



EMC TEST REPORT

Report No. : EME-021403

Model No. : RCS-100

Issued Date : April 7, 2003

Applicant : Rayson Technology Co., Ltd.
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300 Taiwan

Test By : Intertek Testing Services Taiwan Ltd.
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Project Engineer

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Reviewed By

Elton Chen



Table of Contents

Summary of Tests	3
1. General information	4
1.1 Identification of the EUT	4
1.2 Additional information about the EUT	4
1.3 Antenna description	4
1.4 Peripherals equipment.....	4
2. Test specifications.....	5
2.1 Test standard	5
2.2 Operation mode.....	5
2.3 Test equipment.....	6
3. Radiated emission test FCC 15.231 (b)	7
3.1 Operating environment.....	7
3.2 Test setup & procedure.....	7
3.3 Radiated emission limit.....	8
3.3.1 Fundamental and harmonics emission limits.....	8
3.3.2 General radiated emission limit	8
3.4 Calculation of Average Factor	9
3.5 Radiated emission test data FCC 15.231.....	10
3.5.1 Fundamental & Harmonics Radiated Emission Data.....	10
3.6 Measured bandwidth FCC 15.231(C)	11



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FCC ID. : QWORCS-100

Report No.: EME-021403

Page 3 of 11

Summary of Tests

Home Automation -Model: RCS-100

FCC ID: QWORCS-100

Test	Reference	Results
Radiated Emission test	15.231(b), 15.209	Complies
Measured bandwidth	15.231(c)	Complies



1. General information

1.1 Identification of the EUT

Applicant	: Rayson Technology Co., Ltd.
Product	: Home Automation
Model No.	: RCS-100
FCC ID.	: QWORCS-100
Operating Frequency	: 315MHz
Channel Number	: 1 channel
Type of Modulation	: ASK
Power Supply	: 12Vdc Battery
Power Cord	: N/A
Sample Received	: Nov. 14, 2002
Test Date(s)	: Dec. 18, 2002 to April 7, 2003

1.2 Additional information about the EUT

The EUT is Home Automation. It has been designed and tested to offer safe service provided it is installed, operated, maintained and tested in strict accordance with the instructions and warnings contained in instruction manual.

For more detail features, please refer to User's manual as file name "Installation guide.pdf"

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain	: 0dBi
Antenna Type	: PCB Printed
Connector Type	: N/A

1.4 Peripherals equipment

Load: Lamp (330W)



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FCC ID. : QWORCS-100

Report No.: EME-021403

Page 5 of 11

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section 15.231.

2.2 Operation mode

Settled a new 12Vdc alkaline battery into EUT. Press any key of the EUT.

The EUT was transmitted continuously during the test, and it's Not normal operation for end users.



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FCC ID. : QWORCS-100

Report No.: EME-021403

Page 6 of 11

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Series No.	Last Cal. Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	825788/014	May 24, 2002
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	825428/005	June 10, 2002
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	100137	July 10, 2002
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	100186	Oct. 9, 2002
Horn Antenna	EMCO	1GHz~18GHz	3115	9906-5890	Sep. 19, 2002
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	159	June 20, 2002
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	3111	June 20, 2002
Turn Table	HDGmbH	N/A	DS 420S	420/669/01	N/A
Antenna Tower	HDGmbH	N/A	MA 240	240/573	N/A

Note:

1. The calibration interval of the above instruments is 12 months.

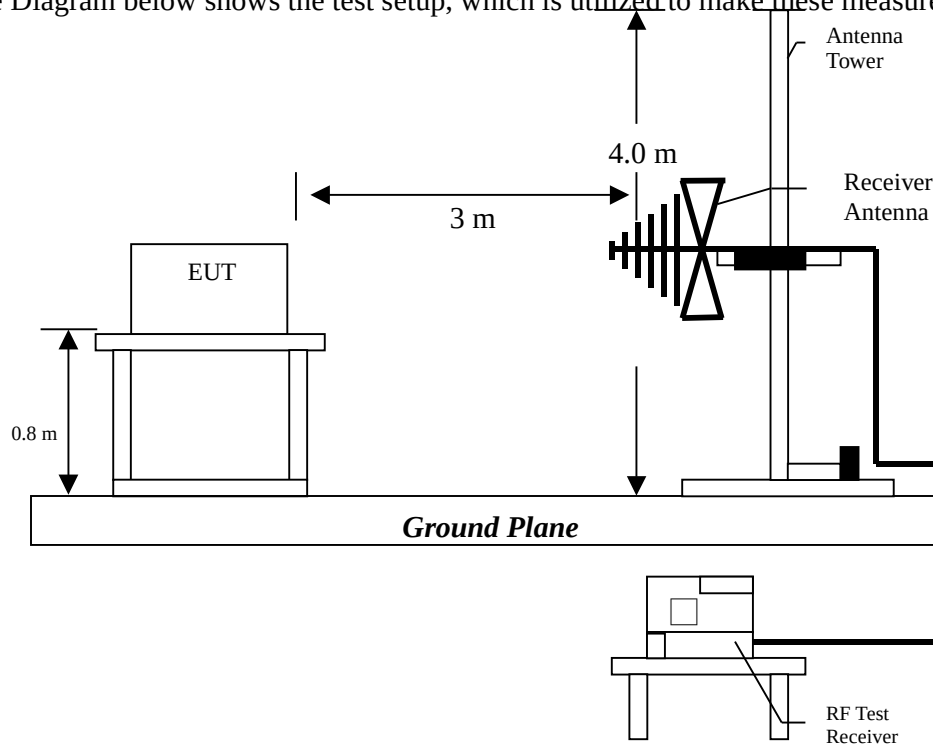
3. Radiated emission test FCC 15.231 (b)

3.1 Operating environment

Temperature: 24 °C
 Relative Humidity: 58 %
 Atmospheric Pressure: 1023 hPa

3.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



The signal is maximized through rotation and placement in the three orthogonal axes. Radiated emission measurements were performed from 30MHz to 25GHz. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.

The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.



3.3 Radiated emission limit

3.3.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(uV/m@3m)	(dBuV/m@3m)	(uV/m@3m)	(dBuV/m@3m)
315	6041.68	75.62	604.17	55.62

3.3.2 General radiated emission limit

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency MHz	15.209 Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Uncertainty was calculated in accordance with NAMAS NIS 81.

Expanded uncertainty (k=2) of radiated emission measurement is ± 4.98 dB.



3.4 Calculation of Average Factor

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured in 50 ms or the repetition cycle, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer in zero span mode at 100KHz resolution bandwidth.

Averaging factor in dB = $20\log(\text{duty cycle})$

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 18.136 ms

The number of short pulses in each period (14) multiplied by the duration of each short pulses (0.07ms) = 0.98

The number of long pulses in each period (11) multiplied by the duration of each long pulses (0.35ms) = 3.85

Effective period of the cycle = $0.98 + 3.85 = 4.83$ ms

DC = $4.83 \text{ ms} / 18.136 \text{ ms} = 0.2663$

Therefore, the averaging factor is found by $20 \log_{10} 0.2663 = -11.49$ dB

Please see the Average Factor plot as file name "Average Factor plot.pdf".



Intertek Testing Services

ETL SEMKO

FCC ID. : QWORCS-100

Report No.: EME-021403

Page 10 of 11

3.5 Radiated emission test data FCC 15.231

3.5.1 Fundamental & Harmonics Radiated Emission Data

The radiated emissions at

Frequency(MHz)	Margin
1574	-3.29
1574	-3.69

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : RCS-100
Test Condition : Transmit mode

Freq. (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Average Factor (dB)	Reading Level (dBuV)	Corrected Level (dBuV/m)	Limit At 3m (dBuV/m)	Margin (dB)
315.2	PK	V	0	14.6	-11.49	60.3	63.41	75.62	-12.21
629.5	PK	V	0	21.7	-11.49	29.6	39.81	55.62	-15.81
943.7	PK	V	0	26.2	-11.49	29.4	44.11	55.62	-11.51
1258	PK	V	0	29.6	-11.49	24.6	42.71	55.62	-12.91
*1574	PK	V	0	31	-11.49	31.2	50.71	54	-3.29
1890	PK	V	0	34.2	-11.49	22.4	45.11	55.62	-10.51
315.2	PK	H	0	14.6	-11.49	64.4	67.51	75.62	-8.11
629.5	PK	H	0	21.7	-11.49	30.7	40.91	55.62	-14.71
943.7	PK	H	0	26.2	-11.49	26.9	41.61	55.62	-14.01
1260	PK	H	0	29.7	-11.49	26.7	44.91	55.62	-10.71
*1574	PK	H	0	31	-11.49	30.8	50.31	54	-3.69
1888	PK	H	0	34.2	-11.49	20.5	43.21	55.62	-12.41

Remark:

1. Corrected Level = Reading Level + Correction Factor + Average Factor – Preamp
2. Correction Factor = Antenna Factor + Cable Loss
3. “-” means the emission is below the noise floor.
4. “*” means the emission within the restricted band meets the requirement of part 15.205. The corresponding limit as per 15.209.



3.6 Measured bandwidth FCC 15.231(C)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20dB down from the modulated carrier.

$$\text{B.W(20dBc) Limit} = 0.25\% \times f(\text{MHz}) = 0.25\% \times 315\text{MHz} = 0.7875\text{MHz}$$

From the plot, the bandwidth is observed to be 470kHz, at 20dBc where the bandwidth limit is 0.7875MHz. and the plot is saved with file name: 20dB bandwidth plot.pdf