

FCC PART 15.249

MEASUREMENT AND TEST REPORT

FOR

Hong Kong RFID Ltd.

**Unit 207A, 2/F, Building 9, No. 5 Science Park West Avenue, Hong Kong Science
Park, Shatin, N.T., Hong Kong**

FCC ID: XNOHKRAR001

Report Concerns: Original Report	Equipment Type: Wireless 2.4GHz Active RFID Reader
Model:	<u>HKRAR-EMWF</u>
Report No.:	<u>STR10078138I-2</u>
Test Date:	<u>2010-08-02 to 2010-08-31</u>
Issue Date:	<u>2010-09-02</u>
Tested By:	<u>Susan Su / Engineer</u> <i>Susan Su</i>
Reviewed By:	<u>Lahm Peng / EMC Manager</u> <i>Lahm peng</i>
Approved & Authorized By:	<u>Jandy so / PSQ Manager</u> <i>Jandyso</i>
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by SEM.Test Compliance Service Co., Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Hong Kong RFID Ltd.
Address of applicant: Unit 207A, 2/F, Building 9, No. 5 Science Park West Avenue,
Hong Kong Science Park, Shatin, N.T., Hong Kong

Manufacturer: Hong Kong RFID Ltd.
Address of manufacturer: Unit 207A, 2/F, Building 9, No. 5 Science Park West Avenue,
Hong Kong Science Park, Shatin, N.T., Hong Kong

General Description of E.U.T

Items	Description
EUT Description:	Wireless 2.4GHz Active RFID Reader
Trade Name:	Empress™
Model No.:	HKRAR-EMWF
Rated Voltage:	DC 5V
Rated Current:	50mA
Output Power:	<10mW
Frequency Range:	2451.15MHz
No. of Channel:	/
Antenna Type:	Detachable Antenna
Size:	13.8X10.7X2.6cm
For more information refer to the circuit diagram form and the user's manual.	

The test data is gathered from a production sample, provided by the manufacturer.

1.2 Test Standards

The following report is prepared on behalf of the Hong Kong RFID Ltd. in accordance with FCC Part 15, Subpart B, Subpart C, and section 15.107, 15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.107, 15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Related Submittal(s)/Grant(s)

No Related Submittal(s).

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted according to the Operating Instructions and let the EUT keep transmitting.

1.5 Test Facility

- **FCC – Registration No.: 994117**

SEM.Test Compliance Services Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 994117.

- **Industry Canada (IC) Registration No.: 7673A**

The 3m Semi-anechoic chamber of SEM.Test Compliance Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 7673A.

1.6 EUT Exercise Software

The EUT exercise program used during the testing was designed to exercise the system components. The test software is started while the whole system is on.

1.7 Accessories Equipment List and Details

Manufacturer	Description	Model	Serial Number
ASUS	Notebook	X50R	/

1.8 EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
Power Cable	1.86	Unshielded	Without Core
RJ45 Cable	1.56	Unshielded	Without Core

2. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§15.207 (a)	Conducted Emission	Compliant
§15.205	Restricted Band of Operation	Compliant
§15.209	Radiated Emission	Compliant
§15.249(a)	Field Strength	Compliant
§15.249(d)	Out of Band Emission	Compliant

3. §15.207 (a) CONDUCTED EMISSIONS

3.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ± 2.88 dB.

3.2 Test Equipment List and Details

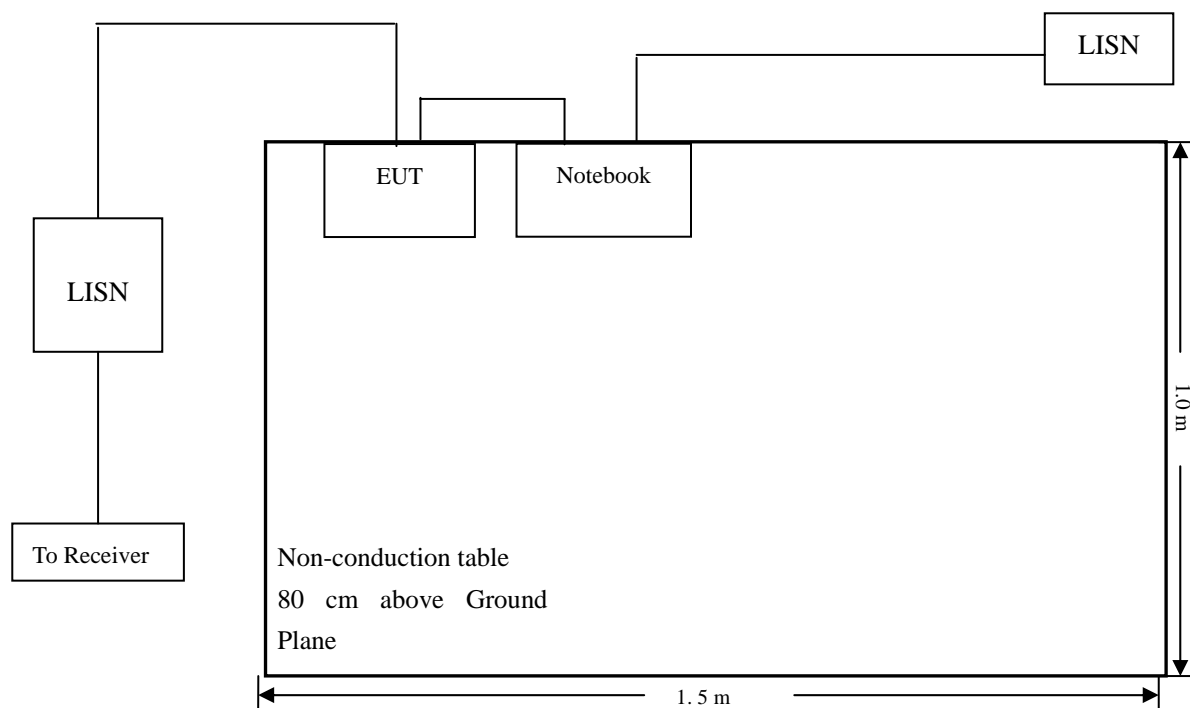
Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2010-08-12	2011-08-11
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2010-08-12	2011-08-11
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2010-08-12	2011-08-11

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

3.3 Test Procedure

Test is conducting under the description of ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

3.4 Basic Test Setup Block Diagram



3.5 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

3.6 Summary of Test Results/Plots

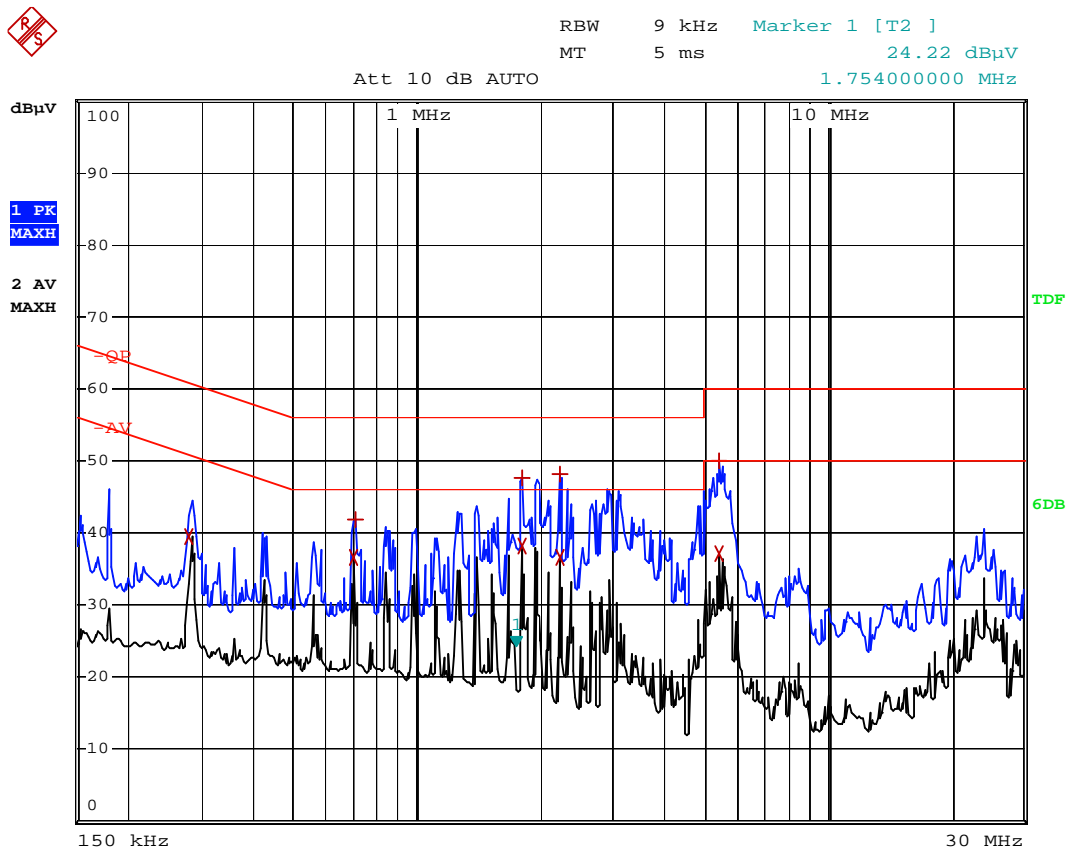
According to the data in section 3.7, the EUT complied with the FCC 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

-7.44 dB μ V at 1.966 MHz in the **Line, Average** detector, 0.15-30MHz

3.7 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

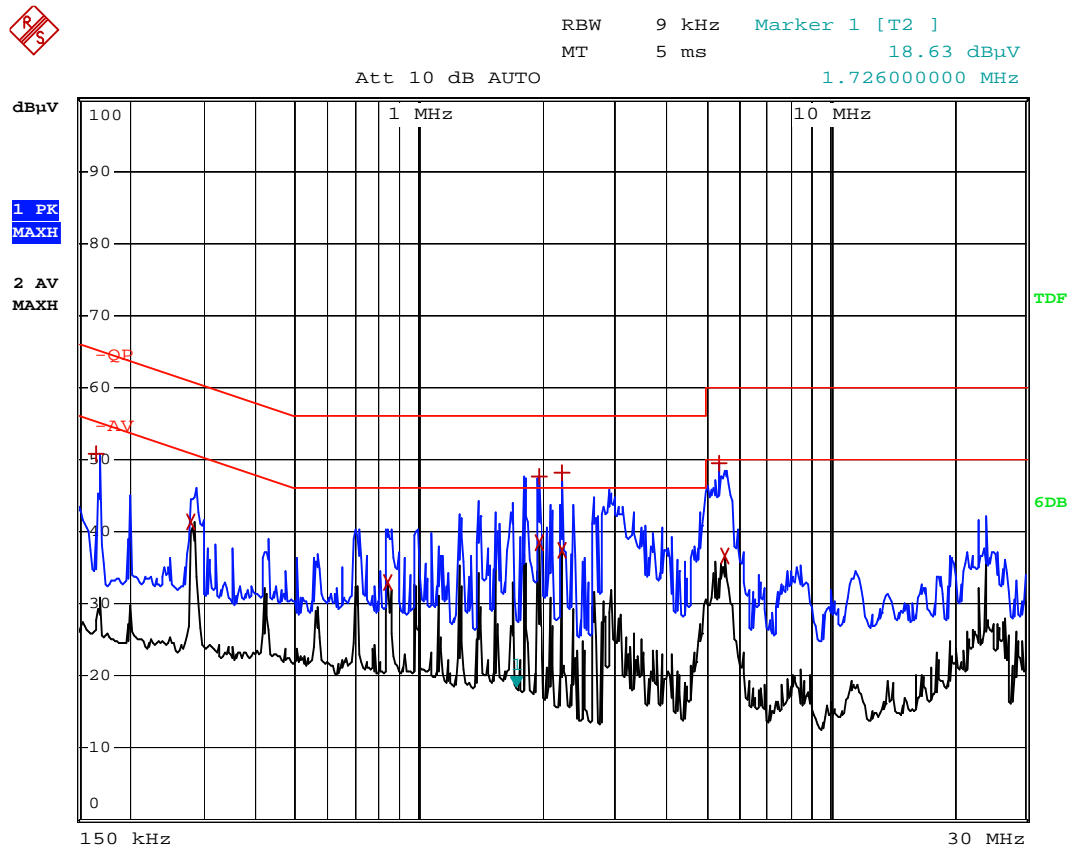
Conducted Disturbance
EUT: Wireless 2.4GHz Active RFID Reader
M/N: HKRAR-EMWF
Operating Condition: RFID Transmitting
Test Specification: N
Comment: 120V/60Hz; DC 5V



EDIT PEAK LIST (Prescan Results)			
Trace1:	-QP		
Trace2:	-AV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
2 Average	282 kHz	39.43	-11.31
2 Average	702 kHz	36.66	-9.33
1 Max Peak	706 kHz	41.84	-14.15
1 Max Peak	1.81 MHz	47.67	-8.32
2 Average	1.814 MHz	38.16	-7.83
1 Max Peak	2.23 MHz	48.10	-7.89
2 Average	2.23 MHz	36.74	-9.25
1 Max Peak	5.438 MHz	50.09	-9.90
2 Average	5.438 MHz	37.01	-12.98

Plot of Conducted Emissions Test Data

Conducted Disturbance
EUT: Wireless 2.4GHz Active RFID Reader
M/N: HKRAR-EMWF
Operating Condition: RFID Transmitting
Test Specification: L
Comment: 120V/60Hz; DC 5V



EDIT PEAK LIST (Prescan Results)				
Trace1:		-QP		
Trace2:		-AV		
Trace3:		---		
TRACE		FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
1	Max Peak	166 kHz	50.68	-14.46
2	Average	282 kHz	41.26	-9.49
2	Average	838 kHz	32.86	-13.13
1	Max Peak	1.966 MHz	47.54	-8.45
2	Average	1.966 MHz	38.55	-7.44
1	Max Peak	2.234 MHz	48.04	-7.95
2	Average	2.234 MHz	37.49	-8.51
1	Max Peak	5.394 MHz	49.59	-10.40
2	Average	5.574 MHz	36.64	-13.35

4. §15.203 - ANTENNA REQUIREMENT

4.1 Standard Applicable

According to FCC 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 use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

4.2 Test Result

This product has an unique and detachable antenna, fulfill the requirement of this section.

5. §15.205, §15.209, §15.249 (a)- RADIATED EMISSION

5.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ± 3.0 dB.

5.2 Standard Applicable

According to §15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field strength of fundamental (milli-volts/meter)	Field strength of fundamental (micro-volts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

EMISSIONS RADIATED OUTSIDE OF THE SPECIFIED FREQUENCY BANDS, EXCEPT FOR HARMONICS, SHALL BE ATTENUATED BY AT LEAST 20 dB BELOW THE LEVEL OF THE FUNDAMENTAL OR TO THE GENERAL RADIATED EMISSION LIMITS IN 15.209,WHICHEVER IS THE LESSER ATTENUATION.

Emissions that fall in the restricted bands (15.205) must be less than 54dBuV/m otherwise the spurious and harmonics must be attenuated by at least 20dB.

5.3 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2010-04-16	2011-04-15
EMI Test Receiver	R&S	ESVB	825471/005	2010-08-12	2011-08-11
Positioning Controller	C&C	CC-C-1F	N/A	2010-08-12	2011-08-11
RF Switch	EM	EMSW18	SW060023	2010-08-12	2011-08-11
Pre-amplifier	Agilent	8447F	3113A06717	2010-08-12	2011-08-11
Pre-amplifier	Compliance Direction	PAP-0118	24002	2010-08-12	2011-08-11
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2010-07-21	2011-07-20
Horn Antenna	ETS	3117	00086197	2010-07-21	2011-07-20

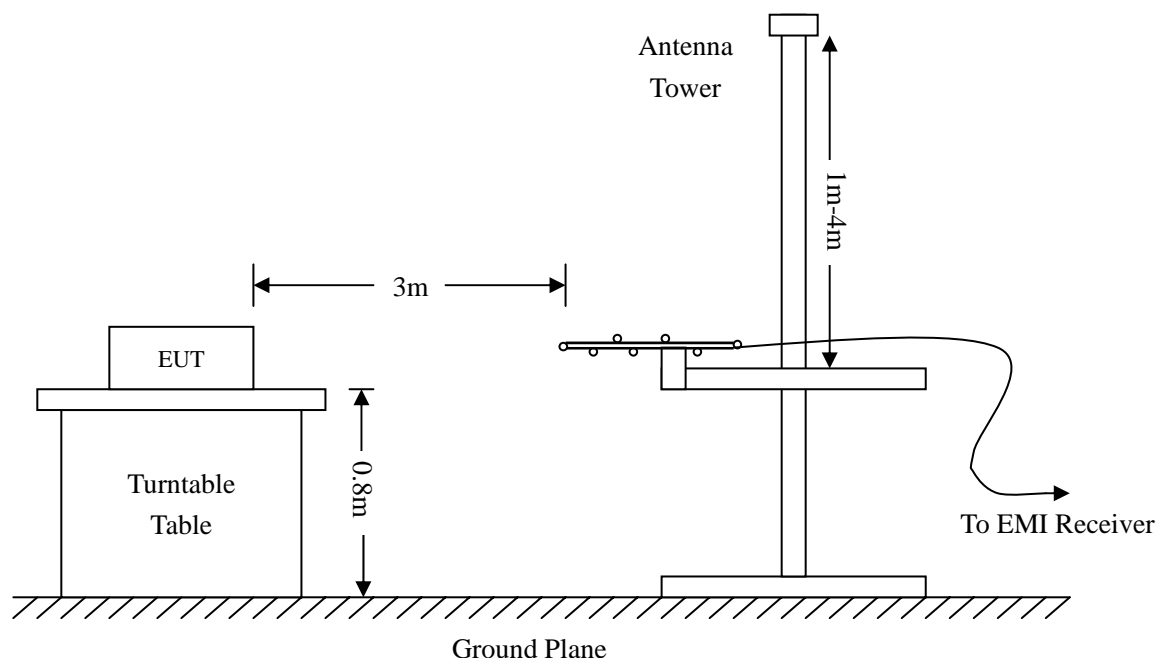
Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

5.4 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.



5.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

5.6 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	60 %
ATM Pressure:	1012 mbar

5.7 Summary of Test Results/Plots

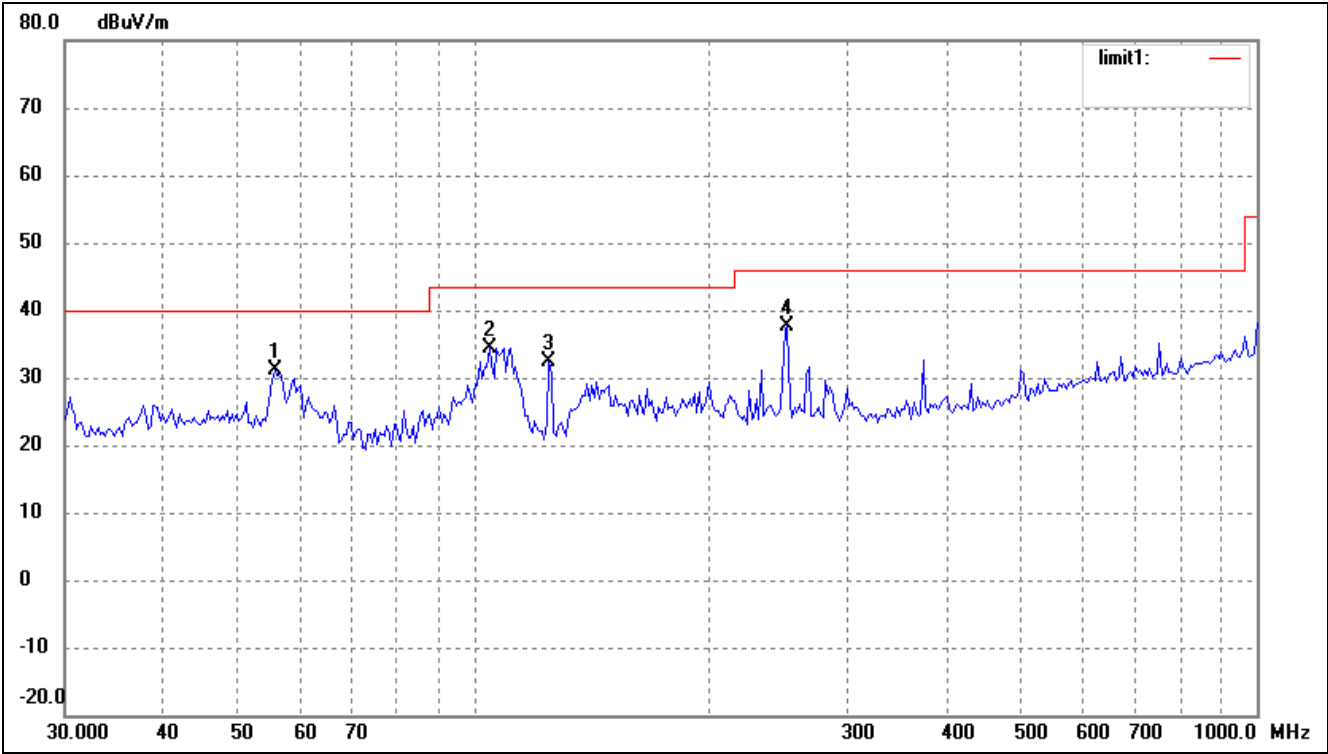
According to the data below, the FCC Part 15.205, 15.209 and 15.249 standards, and had the worst margin of:

-2.18 dB μ V at 33.9546 MHz in the Vertical polarization, 30 MHz to 25 GHz, 3Meters

Plot of Radiation Emissions Test

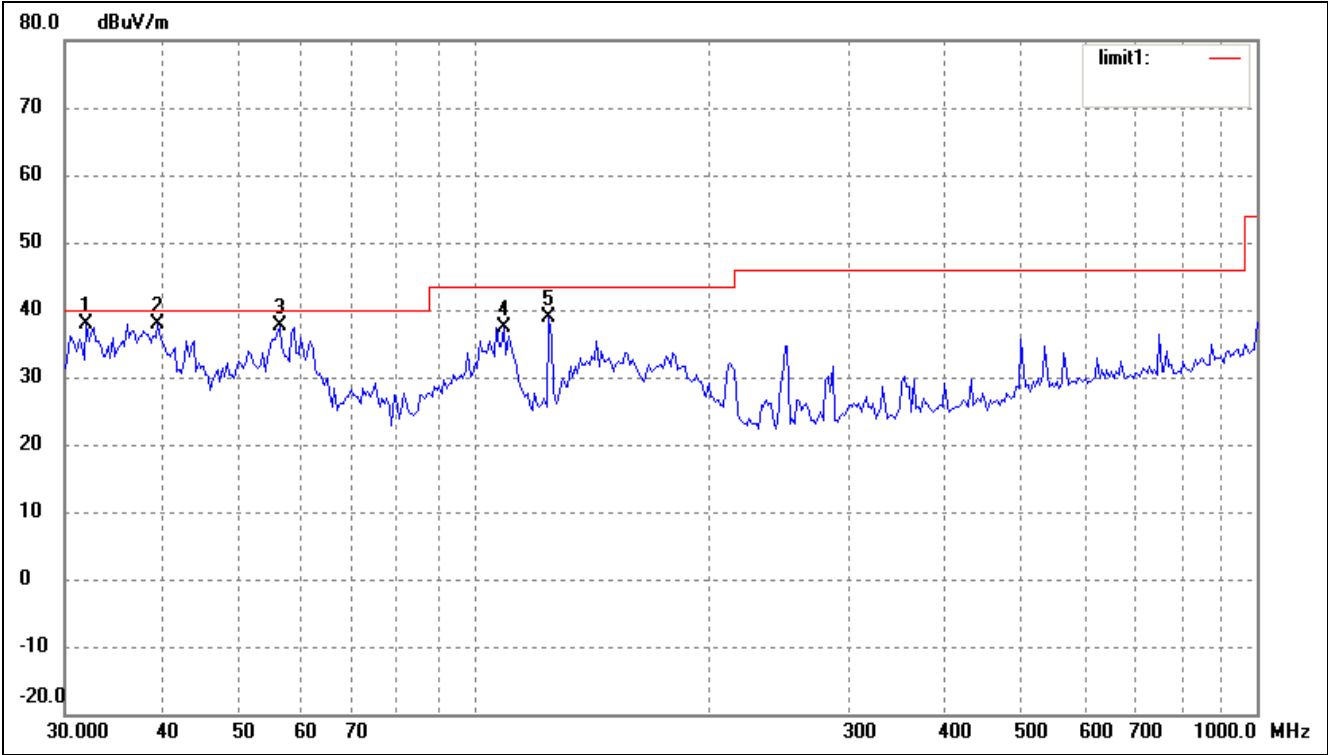
Radiated Disturbance
EUT: Wireless 2.4GHz Active RFID Reader
M/N: HKRAR-EMWF
Operating Condition: Transmitting below 1GHz
Test Specification: Horizontal & Vertical

Horizontal:



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	55.6094	23.75	7.43	31.18	40.00	-8.82	225	100	peak
2	104.5361	27.05	7.41	34.46	43.50	-9.04	149	100	peak
3	124.5690	27.81	4.63	32.44	43.50	-11.06	35	100	peak
4	251.1804	29.93	7.71	37.64	46.00	-8.36	77	100	peak

Vertical:



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	31.9546	31.20	6.62	37.82	40.00	-2.18	33	100	QP
2	39.4372	29.99	7.78	37.77	40.00	-2.23	61	110	QP
3	56.3948	30.31	7.38	37.69	40.00	-2.31	41	100	QP
4	109.0286	30.32	7.03	37.35	43.50	-6.15	112	100	peak
5	124.5690	34.13	4.63	38.76	43.50	-4.74	54	100	QP

Spurious Emission Above 1GHz

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
4902.30	AV	38.0	54	V	34.1	5.2	33	44.3	54	-9.7
4902.30	AV	27.5	61	H	34.1	5.2	33	33.8	54	-20.2
4902.30	PK	51.8	167	V	34.1	5.2	33	58.1	74	-15.9
4902.30	PK	41.3	33	H	34.1	5.2	33	47.6	74	-26.4
7353.45	AV	38.6	90	V	37.4	6.1	33.5	48.6	54	-5.4
7353.45	AV	27.4	91	H	37.4	6.1	33.5	37.4	54	-16.6
7353.45	PK	52.4	58	V	37.4	6.1	33.5	62.4	74	-11.6
7353.45	PK	41.2	267	H	37.4	6.1	33.5	51.2	74	-22.8
2451.15	AV	79.1	333	V	29.1	3.7	34	77.9	94	-16.1
2451.15	AV	67.7	158	H	29.1	3.7	34	66.5	94	-27.5
2451.15	PK	92.9	164	V	29.1	3.7	34	91.7	114	-22.3
2451.15	PK	81.5	31	H	29.1	3.7	34	80.3	114	-33.7

Note: Testing is carried out with frequency rang 30MHz to the tenth harmonics, which above 5th Harmonics is close to the noise base even antenna close up to 1meter distance according the measurement of ANSI C63.4. Emissions 20dB lower than the limit are not reported.

6. §15.249(b) OUT OF BAND EMISSIONS

6.1 Standard Applicable

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 §15.209, whichever is the lesser attenuation.

6.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2010-04-16	2011-04-15
EMI Test Receiver	R&S	ESVB	825471/005	2010-08-12	2011-08-11
Positioning Controller	C&C	CC-C-1F	N/A	2010-08-12	2011-08-11
RF Switch	EM	EMSW18	SW060023	2010-08-12	2011-08-11
Pre-amplifier	Agilent	8447F	3113A06717	2010-08-12	2011-08-11
Pre-amplifier	Compliance Direction	PAP-0118	24002	2010-08-12	2011-08-11
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2010-07-21	2011-07-20
Horn Antenna	ETS	3117	00086197	2010-07-21	2011-07-20

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

6.3 Test Procedure

As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2438.5MHz, than mark the higher-level emission for comparing with the FCC rules.

6.4 Environmental Conditions

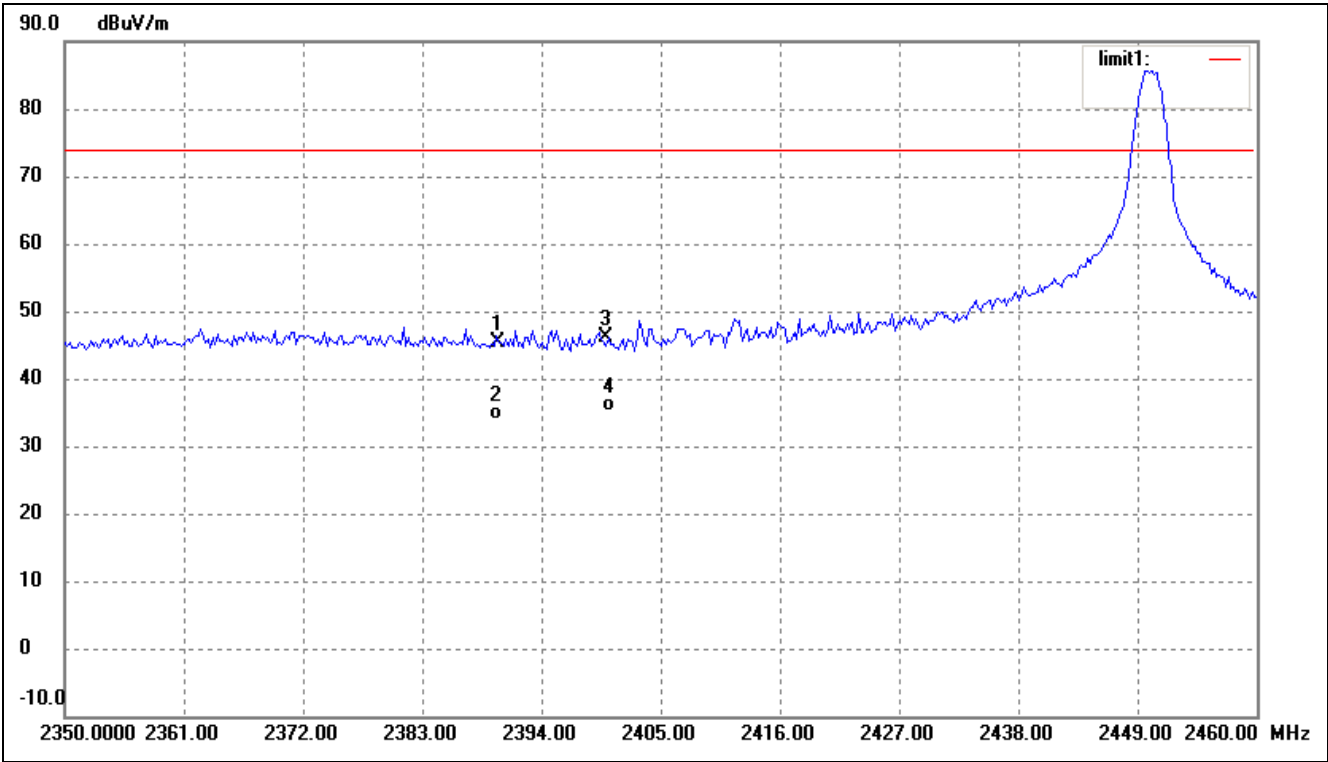
Temperature:	24 °C
Relative Humidity:	54 %
ATM Pressure:	1012 mbar

6.5 Summary of Test Results/Plots

Frequency MHz	Limit dBuV	Result
Low Edge	<54	Pass
High Edge	<54	Pass

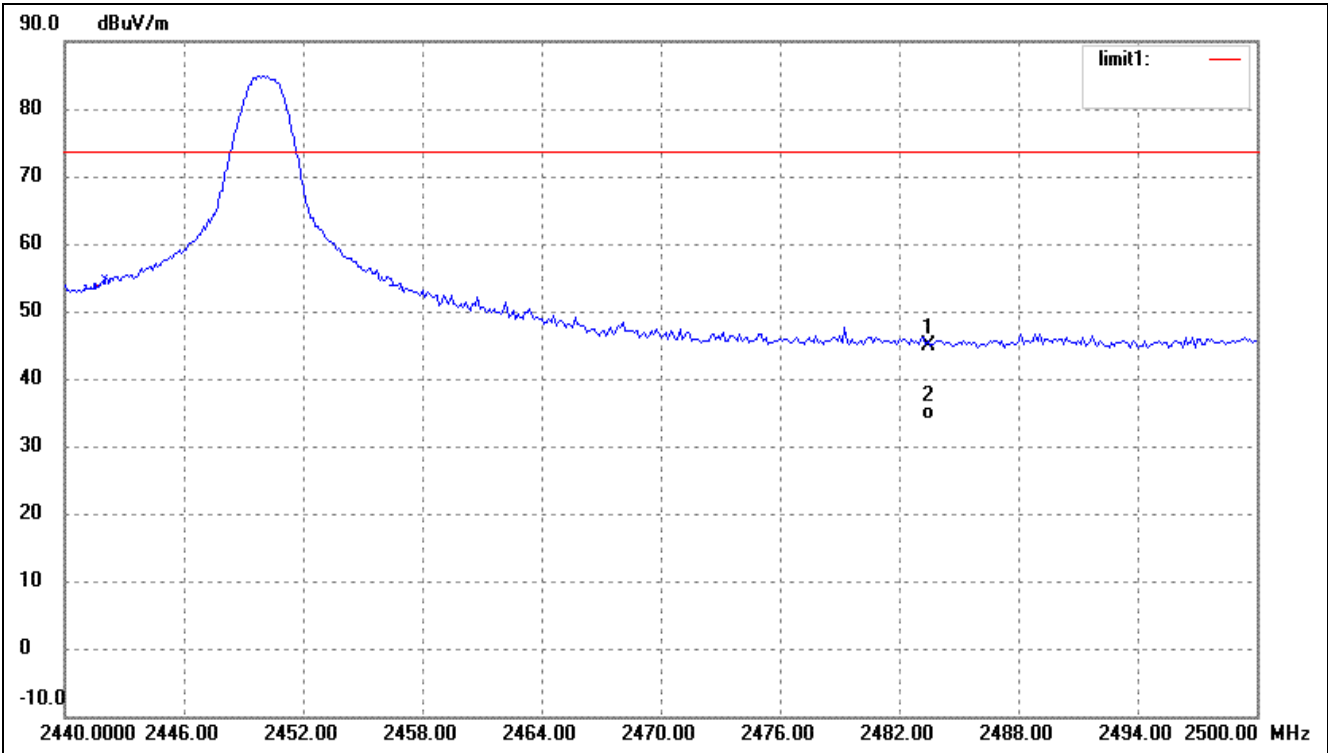
The edge emissions are below the FCC 15.209 Limits. Please refer to the test plots below.

Lowest Bandedge



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2390.000	49.85	-4.54	45.31	74.00	-28.69	Peak Detector
2	2390.000	38.31	-4.54	33.77	54.00	-20.23	AVG Detector
3	2400.000	50.57	-4.52	46.05	74.00	-27.95	Peak Detector
4	2400.000	39.74	-4.52	35.22	54.00	-18.78	AVG Detector

Highest Bandedge



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	49.29	-4.35	44.94	74.00	-29.06	Peak Detector
2	2483.500	38.21	-4.35	33.86	54.00	-20.14	AVG Detector

***** END OF REPORT *****