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Electrical

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ELECTROMAGNETIC EMISSION TEST REPORT

ACCORDING TO 47CFR PART 15, SUBPART C § 15.225, § 15.207, § 15.209 and SUBPART B

for

Baran Advanced Technologies (1986) Ltd.

EQUIPMENT UNDER TEST:

Everswitch iClass™ proximity reader with keypad

Model: ASHKB

Document ID: BARRAD_FCC.15499
Date of Issue: June 2003

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1 Project information

Description of equipment under test

Test item	Everswitch iClass™ proximity reader with keypad
Manufacturer	Baran Advanced Technologies (1986) Ltd.
Types (Models)	ASHKB
Equipment FCC code[1]	DSR

Applicant information

Applicant's responsible person	Mr. Armand Rosenberg, Research and Development Director
Company	Baran Advanced Technologies (1986) Ltd.
P.O.Box	1911
Address	8, Omarim street, industrial zone
City	Omer
Postal code	84965
Country	Israel
Telephone number	+972 8620 0020
Telefax number	+972 8620 0021

Test performance

Project number:	15499
Location	Hermon Laboratories
Receipt date	April 8, 2003
Test started	April 8, 2003
Test completed	April 15, 2003
Purpose of test	Apparatus compliance verification in accordance with emission requirements
Test specification	47CFR Part 15, §15.225, §15.207, §15.209 and subpart B

[1] FCC Equipment codes – see Appendix E

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2 Summary of tests

The EUT was found complying with the limits of 47CFR Part 15, §15.225, §15.207, §15.209 and subpart B.

Parameter	Subclause	Tested by	Date tested	Verdict	Remarks
Transmitter characteristics, §15.225					
Field strength of emission within the assigned band	15.225(a)	Mr. Y. Neuman, test engineer	April 13, 2003	**Pass**	
Out of band spurious emissions (radiated)	15.225(b)	Mr. Y. Neuman, test engineer	April 13, 2003	**Pass**	
Frequency tolerance of carrier signal	15.225(c)	Mr. Y. Neuman, test engineer	April 9, 2003	**Pass**	
Conducted emissions	15.207	Mr. Y. Neuman, test engineer	April 15, 2003	**Pass**	
Unintentional radiation, §15.107					
Conducted emissions	15.107	Mr. Y. Neuman, test engineer	April 15, 2003	**Pass**	
Receiver characteristics, §15.109					
Spurious radiated emissions	15.109	Mr. Y. Neuman, test engineer	April 13, 2003	**Pass**	

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

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3 EUT description

3.1 General description

The EUT, Everswitch proximity reader with keypad, model ASHKB, is a transceiver, which operates at 13.56 MHz and is powered by 10 to 16 V DC through AC/DC adapter.

CPU clock frequency is 3.2 MHz.

3.2 EUT test configuration

120 VAC / 13.5 VDC wall outlet adapter, manufactured by PLUG-IN, model number NF-13-10T, was used throughout the testing.
During conducted emission measurements the transmitter was set to transmitting mode with internal antenna disconnected.

The EUT ports and lines description is given in Table 3.2.1, test configuration is provided 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 (red)	DC input	Non detachable	1	Unshielded	1.5	DC power supply
Ground (black)	Ground	Non detachable	1	Unshielded	1.5	DC power supply
Power	AC power	Wall outlet	1	——	——	AC mains
Signal (green)	Data 0	Non detachable	1	Unshielded	1.5	Open circuit
Signal (white)	Data 1	Non detachable	1	Unshielded	1.5	Open circuit
Signal (brown)	LED input	Non detachable	1	Unshielded	1.5	Open circuit
Signal (violet)	Housing ground	Non detachable	1	Unshielded	1.5	Open circuit
Signal (grey)	Tamper output	Non detachable	1	Unshielded	1.5	Open circuit
Signal (orange)	Buffer input	Non detachable	1	Unshielded	1.5	Open circuit
Signal (blue)	CCTV output	Non detachable	1	Unshielded	1.5	Open circuit

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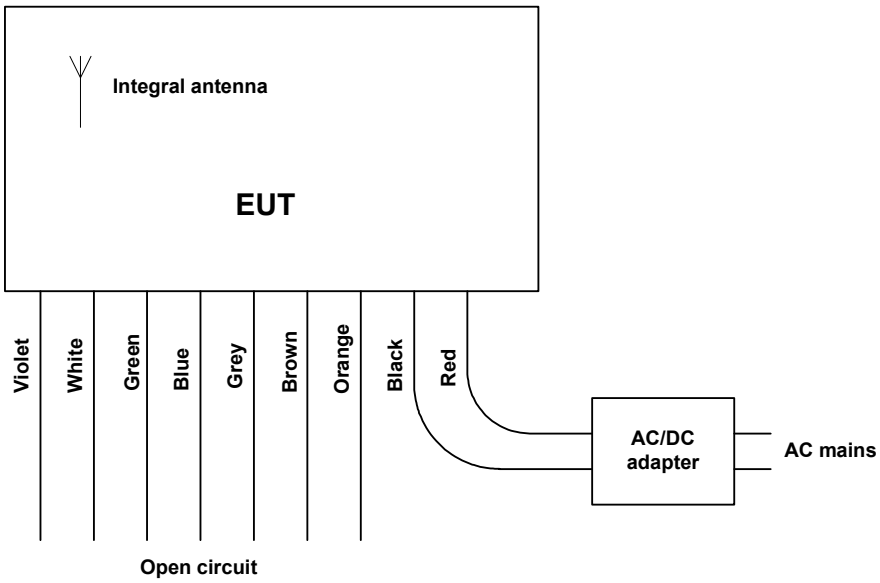
Figure 3.2.1

EUT test configuration



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3.3 Transmitter description

Operating frequency			13.56 MHz		
Maximum rated output power					
At transmitter permanent external 50 Ω RF output connector, dBm			NA		
Electric field strength at 3m distance, dB(μV/m)			71		
Is transmitter output power variable?	**X**	No			
		Yes		continuous variable	
				stepped variable	
				stepsize (dB):.....	
				minimum RF power (dBm):.....	
				maximum RF power (dBm):.....	
Transmitter power source					
	Battery	**Nominal rated voltage (VDC)**			
	Nickel Cadmium				
	Lithium				
	Other				
X	**DC**	**Nominal rated voltage (VDC)**	10 to 16		
	AC mains	**Nominal rated voltage (VAC)**			
Is there common power source for transmitter and receiver			**X**	yes		no
Antenna type					
X	Integral				
	External				

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4 Tests results

4.1 Field strength of emission within the assigned band according to § 15.225 (a)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4
DATE: April 13, 2003
RELATIVE HUMIDITY: 47%
AMBIENT TEMPERATURE: 24°C
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 13.553-13.567 MHz
TEST DISTANCE: 3 m

Peak detector

Frequency, MHz	Field strength, dB(μV/m)	Calculated limit*, dB (μV/m)	Margin, dB	Reference to Plots in Appendix A
13.56	70.51	120	49.49	A3
Measurement uncertainty		± 2.36 dB		

*The limit for 3 m distance was calculated using the square of the inverse linear distance extrapolation factor as follows:

$Lim_{3m} = Lim_{30m} + 40 \log (S_1/S_2)$, where $S_1 = 30$ m, $S_2 = 3$ m.

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0592	HL 0594	HL 1004	HL 1915	HL 2009

LIMIT

The field strength of any emissions within 13.553-13.567 MHz band shall not exceed 10000 μV/m (80 dB(μV/m)) at 30 m.

TEST PROCEDURE

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

The loop antenna was positioned with its plane horizontal. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360°. Then the loop position was changed to vertical. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis. Plots A1 to A4 in Appendix A refer to vertical antenna polarization as the worst case.

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4.2 Out of band radiated spurious emissions according to § 15.225 (b), §15.209

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4/ §13.1.5
MODE OF OPERATION: Tx+Rx
DATE: April 13, 2003
RELATIVE HUMIDITY: 47%
AMBIENT TEMPERATURE: 24°C
AIR PRESSURE: 1012 hPa
RATED CARRIER FIELD STRENGTH: 70.51 dB(μV/m)
TEST DISTANCE: 3 m
OPERATING FREQUENCY: 13.56 MHz
FREQUENCY RANGE: 9 kHz to 1000 MHz

Peak detector

Frequency, MHz	RBW, kHz	VBW, kHz	Ant. pol.	Ant. hgt., m	TT pos., (°)	Radiated emission, dB (μV/m)	Limit, dB (μV/m)	Margin, dB	Verdict	Reference to Plots in Appendix A
0.009–0.15	0.2	0.3	No spurious emissions were found						**Pass**	A5
0.15–1.7	9	30	No spurious emissions were found						**Pass**	A6
1.7–30	9	30	All out of band emissions were found below the limit						**Pass**	A7
27.121	9	30	V	1.00	22	65.55	69.5*	3.95	**Pass**	A7
40.683	120	300	V	1.00	18	38.54	40	1.46	**Pass**	A8
54.241	120	300	V	1.00	20	28.75	40	11.25	**Pass**	A8
67.801	120	300	H	1.20	0	37.87	40	2.13	**Pass**	A8
81.363	120	300	H	2.40	16	32.65	40	7.35	**Pass**	A8
94.923	120	300	H	2.70	196	37.27	43.5	6.23	**Pass**	A8
108.483	120	300	H	2.96	184	41.46	43.5	2.04	**Pass**	A8
122.046	120	300	H	1.70	186	39.66	43.5	3.84	**Pass**	A8
135.612	120	300	V	1.00	9	34.82	43.5	8.68	**Pass**	A8
200–500	120	300	No spurious emissions were found						**Pass**	A9
500–1000	120	300	No spurious emissions were found						**Pass**	A10
Measurement uncertainty			Loop antenna			± 2.36 dB				
			Biconilog antenna			± 5.3 dB (horizontal polarization) ± 6.0 dB (vertical polarization)				

*The limit at 3 m distance was calculated using the square of the inverse linear distance extrapolation factor as follows:

$Lim_{3m} = Lim_{30m} + 40 \log (S_1/S_2)$, where $S_1 = 30$ m, $S_2 = 3$ m.

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

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TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604
HL 1004	HL 1915	HL 2009				

LIMIT

The field strength of any emissions appearing outside of the assigned band shall not exceed the general radiated emission limits shown in Section15.209(a).

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. The loop antenna was positioned with its plane horizontal. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360°. Then the loop position was changed to vertical. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis. Plots A5 to A7 in Appendix A refer to vertical antenna polarization as the worst case.

30 MHz – 1 GHz. To find maximum radiation the turntable was rotated 360°, biconilog antenna height was changed from 1 to 4 m, and the antenna polarization was changed from vertical to horizontal.

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4.3 Frequency tolerance of the carrier signal according to § 15.225 (c)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.6
DATE: April 9, 2003
RELATIVE HUMIDITY: 46%
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1013 hPa
OPERATING FREQUENCY: 13.56 MHz

Temperature, °C	Supply voltage, V DC	Time after EUT energizing, min	Operating frequency, MHz	Frequency tolerance, kHz	Verdict
-20	V_{nom} 13 V	Start-up	13.560030	-0.004	**Pass**
		+2	13.560044	-0.018	**Pass**
		+5	13.560046	-0.020	**Pass**
		+10	13.560052	-0.026	**Pass**
-10	V_{nom} 13 V	Start-up	13.560076	-0.050	**Pass**
		+2	13.560072	-0.046	**Pass**
		+5	13.560070	-0.044	**Pass**
		+10	13.560070	-0.044	**Pass**
0	V_{nom} 13 V	Start-up	13.560084	-0.058	**Pass**
		+2	13.560072	-0.046	**Pass**
		+5	13.560060	-0.034	**Pass**
		+10	13.560050	-0.024	**Pass**
10	V_{nom} 13 V	Start-up	13.560074	-0.048	**Pass**
		+2	13.560048	-0.022	**Pass**
		+5	13.560036	-0.010	**Pass**
		+10	13.560022	0.004	**Pass**
20	V_{min} 10 V	Start-up	13.560064	-0.038	**Pass**
		+2	13.560042	-0.016	**Pass**
		+5	13.560030	-0.004	**Pass**
		+10	13.560018	0.008	**Pass**
	V_{nom} 13 V	Start-up	13.560078	-0.052	**Pass**
		+2	13.560064	-0.038	**Pass**
		+5	13.560034	-0.008	**Pass**
		+10	**13.560026 (Reference)**		
	V_{max} 16 V	Start-up	13.560054	-0.028	**Pass**
		+2	13.560030	-0.004	**Pass**
		+5	13.560006	0.020	**Pass**
		+10	13.559994	0.032	**Pass**
30	V_{nom} 13 V	Start-up	13.560134	-0.108	**Pass**
		+2	13.560112	-0.086	**Pass**
		+5	13.560094	-0.068	**Pass**
		+10	13.560080	-0.054	**Pass**
40	V_{nom} 13 V	Start-up	13.560144	-0.118	**Pass**
		+2	13.560112	-0.086	**Pass**
		+5	13.560106	-0.080	**Pass**
		+10	13.560080	-0.054	**Pass**
50	V_{nom} 13 V	Start-up	13.559620	0.406	**Pass**
		+2	13.559596	0.43	**Pass**
		+5	13.559584	0.442	**Pass**
		+10	13.559564	0.462	**Pass**
Measurement uncertainty		± 0.21 ppm			

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Frequency tolerance of the carrier signal shall be within ± 1.3560026 kHz; hence operating frequency shall be within13.558670 – 13.561382 MHz.

Minimum measured operating frequency: 13.559564 MHz > 13.558670 MHz
Maximum measured operating frequency: 13.560144 MHz < 13.561382 MHz

TEST EQUIPMENT USED:

HL 0026	HL 0337	HL 0493	HL 0559	HL 1842		

LIMIT

The frequency tolerance of the carrier signal shall be maintained within ± 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

TEST PROCEDURE

The EUT was tested in the oven, in temperature range -20° to +50°C with 10° interval.

At each temperature level, prior to frequency measurements, the de-energized EUT was allowed sufficient time for stabilization of all components of oscillator circuit. While maintaining the constant temperature, the EUT was turned on, and the frequency was measured at the startup and two, five and ten minutes after the EUT was energized.

At reference (+20°C) temperature the frequency was measured at nominal input voltage (at the adapter output), and at 85% and 115% of nominal.

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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
DATE:	April 13, 2003
RELATIVE HUMIDITY:	47%
AMBIENT TEMPERATURE:	24°C
AIR PRESSURE:	1012 hPa
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
THE EUT WAS TESTED AS:	TABLE-TOP
RECEIVER OPERATING FREQUENCY:	13.56 MHz
FREQUENCY RANGE:	30 MHz – 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	5th harmonic of the highest frequency or 40 GHz, whichever is lower

The EUT was tested in Tx+Rx mode, all emissions were found below class B specification limit; refer to Paragraph 4.2 and Plots A8 to A10.

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604
HL 1004	HL 2009					

LIMIT § 15.109

Frequency, MHz	Class B equipment @ 3 m dB(µV/m)
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - 1000	54

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°, biconilog antenna height was changed from 1 to 4 m, and the antenna polarization was changed from vertical to horizontal.

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4.5 Conducted emission test according to §15.207, §15.107

METHOD OF MEASUREMENTS:	ANSI 63.4 §13.1.3
MODE OF OPERATION:	Tx+Rx
DATE:	April 15, 2003
RELATIVE HUMIDITY:	49%
AMBIENT TEMPERATURE:	25°C
AIR PRESSURE:	1016 hPa
THE EUT WAS TESTED AS:	TABLE-TOP
DETECTOR USED:	QUASI-PEAK
FREQUECNY RANGE:	150 kHz – 30 MHz
RESOLUTION BANDWIDTH:	9 kHz

Conducted disturbances from the EUT measured using quasi-peak detector were found below the average limit, hence, further measurements with average detector were considered unnecessary.

Quasi-peak detector

Frequency, MHz	Line identification	Measured emissions, dB (µV)	Specification average limit, dB (µV)	Margin, dB	Verdict	Reference to plot in Appendix A
0.209263	Phase	41.45	53.30	11.85	**Pass**	A11
0.376225	Neutral	37.55	48.40	10.85	**Pass**	A13
0.448769	Neutral	36.47	46.96	10.49	**Pass**	A13
0.541700	Neutral	35.18	46.00	10.82	**Pass**	A13
13.560125	Neutral	38.04	50.00	11.96	**Pass**	A14
27.121000	Phase	39.60	50.00	10.40	**Pass**	A12
Measurement uncertainty		9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB				

TEST EQUIPMENT USED:

HL 0447	HL 0672	HL 0787	HL 1204	HL 1430	HL 1502	HL 1510

LIMIT § 15.207, § 15.107

Frequency, MHz	Limit, dB(µV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5	56	46
5 - 30	60	50

*The limit decreases linearly with the logarithm of frequency.

TEST PROCEDURE

The EUT was set up as shown in Photographs 3 and 4. The measurements were performed at mains terminals by means of the LISN, connected to a 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.

To provide correct measurements, the internal antenna was disconnected from the bottom PCB.

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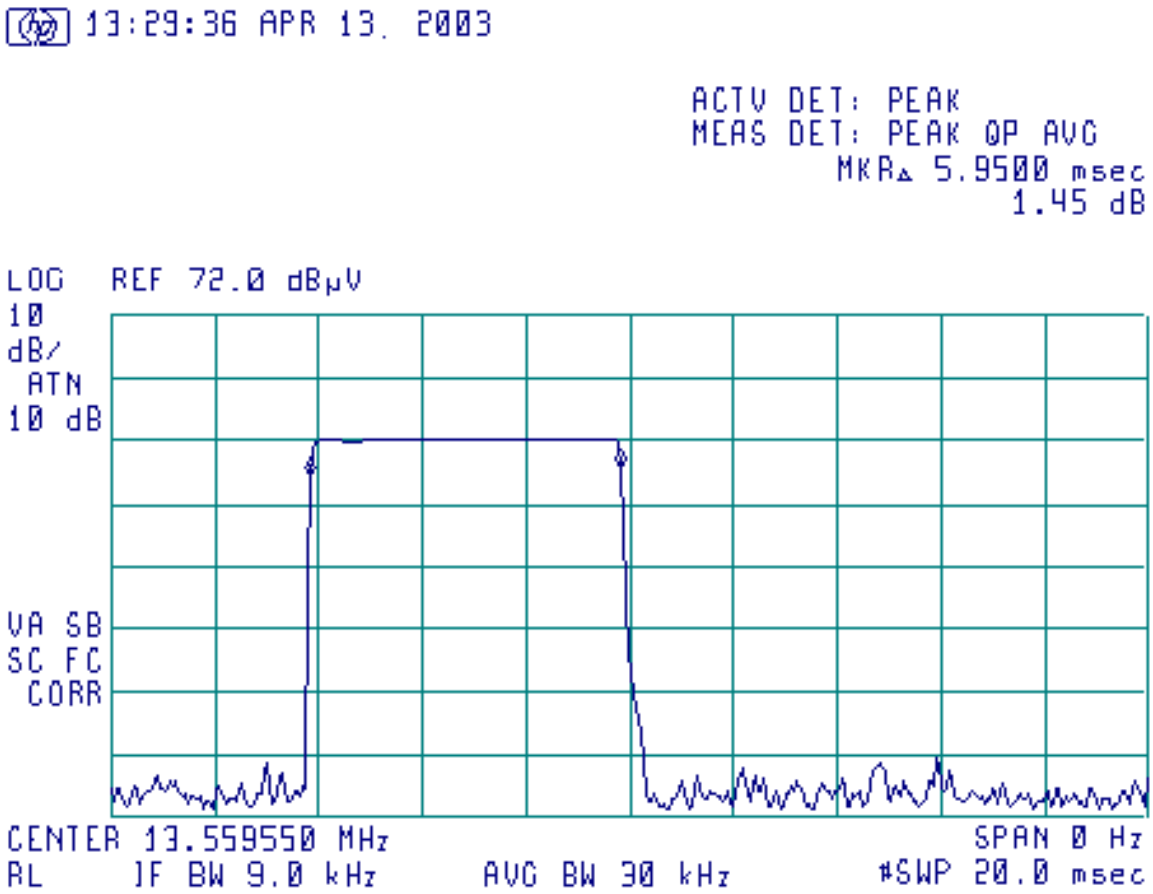
Appendix A Plots

Plot A1

Pulse duration



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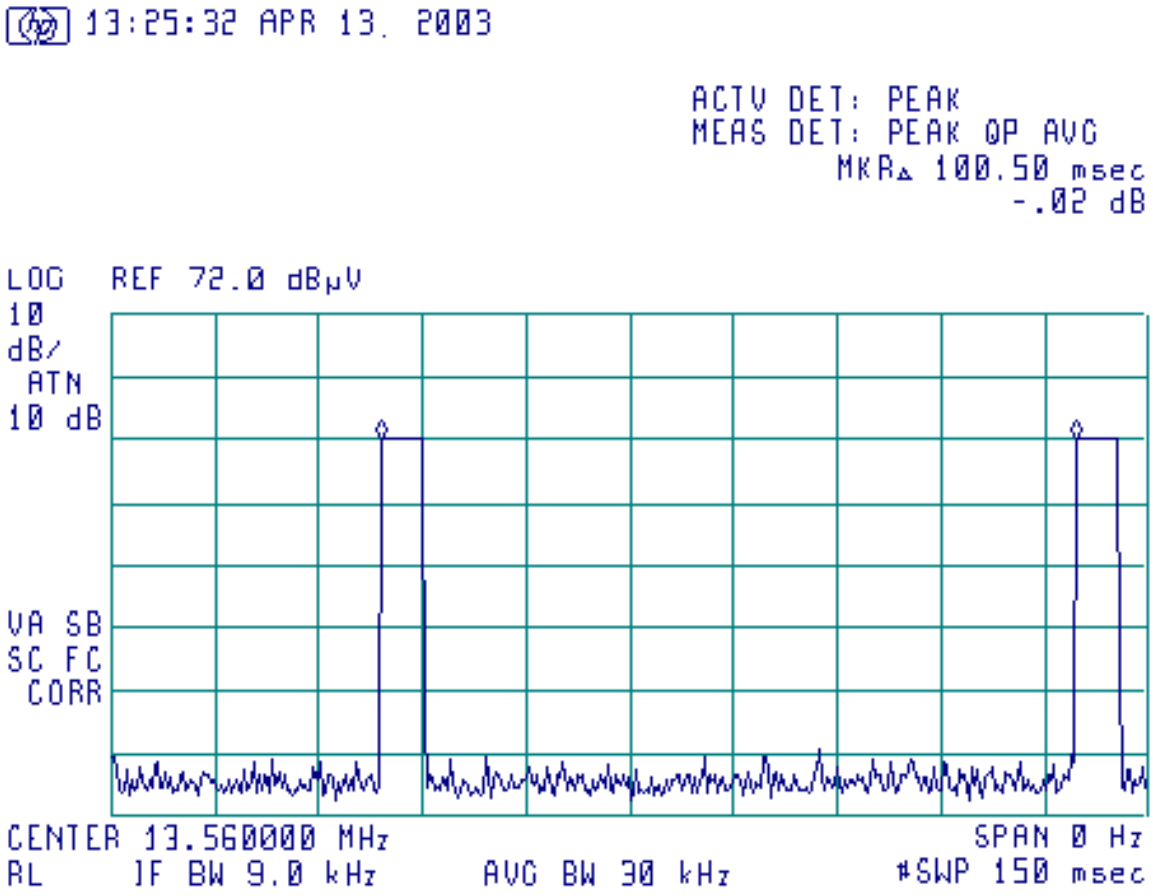
Plot A2

Pulse repetition rate



Pulse repetition rate=9.95 Hz<20 Hz
Peak detector should be used for fundamental frequency and it's harmonics field strength measurements according to Section 15.35(a).

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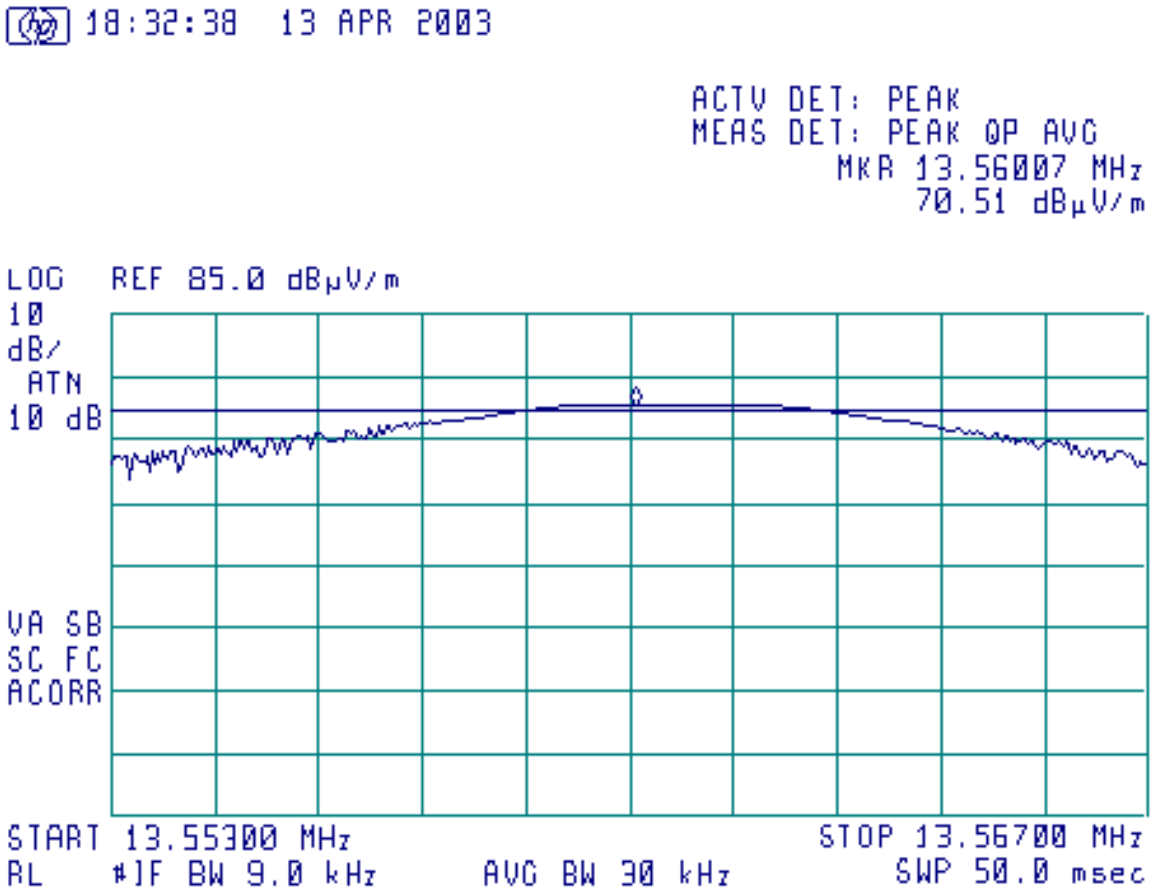
Plot A3

Field strength of emission within the assigned band



Peak result = 70.51 dBuV/m
Limit = 120 dBuV/m @3m

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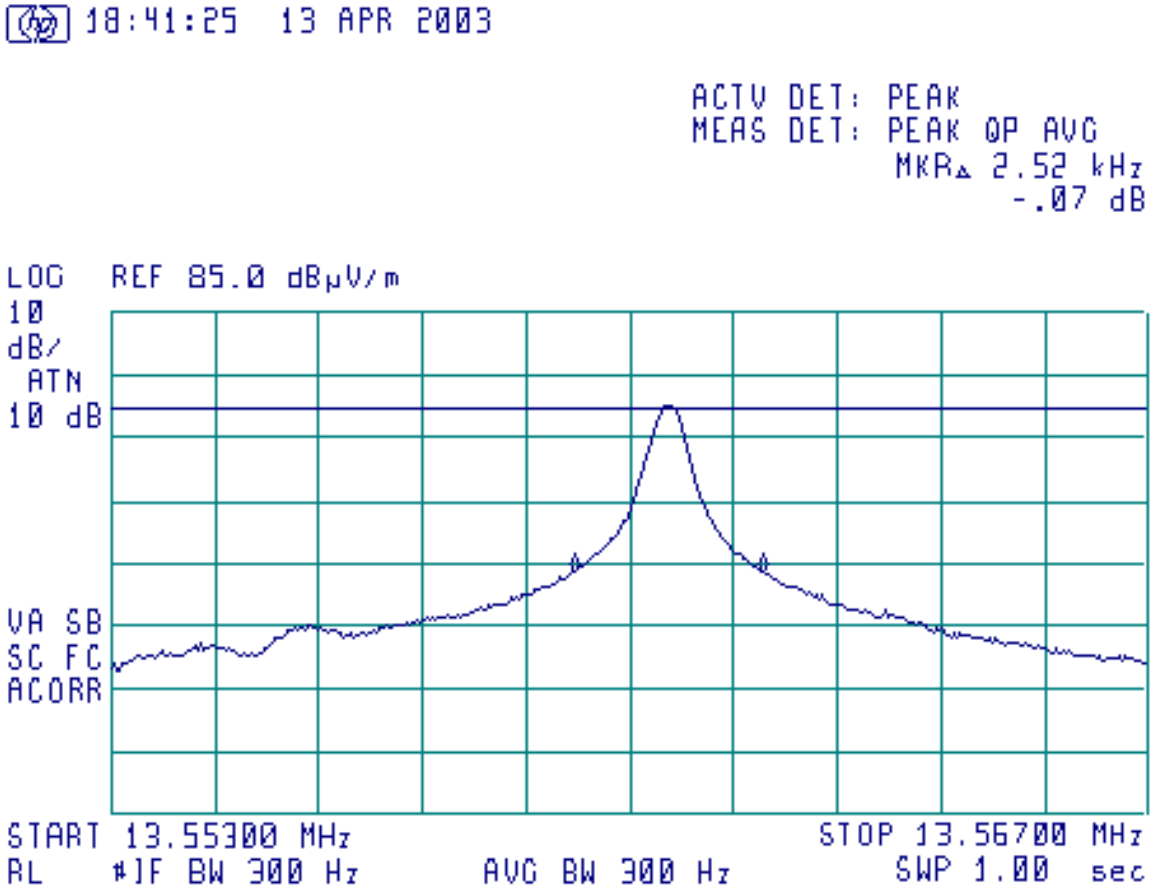
Plot A4

26 dB bandwidth



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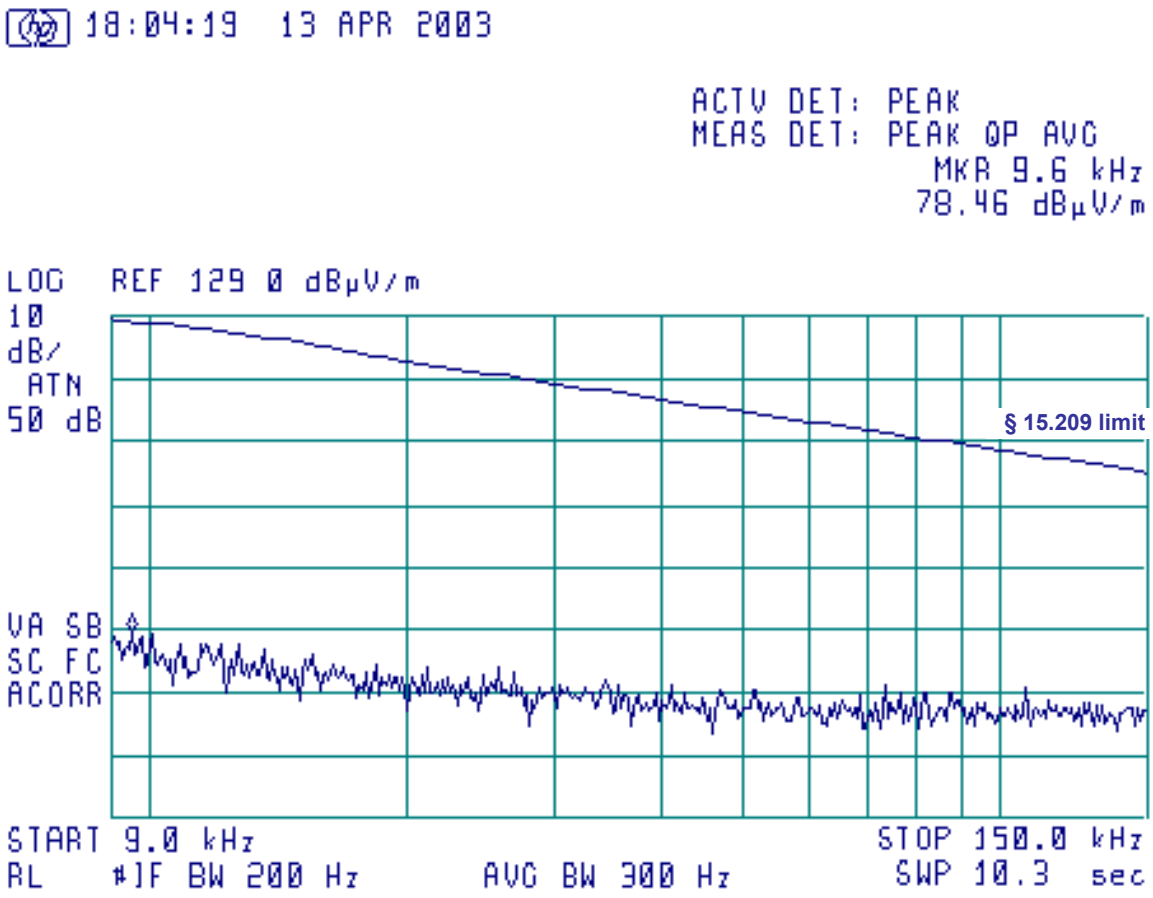
Plot A5

Field strength of out of band emissions

FREQUENCY RANGE: 9 – 150 kHz
POLARIZATION: VERTICAL



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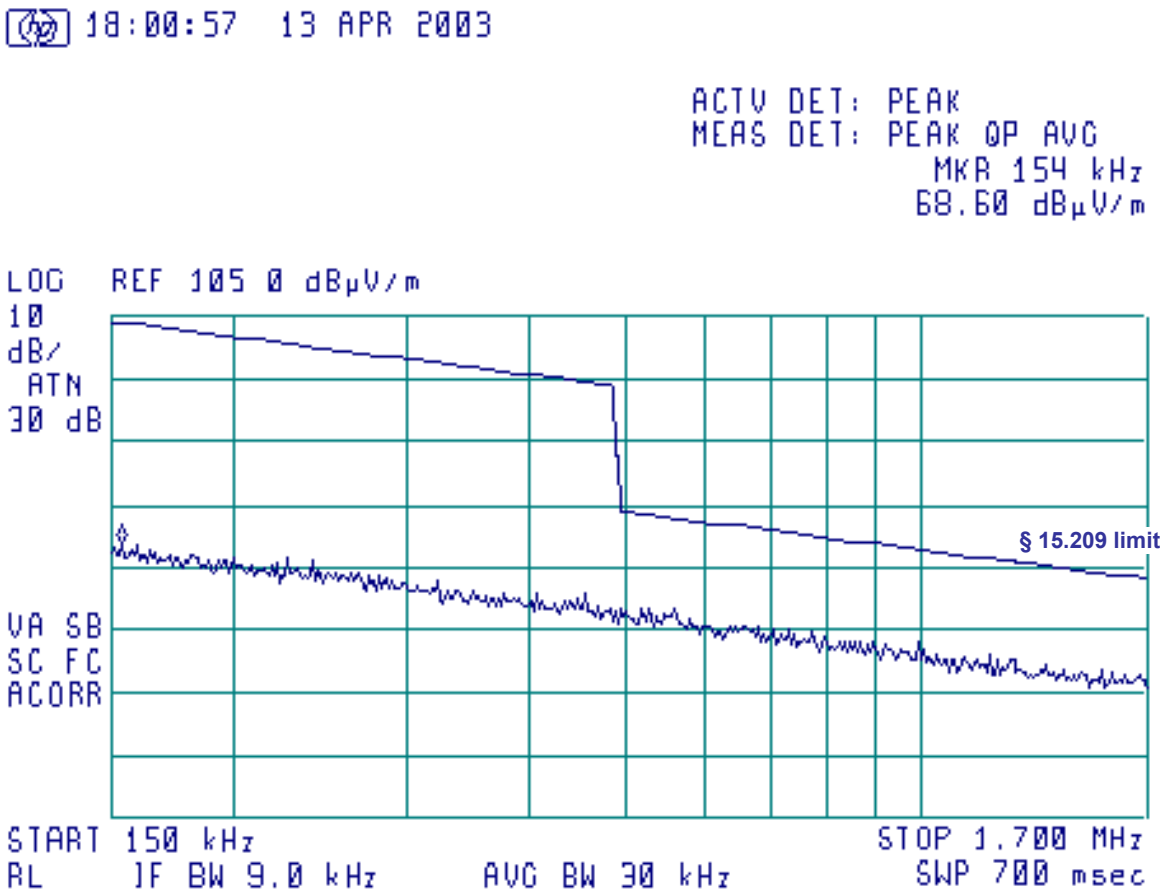
Plot A6

Field strength of out of band emissions

FREQUENCY RANGE: 150 kHz – 1.7 MHz
POLARIZATION: VERTICAL



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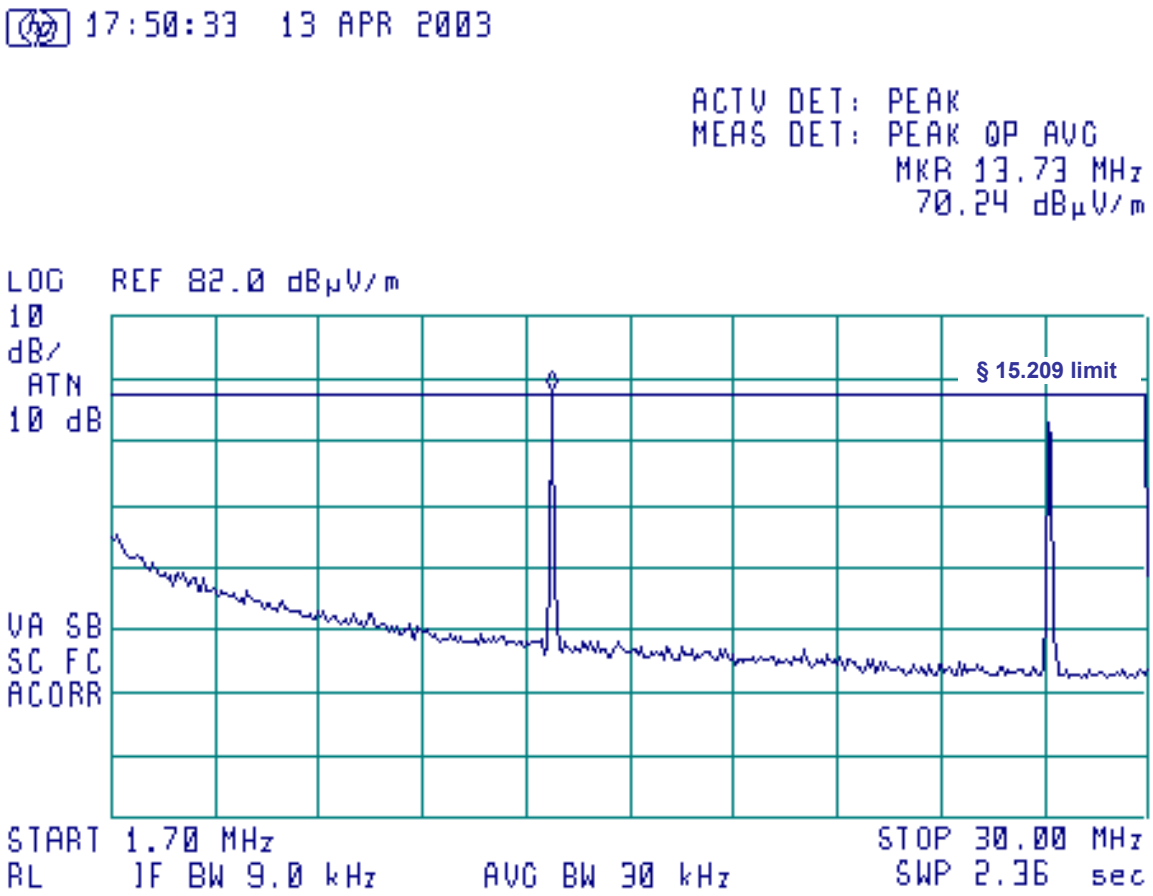
Plot A7

Field strength of out of band emissions

FREQUENCY RANGE: 1.7 – 30 MHz
POLARIZATION: VERTICAL



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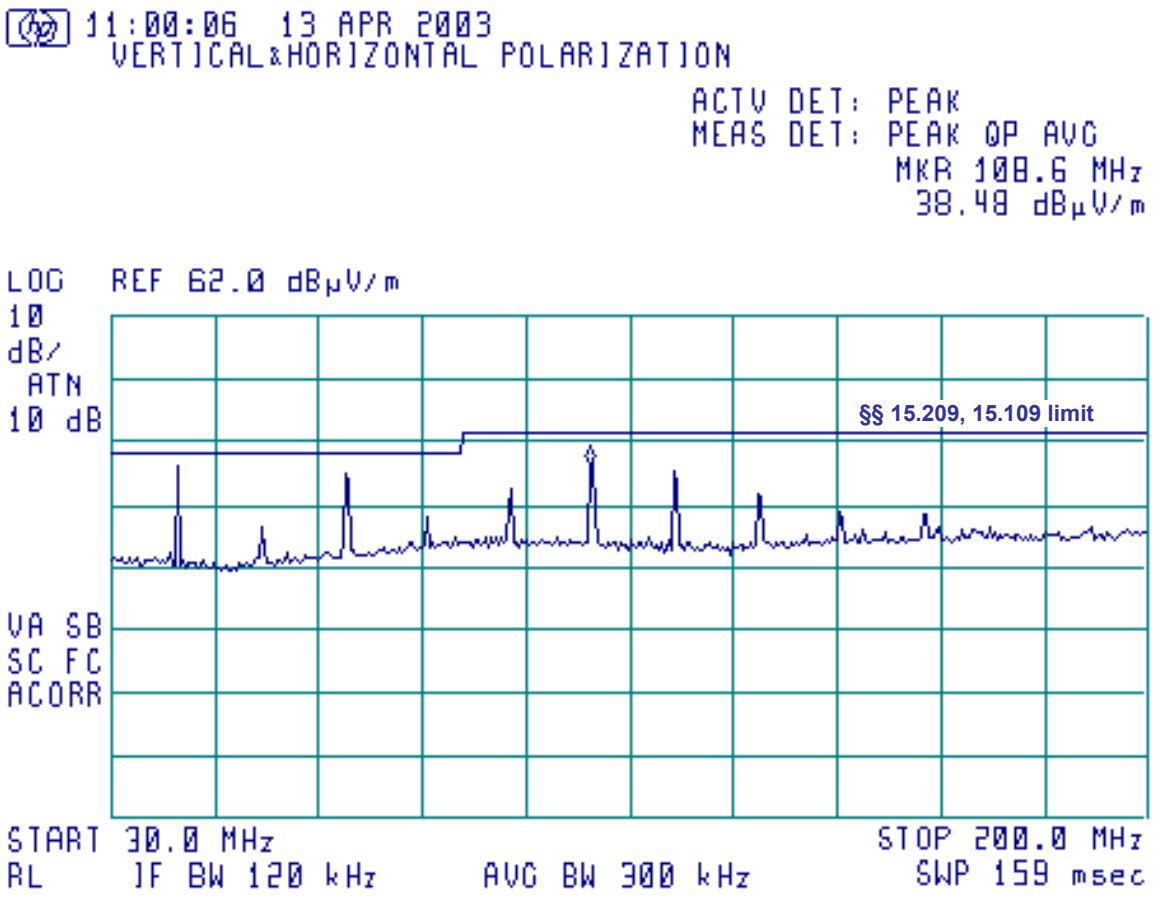
Plot A8

Field strength of out of band emissions

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



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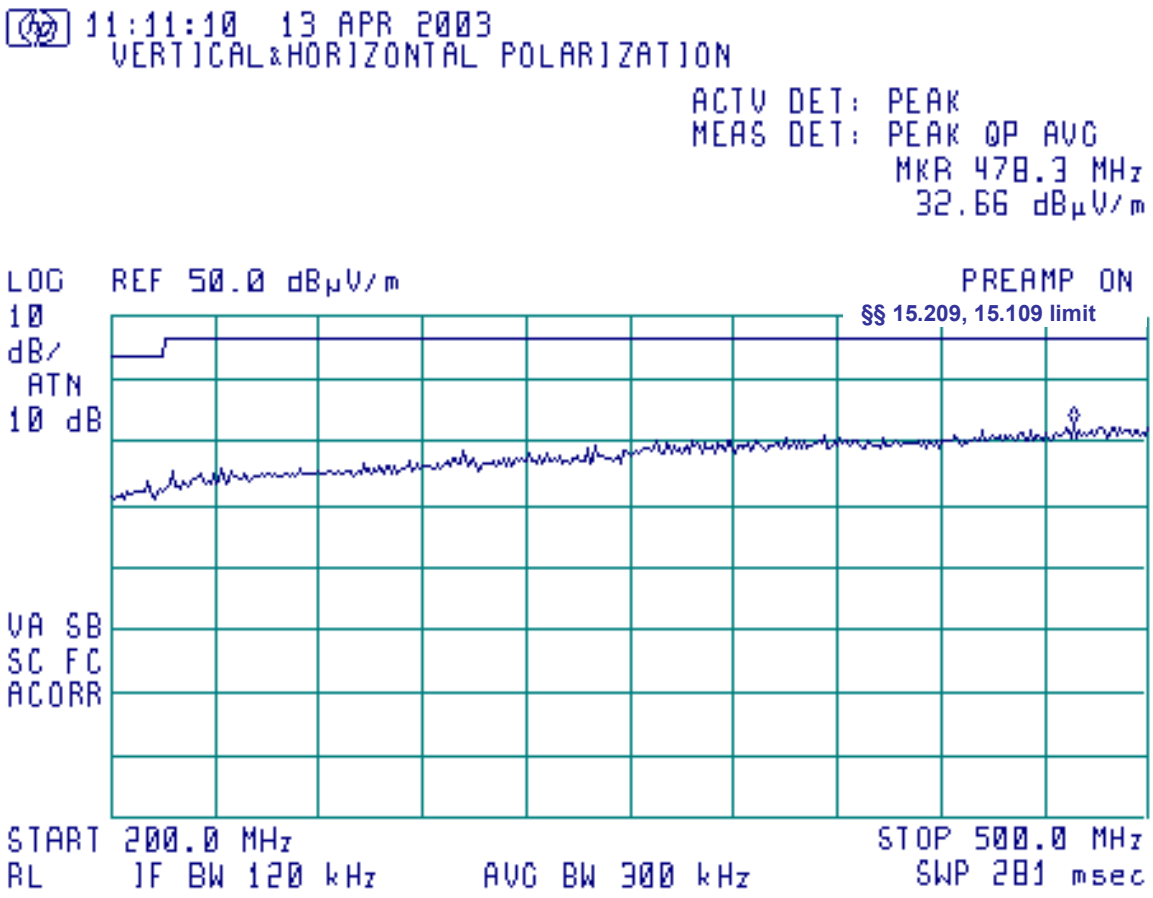
Plot A9

Radiated spurious emission measurements

FREQUENCY RANGE: 200 – 500 MHz
POLARIZATION: VERTICAL & HORIZONTAL



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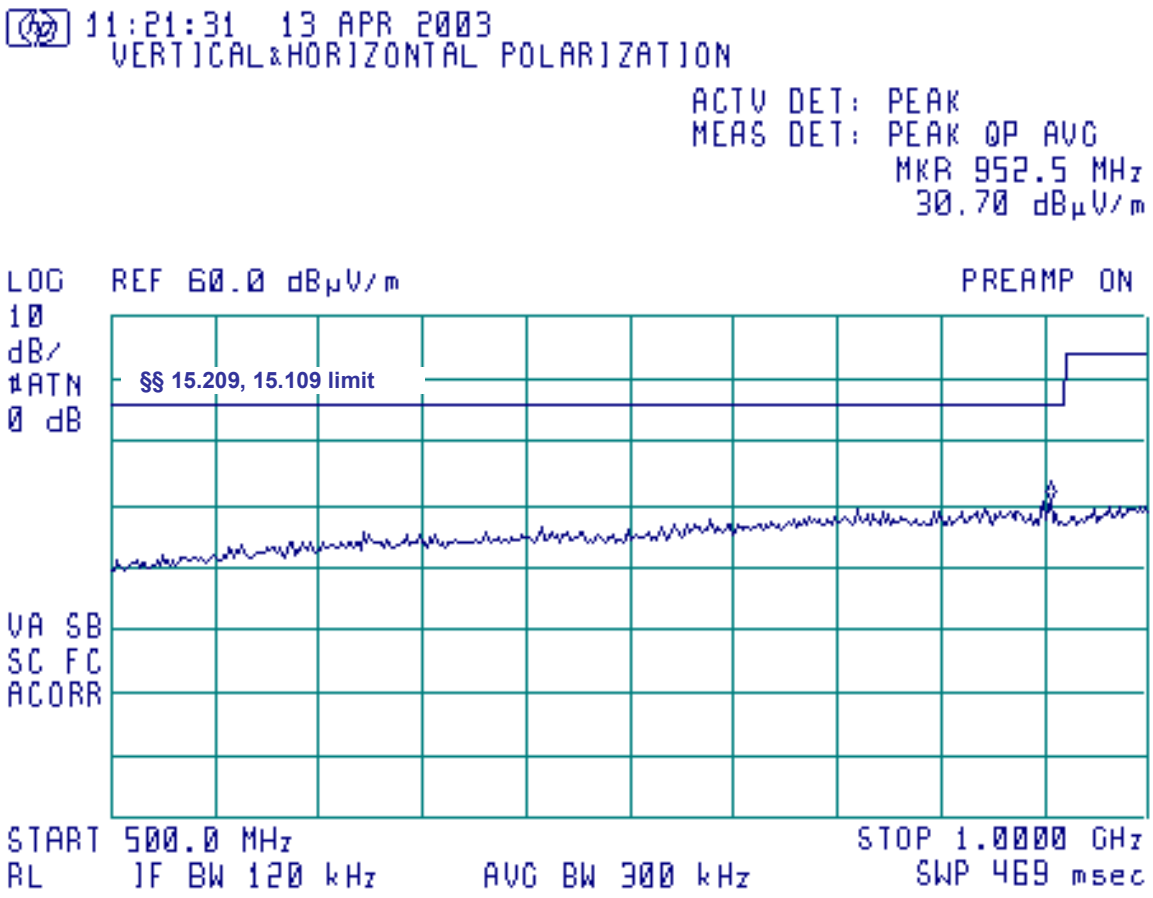
Plot A10

Radiated spurious emission measurements

FREQUENCY RANGE: 500 – 1000 MHz
POLARIZATION: VERTICAL & HORIZONTAL



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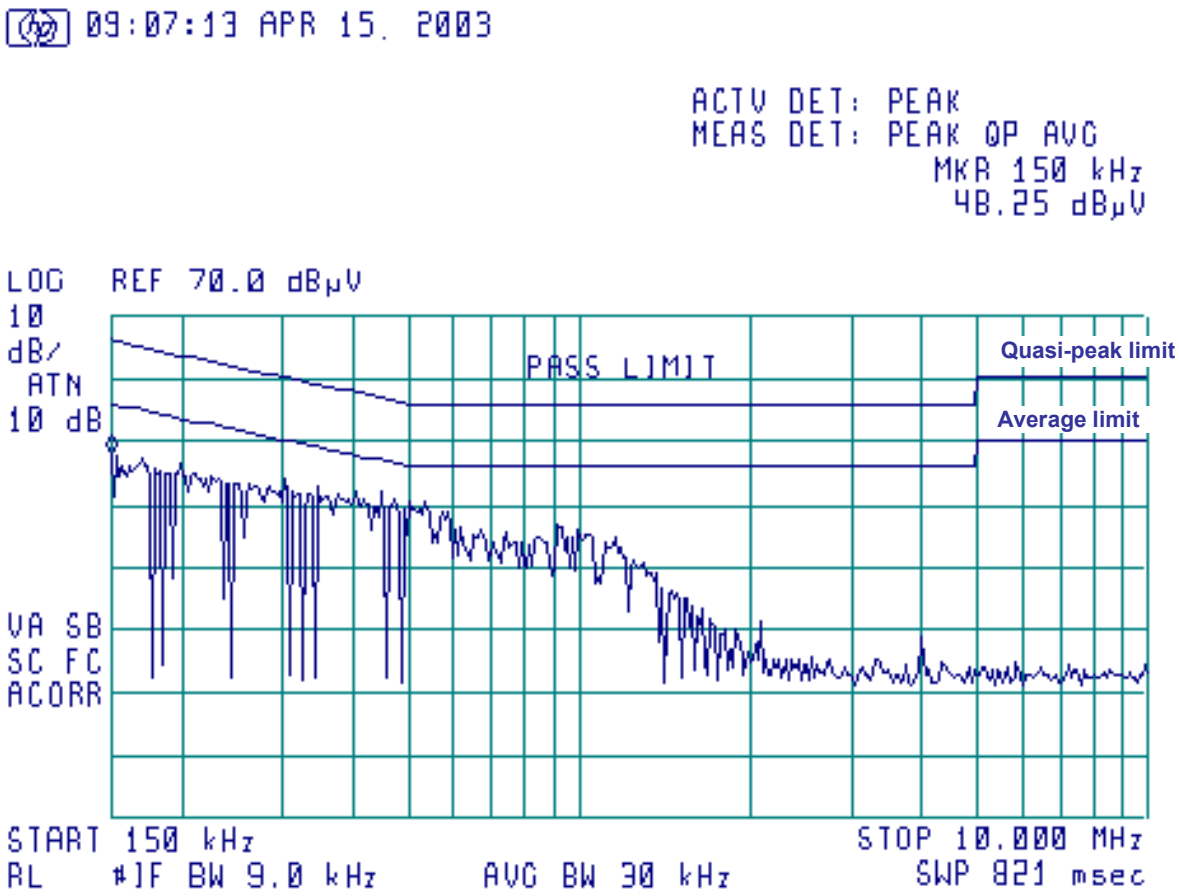
Plot A11

Conducted emission measurements

FREQUENCY RANGE:	0.15 – 10 MHz
LINE:	PHASE
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



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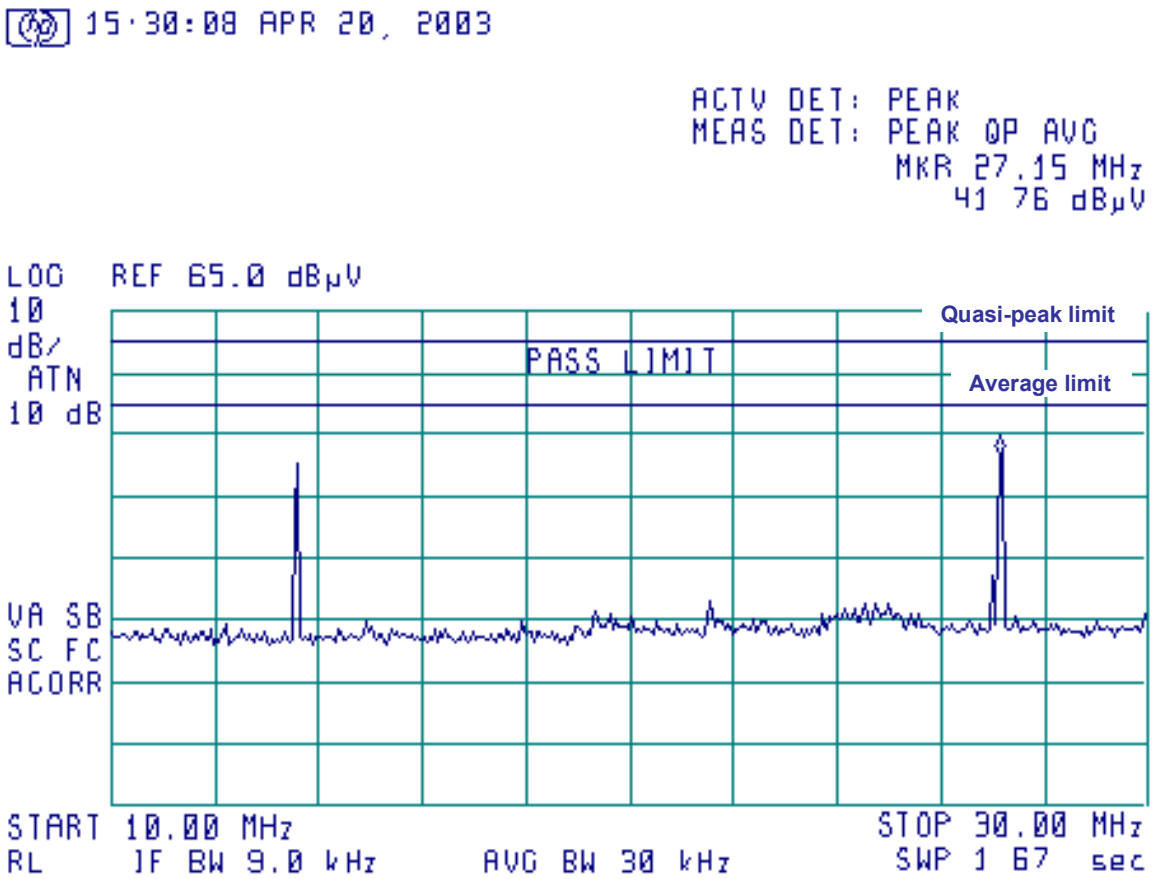
Plot A12

Conducted emission measurements

FREQUENCY RANGE:	10 – 30 MHz
LINE:	PHASE
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



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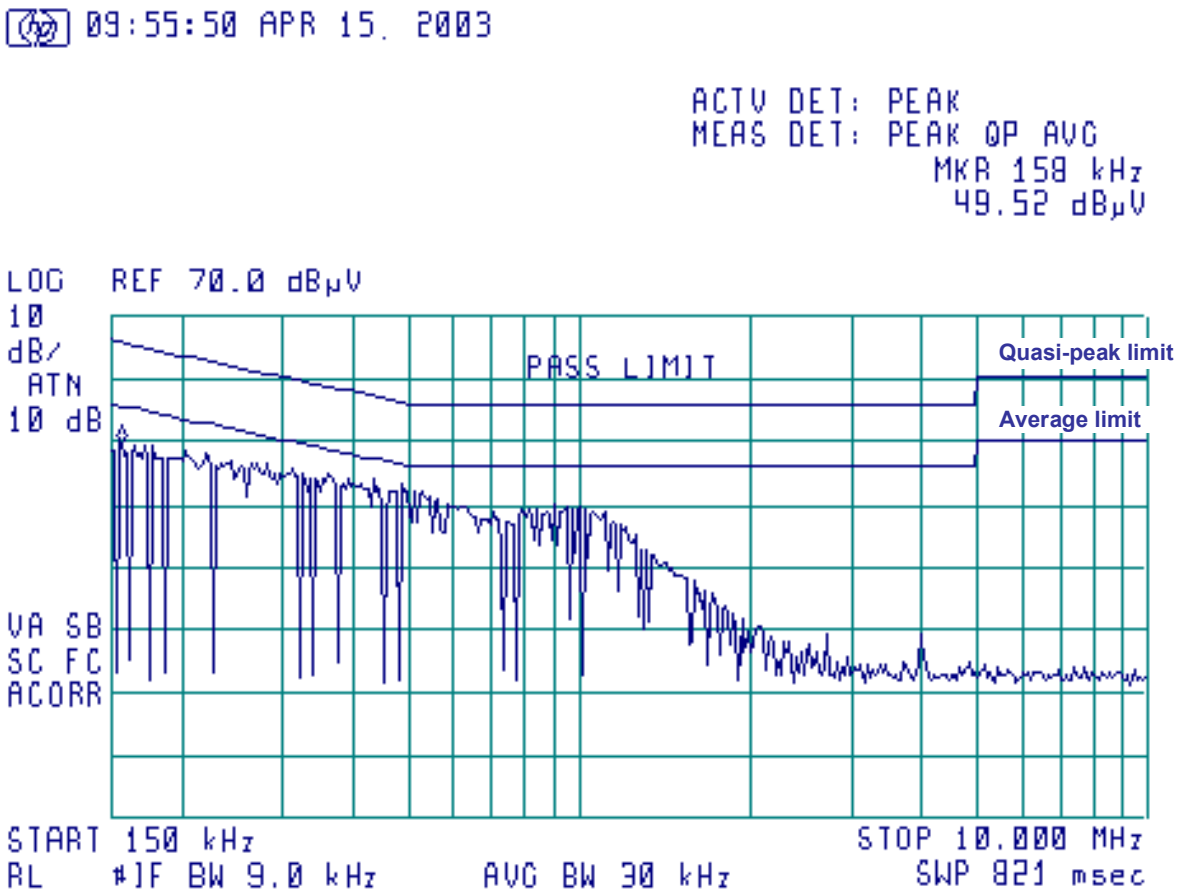
Plot A13

Conducted emission measurements

FREQUENCY RANGE:	0.15 – 10 MHz
LINE:	NEUTRAL
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



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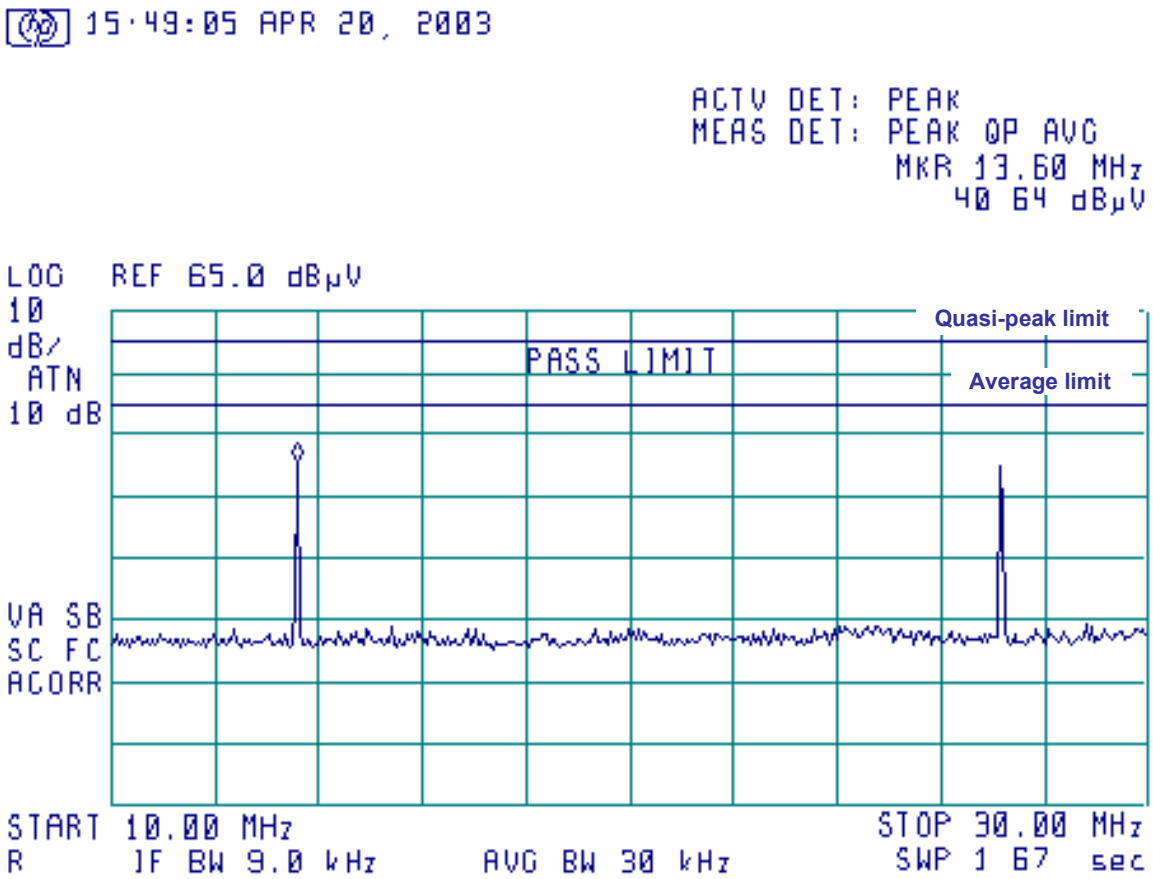
Plot A14

Conducted emission measurements

FREQUENCY RANGE:	10 – 30 MHz
LINE:	NEUTRAL
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



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Appendix B Test setup photographs

Photograph 1

**Radiated emission measurements test setup view with loop antenna,
9 kHz – 30 MHz range, anechoic chamber method**

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Photograph 2

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

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Photograph 3

Conducted emission measurements test setup view

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Photograph 4

Conducted emission measurements test setup view

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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.	
0026	Spectrum analyzer, 100 Hz-2.2 GHz	Anritsu	MS 2601A	3460	9/03
0337	Probe set, hand held, 5 probes	Electro-Metrics	EHFP-30	238	6/04 Check
0447	LISN, 16/2, 300 V RMS	Hermon Labs	LISN 16-1	447	11/03
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	10/05
0493	Oven temperature	Thermotron	S-1.2 Mini-Max	4016	9/03
0521	Spectrum Analyzer with RF filter section (EMI Receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/03
0559	Multimeter digital	Fluke	Fluke 76	0903	10/03
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
0672	Shielded room 4.6(L) x 4.2(W) x 2.4(H) m	Hermon Labs	SR-3	027	11/03 Check
0787	Transient limiter	Hewlett Packard	11947A-8ZE	3107A01877	11/03
1004	Cable coaxial, ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/03
1204	One phase voltage regulator, 2kVA, 0-250V	Hermon Labs	TDGC-2	99	6/04 Check
1430	EMI receiver, 9 kHz – 2.9 GHz	Agilent Technologies	8542E	3807A00262, 3705A00217	9/03
1502	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1502	12/03
1510	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1510	12/03 Check
1842	Power supply, dual regulated, 18 V, 2 A	Horizon Electronics	DHR 18-2	51824226	2/04 Check
1915	Active receiving loop antenna, 1 kHz – 30 MHz	EMC Test Systems	6507	1457	6/04
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	12/03

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Appendix D Test equipment correction factors

Antenna factor
Active loop antenna
Model 6507
S/N 1457

Frequency, MHz	Magnetic antenna factor, dB(S/m)	Electric antenna factor, dB
0.001	-0.8	50.7
0.002	-6.1	45.4
0.003	-10.0	41.5
0.005	-15.3	36.2
0.007	-18.5	33.0
0.009	-20.8	30.7
0.010	-21.9	29.7
0.020	-27.1	24.5
0.050	-31.0	20.5
0.075	-31.7	19.8
0.100	-31.9	19.6
0.150	-32.1	19.4
0.250	-32.3	19.2
0.500	-32.6	18.9
0.750	-32.7	18.8
1.000	-32.8	18.7
2.000	-33.2	18.3
3.000	-33.5	18.0
4.000	-33.9	17.6
5.000	-34.1	17.4
10.000	-34.8	16.7
15.000	-35.3	16.3
20.000	-35.3	16.3
25.000	-35.8	15.7
30.000	-35.9	15.7

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

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

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Correction factor
Line impedance stabilization network
Model LISN 16 - 1
Hermon Laboratories

Frequency, kHz	Correction factor, dB
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 in dB is to be added to meter readings of an interference analyzer or a spectrum analyzer.

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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	Measurement 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	-			

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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), dB	Measurement uncertainty 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				

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Cable RF, 6m, model: M17/167 MIL-C-17, s/n 1502 (HL 1502)
Calibration data (0.1 – 1000 MHz)

No.	Parameter	Set, MHz	Measured, dB	Deviation	Tolerance (specification), dB	Measurement uncertainty dB
1	Attenuation	0.1	0.02	NA	NA	±0.12
2		1	0.07			
3		3	0.15			
4		5	0.17			
5		10	0.26			
6		30	0.43			
7		50	0.57			
8		80	0.72			
9		100	0.81			
10		300	1.48			
11		500	2.00			
12		800	2.70			
13		1000	3.09			

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Cable RF, 8m, model: M17/167 MIL-C-17, s/n 1510 (HL 1510)
Calibration data (0.1 – 1000 MHz)

No.	Parameter	Set, MHz	Measured, dB	Deviation	Tolerance (specification), dB	Measurement uncertainty dB
1	Attenuation	0.1	0.05	NA	NA	±0.12
2		1	0.09			
3		3	0.16			
4		5	0.18			
5		10	0.27			
6		30	0.44			
7		50	0.58			
8		80	0.69			
9		100	0.82			
10		300	1.48			
11		500	2.01			
12		800	2.65			
13		1000	3.12			

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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:

AC	alternating current
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: 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.

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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