

## FCC 15.249 2.4 GHz Report

*for*

**Elitegroup Computer Systems Co., Ltd.**

**No. 239, Sec. 2., TiDing Blvd., Taipei, Taiwan 11493**

**Product Name : Home Gateway**  
**Model Name : GWS-HZW1**  
**Brand : ECS**  
**FCC ID : WL6GWS-HZW1**

**Prepared by: : AUDIX Technology Corporation,  
EMC Department**



The statement is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.  
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

## TABLE OF CONTENTS

Description	Page
TEST REPORT CERTIFICATION .....	3
<b>1. REVISION RECORD OF TEST REPORT .....</b>	<b>4</b>
<b>2. SUMMARY OF TEST RESULTS .....</b>	<b>5</b>
<b>3. GENERAL INFORMATION .....</b>	<b>6</b>
3.1. Description of Application.....	6
3.2. Description of EUT.....	7
3.3. Antenna Information.....	8
3.4. EUT Specifications Assessed in Current Report .....	8
3.5. Description of Key Components.....	8
3.6. Test Configuration .....	9
3.7. Tested Supporting System List.....	10
3.8. Setup Configuration.....	10
3.9. Operating Condition of EUT .....	10
3.10. Description of Test Facility .....	11
3.11. Measurement Uncertainty.....	11
<b>4. MEASUREMENT EQUIPMENT LIST .....</b>	<b>12</b>
4.1. Conducted Emission Measurement .....	12
4.2. Radiated Emission Measurement.....	12
4.3. RF Conducted Measurement .....	13
<b>5. CONDUCTED EMISSION MEASUREMENT .....</b>	<b>14</b>
5.1. Block Diagram of Test Setup.....	14
5.2. Conducted Emission Limit .....	14
5.3. Test Procedure .....	14
5.4. Test Results.....	15
<b>6. RADIATED EMISSION .....</b>	<b>16</b>
6.1. Block Diagram of Test Setup.....	16
6.2. Radiated Emission Limits.....	17
6.3. Test Procedure .....	18
6.4. Measurement Result Explanation .....	19
6.5. Test Results.....	19
<b>7. EMISSION BANDWIDTH MEASUREMENT .....</b>	<b>20</b>
7.1. Block Diagram of Test Setup.....	20
7.2. Test Procedure .....	20
7.3. Test Results.....	20
<b>8. DEVIATION TO TEST SPECIFICATIONS.....</b>	<b>21</b>

APPENDIX A TEST PHOTOGRAPHS  
APPENDIX B EUT PHOTOGRAPHS

## TEST REPORT CERTIFICATION

Applicant : Elitegroup Computer Systems Co., Ltd.  
Manufacturer : Elitegroup Computer Systems Co., Ltd.  
EUT Description  
(1) Product : Home Gateway  
(2) Model : GWS-HZW1  
(3) Brand : ECS  
(4) Power Rating : DC 12V, 2A

Applicable Standards:

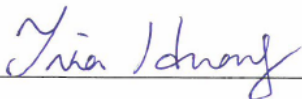
47 CFR FCC Part 15 Subpart C  
ANSI C63.10:2013

**Audix Technology Corp.** tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

**Audix Technology Corp.** does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Report: 2018. 07. 12

Reviewed by:



(Tina Huang/Administrator)

Approved by:



(Ben Cheng/Manager)

## 1. REVISION RECORD OF TEST REPORT

Edition No	Issued Data	Revision Summary	Report Number
0	2018. 07. 12	Original Report	EM-F180275

## 2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	<b>PASS</b>
15.205/ 15.209/ 15.249(a)	Radiated Band Edge and Radiated Spurious Emission Fundamental Frequency	<b>PASS</b>
15.215	Emission Bandwidth	<b>PASS</b>
15.203	Antenna Requirement	<b>PASS</b>

### 3. GENERAL INFORMATION

#### 3.1. Description of Application

Applicant	Elitegroup Computer Systems Co., Ltd. No. 239, Sec. 2, TiDing Blvd, Taipei, Taiwan 11493
Manufacturer	Elitegroup Computer Systems Co., Ltd. No. 239, Sec. 2, TiDing Blvd, Taipei, Taiwan 11493
Product	Home Gateway
Model	GWS-HZW1
Brand	ECS

### 3.2. Description of EUT

Test Model	GWS-HZW1
Serial Number	N/A
Power Rating	DC 12V, 2A
RF Features	WLAN: 802.11b/g/n & BLE ZigBee & Z-Wave WCDMA: Band 2/5 LTE Band 2/4/7
Transmit Type	Z-Wave: 1T1R
Sample Status	Production
Date of Receipt	2018. 06. 15
Date of Test	2018. 06. 27 ~07. 12
Interface Ports of EUT	<ul style="list-style-type: none"><li>● One DC Input Port</li><li>● One Debug Client Port</li><li>● One USB Port</li><li>● One LAN Port</li><li>● One SIM Car Slot</li></ul>
Accessories Supplied	<ul style="list-style-type: none"><li>● AC Adapter</li></ul>

### 3.3. Antenna Information

Mode	Brand	Part No.	Antenna Type	Frequency	Max Gain
Z-Wave	JEM	IAHA201712018 (1510-0102-0236)	PIFA	860-875MHz	0.52dBi
				880-940MHz	0.67dBi

### 3.4. EUT Specifications Assessed in Current Report

Mode	Operating Frequency Range	Channel Number	Modulation	Data Rate
Z-Wave	920.9 to 923.1MHz	3	2-Key FSK/GFSK	Up to 100kbps

Channel List	
Z-Wave	
Channel	Frequency (MHz)
1	920.9
2	921.7
3	923.1

### 3.5. Description of Key Components

Item	Supplier/Brand	Model	Specification
Z-Wave General Purpose Module	Sigma Designs	ZM5202	920.9 to 923.1MHz
802.11b/g/n RTL8723BE Combo module	REALTEK	RTL8723BE	802.11b/g/n/BLE (FCC ID: TX2-RTL8723BE)
LTE Module	QUECTEL	EC21-A	WCDMA: Band 2/5 LTE: Band 2/4/7 FCC ID: XMR201606EC21A
EFR32 802.15.4 Module	MMB Research Inc.	BSB03PA11-CHP	ZigBee FCC ID: XFF-BSB03PA1X
AC Adapter	Asian	WA-24Q12FU	Input: AC 100-240V, 50-60Hz, Output: DC 12V, 2A

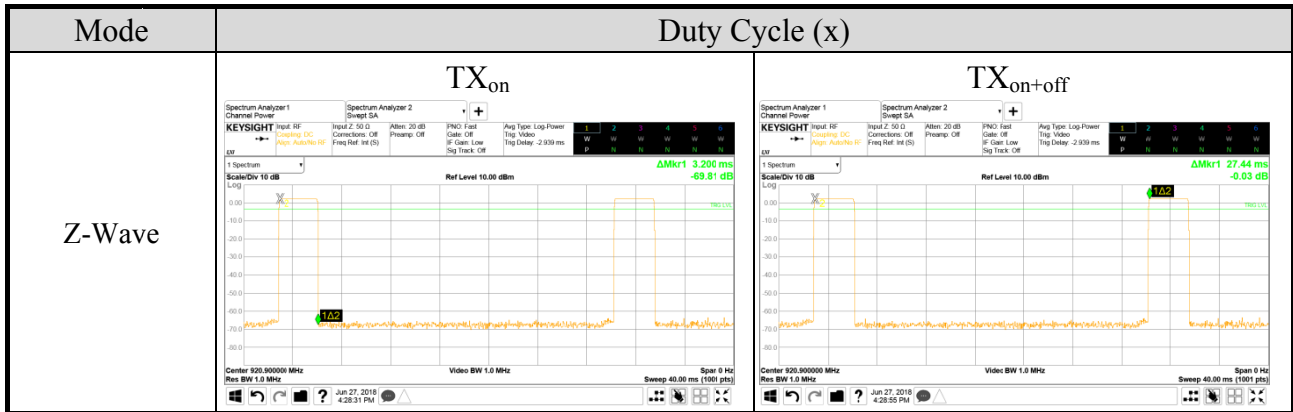
Remark: For more detailed features description, please refer to the manufacturer's specifications or the user manual.



### 3.6. Test Configuration

#### Duty Cycle

Mode	TX <sub>on</sub>	TX <sub>on+off</sub>	Duty Cycle Factor (dB)
Z-Wave	3.2ms	22.44ms	-18.66
Duty Cycle Correction Factor (DCCF)= 20log (TX <sub>on</sub> /TX <sub>on+off</sub> )			



AC Conduction	
Test Case	Normal operation

Item	Mode	Test Frequency (MHz)
Radiated Test Case	Radiated Spurious Emission (30MHz-1GHz) <sup>Note1</sup>	Z-Wave 920.9/921.7/923.1
	Radiated Spurious Emission (Above 1GHz) <sup>Note1</sup>	Z-Wave 920.9/921.7/923.1
	Fundamental Frequency	Z-Wave 920.9/921.7/923.1
	Occupied Bandwidth 99% Power	Z-Wave 920.9/921.7/923.1

Note 1:  Mobile Device

Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow:  Lie  Side  Stand

### 3.7. Tested Supporting System List

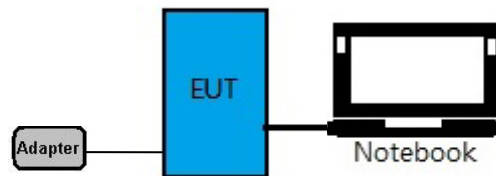
#### 3.7.1. Support Peripheral Unit

No.	Product	Brand	Model No.	Serial No.	Approval
1.	Notebook PC	acer	N16Q2	N/A	Contains FCC ID: PPD-QCNFA435 Contains IC: 4104A-QCNFA435

#### 3.7.2. Cable Lists

No.	Cable Description Of The Above Support Units
1.	USB Cable : Unshielded, Detachable, 2.0m Adapter: Chicony, M/N A11-065N1A DC Cord : Shielded, Undetachable, 1.8m, Bonded a ferrite core AC Power Cord : Unshielded, Detachable, 1.0m

### 3.8. Setup Configuration



### 3.9. Operating Condition of EUT

Test program “Tera term” is used for enabling EUT RF function under continues transmitting and choosing channel.

### 3.10. Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2005 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724 (3) FCC OET Designation No. TW1724
Test Facilities	(1) Semi-Anechoic Chamber (IC Test Site Registration No.: 5183B-1) (2) Fully Anechoic Chamber (IC Test Site Registration No.: 5183B-4)

### 3.11. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Conduction Test	150kHz~30MHz	±3.50dB
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 3.68dB
	Above 1GHz	± 5.82dB

Remark : Uncertainty =  $ku_c(y)$

Test Item	Uncertainty
Occupied Bandwidth 99% Power	± 1kHz

## 4. MEASUREMENT EQUIPMENT LIST

### 4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR	101774	2018. 01. 24	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2017. 11. 12	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2017. 12. 14	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2018. 01. 16	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2018. 04. 20	1 Year
6.	Test Software	Audix	e3	V.6.120424	N.C.R.	N.C.R.

### 4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2017. 09. 13	1 Year
2.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2018. 01. 04	1 Year
3.	Test Receiver	R & S	ESCS30	100338	2018. 06. 20	1 Year
4.	Amplifier	HP	8447D	2944A06305	2018. 01. 30	1 Year
5.	Amplifier	HP	8449B	3008A02678	2018. 03. 06	1 Year
6.	Bilog Antenna	CHASE	CBL6112D	33821	2018. 01. 21	1 Year
7.	Loop Antenna	R&S	HFH2-Z2	891847/27	2017. 12. 18	1 Year
8.	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2018. 03. 08	1 Year
9.	Tunable Notch Filter	K&L	3TNF-800/1000-0.2-N/N0	498	2018. 01. 05	1 Year
10.	Digital Thermo-Hygro Meter	IMax	HTC-1	No.1 3m A/C	2018. 04. 20	1 Year
11.	Digital Thermo-Hygro Meter	EVERY DAY	E-512	RF-02	2018. 04. 20	1 Year
12.	Test Software	Audix	e3	V.6.110601	N.C.R.	N.C.R.

### 4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
1.	Spectrum Analyzer	Keysight	N9020B-544	MY57120357	2018. 01. 15	1 Year
2.	Digital Thermo-Hygro Meter	Shenzhen Datronn Electronics	KT-905	RF	2018. 04. 20	1 Year

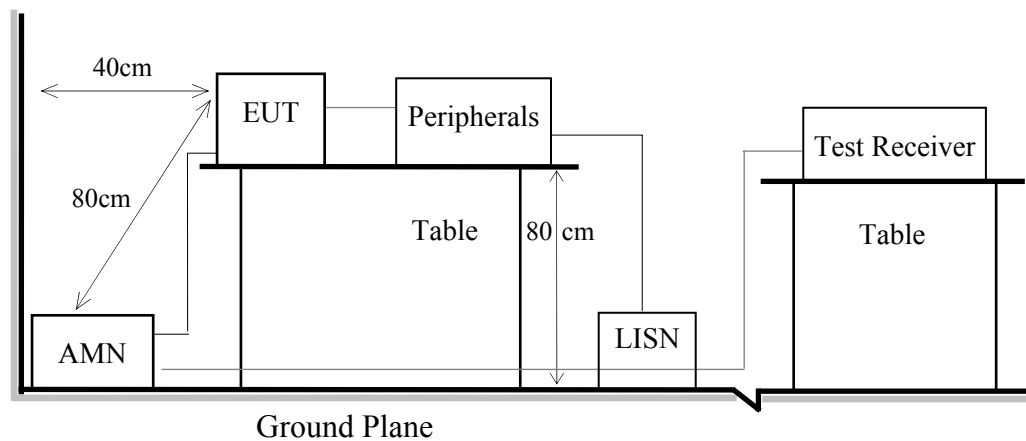
## 5. CONDUCTED EMISSION MEASUREMENT

### 5.1. Block Diagram of Test Setup

#### 5.1.1. Block Diagram of EUT

Indicated as section 3.8

#### 5.1.2. Shielded Room Setup Diagram



### 5.2. Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dB $\mu$ V	56 ~ 46 dB $\mu$ V
500kHz ~ 5MHz	56 dB $\mu$ V	46 dB $\mu$ V
5MHz ~ 30MHz	60 dB $\mu$ V	50 dB $\mu$ V

Remark 1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.

2.: The lower limit applies to the band edges.

### 5.3. Test Procedure

- 5.3.1. To set up the EUT as indicated in ANSI C 63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.
- 5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).
- 5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.)
- 5.3.4. To Check frequency range from 150 kHz to 30 MHz and record the emission which does not have 20 dB below limit.

## **5.4. Test Results**

Please refer to Appendix A.

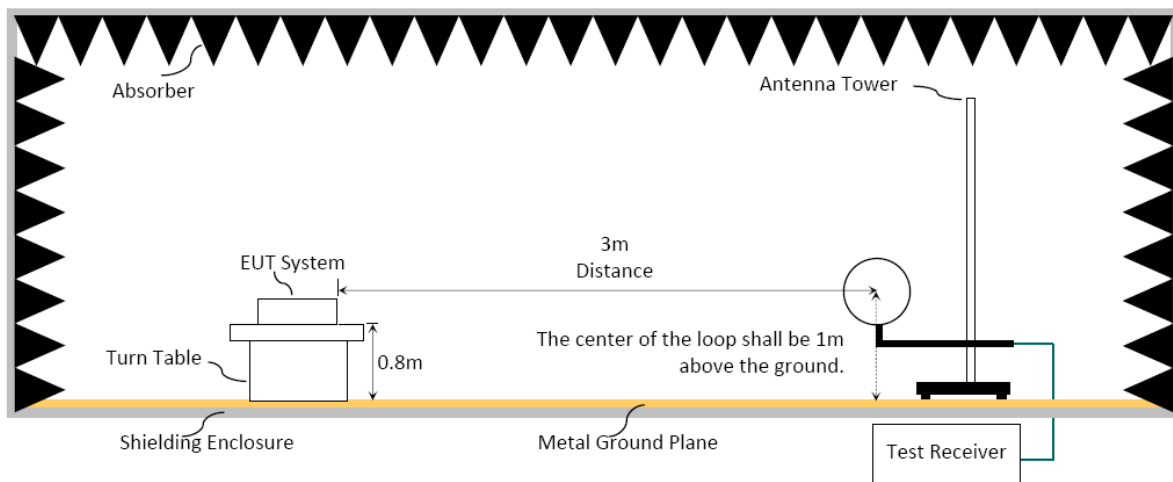
## 6. RADIATED EMISSION

### 6.1. Block Diagram of Test Setup

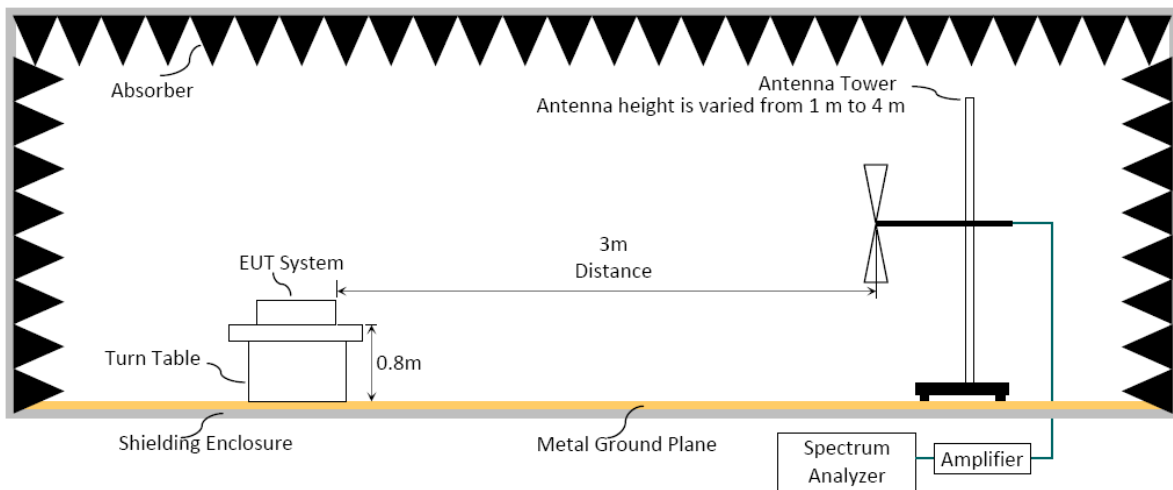
#### 6.1.1. Block Diagram of EUT

Indicated as section 3.8

#### 6.1.2. Setup Diagram for 9kHz-30MHz

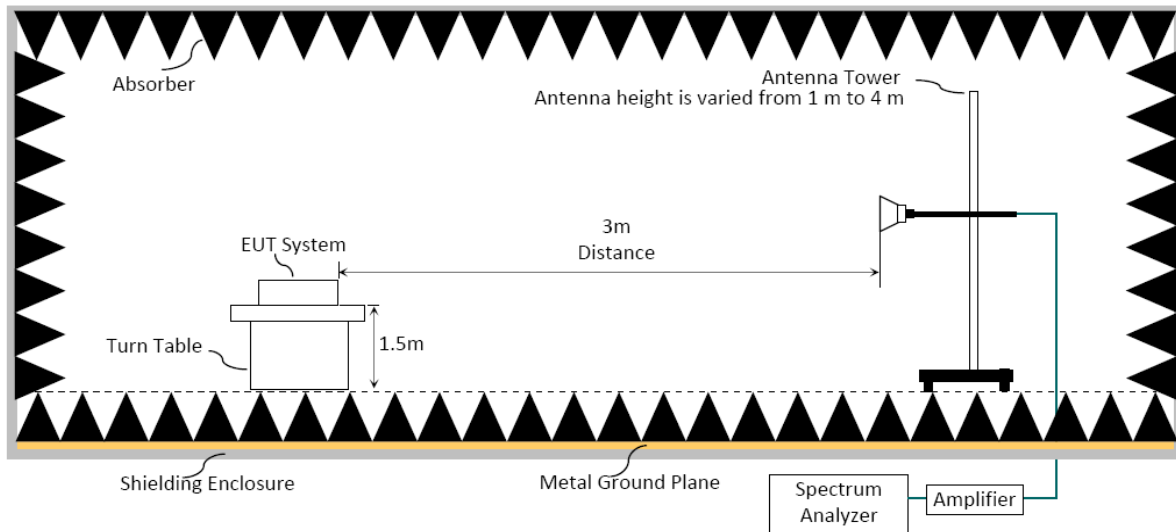


#### 6.1.3. Setup Diagram for 30-1000 MHz





### 6.1.4. Setup Diagram for above 1GHz



## 6.2. Radiated Emission Limits

### 6.2.1. General Limit

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in FCC Section 15.205, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Limits	
		dB $\mu$ V/m	$\mu$ V/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dB $\mu$ V/m (Peak) 54.0 dB $\mu$ V/m (Average)	

Remark : (1) dB $\mu$ V/m = 20 log ( $\mu$ V/m)

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

### 6.2.2. Limite for Fundamental & Harmonics Frequency

Fundamental Frequency	Field strength of fundamental		Field strength of harmonics	
	mV/m	dB $\mu$ V/m	mV/m	dB $\mu$ V/m
902-928MHz	50	94 (Quasi-Peak)	500	74 (Peak)
				54 (Average)
2400-2483.5MHz	50	114 (Peak)	500	74 (Peak)
		94 (Average)		54 (Average)
5725-5875MHz	50	114 (Peak)	500	74 (Peak)
		94 (Average)		54 (Average)
24.0-24.25GHz	250	128 (Peak)	2500	88 (Peak)
		108 (Average)		68 (Average)

Remark: mV/m=1000 $\mu$ V/m; dB $\mu$ V/m = 20 log ( $\mu$ V/m)

### 6.3. Test Procedure

#### Frequency Range 9kHz~30MHz:

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

- (1) RBW = 9kHz with peak and average detector.
- (2) Detector: average and peak (9kHz-490kHz)  
           Q.P. (490kHz-30MHz)

#### Frequency Range 30MHz ~ 25GHz:

The EUT setup on the turn table which has 80 cm (for 30-1000 MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

#### Frequency below 1 GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1)RBW = 120KHz
- (2)VBW  $\geq$  3 x RBW.
- (3)Detector = Peak.
- (4)Sweep time = auto.
- (5)Trace mode = max hold.
- (6)Allow sweeps to continue until the trace stabilizes.
- (7)When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required, otherwise using Q.P. for final measurement.

**Frequency above 1GHz to 10th harmonic (up to 25 GHz):****Peak Detector:**

- (1) RBW = 1MHz
- (2) VBW  $\geq 3 \times$  RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

**Average Detector:** **Option 1:**

- (1) RBW = 1MHz
- (2) VBW  $\geq 1/ T$ .

Modulation Type	T (ms)	1/ T (kHz)	VBW Setting (kHz)
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N/A: 1/ T is not implemented when duty cycle presented in section 3.6 is  $\geq 98$  %.

- (1) Detector = Peak.
- (2) Sweep time = auto.
- (3) Trace mode = max hold.
- (4) Allow sweeps to continue until the trace stabilizes.

 **Option 2:**

Average Emission Level = Peak Emission Level + D.C.C.F.

**6.4. Measurement Result Explanation**

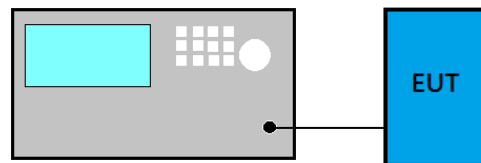
- Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading
- Average Emission Level = Antenna Factor + Cable Loss + Meter Reading
- Average Emission Level = Peak Emission Level + DCCF  
 Duty Cycle Correction Factor (DCCF) =  $20 \log (TX_{on}/TX_{on+off})$  presented in section 3.6
- ERP = Peak Emission Level - 95.2dB - 2.14dB

**6.5. Test Results**

Please refer to Appendix A.

## 7. EMISSION BANDWIDTH MEASUREMENT

### 7.1. Block Diagram of Test Setup



### 7.2. Test Procedure

- (1) Set RBW close to 1-5 % of OBW.
- (2) Set  $VBW \geq RBW$ .
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

### 7.3. Test Results

Please refer to Appendix A

## **8. DEVIATION TO TEST SPECIFICATIONS**

**【NONE】**



# APPDNDIX A

## TEST DATA AND PLOTS

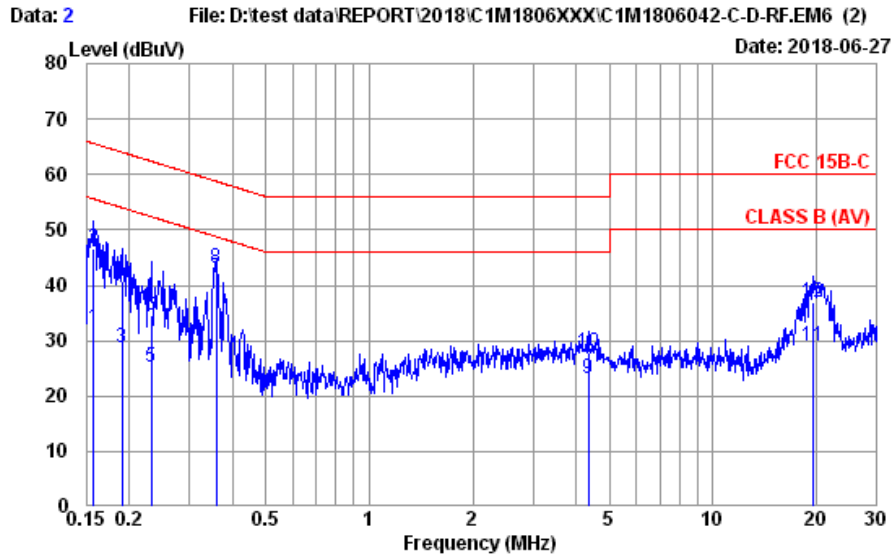
(Model: GWS-HZW1)

## TABLE OF CONTENTS

<b>A.1 CONDUCTED EMISSION</b> .....	<b>2</b>
<b>A.2 RADIATED EMISSION</b> .....	<b>4</b>
A.2.1 Emissions Applied to General Requirement.....	4
A.2.2 Fundamental Frequency .....	15
<b>A.3 EMISSION BANDWIDTH MEASUREMENT</b> .....	<b>18</b>
A.3.1 Emission Bandwidth.....	18
A.3.2 Measurement Plots .....	18

## A.1 CONDUCTED EMISSION

Test Date	2018/06/27	Temp./Hum.	24°C/56%
Test Voltage	AC 120V 60Hz (Via AC Adapter)		



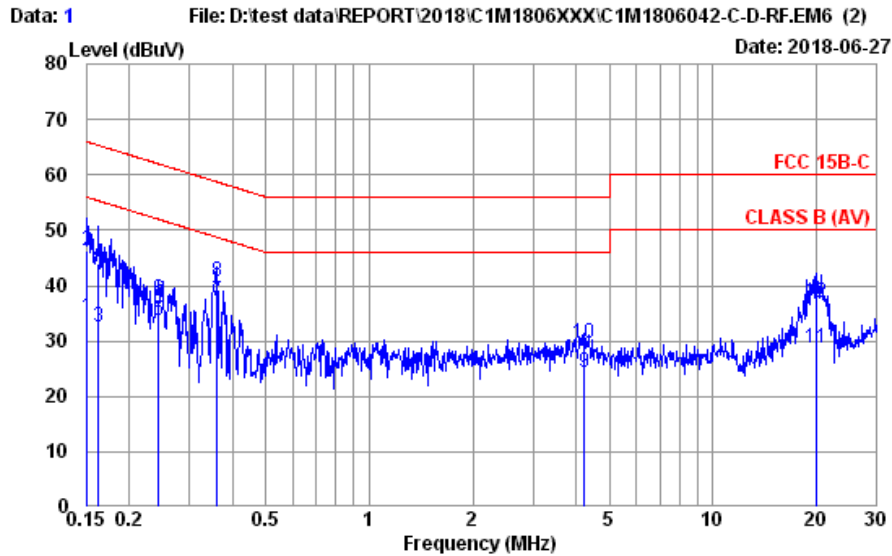
Site no. : No.8 Shielded Room Data no. : 2  
 Condition : ENV4200 100169 LISN Phase : NEUTRAL  
 Limit : FCC 15B-C  
 Env. / Ins. : 24°C / 56% ESR3 (1774) Engineer : Nick Du  
 EUT : GWS-HZW1  
 Power Rating : 120Vac/60Hz  
 Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.157	10.56	0.03	9.98	11.72	32.29	55.60	23.31	Average
2	0.157	10.56	0.03	9.98	26.14	46.71	65.60	18.89	QP
3	0.190	10.53	0.03	9.98	8.25	28.79	54.02	25.23	Average
4	0.190	10.53	0.03	9.98	20.06	40.60	64.02	23.42	QP
5	0.232	10.50	0.03	9.98	4.71	25.22	52.39	27.17	Average
6	0.232	10.50	0.03	9.98	14.11	34.62	62.39	27.77	QP
7	0.358	10.44	0.04	9.98	20.84	41.30	48.78	7.48	Average
8	0.358	10.44	0.04	9.98	22.53	42.99	58.78	15.79	QP
9	4.338	10.65	0.12	10.00	2.36	23.13	46.00	22.87	Average
10	4.338	10.65	0.12	10.00	7.21	27.98	56.00	28.02	QP
11	19.635	13.45	0.27	10.07	5.26	29.05	50.00	20.95	Average
12	19.635	13.45	0.27	10.07	13.11	36.90	60.00	23.10	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.  
 2. If the average limit is met when using a quasi-peak detector,  
 the EUT shall be deemed to meet both limits and measurement  
 with average detector is unnecessary.



Test Date	2018/06/27	Temp./Hum.	24°C/56%
Test Voltage	AC 120V 60Hz (Via AC Adapter)		



Site no. : No.8 Shielded Room      Data no. : 1  
 Condition : ENV4200 100169      LISN Phase : LINE  
 Limit : FCC 15B-C  
 Env. / Ins. : 24°C / 56% ESR3 (1774)      Engineer : Nick Du  
 EUT : GWS-HZW1  
 Power Rating : 120Vac/60Hz  
 Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.151	10.63	0.03	9.98	13.77	34.41	55.96	21.55	Average
2	0.151	10.63	0.03	9.98	25.77	46.41	65.96	19.55	QP
3	0.162	10.61	0.03	9.98	11.94	32.56	55.34	22.78	Average
4	0.162	10.61	0.03	9.98	23.21	43.83	65.34	21.51	QP
5	0.244	10.53	0.03	9.98	13.09	33.63	51.95	18.32	Average
6	0.244	10.53	0.03	9.98	16.89	37.43	61.95	24.52	QP
7	0.360	10.47	0.04	9.98	16.74	37.23	48.74	11.51	Average
8	0.360	10.47	0.04	9.98	20.14	40.63	58.74	18.11	QP
9	4.224	10.63	0.11	10.00	3.58	24.32	46.00	21.68	Average
10	4.224	10.63	0.11	10.00	8.96	29.70	56.00	26.30	QP
11	20.056	13.59	0.27	10.07	4.68	28.61	50.00	21.39	Average
12	20.056	13.59	0.27	10.07	13.12	37.05	60.00	22.95	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.  
 2. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

## A.2 RADIATED EMISSION

Test Date	2018/06/28	Temp./Hum.	21°C/48%
Test Voltage	AC 120V 60Hz (Via AC Adapter)		

### A.2.1 Emissions Applied to General Requirement

#### A.2.1.1 Frequency 9kHz~30MHz

**The emissions (9kHz~30MHz) not reported for there is no emission be found.**

#### A.2.1.2 Frequency Below 1 GHz

Mode	Z-Wave	Frequency	TX 920.9MHz
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#### Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
30.00	24.77	1.20	2.44	28.41	40.00	11.59	Peak
82.38	14.30	2.04	6.29	22.63	40.00	17.37	Peak
174.53	15.68	3.08	13.02	31.78	43.50	11.72	Peak
237.58	18.36	3.70	12.73	34.79	46.00	11.21	Peak
263.77	19.26	3.95	11.52	34.73	46.00	11.27	Peak
399.57	22.04	5.54	6.28	33.86	46.00	12.14	Peak
433.52	22.46	5.87	12.58	40.91	46.00	5.09	Peak
913.67	26.95	8.26	9.24	44.45	46.00	1.55	Peak

#### Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
30.00	24.77	1.20	8.18	34.15	40.00	5.85	Peak
81.41	14.15	2.03	10.74	26.92	40.00	13.08	Peak
174.53	15.68	3.08	11.82	30.58	43.50	12.92	Peak
263.77	19.26	3.95	7.00	30.21	46.00	15.79	Peak
333.61	20.43	4.77	5.40	30.60	46.00	15.40	Peak
433.52	22.46	5.87	6.28	34.61	46.00	11.39	Peak
747.80	25.39	7.34	5.41	38.14	46.00	7.86	Peak
928.22	27.12	8.37	5.33	40.82	46.00	5.18	Peak

Mode	Z-Wave	Frequency	TX 921.7MHz
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**Antenna at Horizontal Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector
82.38	14.30	2.04	6.29	22.63	40.00	17.37	Peak
172.59	15.76	3.06	13.53	32.35	43.50	11.15	Peak
263.77	19.26	3.95	12.07	35.28	46.00	10.72	Peak
433.52	22.46	5.87	12.61	40.94	46.00	5.06	Peak
915.61	26.98	8.28	9.31	44.57	46.00	1.43	Peak
928.22	27.12	8.37	7.39	42.88	46.00	3.12	Peak

**Antenna at Vertical Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector
30.00	24.77	1.20	7.84	33.81	40.00	6.19	Peak
65.89	12.68	1.82	10.67	25.17	40.00	14.83	Peak
81.41	14.15	2.03	11.50	27.68	40.00	12.32	Peak
167.74	15.98	3.01	9.68	28.67	43.50	14.83	Peak
263.77	19.26	3.95	6.72	29.93	46.00	16.07	Peak
433.52	22.46	5.87	6.40	34.73	46.00	11.27	Peak
748.77	25.39	7.34	8.84	41.57	46.00	4.43	Peak

Mode	Z-Wave	Frequency	TX 923.1MHz
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**Antenna at Horizontal Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
82.38	14.30	2.04	6.57	22.91	40.00	17.09	Peak
174.53	15.68	3.08	13.70	32.46	43.50	11.04	Peak
263.77	19.26	3.95	12.64	35.85	46.00	10.15	Peak
433.52	22.46	5.87	12.54	40.87	46.00	5.13	Peak
917.55	26.98	8.28	9.33	44.59	46.00	1.41	Peak
928.22	27.12	8.37	8.72	44.21	46.00	1.79	Peak

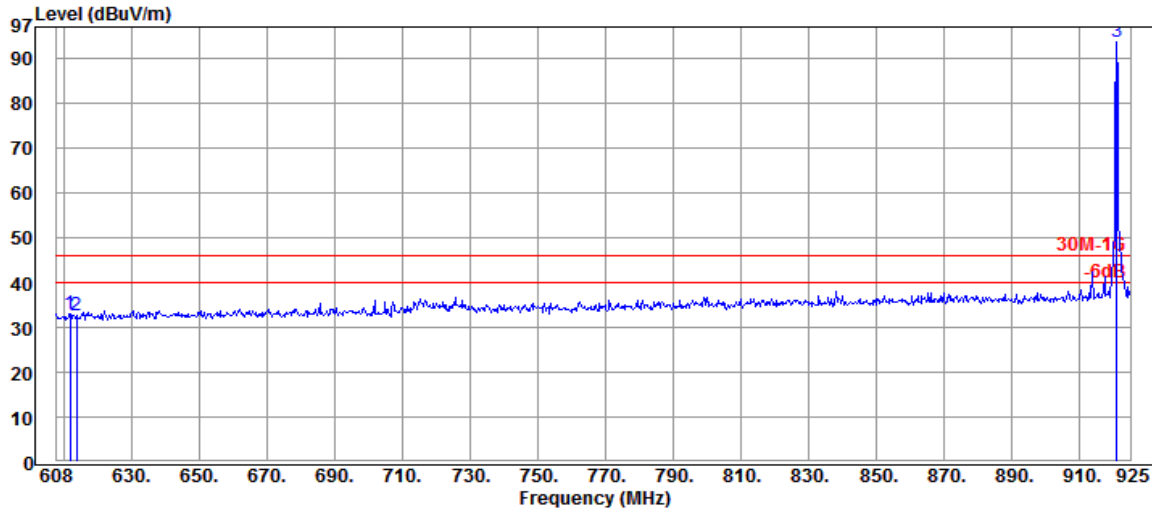
**Antenna at Vertical Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
66.86	12.71	1.84	10.17	24.72	40.00	15.28	Peak
80.44	13.96	2.01	11.25	27.22	40.00	12.78	Peak
174.53	15.68	3.08	11.53	30.29	43.50	13.21	Peak
263.77	19.26	3.95	7.88	31.09	46.00	14.91	Peak
433.52	22.46	5.87	5.86	34.19	46.00	11.81	Peak
533.43	23.69	6.54	6.04	36.27	46.00	9.73	Peak
918.52	27.01	8.30	7.39	42.70	46.00	3.30	Peak
928.22	27.12	8.37	6.92	42.41	46.00	3.59	Peak

A.2.1.3 Frequency Above 1 GHz to 10<sup>th</sup> harmonics

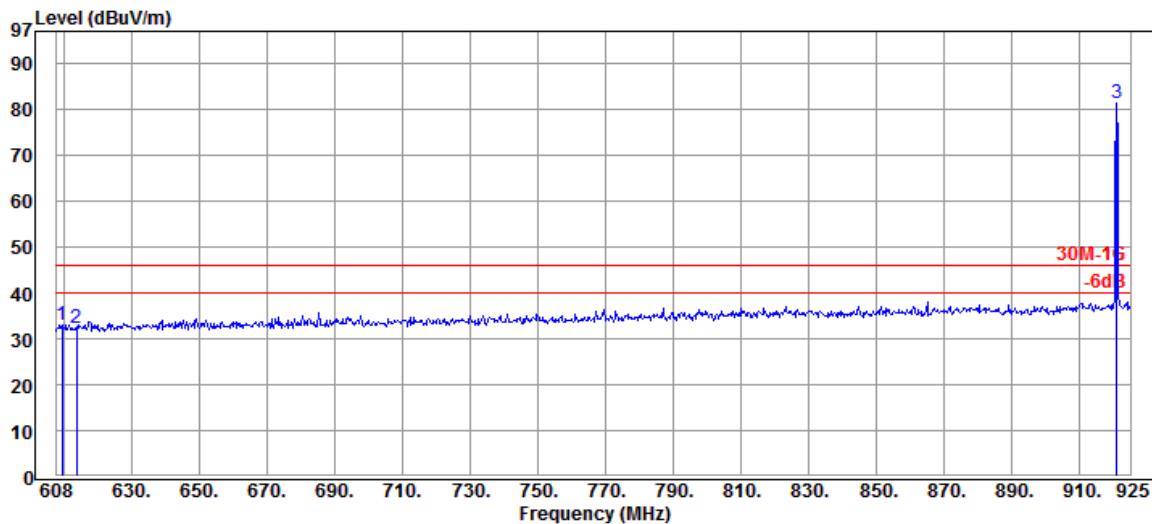
**Band Edge:**

Mode	Z-Wave	Frequency	TX 920.9MHz
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Antenna at Horizontal Polarization

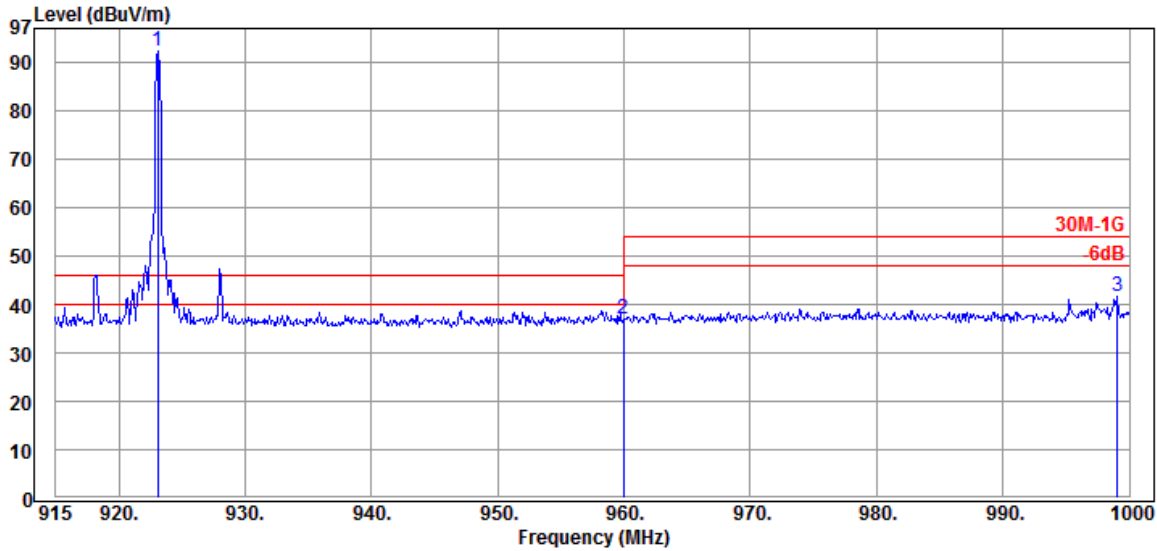
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
612.12	24.67	6.80	1.49	32.96	46.00	13.04	Peak
614.02	24.68	6.80	1.31	32.79	46.00	13.21	Peak
920.88	27.01	8.30	58.20	93.51	---	---	Peak



Antenna at Vertical Polarization

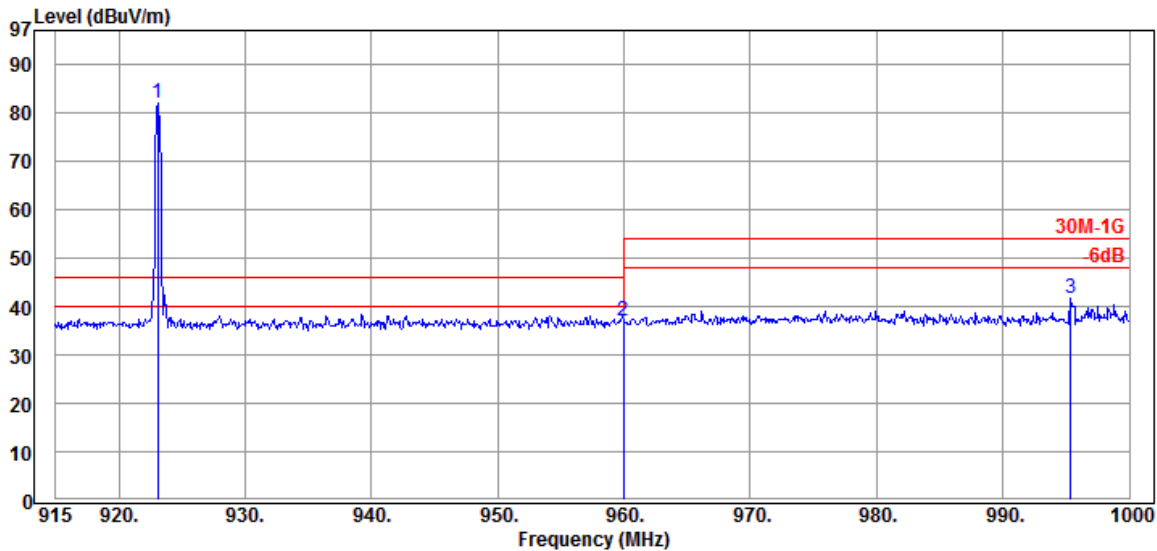
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
609.59	24.67	6.79	1.67	33.13	46.00	12.87	Peak
614.02	24.68	6.80	0.94	32.42	46.00	13.58	Peak
920.88	27.01	8.30	46.07	81.38	---	---	Peak

Mode	Z-Wave	Frequency	TX 923.1MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
923.08	27.05	8.32	57.07	92.44	---	---	Peak
959.97	27.42	8.57	0.97	36.96	46.00	9.04	Peak
999.07	27.83	8.83	5.03	41.69	54.00	12.31	Peak



Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
923.08	27.05	8.32	46.47	81.84	---	---	Peak
959.97	27.42	8.57	1.02	37.01	46.00	8.99	Peak
995.33	27.80	8.81	5.10	41.71	54.00	12.29	Peak

## A.2.1.4 Frequency Above 1 GHz

Mode	Z-Wave	Frequency	TX 920.9MHz
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## Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector
1840.00	30.40	5.81	8.77	44.98	74.00	29.02	Peak
2124.00	31.77	6.24	6.47	44.48	74.00	29.52	Peak
2436.00	32.20	6.61	5.24	44.05	74.00	29.95	Peak
2764.00	32.62	7.10	19.03	58.75	74.00	15.25	Peak
4604.00	34.14	9.46	7.45	51.05	74.00	22.95	Peak
4980.00	34.29	9.60	6.48	50.37	74.00	23.63	Peak
6445.00	36.01	11.25	4.97	52.23	74.00	21.77	Peak
7365.00	35.80	11.95	4.70	52.45	74.00	21.55	Peak
8290.00	35.96	13.23	5.06	54.25	74.00	19.75	Peak

Emission Frequency (MHz)	Peak Emission Level (dB $\mu$ V/m)	DCCF (dB)	Average Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Remark
1840.00	44.98	-18.66	26.32	54.00	27.68	Average
2124.00	44.48	-18.66	25.82	54.00	28.18	Average
2436.00	44.05	-18.66	25.39	54.00	28.61	Average
2764.00	58.75	-18.66	40.09	54.00	13.91	Average
4604.00	51.05	-18.66	32.39	54.00	21.61	Average
4980.00	50.37	-18.66	31.71	54.00	22.29	Average
6445.00	52.23	-18.66	33.57	54.00	20.43	Average
7365.00	52.45	-18.66	33.79	54.00	20.21	Average
8290.00	54.25	-18.66	35.59	54.00	18.41	Average

Mode	Z-Wave	Frequency	TX 920.9MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1840.00	30.40	5.81	8.84	45.05	74.00	28.95	Peak
1952.00	31.24	6.01	12.39	49.64	74.00	24.36	Peak
2124.00	31.77	6.24	11.73	49.74	74.00	24.26	Peak
2764.00	32.62	7.10	19.03	58.75	74.00	15.25	Peak
2996.00	32.88	7.43	12.51	52.82	74.00	21.18	Peak
4604.00	34.14	9.46	8.92	52.52	74.00	21.48	Peak
4996.00	34.30	9.61	12.25	56.16	74.00	17.84	Peak
6445.00	36.01	11.25	6.34	53.60	74.00	20.40	Peak
7000.00	35.80	11.60	9.55	56.95	74.00	17.05	Peak
7365.00	35.80	11.95	6.40	54.15	74.00	19.85	Peak
8290.00	35.96	13.23	3.88	53.07	74.00	20.93	Peak
9210.00	36.52	14.68	1.39	52.59	74.00	21.41	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1840.00	45.05	-18.66	26.39	54.00	27.61	Average
1952.00	49.64	-18.66	30.98	54.00	23.02	Average
2124.00	49.74	-18.66	31.08	54.00	22.92	Average
2764.00	58.75	-18.66	40.09	54.00	13.91	Average
2996.00	52.82	-18.66	34.16	54.00	19.84	Average
4604.00	52.52	-18.66	33.86	54.00	20.14	Average
4996.00	56.16	-18.66	37.50	54.00	16.50	Average
6445.00	53.60	-18.66	34.94	54.00	19.06	Average
7000.00	56.95	-18.66	38.29	54.00	15.71	Average
7365.00	54.15	-18.66	35.49	54.00	18.51	Average
8290.00	53.07	-18.66	34.41	54.00	19.59	Average
9210.00	52.59	-18.66	33.93	54.00	20.07	Average



Mode	Z-Wave	Frequency	TX 921.7MHz
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**Antenna at Horizontal Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector
1844.00	30.52	5.84	10.53	46.89	74.00	27.11	Peak
2764.00	32.62	7.10	19.62	59.34	74.00	14.66	Peak
2996.00	32.88	7.43	7.82	48.13	74.00	25.87	Peak
4608.00	34.14	9.46	9.42	53.02	74.00	20.98	Peak
6450.00	36.03	11.27	4.83	52.13	74.00	21.87	Peak
7375.00	35.80	11.97	5.25	53.02	74.00	20.98	Peak
8295.00	35.96	13.23	3.30	52.49	74.00	21.51	Peak

Emission Frequency (MHz)	Peak Emission Level (dB $\mu$ V/m)	DCCF (dB)	Average Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Remark
1844.00	46.89	-18.66	28.23	54.00	25.77	Average
2764.00	59.34	-18.66	40.68	54.00	13.32	Average
2996.00	48.13	-18.66	29.47	54.00	24.53	Average
4608.00	53.02	-18.66	34.36	54.00	19.64	Average
6450.00	52.13	-18.66	33.47	54.00	20.53	Average
7375.00	53.02	-18.66	34.36	54.00	19.64	Average
8295.00	52.49	-18.66	33.83	54.00	20.17	Average

Mode	Z-Wave	Frequency	TX 921.7MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1492.00	28.00	5.32	9.24	42.56	74.00	31.44	Peak
1844.00	30.52	5.84	8.63	44.99	74.00	29.01	Peak
1896.00	30.88	5.93	12.49	49.30	74.00	24.70	Peak
2128.00	31.77	6.24	9.44	47.45	74.00	26.55	Peak
2764.00	32.62	7.10	20.07	59.79	74.00	14.21	Peak
2988.00	32.88	7.43	11.07	51.38	74.00	22.62	Peak
4608.00	34.14	9.46	8.74	52.34	74.00	21.66	Peak
4988.00	34.30	9.61	13.50	57.41	74.00	16.59	Peak
6450.00	36.03	11.27	6.06	53.36	74.00	20.64	Peak
6970.00	35.82	11.58	11.23	58.63	74.00	15.37	Peak
7235.00	35.80	11.84	13.84	61.48	74.00	12.52	Peak
7375.00	35.80	11.97	7.99	55.76	74.00	18.24	Peak
8295.00	35.96	13.23	5.89	55.08	74.00	18.92	Peak
9215.00	36.52	14.68	2.64	53.84	74.00	20.16	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1492.00	42.56	-18.66	23.90	54.00	30.10	Average
1844.00	44.99	-18.66	26.33	54.00	27.67	Average
1896.00	49.30	-18.66	30.64	54.00	23.36	Average
2128.00	47.45	-18.66	28.79	54.00	25.21	Average
2764.00	59.79	-18.66	41.13	54.00	12.87	Average
2988.00	51.38	-18.66	32.72	54.00	21.28	Average
4608.00	52.34	-18.66	33.68	54.00	20.32	Average
4988.00	57.41	-18.66	38.75	54.00	15.25	Average
6450.00	53.36	-18.66	34.70	54.00	19.30	Average
6970.00	58.63	-18.66	39.97	54.00	14.03	Average
7235.00	61.48	-18.66	42.82	54.00	11.18	Average
7375.00	55.76	-18.66	37.10	54.00	16.90	Average
8295.00	55.08	-18.66	36.42	54.00	17.58	Average
9215.00	53.84	-18.66	35.18	54.00	18.82	Average

Mode	Z-Wave	Frequency	TX 923.1MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1844.00	30.52	5.84	9.48	45.84	74.00	28.16	Peak
2132.00	31.79	6.26	6.04	44.09	74.00	29.91	Peak
2436.00	32.20	6.61	5.30	44.11	74.00	29.89	Peak
2768.00	32.62	7.10	20.16	59.88	74.00	14.12	Peak
3692.00	32.99	8.39	3.80	45.18	74.00	28.82	Peak
4616.00	34.15	9.47	9.16	52.78	74.00	21.22	Peak
6460.00	36.03	11.27	4.73	52.03	74.00	21.97	Peak
7385.00	35.80	11.99	6.98	54.77	74.00	19.23	Peak
8310.00	35.96	13.25	1.87	51.08	74.00	22.92	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1844.00	45.84	-18.66	27.18	54.00	26.82	Average
2132.00	44.09	-18.66	25.43	54.00	28.57	Average
2436.00	44.11	-18.66	25.45	54.00	28.55	Average
2768.00	59.88	-18.66	41.22	54.00	12.78	Average
3692.00	45.18	-18.66	26.52	54.00	27.48	Average
4616.00	52.78	-18.66	34.12	54.00	19.88	Average
6460.00	52.03	-18.66	33.37	54.00	20.63	Average
7385.00	54.77	-18.66	36.11	54.00	17.89	Average
8310.00	51.08	-18.66	32.42	54.00	21.58	Average

Mode	Z-Wave	Frequency	TX 923.1MHz
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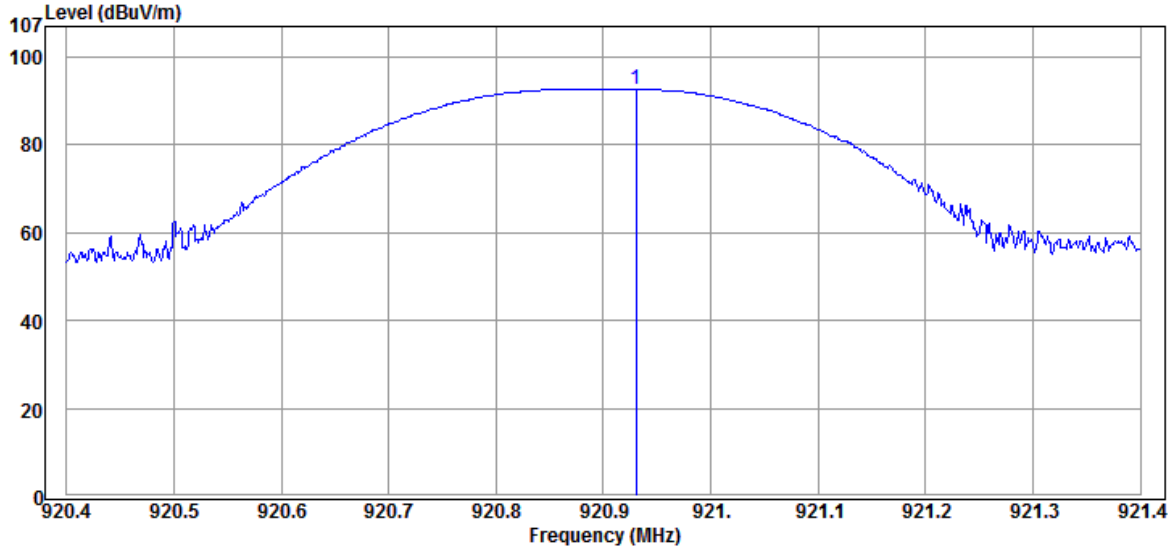
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
1500.00	28.00	5.32	8.32	41.64	74.00	32.36	Peak
1848.00	30.52	5.84	10.05	46.41	74.00	27.59	Peak
1956.00	31.24	6.01	18.20	55.45	74.00	18.55	Peak
2124.00	31.77	6.24	10.69	48.70	74.00	25.30	Peak
2440.00	32.23	6.63	6.44	45.30	74.00	28.70	Peak
2768.00	32.62	7.10	20.91	60.63	74.00	13.37	Peak
2984.00	32.88	7.43	9.27	49.58	74.00	24.42	Peak
3692.00	32.99	8.39	5.96	47.34	74.00	26.66	Peak
4616.00	34.15	9.47	9.36	52.98	74.00	21.02	Peak
5000.00	34.30	9.61	11.32	55.23	74.00	18.77	Peak
6460.00	36.03	11.27	4.52	51.82	74.00	22.18	Peak
6975.00	35.82	11.58	5.90	53.30	74.00	20.70	Peak
7385.00	35.80	11.99	9.05	56.84	74.00	17.16	Peak
8310.00	35.96	13.25	4.65	53.86	74.00	20.14	Peak
9230.00	36.53	14.71	2.21	53.45	74.00	20.55	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1500.00	41.64	-18.66	22.98	54.00	31.02	Average
1848.00	46.41	-18.66	27.75	54.00	26.25	Average
1956.00	55.45	-18.66	36.79	54.00	17.21	Average
2124.00	48.70	-18.66	30.04	54.00	23.96	Average
2440.00	45.30	-18.66	26.64	54.00	27.36	Average
2768.00	60.63	-18.66	41.97	54.00	12.03	Average
2984.00	49.58	-18.66	30.92	54.00	23.08	Average
3692.00	47.34	-18.66	28.68	54.00	25.32	Average
4616.00	52.98	-18.66	34.32	54.00	19.68	Average
5000.00	55.23	-18.66	36.57	54.00	17.43	Average
6460.00	51.82	-18.66	33.16	54.00	20.84	Average
6975.00	53.30	-18.66	34.64	54.00	19.36	Average
7385.00	56.84	-18.66	38.18	54.00	15.82	Average
8310.00	53.86	-18.66	35.20	54.00	18.80	Average
9230.00	53.45	-18.66	34.79	54.00	19.21	Average

A.2.2 Fundamental Frequency

Mode	Z-Wave	Frequency	TX 920.9MHz
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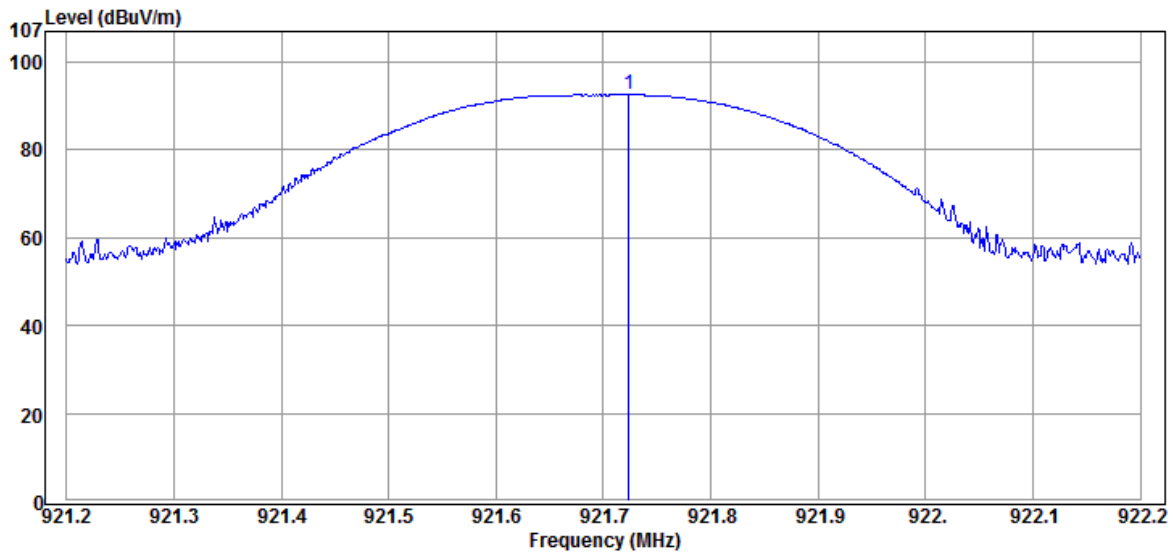


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
920.93	27.05	8.32	57.36	92.73	94.00	1.27	Peak

Remark: Horizontal is the strongest polarization and peak value has complied with average limit, so horizontal won't be listed in test report.

Mode	Z-Wave	Frequency	TX 921.7MHz
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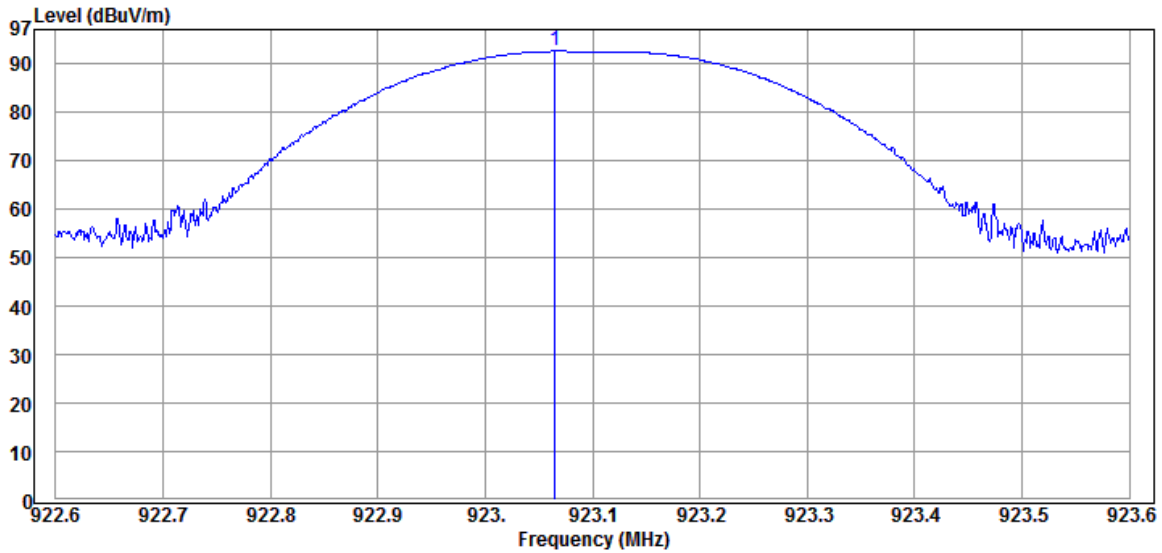


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
921.72	27.05	8.32	57.18	92.55	94.00	1.45	Peak

Remark: Horizontal is the strongest polarization and peak value has complied with average limit, so horizontal won't be listed in test report.

Mode	Z-Wave	Frequency	TX 923.1MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB $\mu$ V)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector
923.07	27.05	8.32	57.15	92.52	94.00	1.48	Peak

Remark: Horizontal is the strongest polarization and peak value has complied with average limit, so horizontal won't be listed in test report.

### A.3 EMISSION BANDWIDTH MEASUREMENT

Test Date	2018/07/12	Temp./Hum.	23°C/53%
Test Voltage	AC 120V 60Hz (Via AC Adapter)		

#### A.3.1 Emission Bandwidth

Mode	Centre Frequency (MHz)	20dB Occupied Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
Z-Wave	920.9	0.113	0.10619
	921.7	0.1115	0.10552
	923.1	0.1147	0.10589

#### A.3.2 Measurement Plots







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# APPDNDIX B

## TEST PHOTOGRAPHS

(Model: GWS-HZW1)