



MEASUREMENT AND TEST REPORT

VERSION 1.00

Computer Peripheral Composite Device

for demonstration of compliance with
Industry Canada ICES-003 & FCC CFR47 Part 15B Certification

Report Prepared for: Rainforest Automation Inc.
34 W 7th Avenue
Vancouver, BC
V5Y 1L6
Canada

Equipment Under Test (EUT): Model RFA-Z105-2, Trade name: EMU-2™
FCC ID of associated transmitter: YCXRFA-Z1052

Applicable Standards:

Emissions	
FCC CFR 47 Part 15B	Emission standard for unintentional radiators
ICES-003:2004 4 th Ed.	Emission standard for digital apparatus

Tested by: Island Compliance Services Inc.
6454 Fitzgerald Road
Courtenay, BC
V9J 1N7

Prepared By	Authorized By
A. Horel (Technical Writer) 	A. Eadie (Sr. EMC Eng.) 

Note: This test report has been prepared for the Applicant and device described herein. It may not be duplicated or used in part without prior written consent from Island Compliance Services Inc.

FCC OATS registration number: 386117
Industry Canada OATS registration number: 95788-1

Revision History

Version	Date	Author	Comment
1.00 Composite	03/10/2012	A. Horel	Original Release

CONTENTS

Contents.....	3
1 Summary of Test Results	4
1.1 Environmental Conditions.....	4
1.2 Standard Test Conditions and Engineering Practices.....	4
2 General Equipment Specifications	5
2.1 Auxiliary Equipment.....	5
2.2 Engineering Changes to Production Unit	5
3 Radiated Emissions Below 1GHz	6
3.1 Test Procedure	6
3.2 Corrected Amplitude & Margin Calculation	6
3.3 Summary of 15.109 Limits.....	6
3.4 Measurement Data.....	7
3.5 Emissions Plot.....	7
3.6 Additional Information.....	7
4 Power Line Conducted Emissions.....	8
4.1 Test Method.....	8
4.2 Limits as per 15.107.....	8
4.3 Line Results Plot	9
4.4 Measurement Data, Line.....	10
4.5 Measurement Data, Neutral	10
4.6 Additional Information.....	10
5 Test Equipment.....	11
6 Test Diagrams	12
6.1 Power line conducted Emissions Test Setup	12
6.2 Radiated Emissions Test Setup.....	12

1 SUMMARY OF TEST RESULTS

The equipment under test was found to comply with the test standards and criteria outlined herein.

Test Description	Reference Specification FCC	Reference Specification Industry Canada	Result	Comment
Radiated Emissions Below 1GHz	FCC Subpart B 15.109	ICES-003 Issue 4	Complies	
Power line Conducted Emissions	FCC Subpart B 15.107	ICES-003 Issue 4	Complies	

1.1 ENVIRONMENTAL CONDITIONS

Description	Reading
Indoor Temperature	24°C
Indoor Humidity	40-50%
Outdoor Temperature	18-24°C
Outdoor Humidity	980-1005 mBar

1.2 STANDARD TEST CONDITIONS AND ENGINEERING PRACTICES

The measurements shown in this test report were made in accordance with the procedures given in ANSI C63.4 2003

2 GENERAL EQUIPMENT SPECIFICATIONS

Item	Description
Manufacturer	Rainforest Automation
Model Number	RFA-Z105-2
Trade Name	EMU-2™
Function	Energy Monitoring Unit
Power Supply Input	AC adapter, 2xAAA for backup
Power Output	0.0257W
Antenna Gain/Type	4.5dBi, Integral PCB Trace
Channel Spacing	5MHz
Frequency Range	2405-2480 MHz
Modulation	0-QPSK

2.1 AUXILIARY EQUIPMENT

Equipment	Description
N/A	

2.2 ENGINEERING CHANGES TO PRODUCTION UNIT

N/A

3 RADIATED EMISSIONS BELOW 1GHz

3.1 TEST PROCEDURE

Maximizing procedure was performed on the six (6) highest emissions readings between the lowest RF frequency generated on the device (without going below 9 kHz) and the 10th harmonic of the highest fundamental frequency. Where applicable, a hybrid antenna, horn antenna and loop antenna were used to cover the relevant frequency bands.

All data was recorded in the peak detection mode. Quasi-peak readings were performed only when an emission was found to be marginal (within -4 dB of specification limits).

All other measurements were lower than 20dB below the limit.

3.2 CORRECTED AMPLITUDE & MARGIN CALCULATION

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

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit for Class A. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

3.3 SUMMARY OF 15.109 LIMITS

Limits below detailed for 3m measurement distance.

Frequency Range (MHz)	Field Strength (μ V/m)	Limit dBuV/m	Detector
30-88	100	40.0	QP
88-216	150	43.5	QP
216-960	200	46.0	QP
960 – 1000	500	54.0	QP
Above 1000	500	54.0	Avg
Above 1000	5000	74.0	Peak

3.4 MEASUREMENT DATA

No.	Freq (MHz)	Rdng (dBuV)	Corrected (dBuV/m)	Spec (dBuV/m)	Margin (dB)	Polarity	Antenna Height
1	47.490M	25.4	32.5	40.0	-7.5	Vert	233
2	86.300M	23.0	34.2	43.5	-9.3	Vert	290
3	73.730M	13.8	22.4	40.0	-17.6	Horiz	265
4	95.307M	12.6	23.4	43.5	-20.1	Horiz	115
5	33.113M	8.8	19.3	40.0	-20.7	Horiz	239
6	02.796M	25.4	36.1	43.5	-7.4	Horiz	295

TABLE 1 - SPURIOUS EMISSIONS MEASUREMENTS

3.5 EMISSIONS PLOT

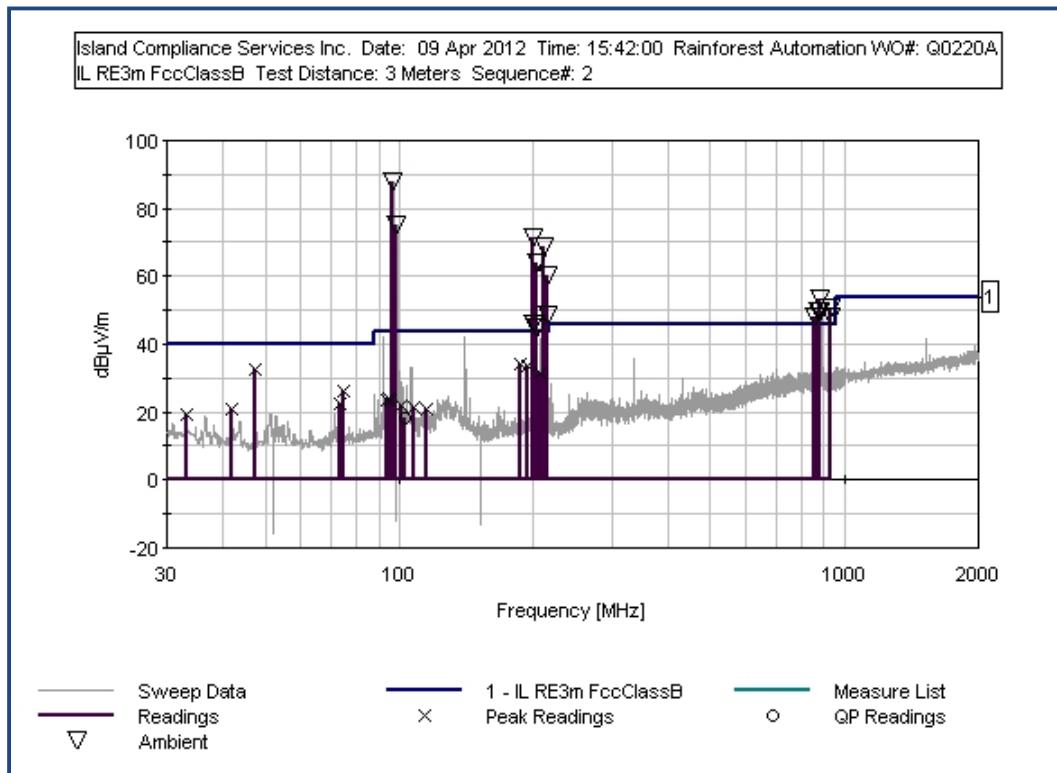


FIGURE 1 - SPURIOUS EMISSIONS PLOT

3.6 ADDITIONAL INFORMATION

Description	Comment
Test Engineer	A. Eadie
Test Date	4/09/2012

4 POWER LINE CONDUCTED EMISSIONS

4.1 TEST METHOD

For the duration of the conducted emissions test, the power cord of the EUT was connected to the main power outlet of the LISN. The LISN in turn is connected to an AC power source. Exploratory tests of the EUT are performed by varying modes and cable positioning. Maximizing procedures are performed on the highest emission readings from the EUT

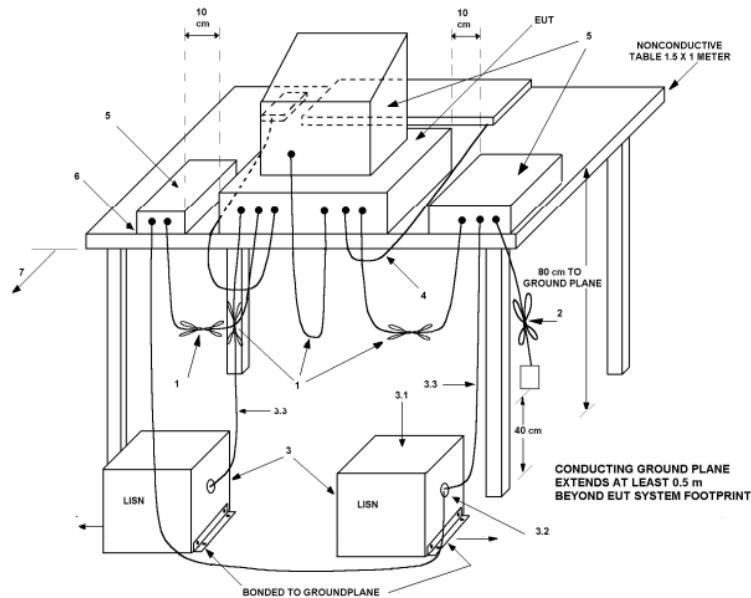


TABLE 2 - TEST ARRANGEMENT FOR CONDUCTED EMISSIONS OF TABLETOP EQUIPMENT

4.2 LIMITS AS PER 15.107

Frequency of emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50

TABLE 3 – CONDUCTED EMISSION LIMITS

4.3 LINE RESULTS PLOT

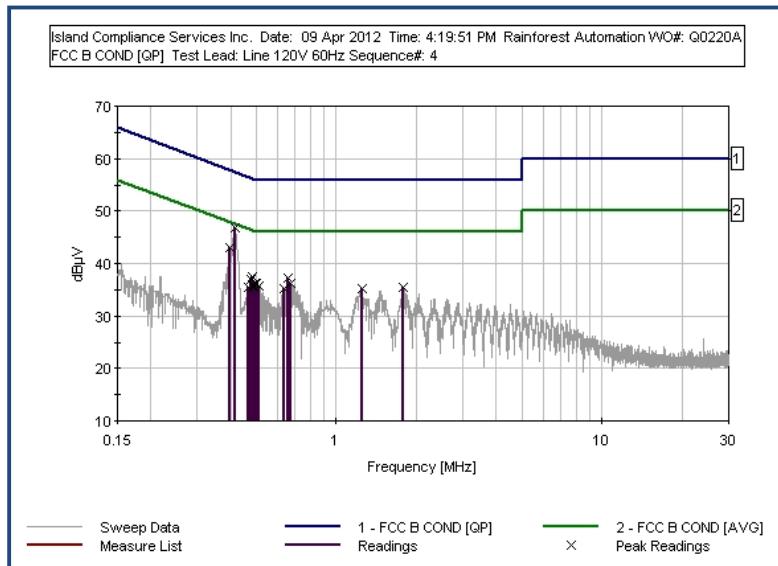


FIGURE 2 - CONDUCTED EMISSIONS PLOT – LINE

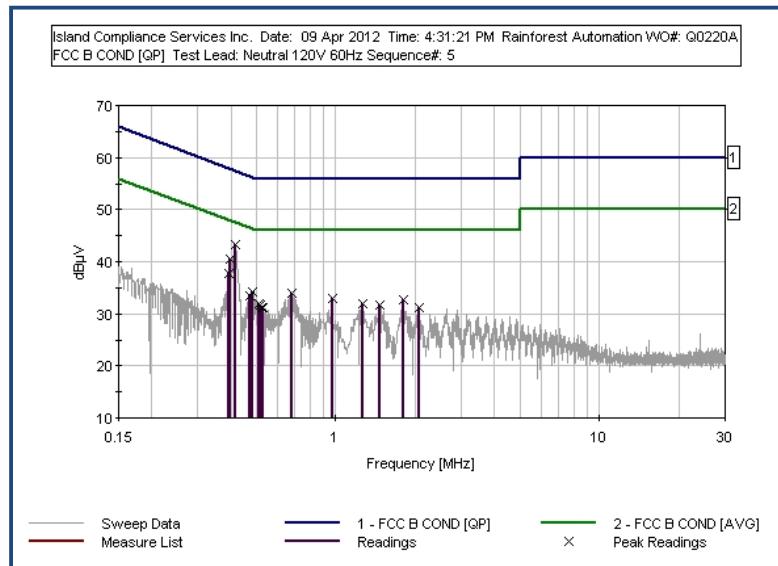


FIGURE 3 - CONDUCTED EMISSIONS PLOT - NEUTRAL

4.4 MEASUREMENT DATA, LINE

No.	Freq (MHz)	Rdng (dBuV)	Corrected (dBuV)	Spec (dBuV)	Margin (dB)	Polarity
1	414.701k	36.8	46.9	57.6	-10.7	Line
2	396.521k	32.8	42.9	57.9	-15.0	Line
3	661.222k	27.1	37.2	56.0	-18.8	Line
4	500.510k	26.0	36.1	56.0	-19.9	Line
5	1.796M	25.3	35.4	56.0	-20.6	Line
6	39.406k	25.2	35.3	56.0	-20.7	Line

4.5 MEASUREMENT DATA, NEUTRAL

No.	Freq (MHz)	Rdng (dBuV)	Corrected (dBuV)	Spec (dBuV)	Margin (dB)	Polarity
1	415.428k	33.2	43.3	57.5	-14.2	Neutral
2	399.430k	30.4	40.5	57.9	-17.4	Neutral
3	683.038k	23.8	33.9	56.0	-22.1	Neutral
4	1.813M	22.6	32.7	56.0	-23.3	Neutral
5	511.418k	21.9	32.0	56.0	-24.0	Neutral
6	2.068M	21.1	31.2	56.0	-24.8	Neutral

4.6 ADDITIONAL INFORMATION

Description	Comment
Test Engineer	A. Eadie
Test Date	4/09/2012

5 TEST EQUIPMENT

All applicable test equipment will be calibrated in accordance with ANSI Standard NCSL Z540-1 or other NIST traceable calibration standard. Equipment is calibrated on a 2 year cycle or according to the manufacturer's recommendations.

Manufacturer	Description	Model	Serial Number	Cal/Char Due Date D/M/Y
HP	Spectrum Analyzer	8566B	1327A00106/ 2648A14332	7/12/2012
Electro Metrics	Line Impedance Stabilization Network	EM-7823	115037	18/10/2012
HP	Pre-selector	85685A	2648A00463	7/12/2012
HP	Quasi Peak Detector	85650A	2521A00704	14/10/2012
Electro Metrics	Hybrid Antenna	EM-3141	9902-1141	18/11/2012
AH Systems	Horn Antenna	SAS-571	1242	18/11/2012
HP	Signal Generator	8657A	2521A00704	15/11/2012
HP	Signal Generator	8673E	2704A00420	7/2/2013
Rohde & Schwarz	Power analyzer	NVRS	844352/043	15/5/2013
Rohde & Schwarz	Power probe	NRV-Z5	8429721029	15/5/2013

6 TEST DIAGRAMS

6.1 POWER LINE CONDUCTED EMISSIONS TEST SETUP



6.2 RADIATED EMISSIONS TEST SETUP

