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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
Telephone number	: +972 3 9386989
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Test performance

Project Number:	: 15316
Location	: Hermon Laboratories
Receipt date	: October 15, 2002
Test completed	: October 15, 2002
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. M. Feldman, test engineer	October 15, 2002	
Field strength of spurious radiation	15.231(b)(3)	X				Mr. M. Feldman, test engineer	October 15, 2002	
Unintentional radiation, §15.107, §15.109								
Conducted emissions	15.107				X			
Radiated emissions	15.109	X				Mr. M. Feldman, test engineer	October 15, 2002	
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.								

Tests performed by: Mr. M. Feldman, test engineer

Test report prepared by: Mrs. M. Cherniavsky, certification engineer

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

Dr. E. Usoskin, 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 round 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: 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	HL 1019	

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: October 15, 2002
RELATIVE HUMIDITY: 38 %
AMBIENT TEMPERATURE: 24 °C
TEST PERFROMED IN: Anechoic chamber
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
MODULATION: Pulse

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

Peak detector

Frequency, MHz	Measured field strength, dB(uV/m)	Specification limit, dB(uV/m)	Margin, dB	Reference to plot in Annex A
418.009	83.14	100.3	17.16	No.2
Measurement uncertainty, dB		+5.73 / -5.57		

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	83.14	-16.35	66.79	80.3	13.51	No.2
Measurement uncertainty, dB		+5.73 / -5.57				

LIMIT § 15.231 (b)

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

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^{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	HL 1019

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

METHOD OF MEASUREMENT:	ANSI 63.4 §13.1.4
DATE:	October 15, 2002
RELATIVE HUMIDITY:	38 %
AMBIENT TEMPERATURE:	24 °C
AIR PRESSURE:	1011 hPa
AMBIENT TEMPERATURE:	23 °C
DISTANCE BETWEEN ANTENNA AND EUT:	3 m (refer to Photographs in Appendix B)
DETECTOR USED:	Peak

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 (4.2 GHz)

Test was performed in anechoic chamber with 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 below the limit			No.8
0.150 - 30	V, H	9	30	All emissions were found below the limit			No.9
Measurement uncertainty, dB				± 4			

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

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
836.028300	51.15	80.3	34.8	60.3	No.10
1672.075000	60.41	74.0	44.06	54.0	No.11
2090.165000	52.14	80.3	35.79	60.3	No.11
2508.047500	58.30	80.3	41.96	60.3	No.11
2926.195000	53.93	80.3	37.58	60.3	No.12
Measurement uncertainty, dB			+5.73 / -5.57		

Notes to table:
* Radiated emission calculation: Peak value + Average factor (-16.35 dB)
RBW: resolution bandwidth = 1000
VBW: video bandwidth = 3000

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 No.8, No.9 in Appendix A refer to vertical antenna polarization as the worst case.
30 MHz – 4.2 GHz frequency range. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

TEST EQUIPMENT USED:

HL 0041	HL 0465	HL 0521	HL 0592	HL 0593	HL 0594	HL 0604
HL 1019	HL 1942					

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	5th harmonic of the highest frequency or 40 GHz, whichever is lower

Frequency, MHz	Antenna polarization	Antenna height, m	Turntable position (°)	Radiated emissions, dB (mV/m)	Specification limit, dB (mV/m)	Margin, dB
110.417856	Horizontal	1	0	13.60	43.5	29.90
Measurement uncertainty, dB	+5.73 / -5.57					

TEST PROCEDURE

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

TEST EQUIPMENT USED:

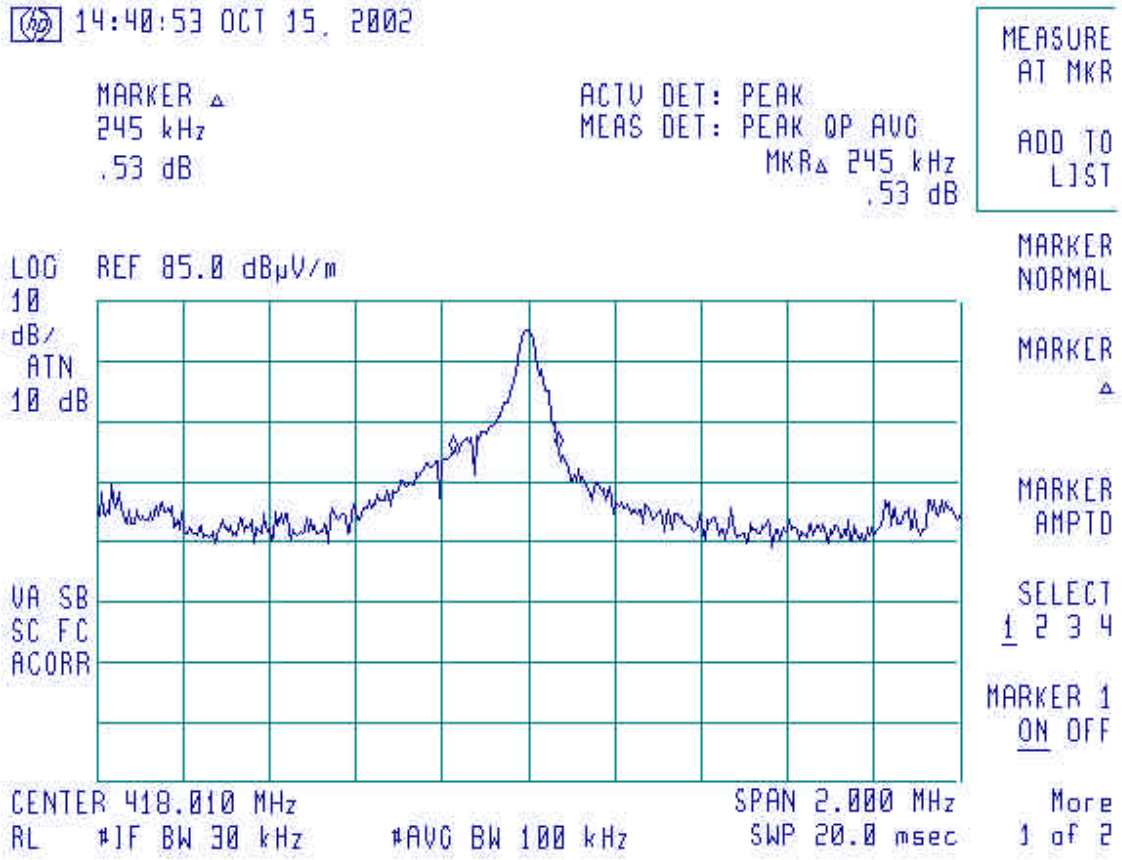
HL 0465	HL 0521	HL 0592	HL 0593	HL 0594	HL 0604	HL 1019

LIMIT § 15.109

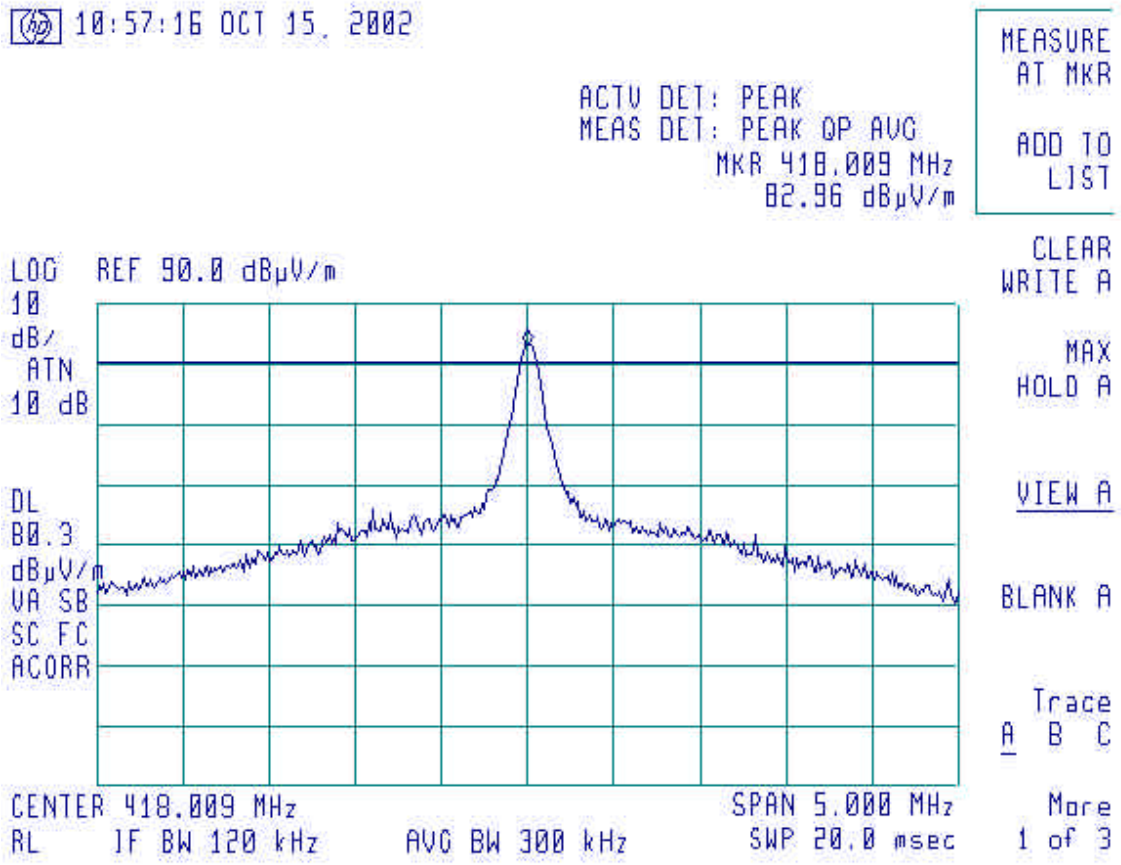
Frequency, MHz	Class B equipment @ 3 m dB(mV/m)
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - 5000	54

Appendix A - Plots

Plot No.1
Occupied bandwidth measurement test result



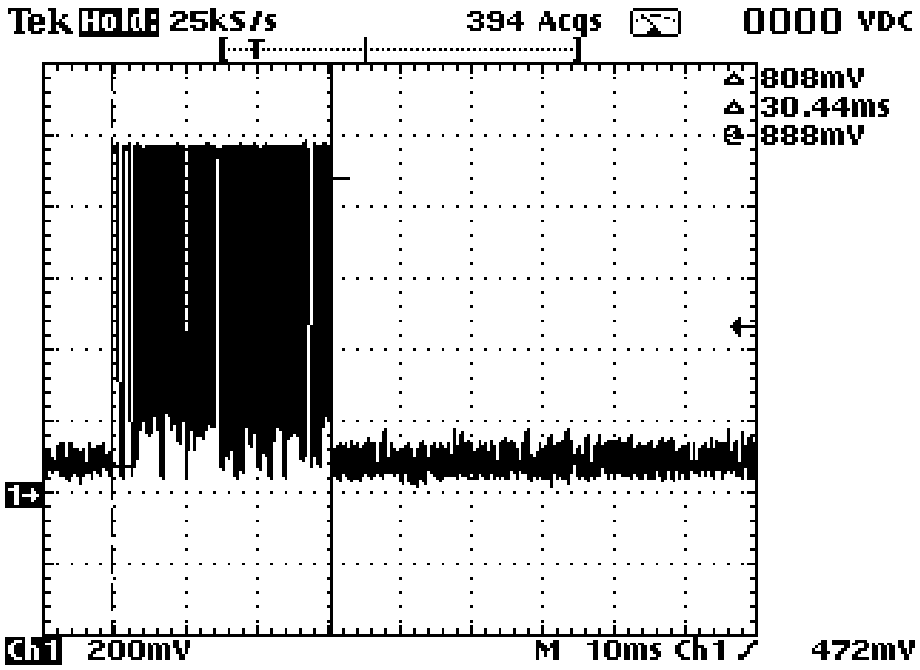
Plot No.2
Field strength of fundamental test result



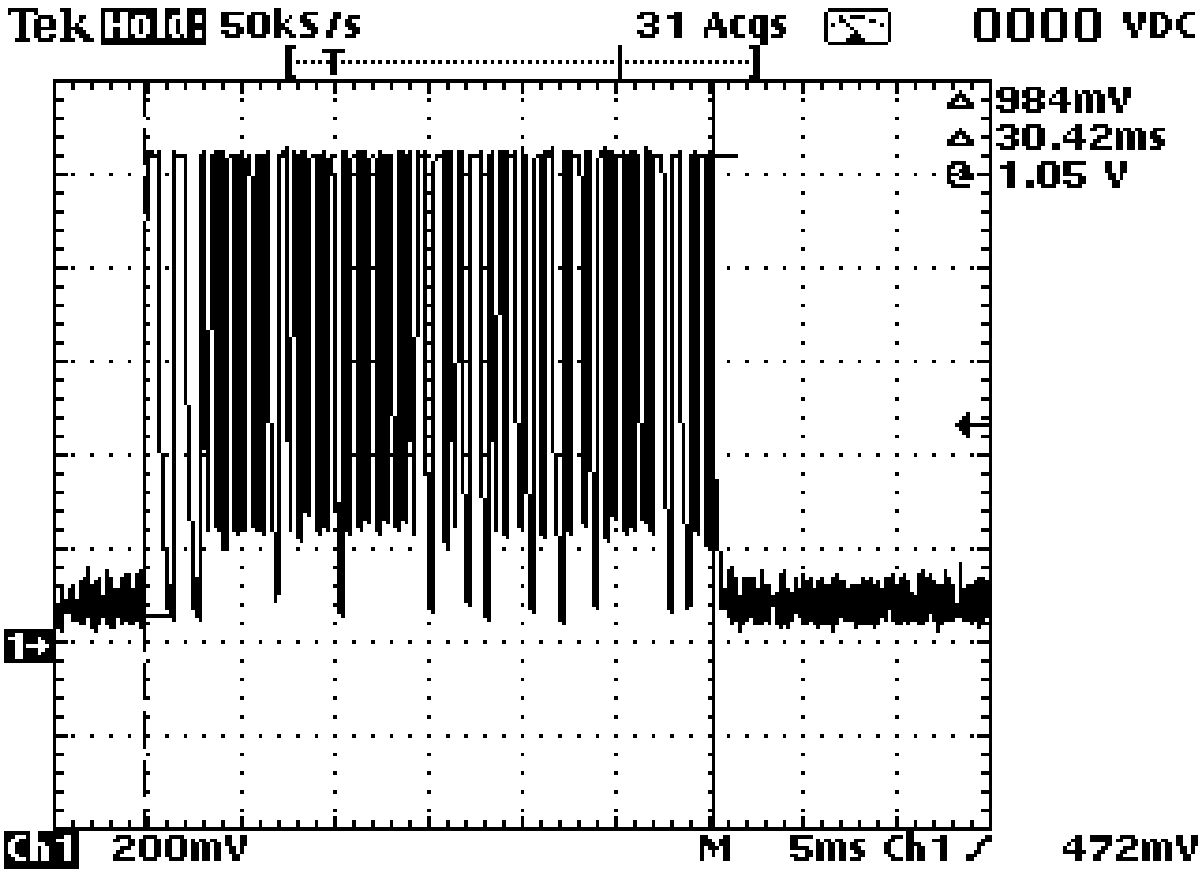
Signal	Frequency, MHz	Peak reference, dB(uV/m)	Average factor, dB	Result, dB(µV/m)	Limit, dB(uV/m)	Margin, dB
1	418.008895	83.14	-16.35	66.79	80.30	-13.51

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

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

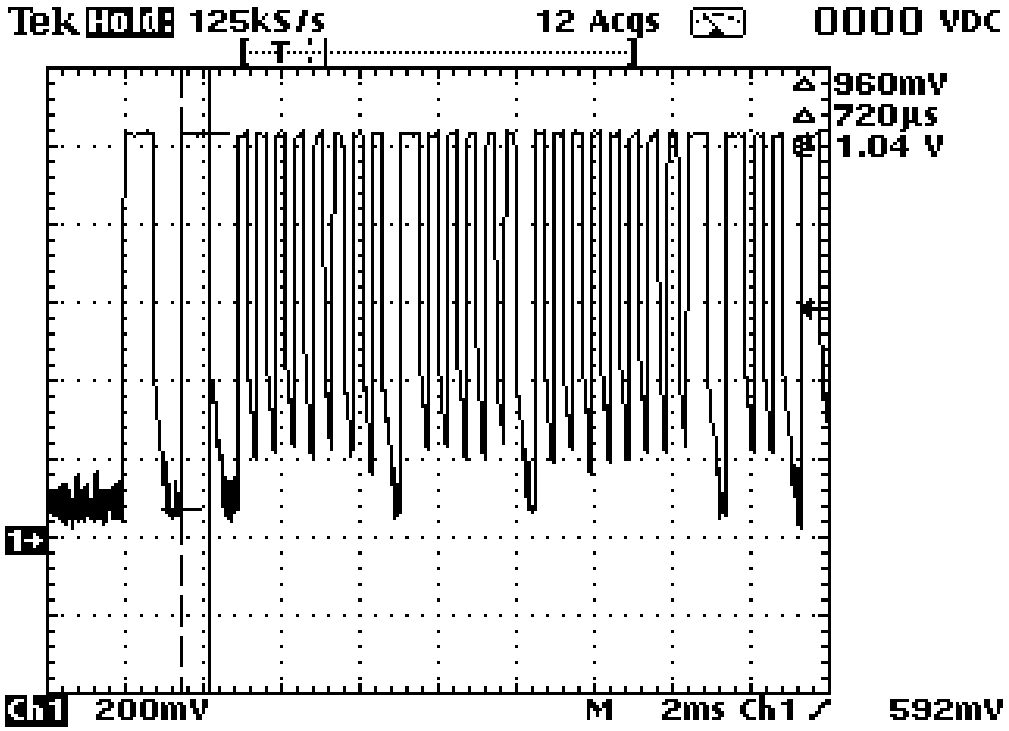


Plot No.4
Tx on (duty cycle) measurement test result

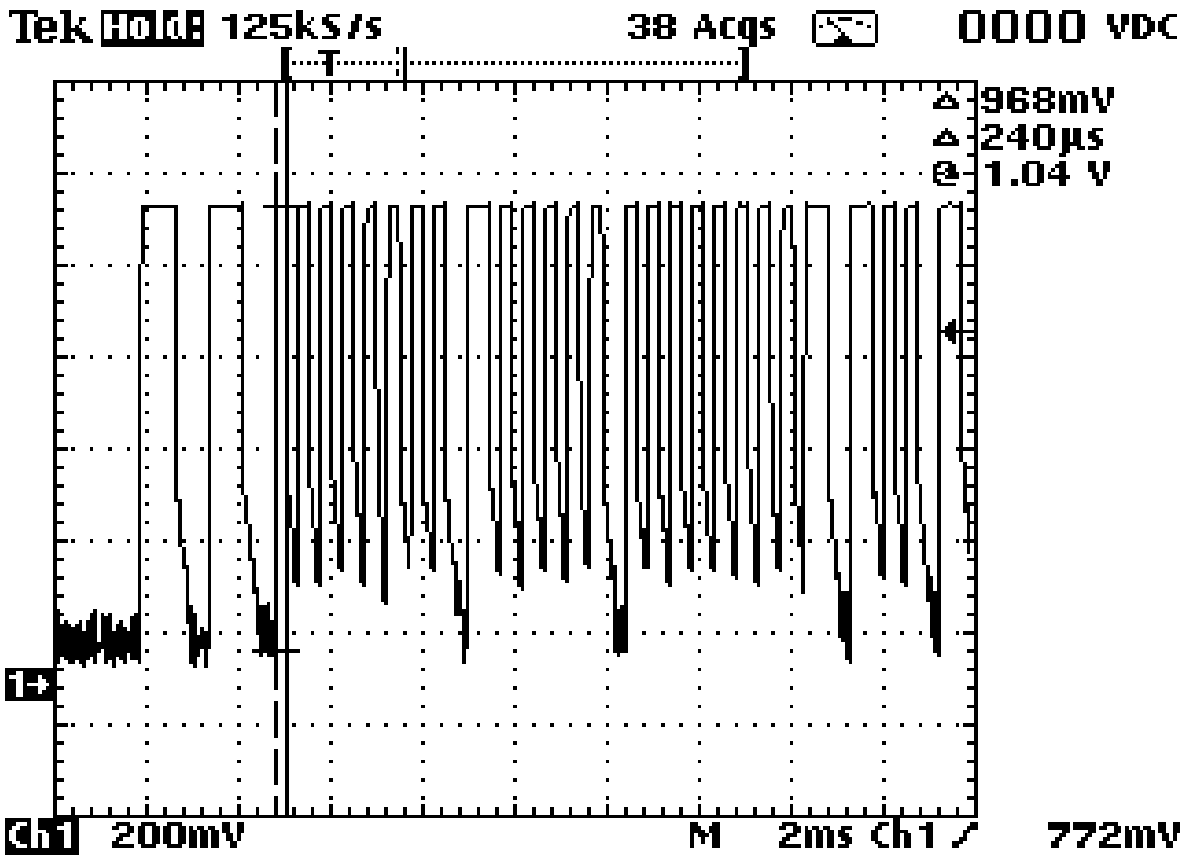


Pulse train duration = 30.42 ms
Tx on = 30.42 x 0.5 = 15.21 ms
Average factor = 20 log 15.21/100 = -16.35 dB

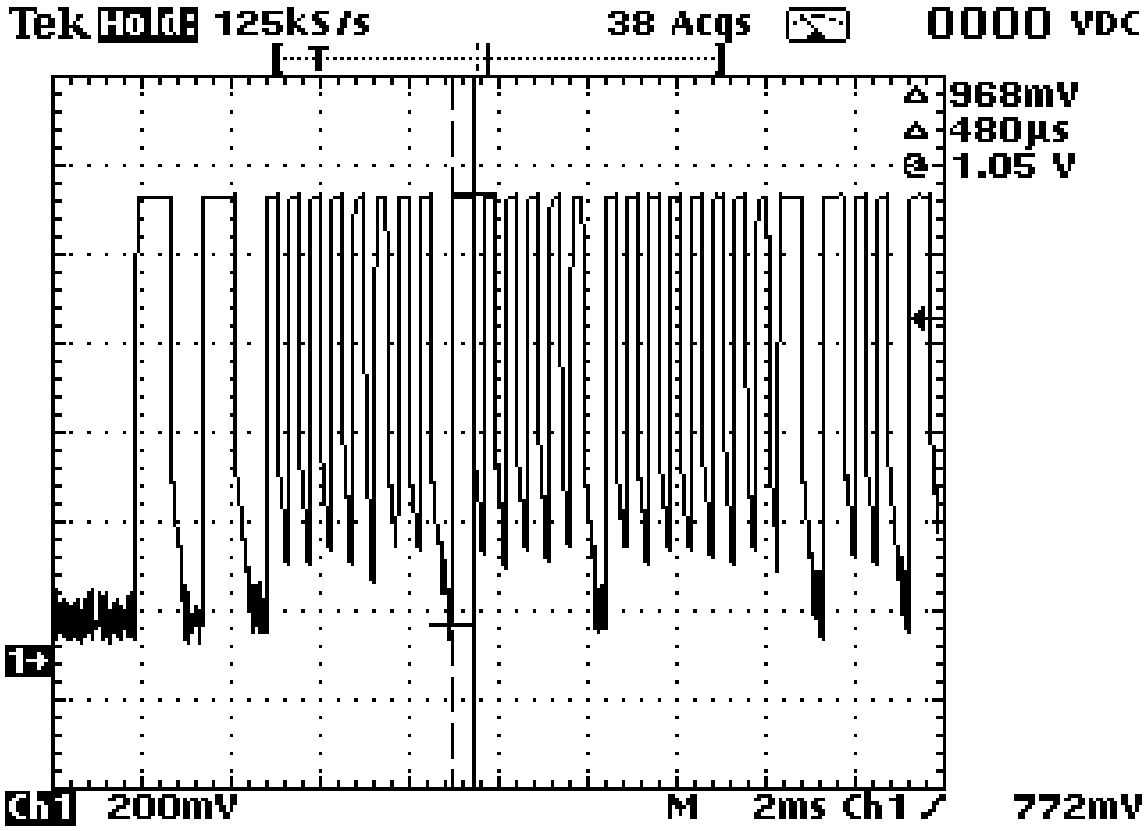
Plot No.5
Tx on (duty cycle) measurement test result



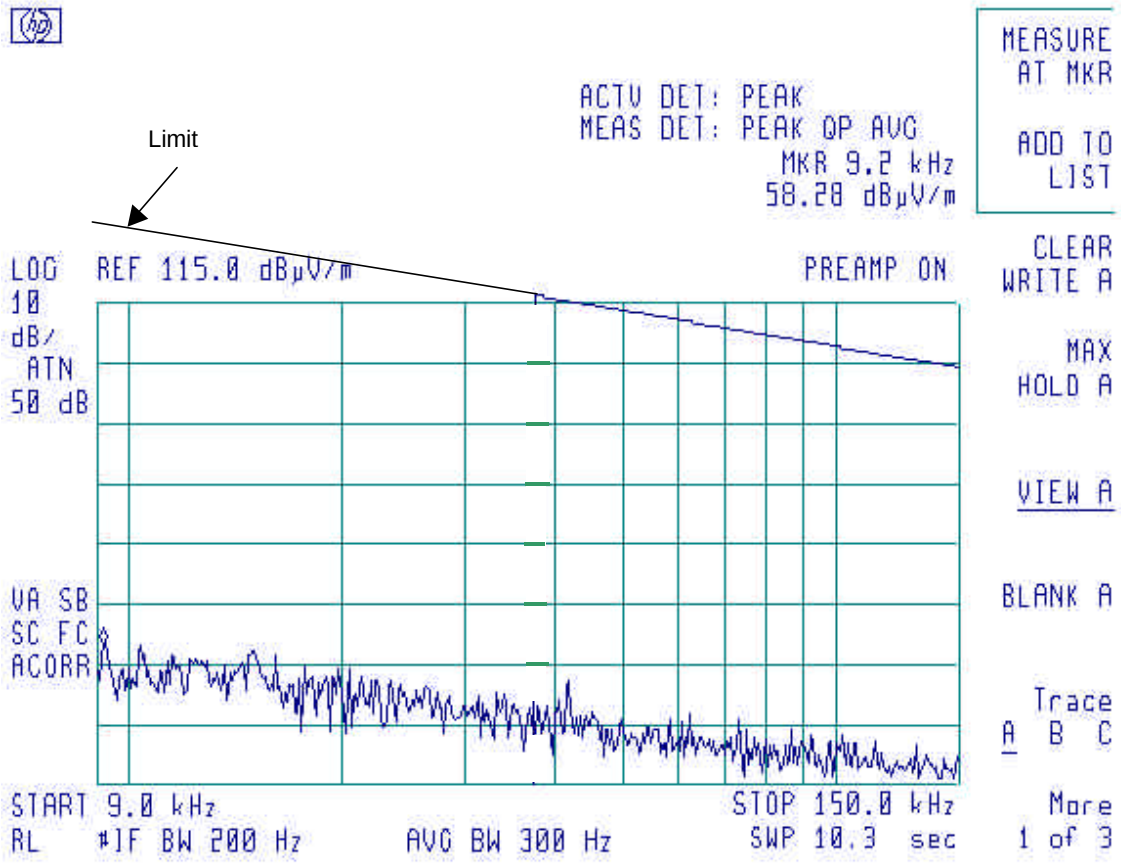
Plot No.6
Tx on (duty cycle) measurement test result



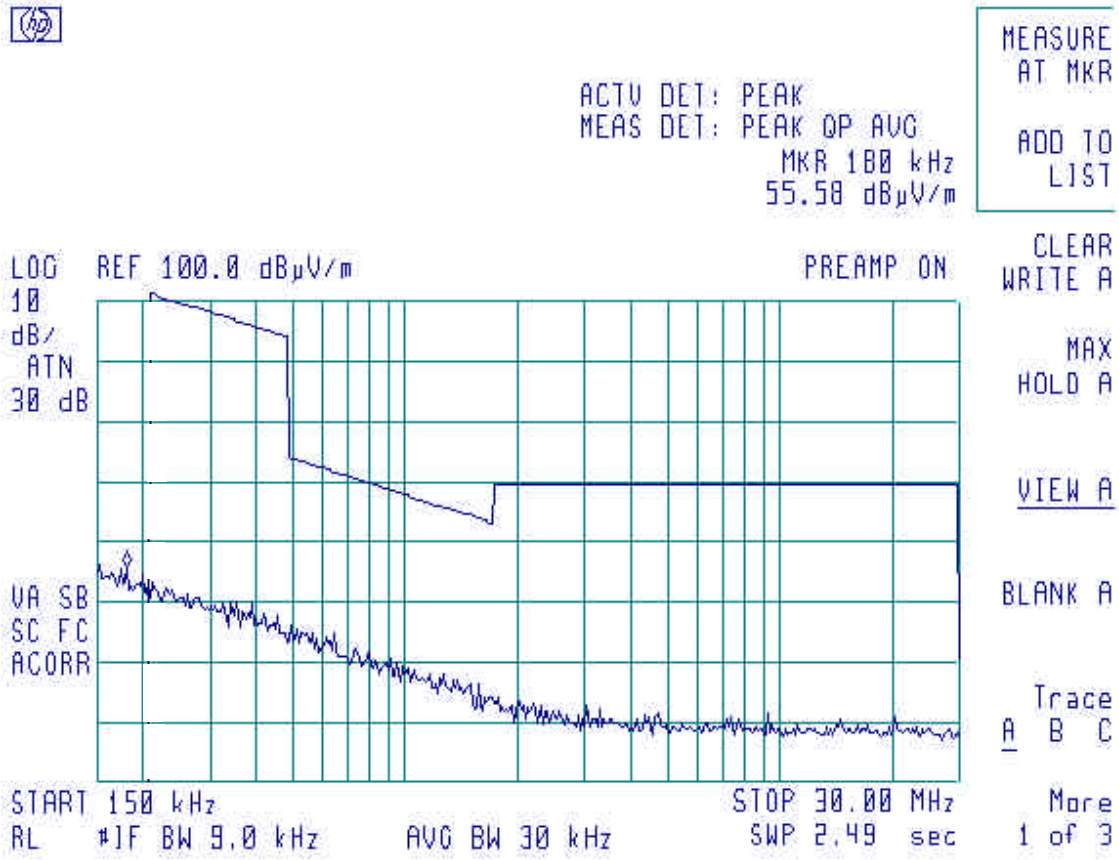
Plot No.7
Tx on (duty cycle) measurement test result



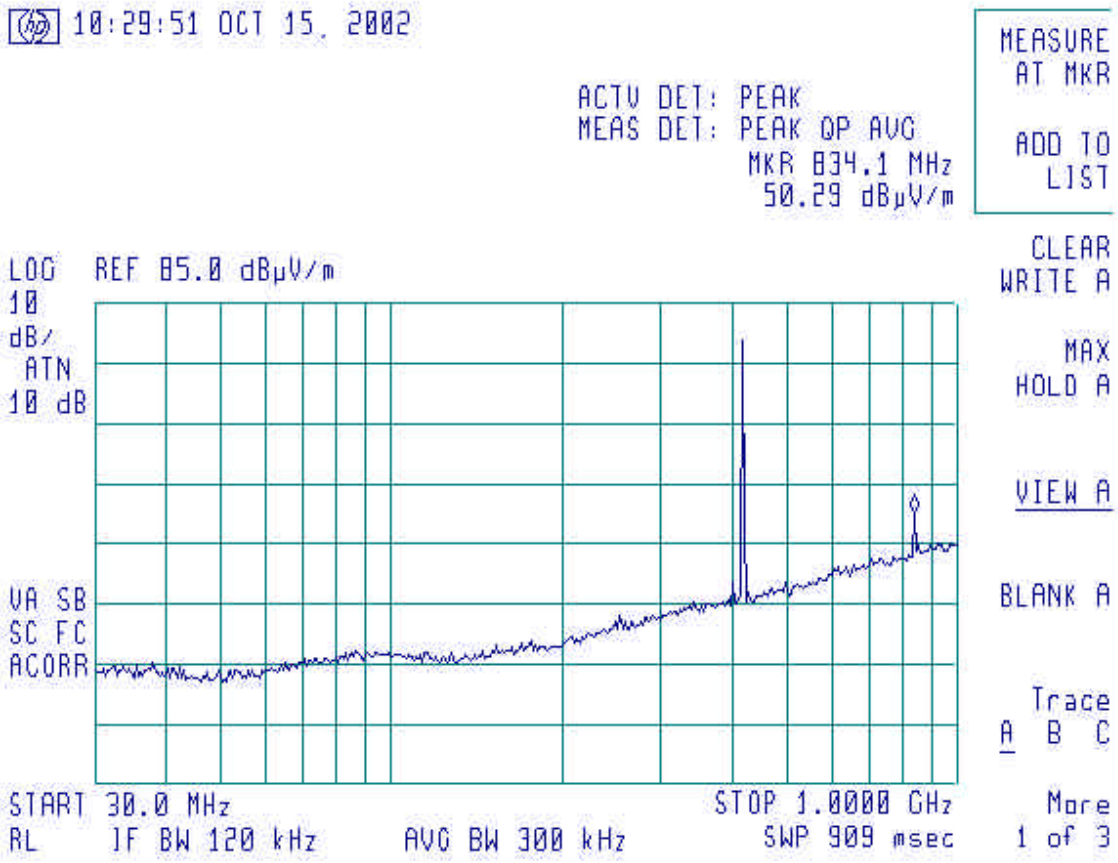
Plot No.8
Spurious emissions test results



Plot No.9
Spurious emissions test results

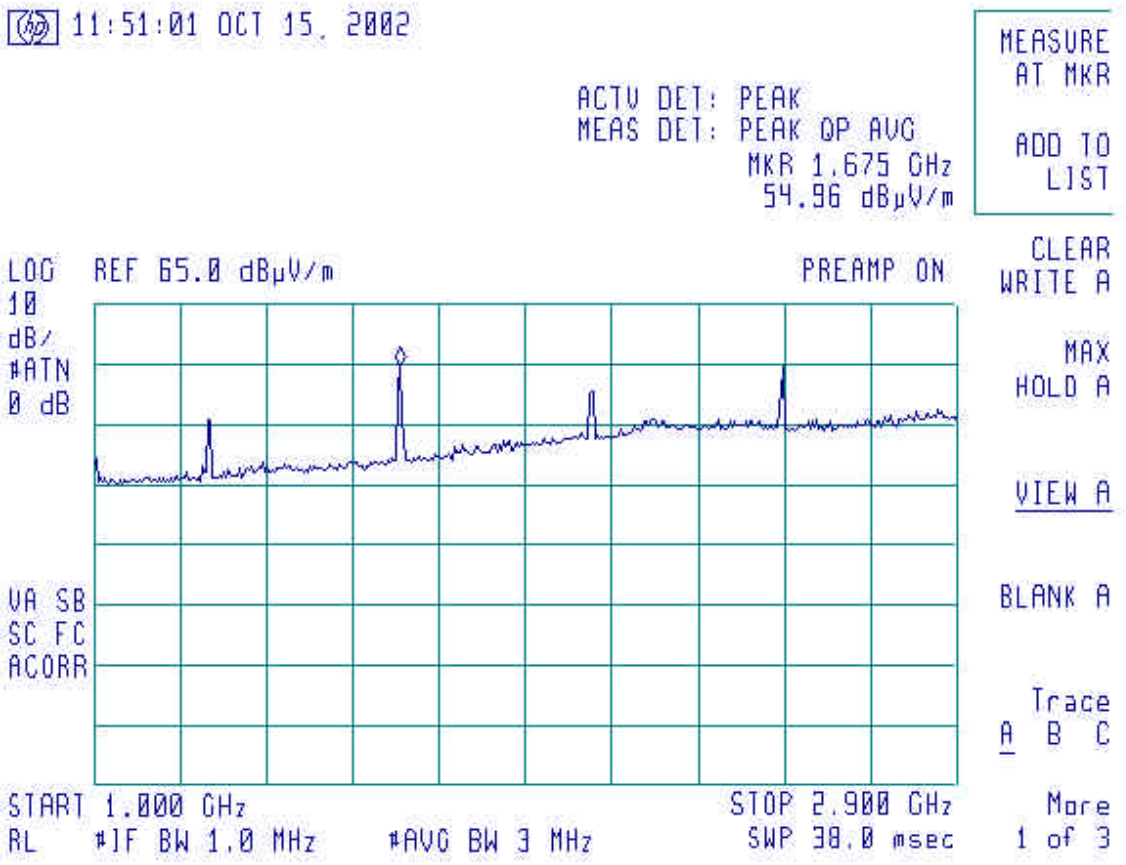


Plot No.10
Spurious emissions test results



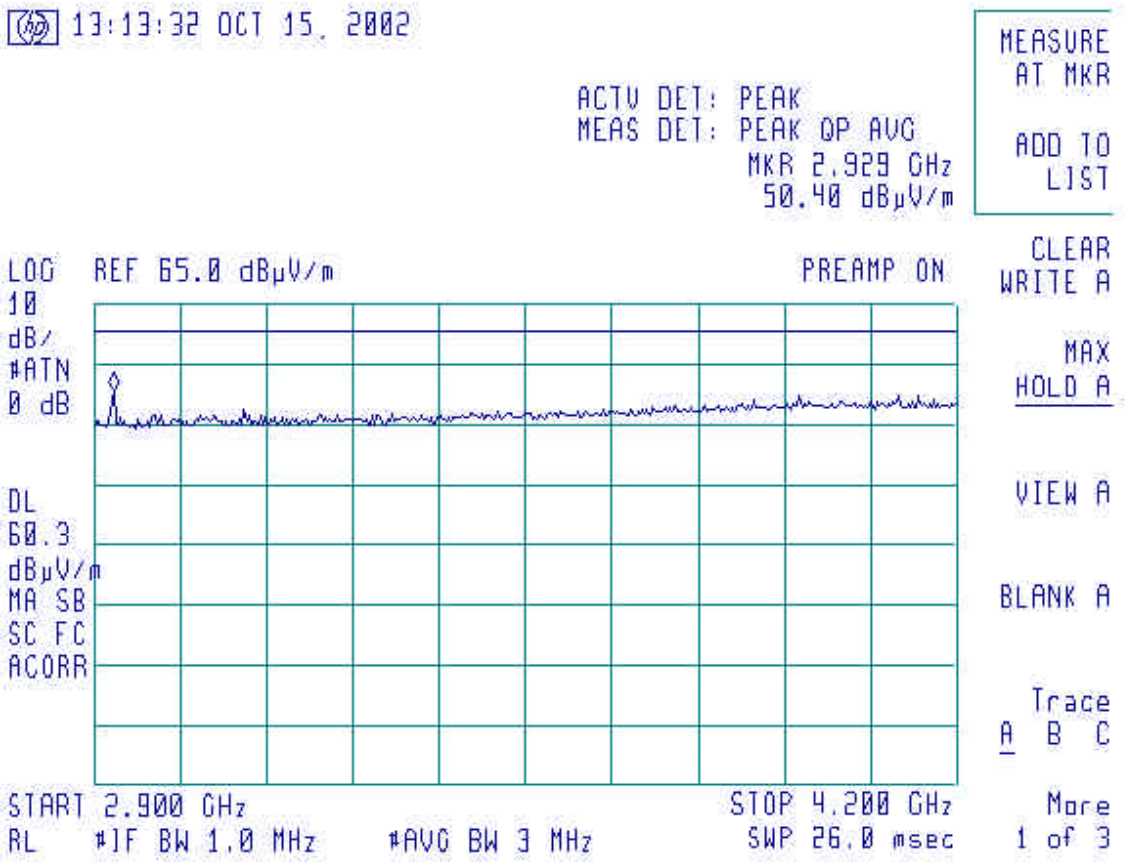
Signal	Frequency, MHz	Peak reference, dB(uV/m)	Average factor, dB	Result, dB(µV/m)	Limit, dB(uV/m)	Margin, dB
1	836.028300	51.15	-16.35	34.8	60.30	-25.5

Plot No.11
Spurious emissions test results



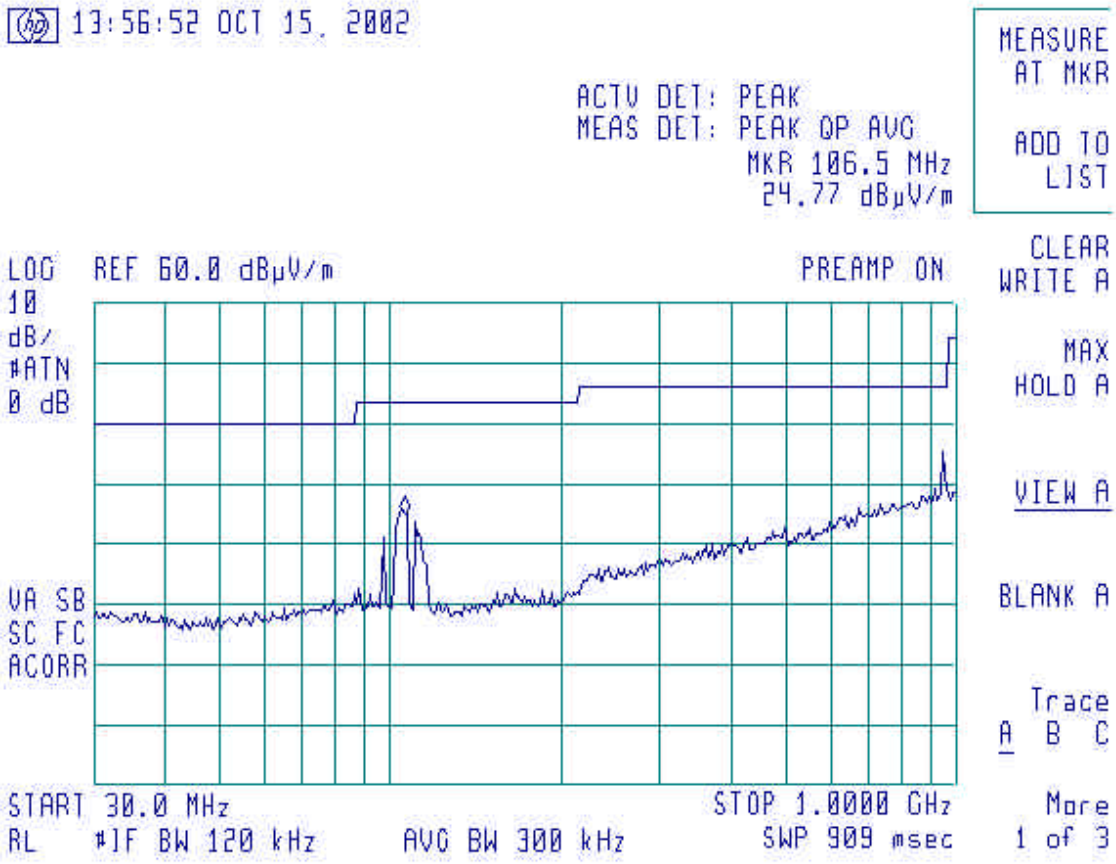
Signal	Frequency, MHz	Peak reference, dB(uV/m)	Average factor, dB	Result, dB(µV/m)	Limit, dB(uV/m)	Margin, dB
1	1672.075000	60.41	-16.35	44.06	54.00	9.94
2	2090.165000	52.14	-16.35	35.79	60.30	24.51
3	2508.047500	58.30	-16.35	41.95	60.30	18.35

Plot No.12
Spurious emissions test results



Signal	Frequency, MHz	Peak reference, dB(uV/m)	Average factor, dB	Result, dB(µV/m)	Limit, dB(uV/m)	Margin, dB
1	2926.195000	53.93	-16.35	37.58	60.30	-22.72

Plot No.13
Unintentional radiated emissions test results



Appendix B - Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibration Month/ year
		Name	Model No.	Serial No.	
0041	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	2811	3/03
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	2/05
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/03
0592	Position controller	Hermon Labs	L2-SR3000	100	5/03 check
0593	Antenna mast, 1-4 m/ 1-6 m pneumatic	Hermon Labs	AM-F1	101	2/03 check
0594	Turntable for anechoic chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	WDC1	102	1/03 check
0604	Antenna biconilog log-periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	1/03
1019	Artificial hand	Hermon Labs	AH-1	173	2/03 check
1942	Cable 18 GHz, 4 m, blue	Rhophase Microwave Ltd.	SPS-1803A-4000-NPS	T4658	10/03

Appendix C – Antenna factors and cable loss

Antenna factor
Double ridged guide antenna
Model RGA-50/60
S/N 2811

Frequency, MHz	Antenna factor, dB(1/m)
1000	24.3
1500	25.4
2000	28.4
2500	29.2
3000	30.5
3500	31.6
4000	33.7
4500	32.2
5000	34.5
5500	34.5
6000	34.6
6500	35.3
7000	35.5
7500	35.9
8000	36.6
8500	37.3
9000	37.7
9500	37.7
10000	38.2
10500	38.5
11000	39.0
11500	40.1
12000	40.2
12500	39.3
13000	39.9
13500	40.6
14000	41.1
14500	40.5
15000	39.9
15500	37.8
16000	39.1
16500	41.1
17000	41.7
17500	45.1
18000	44.3

Antenna factor 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).

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

Appendix C - 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.