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Electrical

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RADIO TEST REPORT

According to 47 CFR Part 15 subpart C §15.231 and subpart B
for

Rosslare Israel Ltd.

EQUIPMENT UNDER TEST:

Remote control transmitter
Models SA26F/FP, SA27F/FP, SA28F/FP

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Contents

1 Project information

Description of equipment under test

Test items	: Remote control transmitter
Manufacturer	: Rosslare Israel Ltd.
Types (Models)	: SA26F/FP, SA27F/FP, SA28F/FP
Equipment FCC code	: DSR

Applicant information

Applicant's responsible person	: Mr. Israel Schneiderman, R&D, RF Design Manager
Company	: Rosslare Israel Ltd.
Address	: 22, Hamelacha street
P.O.Box	: 11407
City	: Rosh Ha'ayin
Postal code	: 48091
Country	: Israel
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Test performance

Project Number:	: 15316
Location	: Hermon Laboratories
Test performed	: October 15, 2002; December 23, 24, 2003
Purpose of test	Apparatus compliance verification in accordance with emission requirements
Test specification(s)	47CFR Part 15, subpart C, §15.231, §15.209, §15.205 and subpart B §15.109

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2 Summary of tests and requirements

Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
Transmitter characteristics, §15.231								
Periodic operation	15.231(a)	X						
Bandwidth of emission	15.231(c)	X				Mr. M. Feldman, test engineer	October 15, 2002	
Field strength of fundamental	15.231(b), (2)	X				Mr. Y. Neuman, test engineer	December 23, 2003	
Field strength of spurious radiation	15.231(b)(3)	X				Mr. I. Fershtater, test engineer	December 24, 2003	
Unintentional radiation, §15.107, §15.109								
Conducted emissions	15.107				X			
Radiated emissions	15.109	X				Mr. I. Fershtater, test engineer	December 24, 2003	
General conditions under §15.231, Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz								
The intentional radiator does not operate in the restricted bands of operation.	15.205	X						
The intentional radiator has permanently attached antenna or antenna that uses a unique coupling to the intentional radiator.	15.203	X				Integral antenna		
No antenna other than that furnished by the responsible party can be used with the device.	15.203	X						
The intentional radiator has no standard antenna jack or electrical connector.	15.203				X			
The intentional radiator must be professionally installed.	15.203				X			
The intentional radiator operates at 418.00 MHz.	15.231 (a)	X						
Intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc.	15.231 (a)	X						
Radio control of toys is not permitted.	15.231 (a)	X						
Continuous transmissions, such as voice or video, and data transmissions are not permitted.	15.231 (a)	X						

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Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	15.231 (a) (1)	X						
A transmitter activated automatically shall cease transmission within 5 seconds after activation.	15.231 (a) (2)				X			
Periodic transmissions at regular predetermined intervals are not permitted.	15.231 (a) (3)	X						
The intentional radiator is used for polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.	15.231 (a) (3)				X			
The intentional radiators employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.	15.231 (a) (4)				X			
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. M. Cherniavsky, MScEE, certification engineer

Test report approved by: Mr. M. Nikishin, MScEE, EMC group leader

Dr. E. Usoskin, PhD, C.E.O.

3 EUT description

3.1 General

The EUT, model numbers SA26F/FP, SA27F/FP, SA28F/FP, is a manually activated remote control transmitter operating at 418 MHz. The F and FP series are designed to function with different receivers. The sole difference between the SA26, SA27, SA28 devices is the number of buttons: 1, 2 or 4 respectively. The device is powered by two internal 1.5 V alkaline batteries and its clocks generate the 4 MHz and 13.0625 MHz.

3.2 Transmitter description

Operating frequency:			418.00 MHz			
Maximum rated output power						
At transmitter permanent external 50 Ω rf output connector (dBm)			NA			
Effective radiated power (for equipment with integral antenna) (dBm)			-10 dBm			
Transmitter duty cycle						
Tx on			15.21 msec			
Modulation						
	Amplitude					
	Frequency					
X	Other (specify): **on/off keying (pulse modulation)**					
Can the transmitter be operated without modulation					X	no
Transmitter power source						
	Battery	**Nominal rated voltage (VDC)**	**3.0**			
	DC	**Nominal rated voltage (VDC)**	NA			
	AC mains	**Nominal rated voltage (VAC)**	NA			
Is there common power source for transmitter and receiver - **NA**				yes		no
Antenna type						
	Integral (coil)					
§15.231(a)(1)						
The EUT is manually activated transmitter. No periodic supervisory transmissions. If a button is pressed, the unit will transmit one sequence of frames per press and automatically stop after that.						

4 Test results

4.1 Bandwidth of emission according to § 15.231 (c)

METHOD OF MEASUREMENT:	ANSI 63.4 §13.1.7
DATE of TEST:	October 15, 2002
RELATIVE HUMIDITY:	38 %
AMBIENT TEMPERATURE:	24 °C
AIR PRESSURE:	1011 hPa
MODULATION:	Peak
DETECTOR USED:	Peak

Carrier frequency MHz	Occupied bandwidth, MHz	Limit, MHz	Reference to plot in Annex A
418	0.245	1.045	No.1
Measurement uncertainty	0.21 ppm		

The maximum allowed occupied bandwidth was calculated as 0.0025 of the center frequency.

TEST PROCEDURE
The spectrum trace data around transmitter fundamental frequency was obtained with the spectrum analyzer in “Max Hold” mode. The bandwidth value was determined between two points 20 dB down from the modulated carrier.

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0593	HL 0594	HL 0604		

LIMIT § 15.231 (c)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

4.2 Field strength of fundamental, § 15.231(b)(2)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.5
DATE of TEST: December 23, 2003
RELATIVE HUMIDITY: 45 %
AMBIENT TEMPERATURE: 22°C
AIR PRESSURE: 1012 hPa
TEST PERFROMED IN: OATS
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
MODE OF OPERATION: Continuous
MODULATION: Pulse
MEASUREMENT UNCERTAINTY: ± 5.3 dB

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

Peak detector

Frequency, MHz	Measured field strength, dB(μV/m)	Specification limit, dB(μV/m)	Margin, dB	Reference to plot in Annex A
418.009	81.68	100.3	18.62	No.2

Average detector (Peak detector measurement + average factor)

Frequency, MHz	Measured field strength, dB(μV/m)	Average factor, dB	Result, dB(μV/m)	Specification limit, dB(μV/m)	Margin, dB	Reference to plot in Annex A
418.009	81.68	-16.35	65.33	80.3	14.97	No.2

LIMIT § 15.231 (b)

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

The specified limit for 418 MHz frequency is 80.3 dB(μV/m).
The above field strength limits are based on average limits.
The provisions of section 15.35 for limiting peak emissions apply.

4.2.1 Average factor calculation, §15.35

Tx ON	Duty cycle	Average factor	Reference to plot in Annex A
15.21 msec	15.21/100	-16.35 dB	No. 3 - 7

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table in each of three orthogonal planes in turn. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

TEST EQUIPMENT USED:

HL 0034	HL 0038	HL 0091	HL 0287	HL 0415	HL 0812	HL 1430

4.3 Field strength of spurious radiation, § 15.231(b)(3)

METHOD OF MEASUREMENT:	ANSI 63.4 §13.1.4
DATE of TEST:	December 24, 2003
RELATIVE HUMIDITY:	44 %
AMBIENT TEMPERATURE:	22°C
AIR PRESSURE:	1011 hPa
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
MODE OF OPERATION:	Continuous
DETECTOR USED:	Peak

Frequency range: 9 kHz – 30 MHz, loop antenna

Frequency, MHz	Antenna polarization	RBW, kHz	VBW, kHz	Radiated emission, dB (mV/m)	Limit @ 3 m, dB(mV/m)	Margin, dB	Ref. to plot in App. A
0.009 – 0.150	V, H	0.2	0.3	All emissions were found at least 40 dB below the limit			No.8, 10, 12
0.150 - 30	V, H	9	30	All emissions were found at least 25 dB below the limit			No.9, 11, 13
Measurement uncertainty, dB				± 4			

Frequency range: 30 MHz – 1000 MHz, biconilog antenna

Frequency, MHz	Radiated emission (peak), dB(mV/m)	Limit (peak) @ 3 m, dB(mV/m)	Radiated emission (average)*, dB (mV/m)	Limit (average) @ 3 m, dB(mV/m)	Ref. to plot in App. A
836.02	60.13	80.3	43.78	60.3	No. 17
Measurement uncertainty, dB			± 6		

Frequency range: 1000 MHz – 4200 MHz, double ridged guide antenna

Frequency, MHz	Radiated emission (peak), dB(mV/m)	Limit (peak) @ 3 m, dB(mV/m)	Radiated emission (average)*, dB (mV/m)	Limit (average) @ 3 m, dB(mV/m)	Ref. to plot in App. A
1254.03	60.06	80.3	43.71	60.3	No.20 – No.22
1672.04	59.92	74.0	43.57	54.0	No.20 – No.22
2090.04	62.98	80.3	46.63	60.3	No.20 – No.22
2508.05	61.95	80.3	45.60	60.3	No.20 – No.22
2926. 00	58.50	80.3	42.15	60.3	No.20 – No.22
3344.00	53.20	80.3	36.85	60.3	No.20 – No.22
3762.00	49.00	74.0	32.65	54.0	No.20 – No.22
4180.00	48.20	74.0	31.85	54.0	No.20 – No.22
Measurement uncertainty, dB			± 6		

Notes to table:
* Radiated emission calculation: Peak value + Average factor (-16.35 dB)
RBW: resolution bandwidth = 1 MHz
VBW: video bandwidth = 3 MHz

LIMIT § 15.231 (b)

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

The specified limit for 418 MHz frequency is 60.3 dB(μV/m)

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height turntable in each of three orthogonal planes in turn. The frequency spectrum was investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to the tenth harmonic.

9 kHz – 30 MHz frequency range. The test was performed in the anechoic chamber. 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 – 4.2 GHz frequency range. Preliminary test was performed in anechoic chamber with biconilog antenna in 30 – 1000 MHz frequency range and with double ridged guide antenna in 1000 – 4200 MHz frequency range; the final test was performed at the OATS. 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.

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 1942	HL 1984	HL 2009		

TEST EQUIPMENT USED AT OATS:

HL 0034	HL 0038	HL 0091	HL 0287	HL 0415	HL 0812	HL 1365
HL 1424	HL 1430	HL 1942	HL 1947	HL 1984	HL 2254	HL 2259
HL 2432						

4.4 Unintentional radiated emissions test according to §15.109

METHOD OF MEASUREMENT: ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
DATE: October 15, 2002
RELATIVE HUMIDITY: 38 %
AMBIENT TEMPERATURE: 24 °C
AIR PRESSURE: 1011 hPa
TEST PERFROMED IN: Anechoic chamber
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
THE EUT WAS TESTED AS: Table-top
FREQUENCY RANGE: 30 MHz – 1 GHz
DETECTOR TYPE: Quasi-peak
RESOLUTION BANDWIDTH: 120 kHz
ANTENNA TYPE: BICONILOG in vertical and horizontal polarization

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

Frequency, MHz	**Antenna polarization**	**Antenna height, m**	**Turntable position (^{o})**	**Radiated emissions, dB (μV/m)**	**Specification limit, dB (μV/m)**	**Margin, dB**
110.417856	Horizontal	1	0	13.60	43.5	29.90
Measurement uncertainty, dB	± 6					

TEST PROCEDURE

The EUT was placed on a wooden 80 cm height table. To find maximum radiation the turntable was rotated 360^o, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

TEST EQUIPMENT USED:

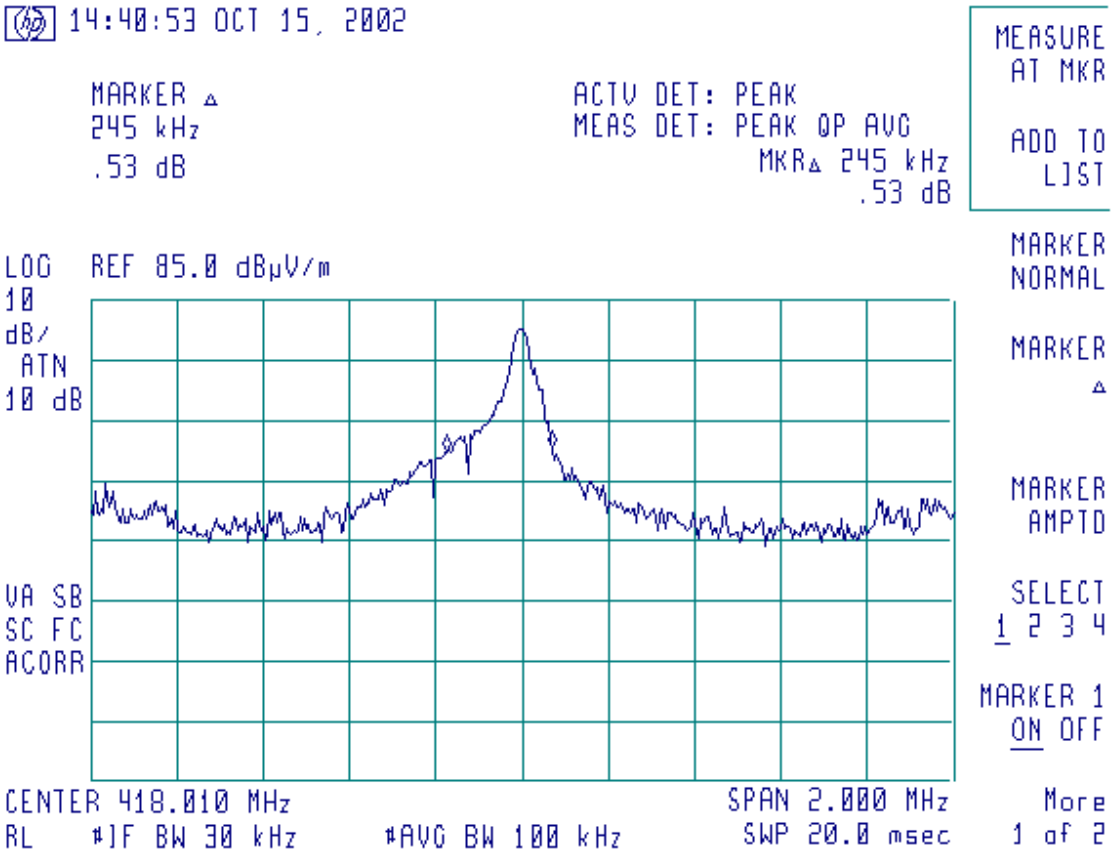
HL 0465	HL 0521	HL 0592	HL 0593	HL 0594	HL 0604	

LIMIT § 15.109

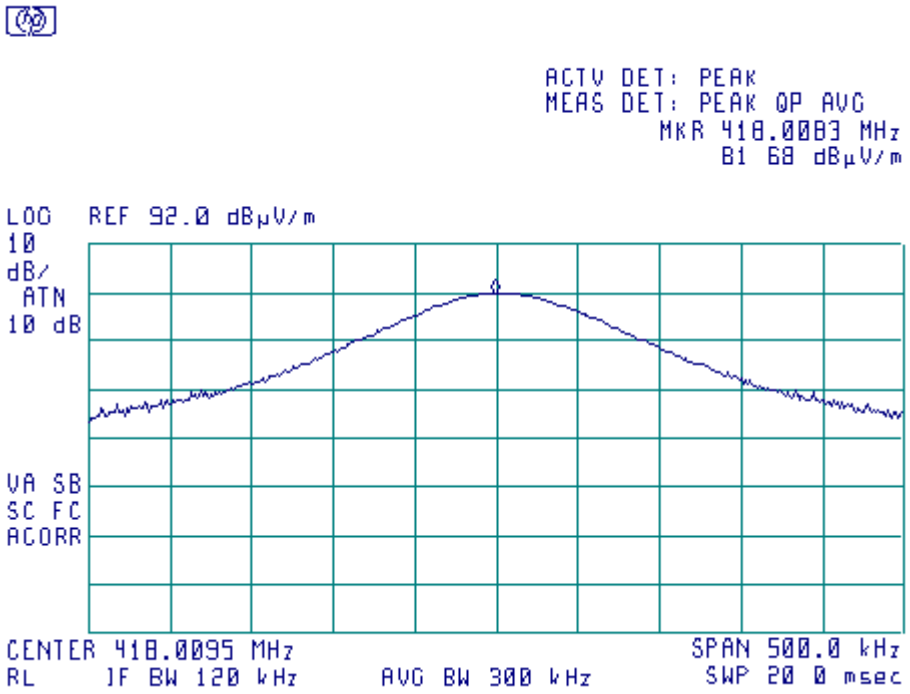
Frequency, MHz	**Class B equipment @ 3 m dB(μV/m)**
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - 5000	54

Appendix A - Plots

Plot No.1
Occupied bandwidth measurement test result



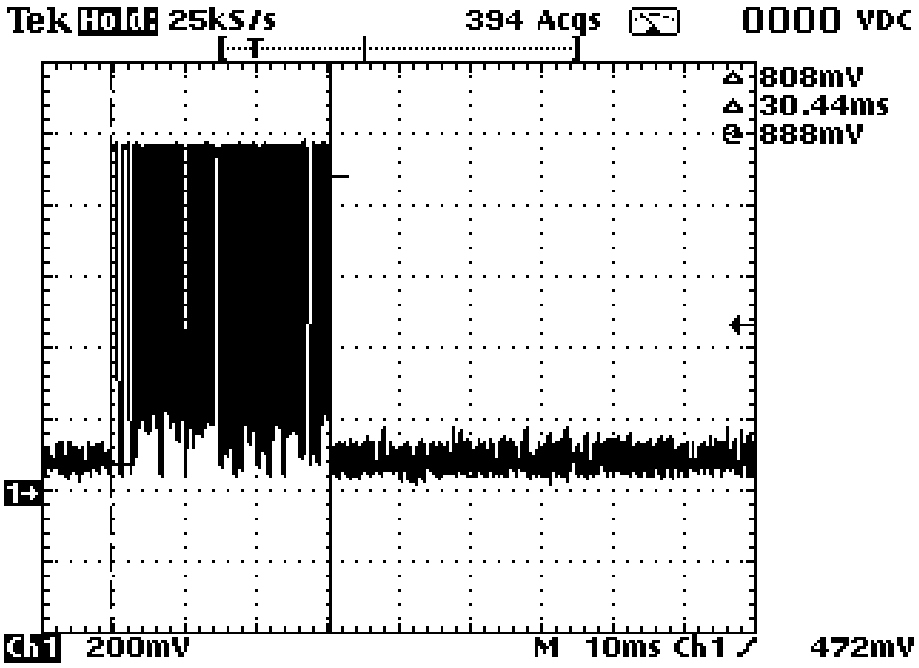
Plot No.2
Field strength of fundamental test result



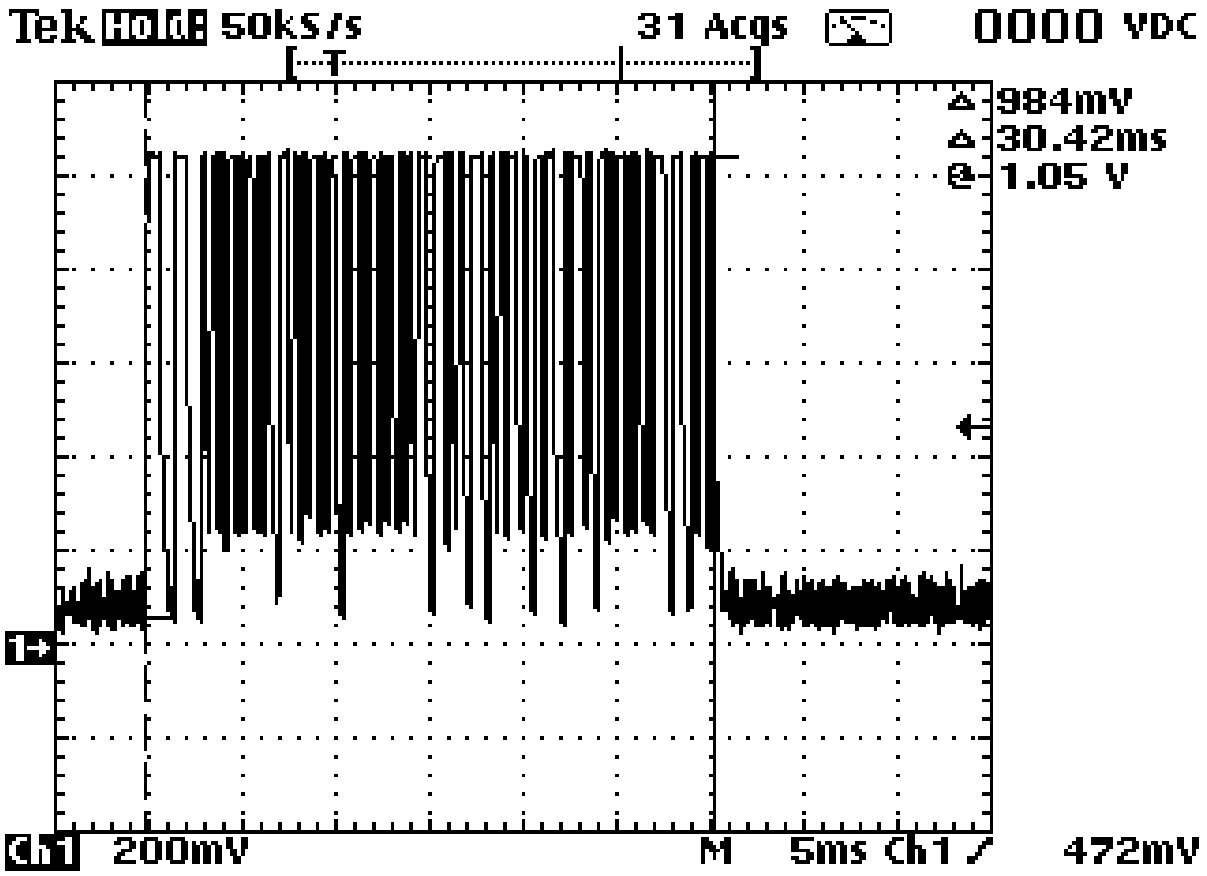
Signal	Frequency, MHz	Peak reference, dB(uV/m)	Average factor, dB	Result, dB(µV/m)	Limit, dB(uV/m)	Margin, dB
1	418.0095	81.68	-16.35	65.33	80.3	14.97

Average factor = 20lg 15.21 msec/100 msec = -16.35 dB

Plot No.3
Pulse train in 0.1 second interval measurement result

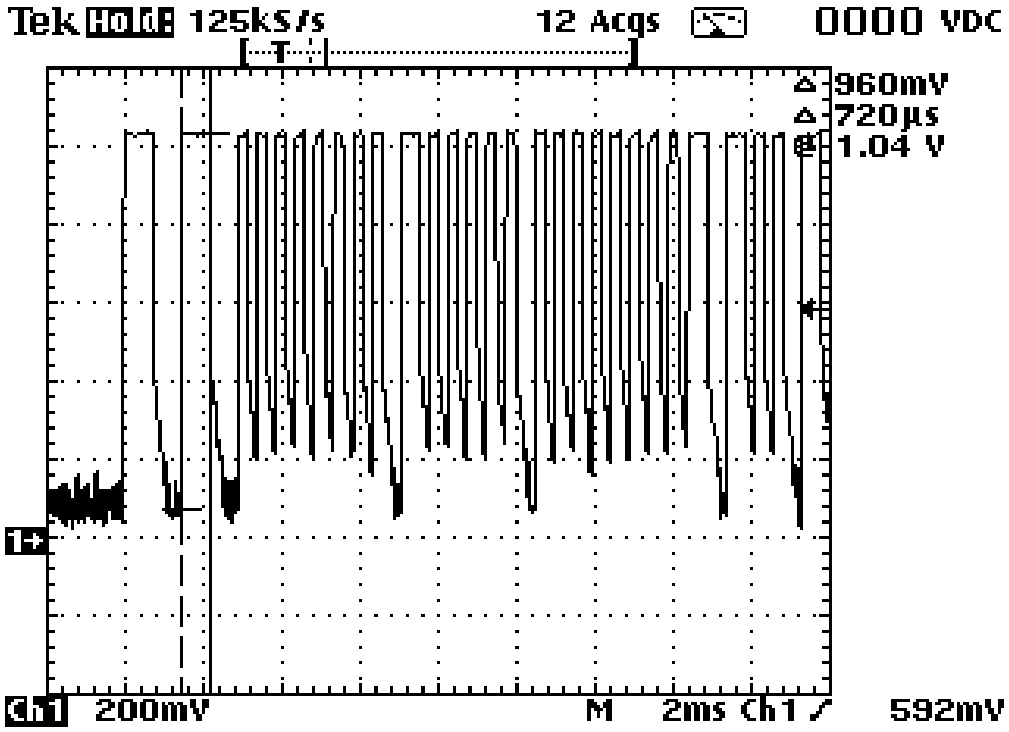


Plot No.4
Tx on (duty cycle) measurement result

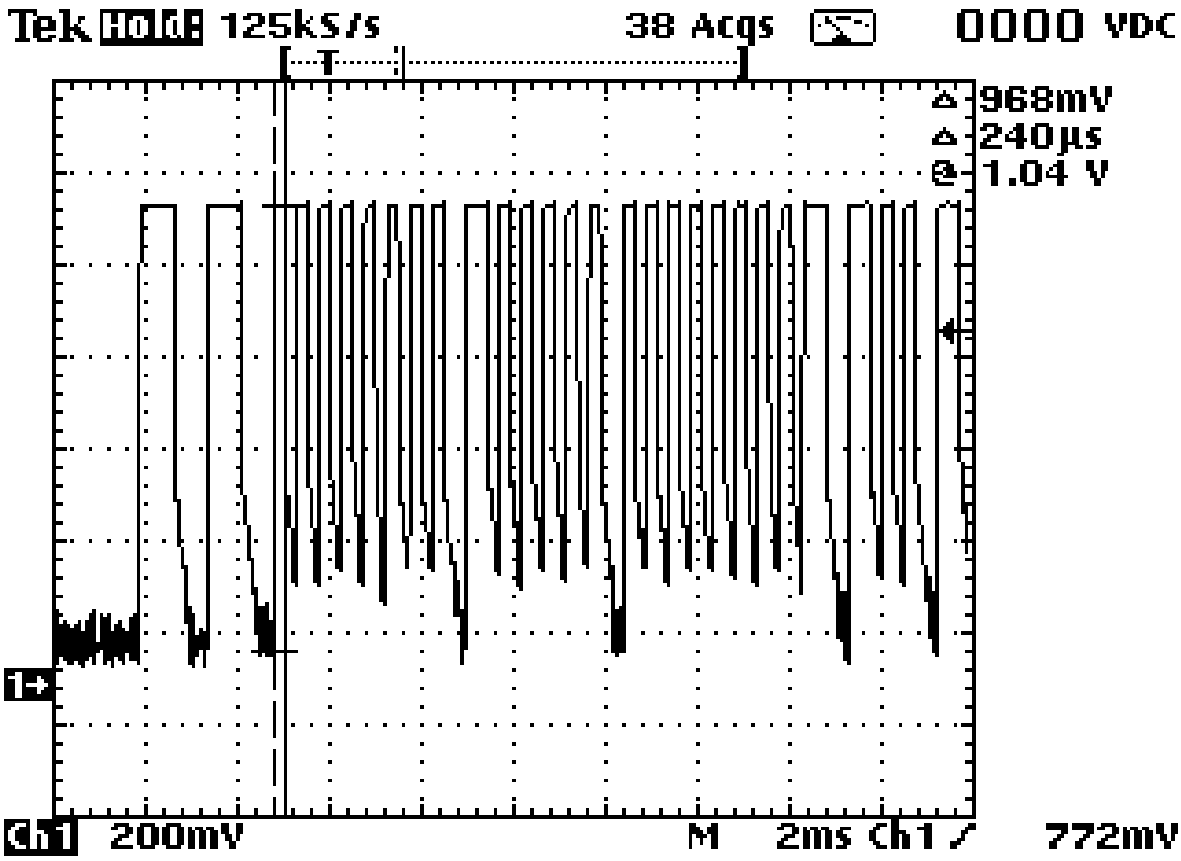


Pulse train duration = 30.42 ms
Tx on = 30.42 x 0.5 = 15.21 ms
Average factor = 20 log 15.21/100 = -16.35 dB

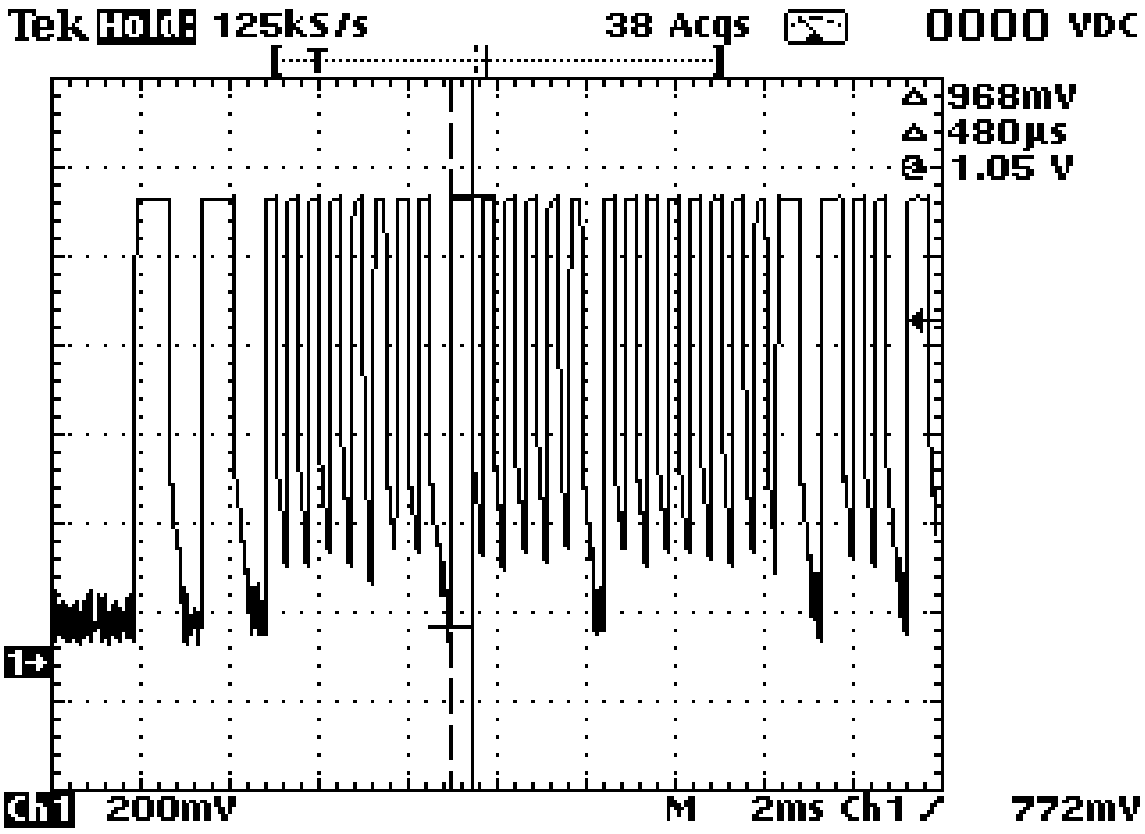
Plot No.5
Tx on (duty cycle) measurement result



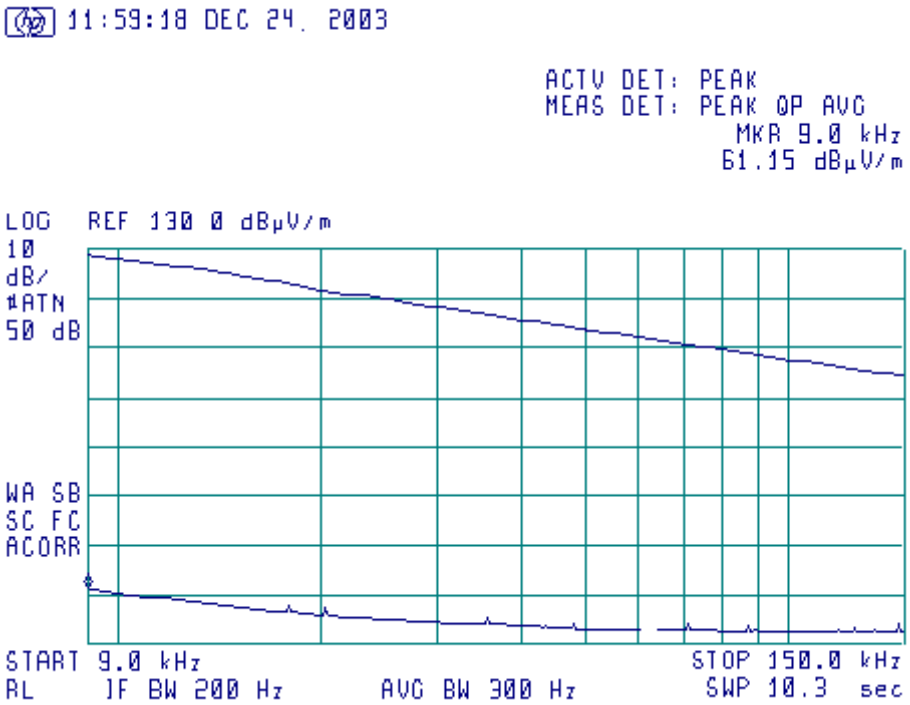
Plot No.6
Tx on (duty cycle) measurement result



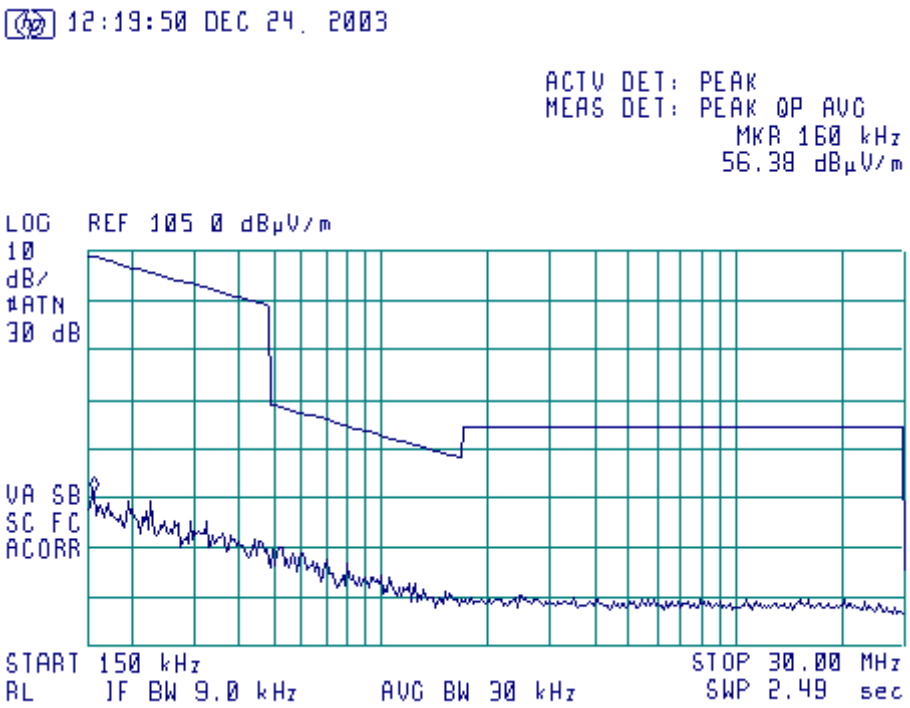
Plot No.7
Tx on (duty cycle) measurement result



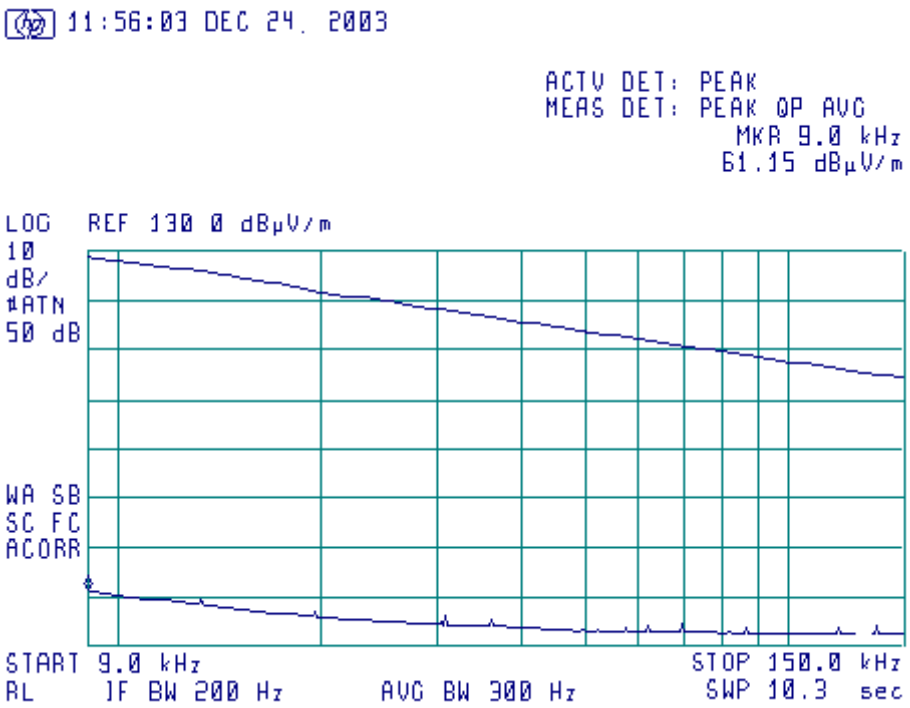
Plot No.8
Spurious emissions test result from 9 kHz to 150 kHz, EUT in X-axis position



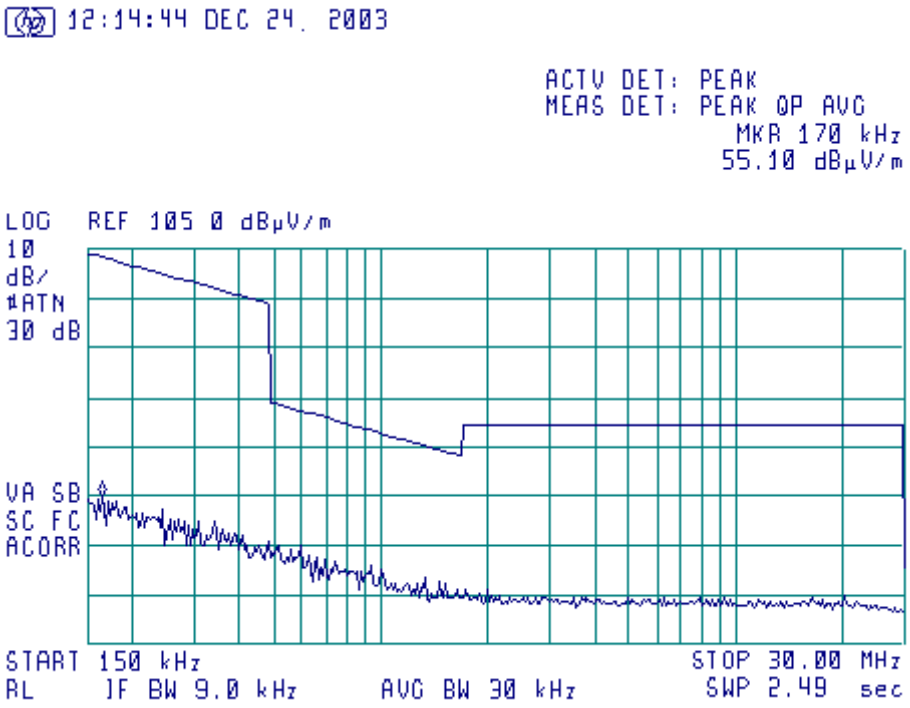
Plot No.9
Spurious emissions test result from 150 kHz to 30 MHz, EUT in X-axis position



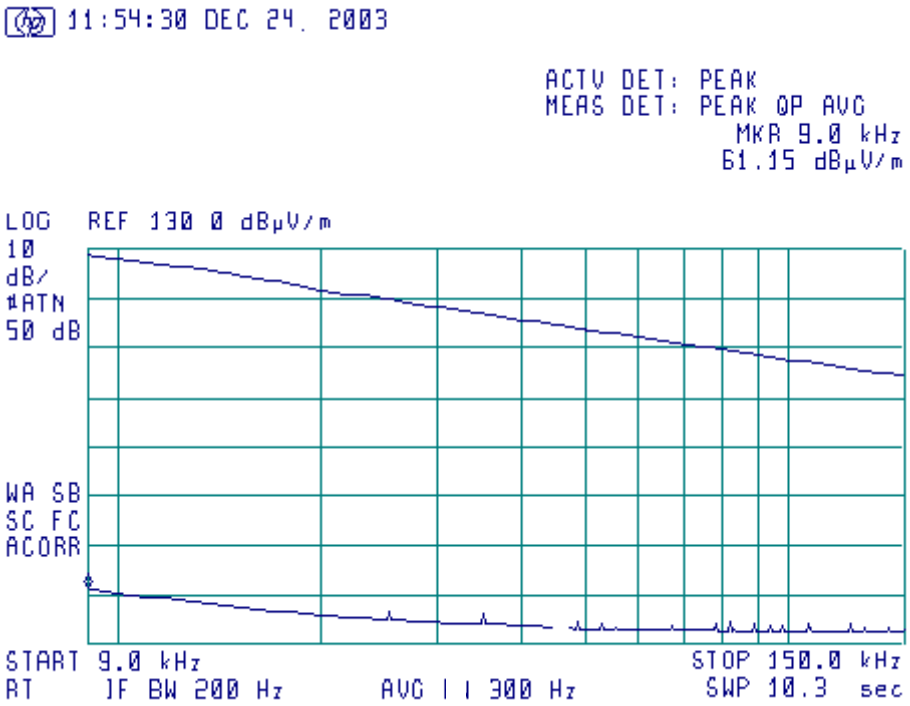
Plot No.10
Spurious emissions test result from 9 kHz to 150 kHz, EUT in Y-axis position



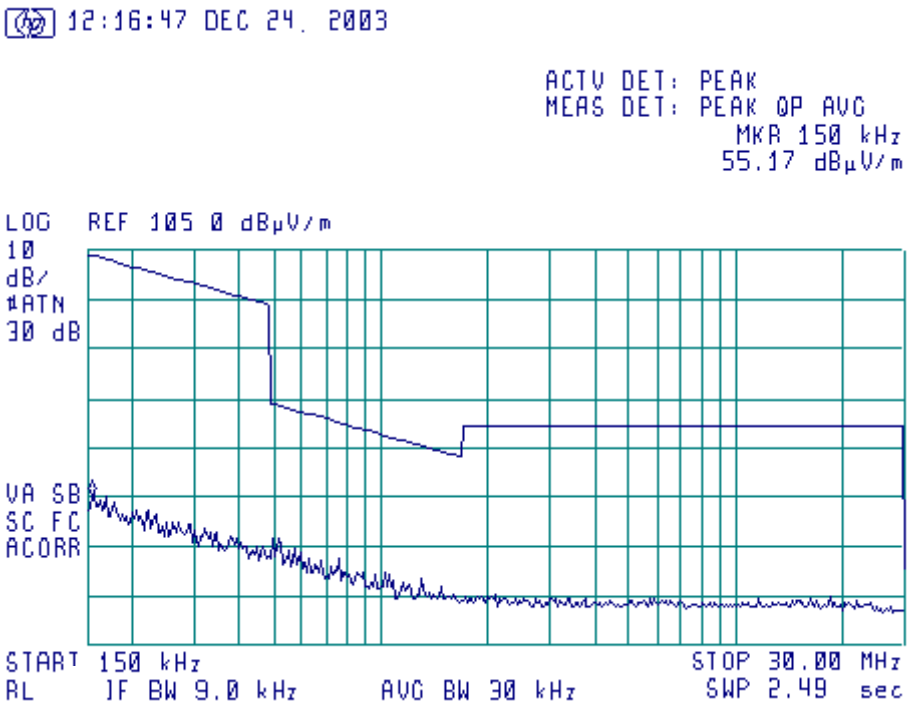
Plot No.11
Spurious emissions test result from 150 kHz to 30 MHz, EUT in Y-axis position



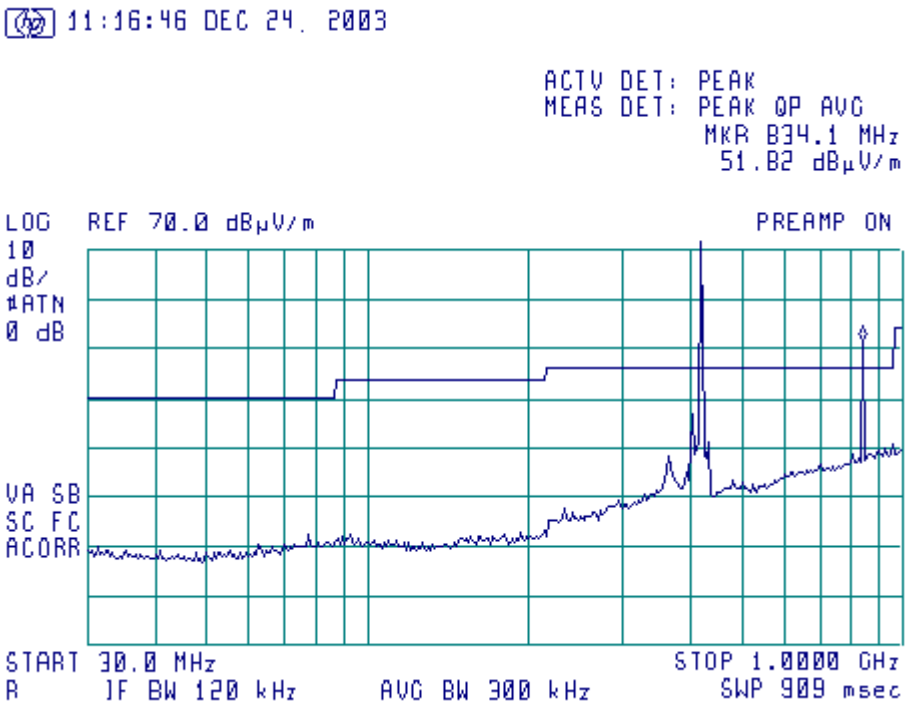
Plot No.12
Spurious emissions test result from 9 kHz to 150 kHz, EUT in Z-axis position



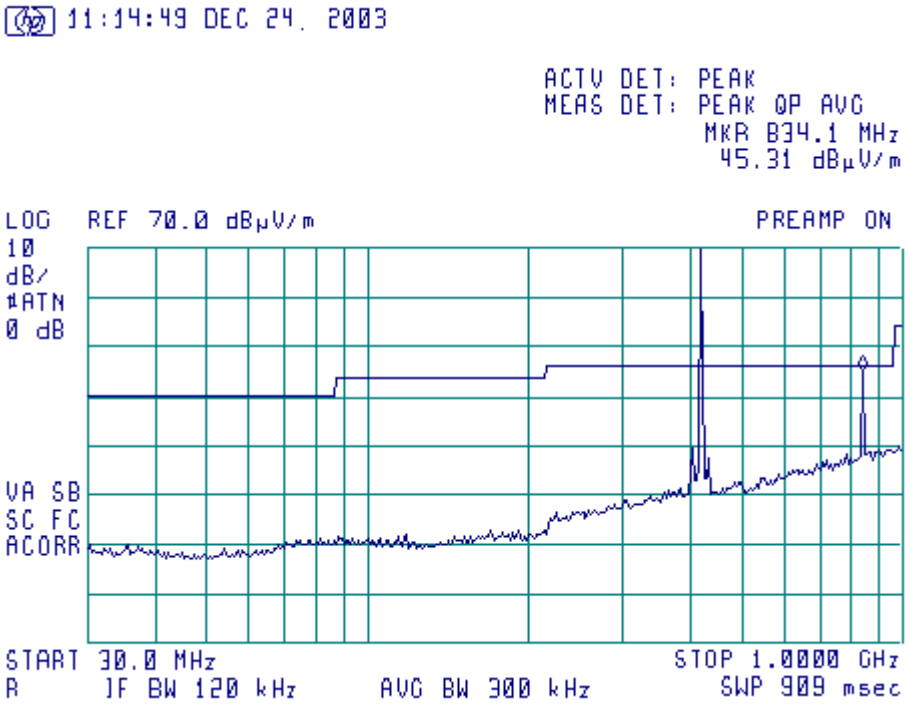
Plot No.13
Spurious emissions test result from 150 kHz to 30 MHz, EUT in Z-axis position



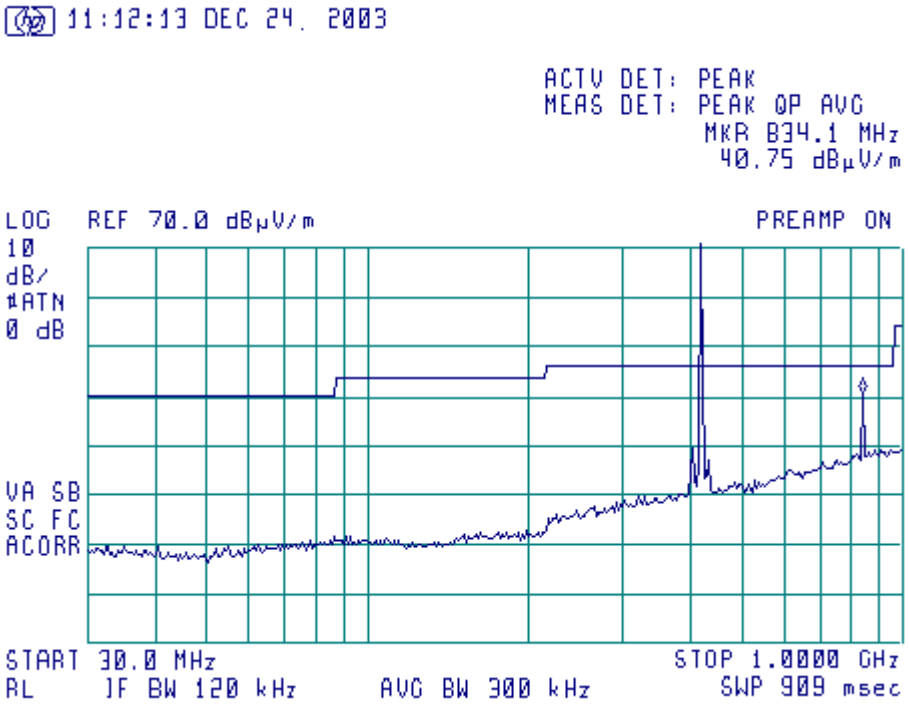
Plot No.14
Spurious emissions test result from 30 MHz to 1000 MHz, EUT in X-axis position, antenna horizontal polarization



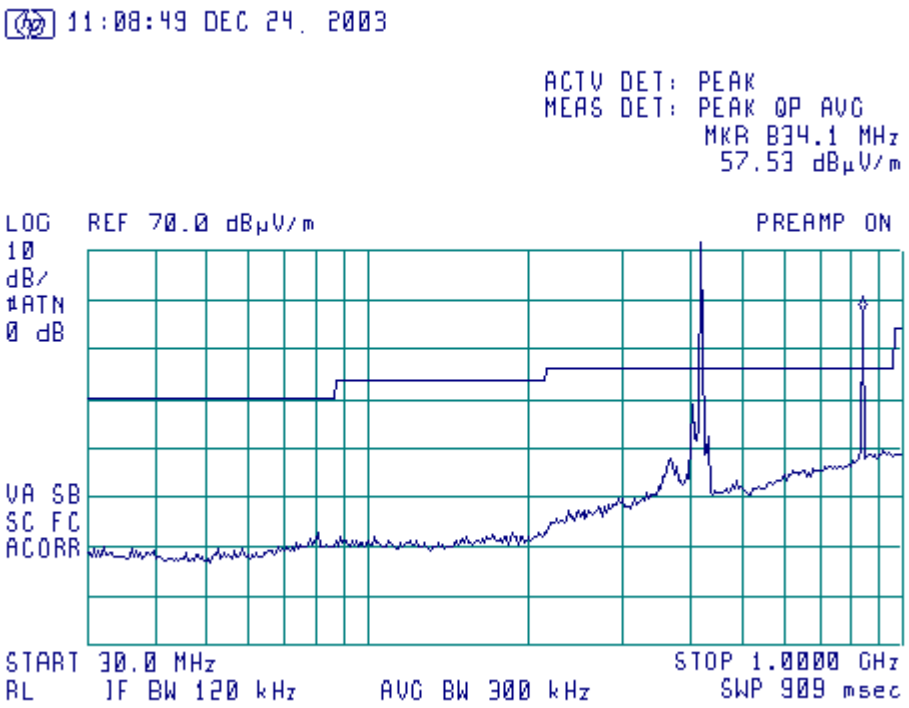
Plot No.15
Spurious emissions test result from 30 MHz to 1000 MHz, EUT in X-axis position, antenna vertical polarization



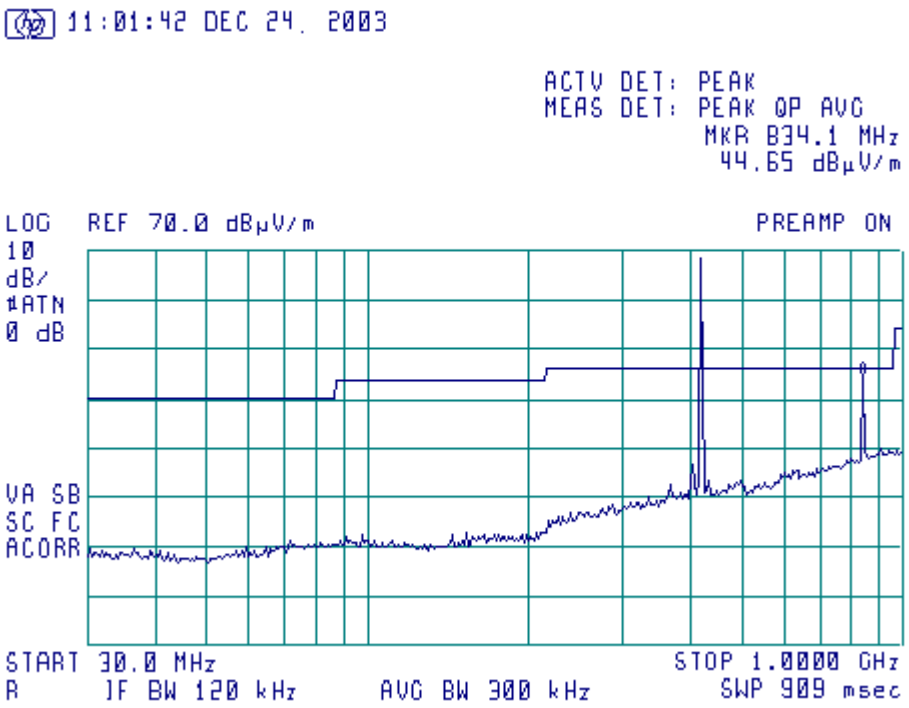
Plot No.16
Spurious emissions test result from 30 MHz to 1000 MHz, EUT in Y-axis position, antenna vertical polarization



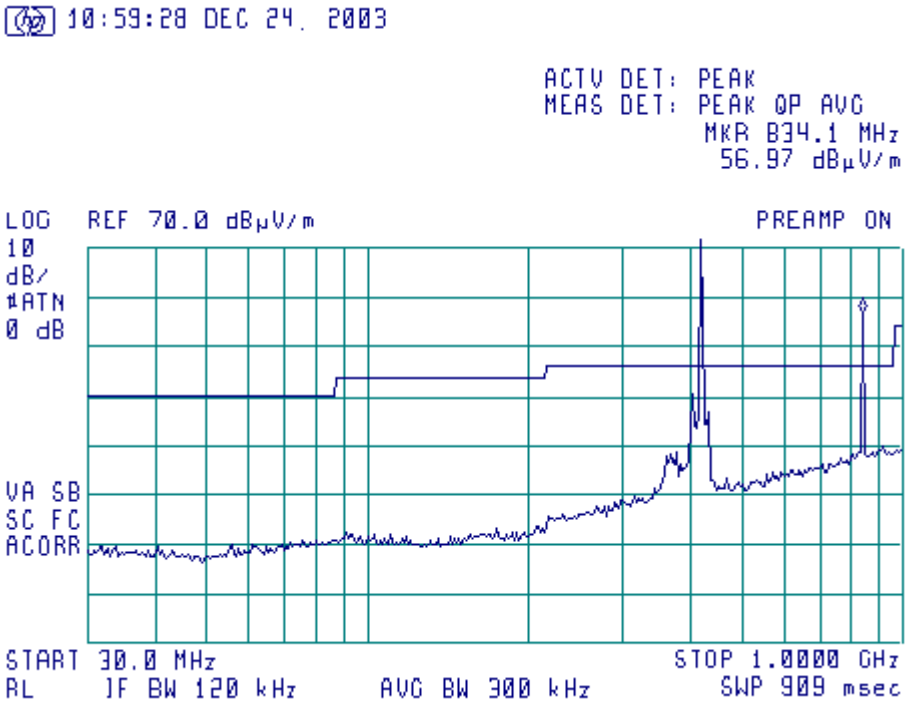
Plot No.17
Spurious emissions test result from 30 MHz to 1000 MHz, EUT in Y-axis position, antenna horizontal polarization



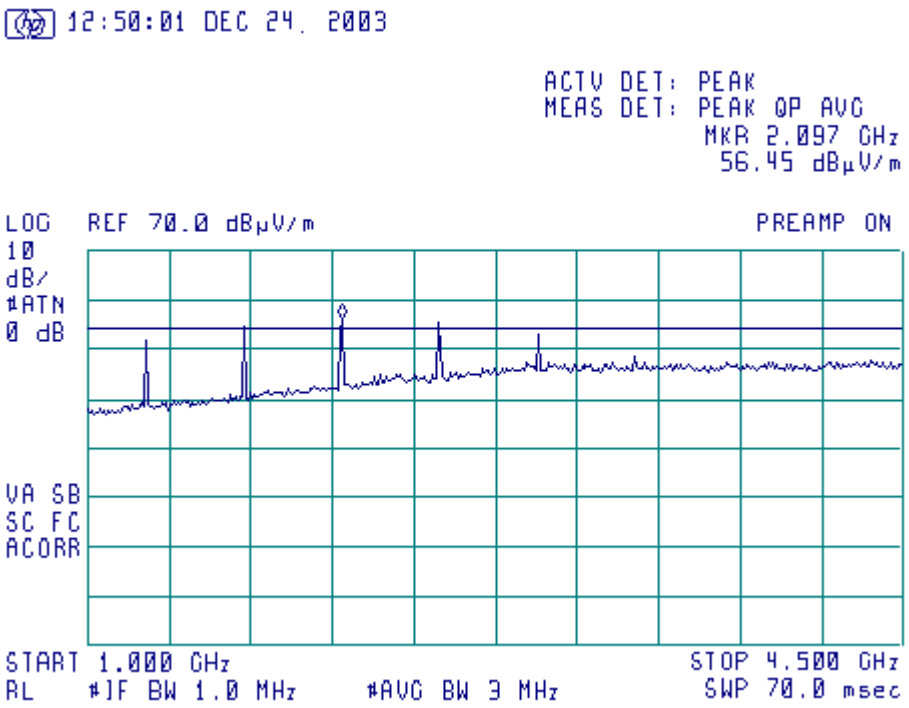
Plot No.18
Spurious emissions test result from 30 MHz to 1000 MHz, EUT in Z-axis position, antenna horizontal polarization



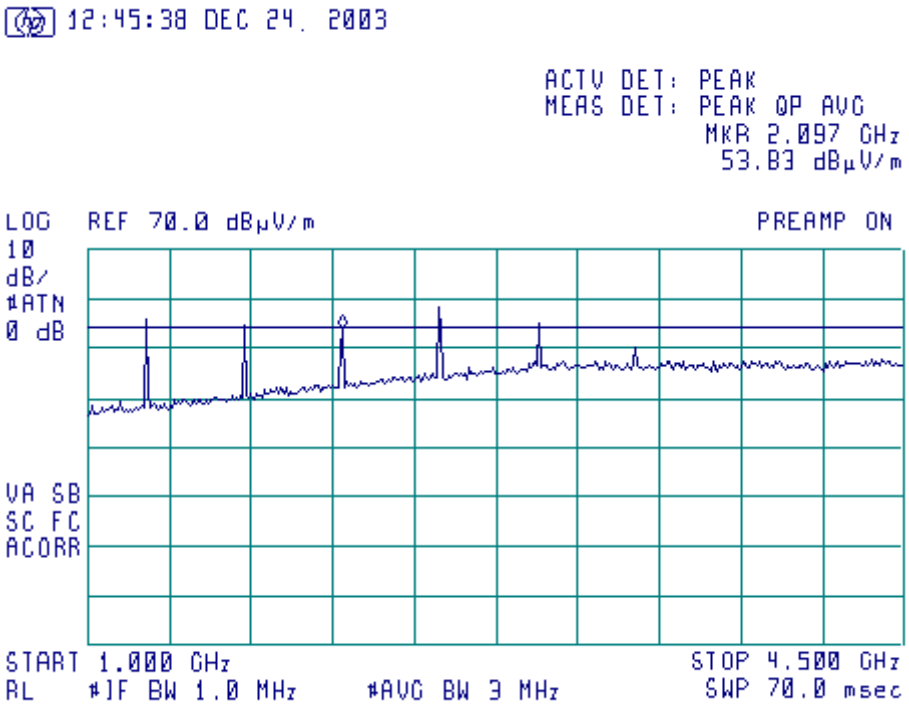
Plot No.19
Spurious emissions test result from 30 MHz to 1000 MHz, EUT in Z-axis position, antenna vertical polarization



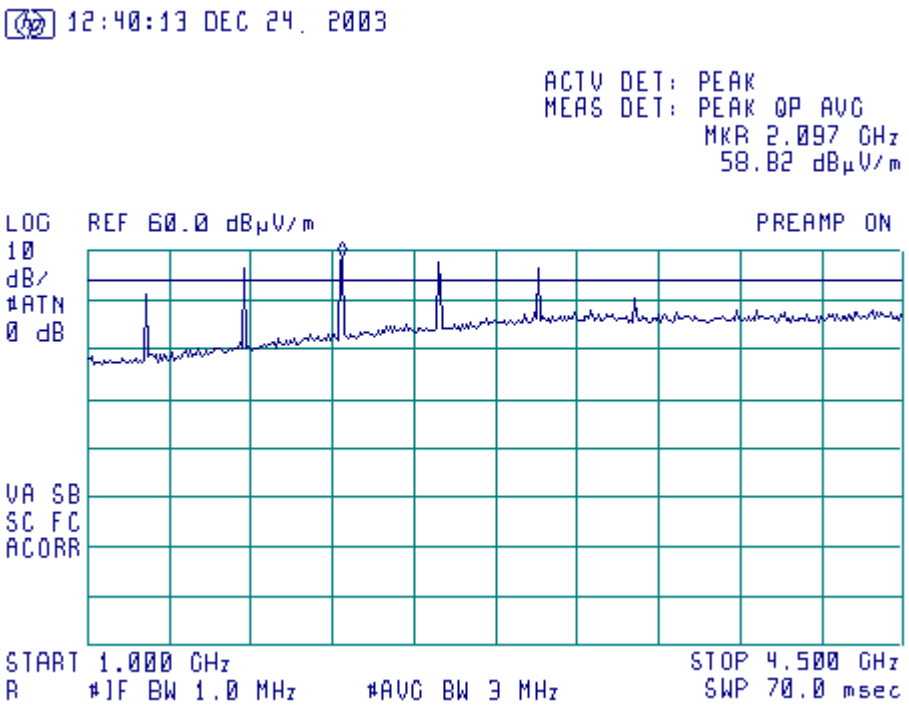
Plot No.20
Spurious emissions test result from 1 GHz to 4.5 GHz, EUT in X-axis position, antenna horizontal and vertical polarization



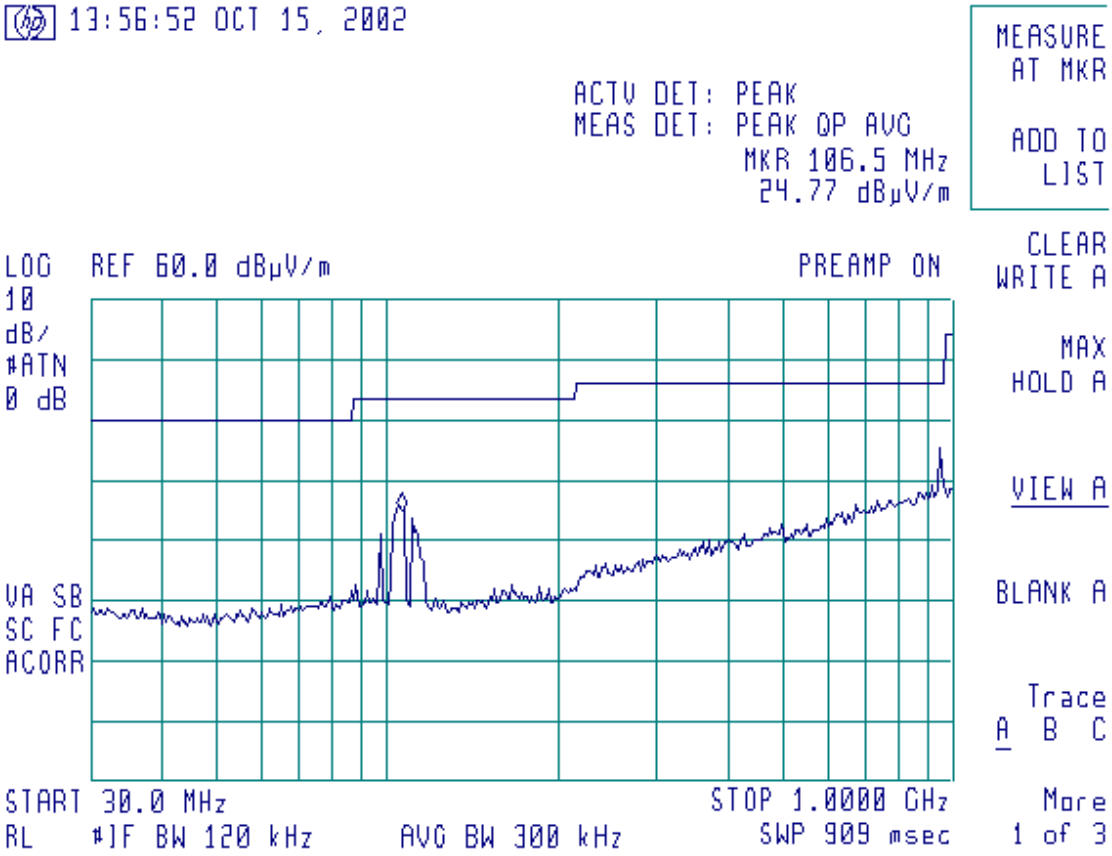
Plot No.21
Spurious emissions test result from 1 GHz to 4.5 GHz, EUT in Y-axis position, antenna horizontal and vertical polarization



Plot No.22
Spurious emissions test result from 1 GHz to 4.5 GHz, EUT in Z-axis position, antenna horizontal and vertical polarization



Plot No.23
Unintentional radiated emissions test result



Appendix B - Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibration Month/ year
		Name	Model No.	Serial No.	
0034	Log periodic antenna, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1988	1/04
0038	Antenna Mast, 1-4 m	Hermon Labs	AM-1	028	2/04 check
0091	Position controller for antenna mast + turntable, OATS	Hermon Labs	CRL-2	NA	4/04 check
0287	Turntable, motorized diameter, 2m	Hermon Labs	TMD-2	042	11/04 check
0415	Cable coax RF, RG-58,	Hermon Labs	CC-3	056	12/04
0446	Active loop antenna 10 kHz-30 MHz	Electro-Mechanics	6502	2857	10/04
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	10/05
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/04
0589	Cable coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	12/04
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
0812	Cable, coax, RG-214, 11.5 m, N-type connectors	Hermon Labs	C214-11	148	12/04
1004	Cable coaxial, ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/04
1365	Cable coaxial, RG-214, 5 m	Hermon Labs	C214-5	1365	4/04
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
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
1984	Antenna, double ridged waveguide horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	3/04
2009	Cable RF, 8 m	Alpha Wire	RG-214	NA	12/04
2254	Cable 40GHz, 0.8 m, blue	Rhophase Microwave Ltd.	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

Appendix C – Antenna factors and cable loss

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).

Antenna factor
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.1988, HL 0034

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
200	12.6	625	20.4
225	12.2	650	20.9
250	13.4	675	22.0
275	14.3	700	22.2
300	15.2	725	22.7
325	15.7	750	22.5
350	15.9	775	22.7
375	16.4	800	22.8
400	17.0	825	23.2
425	17.4	850	23.5
450	17.9	875	23.9
475	18.6	900	24.0
500	19.1	925	24.0
525	19.3	950	24.2
550	19.6	975	24.7
575	19.8	1000	25.1
600	20.0		

Antenna factor 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).

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).

Antenna factor
Double-ridged wave guide horn antenna
Model 3115, S/N 9911-5964, HL1984

Frequency, MHz	Antenna factor, dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.6
2500.0	28.9
3000.0	31.2
3500.0	32.0
4000.0	32.5
4500.0	32.7
5000.0	33.6
5500.0	35.1
6000.0	35.4
6500.0	34.9
7000.0	36.1
7500.0	37.8
8000.0	38.0
8500.0	38.1
9000.0	39.1
9500.0	38.3
10000.0	38.6
10500.0	38.2
11000.0	38.7
11500.0	39.5
12000.0	40.0
12500.0	40.4
13000.0	40.5
13500.0	41.1
14000.0	41.6
14500.0	41.7
15000.0	38.7
15500.0	38.2
16000.0	38.8
16500.0	40.5
17000.0	42.5
17500.0	45.9
18000.0	49.4

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).

Antenna factor
Double-ridged guide horn antenna
Model 3115, serial number: 00027177, HL2432

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).

Cable loss
Cable Coaxial, RG-58/RG-214, s/n 056, HL 0415
+ Cable Coaxial, RG-214, 11.5m, s/n 148, HL 0812

No.	Frequency, MHz	Cable loss, dB	Measured uncertainty, dB
1	20	0.73	±0.12
2	30	0.91	
3	50	1.2	
4	80	1.56	
5	100	1.76	
6	200	2.59	
7	300	3.26	
8	400	3.93	
9	500	4.42	
10	600	4.92	
11	700	5.36	
12	800	5.88	
13	900	6.41	
14	1000	6.71	
15	1500	8.63	
16	2000	10.39	

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		

Cable loss
Cable coaxial, RG-214, 5m, model: C214-5, HL 1365

No.	Set, MHz	Measured, dB	Measured uncertainty dB
1	1000	0.41	±0.12
2	1200	0.44	
3	1400	0.48	
4	1600	0.52	
5	1800	0.55	
6	2000	0.58	
7	2200	0.61	
8	2400	0.64	±0.17
9	2600	0.67	
10	2800	0.7	
11	3000	0.73	
12	3300	0.79	
13	3600	0.84	
14	3900	0.94	
15	4200	1.22	

Cable 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

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

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		

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		

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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Abbreviations and acronyms

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

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
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 C63.2:96	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.