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DATE: 11 August 2016

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

FCC Radio Test Report

for

Haldor Advanced Technologies Ltd.

Equipment under test:

ORLocate Solution System

ORLocate Module

Tested by: _____
N. Levi

Approved by: _____
D. Shidlowsky

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Measurement/Technical Report for

Haldor Advanced Technologies Ltd.

ORLocate Solution System

ORLocate 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 C63.10-2013.

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:	Ronen Shtekel
Equipment Under Test (E.U.T):	ORLocate Solution System
Equipment Model No.:	ORLocate Module
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	19.12.2015
Start of Test:	19.12.2015
End of Test:	22.12.2015
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
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. FCC Designation Number IL1005.
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; Sites No. IC 4025A-1, 4025A-2.

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 ORLocate Solution provides hospitals with both Sterile Processing Department ("SPD") workflow and Intraoperative surgical item management solution focused on Track & Trace of instruments. The solutions facilitates counting before, during and post-surgery as well as an SPD lifecycle management solution for instruments. At the Operating Room, the circulating and scrub nurse can count and add items during surgery, and if required use the Locator device to track missing items in the patient abdomen and/or in the laundry container and thus prevent Retained Surgical Item ("RSI") events and reduce instrument shrinkage.

ORLocate modular architecture enables Haldor to accommodate various customers' needs ranging from a set level solution that includes set level tracking and partial item level tracking such as endoscopes or high value instruments and up to full intraoperative item management with expansion to sponges.

1.4 *Test Methodology*

Radiated testing was performed according to the procedures in C63.10-2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 *Test Facility*

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 *Measurement Uncertainty*

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.10-2013) 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.
A C2PC was granted on 03/11/2014 to allow use of antennas manufactured by Haldor and for limited modular approval in hosts manufactured by Haldor.

The following C2PC changes are being made:

1. Two new loop antennas for the RFID 13.56 MHZ radio are introduced: the Locator and HoveRead. Each of these contain a FCC certified Bluetooth Module under FCC ID: X3ZBTMOD5.
2. The Reader Box has a change in enclosure and in PCB layout.
3. The Reader Box also contains a FCC certified WiFi Module under FCC ID: ZXVHLK-RM04.

Exploratory emission testing was performed in 3 orthogonal polarities to determine the worst case between the 2 new antennas. See table below.

Antenna	Frequency (MHz)	Y (dBuV/m)	X (dBuV/m)	Z (dBuV/m)
Locator	13.56	95.06	**107.9**	107.3
HoveRead		78	**91.09**	91.02

Figure 1. Radiate Emission Screening Results

According to the results the "worst case" antenna was the locator in X axis. Testing was performed on the E.U.T. with Locator antenna.

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*

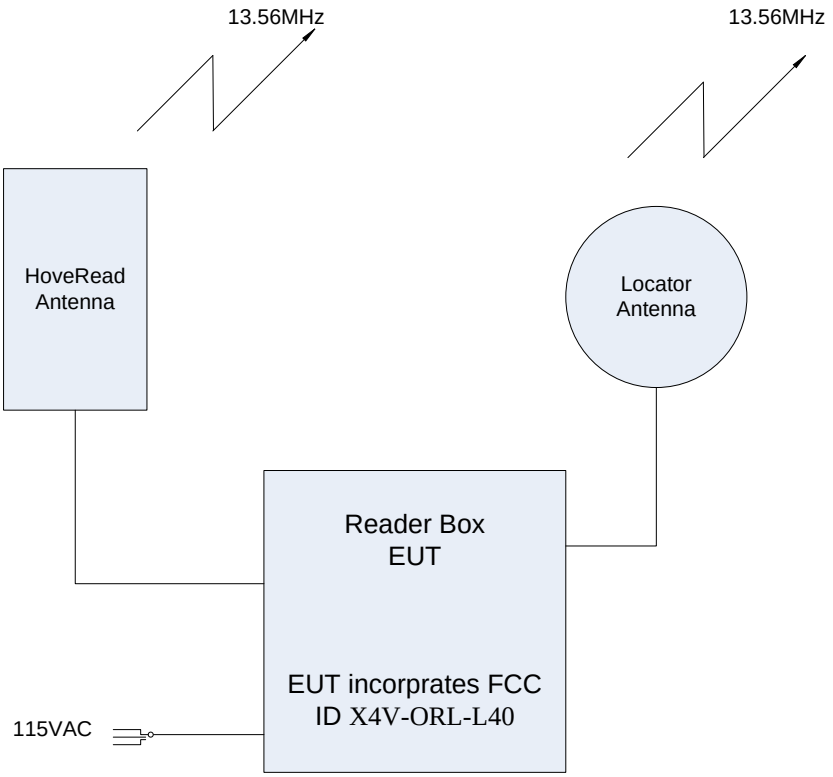

Figure 2. Configuration of Tested System

3. Test Set-up Photos

Figure 3. Screening, Fundamental, and Radiated Emission Test 9kHz-30MHz Locator

Figure 4. Screening Test HoveRead

Figure 5. Radiated Emission Test 30MHz-1000MHz Locator

4. Field Strength of Fundamental

4.1 *Test Specification*

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

4.2 *Test Procedure*

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

The E.U.T. was placed on a non-conductive table, 0.8 meters above the 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.

4.3 *Test Results*

Frequency	**Field Strength**	**Limit**	**Margin**
(MHz)	dBuV/m	dBuV/m	dB
13.56	107.90	124.0	-16.10

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 6.*

Field Strength of Fundamental

E.U.T Description	ORLocate Solution System
Model Number	ORLocate Module
Part Number:	Not designated

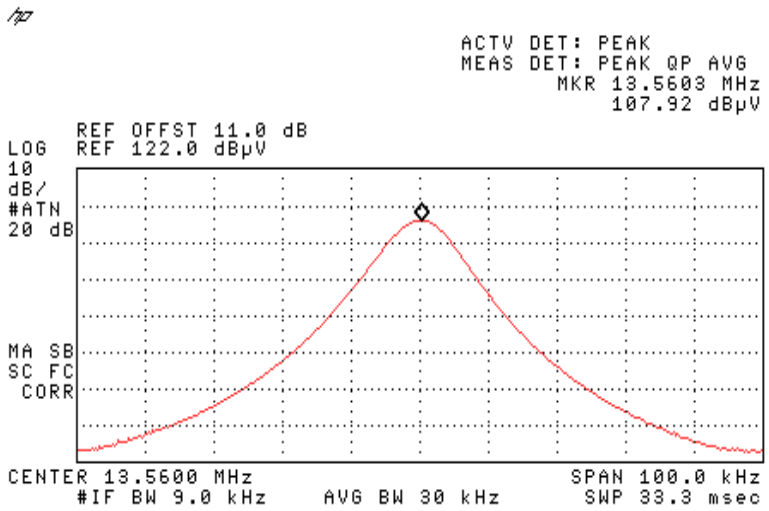

Figure 6. Field Strength of Fundamental

4.4 *Test Instrumentation Used, Field Strength of Fundamental*

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
EMI Receiver	HP	8542E	3906A00276	March 11, 2015	March 11, 2016
RF Filter section	HP	85420E	3705A00248	March 19, 2015	March 19, 2016
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	November 30, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 7 Test Equipment Used

5. Spurious Radiated Emission, 9 kHz – 30 MHz

5.1 *Test Specification*

FCC, Part 15, Subpart C, Section 209

5.2 *Test Procedure*

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

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 2*.

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.

5.3 *Test Results*

JUDGEMENT: Passed

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

All signals were below the EMI receiver noise level which is at least 6dB below the specification limit.

5.4 *Test Instrumentation Used, Radiated Measurements 9kHz-30MHz*

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	January 4, 2015	January 31, 2016
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	November 30, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 8 Test Equipment Used

5.5 *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.

6. Spurious Radiated Emission 30 – 1000 MHz

6.1 *Test Specification*

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

6.2 *Test Procedure*

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

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.

6.3 *Test Results*

JUDGEMENT: Passed

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

For additional information see *Figure 9.*

Spurious Radiated Emission
30 – 1000 MHz

E.U.T Description ORLocate Solution System
Model Number ORLocate Module
Part Number: Not designated

Freq. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Q.Peak Reading (dBµV/m)	Q.Peak Limit (dB µV/m)	Q.Peak. Margin (dB)
67.8	H	39.9	37.9	40.0	-2.1
67.8	V	37.5	35.8	40.0	-4.2
81.37	H	41.9	39.2	40.0	-0.8
81.37	V	42.2	39.4	40.0	-0.6
373.0	H	34.7	28.8	46.0	-17.2
373.0	V	35.0	29.3	46.0	-16.7

Figure 9. Spurious Emission, Locator

6.4 *Test Instrumentation Used, Radiated Measurements 30-1000MHz*

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	January 4, 2015	January 31, 2016
Biconical Antenna	EMCO	3104	2606	December 28, 2015	December 28, 2016
Log Periodic Antenna	EMCO	3146	9505-4081	December 28, 2015	December 28, 2016
Low Noise Amplifier	Sophia Wireless	LNA28-B	232	March 1, 2015	March 1, 2016
Low Noise Amplifier	Narda	DBS-0411N313	13	March 1, 2015	March 1, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 10 Test Equipment Used

7. Intermodulation Radiated

7.1 *Test Procedure*

Intermodulation testing of the Locator antenna was performed with the Bluetooth module located inside the Locator antenna.

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground at a distance of 3 meters from the antenna, using peak detection mode and broadband antennas. The configuration tested is shown in Figure 2.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements.

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

The frequency range 1000 MHz-13000 MHz was scanned (9th order).

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

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.

In the frequency range 30-13000MHz. A computerized EMI receiver complying with CISPR 16 requirements was used.
For all final evaluations, the distance was 3 meters.

The E.U.T. was operated in transmitting mode simultaneously with Bluetooth and RFID.

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.
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

7.2 *Test Limits*

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength* (dBµV/m)	Field strength* (dBµV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 11 Table of Limits

7.3 *Test Results*

JUDGEMENT: Passed

Freq. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak Limit (dB µV/m)	Peak Margin (dB)	Average Reading (dBµV/m)	Average Limit (dB µV/m)	Average Margin (dB)
4870.44	H	52.7	74.0	-21.3	41.5	54.0	-12.5
	V	52.6	74.0	-21.4	41.7	54.0	-12.3
4843.32	H	52.4	74.0	-21.6	41.4	54.0	-12.6
	V	52.5	74.0	-21.5	41.1	54.0	-12.9
7298.88	H	48.4	74.0	-25.6	36.4	54.0	-17.6
	V	48.6	74.0	-25.4	36.6	54.0	-17.4
7271.76	H	48.2	74.0	-25.8	36.1	54.0	-17.9
	V	47.9	74.0	-26.1	36.1	54.0	-17.9
9727.32	H	45.5	74.0	-28.5	34.2	54.0	-19.8
	V	45.9	74.0	-28.1	34.7	54.0	-19.3
9700.2	H	45.1	74.0	-28.9	34.0	54.0	-20.0
	V	45.3	74.0	-28.7	34.3	54.0	-19.7
12155.76	H	55.6	74.0	-18.4	43.3	54.0	-10.7
	V	55.0	74.0	-19.0	42.7	54.0	-11.3

Figure 12 Intermodulation Radiated Results

7.4 *Test Instrumentation Used, Intermodulation Measurements*

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	January 4, 2015	January 31, 2016
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
Low Noise Amplifier	Sophia Wireless	LNA28-B	232	March 1, 2015	March 1, 2016
Low Noise Amplifier	Narda	DBS-0411N313	13	March 1, 2015	March 1, 2016
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 13 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:

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

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)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
0.010	0.4	50.00	1.2
0.015	0.2	100.00	0.7
0.020	0.2	150.00	2.1
0.030	0.3	200.00	2.3
0.050	0.3	300.00	2.9
0.075	0.3	500.00	3.8
0.100	0.2	750.00	4.8
0.150	0.2	1000.00	5.4
0.200	0.3	1500.00	6.7
0.500	0.4	2000.00	9.0
1.00	0.4	2500.00	9.4
1.50	0.5	3000.00	9.9
2.00	0.5	3500.00	10.2
5.00	0.6	4000.00	11.2
10.00	0.8	4500.00	12.1
15.00	0.9	5000.00	13.1
20.00	0.8	5500.00	13.5
		6000.00	14.5

NOTES:

1. The cable type is SPUMA400 RF-11N(X2)and 39m long

2. The cable is manufactured by Huber + Suhner

8.2 *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

8.3 *Correction factors for* *Log ANTENNA*

Model: 3146
Antenna serial number: 9505-4081
3 meter range

CALIBRATION DATA

Frequency, MHz	Antenna factor, dB/m [1)]
200	11.55
250	11.60
300	14.43
400	15.38
500	17.98
600	18.78
700	21.17
800	21.16
900	22.67
1000	24.09

[1)] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.

8.4 *Correction factors for* *Biconical ANTENNA*

Model: 3104
Antenna serial number: 2606
3 meter range

CALIBRATION DATA

Frequency, MHz	Near free space antenna factor, dB/m	Geometry specific correction factor, dB	Free space antenna factor, dB/m [1)]
30	12.97	0.13	12.84
35	12.34	0.09	12.25
40	12.03	0.06	11.97
45	11.42	0.02	11.40
50	11.91	0.03	11.88
60	11.92	0.37	11.55
70	9.60	0.25	9.35
80	6.99	-0.45	7.44
90	10.87	-0.34	11.21
100	11.51	-0.06	11.57
120	13.30	0.20	13.10
140	12.56	-0.01	12.57
160	14.49	-0.12	14.61
180	16.53	0.05	16.48
200	15.30	0.15	15.15

[1)] The antenna factor shall be added to receiver reading in dBμV to obtain field strength in dBμV/m.

8.5 *Correction factors for* *Horn ANTENNA*

Model: 3115
Antenna serial number: 29845
10 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (dB/m)
1000	22.4	10000	36.1
2000	25.2	11000	37.0
3000	31.1	12000	41.3
4000	30.2	13000	38.1
5000	34.2	14000	41.7
6000	31.6	15000	39.0
7000	34.7	16000	38.8
8000	34.8	17000	43.2
9000	36.2	18000	43.7