FCC RF Test Report

APPLICANT	:	**Volansys Technologies Pvt Ltd.**
EQUIPMENT	:	**Modular IoT Gateway**
BRAND NAME	:	**Volansys**
MODEL NAME	:	**VT-GTWY-6UL01-M2-M4**
MARKETING NAME	:	**Modular IoT Gateway**
FCC ID	:	**2AKNO-GW6UL01M2M4**
STANDARD	:	**FCC Part 15 Subpart C §15.247**
CLASSIFICATION	:	**(DTS) Digital Transmission System**

The product was received on Jul. 12, 2017 and testing was completed on Aug. 22, 2017. We, Sporton International (Shenzhen) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Shenzhen) Inc., the test report shall not be reproduced except in full.

Eric Shih

Approved by: Eric Shih / Manager

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR771202A	Rev. 01	Initial issue of report	Aug. 24, 2017

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(d)	RSS-247 5.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 10.13 dB at 500.450 MHz
3.2	15.207	RSS-GEN 8.8	AC Conducted Emission	15.207(a)	Pass	Under limit 11.26 dB at 0.440 MHz
3.3	15.203 & 15.247(b)	N/A	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Volansys Technologies Pvt Ltd.
Block A-7th Floor, Safal Profitaire, Corporate Road, Prahaladnagar, Ahmedabad-380 015, Gujarat. India

1.2 Manufacturer

Volansys Technologies Pvt Ltd.
Block A-7th Floor, Safal Profitaire, Corporate Road, Prahaladnagar, Ahmedabad-380 015, Gujarat. India

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Modular IoT Gateway
Brand Name	Volansys
Model Name	VT-GTWY-6UL01-M2-M4
Marketing Name	Modular IoT Gateway
FCC ID	2AKNO-GW6UL01M2M4
EUT supports Radios application	NFC WLAN 2.4G 802.11b/g/n HT20/ Bluetooth 4.1 LE / v4.2 LE Zigbee/Thread: 250kpbs
HW Version	1.0
SW Version	test 1.2.0
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Antenna Type / Gain	Bluetooth 4.1 LE: Whip/Tilt Antenna with gain 2.15 dBi
Type of Modulation	Bluetooth LE : GFSK

1.5 Modification of EUT

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

1.6 Re-use of Measured Data

1.6.1 Introduction Section

This application re-uses data collected on a similar device. The subject device of this application (Model: VT-GTWY-6UL01-M2-M4, FCC ID: 2AKNO-GW6UL01M2M4) is electrically identical to the reference device (Model:VT-GTWY-6UL01-M4, FCC ID: 2AKNO-GW6UL01M4) for the portions of the circuitry corresponding to the data being re-used, as treated by KDB Publication 178919 D01.

1.6.2 Difference Section

For details concerning the similarity with respect to component placement, mechanical/electrical design etc., please refer to the Operational Description.

The re-used RF data includes the following bands provided in Appendix F (RF Report No. C170223Z01-RP1-2 for the reference device Model:VT-GTWY-6UL01-M4, FCC ID: 2AKNO-GW6UL01M4):

1.6.3 Spot Check Verification Data Section

In order to confirm hardware similarity of the subject device with the reference device, spot check measurements were performed on the subject device for radiated spurious emission, the test result were consistent with FCC ID: 2AKNO-GW6UL01M4.

Assertions concerning the similarity of these devices are based on representations by the applicant. The applicant accepts full responsibility for the validity of the similarity claim, and for the determination that verification test data are sufficient to support it.

1.6.4 Reference detail Section:

Equipment Class	Reference FCC ID	Folder Test/RF Exposure	Report Title/Section
DTS (BLE)	2AKNO-GW6UL01M4	Part15C(C170223Z01-RP1-2)	All conducted sections applicable for Bluetooth 4.1 LE
DTS (WLAN)	2AKNO-GW6UL01M4	Part15C(C170223Z01-RP1-1)	All conducted sections applicable
DTS (Zigbee)	2AKNO-GW6UL01M4	Part15C(C170223Z01-RP1-3)	All conducted sections applicable
DXX (NFC)	2AKNO-GW6UL01M4	Part15C(C170223Z01-RP1-4)	All conducted sections applicable

1.7 Testing Location

Sporton Lab is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600156-0) and the FCC designation No is CN5019.

Test Site	SPORTON International (ShenZhen) Inc.	
Test Site Location	No. 3 Bldg the third floor of south, Shahe River west, Fengzeyuan Warehouse, Nanshan District Shenzhen City Guangdong Province 518055 China TEL: +86-755-3320-2398	
Test Site No.	**Sporton Site No.**	**FCC Test Firm Registration No.**
	03CH01-SZ	577730

Note: The test site complies with ANSI C63.4 2014 requirement.

1.8 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
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ANSI C63.10-2013
- IC RSS-247 Issue 2
- IC RSS-Gen Issue 4

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

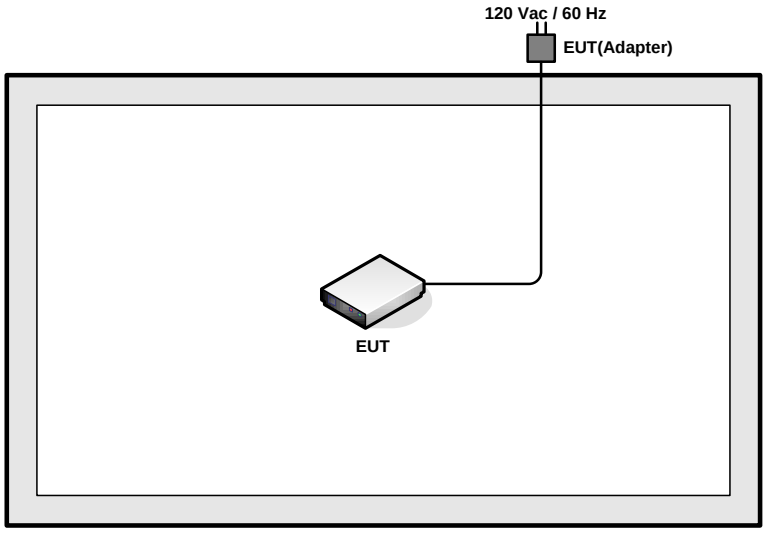
2.1 Test Mode

The following summary table is showing all test modes to demonstrate in compliance with the standard.

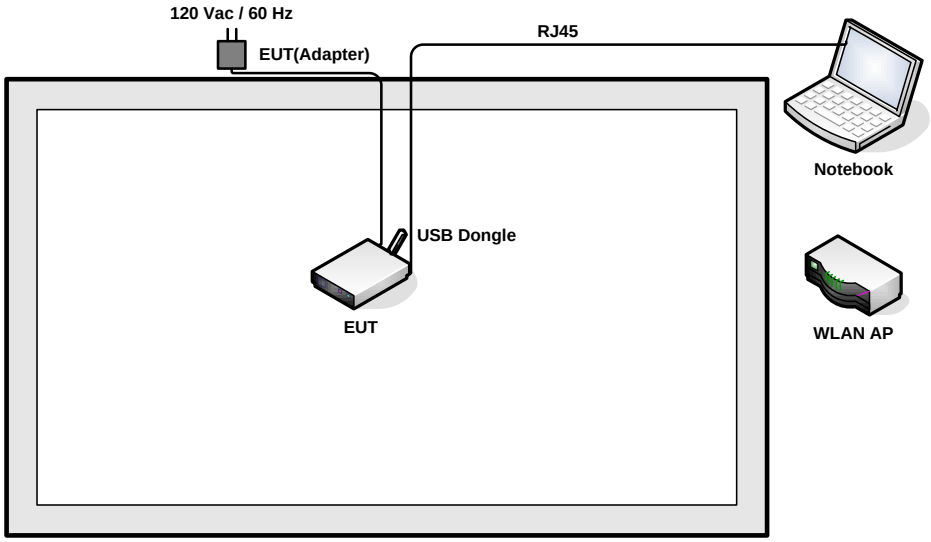
Summary table of Test Cases	
Test Item	**Data Rate / Modulation**
	Bluetooth 4.1 LE / GFSK
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
AC Conducted Emission	Mode 1: WLAN Link + Bluetooth Link + Zigbee Link + Thread Link + Adapter + USB Dongle (Data Link) + RJ-45 Link + SD Card (Data Link) + NFC On

2.2 Connection Diagram of Test System

<Bluetooth 4.1 LE Tx Mode>



<AC Conducted Emission Mode>



2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-Link	DIR-855	KA2DIR855A2	N/A	Unshielded, 1.8 m
2.	Notebook	Lenovo	E450	FCC DoC	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
3.	SD Card	Kingstone	8G	N/A	N/A	N/A
4.	USB Dongle	N/A	N/A	N/A	N/A	N/A

2.4 EUT Operation Test Setup

For Bluetooth 4.1 LE function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the Notebook under large package sizes transmission.

3 Test Result

3.1 Radiated Band Edges and Spurious Emission Measurement

3.1.1 Limit of Radiated Band Edges and Spurious Emission

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. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.1.2 Measuring Instruments

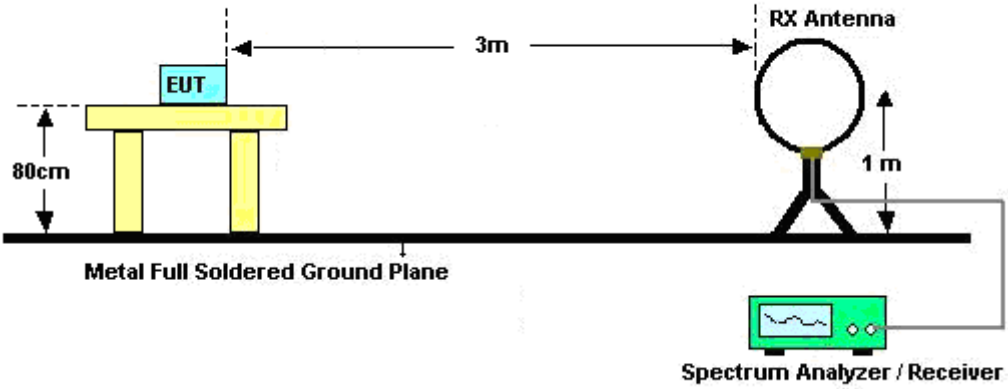
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

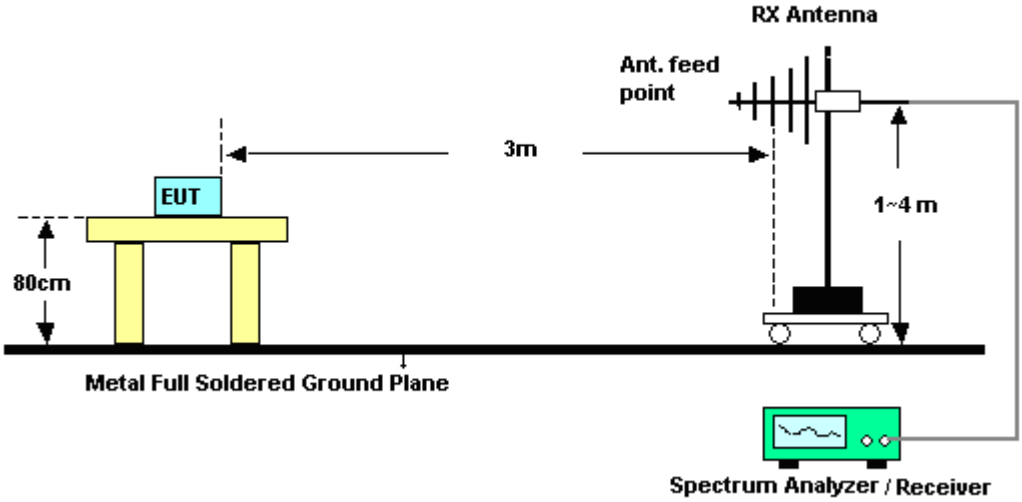
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, 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.
7. 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; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 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.

3.1.4 Test Setup

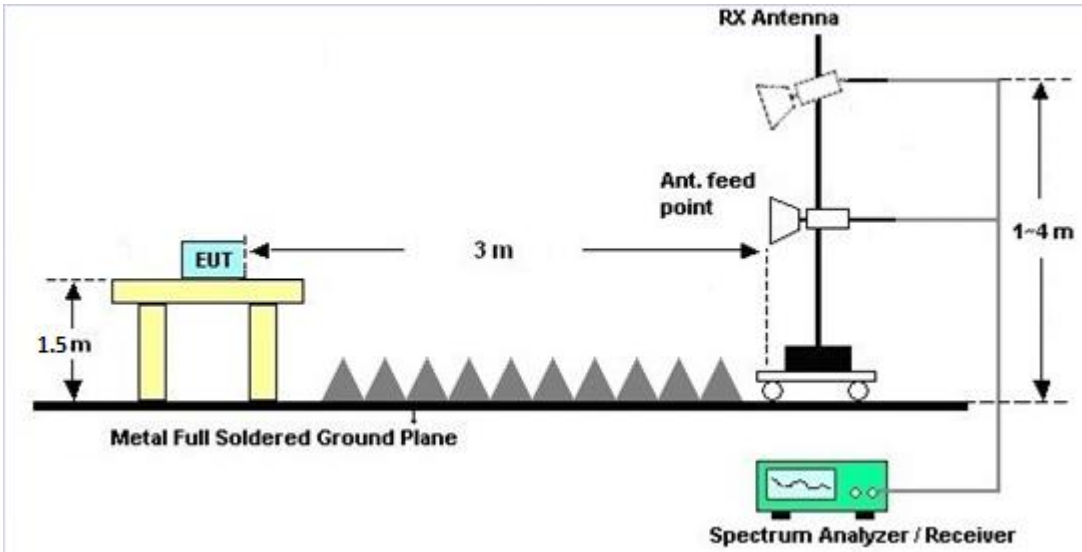
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.1.5 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 was not reported.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.1.7 Duty Cycle

Please refer to Appendix B.

3.1.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix A.

3.2 AC Conducted Emission Measurement

3.2.1 Limit of AC Conducted Emission

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 emission (MHz)	Conducted limit (dBμV)	
	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.

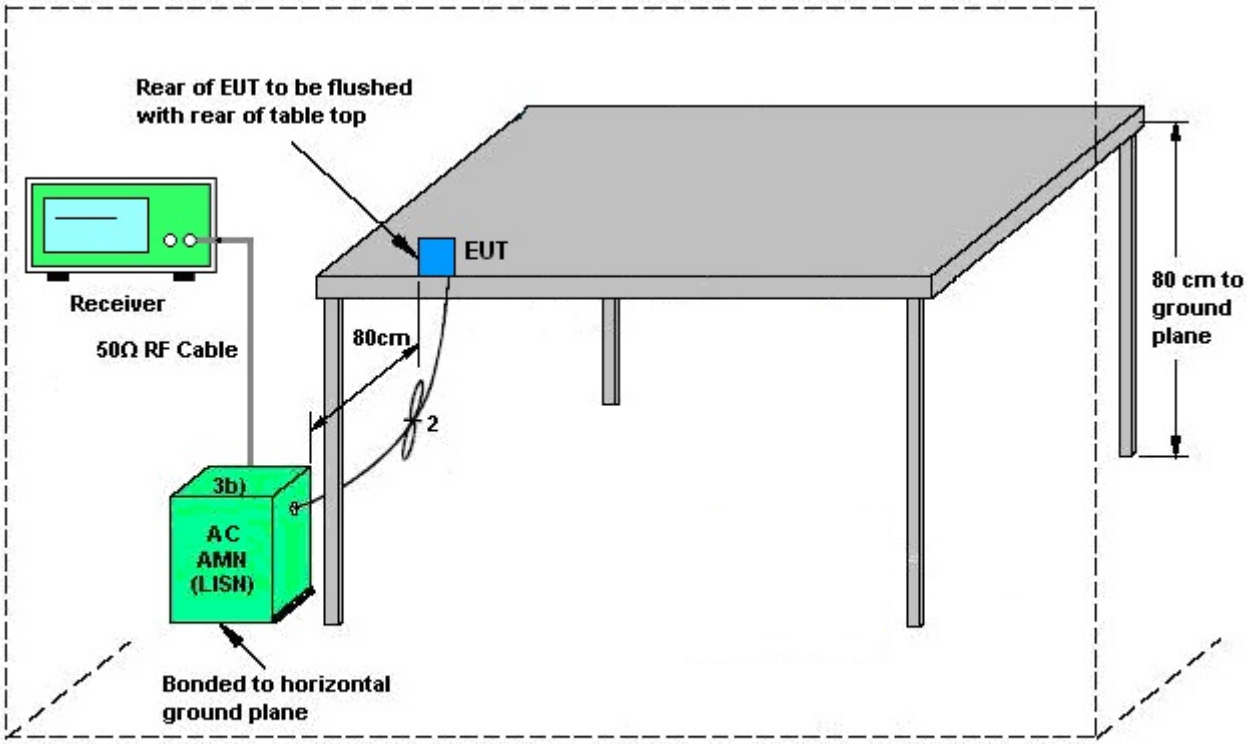
3.2.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 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.

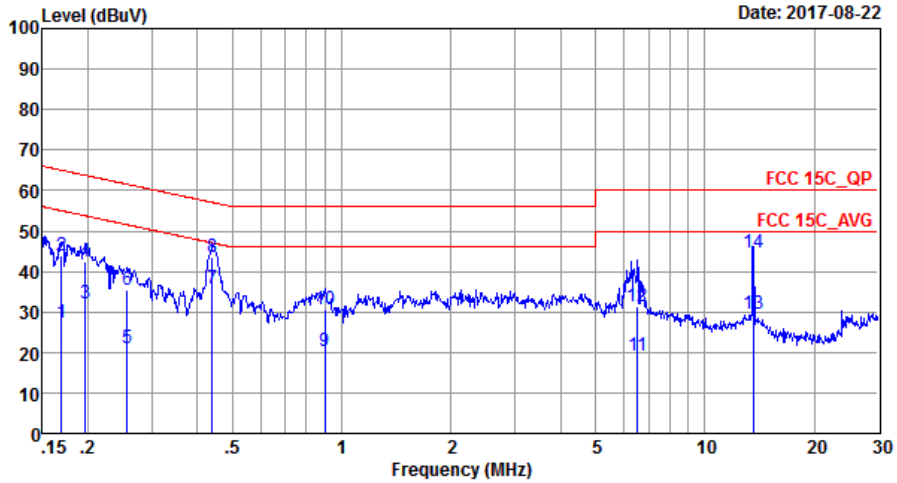
3.2.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.2.5 Test Result of AC Conducted Emission

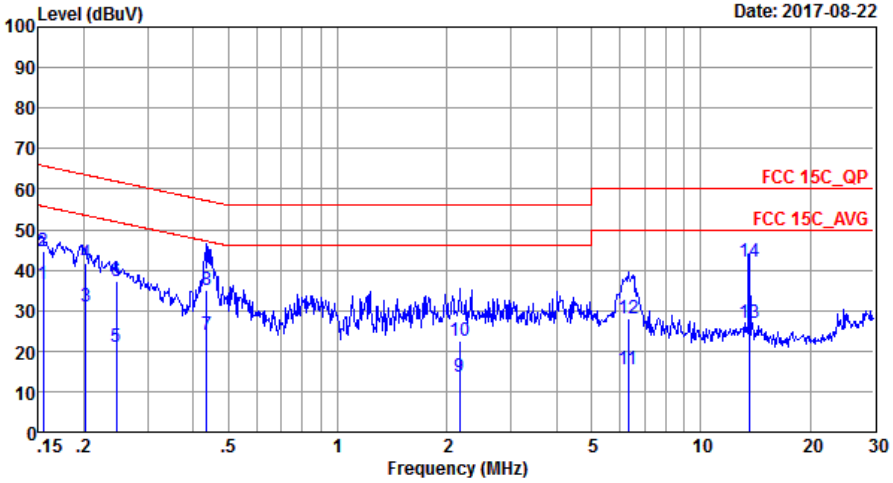
Test Mode :	Mode 1	**Temperature :**	22~25℃
Test Engineer :	Haohai Ye	**Relative Humidity :**	50~55%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	WLAN Link + Bluetooth Link + Zigbee Link + Thread Link + Adapter + USB Dongle (Data Link) + RJ-45 Link + SD Card (Data Link) + NFC On		



Site : CO01-SZ
Condition: FCC 15C_QP LISN_20170301_L LINE

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1		0.17	27.26	-27.73	54.99	16.90	0.03	10.33	Average
2		0.17	43.96	-21.03	64.99	33.60	0.03	10.33	QP
3		0.20	32.16	-21.60	53.76	21.90	0.03	10.23	Average
4		0.20	42.26	-21.50	63.76	32.00	0.03	10.23	QP
5		0.26	20.85	-30.71	51.56	10.60	0.03	10.22	Average
6		0.26	35.55	-26.01	61.56	25.30	0.03	10.22	QP
7	*	0.44	35.81	-11.26	47.07	25.59	0.03	10.19	Average
8		0.44	43.71	-13.36	57.07	33.49	0.03	10.19	QP
9		0.90	20.31	-25.69	46.00	10.10	0.06	10.15	Average
10		0.90	30.51	-25.49	56.00	20.30	0.06	10.15	QP
11		6.52	19.17	-30.83	50.00	8.64	0.22	10.31	Average
12		6.52	31.34	-28.66	60.00	20.81	0.22	10.31	QP
13		13.56	29.50	-20.50	50.00	18.70	0.47	10.33	Average
14		13.56	44.60	-15.40	60.00	33.80	0.47	10.33	QP

Test Mode :	Mode 1	**Temperature :**	22~25℃
Test Engineer :	Haohai Ye	**Relative Humidity :**	50~55%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral
Function Type :	WLAN Link + Bluetooth Link + Zigbee Link + Thread Link + Adapter + USB Dongle (Data Link) + RJ-45 Link + SD Card (Data Link) + NFC On		



Site : CO01-SZ
Condition: FCC 15C_QP LISN_20170301_N NEUTRAL

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.15	36.42	-19.32	55.74	26.00	0.03	10.39	Average
2	0.15	44.62	-21.12	65.74	34.20	0.03	10.39	QP
3	0.20	31.15	-22.34	53.49	20.90	0.03	10.22	Average
4	0.20	41.65	-21.84	63.49	31.40	0.03	10.22	QP
5	0.25	21.15	-30.76	51.91	10.90	0.03	10.22	Average
6	0.25	37.15	-24.76	61.91	26.90	0.03	10.22	QP
7	0.44	23.81	-23.34	47.15	13.60	0.02	10.19	Average
8	0.44	34.91	-22.24	57.15	24.70	0.02	10.19	QP
9	2.17	13.62	-32.38	46.00	3.40	0.05	10.17	Average
10	2.17	22.62	-33.38	56.00	12.40	0.05	10.17	QP
11	6.32	15.68	-34.32	50.00	5.30	0.07	10.31	Average
12	6.32	27.98	-32.02	60.00	17.60	0.07	10.31	QP
13	13.56	27.01	-22.99	50.00	16.39	0.29	10.33	Average
14 *	13.56	42.01	-17.99	60.00	31.39	0.29	10.33	QP

3.3 Antenna Requirements

3.3.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.3 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.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver&SA	Agilent	N9038A	MY52260185	20Hz~26.5GHz	Apr. 20, 2017	Aug. 09, 2017	Apr. 19, 2018	Radiation (03CH01-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 14, 2017	Aug. 09, 2017	May 13, 2018	Radiation (03CH01-SZ)
Bilog Antenna	TeseQ	CBL6112D	23188	30MHz-2GHz	Apr. 25, 2017	Aug. 09, 2017	Apr. 24, 2018	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS Lindgren	3117	00119436	1GHz~18GHz	Nov. 19, 2016	Aug. 09, 2017	Nov. 18, 2017	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz-40GHz	Aug. 10, 2016	Aug. 09, 2017	Aug. 09, 2017	Radiation (03CH01-SZ)
LF Amplifier	Burgeon	BPA-530	102209	0.01~3000Mhz	Apr. 20, 2017	Aug. 09, 2017	Apr. 19, 2018	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1707137	1GHz~18GHz	Oct. 11, 2016	Aug. 09, 2017	Oct. 10, 2017	Radiation (03CH01-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270104	0.5GHz~26.5Ghz	Oct. 11, 2016	Aug. 09, 2017	Oct. 10, 2017	Radiation (03CH01-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	Aug. 09, 2017	NCR	Radiation (03CH01-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Aug. 09, 2017	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Aug. 09, 2017	NCR	Radiation (03CH01-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Jan. 06, 2017	Aug. 22, 2017	Jan. 05, 2018	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2SH	00103912	9kHz~30MHz	Jan. 05, 2017	Aug. 22, 2017	Jan. 04, 2018	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	MessTec	3816/2SH	00103892	9kHz~30MHz	Jan. 05, 2017	Aug. 22, 2017	Jan. 04, 2018	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 19, 2017	Aug. 22, 2017	Jul. 18, 2018	Conduction (CO01-SZ)

NCR: No Calibration Required

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.5 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.1 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.2 dB

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.1 dB

Appendix A. Radiated Spurious Emission

For Bluetooth 4.1 LE

15C 2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		2331.84	40.15	-33.85	74	39.73	27.05	6.65	33.28	100	0	P	H
		2357.25	31.7	-22.3	54	31.07	27.14	6.73	33.24	100	0	A	H
	*	2402	98.4	-	-	97.57	27.23	6.81	33.21	100	0	P	H
	*	2402	97.53	-	-	96.7	27.23	6.81	33.21	100	0	A	H
		2381.085	41.64	-32.36	74	40.95	27.19	6.73	33.23	105	17	P	V
		2389.59	33.14	-20.86	54	32.31	27.23	6.81	33.21	105	269	A	V
	*	2402	103.38	-	-	102.55	27.23	6.81	33.21	105	269	P	V
	*	2402	102.6	-	-	101.77	27.23	6.81	33.21	105	269	A	V
BLE CH 19 2440MHz		2377.9	40.59	-33.41	74	39.9	27.19	6.73	33.23	103	334	P	H
		2368.8	31.74	-22.26	54	31.05	27.19	6.73	33.23	103	334	A	H
	*	2440	102.02	-	-	100.94	27.37	6.86	33.15	103	334	P	H
	*	2440	101.4	-	-	100.32	27.37	6.86	33.15	103	334	A	H
		2488.87	40.96	-33.04	74	39.65	27.5	6.91	33.1	103	334	P	H
		2492.3	32.12	-21.88	54	30.81	27.5	6.91	33.1	103	334	A	H
		2383.78	40.59	-33.41	74	39.9	27.19	6.73	33.23	116	220	P	V
		2367.12	31.89	-22.11	54	31.26	27.14	6.73	33.24	116	220	A	V
	*	2440	104.96	-	-	103.88	27.37	6.86	33.15	116	220	P	V
	*	2440	104.26	-	-	103.18	27.37	6.86	33.15	116	220	A	V
		2494.26	45.97	-28.03	74	44.66	27.5	6.91	33.1	116	220	P	V
		2492.72	35.91	-18.09	54	34.6	27.5	6.91	33.1	116	220	A	V

BLE CH 39 2480MHz	*	2480	104.12	-	-	102.87	27.46	6.91	33.12	119	224	P	H
	*	2480	103.42	-	-	102.17	27.46	6.91	33.12	119	224	A	H
		2483.56	56.74	-17.26	74	55.49	27.46	6.91	33.12	119	224	P	H
		2483.56	40.87	-13.13	54	39.62	27.46	6.91	33.12	119	224	A	H
	*	2480	99.39	-	-	98.14	27.46	6.91	33.12	100	333	P	V
	*	2480	98.75	-	-	97.5	27.46	6.91	33.12	100	333	A	V
		2483.52	52.33	-21.67	74	51.08	27.46	6.91	33.12	100	333	P	V
		2483.52	37.17	-16.83	54	35.92	27.46	6.91	33.12	100	333	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15C 2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		4804	46.97	-27.03	74	61.01	31.71	10.89	56.64	163	360	P	H
		4804	50.97	-23.03	74	65.01	31.71	10.89	56.64	163	360	P	V
BLE CH 19 2440MHz		4880	45.51	-28.49	74	59.72	31.78	10.92	56.91	163	360	P	H
		7320	49.75	-24.25	74	58.63	35.69	13.29	57.86	163	360	P	H
		4880	48.5	-25.5	74	62.71	31.78	10.92	56.91	163	360	P	V
		7320	48.73	-25.27	74	57.61	35.69	13.29	57.86	163	360	P	V
BLE CH 39 2480MHz		4960	46.15	-27.85	74	59.51	31.87	11.02	56.25	163	360	P	H
		7440	48.77	-25.23	74	57.58	35.91	13.06	57.78	163	360	P	H
		4960	49.57	-24.43	74	62.93	31.87	11.02	56.25	163	360	P	V
		7440	49.66	-24.34	74	58.47	35.91	13.06	57.78	163	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15C Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE LF		31.94	24.92	-15.08	40	31.02	25.28	0.27	31.65	-	-	P	H
		299.66	27.21	-18.79	46	38.27	18.2	2.04	31.3	-	-	P	H
		399.57	31.1	-14.9	46	38.61	21.4	2.39	31.3	-	-	P	H
		500.45	35.87	-10.13	46	41.26	23.3	2.71	31.4	100	155	P	H
		549.92	30.5	-15.5	46	34.96	24.1	2.84	31.4	-	-	P	H
		886.51	32.78	-13.22	46	32.43	28.07	3.78	31.5	-	-	P	H
		39.7	26.16	-13.84	40	35.08	22.3	0.38	31.6	100	125	P	V
		142.52	18.17	-25.33	43.5	31.45	16.9	1.24	31.42	-	-	P	V
		299.66	26.79	-19.21	46	37.85	18.2	2.04	31.3	-	-	P	V
		500.45	31.31	-14.69	46	36.7	23.3	2.71	31.4	-	-	P	V
		793.39	30.15	-15.85	46	31.1	26.96	3.59	31.5	-	-	P	V
		966.05	31.98	-22.02	54	30.72	28.73	4.03	31.5	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency per 15.209(c).
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

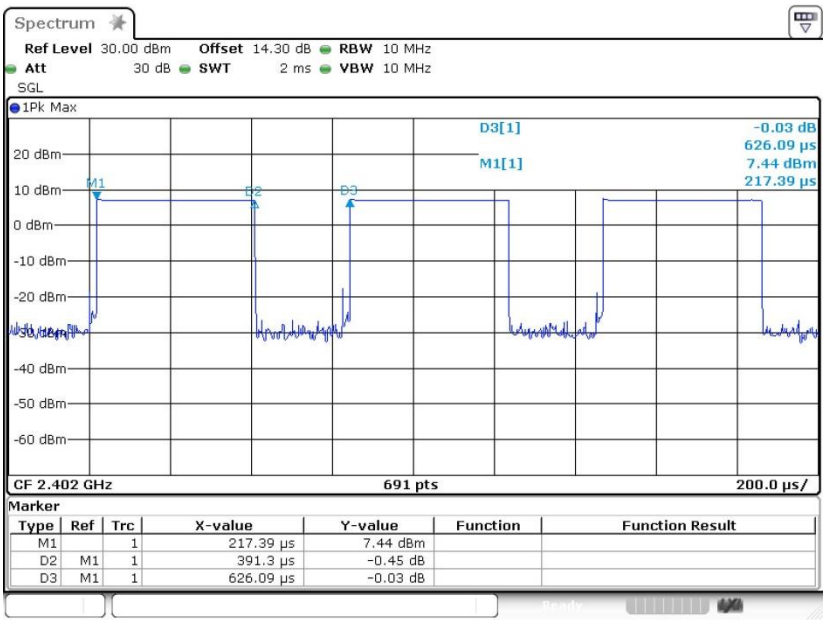
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix B. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth 4.1 LE	62.50	0.391	2.556	3kHz

Bluetooth 4.1 LE



Appendix D. Reference Report

Please refer to report number C170223Z01-RP1-2 which is issued separately.