



DATE: 28 August 2012

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

FCC Radio Test Report
for
3M Electronic Monitoring Ltd.

Equipment under test:

E4 RF

FCC ID: LSQ-E4-RF-2

IC: 4306A-E4RF2

Written by:

D. Shidlowsky, Documentation

Approved by:

A. Sharabi, Test Engineer

Approved by:

I. Raz, EMC Laboratory Manager

This report must not be reproduced, except in full, without the written
permission of I.T.L. (Product Testing) Ltd.

This report relates only to items tested.



E4 RF

FCC ID: LSQ-E4-RF-2

IC: 4306A-E4RF2

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

Equipment type: Part 15 Security/Remote Control Transceiver

47CFR15 Section 15.231 (a-d)

Measurement procedure used is ANSI C63.4-2003.

Application for Certification:
prepared by:

Shai Avigdori
Elmo Tech Ltd.
2 Habarzel St.
Tel-Aviv, 61131
Israel
Tel: +972-3-767-1700
Fax: +972-3-767-1701
e-mail: Shaia@Attentigroup.com

TABLE OF CONTENTS

1.	GENERAL INFORMATION -----	5
1.1	Administrative Information	5
1.2	List of Accreditations	6
1.3	Product Description	7
1.4	Test Methodology	7
1.5	Test Facility	7
1.6	Measurement Uncertainty	8
2.	SYSTEM TEST CONFIGURATION-----	9
2.1	Justification	9
2.2	Special Accessories	9
2.3	Equipment Modifications	9
2.4	Configuration of Tested System	9
3.	CONDUCTED AND RADIATED MEASUREMENT TEST SET-UP PHOTOS-----	10
4.	CONDUCTED EMISSION FROM AC MAINS -----	12
4.1	Test Specification	12
4.2	Test Procedure	12
4.3	Test Results.....	12
4.1	Conducted Emission From AC Mains, Test Equipment Used.....	17
5.	AVERAGE FACTOR CALCULATION HELICAL ANTENNA TRANSMITTER-----	18
5.1	Average Factor Calculation Helical Antenna Transmitter, Test Equipment Used	20
6.	PERIODIC OPERATION HELICAL ANTENNA TRANSMITTER-----	21
6.1	Specification	21
6.2	Requirements	21
6.3	Test Results.....	21
6.1	Periodic Operation Helical Antenna Transmitter, Test Equipment Used	23
7.	FIELD STRENGTH OF FUNDAMENTAL HELICAL ANTENNA TRANSMITTER -----	24
7.1	Test Specification	24
7.2	Test Procedure	24
7.3	Test Results.....	24
7.4	Field Strength of Fundamental Helical Antenna Transmitter, Test Equipment Used	28
8.	RADIATED EMISSION, 9 KHZ – 30 MHZ HELICAL ANTENNA TRANSMITTER-----	29
8.1	Test Specification	29
8.2	Test Procedure	29
8.3	Test Results.....	29
8.4	Spurious Radiated Emission 9 kHz – 30 MHz, Helical Antenna Transmitter, Test Equipment Used	30
8.5	Field Strength Calculation	30
9.	SPURIOUS RADIATED EMISSION HELICAL ANTENNA TRANSMITTER-----	31
9.1	Test Specification	31
9.2	Test Procedure	31
9.3	Test Results.....	32
9.4	Spurious Radiated Emission 30 MHz – 4.5 GHz, Helical Antenna Transmitter, Test Equipment Used	34
10.	BANDWIDTH HELICAL ANTENNA TRANSMITTER -----	35
10.1	Test Specification	35
10.2	Test procedure	35
10.3	Test Results.....	35
10.1	Bandwidth Helical Antenna Transmitter, Test Equipment Used.....	37



11.	26DB BANDWIDTH HELICAL ANTENNA TRANSMITTER-----	38
11.1	Test Specification	38
11.2	Test procedure	38
11.3	Test Results.....	38
11.1	26 dB Bandwidth 433.92 MHz Transmitter, Test Equipment Used	40
12.	AVERAGE FACTOR CALCULATION F ANTENNA TRANSMITTER-----	41
12.1	Average Factor Calculation F Antenna Transmitter, Test Equipment Used ...	43
13.	PERIODIC OPERATION F ANTENNA TRANSMITTER-----	44
13.1	Specification	44
13.2	Requirements	44
13.3	Results.....	44
13.1	Periodic Operation, F Antenna Transmitter Test Equipment Used	46
14.	FIELD STRENGTH OF FUNDAMENTAL F ANTENNA TRANSMITTER -----	47
14.1	Test Specification	47
14.2	Test Procedure	47
14.3	Test Results.....	47
14.4	Field Strength of Fundamental F Antenna Transmitter, Test Equipment Used	51
15.	RADIATED EMISSION, 9 KHZ – 30 MHZ F ANTENNA TRANSMITTER-----	52
15.1	Test Specification	52
15.2	Test Procedure	52
15.3	Test Results.....	52
15.4	Spurious Radiated Emission 9 kHz – 30 MHz, F Antenna Transmitter, Test Equipment Used	53
15.5	Field Strength Calculation	53
16.	SPURIOUS RADIATED EMISSION F ANTENNA TRANSMITTER-----	54
16.1	Test Specification	54
16.2	Test Procedure	54
16.3	Test Results.....	55
16.4	Spurious Radiated Emission 30 MHz – 4.5 GHz, F Antenna Transmitter, Test Equipment Used	57
17.	BANDWIDTH F ANTENNA TRANSMITTER -----	58
17.1	Test Specification	58
17.2	Test procedure	58
17.3	Test Results.....	58
17.1	Bandwidth F Antenna Transmitter, Test Equipment Used.	60
18.	26DB BANDWIDTH F ANTENNA TRANSMITTER-----	61
18.1	Test Specification	61
18.2	Test procedure	61
18.3	Test Results.....	61
18.1	26 dB Bandwidth F Antenna Transmitter, Test Equipment Used	63
19.	APPENDIX A - CORRECTION FACTORS-----	64
19.1	Correction factors for CABLE	64
19.2	Correction factors for CABLE	65
19.3	Correction factors for CABLE	66
12.6	Correction factors for LOG PERIODIC ANTENNA	67
19.4	Correction factors for LOG PERIODIC ANTENNA	68
19.5	Correction factors for BICONICAL ANTENNA	69
19.6	Correction factors for ACTIVE LOOP ANTENNA	70



1. General Information

1.1 Administrative Information

Manufacturer:	3M Electronic 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):	E4 RF
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	22.03.2012
Start of Test:	22.03.2012
End of Test:	25.03.2012
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

3M Electronic Monitoring offers the new Dual Comm RF Monitoring System – a multi client-monitoring unit that is capable of monitoring up to 50 client transmitters within the monitored perimeter. The E4 RF Receiver unit also has the capability to manage the various program schemes, event configurations, and schedules assigned to each client.

E4 RF Receivers are dual communication units – able to communicate with the central monitoring computer via landline and/or via cellular communication. Users can specify either communication type, or can use both methods together for redundancy.

The E4 RF Receiver unit installation is easy, simple, and quick; all one needs is to plug in the power adapter (and the phone cord when landline communication is being used). The LCD screen and buttons enable a simple, intuitive installation process, and afterwards, they enable easy status monitoring. The unit can start tracking the offender as soon as it is installed (utilizing the default parameters).

The installation process is completed after the monitoring center's Data Communication Computer (DCC) downloads the unit's parameters (such as curfew schedule, transmitter ID, call-back phone numbers, settings, etc.) into the E4 RF Receiver unit's memory, thereby setting the unit to active monitoring mode. The E4 RF Receiver internally connects the backup battery and starts tracking the offender.

The E.U.T. includes either an FCC approved 3G modem, FCC ID: QIPPH8-P, manufactured by Cinterion Wireless Modules GmbH or an FCC approved 2G modem, FCC ID: QIPTC63I, manufactured by Cinterion wireless Modules GmbH.

The cellular modem was not active during the tests.

The E.U.T. includes two 433 MHz transmitters which do not transmit simultaneously.

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

The E.U.T. was tested as tabletop equipment with both 433 MHz transceivers not operating simultaneously since in normal operation, the transceivers transmit separately after detection of the RSSI received from a wireless bracelet.

Testing was performed on each 433 MHz transceiver separately.

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

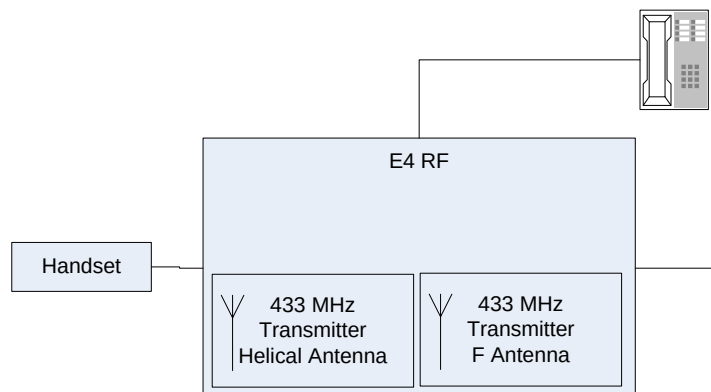


Figure 1. Configuration of Tested System

3. Conducted and Radiated Measurement Test Set-up Photos



Figure 2. Conducted Emission Test

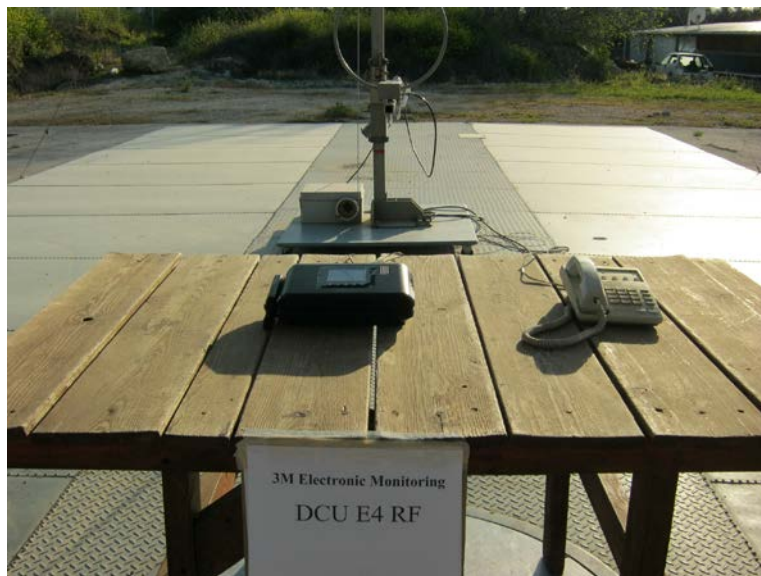


Figure 3. Radiated Emission Test 9 kHz – 30 MHz

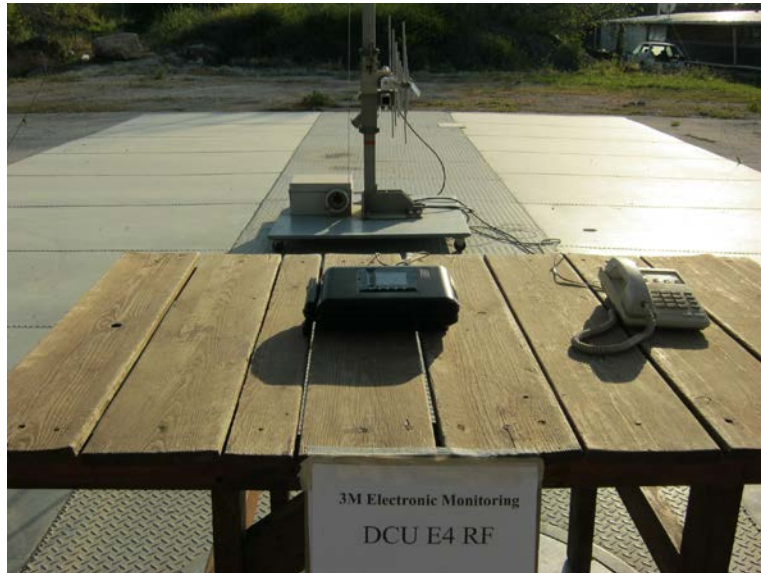


Figure 4. Radiated Emission Test 30-1000 MHz



Figure 5. Radiated Emission Test Above 1000 MHz

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 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 13.1 dB

The margin between the emission levels and the specification limit is, in the worst case, 13.1 dB for the phase line at 0.43 MHz and 15.1 dB at 0.43 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: 24.05.12

Typed/Printed Name: A. Sharabi

Conducted Emission

E.U.T Description: E4 RF
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	0.168485	60.6	50.7	-14.4	27.5	-27.6	0.0
2	0.427608	50.0	44.1	-13.2	34.2	-13.1	0.0
3	1.334735	39.5	35.1	-20.9	15.0	-31.0	0.0
4	2.568163	38.0	34.5	-21.5	18.8	-27.2	0.0
5	3.927544	36.0	32.0	-24.0	16.0	-30.0	0.0
6	18.323809	33.4	27.5	-32.5	18.1	-31.9	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 E4 RF
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 150 kHz
60.1B dBμV

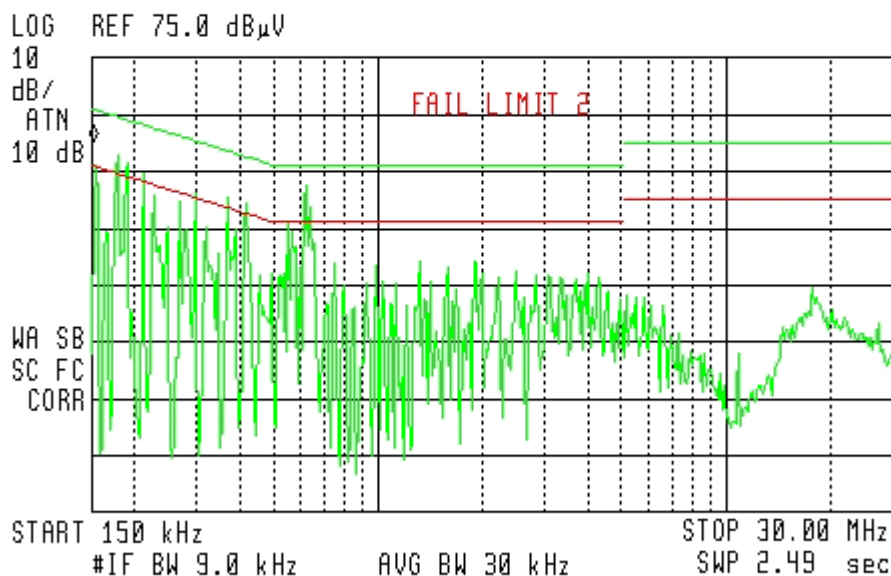


Figure 7. Detectors: Peak, Quasi-peak, Average

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.



Conducted Emission

E.U.T Description E4 RF
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	0.168481	58.8	48.2	-17.0	18.2	-36.9	0.0
2	0.427615	48.2	42.2	-15.1	28.8	-18.6	0.0
3	1.334733	40.5	34.2	-21.8	17.2	-28.8	0.0
4	2.568162	35.3	30.0	-26.0	12.3	-33.7	0.0
5	3.927544	36.7	31.8	-24.2	15.7	-30.3	0.0
6	18.323809	35.1	29.0	-31.0	18.0	-32.0	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 E4 RF
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
MKA 160 kHz
59.55 dBμV

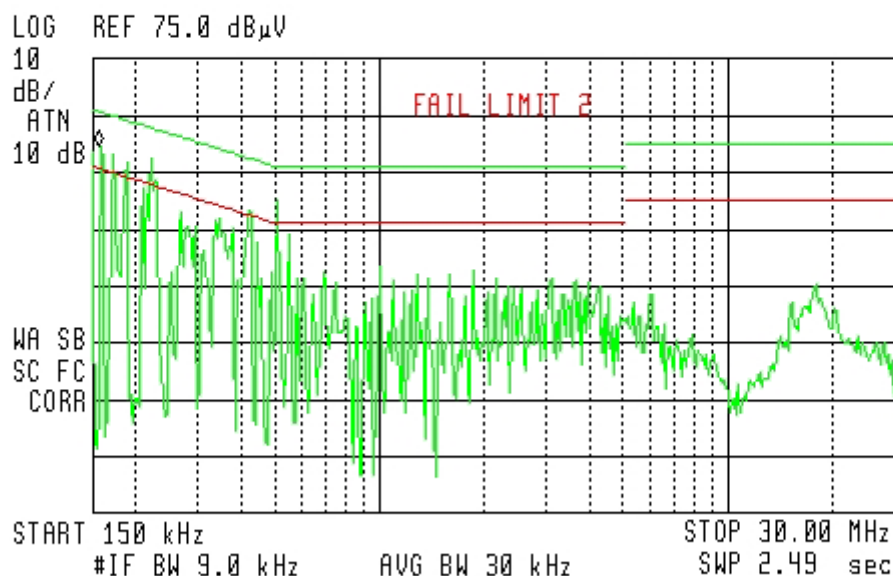


Figure 9 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

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.



4.1 Conducted Emission From AC Mains, 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	JPKG19982	N/A	N/A

Figure 10 Test Equipment Used

5. Average Factor Calculation Helical Antenna Transmitter

1. Burst duration = 4.0 msec
2. Time between bursts >100ms (minimum separation 15 seconds)
3. 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.

$$\text{Average Factor} = 20 \log \left[1 \times \frac{4.0}{100} \times 1 \right] = -27.95\text{dB}$$

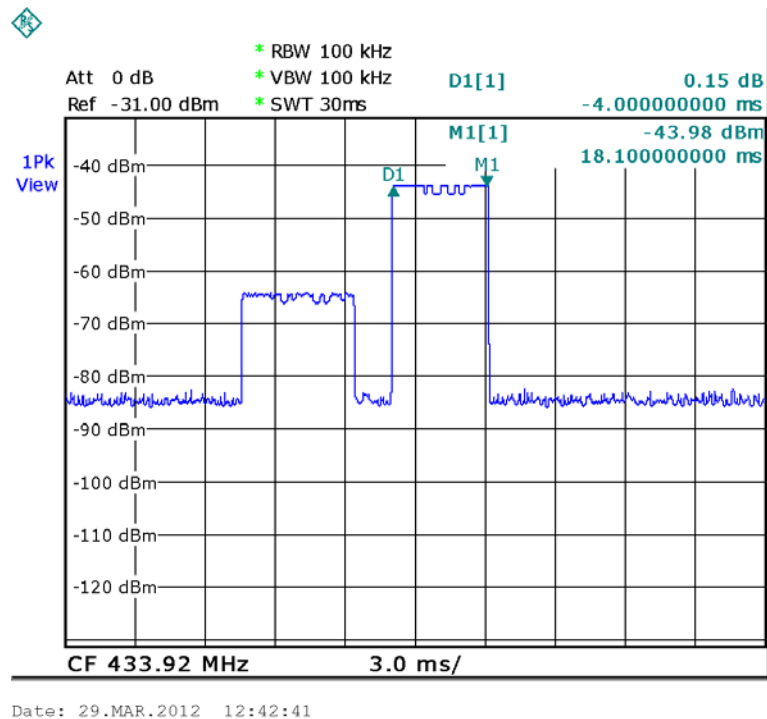


Figure 11. . Burst Duration = 4.0 msec

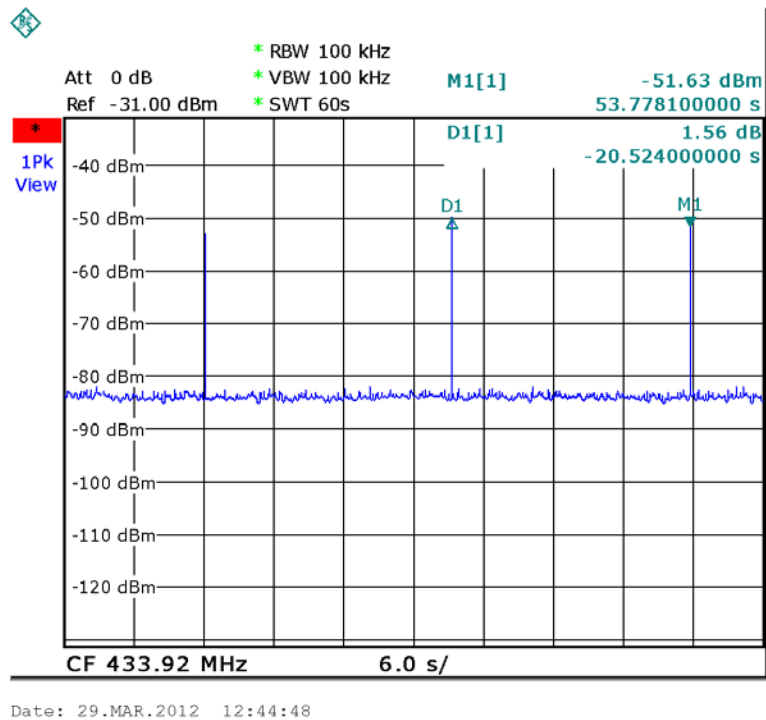


Figure 12. Time Between Bursts > 100 ms (Plot Sweep 20.5 sec)

5.1 Average Factor Calculation Helical Antenna Transmitter, Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	RHODE & SCHWARZ	ESC17	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	February 21, 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

Figure 13 Test Equipment Used

6. Periodic Operation Helical Antenna Transmitter

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.	N/A	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 Figure 14 to 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: 24.05.12

Typed/Printed Name: A. Sharabi

Periodic Operation

E.U.T Description E4 RF
Serial Number: Not Designated

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

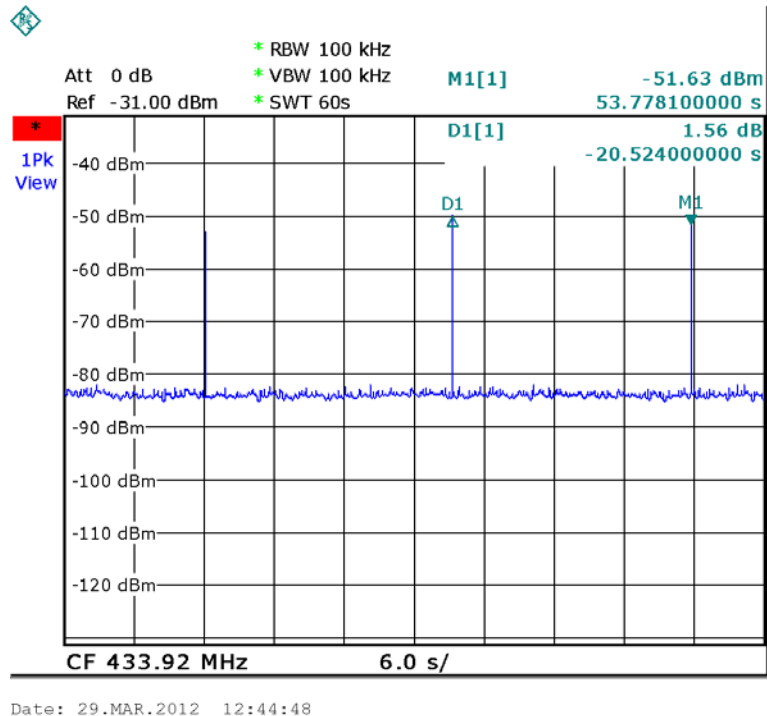


Figure 14. Signal Integrity as a Response to the Bracelet Minimum Transmission Every 20.5 seconds

Periodic Operation

E.U.T Description E4 RF
Serial Number: Not Designated

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

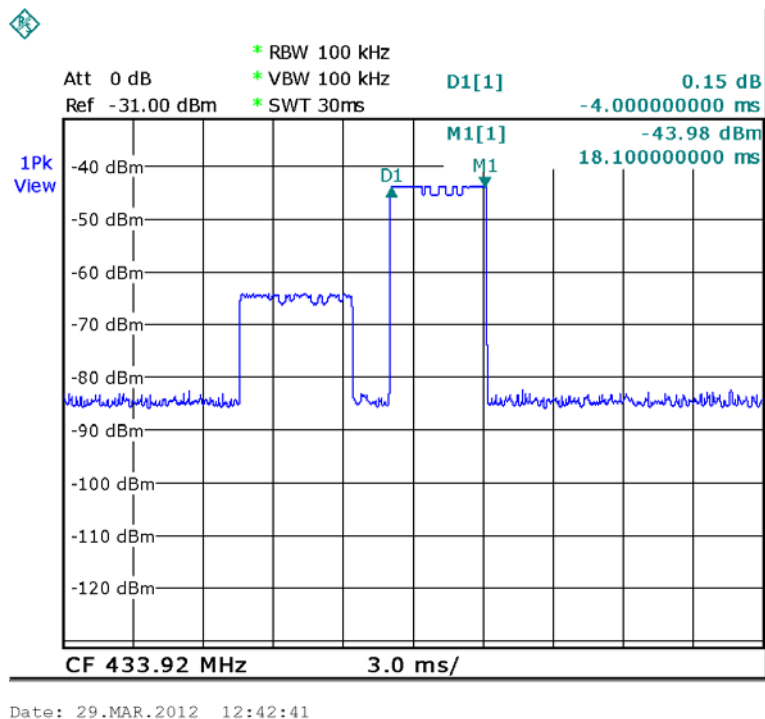


Figure 15. Signal Integrity burst as a Response to the Bracelet Transmission
(Burst width 4.0msec x [3600/20.5] = 4.0 x 175.6 = 0.702 sec < 2 sec)

6.1 Periodic Operation Helical Antenna Transmitter, Test Equipment Used

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

Figure 16 Test Equipment Used

7. Field Strength of Fundamental Helical Antenna Transmitter

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 8.93 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 17 to Figure 19.

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi

Field Strength of Fundamental

E.U.T Description E4 RF
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)
433.95	H	99.85	-27.95	71.9	80.83	-8.93
433.95	V	92.44	-27.95	64.49	80.83	-16.64

Figure 17. 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) + Average Factor (dB)

Field Strength of Fundamental

E.U.T Description E4 RF
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 433.898 MHz
99.85 dB μ V/m

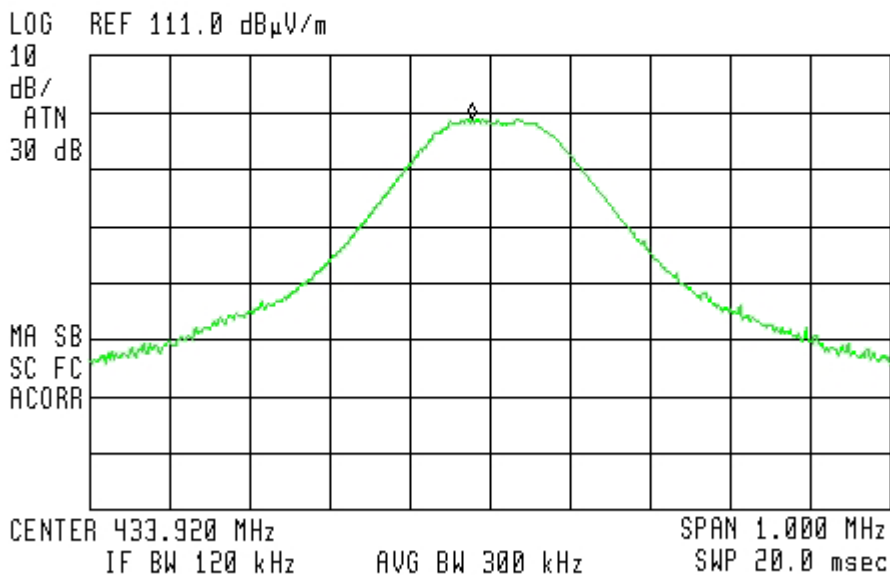


Figure 18. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL.

Field Strength of Fundamental

E.U.T Description: E4 RF
Serial Number: Not Designated

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

Antenna Polarization: Vertical

Test Distance: 3 meters

Detector: Peak

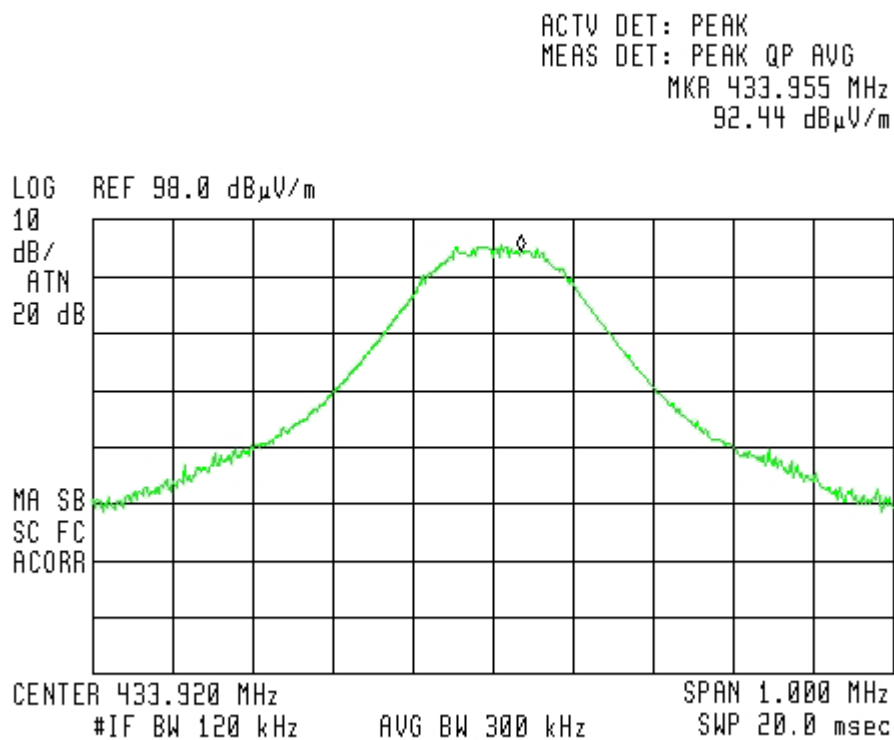


Figure 19. Field Strength of Fundamental. Antenna Polarization: VERTICAL.

7.4 *Field Strength of Fundamental Helical Antenna 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 Log Periodic	ARA	LPD-2010/A	1038	March 29, 2011	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 20. Test Equipment Used

8. Radiated Emission, 9 kHz – 30 MHz Helical Antenna Transmitter

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 3.1.

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 433 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: 24.05.12

Typed/Printed Name: A. Sharabi

8.4 *Spurious Radiated Emission 9 kHz – 30 MHz, Helical Antenna 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 21. Test Equipment Used

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 [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.

9. Spurious Radiated Emission Helical Antenna Transmitter

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 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.



9.3 Test Results

JUDGEMENT: Passed by 31.25 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 31.25 dB in the worst case at the frequency of 1301.80 MHz, horizontal polarization.

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi



Radiated Emission

E.U.T Description E4 RF

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)
867.80	H	40.1	-27.95	12.15	60.83	-48.68
867.80	V	42.5	-27.95	14.55	60.83	-46.28
1301.80	H	50.7	-27.95	22.75	54.0	-31.25
1301.80	V	48.4	-27.95	20.45	54.0	-33.55

Figure 22. 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.

9.4 *Spurious Radiated Emission 30 MHz – 4.5 GHz, Helical Antenna 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
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
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 23. Test Equipment Used

10. Bandwidth Helical Antenna Transmitter

10.1 Test Specification

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

10.2 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.

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.

10.3 Test Results

Bandwidth Reading (kHz)	Specification (1) (kHz)	Margin (kHz)
348	1084.8	-736.8

Figure 24 Bandwidth Test Results Table

JUDGEMENT: Passed by 736.8 kHz

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi

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

Bandwidth Helical Antenna Transmitter



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 348 kHz
.46 dB

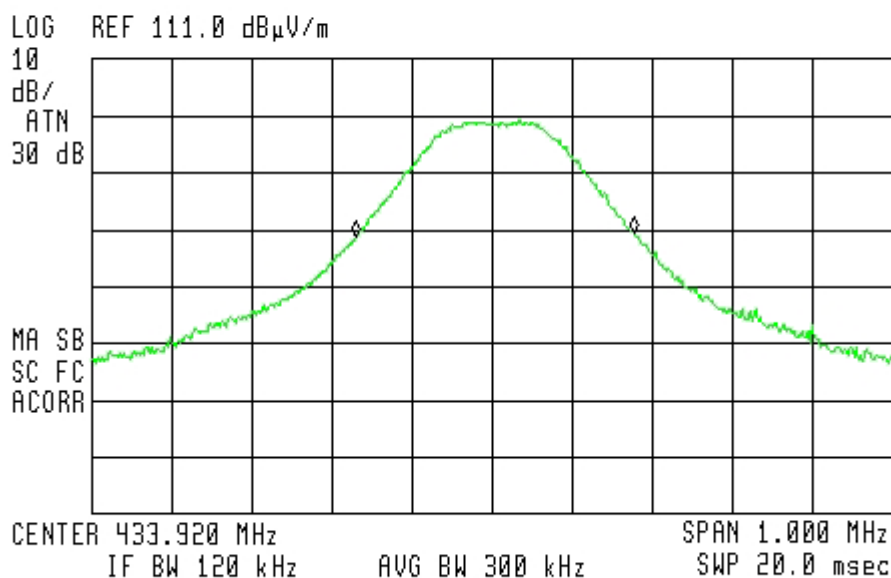


Figure 25 Bandwidth



10.1 Bandwidth Helical Antenna 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 26 Test Equipment Used

11. 26dB Bandwidth Helical Antenna Transmitter

11.1 Test Specification

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

11.2 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 26 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.

11.3 Test Results

Bandwidth Reading (kHz)	Specification (1) (kHz)	Margin (kHz)
433	1084.8	651.8

Figure 27 26 Bandwidth

JUDGEMENT: Passed by 651.8 kHz

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi

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

26 dB Bandwidth Helical Antenna Transmitter

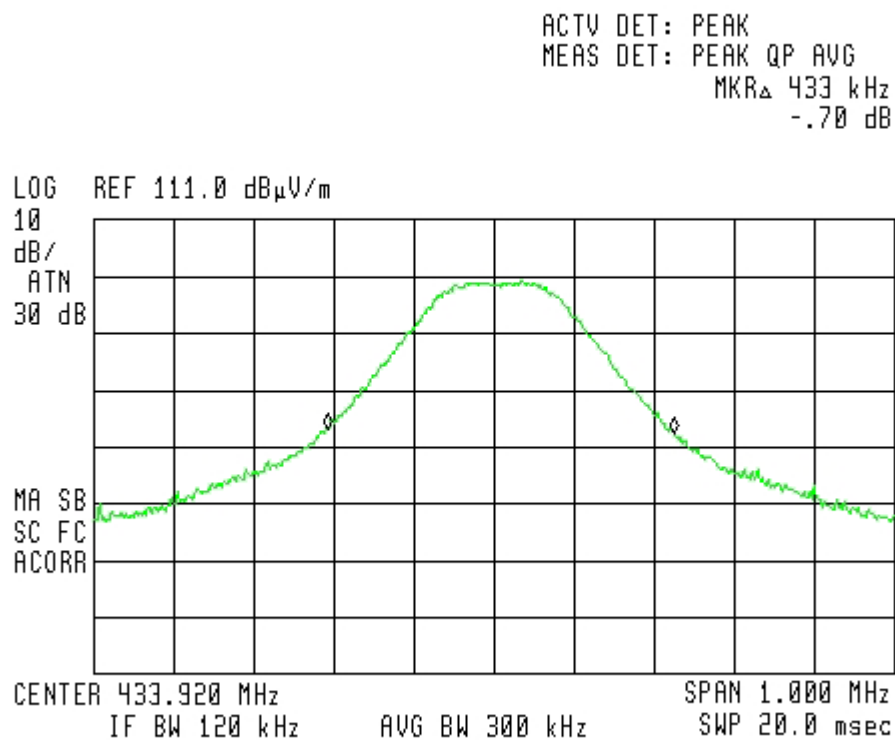


Figure 28 26 dB Bandwidth



11.1 26 dB Bandwidth 433.92 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 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 29 Test Equipment Used

12. Average Factor Calculation F Antenna Transmitter

4. Burst duration = 4.0 msec
5. Time between bursts >100ms
6. 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.

$$\text{Average Factor} = 20 \log \left[1 \times \frac{4.0}{100} \times 1 \right] = -27.95\text{dB}$$

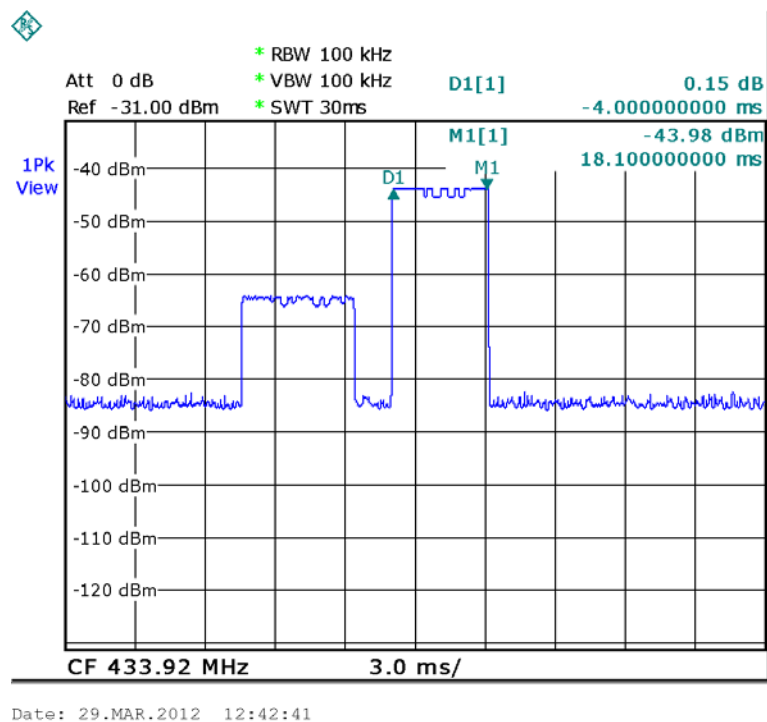


Figure 30. Burst Duration = 4.0 msec

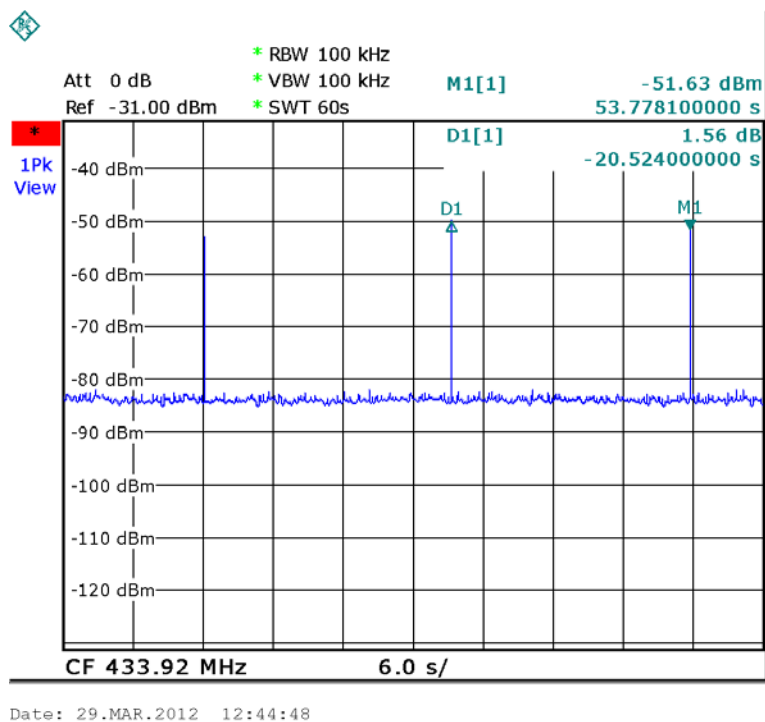


Figure 31. Time Between Bursts > 100 ms (Plot Sweep 20.5 sec)

12.1 Average Factor Calculation F Antenna 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 32 Test Equipment Used

13. Periodic Operation F Antenna Transmitter

13.1 Specification

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

13.2 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.	N/A	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 Figure 33 to Figure 34.	Complies

13.3 Results

JUDGEMENT: Passed

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

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi

Periodic Operation

E.U.T Description E4 RF
Serial Number: Not Designated

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

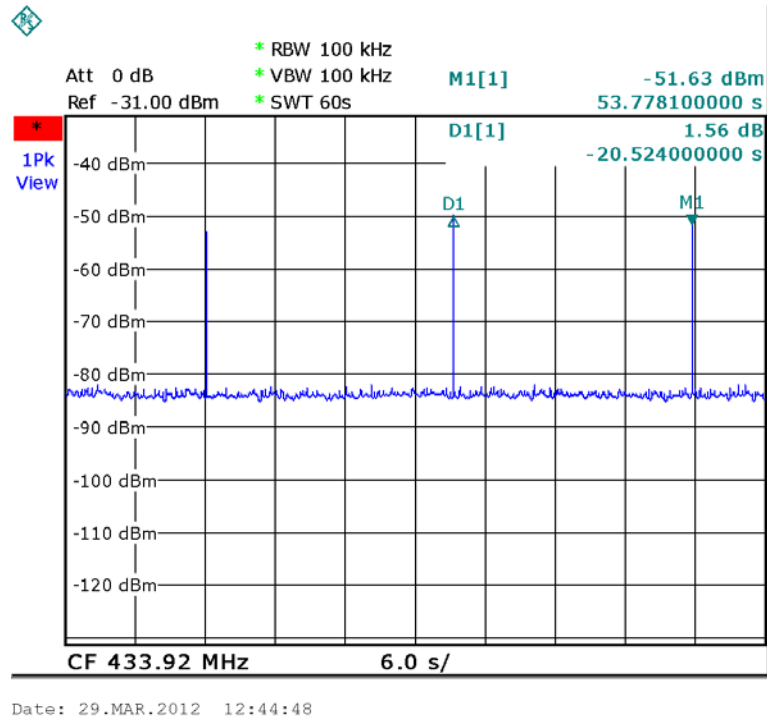
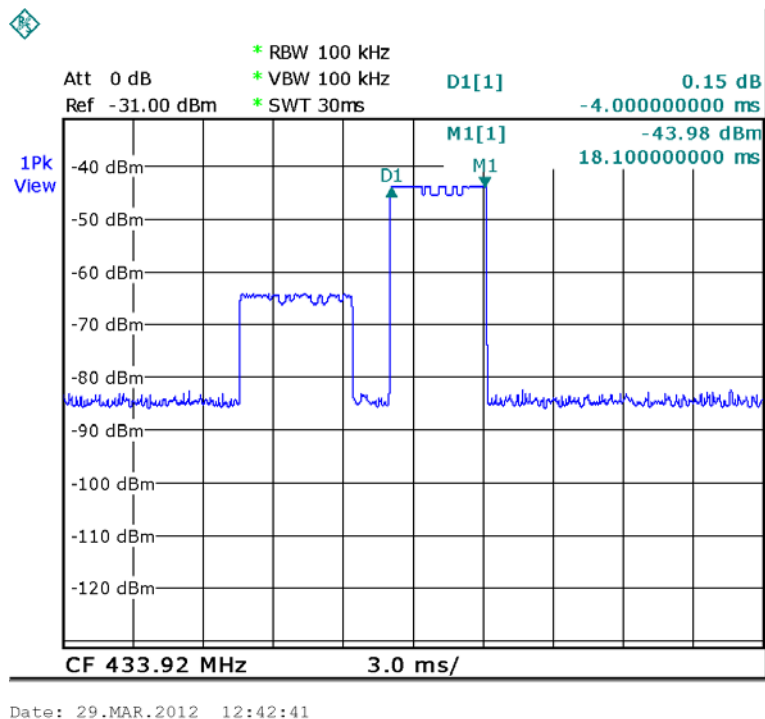


Figure 33. Signal Integrity as a Response to the Bracelet Minimum Transmission Every 20.5 seconds

Periodic Operation

E.U.T Description E4 RF
Serial Number: Not Designated

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



Date: 29.MAR.2012 12:42:41

Figure 34. Signal Integrity burst as a Response to the Bracelet Transmission
(Burst width 4.0msec x [3600/20.5] = 4.0 x 175.6 = 0.702 sec < 2 sec)

13.1 Periodic Operation, F Antenna Transmitter Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	RHODE & SCHWARZ	ESC17	100724	October 30, 2011	1 Year

Figure 35 Test Equipment Used

14. Field Strength of Fundamental F Antenna Transmitter

14.1 Test Specification

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

14.2 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 (433.87 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)

14.3 Test Results

JUDGEMENT: Passed by 8.36 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 17 to Figure 19.

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi

Field Strength of Fundamental

E.U.T Description E4 RF
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	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
433.87	H	100.42	-27.95	72.47	80.83	-8.36
433.87	V	98.10	-27.95	70.15	80.83	-10.38

Figure 36. Field Strength of Fundamental.

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." (dB μ V/m) included the "Correction Factors".
3. "Correction Factors" (dB) = Test Antenna Correction Factor(dB) + Cable Loss.
4. "Average Result" (dB μ V/m)=Peak Reading (dB μ V/m) + Correction Factor (dB)

Field Strength of Fundamental

E.U.T Description E4 RF
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 433.895 MHz
100.42 dB μ V/m

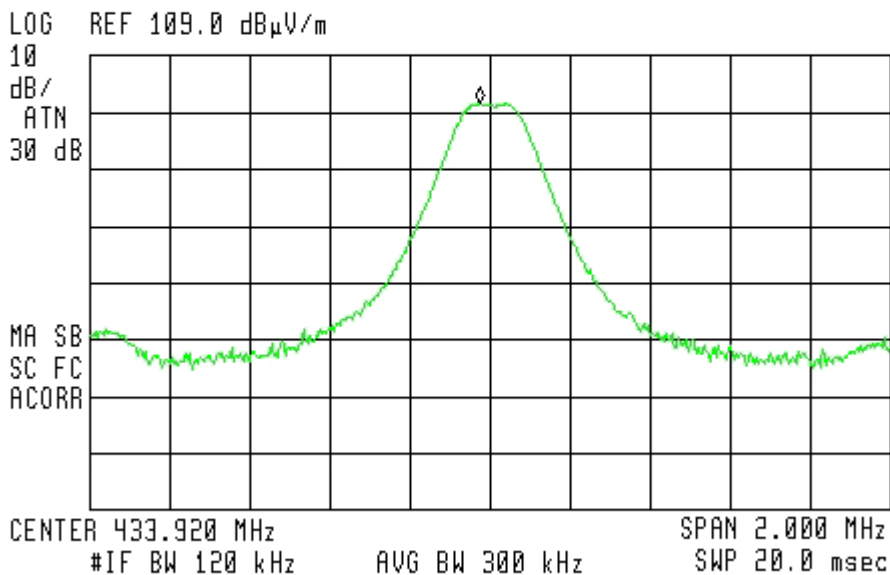


Figure 37. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL.

Field Strength of Fundamental

E.U.T Description E4 RF
Serial Number: Not Designated

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

Antenna Polarization: Vertical

Test Distance: 3 meters

Detector: Peak

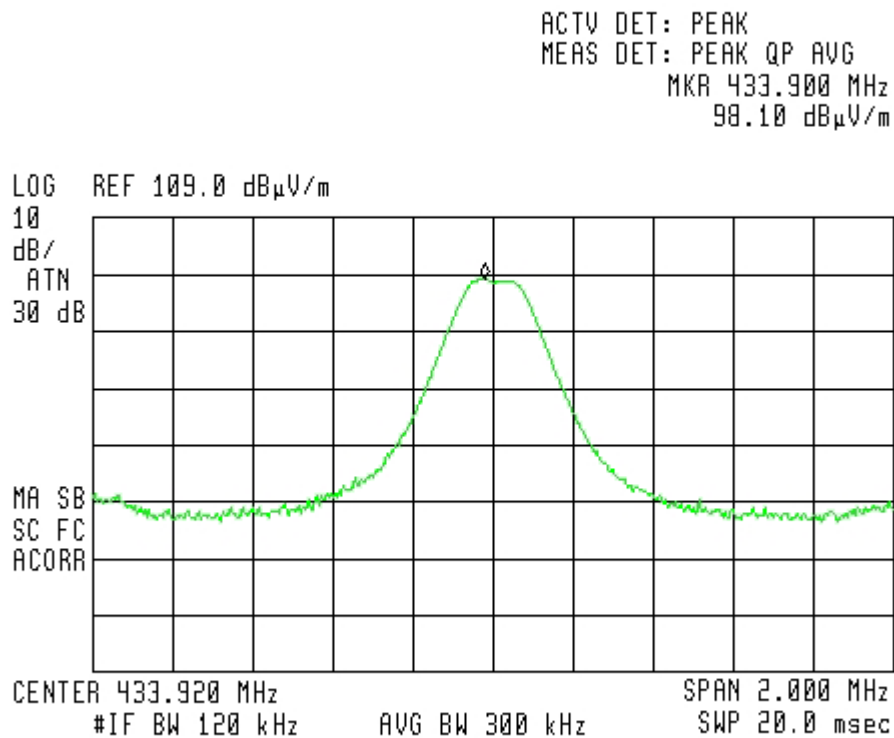


Figure 38. Field Strength of Fundamental. Antenna Polarization: VERTICAL.

14.4 *Field Strength of Fundamental F Antenna 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 Log Periodic	ARA	LPD-2010/A	1038	March 29, 2011	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 39. Test Equipment Used

15. Radiated Emission, 9 kHz – 30 MHz F Antenna Transmitter

15.1 Test Specification

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

15.2 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 433 MHz. This frequency was measured using a peak detector.

15.3 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: 24.05.12

Typed/Printed Name: A. Sharabi

15.4 *Spurious Radiated Emission 9 kHz – 30 MHz, F Antenna 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 40. Test Equipment Used

15.5 *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.

16. Spurious Radiated Emission F Antenna Transmitter

16.1 Test Specification

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

16.2 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.



16.3 Test Results

JUDGEMENT: Passed by 19.75 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 19.75 dB in the worst case at the frequency of 1301.80 MHz, vertical polarization.

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi



Radiated Emission

E.U.T Description E4 RF
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)	Specification (dB μ V/m)	Margin (dB)
867.50	H	53.9	-27.95	25.95	60.83	-34.88
867.50	V	50.5	-27.95	22.55	60.83	-38.28
1301.80	H	60.1	-27.95	32.15	54.0	-21.85
1301.80	V	62.2	-27.95	34.25	54.0	-19.75

Figure 41. 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.

16.4 *Spurious Radiated Emission 30 MHz – 4.5 GHz, F Antenna 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
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
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 42. Test Equipment Used

17. Bandwidth F Antenna Transmitter

17.1 Test Specification

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

17.2 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.

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.

17.3 Test Results

Bandwidth Reading (kHz)	Specification (1) (kHz)	Margin (kHz)
340	1084.8	-744.8

Figure 43 Bandwidth

JUDGEMENT: Passed by 744.8 kHz

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi

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

Bandwidth F Antenna Transmitter



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 340 kHz
.28 dB

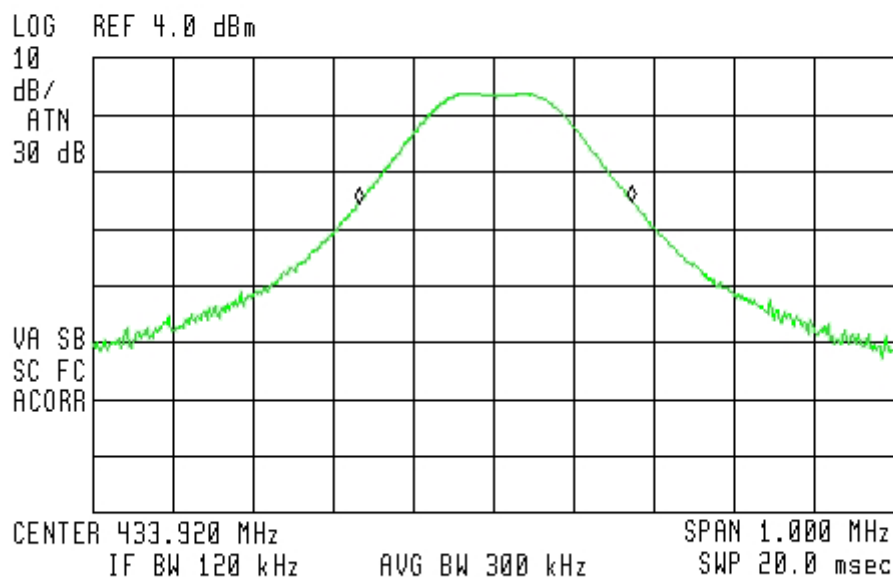


Figure 44 Bandwidth



17.1 Bandwidth F Antenna 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 45 Test Equipment Used

18. 26dB Bandwidth F Antenna Transmitter

18.1 Test Specification

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

18.2 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 26 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.

18.3 Test Results

Bandwidth Reading (kHz)	Specification (1) (kHz)	Margin (kHz)
443	1084.8	-641.8

Figure 46 Bandwidth

JUDGEMENT: Passed by 641.8 kHz

TEST PERSONNEL:

Tester Signature: 

Date: 24.05.12

Typed/Printed Name: A. Sharabi

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

26 dB Bandwidth F Antenna Transmitter



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 443 kHz
-.96 dB

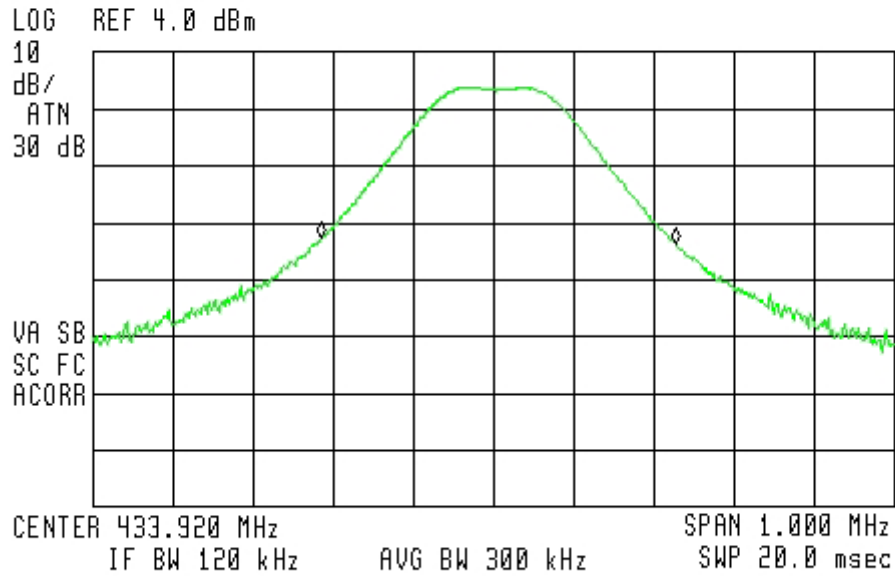


Figure 47 26 dB Bandwidth



18.1 26 dB Bandwidth F Antenna 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 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 48 Test Equipment Used

19. APPENDIX A - CORRECTION FACTORS

19.1 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".

19.2 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.*

19.3 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.

12.6 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".

19.4 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".

**19.5 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".



19.6 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