



RF Test Report

For

Globe Electric Company Inc.

Part 15C Subpart C §15.247			
Test Standards:	RSS 247 Issue 2		
Product Name:	Smart Power Strip		
Tested Model:	<u>50334</u>		
Brand Name:	Globe		
FCC ID:	2AQUQGE50334		
IC:	8290A-GE50334		
Classification	Digital Spread Spectrum (DSS)		
Report No.: <u>EC2011054RF03</u>			
Tested Date: 2020-11-26 to 2020-12-31			
Issued Date:	<u>2020-12-31</u>		
Prepared By:	Jack Lin.		
	Jack Liu / Engineer		
Approved By:	Tiny-yang		
	Tiny Yang / RF Manager		
Hunan Ec	loud Testing Technology Co., Ltd.		
Building A1, Changsha E Cen	ter, No. 18 Xiangtai Avenue, Liuyang Economic and		
Technologica	I Development Zone, Hunan, P.R.C		
Tel.: +86-731	-89634887 Fax.: +86-731-89634887		
	www.nn-ecloud.com		

Note: The test results in this report apply exclusively to the tested model / sample. Without written approval of Hunan Ecloud Testing Technology Co., Ltd., the test report shall not be reproduced except in full.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
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FCC Rule	IC Rule	Description Limit		Result	Remark
15.247(a)(1)	RSS-247 5.1(a)	20dB Bandwidth	NA	Pass	-
-	RSS-Gen 6.7	99% Bandwidth	-	Pass	-
15.247(a)(1)	RSS-247 5.1(b)	Hopping Channel Separation	≥ 2/3 of 20dB BW	Pass	-
15.247(a)(1)	RSS-247 5.1(d)	Number of Channels	≥ 15Chs	Pass	-
15.247(a)(1)	RSS-247 5.1(d)	Average Time of Occupancy	≤ 0.4sec in 31.6sec period	Pass	-
15.247(b)(1)	RSS-247 5.4(b)	Peak Output Power	≤ 125 mW	Pass	-
15.247(d)	RSS-247 5.5	Conducted Band Edges	≤ 20dBc	Pass	-
15.247(d)	RSS-247 5.5	Conducted Spurious Emission	≤ 20dBc	Pass	-
15.247(d)	RSS-247 5.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 7.08 dB at 9920 MHz
15.207	RSS-Gen 8.8	AC Conducted Emission	15.207(a)	Pass	Under limit 3.92 dB at 0.675 MHz
15.203 & 15.247(b)	RSS-Gen 6.8	Antenna Requirement	15.203 & 15.247(b) RSS-GEN 6.8		-

Summary of Test Result



1 Test Laboratory

1.1 Test facility

CNAS (accreditation number:L11138)

Hunan Ecloud Testing Technology Co., Ltd. has obtained the accreditation of China National Accreditation

Service for Conformity Assessment (CNAS).

FCC (Designation number:CN1244, Test Firm Registration

Number:793308)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission

list of test facilities recognized to perform electromagnetic emissions measurements.

ISED(CAB identifier: CN0012, ISED# :24347)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the Wireless Device Testing Laboratories list of

innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.

A2LA (Certificate Number: 4895.01)

Hunan Ecloud Testing Technology Co., Ltd. has been listed by American Association for Laboratory

Accreditation to perform electromagnetic emission measurement.



2 General Description

2.1 Applicant

Globe Electric Company Inc.

150 Oneida, Montreal, Quebec, Canada, H9R 1A8

2.2 Manufacturer

Globe Electric Company Inc.

150 Oneida, Montreal, Quebec, Canada, H9R 1A8

2.3 General Description Of EUT

Product	Smart Power Strip
Model No.	50334
Brand Name	Globe
Additional NO.	N/A
Difference Description	N/A
FCC ID	2AQUQGE50334
IC	8290A-GE50334
Power Supply*	125Vac
Modulation Technology	FHSS
Modulation Type	GFSK, 8DPSK, π/4 DQPSK
Operating Frequency	2402MHz~2480MHz
Number Of Channel	79
Max. Output Power	Bluetooth BR(1Mbps) : 9.95 dBm (0.0099W) Bluetooth BR(2Mbps) : 9.16 dBm (0.0082W) Bluetooth BR(3Mbps) : 9.64 dBm (0.0092W)
Max. e.i.r.p.	11.45 dBm (0.0140W)
Antenna Type	PCB Antenna type with 1.5dBi gain
HW Version	-
SW Version	-
I/O Ports	Refer to user's manual
Cable Supplied	N/A

NOTE:

- 1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
- 2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.



3. *: Pre-test AC120V and AC125V, only the worst AC125V test data is recorded in the report

2.4 Modification of EUT

No modifications are made to the EUT during all test items.

2.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- ANSI C63.10-2013
- IC RSS-247 Issue 2
- IC RSS-Gen Issue 5
- KDB 558074 D01 15.247 Meas Guidance v05r02

Remark:

 This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B&ICES-003, recorded in a separate test report.



3 Test Configuration of Equipment Under Test

3.1 Descriptions of Test Mode

Mode	Channel	Frequency	Bluetooth RF Output Power
	Ch00	2402MHz	8.86
GFSK	Ch39	2441MHz	9.56
	Ch78	2480MHz	9.95
	Ch00	2402MHz	7.9
4π-DQPSK	Ch39	2441MHz	8.65
	Ch78	2480MHz	9.16
	Ch00	2402MHz	8.34
8DPSK	Ch39	2441MHz	9.01
	Ch78	2480MHz	9.64

The transmitter has a maximum peak conducted output power as follows:

Remark:

- 1. All the test data for each data rate were verified, but only the worst case was reported.
- 2. The data rate was set in 3Mbps for all the test items due to the highest RF output power.

3.2 Test Mode

3.2.1 Antenna Port Conducted Measurement

Summary table of Test Cases					
	Data Rate / Modulation				
Test Item	Bluetooth BR 1Mbps	Bluetooth EDR 2Mbps	Bluetooth EDR 3Mbps		
	GFSK	π/4-DQPSK	8-DPSK		
Conducted	Mode 1: CH00_2402 MHz	Mode 4: CH00_2402 MHz	Mode 7: CH00_2402 MHz		
	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz		
Test Cases	Mode 3: CH78_2480 MHz	Mode 6: CH78_2480 MHz	Mode 9: CH78_2480 MHz		

3.2.2 Radiated Emission Test (Below 1GHz)

Radiated	Bluetooth EDR 3Mbps 8-DPSK
Test Cases	Mode 1: CH00_2402MHz

Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type. Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

2. Following channel(s) was (were) selected for the final test as listed above

3.2.3 Radiated Emission Test (Above 1GHz)

	Bluetooth EDR 3Mbps 8-DPSK		
Radiated	Mode 1: CH00_2402 MHz		
Test Cases	Mode 2: CH39_2441 MHz		
	Mode 3: CH78_2480 MHz		

Note : 1. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

2. Following channel(s) was (were) selected for the final test as listed above

3. For frequency above 18GHz, the measured value is much lower than the limit, therefore, it is not reflected in the report.

3.2.4 Power Line Conducted Emission Test:

AC	
Conducted	Mode 1 : Bluetooth Linking + Switching On+lighting
Emission	

3.3 Support Equipment

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	NETGEAR	R7800	PY315100319	N/A	shielded, 1.8 m
2.	Notebook	Lenovo	E470C	FCC sDoC	N/A	shielded cable DC O/P 1.8 m unshielded AC I/P cable1.2 m
3.	WiFi Smart Bulb	Globe	34202*	2AQUQGB34202	N/A	N/A



3.4 Test Setup

The EUT is continuously communicating to the Bluetooth tester during the tests.

EUT was set in the Hidden menu mode to enable BT communications.

🚳 EspRFtestTool				_		×
Tools Help						
ChipType ESP8266	▼ COM	👻 BaudRate	9600	•		
IDI6					RAM	•
				0%	load	bin
wifi Test BT Test Test Mode: TX continues V Attenuation(dB) 0	wifi Adaptivity WiFi Rate: 11b 1M -	Manual BandWidth: 20M	▼ start	Channel: 1/2412 st		

Setup diagram for Conducted Test





Setup diagram for Raidation(9KHz~30MHz) Test



Setup diagram for Raidation(Below 1G) Test





Setup diagram for Raidation(Above1G) Test



Setup diagram for AC Conducted Emission Test



from other units and other metal planes



3.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 5 + 10 = 15 (dB)

For all radiated test items:

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level Over Limit (dB μ V/m) = Level(dB μ V/m) - Limit Level (dB μ V/m)



4 Test Result

4.1 20dB and 99% Bandwidth Measurement

4.1.1 Limit of 20dB and 99% Bandwidth

None; for reporting purposes only.

4.1.2 Test Procedures

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Turn on the EUT and connect it to measurement instrument.
- 3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
 - Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;

RBW \geq 1% of the 20 dB bandwidth; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold.

4. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.

Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel; RBW \geq 1% of the 99% bandwidth; VBW \geq RBW; Sweep = auto; Detector function = sample; Trace = max hold.

4.1.3 Test Result of 20dB Bandwidth

Refer to Appendix A of this test report.

4.1.4 Test Result of 99% Bandwidth

Refer to Appendix B of this test report.



4.2 Peak Output Power Measurement

4.2.1 Limit of Peak Output Power

Section 15.247 (b)

The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts. RSS-247 5.4(b)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W

4.2.2 Test Procedures

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Turn on the EUT and connect it to measurement instrument.
- 3. The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

4.2.3 Test Result of Peak Output Power

Refer to Appendix C of this test report.



4.3 Carrier Frequency Separation Measurement

4.3.1 Limit of Hopping Channel Separation

FCC §15.247 (a) (1)

RSS-247 5.1(b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping 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.

4.3.2 Test Procedures

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Turn on the EUT and connect it to measurement instrument.
- 3. The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

4.3.3 Test Result of Hopping Channel Separation

Refer to Appendix D of this test report.



4.4 Time of Occupancy Measurement

4.4.1 Limit of Average Time of Occupancy

FCC §15.247 (a) (1) (iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

RSS-247 5.1(d)

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

4.4.2 Test Procedures

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Turn on the EUT and connect it to measurement instrument.

3. The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

4. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2441MHz as below:

DH1 time slot= Burst Width (ms)*(1600/ (2*79))*31.6

DH3 time slot= Burst Width (ms)*(1600/ (4*79))*31.6

DH5 time slot= Burst Width (ms)*(1600/ (6*79))*31.6

4.4.3 Test Result of Dwell Time

Refer to Appendix E of this test report.



4.5 Number of Hopping Channels Measurement

4.5.1 Limits of Number of Hopping Channels

FCC § 15.247(a)(1)(iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

RSS-247 5.1(d)

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

4.5.2 Test Procedure

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Turn on the EUT and connect it to measurement instrument.
- 3. The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 100KHz. The analyzer is set to Max Hold.

4.5.3 Test Result of Number of Hopping Channels

Refer to Appendix F of this test report.





4.6 Conducted Band Edges Measurement

4.6.1 Limit of Band Edges

FCC §15.247(d)

IC RSS-247 5.5

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

4.6.2 Test Procedures

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Turn on the EUT and connect it to measurement instrument.
- 3.Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
- 4. Enable hopping function of the EUT and then repeat step 1~3.

4.6.3 Test Result of Conducted Band Edges

Refer to Appendix G of this test report.



4.7 Conducted Spurious Emission Measurement

4.7.1 Limit of Spurious Emission Measurement

FCC §15.247(d)

IC RSS-247 5.5

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

4.7.2 Test Procedure

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Turn on the EUT and connect it to measurement instrument.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4.Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
- 5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

4.7.3 Test Result of Conducted Spurious Emission

Refer to Appendix H of this test report.



4.8 Radiated Band Edges and Spurious Emission Measurement

4.8.1 Limit of Radiated Band Edges and Spurious Emission

FCC §15.247 (d)

IC RSS-247 5.5

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency	Field Strength	Measurement Distance			
(MHz)	(microvolts/meter)	(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: The frequency range from 9KHz to 10th harmonic (25GHz) are checked, and no any emissions were found from 18GHz to 25GHz, So the radiated emissions from 18GHz to 25GHz were not record.





4.8.2 Test Procedures

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Turn on the EUT and connect it to measurement instrument.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW=3RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement:

VBW = 10 Hz, when duty cycle is no less than 98 percent.

VBW \geq 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

- 5. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP.
- 6. Convert the resultant EIRP to an equivalent electric field strength using the following relationship:

E = EIRP – 20 log d + 104.8

Where:

E is the electric field strength in $dB\mu V/m$

EIRP is the equivalent isotropically radiated power in dBm

d is the specified measurement distance in m

 $E[dB\mu V/m] = EIRP[dBm] + 95.2$, for d = 3 m.

7. Compare the resultant electric field strength level with the applicable regulatory limit.





4.8.3 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.



4.8.4 Test Result of Radiated Spurious at Band Edges



























Tel.:+86-731-89634887 Fax.: +86-731-89634887





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4.8.1 Test Result of Radiated Spurious Emission (1GHz ~ 10th Harmonic)

Test Mode :	Bluetooth (3Mbps) CH00 (2402MHz)					Ter	nper	ature	:	21	21~23 ℃		
Test Engineer :	Jack Liu					Re	Relative Humidity :				63~65%		
Frequencey Range	1GHz~3GHz					Po	Polarization :				orizontal		
Test S Tested Test M Da	ite by ode 110 100 80	: 3m Chan : Jack : BT CHOO (dBuV/m)	lber)(2402МН	z)		Tem Pol Pow	p/Hum /Phas er ra	i : e : ting: D	22°C , HORIZ 125V/ ate: 20	/64% ZONTAL AC 20-12-30			
	60							FC		-6dB			
	40 40 20 0 1000	^{مر} م میرون میرون 1300.	HUNDAWAWAWA 1500. 1	700. 11	900. 210	0. 23 Hz)	winkulon (***)) 00.	2500. 2	2700.	300	0		
1	Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Lim lev	it C el l	ver imit	Remark	c .		
	MHZ 02.000	84.95	27.58	ав 4. 19	35. 82	авиу/т 80. 90	74.	v/m 00	ав 6. 90	Peak	-		





Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.









Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.








Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.









Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

Building A1, Changsha E Center, No. 18 Xiangtai Avenue, Liuyang Economic and Technological Development Zone, Hunan, P.R.C FCC ID : 2AQUQGE50334 IC : 8290A-GE50334 www.hn-ecloud.com





Tel.:+86-731-89634887 Fax.: +86-731-89634887





Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.





Tel.:+86-731-89634887 Fax.: +86-731-89634887





Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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4.8.2 Test Result of Radiated Spurious Emission (30MHz ~ 1GHz)

Test Mode :	Bluetooth (3MI	ops) CH00 (2402MHz	Temperature :	23~25 ℃
Test Engineer :	Jack Liu		Relative Humidity :	63~65%
Frequencey Range	30MHz~1GHz		Polarization :	Horizontal
Test S. Tested Test M Da	ite : 3m Chan by : Jack ode : BT CH00 : 	ber 	Temp/Humi : 25°C/64 Pol/Phase : HORIZON Power rating: 120VAc Date: 2020- FCC PART16C PI	% TAL 12-30
	30 100. 200 .	300. 400. 500. Frequency (M	600. 700. 800. 900. Hz)	1000
	MHz dBuV	factor loss factor dB/m dB dB	level level limit Re dBuV/m dBuV/m dB	emark
1 1 2 3 3 6	71. 71. 52. 86 59. 980 50. 63 91. 020 53. 39 39. 520 53. 09 20. 030 52. 76 40. 130 44. 38	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	31. 46 40. 00 -8. 54 QF 34. 40 43. 50 -9. 10 QF 34. 65 43. 50 -8. 85 QF 36. 21 46. 00 -9. 79 QF 38. 21 46. 00 -7. 79 QF 37. 30 46. 00 -8. 70 QF	









4.9 AC Conducted Emission Measurement

4.9.1 Limit of AC Conducted Emission

FCC §15.207

IC RSS-GEN 8.8

For equipment that is designed to be connected to the public utility (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 the limits in the following table.

Frequency of omission (MHz)	Conducted limit (dBµV)			
Frequency of emission (MHZ)	Quasi-peak	Average		
0.15-0.5	66 to 56*	56 to 46*		
0.5-5	56	46		
5-30	60	50		

*Decreases with the logarithm of the frequency.

4.9.2 Test Procedures

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6.Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- 8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.





4.9.3 Test Result of AC Conducted Emission







Result Level= Reading Level + LISN Factor + Cable Loss



4.10 Antenna Requirements

4.10.1 Standard Applicable

According to antenna requirement of §15.203.

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 a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded..

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

4.10.2 Antenna Connected Construction

An PCB antenna design is used

4.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date	Remark
Spectrum Analyzer	Keysight	N9010A	MY56070788	2020-01-15	2021-01-14	Conducted
Power Sensor	Keysight	U2021XA	MY56510025	2020-01-16	2021-01-15	Conducted
Power Sensor	Keysight	U2021XA	MY57030005	2020-01-16	2021-01-15	Conducted
Power Sensor	Keysight	U2021XA	MY56510018	2020-01-16	2021-01-15	Conducted
Power Sensor	Keysight	U2021XA	MY56480002	2020-01-16	2021-01-15	Conducted
Thermal Chamber	Howkin	UHL-34	19111801	2020-05-09	2021-05-08	Conducted
Base Station	R&S	CMW 270	101231	2020-01-16	2021-01-15	Conducted
Signal Generator (Interferer)	Keysight	N5182B	MY56200384	2020-02-21	2021-02-20	Conducted
Signal Generator (Blocker)	Keysight	N5171B	MY56200661	2020-01-15	2021-01-14	Conducted

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV 40	101433	2020-01-16	2021-01-15	Radiation
Amplifier	Sonoma	310	363917	2020-01-15	2021-01-14	Radiation
Amplifier	Schwarzbeck	BBV 9718	327	2020-01-15	2021-01-14	Radiation
Amplifier	Narda	TTA1840-35-HG	2034380	2020-05-22	2021-05-21	Radiation
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-051	2020-02-14	2023-02-13	Radiation
Broadband Antenna	Schwarzbeck	VULB 9168	9168-757	2018-08-31	2021-08-30	Radiation
Horn Antenna	Schwarzbeck	BBHA 9120 D	1677	2020-02-14	2023-02-13	Radiation
Horn Antenna	COM-POWER	AH-1840	101117	2018-06-20	2021-06-19	Radiation
Test Software	Audix	E3	6.111221a	N/A	N/A	Radiation
Filter	Micro-Tronics	BRM 50702	G266	N/A	N/A	Radiation



Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date	Remark
LISN	R&S	ENV216	102125	2020-01-08	2021-01-07	Conducted
LISN	R&S	ENV432	101327	2020-01-08	2021-01-07	Conducted
EMI Test	R&S	ESB3	102143	2020-01-16	2021-01-15	Conducted
Receiver	Ndo	2010	102140	2020 01 10	2021 01 15	Conducted
EMI Test	Audix	Γa	N1/A	N1/A	N1/A	Conducted
Software	Audix	⊑3	IN/A	IN/A	IN/A	Conducted

N/A: No Calibration Required



6 Uncertainty of Evaluation

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	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.42dB
	30MHz ~ 1GMHz	2.50dB
Radiated emission	1GHz ~ 18GHz	3.51dB
	18GHz ~ 40GHz	3.96dB

MEASUREMENT	UNCERTAINTY
Occupied Channel Bandwidth	±196.4Hz
RF output power, conducted	±2.31dB
Power density, conducted	±2.31dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



Appendix A: 20dB Emission Bandwidth

Test Result

TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
		2402	0.930	2401.502	2402.432		PASS
DH5	Ant1	2441	0.936	2440.502	2441.438		PASS
		2480	0.948	2479.496	2480.444		PASS
2DH5 Ant1		2402	1.323	2401.298	2402.621		PASS
	Ant1	2441	1.356	2440.283	2441.639		PASS
		2480	1.320	2479.298	2480.618		PASS
3DH5 A		2402	1.308	2401.307	2402.615		PASS
	Ant1	2441	1.308	2440.307	2441.615		PASS
		2480	1.320	2479.307	2480.627		PASS



Test Graphs



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Appendix B: Occupied Channel Bandwidth

Test Result

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
		2402	0.80486	2401.559	2402.364		PASS
DH5	Ant1	2441	0.83474	2440.537	2441.371		PASS
		2480	0.81678	2479.552	2480.369		PASS
2DH5 Ant1		2402	1.1875	2401.367	2402.554		PASS
	Ant1	2441	1.1919	2440.366	2441.558		PASS
		2480	1.1851	2479.369	2480.554		PASS
3DH5 An		2402	1.1989	2401.356	2402.555		PASS
	Ant1	2441	1.1934	2440.359	2441.552		PASS
		2480	1.1958	2479.357	2480.552		PASS



Test Graphs



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Appendix C: Maximum conducted output power

Test Result

TestMode	Antenna	Channel	Result[dBm]	EIRP [dBm]	Limit[dBm]	Verdict
		2402	8.86	10.36	<=20.97	PASS
DH5	Ant1	2441	9.56	11.06	<=20.97	PASS
		2480	9.95	11.45	<=20.97	PASS
		2402	7.9	9.4	<=20.97	PASS
2DH5	Ant1	2441	8.65	10.15	<=20.97	PASS
		2480	9.16	10.66	<=20.97	PASS
3DH5	Ant1	2402	8.34	9.84	<=20.97	PASS
		2441	9.01	10.51	<=20.97	PASS
		2480	9.64	11.14	<=20.97	PASS



Test Graphs













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Appendix D: Carrier frequency separation

Test Result

TestMode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Нор	0.862	>=0.632	PASS
2DH5	Ant1	Нор	1.026	>=0.904	PASS
3DH5	Ant1	Нор	0.996	>=0.880	PASS



Test Graphs




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🔤 Keysi	ight Spectrur	n Analyzer - Swe	ept SA									
Cento	er Freq	RF 50 Ω 2.44150	AC 0000 G	Hz	, Trig: Fre	NSE:INT	#Avg Typ Avg Hold:	ALIGN AUTO e: RMS 100/100	12:55:58 PI TRAC TYP	MDec 23, 2020 E 1 2 3 4 5 6 E 1	F	requency
10 dBi	Re /div R	ef Offset 9.0 ef 30.00 d	9 dB IBm	Gain:Low	#Atten: 4	0 dB	-		ΔMkr2 9	996 kHz .086 dB		Auto Tune
20.0								044			2.4	Center Freq 41500000 GHz
10.0 0.00 -	- to the second		\$ '	محناسيتين	and all a	ana	- -		a marine	www.	2.4	Start Freq 40500000 GHz
-10.0											2.4	Stop Freq 42500000 GHz
-30.0 -											<u>Auto</u>	CF Step 200.000 kHz Man
-40.0 - -50.0 -												Freq Offset 0 Hz
-60.0												Scale Type
Start #Res	2.44050 BW 300	00 GHz 0 kHz		#VBW	300 kHz			Sweep 1	top 2.442 .000 ms (2500 GHz 1001 pts)	LUg	Lin
MSG								STATUS	6			



Appendix E: Time of occupancy

Test Result

TostModo	Antonno	Channel	BurstWidth	TotalHops	Docult[o]	Limit[s]	Verdict
Testivioue	Antenna	Channer	[ms]	[Num]	Results		
DH1	Ant1	Hop_2441	0.38	100	0.038	<=0.4	PASS
DH3	Ant1	Hop_2441	1.63	100	0.163	<=0.4	PASS
DH5	Ant1	Hop_2441	2.88	130	0.374	<=0.4	PASS
2DH1	Ant1	Hop_2441	0.39	100	0.039	<=0.4	PASS
2DH3	Ant1	Hop_2441	1.64	120	0.197	<=0.4	PASS
2DH5	Ant1	Hop_2441	2.89	80	0.231	<=0.4	PASS
3DH1	Ant1	Hop_2441	0.39	190	0.074	<=0.4	PASS
3DH3	Ant1	Hop_2441	1.64	140	0.229	<=0.4	PASS
3DH5	Ant1	Hop_2441	2.89	60	0.173	<=0.4	PASS



Test Graphs





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Building A1, Changsha E Center, No. 18 Xiangtai Avenue,

Liuyang Economic and Technological Development Zone, Hunan, P.R.C FCC ID : 2AQUQGE50334 IC : 8290A-GE50334 www.hn-ecloud.com Tel.:+86-731-89634887 Fax.: +86-731-89634887



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Building A1, Changsha E Center, No. 18 Xiangtai Avenue, Liuvang Economic and Technological Development Zone, Hunan

Liuyang Economic and Technological Development Zone, Hunan, P.R.C FCC ID : 2AQUQGE50334 IC : 8290A-GE50334 www.hn-ecloud.com Tel.:+86-731-89634887 Fax.: +86-731-89634887