



HERMON LABORATORIES



Electrical

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RADIO TEST REPORT

ACCORDING TO 47 CFR Part 15 SUBPART C §15.231, §15.205, §15.209 and SUBPART B
for

VISONIC Ltd.

EQUIPMENT UNDER TEST:

Personal security transmitter

Model: MDT-122 (433.92)

Approved by: _____

Mr. Arick Elshtein, International Standards Department Manager
Visonic Ltd.

This report is in conformity with ISO/IEC 17025. The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation.
The test results relate only to the items tested. **This test report must not be reproduced in any form except in full with the approval of Hermon Laboratories Ltd.**

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1 Project information

Description of equipment under test

Test item	: Personal security transmitter
Manufacturer	: Visonic Ltd.
Type (Model)	: MDT-122 (433.92)
Equipment FCC code ¹	: DSC

Applicant information

Applicant's responsible person	: Mr. Arick Elshtein, International Standards Department Manager
Company	: Visonic Ltd.
Address	: 27, Habarzel street
City	: Tel Aviv
Postal code	: 69710
Country	: Israel
Telephone number	: +972 3645 6714
Telefax number	: +972 3645 6891

Test performance

Project number:	: 15421
Location	: Hermon Laboratories
Receipt date	: January 23, 2003
Test performed	: March 20, 2003
Purpose of test	: Apparatus compliance verification in accordance with emission requirements
Test specifications	: 47CFR Part 15, subpart C, §15.231, §15.205, §15.209, and subpart B §15.109

¹ FCC Equipment codes – see Appendix E



2 Summary of tests and requirements

Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
Transmitter characteristics, §15.231								
Periodic operation	15.231(a)	X				Refer to Operational Description		
Bandwidth of emission	15.231(c)	X				Mrs. E. Pitt, test engineer	March 19, 2003	
Field strength of fundamental	15.231(b)(2)	X				Mrs. E. Pitt, test engineer	March 19, 2003	
Field strength of spurious radiation	15.231(b)(3)	X				Mrs. E. Pitt, test engineer	March 19, 2003	
						Mr. M. Feldman, test engineer	March 3, 2003	
Conducted emissions	15.207(a)				X			
Unintentional radiation, §15.107, §15.109								
Conducted emissions	15.107				X			
Radiated emissions	15.109	X				Mrs. E. Pitt, test engineer	March 20, 2003	
General conditions under §15.231, Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz								
The intentional radiator does not operate in the restricted bands of operation.	15.205	X						
The intentional radiator has permanently attached antenna or antenna that uses a unique coupling to the intentional radiator.	15.203	X				Refer to Operational Description		
No antenna other than that furnished by the responsible party can be used with the device.	15.203	X						
The intentional radiator has no standard antenna jack or electrical connector.	15.203	X				This requirement does not apply to intentional radiators that must be professionally installed		
The intentional radiator must be professionally installed.	15.203				X			
The Intentional radiator operates at 433.92 MHz.	15.231 (a)	X						
Intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc.	15.231 (a)	X				Refer to Installation instructions		



Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
Radio control of toys is not permitted.	15.231 (a)	X						Refer to Installation instructions
Continuous transmissions, such as voice or video, and data transmissions are not permitted.	15.231 (a)	X						Refer to Installation instructions
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	15.231 (a) (1)	X						
A transmitter activated automatically shall cease transmission within 5 seconds after activation.	15.231 (a) (2)	X						
Periodic transmissions at regular predetermined intervals are not permitted.	15.231 (a) (3)	X						Refer to Operational Description
The intentional radiator polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.	15.231 (a) (3)	X						Refer to Installation instructions
The intentional radiators, employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.	15.231 (a) (4)	X						Refer to Installation instructions
NOTE: C: The parameter is compliant with the requirements. NC: The parameter is not compliant with the requirements. NT: The parameter is not tested. NA: The test of this parameter is not applicable.								

Test report prepared by: Ms. N. Averin, MA, certification engineer

Test report approved by: Mr. M. Nikishin, MSc, EMC group leader

Mr. E. Usoskin, PhD, CEO



3 EUT description

3.1 General description

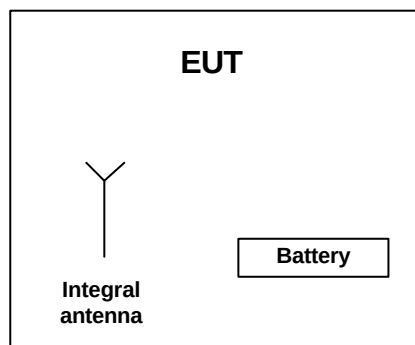
The EUT, MDT-122 (433.92), is a personal security transmitter, which includes RFT-3A module operating at 433.92 MHz.

The device is powered by 3.6 V DC lithium battery.

3.2 EUT test configuration

Test configuration is provided in Figure 3.2.1.

Figure 3.2.1
EUT test configuration





3.3 Transmitter description

Operating frequency:		433.92 MHz	
Maximum rated output power			
At transmitter permanent external 50Ω RF output connector (dBm)		NA	
Effective radiated power (for equipment with integral antenna) (dBm)		-16	
Transmitter duty cycle (worst case)			
Tx on (seconds)		0.067	
Tx off (seconds)		0.033	
Modulation			
	Amplitude		
	Frequency		
X	Other (specify): ASK (ON/OFF KEYING)		
Can the transmitter be operated without modulation		yes	X no
Transmitter power source			
X	Battery	Nominal rated voltage (VDC)	3.6
	Nickel Cadmium		
X	Lithium		
	Other:		
	DC	Nominal rated voltage (VDC)	
	AC mains	Nominal rated voltage (VAC)	
Antenna type			
X	Integral		
	External		
Type of antenna jack¹ - NA			
	standard	connector type	Male Female
	unique	connector type	Male Female

¹ Standard antenna jack use is prohibited excluding devices, which must be professionally installed.



4 Test results

4.1 Bandwidth of emission according to § 15.231 (c)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
DATE: March 19, 2003
RELATIVE HUMIDITY: 56%
AMBIENT TEMPERATURE: 22°C
AIR PRESSURE: 1008 hPa
MODULATION: ON
DETECTOR USED: PEAK

Carrier frequency MHz	Occupied bandwidth, kHz	Reference to plot in Appendix A
433.92	393	A1
Measurement uncertainty, ppm	0.2	

TEST EQUIPMENT USED:

HL 0032	HL 0038	HL 0415	HL 0812	HL 1430		
---------	---------	---------	---------	---------	--	--

LIMIT (§ 15.231 (c))

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

For 433.92 MHz carrier frequency the specified limit is 1.08 MHz

TEST PROCEDURE

The spectrum trace data around transmitter fundamental frequency was obtained with the spectrum analyzer in "Max Hold" mode. The bandwidth value was determined between two points 20 dBc from the peak of modulated carrier.



4.2 Field strength of fundamental, § 15.231

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.5
DATE: March 19, 2003
RELATIVE HUMIDITY: 56%
AMBIENT TEMPERATURE: 22°C
AIR PRESSURE: 1008 hPa
SITE DESCRIPTION: OATS
TEST DISTANCE: 3 m
MODULATION: ON
DETECTOR USED: PEAK

	§ 15.231 (b)	§ 15.231 (e)
The EUT complies with the requirements of	X	

Peak detector

Frequency, MHz	Measured field strength, dB(uV/m)	Specification limit, dB(uV/m)	Margin, dB	Reference to plot in Appendix A
433.963	79.06	100.83	21.77	A2
Measurement uncertainty, dB		± 5.3 dB		

Peak detector + average factor

Frequency, MHz	Measured field strength, dB(uV/m)	Average factor, dB	Calculated result, dB(uV/m)	Specification limit, dB(uV/m)	Margin, dB	Reference to plot in Appendix A
433.963	79.06	-3.5	75.56	80.83	5.27	A2
Measurement uncertainty, dB		± 5.3 dB				

4.2.1 Average factor calculation, §15.35

Tx ON	Duty cycle	Average factor	Reference to plot in Appendix A
66.7	0.667	-3.5	A3

TEST EQUIPMENT USED:

HL 0034	HL 0038	HL 0415	HL 0812	HL 1430		
---------	---------	---------	---------	---------	--	--

LIMIT § 15.231 (b)

Fundamental frequency, MHz	Field strength of fundamental, mV/m @ 3 m
260 – 470	3,750 to 12,500

The specified average limit for 433.92 MHz frequency is 80.83 dB(μV/m)

The specified peak limit for 433.92 MHz frequency is 100.83 dB(μV/m)

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height turntable in each of three orthogonal planes in turn. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antenna polarization was changed from vertical to horizontal.



4.3 Field strength of spurious radiation, § 15.231, § 15.205

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.4
TEST DISTANCE: 3 m
TEST PERFORMED AT FIELD STRENGTH: 79.06 dB(μV/m)
MODULATION: ON
DETECTOR USED: PEAK

9 kHz – 30 MHz range

TEST PERFORMED IN: ANECHOIC CHAMBER
DATE: March 19, 2003
RELATIVE HUMIDITY: 56%
AMBIENT TEMPERATURE: 22°C
AIR PRESSURE: 1008 hPa
ANTENNA TYPE: LOOP

Frequency, MHz	Radiated emission level	Reference to plot in Appendix A
0.009 – 0.15	No spurious emissions were found.	A4
0.15 - 30	No spurious emissions were found.	A5
Measurement uncertainty	± 6.0 dB	

TEST EQUIPMENT USED:

HL 0446	HL 0465	HL 1425	HL 1553	HL 1566			
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**30 – 1000 MHz range**

TEST PERFORMED IN:

ANECHOIC CHAMBER (PRELIMINARY),
OATS (FINAL)

DATE:

March 19, 2003

RELATIVE HUMIDITY:

56%

AMBIENT TEMPERATURE:

22°C

AIR PRESSURE:

1008 hPa

ANTENNA TYPE:

BICONILOG, LOG PERIODIC

Peak detector

Frequency, MHz	RBW, kHz	VBW, kHz	Ant. pol.	Ant. hgt., m	TT pos., (°)	Measured radiated emission, dB(μV/m)	Specification limit, dB(μV/m)	Margin, dB	Reference to plot in Appendix A
867.93	120	300	H	1.0	0	39.19	80.83	41.64	A7
Measurement uncertainty						± 5.3 dB (horizontal polarization) ± 6.0 dB (vertical polarization)			

Peak detector + average factor

Frequency, MHz	RBW, kHz	VBW, kHz	Ant. pol.	Ant. hgt., m	TT pos., (°)	Calculated radiated emission*, dB(μV/m)	Specification limit, dB(μV/m)	Margin, dB	Reference to plot in Appendix A
867.93	120	300	H	1.0	0	35.69	60.83	25.14	A7
Measurement uncertainty						± 5.3 dB (horizontal polarization) ± 6.0 dB (vertical polarization)			

* Radiated emission value was calculated: Peak value + Average factor (= -3.5 dB)

Table calculations and abbreviations:

RBW = resolution bandwidth
VBW = video bandwidth
Ant. pol. = antenna polarization (H-horizontal)
Ant. hgt. = antenna height
TT pos. = turntable position in degrees, (EUT front panel = 0°)
Margin = dB below (negative if above) specification limit

TEST EQUIPMENT USED:

HL 0034	HL 0038	HL 0415	HL 0465	HL 0521	HL 0589	HL 0592	HL 0593
HL 0594	HL 0604	HL 0812	HL 1004	HL 1430			

**1000 – 5000 MHz range**

TEST PERFORMED IN:	ANECHOIC CHAMBER
DATE:	March 3, 2003
RELATIVE HUMIDITY:	52%
AMBIENT TEMPERATURE:	22°C
AIR PRESSURE:	1007 hPa
ANTENNA TYPE:	DOUBLE RIDGED GUIDE

Peak detector

Frequency, MHz	RBW, MHz	VBW, MHz	Ant. pol.	Ant. hgt., m	TT pos., (°)	Measured radiated emission, dB(μV/m)	Specification limit, dB(μV/m)	Margin, dB	Reference to plot in Appendix A
1301.94*	1	3	H	1.0	0	34.95	74.00	39.05	A8
Measurement uncertainty						± 5.3 dB (horizontal polarization) ± 6.0 dB (vertical polarization)			

Peak detector + average factor

Frequency, MHz	RBW, MHz	VBW, MHz	Ant. pol.	Ant. hgt., m	TT pos., (°)	Calculated radiated emission**, dB(μV/m)	Specification limit, dB(μV/m)	Margin, dB	Reference to plot in Appendix A
1301.94*	1	3	H	1.0	0	31.45	54.00	22.55	A8
Measurement uncertainty						± 5.3 dB (horizontal polarization) ± 6.0 dB (vertical polarization)			

* Falls into restricted bands

** Radiated emission value was calculated: Peak value + Average factor (= -3.5 dB)

Table calculations and abbreviations:

RBW	= resolution bandwidth
VBW	= video bandwidth
Ant. pol.	= antenna polarization (H-horizontal)
Ant. hgt.	= antenna height
TT pos.	= turntable position in degrees, (EUT front panel = 0°)
Margin	= dB below (negative if above) specification limit

TEST EQUIPMENT USED:

HL 0465	HL 1424	HL 1425	HL 1942	HL 1984			
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**LIMIT § 15.231 (b)**

Fundamental frequency, MHz	Field strength of harmonics, dB(μV/m) @ 3 m
433.92	60.83

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height turntable in each of three orthogonal planes in turn.

9 kHz – 30 MHz range

The measurements were performed in the anechoic chamber at 3m test distance. The loop antenna was positioned with its plane vertical. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis.

30 – 1000 MHz range

Preliminary measurements were performed in the anechoic chamber at 3m test distance. Final measurements (harmonic emissions) were made at the open field test site at 3m test distance. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

1 – 5 GHz range

The measurements were performed in the anechoic chamber at 3m test distance. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.



4.4 Unintentional radiated emissions test, §15.109

METHOD OF MEASUREMENT: ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
TEST PERFORMED IN: ANECHOIC CHAMBER
DATE: March 20, 2003
RELATIVE HUMIDITY: 54%
AMBIENT TEMPERATURE: 22°C
AIR PRESSURE: 1007 hPa
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
THE EUT WAS TESTED AS: TABLE-TOP
FREQUENCY RANGE: 30 MHz – 2 GHz
DETECTOR TYPE: PEAK
RESOLUTION BANDWIDTH: 120 kHz below 1 GHz, 1 MHz above 1 GHz

The EUT highest used frequency (including operating frequency), MHz	Upper frequency of measurement range, MHz
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

Frequency, MHz	Radiated emission level	Reference to plot in Appendix A
30 - 200	All emissions measured in standby mode were found below the limit	A10
200 - 1000	All emissions measured in standby mode were found below the limit	A11
1000 - 2000	All emissions measured in standby mode were found below the limit	A12
Measurement uncertainty	± 5.3 dB (horizontal polarization) ± 6.0 dB (vertical polarization)	

TEST EQUIPMENT USED:

HL 0032	HL 0034	HL 0038	HL 0041	HL 0465	HL 1424	HL 1425	HL 1553
HL 1566							

LIMIT § 15.109

Frequency, MHz	Class B equipment @ 3 m dB(μV/m)
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - 2000	54

TEST PROCEDURE

The EUT was placed on a wooden 80 cm height turntable. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.



Appendix A Plots

Plot A1

Occupied bandwidth measurements

14:07:22 MAR 19, 2003

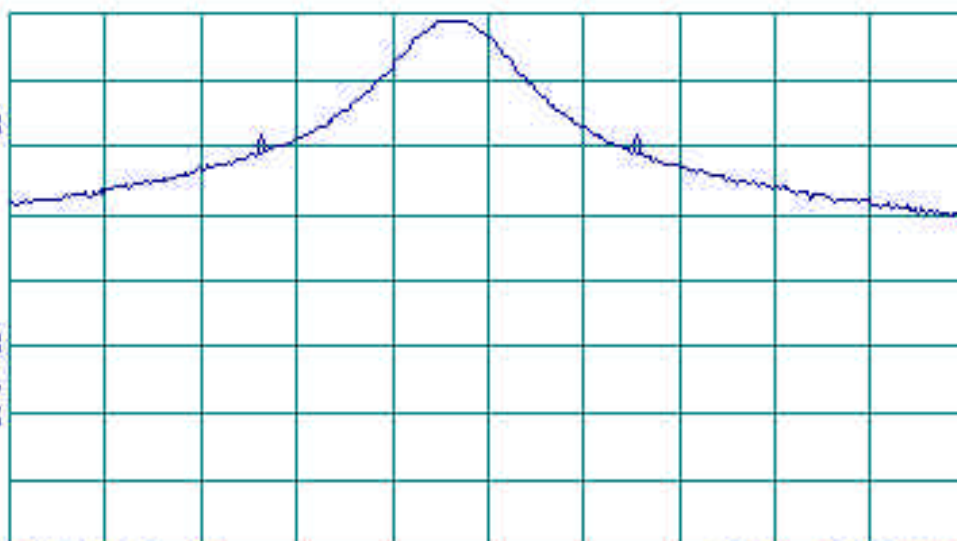
ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR Δ 393 kHz
-.04 dB

MEASURE
AT MKR
ADD TO
LIST

LOG REF 80 0 dB μ V/n

10
dB/
ATN
10 dB

VA SB
SC FC
ACORR



MARKER
NORMAL

MARKER
 Δ

MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
DN DEF

CENTER 434.000 MHz
RL 1F BW 120 kHz

AVG BW 300 kHz

SPAN 1.000 MHz
SWP 20.0 msec

More
1 of 2



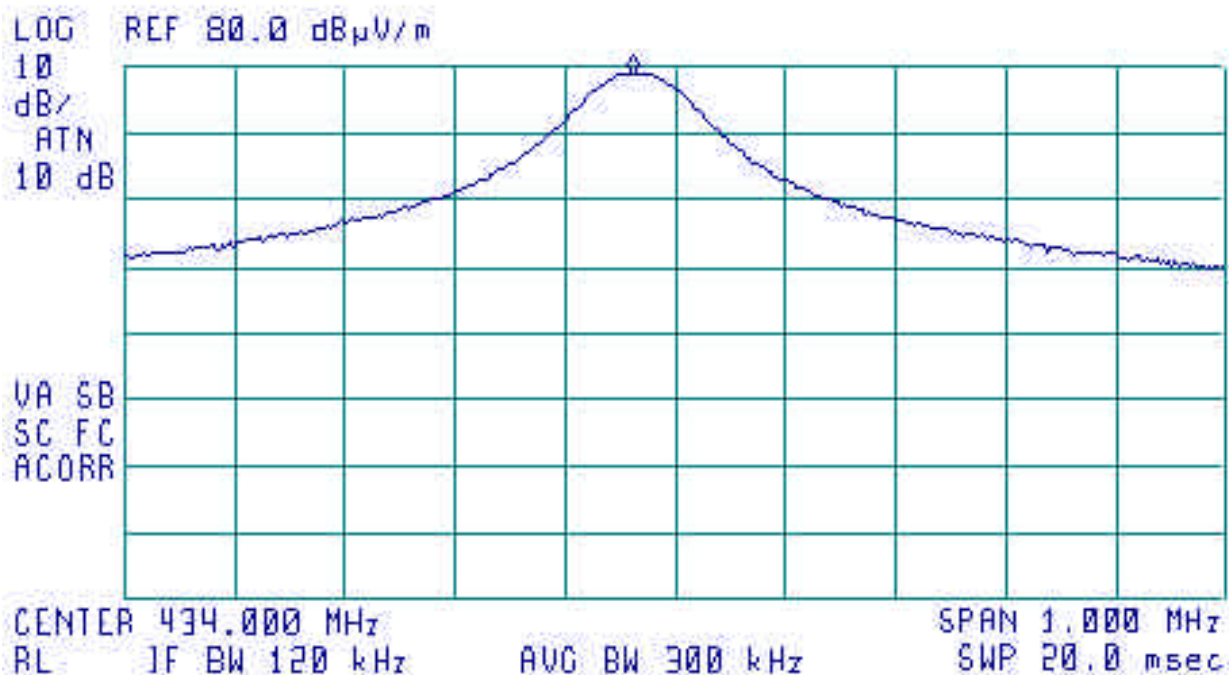
Plot A2

Field strength of fundamental measurements

POLARIZATION: HORIZONTAL

13:55:33 MAR 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKA 433.963 MHz
79.06 dB μ V/m



Peak result = 79.06 dB(μ V/m) (Limit_{PEAK} = 100.83 dB(μ V/m) @3m)

Average factor = $20\log(Tx\ ON / 100) = 20\log(66.7/100) = -3.5\ dB$

Average result = peak result + average factor = $79.06 - 3.5 = 75.56\ dB(\mu V/m)$ (Limit_{AVR} = 80.83 dB(μ V/m) @3m)



Plot A3

Duty cycle measurements

09:51:20 FEB 05 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 19.250 msec
93.59 dB μ V

LO0 REF 112.2 dB μ V

10

dB/

ATN

40 dB

DL

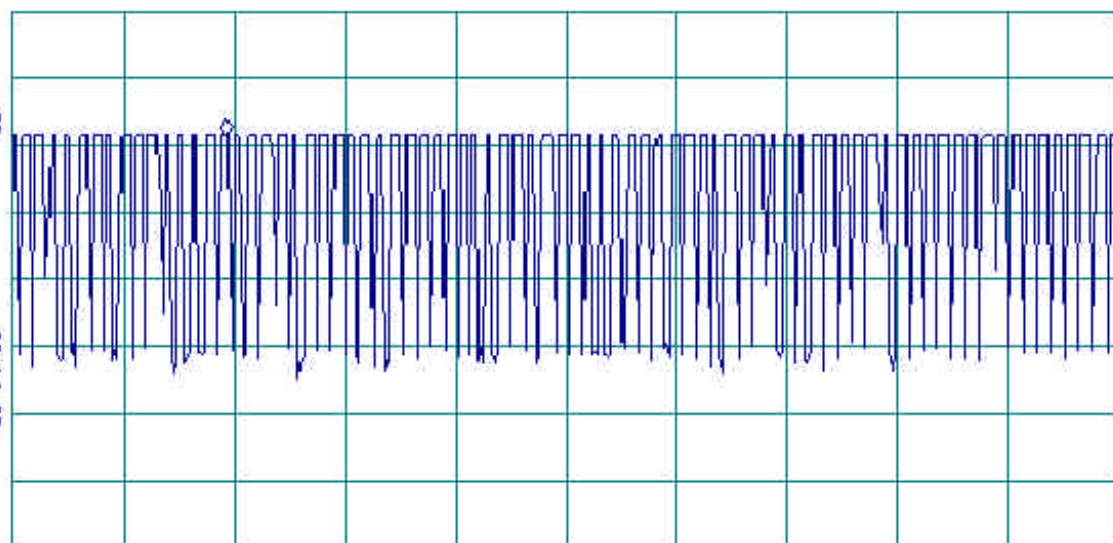
99.0

dB μ V

VA SB

SC FC

ACORR



CENTER 433.938 MHz

RL IF BW 120 kHz

AVC BW 300 kHz

SPAN 0 Hz

#SWP 100 msec

A transmission consists of a preamble signal (12 pulses: each pulse is 400 ms ON and 400 ms OFF) and a sequence of "0" (800 ms ON; 400 ms OFF) or "1" (400 ms ON; 800 ms OFF). The worst case is when all "0" are transmitted.

During the test the transmitter operated in continuous mode.

$Tx\ ON\ in\ 100\ ms\ interval = 100 \times 2/3 = 66.7\ ms.$

$Average\ factor = 20\log(Tx\ ON / 100) = 20\log(66.7/100) = -3.5\ dB$



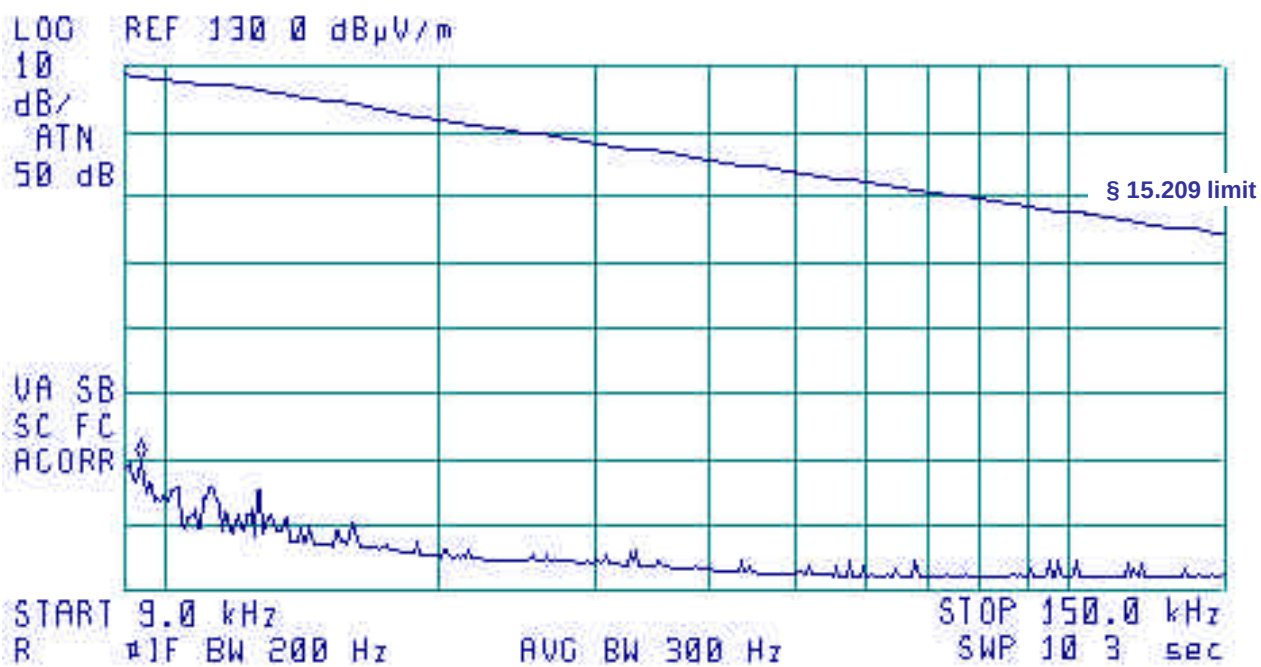
Plot A4

Spurious emission measurements

FREQUENCY RANGE: 9 – 150 kHz

16:04:37 MAR 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 9.5 kHz
69 99 dB μ V/m





Plot A5

Spurious emission measurements

FREQUENCY RANGE: 150 kHz – 30 MHz

16:08:31 MAR 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 150 kHz
66.73 dB μ V/m

LOG REF 105 0 dB μ V/m

10
dB/
ATTN
30 dB

VA SB
SC FC
ACORR

START 150 kHz STOP 30.00 MHz
RL 1F BW 9.0 kHz AVG BW 30 kHz SWP 2.49 sec

§ 15.209 limit



Plot A6

Spurious emission measurements

FREQUENCY RANGE: 30 – 1000 MHz
POLARIZATION: VERTICAL & HORIZONTAL

15:01:48 MAR 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK DP AVG
MKR 439.8 MHz
78.53 dB μ V/m

MEASURE
AT MKR

ADD TO
LIST

LOO REF 80 0 dB μ V/m

PREAMP ON

MARKER
b CF

10
dB/
AIN
10 dB

MARKER
A

VA SB
SC FC
ACORR

NEXT
PEAK

NEXT PK
RIGHT

NEXT PK
LEFT

START 30.0 MHz

STOP 1.0000 GHz

RL 101 BW 120 kHz

AVG BW 300 kHz

SWP 909 msec

None
1 of 2

§ 15.231 peak limit = 80.83 dB(μV/m)@3m

§ 15.231 average limit = 60.83 dB(μV/m)@3m



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Plot A7

Field strength of 2nd harmonic

POLARIZATION: HORIZONTAL

14:20:30 MAR 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK DP AVG
MKR 867.9383 MHz
39.19 dB μ V/m

MEASURE
AT MKR

ADD TO
LIST

MARKER
↑ CF

MARKER
Δ

NEXT
PEAK

NEXT PK
RIGHT

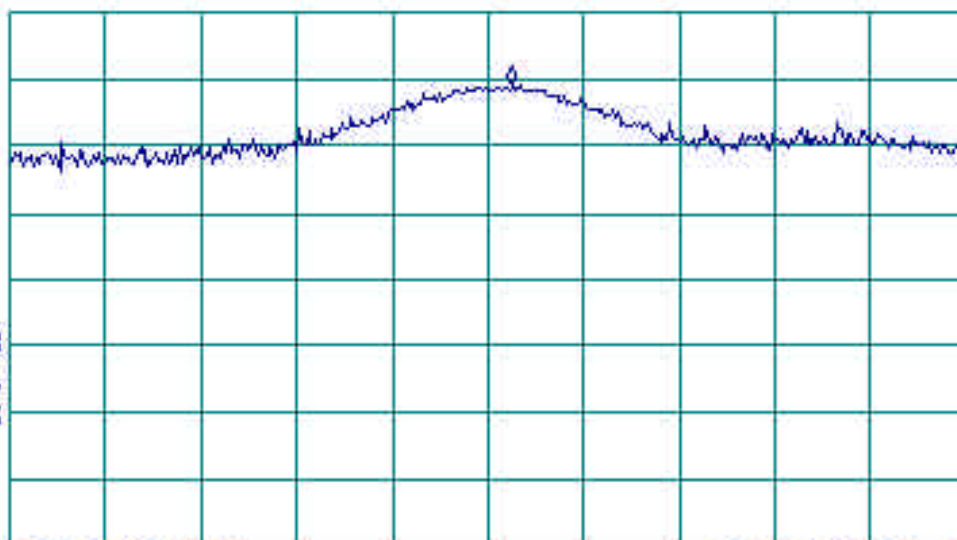
NEXT PK
LEFT

More
1 of 2

LOG REF 50 0 dB μ V/m

10
dB/
#ATN
0 dB

VA SB
SC FC
ACORR



CENTER 867.9178 MHz
R #1F BW 120 kHz

AVG BW 300 kHz

SPAN 500.0 kHz
SWP 20.0 msec

§ 15.231 peak limit = 80.83 dB(μV/m)@3m
§ 15.231 average limit = 60.83 dB(μV/m)@3m



Plot A8

Spurious emission measurements

FREQUENCY RANGE: 1 – 2 GHz
POLARIZATION: VERTICAL & HORIZONTAL

15:14:49 MAR 03, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 1.305 GHz
31.21 dB μ V/m

MEASURE
AT MKR
ADD TO
LIST

LOO REF 65.0 dB μ V/m
10
dB/
#ATN
0 dB

PREAMP ON

§ 15.209 limit

CLEAR
WRITE A

MAX
HOLD A

VIEW A

BLANK A

Trace
A B C

More
1 of 3

VA SB
SC FC
ACORR

START 1.000 GHz

R 11F BW 120 kHz

AVG BW 300 kHz

STOP 2.000 GHz

SWP 930 msec

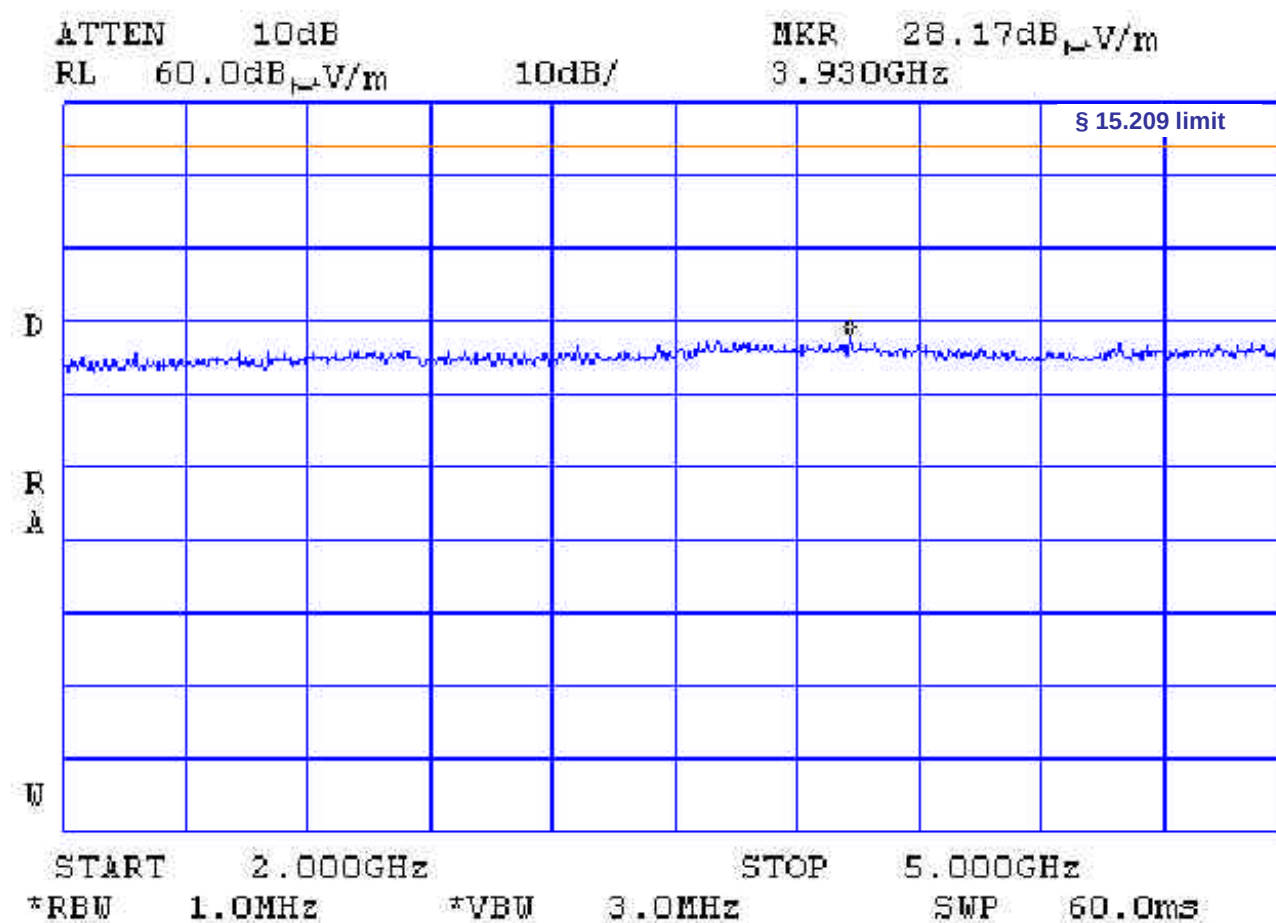
§ 15.231 peak limit = 80.83 dB(μ V/m)@3m
§ 15.231 average limit = 60.83 dB(μ V/m)@3m



Plot A9

Spurious emission measurements

FREQUENCY RANGE: 2 – 5 GHz
POLARIZATION: VERTICAL & HORIZONTAL



§ 15.231 peak limit = 80.83 dB(μ V/m)@3m
§ 15.231 average limit = 60.83 dB(μ V/m)@3m



Plot A10

Unintentional radiated emission measurements

FREQUENCY RANGE: 30 – 200 MHz
POLARIZATION: VERTICAL & HORIZONTAL

00:40:09 MAR 20, 2003

ACTV DET: PEAK
MEAS DET: PEAK DP AVG
MKR 170.9 MHz
17.40 dB μ V/m

MEASURE
AT MKR

ADD TO
LIST

LOO REF 60.0 dB μ V/m

PREAMP ON

MARKER
+ CF

10
dB/
#AIN
0 dB

PASS LIMIT

S 15.109 limit

MARKER
▲

VA SB
SC FC
ACORR

NEXT
PEAK

NEXT PK
RIGHT

NEXT PK
LEFT

START 30.0 MHz

STOP 200.0 MHz

RL 1F BW 120 kHz

AVG BW 300 kHz

SWP 700 msec

Page
1 of 2



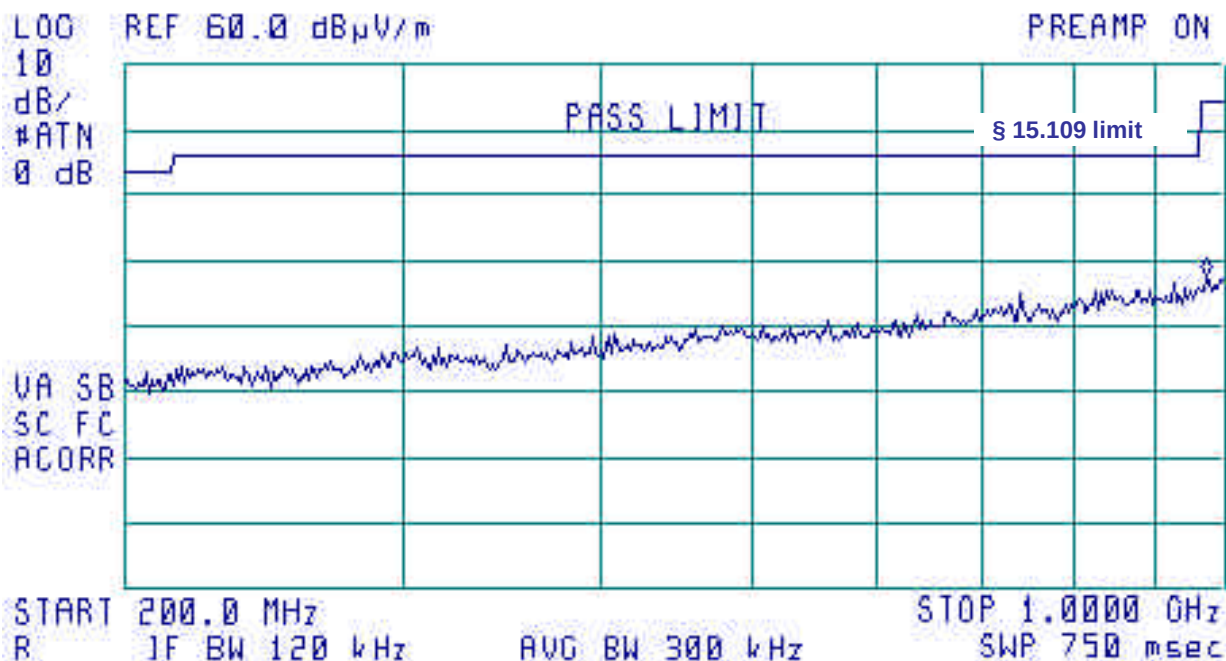
Plot A11

Unintentional radiated emission measurements

FREQUENCY RANGE: 200 – 1000 MHz
POLARIZATION: VERTICAL & HORIZONTAL

08:36:24 MAR 20, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 968.5 MHz
27 57 dB μ V/m





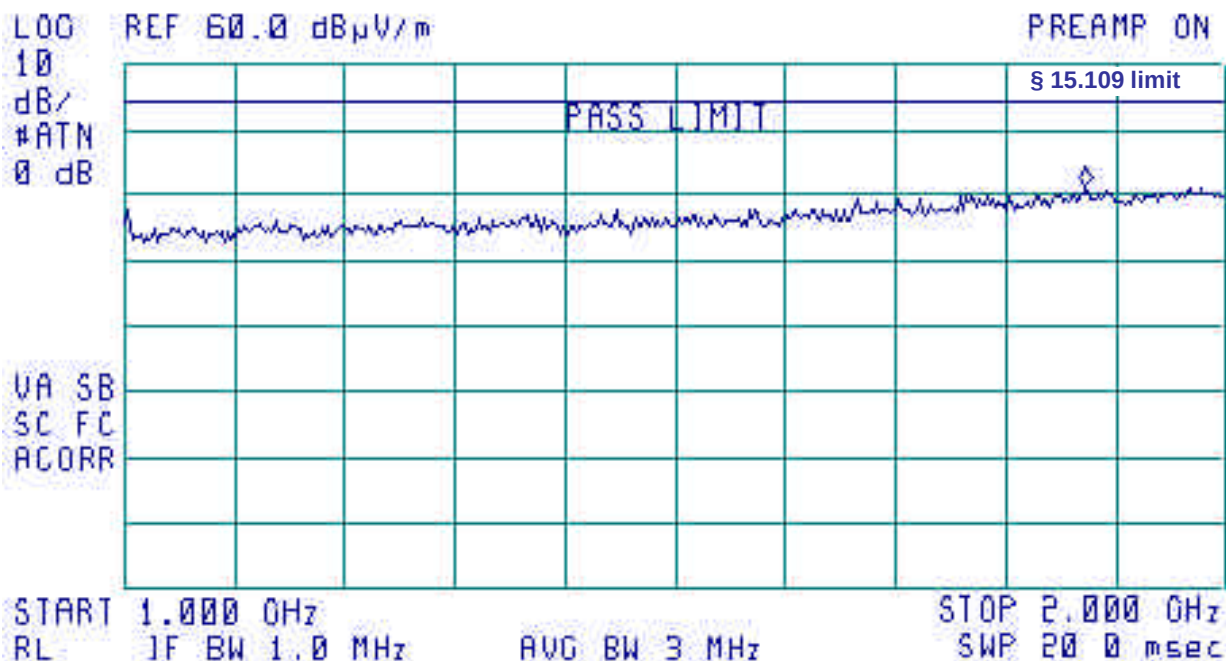
Plot A12

Unintentional radiated emission measurements

FREQUENCY RANGE: 1 – 2 GHz
POLARIZATION: VERTICAL & HORIZONTAL

08:45:30 MAR 20, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 1.873 GHz
41 21 dB μ V/m

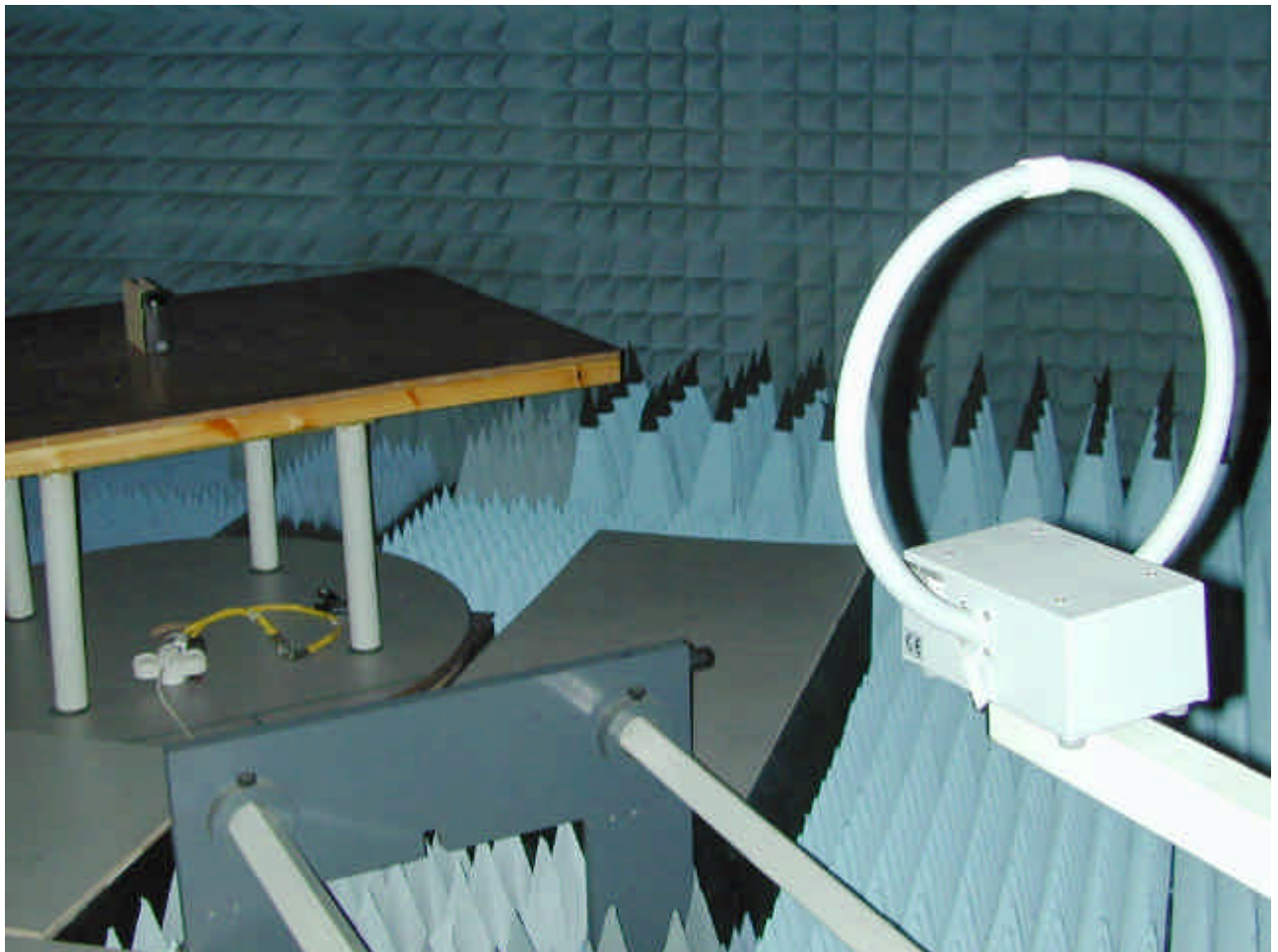




Appendix B Test setup photographs

Photograph 1

Spurious emission measurements test setup view with loop antenna,
performed in anechoic chamber in 9 kHz – 30 MHz range





Photograph 2

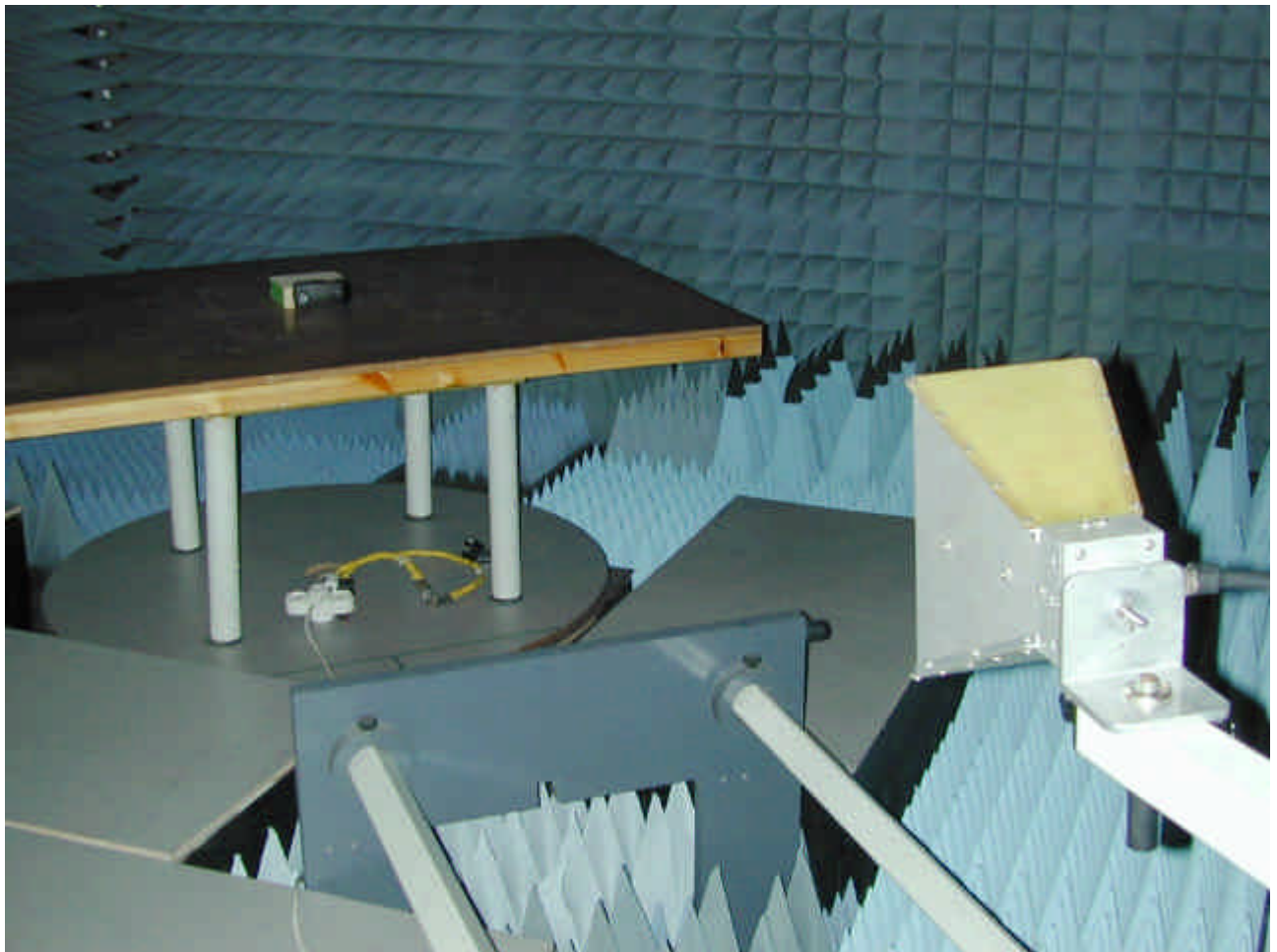
20 dB bandwidth, field strength of fundamental, harmonics emission measurements test setup view with log periodic antenna, performed at OATS in 200 – 1000 MHz range





Photograph 3

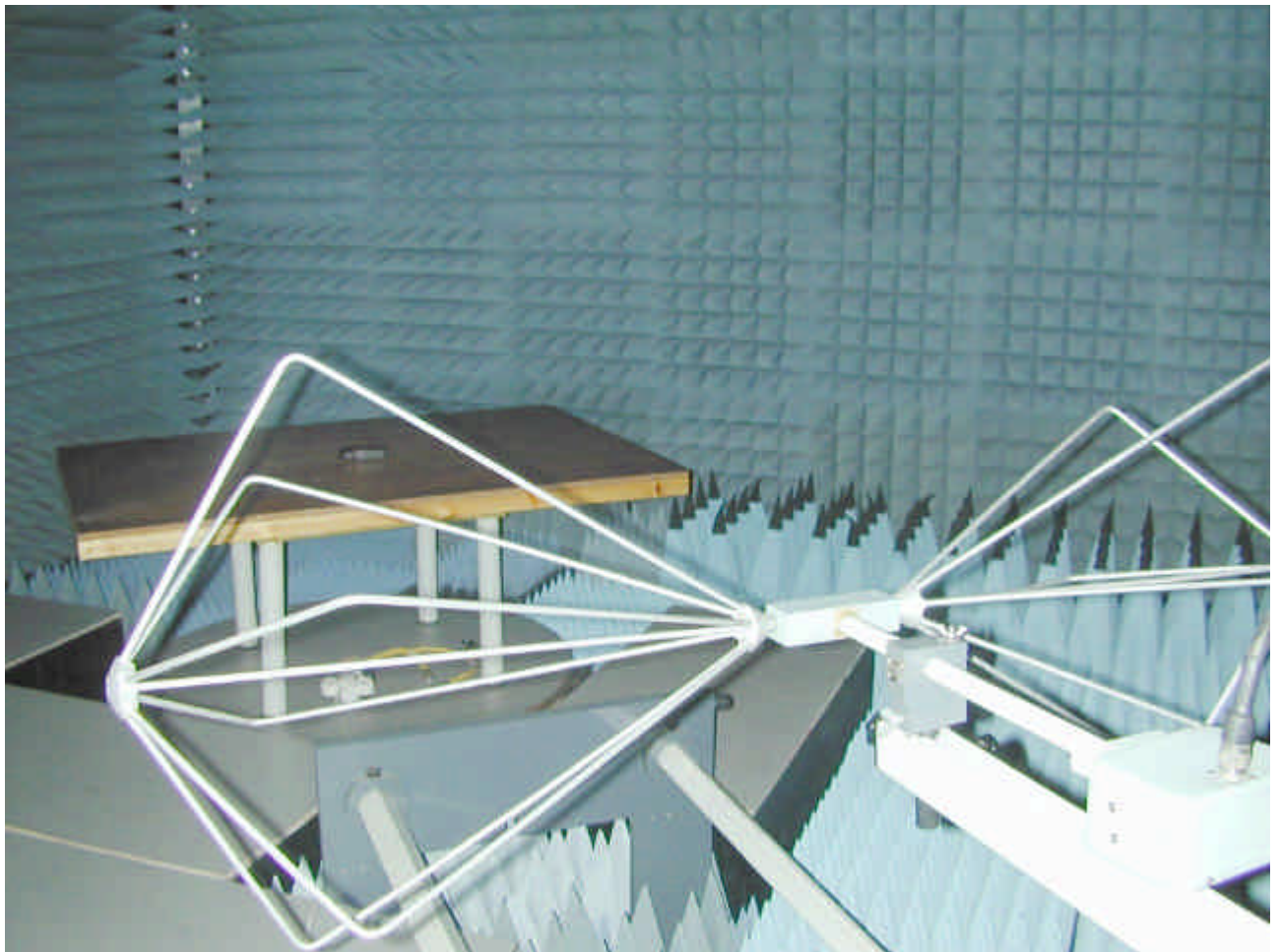
Spurious emission measurements test setup view with double ridged guide antenna, performed in anechoic chamber in 1 – 5 GHz range





Photograph 4

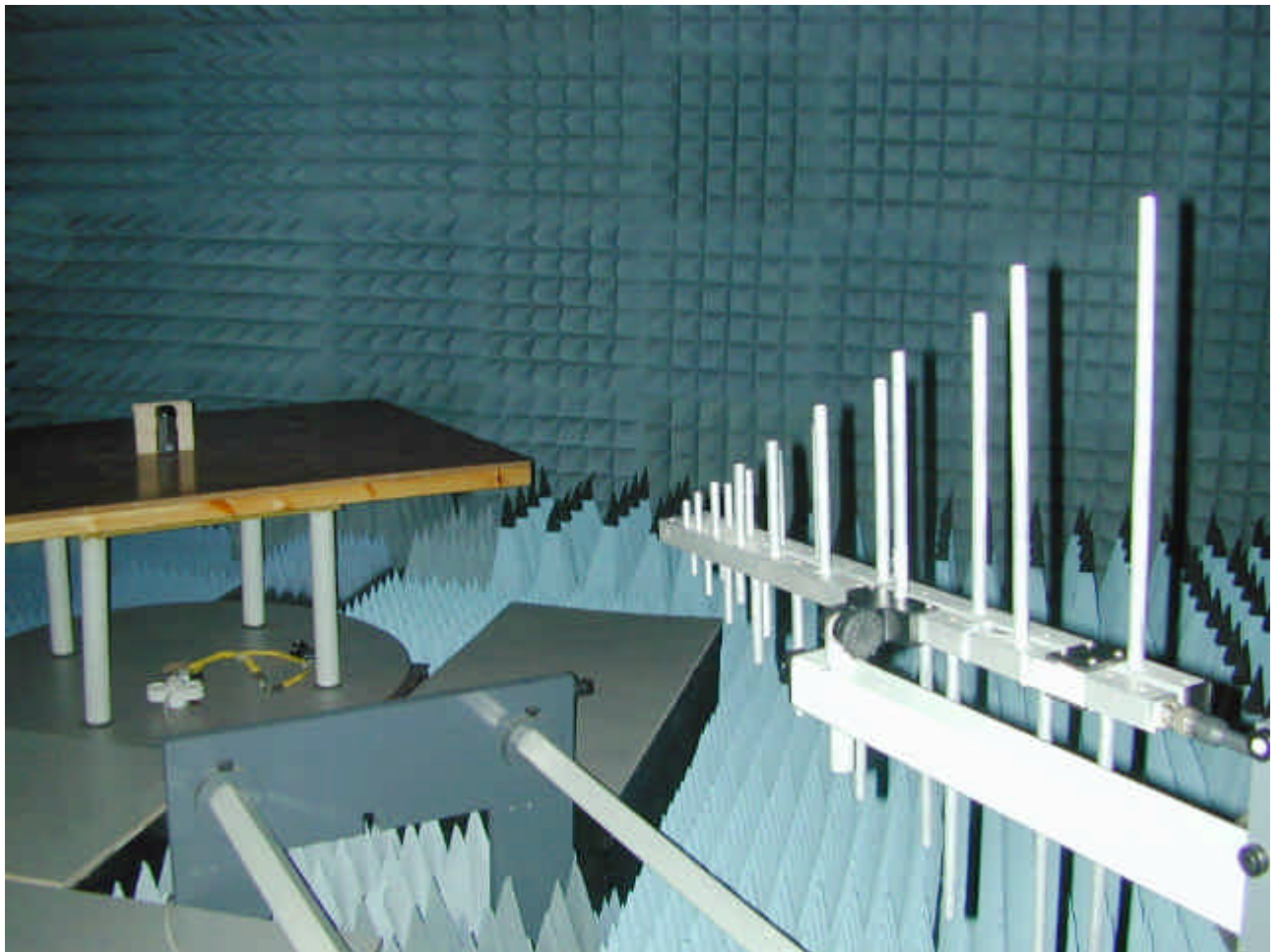
Unintentional radiated emission measurements test setup view with biconical antenna, performed in anechoic chamber in 30 – 200 MHz range





Photograph 5

**Unintentional radiated emission measurements test setup view with log periodic antenna,
performed in anechoic chamber in 200 – 1000 MHz range**





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Photograph 6

EUT view





Appendix C Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibration Month/ year
		Name	Model No.	Serial No.	
0032	Biconical antenna, 20-200 MHz	Electro-Metrics	BIA-25/30	3577	4/04
0034	Log periodic antenna, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1988	1/04
0038	Antenna mast, 1-4 m	Hermon Labs	AM-1	028	2/04 Check
0041	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	2811	3/04
0415	Cables coax RF, misc., RG-58, RG-214	Hermon Labs	CC3	056	5/04
0446	Active loop antenna 10 kHz-30 MHz	Electro-Mechanics	6502	2857	10/03
0447	LISN, 16/2, 300 V RMS	Hermon Labs	LISN 16-1	0447	11/03
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	10/05
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/03
0589	Cable coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	12/03
0592	Position controller	Hermon Labs	L2-SR3000	100	5/04 Check
0593	Antenna mast, 1-4 m/ 1-6 m Pneumatic	Hermon Labs	AM-F1	101	2/04 Check
0594	Turntable for anechoic chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	WDC1	102	1/04 Check
0604	Antenna biconilog log-periodic/T Bow- Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	1/04
0812	Cable, coax, RG-214, 11.5 m, N-type connectors	Hermon Labs	C214-11	148	5/04
1004	Cable, coaxial ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/03
1424	Spectrum analyzer, 30 Hz – 40 GHz	Agilent Technologies	8564 EC	3946A00219	8/03
1425	EMI receiver, 9 kHz – 2.9 GHz	Agilent Technologies	8542E	3710A00222, 3705A00204	9/03
1430	EMI receiver, 9 kHz – 2.9 GHz	Agilent Technologies	8542E	3807A00262, 3705A00217	9/03
1553	Cable RF, 3.5 m	Alpha Wire	RG-214	1553	12/03
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	12/03
1942	Cable 18 GHz, 4 m, blue	Rhophase Microwave Ltd.	SPS-1803A- 4000-NPS	T4658	10/03
1984	Antenna, double-ridged waveguide horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5564	3/04



Appendix D Test equipment correction factors

Antenna factor, active loop antenna
Model 6502
S/N 2857

Frequency, MHz	Antenna factor, dB
0.009	-32.8
0.010	-33.8
0.020	-38.3
0.050	-41.1
0.075	-41.3
0.100	-41.6
0.150	-41.7
0.250	-41.6
0.500	-41.8
0.750	-41.9
1.000	-41.4
2.000	-41.5
3.000	-41.4
4.000	-41.4
5.000	-41.5
10.000	-41.9
15.000	-41.9
20.000	-42.2
25.000	-42.8
30.000	-44.0

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ V/m).



**Antenna factor
Biconical antenna
Electro-Metrics, model BIA-25/30
Ser.No.3577**

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
20	15.1	115	16.7
25	14.6	120	14.1
30	13.7	125	13.1
35	11.8	130	13.0
40	11.4	135	12.9
45	11.7	140	12.7
50	11.4	145	12.5
55	10.5	150	14.3
60	10.3	155	14.8
65	8.9	160	14.7
70	7.6	165	15.1
75	7.3	170	15.6
80	7.3	175	16.5
85	7.8	180	16.7
90	9.4	185	17.3
95	10.6	190	17.9
100	11.8	195	17.6
105	12.5	200	17.9
110	13.7		

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ V/m).

**Antenna factor
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.1988**

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
200	12.6	625	20.4
225	12.2	650	20.9
250	13.4	675	22.0
275	14.3	700	22.2
300	15.2	725	22.7
325	15.7	750	22.5
350	15.9	775	22.7
375	16.4	800	22.8
400	17.0	825	23.2
425	17.4	850	23.5
450	17.9	875	23.9
475	18.6	900	24.0
500	19.1	925	24.0
525	19.3	950	24.2
550	19.6	975	24.7
575	19.8	1000	25.1
600	20.0		

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ V/m).



Antenna factor
Biconilog antenna EMCO, model 3141, Ser.No.1011

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
26	7.8	940	24.0
28	7.8	960	24.1
30	7.8	980	24.5
40	7.2	1000	24.9
60	7.1	1020	25.0
70	8.5	1040	25.2
80	9.4	1060	25.4
90	9.8	1080	25.6
100	9.7	1100	25.7
110	9.3	1120	26.0
120	8.8	1140	26.4
130	8.7	1160	27.0
140	9.2	1180	27.0
150	9.8	1200	26.7
160	10.2	1220	26.5
170	10.4	1240	26.5
180	10.4	1260	26.5
190	10.3	1280	26.6
200	10.6	1300	27.0
220	11.6	1320	27.8
240	12.4	1340	28.3
260	12.8	1360	28.2
280	13.7	1380	27.9
300	14.7	1400	27.9
320	15.2	1420	27.9
340	15.4	1440	27.8
360	16.1	1460	27.8
380	16.4	1480	28.0
400	16.6	1500	28.5
420	16.7	1520	28.9
440	17.0	1540	29.6
460	17.7	1560	29.8
480	18.1	1580	29.6
500	18.5	1600	29.5
520	19.1	1620	29.3
540	19.5	1640	29.2
560	19.8	1660	29.4
580	20.6	1680	29.6
600	21.3	1700	29.8
620	21.5	1720	30.3
640	21.2	1740	30.8
660	21.4	1760	31.1
680	21.9	1780	31.0
700	22.2	1800	30.9
720	22.2	1820	30.7
740	22.1	1840	30.6
760	22.3	1860	30.6
780	22.6	1880	30.6
800	22.7	1900	30.6
820	22.9	1920	30.7
840	23.1	1940	30.9
860	23.4	1960	31.2
880	23.8	1980	31.6
900	24.1	2000	32.0
920	24.1		

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ V/m).



Antenna factor
Double ridged guide antenna
Model RGA-50/60
S/N 2811

Frequency, MHz	Antenna factor, dB
1000	24.3
1500	25.4
2000	28.4
2500	29.2
3000	30.5
3500	31.6
4000	33.7
4500	32.2
5000	34.5
5500	34.5
6000	34.6
6500	35.3
7000	35.5
7500	35.9
8000	36.6
8500	37.3
9000	37.7
9500	37.7
10000	38.2
10500	38.5
11000	39.0
11500	40.1
12000	40.2
12500	39.3
13000	39.9
13500	40.6
14000	41.1
14500	40.5
15000	39.9
15500	37.8
16000	39.1
16500	41.1
17000	41.7
17500	45.1
18000	44.3

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



Antenna factor
Double-ridged wave guide horn antenna
Model 3115
Serial no: 9911-5964

Frequency, MHz	Antenna factor. dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.6
2500.0	28.9
3000.0	31.2
3500.0	32.0
4000.0	32.5
4500.0	32.7
5000.0	33.6
5500.0	35.1
6000.0	35.4
6500.0	34.9
7000.0	36.1
7500.0	37.8
8000.0	38.0
8500.0	38.1
9000.0	39.1
9500.0	38.3
10000.0	38.6
10500.0	38.2
11000.0	38.7
11500.0	39.5
12000.0	40.0
12500.0	40.4
13000.0	40.5
13500.0	41.1
14000.0	41.6
14500.0	41.7
15000.0	38.7
15500.0	38.2
16000.0	38.8
16500.0	40.5
17000.0	42.5
17500.0	45.9
18000.0	49.4

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ V/m).



**Cable coaxial, RG-58/RG-214, model:CC-3, s/n 056 (HL 0415)
+ Cable coaxial, RG-214, 11.5m, model: C214-11, s/n 148 (HL 0812)
Calibration data**

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (specification), dB	Measured uncertainty dB
1	Insertion loss	20	0.73	-	NA	±0.12
2		30	0.91	-		
3		50	1.2	-		
4		80	1.56	-		
5		100	1.76	-		
6		200	2.59	-		
7		300	3.26	-		
8		400	3.93	-		
9		500	4.42	-		
10		600	4.92	-		
11		700	5.36	-		
12		800	5.88	-		
13		900	6.41	-		
14		1000	6.71	-		
15		1500	8.63	-		
16		2000	10.39	-		



**Cable Coaxial, GORE A2P01POL118, 2.3 m, model:GORE-3, s/n 176 (HL 0589)
+ Cable Coaxial, ANDREW PSWJ4, 6m, model: ANDREW -6, s/n 163 (HL 1004)**

Calibration data

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (specification), dB	Measured uncertainty dB	Notes
1	Insertion loss	30	0.33	-	6.5	±0.12	
2		50	0.40	-			
3		100	0.57	-			
4		300	0.97	-			
5		500	1.25	-			
6		800	1.59	-			
7		1000	1.81	-			
8		1200	1.97	-			
9		1400	2.15	-			
10		1600	2.28	-			
11		1800	2.43	-			
12		2000	2.61	-			
13		2200	2.75	-			
14		2400	2.89	-			
15		2600	2.97	-			
16	Insertion loss	2800	3.21	-	6.5	±0.12	
17		3000	3.32	-			
18		3300	3.47	-			
19		3600	3.62	-			
20		3900	3.84	-			
21		4200	3.92	-		±0.17	
22		4500	4.07	-			
23		4800	4.36	-			
24		5100	4.62	-			
25		5400	4.78	-			
26		5700	5.16	-			
27		6000	5.67	-			
28		6500	5.99	-			



Cable RF, 2m, model: Sucoflex 104PE, s/n 13094/4PE (HL 1566)
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (specification), dB	Measured uncertainty dB	Notes
1	Insertion loss	30	0.10	-	5.0	±0.12	
2		50	0.13	-			
3		100	0.20	-			
4		300	0.33	-			
5		500	0.45	-			
6		800	0.60	-			
7		1000	0.65	-			
8		1500	0.91	-			
9		2000	1.08	-			
10		2500	1.19	-			
11		3000	1.28	-			
12		3500	1.49	-			
13		4000	1.63	-			
14	Insertion loss	4500	1.63	-	5.0	±0.17	
15		5000	1.66	-			
16		5500	1.88	-			
17		6000	1.96	-			
18		6500	1.93	-			
19		7000	2.07	-			
20		7500	2.37	-			
21		8000	2.34	-			
22		8500	2.64	-			
23		9000	2.68	-			
24		9500	2.64	-			
25		10000	2.70	-			
26		10500	2.84	-			
27		11000	2.88	-			
28		11500	3.19	-			
29		12000	3.15				
30	Insertion loss	12500	3.20		5.0	±0.26	
31		13000	3.22				
32		13500	3.47				
33		14000	3.41				
34		14500	3.59				
35		15000	3.79				
36		15500	4.24				
37		16000	4.12				
38		16500	4.46				
39		17000	4.50				
40		17500	4.49				
41		18000	4.45				



Cable 18GHz, 4 m, blue, model: SPS-1803A-4000-NPS, s/nT4658 (HL 1942)
Calibration data

Frequency, GHz	Insertion loss, dB
0.03	0.21
0.05	0.26
0.10	0.36
0.20	0.50
0.30	0.61
0.40	0.70
0.50	0.78
0.60	0.85
0.70	0.93
0.80	0.99
0.90	1.04
1.00	1.10
1.10	1.16
1.20	1.22
1.30	1.26
1.40	1.31
1.50	1.35
1.60	1.41
1.70	1.45
1.80	1.49
1.90	1.53
2.00	1.57
2.10	1.61
2.20	1.65
2.30	1.69
2.40	1.72
2.50	1.76
2.60	1.79
2.70	1.83
2.80	1.87
2.90	1.90
3.10	1.97
3.30	2.04
3.50	2.11
3.70	2.18
3.90	2.24
4.10	2.31
4.30	2.38
4.50	2.43
4.70	2.53
4.90	2.53
5.10	2.63
5.30	2.65
5.50	2.72
5.70	2.76
5.90	2.79

Frequency, GHz	Insertion loss, dB
6.10	2.88
6.30	2.90
6.50	2.97
6.70	3.02
6.90	3.04
7.10	3.07
7.30	3.12
7.50	3.13
7.70	3.19
7.90	3.24
8.10	3.30
8.30	3.36
8.50	3.45
8.70	3.41
8.90	3.45
9.10	3.42
9.30	3.55
9.50	3.48
9.70	3.58
9.90	3.61
10.10	3.66
10.30	3.68
10.50	3.70
10.70	3.70
10.90	3.75
11.10	3.78
11.30	3.86
11.50	3.98
11.70	4.10
11.90	4.12
12.10	4.09
12.40	4.13
13.00	4.23
13.50	4.35
14.00	4.40
14.50	4.44
15.00	4.57
15.50	4.66
16.00	4.64
16.50	4.66
17.00	4.75
17.50	4.85
18.00	4.93



Cable, RF, 3.5 m, model: RG-214, s/n 1553 (HL 1553)
Calibration data

No.	Parameter	Set		Measured, dBm	Attenuation, dB	Measured uncertainty dB
		MHz	dBm			
1	Attenuation	1	-0.12	-0.13	0.01	±0.12
2		10	0.00	-0.07	0.07	
3		30	-0.10	-0.22	0.12	
4		50	-0.09	-0.31	0.22	
5		100	-0.13	-0.39	0.26	
6		200	-0.08	-0.48	0.40	
7		300	-0.12	-0.64	0.52	
8		400	-0.03	-0.63	0.60	
9		500	0.19	-0.51	0.70	
10		600	0.05	-0.72	0.77	
11		700	-0.06	-0.90	0.84	
12		800	-0.01	-1.01	1.00	
13		900	0.03	-0.97	1.00	
14		1000	-0.08	-1.13	1.05	
15		2000	-0.19	-1.89	1.70	



Appendix E General information

Test facility description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private EMC, safety, environmental and telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

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

Abbreviations and acronyms

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

cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
DC	direct current
EUT	equipment under test
GHz	gigahertz
H	height
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
m	meter
MHz	megahertz
NA	not applicable
QP	quasi-peak
RF	radio frequency
RE	radiated emission
rms	root mean square
s	second
V	volt
W	width

Specification references

47CFR part 15: 2002	Radio Frequency Devices
ANSI C63.2: 1996	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.



FCC equipment codes and descriptions

CYY	Communications Receiver used w/ P.15 transmitter
DCD	Part 15 Low Power transmitter Below 1705 kHz
DSC	Part 15 Security/Remote Control Transmitter
DSR	Part 15 Remote Control/Security Device Transceiver
DSS	Part 15 Spread Spectrum Transmitter
DXX	Part 15 Low Power Communication Device Transmitter
EAV	Part 15 Automatic Vehicle Identification System
ETB	Part 15 Cordless Telephone Base Transceiver
ETR	Part 15 Cordless Telephone Remote Transceiver
ETS	Part 15 Cordless telephone system
FAP	Part 15 Anti-Pilferage Device
FDS	Part 15 Field Disturbance Sensor
GAT	Part 15 Auditory Assistance Device (Transmitter)
HID	Part 15 TV Interface Device
JBC	Part 15 Class B Computing Device/ Personal Computer
JBP	Part 15 Class B Computing Device Peripheral
PUB	Part 15 Unlicensed PCS base station
PUE	Part 15 Unlicensed PCS portable Tx held to ear
PUF	Part 15 Unlicensed PCS portable Tx held to face
PUT	Part 15 Unlicensed PCS portable Tx worn on body