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DATE: 29 December 2013

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

FCC Radio Test Report

for

Haldor Advanced Technologies Ltd.

Equipment under test:

ORLocate Reception/OR Check-Out System

ORLocate Exit/Reception Module

Written by: _____
R. Pinchuck, Documentation

Approved by: _____
A. Sharabi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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Measurement/Technical Report for

Haldor Advanced Technologies Ltd.

ORLocate Reception/OR Check-Out System

ORLocate Exit/Reception Module

FCC ID: X4V-ORL-L40

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

Equipment type: Part 15 Low Power Communication Device Transmitter

Limits used: 47CFR15 Section 15.225

Measurement procedure used is ANSI C63.4-2003.

Application for Certification prepared by:

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

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1. General Information

1.1. Administrative Information

Manufacturer:	Haldor Advanced Technologies Ltd.
Manufacturer's Address:	2 Habanai St., Hod Hasharon, 4531902 Israel Tel: +972-9-788-5858 Fax: +972-9-788-5861
Manufacturer's Representative:	Gregory Bass
Equipment Under Test (E.U.T):	ORLocate Reception/OR Check-Out System
Equipment Model No.:	ORLocate Exit/Reception Module
Equipment Part No.:	Not designated
Date of Receipt of E.U.T:	19.11.2013
Start of Test:	19.11.2013
End of Test:	20.11.2103
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Subpart C Section 15.225

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-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1.

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

Haldor ORLocate Reception/OR Check-Out System is an RFID system, which provides a solution enabling the enumeration and tracking of RFID tagged surgical instruments and sponges, by utilizing passive RFID tags (battery-less transponder that do not radiate any electromagnetic field when not activated).

1.4. Test Methodology

Radiated testing was 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 November 21, 2012).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6. Measurement Uncertainty

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):

± 4.98 dB.

2. System Test Configuration

2.1. Justification

The 13.56 MHz transmitter was originally authorized for FCC certification under FCC ID: X4V-ORL-L40.

The Class II Permissive Changes to the original product are as follows:

1. Request for Limited Modular Approval in hosts manufactured by Haldor Advanced Technologies Ltd.
2. Use of antennas manufactured by Haldor Advanced Technologies Ltd.

Testing was performed with the E.U.T. on the table transmitting to each type of antenna separately, since the transmission on regular operation does not allow more than one antenna to be active at a specific time.

The C2PC testing includes fundamental power one each antenna type, spurious emission on each antenna and mask test. Frequency tolerance test was not repeated since it was tested on the original Grant and there is no change with the transmitting unit, only the use of new antennas.

2.2. EUT Exercise Software

Normal operation software was used.

2.3. Special Accessories

No special accessories were needed in order to achieve compliance.

2.4. Equipment Modifications

No modifications were needed in order to achieve compliance.

2.5. Configuration of Tested System

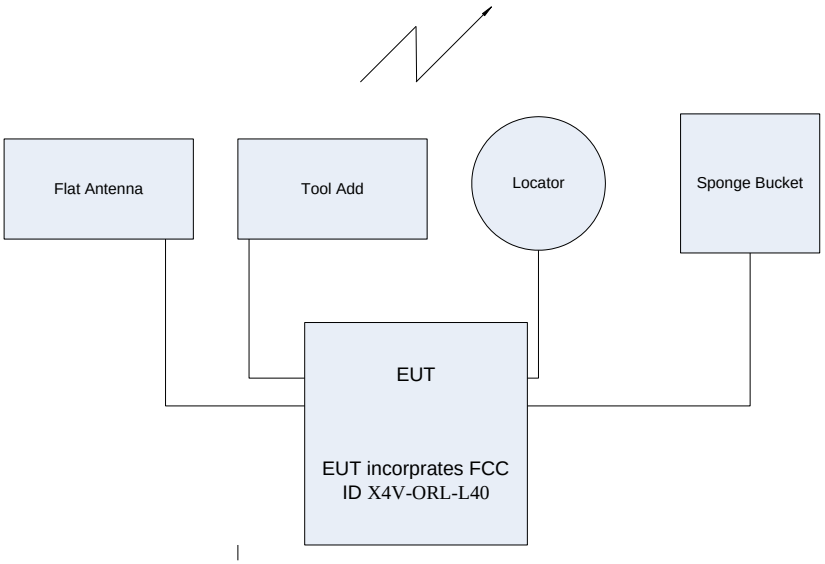

Figure 1. Configuration of Tested System

3. Test Set-up Photos

Figure 2. Radiated Emission Test 9kHz-30MHz Flat Antenna

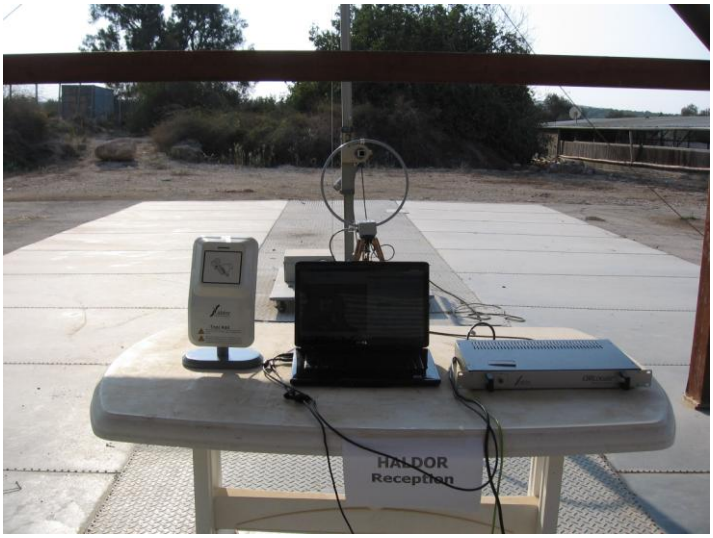

Figure 3. Radiated Emission Test 9kHz-30MHz Tool Add

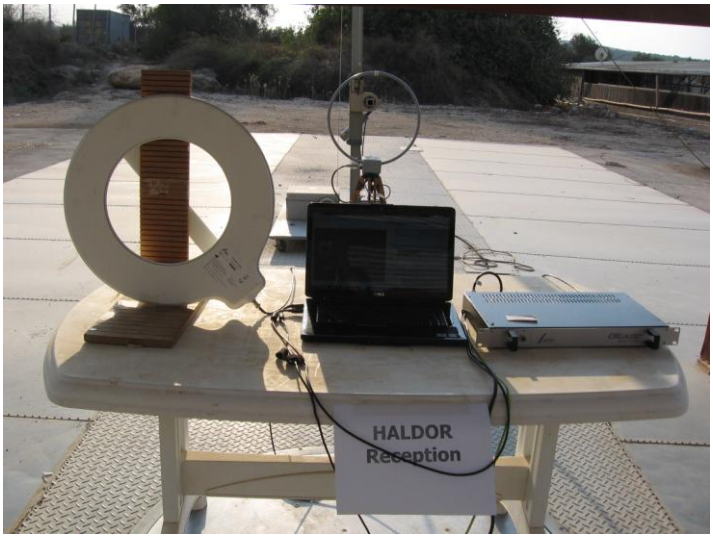

Figure 4. Radiated Emission Test 9kHz-30MHz Locator

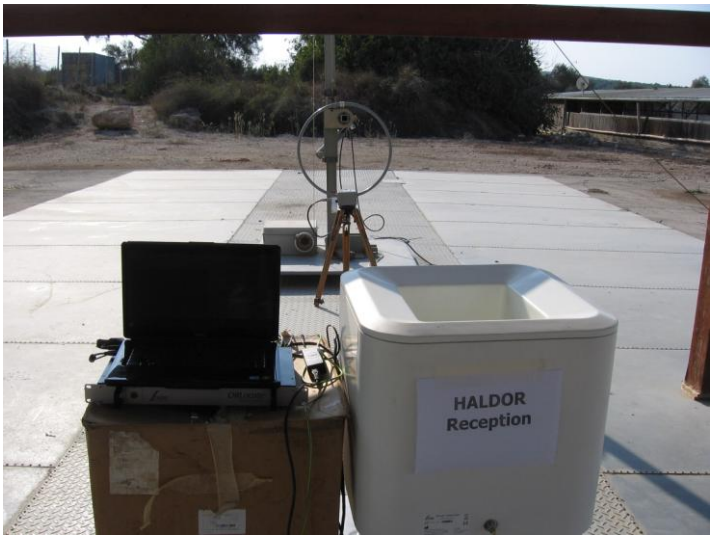

Figure 5. Radiated Emission Test 9kHz-30MHz Sponge Bucket

Figure 6. Radiated Emission Test 30MHz-300MHz Flat Antenna

Figure 7. Radiated Emission Test 30MHz-300MHz Tool Add

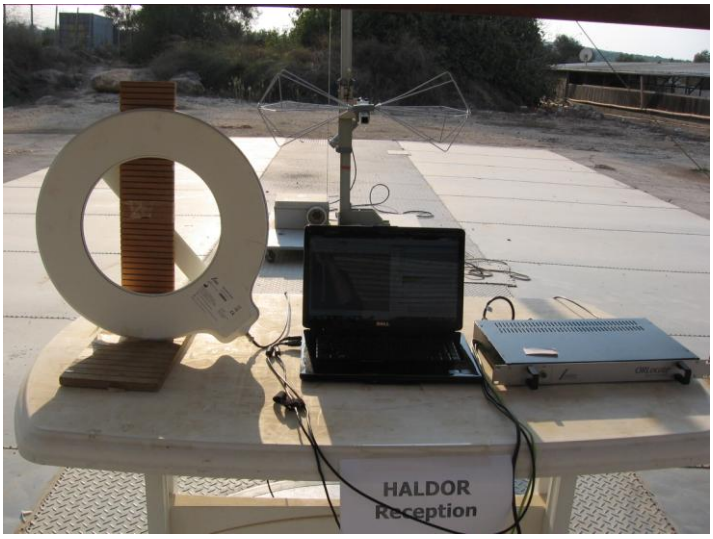

Figure 8. Radiated Emission Test 30MHz-300MHz Locator

Figure 9. Radiated Emission Test 30MHz-300MHz Sponge Bucket

Figure 10. Radiated Emission Test 300MHz-1000MHz Flat Antenna

Figure 11. Radiated Emission Test 300MHz-1000MHz Tool Add

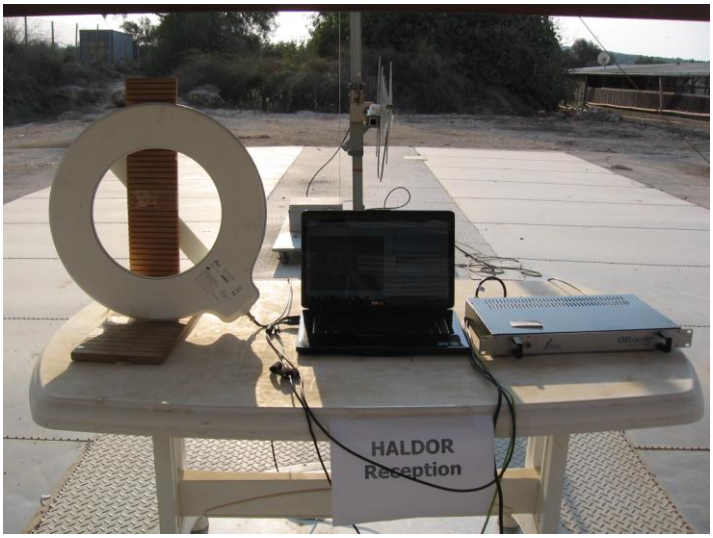

Figure 12. Radiated Emission Test 300MHz-1000MHz Locator

Figure 13. Radiated Emission Test 300MHz-1000MHz Sponge Bucket

4. 26dB Minimum Bandwidth

4.1. Test Specification

F.C.C. Part 15, Subpart C, part 2.1049

4.2. Test Procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 1 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested at 13.56 MHz.

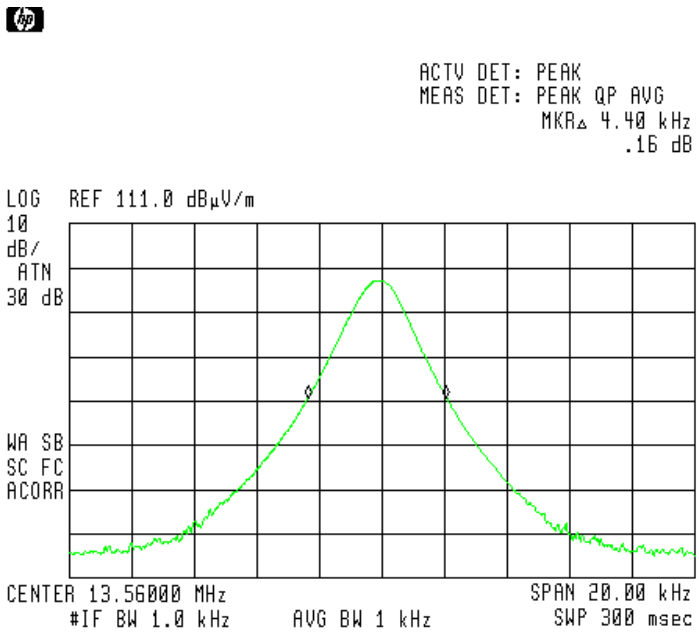

Figure 14. 13.56 MHz

4.3. Test Results

E.U.T Description: ORLocate Reception/OR Check-Out System
Model: ORLocate Exit/Reception Module
Serial Number: Not designated

Operation Frequency (MHz)	Bandwidth Reading (MHz)
13.56	0.0044

Figure 15 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 20.01.14

Typed/Printed Name: A. Sharabi

4.4. Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2013	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 16 Test Equipment Used

5. Field Strength of Fundamental

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.

5.3. Test Results

Frequency	Antenna	Field Strength	Limit	Margin
(MHz)		dBuV/m	dBuV/m	dB
13.56	Sponge Bucket	96.77	124	-27.23
13.56	Tool Add	97.99	124	-26.01
13.56	Locator	119.54	124	-4.46
13.56	Flat Antenna	97.85	124	-26.15

JUDGEMENT: Passed

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 17* to *Figure 24*.

TEST PERSONNEL:

Tester Signature: _____ Date: 20.01.14

Typed/Printed Name: A. Sharabi

Field Strength of Fundamental

E.U.T Description	ORLocate Reception/OR Check-Out System
Model Number	ORLocate Exit/Reception Module
Part Number:	Not designated

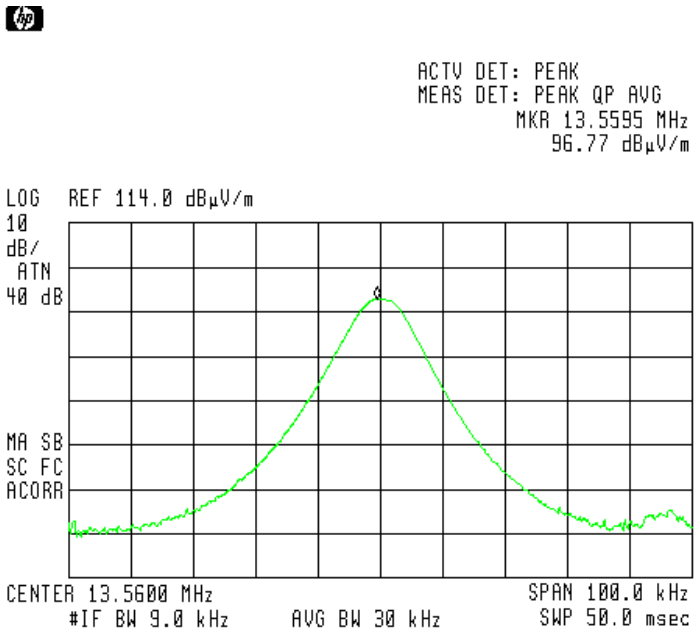

Figure 17. Field Strength of Fundamental, Sponge Bucket Antenna

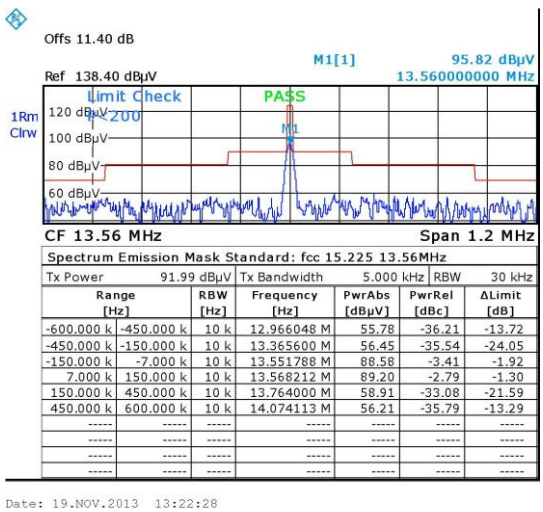

Figure 18. Mask of Fundamental Sponge Bucket Antenna

Field Strength of Fundamental

E.U.T Description	ORLocate Reception/OR Check-Out System
Model Number	ORLocate Exit/Reception Module
Part Number:	Not designated

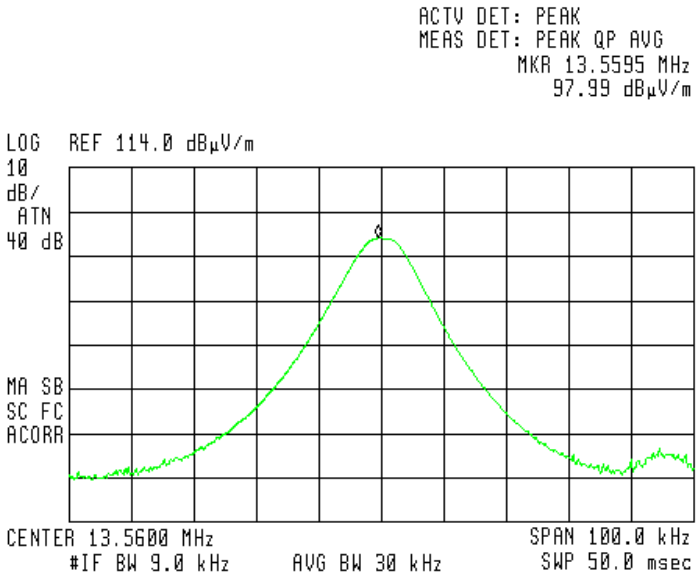

Figure 19. Field Strength of Fundamental, Tool Add Antenna

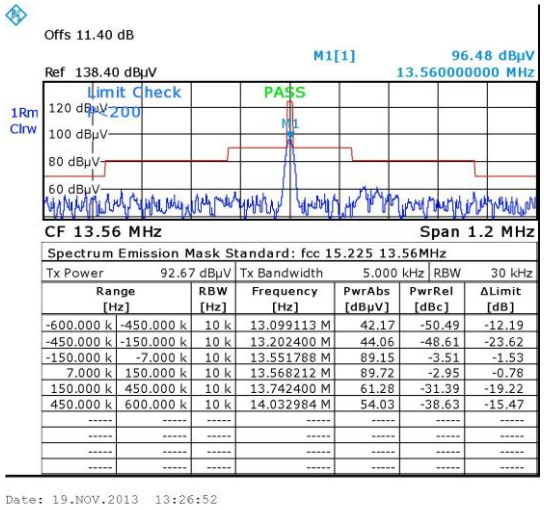

Figure 20. Mask of Fundamental Tool Add Antenna

Field Strength of Fundamental

E.U.T Description	ORLocate Reception/OR Check-Out System
Model Number	ORLocate Exit/Reception Module
Part Number:	Not designated

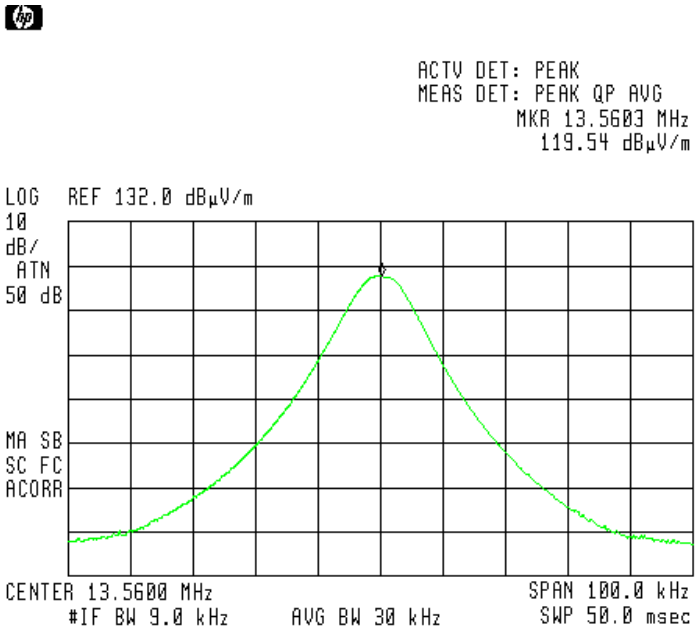

Figure 21. Field Strength of Fundamental, Locator Antenna

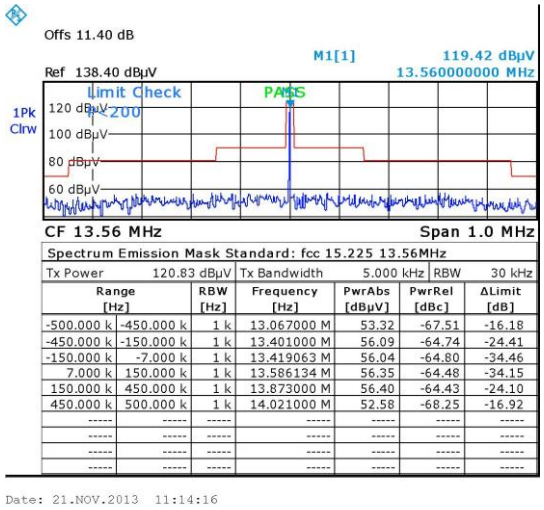

Figure 22. Mask of Fundamental Locator Antenna

Field Strength of Fundamental

E.U.T Description	ORLocate Reception/OR Check-Out System
Model Number	ORLocate Exit/Reception Module
Part Number:	Not designated

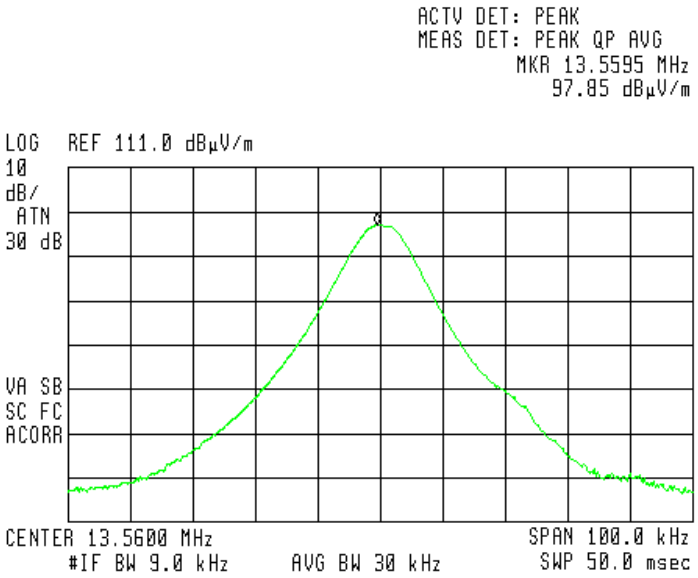

Figure 23. Field Strength of Fundamental, Flat Antenna

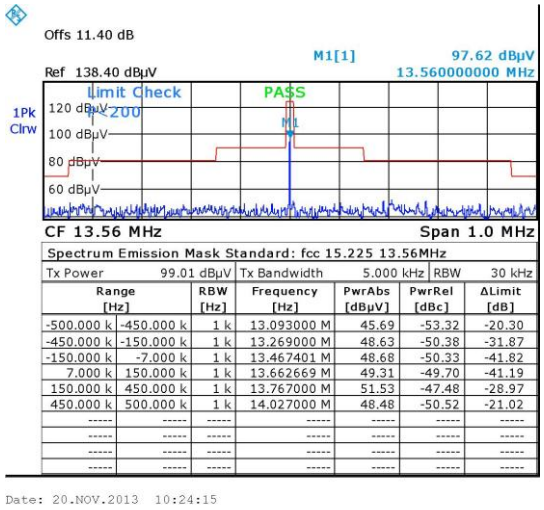

Figure 24. Mask of Fundamental Flat Antenna

5.4. Test Instrumentation Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2013	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

6. Spurious Radiated Emission, 9 kHz – 30 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 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 with CISPR 16 requirements. The specification limits and applicable correction factors are pre-loaded to the receiver.

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.

The signals were more than 20 dB below the specification limit.

TEST PERSONNEL:

Tester Signature: _____ Date: 20.01.14

Typed/Printed Name: A. Sharabi

6.4. Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2013	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

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

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

No external pre-amplifiers are used.

7. Spurious Radiated Emission 30 – 1000 MHz

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 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 configuration tested is shown in *Figure 1*.

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 with CISPR 16 requirements. The specification limits and applicable correction factors are pre-loaded to the receiver.
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

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

TEST PERSONNEL:
Tester Signature: _____ Date: 20.01.14
Typed/Printed Name: A. Sharabi

Spurious Radiated Emission
30 – 1000 MHz

E.U.T Description ORLocate Reception/OR Check-Out System
Model Number ORLocate Exit/Reception Module
Part Number: Not designated

Freq. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Q.Peak Reading (dBµV/m)	Q.Peak Specification (dB µV/m)	Peak. Margin (dB)
40.69	H	35.1	32.4	40.0	-7.6
54.19	H	28.5	22.8	40.0	-17.2
67.75	H	28.2	22.5	40.0	-17.5
81.37	H	27.7	22.0	40.0	-18.0

Figure 25. Spurious Emission, Sponge Bucket

Spurious Radiated Emission
30 – 1000 MHz

E.U.T Description	ORLocate Reception/OR Check-Out System
Model Number	ORLocate Exit/Reception Module
Part Number:	Not designated

Freq.	Polarity	Peak Reading	Q.Peak Reading	Q.Peak Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dBµV/m)	(dB µV/m)	(dB)
40.69	V	40.4	38.3	40.0	-1.70
54.19	V	28.8	23.2	40.0	-16.8
67.75	V	28.3	22.2	40.0	-17.8
81.37	V	26.5	21.0	40.0	-19.0

Figure 26. Spurious Emission, Locator

Spurious Radiated Emission
30 – 1000 MHz

E.U.T Description ORLocate Reception/OR Check-Out System
Model Number ORLocate Exit/Reception Module
Part Number: Not designated

Freq.	Polarity	Peak Reading	Q.Peak Reading	Q.Peak Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dBµV/m)	(dB µV/m)	(dB)
40.69	H	26.0	20.1	40.0	-19.9
54.19	H	27.5	21.0	40.0	-19.0
67.75	H	26.7	20.6	40.0	-19.4
81.37	H	27.6	20.6	40.0	-19.4

Figure 27. Spurious Emission, Tool Add

Spurious Radiated Emission
30 – 1000 MHz

E.U.T Description	ORLocate Reception/OR Check-Out System
Model Number	ORLocate Exit/Reception Module
Part Number:	Not designated

Freq.	Polarity	Peak Reading	Q.Peak Reading	Q.Peak Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dBµV/m)	(dB µV/m)	(dB)
40.69	V	33.9	28.8	40.0	-11.2
54.19	V	23.0	20.0	40.0	-20.0
67.75	V	29.0	24.1	40.0	-15.9
81.37	V	30.1	25.0	40.0	-15.0

Figure 28. Spurious Emission, Flat Antenna

7.4. Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	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

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:

$$[dB\mu v/m]\ FS = RA + AF + CF$$

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

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

No external pre-amplifiers are used.

8. APPENDIX A - CORRECTION FACTORS

8.1. Correction factors for CABLE

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

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

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

NOTES:

1. The cable type is RG-214.

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

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

8.2. 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.

8.3. Correction factors for LOG PERIODIC ANTENNA

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

Distance of 3 meters

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

Distance of 10 meters

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

NOTES:

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

8.4. 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".

8.5. Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (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