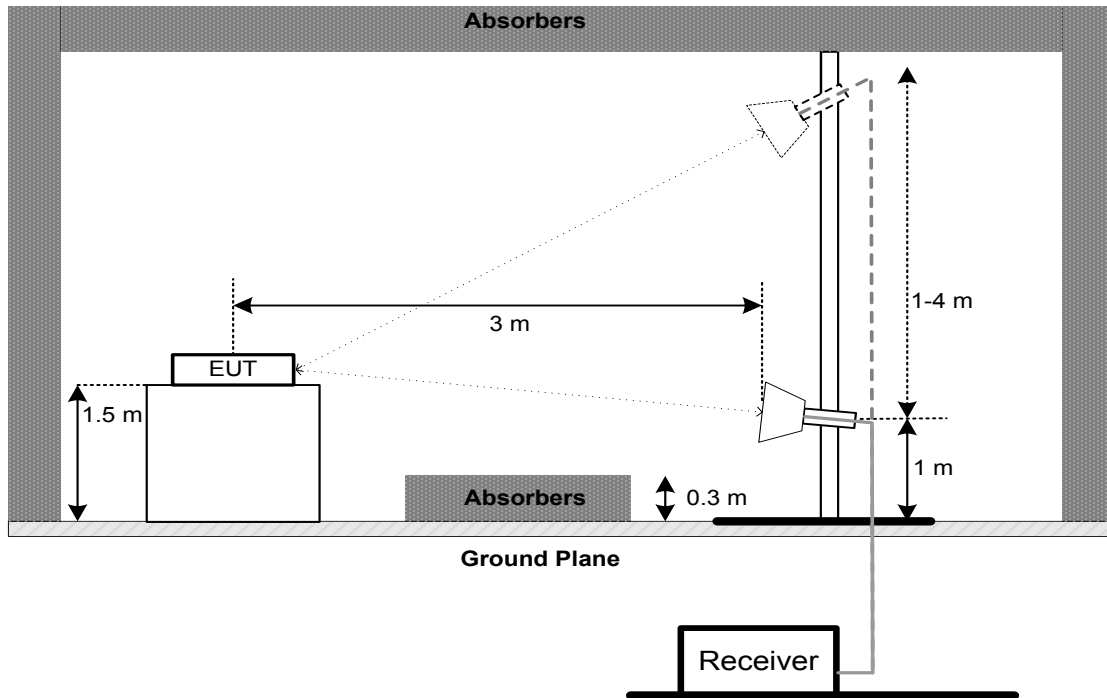
9 kHz-30 MHz



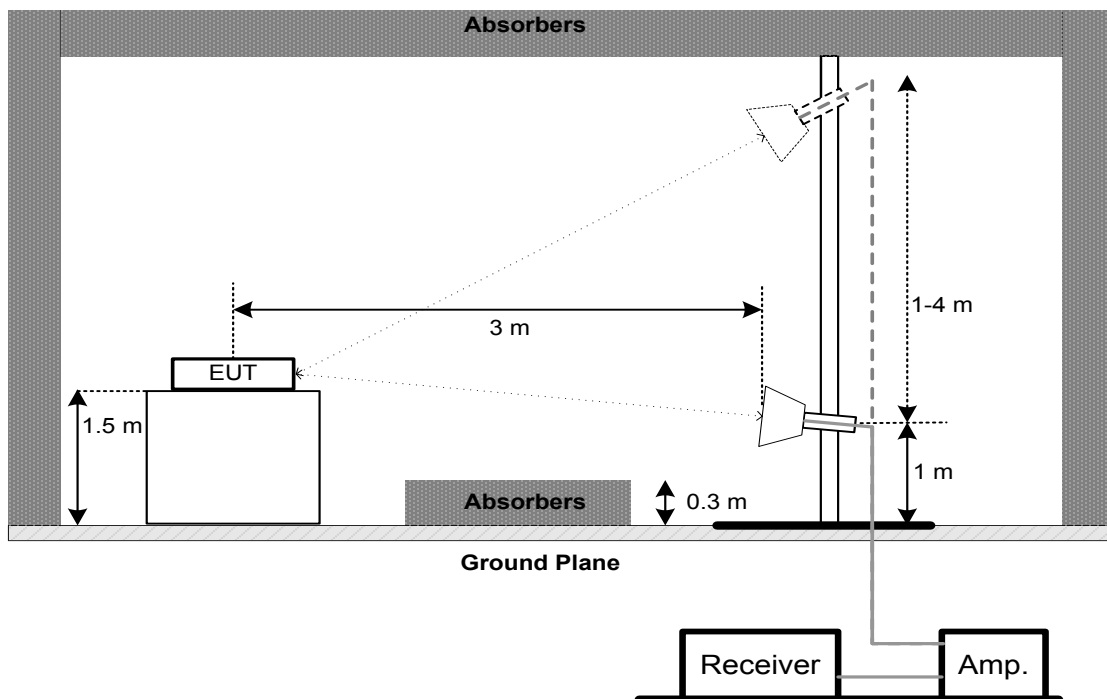
30 MHz to 1 GHz



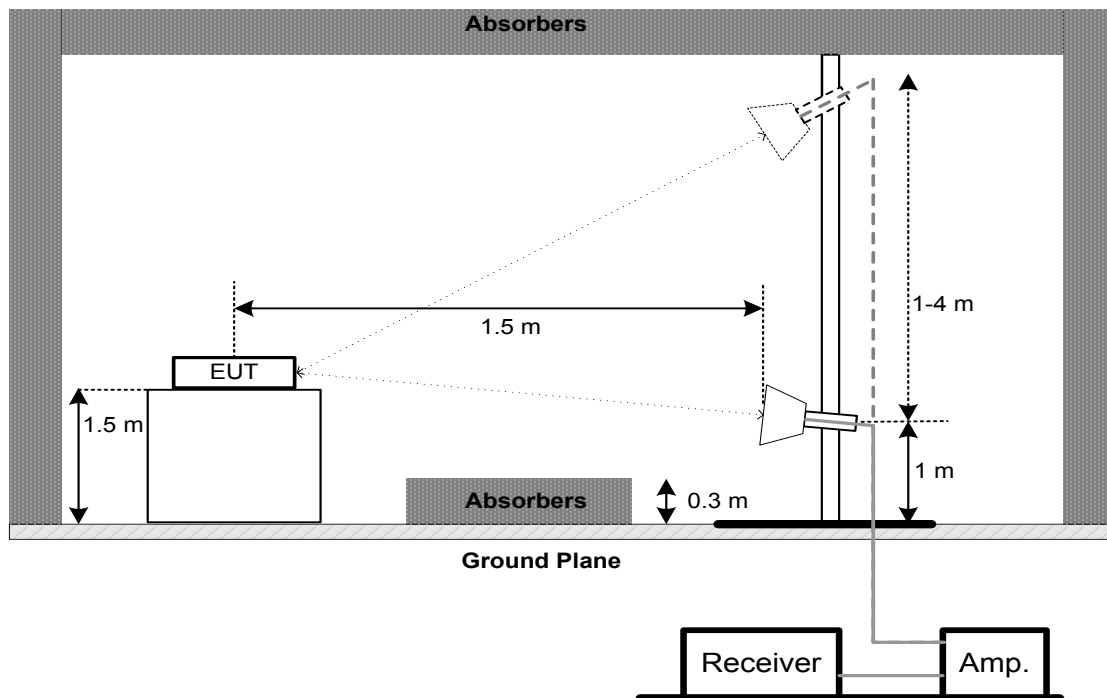
Above 1 GHz Band edge



Harmonic (1 GHz to 18 GHz)



Harmonic (18 GHz to 26.5 GHz)



4.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.6 TEST RESULTS - 9 kHz TO 30 MHz

Please refer to the APPENDIX B

Remark:

- (1) Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB).
- (2) Limit line = specific limits (dBuV) + distance extrapolation factor.

4.7 TEST RESULTS - 30 MHz TO 1000 MHz

Please refer to the APPENDIX C.

4.8 TEST RESULTS - ABOVE 1000 MHz

Please refer to the APPENDIX D.

Remark:

- (1) No limit: This is fundamental signal, the judgment is not applicable.
For fundamental signal judgment was referred to Peak output test.

5. NUMBER OF HOPPING FREQUENCY

5.1 LIMIT

FCC Part15, Subpart C (15.247)	
Section	Test Item
15.247(a)(1)(iii)	Number of Hopping Frequency

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating Frequency Range
RBW	100 kHz
VBW	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

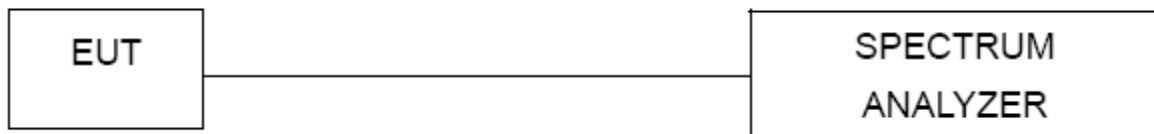
5.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW=100 kHz, VBW=100 kHz, Sweep time = Auto.

5.3 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP



5.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

5.6 TEST RESULTS

Please refer to the APPENDIX E

6. AVERAGE TIME OF OCCUPANCY

6.1 LIMIT

FCC Part15, Subpart C (15.247)		
Section	Test Item	Limit
15.247(a)(1)(iii)	Average Time of Occupancy	0.4sec

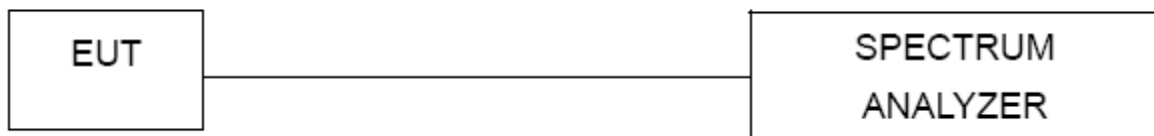
6.2 TEST PROCEDURE

- The transmitter output (antenna port) was connected to the spectrum analyzer
- Set RBW of spectrum analyzer to 1 MHz and VBW to 1 MHz
- Use a video trigger with the trigger level set to enable triggering only on full pulses
- Sweep Time is more than once pulse time
- Set the center frequency on any frequency would be measure and set the frequency span to zero span
- Measure the maximum time duration of one single pulse

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

Please refer to the APPENDIX F

7. HOPPING CHANNEL SEPARATION MEASUREMENT

7.1 LIMIT

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RBW	30 kHz
VBW	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

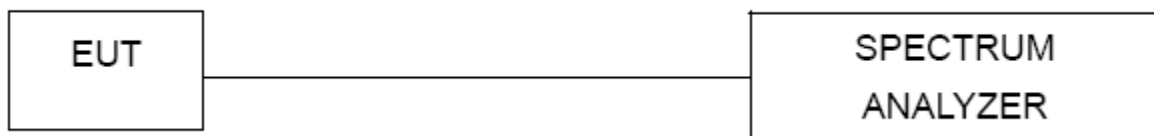
7.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) $\approx$ 30% of the channel spacing
Video (or Average) Bandwidth (VBW) $\geq$ RBW
Sweep = Auto
Detector function = Peak
Trace = Max Hold

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

7.6 TEST RESULTS

Please refer to the APPENDIX G

8. BANDWIDTH TEST

8.1 LIMIT

FCC Part15, Subpart C (15.247)	
Section	Test Item
15.247(a)(1)	Bandwidth

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth
RBW	30 kHz
VBW	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 30 kHz, VBW=100 kHz, Sweep Time = Auto.

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

8.6 TEST RESULTS

Please refer to the APPENDIX H

9. MAXIMUM OUTPUT POWER TEST

9.1 LIMIT

FCC Part15 , Subpart C (15.247)		
Section	Test Item	Limit
15.247(a)(1)	Maximum Output Power	0.125 Watt or 21 dBm

Note: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

9.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 1 MHz/3 MHz, VBW= 1 MHz/3 MHz, Sweep time = Auto.

9.3 DEVIATION FROM STANDARD

No deviation.

9.4 TEST SETUP



9.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

9.6 TEST RESULTS

Please refer to the APPENDIX I

10. CONDUCTED SPURIOUS EMISSION

10.1 LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak Output Power limits. If the transmitter complies with the Output Power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.

10.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW= 100 kHz, VBW=100 kHz, Sweep time = Auto.

10.3 DEVIATION FROM STANDARD

No deviation.

10.4 TEST SETUP



10.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

10.6 TEST RESULTS

Please refer to the APPENDIX J

11. MEASUREMENT INSTRUMENTS LIST

AC Power Line Conducted Emissions					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EMI Test Receiver	R&S	ESCI	100382	Feb. 28, 2021
2	LISN	EMCO	3816/2	52765	Mar. 01, 2021
3	TWO-LINE V-NETWORK	R&S	ENV216	101447	Feb. 28, 2021
4	50Ω Terminator	SHX	TF5-3	15041305	Mar. 01, 2021
5	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
6	Cable	N/A	RG223	12m	Mar. 10, 2021

Radiated Emissions - 9 kHz to 30 MHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1*	Antenna	EM	EM-6876-1	230	Jan. 15, 2022
2	Cable	N/A	RG400 (C-101(3m)+C-70(6m))	N/A	May 31, 2020
3	EMI Test Receiver	R&S	ESCI	100895	Feb. 28, 2021
4	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

Radiated Emissions - 30 MHz to 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Antenna	Schwarzbeck	VULB9160	9160-3232	Mar. 09, 2021
2*	Amplifier	HP	8447D	2944A08742	Mar. 01, 2021
3	Receiver	Agilent	N9038A	MY52130039	Aug. 03, 2020
4	Cable	emci	LMR-400(30MHz-1GHz)(8m+5m)	N/A	May. 25, 2020
5	Controller	CT	SC100	N/A	N/A
6	Controller	MF	MF-7802	MF780208416	N/A
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

Radiated Emissions - Above 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Double Ridged Guide Antenna	ETS	3115	75846	Mar. 19, 2021
2	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Jun. 23, 2020
3	Amplifier	Agilent	8449B	3008A02584	Aug. 03, 2020
4	Microwave Preamplifier With Adaptor	EMC INSTRUMENT	EMC2654045	980039 & HA01	Mar. 07, 2021
5	Receiver	Agilent	N9038A	MY52130039	Aug. 03, 2020
6	Controller	CT	SC100	N/A	N/A
7	Controller	MF	MF-7802	MF780208416	N/A
8	Cable	mitron	RWLP50-4.0A-KJ-S MSM-12M	N/A	Nov. 25, 2020
9	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

**Number of Hopping Frequency &
Average Time of Occupancy &
Hopping Channel Separation Measurement &
Bandwidth &
Maximum Output Power &
Antenna Conducted Spurious Emission**

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 03, 2020
2	EXA Spectrum Analyzer	Keysight	N9010A	MY56480488	Mar. 01, 2021

Remark "N/A" denotes no model name, serial no. or calibration specified.

"*" calibration period of equipment list is three year.

Except * item, all calibration period of equipment list is one year.