FCC TEST REPORT

For

Shenzhen Comma Technology Co., Ltd.

CommaGlove 1S

Model No.: CommaGlove 1S

Additional Model No.: CommaGlove 1S Lite

Prepared for	:	Shenzhen Comma Technology Co., Ltd.
Address	:	Room 3A03 NO.3025 Nanhai Road, Nanshan District, Shenzhen city, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
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Date of receipt of test sample	:	Dec 27, 2016
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	Dec 27, 2016~Jan 04, 2017
Date of Report	:	Jan 04, 2017

FCC TEST REPORT
FCC CFR 47 PART 15 C(15.247): 2015

Report Reference No.	:	**LCS1612273897E**
Date of Issue	:	Jan 04, 2017
Testing Laboratory Name.....	:	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name ..... :		**Shenzhen Comma Technology Co., Ltd.**
Address	:	Room 3A03 NO.3025 Nanhai Road, Nanshan District, Shenzhen city, China
Test Specification		
Standard.....	:	FCC CFR 47 PART 15 C(15.247): 2015
Test Report Form No. ..... :		LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	:	Dated 2011-03

EUT Description. ..... :		**CommaGlove 1S**
Trade Mark.....	:	CommaGlove ™
Model/ Type reference	:	CommaGlove 1S
Ratings	:	DC3.7V by Li-ion Battery (400mAh) Recharged input:DC 5V/400mA
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Calvin Weng		
Calvin Weng/ Administrators	Glin Lu/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS1612273897E	Jan 04, 2017 Date of issue

EUT.....	:	CommaGlove 1S
Type / Model.....	:	CommaGlove 1S
Applicant.....	**:**	**Shenzhen Comma Technology Co., Ltd.**
Address.....	:	Room 3A03 NO.3025 Nanhai Road, Nanshan District, Shenzhen city, China
Telephone.....	:	
Fax.....	:	
Manufacturer.....	**:**	**Shenzhen Comma Technology Co., Ltd.**
Address.....	:	Room 3A03 NO.3025 Nanhai Road, Nanshan District, Shenzhen city, China
Telephone.....	:	
Fax.....	:	
Factory.....	**:**	**Shenzhen Comma Technology Co., Ltd.**
Address.....	:	Room 3A03 NO.3025 Nanhai Road, Nanshan District, Shenzhen city, China
Telephone.....	:	
Fax.....	:	

Test Result	**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
00	2017-01-04	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	CommaGlove 1S
Test Model	:	CommaGlove 1S
Hardware Version	:	Comma Glove D V1.0
Software Version	:	V1.0
Power Supply	:	DC3.7V by Li-ion Battery (400mAh) Recharged input:DC 5V/400mA
EUT Supports Radios Application	:	Bluetooth
Bluetooth	:	
Operating Frequency	:	2.402-2.480GHz
Channel Number	:	40 channels for Bluetooth V4.0 (DTS)
Channel Spacing	:	2MHz for Bluetooth V4.0 (DTS)
Modulation Type	:	GFSK for Bluetooth V4.0 (DTS)
Bluetooth Version	:	V4.0
Antenna Description	:	PCB Antenna, 1.0dBi(Max.)

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
SHENZHEN SAMSON POWER TECHNOLOGY CO LTD	Adapter for Notebook	SA/12PA/05FUK020100U	--	FCC
Lenovo	Notebook	B470	WB05067151	FCC

1.3. External I/O Cable

I/O Port Description	Quantity	Cable
USB Port	1	10cm, unshielded cable

1.4. Description of Test Facility

CNAS Registration Number. is L4595.
FCC Registration Number. is 899208.
Industry Canada Registration Number. is 9642A-1.
VCCI Registration Number. is C-4260 and R-3804.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Statement of The 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 CISPR 16 – 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the LCS 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.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

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

1.7. Description Of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.

Worst-case mode and channel used for 150kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power, that was determined to be BT LE mode(low Channel).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be BT LE mode(low Channel).

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case datarates used during the testing are as follows:

BT LE: 1Mbps, GFSK

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd..

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure KDB558074 D01 DTS Meas. Guidance v03r05 and KDB 662911 are required to be used for this kind of FCC 15.247 digital modulation device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmit condition.

Both left and right earbuds contain the same RF chip, but only the right earbud is able to connect to other bluetooth device, and the left earbud can only match the right earbud, it's not able to connect to other bluetooth device.

3.2. EUT Exercise Software

N/A

3.3. Special Accessories

N/A

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C		
FCC Rules	Description of Test	Result
KDB558074 §6.0	On Time and Duty Cycle	Compliant
§15.247(b)	Maximum Conducted Output Power	Compliant
§15.247(e)	Power Spectral Density	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(a)	Occupied Bandwidth	Compliant
§15.209, §15.247(d)	Radiated and Conducted Spurious Emissions	Compliant
§15.205	Emissions at Restricted Band	Compliant
§15.207(a)	Conducted Emissions	Compliant
§15.203	Antenna Requirements	Compliant
§15.247(i)§2.1093	RF Exposure	Compliant

5. TEST RESULT

5.1. On Time and Duty Cycle

5.1.1. Standard Applicable

None; for reporting purpose only.

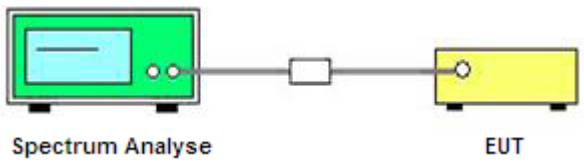
5.1.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the spectrum analyse.

5.1.3. Test Procedures

1. Set the centre frequency of the spectrum analyse to the transmiting frequency;
2. Set the span=0MHz, RBW=8MHz, VBW=50MHz, Sweep time=5ms;
3. Detector = peak;
4. Trace mode = Single hold.

5.1.4. Test Setup Layout

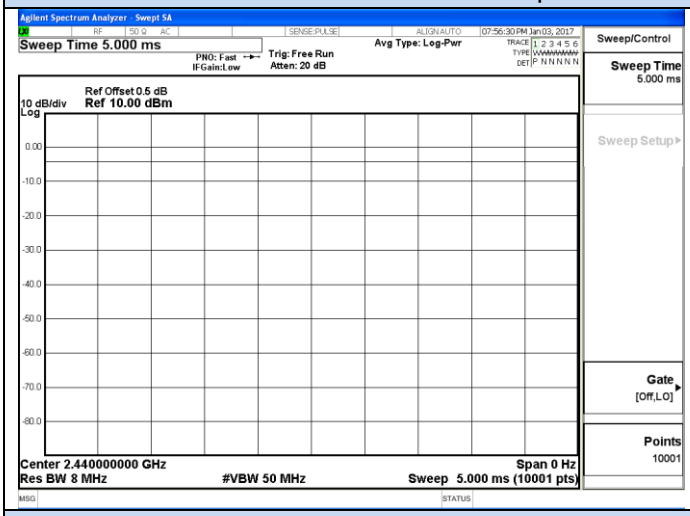


5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.1.6. Test result

Mode	On Time B (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW(KHz)
BLE	5.0	5.0	1	100	0	0.01

Test plot of On Time and Duty Cycle	
	
BT LE	

5.2. Maximum Conducted Output Power Measurement

5.2.1. Standard Applicable

According to §15.247(b): For systems using digital modulation in the 2400-2483.5 MHz and 5725-5850 MHz band, the limit for maximum peak conducted output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter peak output power.

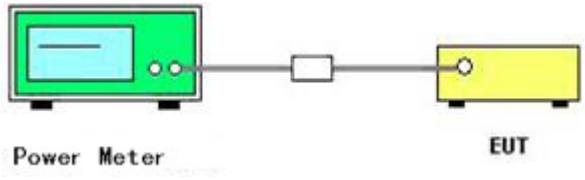
5.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the power meter.

5.2.3. Test Procedures

The transmitter output (antenna port) was connected to the power meter.

5.2.4. Test Setup Layout



5.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.2.6. Test Result of Maximum Conducted Output Power

Temperature	25℃	Humidty	60%
Test Engineer	Chaz	Configurations	BT LE

BT LE

Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Max. Limit (dBm)	Result
0	2402	-3.188	30	Complies
19	2440	-4.076	30	Complies
39	2480	-4.752	30	Complies

5.3. Power Spectral Density Measurement

5.3.1. Standard Applicable

According to §15.247(e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.3.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

5.3.3. Test Procedures

1. The transmitter was connected directly to a Spectrum Analyzer through a directional couple.

2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.

3. Set the RBW = 3 kHz~100kHz.

4. Set the VBW ≥ 3*RBW

5. Set the span to 1.5 times the DTS channel bandwidth.

6. Detector = peak.

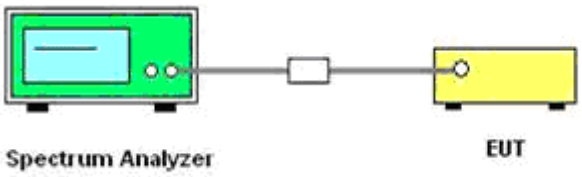
7. Sweep time = auto couple.

8. Trace mode = max hold.

9. Allow trace to fully stabilize.

10. Use the peak marker function to determine the maximum power level in any 3 kHz band segment within the fundamental EBW.

5.3.4. Test Setup Layout



5.3.5. EUT Operation during Test

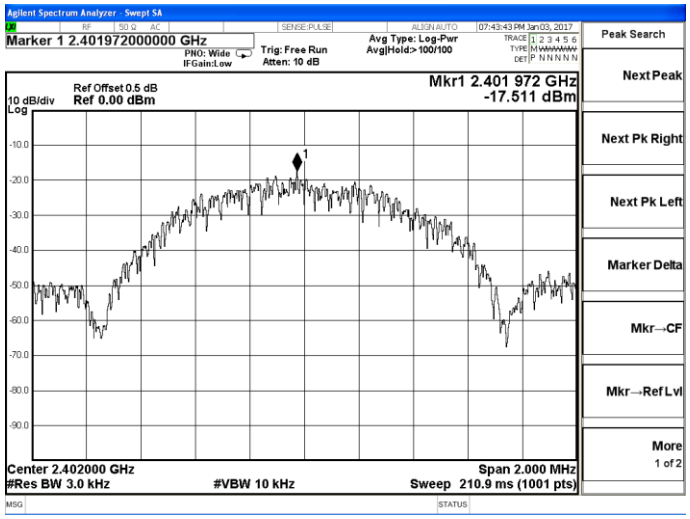
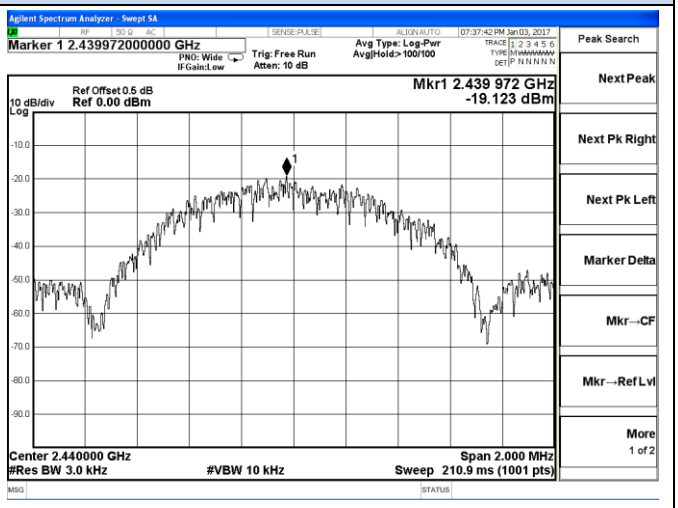
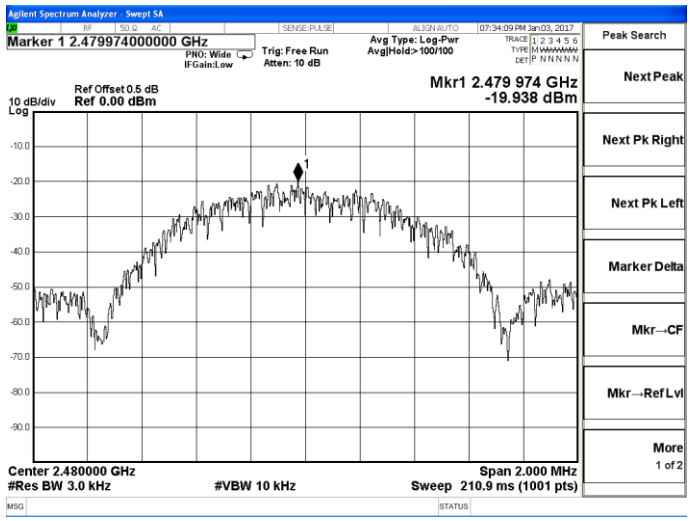
The EUT was programmed to be in continuously transmitting mode.

5.3.6. Test Result of Power Spectral Density

Temperature	25℃	Humidity	60%
Test Engineer	Chaz	Configurations	BT LE

BT LE

Channel	Frequency (MHz)	Mearsured Power Density (dBm/3KHz)	Max. Limit (dBm/3KHz)	Result
0	2402	-17.511	8	Complies
19	2440	-19.123	8	Complies
39	2480	-19.938	8	Complies

Test plot of Power Spectral Density	
	
BT LE-Low channel	BT LE Middle channel
	
BT LE-High channel	

5.4. 6 dB Spectrum Bandwidth Measurement

5.4.1. Standard Applicable

According to §15.247(a)(2): For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

5.4.2. Measuring Instruments and Setting

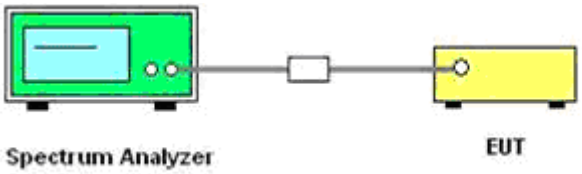
Please refer to section 6 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> RBW
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

5.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth and the video bandwidth were set according to KDB558074.
3. Measured the spectrum width with power higher than 6dB below carrier.

5.4.4. Test Setup Layout



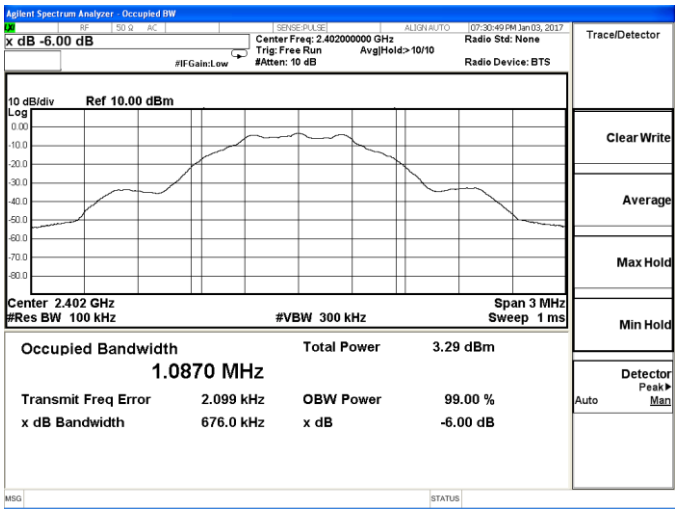
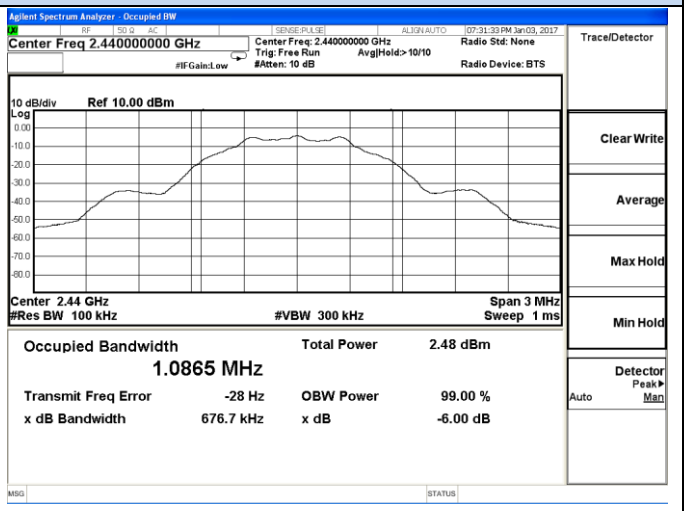
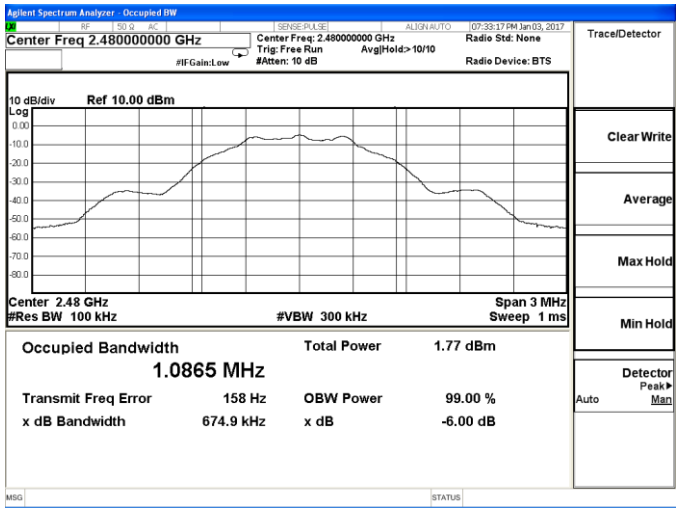
5.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.4.6. Test Result of 6dB Spectrum Bandwidth

Temperature	25℃	Humidity	60%
Test Engineer	Chaz	Configurations	BT LE

BT LE				
Channel	Frequency	6dB Bandwidth (KHz)	Min. Limit (kHz)	Result
0	2402	676.0	500	Complies
19	2440	676.7	500	Complies
39	2480	674.9	500	Complies

Test plot of 6 dB Bandwidth	
	
BT LE-Low channel	BT LE-Middle channel
	
BT LE-High channel	

5.5. Radiated Emissions Measurement

5.5.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. 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.

Frequencies (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

5.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB 100kHz for QP

5.5.3. Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

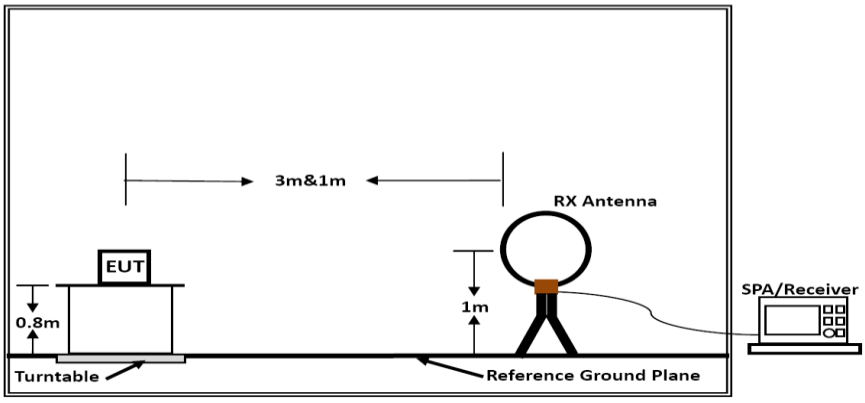
--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

Final measurement:

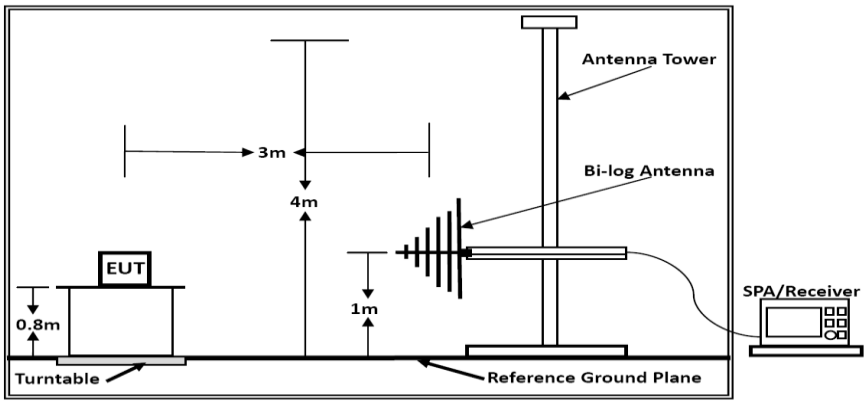
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

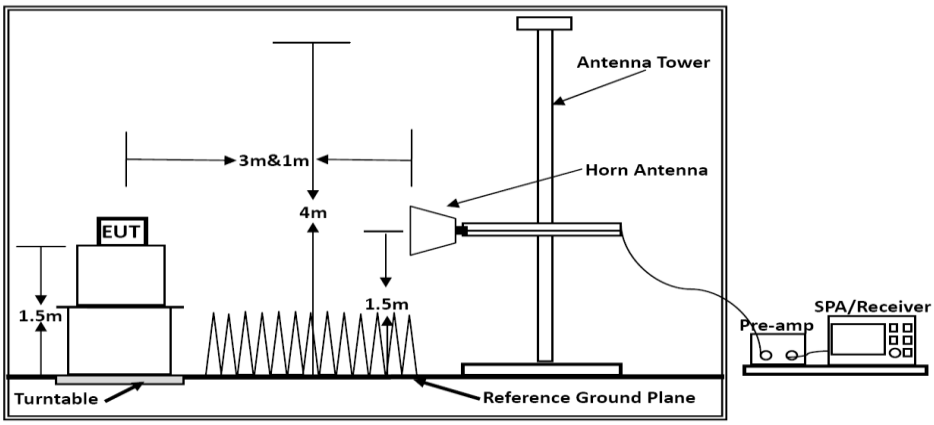
5.5.4. Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1.5m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.5.6. Results of Radiated Emissions (9kHz~30MHz)

Temperature	25℃	Humidty	60%
Test Engineer	Chaz	Configurations	BT LE

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

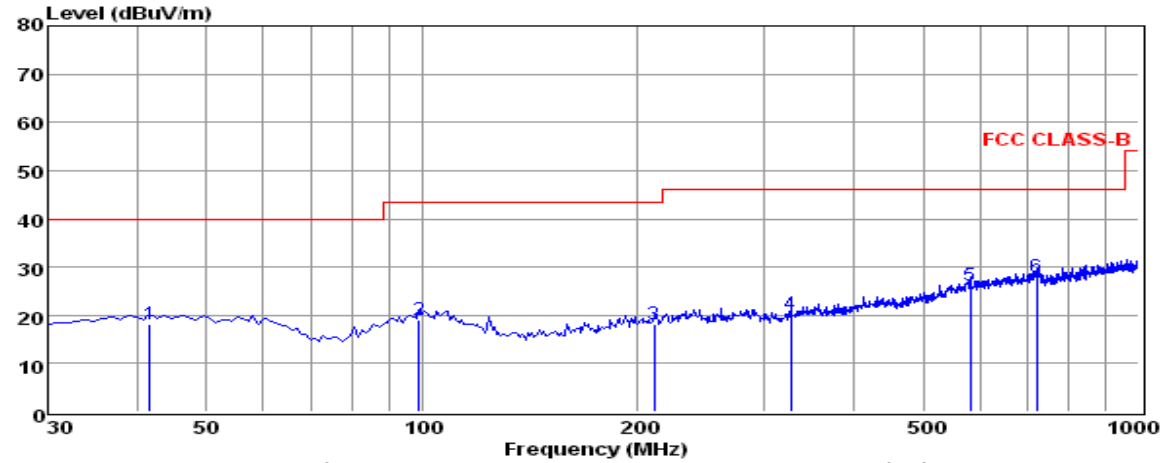
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

5.5.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	25℃	Humidty	60%
Test Engineer	Chaz	Configurations	BT LE (Low CH)

Test result for BT LE (Low Channel)

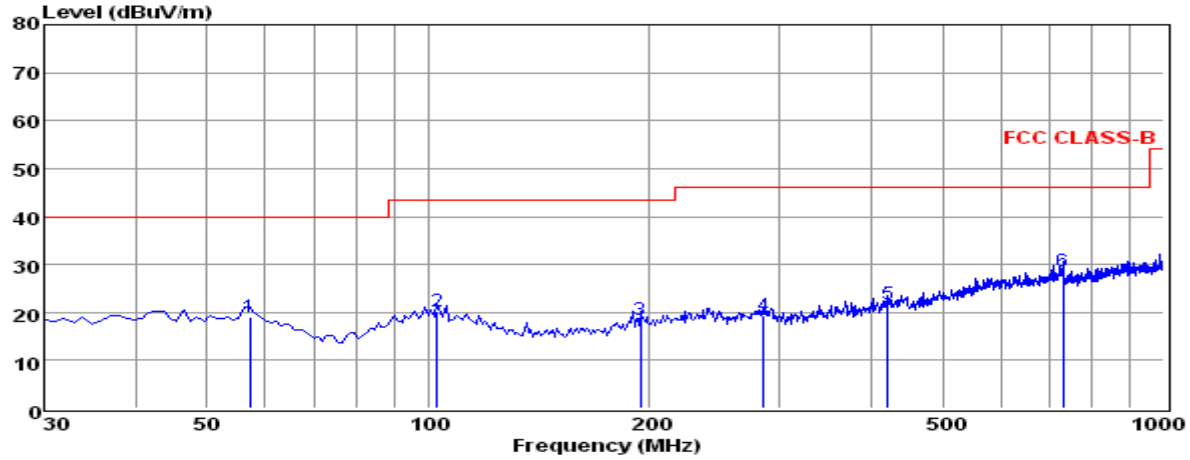
Horizontal:



	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	41.64	4.09	0.50	13.57	18.16	40.00	-21.84	QP
2	98.87	5.34	0.61	13.09	19.04	43.50	-24.46	QP
3	210.42	6.46	0.93	10.90	18.29	43.50	-25.21	QP
4	326.82	5.44	1.04	13.60	20.08	46.00	-25.92	QP
5	582.90	6.38	1.54	18.13	26.05	46.00	-19.95	QP
6	720.64	7.13	1.63	19.07	27.83	46.00	-18.17	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported

Vertical:



	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	57.16	5.71	0.47	12.88	19.06	40.00	-20.94	QP
2	102.75	6.58	0.60	12.91	20.09	43.50	-23.41	QP
3	193.93	6.98	0.76	10.56	18.30	43.50	-25.20	QP
4	286.08	5.45	1.00	12.79	19.24	46.00	-26.76	QP
5	420.91	4.77	1.33	15.47	21.57	46.00	-24.43	QP
6	729.37	7.81	1.70	19.18	28.69	46.00	-17.31	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported

Note:

1). Pre-scan all mode and recorded the worst case results in this report (BT LE (Low Channel)). Emission level (dBuV/m) = 20 log Emission level (uV/m).
2). Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

5.5.8. Results for Radiated Emissions (Above 1GHz)

Channel 0

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4804.0	55.10	33.06	35.04	3.94	57.06	74	-16.94	Peak	Horizontal
4804.0	40.25	33.06	35.04	3.94	42.21	54	-11.79	Average	Horizontal
4804.0	59.13	33.06	35.04	3.94	61.09	74	-12.91	Peak	Vertical
4804.0	42.07	33.06	35.04	3.94	44.03	54	-9.97	Average	Vertical

Channel 19

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4880.0	55.35	33.16	35.15	3.96	57.32	74	-16.68	Peak	Horizontal
4880.0	44.23	33.16	35.15	3.96	46.20	54	-7.80	Average	Horizontal
4880.0	59.21	33.16	35.15	3.96	61.18	74	-12.82	Peak	Vertical
4880.0	42.32	33.16	35.15	3.96	44.29	54	-9.71	Average	Vertical

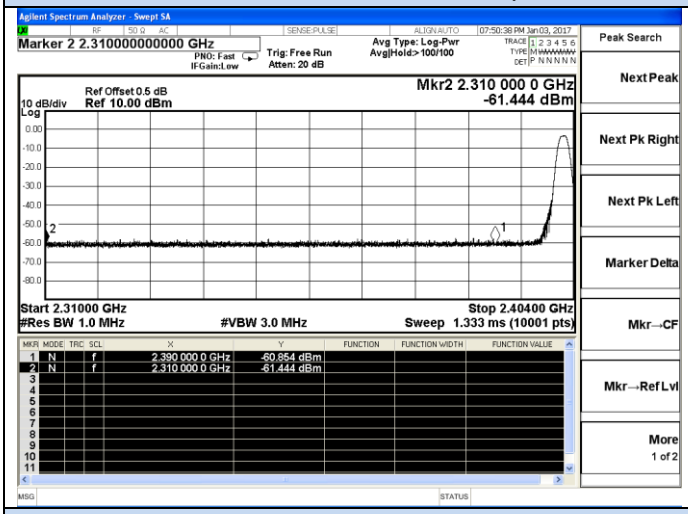
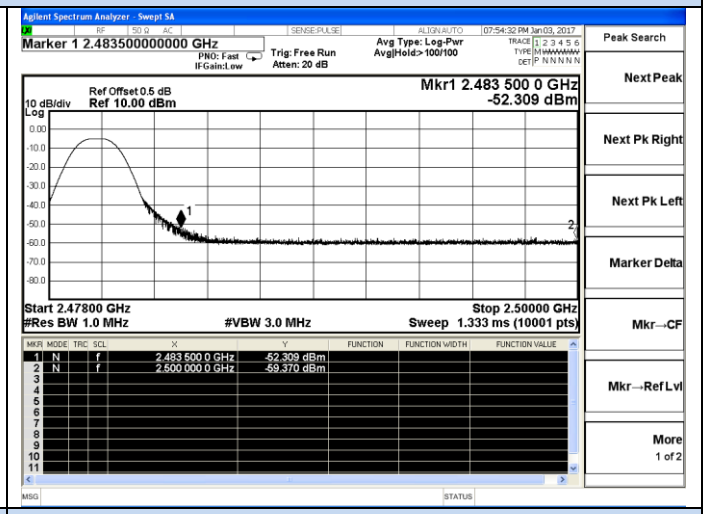
Channel 39

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4960.0	54.89	33.26	35.14	3.98	56.99	74	-17.01	Peak	Horizontal
4960.0	43.01	33.26	35.14	3.98	45.11	54	-8.89	Average	Horizontal
4960.0	58.77	33.26	35.14	3.98	60.87	74	-13.13	Peak	Vertical
4960.0	42.04	33.26	35.14	3.98	44.14	54	-9.86	Average	Vertical

Notes:

1). Measuring frequencies from 9k~10th harmonic or 26.5GHz (which is less), No emission found between lowest internal used/generated frequency to 30MHz.
2). Radiated emissions measured in frequency range from 9k~10th harmonic or 26.5GHz (which is less) were made with an instrument using Peak detector mode.
3). Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

5.5.9. Results of Restricted Bands Test

Test plot of Restricted Bands-conducted	
	
BT LE-Low channel(Peak)	BT LE-High channel(Peak)

BT LE-radiated(calculated)						
Freq. MHz	Reading Level dBm	Antenna Gain dBi	Calculated E dBuV/m	Limit dBuV/m	Margin dB	Remark
2310.000	-61.44	1.00	34.79	74.00	-39.21	Peak
2390.000	-60.85	1.00	35.38	74.00	-38.62	Peak
2483.500	-52.31	1.00	43.92	74.00	-30.08	Peak
2500.000	-59.37	1.00	36.86	74.00	-37.14	Peak

Note:

1). All modes have been tested and we only record the worst test result;
2). Measured E=Reading Level+Antenna Gain+104.77-(20LogD), Where D is 3

5.6. Conducted Spurious Emissions and Band Edges Test

5.6.1. Standard Applicable

According to §15.247 (d): 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

5.6.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Detector	Peak
Attenuation	Auto
RB / VB (Emission in restricted band)	100KHz/300KHz
RB / VB (Emission in non-restricted band)	100KHz/300KHz

5.6.3. Test Procedures

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz

The spectrum from 9kHz to 26.5GHz is investigated with the transmitter set to the lowest,middle, and highest channels.

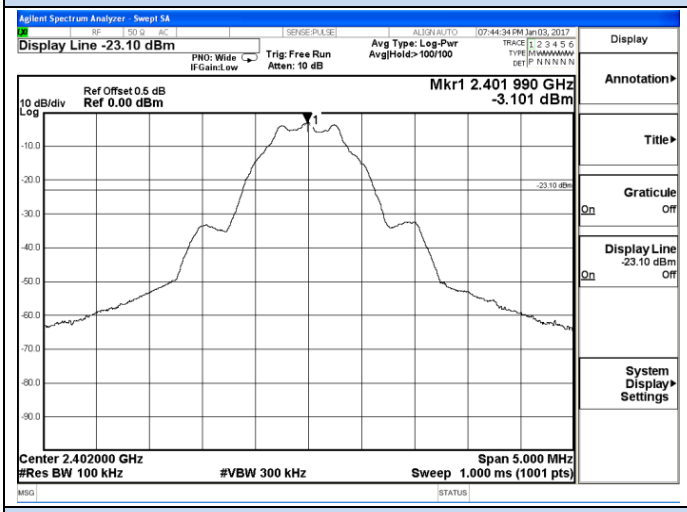
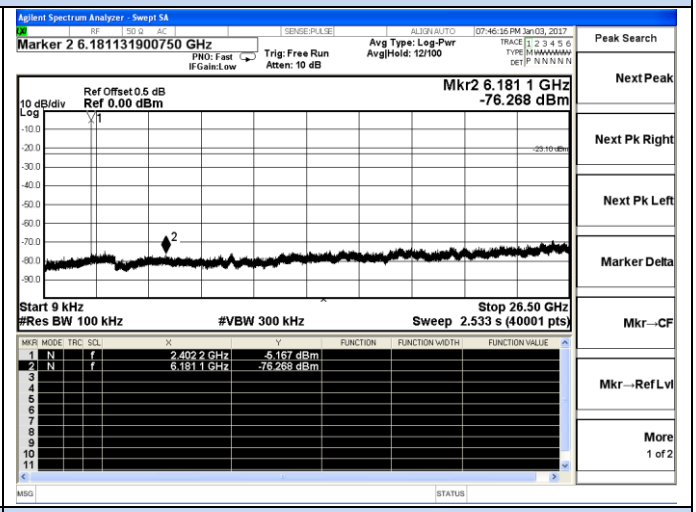
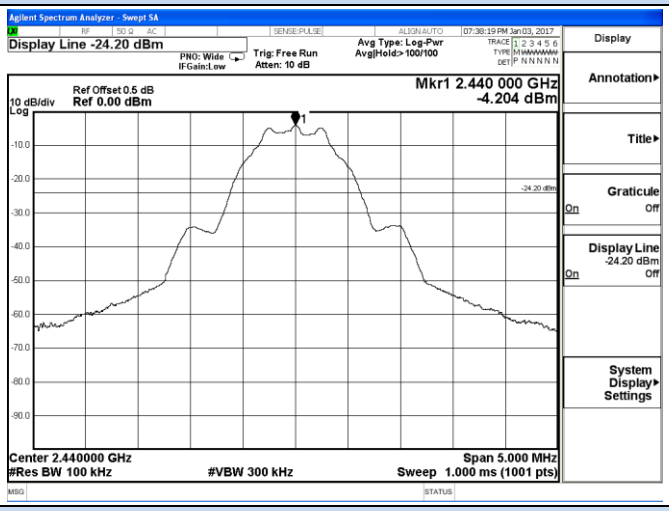
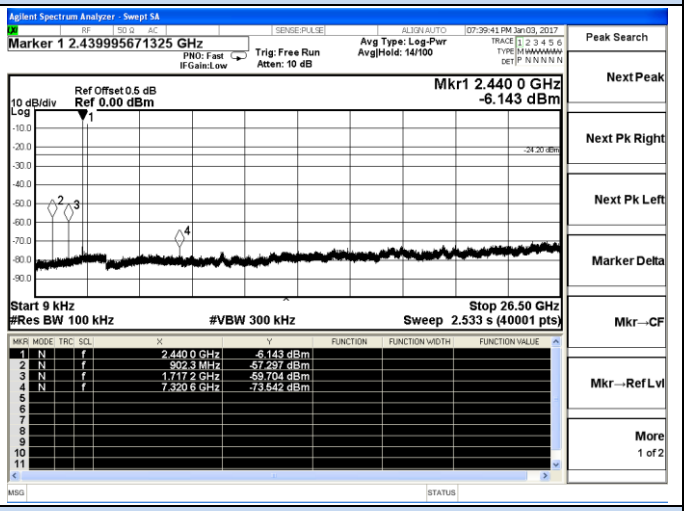
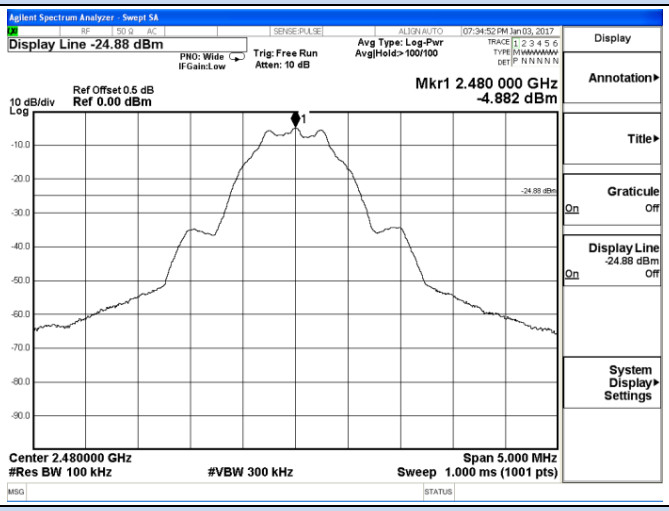
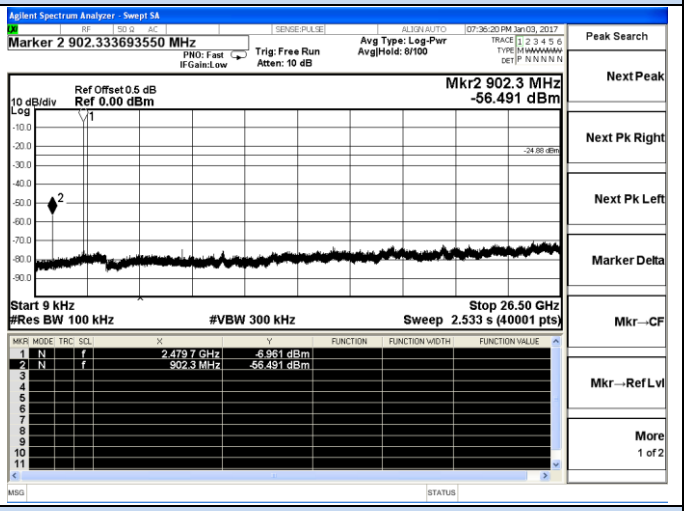
5.6.4. Test Setup Layout

This test setup layout is the same as that shown in section 5.4.4.

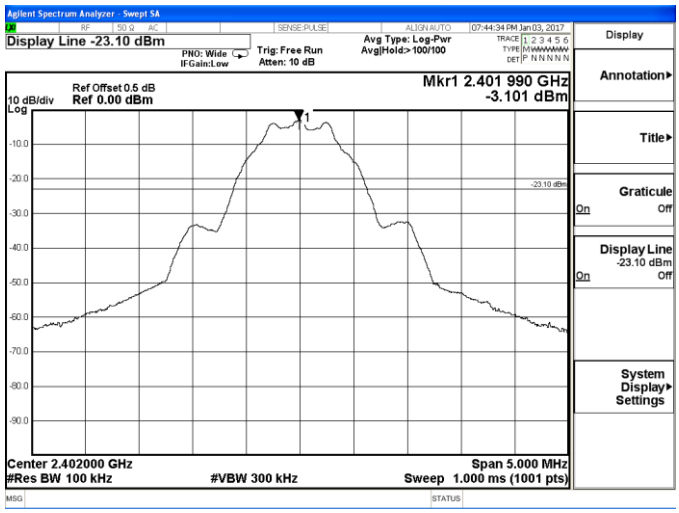
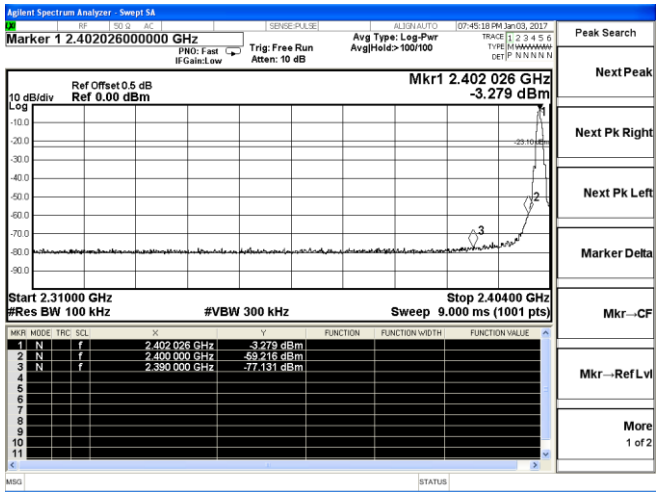
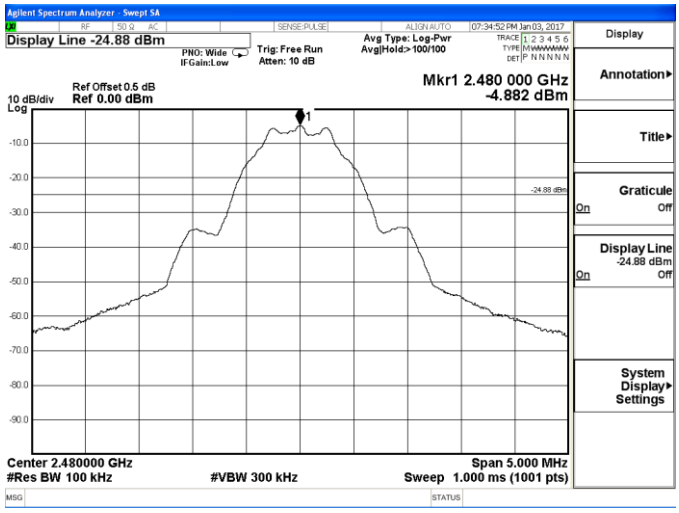
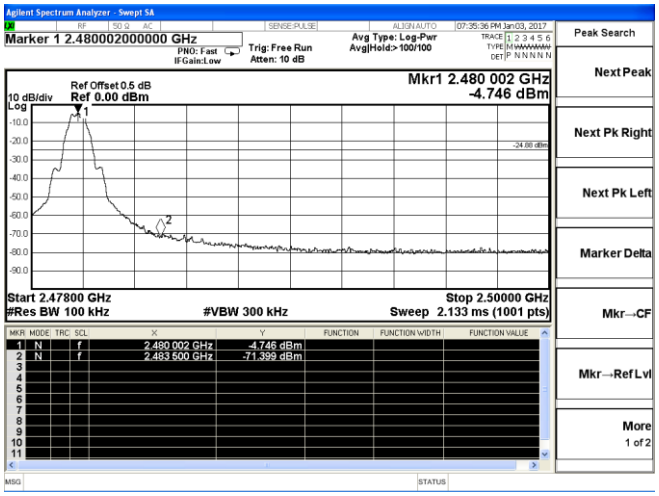
5.6.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.6.6. Test Results of Conducted Spurious Emissions

Test plot of Conducted Spurious Emission	
BT LE	
	
Reference	Low channel
	
Reference	Middle channel
	
Reference	High channel

5.6.7. Test Results of Band Edges Test

Test plot of Band Edges Test	
BT LE	
	
Reference	Low channel
	
Reference	High channel

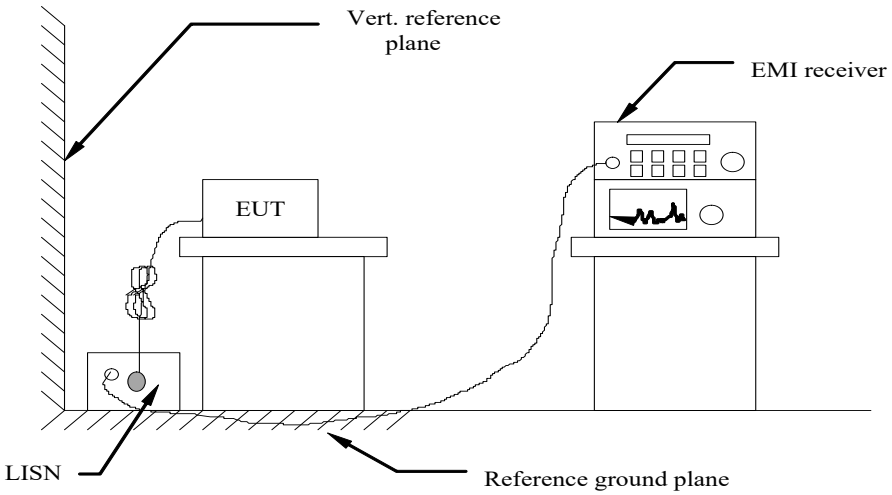
5.7. Power line conducted emissions

5.7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

5.7.2 Block Diagram of Test Setup



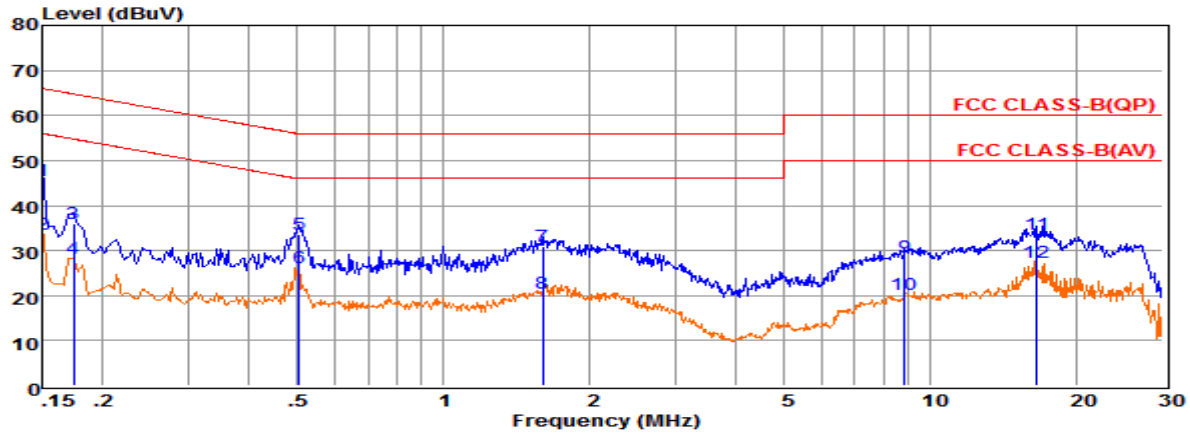
5.7.3 Test Results

PASS.

The test data please refer to following page.

Test result for BT LE(AC 120V)

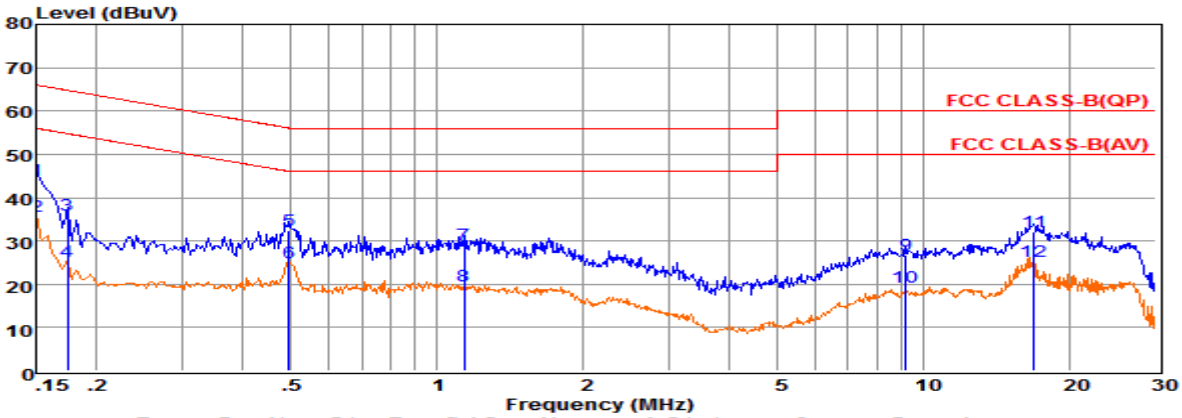
Live Line:



	Freq	Reading	LisnFac	CabLos	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dBuV/m	dBuV/m	dBuV/m	
1	0.15	25.92	9.57	0.02	45.51	66.00	-20.49	QP
2	0.15	13.88	9.57	0.02	33.47	55.99	-22.52	Average
3	0.17	16.45	9.60	0.02	36.07	64.77	-28.70	QP
4	0.17	8.56	9.60	0.02	28.18	54.76	-26.58	Average
5	0.50	13.99	9.62	0.04	33.65	56.00	-22.35	QP
6	0.50	6.51	9.62	0.04	26.17	46.00	-19.83	Average
7	1.60	11.24	9.64	0.05	30.93	56.00	-25.07	QP
8	1.60	0.84	9.64	0.05	20.53	46.00	-25.47	Average
9	8.87	8.91	9.69	0.08	28.68	60.00	-31.32	QP
10	8.87	0.58	9.69	0.08	20.35	50.00	-29.65	Average
11	16.57	13.62	9.73	0.11	33.46	60.00	-26.54	QP
12	16.57	7.61	9.73	0.11	27.45	50.00	-22.55	Average

Remarks: 1. C.F (Correction Factor) = Insertion loss + Cable loss.
2. Measured = Reading + Lisn Factor +Cable Loss.

Neutral Line:



	Freq	Reading	LisnFac	CabLos	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dBuV/m	dBuV/m	dBuV/m	
1	0.15	24.44	9.70	0.02	44.16	66.00	-21.84	QP
2	0.15	15.97	9.70	0.02	35.69	55.99	-20.30	Average
3	0.17	16.18	9.64	0.02	35.84	64.77	-28.93	QP
4	0.17	5.59	9.64	0.02	25.25	54.76	-29.51	Average
5	0.50	12.78	9.62	0.04	32.44	56.05	-23.61	QP
6	0.50	5.29	9.62	0.04	24.95	46.05	-21.10	Average
7	1.14	9.42	9.63	0.05	29.10	56.00	-26.90	QP
8	1.14	-0.08	9.63	0.05	19.60	46.00	-26.40	Average
9	9.20	6.89	9.71	0.08	26.68	60.00	-33.32	QP
10	9.21	-0.36	9.71	0.08	19.43	50.00	-30.57	Average
11	16.84	12.14	9.76	0.11	32.01	60.00	-27.99	QP
12	16.84	5.46	9.76	0.11	25.33	50.00	-24.67	Average

Remarks: 1. C.F (Correction Factor) = Insertion loss + Cable loss.
2. Measured = Reading + Lisn Factor +Cable Loss.

***Note: Pre-scan all mode and recorded the worst case results in this report (BT LE @120VAC).

5.8. Antenna Requirements

5.8.1 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.

5.8.2 Antenna Connected Construction

5.8.2.1. Standard Applicable

According to § 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.

5.8.2.2. Antenna Connector Construction

The **directional gains** of antenna used for transmitting is **1.0dBi, and the antenna is PCB antenna and no consideration of replacement**. Please see EUT photo for details.

5.8.2.3. Results: Compliance.

6. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacture	Model No.	Serial No.	Characteristics	Cal Date	Due Date
EMC Receiver	R&S	ESCS 30	100174	9kHz – 2.75GHz	Jun 18, 2016	Jun 17, 2017
Signal analyzer	Agilent	E4448A(External mixers to 40GHz)	US44300469	9kHz~40GHz	Jul 16, 2016	Jul 15, 2017
LISN	MESS Tec	NNB-2/16Z	99079	9KHz-30MHz	Jun 18, 2016	Jun 17, 2017
LISN	EMCO	3819/2NM	9703-1839	9KHz-30MHz	Jun 18, 2016	Jun 17, 2017
RF Cable-CON	UTIFLEX	3102-26886-4	CB049	9KHz-30MHz	Jun 18, 2016	Jun 17, 2017
ISN	SCHAFFNE	ISN ST08	21653	9KHz-30MHz	Jun 18, 2016	Jun 17, 2017
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30M-18GHz	Jun 18, 2016	Jun 17, 2017
Amplifier	SCHAFFNE	COA9231A	18667	9kHz-2GHzz	Apr 18, 2016	Apr 17, 2017
Amplifier	Agilent	8449B	3008A021	1GHz-26.5GHz	Apr 18, 2016	Apr 17, 2017
Amplifier	MITEQ	AMF-6F-260400	9121372	26.5GHz-40GHz	Apr 18, 2016	Apr 17, 2017
Loop Antenna	R&S	HFH2-Z2	860004/00	9k-30MHz	Apr 18, 2016	Apr 17, 2017
By-log Antenna	SCHWARZB	VULB9163	9163-470	30MHz-1GHz	Apr 18, 2016	Apr 17, 2017
Horn Antenna	EMCO	3115	6741	1GHz-18GHz	Apr 18, 2016	Apr 17, 2017
Horn Antenna	SCHWARZB	BBHA9170	BBHA9170	15GHz-40GHz	Apr 18, 2016	Apr 17, 2017
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz-1GHz	Jun 18, 2016	Jun 17, 2017
RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-H	1GHz-40GHz	Jun 18, 2016	Jun 17, 2017
Power Meter	R&S	NRVS	100444	DC-40GHz	Jun 18, 2016	Jun 17, 2017
Power Sensor	R&S	NRV-Z51	100458	DC-30GHz	Jun 18, 2016	Jun 17, 2017
Power Sensor	R&S	NRV-Z32	10057	30MHz-6GHz	Jun 18, 2016	Jun 17, 2017
AC Power Source	HPC	HPA-500E	HPA-9100	AC 0~300V	Jun 18, 2016	Jun 17, 2017
DC power Soure	GW	GPC-6030D	C671845	DC 1V-60V	Jun 18, 2016	Jun 17, 2017
Temp. and Humidigy Chamber	Giant Force	GTH-225-20-S	MAB0103-00	N/A	Jun 18, 2016	Jun 17, 2017
RF CABLE-1m	JYE Bao	RG142	CB034-1m	20MHz-7GHz	Jun 18, 2016	Jun 17, 2017
RF CABLE-2m	JYE Bao	RG142	CB035-2m	20MHz-1GHz	Jun 18, 2016	Jun 17, 2017
Signal Generator	R&S	SMR40	10016	10MHz~40GHz	Jul 16, 2016	Jul 15, 2017
Universal Radio Communication Tester	R&S	CMU200	112012	N/A	Oct 27, 2016	Oct 26, 2017
Wideband Radia Communication Tester	R&S	CMW500	1201.0002K50	N/A	Nov 19, 2016	Nov 18, 2017
MXG Vector Signal Generator	Agilent	N5182A	MY47071151	250KHz~6GHz	Oct 27, 2016	Oct 26, 2017
MXG Vector Signal Generator	Agilent	E4438C	MY42081396	250KHz~6GHz	Oct 27, 2016	Oct 26, 2017
PSG Analog Signal Generator	Agilent	N8257D	MY46520521	250KHz~20GHz	Nov 19, 2016	Nov 18, 2017
MXA Signal Analyzer	Agilent	N9020A	MY50510140	10Hz~26.5GHz	Oct 27, 2016	Oct 26, 2017
DC Power Supply	Agilent	E3642A	/	0-8V,5A/0-20V,2.5A	May 20, 2016	May 19, 2017
RF Control Unit	Tonscend	JS0806-1	/	/	Nov 19, 2016	Nov 18, 2017
LTE Test Software	Tonscend	JS1120-1	/	Version: 2.5.7.0	N/A	N/A

X-series USB Peak and Average Power Sensor Agilent	Agilent	U2021XA	MY54080022	/	Oct 27, 2016	Oct 26, 2017
4 Ch.Simultaneous Sampling 14 Bits 2 MS/s	Agilent	U2531A	MY54080016	/	Oct 27, 2016	Oct 26, 2017
Test Software	Ascentest	AT890-SW	20141230	Version:	N/A	N/A
Splitter/Combiner(Qty: 2)	Mini-Circuits	ZAPD-50W 4.2-6.0 GHz	NN256400424	/	Oct 27, 2016	Oct 26, 2017
Splitter/Combine(Qty: 2)	MCLI	PS3-7	4463/4464	/	Oct 27, 2016	Oct 26, 2017
ATT (Qty: 1)	Mini-Circuits	VAT-30+	30912	/	Oct 27, 2016	Oct 26, 2017

7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

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