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Date: 14 October 2024

I.T.L. Product Testing Ltd.

FCC/ISED Radio Test Report

for

Roseman Engineering Ltd.

Equipment under test:

Nozzle Reader

Universal Nozzle Reader

(10kHz, 125kHz Transmitters)

FCC ID: JAKNR-G5

IC: 29097NR-G5

Tested by: _____

L. Tenenbaum

Approved by: _____

M. Zohar

This report concerns:	Original Grant
Equipment type:	FCC: Low Power Transmitter Below 1705 kHz ISED: Low Power Transmitter, General Field Limits (9 kHz-30 MHz)
Limits used:	47CFR15 Section 15.209 RSS-Gen, Issue 5, 2018
Measurement procedure:	ANSI C.63.10 2013

Prepared by:

R. Ezrah

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Applicant:

Haim Kashi

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Table of Contents

1. General Information

1.1 Administrative Information

Manufacturer:	Roseman Engineering Ltd.
Manufacturer's Address:	Same as applicant
	Tel: +972. 3.5731801
Equipment Under Test (E.U.T):	Nozzle Reader
Equipment Model No.:	Universal Nozzle Reader
HVIN:	NRD-2000-05
Equipment Part No.:	N/A
Date of Receipt of E.U.T:	February 07 ,2022
Start of Test:	February 07 ,2022
End of Test:	March 11 ,2022
Test Laboratory Location:	I.T.L Product Testing Ltd.
	3 Ha'oreg Street, Modi'in 7177909, Israel
Test Specifications:	FCC Part 15, Subpart C, Section 15.209
	RSS-Gen, Issue 5, 2018, Amendment 1 (2019), Amendment 2 (2021)

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.), FCC Designation No. IL1005.
3. Department of Innovation, Science and Economic Development (ISED) Canada, CAB identifier: IL1002

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 UNR (Universal Nozzle Reader) is an active stand-alone device mounted on the nozzle. It is robust plastic structure enables to operate in harsh fuel environment

The UNR can read the Roseman vehicle identification devices including the USID (Universal Secured Identification Device).

1.4 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.10: 2013& RSS-Gen Issue 5 March 2019 Amendment 1 . 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 No. IL1005.

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 (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4):
30-1000MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 4.96 dB

1 GHz to 6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.19 dB

>6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.51 dB

2. System Test Configuration

2.1 Justification

1. The E.U.T contains 10 kHz and 122.0 kHz transmitters.
2. Exploratory radiated emission screening was performed in two orthogonal orientations, to find the "worst case" type and orientation The "worst case" was found at the Y axis.
3. The evaluation was done with a POE power supply as the "worst case".

Type of Equipment[1]							
☒	Stand Alone (Equipment with/without its own control provisions)						
☐	Combined (Equipment where radio part is fully integrated with another type of equipment)						
☐	Plug in card (Equipment intended for a variety of host systems)						
Intended Use		Condition of use					
☐	Fixed	Always of distance >2m from the people					
☐	Mobile	Always of distance >20cm from the people					
☐	Portable	Always of distance <20cm to human body					
Assigned frequency band		2.4GHz-2.48GHz FHSS, 122KHz RFID, 10KHz EM					
Operational frequencies							
Maximum rated output power		At transmitter 50Ω RF output connector [dBm]					
		Effective Radiated Power (for equipment without RF connector)				+1dBm (2.4GHz)	
Antenna Connection							
☐	Unique Coupling	☐	Standard Connection	☒	Integral	☐	With temporary RF connector
						☒	Without temporary RF connector
Antenna Gain		+2dBi					
Operating channel bandwidth		296KHz					
Type of modulation		MSK					
Bit rate		250Kbs					
Maximum transmitter duty cycle		8%					
Transmitter power source		+1dBm max. (2.4GHz)					
☐	AC	Nominal rated voltage					
☐	DC	Nominal rated voltage					
☒	Battery	Nominal rated voltage	3.6V				
Receiver Class							
Temperature &Voltage extreme condition		-40 – +70deg, 3.7-3V					

2.2 EUT Exercise Software

No special exercise software was used.

2.3 Special Accessories

N/A

[1] The info. on the table was provided by the customer.

2.4 Equipment Modifications

No equipment modifications were required to achieve compliance.

2.5 Configuration of Tested System

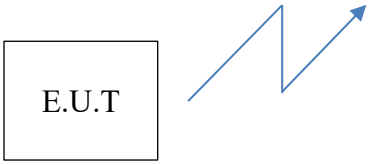


Figure 1. Test Setup

3. Field Strength of Fundamental

3.1 Test Specification

Part 15, Subpart C, Section 15.209(a)

RSS-Gen Issue 5 March 2019 Amendment 1, Section 8.9

3.2 Test Procedure

(Temperature (20°C)/ Humidity (58%RH))

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 in the chamber on a non-conductive table, 0.8 meters above the ground.

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

The turntable and antenna polarity were adjusted for maximum level reading on the EMI receiver.

The EMI receiver was set to the E.U.T. Fundamental Frequency and Peak Detection.

3.3 FCC Test Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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.

3.4 ISED Test Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Magnetic Field strength (microampere/ meter)	Measurement distance (meters)	Magnetic Field strength (dBµA/m)	Magnetic Field strength* (dBµA/m)@3m
0.009-0.490	6.37/F(kHz)	300	-3.0-(-37.7)	77.0-42.2
0.490-1.705	63.7/F(kHz)	30	-17.7-(-28.5)	22.3-11.4
1.705-30.0	0.08	30	-21.9	18.0
Frequency (MHz)	**Field strength (microvolts/meter)**	**Measurement distance (meters)**	**Field strength (dBµV/m)**	**Field strength* (dBµV/m)@3m**
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.

3.5 Test Results

Frequency (kHz)	Peak Reading (dBµV/m)	Avg. Limit* (dBµV/m)	Margin (dB)
10.0	65.6	127.6	-62
121.0	71.0	105.9	-34.9

Figure 2. Field Strength of Fundamental FCC Test Results

Frequency (kHz)	Peak Reading (dBµA/m)	Avg. Limit* (dBµA/m)	Margin (dB)
10.0	14.0	76.1	-62.1
121.0	19.5	54.4	-34.9

Figure 3. Magnetic Field Strength of Fundamental IC Test Results

***Note**: average limit calculation:
20*log(6.37/121)=-25.6dBµA/m@300m=-25.6+ 40*log(300/3)=54.4 dBµA/m@3m
20*log(6.37/10)=-3.9dBµA/m@300m=-3.9+ 40*log(300/3)=76.1 dBµA/m@3m

JUDGEMENT: Passed by -34.9 dB

The details of the highest emissions are given in Figure 4 to Figure 5.

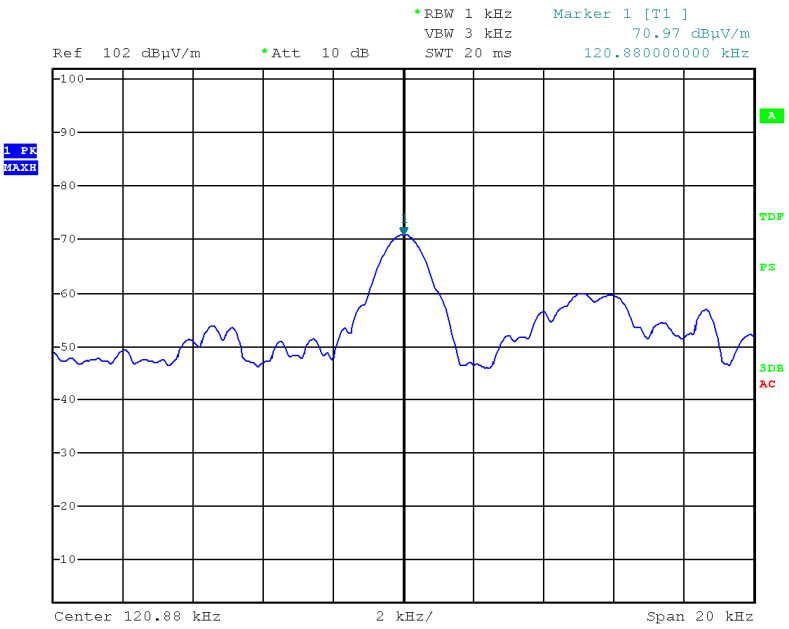


Figure 4. Field Strength of Fundamental, 121kHz electric field

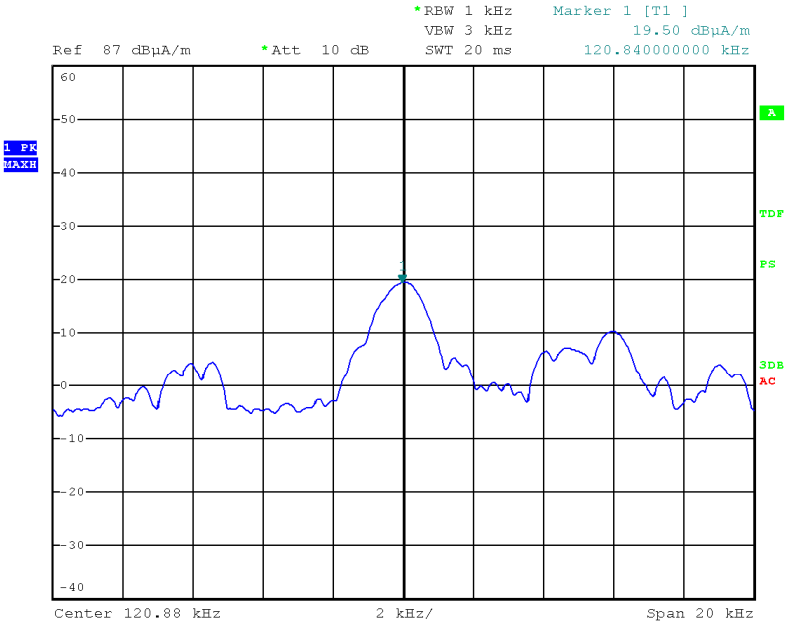


Figure 5. Field Strength of Fundamental, 121kHz magnetic field

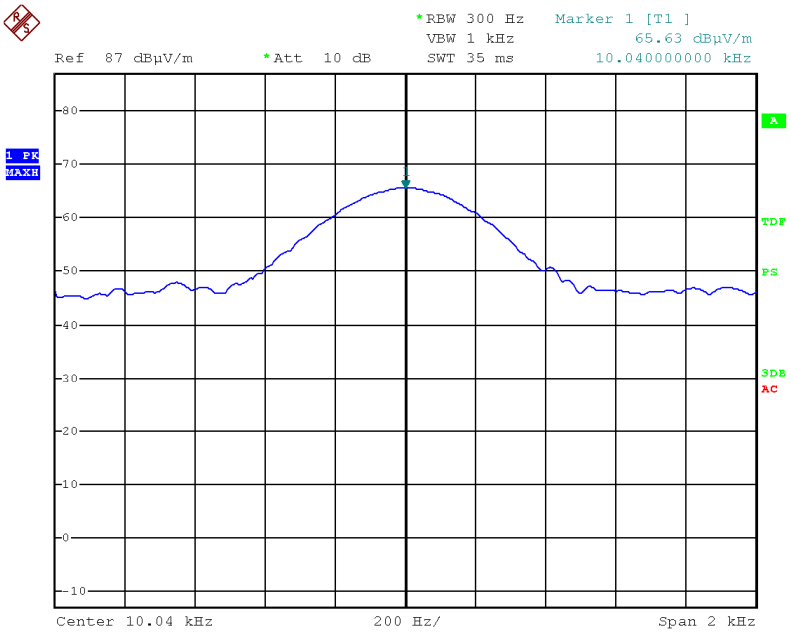


Figure 6. Field Strength of Fundamental, 10kHz electric field

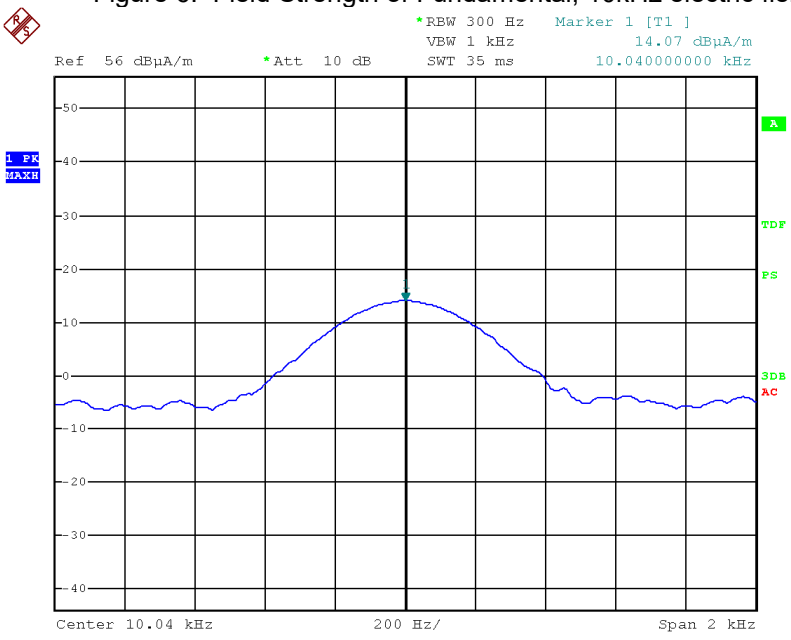


Figure 7. Field Strength of Fundamental, 10kHz magnetic field

3.6 Test Instrumentation Used; Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	February 20, 2022	February 20, 2023
Active Loop Antenna	EMCO	6502	2950	July 5, 2021	July 5, 2022
Semi anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
10 m RF cable	Commscope ORS (Serge)	0623 WBC-400	G020132	May 25, 2021	May 25, 2022

Figure 8. Test Equipment Used

4. Radiated Emission, 9 kHz – 30 MHz

4.1 Test Specification

FCC, Part 15, Subpart C, Section 209(c)

RSS-Gen Issue 5, March 2019, Amendment 1, Section 8.9

4.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))

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 in the chamber on a non-conductive table, 0.8 meters above the ground.

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

The turntable and antenna polarity were adjusted for maximum level reading on the EMI receiver.

The EMI receiver was set to the E.U.T. Fundamental Frequency and Peak Detection.

The frequency range 9 kHz-30 MHz was scanned.

4.3 FCC Test Limit

The level of any unwanted emissions from an intentional radiator shall not exceed the level of the fundamental emission .in addition the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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.

4.4 ISED Test Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	**Magnetic Field strength (microampere/ meter)**	**Measurement distance (meters)**	**Magnetic Field strength (dBµA/m)**	**Magnetic Field strength* (dBµA/m)@3m**
0.009-0.490	6.37/F(kHz)	300	-3.0-(-37.7)	77.0-42.2
0.490-1.705	63.7/F(kHz)	30	-17.7-(-28.5)	22.3-11.4
1.705-30.0	0.08	30	-21.9	18.0
Frequency (MHz)	**Field strength (microvolts/meter)**	**Measurement distance (meters)**	**Field strength (dBµV/m)**	**Field strength* (dBµV/m)@3m**
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.

4.5 Test Results

JUDGEMENT: Pass

See additional information in *Figure 9*.

Specifications: FCC, Part 15, Subpart C, RSS-Gen, Issue 5, Amendment 1, Section 8.9

Antenna Polarization: Horizontal/Vertical

Frequency range: 9 kHz to 30.0 MHz

Test Distance: 3 meters

Detector: Peak

Operation Frequency: 122kHz

Frequency	Polarity	Peak Reading	Limit	Margin
(kHz)	(V/H)	(dBµV/m)	(dBµV/m)	(dB)
No emissions were detected within 20 dB of the limit				

Figure 9. Radiated Emission, FCC Limit

Frequency	Polarity	Peak Reading	Limit	Margin
(kHz)	(V/H)	(dBµA/m)	(dBµA/m)	(dB)
No emissions were detected within 20 dB of the limit				

Figure 10. Radiated Emission, IC Limit

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.

Specifications: FCC, Part 15, Subpart C, RSS-Gen, Issue 5, Amendment 1, Section 8.9

Antenna Polarization: Horizontal/Vertical
Frequency range: 9 kHz to 30.0 MHz
Test Distance: 3 meters
Detector: Peak
Operation Frequency: 10kHz

Frequency	Polarity	Peak Reading	Limit	Margin
(kHz)	(V/H)	(dBµV/m)	(dBµV/m)	(dB)
No emissions were detected within 20 dB of the limit				

Figure 11. Radiated Emission, FCC Limit

Frequency	Polarity	Peak Reading	Limit	Margin
(kHz)	(V/H)	(dBµA/m)	(dBµA/m)	(dB)
No emissions were detected within 20 dB of the limit				

Figure 12. Radiated Emission, IC Limit

4.6 Test Instrumentation Used; Radiated Emission

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	February 20, 2022	February 20, 2023
Active Loop Antenna	EMCO	6502	2950	July 5, 2021	July 5, 2022
Semi anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
10 m RF cable	Commscope ORS (Serge)	0623 WBC-400	G020132	May 25, 2021	May 25, 2022

Figure 13. Test Equipment Used

4.7 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/m (AF) + 0.9 dB (CF) = 45.6 dBµV

No external pre-amplifiers are used.

5. Occupied Bandwidth

5.1 Test Specification

FCC, Part 2, Sub part J, Section 2.1049

RSS-Gen Issue 5 March 2019 Amendment 1, Section 6.6

5.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))

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 in the chamber on a non-conductive table, 0.8 meters above the ground.

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

The transmitter unit was operated with normal modulation. The RBW set to the range of 1% to 5% of the OBW. The span was set to ~ 3 times the OBW.

99% occupied bandwidth function was set on

5.3 Test Limit

N/A

5.4 Test Results

FREQUENCY (kHz)	READING (kHz)
10.0	N/A (the E.U.T transmits in CW)
121.0	

Figure 14. Bandwidth Test Results

Judgement: N/A

6. Test Setup Photos

See a separate file.

7. Appendix A - Correction Factors

ITL # 1075: Active Loop Antenna					
Frequency (MHz)	**MAF (dBs/m)**	**AF (dB/m)**	**Frequency (MHz)**	**MAF (dBs/m)**	**AF (dB/m)**
0.01	-33.1	18.4	2	-40.0	11.5
0.02	-37.2	14.3	3	-40.0	11.5
0.03	-38.2	13.3	4	-40.1	11.4
0.05	-39.8	11.7	5	-40.2	11.3
0.1	-40.1	11.4	6	-40.4	11.1
0.2	-40.3	11.2	7	-40.4	11.1
0.3	-40.3	11.2	8	-40.4	11.1
0.5	-40.3	11.2	9	-40.5	11.0
0.7	-40.3	11.2	10	-40.5	11.0
1	-40.1	11.4	20	-41.5	10.0

ITL # 1349: Log Periodic Antenna			
Frequency (MHz)	**AF (dB/m)**	**Frequency (MHz)**	**AF (dB/m)**
200	11.58	600	18.66
250	12.04	700	20.87
300	14.76	800	21.15
400	15.55	900	22.32
500	17.85	1000	24.22
ITL # 1352: Horn Antenna			
Frequency (MHz)	**AF (dB/m)**	**Frequency (MHz)**	**AF (dB/m)**
0.75	25	9.5	38
1.0	23.5	10.0	38.5
1.5	26.0	10.5	38.5
2.0	29.0	11.0	38.5
2.5	27.5	11.5	38.5
3.0	30.0	12.0	38.0
3.5	31.5	12.5	38.5
4.0	32.5	13.0	40.0
4.5	32.5	13.5	41.0
5.0	33.0	14.0	40.0
5.5	35.0	14.5	39.0
6.0	36.5	15.0	38.0

6.5	36.5		15.5	37.5
7.0	37.5		16.0	37.5
7.5	37.5		16.5	39.0
8.0	37.5		17.0	40.0
8.5	38.0		17.5	42.0
9.0	37.5		18.0	42.5
ITL # 1353: Horn Antenna (@ 3m distance)[2]				
Frequency (MHz)	**Measured antenna factor (dB/m)**		**Frequency (MHz)**	**Measured antenna factor (dB/m)**
18000	32.4		22500	33.0
18500	32.0		23000	33.1
19000	32.3		23500	33.8
19500	32.4		24000	33.5
20000	32.3		24500	33.5
20500	32.8		25000	33.8
21000	32.8		25500	33.9
21500	32.7		26000	34.2
22000	33.1		26500	34.7
ITL #1356: Biconical Antenna				
Frequency (MHz)	**AF (dB/m)**		**Frequency (MHz)**	**AF (dB/m)**
30	13.00		90	8.23
35	10.89		100	11.12
40	10.59		120	13.16
45	10.63		140	13.07
50	10.12		160	14.80
60	9.26		180	16.95
70	7.74		200	17.17
80	6.63			
ITL #1840: Anechoic Chamber RF Cable				
Frequency (MHz)	**Cable Loss (dB)**		**Frequency (MHz)**	**Cable Loss (dB)**
1000.0	-1.4		10000.0	-6.0
1500.0	-1.7		10500.0	-6.2
2000.0	-2.0		11000.0	-6.2
2500.0	-2.3		11500.0	-6.0
3000.0	-2.6		12000.0	-6.0
3500.0	-2.8		12500.0	-6.1
4000.0	-3.1		13000.0	-6.3
4500.0	-3.3		13500.0	-6.5

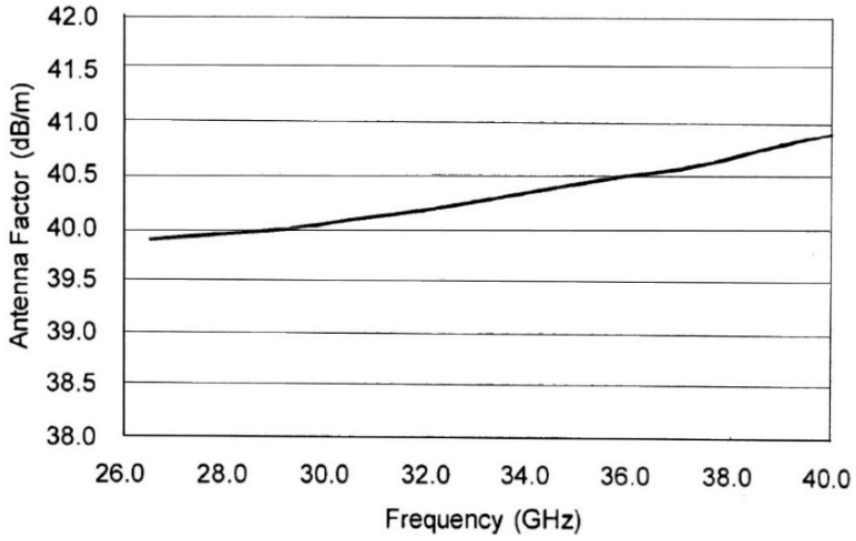
[2] The antenna factor shall be added to the receiver reading in dBµV to obtain field strength in dBµ V/m

5000.0	-3.6		14000.0	-6.7
5500.0	-3.7		14500.0	-7.0
6000.0	-4.0		15000.0	-7.3
6500.0	-4.4		15500.0	-7.5
7000.0	-4.7		16000.0	-7.6
7500.0	-4.8		16500.0	-8.0
8000.0	-5.0		17000.0	-8.0
8500.0	-5.1		17500.0	-8.1
9000.0	-5.6		18000.0	-8.2
9500.0	-5.8			

ITL #1911: OATS RF Cable

Frequency (MHz)	Cable Loss (dB)		Frequency (MHz)	Cable Loss (dB)
1.0	0.5		450.00	5.83
10.00	1.0		500.00	6.33
20.00	1.34		550.00	6.67
30.00	1.5		600.00	6.83
50.00	1.83		650.00	7.17
100.00	2.67		700.00	7.66
150.00	3.17		750.00	7.83
200.00	3.83		800.00	8.16
250.00	4.17		850.00	8.5
300.00	4.5		900.00	8.83
350.00	5.17		950.00	8.84
400.00	5.5		1000.00	9.0

ITL # 1777: 26.5-40 GHz Horn Antenna



End of Test Report