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Electrical

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ELECTROMAGNETIC EMISSION TEST REPORT

ACCORDING TO 47CFR PART 15, SUBPART C § 15.249 and SUBPART B

for

Hi-G-Tek Ltd.

EQUIPMENT UNDER TEST:

DataReader

Model IG-RS-46D-916

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1 Project information

Description of equipment under test

Test items	DataReader
Manufacturer	Hi-G-Tek
Type (Model)	IG-RS-46D-916
Equipment FCC code[1]	DSR

Applicant information

Applicant's responsible person	Mr. A Genin, project manager
Company	Hi-G-Tek
Address	16 Haharoshet street,
Postal code	60375
City	Or-Yehuda
Country	Israel
Telephone number	+972 3 5331575
Telefax number	+972 3 5339225

Test performance

Project number:	14834
Location	Hermon Laboratories
Receipt date	October 4, 2001
Test started	October 4, 2001
Test completed	January 18, 2002
Purpose of test	Apparatus compliance verification in accordance with emission requirements
Test specifications	47CFR Part 15, §15.249 and subpart B

[1] FCC Equipment codes – see Appendix D

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2 Summary of tests

The tests listed in the table below were performed. The EUT was found complying with the limits of 47CFR Part 15, §15.249 and subpart B.

Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
Transmitter characteristics, §15.249								
Field strength of fundamental	(a)	**C**				Mrs. E. Pitt, test engineer	December 5, 2001	
Field strength of harmonics	(a)	**C**				Mrs. E. Pitt, test engineer	December 5, 2001	
Out of band spurious emissions (radiated)	(c)	**C**				Mrs. E. Pitt, test engineer Mr. A. Troupiansky, test engineer	December 5, 2001 January 20, 2002	
Conducted emissions at AC port	15.207, 15.107	**C**				Mrs. E. Pitt, test engineer	December 5, 2001	
Radiated emissions	15.109	**C**				Mrs. E. Pitt, test engineer	December 5, 2001	
Receiver characteristics, §15.109								
Spurious radiated emissions	15.109	**C**				Mrs. E. Pitt, test engineer	December 5, 2001	

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.

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Parameter	Subclause	C	NC	NT	NA	Remarks
General conditions under Part 15						
The Intentional radiator operates at 916.5 MHz frequency.	15.249	**C**				
The intentional radiator has permanently attached antenna or antenna that uses a unique coupling to the intentional radiator.	15.203				**NA**	
The intentional radiator has a standard connector and must be professionally installed. To demonstrate that professional installation is required, the following three points must be addressed: (a) the application (or intended use) of the EUT; (b) the installation requirements of the EUT, and (c) the method by which the EUT will be marketed.	15.203	**C**				
No antenna other than that furnished by the responsible party can be used with the device.	15.203	**C**				Responsibility of the user
Antenna technical characteristics, as referred to in "Transmitter description" table in the test report	15.204	**C**				
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, certification engineer

Mr. M. Nikishin, EMC group leader

Test report approved by: Mr. A. Usoskin, QA manager

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3 EUT description

3.1 General description

The EUT, an outdoor DataReader, model IG-RS-46D-916, is a transceiver operating at 916.5 MHz frequency. The device is powered by 24 V DC via AC/DC adapter.

Local oscillator frequencies are: 16 MHz, 26 MHz and 28 MHz.

3.2 EUT test configuration

The EUT ports and lines description is given in Table 3.2.1, the support/test equipment description is provided in Table 3.2.2. Test configuration is shown in Figure 3.2.1.

Table 3.2.1 EUT ports and lines

Port type	Port description	Connector type	Quantity	Cable type description	Cable length, m	Connected to
Power	DC power	Non-detachable	1	Unshielded	1.5	DC power supply
Signal	Signal	RS 485	1	Shielded	10	MOXA

Table 3.2.2 EUT support/test equipment

Description	Manufacturer	Model number	Note
Computer	COMPAQ	ARMADA	NA
Converter RS232 to RS485	MOXA	MOXA A-50	NA

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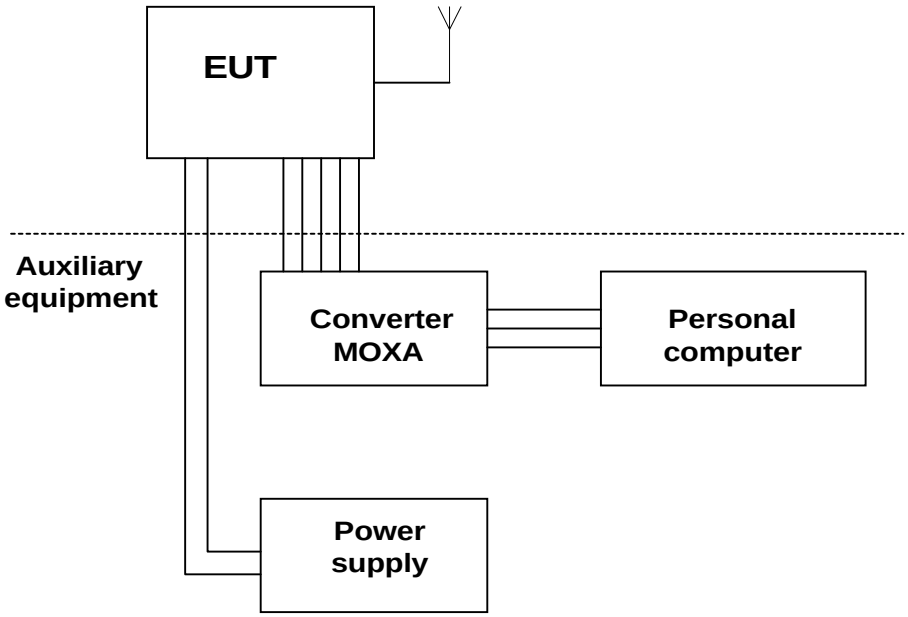
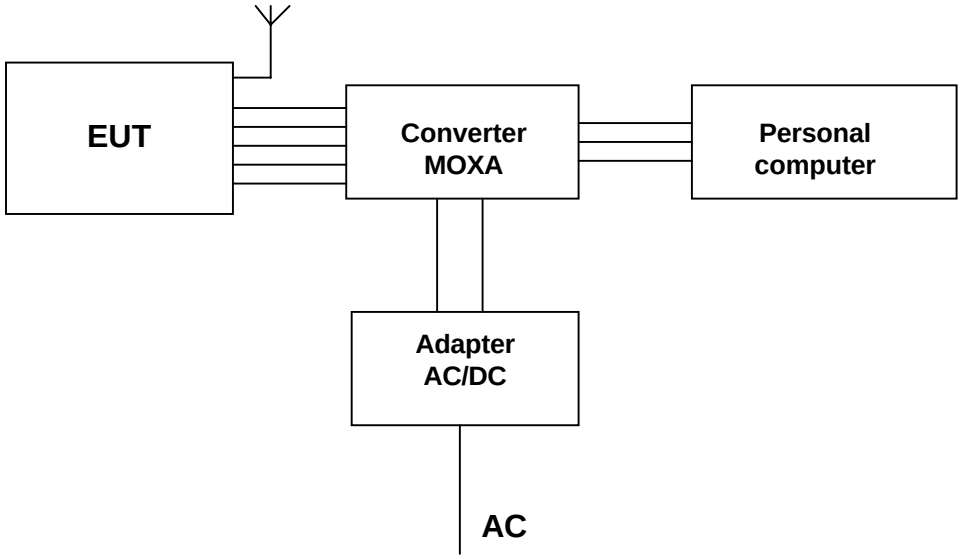
Figure 3.2.1
a) Radiated emission test configuration



b) Conducted emission test configuration



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3.3 Transmitter description

Type of equipment							
v	Stand-alone (Equipment with or without its own control provisions)						
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)						
	Plug-in card (Equipment intended for a variety of host systems)						
	Other:						
Operating frequency						916.5 MHz	
Transmitter aggregate data rate (bits per second)						15625	
Normal test signal						Transmit carrier & transmit message	
Maximum rated output power							
	At transmitter permanent external 50 Ω rf output connector					93.93 dB(μV/m) = -1.3 dBm	
	Effective radiated power (for equipment with integral antenna)					NA	
	Is transmitter output power variable?		No				
		v	Yes			continuous variable	
				v		stepped variable	
						stepsize (dB): 0.18	
						minimum RF power (dBm): -15	
						maximum RF power (dBm): -1.3	
Transmitter power source							
	Battery		**Nominal rated voltage (VDC)**				
	Nickel Cadmium						
	Lithium						
	Other						
v	**DC**		**Nominal rated voltage (VDC)**			24	
	AC mains		**Nominal rated voltage (VAC)**				
Is there common power source for transmitter and receiver						v yes	no

Antenna technical characteristics						
			Type	**Manufacturer**	**Model number**	**Gain**
Integral		with temporary RF connector				
		without temporary RF connector				
External			Whip	PANORAMA	PCG-TNC-921	0 dBi

External antenna connection			
v	standard connector, TNC		unique coupling

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4 Tests results

4.1 Field strength of fundamental according to § 15.249 (a)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4
DATE: December 5, 2001
RELATIVE HUMIDITY: 56 %
AMBIENT TEMPERATURE: 23 °C
TEST PERFORMED IN: ANECHOIC CHAMBER
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
ANTENNA TYPE: BICONILOG

Peak detector

Carrier frequency, MHz	Field strength, dB(µV/m)	Specification limit, dB(µV/m)	Margin, dB	Reference to Plots in Appendix A
916.5	93.78	94	0.22	A1
Measurement uncertainty, dB		+5.73 / -5.57		

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1004	HL 2009

LIMIT

Operating frequency range, MHz	Field strength of fundamental, dB(µV/m)
902-928	94
2400-2483.5	94
5275-5850	94
24000-24250	107.95

For frequencies above 1000 MHz, the above field strength limits are based on average limits.

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table 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 antennas polarization was changed from vertical to horizontal.

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4.2 Field strength of harmonics according to § 15.249 (a)

METHOD OF MEASUREMENTS:	ANSI 63.4 §13.1.4
DATE:	December 5, 2001
RELATIVE HUMIDITY:	56 %
AMBIENT TEMPERATURE:	23 °C
CARRIER FREQUENCY:	916.5 MHz
FIELD STRENGTH LEVEL AT WHICH THE MEASUREMENT HAS BEEN PERFORMED:	93.78 dB(μV/m)
TEST PERFORMED AT:	OATS
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
ANTENNA TYPE:	DOUBLE RIDGED GUIDE
RESOLUTION BANDWIDTH:	1MHz
VIDEO BANDWIDTH:	1MHz

Peak detector

Harmonic, MHz	Field strength, dB(μV/m)	Average limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
1833	42.8	54	11.2	NA
2749.5	45.0	54	9.0	NA
Measurement uncertainty, dB		± 2.36		

Test results obtained using peak detector were found below average limit, therefore further measurements with average detector were considered unnecessary.

TEST EQUIPMENT USED:

HL 0038	HL 0041	HL 0554	HL 1424	HL 1947		

LIMIT

Operating frequency range, MHz	Field strength of harmonics, dB(μV/m)	
	Peak limit	Average limit
902-928	74	54
2400-2483.5	94	74
5275-5850	94	74
24000-24250	107.95	87.95

TEST PROCEDURE

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

To find maximum radiation the turntable was rotated 360^{o}, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

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4.3 Out of band spurious emissions according to § 15.249 (d), §15.209

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4/ §13.1.5
EQUIPMENT UNDER TEST: Outdoor data reader
MODE OF OPERATION: Tx
DATE: December 5, 2001
RELATIVE HUMIDITY: 56 %
AMBIENT TEMPERATURE: 23 °C
TEST DISTANCE: 3 m
CARRIER FREQUENCY: 916.5 MHz
FIELD STRENGTH LEVEL AT WHICH THE MEASUREMENT HAS BEEN PERFORMED: 93.78 dB(μV/m)
FREQUENCY RANGE: 9 kHz – 9.5 GHz

TEST PERFORMED IN: ANECHOIC CHAMBER
FREQUENCY RANGE: 9 kHz – 30 MHz
ANTENNA TYPE: LOOP

Peak detector

Frequency, MHz	Radiated emission, dB (μV/m)	Limit (50 dB below carrier), dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
0.009 – 0.15	No spurious emissions were found			A2
0.15 - 30	No spurious emissions were found			A3
Measurement uncertainty, dB	±4			

TEST PERFORMED IN: ANECHOIC CHAMBER
FREQUENCY RANGE: 30 MHz – 1 GHz

Quasi-peak detector

Frequency, MHz	Antenna polarization	Turntable position, (^{o})	Radiated emission, dB (μV/m)	Limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
40.009000	V	130	34.87	40.00	5.13	A4
328.081550	H	200	41.10	46.00	4.90	A4
344.091900	H	200	40.45	46.00	5.55	A4
360.093200	H	200	35.10	46.00	10.90	A4
376.086200	H	200	37.15	46.00	8.85	A4
945.200000	V	130	45.00	46.00	1.0	A5
Measurement uncertainty, dB	+5.73 / -5.57					

The test results recorded in the table were obtained throughout the testing with biconilog antenna at 1 m height.

Table abbreviations:
Antenna polarization: V = vertical, H = horizontal
Turntable position: 0^o = EUT front panel faces the receiving antenna
Margin = dB below (negative if above) specification limit.

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TEST PERFORMED AT: OATS
FREQUENCY RANGE: 1 – 9.5 GHz
ANTENNA TYPE: DOUBLE RIDGED GUIDE

Peak detector

Frequency, MHz	Antenna polarization	Radiated emission, dB (µV/m)	Limit, dB(µV/m)	Margin, dB	Reference to Plots in Appendix A
1000 – 9500	V+H	No spurious emissions were found except harmonics			NA
Measurement uncertainty, dB		± 2.36			

Table abbreviations:
Antenna polarization: V = vertical, H = horizontal
Margin = dB below (negative if above) specification limit.

LIMIT

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

TEST EQUIPMENT USED:

HL 0038	HL 0041	HL 0446	HL 0465	HL 0521	HL 0554	HL 0589
HL 0593	HL 0594	HL 0604	HL 1004	HL 1424	HL 1947	HL 2009

TEST PROCEDURE

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

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4.4 Receiver spurious emissions, according to §15.109

METHOD OF MEASUREMENT:	ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
TEST PERFORMED IN:	ANECHOIC CHAMBER
MODE OF OPERATION:	Rx
DATE:	December 5, 2001
RELATIVE HUMIDITY:	56 %
AMBIENT TEMPERATURE:	23 °C
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
THE EUT WAS TESTED AS:	TABLE-TOP
RECEIVER OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	30 MHz – 5 GHz

The EUT highest used frequency (not 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	5th harmonic of the highest frequency or 40 GHz, whichever is lower

FREQUENCY RANGE:	30 MHz – 1 GHz
DETECTOR TYPE:	QUASI-PEAK
RESOLUTION BANDWIDTH:	120 kHz

Frequency, MHz	Antenna polarization	Turntable position, (°)	Radiated emissions, dB (µV/m)	Limit, dB (µV/m)	Margin, dB	Reference to Plots in Appendix A
88.032800	V	130	25.56	43.50	17.94	A6
328.081550	H	200	41.10	46.00	4.9	A6
344.091900	H	200	40.45	46.00	5.55	A6
360.093200	H	200	35.10	46.00	10.90	A6
376.086200	H	200	37.15	46.00	8.85	A6
Measurement uncertainty, dB				+5.73 / -5.57		

The test results recorded in the table were obtained throughout the testing with biconilog antenna at 1 m height.

Table abbreviations:
Antenna polarization: V = vertical, H = horizontal
Turntable position: 0° = EUT front panel faces the receiving antenna

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FREQUENCY RANGE: 1 – 5 GHz
ANTENNA TYPE: DOUBLE RIDGED GUIDE

Frequency, MHz	Antenna polarization	Radiated emissions, dB (μV/m)	Limit, dB (μV/m)	Margin, dB	Reference to Plots in Appendix A
1000 – 5000	V + H	No spurious emissions were found.			A7
Measurement uncertainty, dB		± 2.36			

Table abbreviations:
Antenna polarization: V = vertical, H = horizontal

TEST EQUIPMENT USED:

HL 0041	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604
HL 1004	HL 1947	HL 2009				

LIMIT

(§ 15.109)

Frequency, MHz	Class A equipment @ 10 m dB(μV/m)	Class B equipment @ 3 m dB(μV/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 tested, being placed on a wooden 80 cm height table.

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.

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4.5 Conducted emission measurements at AC power port according to §15.207 and §15.107

METHOD OF MEASUREMENTS	ANSI 63.4 §13.1.3
DATE:	December 5, 2001
RELATIVE HUMIDITY:	56 %
AMBIENT TEMPERATURE:	23 °C
THE EUT WAS TESTED AS:	TABLE-TOP
DETECTOR USED:	QUASI-PEAK
FREQUECNY RANGE:	450 kHz – 30 MHz
RESOLUTION BANDWIDTH:	9 kHz
MODE OF OPERATION	Tx

Frequency, MHz	Line identification	Measured emissions, dB (µV)	Specification limit, dB (µV)	Margin, dB	Reference to Plots in Appendix A
7.745585	Neutral	31.33	48.00	16.67	A9
7.791388	Phase	34.91	48.00	13.09	A8
8.248715	Neutral	35.16	48.00	12.84	A9
8.346598	Phase	44.92	48.00	3.08	A8
8.642125	Neutral	33.69	48.00	14.31	A9
8.739990	Phase	33.98	48.00	14.02	A8
9.233408	Phase	30.40	48.00	17.60	A8
Measurement uncertainty, dB		+2.43 / -2.22			

TEST EQUIPMENT USED:

HL 0163	HL 0580	HL 0590	HL 0672	HL 1430	HL 1503	

LIMIT

Frequency, MHz	Limit, dB(µV)
0.45 – 30	48

TEST PROCEDURE

The EUT was set up as shown in associated photograph. The measurements were performed at mains terminals by means of LISN, connected to spectrum analyzer. The unused coaxial connector of the LISN was terminated with 50 Ω. The position of device cables was varied to determine maximum emission level.

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4.6 Unintentional radiated emissions test according to §15.109

METHOD OF MEASUREMENT:	ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
TEST PERFORMED IN:	ANECHOIC CHAMBER
DATE:	December 5, 2001
RELATIVE HUMIDITY:	56 %
AMBIENT TEMPERATURE:	23 °C
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
THE EUT WAS TESTED AS:	TABLE-TOP
FREQUENCY RANGE:	30 MHz – 5 GHz
DETECTOR TYPE:	QUASI-PEAK (30 – 1000 MHz) PEAK (1 – 5 GHz)
RESOLUTION BANDWIDTH:	120 kHz (30 – 1000 MHz) 300 kHz (1 – 5 GHz)

	The EUT highest used frequency (not 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	5th harmonic of the highest frequency or 40 GHz, whichever is lower

The limits for class B unintentional radiated emissions were used while testing the equipment in Rx mode, refer to paragraph 4.4 and Plots A6, A7.

TEST EQUIPMENT USED:

HL 0041	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604
HL 1004	HL 2009					

LIMIT (§ 15.109)

Frequency, MHz	**Class A equipment @ 10 m dB(µV/m)**	**Class B equipment @ 3 m dB(µV/m)**
30 - 88	39.0	40
88 - 216	43.5	43.5
216 - 960	46.4	46
960 - 5000	49.5	54

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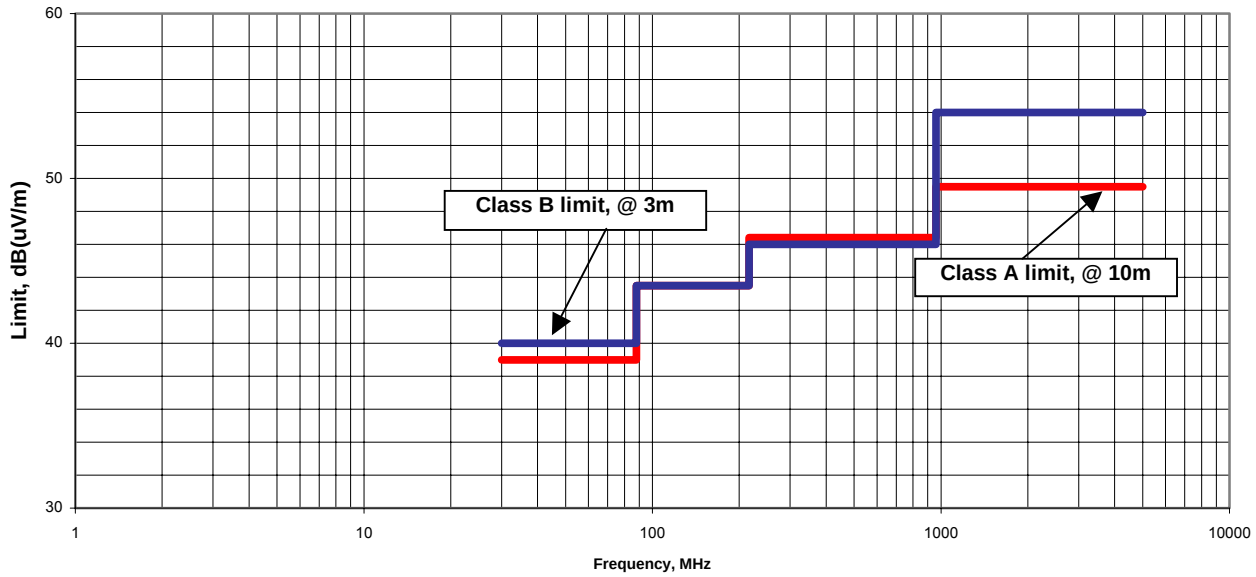
Unintentional radiated emissions test according to §15.109



TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table.

To find maximum radiation the turntable was rotated 360^{o}, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

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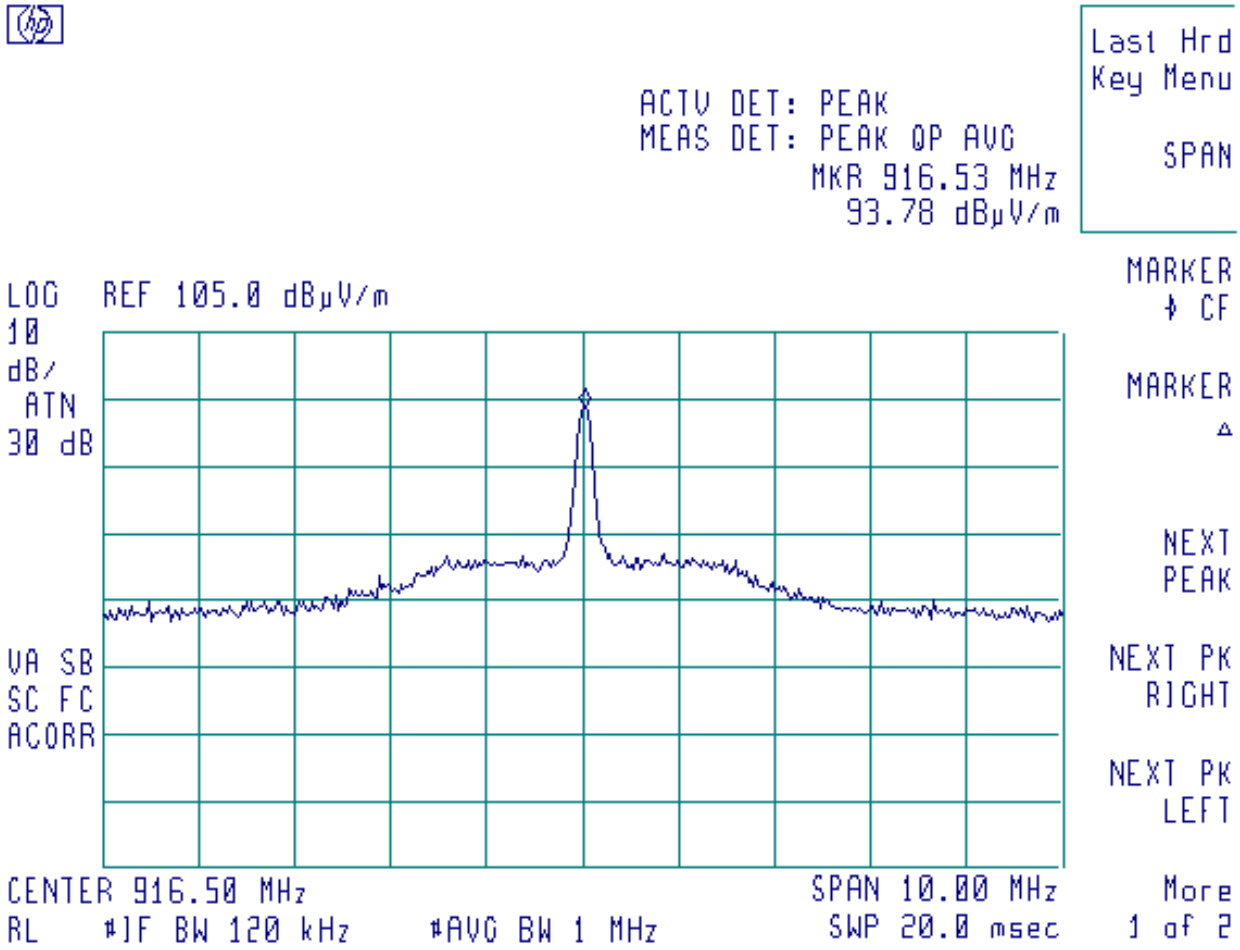
Appendix A Plots

Plot A1
Field strength of fundamental test result



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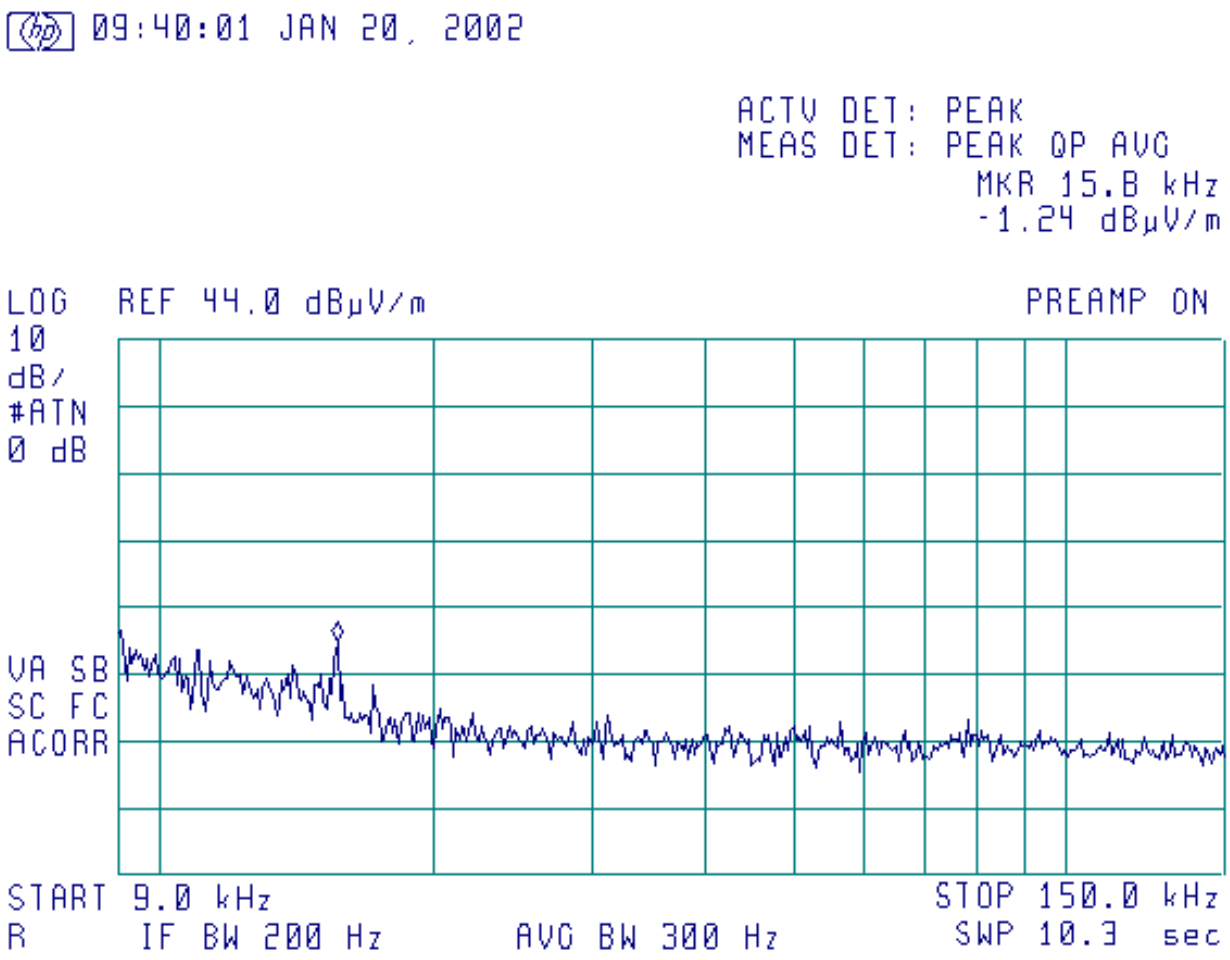
Plot A2
Out of band spurious emissions test results

FREQUENCY RANGE: 9 – 150 kHz



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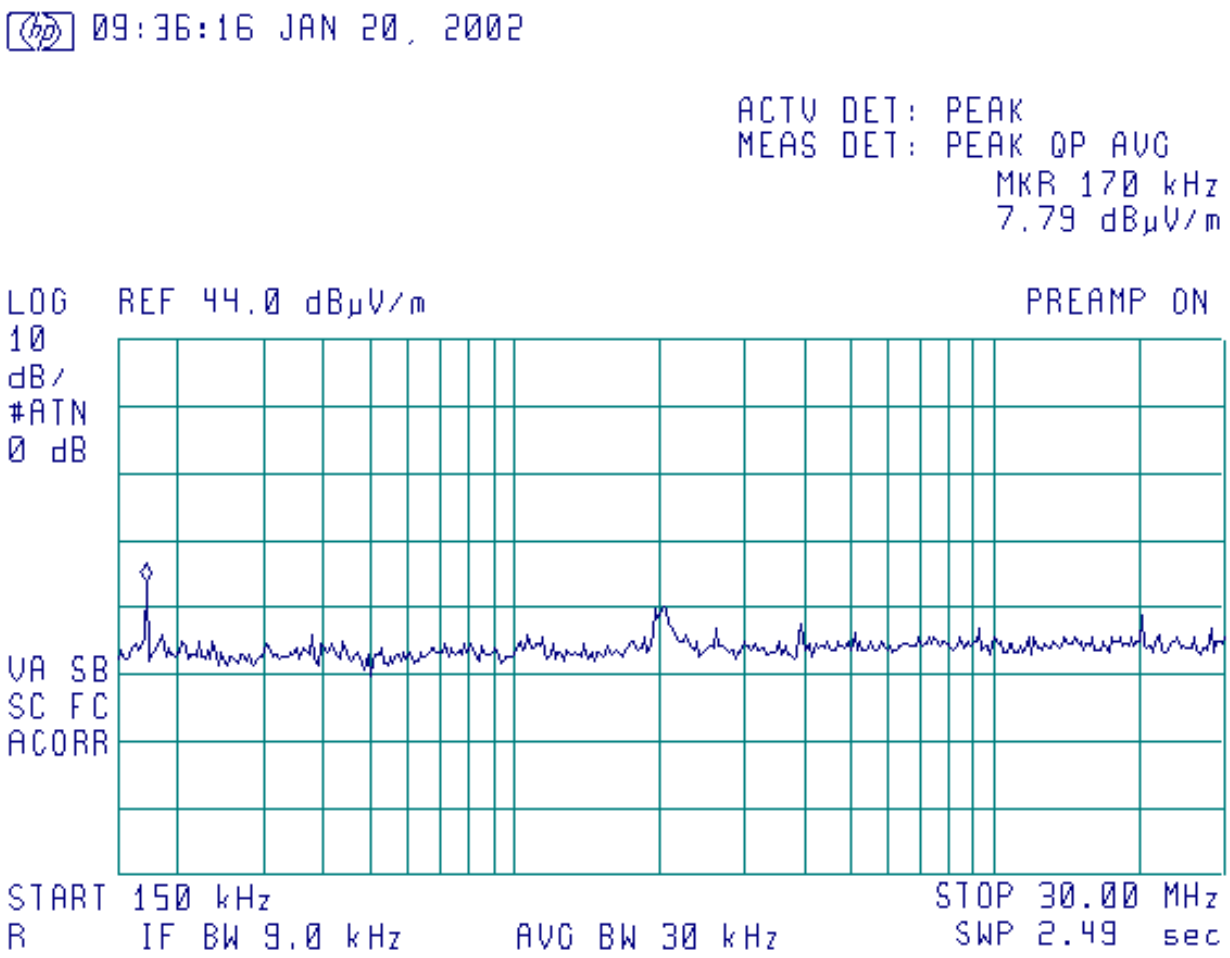
Plot A3
Out of band spurious emissions test results

FREQUENCY RANGE: 0.15 – 30 MHz



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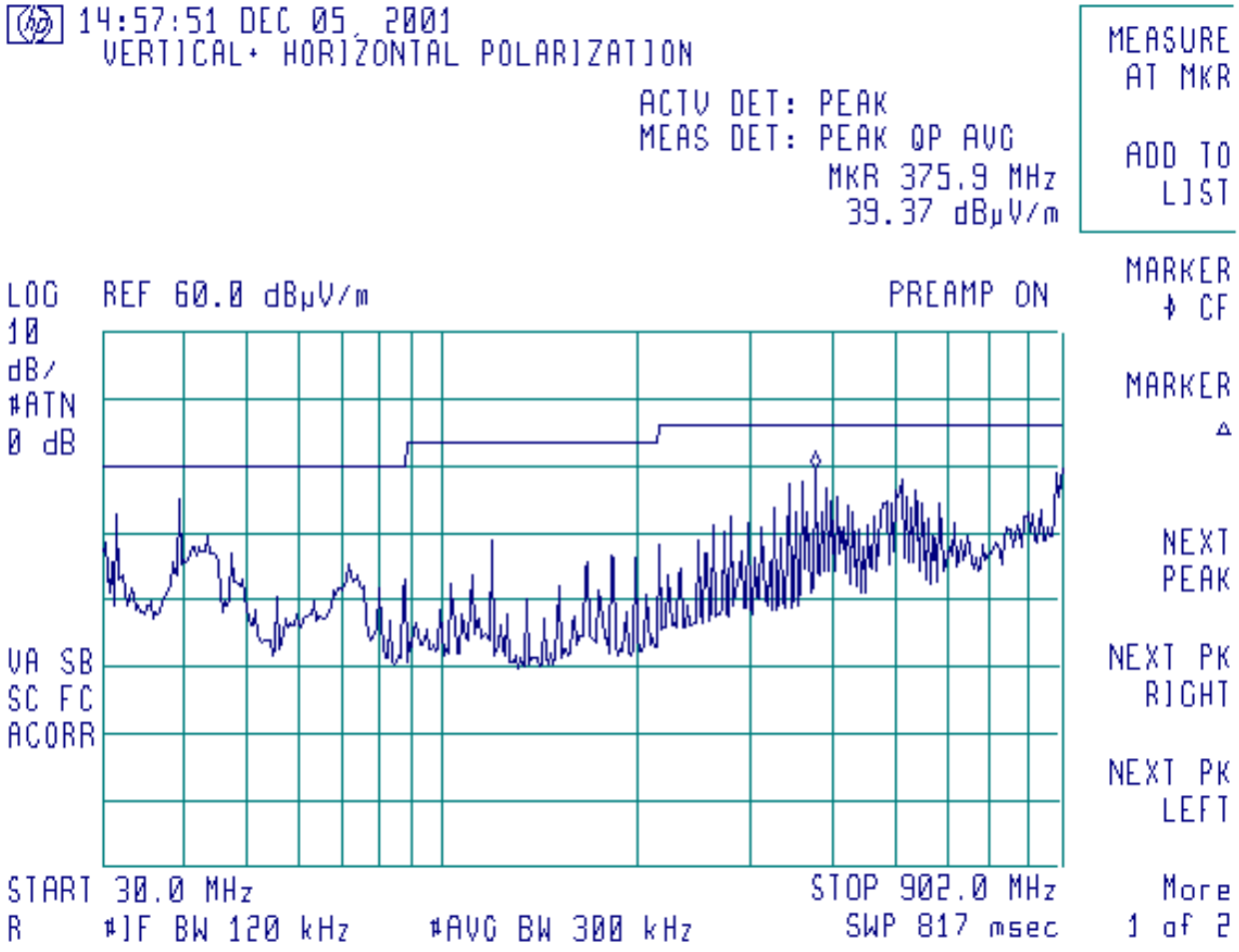
Plot A4
Out of band spurious emissions test results

FREQUENCY RANGE: 30 – 902 MHz



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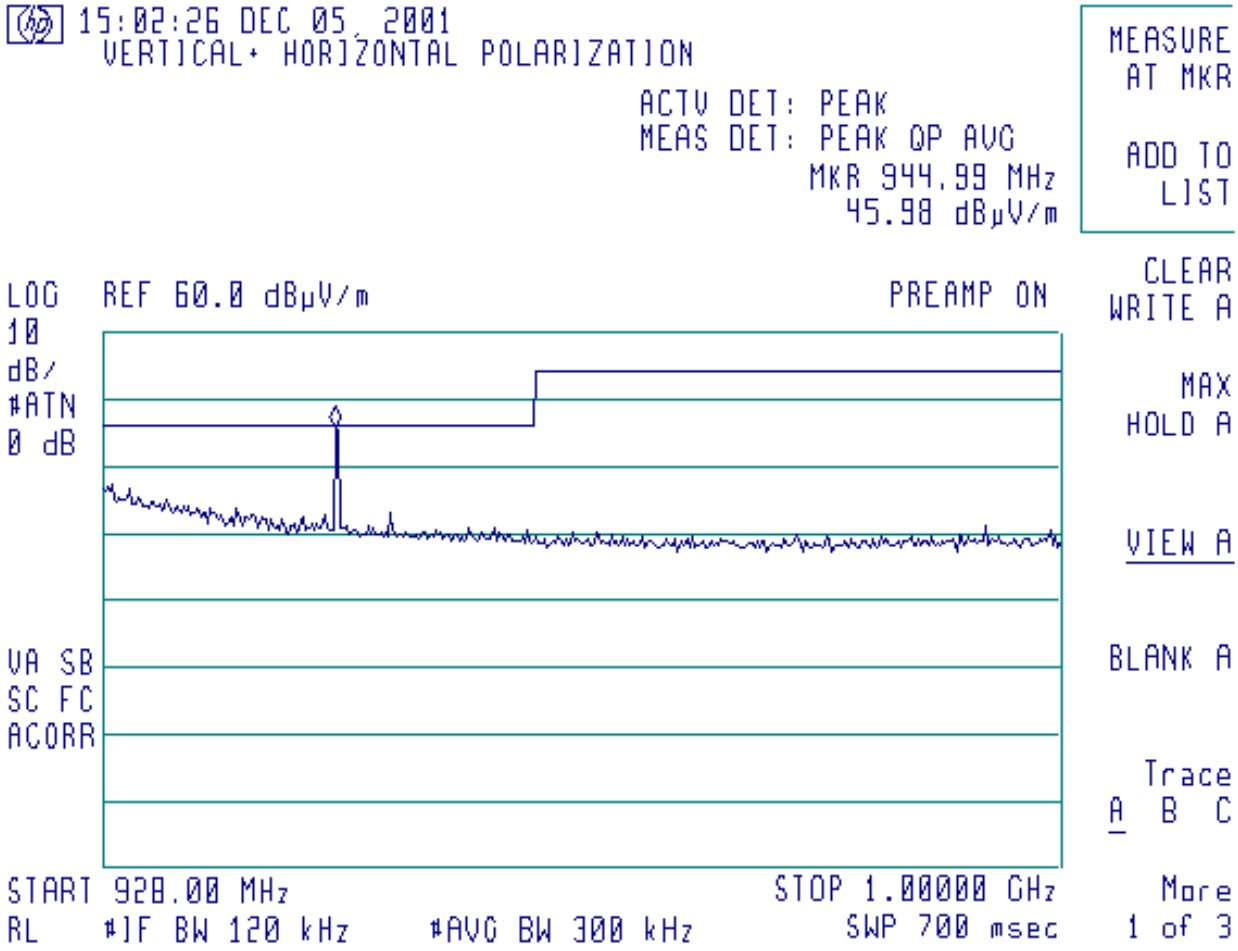
Plot A5
Out of band spurious emissions test results

FREQUENCY RANGE: 928 – 1000 MHz



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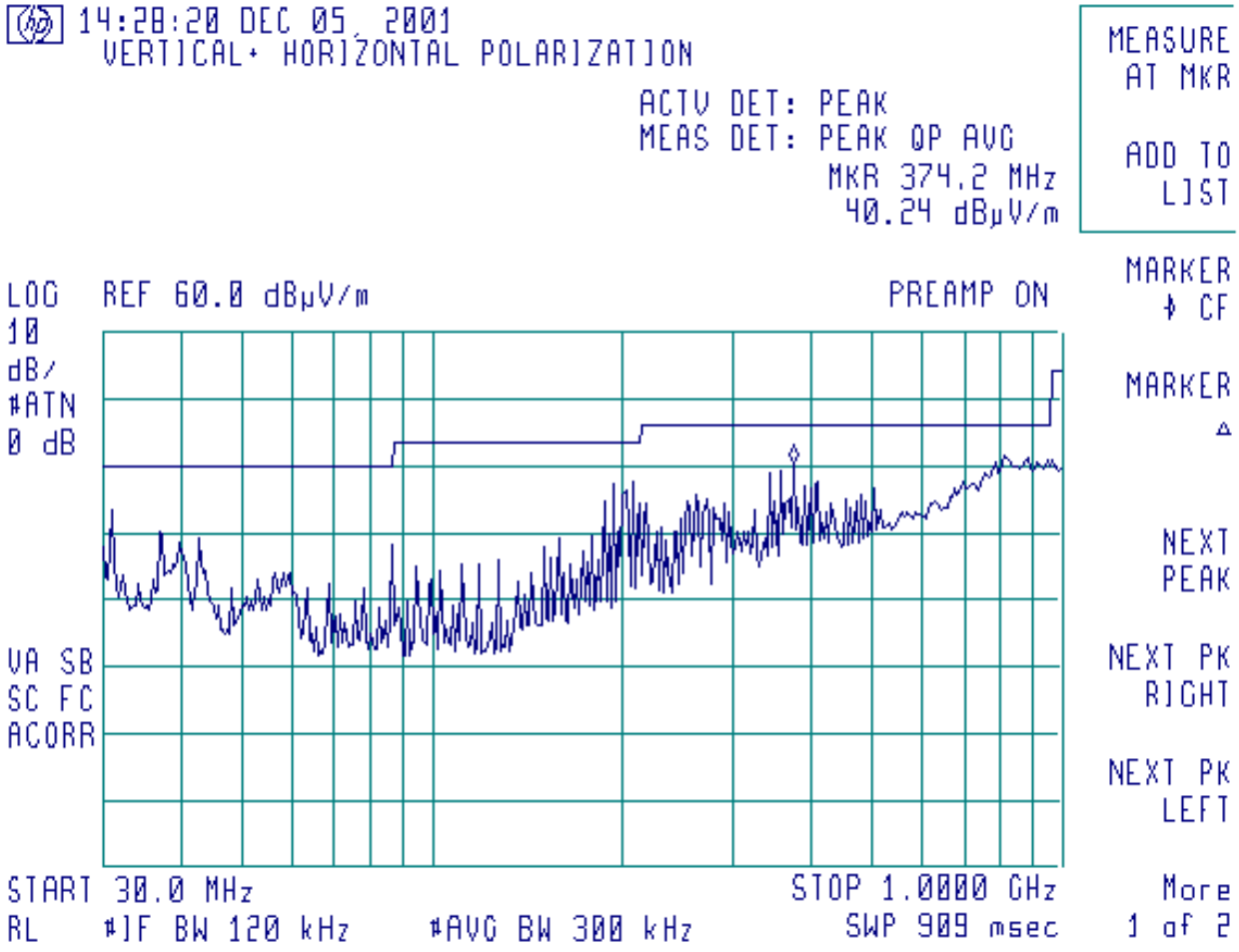
Plot A6
Receiver spurious emissions test results

FREQUENCY RANGE: 30 – 1000 MHz



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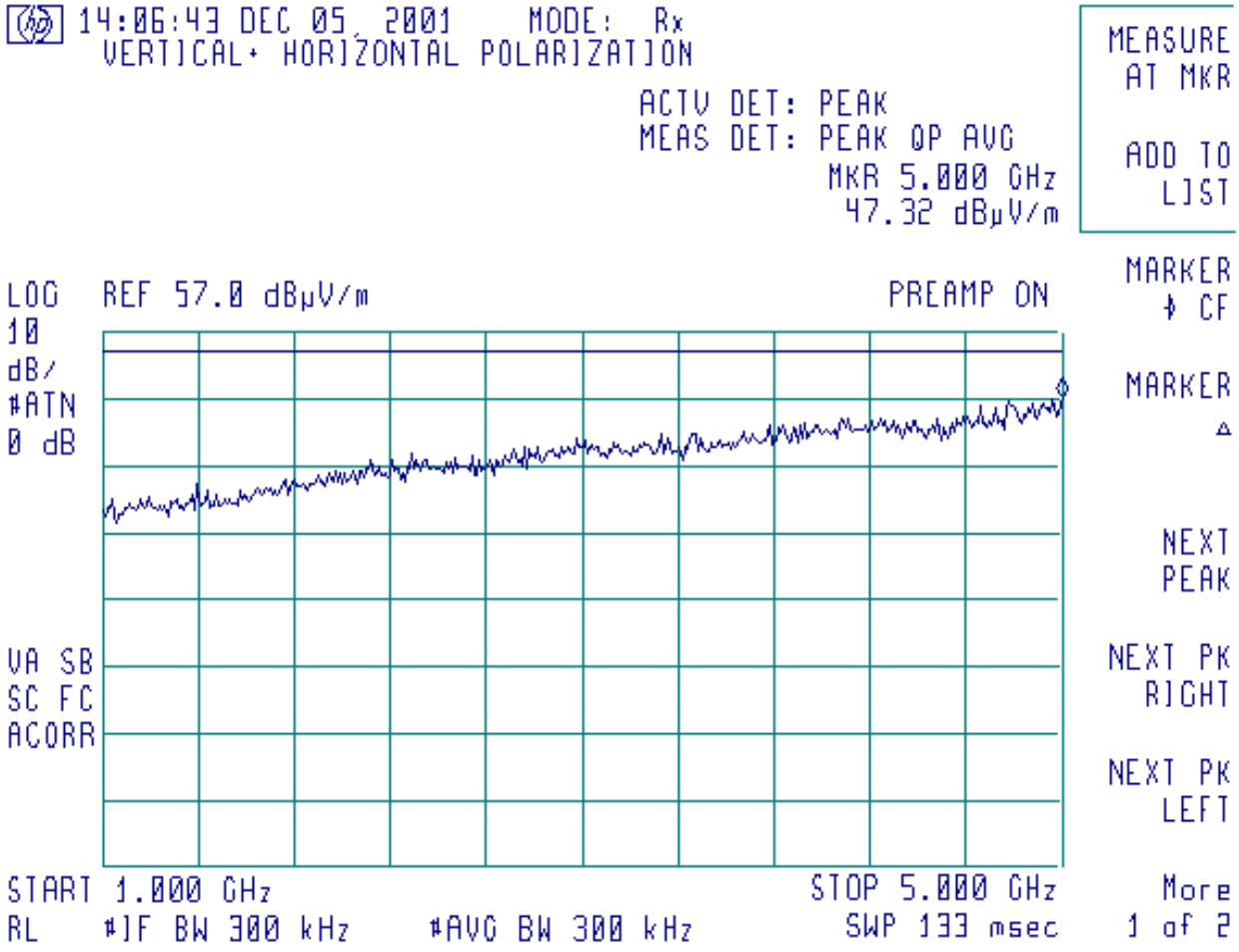
Plot A7
Receiver spurious emissions test results

FREQUENCY RANGE: 1 – 5 GHz



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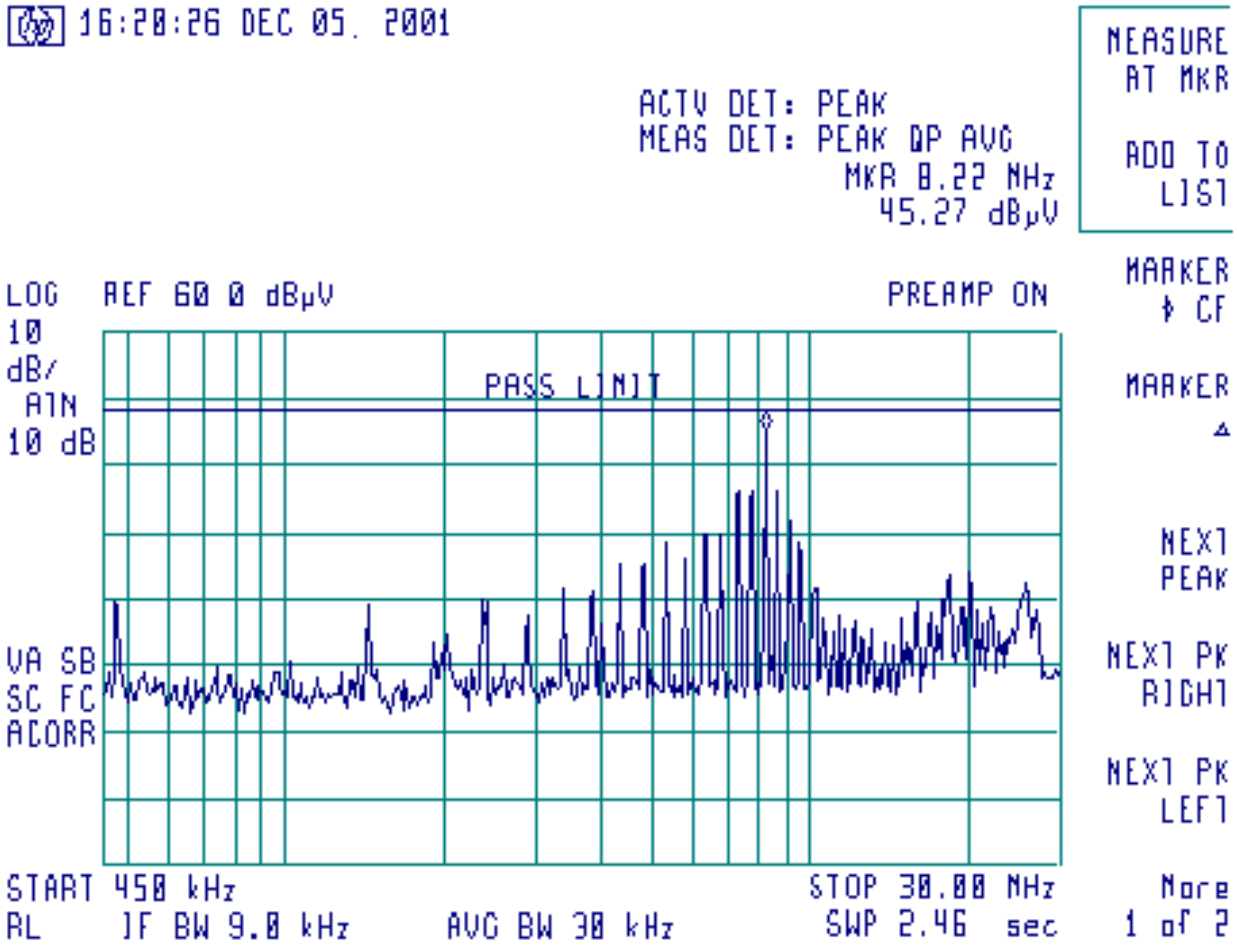
Plot A8
Unintentional conducted emissions on power line

LINE: PHASE



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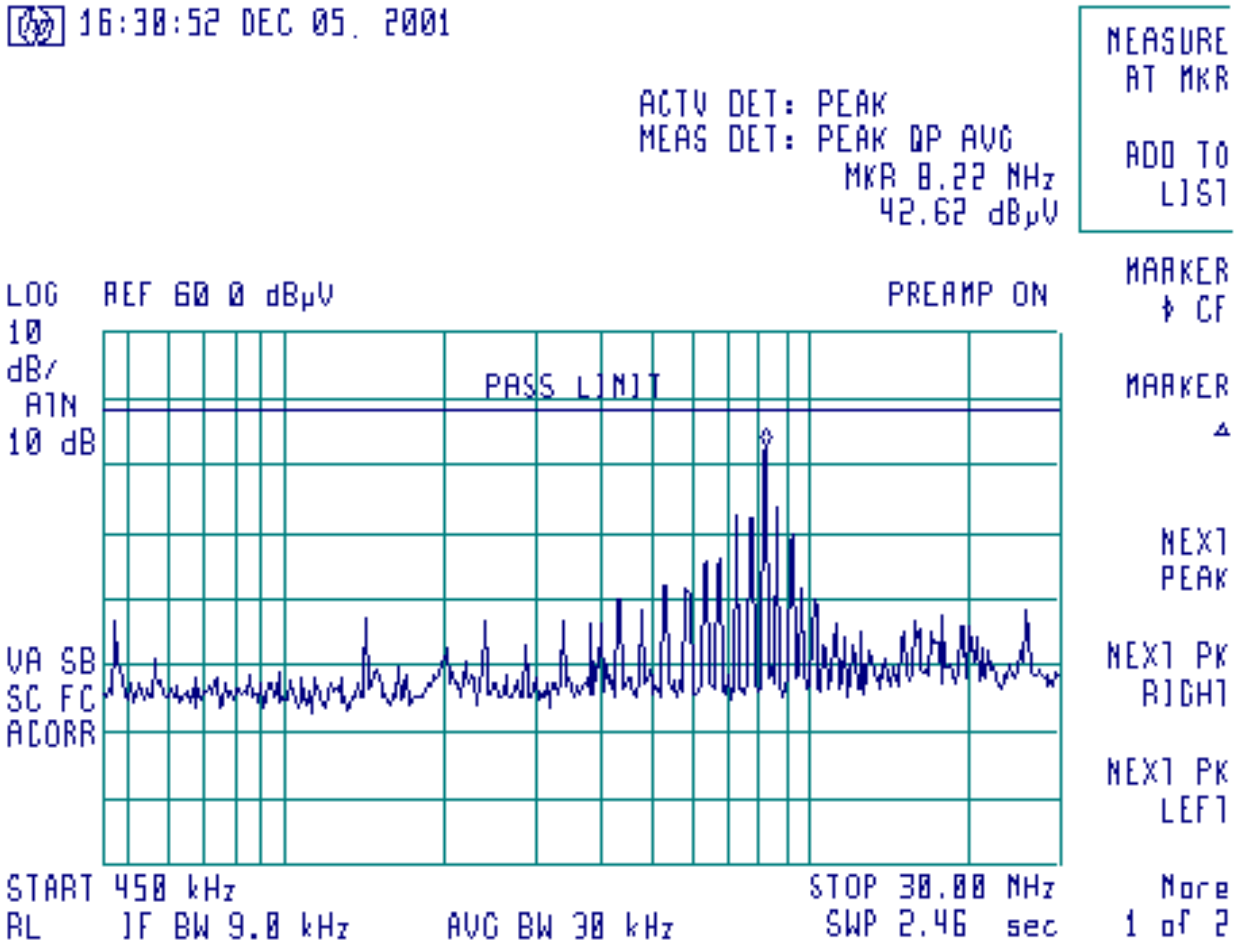
Plot A9
Unintentional conducted emissions on power line

LINE: NEUTRAL



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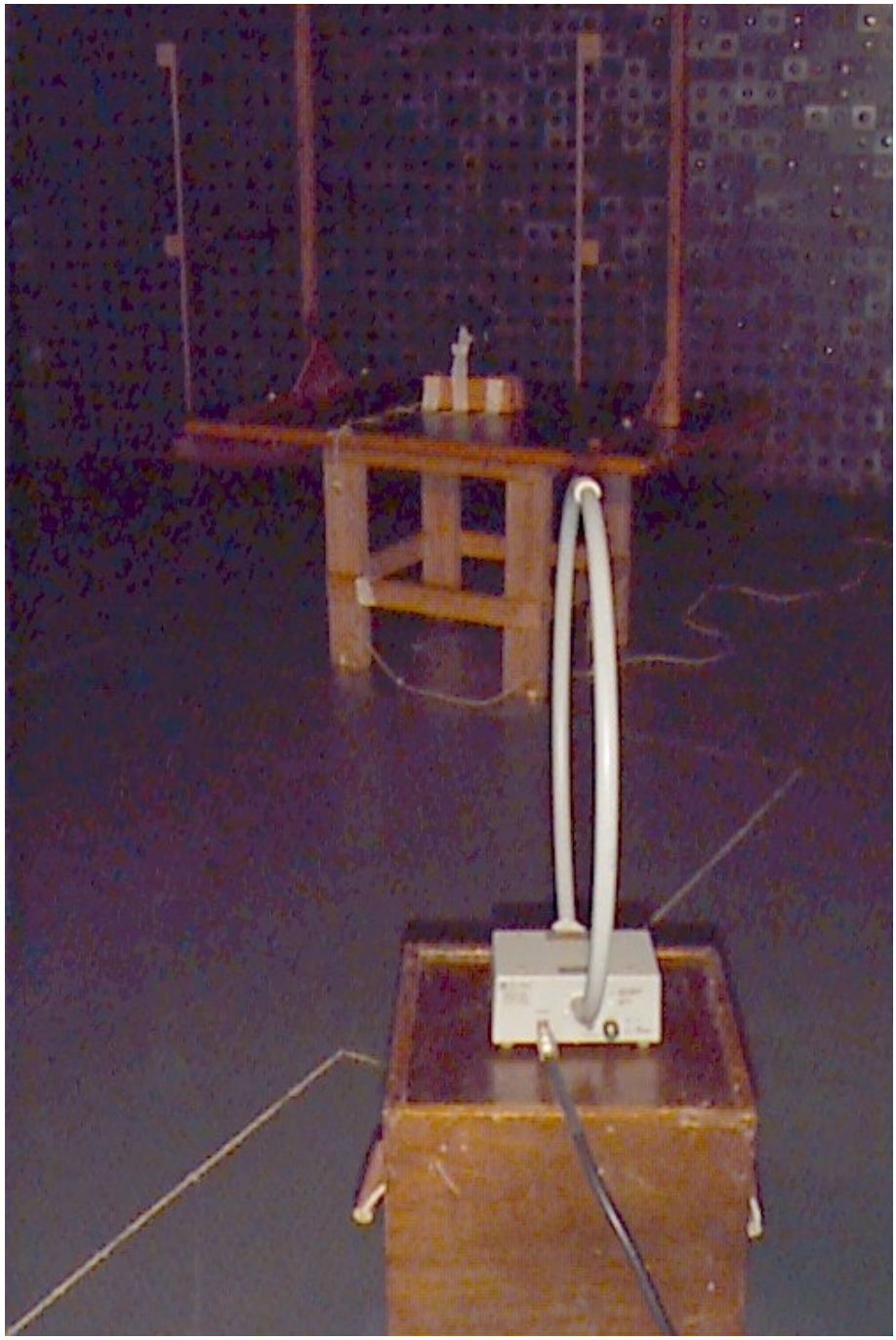
Appendix B Test setup photographs

Photograph 1
Radiated emission measurements test setup with loop antenna,
9 kHz – 30 MHz frequency range, anechoic chamber method



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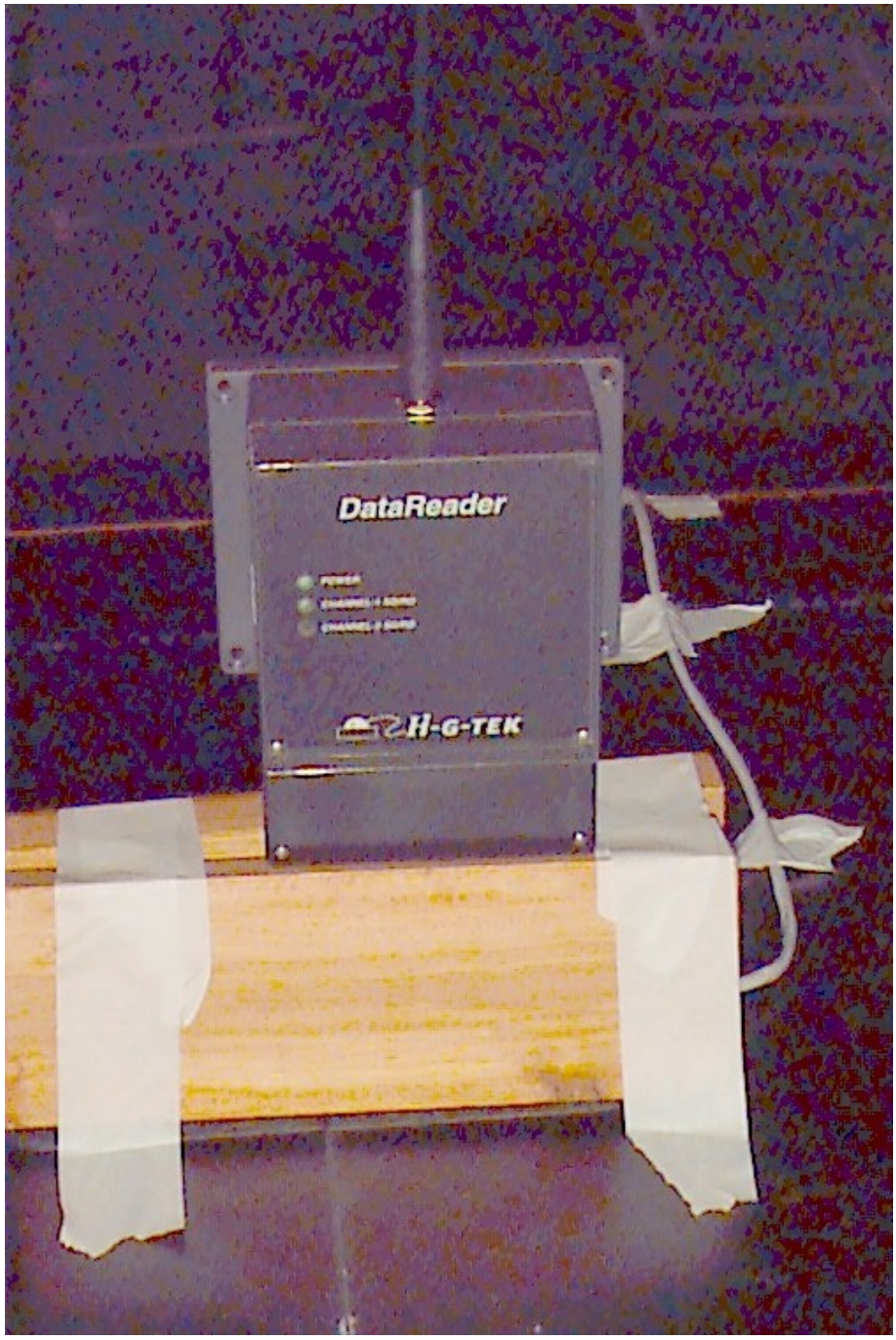
Photograph 2
Radiated emission measurements test setup with loop antenna,
9 kHz – 30 MHz frequency range, anechoic chamber method



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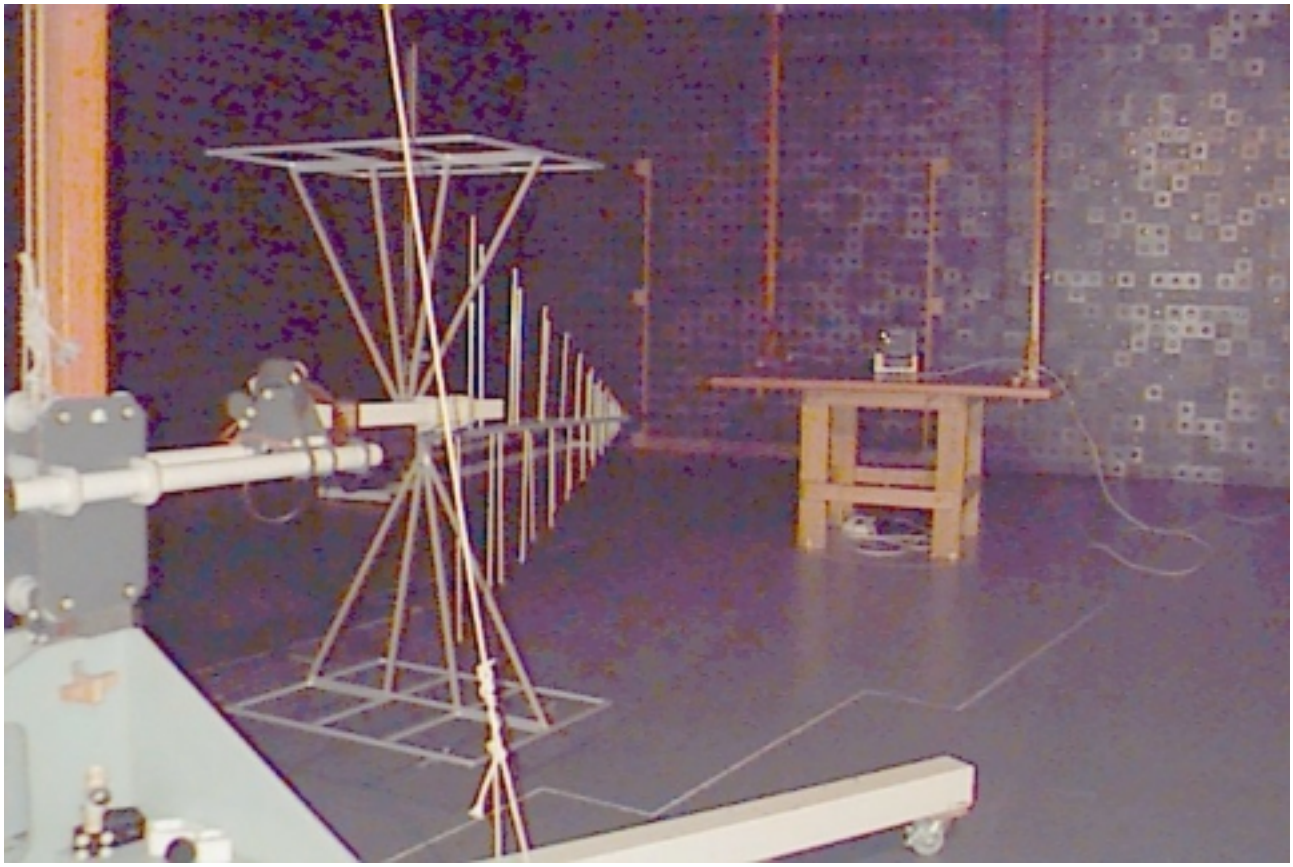
Photograph 3
Radiated emission measurements test setup with biconilog antenna,
30 MHz – 1000 MHz frequency range, anechoic chamber method



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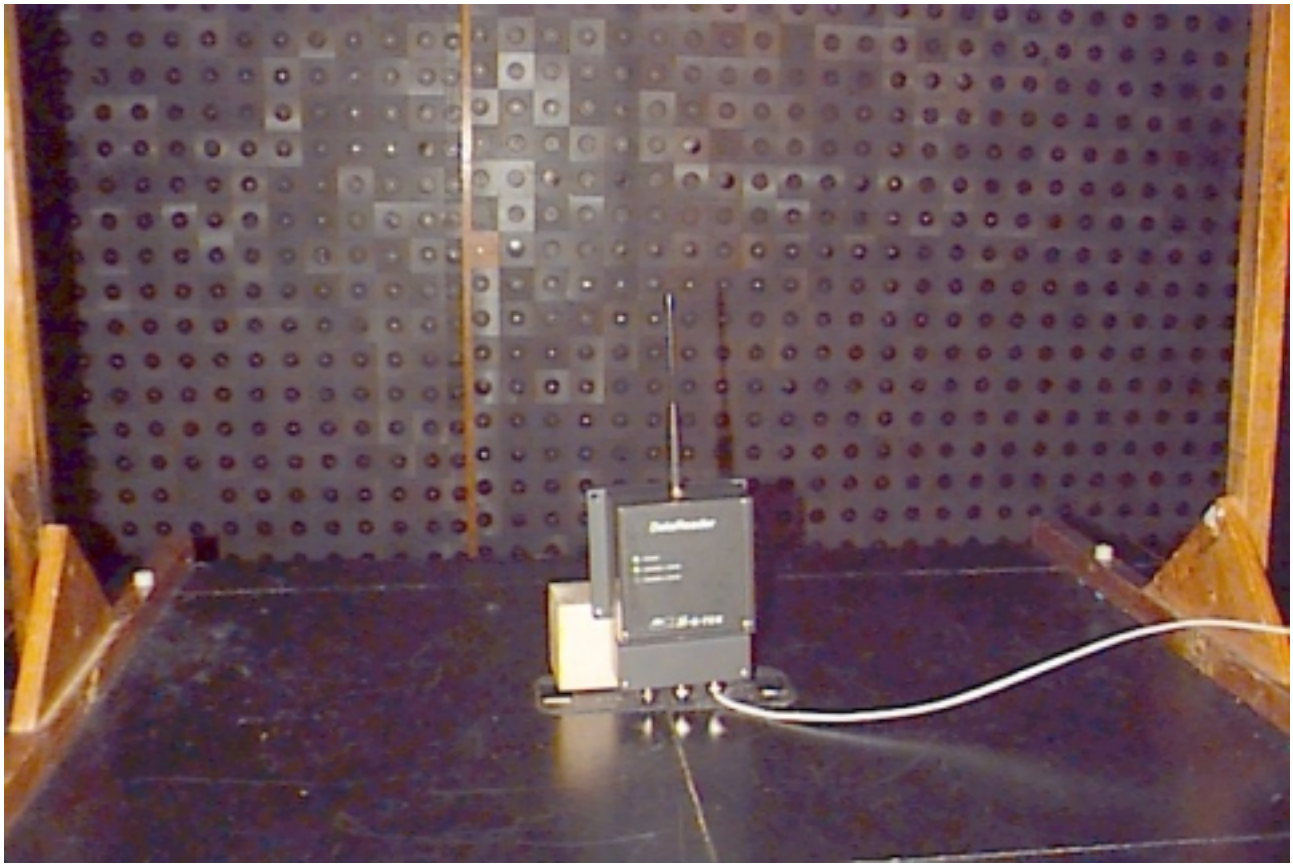
Photograph 4
Radiated emission measurements test setup with biconilog antenna,
30 MHz – 1000 MHz frequency range, anechoic chamber method



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Photograph 5
Radiated emission measurements test setup with double ridged guide antenna,
1 GHz – 9.5 GHz frequency range, OATS method

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Photograph 6
Radiated emission measurements test setup with double ridged guide antenna, 1 GHz – 9.5 GHz frequency range, OATS method

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Photograph 7
Conducted emission measurements test setup

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Appendix C Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibr. Month/ year
		Name	Model No.	Serial No.	
0038	Antenna mast, 1-4 m	Hermon Labs	AM-1	028	2/03 Check
0041	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	2811	3/02
0163	LISN FCC/VDE/MIL -STD	Electro-Metrics	ANS-25/2	1314	10/02
0446	Active loop antenna 10 kHz-30 MHz	Electro-Mechanics	6502	2857	11/02
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	11/02
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/02
0554	Amplifier, 2 – 18 GHz RF	Miteq	AFD-4	4300	12/02
0580	DC block adaptor 10 kHz-2.2 GHz	Anritsu	MA8601 A	580	12/02
0589	Cable coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	12/02
0590	Attenuator 10 dB, 50 Ohm, N-type, 2W	Elisra Electronic Systems	MW2100-N-Type	10	1/03
0593	Antenna mast, 1-4 m/ 1-6 m pneumatic	Hermon Labs	AM-F1	101	2/03 Check
0594	Turntable for anechoic chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	WDC1	102	1/03 Check
0604	Antenna biconilog log-periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	1/03
0672	Shielded room 4.6(L) x 4.2(W) x 2.4(H) m	Hermon Labs	SR-3	027	11/02 Check
1004	Cable, coaxial ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/02
1424	Spectrum analyzer, 30 Hz – 40 GHz	Agilent Technologies	8564 EC	3946A00219	8/02
1430	EMI receiver, 9 kHz – 2.9 GHz	Agilent Technologies	8542E	3807A00262, 3705A00217	9/02
1503	Cable RF, 6 m	Belden	M17/167 MIL-C-17	NA	9/02
1947	Cable 18 GHz, 6.5 m, blue	Rhophase Microwave Ltd.	NPS-1803A-6500-NPS	T4974	10/02
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	12/02

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Appendix D 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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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(μV)	decibel referred to one microvolt
dB(μV/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.

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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

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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(μV) to convert to field intensity in dB(μV)/meter

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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(μV) to convert to field intensity in dB(μV/meter).

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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(μV) to convert to field intensity in dB(μV)/meter

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Correction Factor
Line Impedance Stabilization Network
Model ANS-25/2
Electro-Metrics

Frequency, kHz	Correction Factor
10	4.9
15	2.86
20	1.83
25	1.25
30	0.91
35	0.69
40	0.53
50	0.35
60	0.25
70	0.18
80	0.14
90	0.11
100	0.09
125	0.06
150	0.04

The correction factor dB is to be added to the meter readings (dB/μV) of the interference analyzer or spectrum analyzer.

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Cable RF, 6 m, model: M17/167 MIL-C-17 (HL 1503)
Calibration data

Frequency, MHz	Insertion Loss, dB
	HL1503
0.01	0.02
0.1	0.02
1	0.05
10	0.23
20	0.27
30	0.44
40	0.55
50	0.62
60	0.65
70	0.68
80	0.78
90	0.80
100	0.88
200	1.22
300	1.50
400	1.75
500	2.01
600	2.20
700	2.41
800	2.53
900	2.69
1000	2.89

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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

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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	-			

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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				