

**TEST REPORT**

Applicant Name & Address : Arrayent Health LLC d/b/a Ambio Health  
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United States

Sample Description

Product	: PIR Motion Sensor
FCC ID	: Q4O-1-71
Model No.	: LH-939F-AH
Electrical Rating	: 4.5V DC
Frequency	: 908 – 919 MHz

Date Received : 11 April 2013

Date Test Conducted : 15 April 2013 – 23 April 2013

Test standards : FCC Part 15: 2011

Test Result : Pass

Conclusion : The submitted samples complied with the above rules/standards.

Remark : None.

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## 1. General Description

### 1.1 Product Description

The equipment under test (EUT) is a transceiver at 908-919MHz, it's a Passive infrared (heat) sensor, it can send a signal to Gateway when the sensor detects some movements in the room, it can also report its status when asked by Gateway.

The EUT is powered by 4.5V DC.

We test the sample to determine if it was in compliance with the relevant FCC standards. We found that the unit met the requirements of FCC part 15.249 when tested as received. The worst case's test data was presented in this test report.

Frequency table as below:

Channel	Frequency (MHz)
0	908.45
1	908.82
2	909.20
3	909.57
4	909.95
5	910.32
6	910.70
7	911.07
8	911.45
9	911.82
10	912.20
11	912.57
12	912.94
13	913.32
14	913.69
15	914.07
16	914.44
17	914.82
18	915.19
19	915.57
20	915.94
21	916.31
22	916.69
23	917.06
24	917.44
25	917.81
26	918.19
27	918.56
28	918.94
29	919.31
30	919.69

**1.2 Related Submittal (s) / Grants**

N/A.

**1.3 Test Methodology**

Radiated emission measurements were performed according to the procedures in ANSI C63.10 :2009. Radiated emission measurement was performed in semi-anechoic chamber room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

**1.4 Test Facility**

The Semi-Anechoic chamber used to collect the radiated data is Guangdong Environment Radiation Monitoring Center located at No.860 South Guangzhou Avenue, Guangzhou 510300 China. This test facility and site measurement data have been fully placed on file with the FCC, test firm registration number is 667318.

**Test Equipment List**

Equip No.	Equipment	Manufacturer	Model No.	Cal. Date	Due Date
1.001	3m chamber	ABLATROSS	SAC-3	07 Jul 2012	07 Jul 2013
1.002	EMI receiver	ROHDE & SCHWARZ	ESCI-3	02 Jul 2012	02 Jul 2013
1.011	Biconilog Antenna	ROHDE & SCHWARZ	SWB-VULB 9163	07 Jul.2012	07 Jul.2013
1.001	3m chamber	ABLATROSS	SAC-3	28 Jun.2012	28 Jun.2013
1.003	Spectrum Analyzer	ROHDE & SCHWARZ	FSP30	28 Nov.2012	28 Nov.2013
1.009	Amplifier	B&Z TECHNOLOGIES	SCA-SCU18	07 Jul.2012	07 Jul.2013
1.010	Horn Antenna	ROHDE & SCHWARZ	HF906	07 Jul.2012	07 Jul.2013

## **1.5 Measurement Uncertainty**

Radiated Emission: 3.2dB in the frequency range of 30MHz-10GHz at a level of confidence of 95%.

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

## **2. System Test Configuration**

### **2.1 Justification**

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 : 2009.

The EUT was powered by 4.5V DC in the testing.

Type of modulation: FSK modulation, and only the worst data was reported in this report.

For maximizing emissions, the unit was placed in the center of the turntable, and the turntable was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Chapter 3.

### **2.2 EUT Exercising Software**

There was no special software to exercise the device.

### **2.3 Special Accessories**

No special accessories used.

### **2.4 Equipment Modification**

Any modifications installed previous to testing by Arrayent Health LLC d/b/a Ambio Health will be incorporated in each production model sold/leased in the United States. No modifications were installed by Intertek Testing Services Shenzhen Ltd. Guangzhou Branch.

### **2.5 Support Equipment List and Description**

N/A

### 3. Summary of Test Results

FCC Rules	Description of Test	Result
15.203	Antenna Requirement	Pass
15.207	Disturbance Voltage at the Mains Terminals	N/A
15.215	20 dB bandwidth	Pass
15.249	Radiated Emission	Pass
15.249	Band Edges Measurement	Pass

Remark: When determining the test results, measurement uncertainty of tests has been considered.

#### 3.1 Antenna Requirement

The EUT Antenna Type: PCB antenna.

### 3.2 Radiated Emission

Data is included worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

The measurement was applied in a 3 m semi-anechoic chamber. The EUT was placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mask. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

Broadband antenna was used as receiving antenna. Both horizontal and vertical polarization of the antenna was set on measurement. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2009 requirement during radiated test. The RBW setting on R&S Test Receiver was 120 kHz for 30MHz to 1000MHz, and 1MHz for above 1GHz, VBW is 3 times as RBW.

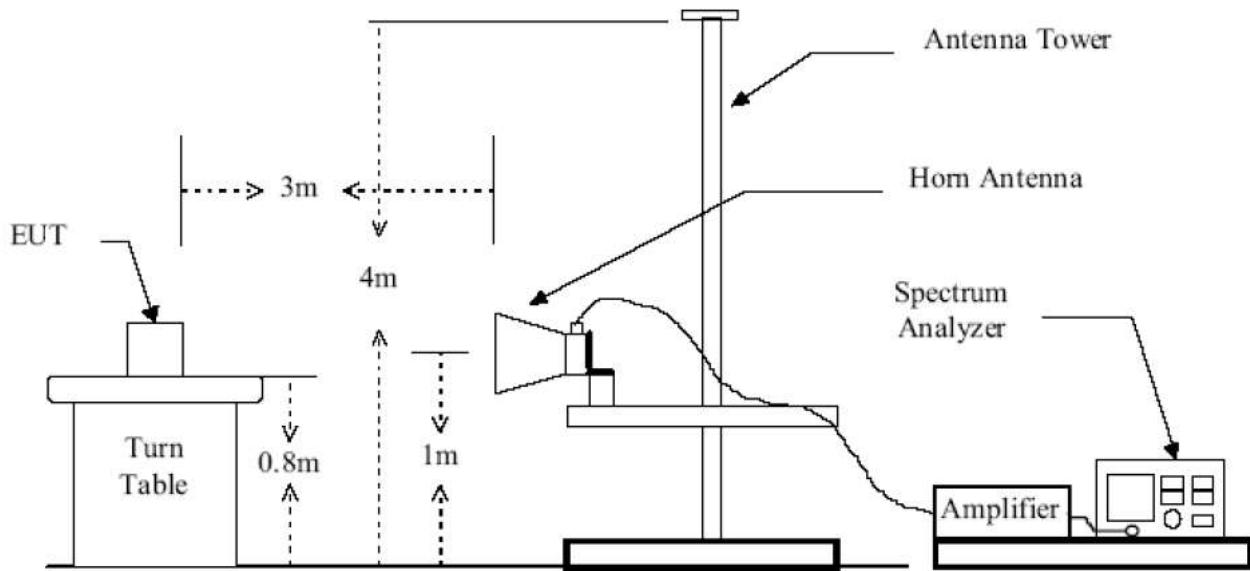
The RE measurement was made with EUT in three axes to find the maximum emission, the worst data was showed in the report.

#### 3.2.1 Radiated Emission Limits

According to FCC 15.249, operating within the bands 902-928 MHz, the field strength of emissions from intentional radiators operated within this frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902-928	50	500

### 3.2.2 Test Setup



### 3.2.3 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

$$\begin{aligned} \text{FS} &= \text{RA} + \text{AF} + \text{CF} - \text{AG} + \text{PD} + \text{AV} \\ \rightarrow \quad \text{FS} &= \text{RA} + \text{Correct Factor} + \text{AV} \end{aligned}$$

Where      FS = Field Strength in dB $\mu$ V/m  
RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V  
CF = Cable Attenuation Factor in dB  
AF = Antenna Factor in dB  
AG = Amplifier Gain in dB  
PD = Pulse Desensitization in dB  
AV = Average Factor in -dB  
Correct Factor = AF + CF – AG + PD

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$\text{FS} = \text{RA} + \text{AF} + \text{CF} - \text{AG} + \text{PD} + \text{AV}$$

Assume a receiver reading of 62.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$\begin{aligned} \text{RA} &= 62.0 \text{ dB}\mu\text{V} \\ \text{AF} &= 7.4 \text{ dB} \\ \text{CF} &= 1.6 \text{ dB} \\ \text{AG} &= 29.0 \text{ dB} \\ \text{PD} &= 0 \text{ dB} \\ \text{AV} &= -10 \text{ dB} \end{aligned}$$

$$\text{Correct Factor} = 7.4 + 1.6 - 29.0 + 0 = -20 \text{ dB}$$

$$\text{FS} = 62 + (-20) + (-10) = 32 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

## 3.2.4 Radiated Emission Test Data

Operation: EUT on transmitting

## Radiated Emissions

908.45MHz  
Emissions Requirement (below 1GHz)

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Correction Factor (dB)	Net at 3m (dB $\mu$ V/m)	QP Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	99.360	-3.5	14.5	11.0	43.5	-35.0
Horizontal	409.980	-2.6	19.3	16.7	46.0	-29.3
Horizontal	908.340	37.8	30.6	68.4	94.0	-25.6
Vertical	98.880	-3.6	14.5	10.9	43.5	-32.6
Vertical	401.880	-4.1	20.5	16.4	46.0	-29.6
Vertical	908.340	25.2	30.6	55.8	94.0	-38.2

## Emissions Requirement(above 1GHz)

Polarization	Frequency (MHz)	PK Reading (dB $\mu$ V)	Correction Factor (dB)	PK Net at 3m (dB $\mu$ V/m)	AV Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	1816.000	40.0	-13.5	26.5	54.0	-27.5
Horizontal	2724.000	40.8	-11.4	29.4	54.0	-24.6
Horizontal	6977.600	46.5	-2.2	44.3	54.0	-9.7
Vertical	1816.000	40.0	-13.5	26.5	54.0	-27.5
Vertical	2724.000	40.9	-11.4	29.5	54.0	-24.5
Vertical	7706.400	45.5	-1.0	44.5	54.0	-9.5

Notes:

1. AT frequencies equal to or less than 1000MHz, quasi-peak detector was used, above 1000MHz, Peak detector was used.
2. All measurements were made at 3 meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. The tests were performed on the EUT with 100% duty cycle.
6. Peak data is below AV limit, so no AV data was calculated, this is deemed to fulfil the standard.

**914.07MHz****Emissions Requirement (below 1GHz)**

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Correction Factor (dB)	Net at 3m (dB $\mu$ V/m)	QP Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	98.760	-3.7	14.5	10.8	43.5	-32.7
Horizontal	408.180	-4.1	20.7	16.6	46.0	-29.4
Horizontal	914.040	29.2	30.6	59.8	94.0	-34.2
Vertical	97.920	-4.3	14.4	10.1	43.5	-33.4
Vertical	405.540	-4.1	20.6	16.5	46.0	-29.5
Vertical	914.040	14.1	30.6	44.7	94.0	-49.3

**Emissions Requirement(above 1GHz)**

Polarization	Frequency (MHz)	PK Reading (dB $\mu$ V)	Correction Factor (dB)	PK Net at 3m (dB $\mu$ V/m)	AV Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	1828.000	39.2	-13.4	25.8	54.0	-28.2
Horizontal	2742.000	40.8	-11.4	29.4	54.0	-24.6
Horizontal	6008.800	44.3	-3.3	41.0	54.0	-13.0
Vertical	1828.000	39.7	-13.4	26.3	54.0	-27.7
Vertical	2742.000	40.8	-11.4	29.4	54.0	-24.6
Vertical	8167.600	45.8	-0.3	45.5	54.0	-8.5

Notes:

1. AT frequencies equal to or less than 1000MHz, quasi-peak detector was used, above 1000MHz, Peak detector was used.
2. All measurements were made at 3 meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. The tests were performed on the EUT with 100% duty cycle.
6. Peak data is below AV limit, so no AV data was calculated, this is deemed to fulfil the standard.

**919.69MHz****Emissions Requirement (below 1GHz)**

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Correction Factor (dB)	Net at 3m (dB $\mu$ V/m)	QP Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	100.560	-4.3	14.6	10.3	43.5	-33.2
Horizontal	605.220	-2.9	24.9	22.0	46.0	-24.0
Horizontal	919.620	34.7	30.4	65.1	94.0	-28.9
Vertical	101.400	-4.2	14.5	10.3	43.5	-33.2
Vertical	418.020	-4.1	20.4	16.3	46.0	-29.7
Vertical	919.980	12.2	30.4	42.6	94.0	-51.4

**Emissions Requirement(above 1GHz)**

Polarization	Frequency (MHz)	PK Reading (dB $\mu$ V)	Correction Factor (dB)	PK Net at 3m (dB $\mu$ V/m)	AV Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	1838.000	39.4	-13.3	26.1	54.0	-27.9
Horizontal	2757.200	40.4	-11.3	29.1	54.0	-24.9
Horizontal	5978.800	44.6	-3.3	41.3	54.0	-12.7
Vertical	1838.000	39.4	-13.3	26.1	54.0	-27.9
Vertical	2757.200	40.4	-11.3	29.1	54.0	-24.9
Vertical	5526.400	44.7	-3.7	41.0	54.0	-13.0

Notes:

1. AT frequencies equal to or less than 1000MHz, quasi-peak detector was used, above 1000MHz, Peak detector was used.
2. All measurements were made at 3 meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. The tests were performed on the EUT with 100% duty cycle.
6. Peak data is below AV limit, so no AV data was calculated, this is deemed to fulfil the standard.

### 3.2.5 Test Result

The data on the above test result table lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

According 15.249, the worst case radiated emission at 8167.600 MHz  
Judgement: Passed by 8.5dB

## 3.3 Band Edges Measurement

### 3.3.1 Limited of the band edges measurement

Sec15.249:

(d) Emissions 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.

The test method is referred to clause 6.9.3 of ANSI C63.10:2009.

Sec15.215:

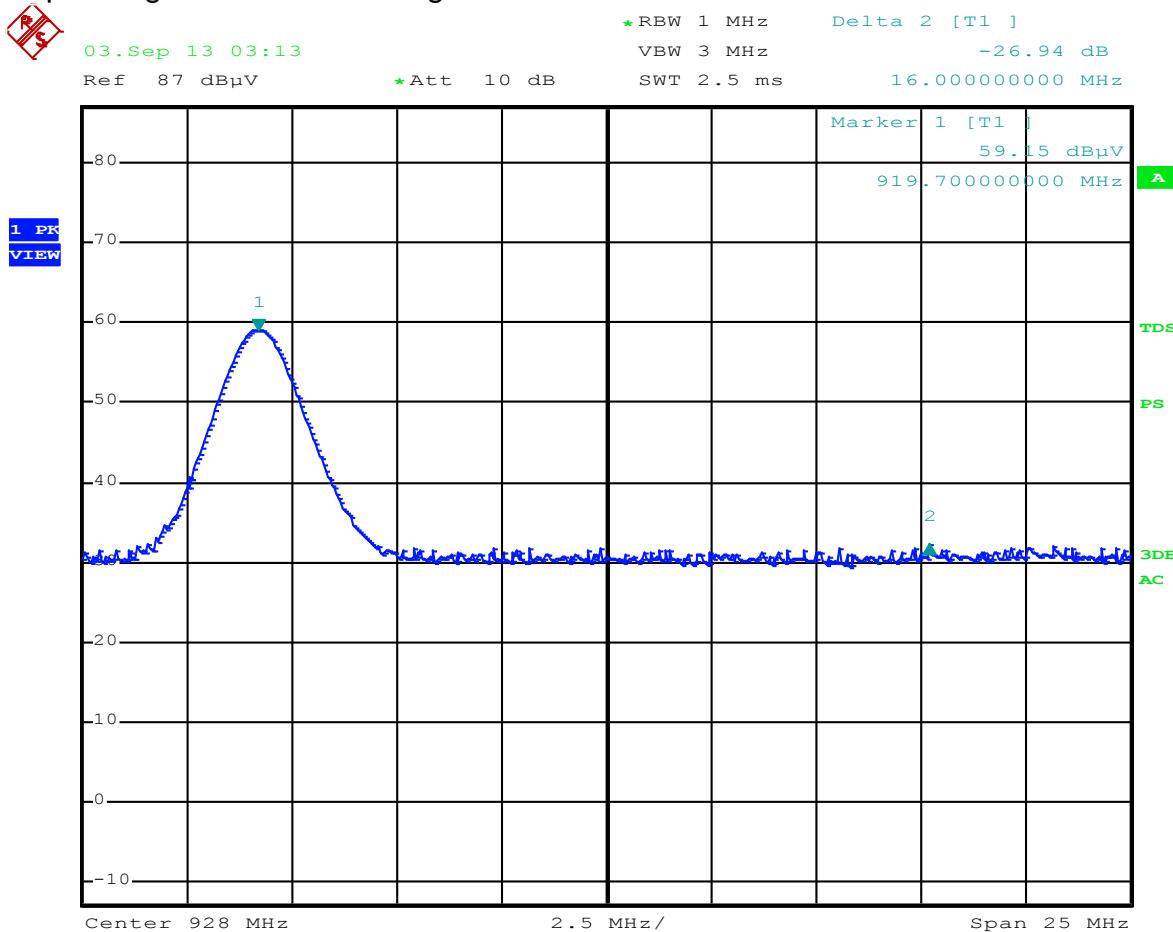
(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20dB bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

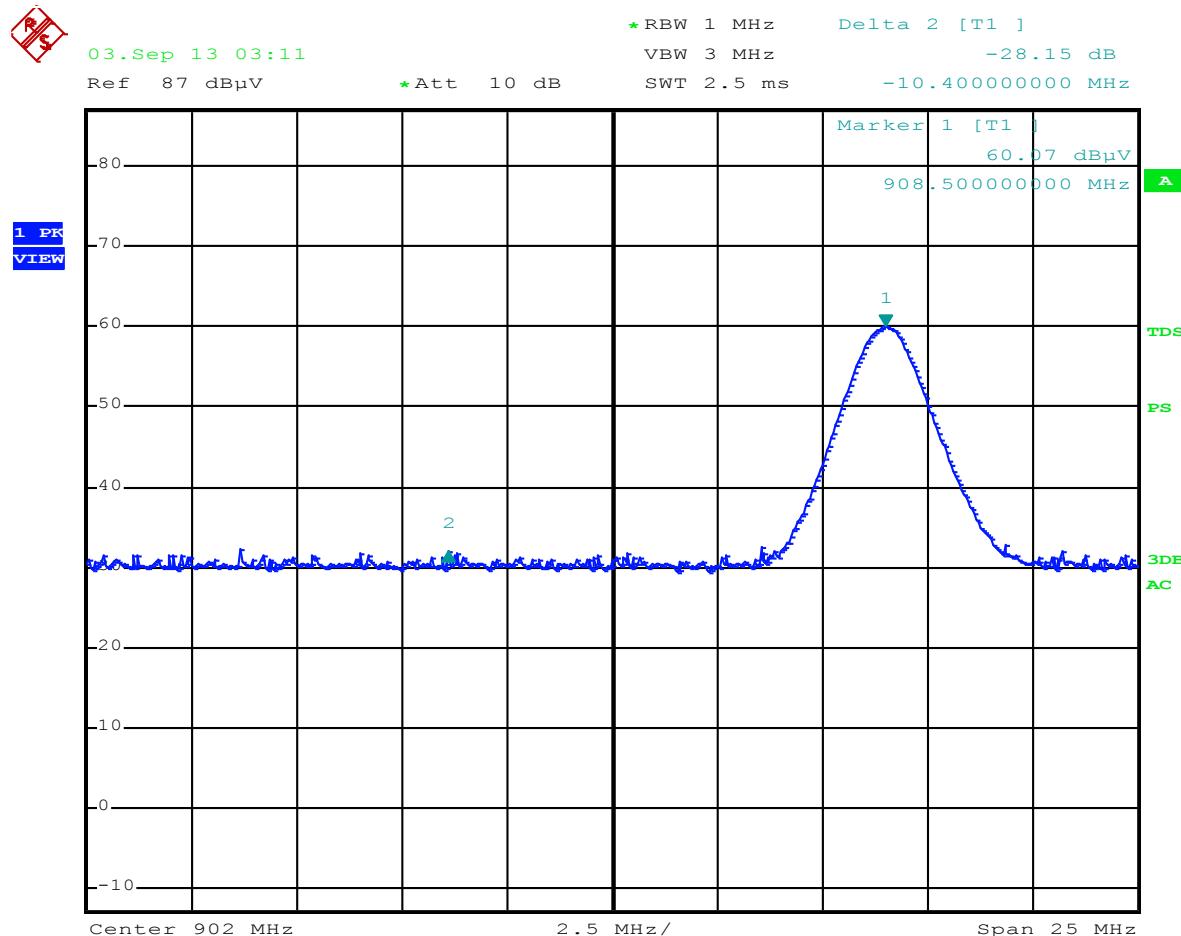
The test method is referred to clause 6.9.1 of ANSI C63.10:2009.

### 3.3.2 Test Plot

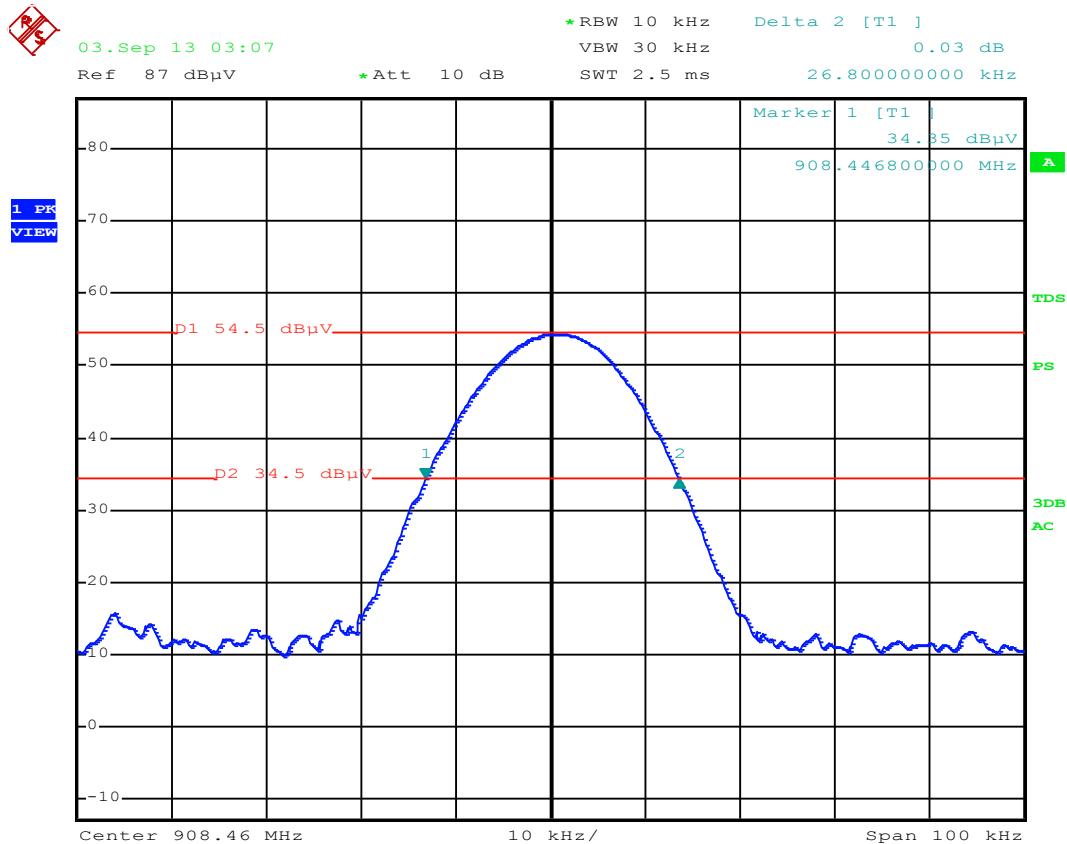
Band edges

Operating mode: Transmitting

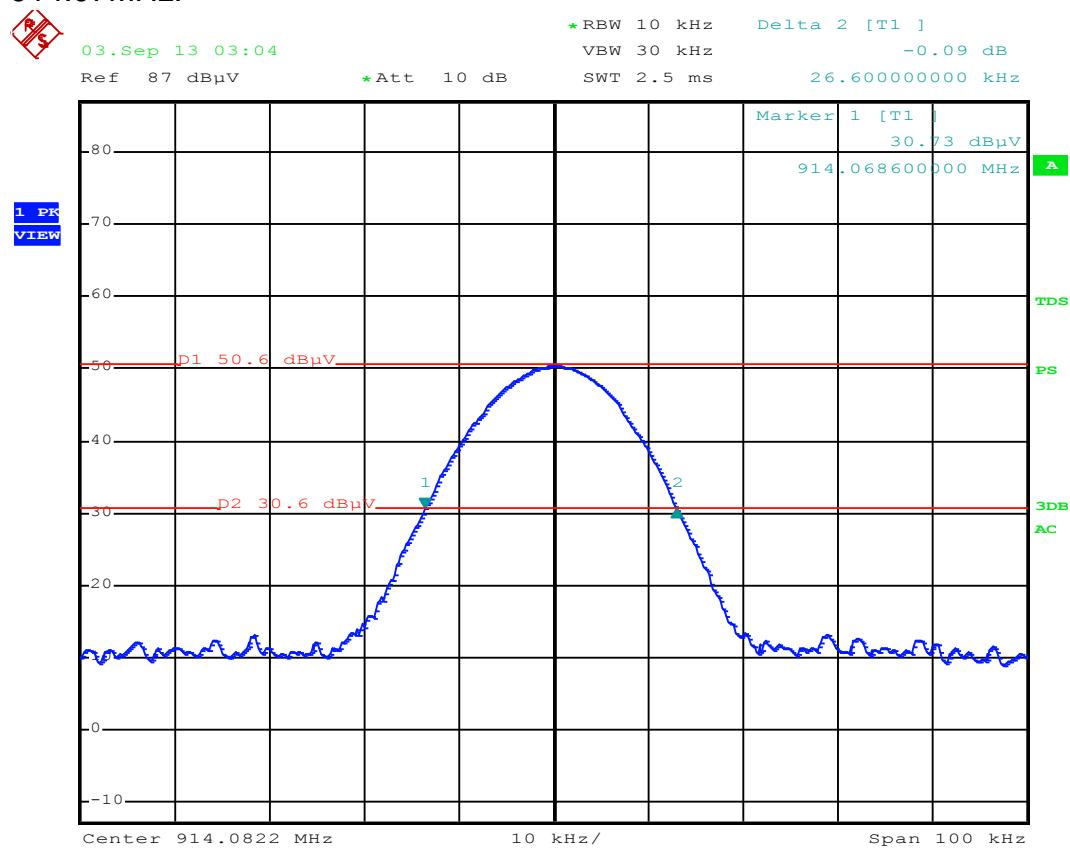




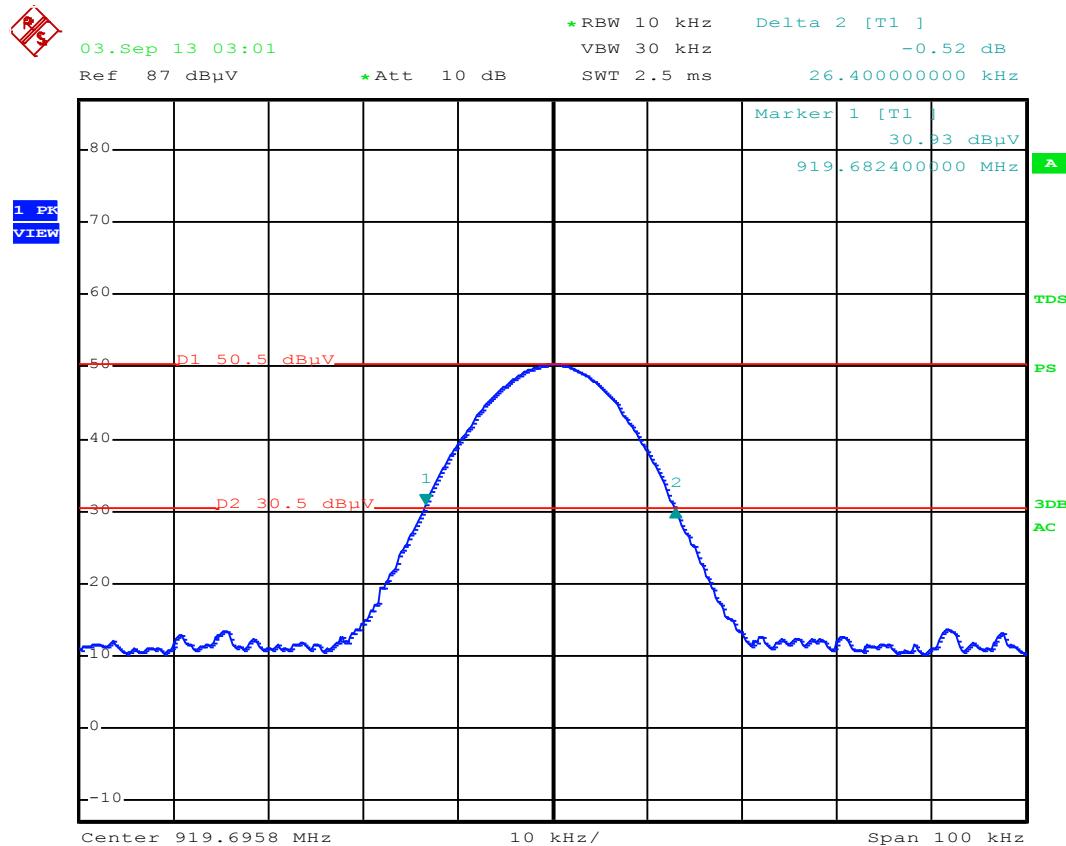
20dB Bandwidth  
Operating mode: Transmitting  
908.45MHz



914.07MHz:



919.69MHz:



### 3.3.3 Test Result

From the plot, the field strength of any emissions outside of the specified frequency band are attenuated to the general radiated emission limits in section 15.209. It fulfils the requirement of 15.249(d).

#### Quasi-Peak Measurement

Bandedge compliance is determined by applying marker-delta method, i.e ( Bandedge Plot).

##### **(i) Lower bandedge:**

QP Resultant field strength = Fundamental emissions (QP value) – delta from the bandedge plot

$$\begin{aligned} &= 68.4 \text{dB}\mu\text{v/m} - 26.94 \text{dB} \\ &= 41.46 \text{dB}\mu\text{v/m} \end{aligned}$$

##### **(ii) Upper bandedge:**

QP Resultant field strength = Fundamental emissions (QP value) – delta from the bandedge plot

$$\begin{aligned} &= 65.1 \text{dB}\mu\text{v/m} - 28.15 \text{dB} \\ &= 36.95 \text{dB}\mu\text{v/m} \end{aligned}$$

The QP resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 46 dB $\mu$ v/m (QP Limit).

### 3.3.4 Transmitter Duty Cycle Calculation FCC Rule 15.35(b, c)

The product has 100% duty cycle.

----- End of Report -----