

62624-KRQ/EMC 98-4246

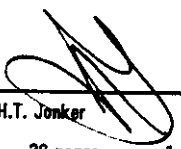
FCC measurements performed on an anti-shoplifting
system, manufactured by Dialog ID Technology,
type LX

FCC ID: KX2LX002

Arnhem, March, 1998

Author H.T. Jonker

By order of Dialog ID Technology B.V. at Harderwijk, The Netherlands

author : H.T. Jonker 

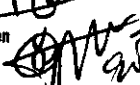
B

28 pages

1 annex

MWE

reviewed : R. Venhuizen 

approved : A.T. van der Meijden 

28/04/17

CONTENTS

	page
1 CONCLUSION	6
2 GENERAL INFORMATION	7
2.1 Product Description	7
2.2 Photographs of the tested system	7
2.3 Test Methodology	7
2.4 Test Facility	7
3 PRODUCT LABELING	8
4 SYSTEM TEST CONFIGURATION	9
4.1 Justification	9
4.2 Configuration of Tested System	9
4.2.1 Equipment under test	9
4.2.2 Power supply	9
4.2.3 Frequency range and X-tal information	10
5 CIRCUIT DIAGRAM(S) OF EQUIPMENT	11
6 GENERAL INFORMATION	12
6.1 Client information	12
6.2 Test data	12
7 CONDUCTED & RADIATED MEASUREMENT PHOTOS	13
7.1 Conducted emission measurement setup	13
7.2 Radiated emission measurement setup (OATS)	14
8 CONDUCTED EMISSION DATA	16
8.1 Test procedure	16
8.2 Test Instrumentation Used for Conducted Measurements	16
8.3 Measured data (mains conducted disturbance voltage)	17
9 RADIATED EMISSION DATA (E-field > 30 MHz)	18
9.1 Test Procedure	18
9.2 Field Strength Calculation	19
9.3 Test Instruments Used for Radiated Measurements	19
9.4 Radiated electromagnetic field strength results	20



photo 4, measurement setup during the H-field emission measurements at 10 meter

8 CONDUCTED EMISSION DATA

8.1 Test procedure

In accordance with § 15.207 the conducted radio frequency disturbance voltages between each of the power lines (live, neutral) and the ground terminal were determined over the frequency range from 450 kHz to 30 MHz. The AC power line conducted emission measurements were performed at the line voltage of 120 V_{ac} and at the power frequency of 60 Hz. Measurements were performed at the AC powerport of the adapter.

The measurement shall show compliance of this (class B) intentional radiator with the conducted limit of 250 μ V (48 dB μ V).

The (floor standing) test set-up was in accordance with the requirements of ANSI C63.4-1992.

The initial step in collecting conducted data is a peak scan measurement over the frequency range of interest. Significant peaks are then marked, and these signals are then quasi-peaked. This procedure is implemented in the utilised test receiver by the incorporated EMI software. The test receiver used also meets the requirement as mentioned in § 15.35 "Measurement detector functions and bandwidths". The test receiver employs a CISPR quasi-peak detector function with a bandwidth of 9 - 10 kHz.

8.2 Test Instrumentation Used for Conducted Measurements

EMI Equipment	Type	Manufacturer	Serial no.	ORS No.	Cal interval
Spectrum analyzer	R3381A	Advantest		078274	yearly (08-98)
LISN (4 x 10 A)	NSLK 8127	Schwarzbeck	8127128	078088	yearly (05-98)
EMI test receiver	ESHS 10	Rohde & Schwarz	840048/009	077989	yearly (07-98)

Note : The Object Registration Number (ORS) is a unique number within the KEMA quality system, which identifies the equipment.

10	RADIATED EMISSION DATA (H-field <30 MHz)	21
10.1	Test Procedure	21
10.2	Field Strength Calculation	22
10.3	Test Instruments Used for H-field Radiated Measurements	22
10.4	Radiated magnetic field strength	23
10.4.1	Results during sweep off mode	24
10.4.2	Results during sweep mode	25
ANNEX A	BANDWIDTH PLOTS	26

3 PRODUCT LABELING

The product labelling information will be send to the commission by Dialoc ID technology separately.

2 GENERAL INFORMATION

2.1 Product Description

The product description will be send to the commission by Dialoc ID technology separately.

2.2 Photographs of the tested system

The photographs of the tested system will be send to the commission by Dialoc ID technology separately.

2.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures as mentioned in section 15.207, section 209 and section 15.223 of 47CFR, Part 15 subpart C.

According to section 15.201 this type of device shall be classified as an intentional radiator and thus is subject to Certification. The measurements were performed in accordance with the test methodology of section 13 of ANSI C63.4-1992.

2.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated and conducted measurement data are located at the premises of KEMA Nederland B.V., Utrechtseweg 310, in Arnhem, The Netherlands. The FCC has per Public Notice declared this measurement facility had been reviewed and to be in compliance with the requirements of Section 2.948 of the FCC Rules. It was accepted by letter with accreditation number 31040/SIT; 1300F2, dated January 13 1998.

4.2.3 Frequency range and X-tal information

center frequency : 8,2 MHz
modulation type : FM
frequency sweep : $\pm$ 300 kHz
modulation f : 82 Hz

μ -controller : PIC 16c57
frequency : 8 MHz
Manufacturer : Microchip

4 SYSTEM TEST CONFIGURATION

4.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it).

The tested system was configured with a transmitting antenna (Tx) and a receiving antenna (Rx). The tested system is powered by means of a $120V_{ac}/24V_{dc}$ adapter. ✓

The transmitter was operating at a centre frequency of 8,2 MHz. The modulation frequency is 82 Hz and is swept from 7,9-8,5 MHz. The frequency sweep is ± 300 kHz. The LX system was configured as a floorstanding equipment during the measurements.

The RF output power of the transmitter was calibrated by the manufacturer to the nominal working transmitting power (50% of the maximum power, $20V_{pp}$ antenna signal).

4.2 Configuration of Tested System

4.2.1 Equipment under test

Device	: anti-shoplifting system
Trade mark	: DIALOC
Type	: LX
Serial number	: 6900001
FCC ID	: KX2 LX002
Power supply	: $120V_{ac}/24V_{dc}$ adapter
Enclosure	: plastic/metal
Interface cabling	: not applicable
Shield termination	: not applicable

4.2.2 Power supply

Device	: Power adapter
Trade mark	: Phihong Enterprise
Type	: PSA-242
P dissipation	: 500 mA
Rating	: $120V_{ac}/24V_{dc}$ adapter
Power supply wire	: 2-wires unshielded cable

6 GENERAL INFORMATION

6.1 Client information

Manufacturer : Dialoc ID technology B.V.
Address : Galvanistraat 24
Postcode : 3846 AT
Place : Harderwijk
Country : The Netherlands

Applicant : Dialoc B.V.
Contact person : Mr. H. Batterink
Telephone : +31 0341 - 420940
Fax : +31 0341 - 425033
Address : Galvanistraat 24
Postal code : 3846 AT
Place : Harderwijk
Country : The Netherlands

6.2 Test data and place of measurement

Test location : KEMA Registered Quality Nederland B.V., The Netherlands
Address : Utrechtseweg 310
Postal code : 6812 AR
Place : Arnhem
Site ID : 31040/SIT
Country : The Netherlands
Date of tests : July and August 1996, April 1998
Test engineer : Mr. A.J. Werner
Mr. H.T. Jonker

5 CIRCUIT DIAGRAMS OF EQUIPMENT

The circuit diagrams will be send to the commission by Dialoc ID technology separately.

9 RADIATED EMISSION DATA (E-field > 30 MHz)

9.1 Test Procedure

In accordance with § 15.209 the field strength levels of radiated emissions above 30 MHz from this intentional radiator at a distance of 3 meters were determined over the frequency range from 30 MHz up to 1000 MHz. The measurement shall show compliance of this intentional radiator. The test set-up was in accordance with the requirements of ANSI C63.4-1992.

Preliminary radiation measurements were performed in a compact anechoic room at a 3 meter test distance. The investigated frequency range from 30 MHz to 1000 MHz was scanned with the aid of the automatic test receiver ESVS10. This receiver automatically calculates the resulting field strength using the entered correction factor for cable loss and antenna factor. The resulting radiation levels are plotted.

Radiation scans were made for various angles of the set-up with respect to the antenna and also for vertical as well as for horizontal antenna polarizations. As a result of the preliminary scans a list remains with frequencies at which relevant spurious radiation levels were detected.

The final measurements in the frequency range 30 - 1000 MHz were performed on the open area test site (OATS) as authorized by the FCC. At those frequencies where significant levels were detected in the compact anechoic room measurements were made on the open field to determine the actual field strength levels. At the open area test site the test receiver, type ESV make Rohde & Schwarz, is used for determining the levels. This receiver automatically selects the quasi-peak detector function with a bandwidth of 120 kHz when switched to the CISPR weighing mode. Signals in the frequency range 30 - 300 MHz were measured using the biconical antenna and signal levels in the frequency range 300 - 1000 MHz were determined with aid of the logperiodic antenna.

The antennas were oriented both for vertical and horizontal polarizations. At each frequency at which a spurious component is present the receiving antenna is raised and lowered through the range of heights of 1 to 4 meter and the table with the test set-up is rotated through 360° in the horizontal plane to ensure maximum signal reception by the receiver.

The data presented in clause 9.4 lists the significant emission frequencies, measured levels, correction factor (includes cable correction and antenna factors), the corrected reading, plus the limit. An explanation of the Correction Factor is given in paragraph 9.2.

8.3 Measured data (mains conducted disturbance voltage)

Standard : FCC part 15 Subpart B
 Port : 120V_{ac}/60Hz mains adapter
 Limits :

Frequency [MHz]	Limit Qp [dB(μV)]
0,45 - 30	48

Operation mode: sweep mode

Results :

Frequency [MHz]	Line/Neutral	Level Qp [dB(μV)]
0,56	N	37
0,84	N	37
1,15	N	37
1,43	N	36
1,45	N	36
1,84	N	25
3,75	N	17
7,92	N	33
8,00	L	25
8,19	L	25
8,49	L	26
14,24	L	20
19,92	L	31

Measurement uncertainty: ± 2 dB

Note 1 : "Qp" are levels and limits referring to measurements with the quasi-peak detector.

Note 2 : The class A emission limits (section 15.107) are (also) allowed for any digital circuitry in the EUT which does not directly enable the transmitter.

Conclusion : Pass (margin 11 dB)

Test personnel:

Tester Signature :



9.4 Radiated electromagnetic field strength results

Standard : FCC part 15 Subpart C

Limits : Measurement distance of 3 m

Frequency [MHz]	Limit Qp [μ V/m]	Limit Qp [dB(μ V/m)]
30 - 88	100	40
88 - 216	150	43,5
216 - 960	200	46
>960	500	54

Prescan results : No significant emissions could be measured above 150 MHz

Final Results :

Frequency [MHz]	Measurement result	Correction factor [dB]	Polarisation [hor./vert.]	Level Qp [dB(μ V/m)]
40,45	13,0	14,5	V	27,5
60,0	18,0	10,0	V	28,0
66,0	18,0	10,0	V	28,0
146,3	19,5	16,5	H	36,0

Measurement uncertainty: ± 3 dB

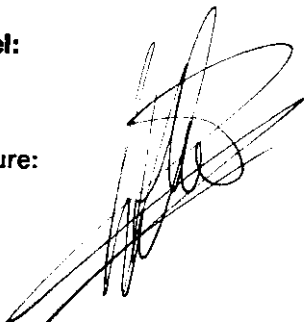
Note 1 : All readings are quasi-peak values using a quasi-peak bandwidth of 120 kHz

Note 2 : The class A emission limits (section 15.109) are allowed for any digital circuitry in the EUT which does not directly enable the transmitter.

Conclusion : Pass (margin is 7,5 dB).

Test personnel:

Tester Signature:



9.2 Field Strength Calculation

The final field strength is calculated by adding the Antenna Factor and Cable Factor to the reading on the test receiver. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - (G)$$

where:

FS = Field strength

RA = Receiver amplitude

AF = Antenna factor

CF = Cable attenuation factor

G = Pre-amplifier gain (used in frequency range 1 - 2 GHz)

Example of calculating the field strength level:

Assume the receiver reading of 26.0 dB μ V at a frequency of 113.6 MHz as obtained for the system with the bus-clock set at 66 MHz:

Measuring value, RA: 26.0 dB(μ V)

Antenna factor, AF: 13.0 (dB/m)

Cable factor, CF: 1.1 (dB)

Thus resulting in a

Field strength, FS: 40.1 dB(μ V/m)

The Correction Factor mentioned in the result tables of clause 9.4 comprises the Antenna factor AF and the Cable attenuation factor CF.

9.3 Test Instruments Used for Radiated Measurements

EMI Equipment	Type	Manufacturer	Serial no.	ORS No.	Cal interval
EMI Test receiver	ESV	Rohde & Schwarz	872148/016	067254	yearly (05-98)
EMI test receiver	ESVS 10	Rohde & Schwarz	827864/001	078086	yearly (09-98)
Biconical antenna	3110	EMCO	1076	078268	yearly (09-98)
Logper antenna	3146	EMCO	9111-3294	074650	yearly (09-98)

10.2 Field Strength Calculation

The field strength is calculated automatically by the EMI-receiver in combination with the active loop antenna by means of a hardware plug (20 dB linear over the range 1 - 30 MHz).

The bandwidth of the sweep which is used by the device is 600 kHz and is less than 10 % of the center frequency.

In accordance with section 15.223(a) of 47 CFR the limit in the band 1.705-10 MHz shall be the sweep of the device (600 kHz) divided by the center frequency (8,2 MHz). So the limit is $73,2 \mu\text{V/m}$ at 30 meters ($37,3 \text{ dB}\mu\text{V/m}$) ✓

10.3 Test Instruments Used for H-field Radiated Measurements

EMI Equipment	Type	Manufacturer	Serial no.	ORS No.	Cal interval
EMI Test receiver	ESHS 10	Rhode & Schwarz	840046/009	077989	yearly (07-98)
EMI Test receiver	ESH2	Rohde & Schwarz	872316/018	067222	yearly (05-98)
Active loop antenna	HFH-Z2	Rohde & Schwarz	335471152	067219	yearly (09-98)

10 RADIATED EMISSION DATA (H-field < 30 MHz)**10.1 Test Procedure**

In accordance with section 15.209 and section 15.223 the magnetic field strength levels of radiated emissions < 30 MHz from this intentional radiator at a distance of 3 and 10 meters were determined over the frequency range from 0,009 MHz up to 30 MHz. The measurement shall show compliance of this intentional radiator. The test set-up was in accordance with the requirements of section 13 of ANSI C63.4-1992.

Preliminary radiation measurements were performed in a compact anechoic room using the active loop antenna, in accordance with section 8.2.1 of ANSI C63-4, at a 3 meter test distance. First a bandwidth plot using the peak-detector was drawn of the sweep fundamental frequency at 8,2 MHz. See annex A for results.

The results of the preliminary measurements were used for the final measurements at the OATS. A conducting ground plane was present. Both the fundamental and the spurious emissions were measured.

In accordance with section 13.1.1 of ANSI C63-4 the frequency was stopped at the middle of the operation frequency range and set on 8,2 MHz. Measurements were also performed during sweep mode.)

In accordance with section 15.223, measurements in band 1.705 - 10 MHz were performed employing both the average- and the peak- detector. The peak limit is calculated by adding 20 dB to the average limit (section 15.35(b) of 47CFR part 15).

The RF output power of the transmitter was calibrated by the manufacturer at the nominal operating power (50% of the maximum power, 20V_{pp} antenna signal).

The data presented in clause 10.4 lists the significant emission frequencies and measured levels.

10.4.1 Results during sweep off mode

Final Results : at 3 meter

frequency [MHz]	Result QP [dB(μV/m)]	Result AV [dB(μV/m)]	Result Peak [dB(μV/m)]
8,203	54	54	57
16,399	44,5	44,5	46
24,605	45,5	45	48

Final Results : at 10 meter

frequency [MHz]	Result QP [dB(μV/m)]	Result AV [dB(μV/m)]	Result Peak [dB(μV/m)]	Limit QP [dB(μV/m)]	Limit AV [dB(μV/m)]	limit Peak [dB(μV/m)]
8,203	51	51	54	-	57,3 ✓	77,3 ✓
16,399	37,5	37	44	49,5 ✓	-	-
24,605	37	37	44	49,5 ✓	-	-

Conclusion : Pass

Test personnel:

Tester Signature:



Name : H.T. Jonker

10.4 Radiated magnetic field strength

Standard : FCC part 15 Subpart C section 15.209 and 15.223

Limits : Distance of 30 m

frequency [MHz] ²⁾	Limit [μ V/m] Quasi-peak	Limit [μ V/m] Average	Limit [μ V/m] Peak	Limit [dB(μ V/m)] Quasi-peak	Limit [dB(μ V/m)] Average	Limit [dB(μ V/m)] Peak
0,09 - 0,49	2400/f for 300m	-	-	calculation	-	-
0,49 - 1,705	24000/f for 30m	-	-	calculation	-	-
1,705-10,0	-	73,2 ¹⁾	732 ¹⁾		37,3 ¹⁾	57,3 ¹⁾
10,0 -30,0	30	-	-	29,5		

¹⁾ Calculated limit, see paragraph 10.2.

²⁾ See section 15.221, 15.225 and section 15.227 for specific emission requirements within the bands 225-1705 kHz, 13.553-13.567 MHz and 26.96-27.28 MHz.

Limits : Distance of 10 m

In accordance with section 15.31 f(2) of 47CFR part 15 the square of an inverse linear distance extrapolation factor (40 dB/decade) was used to calculate the limit at 10 meter measuring distance.

frequency [MHz]	Limit [dB(μ V/m)] Quasi-peak	Limit [dB(μ V/m)] Average	Limit [dB(μ V/m)] Peak
1,705-10,0	-	57,3 ¹⁾	77,3 ¹⁾
10,0 -30,0	49,5	-	-

¹⁾ Calculated limit, see paragraph 10.2.

BANDWIDTH PLOTS

The next two pages show the bandwidth plots of the operating LX system.

10.4.2 Results during sweep mode

Final Results : at 3 meter

frequency [MHz]	Result QP [dB(μV/m)]	Result AV [dB(μV/m)]	Result Peak [dB(μV/m)]
7,888	53,5	27	58
8,473	52,5	28	57,5
15,758	42	23	47
16,949	44,5	24	52
23,643	46	24	48
25,427	44	22	48

Final Results : at 10 meter

frequency [MHz]	Result QP [dB(μV/m)]	Result AV [dB(μV/m)]	Result Peak [dB(μV/m)]	Limit QP [dB(μV/m)]	Limit AV [dB(μV/m)]	limit Peak [dB(μV/m)]
7,888	50	25	51	-	57,3	77,3
8,473	48	32	54	-	57,3	77,3
15,758	33	21	42	49,5	-	-
16,949	36	22	43	49,5	-	-
23,643	43	22	51	49,5	-	-
25,427	35	< 20	42	49,5	-	-

Conclusion : Pass

Test personnel:

Tester Signature:

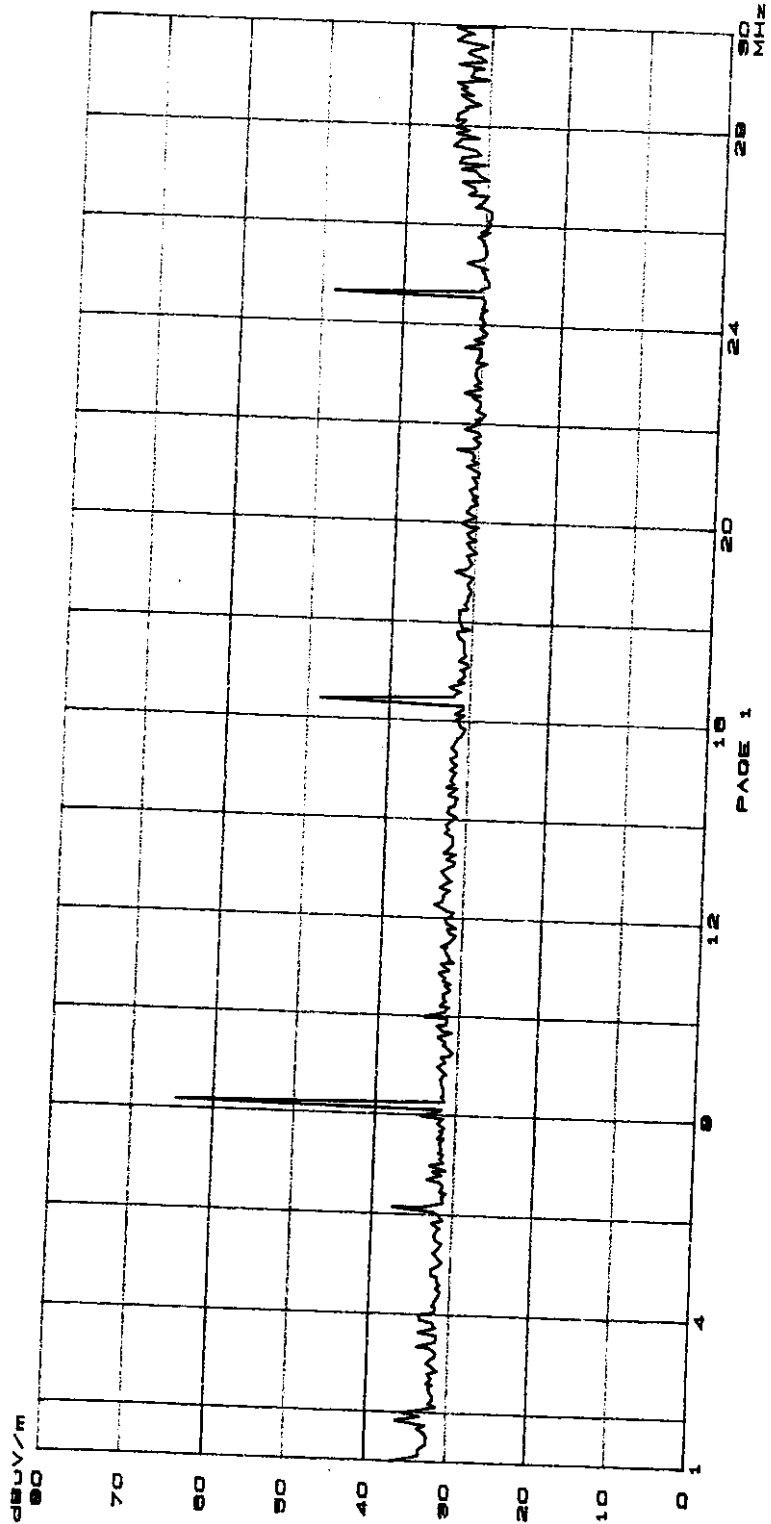
Name : H.T. Jonker

6262400 DIALOC ID Technology H-field pre-measurements 3 m

02. APR 98 11.03

EUT.
Manuf.
Op Cond.
Operator.
Test Spec.
Comments.
ANTI-SHOP LIFTING SYSTEM TYPE LX
DIALOC
NOMINAL OPERATING POWER 20VPP SWEEP OFF
470GR Part13(C) ANSIC08-4
Sweep with plot fundamental + SPURIOUS
SWEEP OFF

Scan Settings (1 Range)
Sweep 30M
IF 10K
Detector PK
Receiver Settings
M-Time 100ms
Auto LN OFF
Sweep 6000



02. Apr 98 10:29

6262400 DIALOC ID Technology H-field pre-measurements 3 m

EUT:
Manuf:
Op Cond:
Operator:
Test Spec:
Comment:
ANTI-SHOP LIFTING SYSTEM TYPE LX
DIALOC
NOMINAL OPERATING POWER 20VPP
470KR Per1500 ANSIC08-4
Bandwidth plot fundamental
sweep 600 kHz

Scan Settings: 1 Range: 100V
Start: 7M
Stop: 9.5K
IF BW: 10K
DeMod: 10K
Recal: 100V
Y-axis: 100V
X-axis: 100V
Time: 100V
Auto: 100V
Lock: 100V
000000

