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DATE: 12 September 2012

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

FCC Radio Test Report

for

3M Resident Monitoring Ltd.

Equipment under test:

Pull Cord Station

PC-840

Written by:

A. Ruta / D. Shidlowsky Documentation

Approved by:

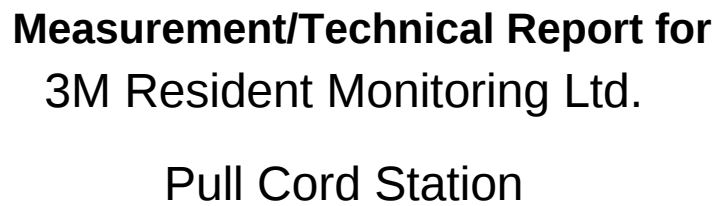
A. Sharabi, Test Engineer

Approved by:

I. Raz, EMC Laboratory Manager

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This report relates only to items tested.



PC-840

FCC ID:QUX-PC-840

IC:4306B-PC840

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

Equipment type: Part 15 Security/Remote Control Transceiver

47CFR15 Sections 15.225; 15.231 (a-d)

Measurement procedure used is ANSI C63.4-2003.

Application for Certification:

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1. General Information

1.1 Administrative Information

Manufacturer: 3M Resident Monitoring Ltd.

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Manufacturer's Representative: Shai Avigdor
Arad Dudkevitz

Equipment Under Test (E.U.T): Pull Cord Station

Equipment Model No.: PC-840

Equipment Serial No.: Not Designated

Date of Receipt of E.U.T: 24.01.2012

Start of Test: 24.01.2012

End of Test: 18.03.2012; 04.07.2012*

Test Laboratory Location: I.T.L (Product Testing) Ltd.
Kfar Bin Nun,
ISRAEL 99780

Test Specifications: FCC Part 15 Subpart C

* Re-testing of fundamental emission and spurious emission of the 318 MHz transmitter was performed on 04 July 2012.



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 Pull Cord Station is a small, wall-mounted device, installed at the bedside or in the lavatories of care centers. If a Resident needs assistance, the Pull Cord Station can be activated to alert care center staff members. The Pull Cord Station can be connected to a variety of triggers and alert devices.

The device comprises a printed circuit board (PCB) that includes a RF transceiver module with an integral antenna, RFID reader with RFID antenna and a microcontroller that controls its operation.

The PC-840 has one RF channel (318MHz) over which it communicates with its monitoring system.

The PC-840 has RFID reader to read 13.56MHz RFID tags included in NTT.

The unit is powered by an external power 12- 24 VDC and an internal 3.6V Lithium battery. When external power is off device continue work with internal battery but in this case RDIF reader does not work.

Once installed and activated the device transmits once every hour supervision signal, including data (e.g. battery ok) in order to indicate that the transmitter is functionally. The total duration of transmissions does not exceed more than one second per hour: 1 transmissions per Hour X 6 mSec (max.) = 0.006 seconds.

The PC – 840 transmit alarm message in case when the pull cord mechanism is pulled down or external push cord button is pressed. In this mode device transmit RF message once every approximately 18-22 seconds.

This will go on until device will pull up by a nurse or staff.

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 in a typical mode of operation representing installation in the field.

2.2 *Special Accessories*

No special accessories were needed.

2.3 *Equipment Modifications*

The RF chip was reprogrammed in order to reduce the fundamental emission of the 318 MHz transmitter below the peak limit specification. The updated SW version used is V1.1. The following testing of the 318 MHz transmitter were repeated on 04 July 2012, fundamental emission and spurious emission.

2.4 *Configuration of Tested System*

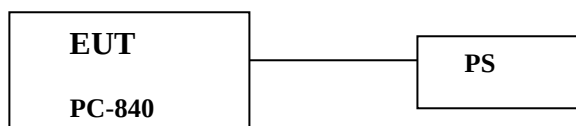


Figure 1. Configuration of Tested System

3. Conducted and Radiated Measurement Test Set-up Photos Transmit Mode



Figure 2. Conducted Emission Test



Figure 3. Radiated Emission Test 9KHz-30MHz

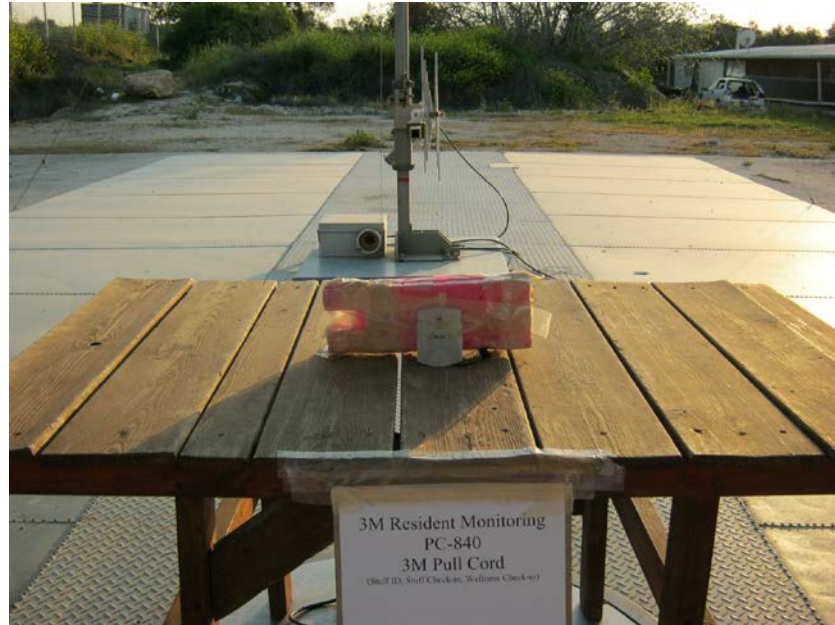


Figure 4. Radiated Emission Test 30MHz-4500MHz



4. Conducted Emission From AC Mains, 13.56 MHz Transmitter Operating

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. 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 μ Hn 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 17.1 dB

The margin between the emission levels and the specification limit is, in the worst case, 17.3 dB for the phase line at 0.44 MHz and 17.1 dB at 0.44 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 5* to *Figure 8*.

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi



Conducted Emission

E.U.T Description Pull Cord Station
Type PC-840
Part 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	0.437135	43.7	39.8	-17.3	29.9	-17.3	0.0
2	1.469340	34.1	30.1	-25.9	22.6	-23.4	0.0
3	2.414997	34.8	31.2	-24.8	20.8	-25.2	0.0
4	4.135186	32.9	28.5	-27.5	17.9	-28.1	0.0
5	9.384670	24.1	19.6	-40.4	8.8	-41.2	0.0
6	21.335565	27.8	22.2	-37.8	8.9	-41.1	0.0

Figure 5. 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 Pull Cord Station
Type PC-840
Part Number: Not Designated

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



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKA 13.53 MHz
72.75 dB μ V

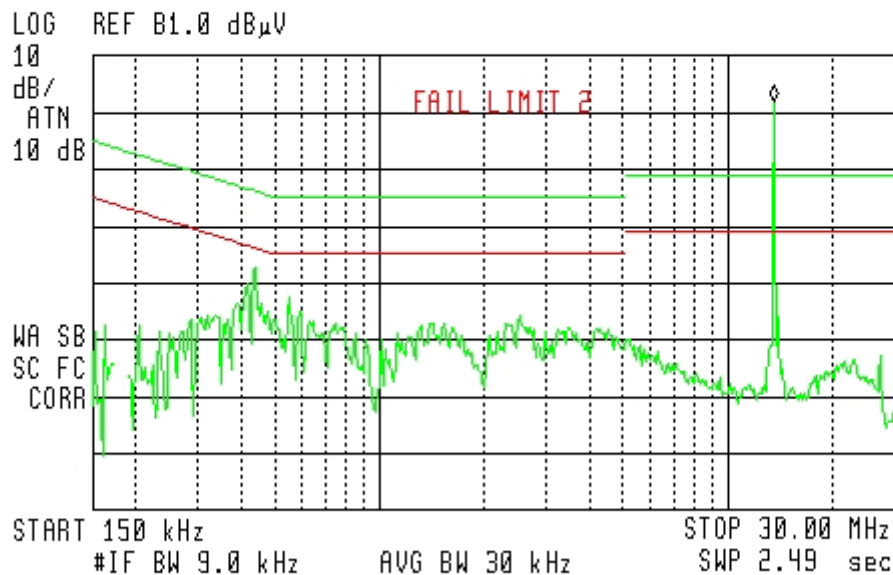


Figure 6. Detectors: Peak, Quasi-peak, Average

Note: Fail indication on the spectral plot results from peak detector level reading above the limit. This indication is for information only and it should not be interpreted as a test failure.

Peak reflects transmitter operation frequency.



Conducted Emission

E.U.T Description Pull Cord Station
Type PC-840
Part 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	0.437142	45.8	39.7	-17.4	30.1	-17.1	0.0
2	1.469338	34.1	30.1	-25.9	22.5	-23.5	0.0
3	2.414996	35.0	31.4	-24.6	20.7	-25.3	0.0
4	4.135186	33.1	28.3	-27.7	17.6	-28.4	0.0
5	9.384670	25.1	21.2	-38.8	10.6	-39.4	0.0
6	21.335565	26.0	20.7	-39.3	9.3	-40.7	0.0

Figure 7. 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	Pull Cord Station
Type	PC-840
Part Number:	Not Designated

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



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKA 13.53 MHz
69.10 dBμV

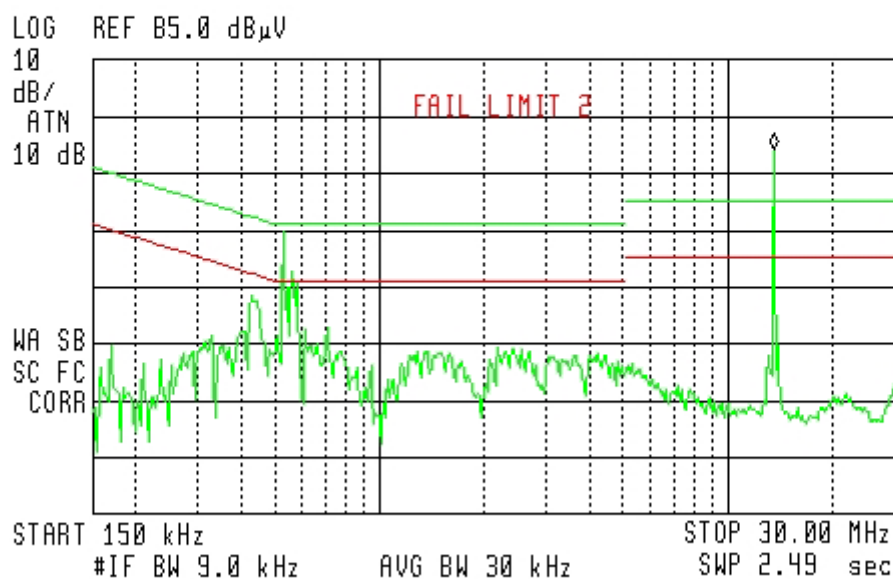


Figure 8 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

Note: Fail indication on the spectral plot results from peak detector level reading above the limit. This indication is for information only and it should not be interpreted as a test failure. Peak reflects transmitter operation frequency.



**4.4 Conducted Emission From AC Mains, 13.56 MHz Transmitter,
Test Equipment Used**

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	JPKG19982	N/A	N/A

Figure 9 Test Equipment Used



5. Field Strength of Fundamental, 13.56 MHz Transmitter

5.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.225(a) (b)

5.2 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 (13.56 MHz) and Peak Detection.

The distance between the E.U.T. and test antenna was 3 meters.

The turntable and antenna were adjusted for maximum level reading on the EMI receiver. The loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.

The average result is:

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

5.3 Test Results

JUDGEMENT: Passed by 59.68 dB (Section 15.225(a))
 Passed by 26.18 dB (Section 15.225(b))
 Passed by 16.18 dB (Section 15.225(c))
 Passed by 5.18 dB (Section 15.209)

The EUT met the FCC Part 15, Subpart C, Sections 15.225(a); (b); (c); Section 15.209; specifications requirements.

The details of the highest emissions are given in *Figure 10* to *Figure 11*.

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi

Field Strength of Fundamental 13.56 MHz Transmitter

E.U.T Description Pull Cord Station
Model Number PC-840
Part Number: Not Designated

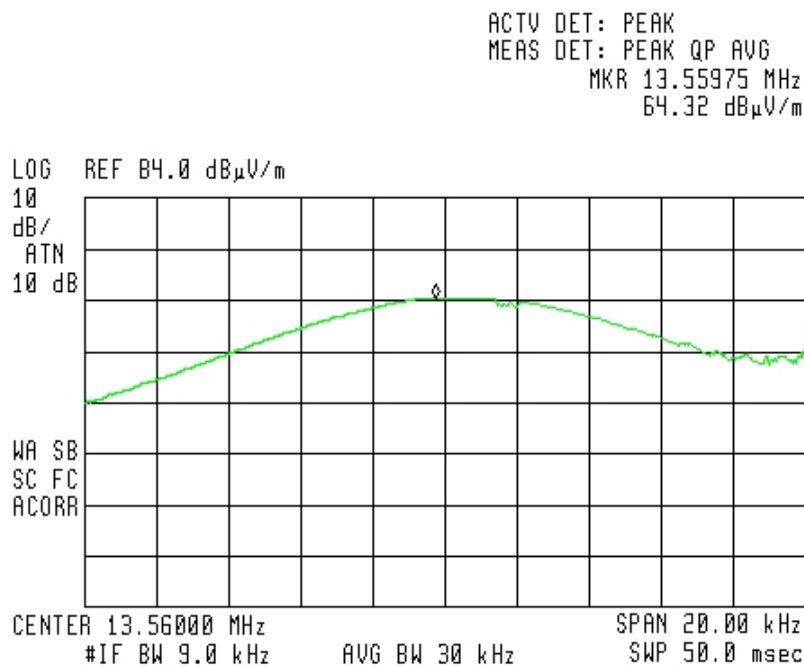


Figure 10. Field Strength of Fundamental

Detector: Peak

Section 15.225 (a): $L_{im30m} = 15848.00 \mu V/m = 84.0 \text{ dB}\mu V/m$

Section 15.225(a): $L_{im3m} = 40 + 84.0 \text{ dB}\mu V/m = 124.0 \text{ dB}\mu V/m$

Section 15.225 (b): $L_{im30m} = 334.00 \mu V/m = 50.50 \text{ dB}\mu V/m$

Section 15.225 (b): $L_{im3m} = 40 + 50.50 \text{ dB}\mu V/m = 90.50 \text{ dB}\mu V/m$

Section 15.225 (c): $L_{im30m} = 106.00 \mu V/m = 40.50 \text{ dB}\mu V/m$

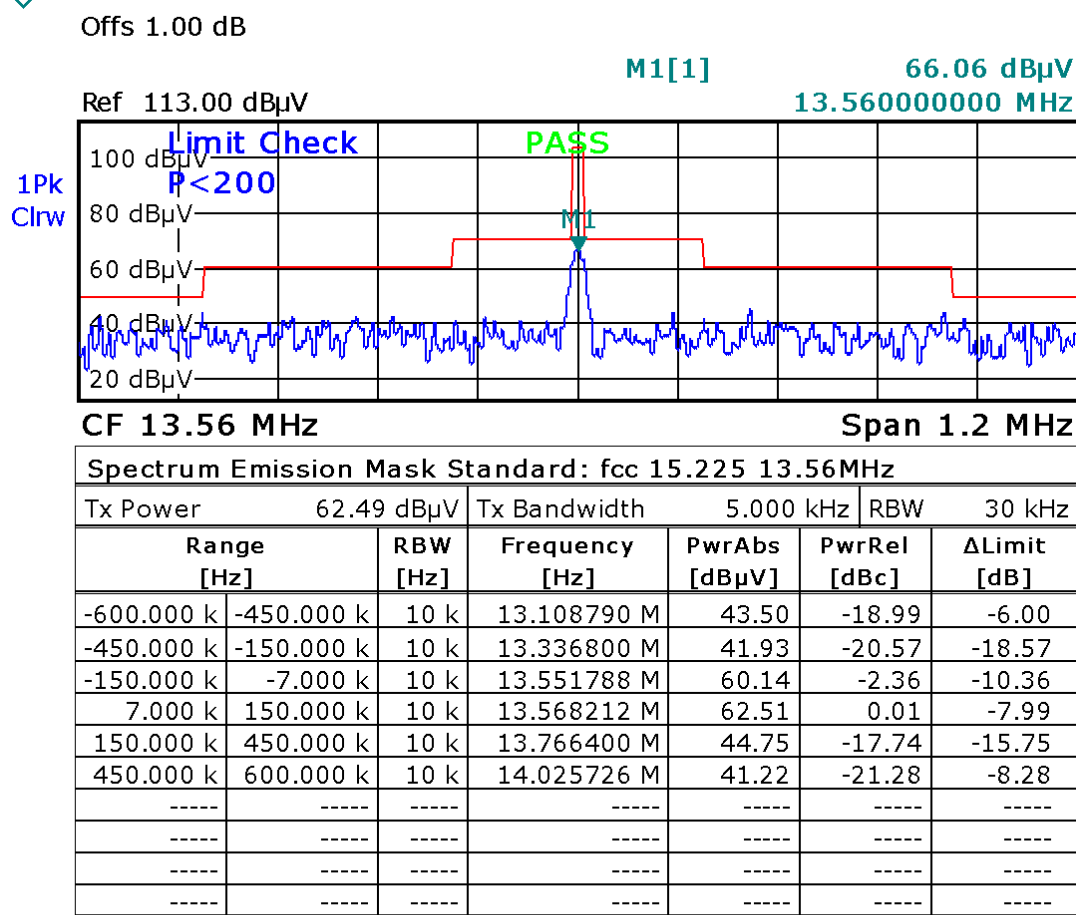
Section 15.225 (c) $L_{im3m} = 40 + 40.50 \text{ dB}\mu V/m = 80.50 \text{ dB}\mu V/m$

Section 15.209: $L_{im30m} = 30.00 \mu V/m = 29.50 \text{ dB}\mu V/m$

Section 15.209: $L_{im3m} = 40 + 29.50 \text{ dB}\mu V/m = 69.50 \text{ dB}\mu V/m$

Field Strength of Fundamental, 13.56 MHz Transmitter

E.U.T Description Pull Cord Station
Model Number PC-840
Part Number: Not Designated



Date: 4.MAR.2012 16:45:13

Figure 11. Mask of Fundamental

Note: Measurements were made in dBμV/m. The antenna factor was added internally. The spectrum analyzer used cannot indicate dBμV/m.

5.4 *Field Strength of Fundamental 13.56 MHz Transmitter, Test Equipment Used*

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	Rohde & Schwarz	ESCI7	100724	October 30, 2011	1 year
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
EMI Receiver Filter 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

Figure 12. Test Equipment Used

6. Spurious Radiated Emission, 9 kHz – 30 MHz, 13.56 MHz

6.1 Test Specification

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

6.2 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 configuration tested is shown in Figure 3.1.

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 13.56 MHz. This frequency was measured using a peak detector.

6.3 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

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

TEST PERSONNEL:

Tester Signature: 

Date: 14.05.12

Typed/Printed Name: A. Sharabi

6.4 *Spurious radiated Emission 9 kHz – 30 MHz, 13.56 MHz Transmitter, Test Equipment Used*

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
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 13. Test Equipment Used

6.5 *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 [dB μ V/m]
 RA: Receiver Amplitude [dB μ V]
 AF: Receiving Antenna Correction Factor [dB/m]
 CF: Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.

7. Spurious Radiated Emission 30 – 1000 MHz, 13.56 MHz Transmitter

7.1 Test Specification

30 MHz-1000 MHz, F.C.C., Part 15, Subpart C

7.2 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 configuration tested is shown in *Figure 3* to *Figure 4*.

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

7.3 Test Results

JUDGEMENT: Passed by 2.8 dB

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 2.8 dB in the worst case at the frequency of 52.80 MHz, vertical polarization.

TEST PERSONNEL:

Tester Signature: 

Date: 14.05.12

Typed/Printed Name: A. Sharabi

Spurious Radiated Emission, 30 – 1000 MHz, 13.56 MHz Transmitter

E.U.T Description Pull Cord Station
Model Number PC-840
Part Number: Not Designated

Freq.	Polarity	Peak Reading	QP Reading	QP Specification	Margin
(MHz)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)
40.70	V	22.7	21.9	40.0	-18.1
52.80	V	40.3	37.2	40.0	-2.8
79.90	V	32.5	25.6	40.0	-14.4

Figure 14. Radiated Emission

Notes: 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.

Peak reading includes Correction Factor.

7.4 *Spurious Radiated Emission 30 – 1000 MHz, 13.56 MHz Transmitter, Test Equipment Used*

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

Figure 15. Test Equipment Used

7.5 *Field Strength Calculation*

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

$$[\text{dB}\mu\text{V/m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

FS: Field Strength [dB μ V/m]

RA: Receiver Amplitude [dB μ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.



8. Frequency Tolerance 13.56 MHz Transmitter

8.1 Test Specification

Part 15 Subpart C Section 15.225(e)

8.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 3.

The E.U.T. was placed in a test fixture enabling coupling from the E.U.T. to the spectrum analyzer.

The E.U.T. and test fixture were placed inside a temperature chamber. The E.U.T. was operated from 115 VAC at normal temperature (25°C).

The chamber temperature was set to +25°C.

The spectrum analyzer was set to 1.0 kHz span and 1.0 kHz resolution B.W.

The carrier frequency was measured and recorded.

The carrier frequency measurement was repeated for:

- (a). +25°C
- (b). -20°C
- (c). +55°C

The carrier frequency was measured and recorded after at least 10 minutes of exposing the E.U.T. to the temperature.

8.3 Test Results

The E.U.T met the requirements of Part 15 Subpart C, Section 225(e) specification.

The frequency offset between the frequency measured under extreme conditions and the nominal carrier frequency measured under normal test conditions, is in the worst case, 1 kHz at -10 °C (spec: +/-1.356 kHz).

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

TEST PERSONNEL:

Tester Signature: 

Date: 14.05.12

Typed/Printed Name: A. Sharabi



Frequency Tolerance 13.56 MHz Transmitter

E.U.T Description Pull Cord Station
Model Number PC-840
Part Number: Not Designated

Specification: FCC Part 15 Subpart C Section 15.225(e)

Temperature (°C)	Voltage (VAC)	Measured Carrier Frequency (MHz)	Nominal Carrier Frequency (MHz)	Δ (kHz)	Specification (kHz)	Pass/Fail
+25	115	13.56025	-		-	-
-20	90	13.56030	13.56025	+0.05	+/-1.356	Pass
-20	130	13.56030	13.56025	+0.05	+/-1.356	Pass
+55	90	13.56020	13.56025	-0.05	+/-1.356	Pass
+55	130	13.56024	13.56025	-0.01	+/-1.356	Pass

Figure 16. Frequency Error

8.1 Frequency Tolerance 13.56 MHz Transmitter, Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Environmental Chamber	THERMOTRON CORP	SM 32C Mini Max	25-1030	February 23, 2012	1 Year
Digital Voltage Meter	Escort	EDM1111A	10313121	December 7, 2010	2 Years
Variable Voltage Transformer	Variac Voltage Co.	-	-	N/A	N/A
Spectrum Analyzer	HP	8594E	3809U03785	March 5, 2012	1 Year

9. Conducted Emission From AC Mains, 318 MHz Transmitter Operating

9.1 Test Specification

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 3.1. 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 μ Hn 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.

9.3 Test Results

JUDGEMENT: Passed by 14.1 dB

The margin between the emission levels and the specification limit is, in the worst case, 16.4 dB for the phase line at 0.16 MHz and 14.1 dB at 0.16 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 17* to *Figure 20*.

TEST PERSONNEL:

Tester Signature: 

Date: 14.05.12

Typed/Printed Name: A. Sharabi

Conducted Emission

E.U.T Description Pull Cord Station
Type PC-840
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	0.159812	50.5	49.1	-16.4	37.1	-18.4	0.0
2	0.214472	28.2	20.8	-42.3	-10.2	-63.3	0.0
3	0.318932	36.0	33.5	-26.2	21.9	-27.9	0.0
4	0.799520	29.2	29.2	-26.8	14.6	-31.4	0.0
5	3.362078	15.3	8.3	-47.7	-6.4	-52.4	0.0
6	5.950697	21.1	14.9	-45.1	-1.2	-51.2	0.0

Figure 17. 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 Pull Cord Station
Type PC-840
Serial Number: Not Designated

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



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKA 160 kHz
51.34 dB μ V

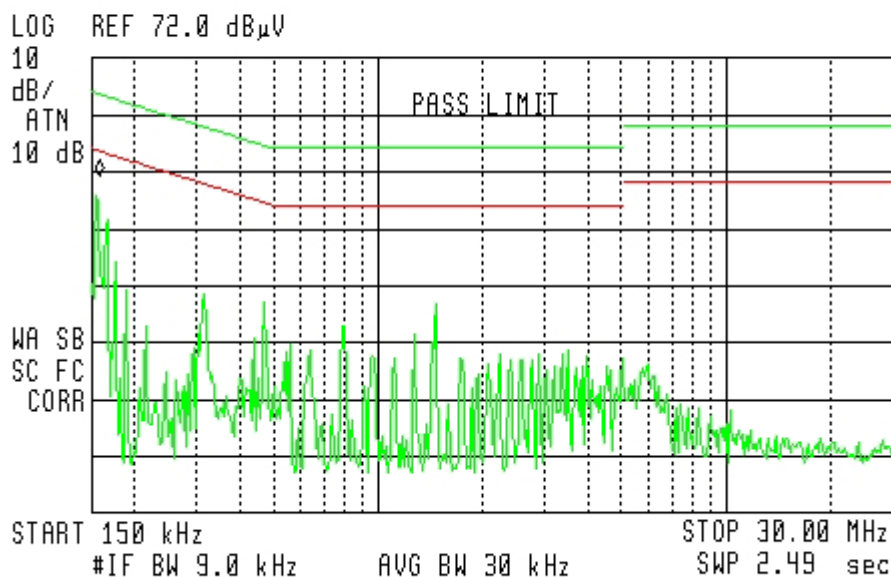


Figure 18. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description Pull Cord Station
Type PC-840
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	0.159824	53.2	51.4	-14.1	41.3	-14.2	0.0
2	0.214468	29.1	19.7	-43.4	-10.4	-63.5	0.0
3	0.318938	38.3	34.2	-25.5	23.6	-26.1	0.0
4	0.799532	30.5	26.4	-29.6	13.4	-32.6	0.0
5	3.362081	15.0	12.0	-44.0	-3.1	-49.1	0.0
6	5.950698	22.1	17.8	-42.2	2.4	-47.6	0.0

Figure 19. 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 Pull Cord Station
Type PC-840
Serial Number: Not Designated

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



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 160 kHz
53.64 dBμV

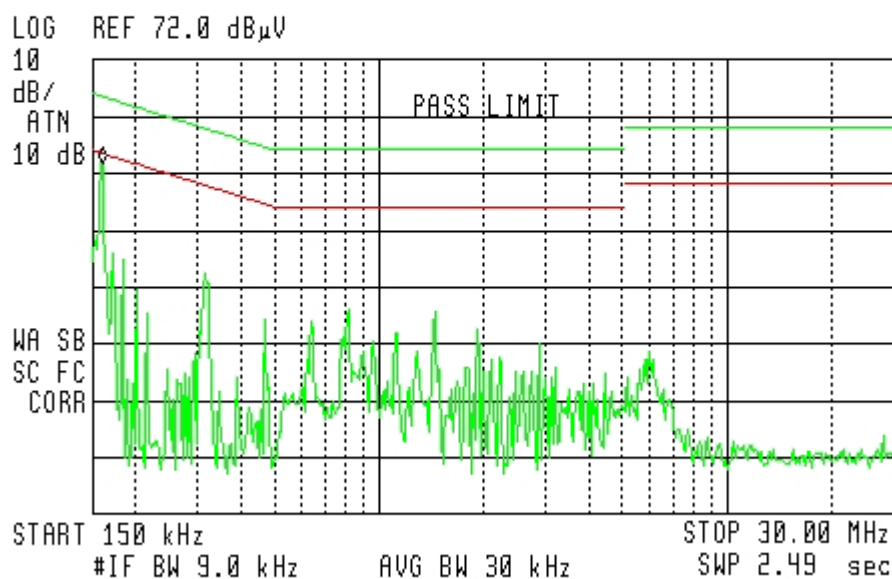


Figure 20 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average



**9.4 Conducted Emission From AC Mains, 318 MHz Transmitter,
Test Equipment Used**

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	127	March 3, 2012	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

Figure 21 Test Equipment Used

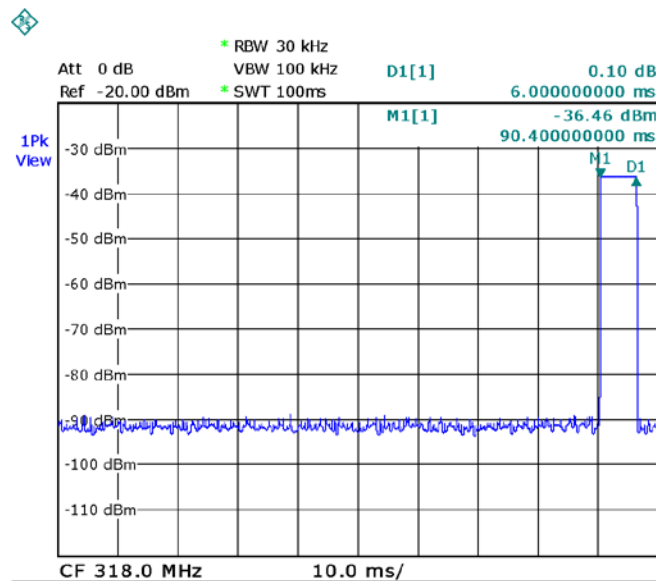
10. Average Factor Calculation 318 MHz Transmitter

1. Burst duration = 6.0 msec
2. Time between bursts >100ms

$$\text{Average Factor} = 20 \log \left[\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within 100msec} \right]$$

Note: Pulse duration and pulse period were considered worst case always ON since unit transmits randomly.

$$\text{Average Factor} = 20 \log \left[1 \times \frac{6}{100} \times 1 \right] = -24.4\text{dB}$$



Date: 29.JAN.2012 11:28:03

Figure 22. Burst Duration = 6.0 msec

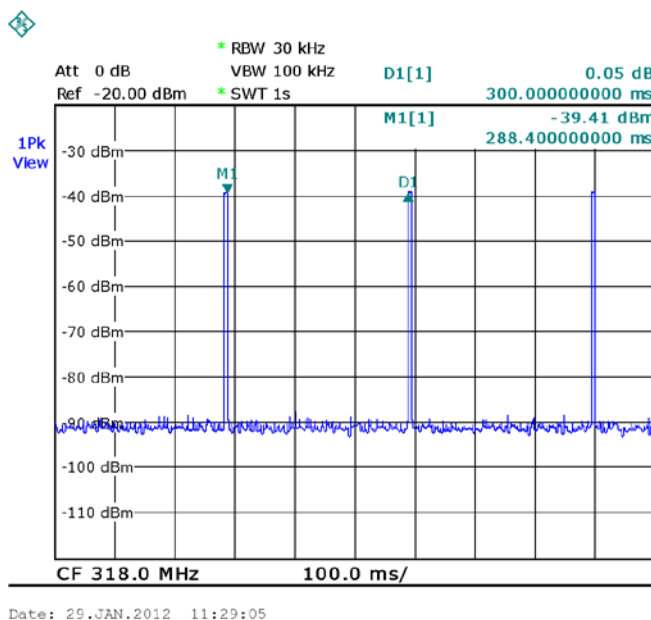


Figure 23. Time Between Bursts > 100 ms (300msec)

10.1 Average Factor Calculation 318 MHz Transmitter, Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 Year
EMI Receiver	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 Years
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

Figure 24 Test Equipment Used

11. Periodic Operation 318 MHz Transmitter

11.1 Specification

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

11.2 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 <i>Figure 25</i>	Complies
An automatically operated transmitter shall cease operation within 5 seconds after activation.	N/A	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 <i>Figure 26</i> to <i>Figure 27</i> .	Complies

11.3 Results

JUDGEMENT: Passed

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

TEST PERSONNEL:

Tester Signature: 

Date: 14.05.12

Typed/Printed Name: A. Sharabi

Periodic Operation

E.U.T Description	Pull Cord Station

Type **PC-840**

Serial Number: Not Designated

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

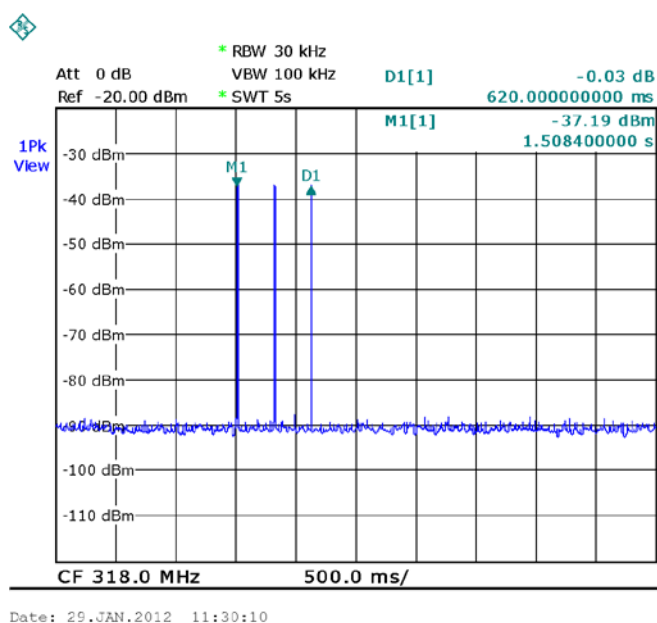


Figure 25. ON /OFF initializing transmission

Periodic Operation

E.U.T Description Pull Cord Station
Type **PC-840**
Serial Number: Not Designated

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

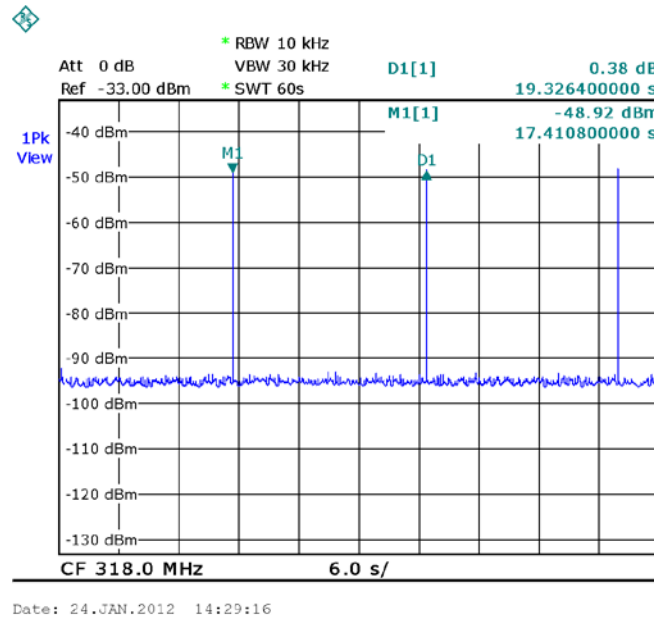


Figure 26. Alarm Message Every 18 Seconds Until Nurse Arrives

Periodic Operation

E.U.T Description Pull Cord Station
Type **PC-840**
Serial Number: Not Designated

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

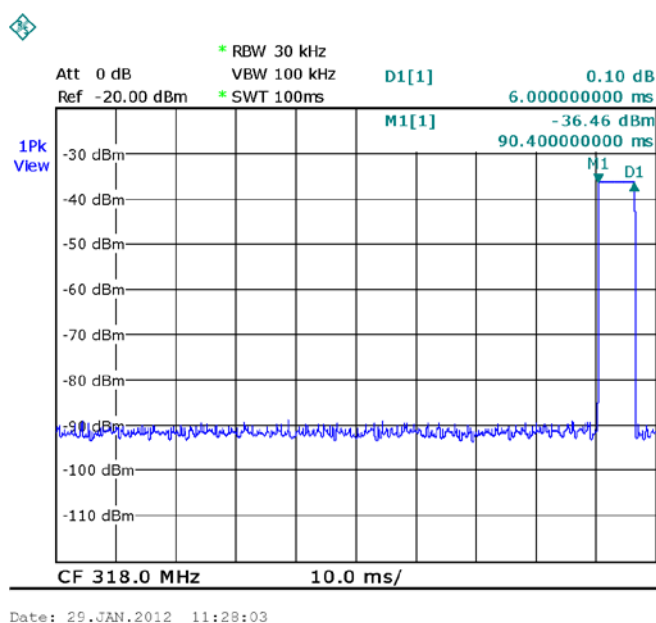


Figure 27. Signal Integrity burst
(Burst width 6.0msec < 2 sec)

11.4 Periodic Operation 318 MHz Transmitter, Test Equipment Used

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

12. Field Strength of Fundamental 318 MHz Transmitter

12.1 Test Specification

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

12.2 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 (418 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(dB μ V/m) + E.U.T. Duty Cycle Factor, in 100msec time window (dB)

12.3 Measured Data

JUDGEMENT: Passed by 5.8 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 28 to Figure 30.

TEST PERSONNEL:

Tester Signature:  Date: 23.07.12

Typed/Printed Name: A. Sharabi

Field Strength of Fundamental

E.U.T Description Pull Cord Station
Type **PC-840**
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.	Pol.	Peak Reading	Average Factor	AVG Result	AVG Specification	Margin
(MHz)	V/H	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
318	H	92.7	-24.4	68.3	75.8	-7.5
318	V	94.4	-24.4	70.0	75.8	-5.8

Figure 28. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL/VERTICAL.

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)+D.C.F. (dB)

Field Strength of Fundamental

E.U.T Description Pull Cord Station
Type **PC-840**
Serial Number: Not Designated

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

Antenna Polarization: Horizontal

Test Distance: 3 meters

Detector: Peak



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 318.035 MHz
92.72 dB μ V/m

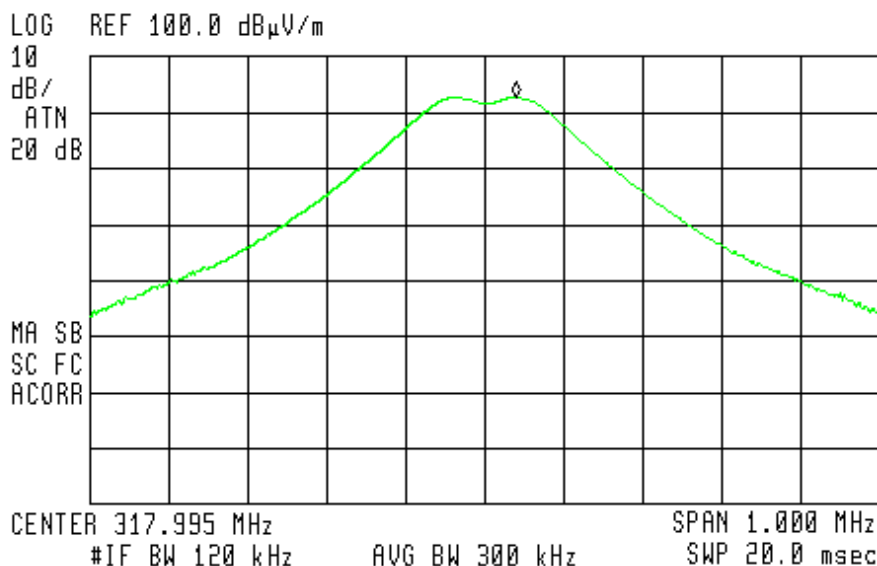


Figure 29. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL.

Field Strength of Fundamental

E.U.T Description Pull Cord Station
Type **PC-840**
Serial Number: Not Designated

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

Antenna Polarization: Vertical

Test Distance: 3 meters

Detector: Peak



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 318.035 MHz
94.44 dB μ V/m

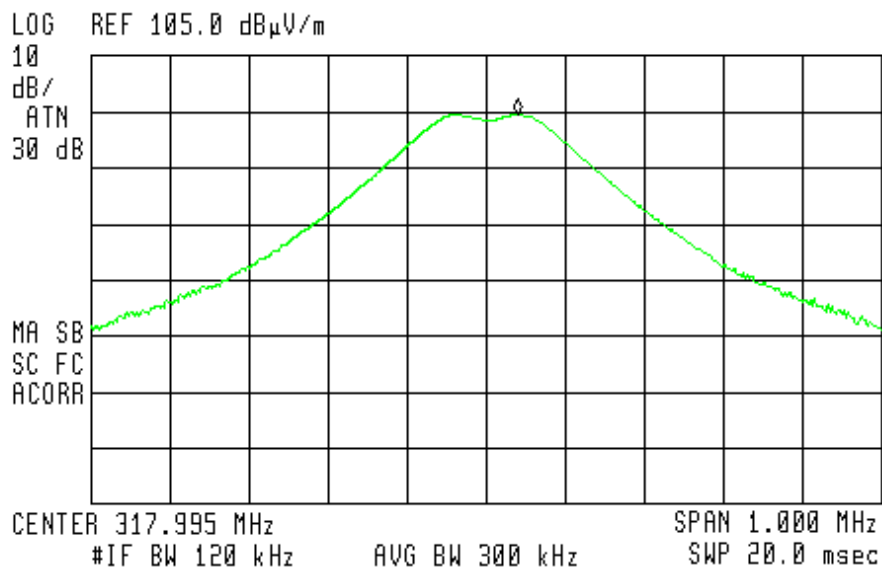


Figure 30. Field Strength of Fundamental. Antenna Polarization: VERTICAL.

12.4 *Field Strength of Fundamental 318 MHz Transmitter, Test Equipment Used*

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 23, 2011	1 Year
RF Section	HP	85420E	3705A00248	November 23, 2011	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 29, 2012	1 Year
Antenna Mast	ARA	AAM-4A	1001	1001	N/A
Turntable	ARA	ART-1001/4	1001	1001	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	1001	N/A
Printer	HP	LaserJet 2200	JPKG19982	JPKG19982	N/A

Figure 31. Test Equipment Used

13. Spurious Radiated Emission, 9 kHz – 30 MHz, 318 MHz Transmitter

13.1 Test Specification

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

13.2 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 3.1.

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 318 MHz. This frequency was measured using a peak detector.

13.3 Measured Data

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: 23.07.12

Typed/Printed Name: A. Sharabi

13.1 *Spurious radiated Emission 9 kHz – 30 MHz, 13.56 MHz Transmitter, Test Equipment Used*

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
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 32. Test Equipment Used

13.2 *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 [dB μ V/m]

RA: Receiver Amplitude [dB μ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.

14. Spurious Radiated Emission, 30 MHz – 4.5 GHz, 318 MHz Transmitter

14.1 Test Specification

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

14.2 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 1. 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.



14.3 Test Data

JUDGEMENT: Passed by 25.8dB

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 25.7 dB in the worst case at the frequency of 1590.00 MHz, vertical polarization.

TEST PERSONNEL:

Tester Signature: _____ Date: 23.07.12

Typed/Printed Name: A. Sharabi



Radiated Emission

E.U.T Description Pull Cord Station
Type PC-840
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 Detector: Peak

Frequency (MHz)	Antenna Polarity (H/V)	Peak Reading (dB μ V/m)	Average Factor (dB μ V/m)	Average Result (dB μ V/m)	Average Specification (dB μ V/m)	Margin (dB)
635.90	V	46.2	24.4	21.8	55.62	-33.8
635.90	H	45.0	24.4	20.6	55.62	-35.0
1590.00	H	53.5	24.4	29.1	55.62	-26.5
1590.00	V	54.3	24.4	29.9	55.62	-25.7

Figure 33. Radiated Emission

Note: 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.

14.4 Spurious Radiated Emission 30 MHz – 4.5 GHz, 318 MHz Transmitter, Test Equipment Used

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, 2012	1 Year
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 27, 2011	2 Years
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 34. Test Equipment Used

15. Bandwidth 318 MHz Transmitter

15.1 Test Specification

F.C.C. Part 15, Subpart C: (15.231(c))

15.2 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. This measurement also represents the 99% occupied bandwidth requirement of Industry Canada.

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.

15.3 Test Results

Bandwidth Reading (kHz)	Specification(1) (kHz)	Margin (kHz)
465	795	-330

Figure 35 Bandwidth

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

JUDGEMENT: Passed by 330 kHz

TEST PERSONNEL:

Tester Signature:  Date: 14.05.12

Typed/Printed Name: A. Sharabi

Note:

The calculated necessary bandwidth per Industry Canada TRC-43 is:
 $B_n = 2DK + B$; $B = R / (\log_2 S)$, 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
 $K = 1$
 $B(n) = 95.7 \text{ kHz}$

Bandwidth 318 MHz Transmitter



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 465 kHz
.06 dB

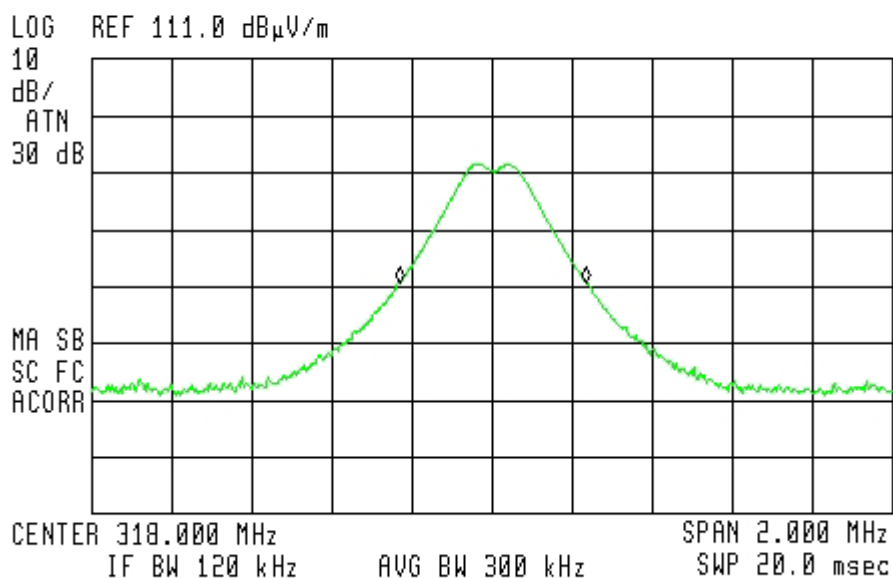


Figure 36 Bandwidth



15.1 Bandwidth 318 MHz Transmitter, Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 Year
EMI Receiver	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	JPKG19982	N/A	N/A

Figure 37 Test Equipment Used

16. Intermodulation Tests

16.1 Test Procedure

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

The E.U.T host was placed on a remote-controlled turntable on the open area test site.

The frequency range 30 MHz – 5.0 GHz was scanned, and the list of the highest emissions was verified and 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.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

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 E.U.T. was tested for intermodulation.

16.2 Test Results

All results were below the results of the fundamental transmitter spurious radiated emission test results.

TEST PERSONNEL:

Tester Signature: 

Date: 14.05.12

Typed/Printed Name: A. Sharabi

16.3 Intermodulation Test Equipment Used

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
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS- 0411N313	013	November 05, 2011	1 Year
Spectrum Analyzer	Rohde & Schwarz	ESCI7	100724	October 30, 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	JPKG19982	N/A	N/A

Figure 38 Test Equipment Used

17. Conducted Emission From AC Mains Receive Mode

17.1 Test Specification

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

17.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 4.1. 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 μ Hn 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 49. Conducted Emission From AC Mains 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.



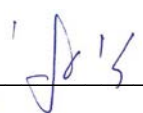
17.3 Test Results

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, 16.4 dB for the phase line at 0.16 MHz and 14.1 dB at 0.16 MHz for the neutral line.

The details of the highest emissions are given in *Figure 39* to *Figure 42*.

TEST PERSONNEL:

Tester Signature: For/  _____

Date: 07.05.12

Typed/Printed Name: I. Siboni

Conducted Emission

E.U.T Description Pull Cord Station
Type PC-840
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	0.159812	50.5	49.1	-16.4	37.1	-18.4	0.0
2	0.214472	28.2	20.8	-42.3	-10.2	-63.3	0.0
3	0.318932	36.0	33.5	-26.2	21.9	-27.9	0.0
4	0.799520	29.2	29.2	-26.8	14.6	-31.4	0.0
5	3.362078	15.3	8.3	-47.7	-6.4	-52.4	0.0
6	5.950697	21.1	14.9	-45.1	-1.2	-51.2	0.0

Figure 39. 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 Pull Cord Station
Type PC-840
Serial Number: Not Designated

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



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKA 160 kHz
51.34 dB μ V

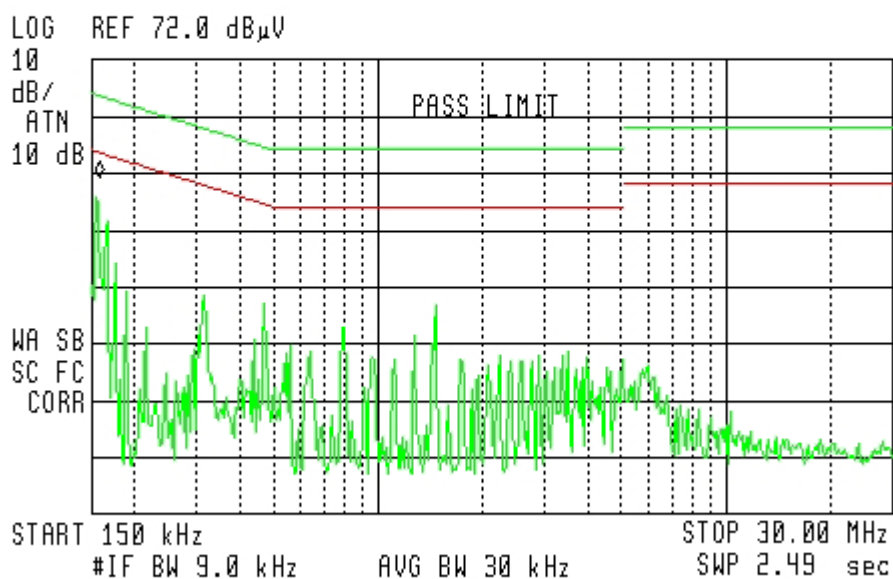


Figure 40. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description Pull Cord Station
Type PC-840
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	0.159824	53.2	51.4	-14.1	41.3	-14.2	0.0
2	0.214468	29.1	19.7	-43.4	-10.4	-63.5	0.0
3	0.318938	38.3	34.2	-25.5	23.6	-26.1	0.0
4	0.799532	30.5	26.4	-29.6	13.4	-32.6	0.0
5	3.362081	15.0	12.0	-44.0	-3.1	-49.1	0.0
6	5.950698	22.1	17.8	-42.2	2.4	-47.6	0.0

Figure 41. 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 Pull Cord Station
Type PC-840
Serial Number: Not Designated

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



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 160 kHz
53.64 dB μ V

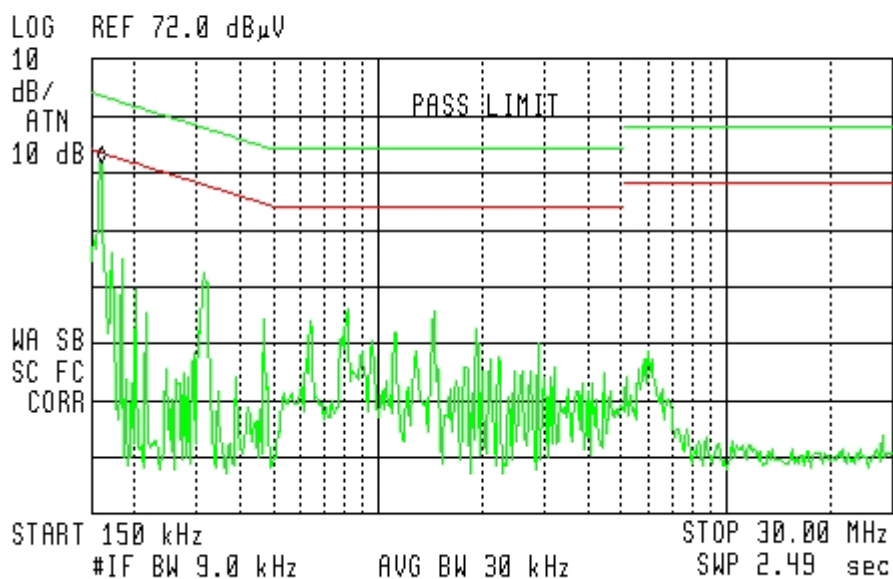


Figure 42 Detectors: Peak, Quasi-peak, Average



**17.4 Conducted Emission From AC Mains, Receive Mode,
Test Equipment Used**

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	127	March 3, 2012	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

Figure 43 Test Equipment Used

18. Radiated Emission Receive Mode

18.1 Test Specification

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

18.2 Test Procedure

The E.U.T operation mode and test set-up are as described in section 4.1.

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 50. Radiated Emission Test*.

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: $FS = 30.7 \text{ dB}\mu\text{V (RA)} + 14.0 \text{ dB (AF)} + 0.9 \text{ dB (CF)} = 45.6 \text{ dB}\mu\text{V}$



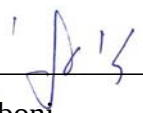
18.3 Test Results

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 20.2 dB in the worst case at the frequency of 52.12 MHz, vertical polarization.

The details of the highest emissions are given in *Figure 44* to *Figure 47*.

TEST PERSONNEL:

Tester Signature: For/  _____

Date: 07.05.12

Typed/Printed Name: I. Siboni



Radiated Emission

E.U.T Description Pull Cord Station
Type PC-840
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	24.1	17.2	-22.8	10.6		11.4
2	78.207300	21.1	15.5	-24.5	8.7		10.4
3	130.041925	25.6	18.7	-24.8	12.0		13.9

**Figure 44. 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.*

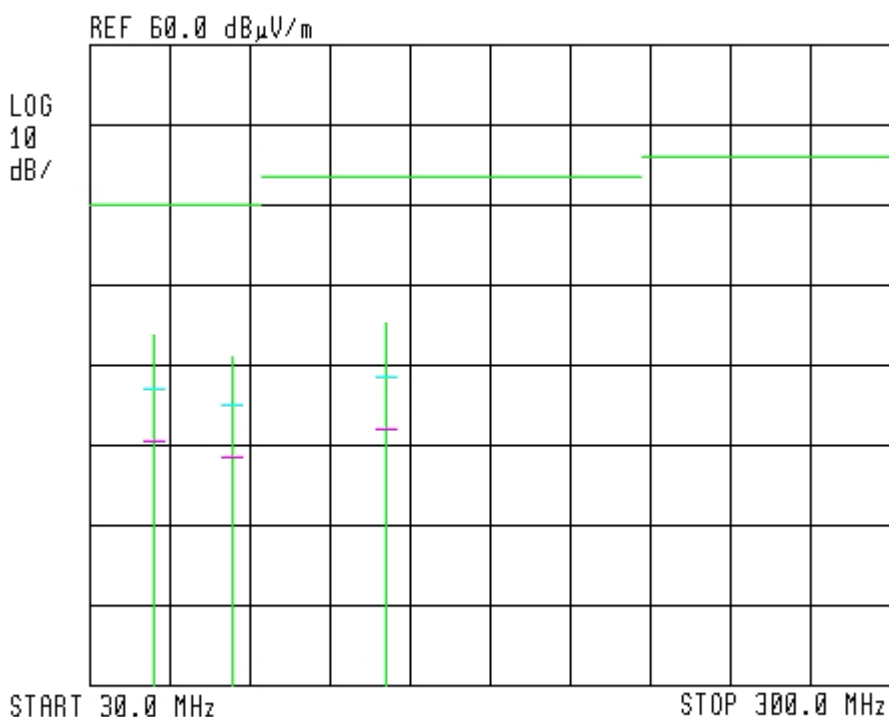
Radiated Emission

E.U.T Description	Pull Cord Station
Type	PC-840
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 45. Radiated Emission. Antenna Polarization: HORIZONTAL
Detectors: Peak, Quasi-peak**



Radiated Emission

E.U.T Description Pull Cord Station
Type PC-840
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	25.9	19.8	-20.2	13.4		11.4
2	78.207300	22.8	15.9	-24.1	9.0		10.4
3	130.041925	24.0	18.4	-25.1	12.6		13.9

**Figure 46. 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.

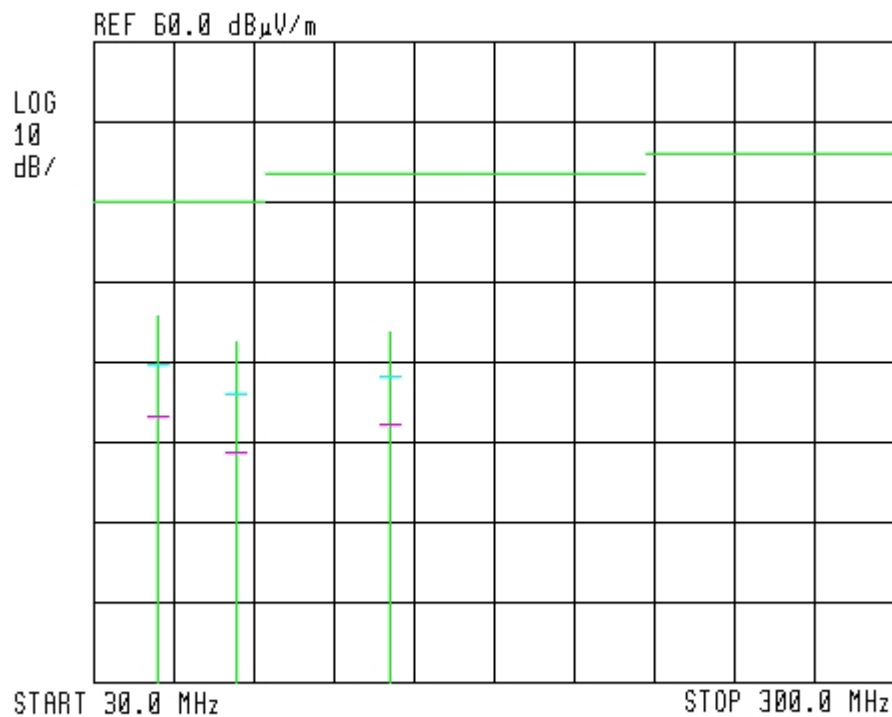
Radiated Emission

E.U.T Description	Pull Cord Station
Type	PC-840
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 47. Radiated Emission. Antenna Polarization: VERTICAL.
Detectors: Peak, Quasi-peak**

18.4 Radiated Emission receive Mode, Test Equipment Used

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, 2012	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	JPKG19982	N/A	N/A

Figure 48. Test Equipment Used

19. Set Up Photographs Receive Mode



Figure 49. Conducted Emission From AC Mains Test



Figure 50. Radiated Emission Test

20. APPENDIX A - CORRECTION FACTORS

20.1 Correction factors for CABLE

from EMI receiver
to test antenna
at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
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		

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".

20.2 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.*

20.3 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.

20.4 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 38M30.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".

20.5 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".

**20.6 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".



20.7 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

21. Comparison Requirements FCC with Industry Canada

FCC Specification	According FCC Standard	IC Standard
Frequency Tolerance	47CFR15.225(e)	RSS-210 Section 2.5 Annex 2 A2.6
Maximum Transmitting Power	47CFR15.225(a)	RSS-210 Section 2.5 Annex 2 A2.6(a)
Spurious Emission	47CFR15.225(d)	RSS-210 Section 2.5 Annex 2 A2.6(d)
Periodic Operation	47CFR15.231 (a)(1-5)	RSS- 210 Issue 8 Section 2.5 Annex 1, A1.1.1
Field Strength at Fundamental	47CFR15.231 (b)	RSS- 210 Issue 8 Annex 1 A1.1.2, Section 2.5
Spurious Emissions	47CFR15.231 (b)	RSS GEN Issue 3 7.2.2(Table3)
Bandwidth	47CFR15.231 (c)	RSS- 210 Issue 8 Section 2.5 Annex 1 A1.1.3
Conducted Limits	47CFR15.107	ICES-003 Issue 4
Radiated Emission Limits	47CFR15.109	ICES-003 Issue 4

Note:

Calculated necessary bandwidth per Industry Canada TRC-43 for the 13.56 MHz transmitter:

The transmitter operates in CW. Therefore the calculated necessary bandwidth is 0 Hz.