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TEST REPORT

Report No.: **CTC20210150E02**

FCC ID.....: **2AKIT-AK022**

Applicant.....: **Lumi United Technology Co., Ltd**

Address.....: 8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave, Taoyuan Residential District, Nanshan District, Shenzhen, China

Manufacturer.....: Lumi United Technology Co., Ltd

Address.....: 8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave, Taoyuan Residential District, Nanshan District, Shenzhen, China

Product Name.....: **Smart Wall Switch (No Neutral, Double Rocker)**

Trade Mark.....: Aqara

Model/Type reference.....: WS-USC02

Listed Model(s): Please see the page 7

Standard.....: **FCC CFR Title 47 Part 15 Subpart C Section 15.247**

Date of receipt of test sample...: Feb. 19, 2021

Date of testing.....: Feb. 20, 2021 ~ Feb. 23, 2021

Date of issue.....: Feb. 24, 2021

Result.....: **PASS**

Compiled by:		
(Printed name+signature)	Terry Su	
Supervised by:		
(Printed name+signature)	Miller Ma	
Approved by:		
(Printed name+signature)	Walter Chen	

Testing Laboratory Name.....: **CTC Laboratories, Inc.**

Address.....: 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

[RSS 247 Issue 2](#): Standard Specifications for Frequency Hopping Systems (FHSs) and Digital Transmission Systems (DTSS) Operating in the Bands 902-928MHz, 2400-2483.5MHz and 5725-5850MHz.

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices.

1.2. Report version

Revised No.	Date of issue	Description
01	Feb. 24, 2021	Original



1.3. Test Description

FCC Part 15 Subpart C (15.247) / RSS 247 Issue 2				
Test Item	Standard Section		Result	Test Engineer
	FCC	IC		
Antenna Requirement	15.203	/	Pass	Terry Su
Conducted Emission	15.207	RSS-Gen 8.8	Pass	Jon Huang
Conducted Band Edge and Spurious Emissions	15.247(d)	RSS 247 5.5	Pass	Terry Su
Radiated Band Edge and Spurious Emissions	15.205&15.209&15.247(d)	RSS 247 5.5	Pass	Terry Su
6dB Bandwidth	15.247(a)(2)	RSS 247 5.2 (a)	Pass	Terry Su
Conducted Max Output Power	15.247(b)(3)	RSS 247 5.4 (d)	Pass	Terry Su
Power Spectral Density	15.247(e)	RSS 247 5.2 (b)	Pass	Terry Su
Transmitter Radiated Spurious	15.209&15.247(d)	RSS 247 5.5&RSS-Gen 8.9	Pass	Terry Su

Note: Based on changes only replace the low section fuse with the high section fuse and replace the insurance resistance in the power supply circuit with the temperature insurance resistance. Radiated emissions(30MHz ~ 1GHz) and conduction emissions require retest in this test report. For other test data, refer to report number: GTI20190176F-1.



1.4. Test Facility

CTC Laboratories, Inc.

Add: 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L5365

CTC Laboratories, Inc. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation. Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 4340.01

CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

Industry Canada (Registration No.: 9783A, CAB Identifier: CN0029)

CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 9783A on Jan, 2016.

FCC (Registration No.: 951311, Designation Number CN1208)

CTC Laboratories, Inc. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 951311, Aug 26, 2017.

1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.



Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.42 dB	(1)
Transmitter power Radiated	2.14 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.08 dB	(1)
Radiated Emissions 30~1000MHz	4.51 dB	(1)
Radiated Emissions 1~18GHz	5.84 dB	(1)
Radiated Emissions 18~40GHz	6.12 dB	(1)
Occupied Bandwidth	-----	(1)

Note (1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=1.96$.

1.6. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	21°C ~ 27°C
Relative Humidity:	40% ~ 60%
Air Pressure:	101kPa



2. GENERAL INFORMATION

2.1. Client Information

Applicant:	Lumi United Technology Co., Ltd
Address:	8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave, Taoyuan Residential District, Nanshan District, Shenzhen, China
Manufacturer:	Lumi United Technology Co., Ltd
Address:	8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave, Taoyuan Residential District, Nanshan District, Shenzhen, China



2.2. General Description of EUT

Product Name:	Smart Wall Switch (No Neutral, Double Rocker)
Trade Mark:	Aqara
Model/Type reference:	WS-USC02
Listed Model(s):	Smart Wall Switch (No Neutral, Single Rocker): WS-USC01, WS-USC01-C1, WS-USC01-C2, WS-USC01-C3, WS-USC01-C4, WS-USC01-C5, WS-USC01-C6, QBKG13LM, QBKG13LM-C1, QBKG13LM-C2, QBKG13LM-C3, QBKG13LM-C4, QBKG13LM-C5, QBKG13LM-C6 Smart Wall Switch (No Neutral, Double Rocker): WS-USC02-C1, WS-USC02-C2, WS-USC02-C3, WS-USC02-C4, WS-USC02-C5, WS-USC02-C6, QBKG14LM, QBKG14LM-C1, QBKG14LM-C2, QBKG14LM-C3, QBKG14LM-C4, QBKG14LM-C5, QBKG14LM-C6
Model Difference:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is rocker quantity.
Power supply:	AC 120V/60Hz
Hardware version:	T1
Software version:	V1.0.1
Zigbee	
Operation frequency:	2405MHz~2480MHz
Channel number:	16
Channel separation:	5MHz
Antenna type:	PCB Antenna
Antenna gain:	2dBi



2.3. Accessory Equipment information

Equipment Information			
Name	Model	S/N	Manufacturer
/	/	/	/
/	/	/	/
Cable Information			
Name	Shielded Type	Ferrite Core	Length
/	/	/	/
Test Software Information			
Name	/	/	/
/	/	/	/



2.4. Operation state

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. Zigbee 16 channels are provided to the EUT. Channels 11/18/26 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)
11	2405
12	2410
:	:
17	2435
18	2440
19	2445
:	:
25	2475
26	2480

Note: The display in grey were the channel selected for testing.

Test mode

For RF test items:
The engineering test program was provided and enabled to make EUT continuous transmit.
For AC power line conducted emissions:
The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.



2.5. Measurement Instruments List

Tonscend JS0806-2 Test system					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Spectrum Analyzer	Rohde & Schwarz	FSU26	100105	Dec. 25, 2021
2	Spectrum Analyzer	Rohde & Schwarz	FUV40-N	101331	Mar. 15, 2021
3	MXG Vector Signal Generator	Agilent	N5182A	MY47420864	Dec. 25, 2021
4	Signal Generator	Agilent	E8257D	MY46521908	Dec. 25, 2021
5	Power Sensor	Agilent	U2021XA	MY5365004	Dec. 25, 2021
6	Power Sensor	Agilent	U2021XA	MY5365006	Dec. 25, 2021
7	Simultaneous Sampling DAQ	Agilent	U2531A	TW54493510	Dec. 25, 2021
8	Climate Chamber	TABAI	PR-4G	A8708055	Dec. 25, 2021
9	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	116410	Dec. 25, 2021
10	Climate Chamber	ESPEC	MT3065	/	Dec. 25, 2021
11	300328 v2.2.2 test system	TONSCEND	v2.6	/	/

Radiated Emission and Transmitter spurious emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	EMI Test Receiver	Rohde & Schwarz	ESCI	100658	Dec. 25, 2021
2	High pass filter	micro-tranics	HPM50111	142	Dec. 25, 2021
3	Log-Bicon Antenna	Schwarzbeck	CBL6141A	4180	Dec. 25, 2021
4	Ultra-Broadband Antenna	ShwarzBeck	BBHA9170	25841	Dec. 25, 2021
5	Loop Antenna	LAPLAC	RF300	9138	Dec. 25, 2021
6	Spectrum Analyzer	Rohde & Schwarz	FSU26	100105	Dec. 25, 2021
7	Horn Antenna	Schwarzbeck	BBHA 9120D	647	Dec. 25, 2021
8	Pre-Amplifier	HP	8447D	1937A03050	Dec. 25, 2021
9	Pre-Amplifier	EMCI	EMC051835	980075	Dec. 25, 2021
10	Antenna Mast	UC	UC3000	N/A	N/A
11	Turn Table	UC	UC3000	N/A	N/A
12	Cable Below 1GHz	Schwarzbeck	AK9515E	33155	Dec. 25, 2021
13	Cable Above 1GHz	Hubersuhner	SUCOFLEX 102	DA1580	Dec. 25, 2021
14	Splitter	Mini-Circuit	ZAPD-4	400059	Dec. 25, 2021
15	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	Dec. 25, 2021
16	RF Connection Cable	Chengdu E-Microwave	---	---	Dec. 25, 2021
17	High pass filter	Compliance	BSU-6	34202	Dec. 25, 2021

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		Direction systems			
18	Attenuator	Chengdu E-Microwave	EMCAXX-10 RNZ-3	---	Dec. 25, 2021
19	High and low temperature box	ESPEC	MT3065	12114019	Dec. 25, 2021

Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	R&S	ENV216	101112	Dec. 25, 2021
2	LISN	R&S	ENV216	101113	Dec. 25, 2021
3	EMI Test Receiver	R&S	ESCI	100658	Dec. 25, 2021

Note:1. The Cal. Interval was one year.

2. The cable loss has calculated in test result which connection between each test instruments.

3. TEST ITEM AND RESULTS

3.1. Conducted Emission

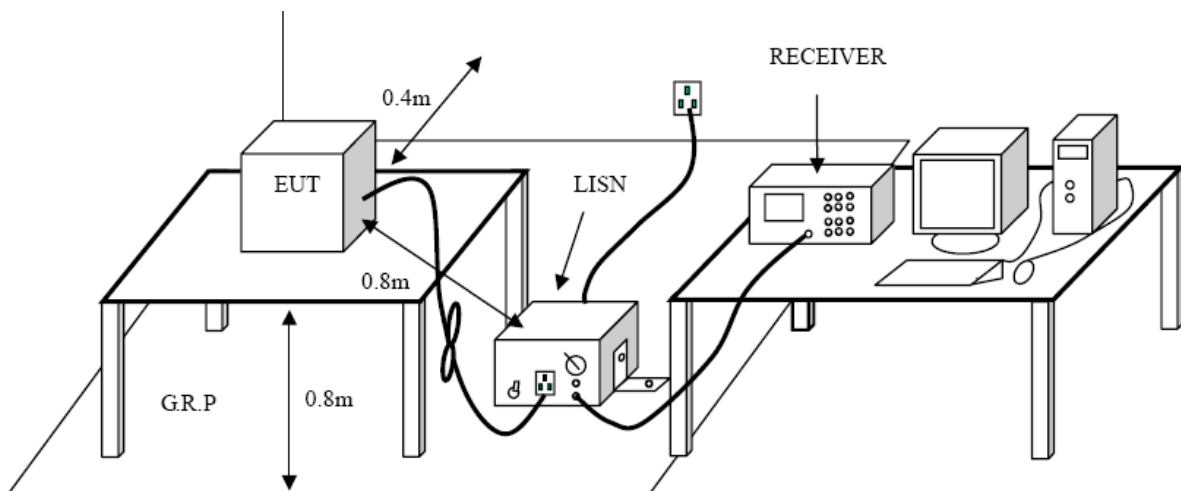
Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.207/ RSS - Gen 8.8

Frequency range (MHz)	Limit (dBuV)	
	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.

Test Configuration



Test Procedure

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
4. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
5. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
6. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
7. During the above scans, the emissions were maximized by cable manipulation.

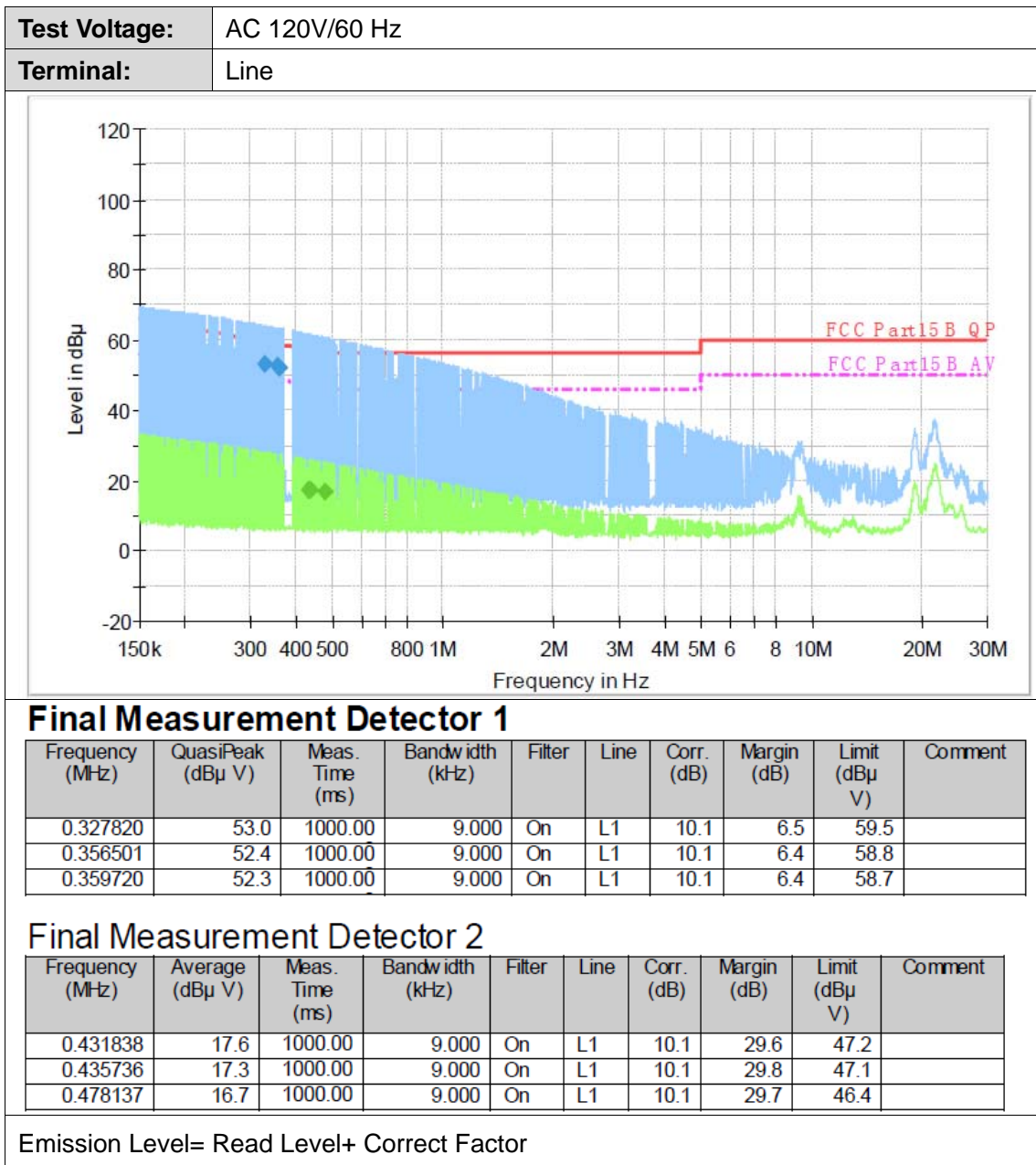


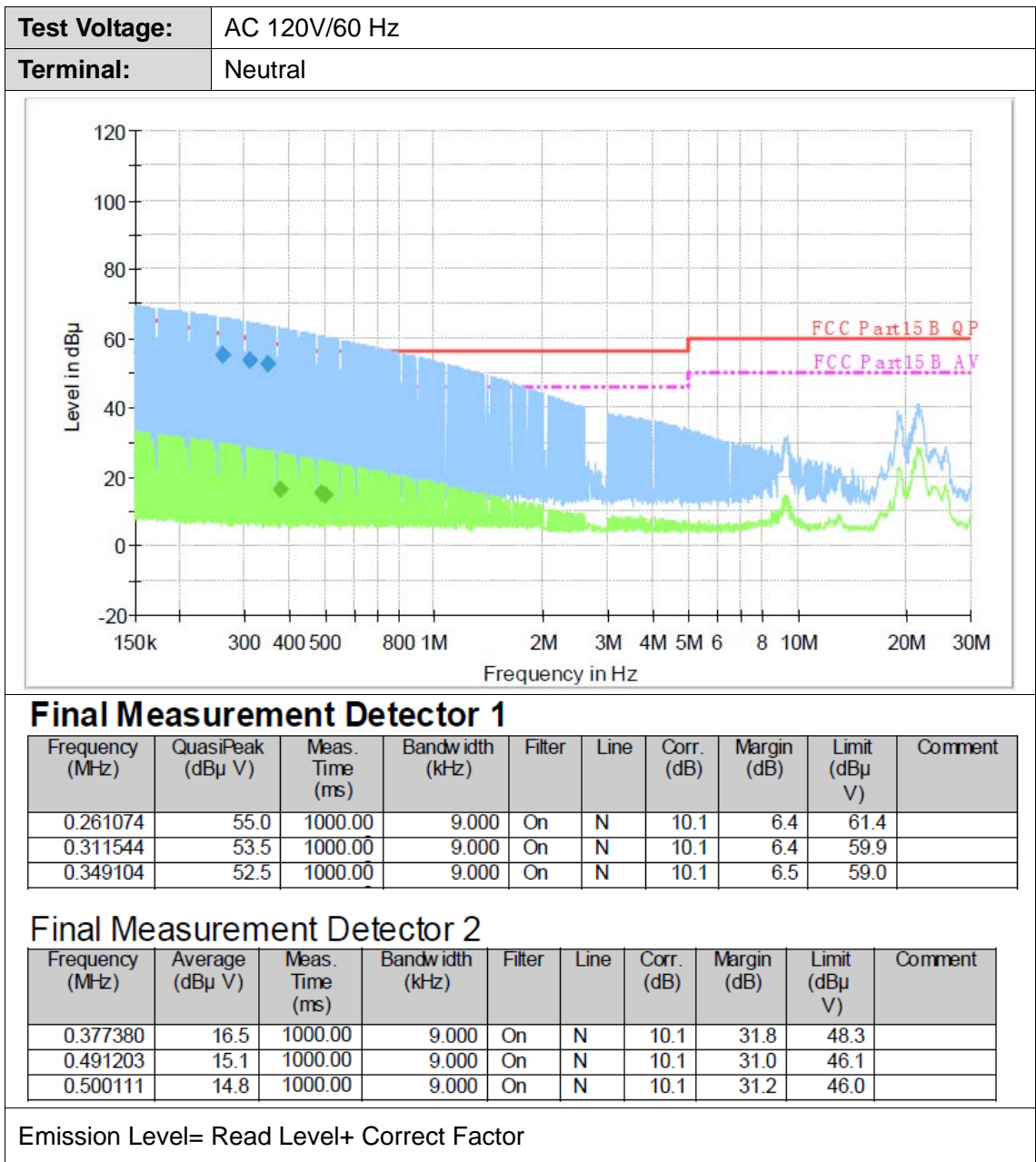


Test Mode:

Please refer to the clause 2.4.

Test Results





3.2. Radiated Emission

Limit

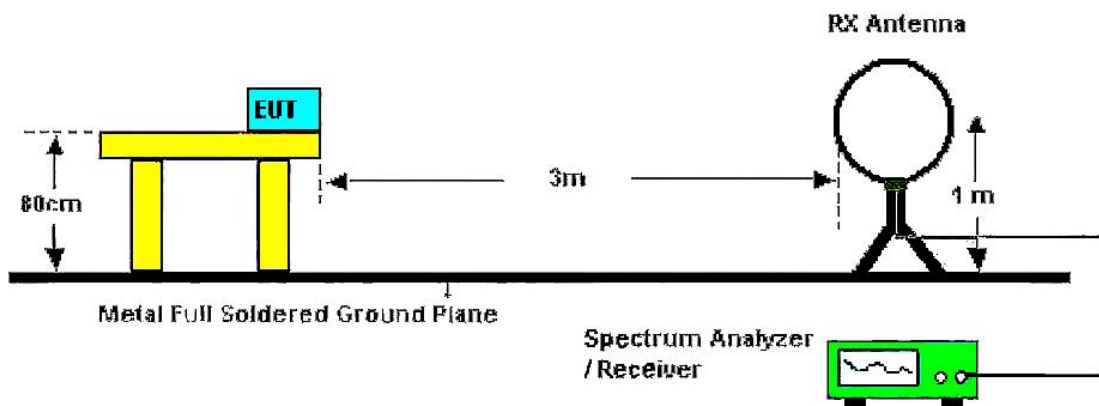
FCC CFR Title 47 Part 15 Subpart C Section 15.209/ RSS – Gen 8.9

Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

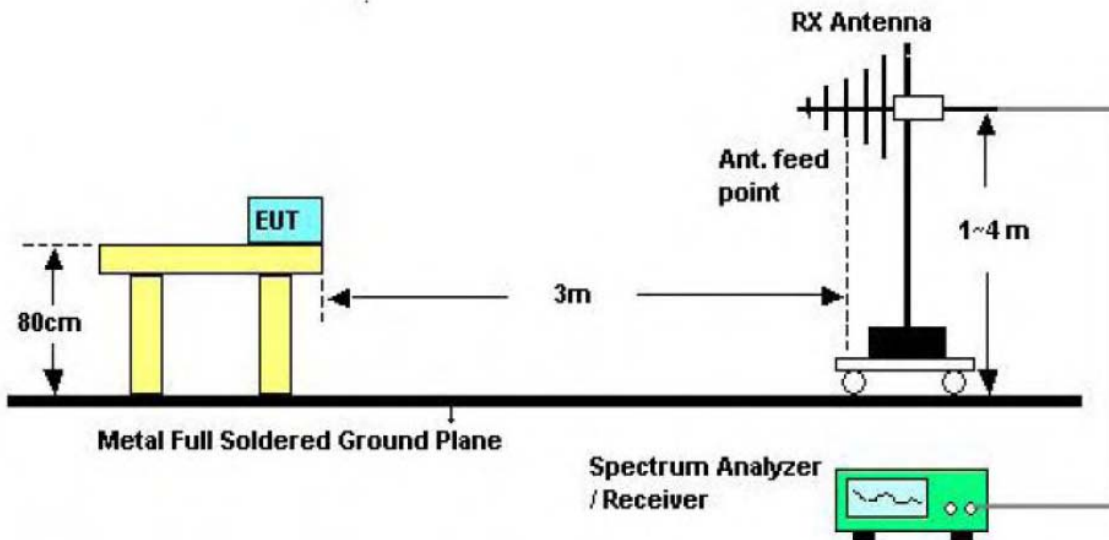
Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBuV/m)=20log Emission Level (uV/m).

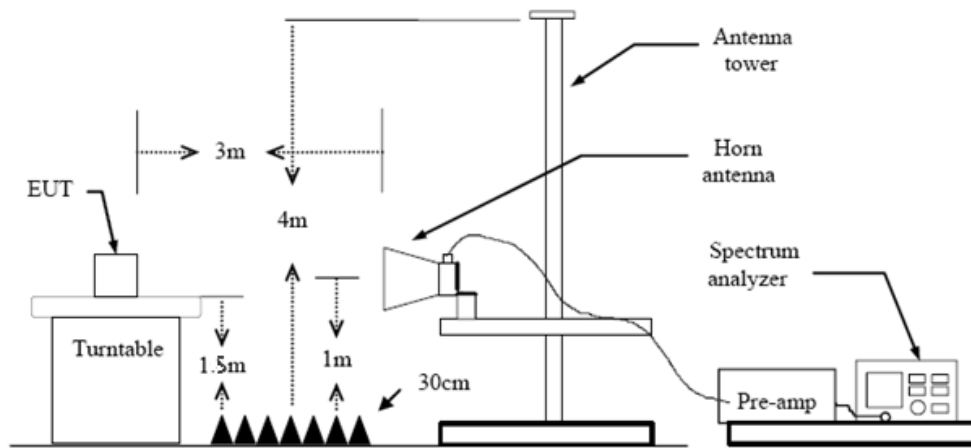
Test Configuration



Below 30MHz Test Setup



Below 1000MHz Test Setup



Above 1GHz Test Setup

Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013
 2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
 4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
 5. Set to the maximum power setting and enable the EUT transmit continuously.
 6. Use the following spectrum analyzer settings
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Below 1 GHz:
RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - (3) From 1 GHz to 10th harmonic:
RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW \geq 1/T Peak detector for Average value.
- Note 1: For the 1/T & Duty Cycle please refer to clause 3.8 Duty Cycle.

Test Mode

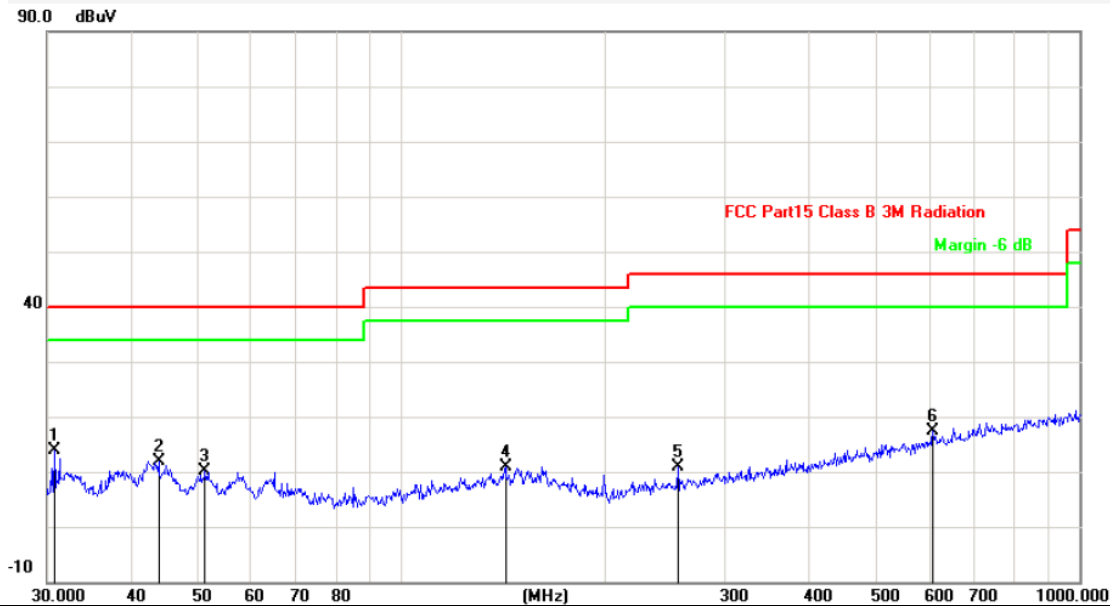
Please refer to the clause 2.4.

Test Result



30MHz-1GHz

Ant. Pol.	Horizontal
Test Mode:	TX Mode 2405MHz
Remark:	Only worse case is reported



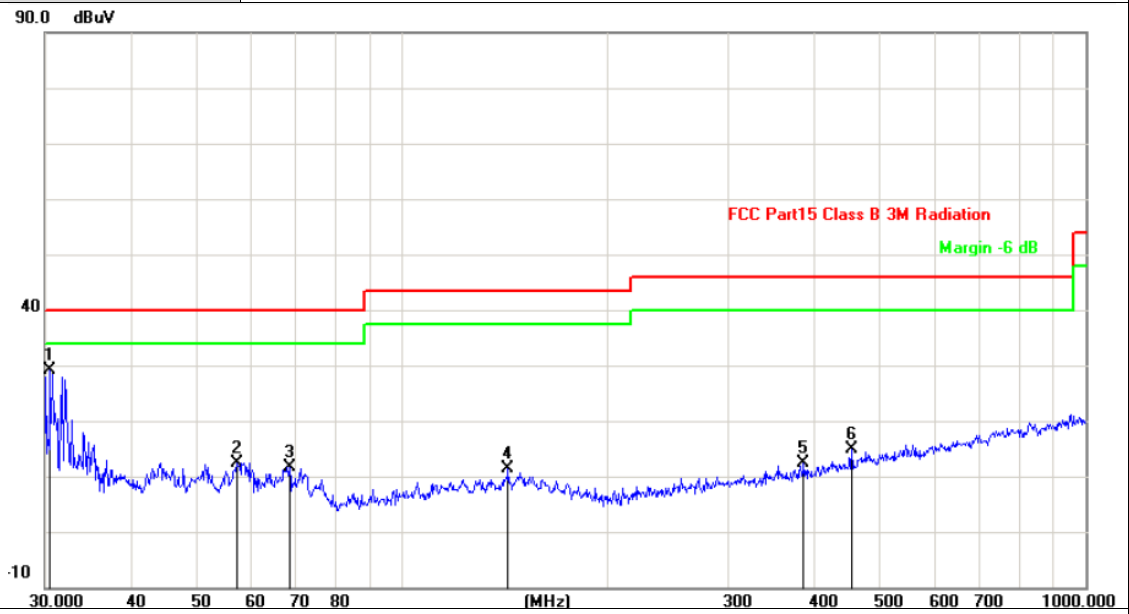
No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	30.7455	-18.15	32.12	13.97	40.00	-26.03	QP
2	43.8119	-17.58	29.48	11.90	40.00	-28.10	QP
3	51.3005	-17.87	27.99	10.12	40.00	-29.88	QP
4	142.3243	-17.44	28.33	10.89	43.50	-32.61	QP
5	255.6231	-18.97	29.92	10.95	46.00	-35.05	QP
6	607.7867	-12.10	29.48	17.38	46.00	-28.62	QP

Remarks:

- Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- Margin value = Level -Limit value



Ant. Pol.	Vertical
Test Mode:	TX Mode 2405MHz
Remark:	Only worse case is reported



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	30.5306	-18.16	47.37	29.21	40.00	-10.79	QP
2	57.1914	-18.31	30.80	12.49	40.00	-27.51	QP
3	68.3908	-20.10	31.71	11.61	40.00	-28.39	QP
4	142.8243	-17.40	28.85	11.45	43.50	-32.05	QP
5	386.6338	-16.04	28.41	12.37	46.00	-33.63	QP
6	454.3099	-14.44	29.23	14.79	46.00	-31.21	QP

Remarks:
 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
 2. Margin value = Level -Limit value

*****THE END*****