HERMON LABORATORIES

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839.01
Electrical

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ELECTROMAGNETIC EMISSION TEST REPORT

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

for

On Track Innovations Ltd.

EQUIPMENT UNDER TEST:

Reader

Model: Saturn M.B V-2

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1 Project information

Description of equipment under test

Test items	:Reader
Manufacturer	:On Track Innovations Ltd.
Types (Models)	:Saturn M.B V-2
Equipment FCC code[1]	:DXX

Applicant information

Applicant's responsible person	:Mr. Hemy Itay, project manager
Company	: On Track Innovations Ltd.
Address	:Zahar industrial zone, P.O.B. 32
City	:Rosh Pina
Postal code	:12000
Country	:Israel
Telephone number	:+972 4 6868000
Telefax number	:+972 4 6938887

Test performance

Project Number:	:14816
Location	:Hermon Laboratories
Receipt date	:September 16, 2002
Test started	:October 7, 2002
Test completed	:October 8, 2002
Purpose of test	Apparatus compliance verification in accordance with emission requirements
Test specification(s)	47CFR Part 15 subpart C §15.225 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 subpart C §15.225 and subpart B.

Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
Transmitter characteristics, §15.225								
Field strength of emission within the assigned band	(a)	**C**				Mrs. E Pitt, test engineer	Oct-7-2002	
Out of band spurious emissions (radiated)	(b)	**C**				Mrs. E Pitt, test engineer	Oct-7-2002	
Frequency tolerance of carrier signal	(c)	**C**				Mrs. E Pitt, test engineer	Oct-8-2002	
Unintentional radiation, §15.107, §15.109								
Conducted emissions	15.107	**C**				Mrs. E Pitt, test engineer	Oct-7-2002	
Radiated emissions	15.109	**C**				Mrs. E Pitt, test engineer	Oct-7-2002	
Receiver characteristics, §15.109								
Spurious radiated emissions	15.109	**C**				Mrs. E Pitt, test engineer	Oct-7-2002	
General conditions under Part 15								
The Intentional radiator operates at 13.56 MHz	15.225	**C**						
The intentional radiator has permanently attached antenna or antenna that uses a unique coupling to the intentional radiator.	15.203	**C**						

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Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
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				**NA**			
No antenna other than that furnished by the responsible party can be used with the device.	15.203					Responsibility of the end 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: Mrs. V. Mednikov, certification engineer

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

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3 EUT description

3.1 General description

The Saturn reader is a compact electronic interface unit, which provides bi-directional contact and non-contact communication with smart cards and RS232 communication with local controller.

The EUT is powered by 12 V DC from AC/ DC adapter.

3.2 EUT test configuration

The EUT ports and lines description is given in Table 3.2.1, test configuration is shown in Figure 3.2.1.
Local oscillator frequencies are 4 MHz, 13.56 MHz, 24 MHz.

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	AC/DC adapter
Signal	RS232	D-type 9 pin	1	shielded	10	controller

3.2.1 Changes made in EUT

To withstand the radiated emission requirements one ferrite bead manufactured by Steward Corp., p/n A2029-0A was installed at RS232 cable (two turns).

It is manufacturer responsibility to implement the change in the production version of the EUT. In any case the test report applies to the tested item only.

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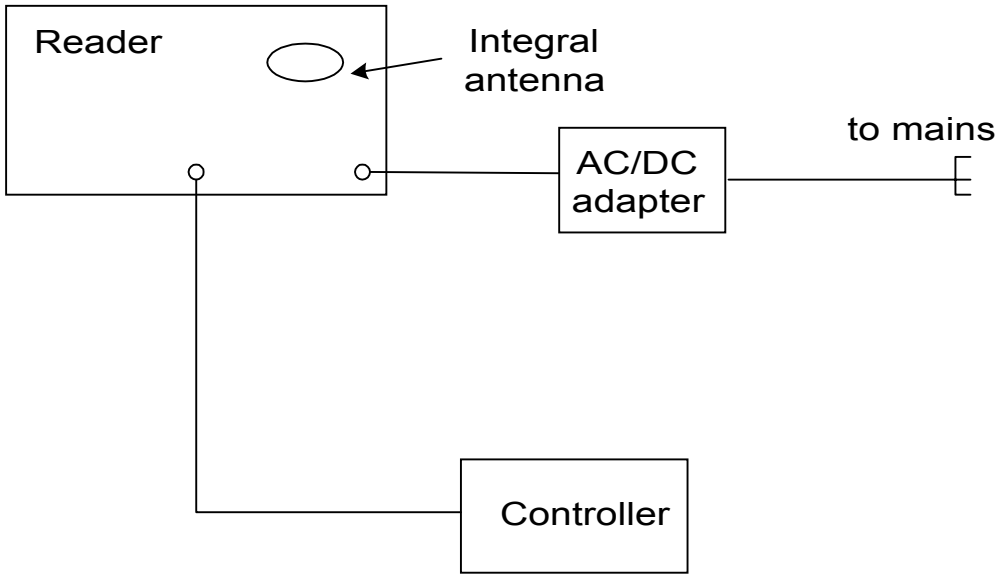
Figure 3.2.1



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3.3 Transmitter description

Type of equipment							
X	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	13.56 MHz						
Transmitter aggregate data rate (bits per second)	106 kBps						
Normal test signal	Repetitive REQB (ISO 14443-3)						
Maximum rated output power							
At transmitter permanent external 50 Ω rf output connector (dBm)							
Effective radiated power (for equipment with integral antenna) (dBm)	23 dBm into 50 Ohm temp antenna connector						
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)**	12				
	AC mains	**Nominal rated voltage (VAC)**					
Is there common power source for transmitter and receiver			**X**	yes		no	

Antenna technical characteristics						
			Type	**Manufacturer**	**Model number**	**Gain**
Integral	**X**	with temporary RF connector	**Loop (very small)**	**OTI**	**1000691**	**NA**
		without temporary RF connector				
External						

External antenna connection NA			
	standard connector		unique coupling

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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
EQUIPMENT UNDER TEST	Reader
DATE:	October 7, 2002
RELATIVE HUMIDITY:	57 %
AMBIENT TEMPERATURE:	23 °C
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
13.562	68.57	120	50.43	A1
Measurement uncertainty, dB		± 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 0446	HL 0521	HL 0589	HL 1004			

LIMIT

The field strength of any emissions within 13.553-13.567 MHz band shall not exceed 10000 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. Plot A1 in Appendix A refers 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
EQUIPMENT UNDER TEST	Reader
MODE OF OPERATION	Tx
DATE:	October 7, 2002
RELATIVE HUMIDITY:	57 %
AMBIENT TEMPERATURE:	23 °C
RATED CARRIER FIELD STRENGTH	68.57 dB(μV/m)
TEST DISTANCE	3 m
OPERATING FREQUENCY	13.56 MHz
FREQUENCY RANGE	9 kHz to 1000 MHz

Frequency, MHz	Radiated emission, dB (μV/m)	Limit, dB (μV/m)	Margin, dB	Reference to Plots in Appendix A
0.009 – 0.15	No spurious emissions found			A2
0.15 – 13.0	No spurious emissions found			A3
13.0 – 13.553	All out of band emissions were found below the limit			A4
13.567 – 14.0	All out of band emissions were found below the limit			A5
14.0 – 30.0	All out of band emissions were found below the limit			A6
39.9864	27.53*	40.0	12.47	A7
40.6800	29.88*	40.0	10.12	A7
48.0085	29.70*	40.0	10.30	A7
67.8012	32.86*	40.0	7.14	A7
72.0123	31.75*	40.0	8.25	A7
76.0124	29.75*	40.0	10.25	A7
Measurement uncertainty, dB		± 2.36 dB		

*** Quasi-peak value**

Table abbreviations:
Margin = dB below (negative if above) specification limit.

TEST EQUIPMENT USED:

HL 0446	HL 0521	HL 0589	HL 0604	HL 1004		

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 turntable in each of three orthogonal planes in turn.

9 kHz – 30 MHz frequency range. 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 A2 to A6 in Appendix A refer to vertical antenna polarization as the worst case.

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30 MHz – 1000 MHz 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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4.3 Frequency tolerance of the carrier signal according to § 15.225 (c)

METHOD OF MEASUREMENTS	ANSI 63.4 §13.1.6
EQUIPMENT UNDER TEST	Reader
MODE OF OPERATION	Tx
DATE:	October 8, 2002
RELATIVE HUMIDITY:	57 %
AMBIENT TEMPERATURE:	23 °C
OPERATING FREQUENCY	13.56 MHz

Temperature, . °C	Supply voltage, V AC	Operating frequency, kHz	Frequency tolerance*, kHz	Reference to Plots in Appendix A
T_{nom} 20 °C	**V_{nom} 120 V**	**13560.3**	**Reference**	A8
	V_{min} 102 V	13560.3	0	-
	V_{max} 138 V	13560.3	0	-
T_{min} –20 °C	V_{min} .120 V	13560.9	0.6	A9
T_{max} +50 °C	V_{max} .120 V	13560.1	-0.2	A10
Measurement uncertainty		± 0.21 ppm		

* Frequency tolerance of the carrier signal shall be within ± 1.35603 kHz

TEST EQUIPMENT USED:

HL 0026	HL 0493	HL 0559				

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° – +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. The results provided in the Table above refer to the worst case.
At reference (+20°C) temperature the frequency was measured at input voltage (at the adapter input) 85% and 115% of nominal. As the adapter output voltage remained 12 V DC in each case, no difference in frequency values was observed.

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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
EQUIPMENT UNDER TEST	Reader
TEST PERFORMED IN:	ANECHOIC CHAMBER
MODE OF OPERATION	Tx
DATE	October 7, 2002
RELATIVE HUMIDITY	59 %
AMBIENT TEMPERATURE:	23 °C
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
THE EUT WAS TESTED AS:	TABLE-TOP
RECEIVER OPERATING FREQUENCIES	13.56 MHz
FREQUENCY RANGE:	30 MHz – 1 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	5^{th} harmonic of the highest frequency or 40 GHz, whichever is lower

The EUT was tested in Tx mode, all emissions were found below class B specification limit, refer to paragraph 4.2 and Plot A7.

TEST EQUIPMENT USED:

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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4.5 Unintentional conducted emissions test according to §15.107, §15.207

METHOD OF MEASUREMENTS	ANSI 63.4 §13.1.3
DATE:	October 7, 2002
MODE OF OPERATION	Tx
RELATIVE HUMIDITY:	54%
AMBIENT TEMPERATURE:	22 °C
THE EUT WAS TESTED AS:	TABLE-TOP
DETECTOR USED:	QUASI-PEAK
FREQUECNY RANGE:	450 kHz – 30 MHz
RESOLUTION BANDWIDTH:	9 kHz
LINES TESTED	PHASE/NEUTRAL

Class B equipment

Line: Phase

Frequency, MHz	Measured emissions, dB (µV)	Specification limit, dB (µV)	Margin, dB	Reference to Plots in Appendix A
0.512500	32.10	48.00	15.90	A11, A12
0.729863	35.91	48.00	12.09	A11, A12
0.789863	35.86	48.00	12.14	A11, A12
0.839863	35.19	48.00	12.81	A11, A12
0.889863	33.55	48.00	14.45	A11, A12
13.559975	39.73	48.00	8.27	A11, A12
Measurement uncertainty, dB		+2.43 dB / -2.22 dB		

TEST EQUIPMENT USED:

HL 0163	HL 0521	HL 0586	HL 0787	HL 1003		

LIMIT

Frequency, MHz	Class A Equipment, dB(µV)	Class B equipment, dB(µV)
0.45 – 1.705	60.0	48
1.705 - 30	69.5	48

TEST PROCEDURE

The EUT was set up as shown in Photograph 4 (Appendix B). 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 PERFROMED IN:	ANECHOIC CHAMBER
DATE	October 7, 2002
RELATIVE HUMIDITY	59%
AMBIENT TEMPERATURE:	23 °C
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
THE EUT WAS TESTED AS:	TABLE-TOP
FREQUECNY RANGE:	30 MHz – 1 GHz
DETECTOR TYPE:	QUASI-PEAK
RESOLUTION BANDWIDTH:	120 kHz

	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	5^{th} 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 Tx mode, refer to paragraph 4.2 and Plot A7.

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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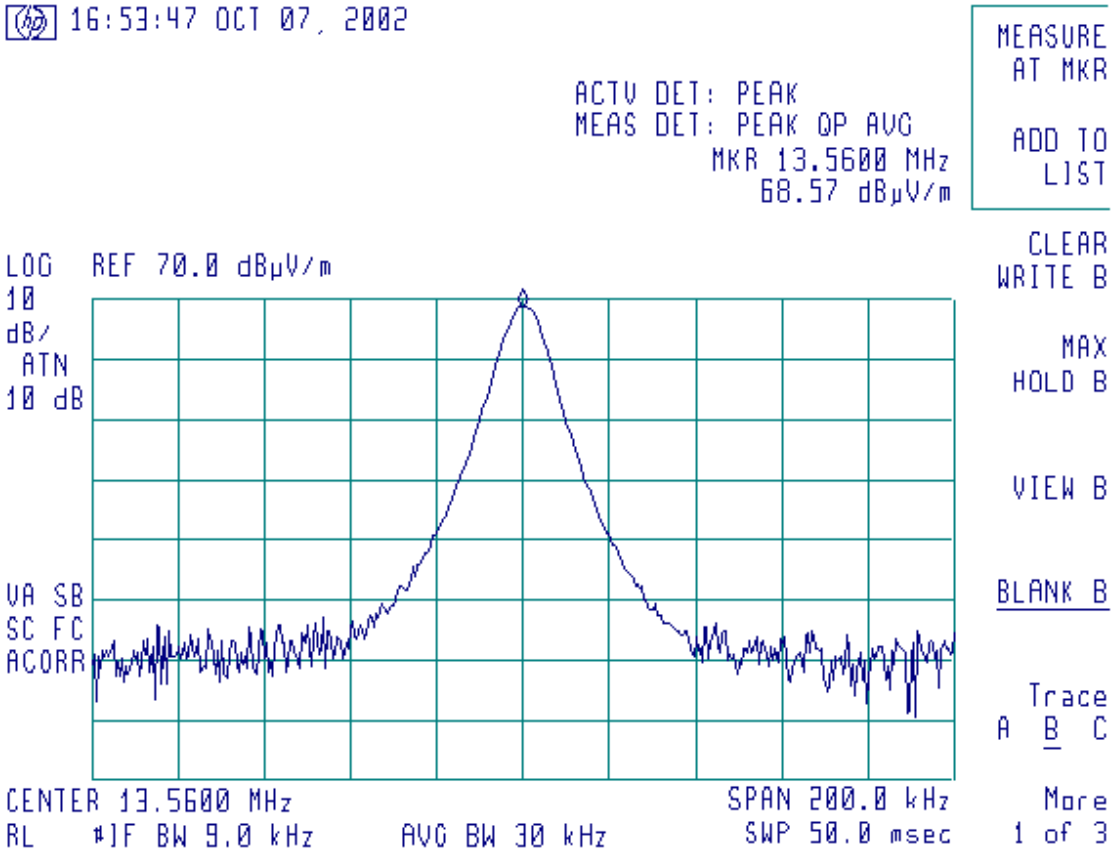
Appendix A Plots

Plot A1 Field strength of emission within the assigned band



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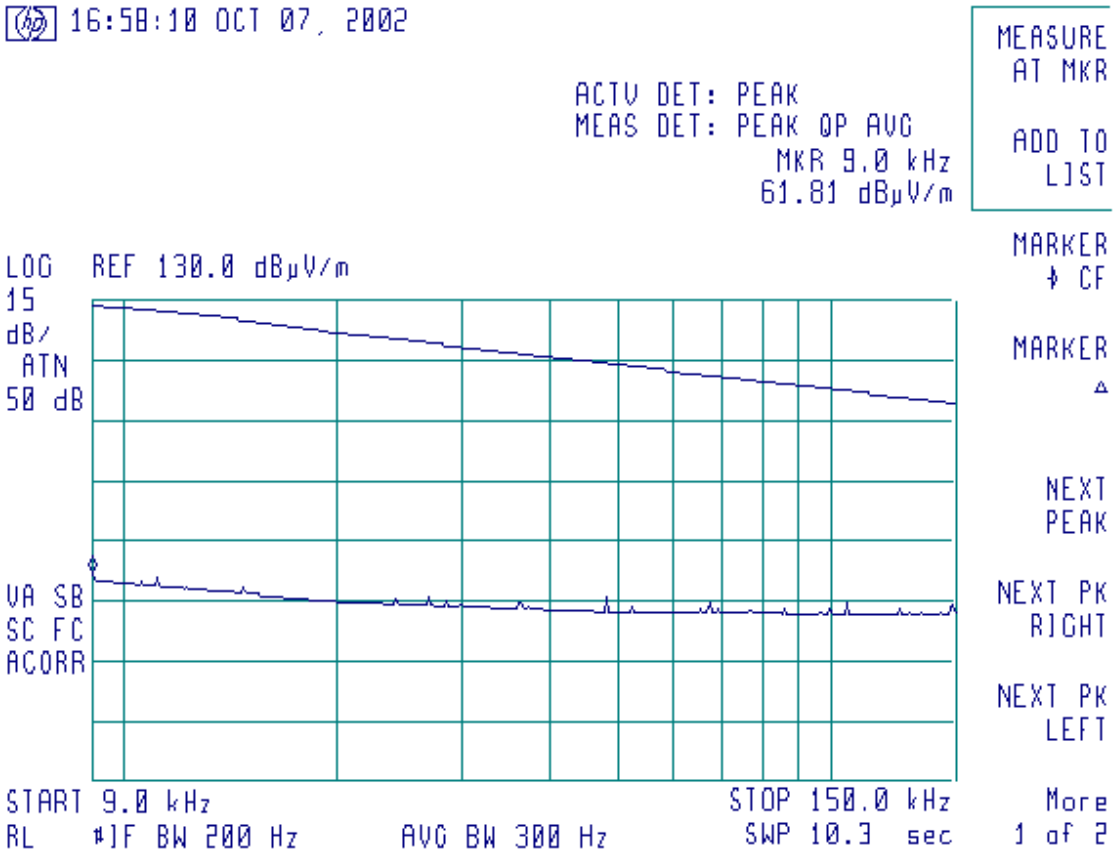
Plot A2 Field strength of out of band emissions,
9 kHz – 150 kHz frequency range



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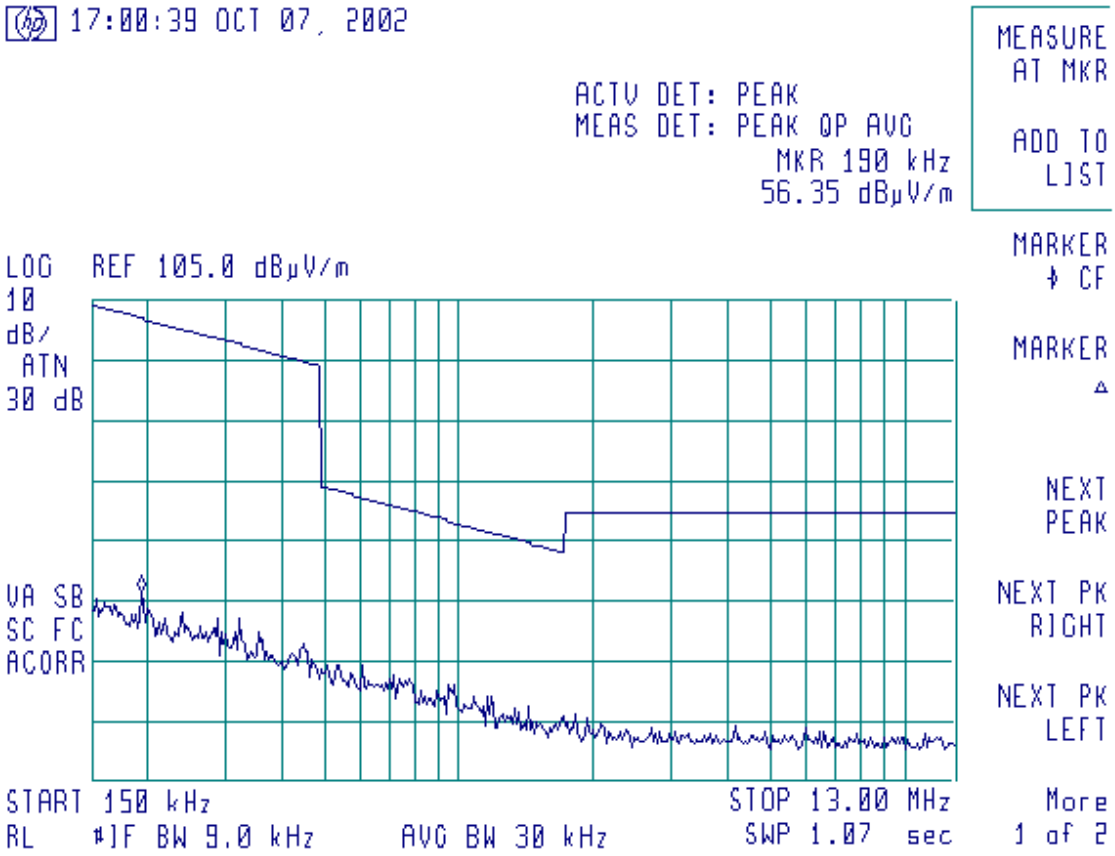
Plot A3 Field strength of out of band emissions,
150 kHz – 13.00 MHz frequency range



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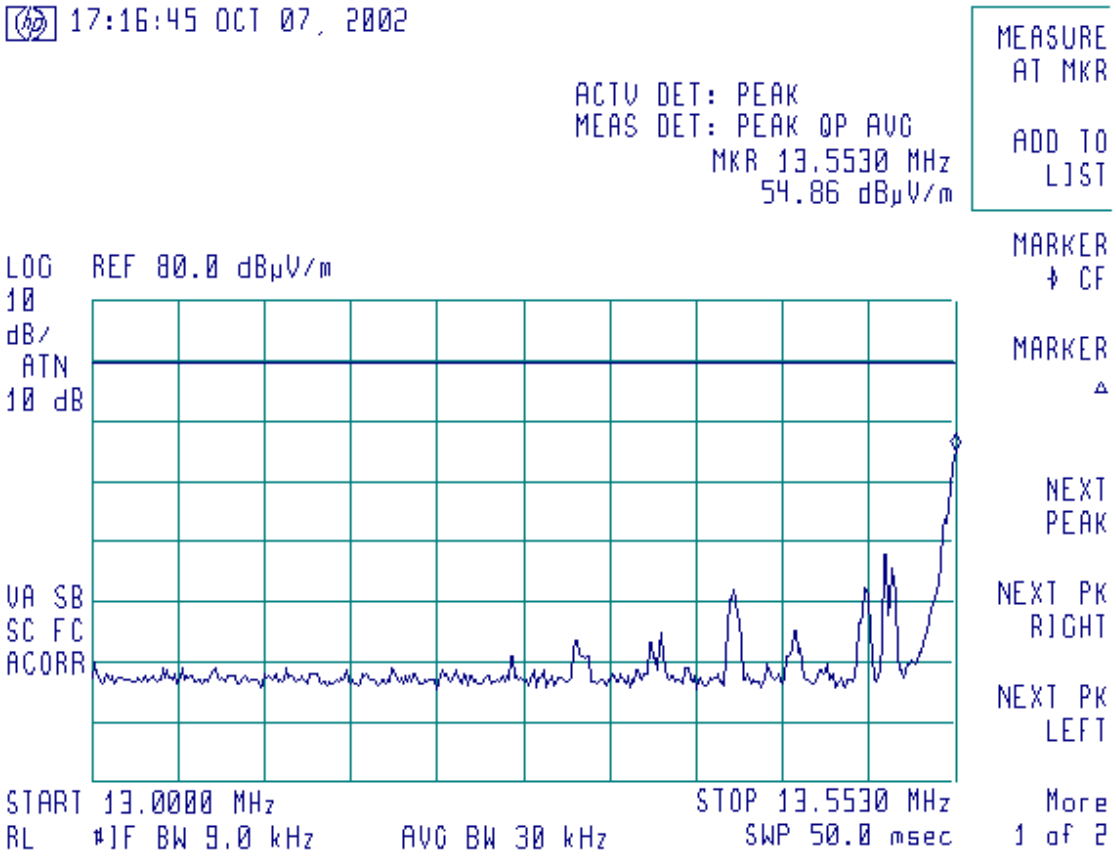
Plot A4 Field strength of out of band emissions,
13.00 – 13.553 MHz frequency range



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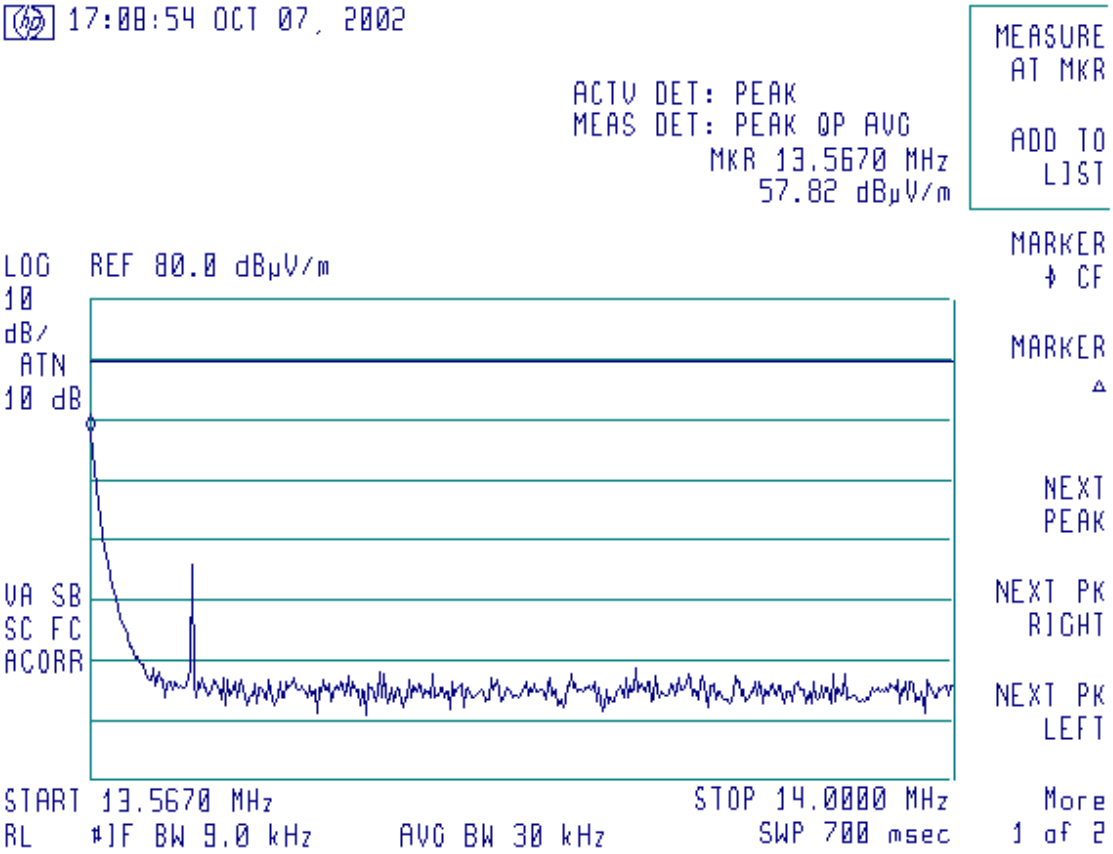
Plot A5 Field strength of out of band emissions,
13.567 – 14.00 MHz frequency range



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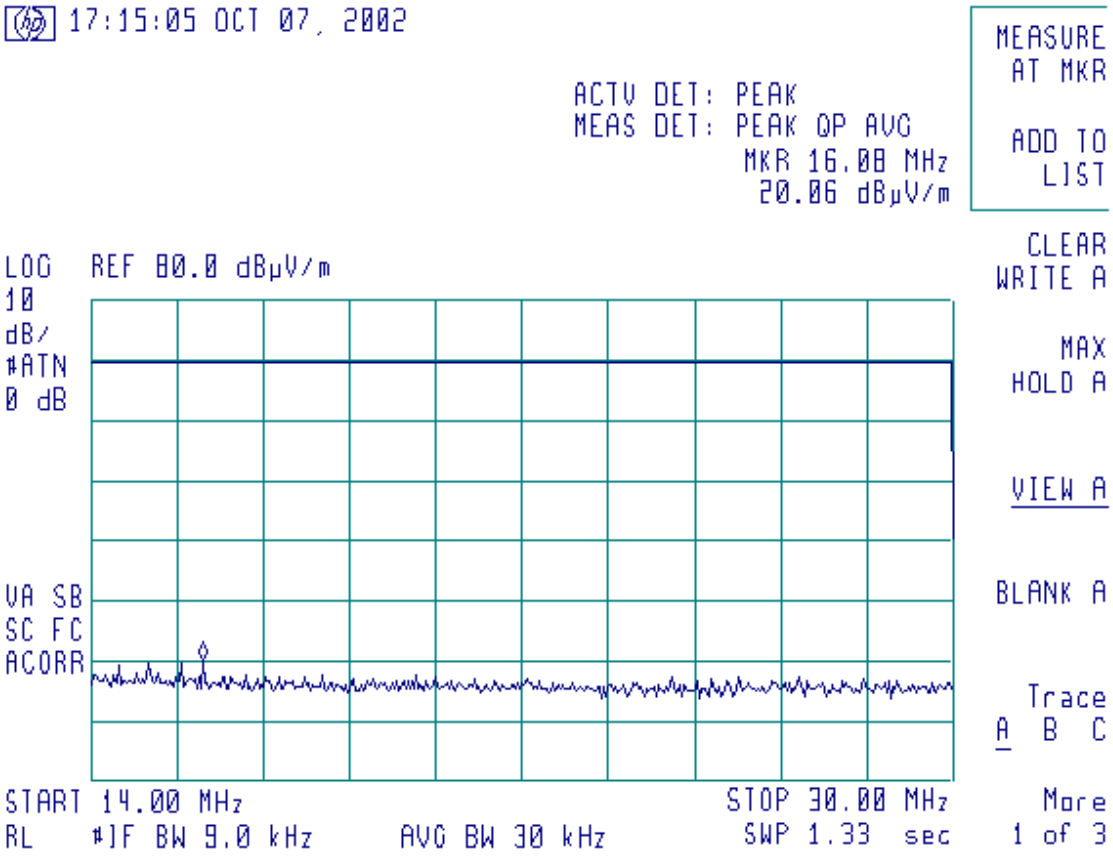
Plot A6 Field strength of out of band emissions,
14.00 – 30.00 MHz frequency range



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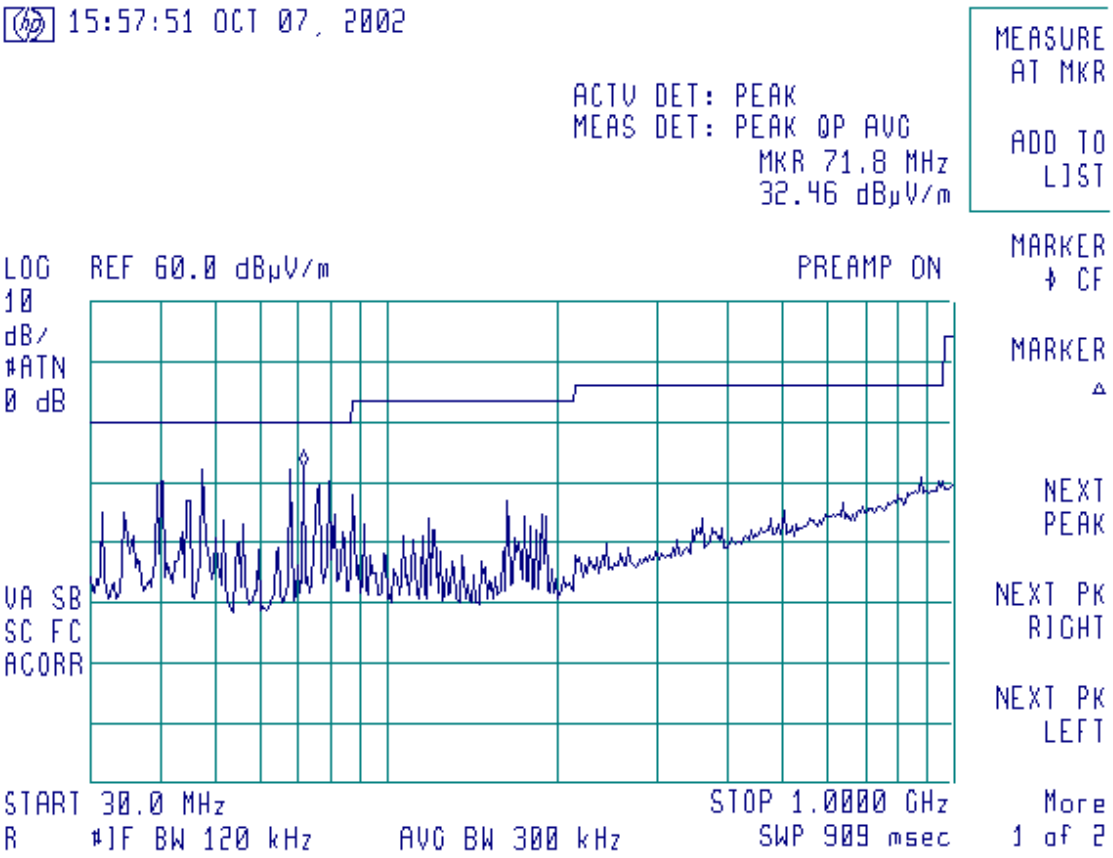
**Plot A 7 Field strength of spurious emissions,
30 – 1000 MHz frequency range,
vertical / horizontal polarization**



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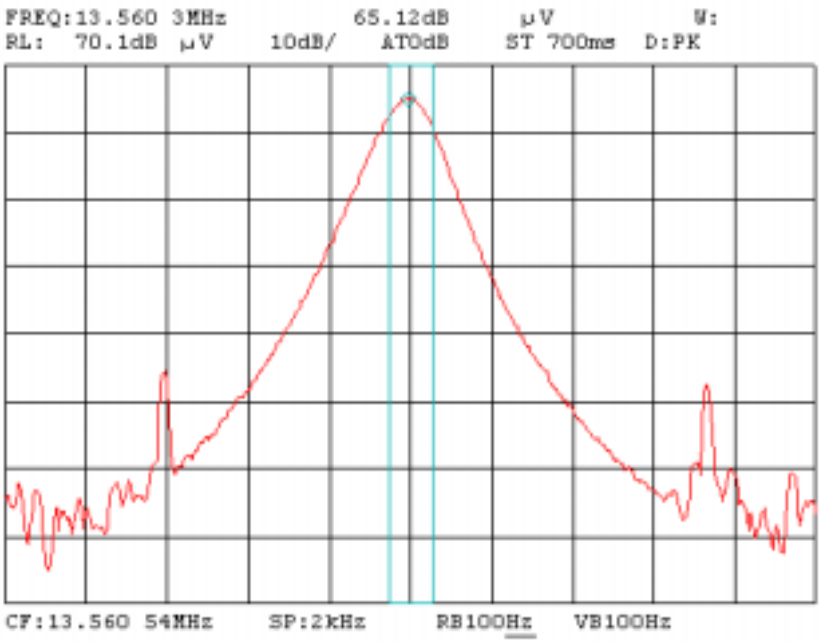
Plot A8 Frequency tolerance,
temperature 20°C, supply voltage 120 V (reference)



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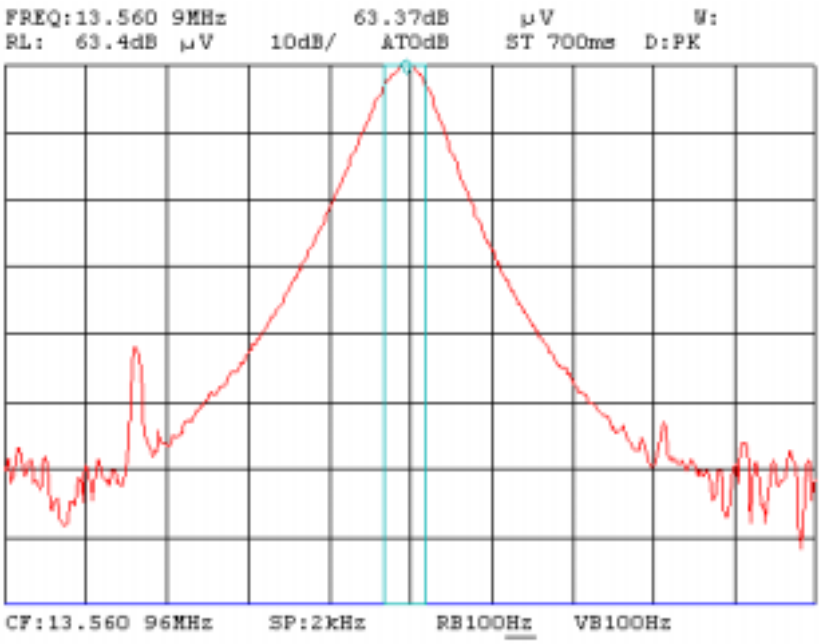
Plot A9 Frequency tolerance,
temperature -20°C, supply voltage 120 V



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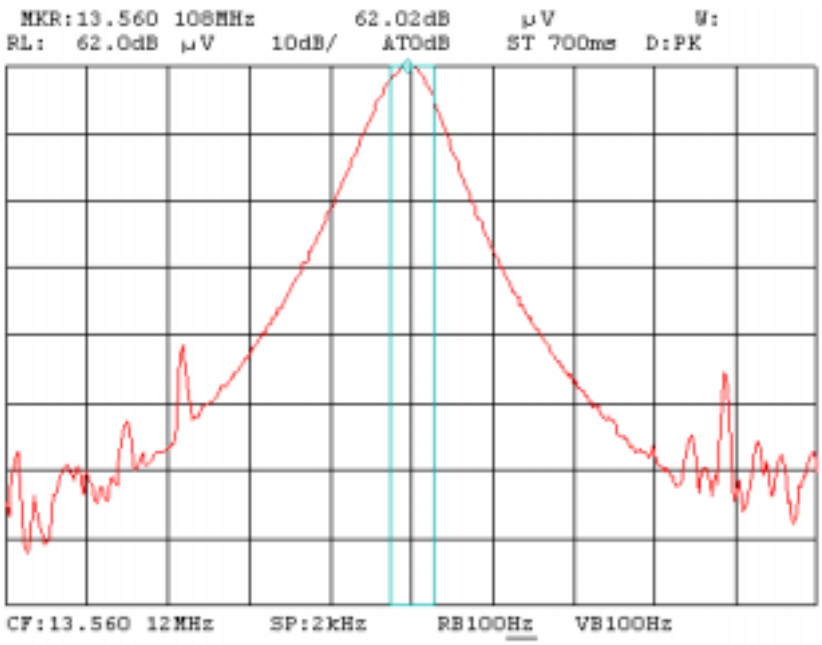
Plot A10 Frequency tolerance,
temperature +50°C, supply voltage 120 V



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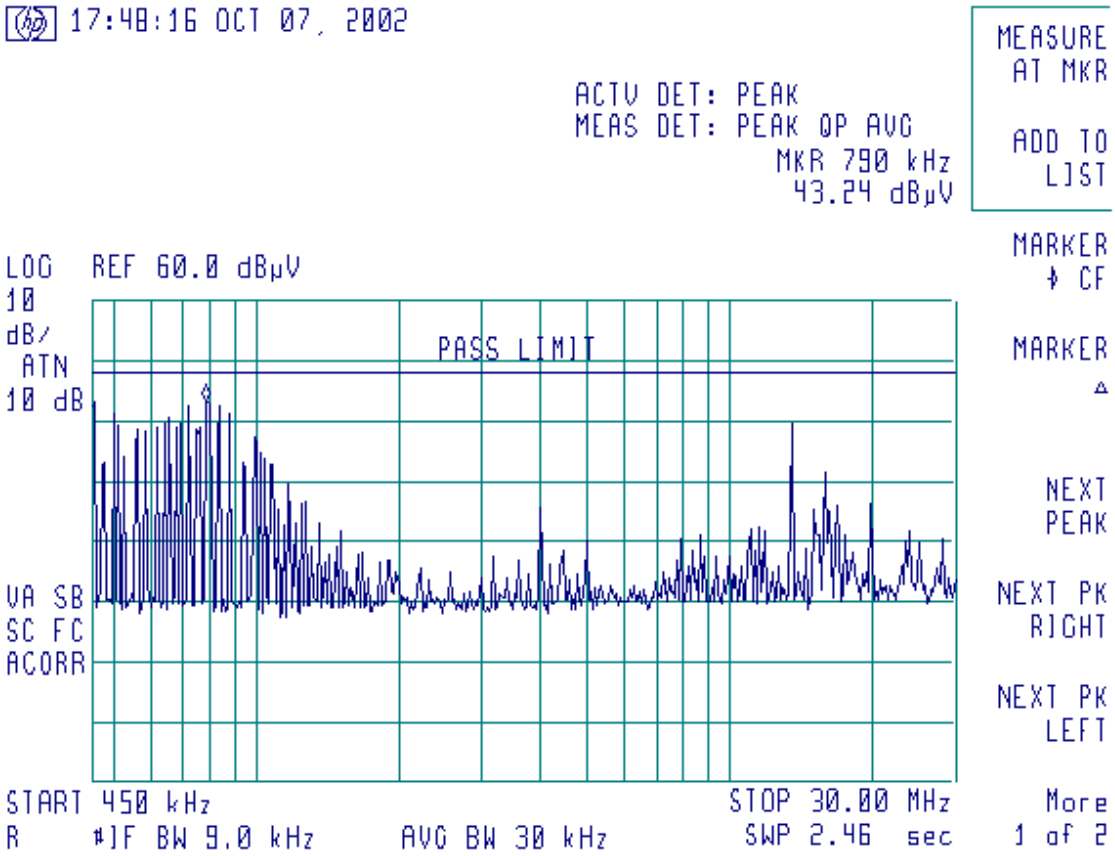
Plot A11 Unintentional conducted emissions on power line, Phase



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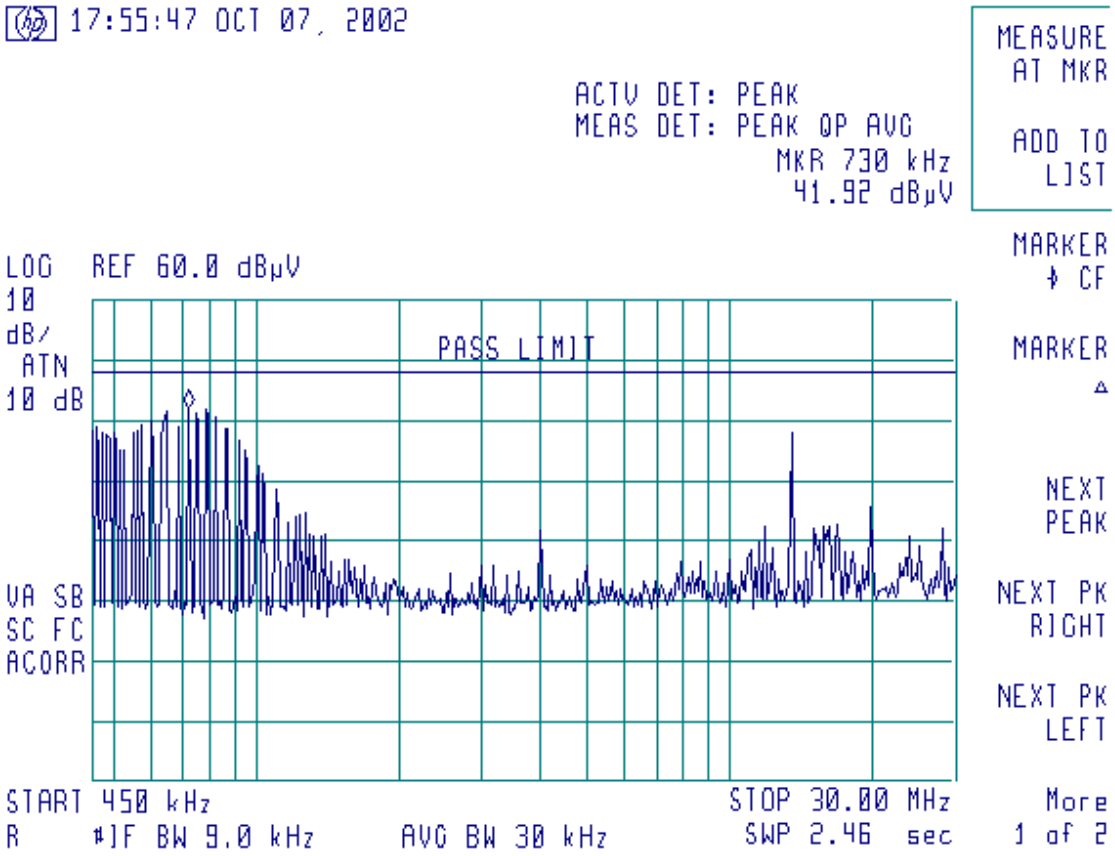
Plot A12 Unintentional conducted emissions on power line, Neutral



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Appendix B Test setup photographs

Photograph 1 EUT test setup

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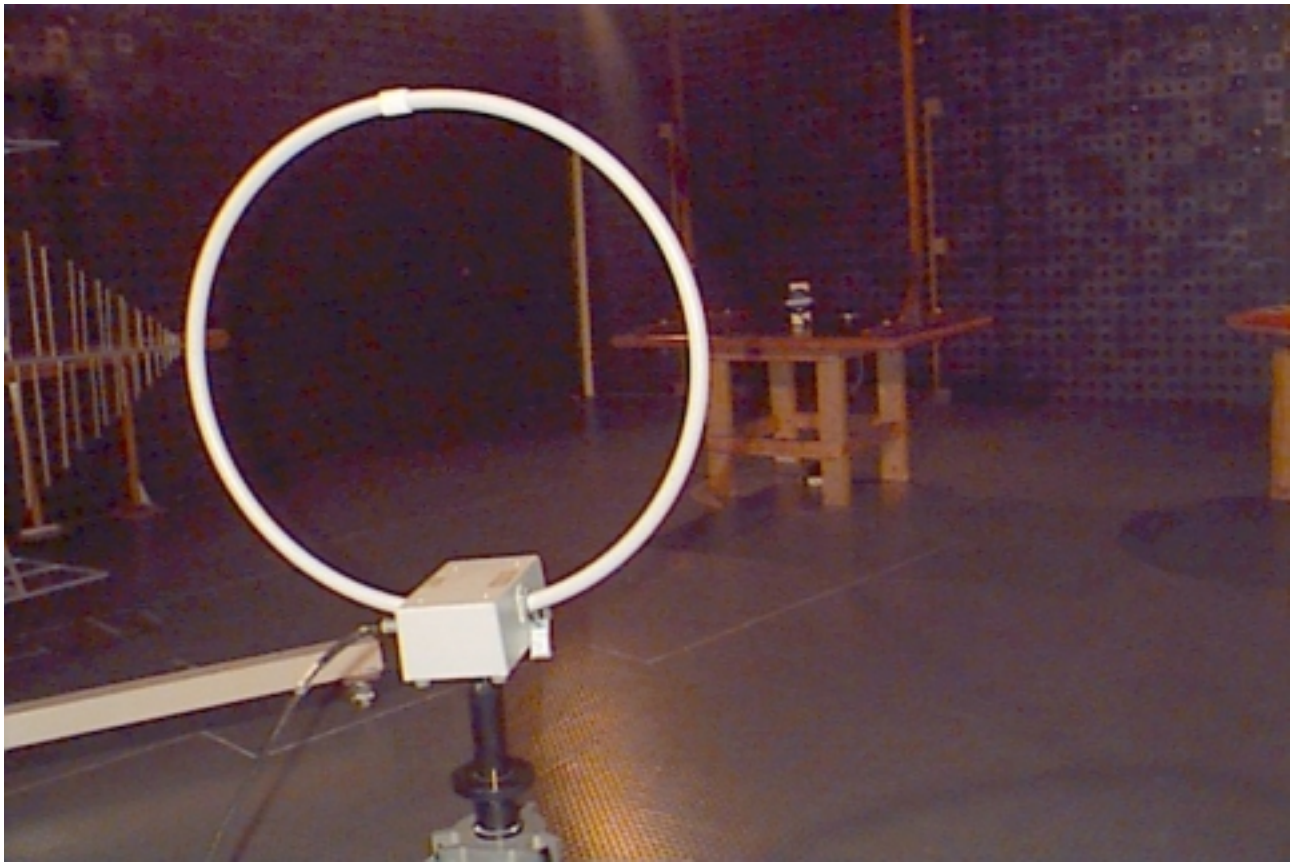
Photograph 2 Radiated emission measurements test setup with loop antenna, 9 kHz – 30 MHz frequency range, anechoic chamber method



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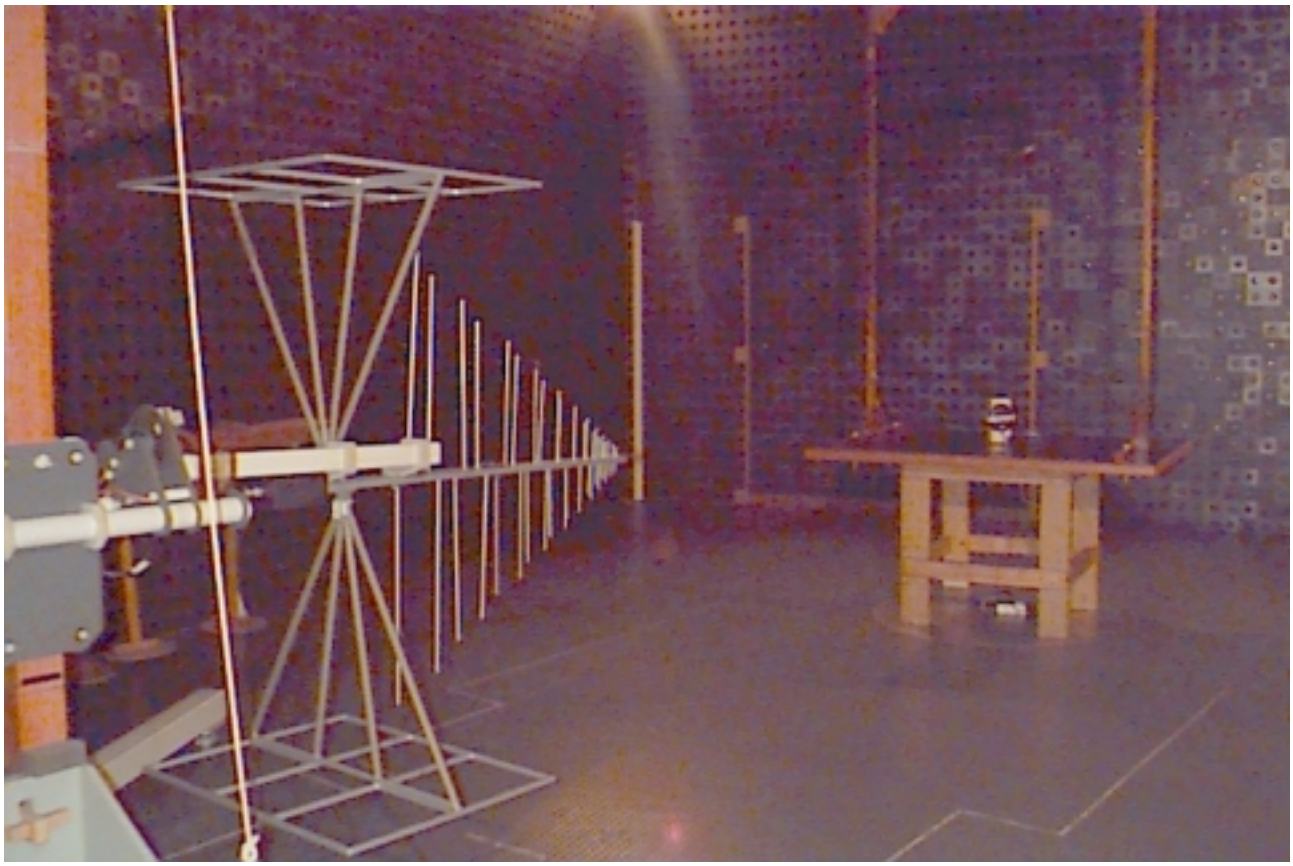
Photograph 3 Radiated emission measurements test setup with biconilog antenna, 30 MHz – 1000 MHz frequency range, anechoic chamber method



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Photograph 4 Conducted emission measurements test setup

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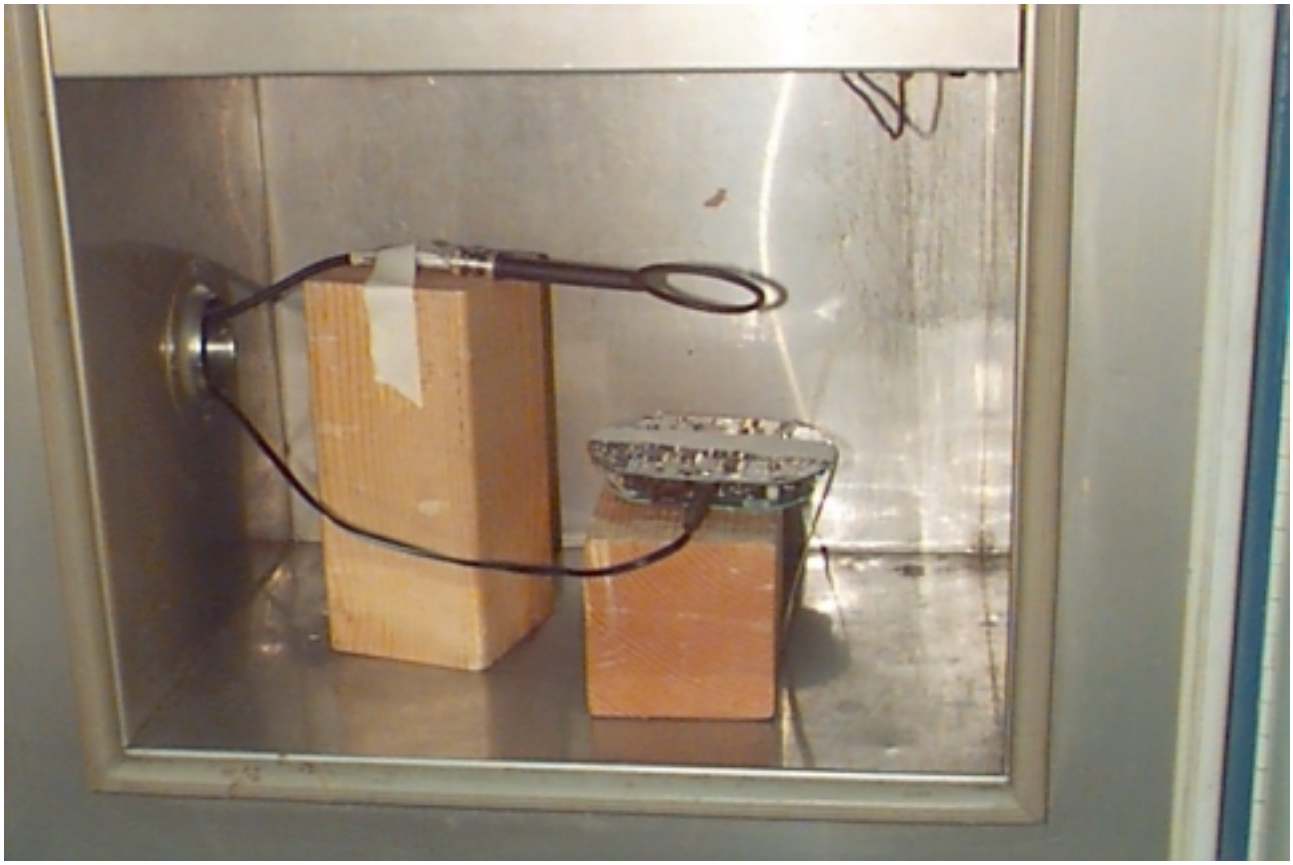
Photograph 5 Frequency tolerance test setup



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Photograph 6 Frequency tolerance test setup

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Appendix C Test equipment used for tests and correction factors

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	8/03
0163	LISN FCC/VDE/MIL -STD	Electro-Metrics	ANS-25/2	1314	10/03
0446	Active Loop Antenna, 10 kHz-30 MHz	Electro-Mechanics	6502	2857	11/02
0493	Oven temperature	Thermotron	S-1.2 Mini-Max	4016	3/03
0521	Spectrum Analyzer with RF filter section (EMI Receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	7/03
0559	Multimeter Digital	Fluke	76	0903	10/03
0586	Load termination BNC 50 Ohm, 0.5 W	Hermon Labs	LT-50	095	11/02 check
0589	Cable Coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	11/02
0604	Antenna Biconilog Log-Periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	12/02
0787	Transient limiter	Hewlett Packard	11947A-8ZE	3107A01877	11/02
1003	Cable coaxial, M17/164, 10 m	Hermon Labs	C17164-10	161	11/02
1004	Cable coaxial, ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/02

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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.

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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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	30	0.33	-			
2	Loss	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	-	≤ 6.5	±0.12	
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	2800	3.21	-	≤ 6.5	±0.12	
17	Loss	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 coaxial M17/164
Model: C17164-10, s/n 161 (HL 1003)
Calibration data

No.	Parameter	SET, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB	Notes
1	Insertion	30	0.41	-	≤ 12.5	±0.12	
2	Loss	50	0.52	-			
3		100	0.75	-			
4		300	1.45	-			
5		500	2.01	-			
6		800	2.71	-			
7		1000	3.14	-			
8		1200	3.56	-			
9		1400	3.93	-			
10		1600	4.31	-			
11		1800	4.63	-			
12		2000	4.97	-			
13		2200	5.32	-			
14		2400	5.65	-			
15		2600	6.01	-			
16	Insertion	2800	6.42	-	≤ 12.5	±0.12	
17	Loss	3000	6.76	-			
18		3300	7.12	-			
19		3600	7.53	-			
20		3900	7.95	-			
21		4200	8.32	-		±0.17	
22		4500	8.72	-			
23		4800	9.14	-			
24		5100	9.59	-			
25		5400	10.00	-			
26		5700	10.49	-			
27		6000	11.07	-			
28		6500	11.80	-			

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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