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DATE: 18 June 2013

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

FCC Radio Test Report

for

Hi-G-Tek Ltd.

Equipment under test:

AVL Reader

IG-AV1-43-916

Written by: _____
R. Pinchuck, Documentation

Approved by: _____
I. Siboni, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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Measurement/Technical Report for
Hi-G-Tek Ltd.

Equipment under test:

AVL Reader

FCC ID: OB6-IGAV143916

This report concerns:	Original Grant: Class II change: X Class I change:
Equipment type:	Radio Transmitter

Limits used:
47CFR Part 15, Subpart C, Section 15.249

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:	Hi-G-Tek Ltd.
Manufacturer's Address:	16 Hacharoshet St. Or-Yehuda 60375 Israel Tel: +972-3-533-9359 Fax: +972-3-533-9225
Manufacturer's Representative:	Roni Cohen
Equipment Under Test (E.U.T):	AVL Reader
Equipment Model No.:	IG-AV1-43-916
Equipment Serial No.:	1880097998
Date of Receipt of E.U.T:	02.06.2013
Start of Test:	02.06.2013
End of Test:	02.06.2013
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 71100
Test Specifications:	FCC Part 15, Subpart C

1.2 Abbreviations and Symbols

The following abbreviations and symbols are applicable to this test report:

A/m	ampere per meter
AC	alternating current
AM	amplitude modulation
ARA	Antenna Research Associates
Aux	auxiliary
Avg	average
CDN	coupling-decoupling network
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dbµV	decibel referred to one microvolt
dbµV/m	decibel referred to one microvolt per meter
DC	direct current
EFT/B	electrical fast transient/burst
EMC	electromagnetic compatibility
ESD	electrostatic discharge
E.U.T.	equipment under test
GHz	gigahertz
HP	Hewlett Packard
Hz	Hertz
kHz	kilohertz
kV	kilovolt
LED	light emitting diode
LISN	line impedance stabilization network
m	meter
mHn	millihenry
MHz	megahertz
msec	millisecond
N/A	not applicable
per	period
QP	quasi-peak
PC	personal computer
RF	radio frequency
RE	radiated emission
sec	second
V	volt
V/m	volt per meter
VRMS	volts root mean square

1.3 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. 861911.
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.
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.

1.4 Product Description:

AVL Reader- p/n IG- AV1-43-916

This data reader uses active wireless technology to provide automatic processing and real-time monitoring of cargos during transit. The reader powered from the truck power is installed in the truck's cabin, it has read/write capabilities for communicating with the cargo / tank outlets sensors simultaneously in order to verify their presence and status. The reader uses one channel for communication, it is equipped with back up battery and it has two RS232 channel as well as one RS485 channel used to communicate with other devices of the Tanker Truck Monitoring System.

AVL Reader p/n IG- AV1-43-916

High Frequency channel: Transmit/Receive at 916.5MHz, FSK modulated with 40k Hz deviation and 16kHz data.

1.5 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.

1.6 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Lod, Israel. This site is a FCC listed test laboratory (FCC Registration No. 861911, date of listing June 30, 2010).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.7 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2 System Test Configuration

2.1 Justification

The EUT was originally authorized for FCC under FCC ID: OB6-IGAV143916.
A C2PC was performed due to an antenna change and was authorized on 2/22/2007.
Hi-G-Tek has again changed the antenna and a C2PC is being submitted.
Due to the antenna change, field strength of fundamental and spurious radiated emission tests only were performed.
No other changes have been made to the EUT.

2.2 EUT Exercise Software

See ITL test report E67384.00.

2.3 Special Accessories

See ITL test report E67384.00.

2.4 Equipment Modifications

See ITL test report E67384.00.

2.5 Configuration of Tested System

The configuration of the tested system is described below.

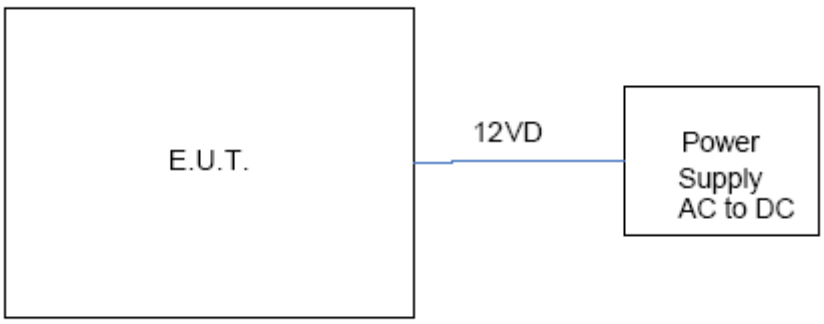

Figure 1. Configuration of Tested System

3 Block Diagram

3.1 Schematic Block/Connection Diagram

See ITL test report E67384.00.

3.2 Theory of Operation

See ITL test report E67384.00.

4 Field Strength of Fundamental

4.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.249(a)

4.2 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 (916.500MHz) 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.

4.3 Measured Data

JUDGEMENT: Passed by 0.1 dB

The EUT met the FCC Part 15, Subpart C, Section 15.249(a) specification requirements.

The details of the highest emissions are given in *Figure 2*.

TEST PERSONNEL:

Tester Signature: _____ Date: 18.06.13

Typed/Printed Name: I. Siboni

Field Strength of Fundamental

E.U.T Description	AVL Reader
Model Number	IG-AV1-43-916
Serial Number:	1880097998

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Horizontal/Vertical Frequency 916.53 MHz

Test Distance: 3 meters Detector: Peak

Freq.	Pol.	Peak Reading	Specification	Margin
(MHz)	V/H	(dBµV/m)	(dBµV/m)	(dB)
916.53	H	91.3	94.0	-2.7
916.53	V	93.9	94.0	-0.1

Figure 2. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL/VERTICAL. Detector: Peak

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.

"Peak Amp." includes "Correction Factors.

"Correction Factors" = Antenna Correction Factor + Cable Loss.

Field Strength of Fundamental

E.U.T Description	AVL Reader
Model Number	IG-AV1-43-916
Serial Number:	1880097998

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Horizontal Frequency 916.53 MHz

Test Distance: 3 meters Detector: Peak

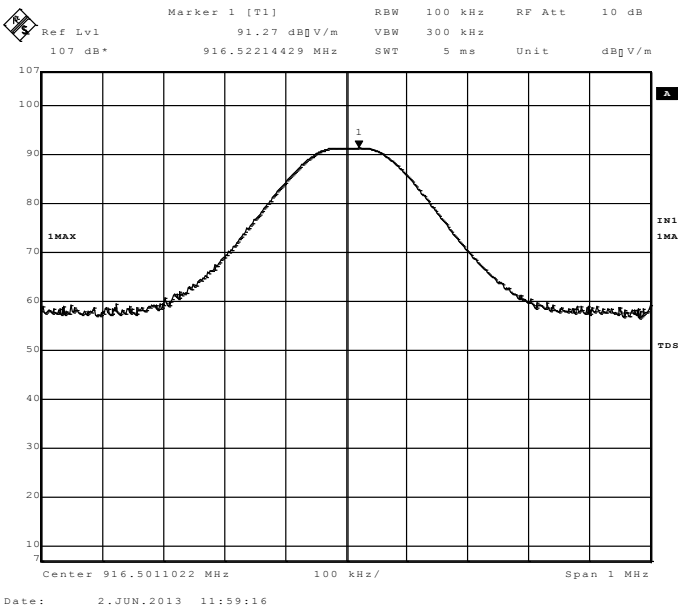

Figure 3. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL Detector: Peak

Field Strength of Fundamental

E.U.T Description	AVL Reader
Model Number	IG-AV1-43-916
Serial Number:	1880097998

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Vertical
Test Distance: 3 meters

Frequency 916.53 MHz
Detector: Peak

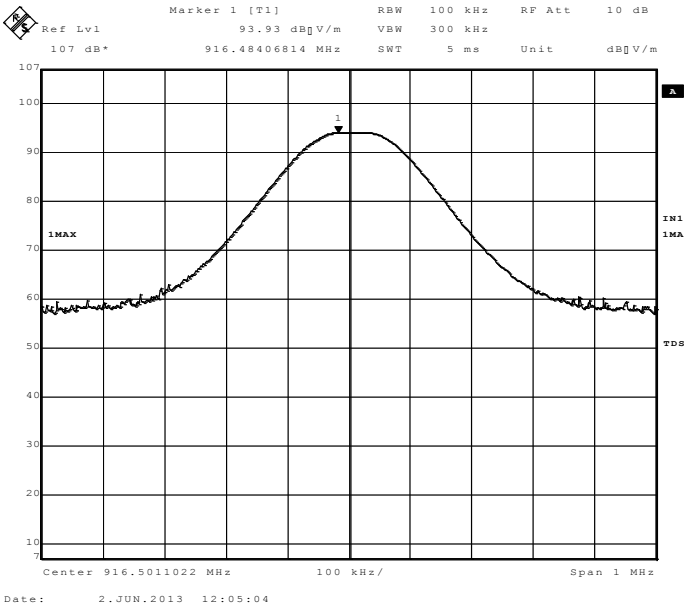

Figure 4. Field Strength of Fundamental. Antenna Polarization: VERTICAL. Detector: Peak

4.4 Test Instrumentation Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	Rohde & Scwarz	ESIB7	100120	November 01, 2012	1 Year
Antenna Bioconical	EMCO	3142B	1250	July 07, 2012	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Turntable Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

5 Radiated Measurement Photo

Figure 5. Radiated Emission Test

6 Spurious Radiated Emission 9kHz-30 MHz

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 1*.

The frequency range 9kHz-30 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.
The emissions were measured using a computerized EMI receiver complying with 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-30 MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.
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.

During this test the E.U.T. was operated in continuous transmission to enable better detection of signals.

6.1 Measured Data

JUDGEMENT: Passed

The signals in the band 9 kHz – 30 MHz were 20dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 15.249 specification.

TEST PERSONNEL:

Tester Signature: _____ Date: 18.06.13

Typed/Printed Name: I. Siboni

6.2 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	Rohde & Schwarz	1066.301	100120	November 01, 2012	1 Year
Active Loop Antenna	EMCO	6502	9506-2950	October 21, 2012	1 Year
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Turntable Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

6.3 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]

7 Spurious Radiated Emission 30MHz-10GHz

7.1 Spurious Radiated Emission 30 MHz-10GHz

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, 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.

The frequency range 30MHz –10GHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emission levels were compared to the requirement of Section 15.249.

In the frequency range 30MHz-2.9GHz, a computerized EMI receiver complying with CISPR 16 requirements was used. The test distance was 3 meters.

In the frequency range 2.9-10 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.).

7.2 Test Data

JUDGEMENT: Passed by 4.6 dB

All other signals not included in the result tables are at least 20dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Section 15.249, specification.

The details of the highest emissions are given in *Figure 6* to *Figure 7*.

TEST PERSONNEL:

Tester Signature: _____ Date: 18.06.13

Typed/Printed Name: I. Siboni

Spurious Radiated Emission Above 1 GHz

E.U.T Description	AVL Reader
Model Number	IG-AV1-43-916
Serial Number:	1880097998

Specification: F.C.C., Part 15, Subpart C, 15.249

Antenna Polarization: Horizontal
Test Distance: 3 meters

Frequency range: 1.0 GHz to 9.2 GHz
Detector: Peak, Average

Frequency (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak Specification (dB µV/m)	Margin (dB)
1833.0	H	59.4	74.0	-14.6
1833.0	V	63.2	74.0	-10.8
2749.6	H	63.2	74.0	-10.8
2749.6	V	61.2	74.0	-12.8

Figure 6. Spurious Radiated Emission. Antenna Polarization: HORIZONTAL Detector: Peak, Average

Pk Delta/ Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak" and "Average" include correction factor.

"Correction Factor" = Antenna Factor + Cable Loss

Spurious Radiated Emission Above 1 GHz

E.U.T Description AVL Reader
Model Number IG-AV1-43-916
Serial Number: 1880097998

Specification: F.C.C., Part 15, Subpart C, 15.249

Antenna Polarization: Horizontal
Test Distance: 3 meters
Frequency range: 1.0 GHz to 9.2 GHz
Detector: Peak, Average

Frequency (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Specification (dB µV/m)	Margin (dB)
1833.0	H	47.60	54.0	-6.40
1833.0	V	49.40	54.0	-4.60
2749.6	H	42.20	54.0	-11.80
2749.6	V	42.22	54.0	-11.78

Figure 7. Spurious Radiated Emission. Antenna Polarization: HORIZONTAL Detector: Peak, Average

Notes:

1. *Horizontal axis shows logarithmic frequency scale.*
2. *The vertical axis shows amplitude (in dB µV/m).*
3. *Peak detection is designated by the top of each vertical line.*
4. *Average detection is designated by the first dash mark (from the top) of each vertical line.*

7.3 Test Instrumentation Used, Spurious Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	Rohde & Schwarz	1066.301	100120	November 01, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 08, 2012	1 Year
Biconilog Antenna	EMCO	3142B	1250	July 07, 2012	1 Year
Horn Antenna	ETS	3115	6142	March 14, 2012	2 Years
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Turntable Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

8 APPENDIX A - CORRECTION FACTORS

8.1 Correction factors for CABLE

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

FRQ	S.G.	REF	A AMP	
10K	-30	-29.8	-30.2	0.4
15K	-30	-29.5	-29.7	0.2
20K	-30	-29.7	-29.9	0.2
30K	-30	-29.6	-29.9	0.3
50K	-30	-29.7	-30.0	0.3
75K	-30	-29.7	-30.0	0.3
100K	-30	-29.8	-30.0	0.2
150K	-30	-29.8	-30.0	0.2
200K	-30	-29.9	-30.2	0.3
500K	-30	-29.9	-30.3	0.4
1M	-30	-30.1	-30.5	0.4
1.5M	-30	-30.1	-30.6	0.5
2M	-30	-30.2	-30.7	0.5
5M	-30	-30.3	-30.9	0.6
10M	-30	-30.2	-31.0	0.8
15M	-30	-30.2	-31.1	0.9
20M	-30	-30.5	-31.3	0.8

FRQ	S.G.	REF	A	
			AMP	
50M	-30	-30.5	-31.7	1.2
100M	-30	-30.5	-32.2	0.7
150M	-30	-30.4	-32.5	2.1
200M	-30	-30.5	-32.8	2.3
300M	-30	-30.4	-33.3	2.9
500M	-30	-30.5	-34.3	3.8
750M	-30	-30.7	-35.3	4.8
1G	-30	-30.9	-36.3	5.4
1.5G	-15	-15.7	-22.4	6.7
2G	-15	-15.9	-24.9	9.0
2.5G	-15	-16.3	-25.7	9.4
3G	-15	-16.5	-26.4	9.9
3.5G	-15	-16.7	-26.9	10.2
4G	-15	-16.3	-27.5	11.2
4.5G	-15	-16.6	-28.7	12.1
5G	-15	-16.8	-29.9	13.1
5.5G	-15	-17.6	-31.1	13.5
6G	-15	-17.2	-31.7	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 Bilog ANTENNA

Model: 3142
Antenna serial number: 1250
3 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (dB/m)
30	18.4	1100	25
40	13.7	1200	24.9
50	9.9	1300	26
60	8.1	1400	26.1
70	7.4	1500	27.1
80	7.2	1600	27.2
90	7.5	1700	28.3
100	8.5	1800	28.1
120	7.8	1900	28.5
140	8.5	2000	28.9
160	10.8		
180	10.4		
200	10.5		
250	12.7		
300	14.3		
400	17		
500	18.6		
600	19.6		
700	21.1		
800	21.4		
900	23.5		
1000	24.3		

8.3 Correction factors for Horn ANTENNA

Model: 3115
Antenna serial number: 6142
3 meter range

FREQUENCY (MHz)	Antenna Factor (dB/m)	FREQUENCY (MHz)	Antenna Factor (dB/m)
1000	23.9	10500	38.4
1500	25.4	11000	38.5
2000	27.3	11500	39.4
2500	28.5	12000	39.2
3000	30.4	12500	39.4
3500	31.6	13000	40.7
4000	33	14000	42.1
4500	32.7	15000	40.1
5000	34.1	16000	38.2
5500	34.5	17000	41.7
6000	34.9	17500	45.7
6500	35.1	18000	47.7
7000	35.9		
7500	37.5		
8000	37.6		
8500	38.3		
9000	38.5		
9500	38.1		
10000	38.6		

8.4 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

9 APPENDIX B - MEASUREMENT UNCERTAINTY

9.1 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