

Test Report: 2007 118316 RX01 FCC

Project number: 8316-1

Applicant: Carttronics LLC
2042 Corte Del Nogal Suite C
Carlsbad, CA 92011

Equipment Under Test (EUT): Reset Controller


Model: RX01

In Accordance With: FCC Part 15 Subpart C, 15.249
CANADA, IC RSS-Gen, IC RSS 210

FCC ID# USH00004

IC ID# 6834A-00004

Tested By: Nemko USA Inc.
11696 Sorrento Valley Road, Suite F
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Authorized By: 
Alan Laudani, EMC/RF Test Specialist

Date: NOVEMBER 7, 2007

Total Number of Pages: 22

Section 1. Summary of Test Results

General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

This Radio Standards Specification (RSS) sets out the requirements for license exempt low-power intentional radiators. The applicable standard for low-power intentional radiators in Canada, corresponding to FCC Part 15 Subpart C, is RSS-210. The two are very closely harmonized in terms of permitted frequencies, types of operation, and other technical requirements. The test results reported in this report are deemed satisfactory evidence of compliance with Industry Canada Standard RSS-210.

The assessment summary is as follows:

Apparatus Assessed:	Reset Controller Model RX01
Specification:	FCC Part 15 Subpart C, 15.249 IC RSS-Gen (Issue 2, June 2007), IC RSS 210 (Issue 7, June 2007)
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None

Report Release History:

REVISION	DATE	COMMENTS
-	November 7, 2007	Prepared By: Ferdinand S. Custodio
-	November 7, 2007	Initial Release: Alan Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY: _____


Ferdinand S. Custodio, EMC Test Engineer

Date: November 7, 2007

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Section 2: Equipment Under Test

2.1 Product Identification

The Equipment Under Test was identified as follows:

RX01 Reset Controller

Engineering sample, no serial number available during assessment.



2.2 Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

Sample No.	Description	Serial No.
RX01	Reset Controller ASSY No. 50004-001 in a plastic enclosure with a 3.3dBi gain antenna	N/A

2.3 Theory of Operation

The RX01 is a Reset Controller used in retail stores for shopping cart security. It is a 2.4GHz radio transmitter and was exercised by fully powering on the unit and the output verified by a Spectrum Analyzer. For testing purposes, the EUT was programmed to transmit continuously.

2.4 Technical Specifications of the EUT

Manufacturer:	Carttronics LLC
Operating Frequency:	2405 to 2480 MHz in the 2400 - 2483.5 MHz Band
Emission Designator	3M00F1D
Rated Power:	134 μ W
Modulation:	FSK
Type of Receiver:	Heterodyne type with in-phase and quadrature components
Antenna Data:	PCB Printed "Inverted F-Antenna" (Max gain 3.3 dBi)
Antenna Connector:	NONE
Power Source:	9 Volt Alkaline Battery ANSI 1604A IEC 6LR61

Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.249

Operation within the bands 902-928 MHz, 2400-2483.5 MHz,
5725-5850 MHz and 24.0-24.25 GHz bands.

RSS-Gen General Requirements and Information for the Certification of
Radiocommunication Equipment

RSS-210 Low-power License-exempt Radiocommunication Devices (All
Frequency Bands): Category I Equipment

3.2 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	17 – 24 °C
Humidity range	:	23 - 70 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 5% of rated voltages

3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	7/10/2007	07/10/08
317	Preamplifier	HP	8449A	2749A00167	2/9/2007	02/09/08
625	Dbl Ridge Horn	EMCO	3116	2325	NCR	Verified
835	Spectrum Analyzer	Rohde & Schwarz	RHDFSEK	829058/005	6/20/2007	06/20/08
N149	Environmental Chamber	Cincinnati Sub-Zero	ZPHS-32-2-2-H/AC	ZP0552665	5/30/2007	5/30/2008
110	Antenna, LPA	Electrometrics	LPA-25	1217	12/18/2006	12/18/07
899	RF Filter Section	HP	85460A	3448A00288	1/18/07	1/18/08
898	EMI Receiver	HP	8546A	3625A00348	1/18/07	1/18/08
897	Spectrum Analyzer	Rohde & Schwarz	FSP7	837620/009	9/14/2007	09/14/08
772	DC Power Supply	Micronta	22-121	74103233-A	NCR	Verified
815	Multimeter	Fluke	111	78130066	7/9/2007	07/09/08

Open Area Test Site Industry Canada Number:	2040B-1 OATS
Open Area Test Site FCC Number:	RN 90579

Section 4: Observations

4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.4 Test Deleted

No Tests were deleted from this assessment.

4.5 Additional Observations

There were no additional observations made during this assessment.

Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C: Test Results and corresponding IC RSS-210 equivalent.

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N No: not applicable / not relevant
Y Yes: Mandatory i.e. the apparatus shall conform to these test.
N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

5.1 FCC Part 15 Subpart C and IC RSS-210 Equivalent: Test Results

Part 15	Test Description	Required	Result
15.207 (a) <i>IC RS-Gen 7.2.2</i>	Power line Conducted Emissions	N ¹	
15.209 (a) <i>IC RS-210 2.2/2.7</i>	Radiated Emissions within Restricted Bands	Y	Pass
15.215 (c) <i>IC RS-Gen 4.6.1</i>	Occupied Bandwidth	Y	Pass
15.249 (a) <i>IC RS-210 A2.9</i>	Radiated Emissions not in Restricted Bands	Y	Pass
15.249 (b)	Fixed Point-to-Point operation in the 24.0-24.25 GHZ Band	N	
15.249 (d) <i>IC RS-210 2.6</i>	Spurious Emissions (except Harmonics)	Y	Pass
<i>IC RS-Gen 4.10</i>	Receiver Spurious Emissions	Y ²	Pass
<i>IC RS-210 2.1, IC RS-Gen 4.7</i>	Frequency Stability	N	

Notes:

¹ EUT does not operate directly or indirectly from the public utility AC power supply

² Spurious Emissions was measured when the unit is in "Receive" mode to show compliance with IC RSS General Receiver requirements, however no emissions were detected.

Appendix A: Test Results

Clause 15.209(a) Radiated Emissions within Restricted Bands

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (uV/meter)	Measurement Distance (meter)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Conditions:

Sample Number:	RX01	Temperature:	17
Date:	November 6, 2007	Humidity:	70
Modification State:		Tester:	Ferdinand Custodio
		Laboratory:	SOATS

Test Results:

There are no emissions found that falls within the Restricted Band of Operations as mandated by § 15.205

Additional Observations:

The Spectrum was searched from 30MHz to the 10th Harmonic.

The EUT was measured on three orthogonal axis.

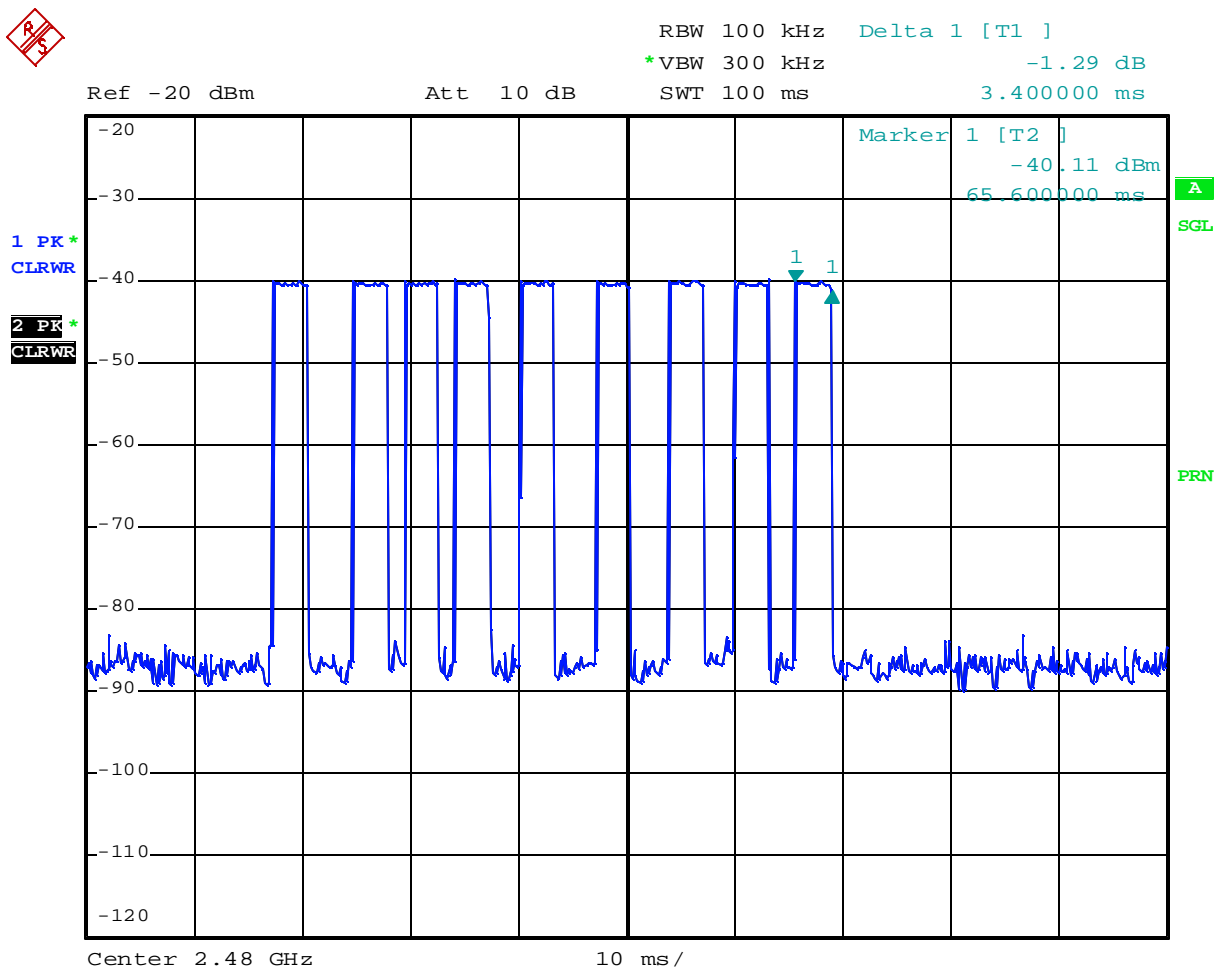
All Measurements below 1GHz were performed at 3m employing a CISPR quasi-peak detector. Average measurements above 1GHz were done utilizing RBW of 1MHz and VBW of 10Hz for non-intentional radiation emissions and Peak + duty cycle factor for intentional radiation emissions.

IC RS-210 2.2/2.7 Radiated Emissions within Restricted Bands

Test Results:

Results are similar to Clause 15.209(a) Radiated Emissions within Restricted Bands.

Duty Cycle Plots



Date: 6.NOV.2007 13:15:30

Duty Cycle Computations = $3.4\text{ms} \times 9$
 = $30.6\text{ms}/100\text{ms}$
 = 0.306 or 30.6%
Duty Cycle Factor = $20 \times \log(.306)$ or -10.29dB

Clause 15.215(c) Occupied Bandwidth

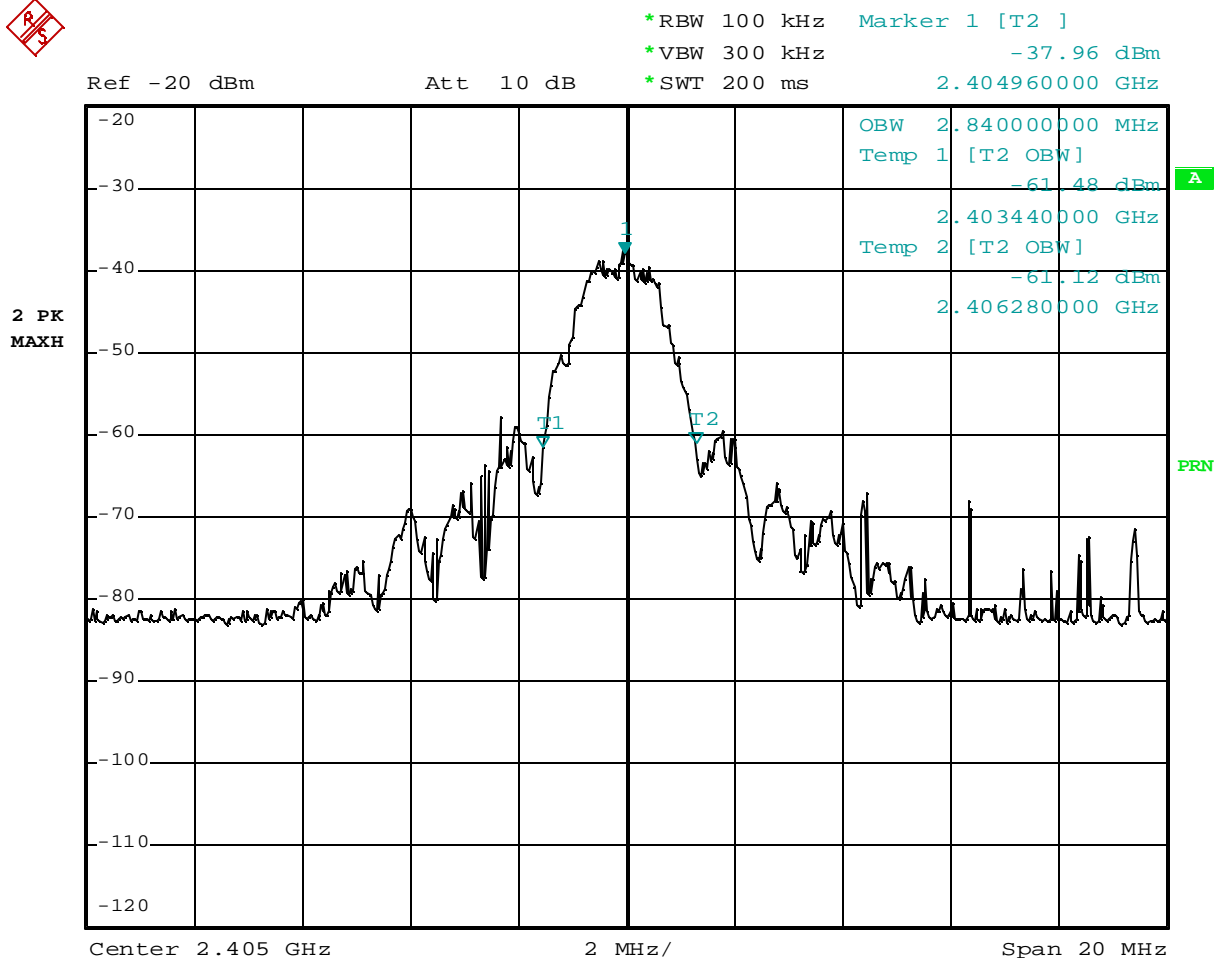
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Sec. Sec. 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the 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 requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Conditions:

Sample Number:	RX01	Temperature:	24
Date:	November 6, 2007	Humidity:	40
Modification State:		Tester:	Ferdinand Custodio
		Laboratory:	Nemko

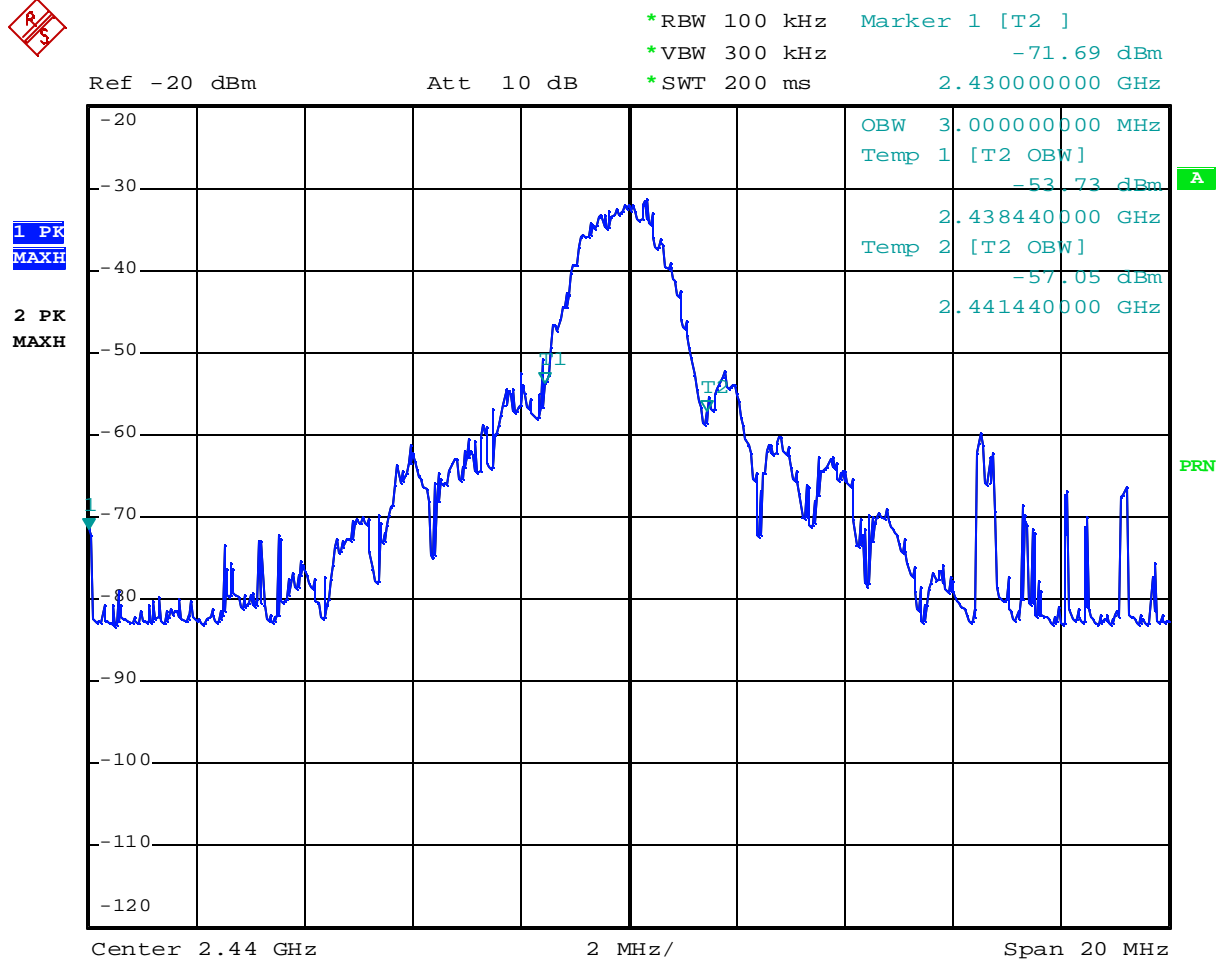
Test Results:

See attached plots



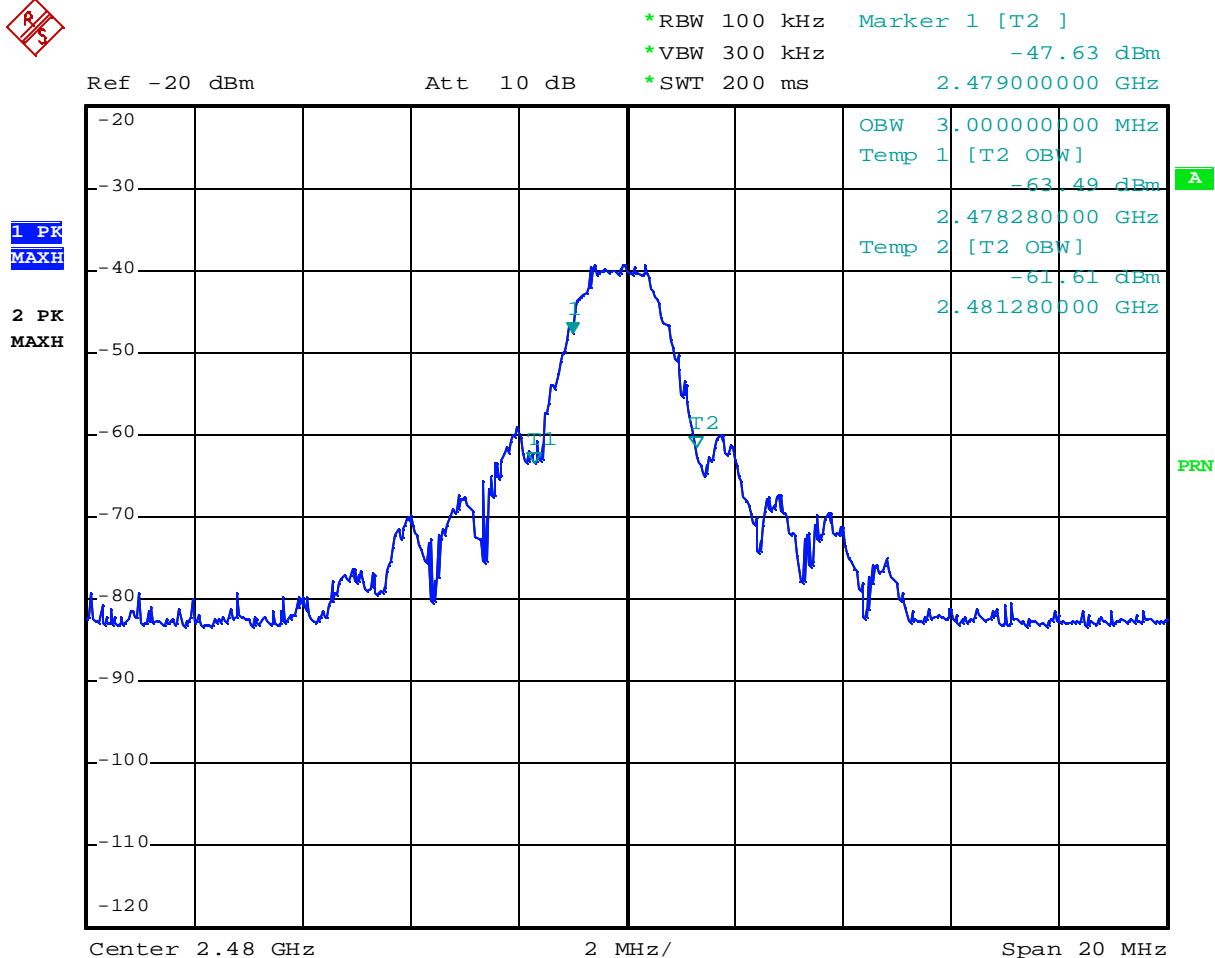
Date: 6.NOV.2007 12:49:23

**Measured Occupied Bandwidth = 2.84MHz
Low Channel (2.405GHz)**



Date: 6.NOV.2007 12:52:55

**Measured Occupied Bandwidth = 3.00MHz
 Mid Channel (2.44GHz)**



Date: 6.NOV.2007 12:58:36

**Measured Occupied Bandwidth = 3.00MHz
 High Channel (2.48GHz)**

Band edge Measurements:

Test Results:

Band edge emissions were measured under Part 15.209 General Emission Limits. The EUT was measured on three orthogonal axis and only the worst case reported. Average measurement were obtained using Peak + duty cycle factor. This process was repeated for the upper band edge measurement.

Radiated Emissions Data															
Complete	<u>YES</u>				Job # : <u>8316-1</u>					Test # : <u>1</u>					
Preliminary					Page <u>1</u>					of <u>1</u>					
Client Name :	<u>Carttronics LLC</u>														
EUT Name :	<u>Reset Controller</u>														
EUT Model # :	<u>RX01</u>														
EUT ANTENNA Part # :															
EUT Serial # :	<u>N/A</u>														
EUT Config. :	<u>Low and High Channels</u>														
Specification :	<u>FCC Part 15.209(a)</u>														
Rod. Ant. # :	<u>NA</u>				Temp. (deg. C) :				<u>17</u>				Reference :		
Bicon Ant. # :	<u>NA</u>				Humidity (%) :				<u>70</u>				Date : <u>Nov. 6, 2007</u>		
Log Ant. # :	<u>NA</u>				EUT Voltage :				<u>9VDC</u>				Time : <u>3:00PM</u>		
DRG Ant. # :	<u>529</u>				EUT Frequency :								Staff : <u>FSCustodio</u>		
Dipole Ant. # :	<u>NA</u>				Phase :								Photo ID: _____		
Cable# :	<u>40ft</u>				Location :				<u>SQATS</u>				Peak Res Bandwidth: <u>1 MHz</u>		
Preamp# :	<u>317</u>				Distance :				<u>3M</u>				Peak Video Bandwidth <u>1 MHz</u>		
Spec An. # :	<u>835</u>				Duty Cycle Factor				<u>-10.29</u>				Average <u>Peak + DCF</u>		

Meas. Freq. (MHz)	Vertical (dBuV)		Horizontal (dBuV)		CF (db)	Max Level (dBuV/m)		Spec. Limit (dBuV/m)		Margin dB		EUT Rotation	Ant. Height	Pass Fail Unc.	Comment
	pk	av	pk	av		pk	av	pk	av	pk	av				
2400.0	44.6	34.3	45.3	35.0	12.5	57.79	47.5	74.0	54.0	-16.2	-6.5			Pass	Low Channel
2483.5	41.3	31.0	41.4	31.1	12.5	53.83	43.54	74.0	54.0	-20.2	-10.5			Pass	High Channel

Note: Correction factor (CF) computations (Preamp)

= Antenna Factor + Path Loss – RF Gain

= 28.4+ 17.6 – 33.5

= 12.5

Clause 15.249(a) Radiated Emissions not in Restricted Bands

Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (mV/meter)	Field strength of harmonics (uV/meter)
902-928	50	500
2400-2483.5	50	500
5725-5875	50	500
24000-24250	250	2500

Test Conditions:

Sample Number:	RX01	Temperature:	17
Date:	November 6, 2007	Humidity:	70
Modification State:		Tester:	Ferdinand Custodio
		Laboratory:	SOATS

Test Results:

See Attached Plots.

Additional Observations:

The Spectrum was searched from 30MHz to the 10th Harmonic-25000MHz.

The EUT was measured on three orthogonal axis.

All Measurements (including above 1GHz) were performed at 3m with a Peak detector of 1MHz RBW/VBW. Average measurements are computed using the formula $FS_{avg} = FS_{peak} - 20 \log(\text{duty cycle})$.

Voltage variations of +/-15% for fundamental emission verification were done during this test. The output was monitored when voltage was varied from 7.65VDC to 10.35VDC. No change in output was observed.



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Radiated Emissions Data

Complete YES

Preliminary

Job # : 8116-1 Test # : 1

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Client Name : Carttronics LLC

EUT Name : Reset Controller

EUT Model # : RX01

EUT Serial # : N/A

EUT Config. : Low, Mid and High Channels

Specification : Clause 15.249(a)

Rod. Ant. # : NA

Temp. (deg. C) : 17

Date : Nov. 6, 2007

Bicon Ant.# : NA

Humidity (%) : 70

Time : 3:00PM

Log Ant.# : NA

EUT Voltage : 9VDC

Staff : FSCustodio

DRG Ant. # : 529

EUT Frequency :

Photo ID:

Dipole Ant.# : NA

Phase:

Peak Res Bandwidth: 1 MHz

Cable# : 40ft

Location: SOATS

Peak Video Bandwidth 1 MHz

Preamp# : NA

Distance: 3 m

Spec An.# : 835

Duty Cycle Factor -10.29

QP # : NA

Duty Cycle 0.31

Meas. Freq. (MHz)	Vertical (dBuV)		Horizontal (dBuV)		CF (db)	Max Level (dBuV/m)		Spec. Limit (dBuV/m)		Margin dB		EUT Orientation	Ant. Height	Pass Fail Unc.	Comment
	pk	av	pk	av		pk	av	pk	av	pk	av				
2405.00	53.7	43.4	50.8	40.5	35.4	89.1	78.8	94.0		-15.2		180.0	1.0	Pass	
2440.00	54.4	44.1	52.3	42.1	35.4	89.8	79.5	94.0		-14.5		180.0	1.0	Pass	
2480.00	56.4	46.1	54.3	44.0	35.4	91.7	81.4	94.0		-12.6		180.0	1.0	Pass	

Correction factor (CF) computations

Antenna Factor + Path Loss – RF Gain (Preamp) =

$$29.5 + 5.9 - 0 = 35.4$$

Field Strength of Fundamental Calculations:

Average Power Level Limit = 50 mV/m

Highest of Vertical or Horizontal Peak Reading

Average = Peak + Duty Cycle Factor

$$56.4 + (-10.29) = 46.1$$

Max Level = Average Reading + Correction Factor

$$= 46.1 + 35.4 = 81.4 \text{ dBuV/m}$$

$$10^{((81.4-120)/20)} = 0.031 \text{ V/m}$$

0.012 V/m = **12 mV/m** which complies.

Clause 15.249(d) Spurious Emissions (except Harmonics)

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 Sec. 15.209, whichever is the lesser attenuation.

Test Conditions:

Sample Number:	RX01	Temperature:	17
Date:	November 6, 2007	Humidity:	70
Modification State:	Transmit	Tester:	Ferdinand Custodio
		Laboratory:	SOATS

Test Results:

See Attached Plots.

Additional Observations:

The Spectrum was searched from 30MHz to the 10th Harmonic.

The EUT was measured on three orthogonal axis, only the worst case is reported.

All measurements were performed at 3m with a Quasi-Peak detector below 1GHz when a valid emission is found otherwise Peak detector. Peak detector with settings of 1MHz RBW/VBW is used above 1GHz.

No Spurious Emissions were detected above 1GHz.



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Radiated Emissions Data

Job # : 8316-1 Date : Nov. 6, 2007
NEX #: 95120 Time : 4:00PM
Staff : FSC

Page 1 of 1

Client Name :	Carttronics LLC
EUT Name :	Remote Controller
EUT Model # :	RX01
EUT Serial # :	N/A
EUT Config. :	Transmit @ 2480 MHz (High Channel)

EUT Voltage :	9VDC
EUT Frequency :	
Phase:	
NOATS	
SOATS	X
Distance < 1000 MHz:	
Distance > 1000 MHz:	3 m

Specification : CFR47 Part 15, Subpart B, Class B

Loop Ant. #:	NA		
Bicon Ant. #:	NA	Temp. (°C) :	17
Log Ant. #:	110	Humidity (%) :	70
DRG Ant. #	NA	Spec An. #:	899/898
Dipole Ant. #:	NA	Spec An. Display #:	899/898
Cable LF#:	SOATS	QP #:	
Cable HF#:	NA	PreSelect#:	NA
Preamp LF#:	NA		
Preamp HF#	NA		

Quasi-Peak	RBW: <u>120 kHz</u> Video Bandwidth <u>300 kHz</u>
Peak	RBW: <u>1 MHz</u> Video Bandwidth <u>3 MHz</u>
Average	RBW: <u>1 MHz</u> Video Bandwidth <u>10 Hz</u>

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.

Measurements above 1 GHz are Average values, unless otherwise stated.

[illegible]

IC RS-210 2.1, IC RS-Gen 4.7 Frequency Stability

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.

The reference temperature for transmitters is +20°C, unless specified otherwise in the applicable RSS to the device.

A hand-held device that is only capable of operating using internal batteries shall be tested using a new battery without any further requirement to vary the supply voltage. Alternatively, an external supply voltage can be used and set at the battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environment test chamber, the unmodulated carrier frequency shall be measured under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement. The following temperatures and supply voltage ranges apply, unless specified otherwise in the applicable RSS.

(a) at temperatures of -30°C, +20°C and +50°C, and at the manufacturer's rated supply voltage; and

(b) at temperature of +20°C and at ± 15 percent of the manufacturer's rated supply voltage.

Test Conditions:

Sample Number:	RX01	Temperature:	23°C
Date:	November 6, 2007	Humidity:	49%
Modification State:	Transmit	Tester:	Ferdinand Custodio
		Laboratory:	Humidity Chamber

Test Results

Note: Clause A2.9 (RSS 210) does not require frequency stability test.