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RADIO TEST REPORT

ACCORDING TO 47 CFR Part 15 SUBPART C §15.231, §15.205, §15.209 and SUBPART B;
RSS-210 Issue 5:2001; ICES-003 Issue 3:1997

for

VISONIC Ltd.

EQUIPMENT UNDER TEST:

Supervised wireless Power Code smoke detector

Model: MCT-425 @ 315 MHz

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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Date of Issue: May 2003



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1 Project information

Description of equipment under test

Test items	: Supervised wireless Power Code smoke detector
Manufacturer	: Visonic Ltd.
Types (Models)	: MCT-425 @ 315 MHz
Equipment FCC code ¹	: DSC

Applicant information

Applicant's responsible person	: Mr. Arick Elshtein, project manager
Company	: Visonic Ltd.
Address	: 27 Habarzel Street
Postal code	: 69710
City	: Tel Aviv
Country	: Israel
Telephone number	: +972 3 6456714
Telefax number	: +972 3 6456891

Test performance

Project Number:	: 15461
Location	: Hermon Laboratories
Receipt date	: March 13, 2003
Test performed	: March 20, 2003
Purpose of test	: Apparatus compliance verification in accordance with emission requirements
Test specification(s)	: 47CFR Part 15, subpart C, §15.231, §15.205, §15.209, and subpart B §15.109; RSS-210 Issue 5: 2001 and ICES-003 Issue 3: 1997

¹ FCC Equipment codes – see Appendix D



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 Installation instructions		
Bandwidth of emission	15.231(c)	X				Mr. A. Troupianski, test engineer	March 18, 2003	
Field strength of fundamental	15.231(b)(2)	X				Mr. Y. Neuman, test engineer	March 13, 2003	
Field strength of spurious radiation	15.231(b)(3)	X				Mr. A. Troupianski, test engineer	March 16, 19, 2003	
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 Installation instructions		
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 315 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		
Radio control of toys is not permitted.	15.231 (a)	X				Refer to Installation instructions		



Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
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 Installation instructions		
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: Mrs. V. Mednikov, MSc, certification engineer

Test report approved by: Mr. E. Usoskin, PhD, C.E.O.





3 EUT description

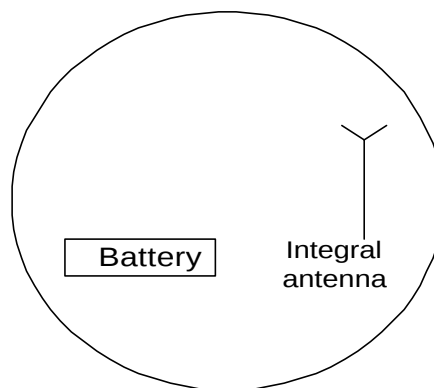
3.1 General description

The MCT-425 is a low profile, battery operated, photoelectric smoke detector, which shares its housing with a UHF "Power Code" type transmitter.

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:		315 MHz					
Extreme temperature conditions ² :							
Operating Temperature: 0°C to 38°C (32°F to 100°F)							
Heat Detection: Alarm if ambient temperature exceeds 57°C (135°F)							
Maximum rated output power							
At transmitter permanent external 50 Ω rf output connector (dBm)		NA					
Effective radiated power (for equipment with integral antenna) (dBm)		-17					
Transmitter duty cycle (worst case)							
Tx on (seconds)		0.062					
Tx off (seconds)		0.038					
Modulation							
	Amplitude						
	Frequency						
X	Other (specify): ASK (ON OFF KEYING)						
Can the transmitter be operated without modulation			yes		no		
Transmitter power source							
X	Battery	Nominal rated voltage (VDC)	9				
	Nickel Cadmium						
	Lithium						
X	Alkaline						
	DC	Nominal rated voltage (VDC)					
	AC mains	Nominal rated voltage (VAC)					
Is there common power source for transmitter and receiver			yes		no		
Antenna type							
X	Integral						
	External						
Type of antenna jack ³ - NA							
	standard		connector type		Male		Female
	unique		connector type		Male		Female

² Frequency tolerance test for devices operating in the frequency band 40.66 – 40.70 MHz shall be performed in normal and extreme test conditions.

³ 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) and RSS-210 § 6.1.1(c)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
DATE: March 18, 2003
RELATIVE HUMIDITY: 43 %
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1012 hPa
MODULATION: ON
DETECTOR USED: Peak

Carrier frequency MHz	Occupied bandwidth, kHz	Reference to plot in Annex A
315	345	A1
Measurement uncertainty, ppm		0.2

TEST EQUIPMENT USED:

HL 0034	HL 0038	HL 1365	HL 1430	HL 1947		
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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 315 MHz frequency the specified limit is 787.5 kHz

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.



4.2 Field strength of fundamental, § 15.231 and RSS-210 § 6.1.1(b)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.5
 DATE: March 13, 2003
 RELATIVE HUMIDITY: 51 %
 AMBIENT TEMPERATURE: 22 °C
 AIR PRESSURE: 1013 hPa
 SITE DESCRIPTION: Anechoic chamber
 MODULATION: ON
 DETECTOR USED: Peak

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

Frequency, MHz	Measured field strength, dB(uV/m)	Average factor, dB	Calculated result, dB(uV/m)	Specification limit, dB(uV/m)	Reference to plot in Annex A
315	78.06	-4.2	73.86	75.62	A2
Measurement uncertainty, dB			± 6		

4.2.1 Average factor calculation, §15.35

Tx ON	Duty cycle	Average factor	Reference to plot in Annex A
61.47	0.6147	-4.2	A3 to A4

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0592	HL 0604	HL 1004	HL 2009
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LIMIT § 15.231 (b)

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

The specified limit for 315 MHz frequency is 75.62 dB(mV/m)

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height turntable in vertical and horizontal position 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 and RSS-210 § 6.1.1(b)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.4
 TEST PERFORMED IN: Anechoic chamber; OATS
 DATE: March 13, 16, 2003
 RELATIVE HUMIDITY: 43 %
 AMBIENT TEMPERATURE: 23 °C
 AIR PRESSURE: 1012 hPa
 TEST PERFORMED AT FIELD STRENGTH: 78.06 dB(μV/m)
 MODULATION: ON
 DETECTOR USED: Peak
 RANGE OF MEASUREMENTS: 9 kHz to 3200 MHz

Frequency, MHz	RBW, kHz	VBW, kHz	Radiated emission (peak), dB(mV/m)	Limit (peak) @ 3 m, dB(mV/m)	Radiated emission, (avrg)* dB(mV/m)	Limit (avrg) @ 3 m, dB(mV/m)	Ref. to plot in App. A
629.9	120	300	44.26	75.62	40.06	55.62	A11
944.9	120	300	49.52	75.62	45.32	55.62	A12
1259.8	1000	3000	41.06	75.62	36.86	55.62**	A14
1574.8	1000	3000	50.14	74.00	45.94	54.00	A15
1889.7	1000	3000	44.07	75.62	39.87	55.62	A16
2204.8	1000	3000	46.14	74.00	41.94	54.00	A18
2519.7	1000	3000	52.57	75.62	48.37	55.62	A19
2834.7	1000	3000	47.28	74.00	43.08	54.00	A20
3149.8	1000	3000	46.65	75.62	42.45	55.62	-
Measurement uncertainty, dB				± 6			

For test results refer to Plots A5 to A20.

* Radiated emission value was calculated: Peak value + Average factor

** In Canada the limit at this frequency is 54.00 dB(mV/m) (falls into the restricted band)

Notes to table:

RBW: resolution bandwidth

VBW: video bandwidth

TEST EQUIPMENT USED:

HL 0041	HL 0446	HL 0465	HL 0521	HL 0589	HL 0604	HL 1004
HL 1947						

LIMIT § 15.231 (b)

Fundamental frequency (MHz)	Field strength of harmonics (b) (mV/m) @ 3 m
260 – 470	375 to 1,250

The specified limit for 315 MHz frequency is 55.62 dB(mV/m)

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height turntable in vertical and horizontal position in turn.

9 kHz – 30 MHz frequency range. 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 MHz – 9.5 GHz frequency range. 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 according to §15.109 and ICES-003

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: 43 %
 AMBIENT TEMPERATURE: 23 °C
 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	Antenna polarization	Antenna height, m	Turntable position (°)	Radiated emissions, dB (mV/m)	Specification limit, dB (mV/m)	Ref. to plot in App. A
30 - 2000	No unintentional emissions were found					A7, A21, A22
Measurement uncertainty, dB		± 6				

TEST EQUIPMENT USED:

HL 0034	HL 0041	HL 1425	HL 1553	HL 1566		
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LIMIT (§ 15.109)

Frequency, MHz	Class A equipment @ 10 m dB(mV/m)	Class B equipment @ 3 m dB(mV/m)
30 - 88	39.0	40
88 - 216	43.5	43.5
216 - 960	46.4	46
960 - 5000	49.5	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.



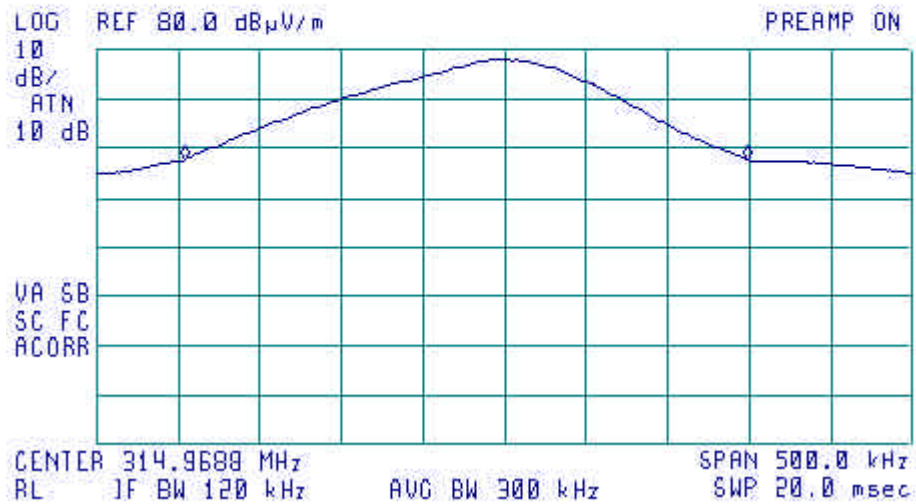
Appendix A - Plots

Plot A1

Occupied bandwidth measurements

08:43:13 MAR 18, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKRΔ 345.0 kHz
-.03 dB





Plot A2

Field strength of fundamental

Note Horizontal polarization

14:12:10 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 314.978 MHz
78.06 dB μ V/m

LOG REF 82.0 dB μ V/m

10
dB/
ATN
10 dB

VA SB
SC FC
ACORR

CENTER 314.978 MHz

RL IF BW 120 kHz

AVG BW 300 kHz

SPAN 2.000 MHz

SWP 20.0 msec

LIMIT_{peak} = 95.6 dB(mV/m) @3m

LIMIT_{average} = 75.6 dB(mV/m) @3m

$E_{avrg} = E_{peak} + \text{Average Factor} = 78.06 \text{ dB}(\mu\text{V/m}) - 4.2 \text{ dB} = 73.86 \text{ dB}(\mu\text{V/m})$

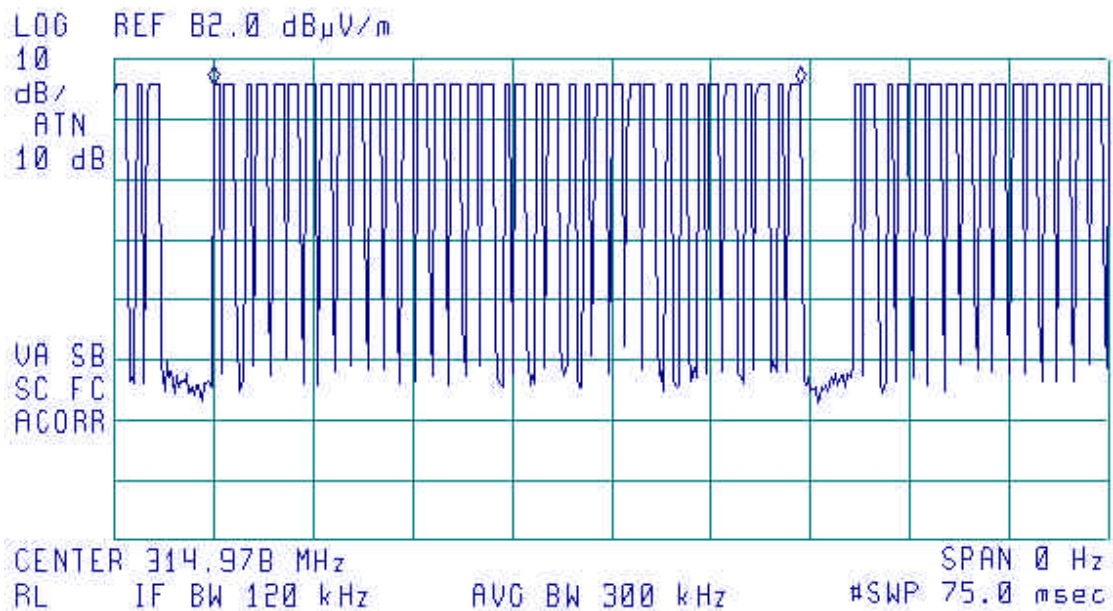


Plot A3

Transmission duration

14:24:09 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKRΔ 44.250 msec
.00 dB



One transmission duration is 44.25 ms

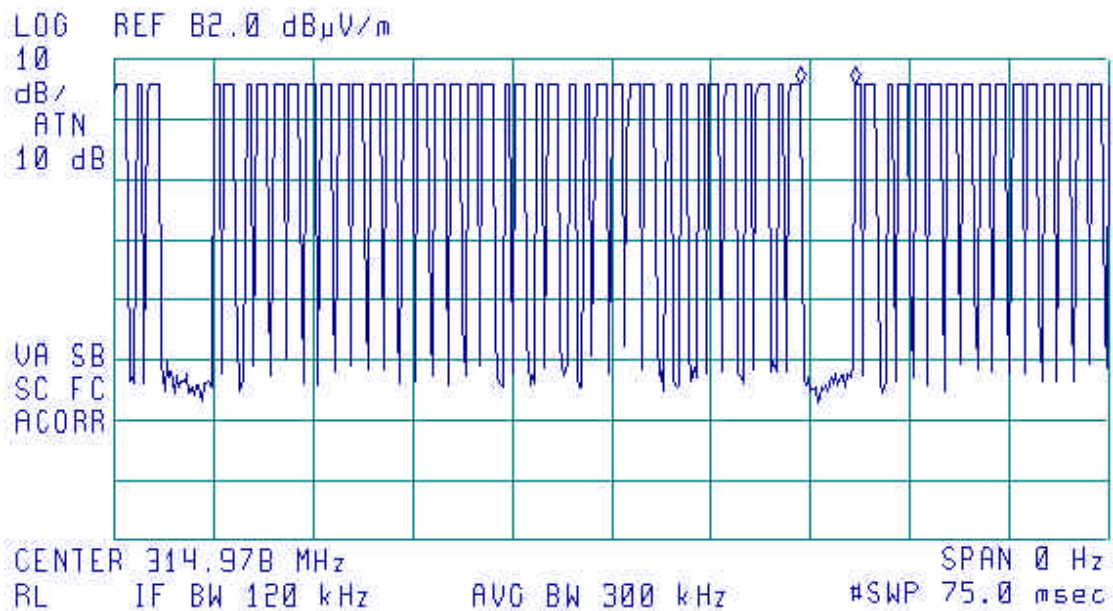


Plot A4

Duty cycle measurements

14:26:39 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKRΔ 4.1250 msec
.00 dB



The time between the end of one transmission and the beginning of the other one is 4.125 ms.

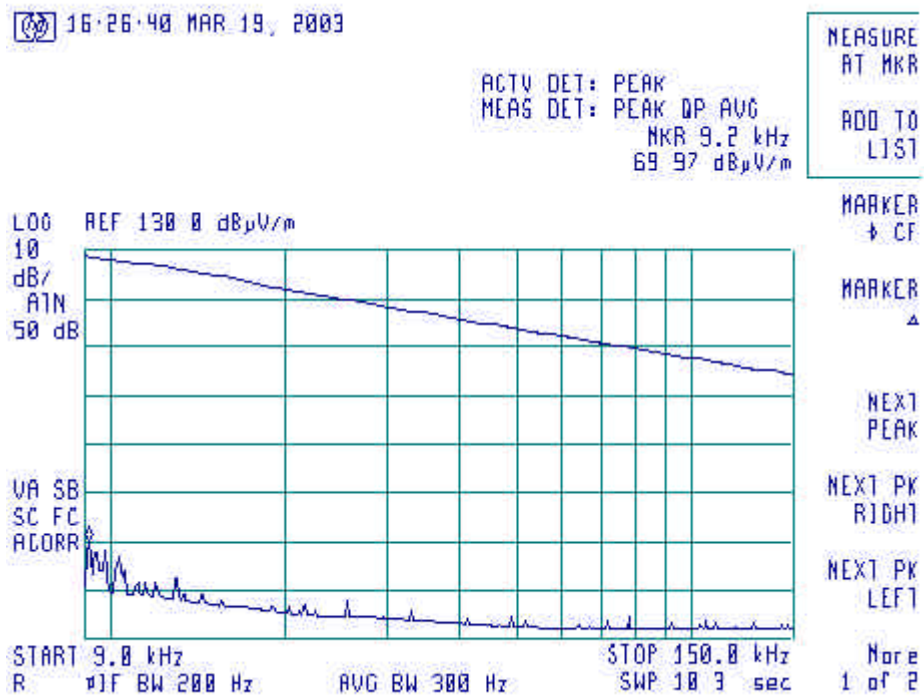
“Power code” means transmission of a sequence of “0” (1/3 ON; 2/3 OFF) or “1” (2/3 ON; 1/3 OFF). The worst case is when all “1” are transmitted.

$\text{Tx ON in 100 ms interval} = (100 - 2 \times 4.125) \times 2/3 = 61.47 \text{ ms.}$



Plot A5

Spurious emission measurements
in 9 – 150 kHz frequency range



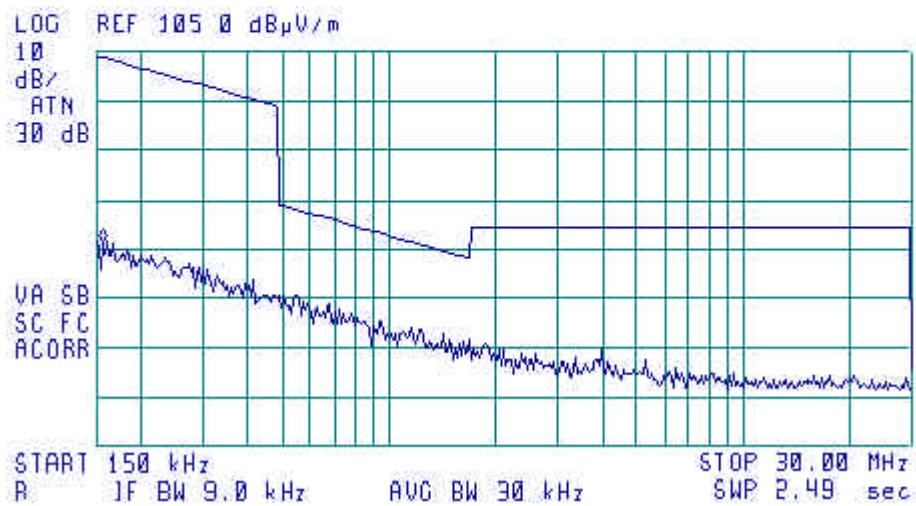


Plot A6

Spurious emission measurements
in 150 kHz – 30 MHz frequency range

16:29:19 MAR 19, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 160 kHz
66.37 dB μ V/m





Plot A7

Spurious emission measurements
in 30 – 300 MHz range

Note Vertical & Horizontal polarization

14:56:47 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 300.0 MHz
33.12 dB μ V/m

LOG REF 55.0 dB μ V/m

10
dB/
ATN
10 dB

UA SB
SC FC
ACORR

START 30.0 MHz STOP 300.0 MHz
R IF BW 120 kHz AVG BW 300 kHz SWP 700 msec

No spurious emissions were found.



Plot A8

Spurious emission measurements
in 300 – 314.5 MHz range

Note Vertical & Horizontal polarization

15:08:35 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 314.50 MHz
49.01 dB μ V/m

LOG REF 55.0 dB μ V/m

10
dB/
ATTN
10 dB

VA SB
SC FC
ACORR

START 300.00 MHz

RL IF BW 120 kHz

AVC BW 300 kHz

STOP 314.50 MHz

SWP 20.0 msec

No spurious emissions (except fundamental) were found.



Plot A9

Spurious emission measurements
in 315.5 – 330 MHz range

Note Vertical & Horizontal polarization

15:13:46 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 315.50 MHz
49.62 dB μ V/m

LOG REF 55.0 dB μ V/m

10
dB/
ATN
10 dB

VA SB
SC FC
ACORR

START 315.50 MHz

RL IF BW 120 kHz

AVC BW 300 kHz

STOP 330.00 MHz

SWP 20.0 msec

No spurious emissions (except fundamental) were found.



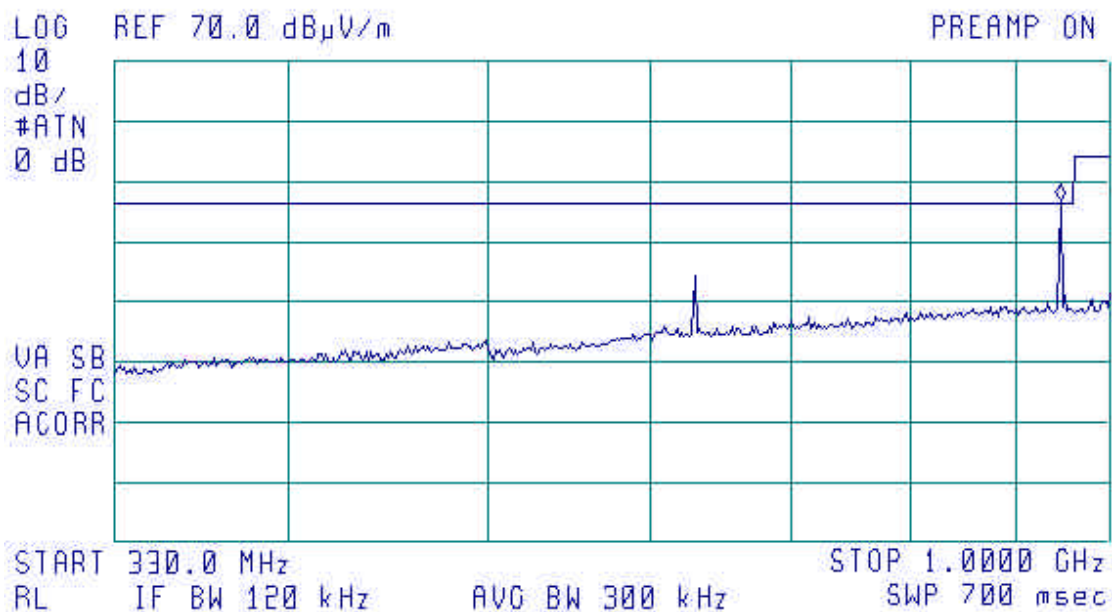
Plot A10

Spurious emission measurements
in 330 – 1000 MHz range

Note Vertical & Horizontal polarization

15:20:35 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 944.1 MHz
46.72 dB μ V/m



No spurious emissions were found except 2nd and 3rd harmonics of fundamental.



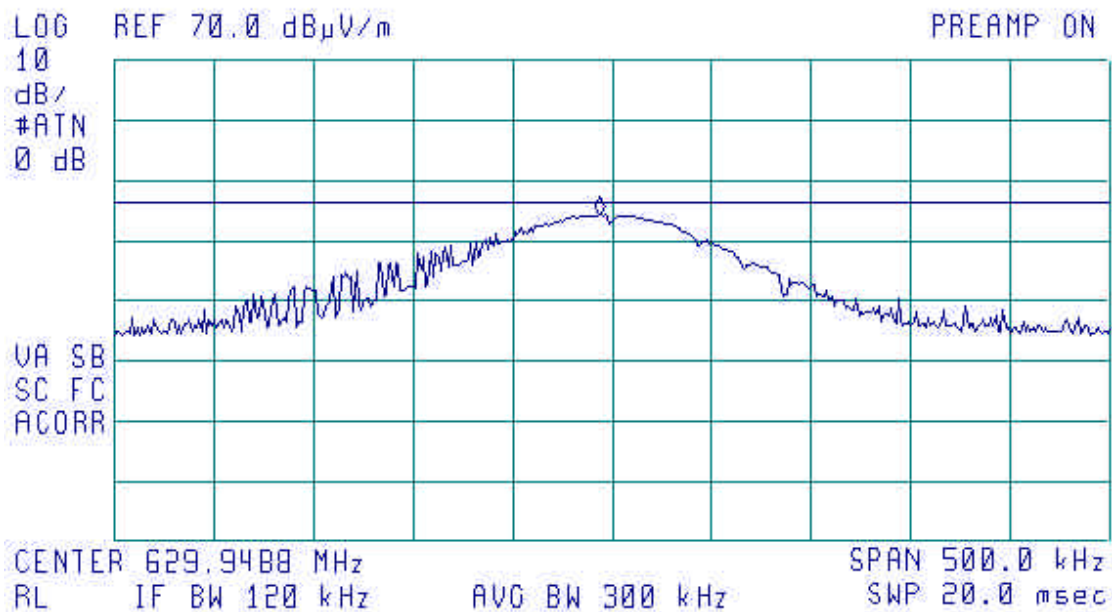
Plot A11

Field strength of 2nd harmonic

Note Horizontal polarization

16:00:54 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 629.9425 MHz
44.26 dB μ V/m



The 2nd harmonic of fundamental.

Average value=44.26 dB(μ V/m) – 4.2 dB (avg.factor) = 40.06 dB(μ V/m)



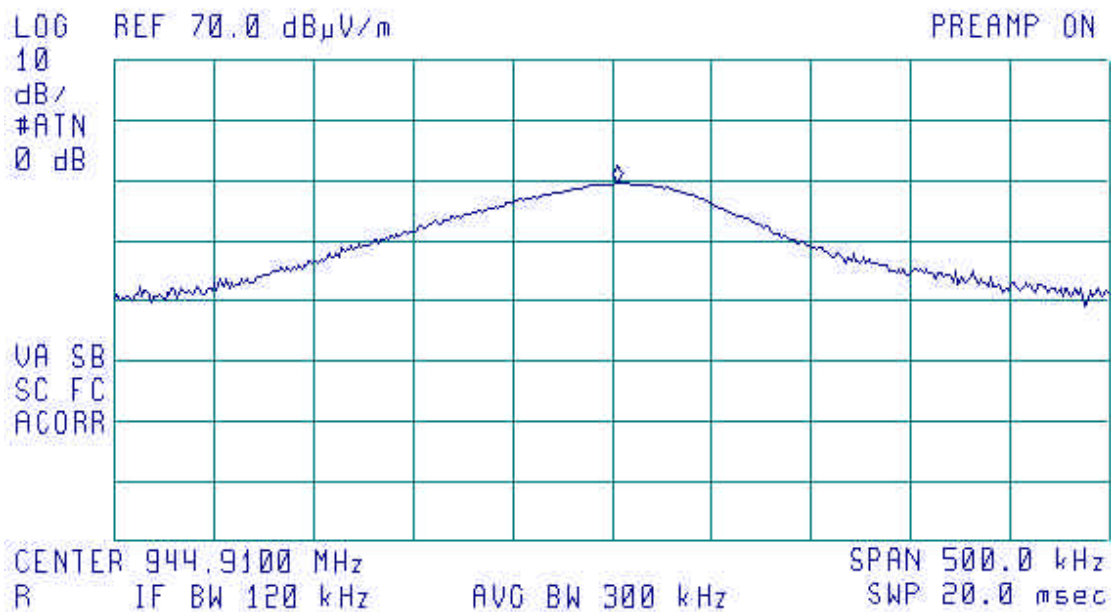
Plot A12

Field strength of 3rd harmonic

Note Horizontal polarization

16:14:31 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 944.9125 MHz
49.52 dB μ V/m



The 3rd harmonic of fundamental.

Average value = 49.52 dB(μ V/m) – 4.2 dB (avg.factor) = 45.32 dB(μ V/m)



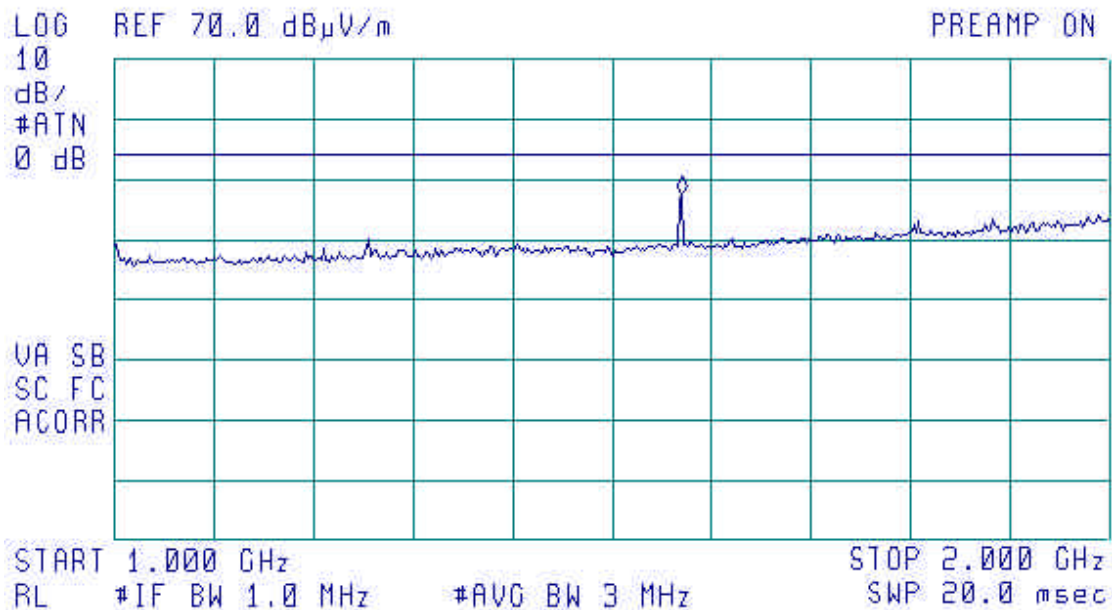
Plot A13

Spurious emission measurements
in 1 – 2 GHz range

Note Vertical & Horizontal polarization

16:40:50 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.570 GHz
47.33 dB μ V/m



No spurious emissions were found except harmonics.



Plot A14

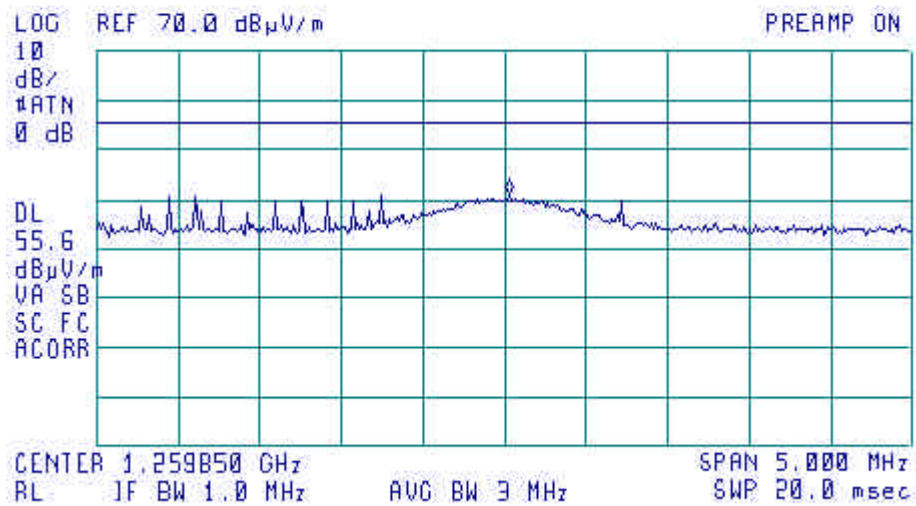
Field strength of 4th harmonic

Note Horizontal polarization

11:52:55 MAR 19, 2003

STEP 315.000 MHz

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 1.259875 GHz
41.06 dB μ V/m



Average value = 41.06 dB(μ V/m) – 4.2 dB (avg.factor) = 36.86 dB(μ V/m)



Plot A15

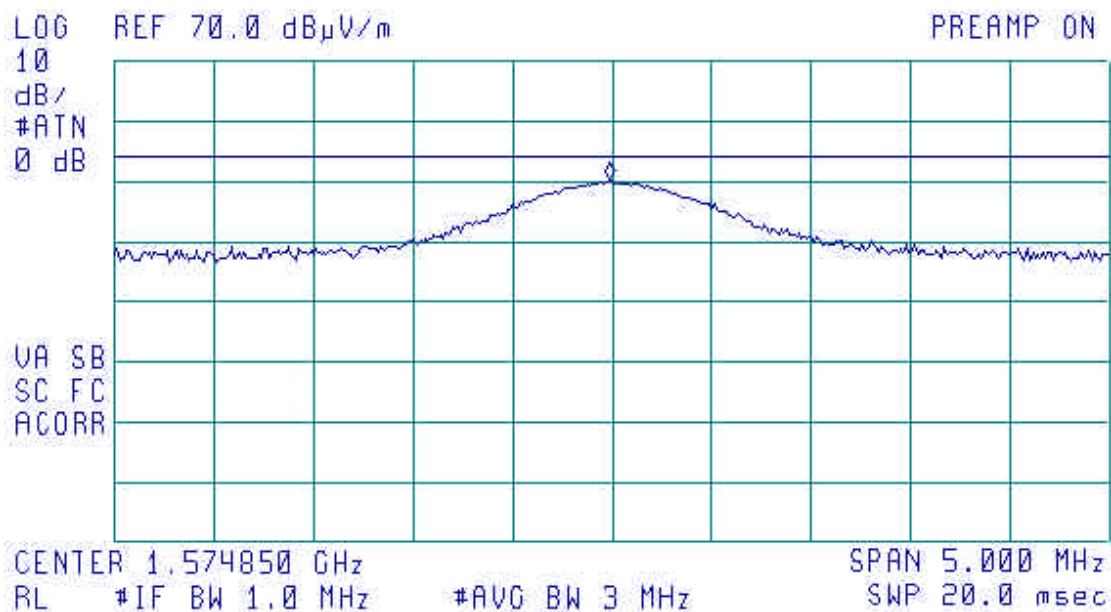
Field strength of 5th harmonic

Note

Horizontal polarization

16:59:13 MAR 13, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 1.574838 GHz
50.14 dB μ V/m



The 5th harmonic of fundamental falls into a restricted band.

Average value = 50.14 dB(μ V/m) – 4.2 dB (avg.factor) = 45.94 dB(μ V/m)



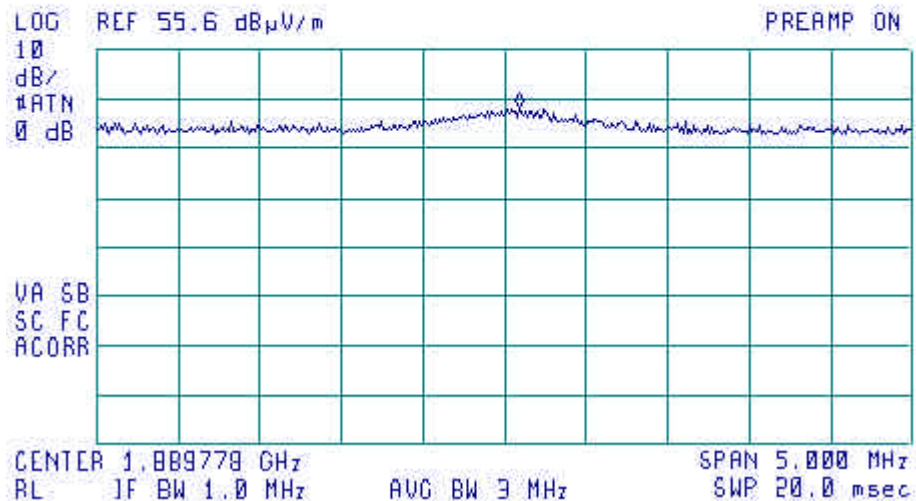
Plot A16

Field strength of 6th harmonic

Note Horizontal polarization

10:52:47 MAR 16, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 1.889865 GHz
44.07 dB μ V/m



Average value = 44.07 dB(μ V/m) – 4.2 dB (avg.factor) = 39.87 dB(μ V/m)

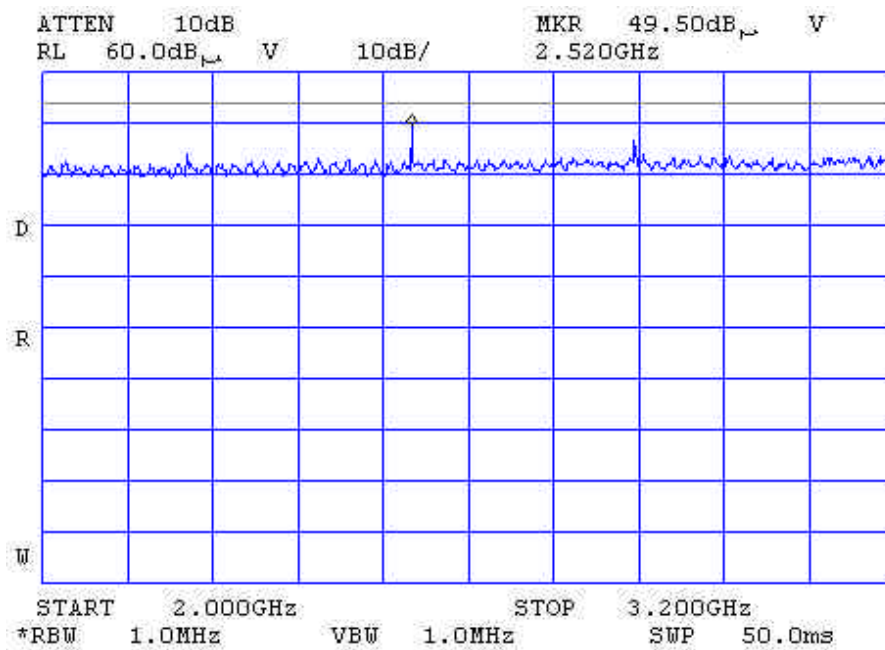


Plot A17

Spurious emission measurements
in 2 – 3.2 GHz range

Note

Vertical & Horizontal Polarization





Plot A18

Field strength of 7th harmonic

Note Horizontal polarization

11:00:09 MAR 16, 2003

STEP 314.963 MHz

ACTU DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.204791 GHz
46.14 dB μ V/m

LOG REF 55.6 dB μ V/m

PREAMP ON

10
dB/
#ATN
0 dB

VA SB
SC FC
ACORR

CENTER 2.204741 GHz
RL IF BW 1.0 MHz

AVG BW 3 MHz

SPAN 5.000 MHz
SWP 20.0 msec

Average value = 46.14 dB(μ V/m) – 4.2 dB (avg.factor) = 41.94 dB(μ V/m)



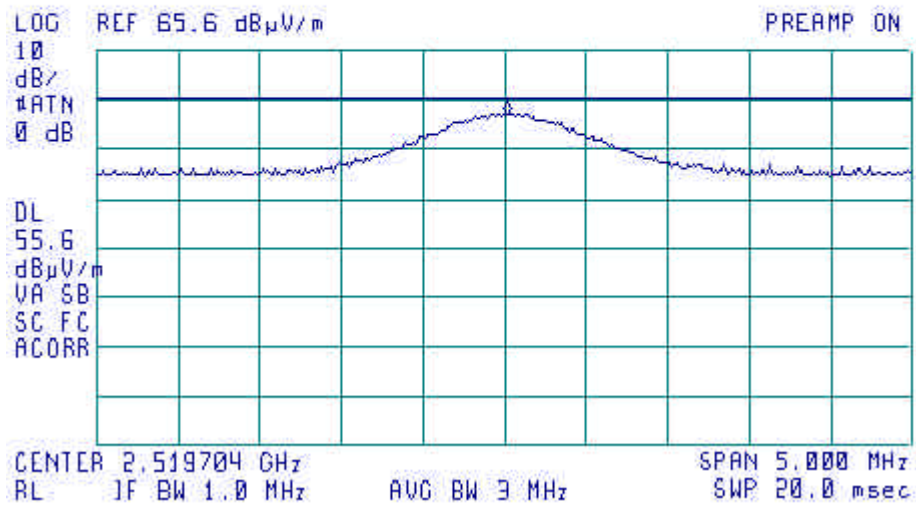
Plot A19

Field strength of 8th harmonic

Note Horizontal polarization

11:58:48 MAR 16, 2003

ACTU DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.519716 GHz
52.57 dB μ V/m



Average value = 52.57 dB(μ V/m) – 4.2 dB (avg.factor) = 48.37 dB(μ V/m)



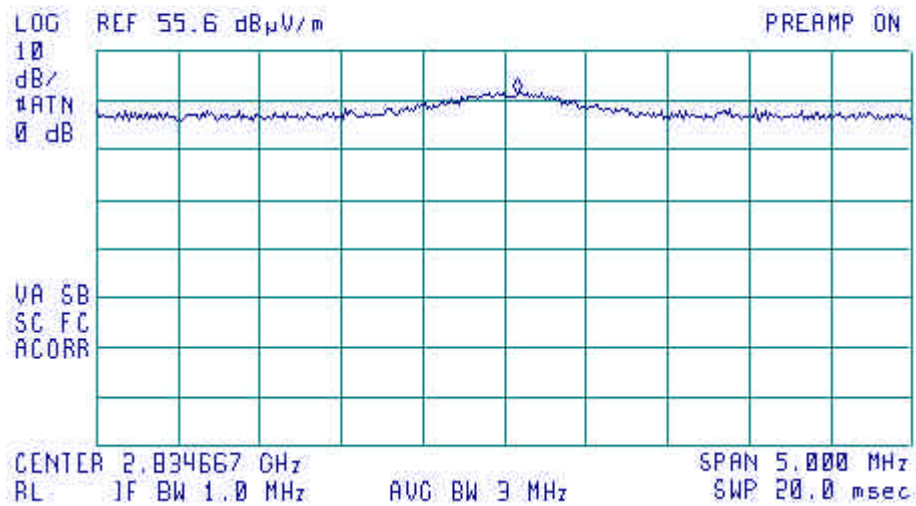
Plot A20

Field strength of 9th harmonic

Note Vertical polarization

11:22:39 MAR 16 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.834742 GHz
47.28 dB μ V/m



Average value = 47.28 dB(μ V/m) – 4.2 dB (avg.factor) = 43.08 dB(μ V/m)



Plot A21

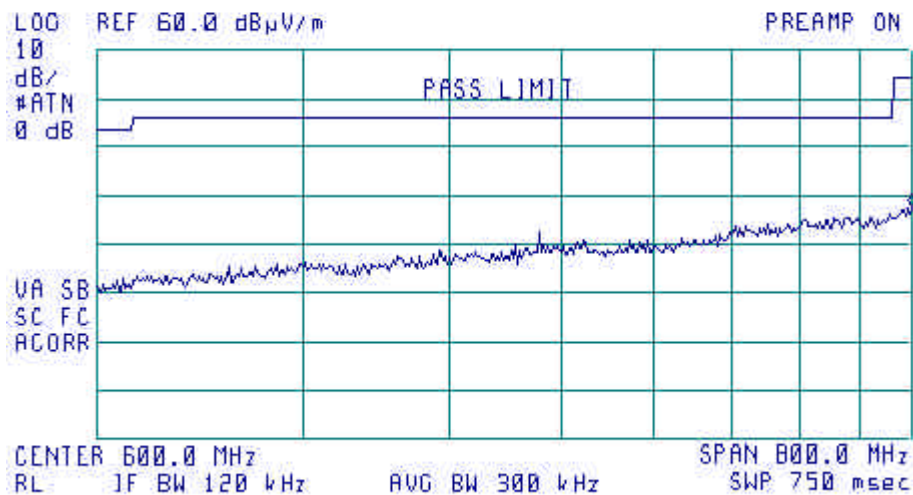
Unintentional radiated emission measurements
in 200 – 1000 MHz range

Note

Vertical & Horizontal Polarization

08:23:03 MAR 20, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 1.0000 GHz
27.75 dB μ V/m





Plot A22

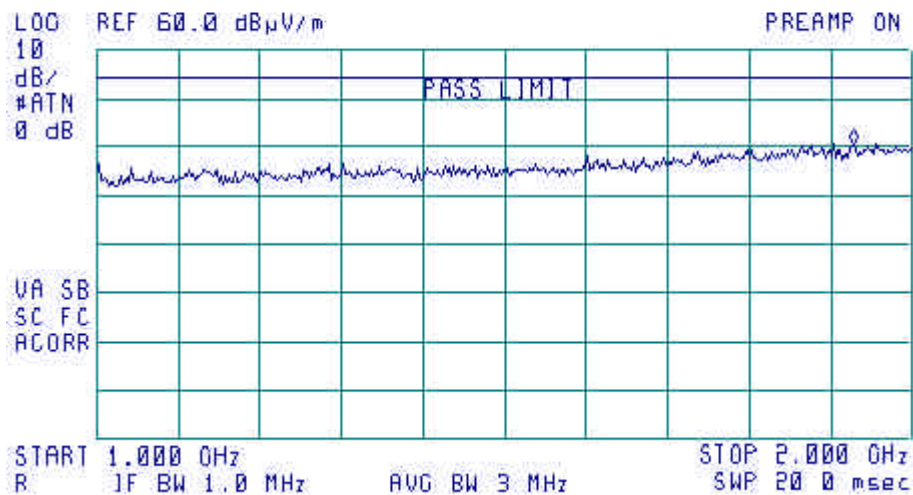
Unintentional radiated emission measurements
in 1000 – 2000 MHz range

Note

Vertical & Horizontal Polarization

08:48:46 MAR 20, 2003

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 1.928 GHz
40 69 dB μ V/m

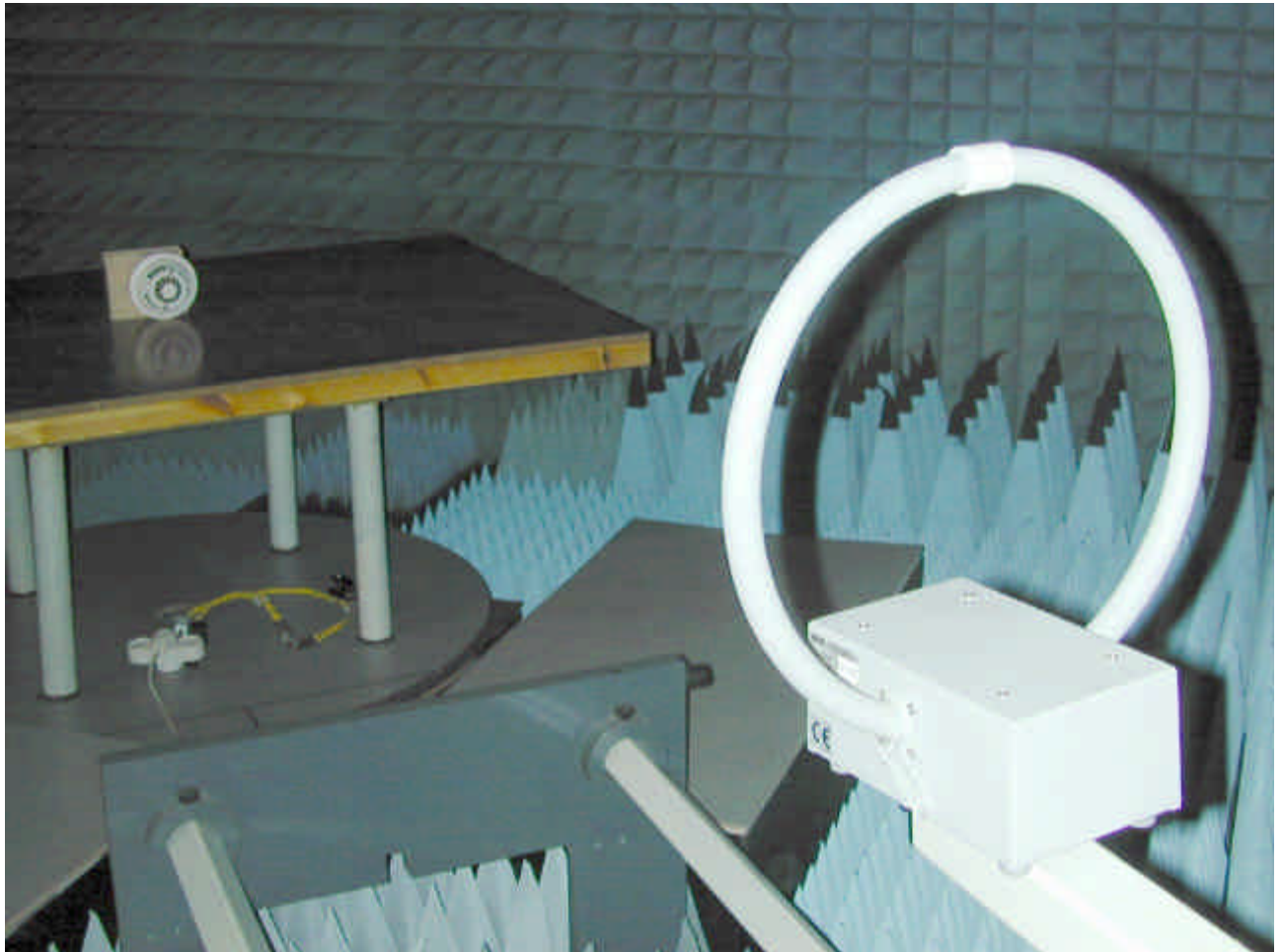




Appendix B – Test setup photographs

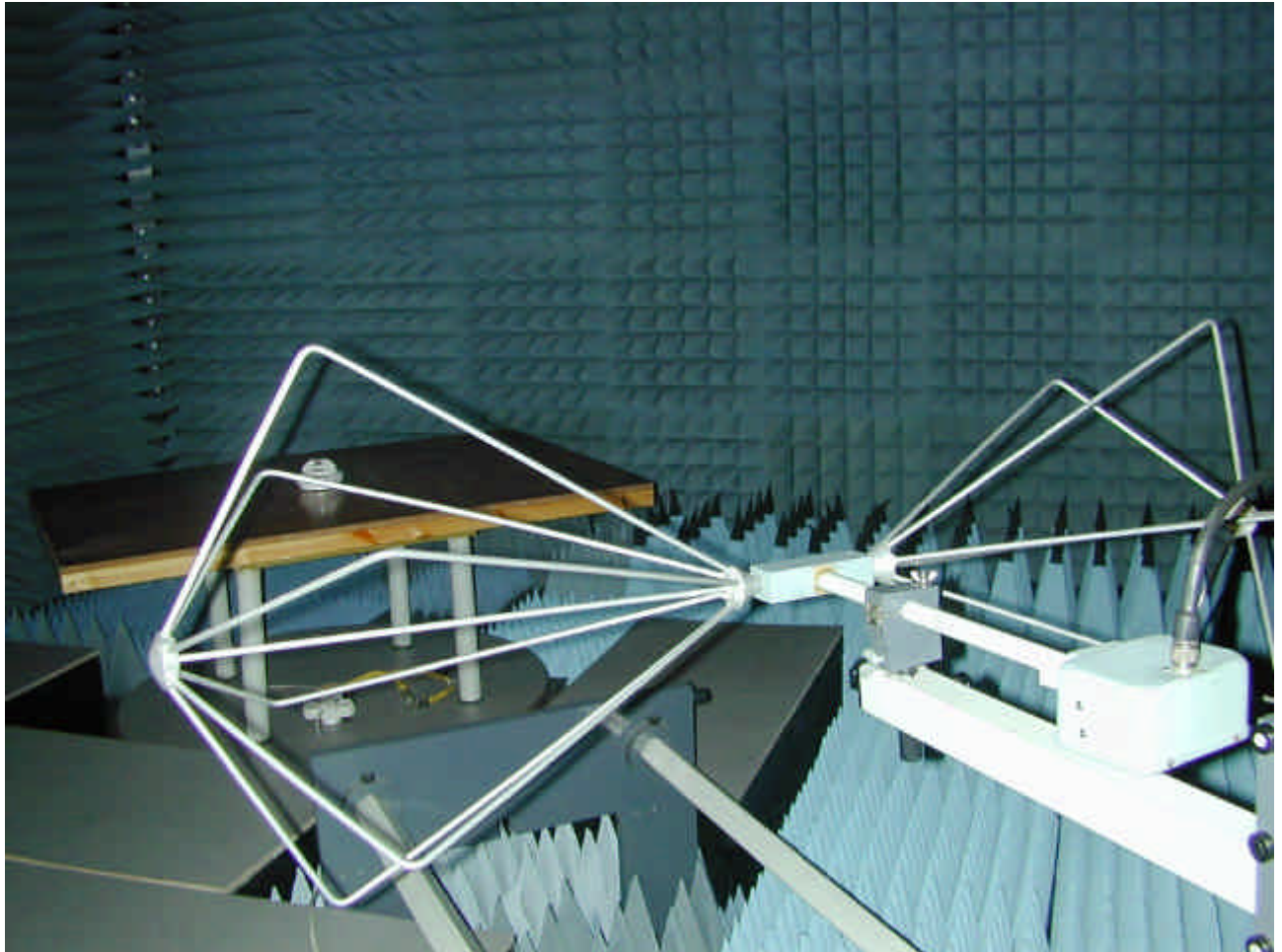
Photograph 1

Spurious emission measurement setup in 9 kHz – 30 MHz range,
Loop antenna in vertical polarization



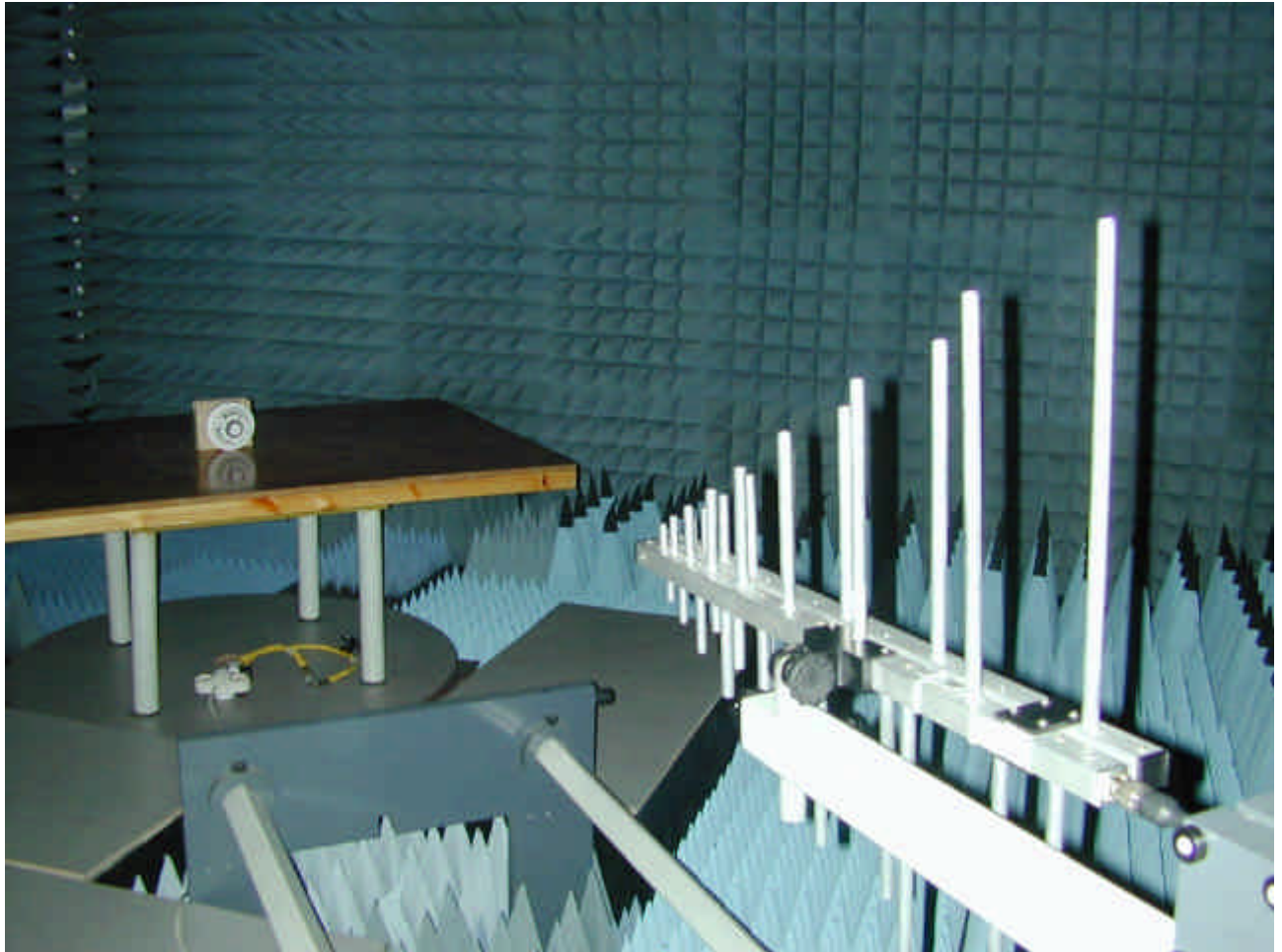


Photograph 2
Spurious emission measurement setup in 30 – 200 MHz range,
Biconical antenna in horizontal polarization



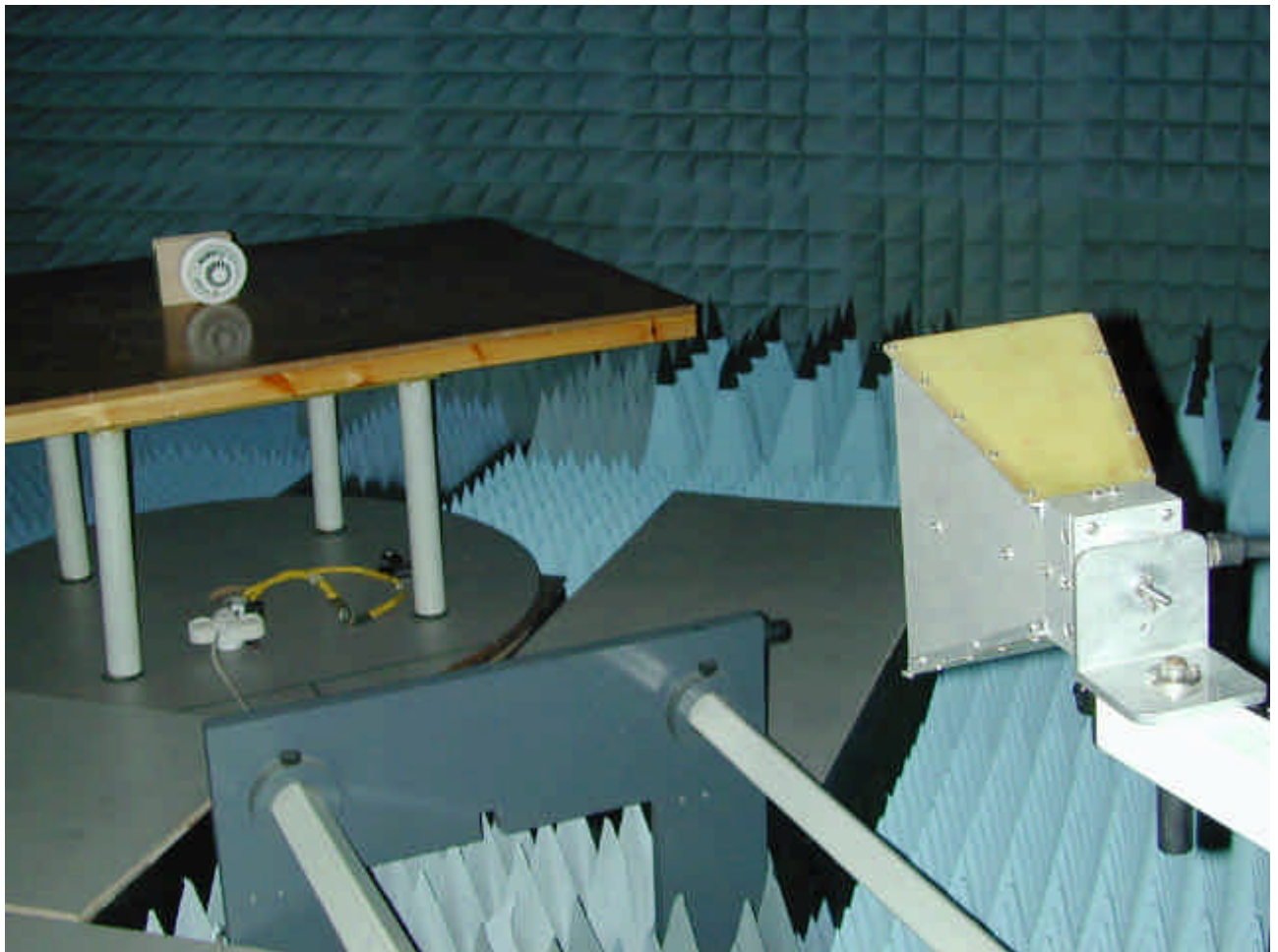


Photograph 3
Spurious emission measurement setup in 200 – 1000 MHz range,
Log periodic antenna in vertical polarization





Photograph 4
Spurious emission measurement setup in 1 – 3.2 GHz range,
Horn antenna in horizontal polarization





Photograph 5
20 dB bandwidth measurement setup,
Log periodic antenna in vertical polarization



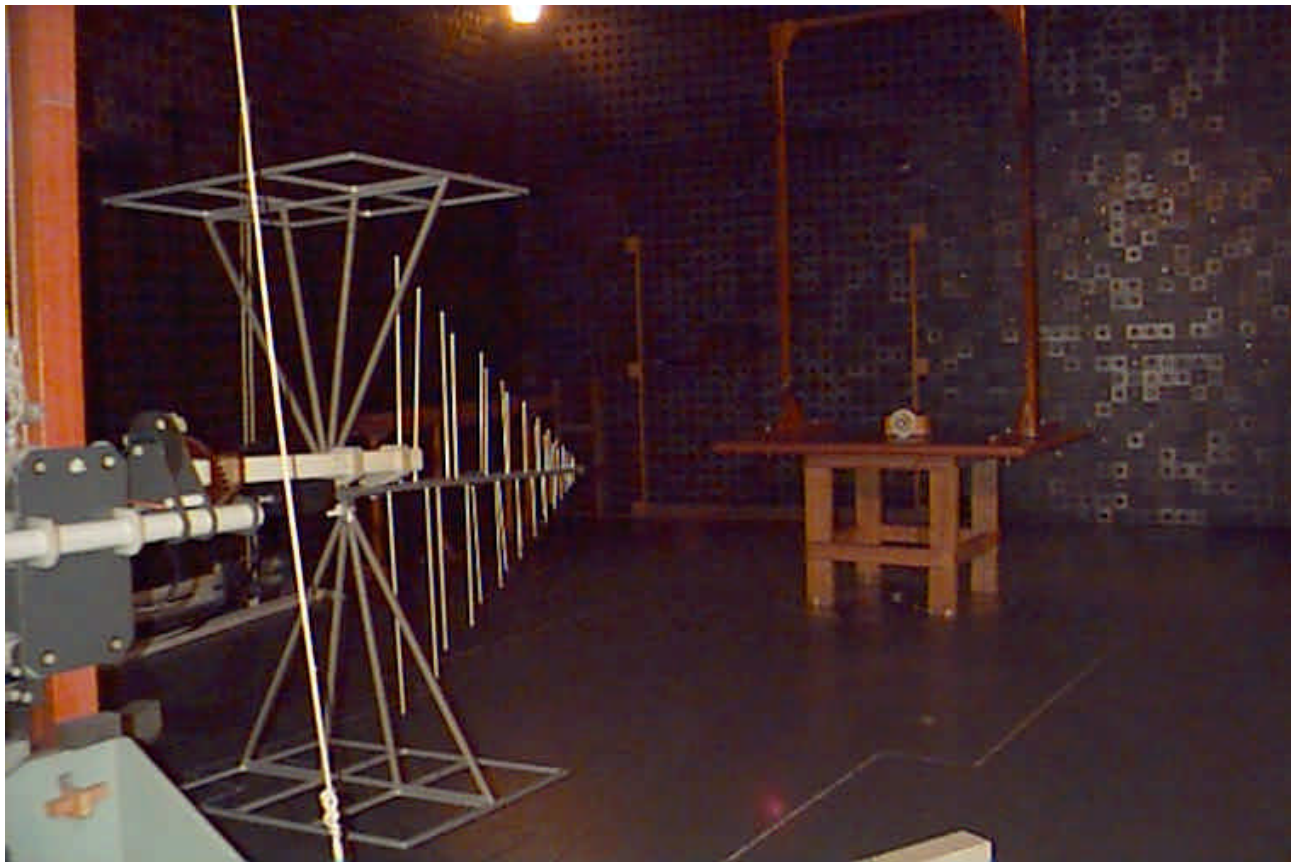


Photograph 6
Harmonics emission measurement setup,
Horn antenna in vertical polarization





Photograph 7
Unintentional radiated emission measurement setup in 30 – 2000 MHz range,
Biconilog antenna in vertical polarization





Appendix C - Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibration Month/ year
		Name	Model No.	Serial No.	
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	8/03
0446	Active Loop Antenna 10 kHz-30 MHz	Electro-Mechanics	6502	2857	10/03
0465	Anechoic Chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	3/04
0521	Spectrum Analyzer with RF filter section (EMI Receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	7/03
0589	Cable Coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	11/03
0592	Position controller	Hermon Labs	L2-SR3000	100	5/04 check
0604	Antenna Biconilog Log-Periodic/T Bow- Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	1/04
1004	Cable coaxial, ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/03
1365	Cable coaxial, RG-214, 5 m	Hermon Labs	C214-5	1365	4/04
1425	EMI Receiver System, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3710A00222	9/03
1430	EMI Receiver System, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3807A00262	9/03
1553	Cable RF, 3.5 m	Alpha wire	RG-214	149	12/03
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	12/03
1947	Cable 18 GHz, 6.5 m, blue	Rhophase Microwave Ltd	NPS-1803A- 6500-NPS	T4974	10/03
2009	Cable RF, 8 m	Alpha Wire	RG-214	2009	12/03



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



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



**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 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 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



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	Meas. Uncert., 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 Coaxial, S-FLC 12-50, 5 m,
Model C214-5, s/n 1365 (HL 1365)
Calibration data

No.	Parameter	SET, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB
1	Insertion Loss	1000	0.41	-	NA	±0.12
2		1200	0.44	-		
3		1400	0.48	-		
4		1600	0.52	-		
5		1800	0.55	-		
6		2000	0.58	-		
7		2200	0.61	-		
8		2400	0.64	-		±0.17
9		2600	0.67	-		
10		2800	0.7	-		
11		3000	0.73	-		
12		3300	0.79	-		
13		3600	0.84	-		
14		3900	0.94	-		
15		4200	1.22	-		



Cable RF, 2 m
Model: Sucoflex 104PE; s/n 13094/4PE (HL 1566)

No.	Parameter	SET, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB
1	Insertion Loss	30	0.12	-	NA	±0.12
2		50	0.15	-		
3		100	0.22	-		
4		300	0.39	-		
5		500	0.52	-		
6		800	0.65	-		
7		1000	0.76	-		
8		1500	1.01	-		
9		2000	1.13	-		
10		2500	1.24	-		
11		3000	1.39	-		
12		3500	1.55	-		±0.17
13		4000	1.69	-		
14		4500	1.92	-		
15		5000	1.92	-		
16		5500	2.05	-		
17		6000	2.21	-		
18		6500	2.28	-		
19		7000	2.39	-		
20		7500	2.67	-		
21	Insertion Loss	8000	2.66	-	NA	±0.17
22		8500	2.91	-		
23		9000	2.91	-		
24		9500	2.95	-		
25		10000	3.08	-		
26		10500	3.3	-		
27		11000	3.6	-		
28		11500	3.58	-		
29		12000	3.63	-		
30		12500	3.58	-		±0.26
31		13000	3.82	-		
32		13500	4.19	-		
33		14000	4.14	-		
34		14500	4.67	-		
35		15000	4.77	-		
36		15500	4.77	-		
37		16000	4.71	-		
38		16500	5.46	-		
39		17000	5.78	-		
40		17500	5.98	-		
41		18000	5.88	-		



Cable, RF, 3.5 m
Model: RG-214 (HL 1553)

No.	Parameter	Set		Measured, dBm	Attenuation, dB	Meas. Uncert., 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	



Cable 18GHz, 6.5 m, blue, model: NPS-1803A-6500-NPS, s/n T4974 (HL 1947)
Calibration data

Frequency, GHz	Insertion Loss, dB
	HL1947
0.03	0.30
0.05	0.38
0.10	0.53
0.20	0.74
0.30	0.91
0.40	1.05
0.50	1.18
0.60	1.29
0.70	1.40
0.80	1.50
0.90	1.59
1.00	1.68
1.10	1.77
1.20	1.86
1.30	1.94
1.40	2.01
1.50	2.08
1.60	2.16
1.70	2.22
1.80	2.29
1.90	2.36
2.00	2.42
2.10	2.48
2.20	2.54
2.30	2.60
2.40	2.66
2.50	2.71
2.60	2.77
2.70	2.83
2.80	2.89
2.90	2.95
3.10	3.06
3.30	3.17
3.50	3.28
3.70	3.39
3.90	3.51
4.10	3.62
4.30	3.76
4.50	3.87
4.70	4.01
4.90	4.10
5.10	4.21
5.30	4.31
5.50	4.43
5.70	4.56
5.90	4.71

Frequency, GHz	Insertion Loss, dB
	HL1947
6.10	4.87
6.30	4.95
6.50	4.94
6.70	4.88
6.90	4.87
7.10	4.83
7.30	4.85
7.50	4.86
7.70	4.91
7.90	4.96
8.10	5.03
8.30	5.08
8.50	5.13
8.70	5.21
8.90	5.22
9.10	5.34
9.30	5.35
9.50	5.52
9.70	5.51
9.90	5.66
10.10	5.70
10.30	5.78
10.50	5.79
10.70	5.82
10.90	5.86
11.10	5.94
11.30	6.06
11.50	6.21
11.70	6.44
11.90	6.61
12.10	6.76
12.40	6.68
13.00	6.66
13.50	6.81
14.00	6.90
14.50	6.90
15.00	6.97
15.50	7.17
16.00	7.28
16.50	7.27
17.00	7.38
17.50	7.68
18.00	7.92



Cable RF, 8 m, model:RG-214, s/n C-56 (HL 2009)
Calibration data

No.	Parameter	SET, MHz	Measured, dB	Deviation	Tolerance (Specification)	Meas. Uncert., dB	Notes
1	Insertion Loss	1	0.10	NA	NA	±0.12	
2		10	0.14				
3		30	0.25				
4		50	0.34				
5		100	0.53				
6		300	0.99				
7		500	1.31				
8		800	1.73				
9		1000	1.98				
10		1100	2.11				
11		1200	2.21				
12		1300	2.35				
13		1400	2.46				
14		1500	2.55				
15		1600	2.68				
16		1700	2.78				
17		1800	2.88				
18		1900	2.98				
19		2000	3.09				



Appendix E - General information

Test facility description

Tests were performed at Hermon Laboratories Ltd., 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 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, 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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e-mail: mail@hermonlabs.com

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

Abbreviations and acronyms

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

AC	alternating current
AE	auxiliary equipment
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
EMC	electromagnetic compatibility
EUT	equipment under test
GHz	gigahertz
H	height
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
LISN	line impedance stabilization network
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: 2001	Radio Frequency Devices
ANSI C63.2:96	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4:92	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