

# FCC TEST REPORT

For

**Energy Monitoring Fluorescent Light & Appliance Module**

**Model Number: 45653, ZW4102**

**FCC ID: U2ZZW4102**

**Report Number : WT108002707**

Test Laboratory : Shenzhen Academy of Metrology and Quality  
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## Test report declaration

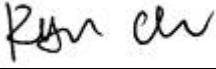


Applicant : SHEENWAY ASIA LTD.  
Address : Room 1313, 13/F., Austin Tower, Tsim Sha Tsui, Kowloon, Hong Kong.  
Manufacturer : SHEENWAY ASIA LTD.  
Address : Room 1313, 13/F., Austin Tower, Tsim Sha Tsui, Kowloon, Hong Kong.  
Factory : KONIG ELECTRONIC (HUIZHOU) LTD.  
Address : 2-Plant, East Lake Side, QingTang, Lian He Village, Shui Kou, Hui Cheng District, Huizhou, Guangdong, China.  
EUT Description : Energy Monitoring Fluorescent Light & Appliance Module  
Model No : 45653, ZW4102  
FCC ID : U2ZZW4102

### Test Standards:

**FCC Part 15 15.203, 15.207, 15.249**

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 C63.4 (2003) 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:  Date: Aug.20,2010  
(Ryan Chen)  
Checked by:  Date: Aug.20,2010  
(Dewelly Yang)  
Approved by:  Date: Aug.20,2010  
(Peter Lin)

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## 1. TEST RESULTS SUMMARY

Table 1 Test Results Summary

Test Items	FCC Rules	Test Results
Conducted Disturbance	15.207	N/A
Radiated disturbance	15.249	Pass
Occupied Bandwidth	15.249	Pass
Band Edges	15.249	Pass
Antenna Requirement	15.203	Pass

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

## **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 Bldg. of Metrology & Quality Inspection, Longzhu Road, Nanshan District, Shenzhen, Guangdong, 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 97379(open area test site) and 274801(semi anechoic chamber).

The Laboratory is listed in Voluntary Control Council for Interference by Information Technology Equipment (VCCI), and the registration number are R-1974(open area test site), R-1966(semi anechoic chamber), C-2117(mains ports conducted interference measurement) and T-180(telecommunication ports conducted interference measurement).

The Laboratory is registered to perform emission tests with Industry Canada (IC), and the registration number is IC4174.

TUV Rhineland accredits the Laboratory for conformance to IEC and EN standards, the registration number is E2024086Z02.

### **2.3.Measurement Uncertainty**

Conducted Emission

9kHz~30MHz 3.5dB

Radiated Emission

30MHz~1000MHz 4.5dB

1GHz~18GHz 4.6dB

### 3. PRODUCT DESCRIPTION

#### 3.1. EUT Description

Description : Energy Monitoring Fluorescent Light & Appliance Module

Manufacturer : SHEENWAY ASIA LTD.

Model Number : 45653, ZW4102

Rated Input : AC 120V, 60Hz

Operate Frequency : 908.4MHz

Modulation : FSK

Antenna : Printed antenna

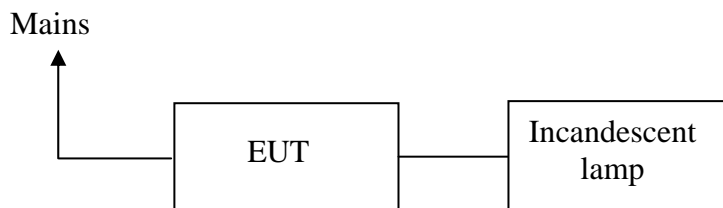
Designation

Remark: 45653 and ZW4102 are identical in schematic, structure and critical components except for model number, which vary with different customer.

#### 3.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: U2ZZW4102 filing to comply with Section 15.203, 15.207, 15.249 of the FCC Part 15, Subpart C Rules.

#### 3.3. Block Diagram of EUT Configuration



Test Setup

#### 3.4. Operating Condition of EUT

Test Mode 1: Transmitting at 908.4MHz

Test Mode 2: RX

### 3.5. Special Accessories

Not available for this EUT intended for grant.

### 3.6. Equipment Modifications

Not available for this EUT intended for grant.

### 3.7. Support Equipment List

Table 2 Support Equipment List

Name	Model No	S/N	Manufacturer
--	--	--	--

### 3.8. Test Conditions

Date of test: Jul.29, 2010-Apr.08, 2010

Date of EUT Receive: Jul.14, 2010

Temperature: 23-25 °C

Relative Humidity: 46-50%



#### 4. TEST EQUIPMENT USED

Table 3 Test Equipment

No.	Equipment	Manufacturer	Model No.	Last Cal.	Cal. Interval
SB2603	EMI Test Receiver	Rohde & Schwarz	ESCS30	Jan.22, 2010	1 Year
SB4357	AMN	Rohde & Schwarz	ENV216	Jan.22, 2010	1 Year
SB3436	EMI Test Receiver	Rohde & Schwarz	ESI26	Jan.22, 2010	1 Year
SB3440	Bilog Antenna	Chase	CBL6112B	Jan.22, 2010	1 Year
SB3435	Horn Antenna	Rohde & Schwarz	HF906	Jan.22, 2010	1 Year
SB3435/01	Amplifier(1-18GHz)	Rohde & Schwarz	---	Jan.22, 2010	1 Year
SB3435/02	Amplifier(18-40GHz)	Rohde & Schwarz	---	May.02, 2010	1 Year
SB3435/03	Horn Antenna	Rohde & Schwarz	AT4560	May.02, 2010	1 Year
SB3450/01	3m Semi-anechoic chamber	Albatross Projects	9X6X6	Jan.30, 2009	2 Years

## 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 (Class B)

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

\*Decreasing linearly with logarithm of the frequency

\*The lower limit shall apply at the transition 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 a Artificial Mains Network (A.M.N.). A EMI test receiver (R&S Test Receiver ESCS30) is used to test the emissions from both sides of AC line. According to the requirements in Section 7 and 13 of ANSI C63.4-2003. 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 9kHz.

### 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.

### 5.4. Test Data

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

Test mode 1: Transmitting at 908.4MHz (the worst case)

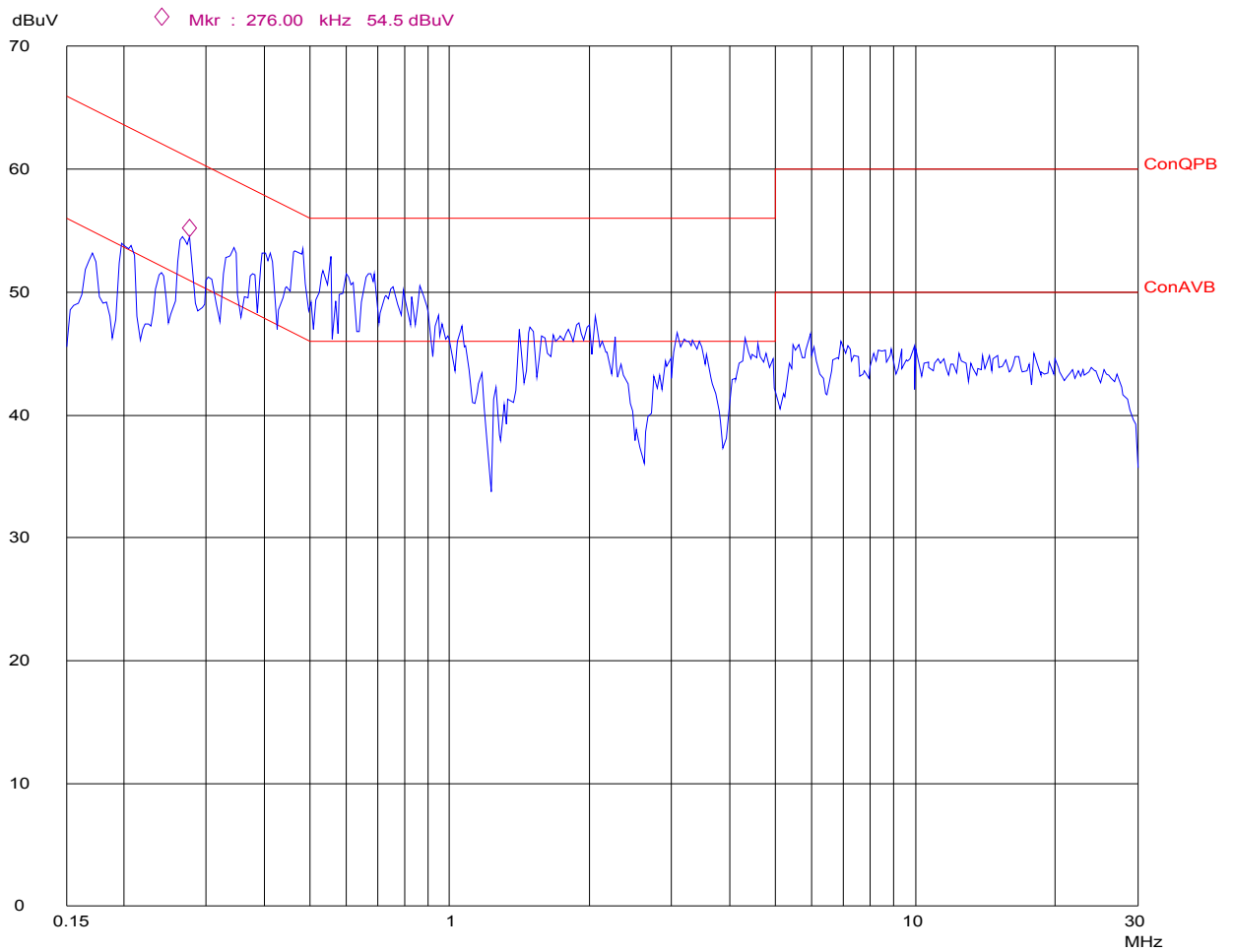
Table 5 Conducted Disturbance Test Data

Model No.: 45653							
Test mode: 1							
Line							
Frequency MHz	QP		AV		QP	AV	Factor (dB)
	Level (dBuV)	Limit (dBuV)	Level (dBuV)	Limit (dBuV)	Reading (dBuV)	Reading (dBuV)	
0.276	52.5	60.9	46.7	50.9	42.8	37.0	9.7
0.345	51.3	59.1	44.9	49.1	41.6	35.2	9.7
0.471	50.8	56.5	44.1	46.5	41.1	34.4	9.7
0.555	50.0	56	43.1	46	40.2	33.3	9.8
0.670	49.3	56	42.2	46	39.5	32.4	9.8
2.055	43.6	56	38.1	46	33.7	28.2	9.9
Neutral							
Frequency MHz	QP		AV		QP	AV	Factor (dB)
	Level (dBuV)	Limit (dBuV)	Level (dBuV)	Limit (dBuV)	Reading (dBuV)	Reading (dBuV)	
0.201	53.3	63.6	51.1	53.6	43.6	41.4	9.7
0.276	53.9	60.9	47.5	50.9	44.2	37.8	9.7
0.345	52.7	59.1	45.9	49.1	43.0	36.2	9.7
0.483	52.4	56.3	45.9	46.3	42.7	36.2	9.7
0.665	51.0	56	43.9	46	41.2	34.1	9.8
1.505	45.2	56	38.7	46	35.4	28.9	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.

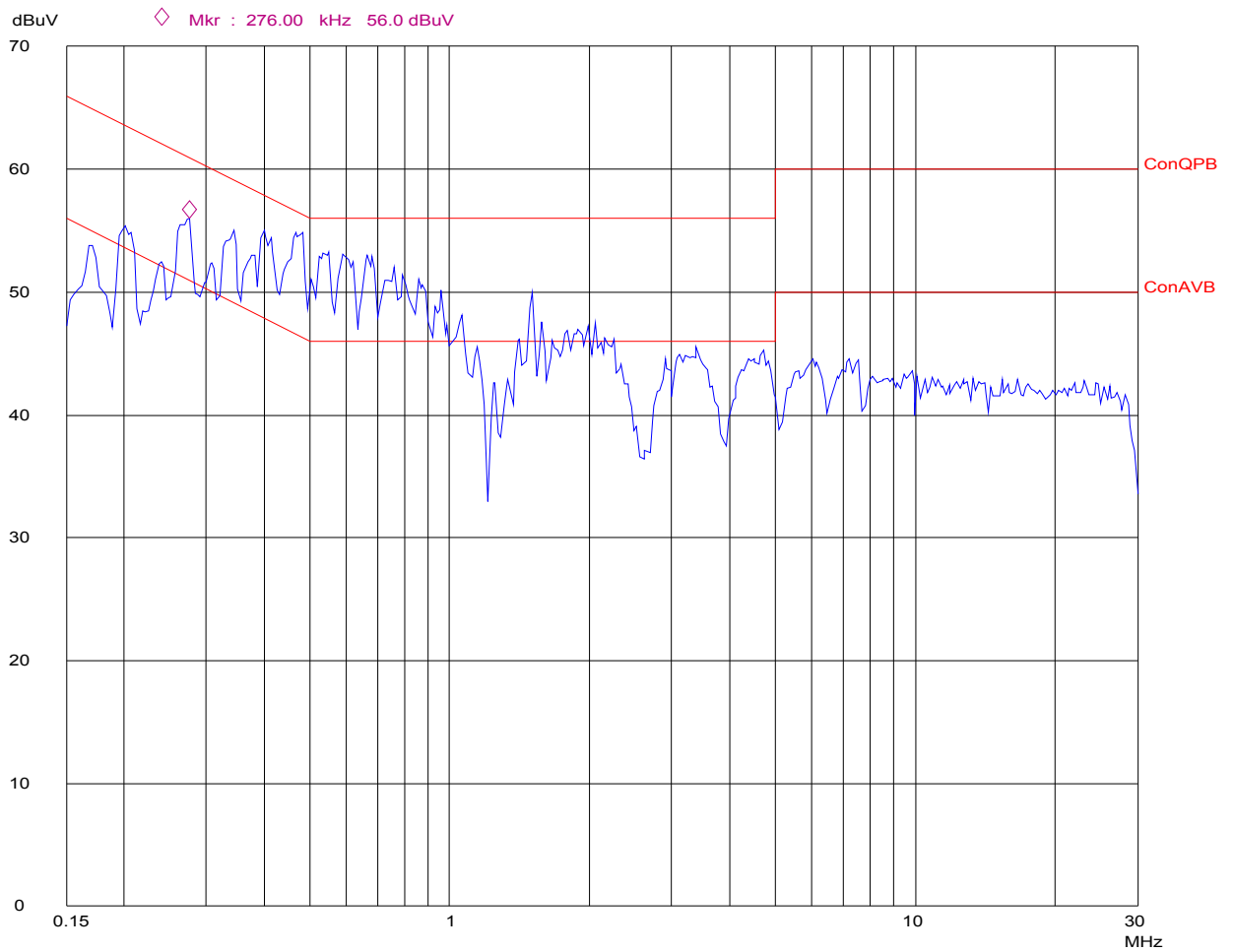
# Conducted Disturbance

EUT: M/N:45653  
Op Cond: TX  
Test Spec: L  
Comment: AC 120V/60Hz



# Conducted Disturbance

EUT: M/N:45653  
Op Cond: TX  
Test Spec: N  
Comment: AC 120V/60Hz



## 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 (Class B)

FREQUENCY MHz	FIELD STRENGTHS LIMITS ( $\mu\text{V/m}$ )	FIELD STRENGTHS LIMITS dB ( $\mu\text{V/m}$ )
Fundamental	50000	94.0
Harmonics	500	54.0
30 ~ 88	100	40.0
88 ~ 216	150	43.5
216 ~ 960	200	46.0
960 ~	500	54.0

\* The lower limit shall apply at the transition frequency.

\* The test distance is 3m.

### 6.2. Test Procedure

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 between 1 to 4 meters to find out the maximum emission level. Broadband antenna is used as a receiving antenna. 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 hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 and 13 of ANSI C63.4-2003.

The RBW of the EMI test receiver is :

30~1000MHz      120KHz  
1000-18000MHz   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 position, and the test data which was shown in the follow was the worst case.

## 6.4. Test Data

Table 7 Radiated Disturbance Test Data

Model No.: 45653								
Test mode: 1								
Frequency (MHz)	Polarization	Reading Value (dB $\mu$ V)	Correction Factor (dB)	Antenna Factor (dB/m)	Emission Level dB ( $\mu$ V/m)	Limits dB ( $\mu$ V/m)	EUT axes	Note
30.124	Horizontal	5.0	0.9	18.8	24.7	40.0	X	QP
72.450	Horizontal	14.6	1.4	7.8	23.8	40.0	X	QP
908.402	Horizontal	61.6	5.1	20.7	87.4	94.0	X	Fundamental QP
1816.816	Horizontal	54.4	-32.3	27.2	49.3	74.0	X	Harmonics PK
1816.816	Horizontal	48.5	-32.3	27.2	43.4	54.0	X	Harmonics AV
30.214	Vertical	18.7	0.9	18.8	38.4	40.0	X	QP
37.231	Vertical	22.2	1.2	15.3	38.7	40.0	X	QP
73.511	Vertical	20.0	1.4	7.8	29.2	40.0	X	QP
908.420	Vertical	61.7	5.1	20.7	87.5	94.0	X	Fundamental QP
1816.808	Vertical	57.5	-32.3	27.2	52.4	74.0	X	Harmonics PK
1816.808	Vertical	51.4	-32.3	27.2	46.3	54.0	X	Harmonics AV
2725.219	Vertical	48.3	-31.8	29.9	46.4	74.0	X	Harmonics PK
2725.219	Vertical	41.0	-31.8	29.9	39.1	54.0	X	Harmonics AV
Above 2725.219	Not detected							

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

2. Correction Factor(dB) = Cable Factor (dB)+Amplifier Factor(dB)

3. The other emission levels were less than the limit 20dB

Table 8 Radiated Disturbance Test Data

Model No.: 45653								
Test mode: 2								
Frequency (MHz)	Polarization	Reading Value (dB $\mu$ V)	Correction Factor (dB)	Antenna Factor (dB/m)	Emission Level dB ( $\mu$ V/m)	Limits dB ( $\mu$ V/m)	EUT axes	Note
30.222	Horizontal	3.7	0.9	18.8	23.4	40.0	X	QP
72.456	Horizontal	15.9	1.4	7.8	25.1	40.0	X	QP
30.224	Vertical	18.1	0.9	18.8	37.8	40.0	X	QP
37.211	Vertical	21.2	1.2	15.3	37.7	40.0	X	QP
73.500	Vertical	20.3	1.4	7.8	29.5	40.0	X	QP
Above 1000	Not detected							

- Note: 1. Emission level(dBuV/m)=Reading Value(dBuV) + Correction Factor(dB)+Antenna Factor (dB/m)  
 2. Correction Factor(dB) = Cable Factor (dB)+Amplifier Factor(dB)  
 3. The other emission levels were less than the limit 20dB



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			

Except as shown in table 7 to table 8, all other emission of the above band were less than the limit 20dB.

## 7. OCCUPIED BANDWIDTH

### 7.1. Test Standard and Limit

#### 7.1.1. Test Standard

FCC Part 15

### 7.2. Test Procedure

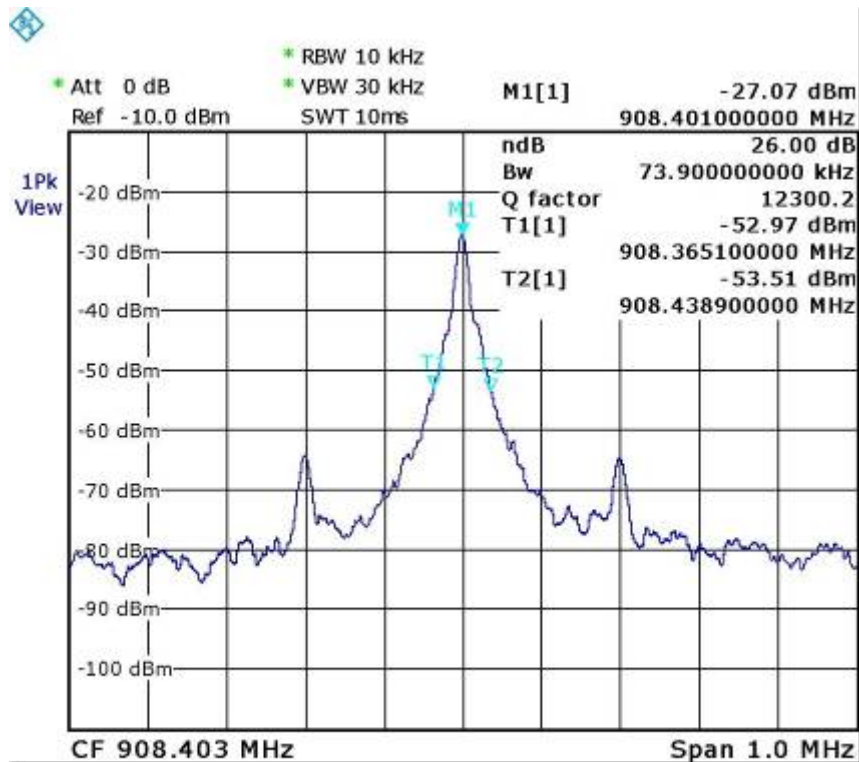
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set EMI test receiver(ESIB26) Center Frequency = fundamental frequency, RBW=10kHz, VBW= 30kHz, Span=1MHz.
4. Set EMI test receiver(ESIB26) Max hold. Mark peak, -26dB.

### 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

26dB bandwidth =73.9 kHz



## **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**

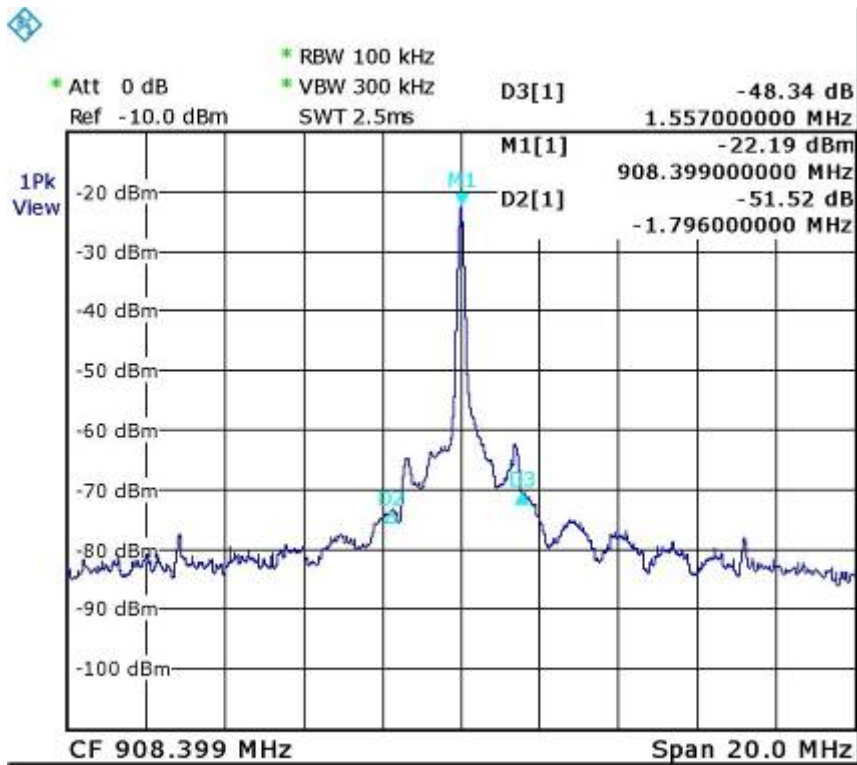
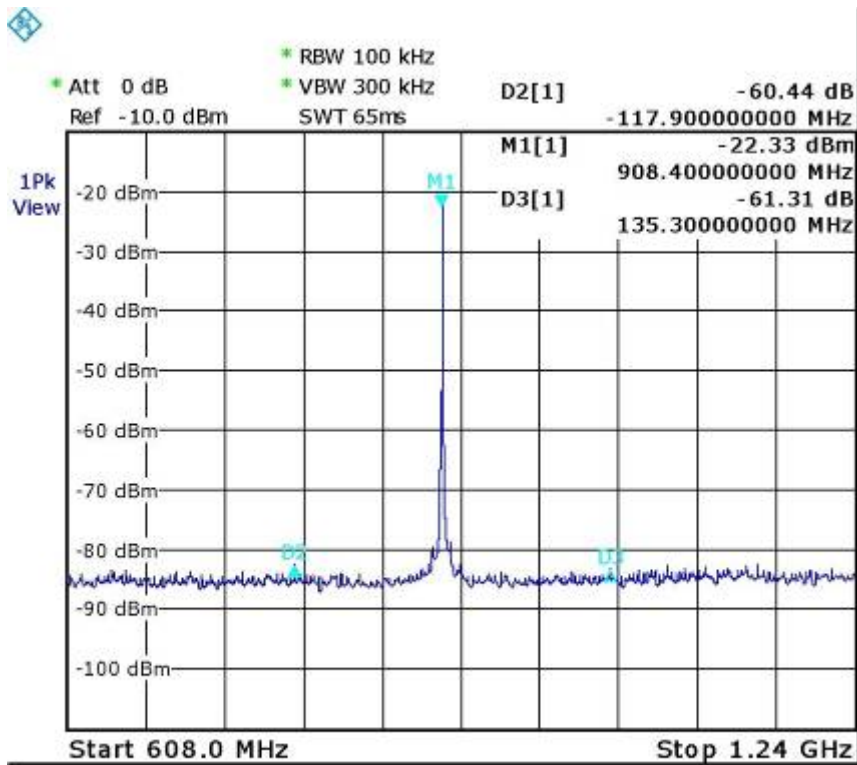
The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application. The detailed information refers to test picture.

### **8.5. Test Data**

All the emission outside 902 to 928 is lower than 46 dB ( $\mu\text{V}/\text{m}$ ).

NOTE 1: The band edge emission plot of on page 26 low frequency shows 48.3dBc. The emission of carrier strength list in the test result of Fundamental is 87.5dBuV/m (QP), so the maximum field strength in restrict band is  $87.5-48.3=39.2\text{dBuV}/\text{m}$  which is under 46dBuV/m limit.

NOTE 2: The band edge emission plot of on page 26 high frequency shows 51.5dBc. The emission of carrier strength list in the test result of Fundamental is 87.5dBuV/m (QP), so the maximum field strength in restrict band is  $87.5-51.5=36.0\text{dBuV}/\text{m}$  which is under 46dBuV/m limit.



## **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 a printed antenna which is integrated inside the enclosure, this is permanently attached antenna and meets the requirements of this section.