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DATE: 10 September 2012

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

3M Resident Monitoring Ltd.

Equipment under test:

3M Universal Receiver

URC-830-2

Written by: _____
I. Smilansky, Documentation

Approved by: _____
A. Sharabi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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Measurement/Technical Report for

3M Resident Monitoring Ltd.

3M Universal Receiver

URC-830-2

FCC ID:QUX-URC-830-2
IC: 4306B-URC8302

This report concerns:	Original Grant:	x
	Class I change:	
	Class II change:	

Equipment type: Part 15 Security/Remote Control Transceiver

47CFR15 Section 15231 (a-d)

Measurement procedure used is ANSI C63.4-2003.

Application for Certification
prepared by:

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Applicant for this device:
(different from "prepared by")

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1. General Information

1.1 Administrative Information

Manufacturer:	3M Resident Monitoring Ltd.
Manufacturer's Address:	P.O.B. 13236 2 Habarzel St., Tel-Aviv, 61132 Israel Tel: +972-3-767-1700 Fax: +972-3-767-1701
Manufacturer's Representative:	Shai Avigdori Arad Dudkevitz
Equipment Under Test (E.U.T):	3M Universal Receiver
Equipment Model No.:	URC-830-2
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	23.01.2012
Start of Test:	23.01.2012
End of Test:	06.03.2012
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Subpart C

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.
6. TUV Product Services, England, ASLLAS No. 97201.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The URC-830-2 is a wall mounted external alarm siren and corridor light switching device for use in various resident monitoring sites and applications.
The URC-830-2 will replace the existing method of hard wiring pull cords to corridor lights.
The URC-830-2 device receives an alarm messages from various resident monitoring devices and turns ON/OFF the corridor light and/or alarm sirens and sends a status or alarm messages back to the AMS system.
The URC-830-2 has two separate device channels, each with dedicated alarm relay, and separate device list. Each device list can be updated (added or cleared) from the AMS system with special commands.
Additionally each of device list relay can be assigned like a “System Down” alarm relay. Then the device starts to receive a pager messages and can be turn ON/OFF the alarm relay, depending of the received pager message type.
The URC-830-2 device transmits the following message types: sanity message - each hour, alarm message - each 20 seconds, and acknowledge message – immediately after receiving of the command message from the AMS system.
The URC-830-2 device comprises a 433 MHz RF transceiver and an integral helical antenna.

The unit is powered by a 100-240VAC to 12VDC power adapter and includes an internal 3.6V backup battery.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing September 3, 2009).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) 0.15 – 30 MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 3.44 dB

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.96 dB

2. System Test Configuration

2.1 Justification

Testing was performed with the EUT in vertical position as the EUT is wall mounted device.

2.2 Special Accessories

No special accessories were needed.

2.3 Equipment Modifications

No modifications were needed in order to achieve compliance

2.4 Configuration of Tested System

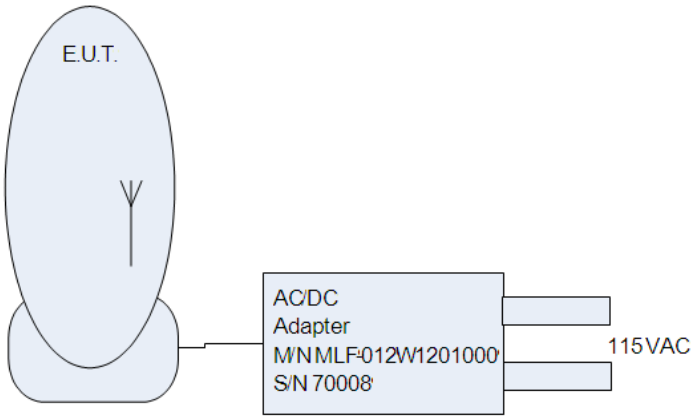

Figure 1. Configuration of Tested System

3. Conducted and Radiated Measurement Test Set-up Photo

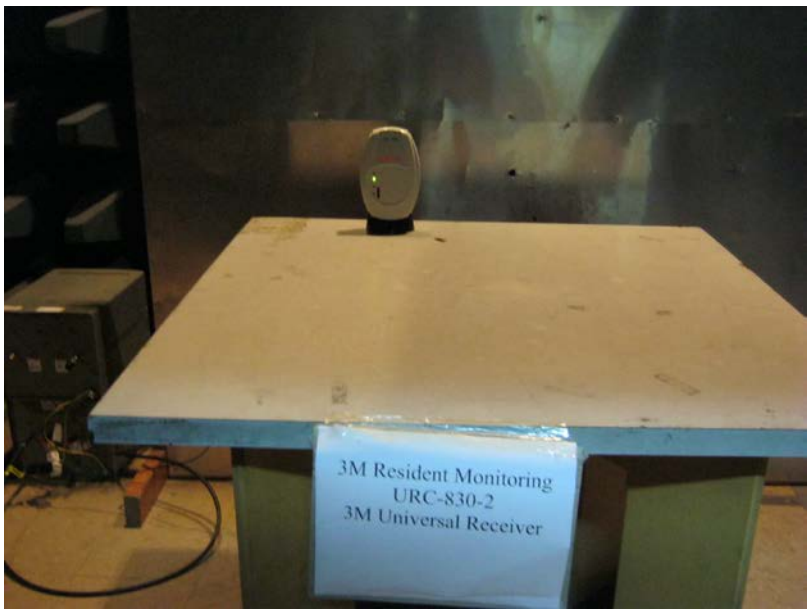

Figure 2. Conducted Emission Test

Figure 3. Radiated Emission Test 9 KHz - 30 MHz

Figure 4. Radiated Emission Test 30 MHz – 1 GHz

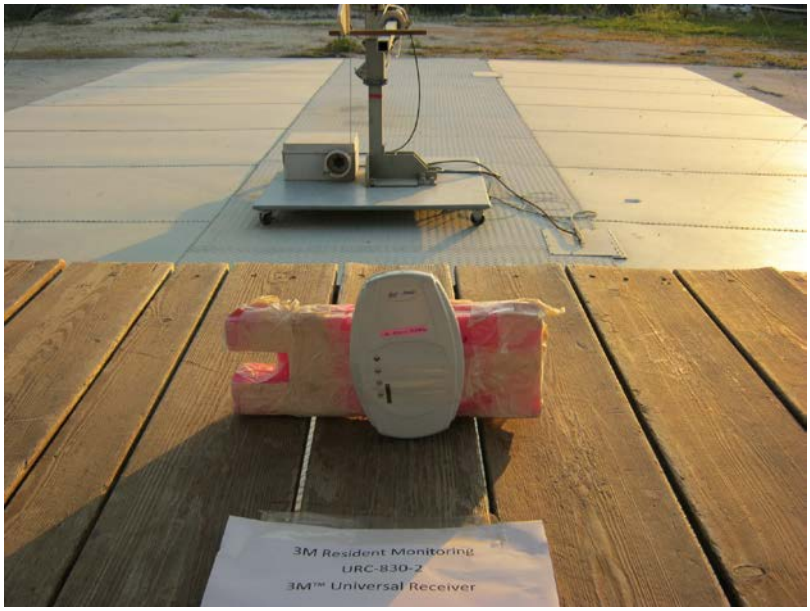

Figure 5. Radiated Emission Test 1 GHz - 4.5 GH

4. Conducted Emission From AC Mains

4.1 Test Specification

F.C.C., Part 15, Subpart C

4.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 3.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 115 V AC / 60 Hz via a 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, and using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.3 Test Results

JUDGEMENT: Passed by 21.8 dB

The margin between the emission levels and the specification limit is, in the worst case, 21.8 dB for the phase line at 0.176 MHz and 21.9 dB at 0.176 MHz for the neutral line.

The EUT met the F.C.C. Part 15, Subpart C specification requirements.

The details of the highest emissions are given in *Figure 6* to *Figure 9*.

TEST PERSONNEL:

Tester Signature: _____ Date: 04.06.12

Typed/Printed Name: A. Sharabi

Conducted Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.176000	45.6	43.0	-21.8	24.9	-29.8	0.0
2	0.338239	34.9	31.4	-27.9	13.5	-35.8	0.0
3	0.665917	27.5	24.3	-31.7	7.3	-38.7	0.0
4	1.683295	21.0	17.4	-38.6	3.4	-42.6	0.0
5	3.447539	25.3	22.1	-33.9	7.9	-38.1	0.0
6	7.400564	18.9	15.1	-44.9	1.9	-48.2	0.0

Figure 6. Detectors: Peak, Quasi-peak, AVERAGE .

Note: QP Delta/Av Delta refer to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

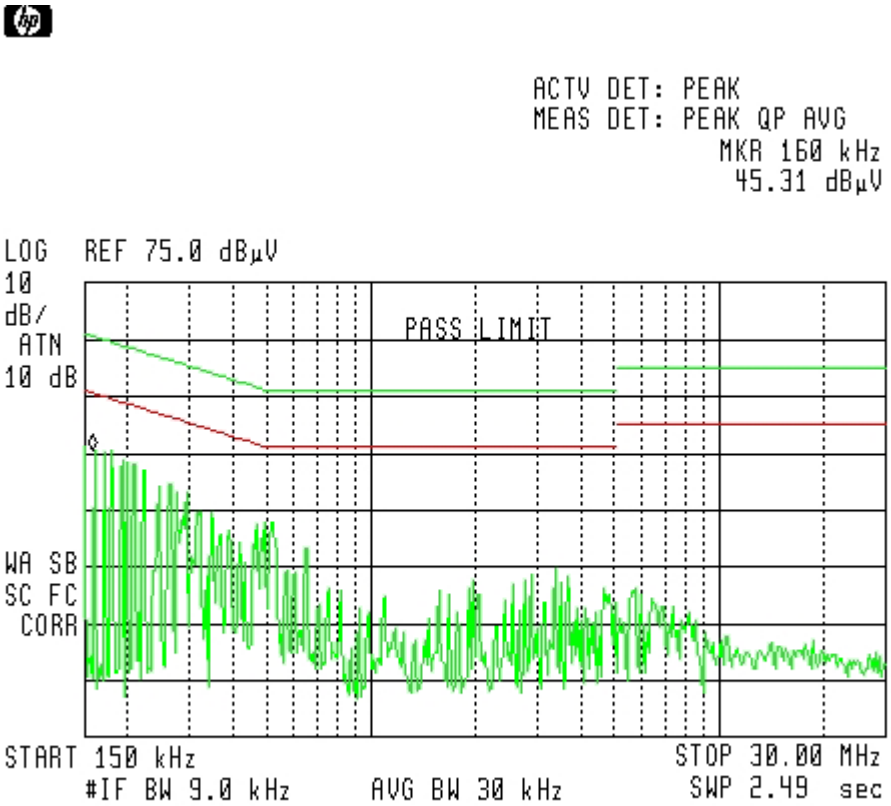

Figure 7. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.175997	45.0	42.8	-21.9	24.7	-30.0	0.0
2	0.338244	34.4	31.0	-28.4	14.2	-35.1	0.0
3	0.665913	26.1	23.0	-33.0	10.4	-35.6	0.0
4	1.683293	22.8	18.1	-37.9	7.4	-38.6	0.0
5	3.447539	26.2	21.8	-34.2	11.8	-34.2	0.0
6	7.400564	18.0	13.5	-46.5	4.0	-46.0	0.0

Figure 8. Detectors: Peak, Quasi-peak, AVERAGE

Note: QP Delta/Av Delta refer to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

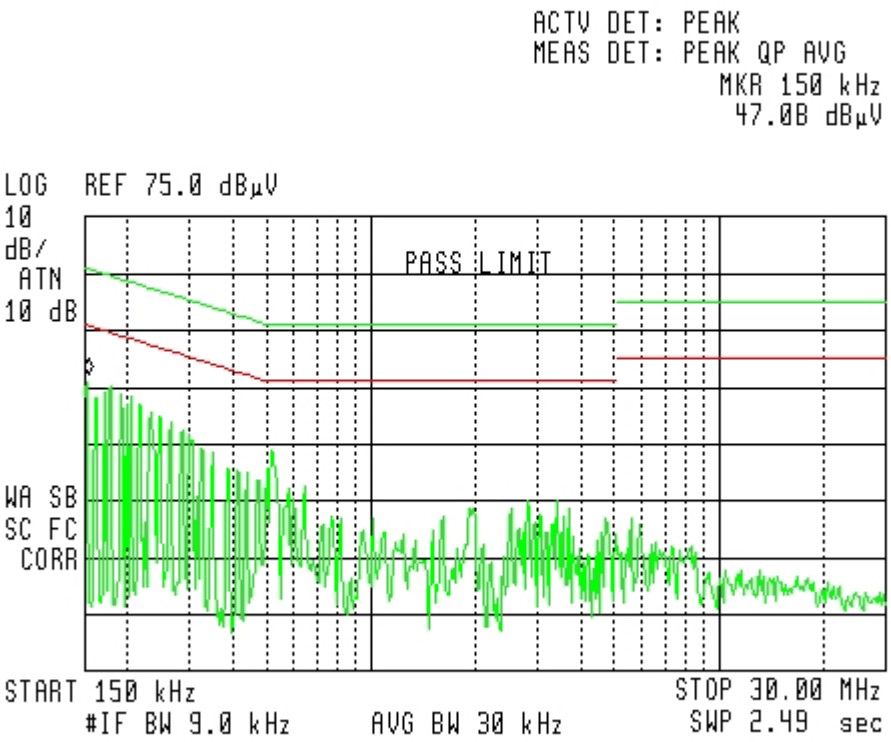

Figure 9 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

4.4 Test Equipment Used, Conducted Emission From AC Mains

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	127	March 3, 2011	1 Year
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1Year
RF Filter Section	HP	85420E	3705A00248	December 12, 2011	1Year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

5. Average Factor Calculation

1. Burst duration = 7.2 ms
2. Time between bursts = 290 ms
3. $$\text{Average Factor} = 20\log\left[\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within } 100\text{msec}\right]$$

$$\text{Average Factor} = 20\log\left[1 \times \frac{7.2}{100} \times 1\right] = -22.8dB$$

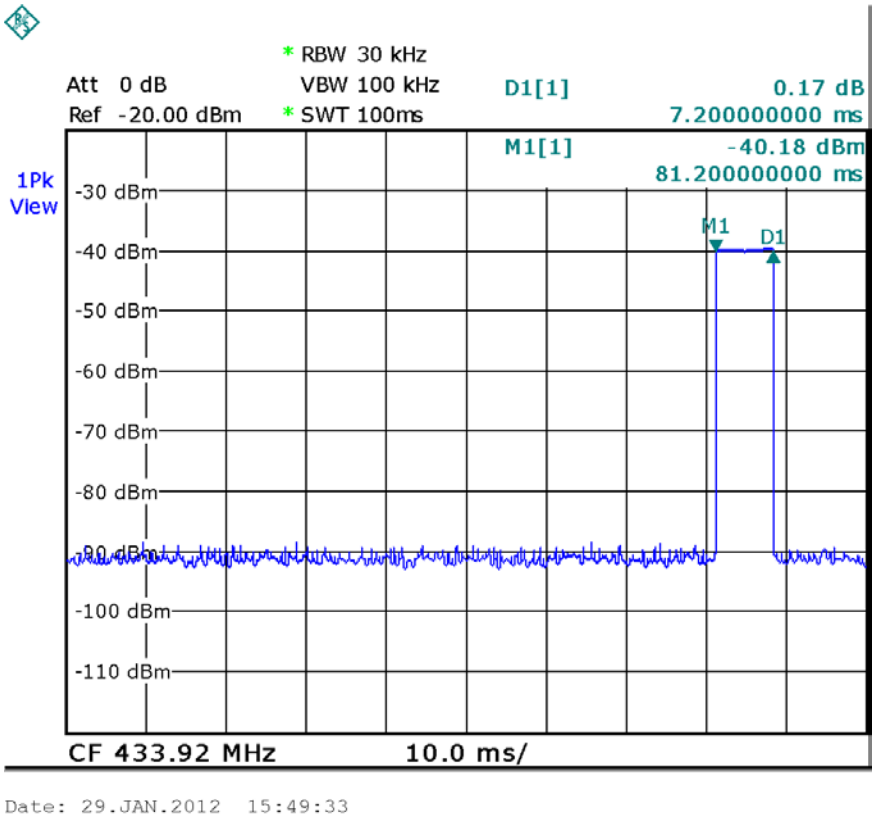

Figure 10. Burst duration = 7.2msec

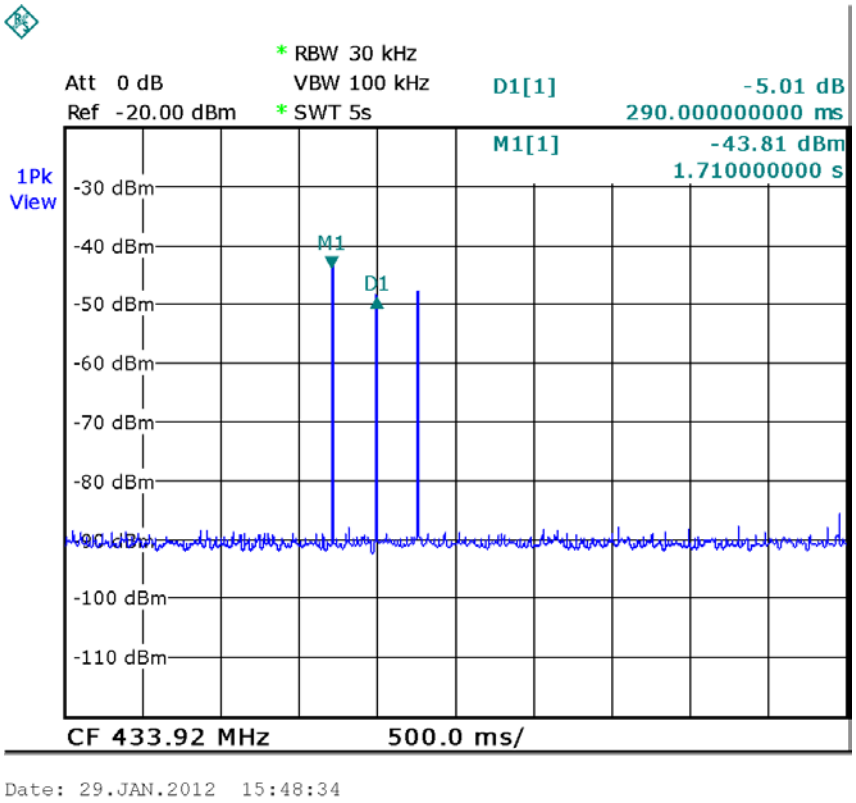

Figure 11. Time between bursts = 290msec , >100ms

5.1 Test Equipment Used, Average Factor Calculation

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	Rohde & Schwarz	ESCI7	100724	October 30, 2011	1 Year
Antenna Bioconical	ARA	BCD 235/B	1041	November 12, 2011	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 29, 2011	1 year
Antenna-Log Periodic	A.H.System	SAS-200/511	253	October 19, 2011	2 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A

6. Periodic Operation

6.1 Specification

F.C.C., Part 15, Subpart C, Section 15.231(a)

6.2 Requirements

Requirement	Rationale	Verdict
Continuous transmissions are not permitted.	N/A	Complies
A manually operated transmitter shall be deactivated within not more than 5 seconds after releasing the switch.	See plots in Figure 12	Complies
An automatically operated transmitter shall cease operation within 5 seconds after activation.	See plots in Figure 13	Complies
Periodic transmissions at regular predetermined intervals are not permitted.	N/A	Complies
Polling or supervised transmissions to determine system integrity of transmitter used in security or safety applications shall not exceed more than 2 seconds per hour.	See plots in Figure 14to Figure 15	Complies

6.3 Test Results

JUDGEMENT: Passed

The EUT met the FCC Part 15, Subpart C, Section 15.231(a) specification requirements.

TEST PERSONNEL:

Tester Signature: _____ Date: 04.06.12

Typed/Printed Name: A. Sharabi

Periodic Operation

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(a)

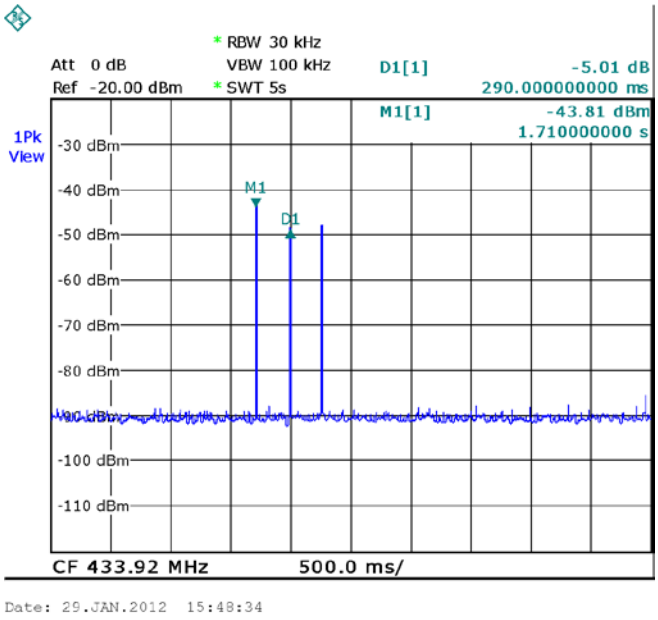

Figure 12. ON /OFF initializing transmission

Periodic Operation

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(a)

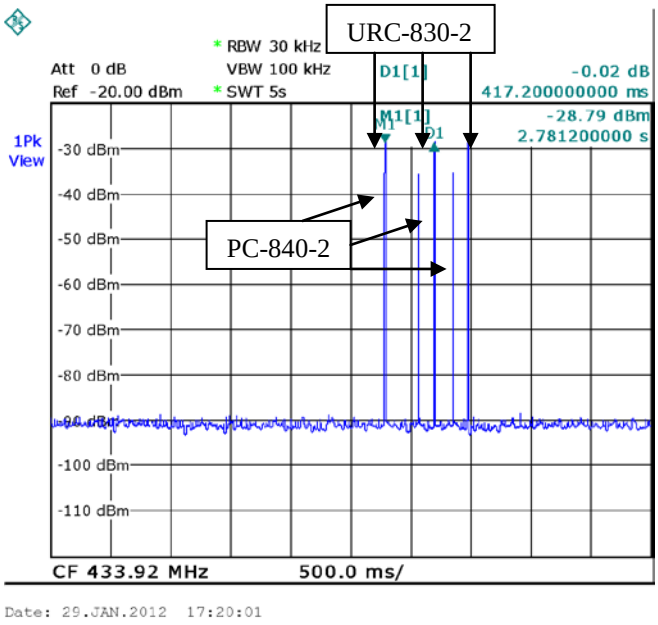

Figure 13. Automatic transmission when PC-840-2 detected

Periodic Operation

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(a)

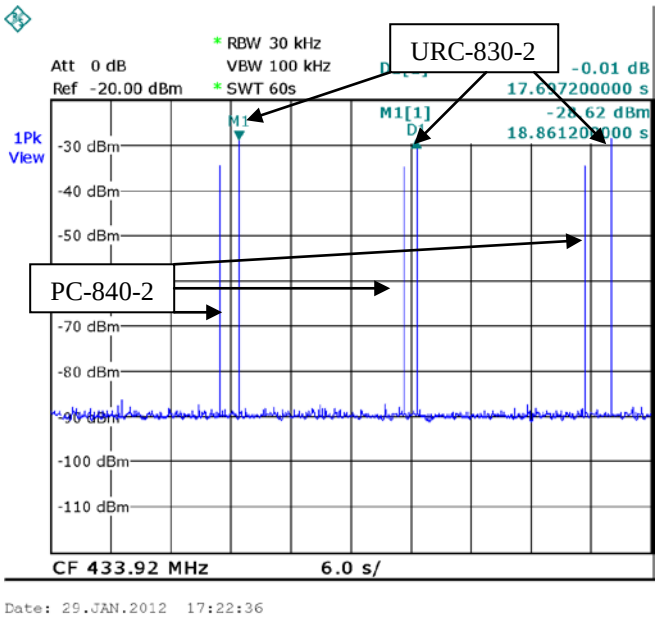

Figure 14. Transmission During Pendency of Alarm Condition, Once Every 18-22 Seconds

Periodic Operation

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(a)

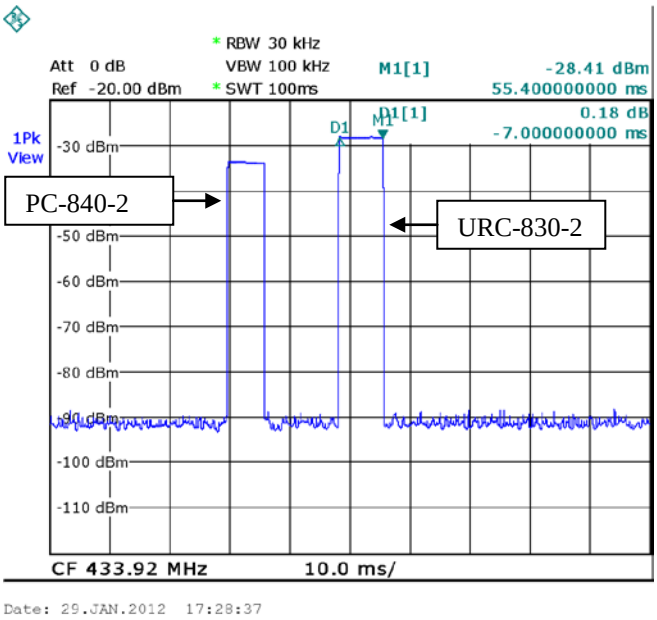

Figure 15. Burst Width is the Same for Manual, Automatic, and System Integrity Transmissions

(System Integrity Time Within One Hour => Burst Width x 1 Transmission Signal/Hour = 7msec/hr < 2sec)

6.4 Test Equipment Used, Periodic Operation

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	Rohde & Schwarz	ESCI7	100724	October 30, 2011	1 Year

7. Field Strength of Fundamental

7.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.231(b)

7.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

The E.U.T. was placed on a non-conductive table, 0.8 meters above the O.A.T.S. ground plane.
The EMI receiver was set to the E.U.T. Fundamental Frequency (433.92 MHz) and Peak Detection.
The turntable and antenna mast were adjusted for maximum level reading on the EMI receiver.
The measurement was performed for vertical and horizontal polarizations of the test antenna.

The average result is:

Peak Level(dBµV/m) + E.U.T. Duty Cycle Factor, in 100msec time window (dB)

7.3 Test Results

JUDGEMENT: Passed by 3.6 dB

The EUT met the FCC Part 15, Subpart C, Section 15.231(b) specification requirements.

The details of the highest emissions are given in Figure 16 to Figure 18.

TEST PERSONNEL:

Tester Signature: _____ Date: 04.06.12

Typed/Printed Name: A. Sharabi

Field Strength of Fundamental

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(b)

Antenna Polarization: Horizontal/Vertical

Test Distance: 3 meters Detector: Peak

Freq. (MHz)	Pol. V/H	Peak Reading (dBµV/m)	Average Factor (dB)	AVG Result (dBµV/m)	AVG Specification (dBµV/m)	Margin (dB)
433.915	H	100.03	22.8	77.2	80.8	-3.6
433.915	V	97.84	22.8	75.0	80.8	-5.8

Figure 16. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL/VERTICAL. Detector: Peak

Notes:

1. Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.
2. “Peak Reading.” (dBµV/m) included the “Correction Factors”.
3. “Correction Factors” (dB) = Test Antenna Correction Factor(dB) + Cable Loss.
4. “Average Factor = 20 log [(burst duration/100msec)*Num of burst within 100msec)]= 20 log [(7.2/100)*1)]= -22.8
5. “Average Result” (dBµV/m)=Peak Reading (dBµV/m)+Average Factor (dB)

Field Strength of Fundamental

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(b)

Antenna Polarization: Horizontal
Test Distance: 3 meters Detector: Peak

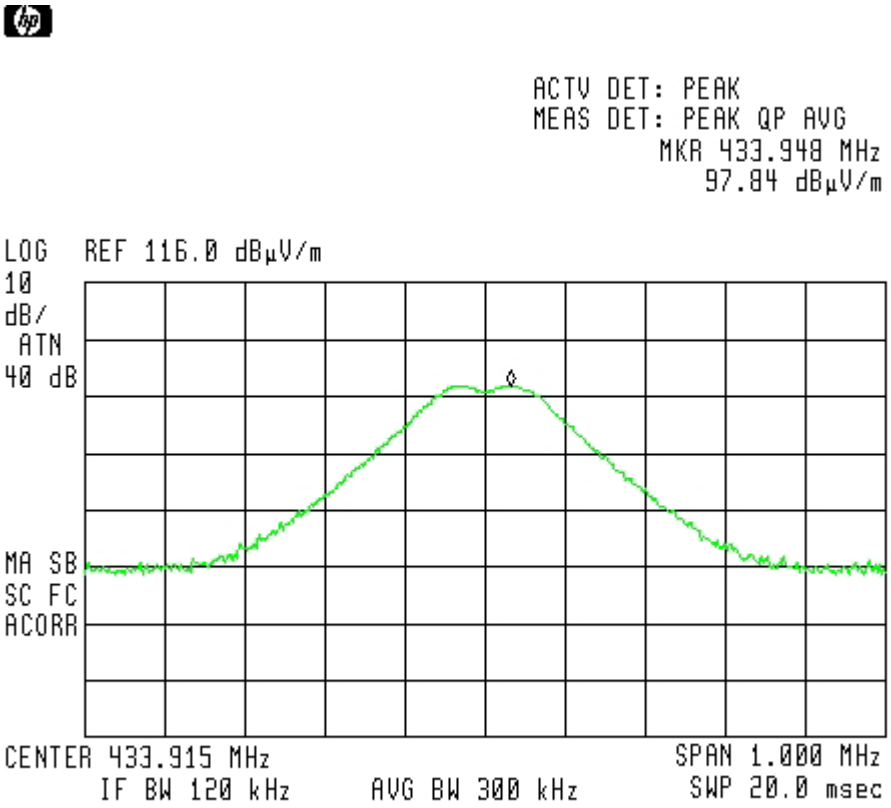

Figure 17. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL. Detector: Peak

Field Strength of Fundamental

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(b)

Antenna Polarization: Vertical

Test Distance: 3 meters Detector: Peak

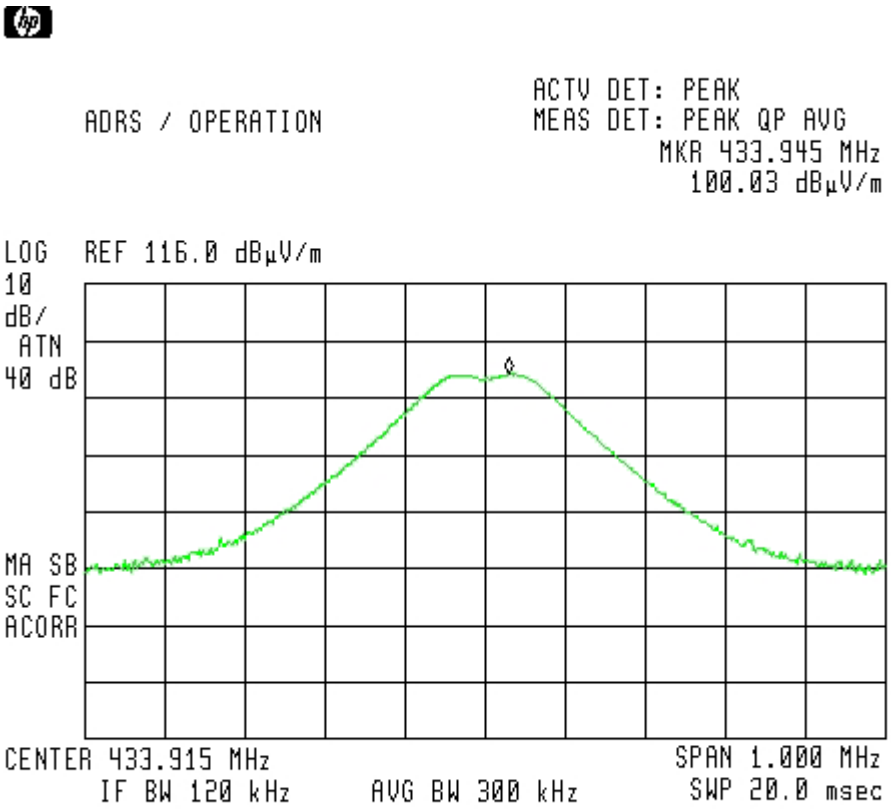

Figure 18. Field Strength of Fundamental. Antenna Polarization: VERTICAL. Detector: Peak

7.4 Test Equipment Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 29, 2011	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

8. Spurious Radiated Emission, 9 kHz – 30 MHz

8.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

8.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in *Figure 3*

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was operated at the frequency of 433.92 MHz. This frequency was measured using a peak detector.

8.3 Test Results

JUDGEMENT: Passed

The EUT was tested and it met the requirements of the FCC Part 15, Subpart C, specification.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature: _____ Date: 04.06.12

Typed/Printed Name: A. Sharabi

8.4 Test Equipment Used, Spurious Radiated Emission, 9 kHz – 30 MHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2011	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A

8.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

FS = RA + AF + CF

FS: Field Strength [dBµv/m]
RA: Receiver Amplitude [dBµv]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dBµV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBµV

No external pre-amplifiers are used.

9. Spurious Radiated Emission 30 MHz - 4500 MHZ

9.1 Test Specification

30 - 4500 MHz, F.C.C., Part 15, Subpart C

9.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.
See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.
A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in *Figure 4* to *Figure 5*.
The signals from the list of the highest emissions were verified and the list was updated accordingly.
The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 2.9 – 4.5 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The emissions were measured at a distance of 3 meters.

9.3 Test Results

JUDGEMENT: Passed.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.

The margin between the emission level and the specification limit was 12.9 dB in the worst case at the frequency of 2169.4 MHz, horizontal polarization.

TEST PERSONNEL:

Tester Signature: _____ Date: 04.06.12

Typed/Printed Name: A. Sharabi

Radiated Emission

E.U.T Description 3M Universal Receiver
Type URC-830-2
Serial Number: Not Designated

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 30 MHz to 4500 MHz
Antenna: 3 meters distance Detectors: Peak, Quasi-peak

Frequency (MHz)	**Antenna Polarity** (H/V)	**Peak Reading** (dBµV/m)	**Average Factor** (dBµV/m)	**Average Result** dBµV/m)	**Average Specification** (dBµV/m)	**Margin** (dB)
867.8	V	53.0	22.8	30.2	54.0	-23.8
867.8	H	46.9	22.8	24.1	54.0	-29.9
2169.4	V	67.3	22.8	44.5	60.8	-16.3
2169.4	H	70.7	22.8	47.9	60.8	-12.9

Figure 19. Radiated Emission..
Detectors: Peak, Quasi-peak

Notes:

1. Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.
2. “Peak Reading.” (dBµV/m) included the “Correction Factors”.
3. “Correction Factors” (dB) = Test Antenna Correction Factor(dB) + Cable Loss.
4. “Average Result” (dBµV/m)=Peak Reading (dBµV/m)+ Average Factor (dB)

9.4 Test Equipment Used, Spurious Radiated Emission, 30 MHz – 4500 MHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 5, 2011	1 Year
Spectrum Analyzer	Rohde & Schwarz	ESCI7	100724	October 30, 2011	1 Year
Antenna Bioconical	ARA	BCD 235/B	1041	November 12, 2011	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 29, 2011	1 year
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 27, 2011	2 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

10. Bandwidth

10.1 Test procedure

The transmitter unit operated with normal modulation. The spectrum analyzer was set to 120 kHz resolution BW and center frequency of the transmitter fundamental. The spectrum bandwidth of the transmitter unit was measured and recorded. The BW was measured at 20 dBc points.

The EUT was set up as shown in Figure 1, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on the modulation envelope.

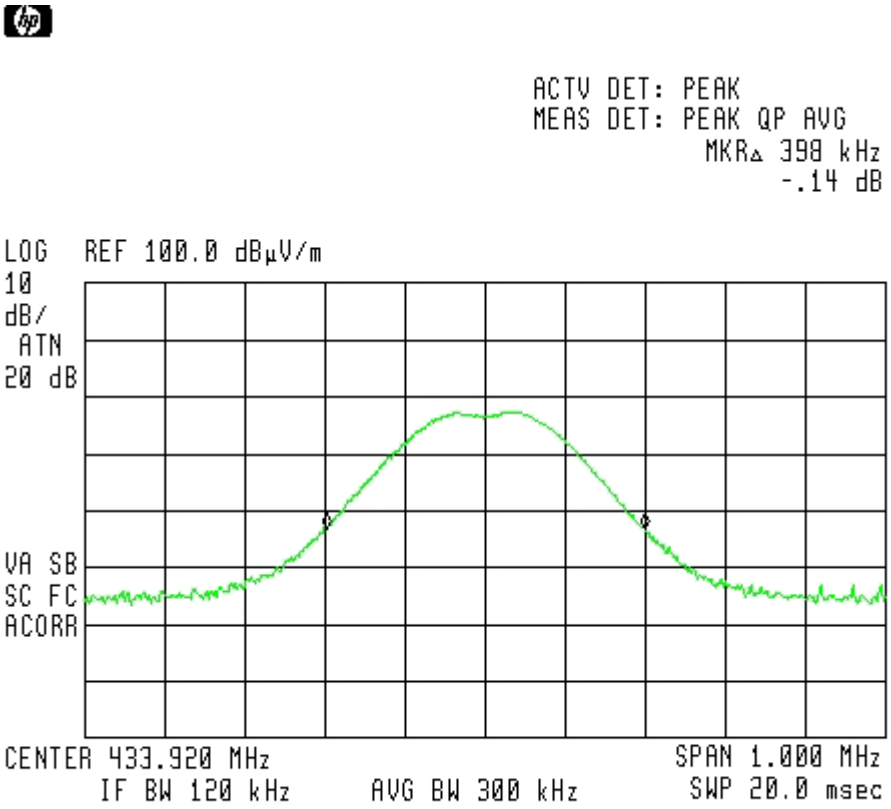

Figure 20

10.2 Test Results

E.U.T Description: 3M Universal Receiver
Model: URC-830-2
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C: (15.231(c))

Bandwidth Reading (kHz)	Specification (1) (kHz)	Margin (kHz)
398	1084	686

Figure 21 Bandwidth

JUDGEMENT: Passed by 686 kHz

TEST PERSONNEL:

Tester Signature: _____ Date: 04.06.12

Typed/Printed Name: A. Sharabi

(1) 0.25% of the E.U.T. fundamental frequency, Section 15.231(c).

Note:

The calculated necessary bandwidth per Industry Canada TRC-43 is:
Bn= 2DK+B; B=R/($\log_2$S), for Frequency Shift Keying digital data Tx
Max. Tx bit rate (R): 31.25 Kbit/ Sec
No. of signaling states (S): 2
Peak deviation (D): 31.7 kHz
K=1
B(n) = 95.7 kHz

10.3 Test Equipment Used, Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 29, 2011	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 22 Test Equipment Used

11. Receiver Conducted Emission From AC Mains

11.1 Test Specification

0.15 - 30 MHz, FCC Part 15, Subpart B, CLASS B

11.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 2. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room (see Section 3), with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 2. Conducted Emission Test*.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying to CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

11.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Subpart B, Class B specification.

The margin between the emission levels and the specification limit is, in the worst case, 21.8 dB for the phase line at 0.18 MHz and 21.9 dB at 0.18 MHz for the neutral line.

The details of the highest emissions are given in *Figure 23* to *Figure 9*.

Conducted Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification:	FCC Part 15, Subpart B, Class **B**
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.176000	45.6	43.0	-21.8	24.9	-29.8	0.0
2	0.338239	34.9	31.4	-27.9	13.5	-35.8	0.0
3	0.665917	27.5	24.3	-31.7	7.3	-38.7	0.0
4	1.683295	21.0	17.4	-38.6	3.4	-42.6	0.0
5	3.447539	25.3	22.1	-33.9	7.9	-38.1	0.0
6	7.400564	18.9	15.1	-44.9	1.9	-48.2	0.0

Figure 23. Detectors: Peak, Quasi-peak, AVERAGE .

Note: QP Delta/Av Delta refer to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: FCC Part 15, Subpart B, Class **B**
Lead: Phase
Detectors: Peak, Quasi-peak, Average

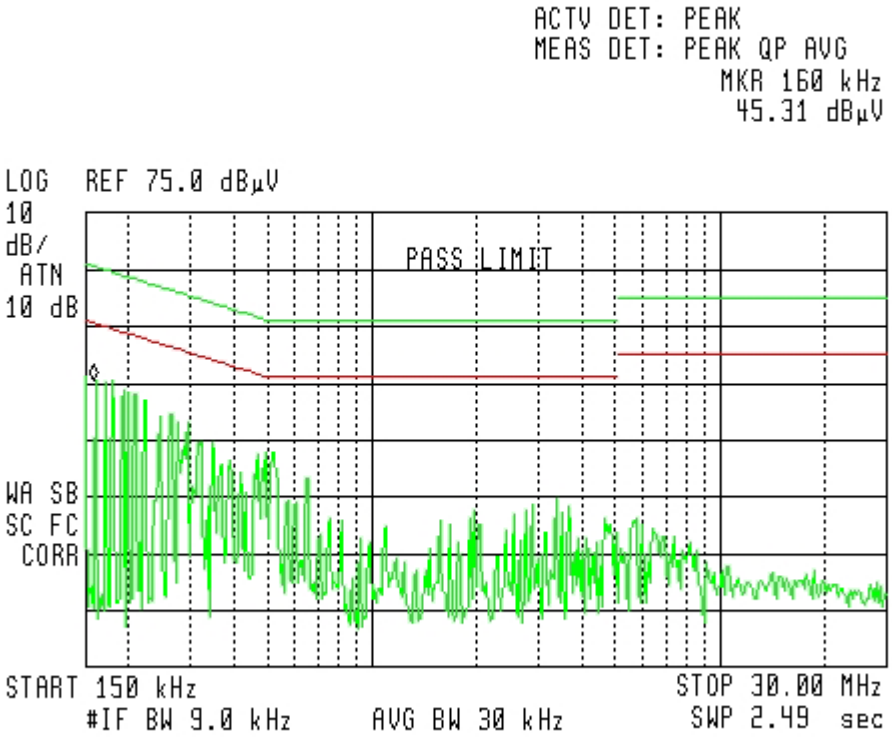

Figure 24. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification:	FCC Part 15, Subpart B, Class **B**
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.175997	45.0	42.8	-21.9	24.7	-30.0	0.0
2	0.338244	34.4	31.0	-28.4	14.2	-35.1	0.0
3	0.665913	26.1	23.0	-33.0	10.4	-35.6	0.0
4	1.683293	22.8	18.1	-37.9	7.4	-38.6	0.0
5	3.447539	26.2	21.8	-34.2	11.8	-34.2	0.0
6	7.400564	18.0	13.5	-46.5	4.0	-46.0	0.0

Figure 25. Detectors: Peak, Quasi-peak, AVERAGE

Note: QP Delta/Av Delta refer to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification:	FCC Part 15, Subpart B, Class **B**
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

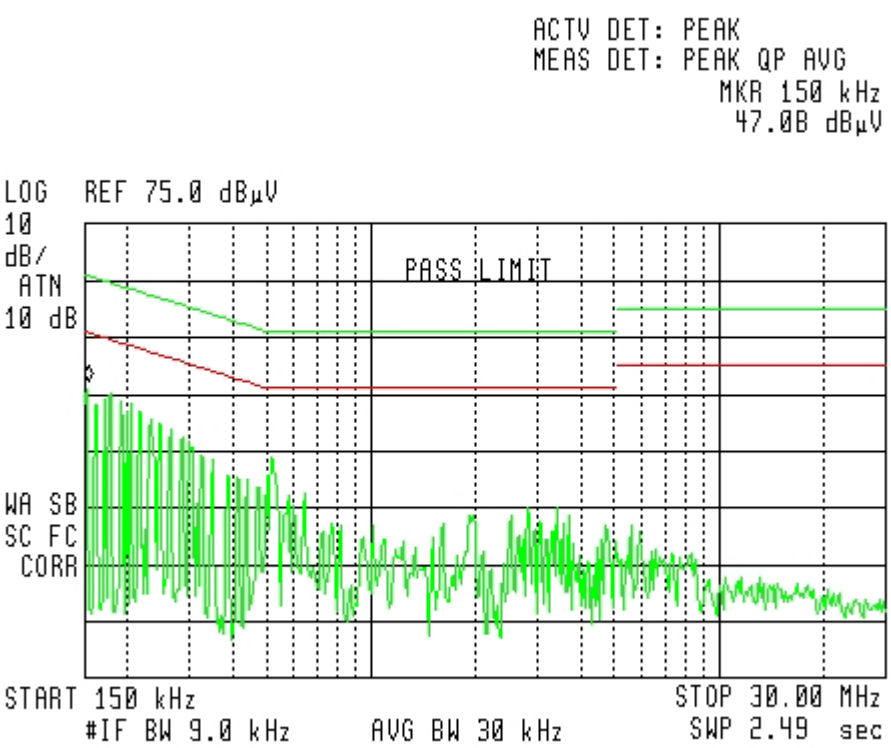

Figure 26 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

11.4 Test Equipment Used, Receiver Conducted Emission From AC Mains

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	127	March 3, 2011	1 Year
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1Year
RF Filter Section	HP	85420E	3705A00248	December 12, 2011	1Year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

12. Receiver Radiated Emission

12.1 Test Specification

30-1000 MHz, FCC Part 15, Subpart B, CLASS B

12.2 Test Procedure

The E.U.T operation mode and test set-up are as described in section 2.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in
Figure 4. Radiated Emission Test 30 MHz – 1 GHz.

The E.U.T. highest frequency source or used frequency is 10.1 MHz.

The frequency range 30-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:
Turning the E.U.T on and off.
Using a frequency span less than 10 MHz.
Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The emissions were measured at a distance of 3 meters.

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

FS = RA + AF + CF

Where:

FS:	Field strength [dBμV/m]
RA:	Receiver Amplitude [dBμV]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable attenuation Factor [dB]

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

12.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Subpart B, Class B specification.

The margin between the emission level and the specification limit is 19.2 dB in the worst case at the frequency of 52.12 MHz, vertical polarization.

The details of the highest emissions are given in *Figure 27* to *Figure 30*.

Radiated Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal
Antenna: 3 meters distance
Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak dBuV/m	QP dBuV/m	QP Delta L 1 (dB)	Avg dBuV/m	Av Delta L 2 (dB)	Corr (dB)
1	52.125750	22.8	17.3	-22.7	10.6		11.4
2	78.207300	21.3	15.6	-24.4	8.9		10.4
3	130.041925	24.3	18.6	-24.9	11.9		13.9

Figure 27. Radiated Emission. Antenna Polarization: HORIZONTAL. Detectors: Peak, Quasi-peak

Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

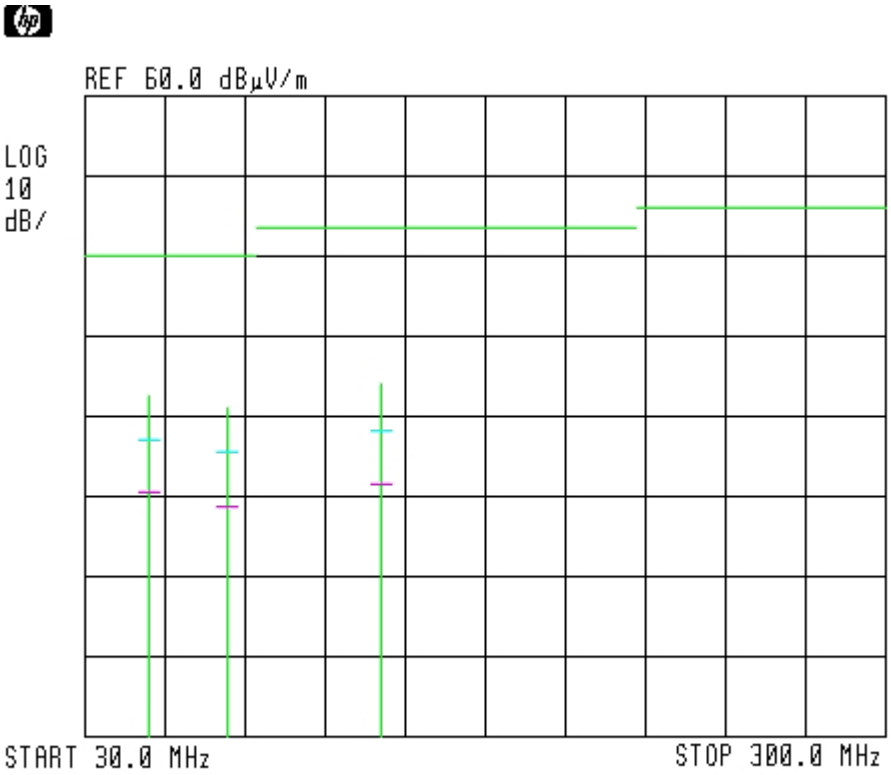

Figure 28. Radiated Emission. Antenna Polarization: HORIZONTAL Detectors: Peak, Quasi-peak

Radiated Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Vertical
Antenna: 3 meters distance
Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak dBuV/m	QP dBuV/m	QP Delta L 1 (dB)	Avg dBuV/m	Av Delta L 2 (dB)	Corr (dB)
1	52.125750	31.6	20.8	-19.2	10.9		11.4
2	78.207300	28.1	18.0	-22.0	8.9		10.4
3	130.041925	24.5	18.6	-24.9	11.8		13.9

Figure 29. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Radiated Emission

E.U.T Description	3M Universal Receiver
Type	URC-830-2
Serial Number:	Not Designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz
Detectors: Peak, Quasi-peak

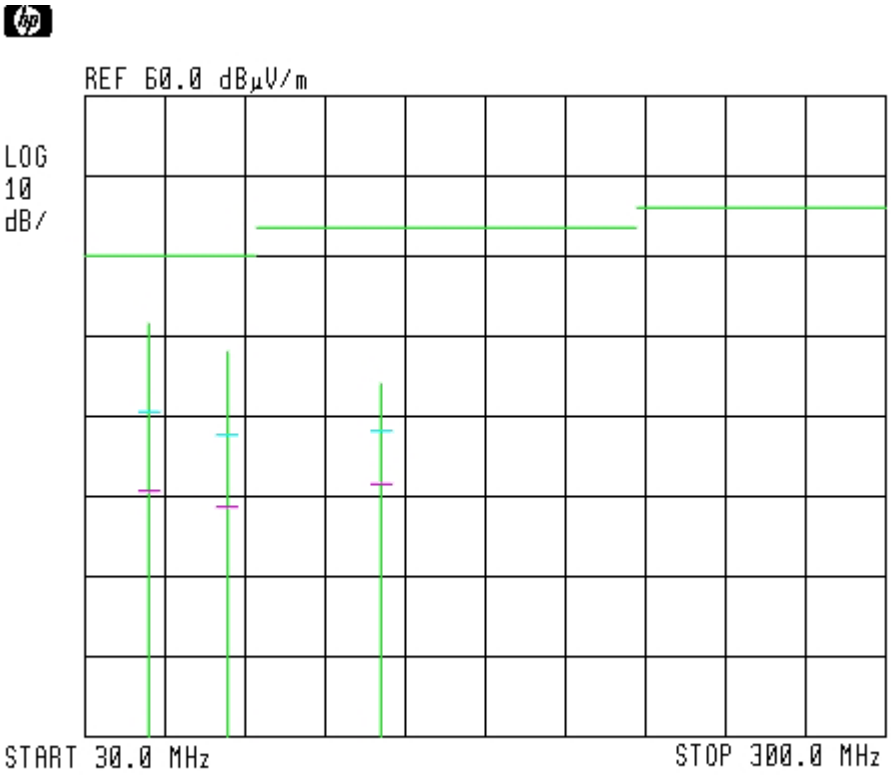

Figure 30. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak, Quasi-peak

12.4 Test Equipment Used, Receiver Spurious Radiated Emission, 30 MHz – 1000 MHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	November 12, 2011	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 29, 2011	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

13. APPENDIX A - CORRECTION FACTORS

13.1 Correction factors for CABLE

**from EMI receiver
to test antenna
at 3 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
90.0	1.6
100.0	1.7
150.0	2.0
200.0	2.3
250.0	2.7
300.0	3.1
350.0	3.4
400.0	3.7
450.0	4.0
500.0	4.3
600.0	4.7
700.0	5.3
800.0	5.9
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 27 meters.

3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

13.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

13.3 Correction factors for CABLE

from spectrum analyzer to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.

2. The cable is used for measurements above 2.9 GHz.

3. The overall length of the cable is 10 meters.

13.1 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.*
3. *The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".*

13.2 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. *Antenna serial number is 253.*
2. *The above lists are located in file number SAS3M0.ANT for a 3 meter range.*
3. *The files mentioned above are located on the disk marked "Antenna Factors".*

13.3 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.

2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

13.4 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2

14. Comparison requirements FCC with Industry Canada

FCC Specification	According FCC Standard	IC Standard
Periodic Operation	FCC Part 15.231 (a)(1-5)	RSS- 210 Issue 8 Section 2.5 Annex 1, A1.1.1
Field Strength at Fundamental	FCC Part 15.231 (b)	RSS- 210 Issue 8 Annex 1 A1.1.2, Section 2.5
Spurious Emissions	FCC Part 15.231 (b)	RSS GEN Issue 3 7.2.2(Table3)
Bandwidth	FCC Part 15.231 (c)	RSS- 210 Issue 8 Section 2.5 Annex 1 A1.1.3