ELECTROMAGNETIC EMISSIONS TEST REPORT

ACCORDING TO FCC PART 15, SUBPART C, §15.209

FOR

VISONIC Ltd.

EQUIPMENT UNDER TEST

EXTERNAL READER OF ACCESS CONTROL SYSTEM

Prepared by: ____________
Mrs. M. Cherniavsky, certif. engineer
Hermon Labs

Approved by: ____________
Mr. A. Usoskin, QA manager
Hermon Labs

Approved by: ____________
Mr. Arick Elshtein, technical support manager
Visonic Ltd.

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ACCREDITED
839.01

Description of equipment under test

Test items	External tag reader, FCC ID:GSARDR
Manufacturer	Visonic Ltd.
Brand Mark	Visonic Ltd.
Type (Model)	RDR-1
Trade Name	TAG-IN-A-BAG External Reader

Applicant information

Applicant's representative & responsible person Mr.	Mr. Arick Elshtein, technical support manager
Company	Visonic Ltd.
Address	30 Habarzel St.
P.O. Box	22020
Postal code	61220
City	Tel Aviv
Country	Israel
Telephone number	011-972-3645 6714
Telefax number	011-972-3645 6789

Test performance

Project Number	13114
Location of the test	Hermon Laboratories, Binyamina, Israel
Test started	October 29, 1998
Test completed	November 18, 1998
Purpose of test	The EUT certification in accordance with
CFR 47, part 2, §2.1033	
Test specification(s)	FCC part 15, subpart C, §15.209

Through this report a point is used as the decimal separator and the thousands are counted with a comma.
This report is in conformity with EN 45001 and ISO GUIDE 25.
The test results relate only to the items tested.

Table of Contents

1 General Information

1.1 Abbreviations and Acronyms

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

AC	alternating current
BW	bandwidth
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
DC	direct current
EUT	Equipment Under Test
GHz	gigahertz
H	height
HL	Hermon Laboratories
HP	Hewlett Packard
Hz	hertz
IF	intermediate frequency
kHz	kilohertz
L	length
m	meter
mm	millimeter
MHz	megahertz
msec	millisecond
NA	Not Applicable
NARTE	National Association of Radio and Telecommunications Engineers, Inc.
Ohm	Ohms
QP	quasi-peak (detector)
RBW	resolution bandwidth
RF	Radio Frequency
RE	radiated emission
RMS	root-mean-square
sec	second
V	volt

1.2 Specification References

CFR 47 part 15: October 1997	Radio Frequency Devices.
ANSI C63.2:06/1987	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4:1992	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

1.3 EUT Description

The EUT, external reader RDR-1, is a part of TAG-IN-A-BAG (TIAB) proximity access control system, which contains a transmitter operating at 125 kHz±2% frequency. The TAG-IN-A-BAG is used to limit access to restricted areas, while permitting authorized people to enter. The TIAB has an internal proximity tag reader. For installations in which an additional tag reader is required, an external reader RDR-1 can be used. The external reader is connected to the TIAB control unit by means of integral 4 wires.
When presenting a personal tag to the internal or external reader, it is powered by the RF signal transmitted from the reader. As a result, the tag transmits a coded RF signal back to the reader, causing it to energize an output relay.
A permanently attached loop antenna, disposed on the perimeter of printed circuit board, is used in RDR-1. The TIAB system is powered by 12 V DC power supply.

1.4 Statement of Manufacturer

I, Arick Elshtein, technical support manager of Visonic Ltd., declare that the external reader of the access control system, model RDR-1, was tested on October 29, November 18, 1998 by Hermon Laboratories and which this test report applies to, is identical of the equipment that will be marketed.

The term identical means identical within the variations that can be expected to arise as a result of quantity production technique.

Arick Elshtein, technical support manager
Visonic Ltd.

Signature: Elshtein

Date: 11/15/98

2 Test Facility Description

2.1 General

Tests were performed at Hermon Laboratories, which is a fully independent, private EMC, Safety and Telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of the Code of Federal Regulations 47 (CFR 47), recognized by VDE (Germany) for witness test, accredited by Netherlands Metrology Institute according to EN 45001 for all European Telecommunications (Network and Wireless) standards, including Safety, recognized by TUV Sudwest (Germany) for Safety testing, and Accredited by AMTAC (UK) for safety of Medical Devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO GUIDE 25/EN 45001 for EMC, Telecommunications and Product Safety of Information Technology Equipment (Certificate No. 839.01).

Address: PO Box 23, Binyamina 30550, Israel.
Telephone: +972-6-628-8001
Fax: +972-6-628-8277

Person for contact: Mr. Alex Usoskin, testing and QA manager.

2.2 Equipment Calibration

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of MIL-STD-45662A.
The laboratory standards are calibrated by the third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

2.2.1 Uncertainty in Hermon Labs Measurements.

Radiated Emissions (95% Confidence)	Biconical Antenna: 3m measuring distance : + 4.06 dB Expanded uncertainty : - 3.98 dB Expanded uncertainty : + 2.032 dB Combined standard uncertainty : - 1.99 dB Combined standard uncertainty 10m measuring distance : + 3.98 dB Expanded uncertainty : - 4.08 dB Expanded uncertainty : + 1.99 dB Combined standard uncertainty : - 2.04 dB Combined standard uncertainty Log periodic Antenna: 3m measuring distance : + 4.74 dB Expanded uncertainty : - 3.26 dB Expanded uncertainty : + 2.37 dB Combined standard uncertainty : - 1.63 dB Combined standard uncertainty 10m measuring distance : + 3.06 dB Expanded uncertainty : - 3.00 dB Expanded uncertainty

2.3 Laboratory Personnel

The two people of Hermon Laboratories that have participated in measurements and documentation preparation are: Mrs. Eleonora Pitt, test engineer and Mrs. Marina Cherniavsky - certification engineer.
M. Cherniavsky is a telecommunication engineer certified by the National Association of Radio and Telecommunications Engineers (NARTE, USA).
The Hermon Laboratories' personnel that participated in this project have more than 50 years combined experience time in EMC measurements and electronic products design.

2.4 Statement of Qualification

The test measurement data supplied in this test measurement report having been received by me, is hereby duly certified. The following is a statement of my qualifications:
I am an engineer, graduated from university in 1974 with an MScEE degree, have obtained 25 years experience in EMC measurements and have been with Hermon Laboratories since 1991.

Name: Mrs. Eleonora Pitt
Position: test engineer

Signature: [signature]
Date: November 10, 1998

I hereby certify that this test measurement report was prepared by me and is hereby duly certified. The following is a statement of my qualifications.
I am an engineer, graduated from University in 1971, with an MScEE degree, have obtained 25 years experience in electronic products design and development and have been with Hermon Laboratories since 1991. Also, I am a Telecommunication Class II engineer certified by the National Association of Radio and Telecommunications Engineers, Inc. (USA.), the certificate no. is E2-03410.

Name: Mrs. Marina Cherniavsky
Position: certif. engineer

Signature: [signature]
Date: November 10, 1998

3 Radiated Emission Measurements

3.1 Field Strength of Emissions according to § 15.209 (a)

3.1.1 Specified limit

Frequency, MHz	Field strength, microvolts/meter	Measurement distance, meters
0.009 – 0.490	2400/F	300

3.1.2 Extrapolation (distance correction) factor

The test was performed in the Hermon Labs open field test site at 10 meter test distance, i.e. the distance between measuring antenna and EUT boundary. The proper extrapolation factor was determined by making measurements at 3, 10 and 19 meter measurement distances.
The distance correction factor is determined from the equation:

$E_{10\,m}$ dB(μV/m) = $E_{300\,m}$ dB(μV/m) + DF x log (300/10), where

$E_{300\,m}$ dB(μV/m) – radiated emissions @ 300 meter distance
$E_{10\,m}$ dB(μV/m) - radiated emissions @ 10 meter distance
DF (dB) – distance correction factor.

Distance correction factor DF was calculated by using measurement results at 3 m, 10 m and 19 m test distance. The measurement results for distance correction factor calculation are given in Table 3.1.1.
1. Using measurements at 3 m and 10 m test distance, the distance factor was calculated as follows:

DF_1 x log (10/3) = 86.6 dB(μV/m) – 62.0 dB(μV/m), thus

DF_1= 47 dB.

2. Using measurements at 10 m and 19 m test distance, the distance factor was calculated as follows:

DF_2 x log (19/10) = 62.0 dB(μV/m) – 47.9 dB(μV/m), thus

DF_2 = 50.6 dB.

The DF=47 dB was applied for limit calculation at 10 m test distance measurements.

For example, for124 kHz frequency the calculated limit is:
Limit $_{10m}$ = Limit $_{300\,m}$ + 47 log (300/10) = 25.7 dB(μV/m) + 69.4 dB = 95.1 dB(μV/m).

For 248 kHz frequency the calculated limit is:
Limit $_{10m}$ = Limit $_{300\,m}$ + 47 log (300/10) = 19.7 dB(μV/m) + 69.4 dB = 89.1 dB(μV/m).

3.1.3 Test Procedure and Results

The external reader with TIAB unit and DC power supply were placed on the wooden turntable, as shown in Figure 3.1 and Photographs 3.1.1 and 3.1.2. The EUT was operated in continuous transmitting mode during the testing. The frequency range from 9 kHz up to 10^{th} harmonic was investigated.
Loop antenna was used. To find maximum radiation the turntable was rotated 360°, measuring loop antenna center was positioned at 1 m height. The antenna was rotated about its vertical axis and the antenna polarization was changed from vertical to horizontal.
The average detector was used. The test measurement results were recorded into Table 3.1.2.

Reference numbers of test equipment used

HL 0027	HL 0028	HL 0038	HL 0275	HL 0287	HL 0446	HL 0812
HL 0813						

Full description is given in Appendix A.

Table 3.1.1
Radiated Emission Measurements
(Field strength of fundamental frequency)

TEST SPECIFICATION: FCC part 15 subpart C § 15.209
COMPANY: Visonic Ltd.
EUT: RDR-1
DATE: October 29, 1998
RELATIVE HUMIDITY: 67%
AMBIENT TEMPERATURE: 24°C

Frequency kHz	Test Distance m	Detector Type	Measured Result dB (μV)	Correction Factor dB	Radiated Emissions dB (μV/m)
126	3	Peak, average	76.7	9.9	86.6
126	10	Peak, average	52.1	9.9	62.0
126	19	Peak, average	38.0	9.9	47.9

Notes to Table:

Resolution bandwidth = 200 Hz was used.
Loop Antenna was used
Radiated Emission dB(μV/m) = Measured Results {dB(μV)} + Correction Factor (dB).
Correction Factor = Antenna Factor + Cable Loss (refer to Appendix B)

Test Performed by:
Mrs. Eleonora Pitt, test engineer

Hermon Labs

Table 3.1.2

Radiated Emission Measurements – Test Results

TEST SPECIFICATION: FCC part 15 subpart C § 15.209
COMPANY: Visonic Ltd.
EUT: RDR-1
DATE: October 29, 1998
RELATIVE HUMIDITY: 67%
AMBIENT TEMPERATURE: 24°C

MEASUREMENTS PERFORMED AT 10 METRES DISTANCE

Frequency kHz	Resolution Bandwidth kHz	Measured Result dB (μV)	Correction Factor dB	Radiated Emissions dB (μV/m)	Calculated Limit dB (μV/m)	Specified Margin dB	Pass/ Fail
124	0.2	52.1	9.9	61.5	95.1	34.0	Pass
248	9	39.0	9.9	48.9	89.1	40.2	Pass
372	9	34.0	9.9	43.9	85.6	41.7	Pass

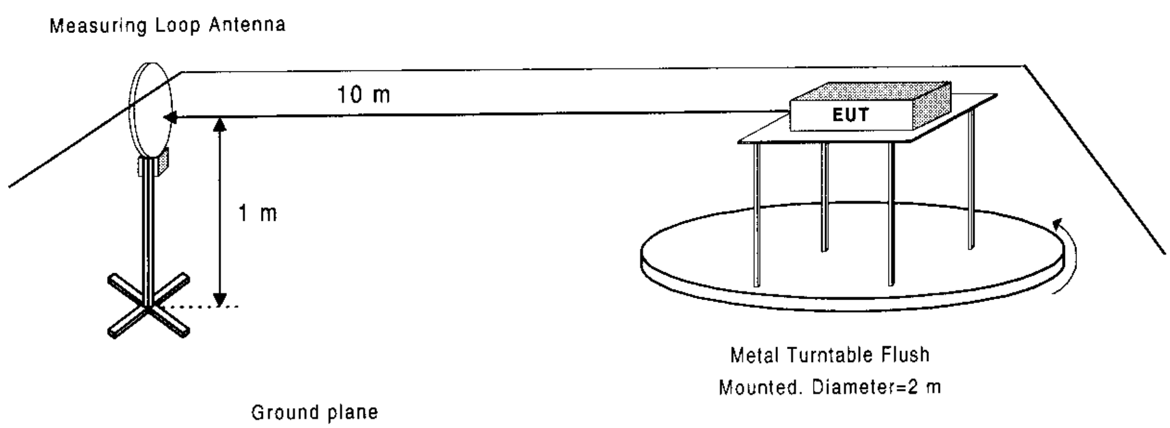
Notes to Table:

Loop antenna and Average detector was used.
Radiated Emission dB(μV/m) = Measured Results {dB(μV)} + Correction Factor (dB).
Correction Factor = Antenna Factor + Cable Loss (refer to Appendix B)
Calculated Limit in accordance with section 3.1.2 of this test report.

Test Performed by:
Mrs. Eleonora Pitt, test engineer

Hermon Labs

Figure 3.1
Radiated Emission Test Setup



3.2 Unintentional Radiated emissions test

3.2.1 Definition of the test

This test was performed to measure radiated emissions from the incorporated digital device of the EUT and also to verify the EUT full compliance with §15.109, §15.209.

3.2.2 The test set-up configuration, Test Procedure and Results

The radiated emissions measurements of the EUT incorporated digital device were performed in the anechoic chamber at 3 meter measuring distance in the frequency range from 30 MHz to 1 GHz. The EUT with connected to terminal block wires was placed on the wooden table as shown in Figure 3.2 and Photographs 3.2.1, 3.2.2. The biconical and log periodic antennas were used. To find maximum radiation the turntable was rotated 360°, the cables position was varied, the measuring antenna height changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.
The measurements were performed with the EMI receiver settings: RBW=120 kHz, quasi-peak detector.
The results of measurements were recorded into Table 3.2.1 and shown in Plot 3.2.1.

Reference numbers of test equipment used

HL 0275	HL 0465	HL 0521	HL 0593	HL 0594	HL 0604	HL 0815
HL 0816						

Full description is given in Appendix A.

Table 3.2.1

Radiated Emission Measurements Test Results
Frequency range 30 MHz - 1 GHz

TEST SPECIFICATION: FCC part 15 subpart C §15.109, §15.209
COMPANY: Visonic Ltd.
EUT: RDR-1
DATE: November 18, 1998
Relative Humidity: 67%
Ambient Temperature: 24°C

MEASUREMENTS PERFORMED AT 3 METRES DISTANCE

Frequency MHz	Radiated Emissions dB (µV/m)	Specified Limit dB (µV/m)	Specified Margin dB	Pass/ Fail
76.896	25.81	40	14.19	Pass
77.228	25.75	40	14.25	Pass

Notes to Table:

Biconilog antenna and quasi peak detector with resolution bandwidth = 120 kHz were used.

Test Performed by:
Mrs. Eleonora Pitt, test engineer

Hermon Labs

Plot 3.2.1
Radiated Emission Test Results

Test Name FCC B RE 3m
EUT Model Number TAG-IN-A-BAG (CONF. B)
Analyzer Model Number HP8546A
Site Description ANECHOIC CHAMBER
Operator Name PITT
Customer Name VISONIC

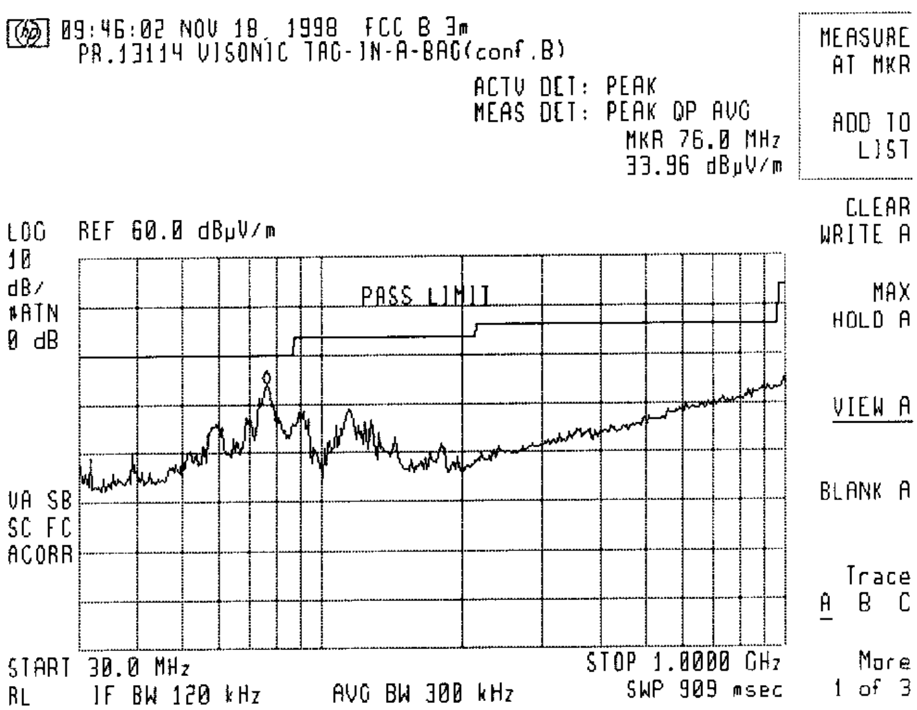
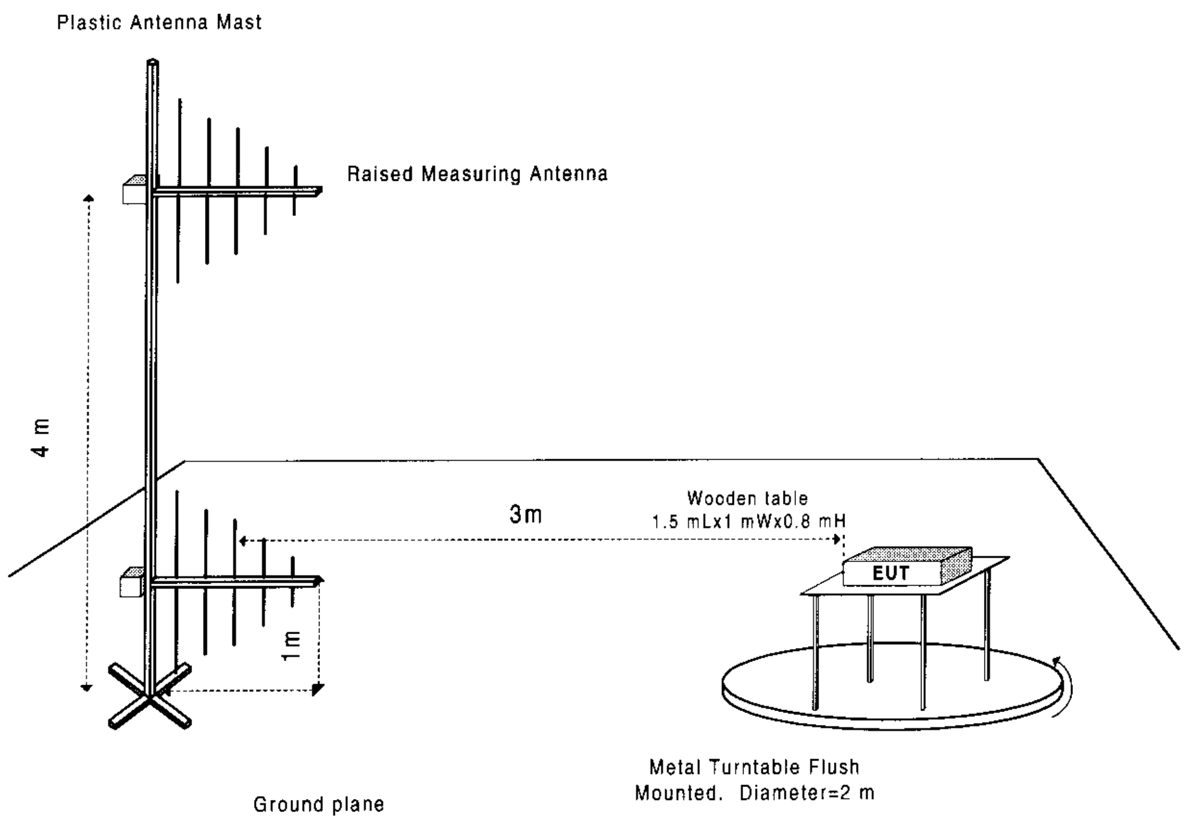


Figure 3.2
Radiated Emission Test Setup



4. Summary and Signatures

The EUT, RDR-1, was found to be in compliance with the FCC part 15 subpart B §15.109 class B and subpart C §15.209 limits.

Test performed by:

Mrs. Eleonora Pitt, test engineer

Approved by:

Dr. Edward Usoskin, C.E.O.

Responsible person from Visonic Ltd.

Mr. Arick Elshtein, technical support manager

APPENDIX A – Test equipment and ancillaries used for tests

HL Serial No.	Serial No.	Description	Manufacturer	Model No.	Due Calibr.
0027	4838	Spectrum Analyzer, 50 Hz-2 GHz	Anritsu	MS-611A	10/99
0028	4147	Interference Analyzer, 9KHz-1GHz	Electro-Metrics	EMC 30MKIV	7/99
0038	38	Antenna Mast, 1-4 m	Hermon Labs	AM-1	2/99
0275	0275	Wooden Table, 1.5 x 1.0 x 0.8	Hermon Labs	NA	NA
0287	0287	Metal Turntable Flush Mounted	Hermon Labs	HLTT-MDC1	4/99
0446	2857	Antenna, Loop active, 10 kHz – 30 MHz	Electro-Mechanics	6502	10/99
0465	0465	Anechoic Chamber 9 mL x 6.5 mW x 5.5 mH	Hermon Labs	AC-1	10/99
0521	0319	Spectrum Analyzer with RF filter section (EMI Receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	7/99
0593	593	Antenna Mast, 1-4 m/ 1-6 m Pneumatic	Hermon Labs	HLAM-F1	4/99
0594	594	Turntable for anechoic chamber, flush mounted, D=1.2 m, pneumatic	Hermon Labs	HL TT-WDC1	11/99
0604	1011	Antenna Log-Periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141 BICONILOG	12/98
0812	812	Cable, coax, RG-214, 11.5 m, N-type connectors	Hermon Labs	C10M	8/99
0813	813	Cable, coax, RG-214, 12 m, N-type connectors	Hermon Labs	CRA	8/99
0815	815	Cable, coax, RG-214, 7.3 m, N-type connectors	Hermon Labs	C56	8/99
0816	816	Cable, coax, RG-214, 8 m, N-type connectors	Hermon Labs	C7576	8/99

APPENDIX B-Test Equipment Correction Factors

Antenna Factor
Loop Antenna,Electro-Mechanics, Model 6502
Ser.No.2857

Frequency MHz	Antenna Factor dB(1/m)
0.009	18.7
0.010	17.7
0.020	13.2
0.050	10.4
0.075	10.2
0.100	9.9
0.150	9.8
0.250	9.9
0.500	9.8
0.750	9.7
1.000	10.1
2.000	10.0
3.000	10.2
4.000	10.1
5.000	10.1
10.000	9.6
15.000	9.6
20.000	9.3
25.000	8.7
30.000	7.5

Antenna factor is to be added to receiver meter reading in dB(μV) to convert to field intensity in dB(μV/meter).

Antenna Factor at 3m calibration
Biconilog Antenna EMCO Model 3141
Ser.No.1011

Frequency, MHz	Antenna Factor, dB(1/m)
26	7.8
28	7.8
30	7.8
40	7.2
60	7.1
70	8.5
80	9.4
90	9.8
100	9.7
110	9.3
120	8.8
130	8.7
140	9.2
150	9.8
160	10.2
170	10.4
180	10.4
190	10.3
200	10.6
220	11.6
240	12.4
260	12.8
280	13.7
300	14.7
320	15.2
340	15.4
360	16.1
380	16.4
400	16.6
420	16.7
440	17.0
460	17.7
480	18.1
500	18.5
520	19.1
540	19.5
560	19.8
580	20.6
600	21.3
620	21.5
640	21.2
660	21.4
680	21.9
700	22.2
720	22.2
740	22.1
760	22.3
780	22.6
800	22.7
820	22.9
840	23.1
860	23.4
880	23.8
900	24.1
920	24.1

Frequency, MHz	Antenna Factor, dB(1/m)
940	24.0
960	24.1
980	24.5
1000	24.9
1020	25.0
1040	25.2
1060	25.4
1080	25.6
1100	25.7
1120	26.0
1140	26.4
1160	27.0
1180	27.0
1200	26.7
1220	26.5
1240	26.5
1260	26.5
1280	26.6
1300	27.0
1320	27.8
1340	28.3
1360	28.2
1380	27.9
1400	27.9
1420	27.9
1440	27.8
1460	27.8
1480	28.0
1500	28.5
1520	28.9
1540	29.6
1560	29.8
1580	29.6
1600	29.5
1620	29.3
1640	29.2
1660	29.4
1680	29.6
1700	29.8
1720	30.3
1740	30.8
1760	31.1
1780	31.0
1800	30.9
1820	30.7
1840	30.6
1860	30.6
1880	30.6
1900	30.6
1920	30.7
1940	30.9
1960	31.2
1980	31.6
2000	32.0

Antenna factor is to be added to receiver meter reading in dB(μV) to convert to field intensity in dB(μV/meter).

FCC ID: GSARDR

Passive RF/ID Basics

1.1 Introduction

Radio Frequency Identification (RFID) systems use radio frequency to identify, locate and track people, assets, and animals. Passive RFID systems are composed of three components – an interrogator (reader), a passive tag, and a host computer. The tag is composed of an antenna coil and a silicon chip that includes basic modulation circuitry and non-volatile memory. The tag is energized by a time-varying electromagnetic radio frequency (RF) wave that is transmitted by the reader. This RF signal is called a 'carrier signal'. When the RF field passes through an antenna coil, there is an AC voltage generated across the coil. This voltage is rectified to supply power to the tag. The information stored in the tag is transmitted back to the reader. This is often called backscattering. By detecting the backscattering signal, the information stored in the tag can be fully identified.

1.2 Definitions

1.2.1. Reader

Usually a microcontroller-based unit with a wound output coil, peak detector hardware, comparators, and firmware designed to transmit energy to a tag and read information back from it by detecting the backscatter modulation.

1.2.2. Tag

An RFID device incorporating a silicon memory chip (usually with on-board rectification bridge and other RF front-end devices), a wound or printed input/output coil, and (at lower frequencies) a tuning capacitor.

1.2.3. Carrier

A Radio Frequency (RF) sine wave generated by the reader to transmit energy to the tag and retrieve data from the tag. In these examples the ISO frequencies of 125 kHz and 13.56 MHz are assumed; higher frequencies are used for RFID tagging but the communication methods are somewhat different. 2.45 GHz, for example, uses a true RF link. 125 kHz and 13.56 MHz, utilize transformer-type electromagnetic coupling.

1.2.4. Modulation

Periodic fluctuations in the amplitude of the carrier, used to transmit data back from the tag to the reader.

Systems incorporating passive RFID tags operate in ways that may seem unusual to anyone who already understands RF or microwave systems. There is only one transmitter – the passive tag is not a transmitter or transponder in the purest definition of the term, yet bidirectional communication is taking place. The RF field generated by a tag reader (the energy transmitter) has three purposes:

1. **Induce enough power into the tag coil to energize the tag.** Passive tags have no battery or other power source; they must derive all power for operation from the reader field. 125 kHz and 13.56 MHz tag designs must operate over a vast dynamic range of carrier input, from the very near field (in the range of 200 VPP) to the maximum read distance (in the range of 5 VPP).
2. **Provide a synchronized clock source to the tag.** Most RFID tags divide the carrier frequency down to generate an on-board clock for state machines, counters, etc., and to derive the data transmission bit rate for data returned to the reader. Some tags, however, employ on-board oscillators for clock generation.
3. **Act as a carrier for return data from the tag.** Backscatter modulation requires the reader to peak-detect the tag's modulation of the reader's own carrier. See Section 1.4 for additional information on backscatter modulation.

1.3 System Handshake

Typical handshake of a tag and reader is as follows:

1. The reader continuously generates an RF carrier sine wave, watching always for modulation to occur. Detected modulation of the field would indicate the presence of a tag.
2. A tag enters the RF field generated by the reader. Once the tag has received sufficient energy to operate correctly, it divides down the carrier and begins clocking its data to an output transistor, which is normally connected across the coil inputs.
3. The tag's output transistor shunts the coil, sequentially corresponding to the data which is being clocked out of the memory array.
4. Shunting the coil causes a momentary fluctuation (dampening) of the carrier wave, which is seen as a slight change in amplitude of the carrier.
5. The reader peak-detects the amplitude-modulated data and processes the resulting bitstream according to the encoding and data modulation methods used.

1.4 Backscatter Modulation

This terminology refers to the communication method used by a passive RFID tag to send data back to the reader. By repeatedly shunting the tag coil through a transistor, the tag can cause slight fluctuations in the reader's RF carrier amplitude. The RF link behaves essentially as a transformer; as the secondary winding (tag coil) is momentarily shunted, the primary winding (reader coil) experiences a momentary voltage drop. The reader must peak-detect this data at about 60 dB down (about 100 mV riding on a 100V sine wave) as shown below:

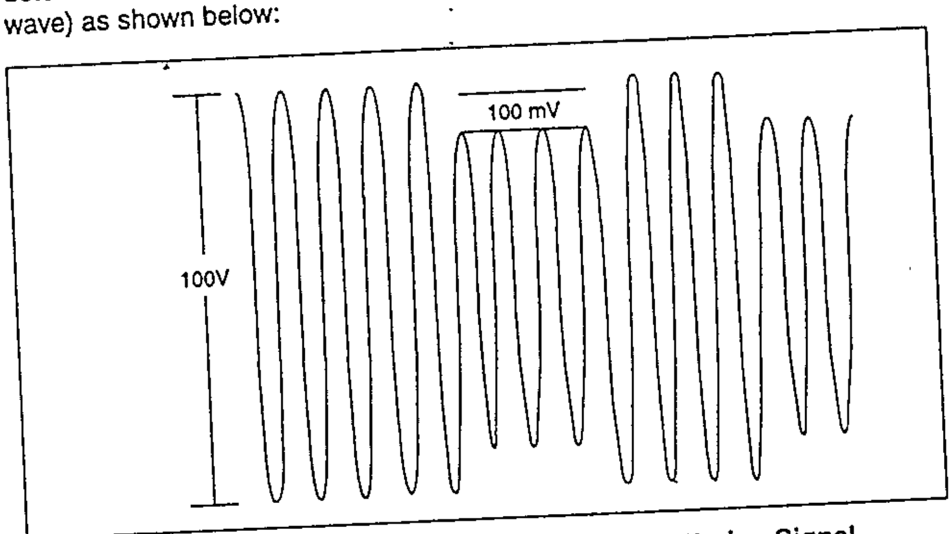


Figure 1.1: Amplitude – Modulated Backscattering Signal

This amplitude-modulation loading of the reader's transmitted field provides a communication path back to the reader. The data bits can then be encoded or further modulated in a number of ways.

1.5 Data Encoding

Data encoding refers to processing or altering the data bitstream in-between the time it is retrieved from the RFID chip's data array and its transmission back to the reader. The various encoding algorithms affect error recovery, cost of implementation, bandwidth, synchronization capability, and other aspects of the system design. Entire textbooks are written on the subject, but there are several popular methods used in RFID tagging today:

1. **NRZ (Non-Return to Zero) Direct.** In this method no data encoding is done at all; the 1's and 0's are clocked from the data array directly to the output transistor. A low in the peak-detected modulation is a '0' and a high is a '1'.
2. **Differential Biphase.** Several different forms of differential biphase are used, but in general the bitstream being clocked out of the data array is modified so that a transition always occurs on every clock edge, and 1's and 0's are distinguished by the transitions within the middle of the clock period. This method is used to embed clocking information to help synchronize the reader to the bitstream; and because it always has a transition at a clock edge, it inherently provides some error correction capability. Any clock edge that does not contain a transition in the data stream is in error and can be used to reconstruct the data.
3. **Biphase_L (Manchester).** This is a variation of biphase encoding, in which there is not always a transition at the clock edge.

FCC requirements § 2.1033 (b)(6)

TEST MEASUREMENT REPORT

Contains 26 pages and follows this page.