

FCC PART 15.247

TEST REPORT

For

Shanghai HowayGIS Co., Ltd

Room 230, Focus building, Chunshe Road, Minhang Distract, Shanghai ,China

FCC ID: 2AAZDS1XN2015

Report Type: Amended Report	Product Type: Handheld GPS/GIS Data Collector
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Report Number: RKS150703001-00C	
Report Date: 2015-07-06	
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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Issue
1	BZT-20140213250F1	Original Report	2014-2-20
2	RKS150703001-00C	Amended Report	2015-7-6

Note:

This is an amended report application based on BZT-20140213250F1 Create by BZT Testing Technology Co., Ltd. (FCC ID: 2AAZDS1XN2014) , the details as below

The different as below,

1.The EUT only added the GSM chip, No other has been changed.PCB layout and circuit are the same

The detail information, please check the reports.

Based on the above difference, it will affect nothing, so we refer to the original report BZT-20140213250F1 that issued on 2014-2-20.

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1091	RF Exposure	Compliance*
§15.203	Antenna Requirement	Compliance*
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance*
§15.247(b)(3)	Maximum Conducted Output Power	Compliance*
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance*
§15.247(e)	Power Spectral Density	Compliance*

Compliance*: Please refer to the report number : BZT-20140213250F1
Create by BZT Testing Technology Co., Ltd. (FCC ID : 2AAZDS1XN2014)

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

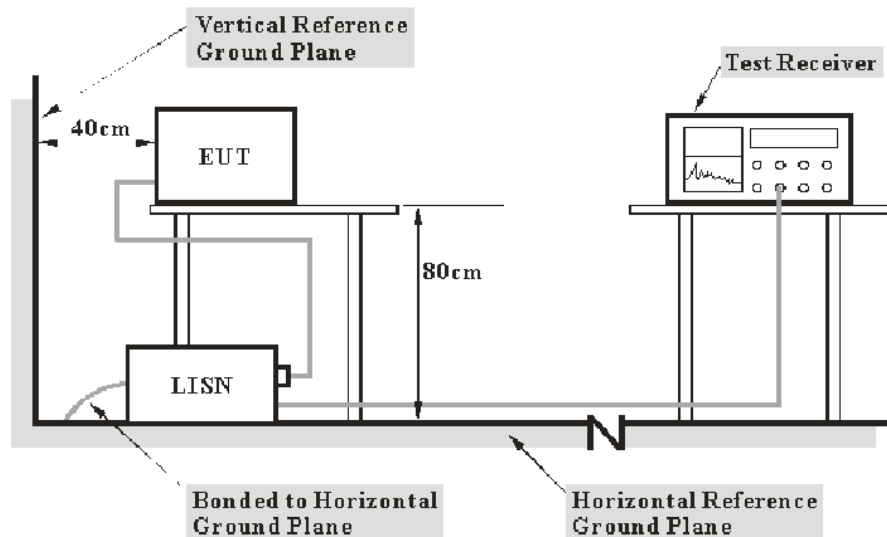
Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements may be receiver reading, attenuation of the connection between LISN and receiver, LISN voltage division factor, LISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Kunshan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report.

Port	Expanded Measurement uncertainty
AC Mains	3.26 dB (k=2, 95% level of confidence)
CAT 3	3.70 dB (k=2, 95% level of confidence)
CAT 5	3.86 dB (k=2, 95% level of confidence)
CAT 6	4.64 dB (k=2, 95% level of confidence)

EUT Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2009 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The adapter was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	831294/005	2014-09-16	2015-09-16
Rohde & Schwarz	LISN	ESH3-Z5	12005	2014-09-16	2015-09-16
Rohde & Schwarz	LISN	ESH3-Z5	12008	2014-09-16	2015-09-16
Rohde & Schwarz	CE Test software	EMC 32	V 09.10.0	--	--

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, the worst margin reading as below:

14.81 dB at 10.086 in the **Line** conducted mode

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

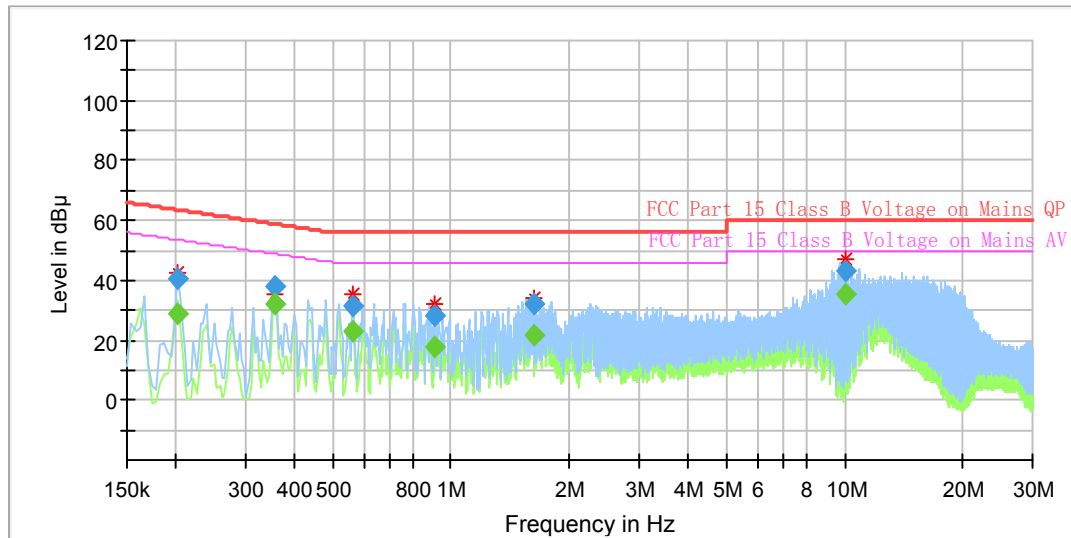
Test Data

Environmental Conditions

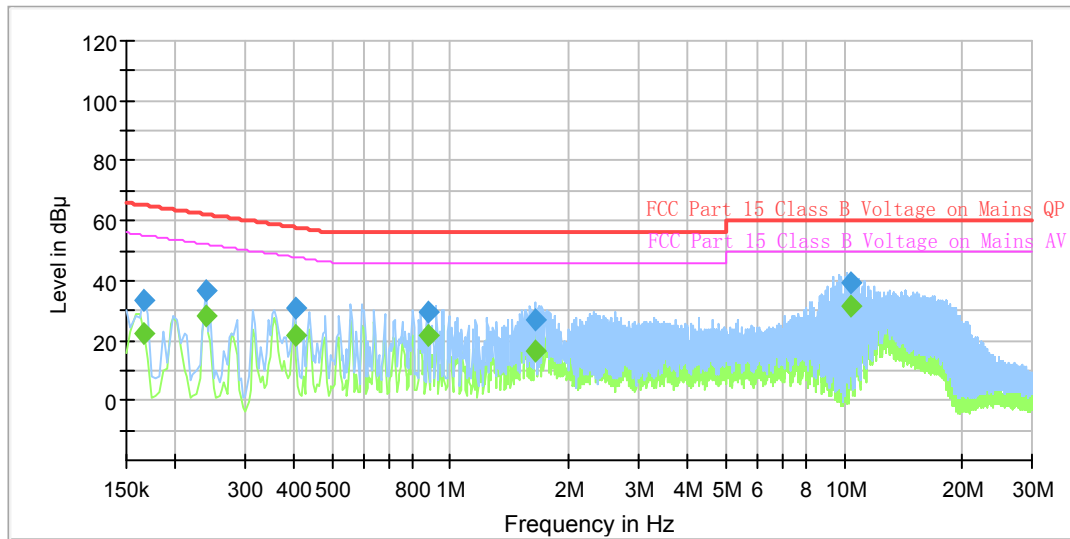
Temperature:	23 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Yao on 2015-07-06.

EUT operation mode: Transmitting

AC 120V/60 Hz, Line

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Line	Corr. (dB)
0.202000	---	28.80	53.53	24.73	L1	11.0
0.202000	40.39	---	63.53	23.14	L1	11.0
0.358000	---	32.17	48.77	16.60	L1	11.0
0.358000	38.00	---	58.77	20.77	L1	11.0
0.562000	---	22.85	46.00	23.15	L1	11.1
0.562000	31.55	---	56.00	24.45	L1	11.1
0.910000	---	17.80	46.00	28.20	L1	11.1
0.910000	28.51	---	56.00	27.49	L1	11.1
1.630000	---	21.72	46.00	24.28	L1	11.2
1.630000	32.13	---	56.00	23.87	L1	11.2
10.086000	---	35.19	50.00	14.81	L1	11.4
10.086000	42.90	---	60.00	17.10	L1	11.4

AC 120V/60 Hz, Neutral

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Line	Corr. (dB)
0.166000	---	22.20	55.16	32.96	N	11.0
0.166000	33.51	---	65.16	31.65	N	11.0
0.238000	---	28.34	52.17	23.83	N	11.0
0.238000	36.83	---	62.17	25.34	N	11.0
0.402000	---	21.65	47.81	26.16	N	11.0
0.402000	30.48	---	57.81	27.33	N	11.0
0.874000	---	21.57	46.00	24.43	N	11.1
0.874000	29.63	---	56.00	26.37	N	11.1
1.646000	---	16.53	46.00	29.47	N	11.2
1.646000	27.05	---	56.00	28.95	N	11.2
10.402000	---	31.54	50.00	18.46	N	11.4
10.402000	39.01	---	60.00	20.99	N	11.4

Note:

- 1) Corr.=LISN VDF (Voltage Division Factor) + Cable Loss
- 2) Corrected Amplitude = Reading + Corr.
- 3) Margin = Limit –Corrected Amplitude

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

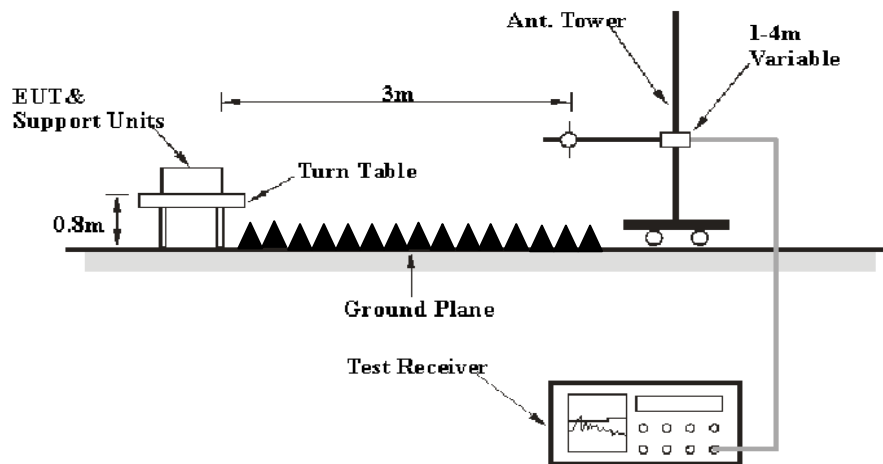
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expanded combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Kunshan) is 5.91 dB for 30MHz-1GHz and 4.92 dB for above 1GHz, 1.95dB for conducted measurement at antenna port. And the uncertainty will not be taken into consideration for the test data recorded in the report

EUT Setup

Below 1 GHz:



Above 1GHz:

The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4-2009. The specification used was the FCC 15.209, and FCC 15.247 limits.

The adapter was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 1 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sonoma Instrument	Amplifier	330	171377	2014-09-16	2015-09-16
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2014-09-16	2015-09-16
Sunol Sciences	Broadband Antenna	JB3	A090314-1	2014-09-12	2015-09-12
ETS	Horn Antenna	3115	6229	2014-09-12	2015-09-12
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2014-09-16	2015-09-16
Mini	Pre-amplifier	ZVA-183-S+	857001418	2014-09-16	2015-09-16
champrotek	Chamber	Chamber A	1#	2014-09-17	2015-09-17
R&S	Auto test Software	EMC32	V 09.10.0	-	-

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

9.21 at 44.79MHz in the vertical polarization

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

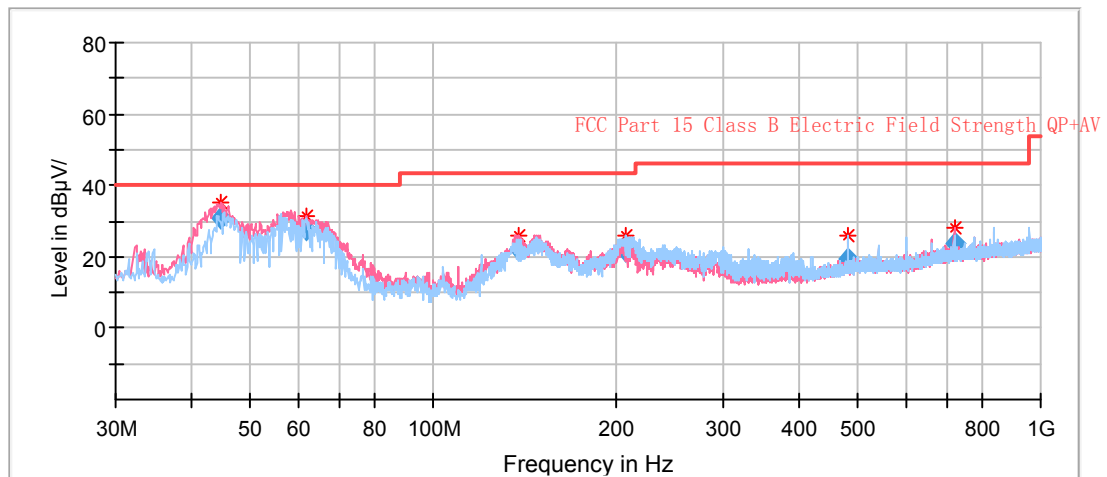
In BACL, $U_{(Lm)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Yao on 2015-7-6.

EUT operation mode: Charging & Transmitting

30 MHz-1 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB μV/m)	Margin (dB)
44.792500	43.99	QP	63.0	100.0	V	-13.2	30.79	40.00	9.21
61.767500	44.31	QP	30.0	100.0	V	-16.7	27.61	40.00	12.39
138.155000	34.13	QP	115.0	100.0	V	-12.1	22.03	43.50	21.47
207.267500	33.81	QP	288.0	200.0	H	-12.3	21.51	43.50	21.99
480.080000	25.6	QP	52.0	100.0	H	-6.0	19.60	46.00	26.40
720.033750	25.77	QP	222.0	100.0	V	-2.1	23.67	46.00	22.33

1GHz -25 GHz: (Scan with GFSK, $\pi/4$ -DQPSK, 8-DPSK mode, the worst case is BDR Mode (GFSK))

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.247/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB µ V/m)	Margin (dB)
Low Channel (2402 MHz)									
2402.224449	68.94	PK	160.0	100.0	V	3.0	71.95	/	/
2402.224449	66.58	Ave	160.0	100.0	V	3.0	69.59	/	/
2402.224449	67.61	PK	220.0	100.0	H	3.0	70.62	/	/
2402.224449	65.54	Ave	220.0	100.0	H	3.0	68.55	/	/
2328.757515	41.07	PK	332.0	139.0	V	2.9	43.98	73.90	29.92
2328.757515	22.63	Ave	332.0	139.0	V	2.9	25.54	53.90	28.36
2355.310621	40.09	PK	34.0	134.0	V	3.0	43.1	73.90	30.8
2355.310621	25.99	Ave	34.0	134.0	V	3.0	29	53.90	24.9
4804.009018	41.13	PK	180.0	200.0	V	11.6	52.74	73.90	21.16
4804.009018	30.81	Ave	180.0	200.0	V	11.6	42.42	53.90	11.48
5990.440881	39.25	PK	4.0	100.0	V	15.0	54.26	73.90	19.64
5990.440881	26.74	Ave	4.0	100.0	V	15.0	41.75	53.90	12.15
7206.027655	32.11	PK	75.0	146.0	V	17.2	49.32	73.90	24.58
7206.027655	18.29	Ave	75.0	146.0	V	17.2	35.5	53.90	18.4

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
Middle Channel (2441MHz)									
2441.175321	69.11	PK	168.0	100.0	V	2.6	71.7	/	/
2441.175321	67.35	Ave	168.0	100.0	V	2.6	69.94	/	/
2441.232411	67.9	PK	168.0	100.0	H	2.6	70.49	/	/
2441.232411	66.07	Ave	168.0	100.0	H	2.6	68.66	/	/
1332.184369	50.64	PK	315.0	100.0	H	-2.0	48.63	73.90	25.27
1332.184369	28	Ave	315.0	100.0	H	-2.0	25.99	53.90	27.91
1649.979960	50.5	PK	356.0	100.0	H	0.1	50.59	73.90	23.31
1649.979960	27.57	Ave	356.0	100.0	H	0.1	27.66	53.90	26.24
4882.060521	44.19	PK	321.0	200.0	H	11.7	55.88	73.90	18.02
4882.060521	35.26	Ave	321.0	200.0	H	11.7	46.95	53.90	6.95
5991.002004	38.91	PK	295.0	100.0	H	15.0	53.9	73.90	20
5991.002004	29.87	Ave	295.0	100.0	H	15.0	44.86	53.90	9.04
7323.036874	31.18	PK	288.0	199.0	H	17.5	48.67	73.90	25.23
7323.036874	18.22	Ave	288.0	199.0	H	17.5	35.71	53.90	18.19

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB μV/m)	Margin (dB)
High Channel (2480 MHz)									
2480.939479	68.7	PK	36.0	100.0	V	3.2	71.6	/	/
2480.939479	66.22	Ave	36.0	100.0	V	3.2	69.12	/	/
2480.939479	67.94	PK	36.0	100.0	H	3.2	70.84	/	/
2480.939479	65.65	Ave	36.0	100.0	H	3.2	68.55	/	/
2502.785570	37.69	PK	290.0	110.0	V	3.3	40.69	73.90	32.9
2502.785570	24.24	Ave	290.0	110.0	V	3.3	27.24	53.90	26.35
2532.444889	36.15	PK	283.0	150.0	V	3.4	39.25	73.90	34.34
2532.444889	22.74	Ave	283.0	150.0	V	3.4	25.84	53.90	27.75
3967.274549	31.81	PK	16.0	200.0	V	10.0	41.51	73.90	32.08
3967.274549	18.25	Ave	16.0	200.0	V	10.0	27.95	53.90	25.64
4960.080762	40.59	PK	174.0	200.0	H	11.9	52.19	73.90	21.4
4960.080762	31.08	Ave	174.0	200.0	H	11.9	42.68	53.90	10.91
7440.075150	32.14	PK	263.0	200.0	H	17.7	49.54	73.90	24.05
7440.075150	18.28	Ave	263.0	200.0	H	17.7	35.68	53.90	17.91

Note:

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

***FCC §15.247(a) (1)-CHANNEL SEPARATION TEST**

Applicable Standard

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

Test Procedure

1. Set the EUT in transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.

Test Data

Compliance*: Please refer to the report number : BZT-20140213250F1 in page 64 Section 6
Create by BZT Testing Technology Co., Ltd.
(FCC ID : 2AAZDS1XN2014)

***FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH**

Applicable Standard

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.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Data

Compliance*: Please refer to the report number : BZT-20140213250F1 in page 71 Section 7
Create by BZT Testing Technology Co., Ltd.
(FCC ID : 2AAZDS1XN2014)

***FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST**

Applicable Standard

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the max-hold function record the quantity of the channel.

Test Data

Compliance*: Please refer to the report number : BZT-20140213250F1 in page 54 Section 4
Create by BZT Testing Technology Co., Ltd.
(FCC ID : 2AAZDS1XN2014)

***FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)**

Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 X channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Test Data

Compliance*: Please refer to the report number : BZT-20140213250F1 in page 56 Section 5
Create by BZT Testing Technology Co., Ltd.
(FCC ID : 2AAZDS1XN2014)

***FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT**

Applicable Standard

According to §15.247(b) (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. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Data

Compliance*: Please refer to the report number : BZT-20140213250F1 in page 78 Section 8
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***FCC §15.247(d) - BAND EDGES TESTING**

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Compliance*: Please refer to the report number : BZT-20140213250F1 in page 42 Section 3.2.9
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******* END OF REPORT *******