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Test Report:	2007 031019 MX01 FCC
Project number:	26-1019-EXPR1
Applicant:	Carttronics LLC 2042 Corte Del Nogal Suite C Carlsbad, CA 92011
Equipment Under Test (EUT):	Low Power Sensor Device
Model:	MX01
In Accordance With:	FCC Part 15 Subpart C, 15.249 CANADA, IC RSS-Gen, IC RSS 210
FCC ID#	USH00001
IC ID#	6834A-00001
Tested By:	Nemko USA Inc. 11696 Sorrento Valley Road, Suite F San Diego, CA 92121
Authorized By:	Michael T. Krumweide, EMC Supervisor
Date:	MARCH 27, 2007
Total Number of Pages:	33

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 is 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: Low Power Sensor Device Model MX01

Specification: FCC Part 15 Subpart C, 15.249
IC RSS-Gen (Issue 1, September 2005), IC RSS 210 (Issue 6, September 2005)

Compliance Status: Complies

Exclusions: None

Non-compliances: None

Report Release History:

REVISION	DATE	COMMENTS
-	March 27, 2007	Prepared By: Ferdinand S. Custodio
-	March 27, 2007	Initial Release: Mike T. Krumweide

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: _____ Date: March 27, 2007
Ferdinand S. Custodio, EMC Test Engineer

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Section 2: Equipment Under Test

2.1 Product Identification

The Equipment Under Test was identified as follows:

MX01 Low Power Sensor Device

Engineering sample, serial number not 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.
MX01	Low Power Sensor Device ASSY No. 50303-001 in a plastic enclosure with a 1.5dBi gain antenna	NA

2.3 Theory of Operation

The MX01 is a Low Power Sensor Device 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.

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	2M72F1D
Rated Power:	1.99 mW
Modulation:	QPSK
Type of Receiver:	Heterodyne type with in-phase and quadrature components
Antenna Data:	Centurion WCP2400-MMCX8 (1.5 dBi Gain)
Antenna Connector:	MMCX
Power Source:	AC Adapter 9VDC GlobTek®,Inc. Model # GT- A81051-0509UW2 SN5105HB

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	:	14 – 27 ^{o}C
Humidity range	:	19 - 44 %
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
674	Spectrum Analyzer	HP	2882	2007A00910	2/15/06	2/15/07
675	Spectrum Analyzer Display	HP	85662A	2005A01282	2/15/06	2/15/07
676	Quasi-Peak Adapter	HP	85650A	2430A00576	1/5/06	1/5/07
805	LISN	Solar	9348-50-R-24-BNC	992823	12/1/06	12/1/07
542	High Pass Filter	Solar	7801-5.0	838132	3/1/06	3/1/07
560	Transient Limiter	HP	11947A	2820A00502	1/18/06	1/18/07
833	Peak Power Meter	HP	HP8900D	2131A00861	3/31/06	3/31/07
114	Antenna, Bicon	EMCO	3104	2997	12/20/2006	12/20/07
110	Antenna, LPA	Electrometrics	LPA-25	1217	12/18/2006	12/18/07
827	Preamplifier	Com-Power	PA-103	161032	1/11/06	1/11/07
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	6/20/06	6/20/07
842	Preamp	NA	Nemko	NA	Verified 3/27/07	
897	Spectrum Analyzer	Rohde & Schwarz	FSP7	837620/009	8/11/06	8/11/07
835	Spectrum Analyzer	Rohde & Schwarz	RHDFSEK	829058/005	1/18/06	1/18/07
N149	Environmental Chamber	Cincinnati Sub-Zero	ZPHS-32-2-2-H/AC	ZP0552665	5/11/06	5/11/07
911	Spectrum Analyzer	Agilent	E4440A	US41421266	6/7/06	6/7/2007
529	Antenna, DRWG	EMCO	3115	2505	8/31/2006	08/31/07
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

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) *IC RS-Gen 7.2.2*	Power line Conducted Emissions	Y	Pass
15.209 (a) *IC RS-210 2.2/2.7*	Radiated Emissions within Restricted Bands	Y	Pass
15.215 (c) *IC RS-Gen 4.4.1*	Occupied Bandwidth	Y	Pass
15.249 (a) *IC RS-210 A2.9*	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) *IC RS-210 2.6*	Spurious Emissions (except Harmonics)	Y	Pass
2.1055 (a) *IC RS-210 2.1,IC RS-Gen 4.5*	Frequency Stability	Y	Pass

Notes:

Spurious Emissions was measured when the unit is in "Stand By" 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:	MX01	**Temperature:**	14
Date:	December 19, 2007	**Humidity:**	27
Modification State:		**Tester:**	Ferdinand Custodio
		Laboratory:	OATS

Test Results:

See Attached Plots.

Additional Observations:

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

These results apply to emissions found in the restricted bands defined in FCC Part 15 Subpart C, 15.205. 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 (duty cycle). Only the worst channel reported.

Clause 15.209(a) Radiated Emissions within Restricted Bands (Below 1GHz)

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Radiated Emissions Data

Complete X — Job # : 26-1019-EXPR — Test # : 4
Preliminary — Page — of

Client Name : Carttronics
EUT Name : TX Minder
EUT Model # : MX01
EUT Part # :
EUT Serial # :
EUT Config. : Normal Operation

Specification : FCC Part 15 Subpart C, 15.205 — Reference :
Rod. Ant. #: NA — Temp. (deg. C) : 27 — Date : Nov. 22, 2006
Bicon Ant.#: 114 — Humidity (%) : 19 — Time :
Log Ant.#: 110 — EUT Voltage : 120 — Staff : Ferdinand Custodio
DRG Ant. # 529 — EUT Frequency : 60 — Quasi-Peak RBW: 120 kHz
Dipole Ant.#: NA — Phase: 1 — Video Bandwidth 120 kHz
Cable#: SOATS — Location: SOATS — Average RBW: 1 MHz
Preamp#: 827 — Distance: 3 meters — Video Bandwidth 10 Hz
Spec An.#: 911 — Peak RBW: 1 MHz
QP #: 911 — Video Bandwidth 1 MHz
PreSelect#: NA

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

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Atten. (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
111.82	V		46.05	14.2	1.8	32.5	29.5	43.5	-14.0	Pass	Ambient noise

Clause 15.209(a) Radiated Emissions within Restricted Bands (Above 1GHz)

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Radiated Emissions Data

Complete	YES			Job # : 26-1019-EXPR1	Test # : 2
Preliminary				Page 1	of 1
Client Name :	Expertise Engineering				
EUT Name :	Low Power Sensor Module				
EUT Model # :	MX01 Transmitter				
EUT ANTENNA Part # :					
EUT Serial # :					
EUT Config. :	Transmit (Low, Mid and High Channels)				
Specification :	FCC Part 15.209 (a) Restricted Bands				
Rod. Ant. #:	NA	Temp. (deg. C) :	14	Date :	Dec. 19, 2006
Bicon Ant.#:	NA	Humidity (%) :	27	Time :	2:00PM
Log Ant.#:	NA	EUT Voltage :	120VAC	Staff :	FSCustodio
DRG Ant. #	877	EUT Frequency :	60Hz	Photo ID:	
Dipole Ant.#:	NA	Phase:	1	Peak Res Bandwidth:	1 MHz
Cable#:	40ft	Location:	SOATS	Peak Video Bandwidth	1 MHz
Preamp#:	842	Distance:	3 m	AVE Res Bandwidth:	1 MHz
Spec An.#:	835	Duty Cycle Factor	-20	AVE Video Bandwidth	10 Hz
QP #:	NA	Duty Cycle (%)	0.10		

Meas. Freq. (MHz)	Vertical (dBuV) pk	Vertical (dBuV) av	Horizontal (dBuV) pk	Horizontal (dBuV) av	CF (db)	Max Level (dBuV/m) pk	Max Level (dBuV/m) av	Spec. Limit (dBuV/m) pk	Spec. Limit (dBuV/m) av	Margin dB pk	Margin dB av	EUT Rotation	Ant. Height	Pass Fail Unc.	Comment
4810.00	68.1	48.1	63.1	43.1	-4.5	63.6	43.6	74.0	54.0	-10.4	-10.4	250.0	1.1	Pass	
4890.00	69.6	49.6	62.8	42.8	-4.5	65.1	45.1	74.0	54.0	-8.9	-8.9	270.0	1.3	Pass	
4960.00	69.9	49.9	67.9	47.9	-6.5	63.4	43.4	74.0	54.0	-10.6	-10.6	200.0	1.0	Pass	

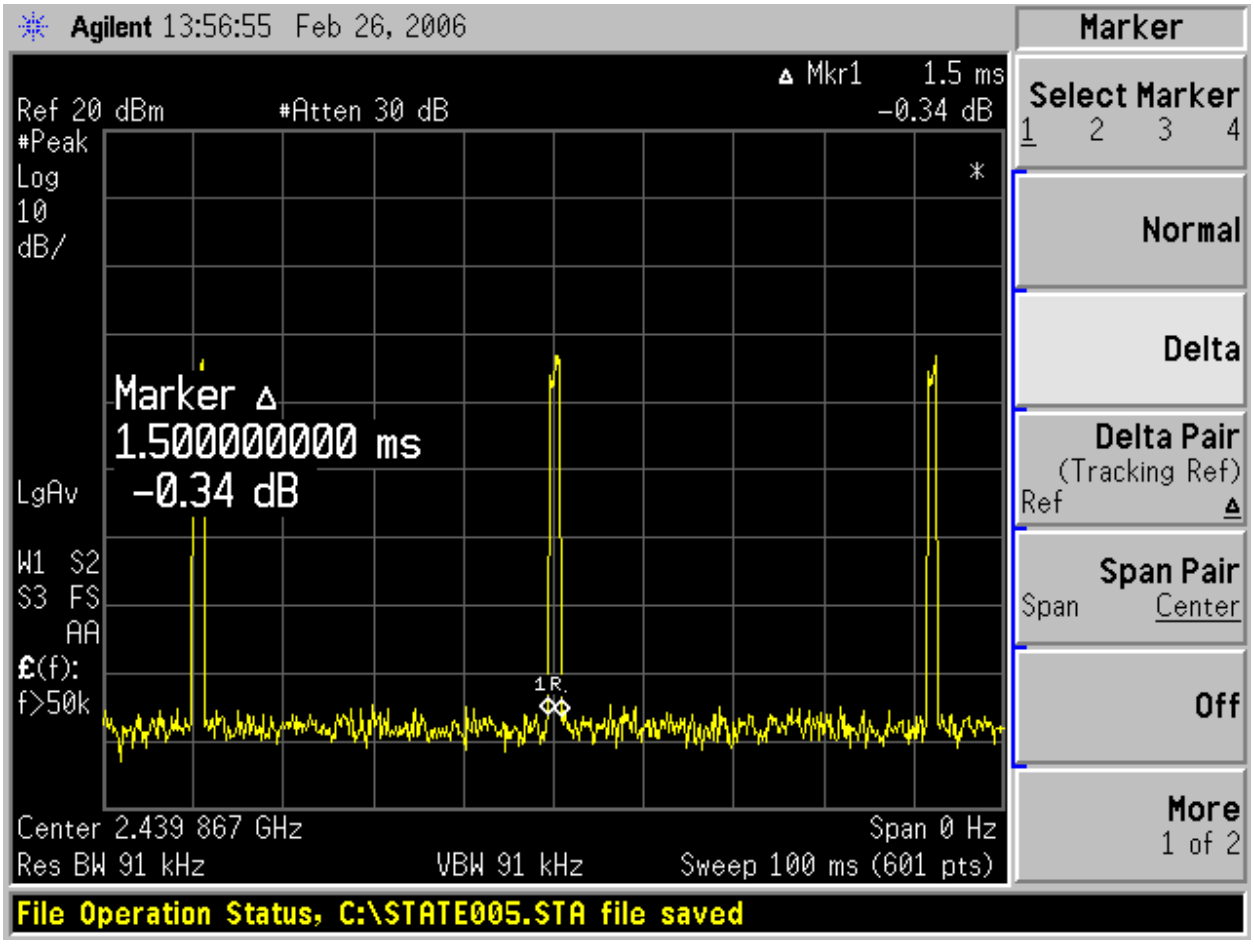
Note: *Correction factor (CF) computations = Antenna Factor + Path Loss – RF Gain (Preamp)*
= 33.9+ 6.0 – 44.4
= -4.5

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 test results. Please refer to previous plots on page 13 and 14.

Duty Cycle Plots



Duty Cycle Computations *= 1.5ms x 3*
= 4.5ms/100ms
= 0.045 or 4.5%

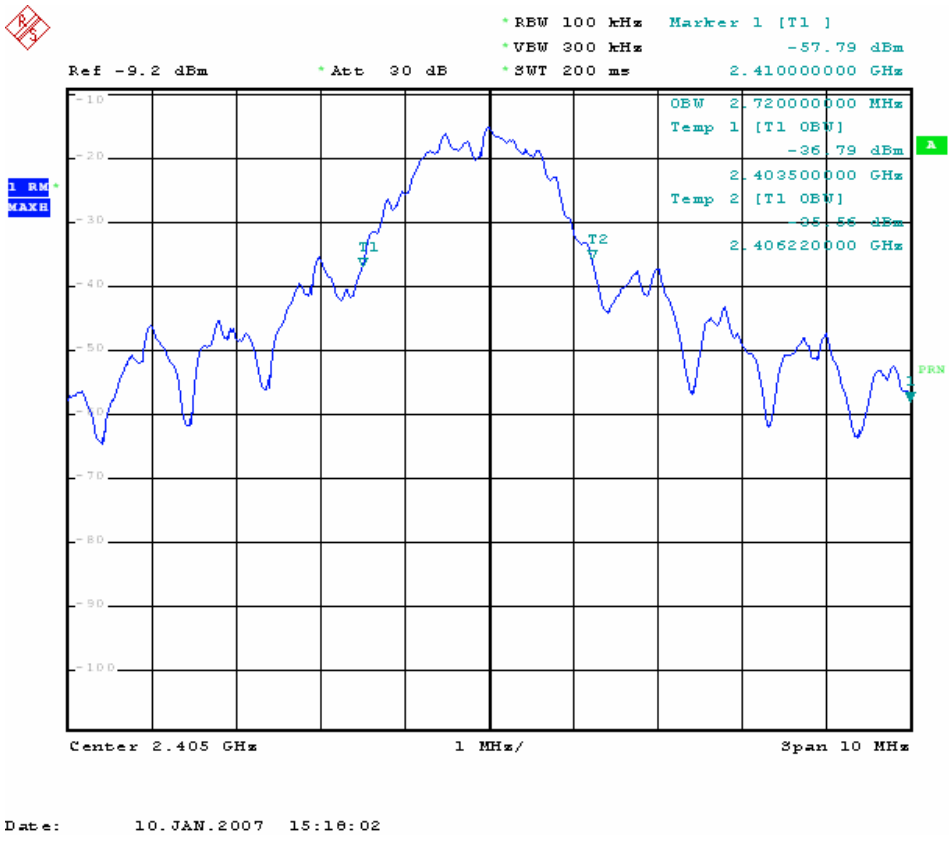
Clause 15.215(c) Occupied Bandwidth

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.

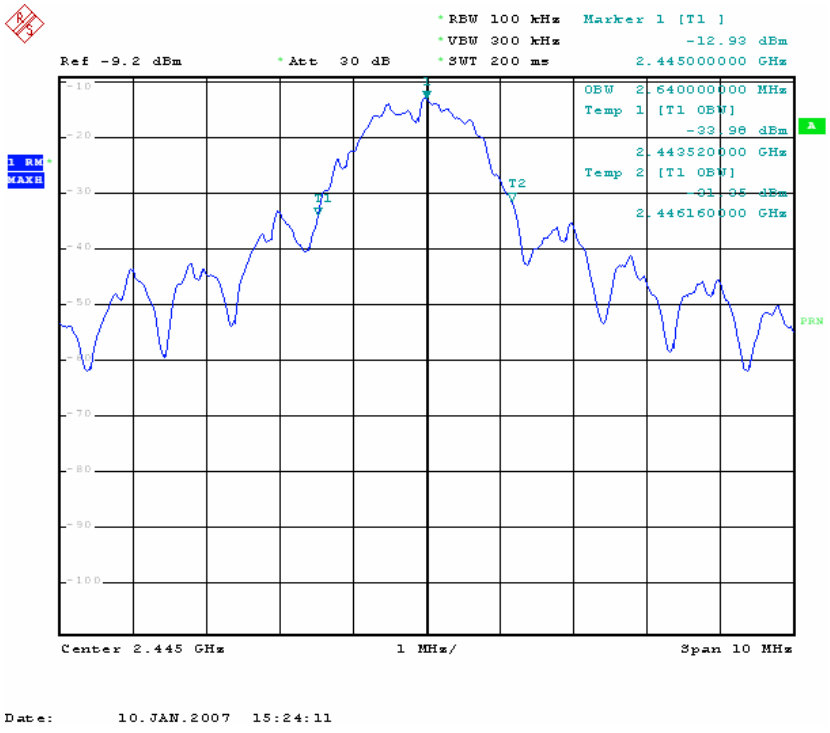
Test Conditions:

Sample Number:	MX01	**Temperature:**	22
Date:	January 10, 2007	**Humidity:**	44
Modification State:		**Tester:**	Ferdinand Custodio
		Laboratory:	Nemko

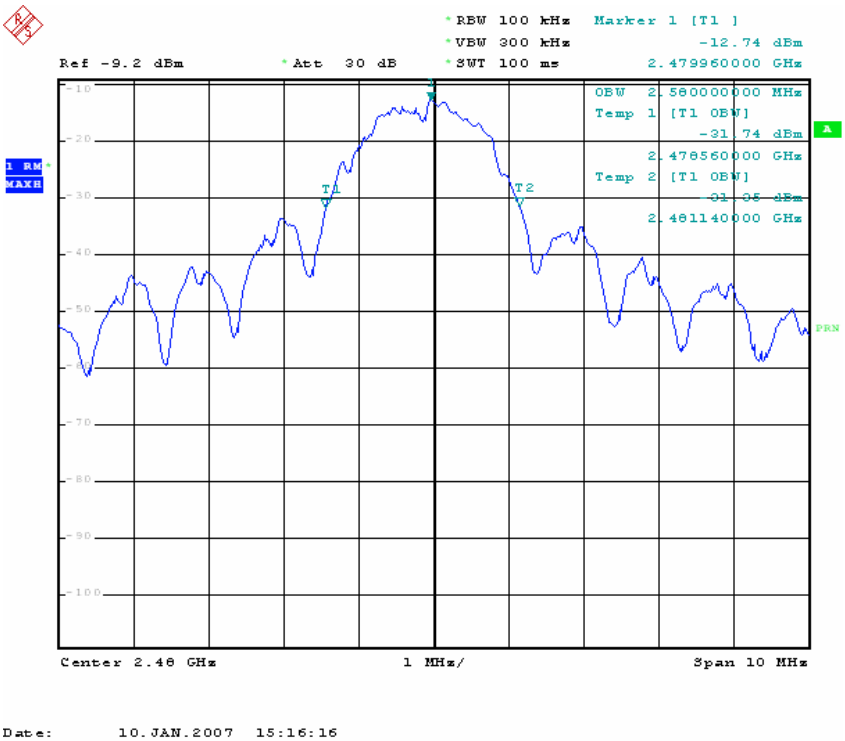
Test Results:



Measured Occupied Bandwidth (Low Channel) = 2.72MHz



Measured Occupied Bandwidth (Mid Channel) = 2.64MHz



Measured Occupied Bandwidth (High Channel) = 2.58MHz

Band edge Measurements:

Test Results:

Band edge emissions were measured under Part 15.209 General Emission Limits. The EUT was tuned to the lowest frequency of operation; emission was measured at the lower band edge on three orthogonal axis. Only the worst result is reported. Using Peak detector, Average level was computed using the corresponding duty cycle correction factor. This process was repeated for the upper band edge measurement.

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Radiated Emissions Data

Complete	YES					Job # :	26-1019-EXPR1	Test # : 2
Preliminary						Page	1	of 1
Client Name :	Expertise Engineering							
EUT Name :	Low Power Sensor Device							
EUT Model # :	MX01 Transmitter							
EUT ANTENNA Part # :								
EUT Serial # :								
EUT Config. :	Transmit (Low and High Channels)							
Specification :	FCC Part 15.209 (a)							
Rod. Ant. #:	NA	Temp. (deg. C) :	14			Date :	3/27/2007	
Bicon Ant.#:	NA	Humidity (%) :	55			Time :	8:00AM	
Log Ant.#:	NA	EUT Voltage :	120VAC			Staff :	FSCustodio	
DRG Ant. #	877	EUT Frequency :	60Hz			Photo ID:		
Dipole Ant.#:	NA	Phase:	1			Peak Res Bandwidth:	1 MHz	
Cable#:	40ft	Location:	SOATS			Peak Video Bandwidth	1 MHz	
Preamp#:	842	Distance:	3 m			AVE Res Bandwidth:	1 MHz	
Spec An.#:	911	Duty Cycle Factor	-20			AVE Video Bandwidth	10 Hz	
QP #:	NA	Duty Cycle (%)	0.10					

Meas. Freq. (MHz)	Vertical (dBuV) pk	Vertical (dBuV) av	Horizontal (dBuV) pk	Horizontal (dBuV) av	CF (db)	Max Level (dBuV/m) pk	Max Level (dBuV/m) av	Spec. Limit (dBuV/m) pk	Spec. Limit (dBuV/m) av	Margin dB pk	Margin dB av	EUT Rotation	Ant. Height	Pass Fail Unc.	Comment
2400.00	68.3	48.3	66.8	46.8	-15.6	52.7	32.7	74.0	54.0	-21.3	-21.3	270.0	1.3	Pass	
2483.50	67.2	47.2	60.1	40.1	-15.6	51.6	31.6	74.0	54.0	-22.4	-22.4	200.0	1.0	Pass	

Note: *Correction factor (CF) computations = Antenna Factor + Path Loss – RF Gain (Preamp)*
= 28.5+ 4.0 – 48.1
= -15.6

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:	MX01	**Temperature:**	16
Date:	January 19, 2007	**Humidity:**	25
Modification State:		**Tester:**	Ferdinand Custodio
		Laboratory:	OATS

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.

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 (duty cycle).

Voltage variation of +/-15% for fundamental emission verification were done inside an environmental chamber. The EUT was tune to the middle channel and the output 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			Job # :	26-1019-EXPR1 Test # : 2
Preliminary				Page	1 of 1
Client Name :	Expertise Engineering				
EUT Name :	Low Power Sensor Device				
EUT Model # :	MX01				
EUT ANTENNA Part # :					
EUT Serial # :					
EUT Config. :	Transmit (Low, Mid and High Channels)				
Specification :	Clause 15.249(a)				
Rod. Ant. #:	NA	Temp. (deg. C) :	16	Date :	Dec. 19, 2006
Bicon Ant.#:	NA	Humidity (%) :	25	Time :	2:00PM
Log Ant.#:	NA	EUT Voltage :	120VAC	Staff :	FSCustodio
DRG Ant. #	877	EUT Frequency :	60Hz	Photo ID:	
Dipole Ant.#:	NA	Phase:	1	Peak Res Bandwidth:	1 MHz
Cable#:	40ft	Location:	SOATS	Peak Video Bandwidth	1 MHz
Preamp#:	NA	Distance:	3 m	AVE Res Bandwidth:	1 MHz
Spec An.#:	835	Duty Cycle Factor	-20	AVE Video Bandwidth	10 Hz
QP #:	NA	Duty Cycle	0.10		

Meas. Freq. (MHz)	Vertical (dBuV) pk	Vertical (dBuV) av	Horizontal (dBuV) pk	Horizontal (dBuV) av	CF (db)	Max Level (dBuV/m) pk	Max Level (dBuV/m) av	Spec. Limit (dBuV/m) pk	Spec. Limit (dBuV/m) av	Margin dB pk	Margin dB av	EUT Rotation	Ant. Height	Pass Fail Unc.	Comment
2405.00	59.1	39.1	54.4	34.4	32.5	91.6	71.6		94.0		-22.4	250.0	1.1	Pass	
2445.00	59.4	39.4	56.3	36.3	32.5	91.9	71.9		94.0		-22.1	270.0	1.3	Pass	
2480.00	67.2	47.2	65.9	45.9	32.5	99.7	79.7		94.0		-14.3	180.0	1.2	Pass	

Note: *Correction factor (CF) computations = Antenna Factor + Path Loss – RF Gain (Preamp)*
= 28.5+ 4.0 – 0
= 32.5

Rated Power Calculations:

TP $=(FS \times D)^2 / (30 \times G)$
where

TP= Transmitter Output Power in watts
FS= Field Strength in V/m (79.7+20 then converted to V/m)
D = Distance in meters
G = Antenna Gain reference to Isotropic
$=(0.0966 \times 3)^2 / (30 \times 1.41)$
$=(0.2898)^2 / 42.3$
=**1.99mW**

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:	MX01	**Temperature:**	27
Date:	November 22, 2006	**Humidity:**	19
Modification State:		**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 with supplied AC Adapter.

All Measurements were performed at 3m with a Quasi-Peak detector below 1GHz and a Peak detector of 1MHz RBW/VBW above 1GHz. Only the worst case channel is reported.

No Spurious Emissions (except Harmonics) were detected above 1GHz.

Measurements without RF gain were measured using Asset # 899 and 898 with built-in pre-amp.

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Radiated Emissions Data

Complete X
Preliminary

Job # : 26-1019-EXPR Test # : 4
Page of

Client Name : Carttronics
EUT Name : TX Minder
EUT Model # : MX01
EUT Part # :
EUT Serial # :
EUT Config. : Normal Operation

Specification : Clause 15.249 (d) Reference :

Rod. Ant. #:	NA	Temp. (deg. C) :	27	Date :	Nov. 22, 2006
Bicon Ant.#:	114	Humidity (%) :	19	Time :	
Log Ant.#:	110	EUT Voltage :	120	Staff :	Ferdinand Custodio
DRG Ant. #	529	EUT Frequency :	60	Quasi-Peak RBW:	120 kHz
Dipole Ant.#:	NA	Phase:	1	Video Bandwidth	120 kHz
Cable#:	SOATS	Location:	SOATS	Average RBW:	1 MHz
Preamp#:	827	Distance:	3 meters	Video Bandwidth	10 Hz
Spec An.#:	911/899/898			Peak RBW:	1 MHz
QP #:	911			Video Bandwidth	1 MHz
PreSelect#:	NA				

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

Meas. Freq. (MHz)	Ant. Pol. (H/V)	Atten. (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
30.527	V		37.77	12.9	1.0	32.4	19.2	40.0	-20.8	Pass	Ambient noise
111.82	V		46.05	14.2	1.8	32.5	29.5	43.5	-14.0	Pass	Ambient noise
144.09	V		18.1	11.7	1.8	0.0	31.6	43.5	-12.0	Pass	
300	V		10.1	14	2.9	0.0	27.0	46.0	-19.0	Pass	Ambient noise
320	V		10.6	14.6	3.1	0.0	28.3	46.0	-17.7	Pass	
345	V		8.4	14.5	3.1	0.0	26.0	46.0	-20.0	Pass	Ambient noise
535.89	H		13.8	18.5	4.3	0.0	36.6	46.0	-9.4	Pass	

IC RSS-Gen 7.2.2 Transmitter and Receiver AC Power Lines Conducted Emissions Limits

The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.
Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.
The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network. A description of the method of measurement that is acceptable to Industry Canada is found in RSS-212.

AC Power Lines Conducted Emissions Limits

Frequency range (MHz)	**Conducted limit (dBµV)**	
	Quasi-peak	**Average**
0.15 – 0.5	66 to 56*****	56 to 46*****
0.5 – 5	56	46
5 – 30	60	50

*Decreases with the logarithm of the frequency

Test Conditions:

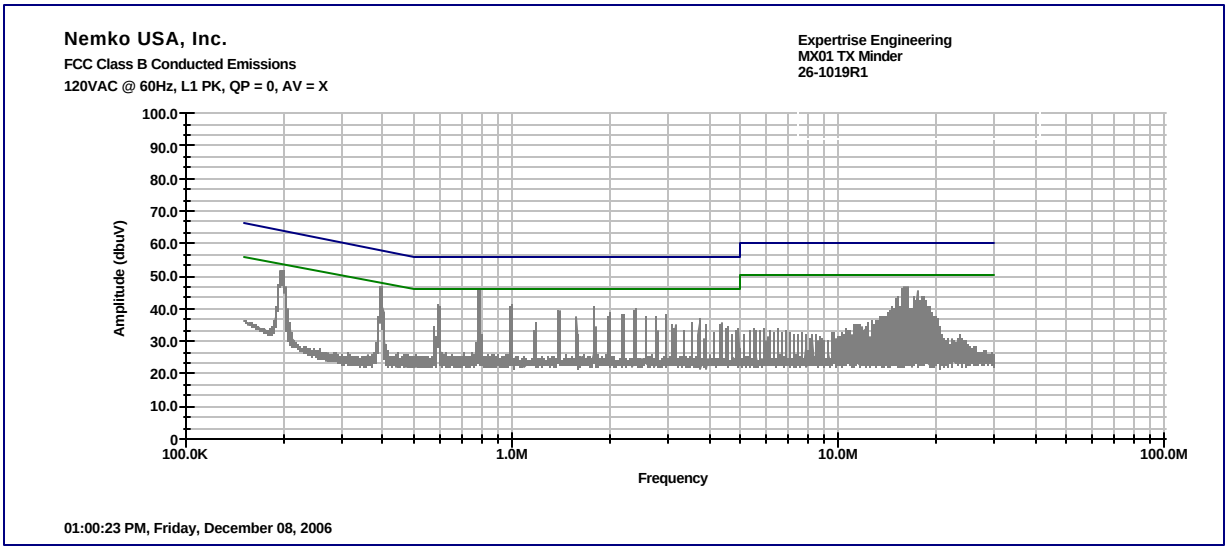
Sample Number:	MX01	**Temperature:**	22
Date:	December 8, 2006	**Humidity:**	44
Modification State:	Transmit	**Tester:**	Ferdinand Custodio
		Laboratory:	Shield Room #1

Test Results:

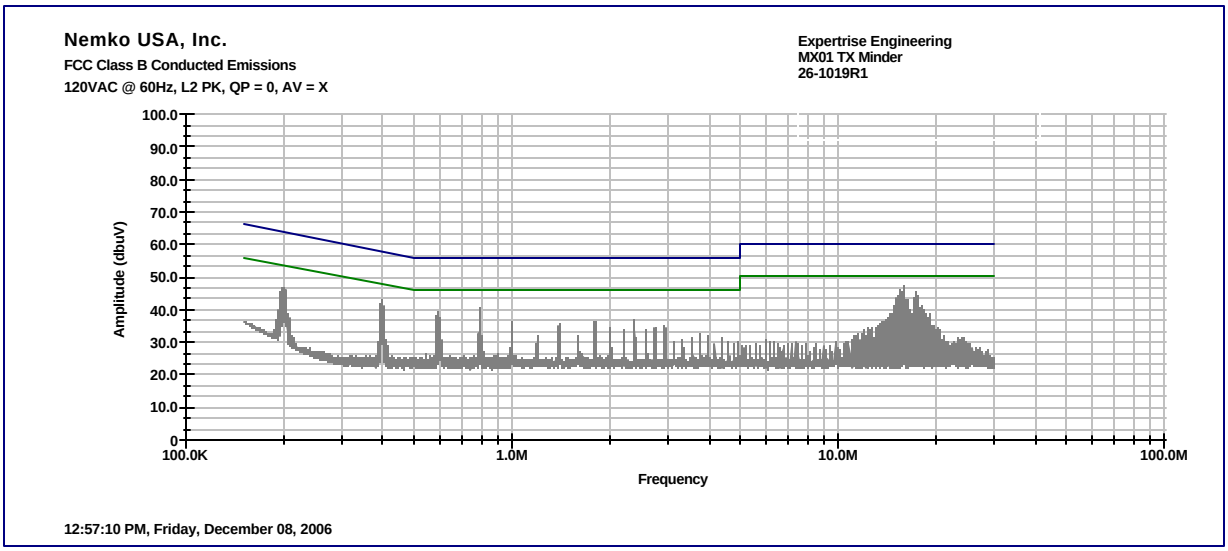
See Attached Plots.

Notes:

- Test was done using the supplied AC Adapter/Charger (GlobTek Inc. Model# GT- A81051-0509UW2, DC 9V). Detector is Peak with RF BW of 100kHz. No Average and Quasi Peak measurements were done since peak results are below the Average limits.
- Data are peak. Green limit line is Average while Blue limit line is Quasi Peak.



Line 1



Line 2

Legend:

Gray - Peak Data
Green - Average limit
Blue - Quasi Peak limit

Clause 2.1055(a) Frequency Stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From -30[deg] to +50[deg] centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

Test Conditions:

Sample Number:	MX01	**Temperature:**	19.4
Date:	January 12, 2007	**Humidity:**	26
Modification State:	Transmit	**Tester:**	Ferdinand Custodio
		Laboratory:	Humidity Chamber

Test Results:

12600 Hz difference, which corresponds to 5.15 ppm
Limit = 10 ppm (+/-0.001%)

See Attached Plots.

Part 2.1055 (-30°C to +50°C)
Spectrum Analyzer @ 100KHz RBW, 100KHZ VBW, 5MHz Span **Low Channel**
Worst case variation: **10000.0 Hz (>Set freq.)** **Set Frequency:** **2405** MHz@25C
3460.0 Hz (<Set freq.)
*Red are negative numbers

Temp.Set Point Temp.Actual	Time	**85% of Vnom (7.65VDC)** Frequency ? (MHz) Difference (MHz)	**Vnom=9VDC** Frequency ? (MHz) Difference (MHz)	**115% of Vnom (10.35VDC)** Frequency ? (MHz) Difference (MHz)
-30 -29.9	8:30AM	2404.9998 0.000200000	2404.9998 0.000200000	2405.0021 0.002100000
-20 -20.1	9:30AM	2404.9996 0.000400000	2404.9996 0.000400000	2405.0021 0.002100000
-10 -10	10:30AM	2404.9996 0.000400000	2404.9998 0.000200000	2405.0021 0.002100000
0 0.1	11:30AM	2404.99967 0.000330000	2404.99967 0.000330000	2405.01 0.010000000
10 10.01	12:30PM	2404.99967 0.000330000	2404.99967 0.000330000	2405.0021 0.002100000
20 20.1	1:30PM	2404.99957 0.000430000	2404.99967 0.000330000	2405 0.000000000
30 29.99	2:30PM	2404.99957 0.000430000	2404.99957 0.000430000	2405 0.000000000
40 40.02	3:30PM	2404.99654 0.003460000	2404.99654 0.003460000	2405.0021 0.002100000
50 50	4:30PM	2404.99957 0.000430000	2404.99957 0.000430000	2405.0021 0.002100000

Low Channel (2405MHz)

Part 2.1055 (-30°C to +50°C)
Spectrum Analyzer @ 100KHz RBW, 100KHZ VBW, 5MHz Span

Worst case variation: **12600.0** **Hz (>Set freq.)**
1550.0 **Hz (<Set freq.)**

Mid Channel
Set Frequency: **2445** MHz@25C
*Red are negative numbers

Temp.Set Point Temp.Actual	Time	**85% of Vnom (7.65VDC)** Frequency ? (MHz) Difference (MHz)	**Vnom=9VDC** Frequency ? (MHz) Difference (MHz)	**115% of Vnom (10.35VDC)** Frequency ? (MHz) Difference (MHz)
-30 -29.9	8:30AM	2444.99845 0.001550000	2444.99845 0.001550000	2445.0012 0.001200000
-20 -20.1	9:30AM	2444.9997 0.000300000	2444.9997 0.000300000	2445 0.000000000
-10 -10	10:30AM	2444.9997 0.000300000	2444.9997 0.000300000	2445.00128 0.001280000
0 0.1	11:30AM	2444.99978 0.000220000	2444.99953 0.000470000	2445.00128 0.001280000
10 10.01	12:30PM	2444.99953 0.000470000	2444.99953 0.000470000	2445.001 0.001000000
20 20.1	1:30PM	2444.999323 0.000677000	2444.999323 0.000677000	2445 0.000000000
30 29.99	2:30PM	2444.99942 0.000580000	2444.999 0.001000000	2445.00128 0.001280000
40 40.02	3:30PM	2444.9993 0.000700000	2444.9993 0.000700000	2445 0.000000000
50 50	4:30PM	2444.9993 0.000700000	2444.9996 0.000400000	2445.0126 0.012600000

Mid Channel (2445MHz)

Part 2.1055 (-30°C to +50°C)

Spectrum Analyzer @ 100KHz RBW, 100KHZ VBW, 5MHz Span

High Channel

Worst case variation: **4400.0** **Hz (>Set freq.)**

10000.0 **Hz (<Set freq.)**

Set Frequency: **2480** MHz@25C

*Red are negative numbers

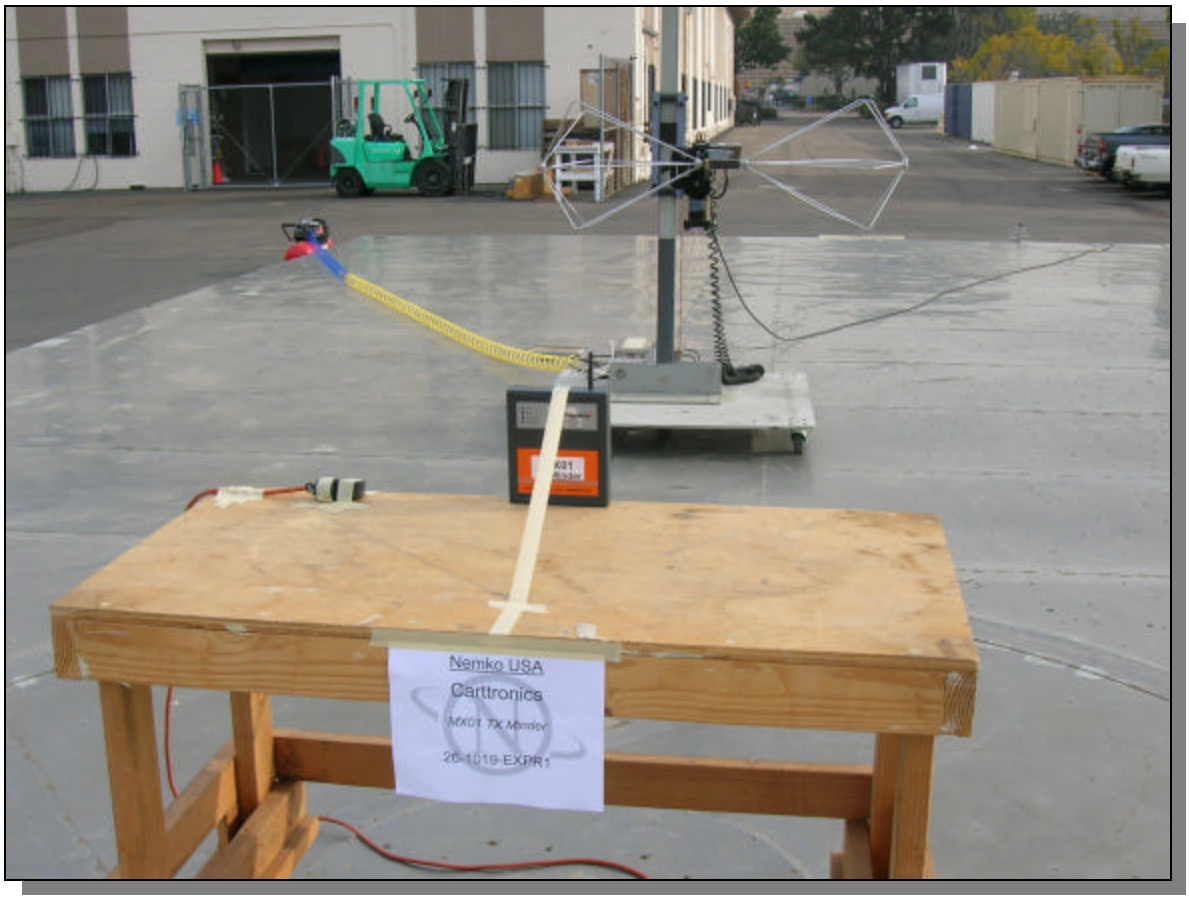
Temp.Set Point Temp.Actual	Time	**85% of Vnom (7.65VDC)** Frequency ? (MHz) Difference (MHz)	**Vnom=9VDC** Frequency ? (MHz) Difference (MHz)	**115% of Vnom (10.35VDC)** Frequency ? (MHz) Difference (MHz)
-30 -29.9	8:30AM	2479.9992 0.000800000	2479.9992 0.000800000	2480.0034 0.003400000
-20 -20.1	9:30AM	2479.9992 0.000800000	2479.9992 0.000800000	2480.0036 0.003600000
-10 -10	10:30AM	2479.9989 0.001100000	2479.99 0.010000000	2480.0022 0.002200000
0 0.1	11:30AM	2479.9991 0.000900000	2479.9993 0.000700000	2480.0027 0.002700000
10 10.01	12:30PM	2479.9991 0.000900000	2479.9991 0.000900000	2480.0027 0.002700000
20 20.1	1:30PM	2479.9992 0.000800000	2479.9989 0.001100000	2480 0.000000000
30 29.99	2:30PM	2479.9992 0.000800000	2479.9992 0.000800000	2480 0.000000000
40 40.02	3:30PM	2479.999 0.001000000	2479.99945 0.000550000	2480.0038 0.003800000
50 50	4:30PM	2479.9992 0.000800000	2479.999 0.001000000	2480.0044 0.004400000

High Channel (2480MHz)

Appendix B: Setup Photographs

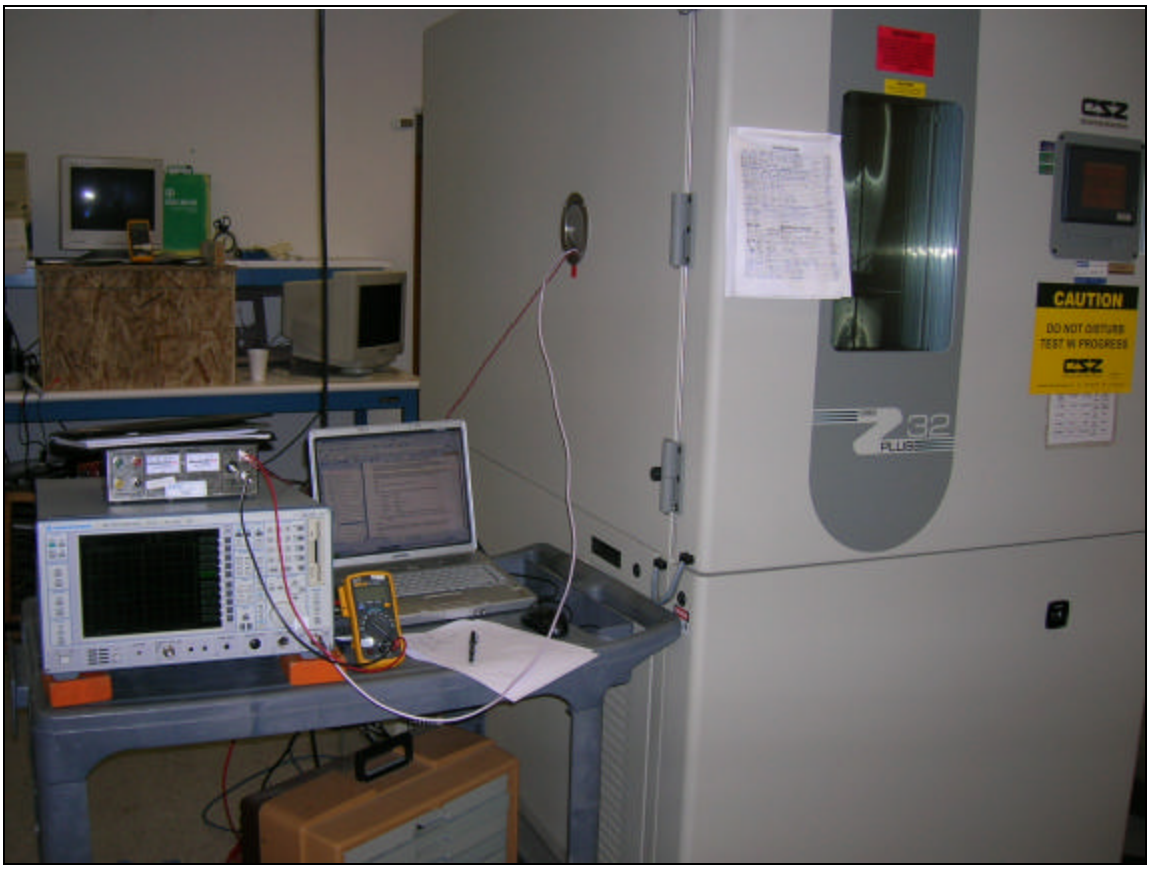
Spurious Emissions Setup (above 1GHz):

Spurious Emissions Setup (below 1GHz):



Conducted Emissions Test Setup:

Frequency Stability Test Setup:



Appendix C: Block Diagram of Test Setups

Test Site For Radiated Emissions