



## **TEST REPORT**

**Date:** 2015-03-24

**Report No.:** 60.870.14.022.03F

**Applicant:** Hong Kong RFID Ltd.  
Unit 11, 9/F, Wah Wai Centre, 38-40 Au Pui Wan Street,  
Fotan, Shatin, N.T., Hong Kong

**Description of Samples:** Model name: EMPRESS 2.4GHz WIRELESS ACTIVE  
RFID READER

Model no.: HKRAR-EM02-SP, HKRAR-EM02-ETH,  
HKRAR-EM02-POE,  
FCCID: XNO-HKRAR-EM02

**Date Samples Received:** 2015-03-02

**Date Tested:** 2015-03-03 to 2015-03-23

**Investigation Requested:** FCC Part 15 Subpart B

**Conclusions:** The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

**Remarks:** ---

Checked by:

Approved by:-

---

Ray Cheung  
Project Engineer  
Wireless & Telecom department

---

John Zhi  
Project Manager  
Wireless & Telecom department



Report No.: 60.870.14.022.03F

## CONTENT:

Cover	Page 1 of 13	
Content	Page 2 of 13	
<b><u>1.0</u></b>	<b><u>General Details</u></b>	
1.1	Test Laboratory	Page 3 of 13
1.2	Applicant Details	Page 3 of 13
1.3	Equipment Under Test [EUT]	Page 4 of 13
1.4	Equipment Modification	Page 4 of 13
1.5	Related Submittal(s) Grants	Page 4 of 13
<b><u>2.0</u></b>	<b><u>Technical Details</u></b>	
2.1	Investigations Requested	Page 5 of 13
2.2	Test Standards and Results Summary	Page 5 of 13
<b><u>3.0</u></b>	<b><u>Test Methodology</u></b>	
3.1	Radiated Emission	Page 6 of 13
3.2	Field Strength Calculation	Page 6 of 13
3.3	Conducted Emission	Page 6 of 13
<b><u>4.0</u></b>	<b><u>Test Result</u></b>	
4.1	Spurious Radiated Emission	Page 7-9 of 13
4.2	Conducted Emission	Page 10-12 of 13
<b><u>5.0</u></b>	<b><u>List of Equipment</u></b>	Page 13 of 13
<b><u>Appendix A</u></b>		
Photos of Test Setup		
<b><u>Appendix B</u></b>		
External EUT Photos		
<b><u>Appendix C</u></b>		
Internal EUT Photos		



**Report No.: 60.870.14.022.03F**

## **1.0 General Details**

### **1.1 Test Laboratory**

TUV SUD Certification and Testing (China) Co., Ltd  
Building 12&13, Zhiheng Wisdomland Business Park,  
Nantou Checkpoint Road 2, Shenzhen, 518052  
Registration Number: 502708

Tested by:

A handwritten signature in blue ink, appearing to read 'Ray'.

---

Ray Cheung

### **1.2 Applicant Details**

#### **Applicant**

**Hong Kong RFID Ltd.**

Unit 11, 9/F, Wah Wai Centre, 38-40 Au Pui Wan  
Street, Fotan, Shatin, N.T., Hong Kong

#### **Manufacturer**

**Hong Kong RFID Ltd.**

Unit 11, 9/F, Wah Wai Centre, 38-40 Au Pui Wan  
Street, Fotan, Shatin, N.T., Hong Kong



**Report No.: 60.870.14.022.03F**

### **1.3 Equipment Under Test [EUT]**

#### **Description of Sample**

Product Description:	EMPRESS 2.4GHz WIRELESS ACTIVE RFID READER
Model No:	HKRAR-EM02
FCCID:	XNO-HKRAR-EM02
Rating:	AC/DC Adaptor Model: KSAS0120500200HK Input: 100-240VAC, 50/60Hz Output: 5.0 VDC, 2A
Accessories and Auxiliary Equipment:	AC/DC power adaptor, ThinkPad Notebook
EUT Exercising Software:	None

#### **Description of EUT**

The Equipment Under Test (EUT) is a RFID Reader.

As per Client Declaration, the circuit design, PCB Layout, shielding and interfaces of HKRAR-EM02-SP are identical for HKRAR-EM02-ETH, HKRAR-EM02-POE, only the Power Source Connection and grouping are different. So we use the HKRAR-EM02-SP as a representative model.

### **1.4 Equipment Modification**

No modification was conducted on the tested sample by TUV SUD Hong Kong Ltd.

### **1.5 Related Submittal(s) Grants**

This is a signal application subject to Certificate Authorization.

Report No.: 60.870.14.022.03F

## **2.0 Technical Details**

### **2.1 Investigations Requested**

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15 and ANSI C63.4: 2009.

### **2.2 Test Standards and Results Summary Tables**

<b>EMISSION Results Summary</b>					
Test Condition	FCC Test Requirement	Class / Severity	Test Result		
			Pass	Failed	N/A
Radiated Emissions, 30MHz to 4.5GHz	Part 15.109	Class B	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conducted Emissions on AC, 0.15MHz to 30MHz	Part 15.107	Class B	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: N/A - Not Applicable

### **3.0 Test Methodology**

#### **3.1 Radiated Emission**

The sample was placed 0.8m above the ground plane on a standard emission test site \*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

#### **3.2 Field Strength Calculation**

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

$FS = R + \text{System Factor}$

$\text{System Factor} = AF + CF + FA - PA$

Where FS = Net Field Strength in dBuV/m at 3 meters.

R = Reading of Spectrum Analyzer / Test Receiver in dBuV.

AF = Antenna Factor in dB.

CF = Cable Attenuation Factor in dB.

FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

#### **3.3 Conducted Emissions**

The EUT was placed on a non-metallic table 0.8m above the horizontal metal reference plane and 0.4m from a vertical ground plane which is connected to the horizontal metal ground plane. Meanwhile, the AC main of EUT was connected to the distance of 0.8m line impedance stabilization network (LISN) during measurement.

Initial measurements were performed in quasi-peak and average detection modes by the test receiver, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

Report No.: 60.870.14.022.03F

## 4.0 Test Results

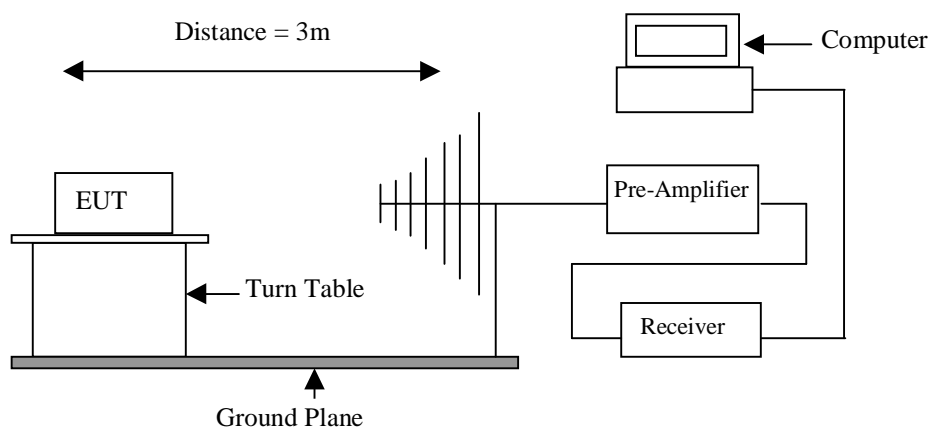
### 4.1 **Spurious Radiated Emissions ( 30MHz to 10GHz )**

Test Requirement:	FCC Part 15 section 15.109 Class B
Test Method:	ANSI C63.4:2009
Test Date:	2015-03-18
Mode of Operation:	PC Communication mode

Detector Function:	Quasi-peak (Below 1000 MHz) Average (Above 1000 MHz)
--------------------	---

Measurement BW:	120 kHz (Below 1000 MHz) 1 MHz (Above 1000 MHz)
-----------------	--

#### **Test Setup:**



**Report No.: 60.870.14.022.03F**

**Results: PASS**

<b>Spurious Radiated Emissions</b>							
Frequency MHz	Polarity	Reading dBuV	Factor dB/m	Measurement dBuV/m	Limit dBmV/m	Margin dB	Detector
34.619	V	24.15	12.7	36.85	40.0	-3.15	QP
47.804	V	23.80	15.4	39.2	40.0	-0.8	QP
86.060	V	18.6	10.8	38.2	40.0	-1.8	QP
86.047	H	26.7	10.8	37.5	40.0	-2.5	QP

Note:

- No further spurious emissions found between 30 MHz and lowest internal used/generated frequency.
- No significant emissions noise floors were detected above 1 GHz.

Remark:

- Calculated measurement uncertainty:  $\pm 3.2$  dB .

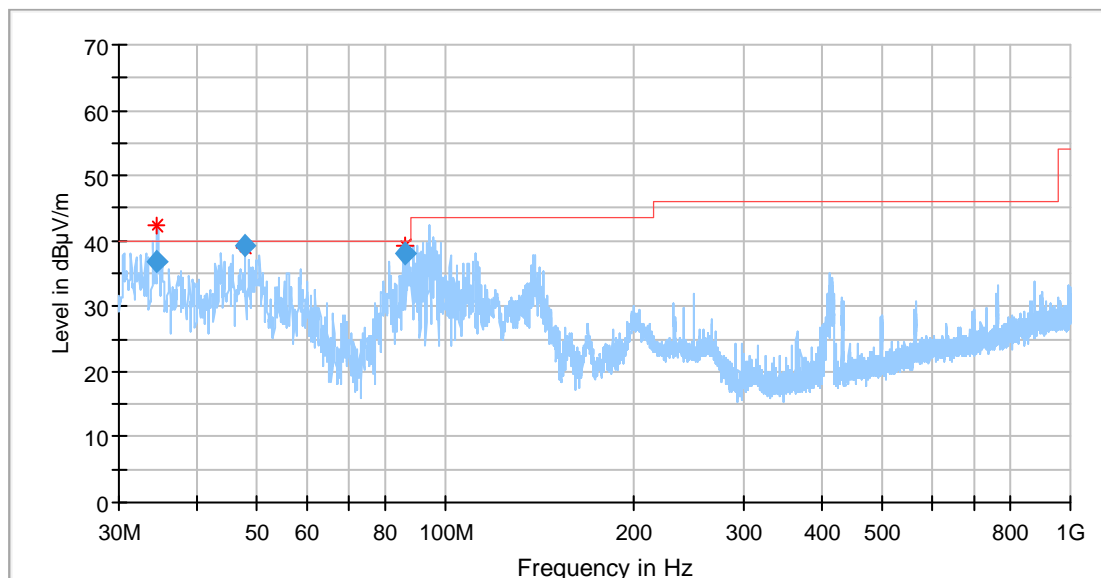
**Limits for Radiated Emissions [ Section 15.109 Class B] :**

Frequency Range [MHz]	Quasi-Peak Limits [ $\mu$ V/m]
30-88	100
88-216	150
216-960	200
Above 960	500

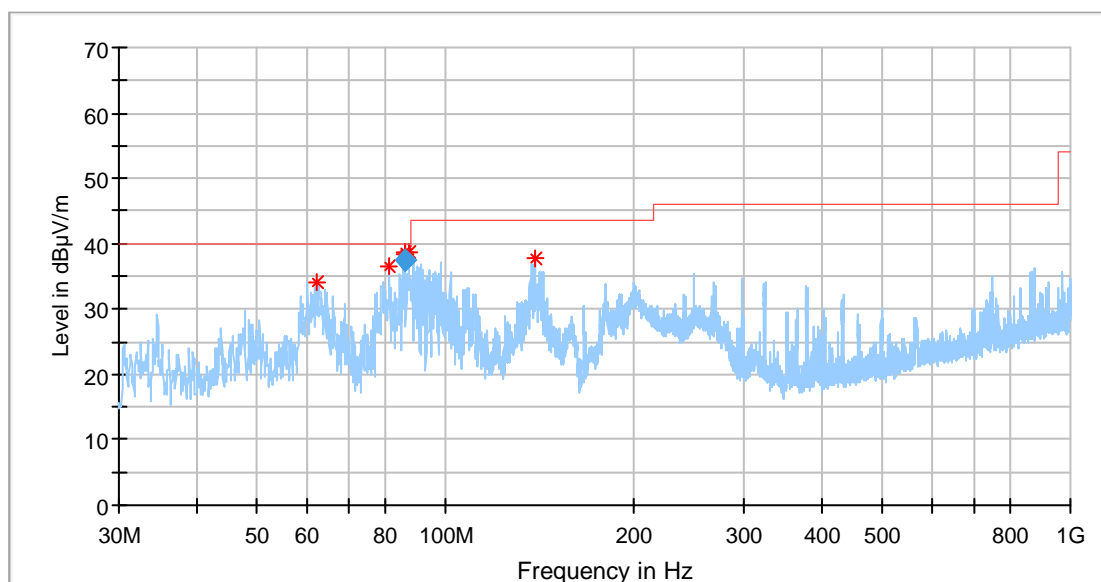
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.



### Vertical



### Horizontal

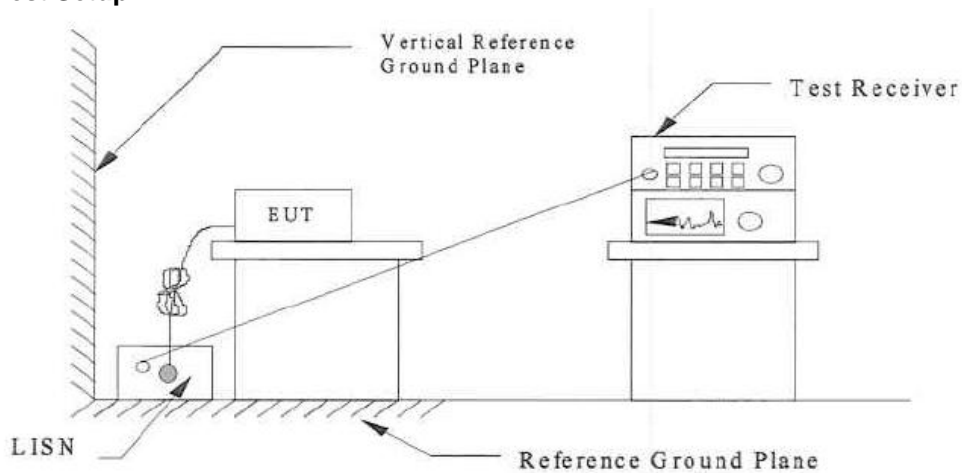


**Report No.: 60.870.14.022.03F**

#### 4.2 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC part 15 Section 15.107 Class B
Test Method:	ANSI C63.4:2009
Test Date:	2015-03-18
Mode of Operation:	PC Communication mode
Detector Function	Quasi-peak, average
Measurement BW	9kHz (150kHz to 30MHz)

#### Test Setup:



**Result: PASS**

- Refer Figures and tables for the result.

#### Limits for Conducted Emission [ Section 15.107]:

Frequency Range [MHz]	Quasi-Peak Limit [dB $\mu$ V]	Average Limit [dB $\mu$ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

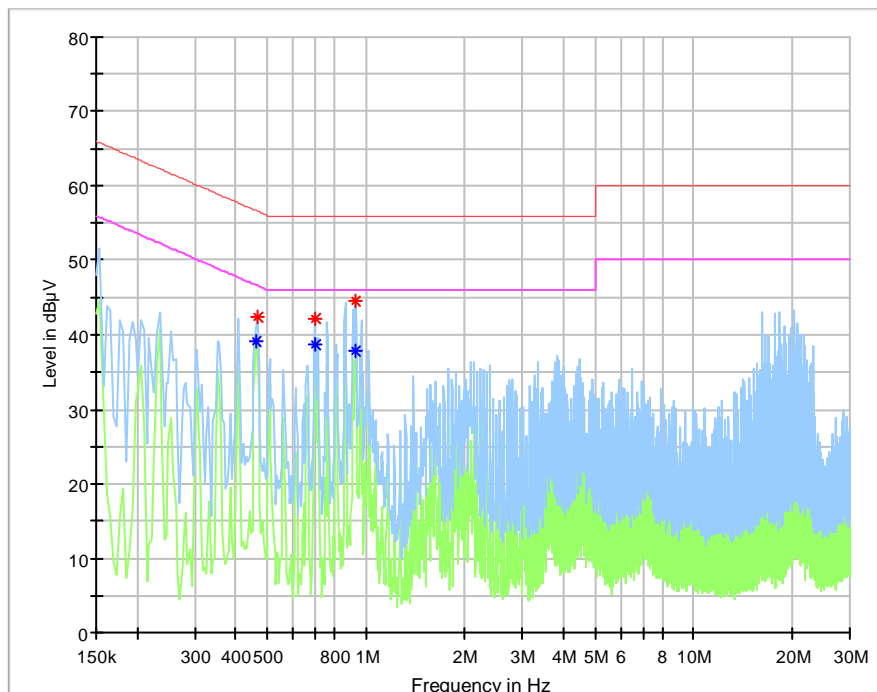
\* Decreases with the logarithm of the frequency.

Remarks:

Calculated measurement uncertainty:  $\pm 2.8$ dB

Report No.: 60.870.14.022.03F

Result data graph shows the conducted emission (Live).

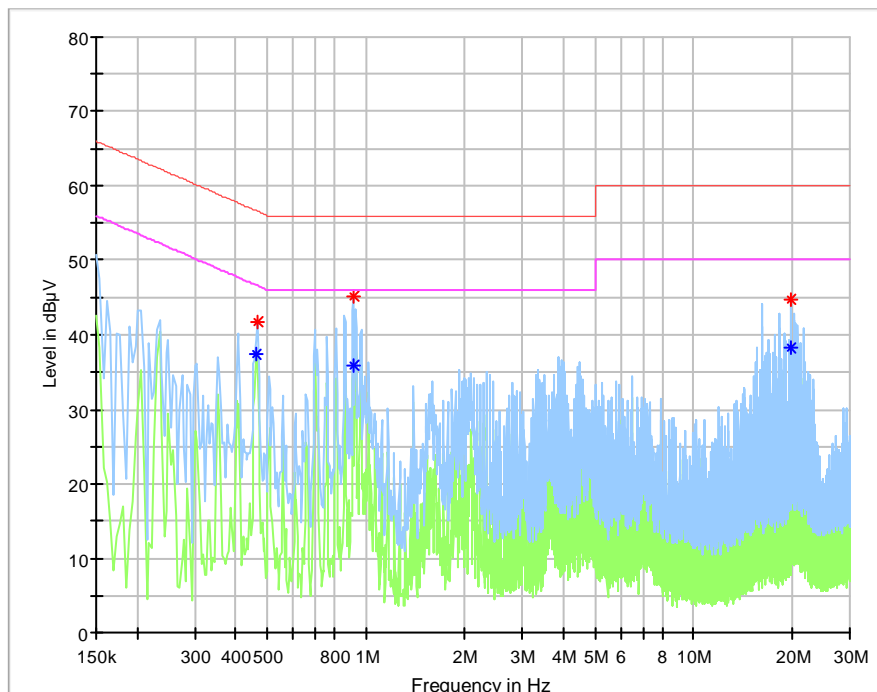


Refer to the following table for the result details:

Conducted Emission					
Frequency (MHz)	Detector (QP/AV)	Phase	Result (dBμV)	Limit (dBμV)	Margin
0.466	QP	L	42.30	56.58	-14.28
0.698	QP	L	42.22	56.00	-13.78
0.930	QP	L	44.42	56.00	-11.58

Report No.: 60.870.14.022.03F

Result data graph shows the conducted emission (Neutral).



Refer to the following table for the result details:

Conducted Emission					
Frequency (MHz)	Detector (QP/AV)	Phase	Result (dBμV)	Limit (dBμV)	Margin
0.466	QP	N	41.80	56.59	-14.79
0.914	QP	N	45.20	56.00	-10.80
19.710	QP	N	44.79	60.00	-15.21

Report No.: 60.870.14.022.03F

## 5.0 List of Measurement Equipment

### Radiated Emission Test

Description	Manufacturer	Model no.	Serial no.	CAL due
Spectrum Analyzer	R&S	FSV40	101031	17 Aug 2015
Trilog Super Broadband Test Antenna	Scwarzbeck	VULB 9163	708	17 Aug 2015
Horn Antenna	R&S	HF907	102295	17 Aug 2015
Signal Generator	R&S	SML01	67	Jul. 16 2015
Signal Generator	HP	8920B	13215S1	Jul. 16 2015
3m Semi- Anechoic Chamber	TDK	8X4X4	---	29 Aug 2015
Temperature and Humidity Chamber	XingBao	XB1212	N/A	Jan. 20 2015
Pre-amplifier	R&S	SCU 18	102230	17 Aug 2015
Pre-amplifier	R&S	SCU 40A	100432	17 Aug 2015

### Conducted Emission Test

Description	Manufacturer	Model no.	Serial no.	CAL due
EMI Test Receiver	R&S	ESR 3	101782	2015-08-17
LISN	R&S	ENV4200	100249	2015-08-17
LISN	R&S	ENV216	100326	2015-08-17
ISN	R&S	ENY81	100177	2015-08-17
High Voltage Probe	R&S	TK9420(VT9420)	9420-58	2015-08-17
RF Current Probe	R&S	EZ-17	100816	2015-08-17

Remarks:

CM Corrective Maintenance  
N/A Not Applicable or Not Available  
TBD To Be Determined