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ELECTROMAGNETIC EMISSIONS TEST REPORT

according to 47CFR Part 90, subpart I and part 15, subpart B
for

Telematics Wireless Ltd.

EQUIPMENT UNDER TEST:

Monitoring service reader
Model:FP100RA 915

Document ID: TELRAD_FCC.15717_rev3.doc
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1 Project information

Description of equipment under test

Test items	: Monitoring service reader
Manufacturer	: Telematics Wireless Ltd.
Types (Models)	: FP100RA 915

Applicant information

Applicant's responsible person	: Mr. Roman Sternberg, VP marketing
Company	: Telematics Wireless Ltd.
Address	: 26, Hamelacha street
P.O.Box	: 1911
City	: Holon
Postal code	: 58117
Country	: Israel
Telephone number	:+972-3557 5750
Telefax number	:+972-3557 5753

Test performance

Project Number:	: 15717
Location	: Hermon Laboratories
Receipt date	: October 26, 2003
Test started	: November 3, 2003
Test completed	: February 2, 2004
Purpose of test	: Apparatus compliance verification in accordance with emission requirements
Test specification(s)	47CFR part 90, §§90.205, 90.209, 90.210, 90.213, part 15 §15.107, §15.109

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2 Summary and signatures

The EUT, FP100RA 915 reader, was tested according to FCC part 90 subpart I, §§90.205(k), 90.209, 90.210(k)(3), part 15 §§15.107, 15.109 and found to comply with the standard requirements.

Test description	Specification reference	Tested by	Date tested	Test report paragraph	Verdict
RF output power	90.205(k); 2.1046	Mr. Y. Neuman, test engineer	November 4, 2003	4.1	Pass
Occupied bandwidth	90.209; 2.1049	Mr. Y. Neuman, test engineer	November 4, 2003	4.2	Pass
Emission mask	90.210(k)(3); 2.1051	Mr. Y. Neuman, test engineer	November 4, 2003	4.3	Pass
Radiated spurious emissions	90.210; 2.1053	Mr. Y. Neuman, test engineer	November 3, December 1, 2003	4.3	Pass
Radiated emissions	15.109	Mr. Y. Neuman, test engineer	January 20, 21, 2004	4.4	Pass
Antenna power conducted	15.111	Mr. Y. Neuman, test engineer	January 21, 2004	4.5	Pass
Frequency stability	90.213, 2.1055	Mr. Y. Neuman, test engineer	December 1, 2003	4.6	Tested
Conducted emissions	15.109	Mr. B. Efros, test engineer	February 2, 2004	4.7	Pass

Test report prepared by:

Mrs. M. Cherniavsky, MScEE, certification engineer _____

Test report approved by:

Mr. Michael Nikishin, MScEE, group leader _____

Mr. Edward Usoskin, PhD, C.E.O. _____

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3 EUT description

3.1 General description

The EUT, a reader, is the roadside component of a vehicle identification system, operating at 915 MHz with ASK modulation and utilizing external antenna. Data bit rate is 500 kbps. The device is powered from mains via AC/DC adapter.
The frequencies generated or used in the EUT are: 50 kHz, 16 MHz (reference clock), 70 MHz (Tx IF), 422.5 MHz (Tx VCO), 925 MHz (Rx LO).

3.2 EUT test configuration

The EUT ports and lines description is given in Table 3.4.1, support/test equipment list is provided in Table 3.4.2, test configuration is shown in Figure 3.4.1.
The conducted measurements were performed at “Ant main” port because of lesser attenuation from the RF amplifier output (connectors “Ant 1” – “Ant 4” can be used instead of “Ant main”, in this case the additional multiplexer is involved, as shown in RF switch block diagram attached to this Application).

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	DC jack	1	Unshielded	1.5	AC/DC adapter
Signal	Host, RS232/422	D-type 9	1	Unshielded	2	PC
Signal	Aux, RS232	D-type 9	1	Unshielded	2	Open circuit
Signal	Maintenance, RS232	D-type 9	1	Unshielded	2	Open circuit
Signal	I/O	D-type 25	1	Unshielded	1	Open circuit
Signal	Antenna	SMA	5	coax	NA	50 Ohm termination

Table 3.2.2
EUT support/test equipment

Description	Manufacturer	Model number	Serial number
Laptop with adapter	Toshiba	PA1262E	28012460
ITE power supply (adapter)	Potrans Electrical Corp.	UP30437	1711-030-A

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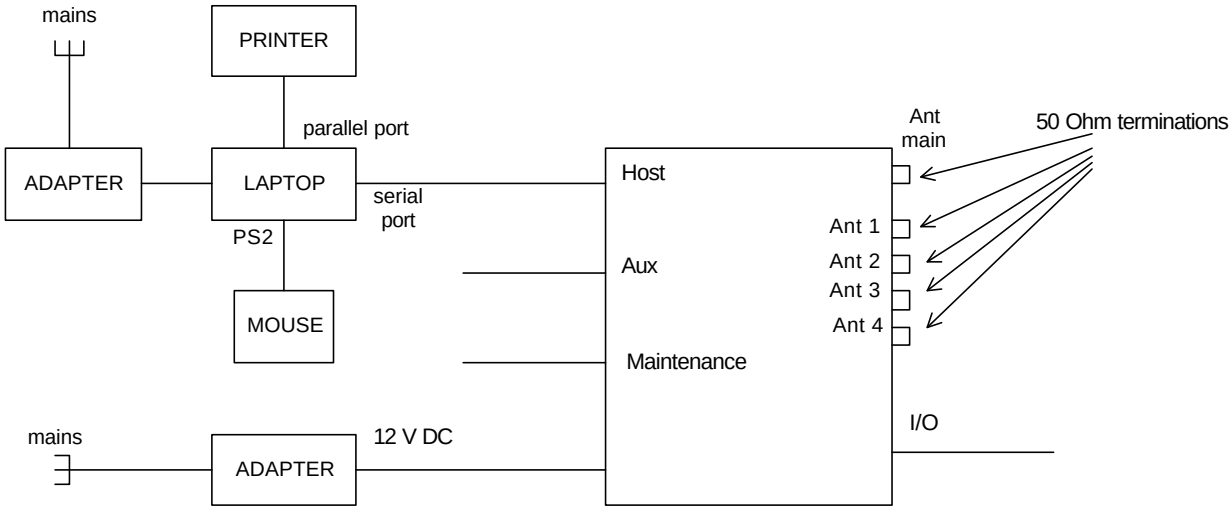
Figure 3.2.1

EUT test configuration



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4 Test results

4.1 Peak output power test according to part 90 §90.205(k)

DATE of TEST: November 4, 2003
AMBIENT TEMPERATURE: 23°C
RELATIVE HUMIDITY: 38 %
AIR PRESSURE: 1016 hPa
MEASUREMENT UNCERTAINTY: ±4.5 dB

Carrier frequency, MHz	Peak output power, dBm	Limit, dBm	Margin, dB	Verdict
915.00	26.2	44.7	18.5	Pass

LIMITATION ON POWER

Operating frequency range, MHz	Maximum effective radiated power (ERP)
902 - 927.25	30 W (44.7 dBm)

TEST PROCEDURE

The EUT main antenna port was connected via attenuator to power meter and peak output power was measured.

TEST EQUIPMENT USED:

HL 0460	HL 0846	HL 1097				

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4.2 Occupied bandwidth according to part 90 §90.209(5)

METHOD OF MEASUREMENTS	ANSI C63.4 §13.1.7
DATE of TEST:	November 4, 2003
AMBIENT TEMPERATURE:	23°C
RELATIVE HUMIDITY:	38 %
AIR PRESSURE:	1016 hPa
MEASUREMENT UNCERTAINTY:	±2.6 dB
CARRIER FREQUENCY:	915.00 MHz

Measured bandwidth, MHz	Authorized bandwidth, MHz	Margin, MHz	Reference to Plots in Appendix A	Verdict
3.88	12	6.9	A1	Pass

LIMIT

Operating frequency range, MHz	Authorized bandwidth, MHz
909.75 – 921.75	12

TEST PROCEDURE

The EUT RF output was connected to the spectrum analyzer, which settings are shown in the plots. Spectrum analyzer readings were corrected for external attenuation and cable loss.

TEST EQUIPMENT USED:

HL 1097	HL 1424	HL 1991	HL 2254		

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4.3 Emission mask and radiated spurious emissions test according to part 90 §90.210(k)(3)

METHOD OF MEASUREMENTS	ANSI 63.4 §13.1.4
DATE of TEST:	November 4, 2003
AMBIENT TEMPERATURE:	30°C
RELATIVE HUMIDITY:	38 %
AIR PRESSURE:	1014 hPa
FREQUENCY RANGE:	9 kHz – 9.3 GHz
MEASUREMENT UNCERTAINTY:	±4.3 dB (conducted method)
	±4.5 dB (radiated method)

The peak power of any emission shall be attenuated below the power of the highest emission contained within the licensee's sub-band in accordance with the following schedule:

1) On any frequency within the authorized bandwidth: zero dB;
2) On any frequency outside the licensee's sub-band edges: 55 + 10 log (P) dB, where (P) is the highest emission (in watts) of the transmitter inside the licensee's sub-band.

4.3.1 Test procedure

Conducted spurious emissions were measured at the EUT main antenna terminal in the frequency range from 9 kHz up to 9.3 GHz.

The following calculated limit was applied to spurious emissions throughout the testing in transmit mode:
the specified limit 55 + 10 log (P) was converted in EIRP units – 25 dBm.
This limit was applied to spurious emissions throughout the following frequency ranges:
9 kHz to 909.75 MHz and 921.75 MHz to 9.3 GHz.
Emissions at the lower band edge and at the higher band edge were tested**.** No spurious emissions except 3rd and 5th harmonics were found, the harmonics were 30 dB below limit. The full test results are shown in Plots A2 to A12.

Radiated spurious emissions were measured at 3m test distance in the anechoic chamber from 9 kHz up to 6.5 GHz and at OATS from 6.5 GHz up to 9.3 GHz:
with the loop antenna in the 9 kHz to 30 MHz range,
the biconilog - in the 30 MHz to 1000 MHz range,
the double ridged guide – in 1 GHz to 9.3 GHz range.
The EUT was set up on the 80 cm height wooden table as shown in Figures 4.3.1 and 4.3.2.

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 – 9.3 GHz frequency range. 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.

The specified limit 55 + 10 log (P) was converted in 70 dB(μV/m) equivalent field strength at 3 m
E = sqrt(30P) /r, where P = –25 dBm = 3 x10^{-6} W.
E [dBμV/m] = 20 log {10^{6} x sqrt (30x3x10^{-6})/3} = 70 dBμV/m.
The full test results are shown in Plots A13 to A18.

All spurious emissions were found at least 20 dB below specified limit.

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TEST EQUIPMENT USED FOR CONDUCTED METHOD:

HL 1097	HL 1424	HL 1991	HL 2254			

TEST EQUIPMENT USED IN ANECHOIC CHAMBER:

HL 0446	HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 1004	HL 1947	HL 2009	HL 2432		

TEST EQUIPMENT USED AT OPEN AREA TEST SITE:

HL 0038	HL 0091	HL 0287	HL 1200	HL 1424	HL 1942	HL 2254
HL 2259	HL 2432					

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Figure 4.3.1

Set up for radiated emissions measurement with loop antenna

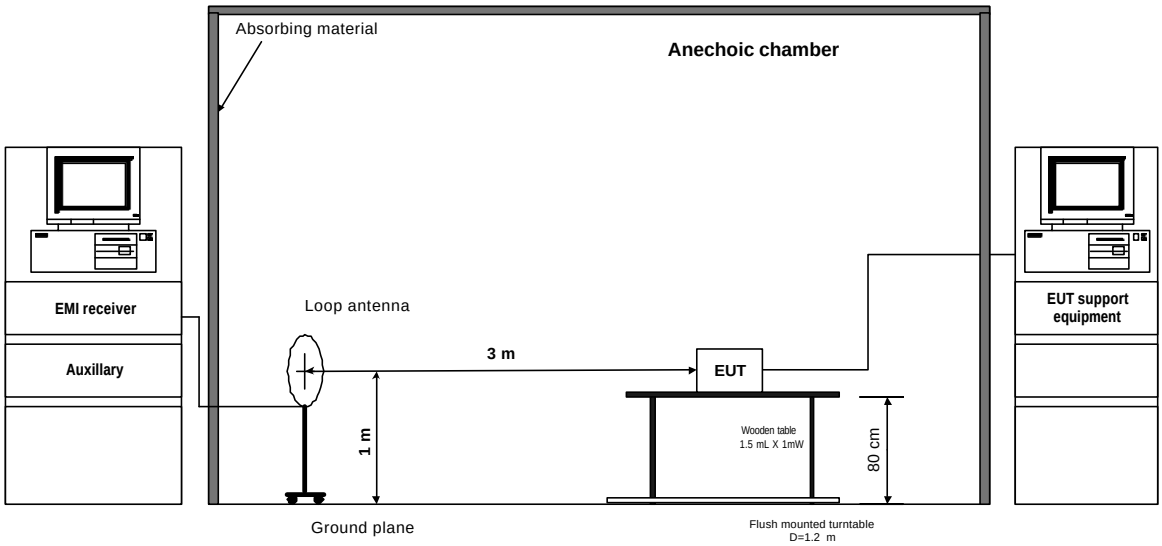
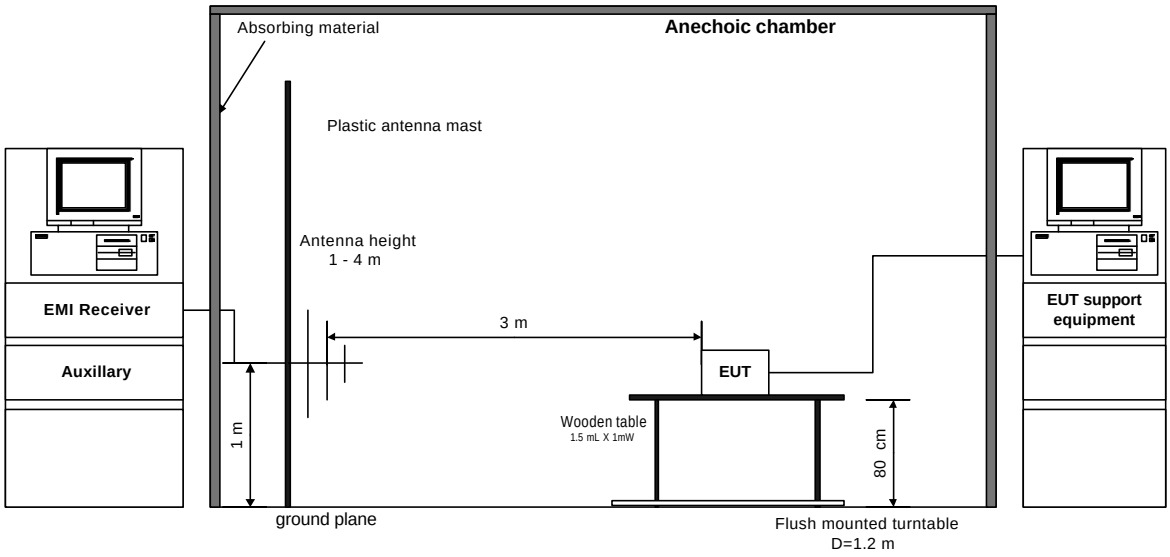


Figure 4.3.2

Set up for radiated emissions measurement with biconilog antenna



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4.4 Unintentional radiated emissions test according to §15.109

METHOD OF MEASUREMENT:	ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
TEST PERFROMED AT:	Anechoic chamber
DATE of TEST:	January 20, 21, 2004
AMBIENT TEMPERATURE:	22°C
RELATIVE HUMIDITY:	41 %
AIR PRESSURE:	1013 hPa
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
THE EUT WAS TESTED AS:	Table-top
FREQUECNY RANGE:	30 MHz – 5 GHz
DETECTOR TYPE:	Peak
MEASUREMENT UNCERTAINTY:	± 6 dB max

For test procedure and setup refer to section 4.3, radiated emissions. For full test results refer to plots A19 to A21.

Quasi-peak detector, RBW = 120 kHz

Frequency, MHz	Antenna polarization	Antenna height, m	Turntable position (°)	Radiated emissions, dB (µV/m)	Limit, dB (µV/m)	Margin, dB	Verdict
48.01	Vertical	1.00	0	37.30	40.00	2.70	Pass
80.01	Horizontal	2.40	0	37.30	40.00	2.70	Pass
112.01	Horizontal	3.30	57	42.52	43.50	0.98	Pass
144.02	Horizontal	1.50	215	40.59	43.50	2.91	Pass
192.01	Horizontal	1.60	220	41.67	43.50	1.83	Pass
399.99	Horizontal	1.10	250	41.69	46.00	4.31	Pass
533.18	Vertical	1.00	0	42.93	46.00	3.07	Pass
720.00	Horizontal	1.10	0	44.00	46.00	2.00	Pass

The recorded test results were obtained through measurements with biconilog antenna.

LIMIT (§ 15.109)

Frequency, MHz	Class B equipment @ 3 m dB(µV/m)
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
960 - 5000	54.0

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604
HL 1004	HL 1947	HL 2009	HL 2432			

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4.5 Antenna power conducted test according to §15.111

DATE of TEST: January 21, 2004
AMBIENT TEMPERATURE: 22°C
RELATIVE HUMIDITY: 41 %
AIR PRESSURE: 1013 hPa
THE EUT WAS TESTED AS: Table-top
FREQUECNY RANGE: 30 MHz – 5 GHz
MEASUREMENT UNCERTAINTY: ± 3.5 dB

For test procedure and setup refer to section 4.3, conducted emissions. For full test results refer to plots A22 to A27.

Frequency, MHz	Spurious emission level, dBm		Margin, dB	Verdict	Reference to Plots in Appendix A
	Measured	Limit			
422.497	-75.33	-57	18.33	Pass	A23
924.990	-58.17	-57	1.17	Pass	A24
1849.92	-61.67	-57	4.67	Pass	A26
2774.97	-62.67	-57	5.67	Pass	A27

LIMIT (§ 15.111)

The power at the antenna terminal at any frequency within the range of measurements specified in section 15.33 shall not exceed 2.0 nanowatts (-57 dBm).

TEST EQUIPMENT USED:

HL 1424	HL 2254			HL 0593	HL 0594	HL 0604

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4.6 Frequency stability measurement according to §90.213

DATE of TEST: December 1, 2003
AMBIENT TEMPERATURE: 22°C
RELATIVE HUMIDITY: 46 %
AIR PRESSURE: 1015 hPa

TEST PROCEDURE

The EUT frequency stability was measured with variation of supply voltage or ambient temperature in the range from –30°C to +50°C.

Frequency stability test results vs supply voltage

Voltage, V	Frequency, Hz	Displacement, Hz	Time, min
Ucc=12 V	914999643	13	startup
	914999621	-9	+2
	914999627	-3	+5
	914999630	0	+10
Ucc=8 V	914999666	36	startup
	914999627	-3	+2
	914999615	-15	+5
	914999614	-16	+10
Ucc=40 V	914999638	8	startup
	914999617	-13	+2
	914999606	-24	+5
	914999604	-26	+10

Reference frequency: 914999630 Hz

For information only: 2.5 ppm = ± 2287 Hz

TEST EQUIPMENT USED:

HL 0026	HL 0481	HL 0493	HL 0559	HL 1188		

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Frequency stability test results vs ambient temperature

Temperature, °C	Frequency, Hz	Displacement, Hz	Time, min
t°=30°C	914999679	49	startup
	914999645	15	+2
	914999645	15	+5
	914999654	24	+10
t°=40°C	914999640	10	startup
	914999632	2	+2
	914999636	6	+5
	914999649	19	+10
t°=50°C	914999688	58	startup
	914999679	49	+2
	914999723	93	+5
	914999757	127	+10
t°=10°C	915000006	376	startup
	914999976	346	+2
	914999961	331	+5
	914999960	330	+10
t°=0°C	915000392	762	startup
	915000316	686	+2
	915000273	643	+5
	915000252	622	+10
t°=-10°C	915001191	1561	startup
	915001087	1457	+2
	915000993	1363	+5
	915000944	1314	+10
t°=-20°C	915001973	2343	startup
	915001724	2094	+2
	915001644	2014	+5
	915001584	1954	+10
t°=-30°C	915002605	2975	startup
	915002555	2925	+2
	915002501	2871	+5
	915002446	2816	+10

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4.7 Conducted emissions test according to §15.107

METHOD OF MEASUREMENTS	ANSI 63.4 §13.1.3
DATE of TEST:	February 2, 2004
RELATIVE HUMIDITY:	53%
AMBIENT TEMPERATURE:	20°C
AIR PRESSURE:	1017 hPa
THE EUT WAS TESTED AS:	TABLE-TOP
DETECTOR USED:	QUASI-PEAK
FREQUECNY RANGE:	150 kHz – 30 MHz
RESOLUTION BANDWIDTH:	9 kHz
MEASUREMENT UNCERTAINTY, dB	± 3.9 dB in 9 – 150 kHz ± 3.8 dB in 150 kHz – 30 MHz

EUT power lines, stand by mode

Quasi-peak detector

Frequency, MHz	Line identification	Measured emissions, dB (mV)	Specification QP limit, dB (mV)	Margin, dB	Verdict	Reference to Plots in Appendix A
0.88	2	34.45	56.00	21.55	Pass	A29
2.05	2	37.39	56.00	18.61	Pass	A29
2.64	1	39.44	56.00	16.56	Pass	A28
13.80	1	43.34	60.00	16.66	Pass	A28
14.63	1	45.46	60.00	14.54	Pass	A28
18.54	1	40.94	60.00	19.06	Pass	A28
24.62	1	43.13	60.00	16.87	Pass	A28

Average detector

Frequency, MHz	Line identification	Measured emissions, dB (mV)	Specification AVRG limit, dB (mV)	Margin, dB	Verdict	Reference to Plots in Appendix A
0.88	2	34.19	46.00	11.81	Pass	A29
2.05	2	34.76	46.00	11.24	Pass	A29
2.64	1	34.59	46.00	11.41	Pass	A28
13.80	1	39.03	50.00	10.97	Pass	A28
14.63	1	43.60	50.00	6.40	Pass	A28
18.54	1	37.75	50.00	12.25	Pass	A28
24.62	1	39.13	50.00	10.87	Pass	A28

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EUT power lines, transmit mode

Quasi-peak detector

Frequency, MHz	Line identification	Measured emissions, dB (mV)	Specification QP limit, dB (mV)	Margin, dB	Verdict	Reference to Plots in Appendix A
2.58	2	39.36	56.00	16.64	Pass	A31
14.33	1	44.83	60.00	15.17	Pass	A30
14.52	2	43.10	60.00	16.90	Pass	A31
14.86	1	43.13	60.00	16.87	Pass	A30
18.55	1	42.71	60.00	17.29	Pass	A30
20.37	2	41.00	60.00	19.00	Pass	A31
24.82	2	43.76	60.00	16.24	Pass	A31
25.39	1	44.58	60.00	15.42	Pass	A30

Average detector

Frequency, MHz	Line identification	Measured emissions, dB (mV)	Specification AVRG limit, dB (mV)	Margin, dB	Verdict	Reference to Plots in Appendix A
2.58	2	34.23	46.00	11.77	Pass	A31
14.33	1	38.86	50.00	11.14	Pass	A30
14.52	2	40.79	50.00	9.21	Pass	A31
14.86	1	36.70	50.00	13.30	Pass	A30
18.55	1	40.78	50.00	9.22	Pass	A30
20.37	2	38.36	50.00	11.64	Pass	A31
24.82	2	41.07	50.00	8.93	Pass	A31
25.39	1	42.12	50.00	7.88	Pass	A30

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Laptop power lines

Quasi-peak detector

Frequency, MHz	Line identification	Measured emissions, dB (mV)	Specification QP limit, dB (mV)	Margin, dB	Verdict	Reference to Plots in Appendix A
0.29	1	34.69	60.49	25.80	Pass	A32
0.64	2	33.12	56.00	22.88	Pass	A33
1.05	2	32.50	56.00	23.50	Pass	A33
1.52	1	34.32	56.00	21.68	Pass	A32
2.81	1	33.25	56.00	22.75	Pass	A32
5.85	1	34.58	60.00	25.42	Pass	A32

Average detector

Frequency, MHz	Line identification	Measured emissions, dB (mV)	Specification AVRG limit, dB (mV)	Margin, dB	Verdict	Reference to Plots in Appendix A
0.29	1	34.55	50.49	15.94	Pass	A32
0.64	2	32.97	46.00	13.03	Pass	A33
1.05	2	32.32	46.00	13.68	Pass	A33
1.52	1	31.03	46.00	14.97	Pass	A32
2.81	1	31.16	46.00	14.84	Pass	A32
5.85	1	32.53	50.00	17.47	Pass	A32

LIMIT

Frequency, MHz	Class B equipment, dB(mV)	
	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 measurements were performed at mains terminals by means of LISN, connected to spectrum analyzer in the frequency range as referred to in the table above. The unused coaxial connector of the LISN was terminated with 50 Ω.
The measurements were made with quasi-peak and average detectors as referred to in the tables.
The position of the EUT cables was varied to determine maximum emission level.

TEST EQUIPMENT USED:

HL 0447	HL 1430	HL 1501	HL 1503			

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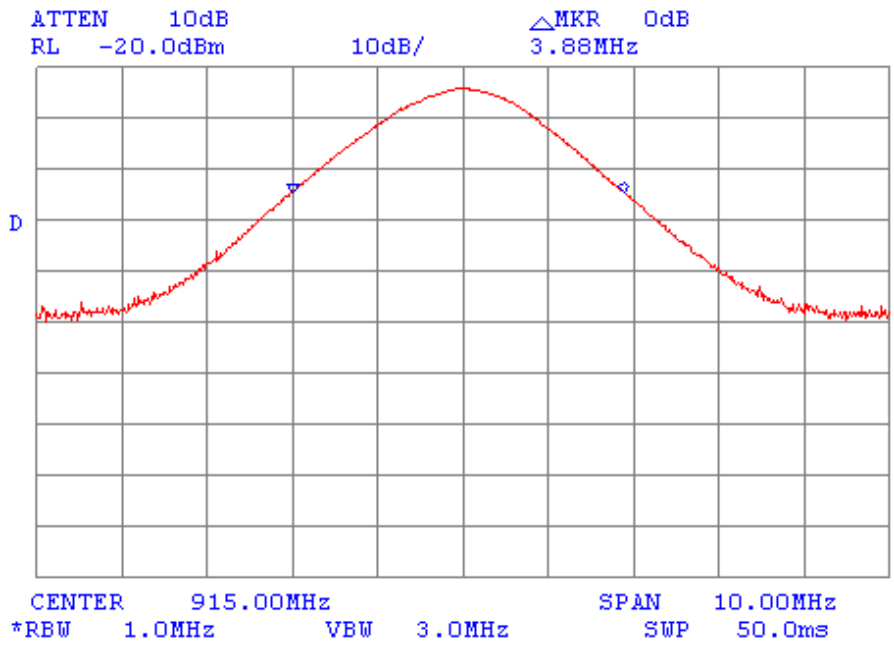
Appendix A Plots

Plot A 1

20 dB bandwidth measurement result



Limit=12 MHz
5% of 12 MHz=600 kHz, RBW = 1 MHz
Note: Measurement was performed in continuous transmission mode

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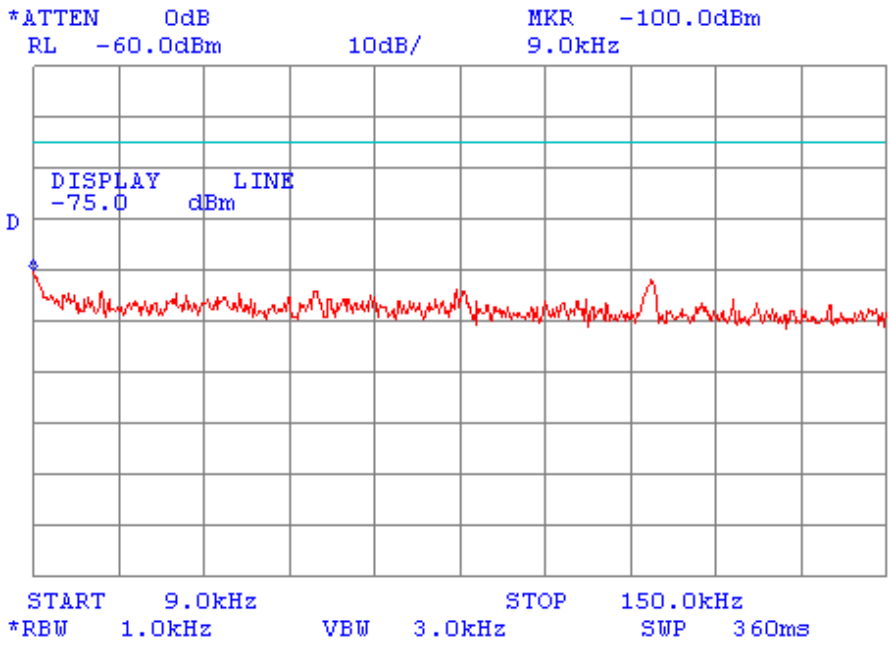
Plot A 2

Conducted spurious emission measurements from 9 kHz to 150 kHz



External attenuation 50 dB
Cable loss 0 dB
No spurious emissions were found

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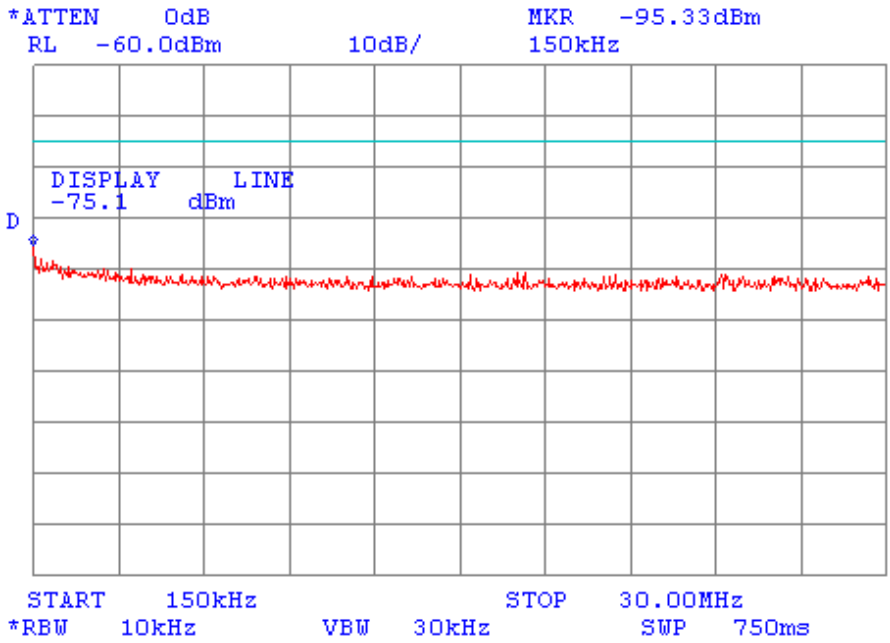
Plot A 3

Conducted spurious emission measurements from 150 kHz to 30 MHz



External attenuation 50 dB
Cable loss 0.1 dB

No spurious emissions were found

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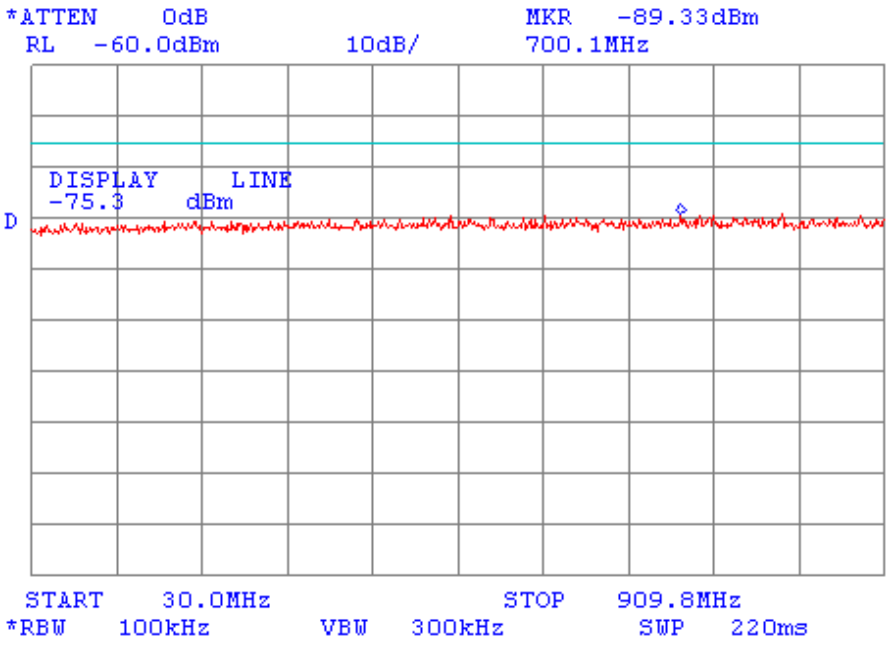
Plot A 4

Conducted spurious emission measurements from 30 MHz to 909.8 MHz



External attenuation 50 dB
Cable loss 0.3 dB

No spurious emissions were found

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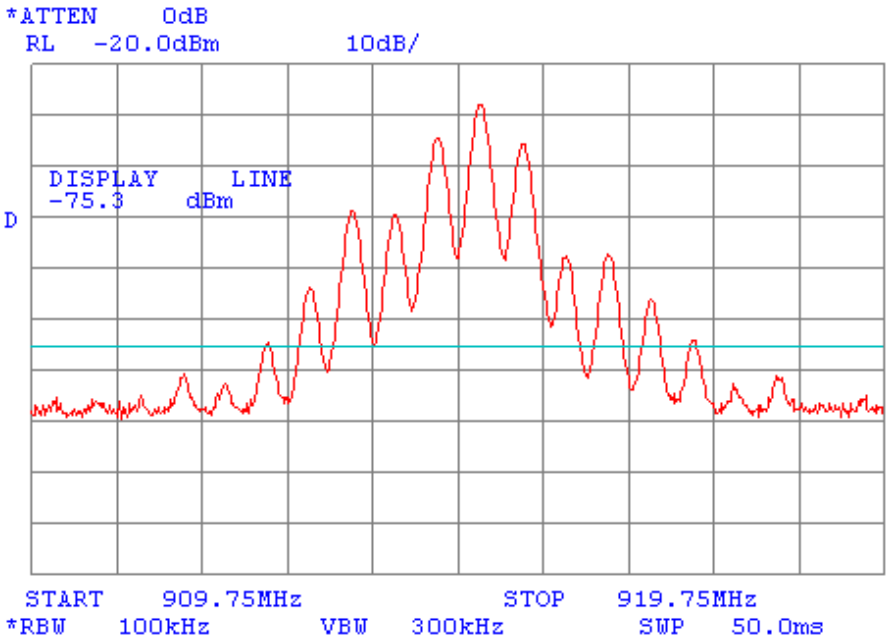
Plot A 5

Conducted spurious emission measurements from 909.75 MHz to 919.75 MHz



External attenuation 50 dB
Cable loss 0.3 dB

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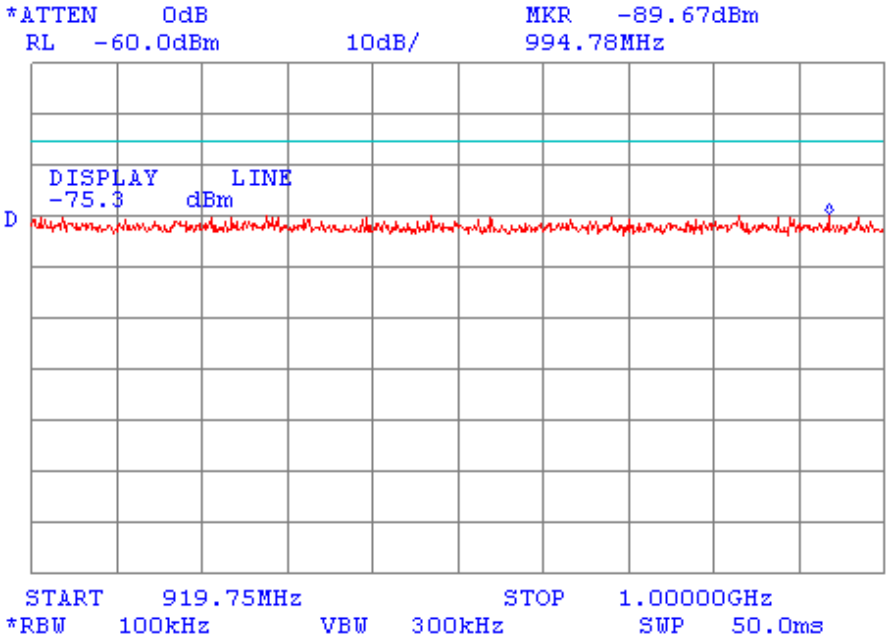
Plot A 6

Conducted spurious emission measurements from 919.75 MHz to 1000 MHz



External attenuation 50 dB
Cable loss 0.3 dB

No spurious emissions were found

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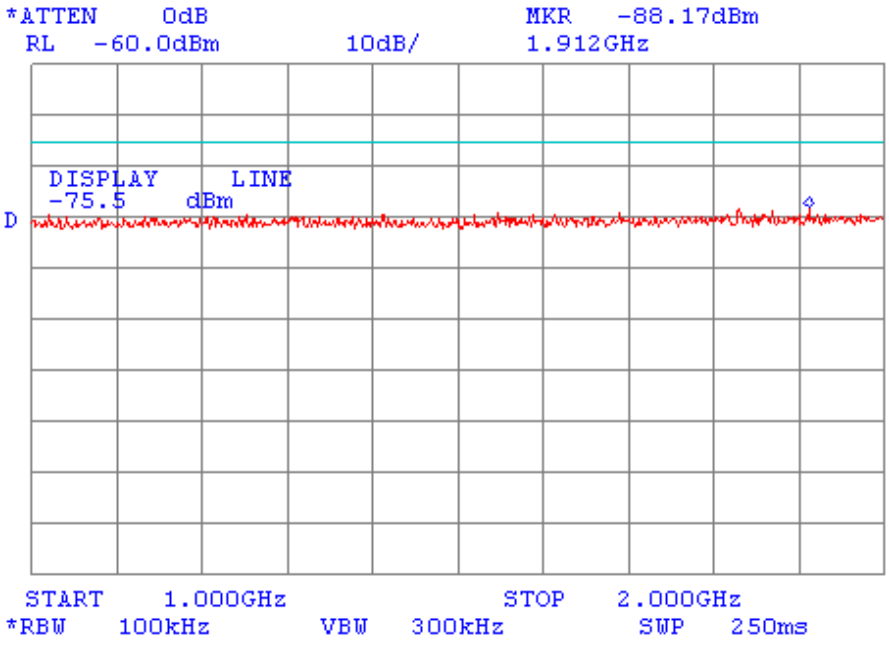
Plot A 7

Conducted spurious emission measurements from 1.000 GHz to 2.000 GHz



External attenuation 50 dB
Cable loss 0.5 dB

No spurious emissions were found

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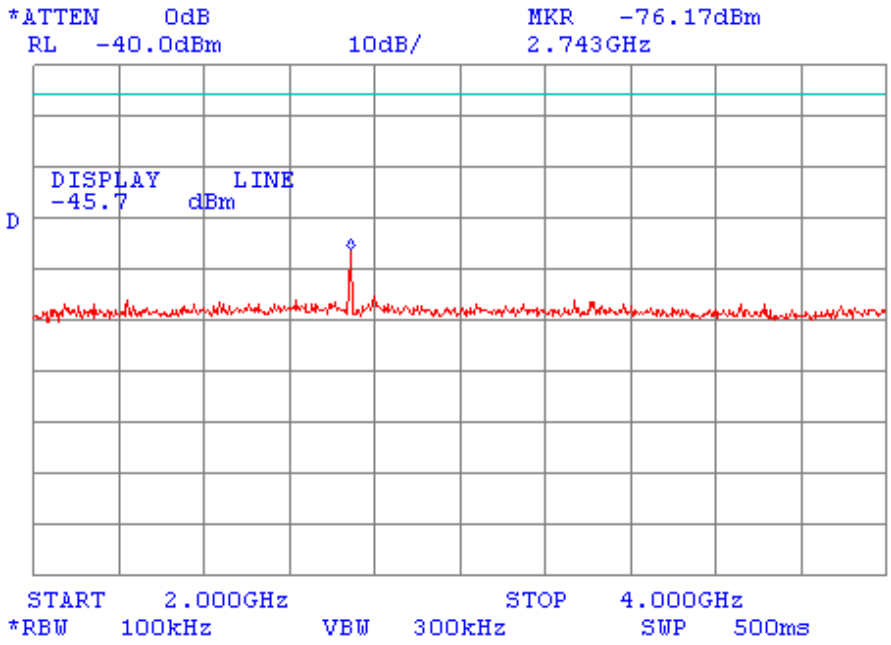
Plot A 8

Conducted spurious emission measurements from 2.000 GHz to 4.000 GHz



External attenuation 20 dB
Cable loss 0.7 dB

No spurious emissions were found except 3rd harmonic of fundamental.

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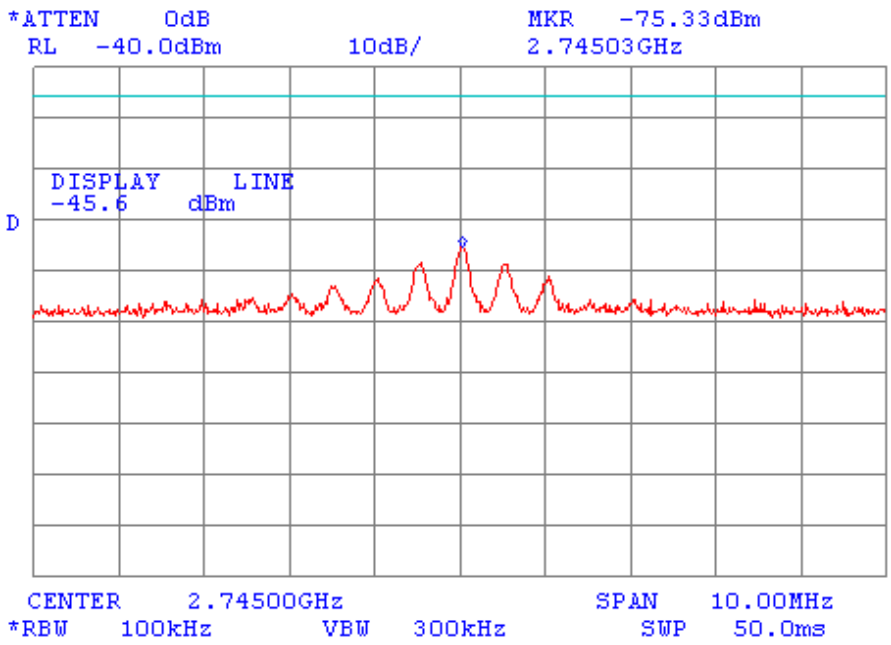
Plot A 9

Conducted spurious emission measurements, 3rd harmonic of fundamental



External attenuation 20 dB
Cable loss 0.6 dB

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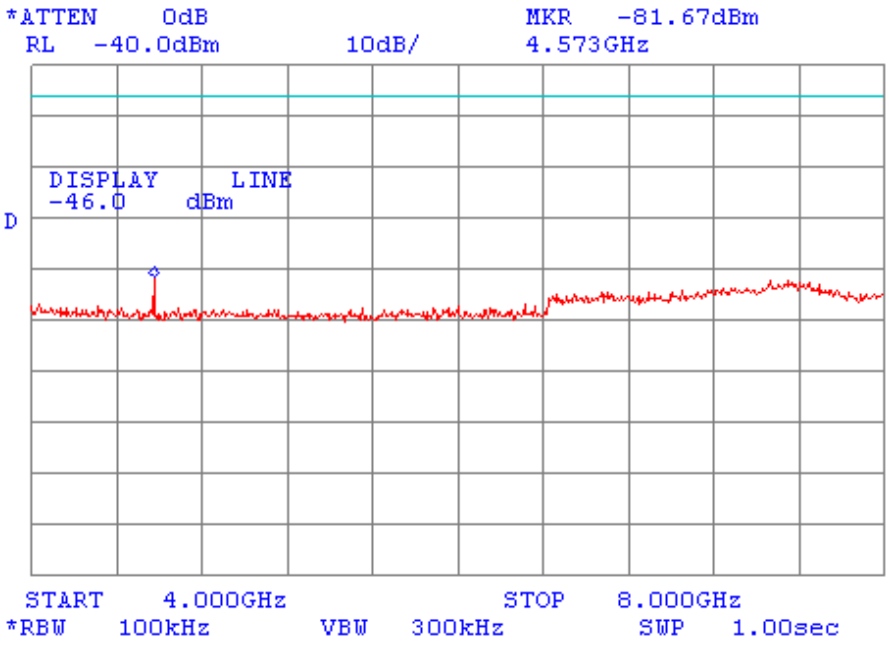
Plot A 10

Conducted spurious emission measurements from 4.000 GHz to 8.000 GHz



External attenuation 20 dB
Cable loss 1.0 dB

No spurious emissions were found except the 5th harmonic of fundamental.

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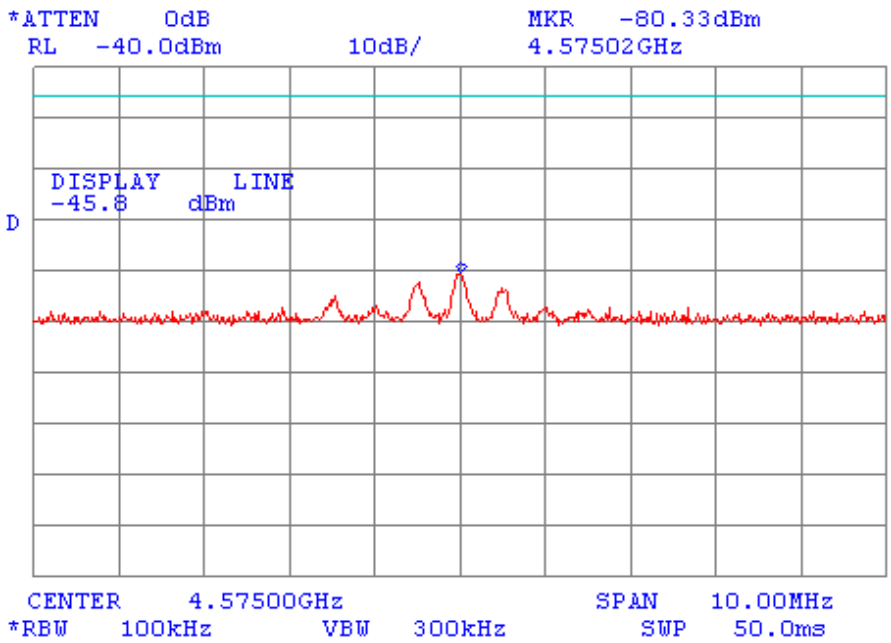
Plot A 11

Conducted spurious emission measurements, 5th harmonic of fundamental



External attenuation 20 dB
Cable loss 0.8 dB

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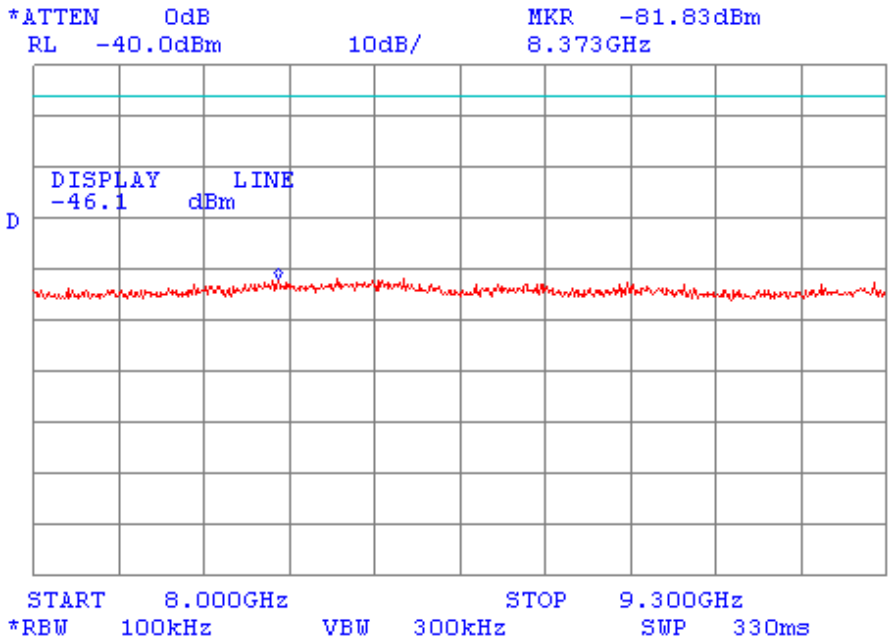
Plot A 12

Conducted spurious emission measurements from 8.000 GHz to 9.300 GHz



External attenuation 20 dB
Cable loss 1.1 dB

No spurious emissions were found.

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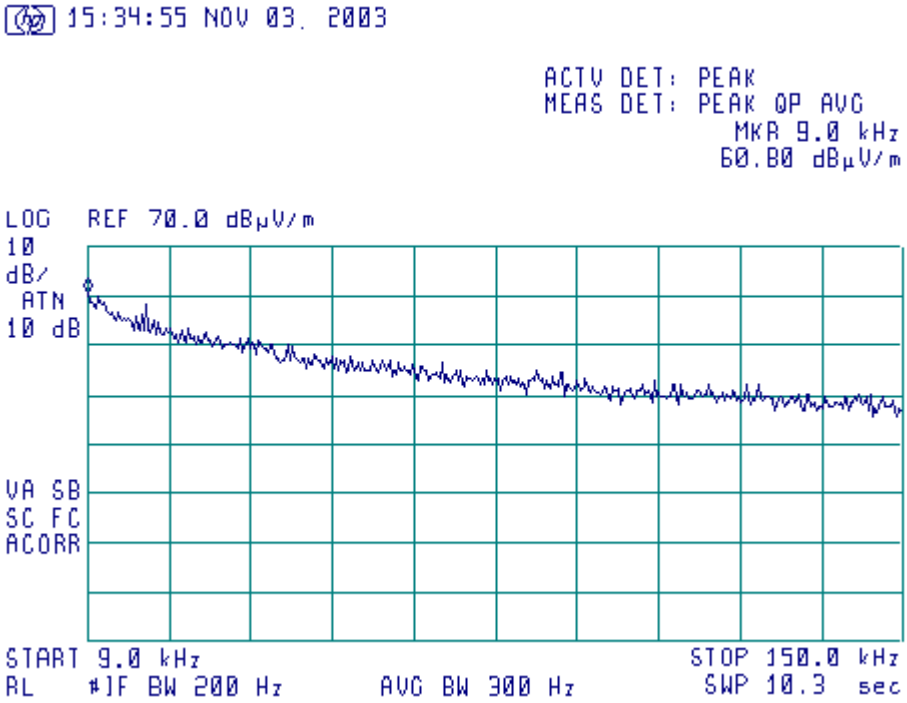
Plot A 13

Radiated spurious emission measurements in the anechoic chamber from 9 kHz to 150 kHz



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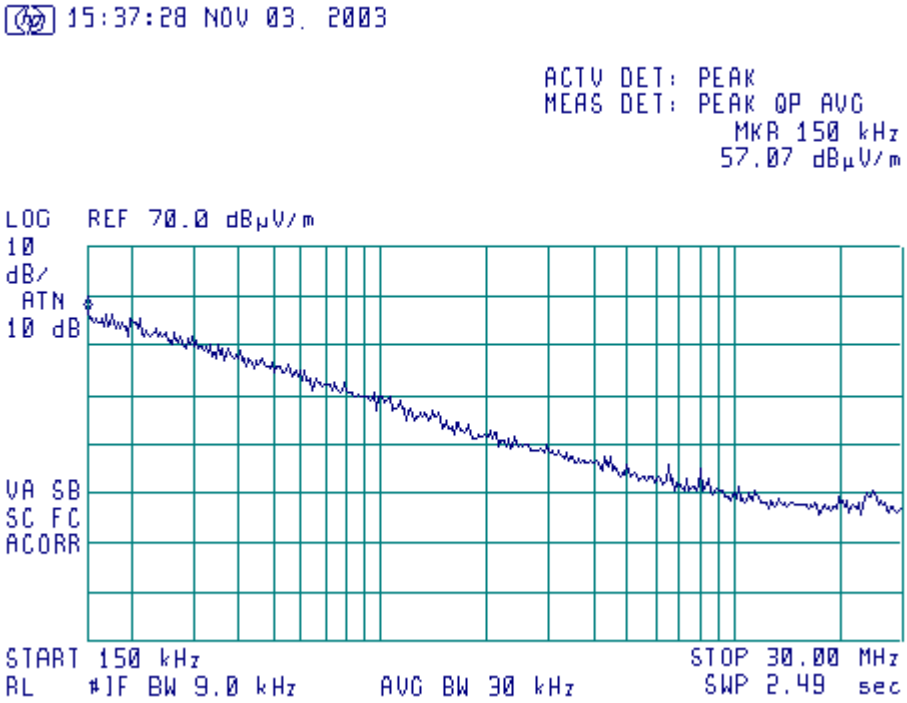
Plot A 14

Radiated spurious emission measurements in the anechoic chamber from 150 kHz to 30 MHz



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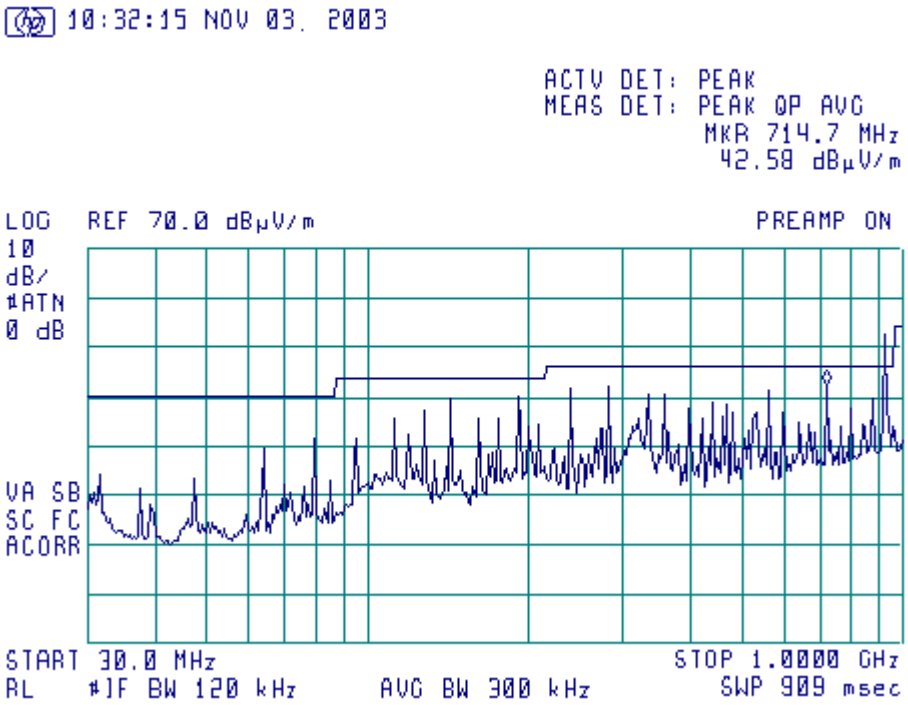
Plot A 15

Radiated spurious emission measurements in the anechoic chamber from 30 MHz to 1000 MHz



Limit: 70 dB(µV/m)
All spurious emissions were found more than 20 dB below the limit.

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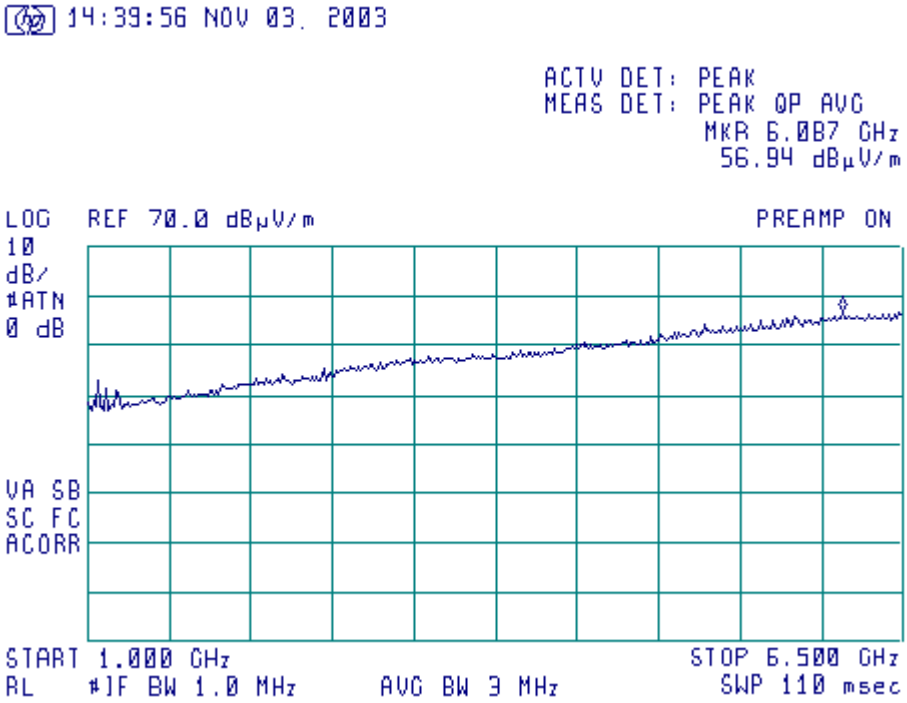
Plot A 16

Radiated spurious emission measurements in the anechoic chamber from 1 GHz to 6.5 GHz



No spurious emissions were found.

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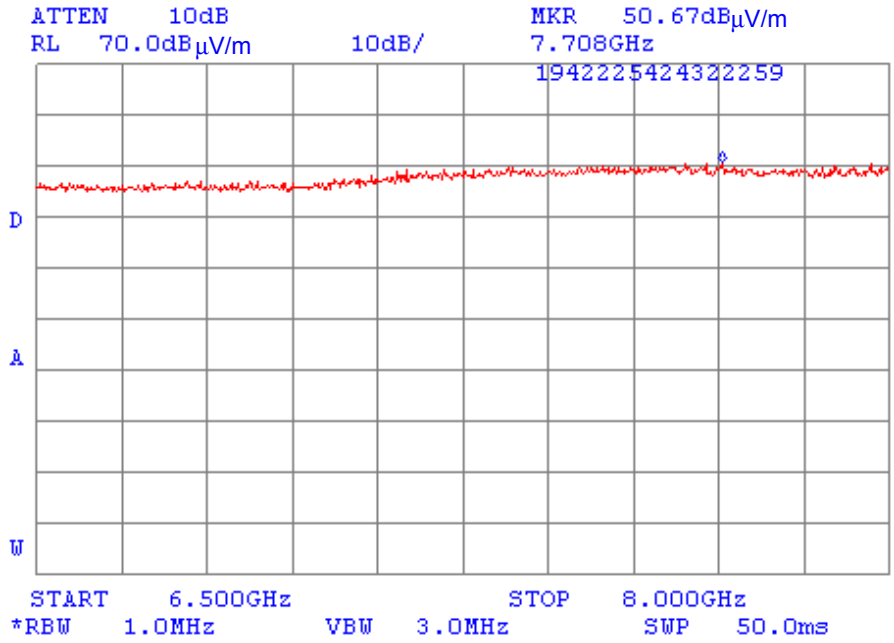
Plot A 17

Radiated spurious emission measurements at the OATS from 6.5 GHz to 8 GHz



No spurious emissions were found.

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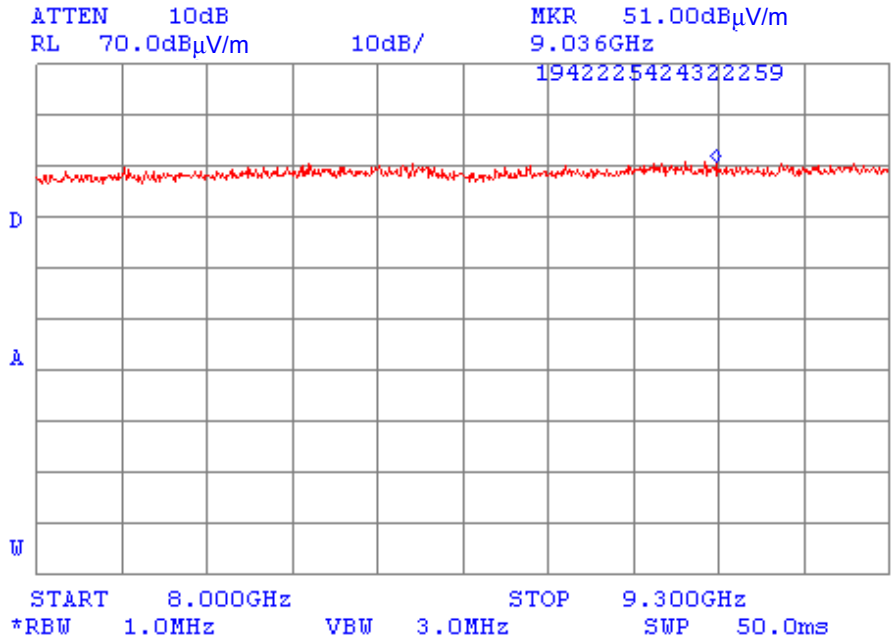
Plot A 18

Radiated spurious emission measurements at the OATS from 8 GHz to 9.3 GHz



No spurious emissions were found.

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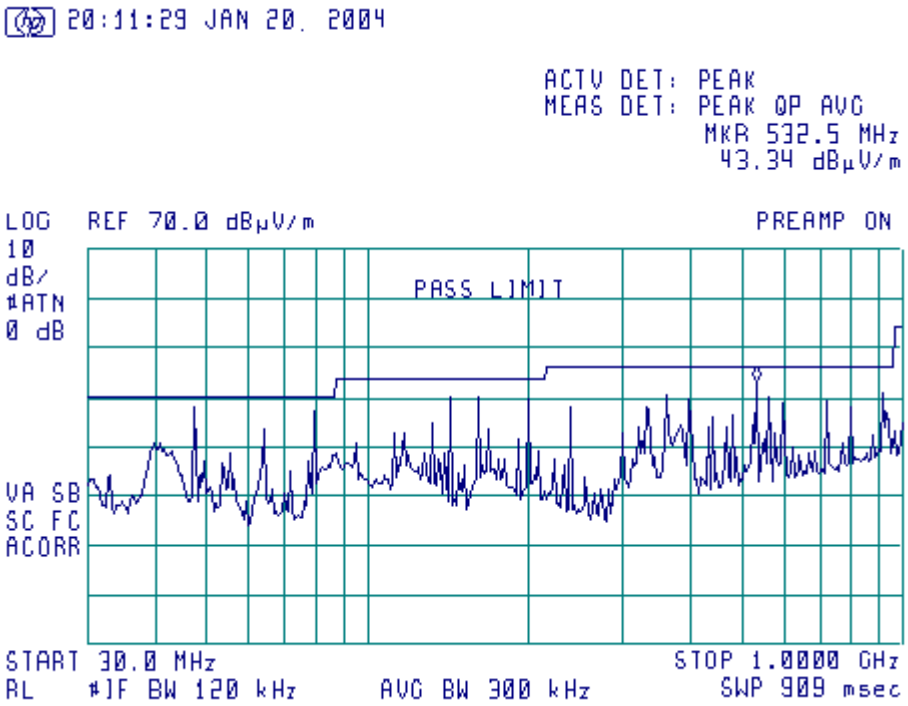
Plot A 19

Radiated emission measurements in the anechoic chamber from 30 MHz to 1000 MHz, test distance 3 m, vertical & horizontal antenna polarization



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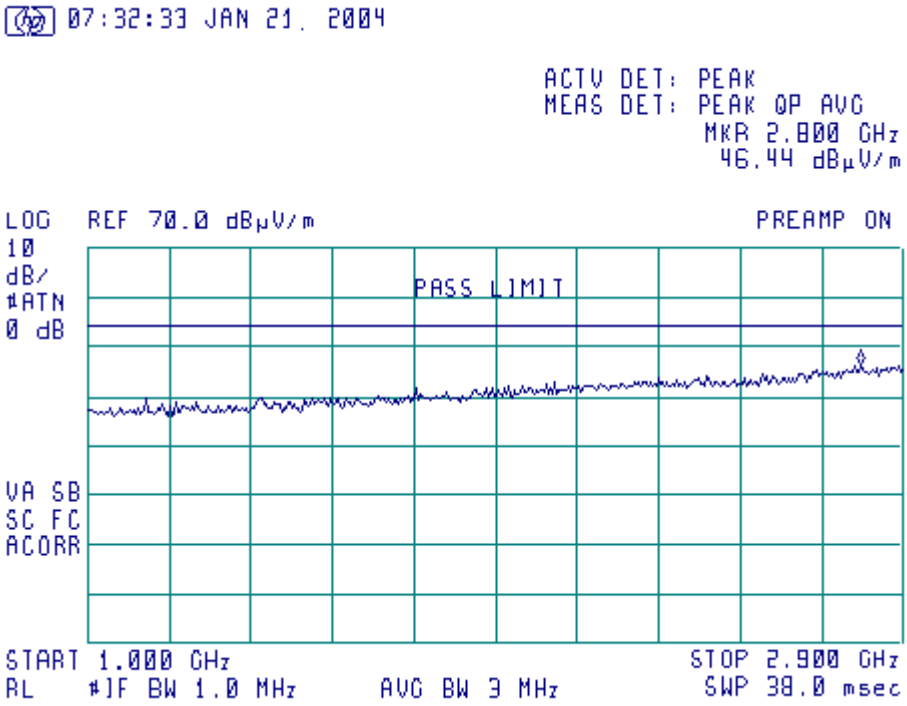
Plot A 20

Radiated emission measurements in the anechoic chamber from 1 GHz to 2.9 GHz, test distance 3 m, vertical & horizontal antenna polarization



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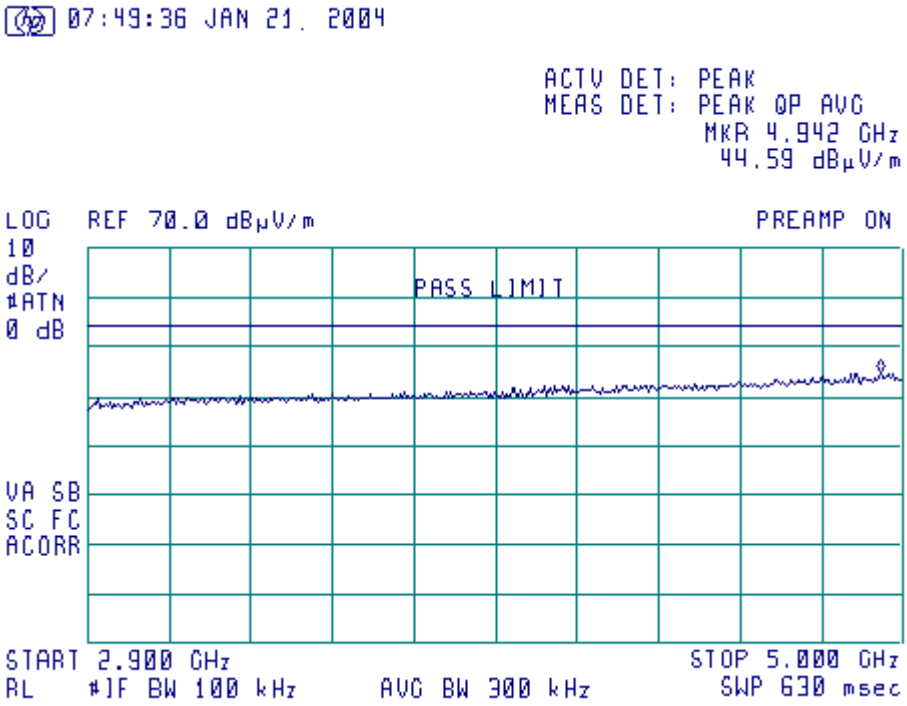
Plot A 21

Radiated emission measurements in the anechoic chamber from 2.9 GHz to 5 GHz, test distance 3 m, vertical & horizontal antenna polarization



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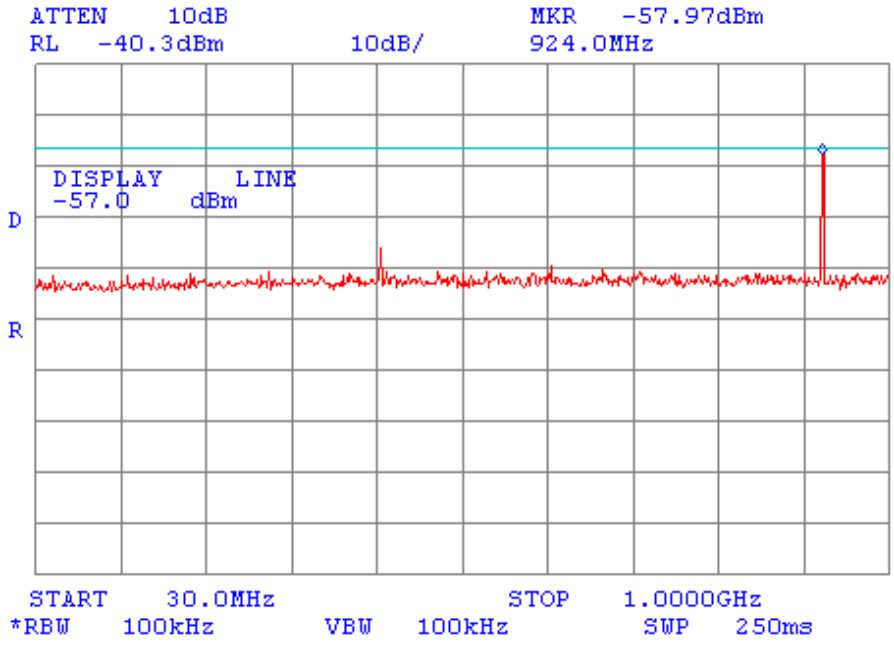
Plot A 22

Conducted spurious emission measurements in Rx mode



Cable loss 0.3 dB included

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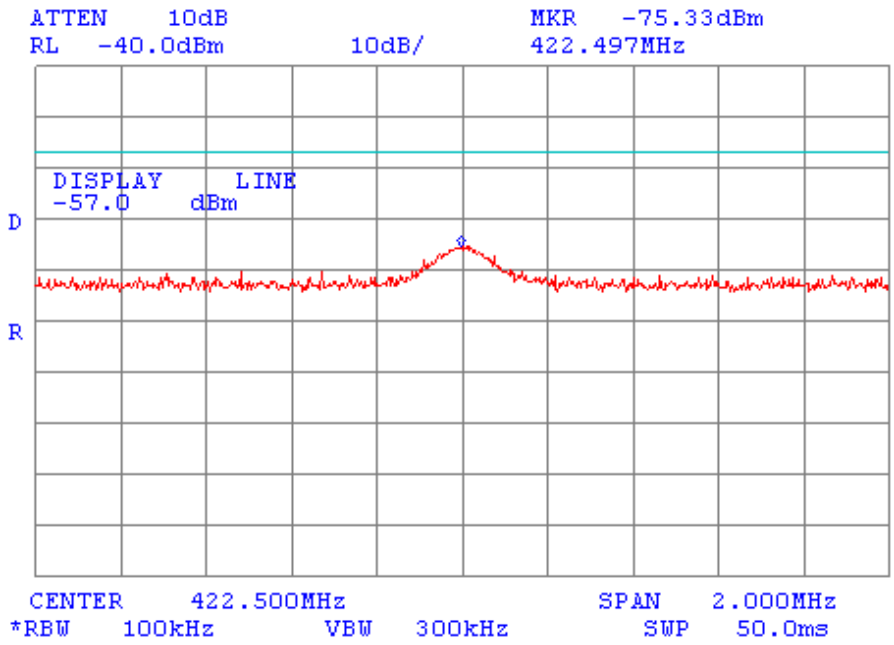
Plot A 23

Conducted spurious emission measurements in Rx mode



Cable loss 0.2 dB included

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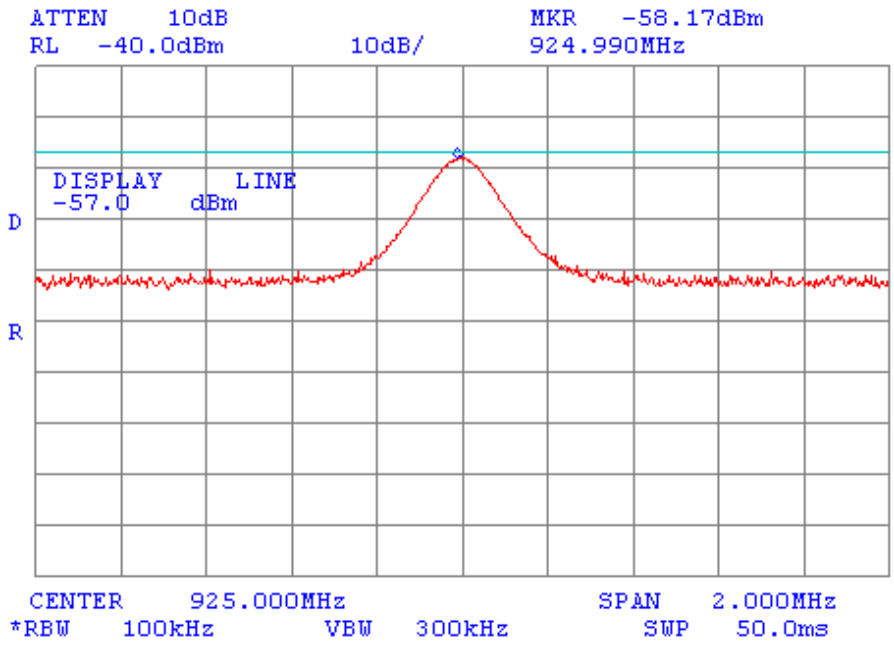
Plot A 24

Conducted spurious emission measurements in Rx mode



Cable loss 0.3 dB included

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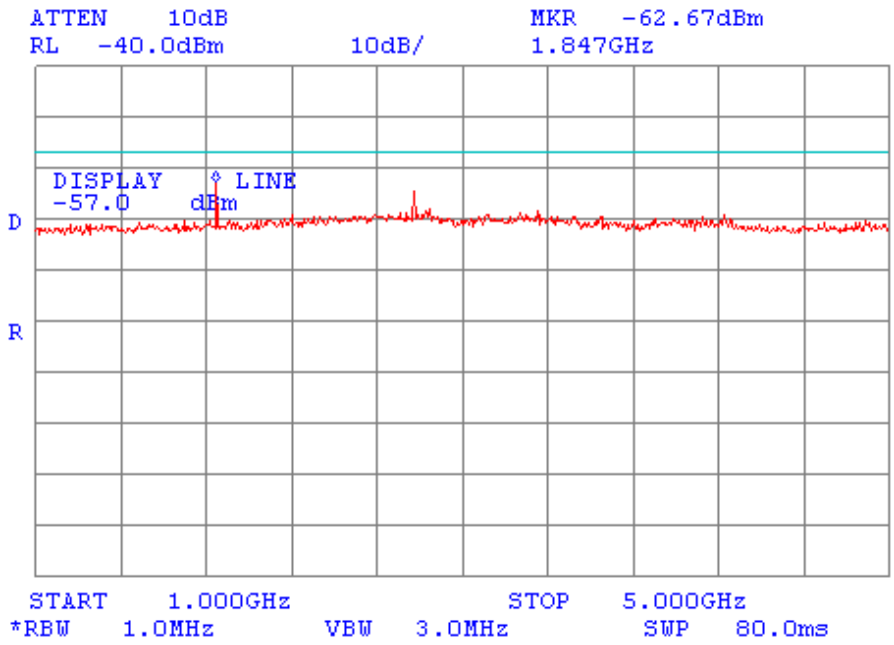
Plot A 25

Conducted spurious emission measurements in Rx mode



Cable loss 0.8 dB included

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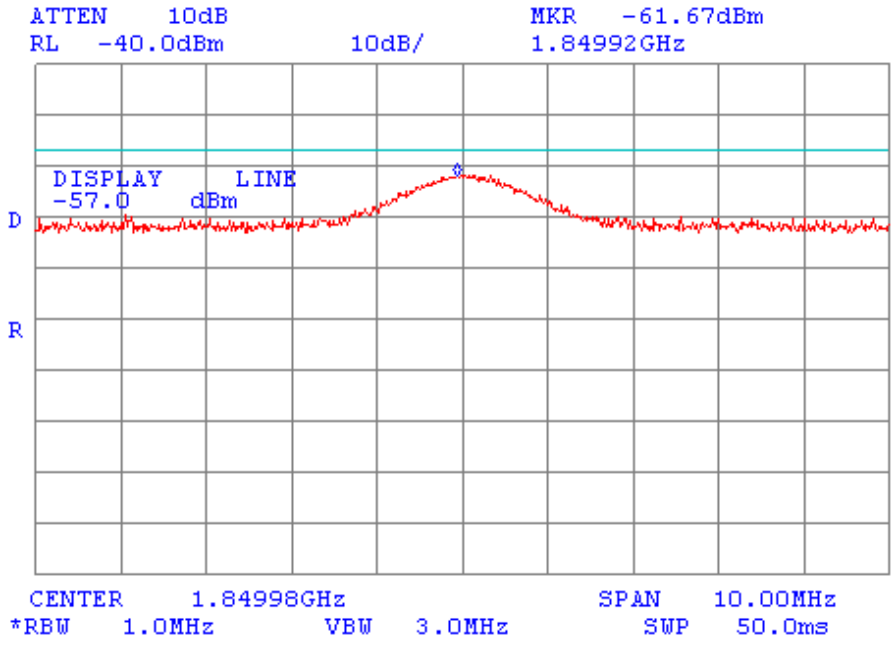
Plot A 26

Conducted spurious emission measurements in Rx mode



Cable loss 0.5 dB included

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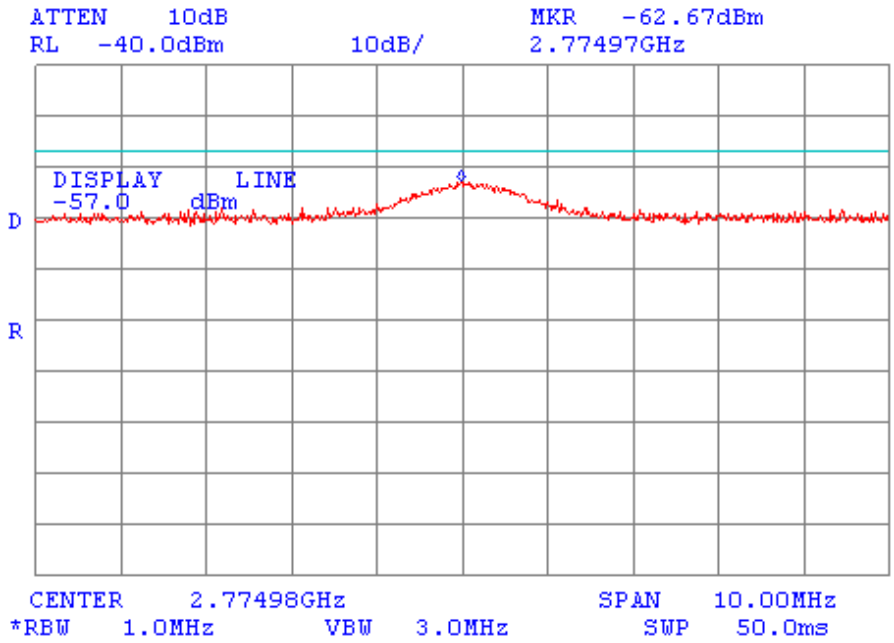
Plot A 27

Conducted spurious emission measurements in Rx mode



Cable loss 0.6 dB included

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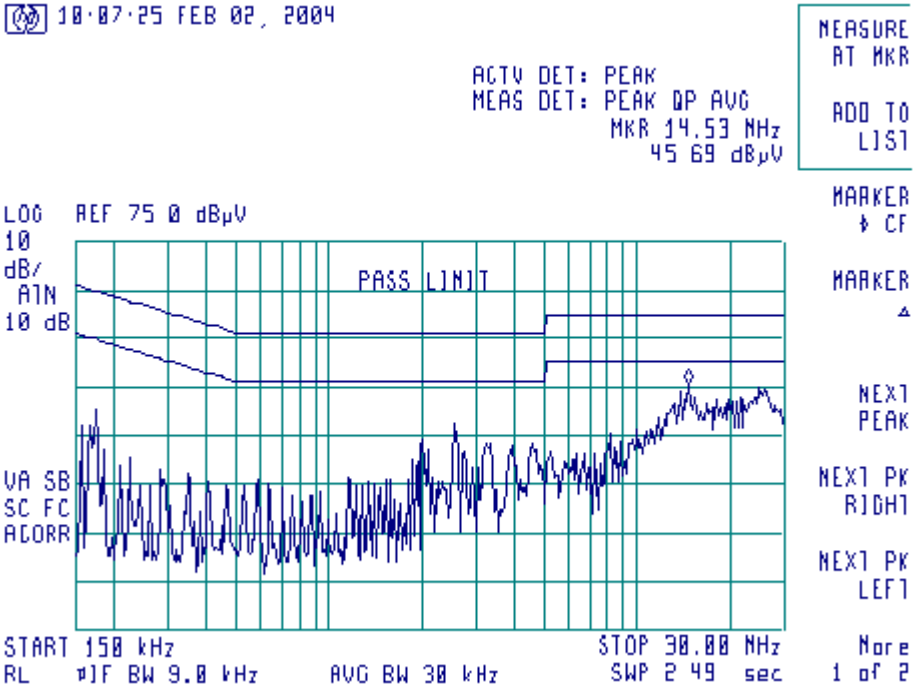
Plot A 28

Conducted emission measurement results at the EUT AC first line in stand by mode



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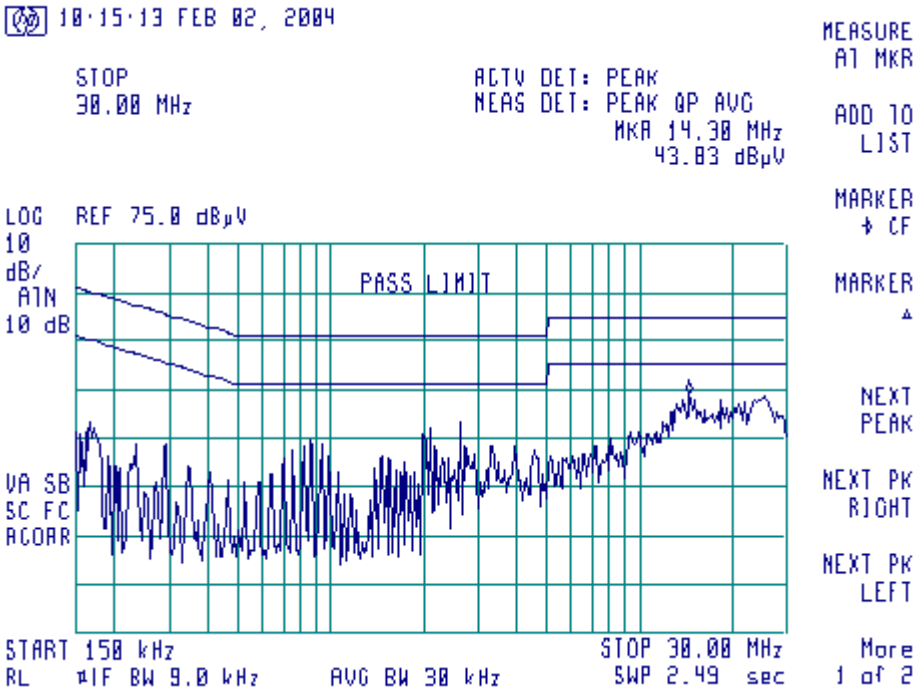
Plot A 29

Conducted emission measurements test results at the EUT AC second line in stand by mode



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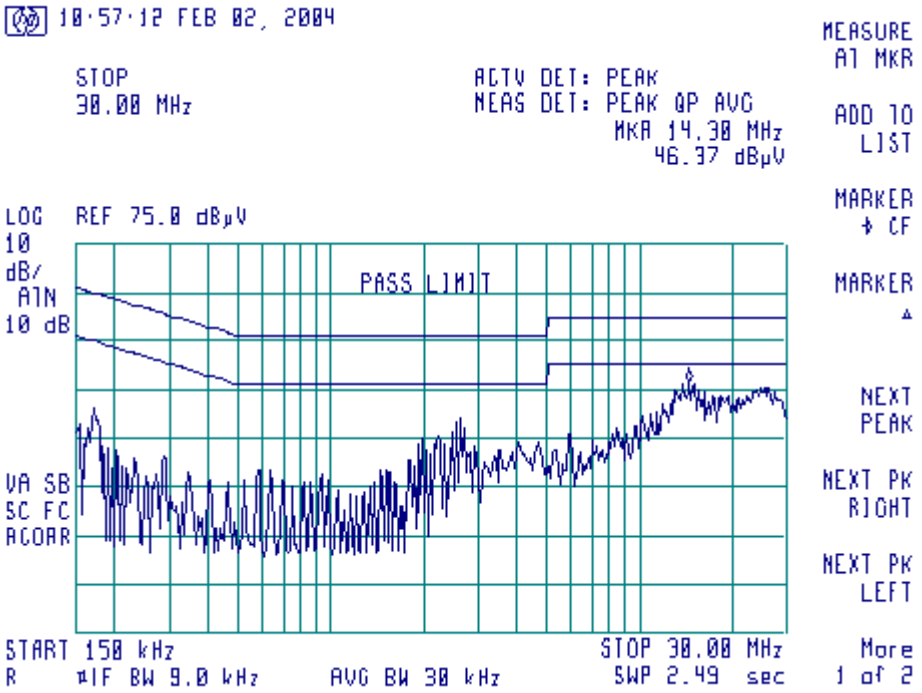
Plot A 30

Conducted emission measurements test results at the EUT AC first line in transmit mode



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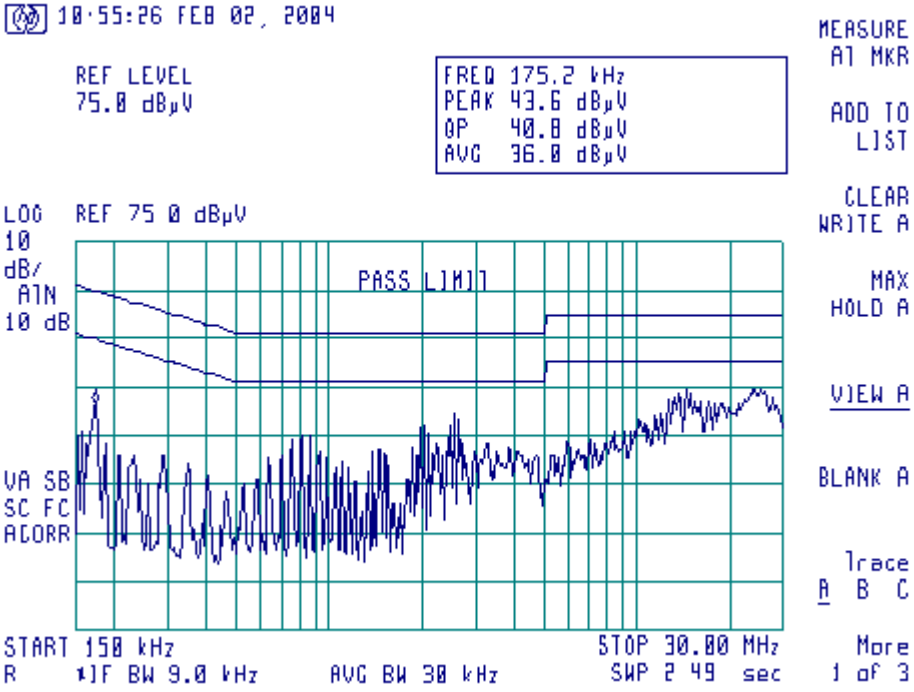
Plot A 31

Conducted emission measurements test results at the EUT AC second line in transmit mode



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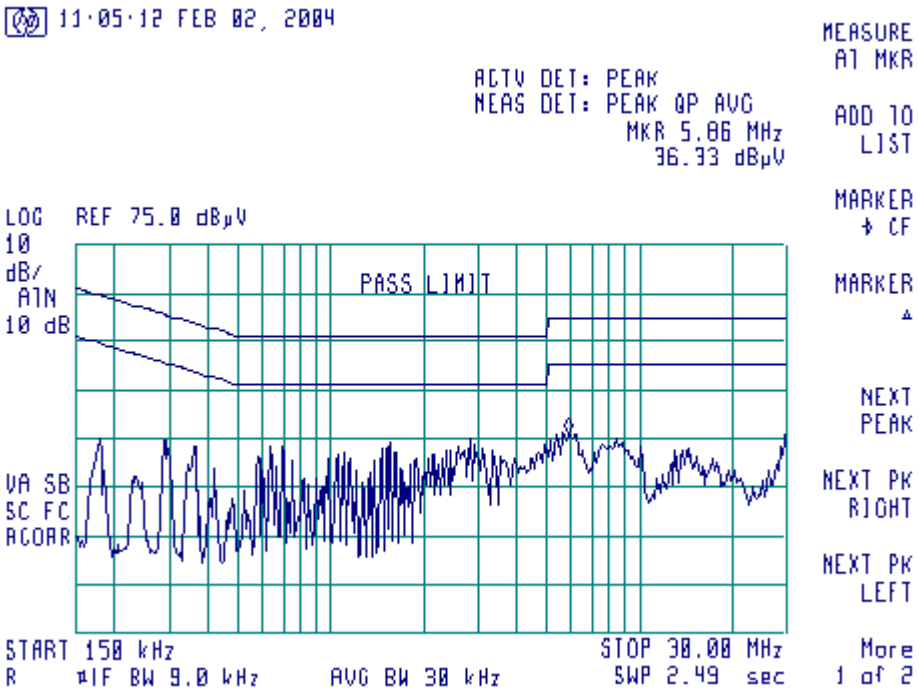
Plot A 32

Conducted emission measurements test results at the laptop AC first line



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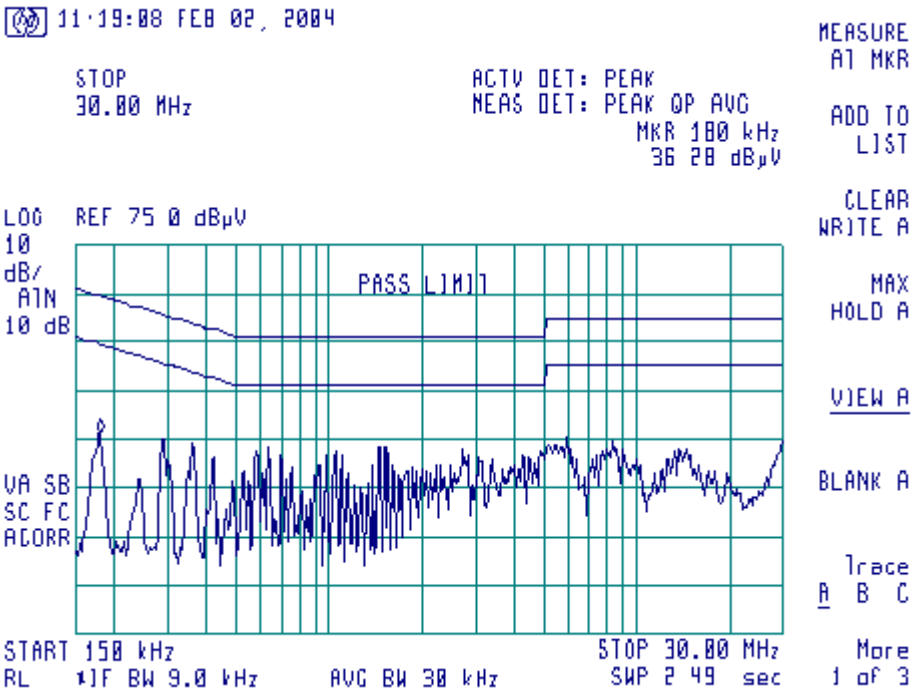
Plot A 33

Conducted emission measurements test results at the laptop AC first line



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Appendix B 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	9/04
0038	Antenna mast, 1-4 m	Hermon Labs	AM-1	028	2/04 check
0091	Position controller for antenna mast + turntable, OFTS	Hermon Labs	CRL-2	091	4/04 check
0287	Turntable, motorized diameter, 2 m	Hermon Labs	TMD-2	042	11/04 check
0446	Active loop antenna, 10 kHz-30 MHz	Electro-Mechanics	6502	2857	10/04
0447	LISN, 16/2, 300 V RMS	Hermon Labs	LISN 16-1	447	11/04
0460	Power sensor 500 kHz to 18 GHz, 50 Ohm	Boonton	51075	27705	2/04
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	10/05 check
0481	Power supply 40 V/1 A	Horizon Electronics	DHP 40-1	7625	2/04
0493	Oven temperature	Thermotron	S-1.2 Mini-Max	4016	9/04
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/04
0559	Multimeter digital	Fluke	76	0903	10/04
0589	Cable coaxial, GORE A2POL118.2, 3 m	Hermon Labs	GORE-3	589	11/04
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
0846	Power meter, RF	Boonton	4200	232919BE	12/04
1004	Cable, coaxial ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/04
1097	Attenuator, 50 Ohm, 2 W, DC to 8 GHz, 20 dB	Midwest Microwave	0793-20-NN-07	1097	1/04
1188	Power supply, controllable, DC, 40V/30A	Power/Mate corp.PMC	0-40/3A	9677	1/04
1200	Quadruplexer, 1-12 GHz	Elettronica S.p.A.-Roma	UE 84	0240	4/04 check
1424	Spectrum analyzer, 30 Hz - 40 GHz	Agilent Technologies	8564EC	3946A00219	8/04
1430	EMI Receiver System, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3807A00262	9/04

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HL Serial No.	Description	Manufacturer information			Due Calibr. Month/ year
		Name	Model No.	Serial No.	
1501	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1501	12/04 check
1503	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1503	9/04 check
1942	Cable 18 GHz, 4 m, blue	Rhophase Microwave Ltd	SPS-1803A-4000-NPS	T4658	10/04
1947	Cable 18 GHz, 6.5 m, blue	Rhophase Microwave Ltd	NPS-1803A-6500-NPS	T4974	10/04
1991	Attenuator, DC – 18 GHz, 30 dB, 2 W	Midwest Microwave	ATT 0290-30-SMA-02	NA	11/04
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	12/04
2254	Cable 40 GHz, 0.8 m, blue	Rhophase Microwave	KPS-1503A-800-KPS	W4907	11/04
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	11/04
2432	Antenna, double-ridged waveguide horn, 1-18 GHz	EMC Test Systems	3115	000271777	7/04

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Appendix C Antenna factors and cable loss

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.

Antenna factor
Active loop antenna
Model 6502
S/N 2857, HL 0446

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

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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Antenna factor
Double-ridged guide horn antenna
Model 3115, serial number: 00027177, HL 2432

Frequency, MHz	Antenna factor. dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.8
2500.0	28.9
3000.0	30.7
3500.0	31.8
4000.0	33.0
4500.0	32.8
5000.0	34.2
5500.0	34.9
6000.0	35.2
6500.0	35.4
7000.0	36.3
7500.0	37.3
8000.0	37.5
8500.0	38.0
9000.0	38.3
9500.0	38.3
10000.0	38.7
10500.0	38.7
11000.0	38.9
11500.0	39.5
12000.0	39.5
12500.0	39.4
13000.0	40.5
13500.0	40.8
14000.0	41.5
14500.0	41.3
15000.0	40.2
15500.0	38.7
16000.0	38.5
16500.0	39.8
17000.0	41.9
17500.0	45.8
18000.0	49.1

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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Cable loss
Cable Coaxial, GORE A2P01POL118, 2.3 m, model:GORE-3, HL 0589
+ Cable Coaxial, ANDREW PSWJ4, 6m, model: ANDREW-6, HL 1004

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	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	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 loss
Cable 18 GHz, 4 m, blue, model: SPS-1803A-4000-NPS, S/N T4658, HL 1942

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

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

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Cable loss
Cable 18 GHz, 6.5 m, blue, model: NPS-1803A-6500-NPS, S/N T4974, HL 1947

Frequency, GHz	Cable loss, dB
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	Cable loss, dB
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 loss
RF cable 8 m, model RG-214, HL 2009

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	1	0.10	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 loss
Cable 40 GHz, 0.8 m, blue, model: KPS-1503A-800-KPS, S/N W4907, HL 2254

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.04	5.10	0.80	15.00	1.49
0.05	0.07	5.30	0.83	15.50	1.49
0.10	0.09	5.50	0.83	16.00	1.46
0.20	0.15	5.70	0.84	16.50	1.47
0.30	0.19	5.90	0.87	17.00	1.50
0.40	0.25	6.10	0.86	17.50	1.57
0.50	0.29	6.30	0.89	18.00	1.63
0.60	0.33	6.50	0.90	18.50	1.57
0.70	0.37	6.70	0.89	19.00	1.63
0.80	0.41	6.90	0.93	19.50	1.65
0.90	0.44	7.10	0.92	20.00	1.64
1.00	0.45	7.30	0.95	20.50	1.75
1.10	0.48	7.50	0.96	21.00	1.72
1.20	0.51	7.70	0.97	21.50	1.78
1.30	0.53	7.90	1.01	22.00	1.76
1.40	0.54	8.10	1.00	22.50	1.72
1.50	0.57	8.30	1.05	23.00	1.83
1.60	0.59	8.50	1.04	23.50	1.80
1.70	0.04	8.70	1.07	24.00	1.90
1.80	0.07	8.90	1.11	24.50	1.81
1.90	0.09	9.10	1.09	25.00	1.98
2.00	0.15	9.30	1.14	25.50	1.91
2.10	0.19	9.50	1.12	26.00	2.02
2.20	0.25	9.70	1.15	26.50	1.92
2.30	0.29	9.90	1.16	27.00	1.97
2.40	0.33	10.10	1.16	28.00	2.02
2.50	0.37	10.30	1.19	29.00	1.95
2.60	0.41	10.50	1.14	30.00	1.94
2.70	0.44	10.70	1.19	31.00	2.11
2.80	0.45	10.90	1.17	32.00	2.17
2.90	0.48	11.10	1.13	33.00	2.27
3.10	0.61	11.30	1.20	34.00	2.27
3.30	0.64	11.50	1.13	35.00	2.29
3.50	0.65	11.70	1.20	36.00	2.35
3.70	0.68	11.90	1.18	37.00	2.37
3.90	0.69	12.10	1.14	38.00	2.40
4.10	0.71	12.40	1.19	39.00	2.57
4.30	0.73	13.00	1.34	40.00	2.36
4.50	0.75	13.50	1.33		
4.70	0.77	14.00	1.48		
4.90	0.79	14.50	1.45		

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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, 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) and approved by Israel Ministry of environmental protection, radiation hazards department (Permit number 1158).

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Abbreviations and acronyms

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

ASK	amplitude shift keying
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
EUT	equipment under test
GHz	gigahertz
H	height
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
LNA	low noise amplifier
LMS	location and monitoring service
LO	local oscillator
m	meter
MHz	megahertz
NA	not applicable
QP	quasi-peak
RF	radio frequency
Rx	receiver
rms	root mean square
s	second
Tx	transmitter
V	volt
W	width

Specification references

47CFR part 90: 2002	Private land mobile radio services
ANSI C63.2:96	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4:2001	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.