# FCC TEST REPORT

For

**In-Wall Capacitive Dimmer** 

Model Number: ZW3009

**FCC ID: U2ZZW3009** 

Report Number: WT178003393

Test Laboratory : Shenzhen Academy of Metrology and Quality Inspection

National Digital Electronic Product Testing Center

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# **Test report declaration**

Applicant : SHEENWAY ASIA LTD.

Address : Room1313, 13/F., AustinTower, 22-26AustinAvenu, TsimSha

Tsui, Kowloon. Hong Kong. China

Manufacturer : SHEENWAY ASIA LTD.

Address : Room1313, 13/F., AustinTower, 22-26AustinAvenu, TsimSha

Tsui, Kowloon. Hong Kong. China

EUT Description : In-Wall Capacitive Dimmer

Model No : ZW3009

FCC ID : U2ZZW3009

Test Standards:

FCC Part 15 (October 1, 2016 Edition)

ANSI C63.10-2013

The EUT described above is tested by Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory to determine the maximum emissions from the EUT. Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory is assumed full responsibility for the accuracy of the test results. 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 FCC Rules Part 15.249.

The test report is valid for above tested sample only and shall not be reproduced in part without written approval of the laboratory.

Project Engineer:	1838z	Date:	Jul.03,2017	
	(Chen Qichun)			
Checked by:	相互钢	Date:	Jul.03,2017	
	(Lin Yixiang)			
Approved by:	种八	Date:	_Jul.03,2017	
	(Lin Bin)			

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# Shenzhen Academy of Metrology & Quality Inspection

# **TC** National Digital Electronic Product Testing Center

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# 1. TEST RESULTS SUMMARY

Table 1 Test Results Summary

Tuote 1 Test Results Summary							
Test Items	FCC Rules	Test Results					
Conducted Disturbance	15.207	Pass					
Radiated disturbance	15.249	Pass					
Occupied Bandwidth	15.215	Pass					
Band Edges	15.249	Pass					
Antenna Requirement	15.203	Pass					

Remark: "N/A" means "Not applicable."

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#### 2. GENERAL INFORMATION

#### 2.1. Report information

- 2.1.1.This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that SMQ approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that SMQ in any way guarantees the later performance of the product/equipment.
- 2.1.2. The sample/s mentioned in this report is/are supplied by Applicant, SMQ therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.
- 2.1.3. Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through SMQ, unless the applicant has authorized SMQ in writing to do so.

#### 2.2. Laboratory Accreditation and Relationship to Customer

The testing report were performed by the Shenzhen Academy of Metrology and quality Inspection EMC Laboratory (Guangdong EMC compliance testing center), in their facilities located at No.4 TongFa Road, Xili Town, Nanshan District, Shenzhen, China. At the time of testing, Laboratory is accredited by the following organizations:

China National Accreditation Service for Conformity Assessment (CNAS) accredits the Laboratory for conformance to FCC standards, EMC international standards and EN standards. The Registration Number is CNAS L0579.

The Laboratory is listed in the United States of American Federal Communications Commission (FCC), and the registration number are 806614 (3m anechoic chamber), 446246 (10m anechoic chamber) and 994606 (10m anechoic chamber).

The Laboratory is registered to perform emission tests with Industry Canada (IC), and the registration number is 11177A.

TUV Rhineland accredits the Laboratory for conformance to IEC and EN standards, the registration number is UA 50303686.

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# 2.3. Measurement Uncertainty

Conducted Emission
9kHz~30MHz 3.5dB

Radiated Emission
30MHz~1000MHz 4.5dB
1GHz~18GHz 4.6dB

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# 3. PRODUCT DESCRIPTION

#### 3.1. EUT Description

Description : In-Wall Capacitive Dimmer

Manufacturer : SHEENWAY ASIA LTD.

Model Number : ZW3009

Rated Input : AC 120V/60Hz

Power supply : AC 120V/60Hz

Operate Frequency : 908.4MHz, 916MHz

Modulation 908.4MHz: FSK, 916MHz: GFSK

Antenna Designation : Integrated

## 3.2. Block Diagram of EUT Configuration



**Test Setup** 

#### 3.3. Operating Condition of EUT

Mode 1: Transmitting at 908.4MHz

Mode 2: Transmitting at 916MHz

Mode 3: Dimming, Receiving

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## 3.4. Special Accessories

Not available for this EUT intended for grant.

# 3.5. Equipment Modifications

Not available for this EUT intended for grant.

# 3.6. Support Equipment List

Table 2 Support Equipment List

Name	Model No	S/N	Manufacturer	

#### 3.7. Test Conditions

Date of test: Jun.27, 2017 - Jun.30, 2017

Date of EUT Receive: Jun.19, 2017

Temperature: (21-25) °C

Relative Humidity: (42-57)%

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# 4. TEST EQUIPMENT USED

Table 3 Test Equipment

Equipment	Manufacturer	Model No.	Last Cal.	Cal. Interval
Test Receiver	Rohde & Schwarz	ESCS30	Nov.29, 2016	1 Year
AMN	Rohde & Schwarz	ESH2-Z5	Jan.03, 2017	1 Year
EMI Test Receiver	Rohde & Schwarz	ESU40	Mar.21, 2017	1 Year
Broadband antenna	SCHWARZBECK	VULB9163	Mar.22, 2017	1 Year
Horn Antenna	Rohde & Schwarz	HF907	Mar.22, 2017	1 Year
Preamplifier	Rohde & Schwarz	SCU-18	Mar.06, 2017	1 Year
	Test Receiver  AMN  EMI Test Receiver  Broadband antenna  Horn Antenna	Test Receiver Rohde & Schwarz  AMN Rohde & Schwarz  EMI Test Receiver Rohde & Schwarz  Broadband antenna SCHWARZBECK  Horn Antenna Rohde & Schwarz	Test Receiver Rohde & Schwarz ESCS30  AMN Rohde & Schwarz ESH2-Z5  EMI Test Receiver Rohde & Schwarz ESU40  Broadband antenna SCHWARZBECK VULB9163  Horn Antenna Rohde & Schwarz HF907	Test Receiver Rohde & Schwarz ESCS30 Nov.29, 2016  AMN Rohde & Schwarz ESH2-Z5 Jan.03, 2017  EMI Test Receiver Rohde & Schwarz ESU40 Mar.21, 2017  Broadband antenna SCHWARZBECK VULB9163 Mar.22, 2017  Horn Antenna Rohde & Schwarz HF907 Mar.22, 2017

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#### 5. CONDUCTED DISTURBANCE TEST

#### 5.1. Test Standard and Limit

#### 5.1.1.Test Standard

FCC Part 15 15.207

#### 5.1.2.Test Limit

Table 4 Conducted Disturbance Test Limit

Fraguenov	Maximum RF Line Voltage (dB $\mu$ V)				
Frequency	Quasi-peak Level	Average Level			
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *			
500kHz~5MHz	56	46			
5MHz~30MHz	60	50			

<sup>\*</sup>Decreasing linearly with logarithm of the frequency

#### 5.2. Test Procedure

The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through an Artificial Mains Network (A.M.N.). AN EMI test receiver is used to test the emissions from both sides of AC line. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode.

The bandwidth of EMI test receiver is set at 9 kHz.

#### 5.3. Test Arrangement

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

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<sup>\*</sup>The lower limit shall apply at the transition frequency.

#### 5.4. Test Data

The emissions don't show in below are too low against the limits. Refer to the test curves.

Test mode 3: Dimming, Receiving (worst-case)

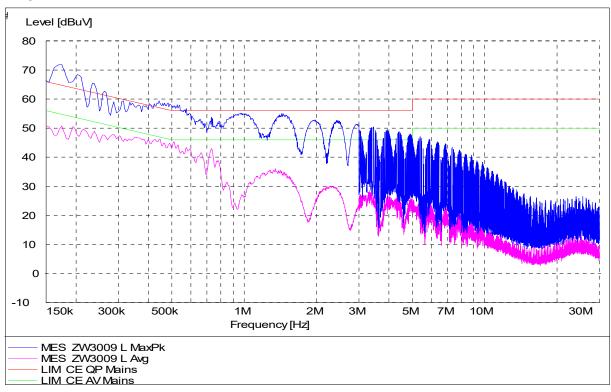
Table 5 Conducted Disturbance Test Data									
Model No.: ZW3009									
Test mode: 3									
			Line						
_	Q	P	AV	/	QP	AV			
Frequency	Level	Limit	Level	Limit	Reading	Reading	Factor		
MHz	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)		
0.174	62.3	64.8	50.5	54.8	52.6	40.8	9.7		
0.202	57.8	63.5	47.1	53.5	48.1	37.4	9.7		
0.234	56.3	62.3	48.0	52.3	46.6	38.3	9.7		
0.442	50.3	57.0	46.2	47.0	40.6	36.5	9.7		
0.538	48.2	56	41.8	46	38.4	32.0	9.8		
0.974	46.4	56	26.7	46	36.6	16.9	9.8		
1.450	45.1	56	34.5	46	35.3	24.7	9.8		
			Neutra	al					
_	Q	P	AV		QP	AV	F (		
Frequency	Level	Limit	Level	Limit	Reading	Reading	Factor		
MHz	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)		
0.174	62.8	64.8	50.6	54.8	53.1	40.9	9.7		
0.198	59.2	63.7	49.4	53.7	49.5	39.7	9.7		
0.242	52.6	62.0	47.7	52.0	42.9	38.0	9.7		
0.298	51.7	60.3	46.7	50.3	42.0	37.0	9.7		
0.526	49.6	56	43.9	46	39.8	34.1	9.8		
0.998	46.1	56	26.3	46	36.3	16.5	9.8		
1.486	45.9	56	34.0	46	36.1	24.2	9.8		

REMARKS: 1. Emission level(dBuV)=Read Value(dBuV) + Correction Factor(dB)

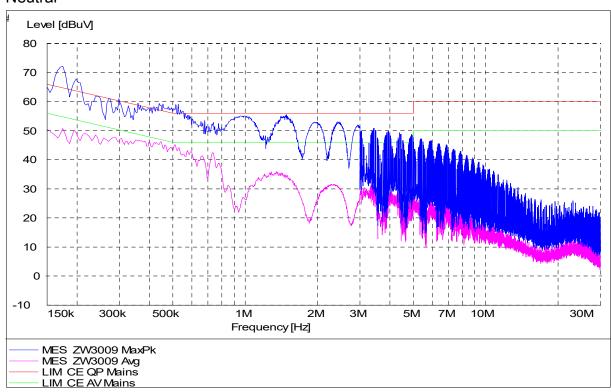
- 2. Correction Factor(dB) =LISN Factor (dB) + Cable Factor (dB)+Limiter Factor(dB)
- 3. The other emission levels were very low against the limit.

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#### Line



#### Neutral



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#### 6. RADIATED DISTURBANCE TEST

#### 6.1. Test Standard and Limit

#### 6.1.1.Test Standard

FCC Part 15 15.249

#### 6.1.2.Test Limit

Table 6 Radiated Disturbance Test Limit

FREQUENCY		FIELD	FIELD
MHz		STRENGTHS	STRENGTHS
		LIMITS	LIMITS
		(μV/m)	dB (μV/m)
Fundamen		50000	94.0
Harmonic	S	500	54.0
30 ~	88	100	40.0
88 ~	216	150	43.5
216 ~	960	200	46.0
960 ~		500	54.0

<sup>\*</sup> The lower limit shall apply at the transition frequency.

#### 6.2. Test Procedure

Radiated emission test below 1 GHz, test at SAC, the EUT is placed on a turntable, which is 0.8 meter above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can move up and down to find out the maximum emission level. Radiated emission test above 1 GHz, test at FAR, the EUT is placed on a non-conductive table, which is 1.5 meter above ground. Broadband antenna is used as a receiving antenna at frequency range 30MHz to 1000MHz, Horn antenna is used as a receiving antenna at frequency range above 1GHz. Both horizontal and vertical polarization of the antenna is set on test, in order to find out the max emission, the relative positions of this EUT was rotated through three orthogonal axes.

The RBW of the EMI test receiver is:

30~1000MHz 120KHz 1-18GHz 1MHz

#### 6.3. Test Arrangement

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture. The EUT shall be measured in the XYZ three positions, and the test data which was shown in the follow was the worst case.

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<sup>\*</sup> The test distance is 3m.

#### 6.4. Test Data

Table 7 Radiated Disturbance Test Data

Model No.: ZW3009

Test mode:	· •	Correction	Antenna	Reading	Emission			
Frequency (MHz)	Polarization	Factor (dB)	Factor (dB/m)	Value (dB µ V)	Level	Limits dB ( µ V/m)	EUT axes	Note
32.007	Vertical	0.6	12.3	9.5	22.4	40.0	Х	QP
38.658	Vertical	0.7	12.3	10.7	23.7	40.0	Х	QP
44.975	Vertical	0.7	13.6	7.9	22.2	40.0	Х	QP
908.400	Vertical	3.9	21.1	49.6	74.6	94	Х	Fundamental QP
1239.955	Vertical	-41.0	24.3	56.1	39.4	74	Х	PK
1239.955	Vertical	-41.0	24.3	45.3	28.6	54	Х	AV
2531.193	Vertical	-40.0	28.6	52.8	41.4	74	Х	PK
2531.193	Vertical	-40.0	28.6	38.4	27.0	54	Х	AV
4541.971	Vertical	-39.4	33.7	50.4	44.7	74	Х	Harmonics PK
4541.971	Vertical	-39.4	33.7	39.3	33.6	54	Х	Harmonics AV
6358.790	Vertical	-35.1	34.7	51.8	51.4	74	Х	Harmonics PK
6358.790	Vertical	-35.1	34.7	41.7	41.3	54	Х	Harmonics AV
9992.378	Vertical	-34.4	37.0	51.9	54.5	74	Х	Harmonics PK
9992.378	Vertical	-34.4	37.0	41.7	44.3	54	Х	Harmonics AV
40.447	Horizontal	0.7	13.6	-2.6	11.7	40.0	Х	QP
56.127	Horizontal	0.9	13.0	1.6	15.5	40.0	Х	QP
102.228	Horizontal	1.1	13.2	-0.2	14.1	43.5	Х	QP
908.400	Horizontal	3.9	21.1	58.9	83.9	94	Х	Fundamental QP
1239.956	Horizontal	-41.0	24.3	56.7	40.0	74	Х	PK
1239.956	Horizontal	-41.0	24.3	45.2	28.5	54	Х	AV
2725.241	Horizontal	-39.8	29.6	51.0	40.8	74	Х	Harmonics PK
2725.241	Horizontal	-39.8	29.6	37.9	27.7	54	Х	Harmonics AV

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#### Table 8 Radiated Disturbance Test Data

Model No.: ZW3009

Test mode:	2							
Frequency (MHz)	Polarization	Correction Factor (dB)	Antenna Factor (dB/m)	Reading Value (dB µ V)	Emission Level dB ( µ V/m)	Limits dB ( µ V/m)	EUT axes	Note
32.568	Horizontal	0.7	12.3	2.3	15.3	40.0	Х	QP
56.046	Horizontal	0.9	13.0	0.8	14.7	40.0	Х	QP
96.209	Horizontal	1.1	12.8	-1.4	12.5	43.5	Х	QP
916.000	Horizontal	3.9	21.1	55.2	80.2	94	Х	Fundamental QP
1239.959	Horizontal	-41.0	24.3	60.9	44.2	74	Х	PK
1239.959	Horizontal	-41.0	24.3	50.0	33.3	54	Х	AV
1592.646	Horizontal	-40.6	25.1	58.9	43.4	74	Х	PK
1592.646	Horizontal	-40.6	25.1	40.8	25.3	54	Х	AV
2936.196	Horizontal	-39.4	29.4	53.1	43.1	74	Х	PK
2936.196	Horizontal	-39.4	29.4	37.8	27.8	54	Х	AV
31.087	Vertical	0.6	12.3	8.3	21.2	40.0	Х	QP
38.718	Vertical	0.7	12.3	9.9	22.9	40.0	Х	QP
44.718	Vertical	0.7	13.6	7.4	21.7	40.0	Х	QP
916.000	Vertical	3.9	21.1	49.5	74.5	94	Х	Fundamental QP
1239.954	Vertical	-41.0	24.3	62.4	45.7	74	Х	PK
1239.954	Vertical	-41.0	24.3	50.1	33.4	54	Х	AV
1499.979	Vertical	-40.8	25.1	53.4	37.7	74	Х	PK
1499.979	Vertical	-40.8	25.1	41.1	25.4	54	Х	AV
8243.924	Vertical	-37.6	36.5	50.8	49.7	74	Х	Harmonics PK
8243.924	Vertical	-37.6	36.5	36.7	35.6	54	Х	Harmonics AV

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Table 9 Radiated Disturbance Test Data

Model No.:	ZW3009							
Test mode: 3	3							
Frequency (MHz)	Polarization	Correction Factor (dB)	Antenna Factor (dB/m)	Reading Value (dB $\mu$ V)	Emission Level dB ( $\mu$ V/m)	Limits dB ( µ V/m)	EUT axes	Note
33.897	Horizontal	0.7	12.3	-0.9	12.1	40.0	X	QP
48.891	Horizontal	0.7	13.6	-2.6	11.7	40.0	X	QP
103.105	Horizontal	1.2	13.2	-1.2	13.2	43.5	X	QP
225.95	Horizontal	1.7	11.2	0.3	13.2	46.0	X	QP
2147.764	Horizontal	-40.4	28.6	51.0	39.2	74	X	PK
2147.764	Horizontal	-40.4	28.6	37.1	25.3	54	X	AV
6400.047	Horizontal	-34.6	34.8	50.5	50.7	74	X	PK
6400.047	Horizontal	-34.6	34.8	36.4	36.6	54	X	AV
9586.443	Horizontal	-36.7	37.2	51.8	52.3	74	X	PK
9586.443	Horizontal	-36.7	37.2	37.9	38.4	54	X	AV
30.205	Vertical	0.6	12.3	7.3	20.2	40.0	X	QP
39.019	Vertical	0.7	12.3	7.9	20.9	40.0	X	QP
45.129	Vertical	0.8	13.6	2.5	16.9	40.0	X	QP
52.944	Vertical	0.7	13.3	-0.3	13.7	40.0	X	QP
4138.658	Vertical	-39.4	32.9	51.2	44.7	74	X	PK
4138.658	Vertical	-39.4	32.9	37.4	30.9	54	X	AV
6384.671	Vertical	-34.7	34.7	50.9	50.9	74	X	PK
6384.671	Vertical	-34.7	34.7	36.7	36.7	54	X	AV
8803.215	Vertical	-36.6	37.0	50.1	50.5	74	X	PK
8803.215	Vertical	-36.6	37.0	36.5	36.9	54	X	AV

 $Note: 1.\ Emission\ level (dBuV/m) = Reading\ Value (dBuV)\ +\ Correction\ Factor (dB) + Antenna\ Factor\ (dB/m)$ 

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<sup>2.</sup> Correction Factor(dB) = Cable Factor (dB)+Amplifier Factor(dB)

<sup>3.</sup> No other spurious and harmonic emissions were reported greater than listed emissions above table.

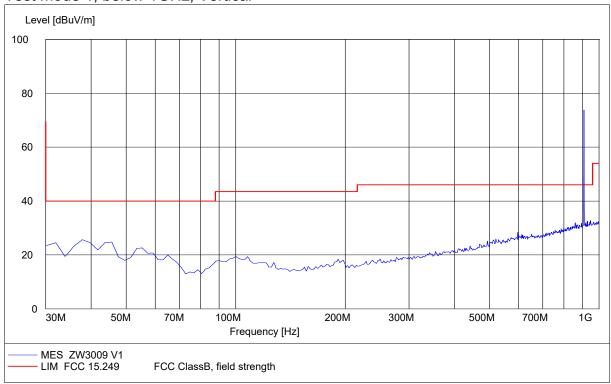
Table 10 Restricted Band Radiated Emission Data

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
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	
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	
6.31175 - 6.31225	123 - 138	2200 - 2300	
8.291 - 8.294	149.9 - 150.05	2310 - 2390	
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	
12.29 - 12.293	167.72 - 173.2	3332 - 3339	
12.51975 -	240 - 285	3345.8 - 3358	
12.52025	322 - 335.4	3600 - 4400	
12.57675 -			
12.57725			
13.36 - 13.41			

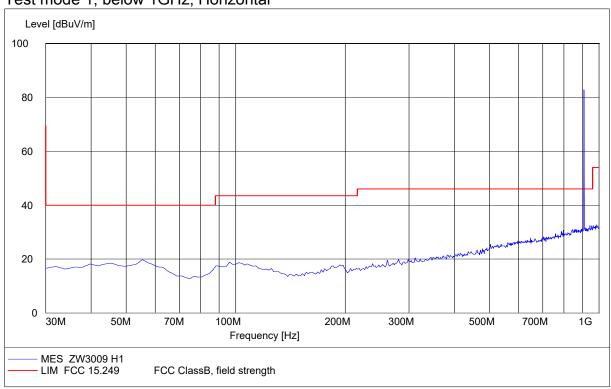
All the emission levels of the above band were less than the limit 20dB.

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# Test mode 1, below 1GHz, Vertical



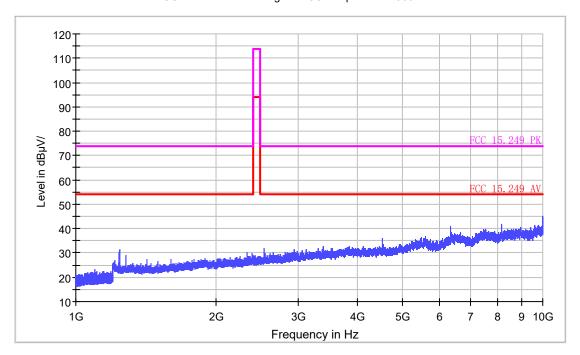
#### Test mode 1, below 1GHz, Horizontal



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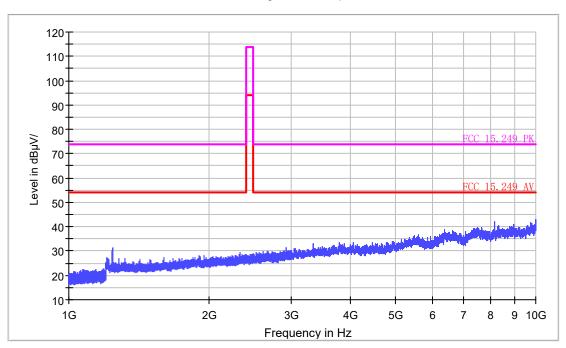
# Test mode 1, above 1GHz, Vertical

FCC Electric Field Strength 1-18GHz operate on 900MHz



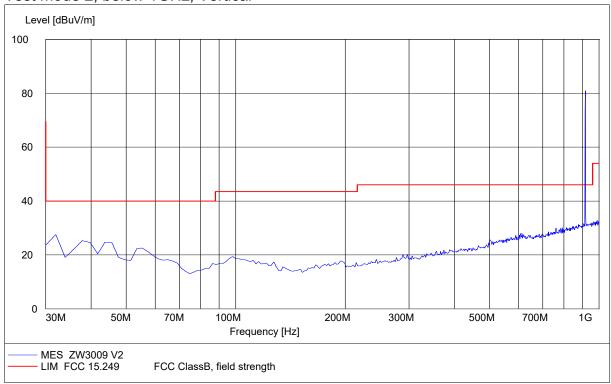
# Test mode 1, above 1GHz, Horizontal

FCC Electric Field Strength 1-18GHz operate on 900MHz

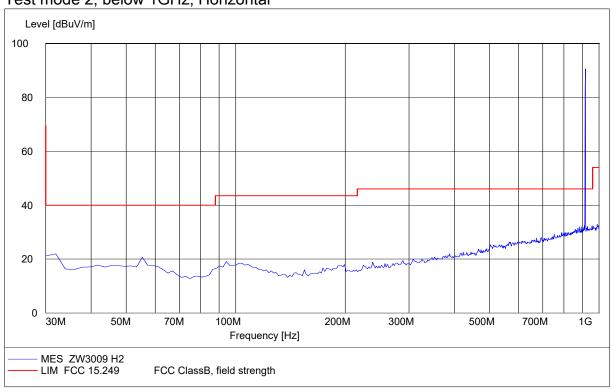


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# Test mode 2, below 1GHz, Vertical



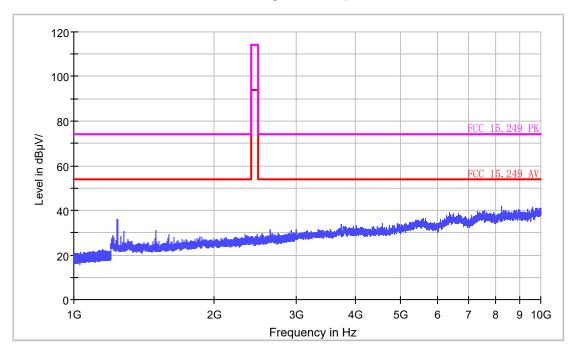
#### Test mode 2, below 1GHz, Horizontal



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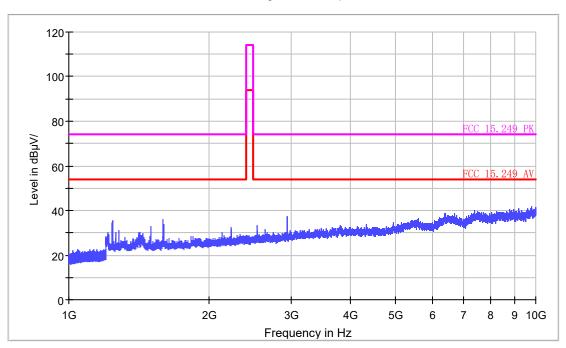
# Test mode 2, above 1GHz, Vertical

FCC Electric Field Strength 1-18GHz operate on 900MHz



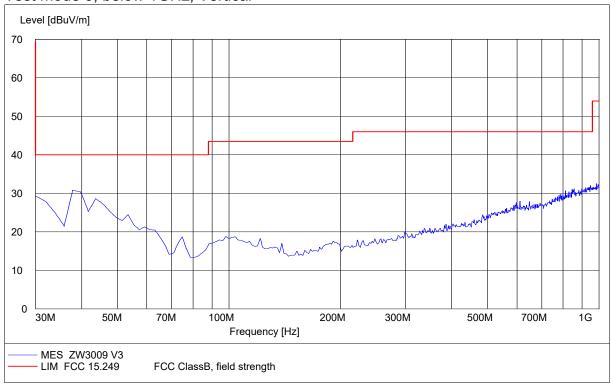
# Test mode 2, above 1GHz, Horizontal

FCC Electric Field Strength 1-18GHz operate on 900MHz

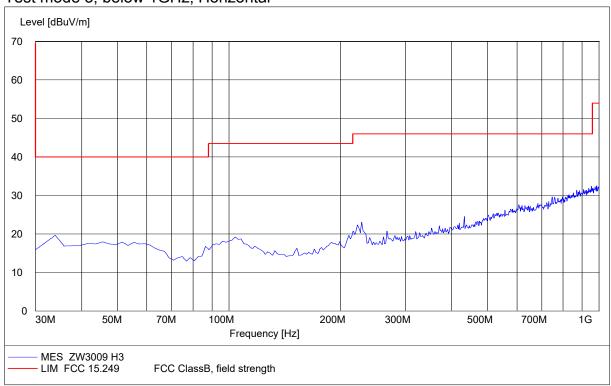


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# Test mode 3, below 1GHz, Vertical



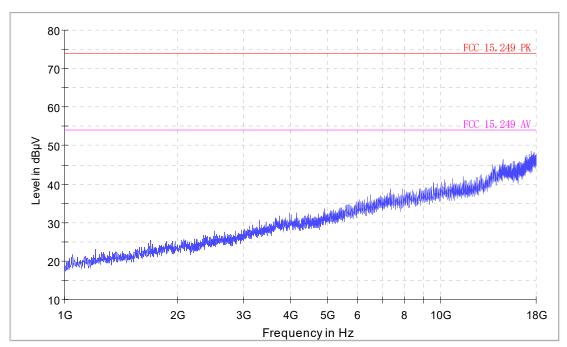
#### Test mode 3, below 1GHz, Horizontal



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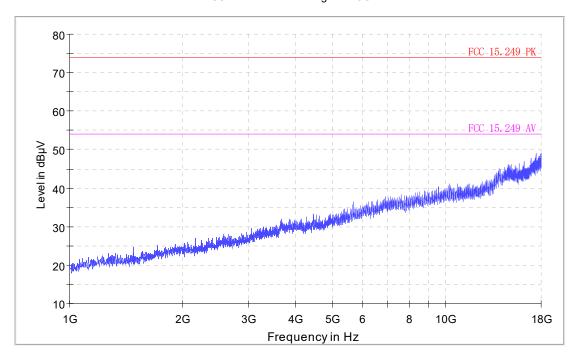
# Test mode 3, above 1GHz, Vertical

FCC Electric Field Strength 1-18GHz



#### Test mode 3, above 1GHz, Horizontal

FCC Electric Field Strength 1-18GHz



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#### 7. OCCUPIED BANDWIDTH

#### 7.1. Test Standard and Limit

#### 7.1.1.Test Standard

FCC Part 15 15.215

#### 7.2. Test Procedure

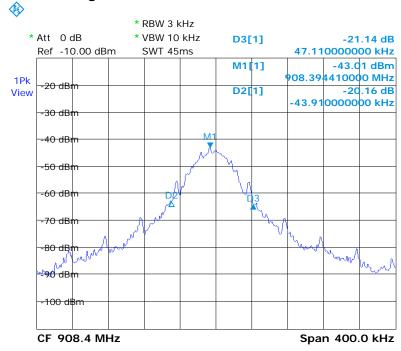
- 1. Set EUT as normal operation
- 2. Set EMI test receiver Center Frequency = fundamental frequency, RBW=1% to 5% of the OBW, VBW=3 times of RBW, Span=Wide enough to capture the complete power envelope.
- 3. Set EMI test receiver Max hold. Mark peak, -20dB.

#### 7.3. Test Arrangement

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

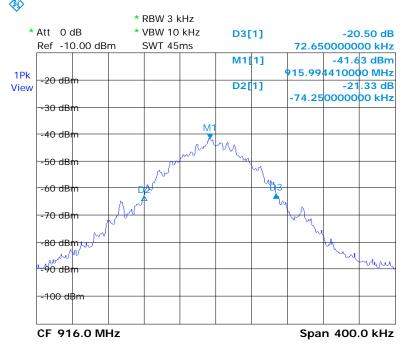
#### 7.4. Test Data

Transmitting at 908.4MHz: 20dB bandwidth =91.0kHz



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# Transmitting at 916MHz: 20dB bandwidth =146.9 kHz



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#### 8. BAND EDGE

#### 8.1. Test Standard and Limit

#### 8.1.1.Test Standard

FCC Part 15 15.249

#### 8.2. Band Edge FCC 15.249(d) Limit

Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation

#### 8.3. 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 instruments. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- 3. Measure the highest amplitude appearing on spectral display and set it as reference level. Plot the graph with marking the highest point and edge frequency.
- 4. Repeat above procedures until all measured frequencies were complete.

#### 8.4. Test Arrangement

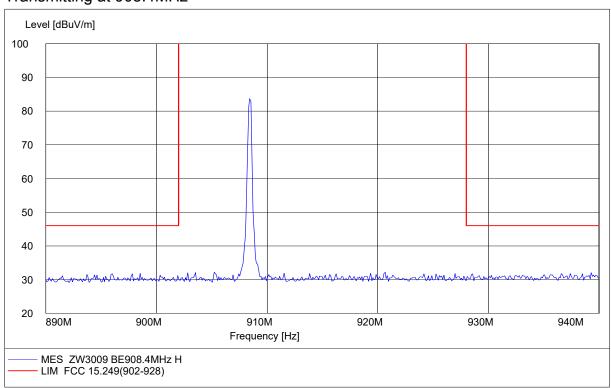
The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

#### 8.5. Test Data

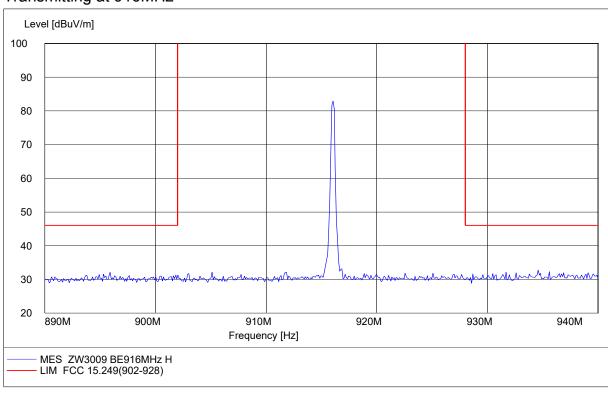
All the emission outside 902 to 928 is lower than 46 dB ( $\mu$  V/m). The detailed information refers to test picture.

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# Transmitting at 908.4MHz



#### Transmitting at 916MHz



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# 9. ANTENNA REQUIREMENT

According to Section 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 EUT has a built in antenna which is integrated inside the enclosure, this is permanently attached antenna and meets the requirements of this section.

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