FCC Test Report

Report No.: AGC03554191103FE03

FCC ID	:	2AVK3GATEWAY
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Bivar Wireless Gateway Communication Center
BRAND NAME	:	Bivar
MODEL NAME	:	Gateway, BWGCC-0101
APPLICANT	:	BIVAR INC.
DATE OF ISSUE	:	Jan. 02, 2020
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15 Rules
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 02, 2020	Valid	Initial Release

TABLE OF CONTENTS

1. VERIFICATION OF CONFORMITY

Applicant	BIVAR INC.
Address	4 THOMAS, IRVINE, CA 92618 U.S.A.
Manufacturer	BIVAR INC.
Address	4 THOMAS, IRVINE, CA 92618 U.S.A.
Factory	BIVAR INC.
Address	4 THOMAS, IRVINE, CA 92618 U.S.A.
Product Designation	Bivar Wireless Gateway Communication Center
Brand Name	Bivar
Test Model	Gateway
Serial Model	BWGCC-0101
Difference Description	All the same except the model name.
Date of test	Nov. 21, 2019~Dec. 31, 2019
Deviation	No any deviation from the test method.
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.249.

Prepared By — Donjon Huang (Project Engineer) — Dec. 31, 2019

Reviewed By — Max Zhang (Reviewer) — Dec. 31, 2019

Approved By — Forrest Lei (Authorized Officer) — Dec. 31, 2019

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

A major technical description of EUT is described as following

Operation Frequency	915MHz
Maximum field strength	87.50dBuV/m(Average)@3m
Modulation	FSK
Number of channels	1
Antenna Gain	0dBi
Antenna Designation	Whip antenna
Hardware Version	V3.1.0
Software Version	2019110000
Power Supply	DC 5V by adapter.

2.2. TABLE OF CARRIER FREQUENCY

Frequency Band	Frequency
902-928MHz	915MHz

3. MEASUREMENT UNCERTAINTY

The uncertainty is calculated using the methods suggested in the “Guide to the Expression of Uncertainty in measurement” (GUM) published by CISPR and ANSI.

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %

4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Transmitting mode

Note:
1. only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

5.2 EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Bivar Wireless Gateway Communication Center	Gateway	FCC ID: 2AVK3GATEWAY	EUT
2	Adapter	WS2U050-2000	Input: 100-240V 50/60Hz 0.4A Output: 5.0V 2A	AE
3	Antenna	N/A	N/A	AE

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.249&15.209	Radiated Emission	Compliant
§15.215	20dB bandwidth	Compliant
§15.207	Conducted Emission	Compliant

6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Jun. 10, 2019	Jun. 09, 2020
LISN	R&S	ESH2-Z5	100086	Aug. 26, 2019	Aug. 25, 2020
Test software	R&S	ES-K1 (Ver. V1.71)	N/A	N/A	N/A

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Jun. 12, 2019	Jun. 11, 2020
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 12, 2019	Dec. 11, 2020
Attenuator	ZHINAN	E-002	N/A	Sep. 09, 2019	Sep. 08, 2020
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 21, 2017	Sep. 20, 2020
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 13, 2018	Jun. 12, 2020
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 17, 2018	May. 16, 2020
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 15, 2019	Oct. 14, 2020
ANTENNA	SCHWARZBECK	VULB9168	494	Sep. 20, 2019	Sep. 19, 2020

7. RADIATED EMISSION

7.1TEST LIMIT

Standard FCC15.249

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
900-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

Standard FCC 15.209

Frequency (MHz)	Distance Meters	Field Strengths Limit	
		μV/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(kHz)	---
0.490 ~ 1.705	30	24000/F(kHz)	---
1.705 ~ 30	30	30	---
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	Other:74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Remark: (1) Emission level dBμV = 20 log Emission level μV/m

(2) The smaller limit shall apply at the cross point between two frequency bands.

(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

7.2. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use minimum resolution bandwidth of 1 MHz. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

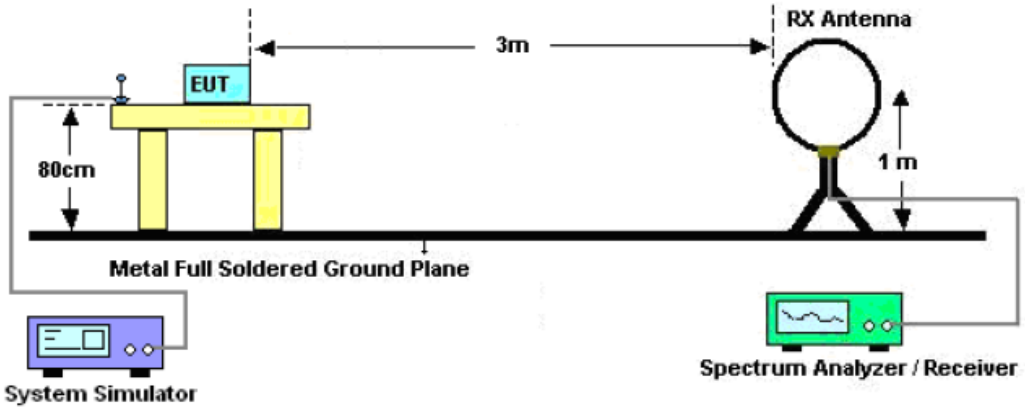
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz RBW 2MHz/ VBW 6MHz for Peak, RBW 2MHz/1kHz for Average

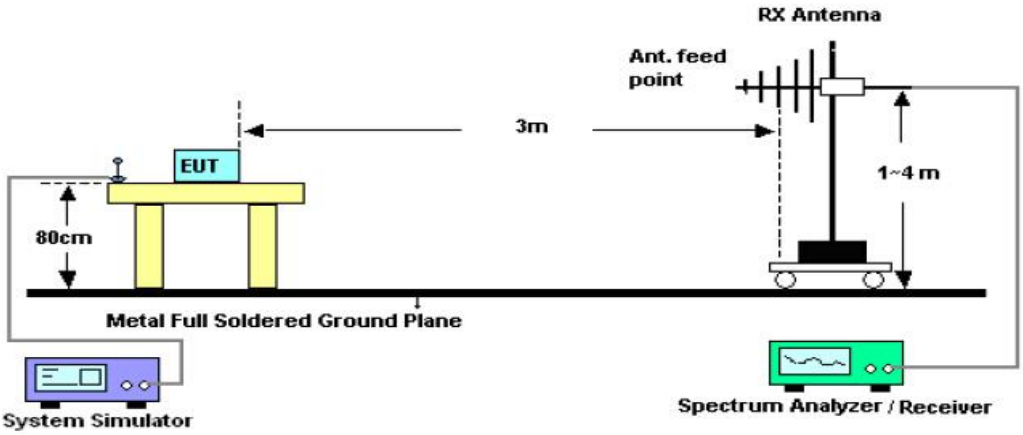
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

7.3. TEST SETUP

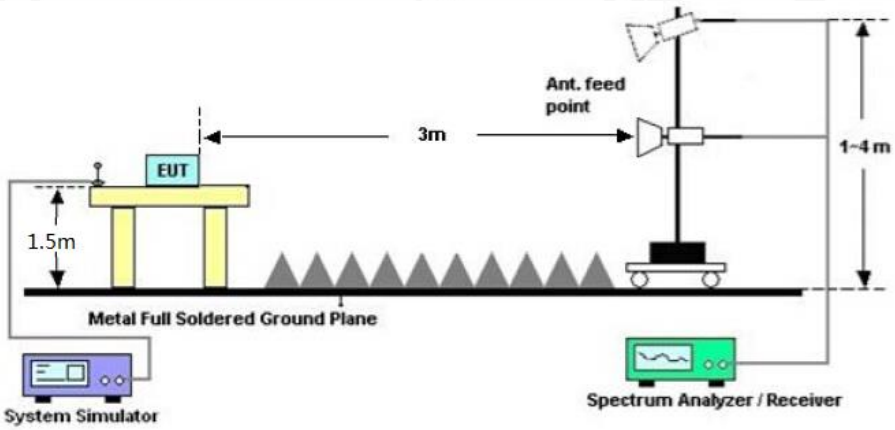
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



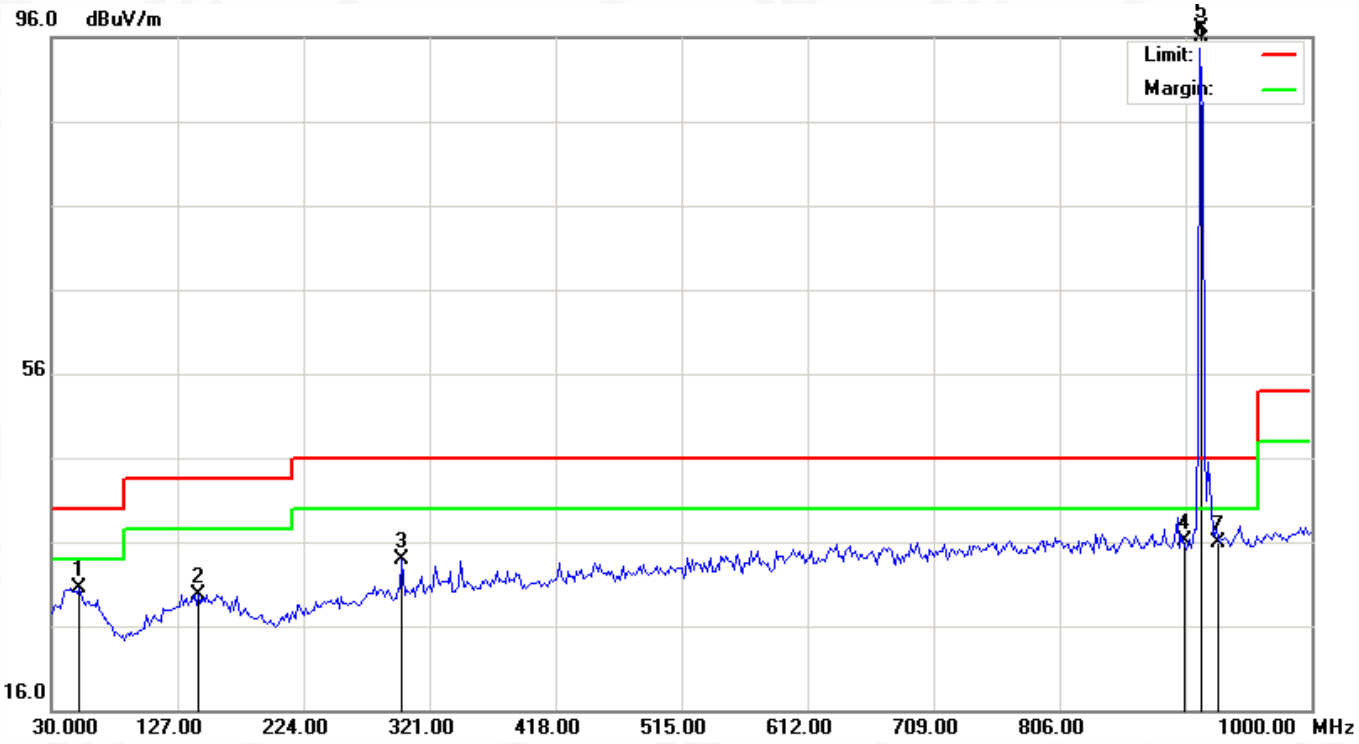
7.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

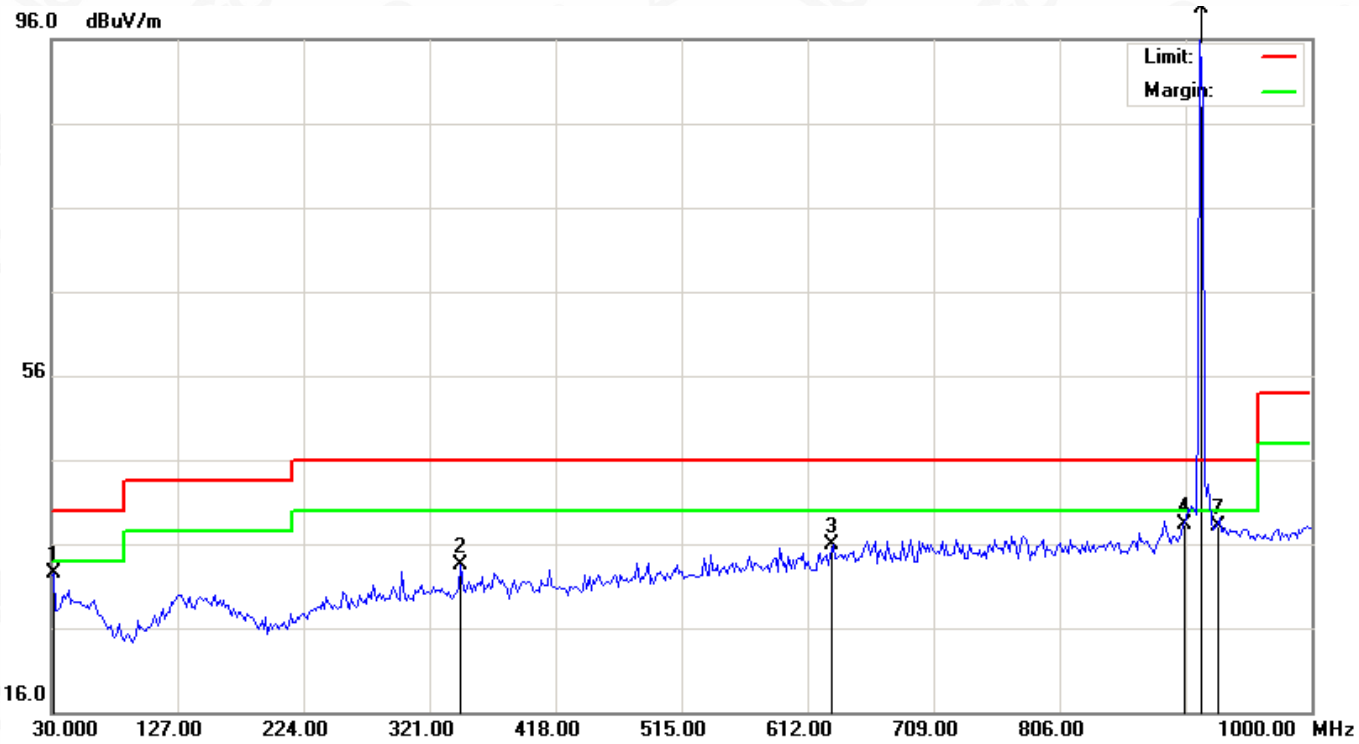
RADIATED EMISSION 30MHz- 1GHZ

EUT：	Bivar Wireless Gateway Communication Center	Model Name. ：	Gateway
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 5V
Test Mode ：	Mode 1	Polarization :	Horizontal



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		51.0167	10.91	19.64	30.55	40.00	-9.45	peak			
2		143.1665	10.57	19.22	29.79	43.50	-13.71	peak			
3		299.9832	14.40	19.47	33.87	46.00	-12.13	peak			
4		902.0000	4.32	31.72	36.04	46.00	-9.96	peak			
5	*	915.0000	65.28	31.83	97.11	114.00	-16.89	peak			
6	X	915.0000	52.88	31.83	84.71	94.00	-9.29	AVG			
7		928.0000	3.88	31.94	35.82	46.00	-10.18	peak			

EUT：	Bivar Wireless Gateway Communication Center	Model Name. ：	Gateway
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 5V
Test Mode ：	Mode 1	Polarization：	Vertical



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		31.6167	14.19	18.22	32.41	40.00	-7.59	peak			
2		345.2500	12.42	21.06	33.48	46.00	-12.52	peak			
3		631.3999	8.58	27.33	35.91	46.00	-10.09	peak			
4		902.0000	6.50	31.72	38.22	46.00	-7.78	peak			
5	*	915.0000	68.07	31.83	99.90	114.00	-14.10	peak			
6	X	915.0000	55.67	31.83	87.50	94.00	-6.50	AVG			
7		928.0000	6.24	31.94	38.18	46.00	-7.82	peak			

RESULT: PASS

Note:

Factor=Antenna Factor + Cable loss, Margin=Result-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

The emission above the limit is the fundamental wave.

RADIATED EMISSION ABOVE 1GHZ

EUT：	Bivar Wireless Gateway Communication Center	Model Name. ：	Gateway
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 5V
Test Modulation ：	Mode 1	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1830.7831	65.25	-13.62	51.63	74.00	-22.37	peak
1830.7831	53.25	-13.62	39.63	54.00	-14.37	AVG
5489.649	61.91	-5.29	56.62	74.00	-17.38	peak
5489.649	49.91	-5.29	44.62	54.00	-9.38	AVG
6405.0405	53.61	-3.23	50.38	74.00	-23.62	peak
6405.0405	41.61	-3.23	38.38	54.00	-15.62	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT：	Bivar Wireless Gateway Communication Center	Model Name. ：	Gateway
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 5V
Test Modulation ：	Mode 1	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1829.883	69.12	-13.63	55.49	74.00	-18.51	peak
1829.883	57.12	-13.63	43.49	54.00	-10.51	AVG
5489.649	69.76	-5.29	64.47	74.00	-9.53	peak
5489.649	57.76	-5.29	52.47	54.00	-1.53	AVG
6405.0405	55.58	-3.23	52.35	74.00	-21.65	peak
6405.0405	43.58	-3.23	40.35	54.00	-13.65	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Note: Other emissions from 1G to 9.2GHz are considered as ambient noise. No recording in the test report.
Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.
The “Factor” value can be calculated automatically by software of measurement system.

8. FCC LINE CONDUCTED EMISSION TEST

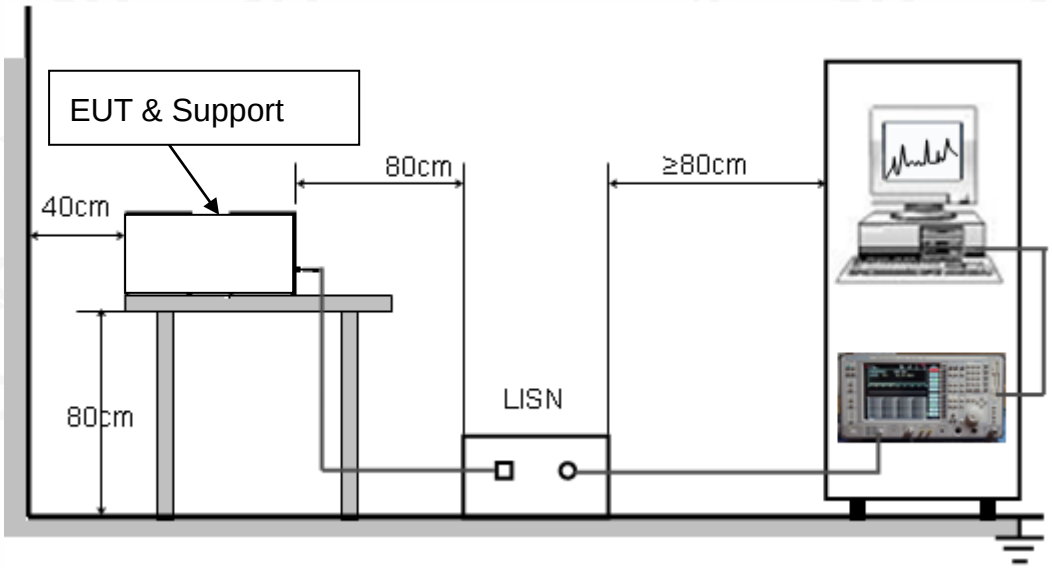
8.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

8.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



8.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC charging voltage by adapter which received AC120V/60Hz power by a LISN..
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

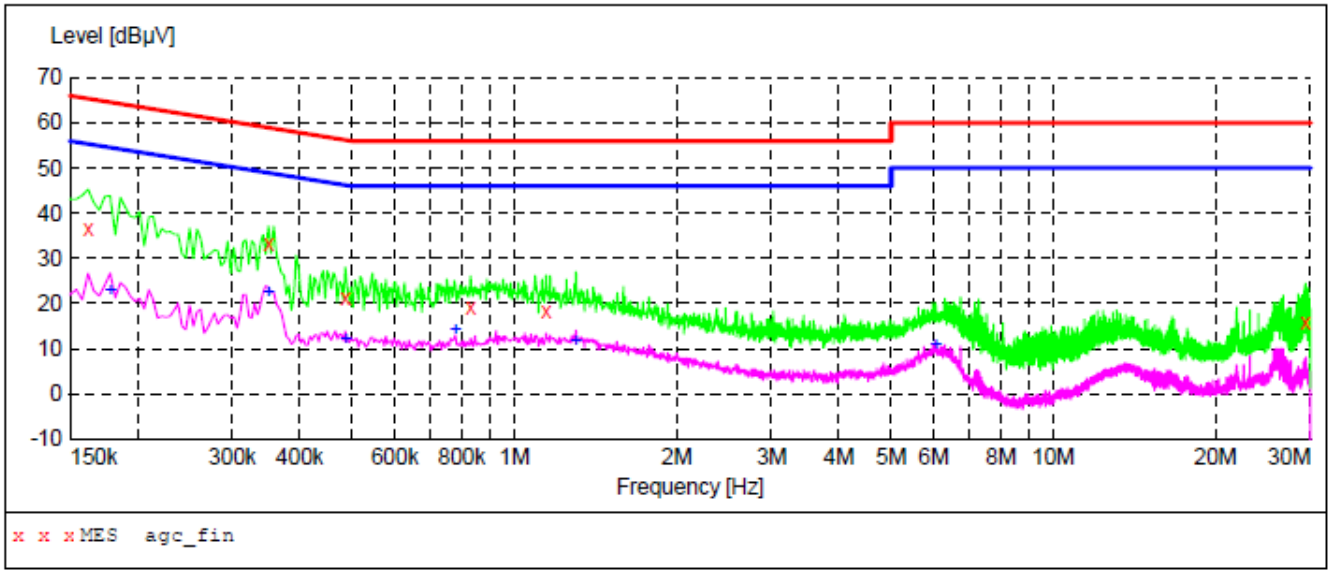
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

8.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

8.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

Line Conducted Emission Test Line 1-L



MEASUREMENT RESULT: "agc_fin"

2019/11/27 22:40

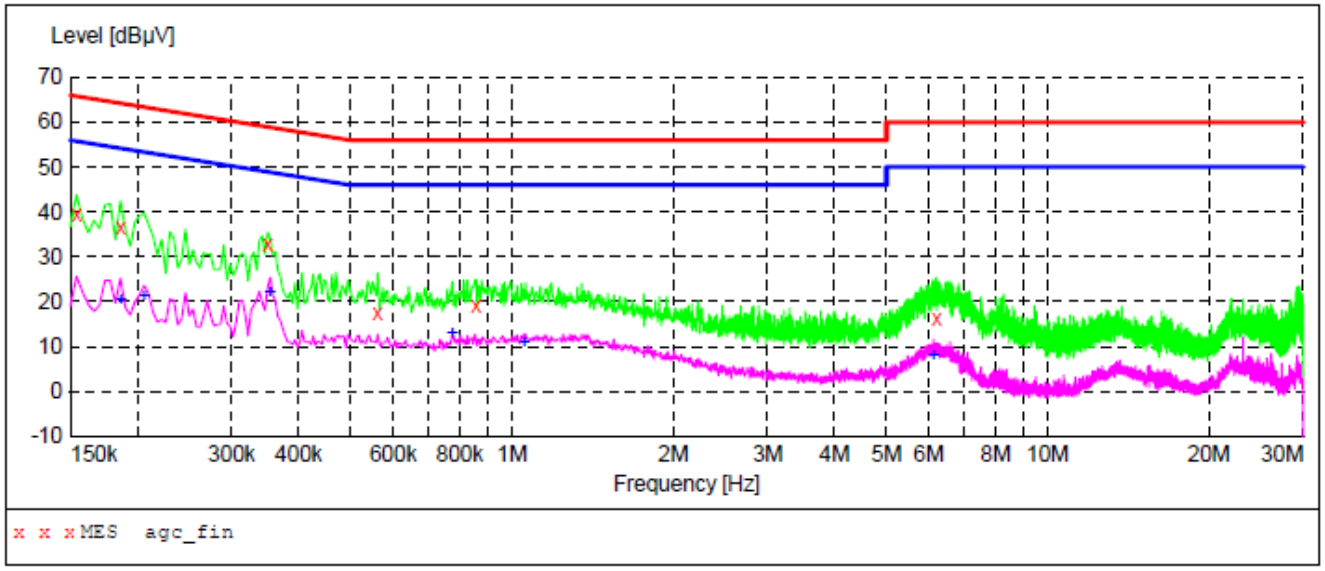
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.162000	36.50	10.7	65	28.9	QP	L1	FLO
0.350000	33.40	10.5	59	25.6	QP	L1	FLO
0.486000	21.40	10.9	56	34.8	QP	L1	FLO
0.830000	19.20	10.7	56	36.8	QP	L1	FLO
1.146000	18.30	11.3	56	37.7	QP	L1	FLO
29.362000	16.00	13.2	60	44.0	QP	L1	FLO

MEASUREMENT RESULT: "agc_fin2"

2019/11/27 22:40

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.178000	23.00	10.7	55	31.6	AV	L1	FLO
0.350000	22.50	10.5	49	26.5	AV	L1	FLO
0.486000	12.10	10.9	46	34.1	AV	L1	FLO
0.778000	14.10	10.5	46	31.9	AV	L1	FLO
1.302000	11.60	11.3	46	34.4	AV	L1	FLO
6.050000	11.00	11.5	50	39.0	AV	L1	FLO

Line Conducted Emission Test Line 2-N



MEASUREMENT RESULT: "agc_fin"

2019/11/27 22:44

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154000	39.30	10.7	66	26.5	QP	N	FLO
0.186000	36.50	10.8	64	27.7	QP	N	FLO
0.350000	32.80	10.5	59	26.2	QP	N	FLO
0.562000	17.30	10.7	56	38.7	QP	N	FLO
0.858000	18.90	10.8	56	37.1	QP	N	FLO
6.198000	16.30	11.5	60	43.7	QP	N	FLO

MEASUREMENT RESULT: "agc_fin2"

2019/11/27 22:44

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.186000	20.20	10.8	54	34.0	AV	N	FLO
0.206000	21.20	10.8	53	32.2	AV	N	FLO
0.354000	22.20	10.4	49	26.7	AV	N	FLO
0.774000	12.90	10.5	46	33.1	AV	N	FLO
1.054000	10.80	11.2	46	35.2	AV	N	FLO
6.122000	8.10	11.5	50	41.9	AV	N	FLO

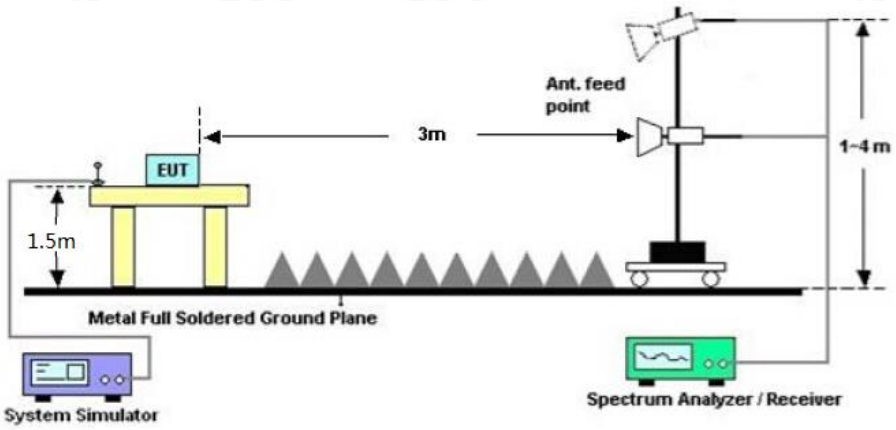
RESULT: PASS

9. 20DB BANDWIDTH

9.1. MEASUREMENT PROCEDURE

1. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
2. Set SPA Centre Frequency = Operation Frequency, RBW= 2 KHz, VBW≥3×RBW.
3. Set SPA Trace 1 Max hold, then View.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

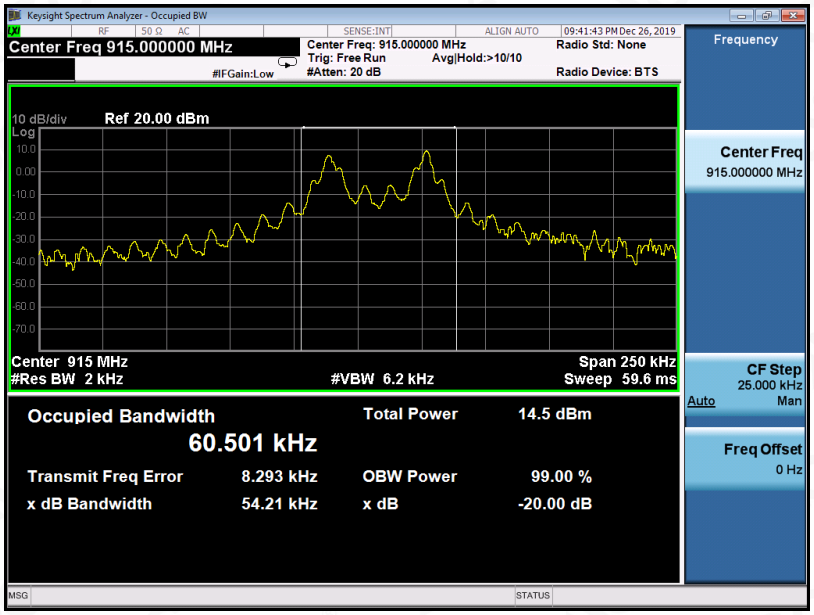


9.3. MEASUREMENT RESULTS

TEST ITEM	20DB BANDWIDTH
TEST MODULATION	FSK

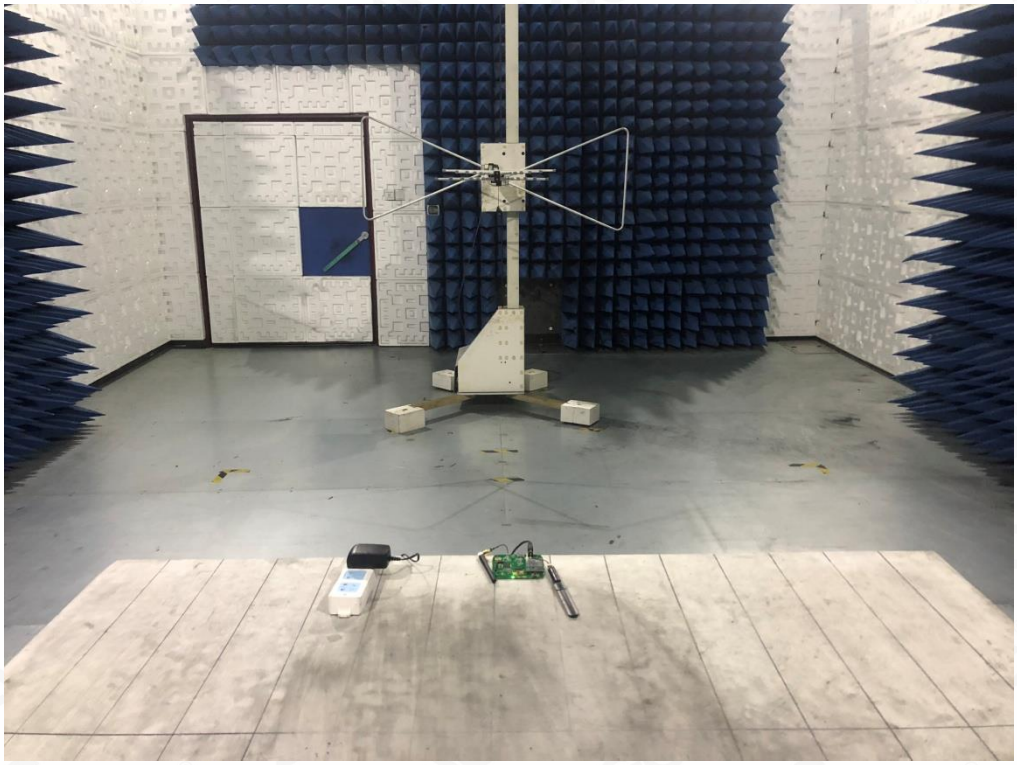
Test Data (KHz)		Criteria
915MHz	54.21	PASS

TEST PLOT OF BANDWIDTH



APPENDIX A: PHOTOGRAPHS OF TEST SETUP

FCC RADIATED EMISSION TEST SETUP BELOW 1GHZ



FCC RADIATED EMISSION TEST SETUP ABOVE 1GHZ

CONDUCTED EMISSION TEST

----END OF REPORT----