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839.01
Electrical

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 4 6288277
e-mail: *mail@hermonlabs.com*

RADIO TEST REPORT

according to 47CFR Part 15, §15.247 and subpart B
for

Roseman Engineering Ltd

EQUIPMENT UNDER TEST:

915 MHz transceiver module
Model: RM915

Document ID: ROSRAD_FCC.15655
Date of Issue: September 2003

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Contents

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

1 Project information

EUT attributes

Test item	915 MHz transceiver module
Type (Model)	RM915
Software revision of radio unit	1.00
Equipment FCC code	DSS

Applicant information

Applicant's responsible person	Mr. Lior Yehoshua, chief engineer
Applicant/Manufacturer	Roseman Engineering Ltd.
Address	65, Weizman street
City	Givataim
Postal code	53468
Country	Israel
Telephone number	+972 3 5731 801
Telefax number	+972 3 5731 807

Test details

Project number	15655
Location	Hermon Laboratories
Receipt date	August 21, 2003
Test started	August 21, 2003
Test completed	September 1, 2003
Purpose of test	Apparatus compliance verification in accordance with emission requirements
Test specifications	47CFR Part 15, §15.247 and subpart B

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P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

2 Summary of tests

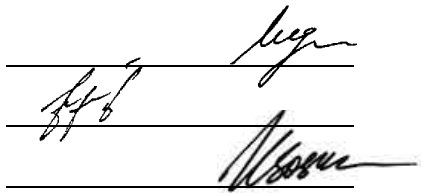
The tests listed in the table below were performed. The EUT was found complying with the limits of 47CFR Part 15, §15.247 and subpart B.

Parameter	Subclause	Tested by	Date tested	Verdict	Remarks
Transmitter characteristics					
Occupied bandwidth of hopping channel	15.247 (a)(1) (i – iii)	Mr. I. Fershtater, test engineer	August 21, 2003	Pass	
Hopping channels frequency separation	15.247 (a)(1)	Mr. I. Fershtater, test engineer	August 21, 2003	Pass	
Number of hopping channels	15.247 (a)(1) (i – iii)	Mr. I. Fershtater, test engineer	August 21, 2003	Pass	
Average time of occupancy	15.247 (a)(1) (i – iii)	Mr. M. Nikishin, EMC group leader	August 21, 2003	Pass	
Maximum peak output power	15.247b(1), b(2), b(3)	Mr. Y. Neuman, test engineer	August 21, 2003	Pass	
Spurious emissions (radiated)	15.247(c), 15.209, 15.205(a,c)	Mr. I. Fershtater, test engineer	August 21, 24, September 1, 2003	Pass	
Conducted emissions at AC line	15.207	Mr. I. Fershtater, test engineer	August 24, 2003	Pass	
Unintentional radiation, §15.107, §15.109					
Conducted emissions	15.107	Mr. I. Fershtater, test engineer	August 24, 2003	Pass	
Radiated emissions	15.109	Mr. I. Fershtater, test engineer	August 24, 2003	Pass	

Test report prepared by: Mrs. V. Mednikov, MSc, certification engineer

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

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



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Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

3 EUT description

3.1 General description

The EUT is a low power FHSS transceiver module, operating in 902-918 MHz band.
The module has an integral antenna and is powered from 9 to 30 V DC.

3.2 EUT test configuration

EUT operating frequencies generated by clocks and oscillators are provided in Table 3.2.1, ports and lines description is given in Table 3.2.2 and the test configuration is shown in Figure 3.2.1.

Table 3.2.1

EUT operating frequencies

Frequency	Description
5.0 MHz	MP clock
16.0 MHz	Synthesizer reference
10.7 MHz	Intermediate frequency

Table 3.2.2

EUT ports and lines

Port type	Port description	Connector type	Quantity	Cable type description	Cable length, m	Connected to
Power	DC power	Header 2x6 pins	1	Unshielded	1	DC PS
Signal	Data		1	Unshielded	1	open circuit

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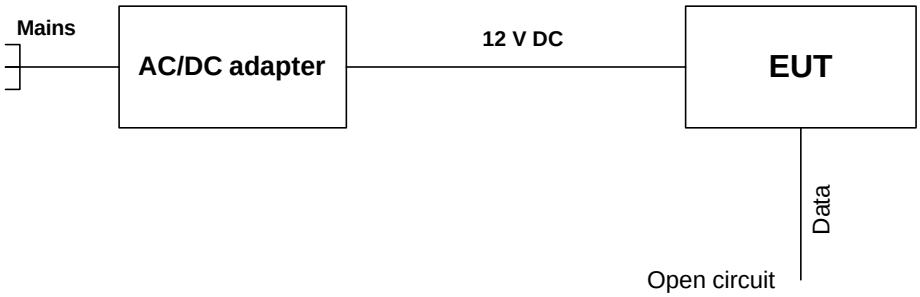
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Figure 3.2.1

EUT test configuration



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Binyamina 30500, Israel
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Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

3.3 Transmitter description

Type of equipment							
X	Stand-alone (Equipment with or without its own control provisions)						
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)						
	Plug-in card (Equipment intended for a variety of host systems)						
	Other:						
Operating frequency range	914.8 – 927.6 MHz						
Spread spectrum technique used							
X	Frequency hopping (FHSS)						
	Digitally modulated						
	Combined						
Spread spectrum parameters							
Dig. Mod.	chip sequence length (bits)						
	spectrum width (MHz)						
FHSS	total number of hops (units)	51					
	dwell time (milliseconds)	212					
	bandwidth per hop (MHz)	0.185					
	max. separation of hops (MHz)	0.26					
Transmitter aggregate data rate (bits per second)					32 kbps		
Normal test signal					PRBS		
Maximum rated output power							
At transmitter permanent external 50 Ω rf output connector (dBm)							
Effective radiated power (for equipment with integral antenna) (dBm)					18		
Is transmitter output power variable?	**X**	No					
		Yes		continuous variable			
				stepped variable			
				stepsize (dB):.....			
				minimum RF power (dBm):.....			
				maximum RF power (dBm):.....			
Transmitter power source							
	Battery	**Nominal rated voltage (VDC)**					
	Nickel Cadmium						
	Lithium						
	Other						
X	**DC**	**Nominal rated voltage (VDC)**	9 to 30				
	AC mains	**Nominal rated voltage (VAC)**					
Is there common power source for transmitter and receiver					**X**	yes		no

Antenna technical characteristics						
			Type	**Manufacturer**	**Model number**	**Gain**
Integral		with temporary RF connector	½ wave centre fed dipole	Galtronics	021006061-2583	0 dBi
	X	without temporary RF connector				
External						

External antenna connection - NA			
	standard connector		unique coupling

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

4 Test results

4.1 Occupied bandwidth of hopping channels and channel carrier frequencies separation according to § 15.247(a)(1)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.7
DATE: August 21, 2003
RELATIVE HUMIDITY: 44 %
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 902-928 MHz
MODULATION TECHNIQUE: FHSS

Carrier frequency, MHz	Measured 20 dB bandwidth, kHz	Reference to Plots in Appendix A
914.849	182.5	A1
921.249	166.3	A2
927.649	155.0	A3
Measurement uncertainty, dB	± 2.3	

Frequency, MHz	Channel carrier frequency separation, kHz	Reference to Plots in Appendix A
Near the lower band edge	257.5	A4
Measurement uncertainty, dB	± 2.3	

TEST EQUIPMENT USED:

HL 0465	HL 0589	HL 0604	HL 1004	HL 2009		

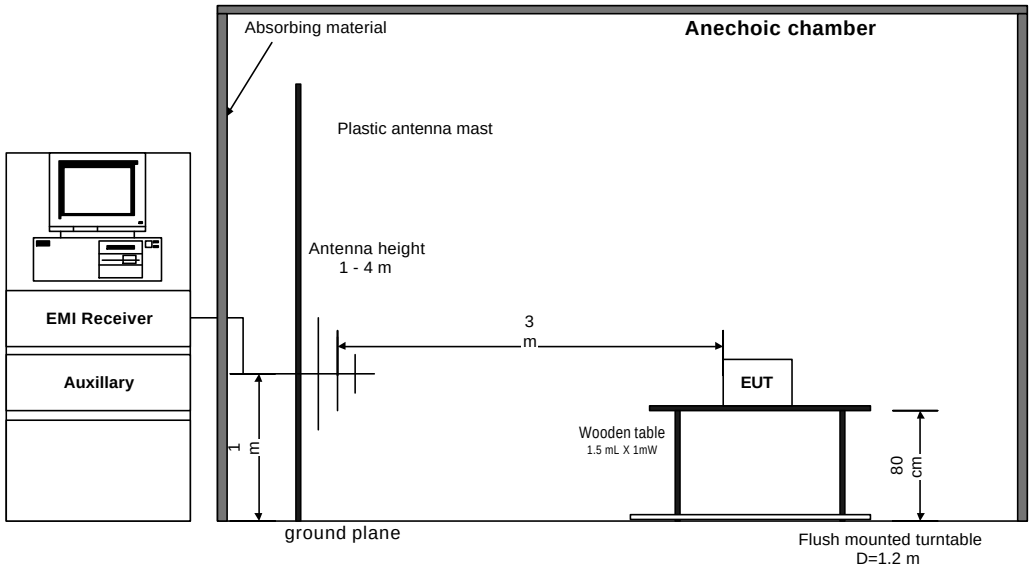
LIMIT

Operating frequency range, MHz	Allowed bandwidth	Channel carrier frequency separation (minimum)
902-928, hopping	≤ 500 kHz @ 20 dBc	25 kHz or 20 dB bandwidth, which is greater
2400-2483.5; 5725-5850, hopping	≤ 1 MHz @ 20 dBc	
2400-2483.5, hopping	> 1 MHz @ 20 dBc	
	any admissible	

TEST PROCEDURE
The EUT was set up as shown in Figure 4.1.1. The measuring antenna was connected to spectrum analyzer, which settings are shown in Plots.
The measurements were performed in normal mode of operation for carrier (channel) frequency at low and high edges and at the middle of the frequency band.

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Figure 4.1.1



Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

4.2 Number of hopping channels according to § 15.247(a)(1)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
DATE: August 21, 2003
RELATIVE HUMIDITY: 44 %
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 902-928 MHz
MODULATION TECHNIQUE: FHSS

Occupied frequency range	Measured 20 dB bandwidth, kHz	Number of channels	Reference to Plots in Appendix A
914-928	182.5	51	A5

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0604	HL 1004	HL 2009	

LIMIT

Operating frequency range, MHz	20 dB bandwidth	Number of frequencies
902-928, hopping	< 250 kHz	≥ 50
	≥ 250 kHz	≥ 25
2400-2483.5; 5725-5850, hopping	≤ 1 MHz	≥ 75
2400-2483.5, hopping	> 1 MHz	≥ 15 non-overlapping channels with total span ≥ 75 MHz
Hybrid	No requirements	

TEST PROCEDURE

The setup was the same as in Paragraph 4.1. The measuring antenna was connected to spectrum analyzer, which settings are shown in Plots.

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

4.3 Average time of hopping frequency occupancy according to § 15.247(a)(1), (f)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
DATE: September 1, 2003
RELATIVE HUMIDITY: 45 %
AMBIENT TEMPERATURE: 24 °C
AIR PRESSURE: 1009 hPa
OPERATING FREQUENCY RANGE: 902-928 MHz
MODULATION TECHNIQUE: FHSS

Carrier frequency, MHz	Total time of 1 transmission at one frequency	Max Tx ON within 1 transmission at one frequency	Maximum time of occupancy during 20 s period	Reference to Plots in Appendix A
921.2493	348 ms	105.6 ms	211.2 ms	A6 – A10
Measurement uncertainty, ppm		± 0.21		

TEST EQUIPMENT USED:

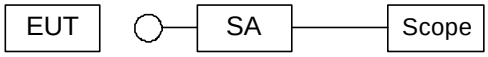
HL 0026	HL 0337	HL 1511	HL 1562			

LIMIT

Operating frequency range, MHz	Number of frequencies	Average time of occupancy
902-928, hopping	≥ 50	≤ 0.4 s within 20 s period
	≥ 25	≤ 0.4 s within 10 s period
2400-2483.5; 5725-5850, hopping	≥ 75	≤ 0.4 s within 30 s period
2400-2483.5, hopping	≥ 15 non-overlapping channels with total span ≥ 75 MHz	≤ 0.4 s within the time required to hop through all channels
Hybrid	with the hopping system operation turned on, an average time of occupancy on any frequency shall not exceed 0.4 s within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.	

TEST PROCEDURE

The EUT was placed 7 cm from a probe, connected to spectrum analyzer. The video output of spectrum analyzer was connected to oscilloscope, which settings are shown in the plots.



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P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

4.4 Maximum peak output power test according to §15.247 (b)(1), (b)(2), (b)(3)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4
DATE: August 21, 2003
RELATIVE HUMIDITY: 44 %
AMBIENT TEMPERATURE: 23 °C
AIR PRESSURE: 1012 hPa
OPERATING FREQUENCY RANGE: 902-928 MHz
MODULATION TECHNIQUE: FHSS
HOPPING FUNCTION: Disabled

Carrier frequency, MHz	Peak output power, dBm	Limit, dBm	Margin, dB	Reference to Plots in Appendix A
914.8493	16.6	30.0	13.4	A11
921.2493	17.8	30.0	12.2	A12
927.6493	17.5	30.0	12.5	A13
Measurement uncertainty, dB		± 2.3		

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0604	HL 1004	HL 2009	

LIMIT

Operating frequency range, MHz	Number of hopping channels	Maximum peak output power, W
902-928 (hopping)	≥ 50	1
	< 50	0.25
2400-2483.5 (hopping)	≥ 75	1
	other admissible	0.125
5725-5850 (hopping)	any admissible	1

TEST PROCEDURE

Field strength of carrier was measured at 3 m test distance.
The EUT was placed on a wooden 80 cm height turntable. 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.
The peak output power was calculated as referred to in pages 27 to 29.

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

4.5 Out of band radiated emissions test according to §15.247(c)

METHOD OF MEASUREMENTS	ANSI 63.4 §13.1.4
DATE:	August 21, September 1, 2003
RELATIVE HUMIDITY:	44 %
AMBIENT TEMPERATURE:	23 °C
AIR PRESSURE:	1012 hPa
RATED RF OUTPUT POWER:	18 dBm
TEST DISTANCE:	3 m
OPERATING FREQUENCY RANGE:	914-928 MHz
MODULATION TECHNIQUE:	FHSS
HOPPING FUNCTION:	Disabled
FREQUENCY RANGE:	5 MHz – 9.3 GHz

For all test results refer to Plots A14 to A67.

Peak detector, RBW = 1 MHz; VBW = 3 MHz

Frequency, GHz	Antenna type	Antenna polarization	Radiated emission, dB (μV/m)	Limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
2.7445	Horn	Vertical	50.0	74.0	24.0	A26
2.7639	Horn	Vertical	48.5	74.0	25.5	A42
2.7830	Horn	Vertical	51.2	74.0	22.8	A63
Measurement uncertainty, dB			± 2.36 dB			

Average detector, RBW = 1 MHz, VBW = 10 Hz

Frequency, MHz	Antenna type	Antenna polarization	Radiated emission, dB (μV/m)	Limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
2.7445	Horn	Vertical	36.7	54.0	17.3	A27
2.7639	Horn	Vertical	36.3	54.0	17.7	A43
2.7830	Horn	Vertical	38.5	54.0	15.5	A64
Measurement uncertainty, dB			± 2.36 dB			

Notes to table:
Margin = dB below (negative if above) specification limit.
RBW = resolution bandwidth;
VBW = video bandwidth.

TEST EQUIPMENT USED:

HL 0446	HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 1004	HL 1200	HL 1424	HL 1942	HL 1947	HL 1954
HL 1984	HL 2009	HL 2259	HL 2432			

LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

TEST PROCEDURE

5 – 30 MHz range. The EUT was placed on a wooden 80 cm height turntable. 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 range. The EUT was placed on a wooden 80 cm height turntable. 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.

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

4.6 Unintentional radiated emissions test according to §15.109

METHOD OF MEASUREMENT:	ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
MODE OF OPERATION	Rx
DATE:	August 24, 2003
RELATIVE HUMIDITY	51 %
AMBIENT TEMPERATURE:	25°
AIR PRESSURE	1011 hPa
TEST PERFROMED IN:	ANECHOIC CHAMBER
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
THE EUT WAS TESTED AS:	TABLE-TOP
FREQUECNY RANGE:	30 – 1000 MHz
DETECTOR TYPE:	QUASI-PEAK
RESOLUTION BANDWIDTH:	120 kHz

	The EUT highest used frequency (not including operating frequency), MHz	**Upper frequency of measurement range, MHz**
	Below 1.705	30
X	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

All emissions were found more than 15 dB below the specified limit, refer to Plots A68, A69.

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0604	HL 1004	HL 2009	

LIMIT (§ 15.109)

Frequency, MHz	**Class A equipment @ 10 m dB(μV/m)**	**Class B equipment @ 3 m dB(μV/m)**
30 - 88	39.0	40
88 - 216	43.5	43.5
216 - 960	46.4	46
960 - 5000	49.5	54

TEST PROCEDURE

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

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P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

4.7 Conducted emission test according to §15.207, §15.107

METHOD OF MEASUREMENTS:	ANSI 63.4 §13.1.3
MODE OF OPERATION:	Tx; Rx
DATE:	August 24, 2003
RELATIVE HUMIDITY:	51%
AMBIENT TEMPERATURE:	25°C
AIR PRESSURE:	1011 hPa
THE EUT WAS TESTED AS:	TABLE-TOP
DETECTOR USED:	PEAK
FREQUECNY RANGE:	150 kHz – 30 MHz
RESOLUTION BANDWIDTH:	9 kHz

Conducted disturbances from the EUT measured using peak detector were found more than 30 dB below the average limit, hence, further measurements with quasi-peak and average detectors were considered unnecessary. The test results are demonstrated in Plots A70 to A73.

TEST EQUIPMENT USED:

HL 0163	HL 0787	HL 1202	HL 1502	HL 1510		

LIMIT § 15.207, § 15.107

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

*The limit decreases linearly with the logarithm of frequency.

TEST PROCEDURE

The EUT was set up as shown in Photograph 1. The measurements were performed at AC/DC adapter input terminals by means of the LISN, connected to a spectrum analyzer. The unused coaxial connector of the LISN was terminated with 50 Ω. The position of device cables was varied to determine maximum emission level.

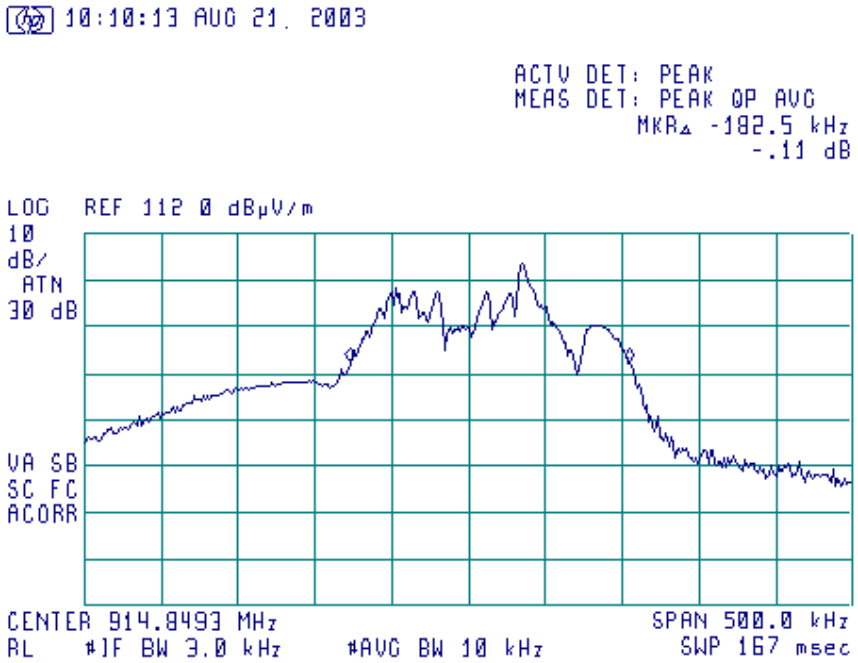
Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Appendix A Plots

Plot A1

20 dB bandwidth

F_{LOW}: 914.8493 MHz



20 dB bandwidth = 182.5 kHz

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Binyamina 30500, Israel
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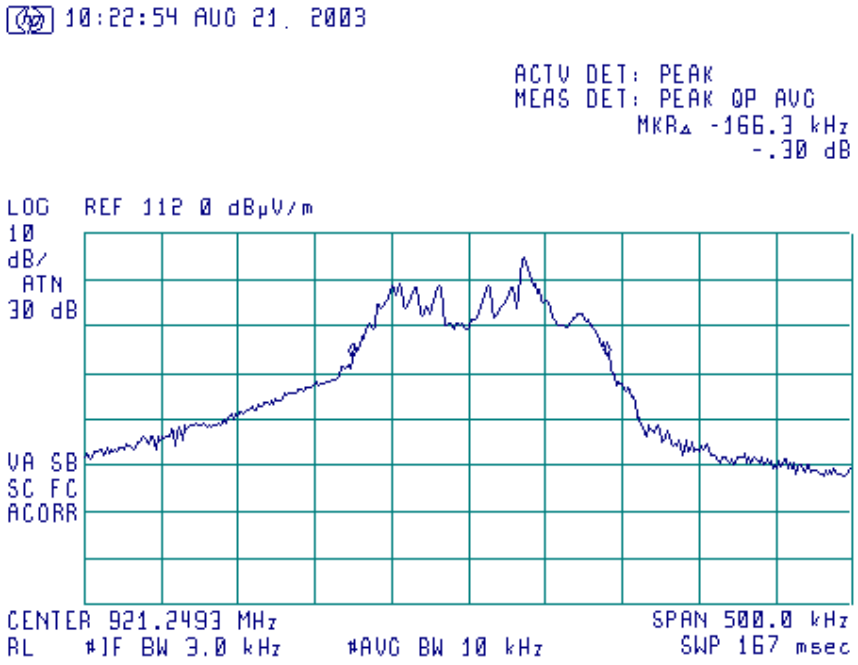
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A2

20 dB bandwidth

F_{MIDDLE}: 921.2493 MHz



20 dB bandwidth = 166.3 kHz

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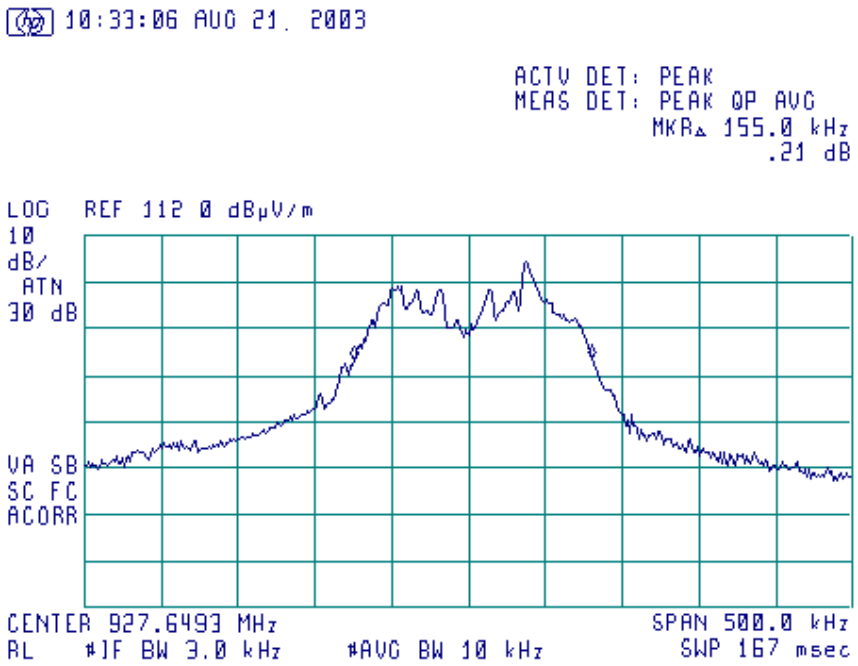
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A3

20 dB bandwidth

F_{HIGH}: 927.6493 MHz

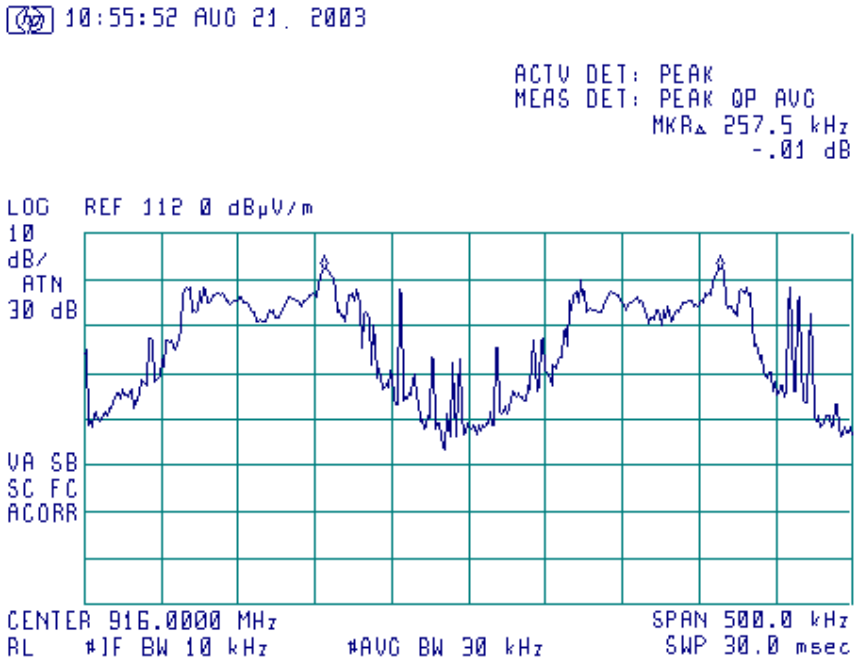


20 dB bandwidth = 155 kHz

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A4

Channel carrier frequencies separation

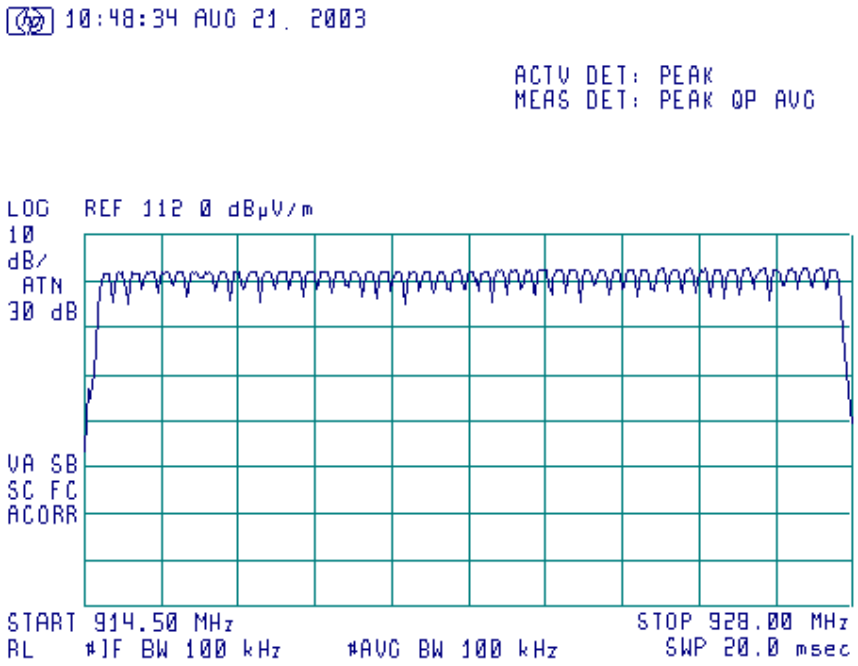


Channel carrier frequency separation is 257.5 kHz

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A5

Number of hopping channels



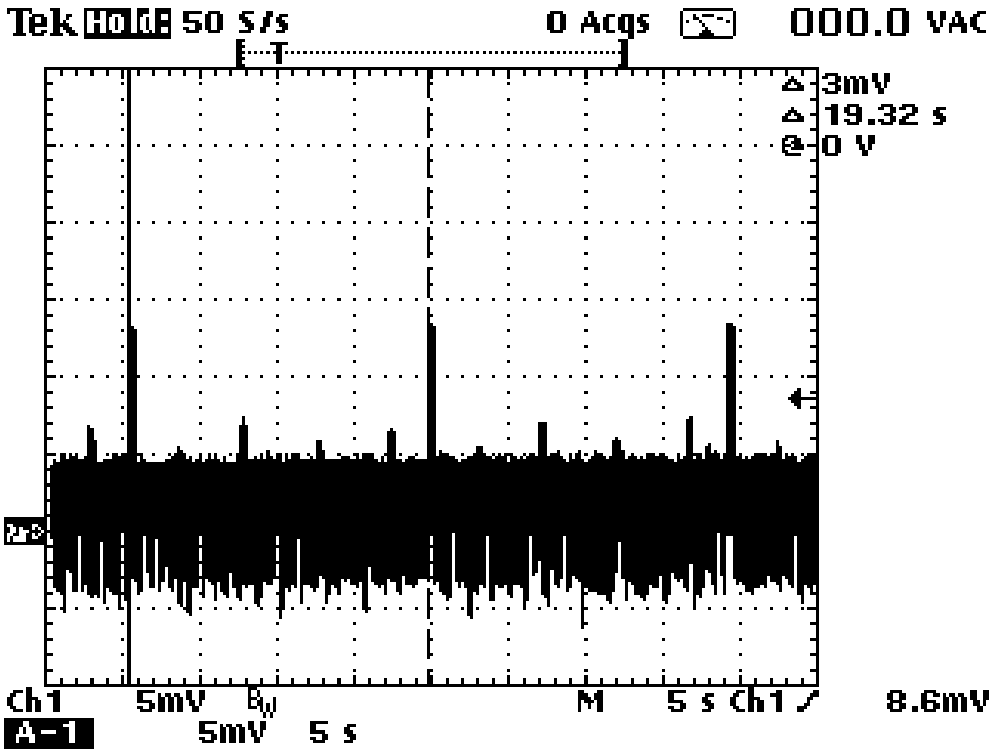
51 hopping frequencies

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A6

Average time of occupancy

Transmission bursts repetition rate



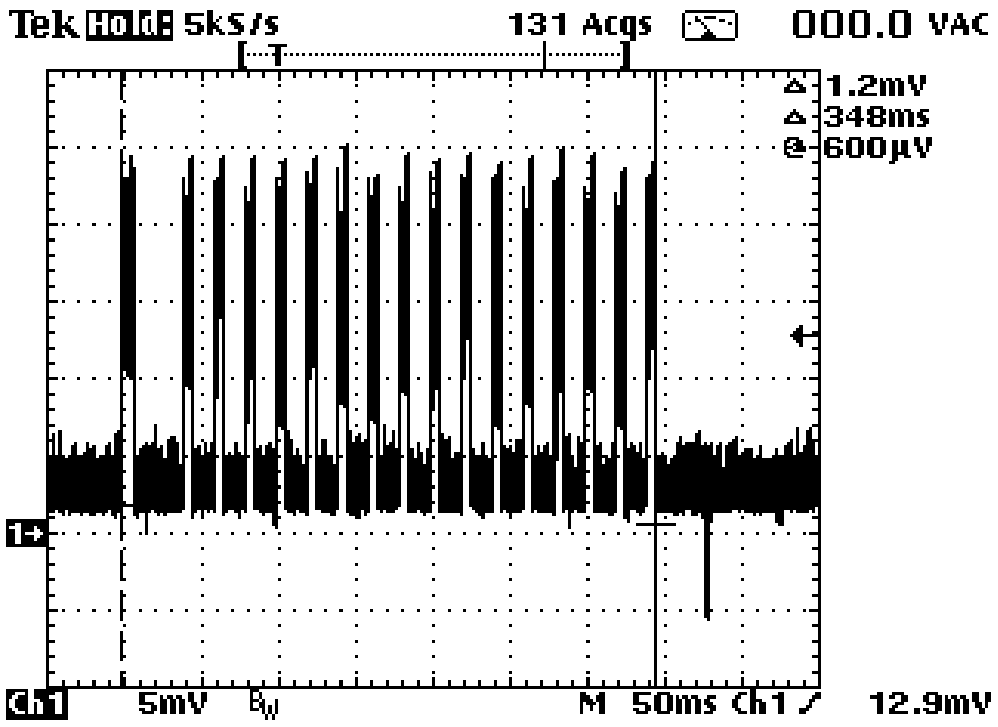
Transmission burst repetition rate is 19.32 s

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A7

Average time of occupancy

Burst duration



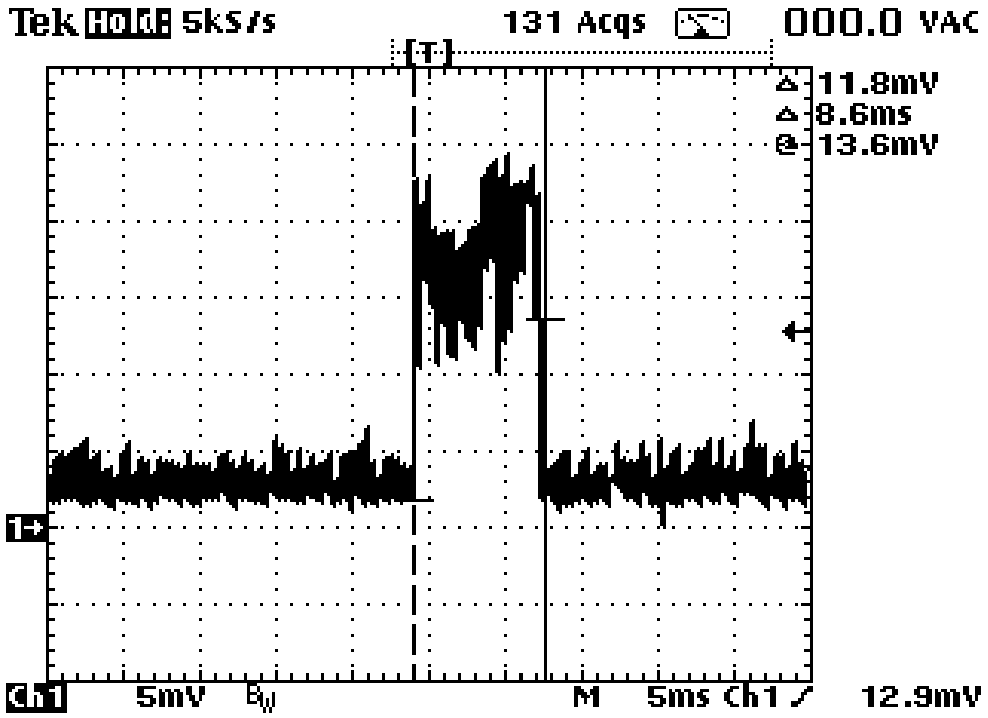
Burst duration is 348 ms

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A8

Average time of occupancy

First transmission pulse duration



First pulse duration is 8,6 ms

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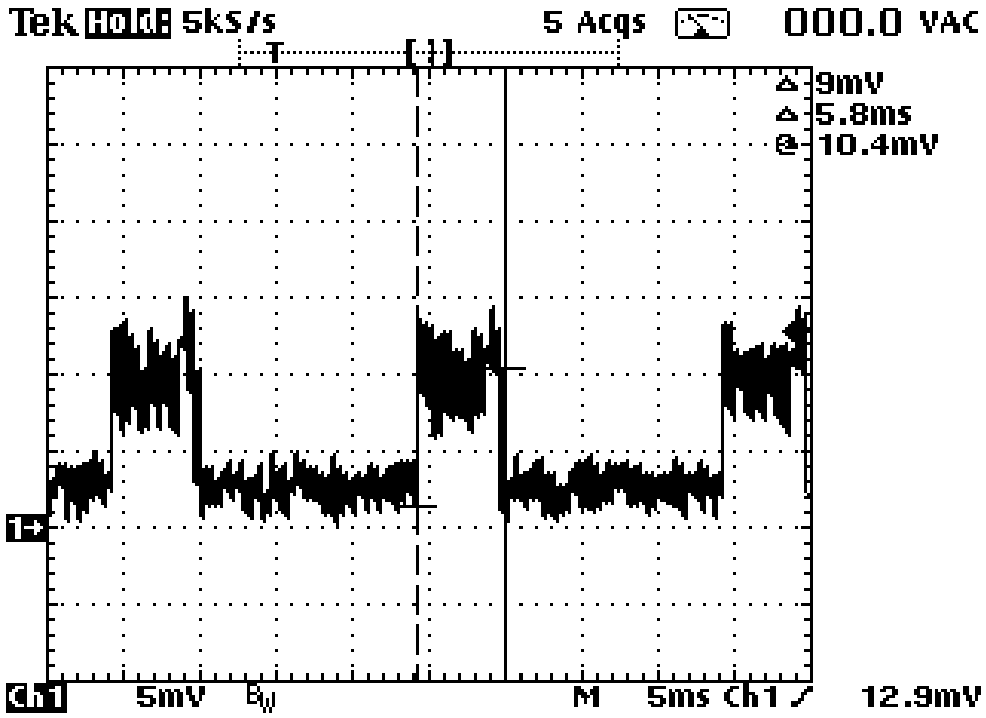
Plot A9

Average time of occupancy

Transmission pulse duration



Other pulse duration is 5.8 ms

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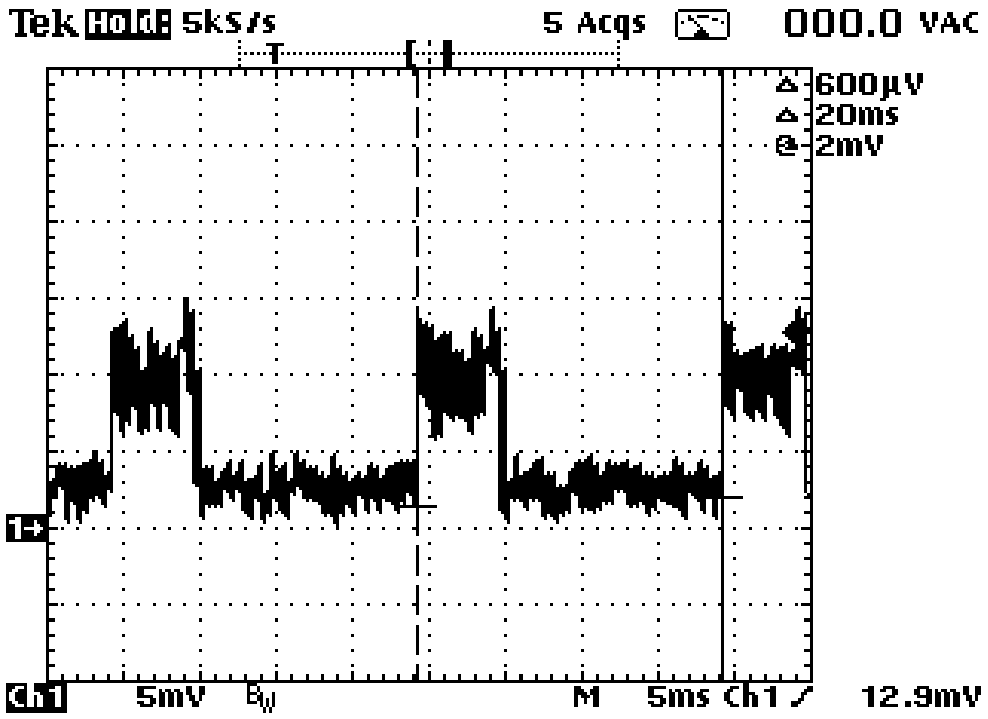
Plot A10

Average time of occupancy

Transmission pulse repetition rate



Pulse repetition rate within one transmission is 20 ms

Tx ON within one transmission burst = 8.6 + 16*5.8 = 101.4 ms
According to Operational description, supplied by the customer, the maximum first pulse duration is 12.8 ms, hence the maximum Tx ON within one transmission burst = 7 + 17*5.8 = 105.6 ms

Maximum time of occupancy within 20 s period = 2*105.6 = 211.2 ms

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Binyamina 30500, Israel
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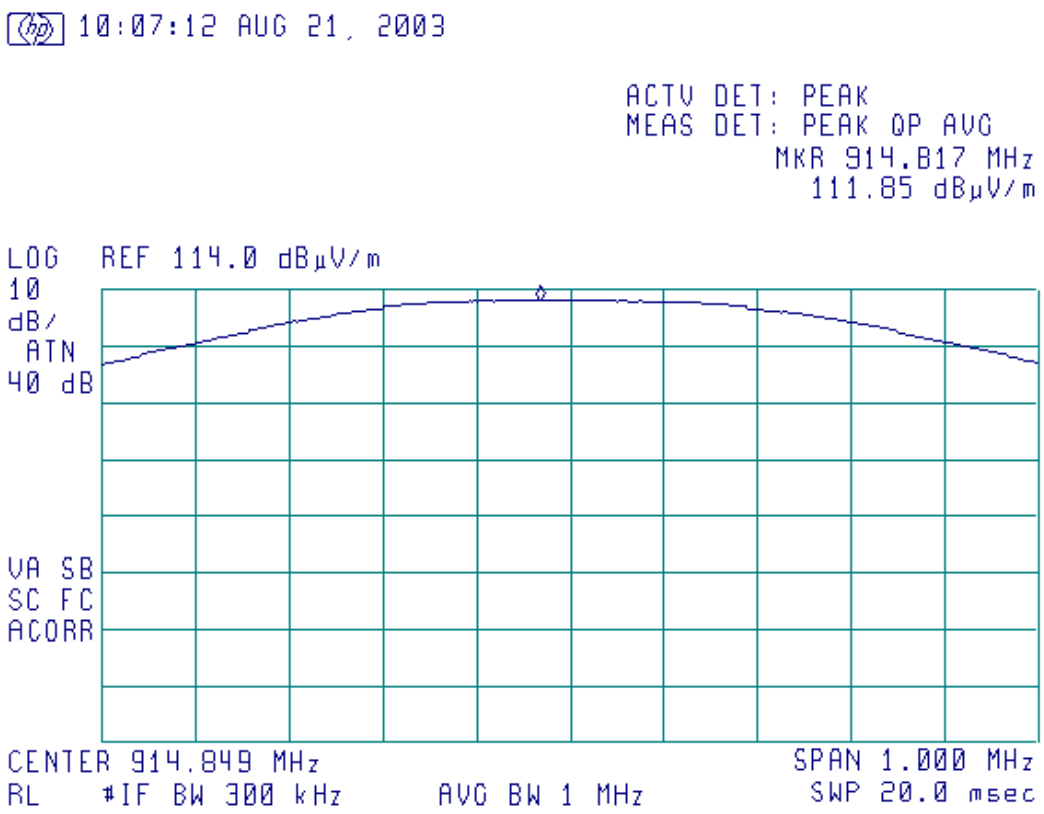
Plot A11

Peak output power

F_{LOW} 914.8493 MHz



Antenna polarization: vertical
E = 111.85 dB(µV/m) @ 3 m
Calculation of peak output power: 111.85 – 95.23 – 0 (Antenna gain) = 16.62 dBm

The maximum field strength E, measured with RBW = 100 kHz, was found 109.95 dB(µV/m) and was taken as a reference level for calculating spurious emission limit.

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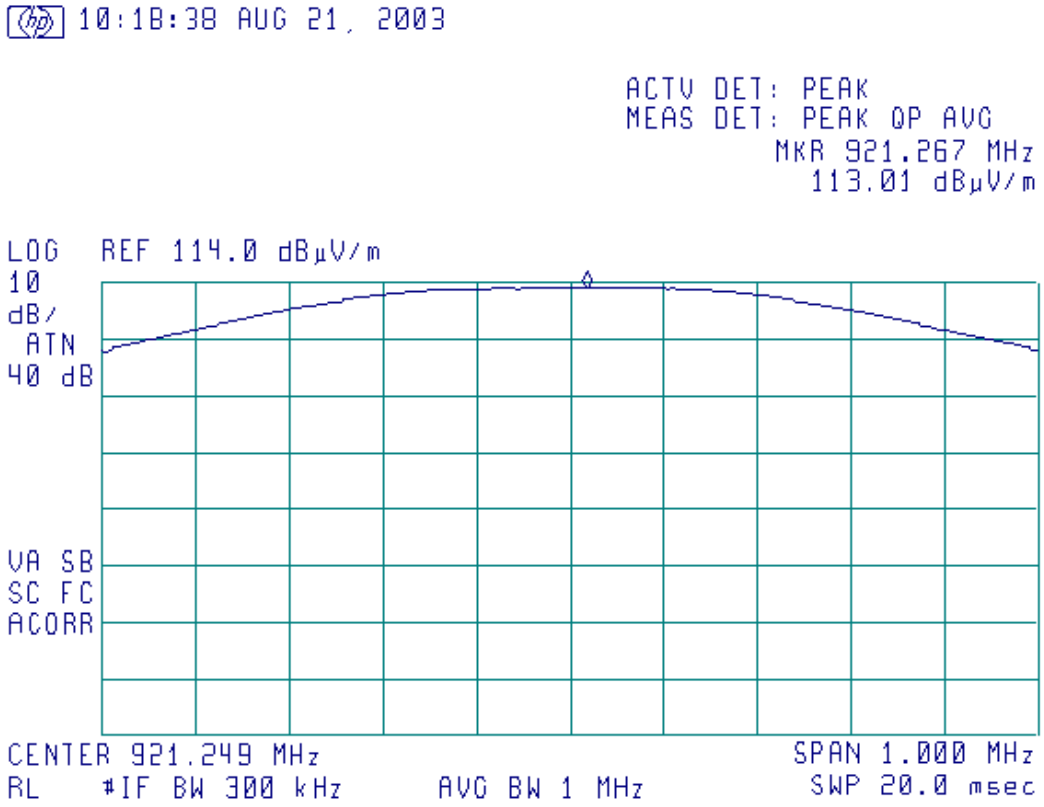
Plot A12

Peak output power

F_{MIDDLE}: 921.2493 MHz



Antenna polarization: vertical
E = 113.01 dB(µV/m) @ 3 m
Calculation of peak output power: 113.01 – 95.23 – 0 (Antenna gain) = 17.78 dBm

The maximum field strength E, measured with RBW = 100 kHz, was found 111.05 dB(µV/m) and was taken as a reference level for calculating spurious emission limit.

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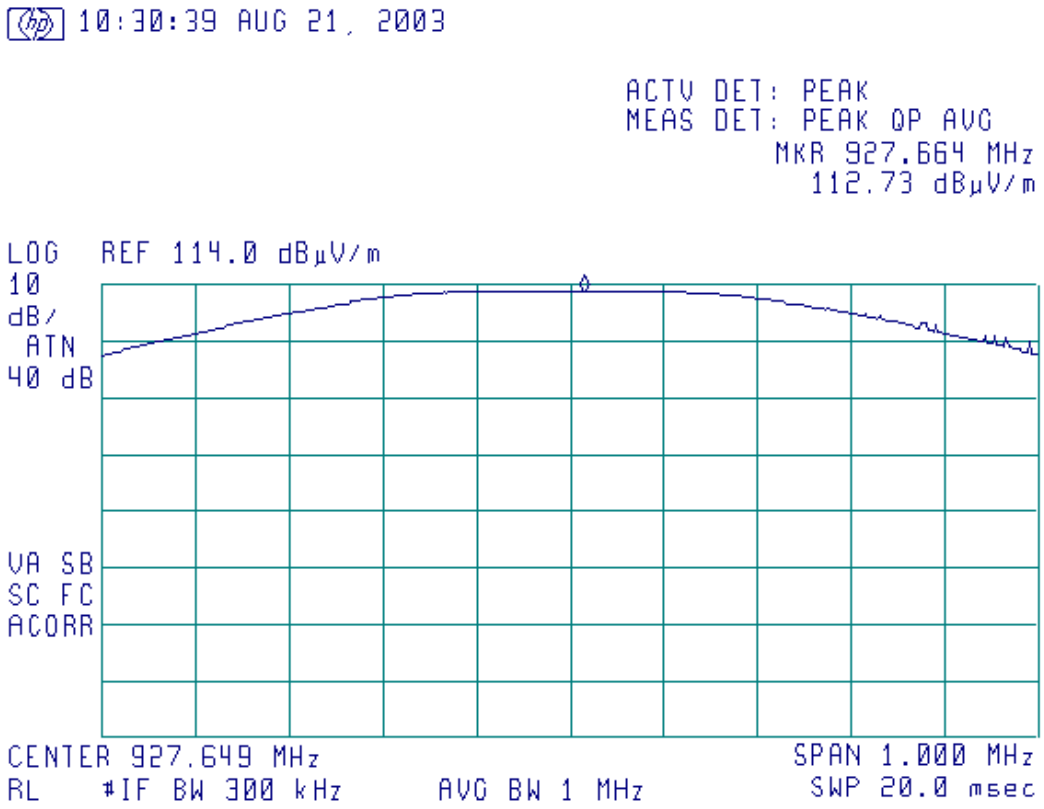
Plot A13

Peak output power

F_{HIGH} 927.6493 MHz



Antenna polarization: vertical
E = 112.73 dB(µV/m) @ 3 m
Calculation of peak output power: 112.73 – 95.23 – 0 (Antenna gain) = 17.5 dBm

The maximum field strength E, measured with RBW = 100 kHz, was found 110.89 dB(µV/m) and was taken as a reference level for calculating spurious emission limit.

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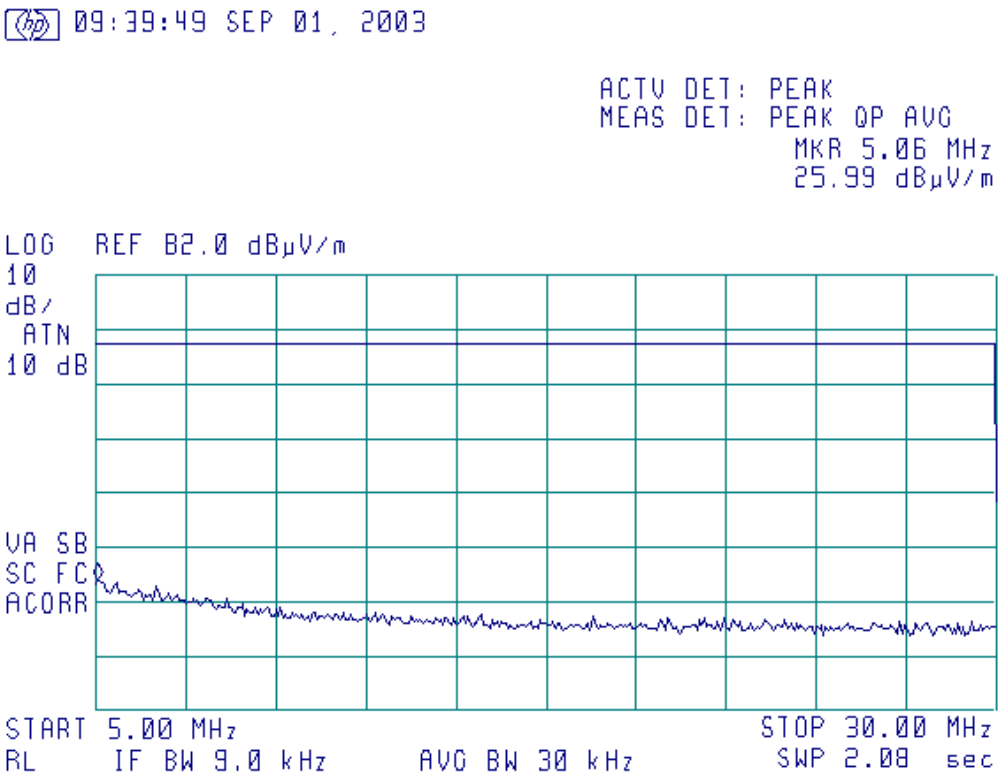
Plot A14

Radiated spurious emission measurements
in 5 – 30 MHz range
F_{LOW} = 914.8493 MHz



No spurious emissions were found

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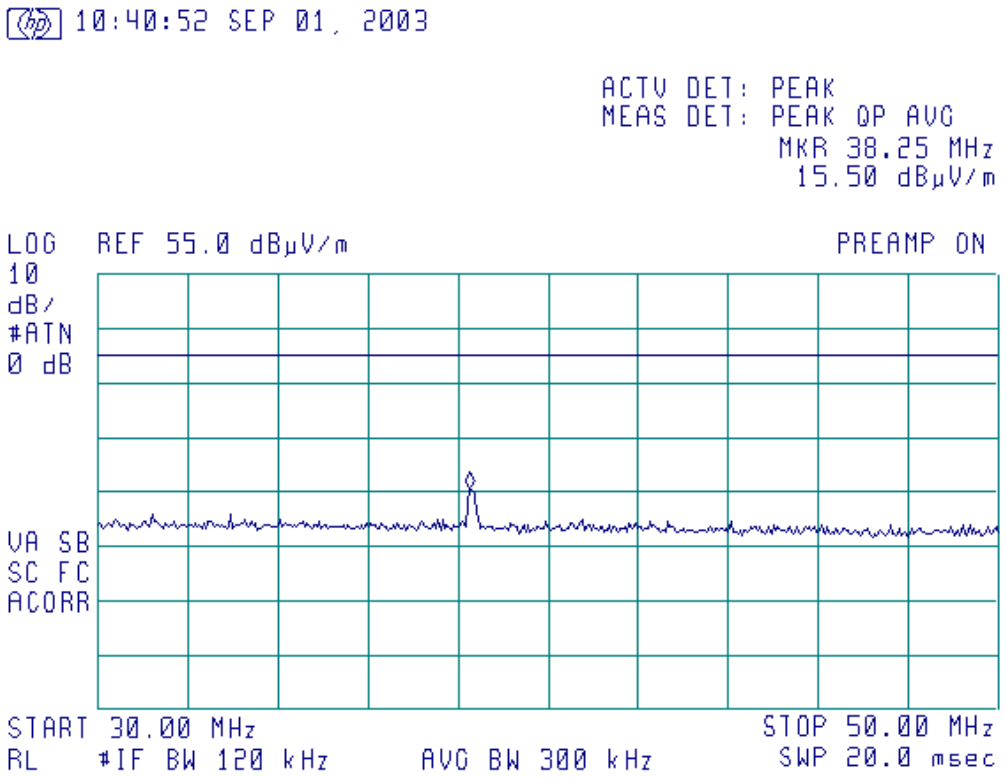
Plot A15

Radiated spurious emission measurements
in 30 – 50 MHz range
F_{LOW} = 914.8493 MHz

Vertical and horizontal polarization



Limit (quasi-peak) for radiated spurious emissions in restricted bands is 40 dB(µV/m)

No spurious emissions were found.

Ambient noise more than 24 dB below the limit

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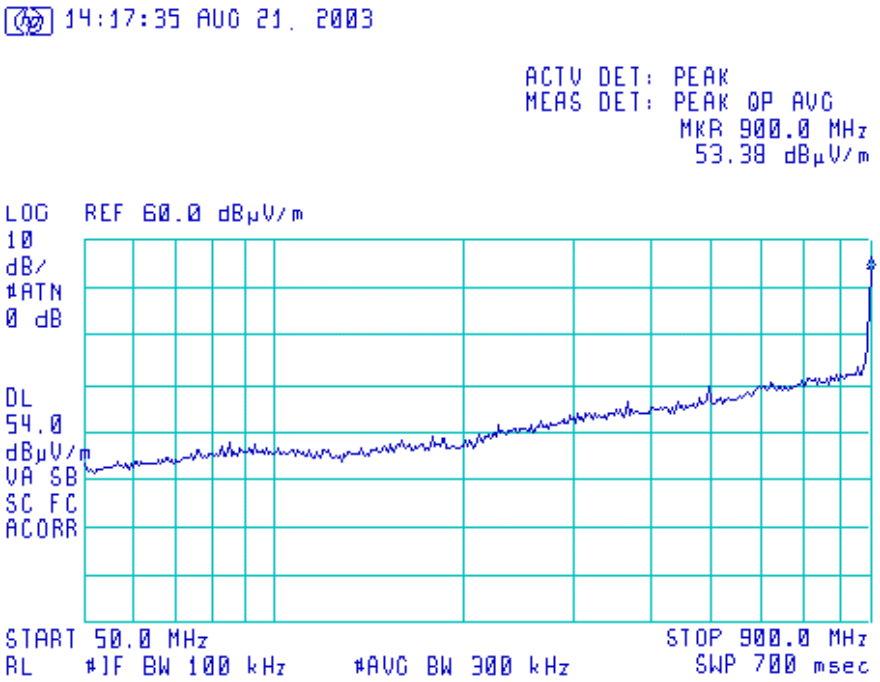
Plot A16

Radiated spurious emission measurements
in 50 – 900 MHz range
F_{LOW} = 914.8493 MHz

Vertical polarization



The limit for radiated spurious emissions at 900 MHz is 89.95 dB(µV/m)

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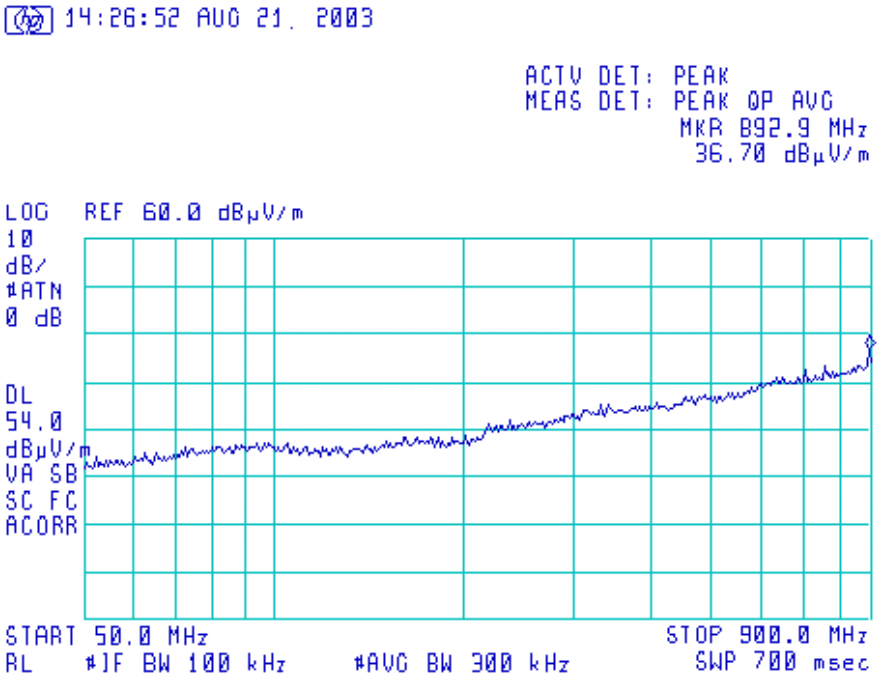
Plot A17

Radiated spurious emission measurements
in 50 – 900 MHz range
F_{LOW} = 914.8493 MHz

Horizontal polarization



The limit for radiated spurious emissions at 900 MHz is 89.95 dB(µV/m)

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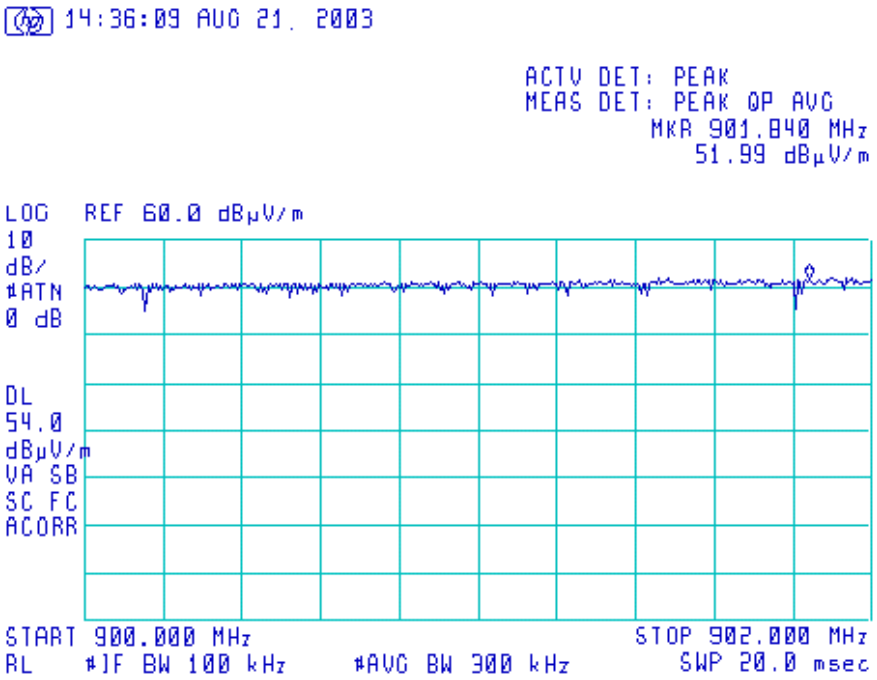
Plot A18

Radiated spurious emission measurements
in 900 – 902 MHz range
F_{LOW} = 914.8493 MHz

Vertical polarization



The limit for radiated spurious emissions is 89.95 dB(µV/m)

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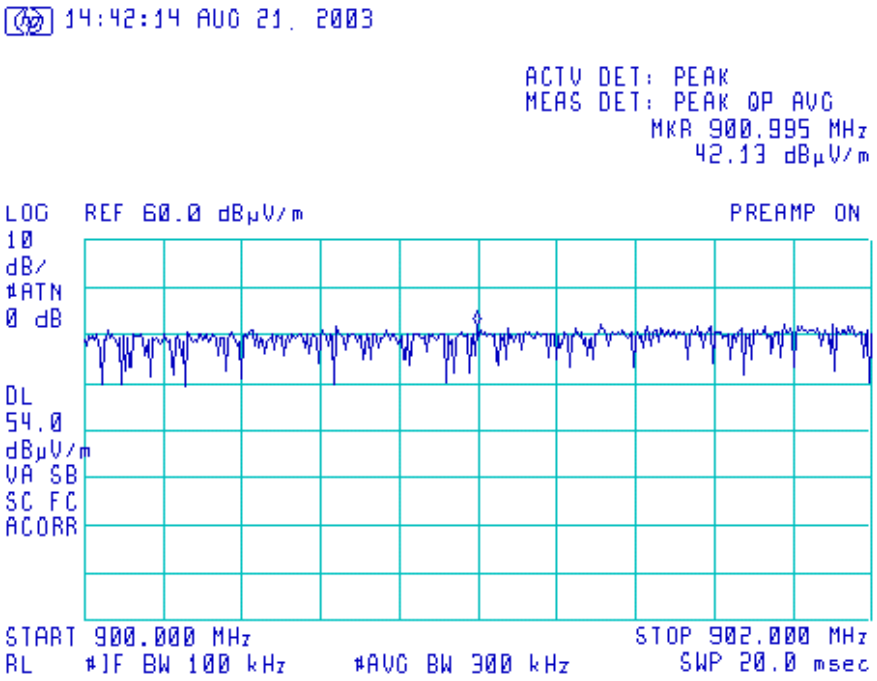
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A19

Radiated spurious emission measurements
in 900 – 902 MHz range
F_{LOW} = 914.8493 MHz

Horizontal polarization



The limit for radiated spurious emissions is 89.95 dB(µV/m)

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Fax.+972 46288277
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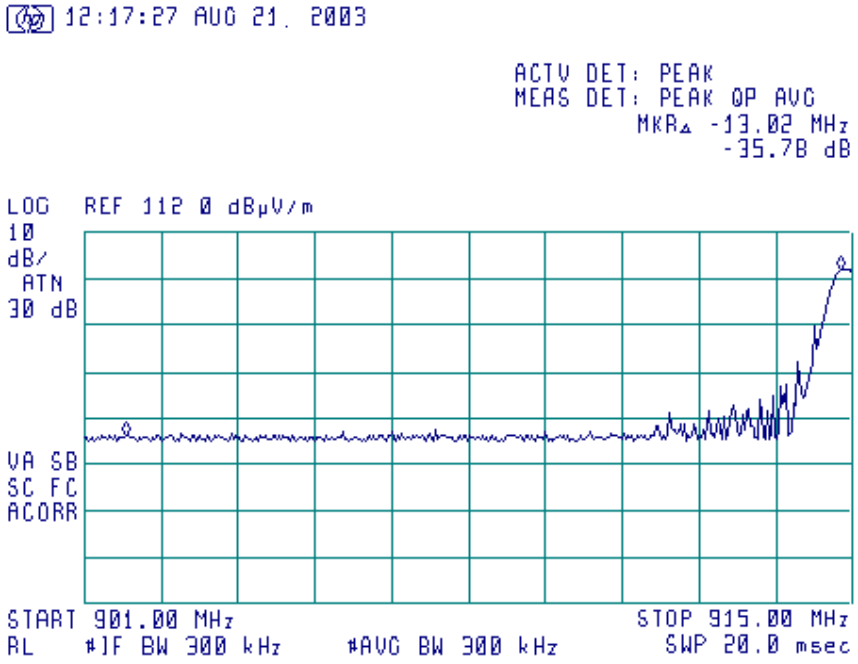
Plot A20

Radiated spurious emission measurements
in 901 – 915 MHz range
F_{LOW} = 914.8493 MHz

Vertical polarization



Emission level at the lower band edge is more than 35 dB below the carrier field strength level

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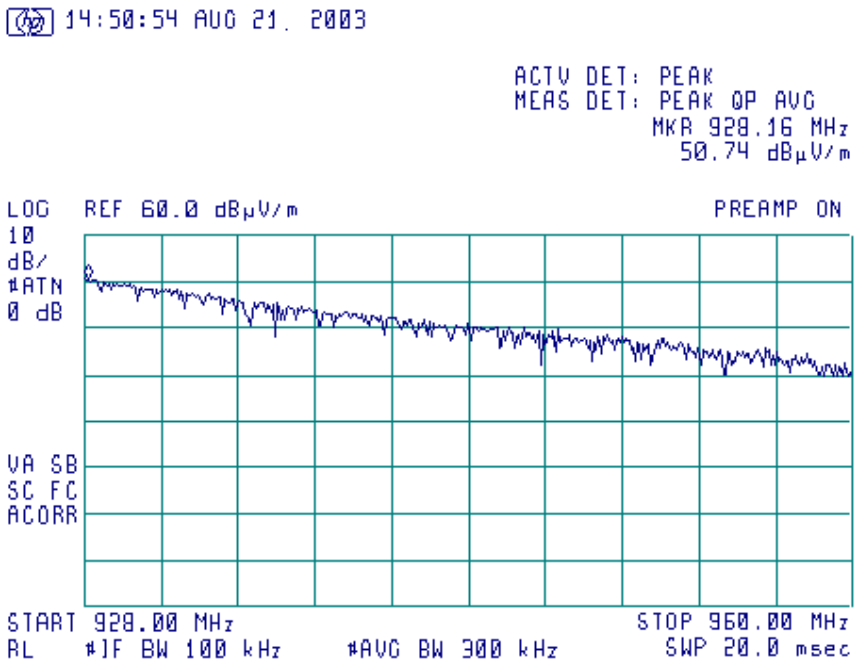
e-mail: *mail@hermonlabs.com*

Plot A21

Radiated spurious emission measurements
in 928 – 960 MHz range
F_{LOW} = 914.8493 MHz

Vertical polarization



The limit for radiated spurious emissions is 89.95 dB(µV/m)

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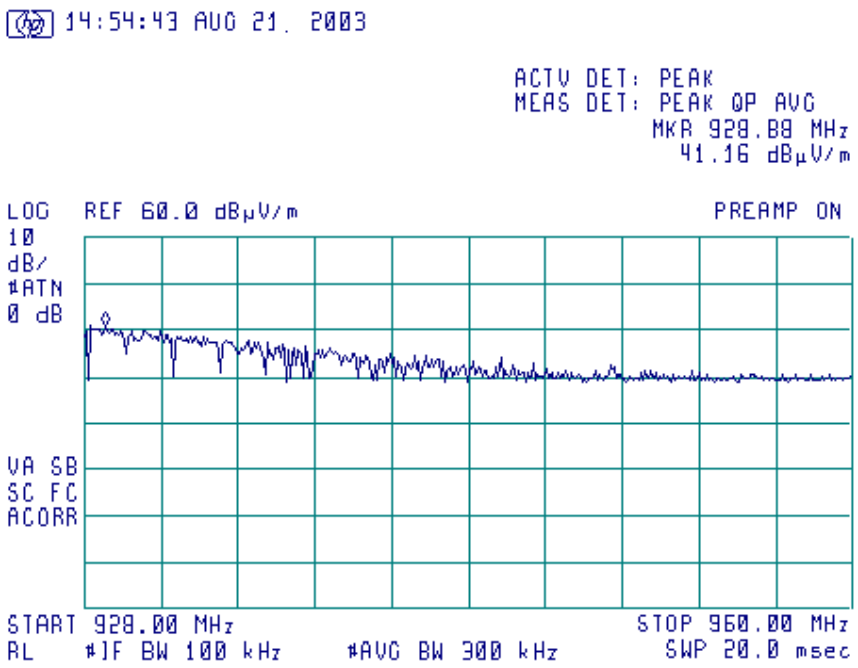
Plot A22

Radiated spurious emission measurements
in 928 – 960 MHz range
F_{LOW} = 914.8493 MHz

Horizontal polarization



The limit for radiated spurious emissions is 89.95 dB(µV/m)

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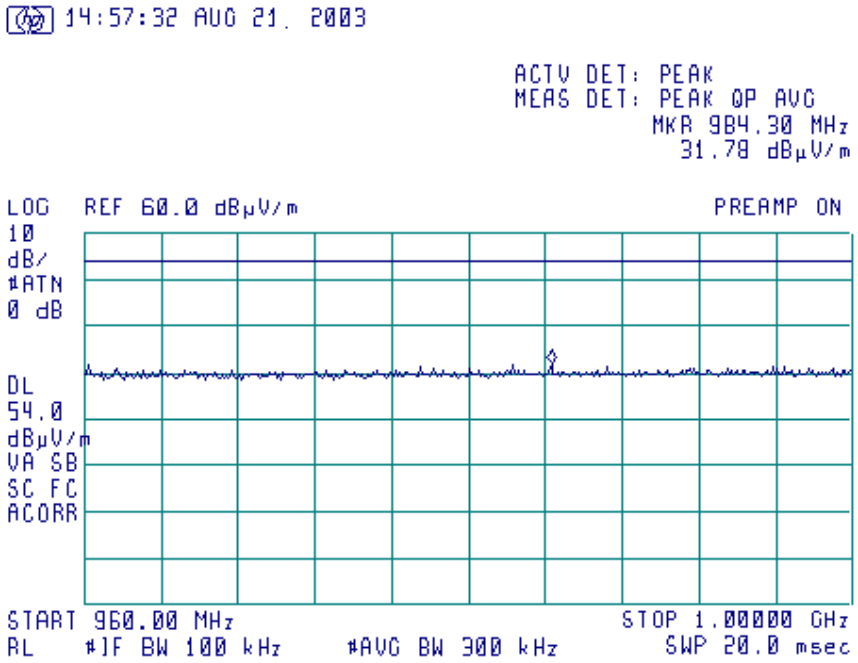
Plot A23

Radiated spurious emission measurements
in 960 – 1000 MHz range
F_{LOW} = 914.8493 MHz

Vertical polarization



Limit (quasi-peak) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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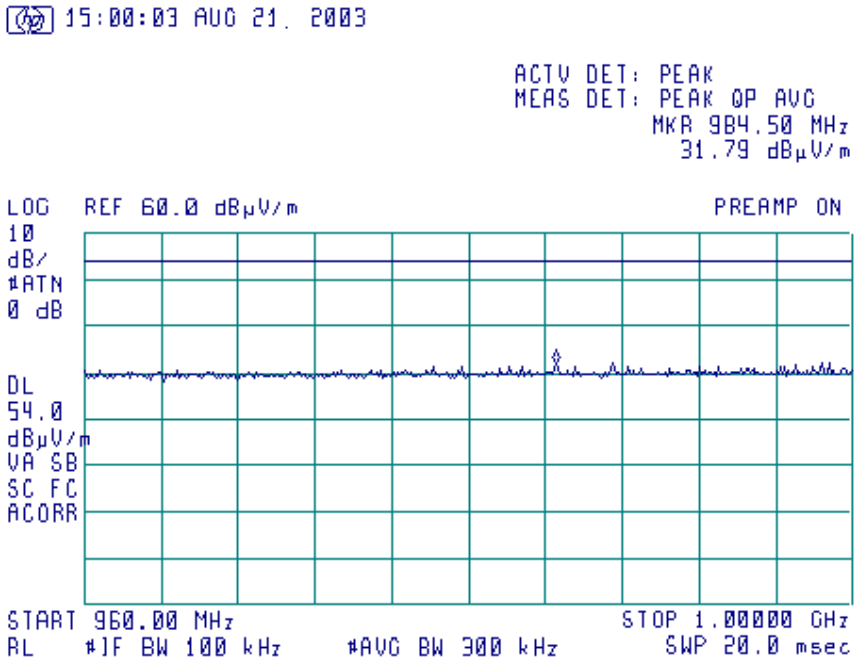
Plot A24

Radiated spurious emission measurements
in 960 – 1000 MHz range
F_{LOW} = 914.8493 MHz

Horizontal polarization



Limit (quasi-peak) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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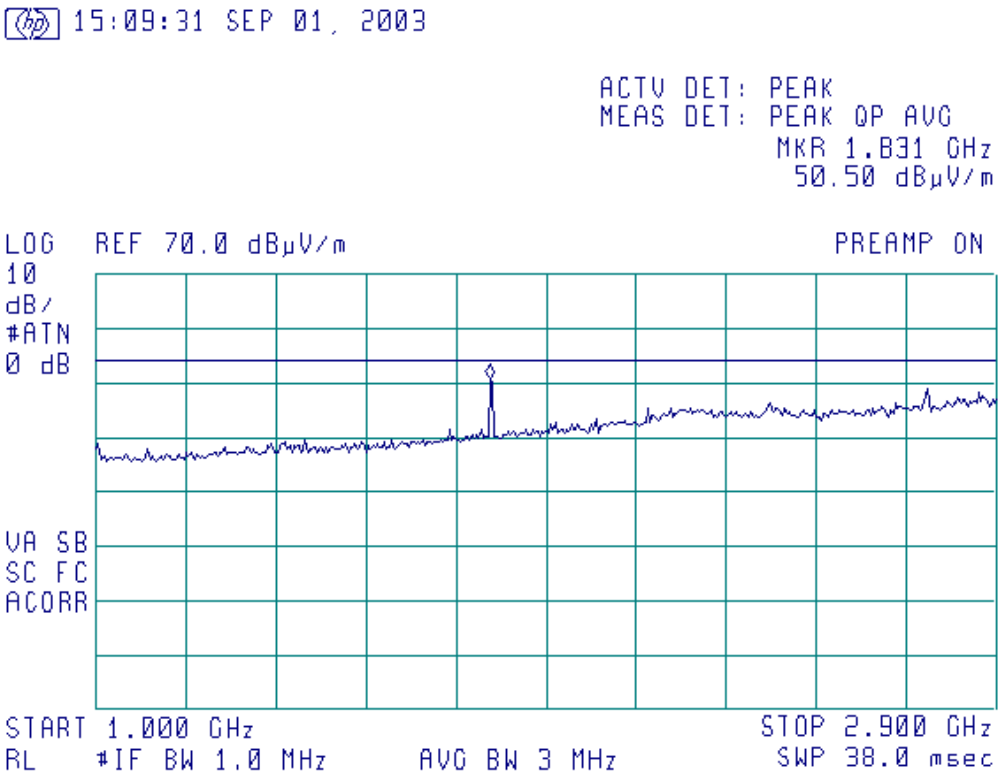
Plot A25

Radiated spurious emission measurements
in 1 – 2.9 GHz range
F_{LOW} = 914.8493 MHz

Vertical and horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions except the 2nd and the 3rd harmonics were found.

The 2nd harmonic-does not fall into the restricted band.

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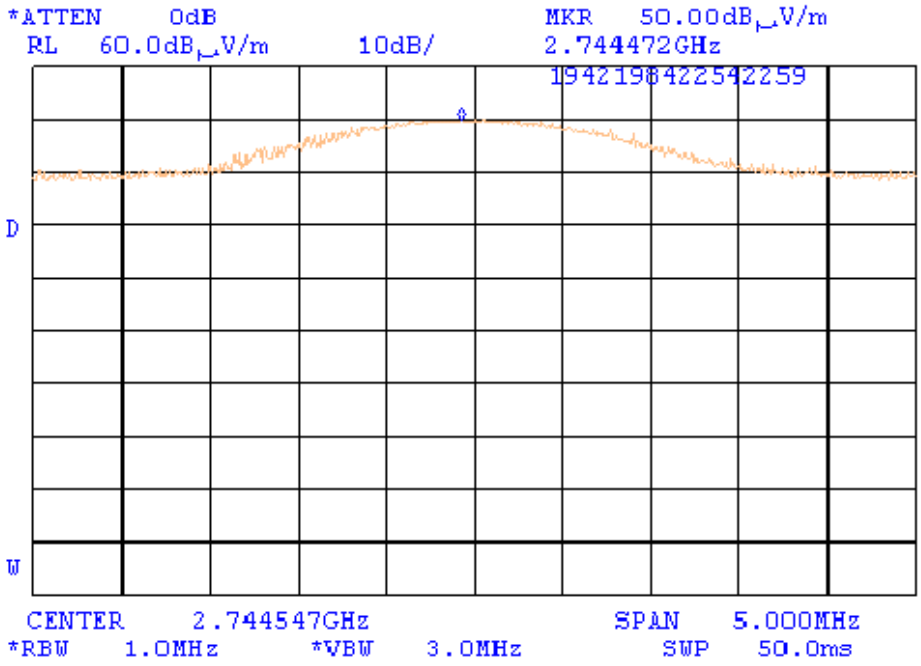
Plot A26

Radiated spurious emission measurements
3rd harmonic
F_{LOW} = 914.8493 MHz

Vertical polarization,
peak detector



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

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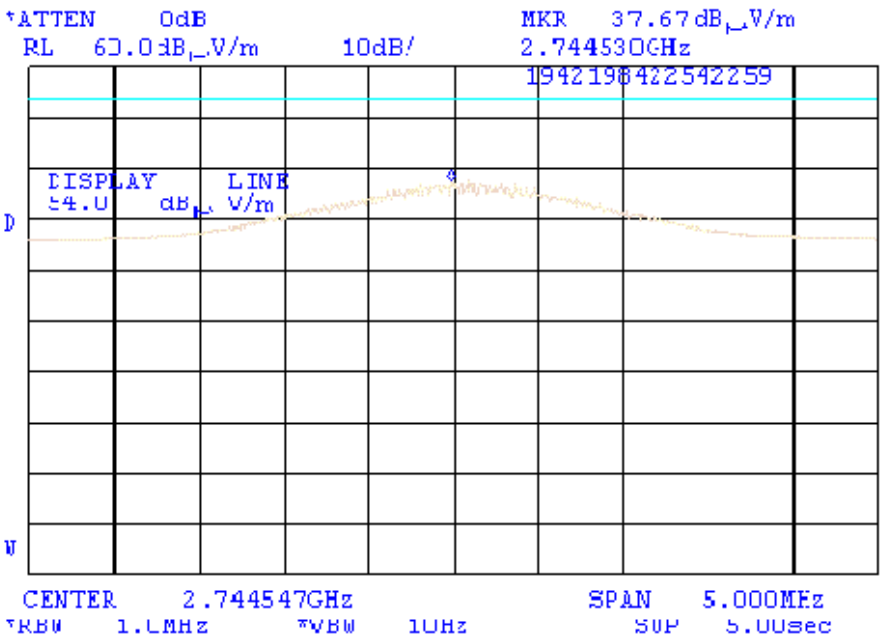
Plot A27

Radiated spurious emission measurements
3rd harmonic
F_{LOW} = 914.8493 MHz

Vertical polarization,
average detector



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

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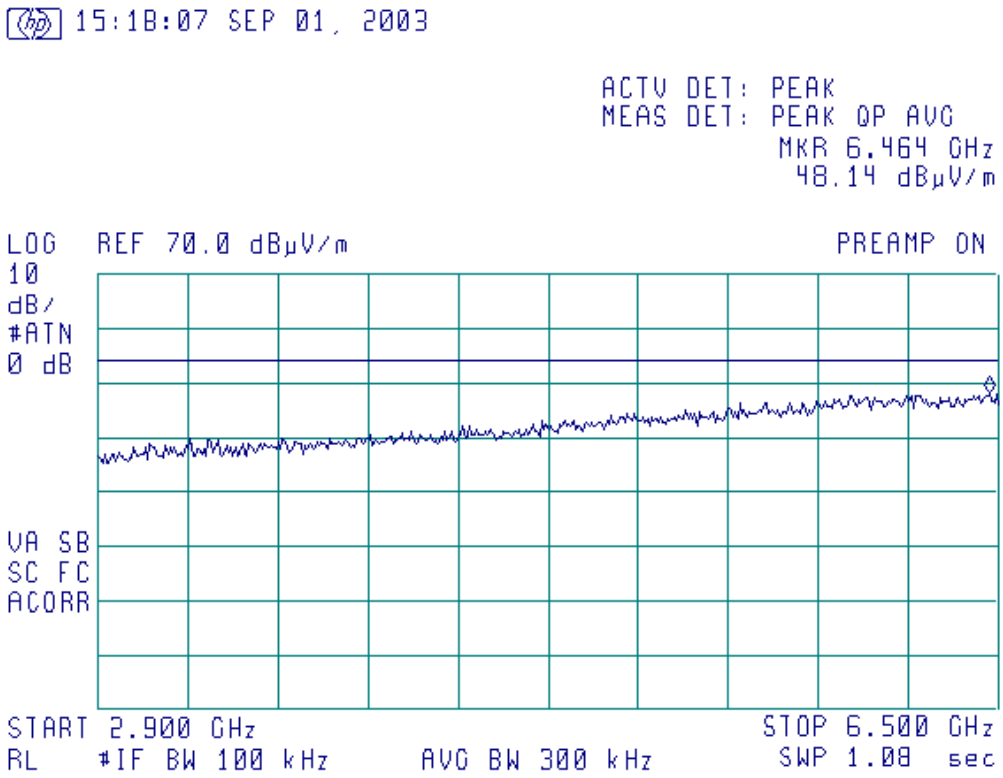
Plot A28

Radiated spurious emission measurements
in 2.9 – 6.5 GHz range
F_{LOW} = 914.8493 MHz

Vertical and horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found.

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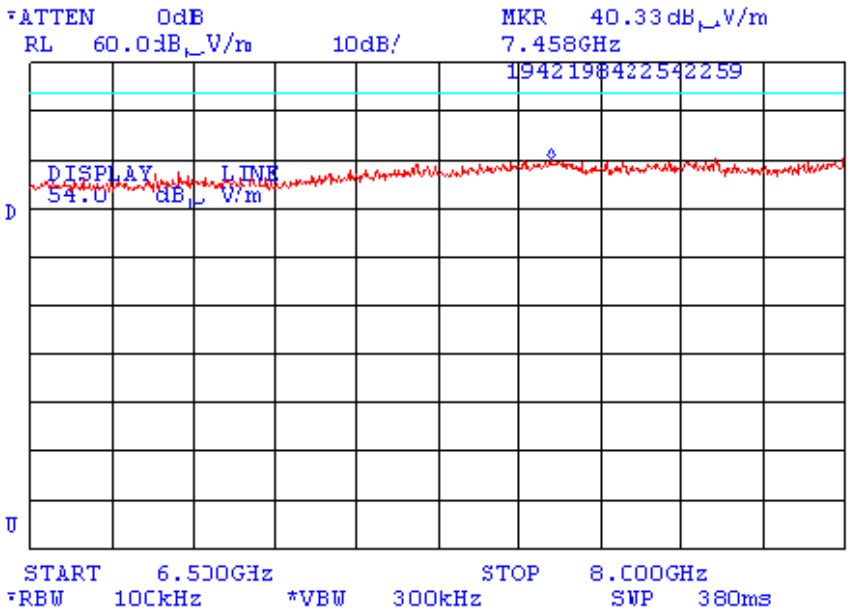
Plot A29

Radiated spurious emission measurements
in 6.5 – 8 GHz range
F_{LOW} = 914.8493 MHz

Vertical polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found.

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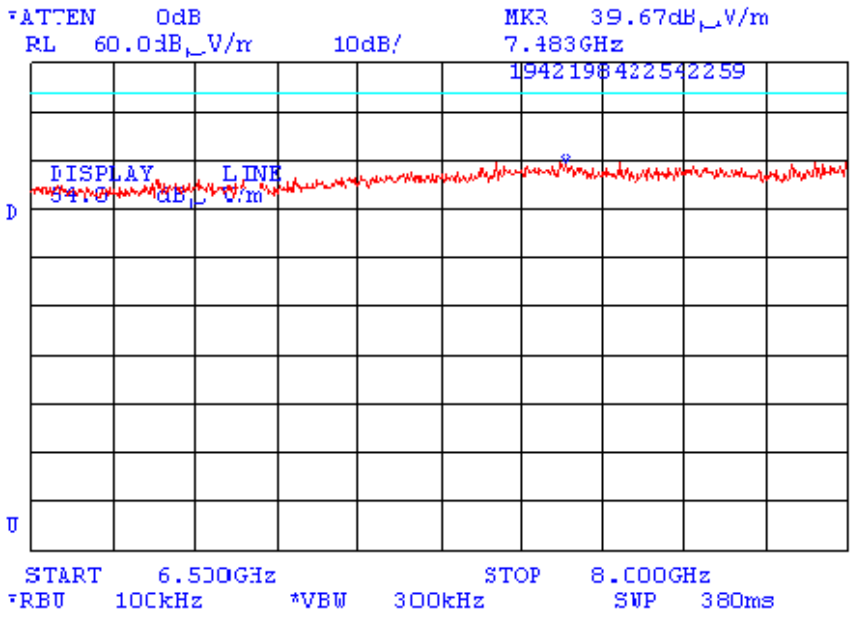
Plot A30

Radiated spurious emission measurements
in 6.5 – 8 GHz range
F_{LOW} = 914.8493 MHz

Horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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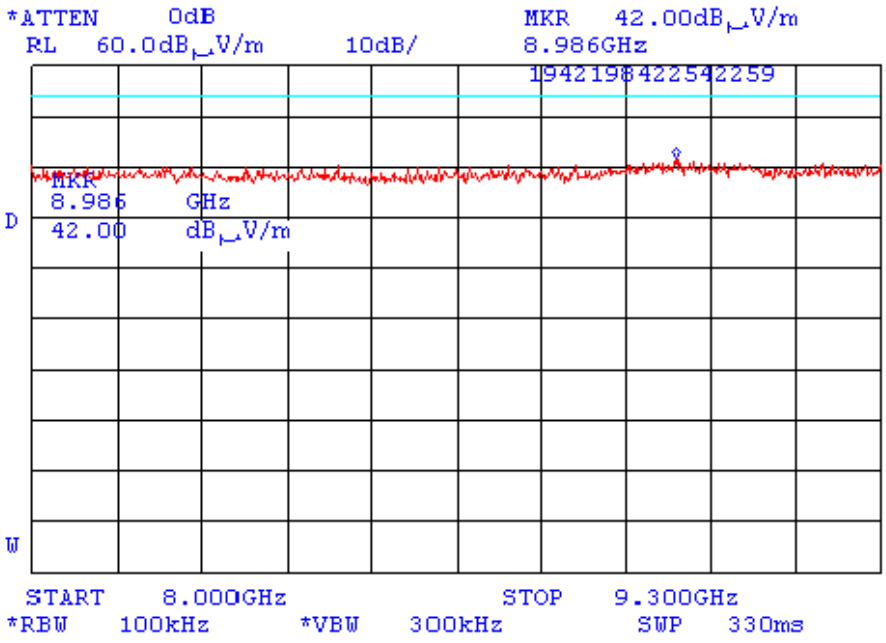
Plot A31

Radiated spurious emission measurements
in 8 – 9.3 GHz range
F_{LOW} = 914.8493 MHz

Vertical polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found.

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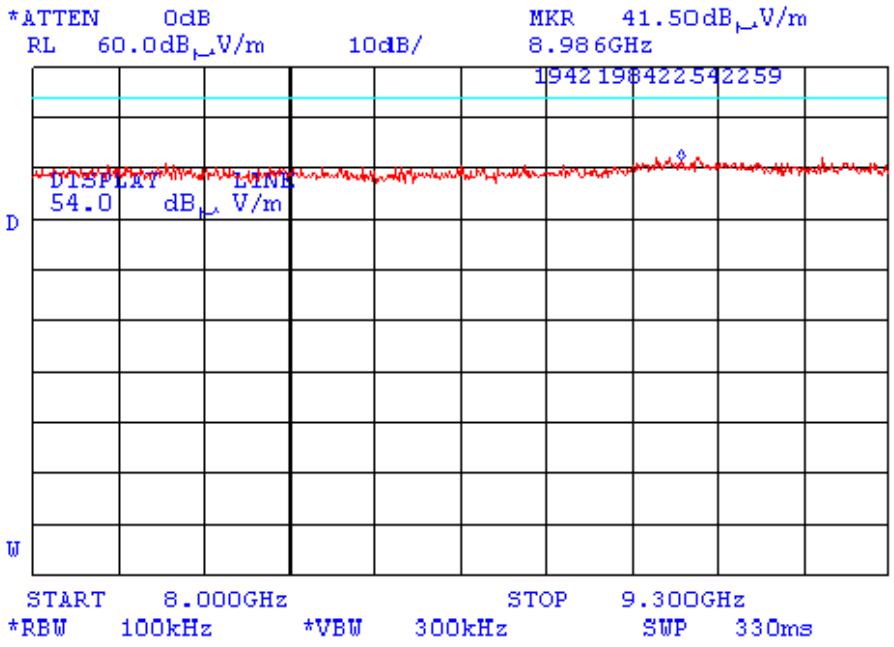
Plot A32

Radiated spurious emission measurements
in 8 – 9.3 GHz range
F_{LOW} = 914.8493 MHz

Horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found.

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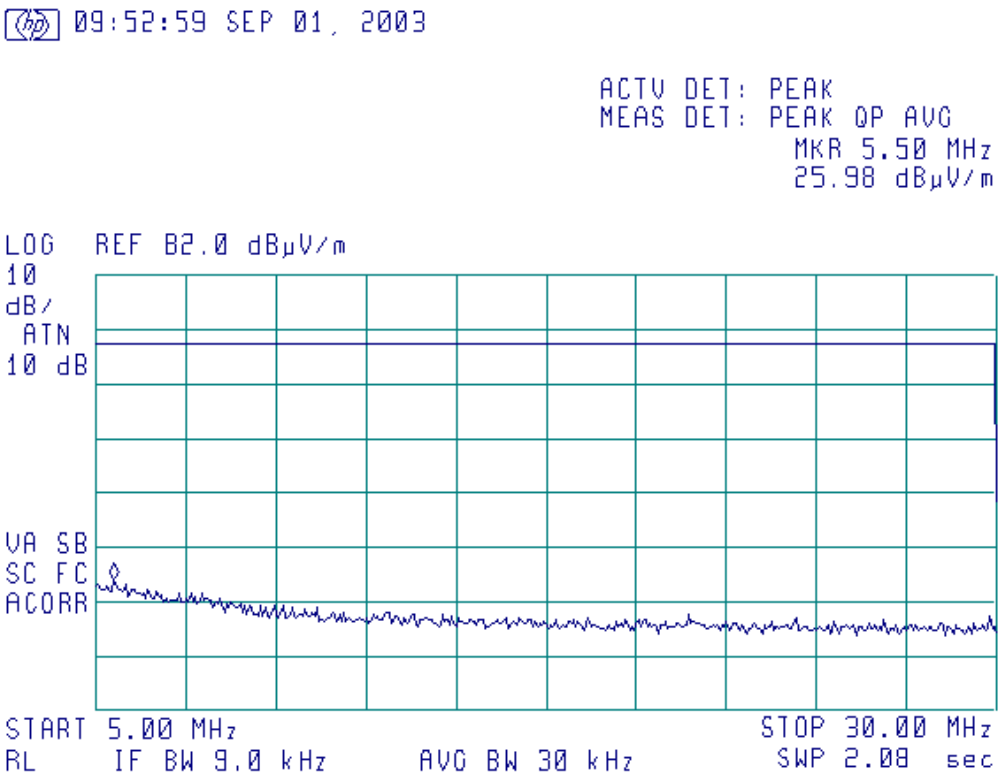
Plot A33

Radiated spurious emission measurements
in 5 – 30 MHz range
F_{MIDDLE} = 921.2493 MHz



No spurious emissions were found

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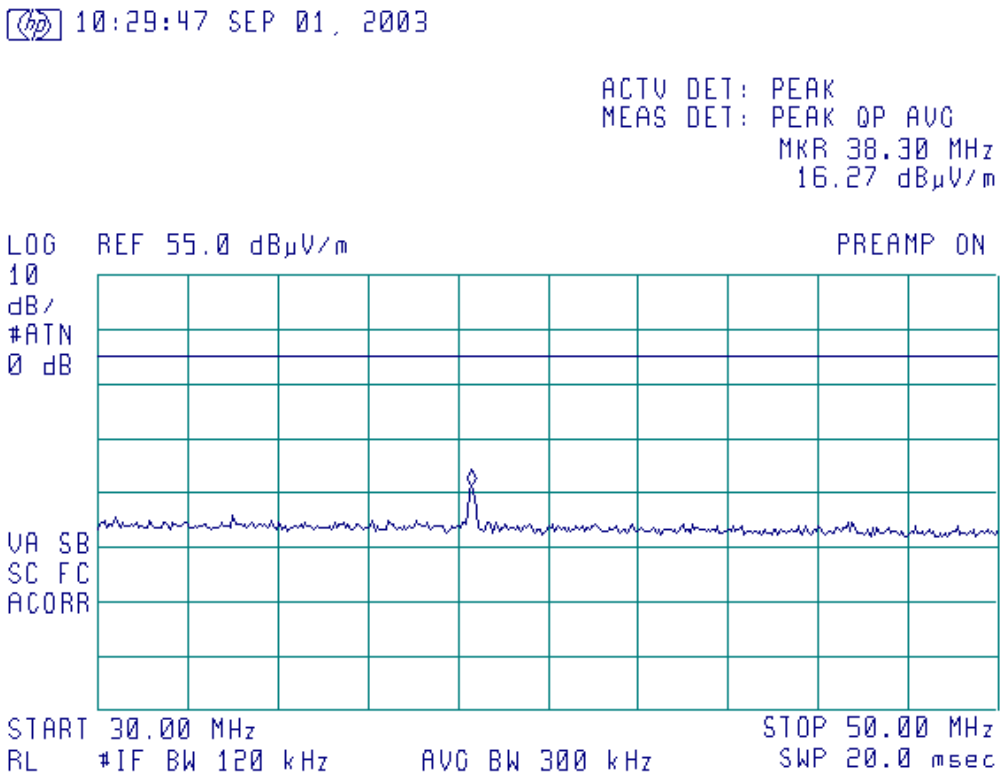
Plot A34

Radiated spurious emission measurements
in 30 – 50 MHz range
F_{MIDDLE} = 921.2493 MHz



Limit (quasi-peak) for radiated spurious emissions in restricted bands is 40 dB(µV/m)

No spurious emissions were found.

Ambient noise more than 20 dB below the limit

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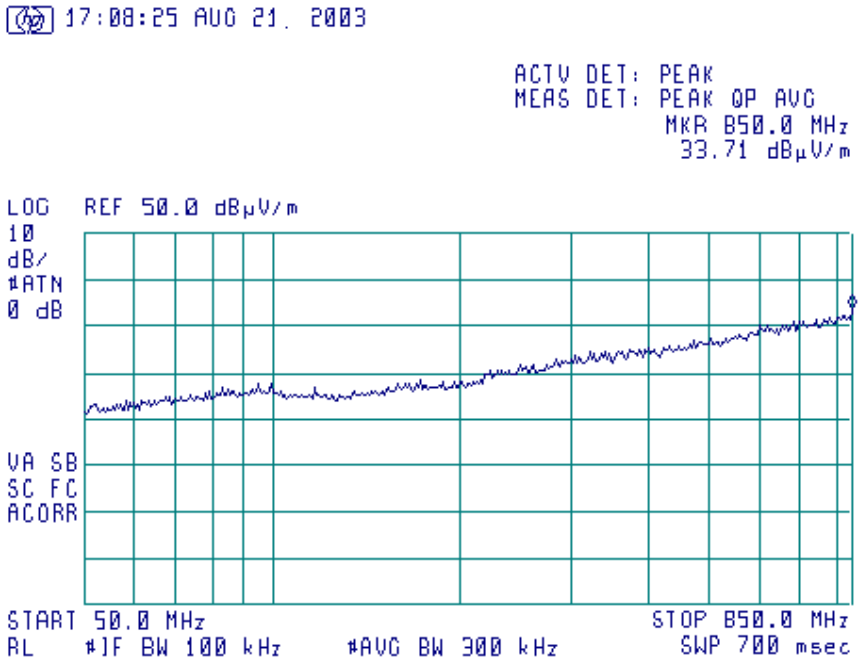
Plot A35

Radiated spurious emission measurements
in 50 – 850 MHz range
F_{MIDDLE} = 921.2493 MHz

Vertical polarization



No spurious emissions were found

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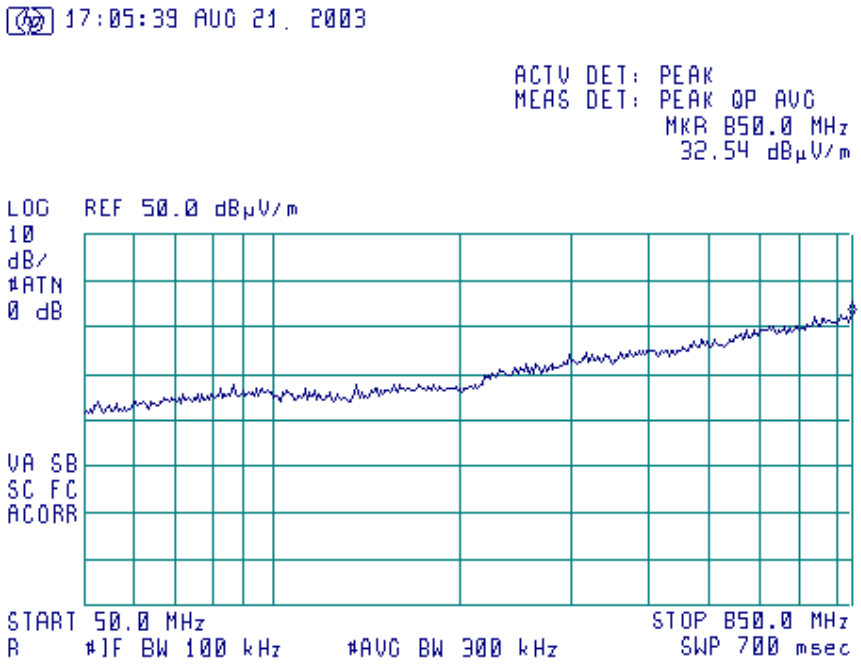
Plot A36

Radiated spurious emission measurements
in 50 – 850 MHz range
F_{MIDDLE} = 921.2493 MHz

Horizontal polarization



No spurious emissions were found

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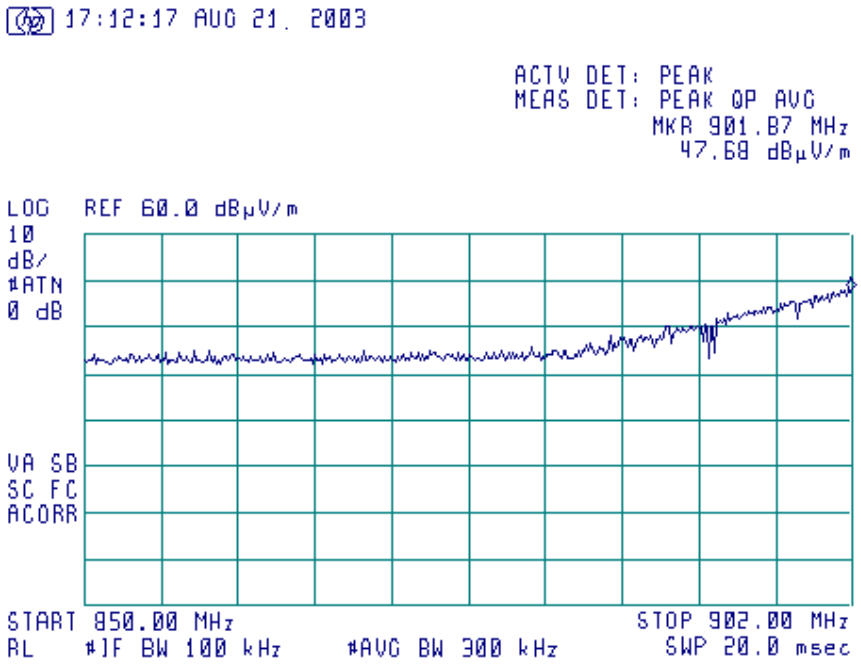
Plot A37

Radiated spurious emission measurements
in 850 – 902 MHz range
F_{MIDDLE} = 921.2493 MHz

Vertical polarization



The limit for radiated spurious emissions is 91.95 dB(µV/m)

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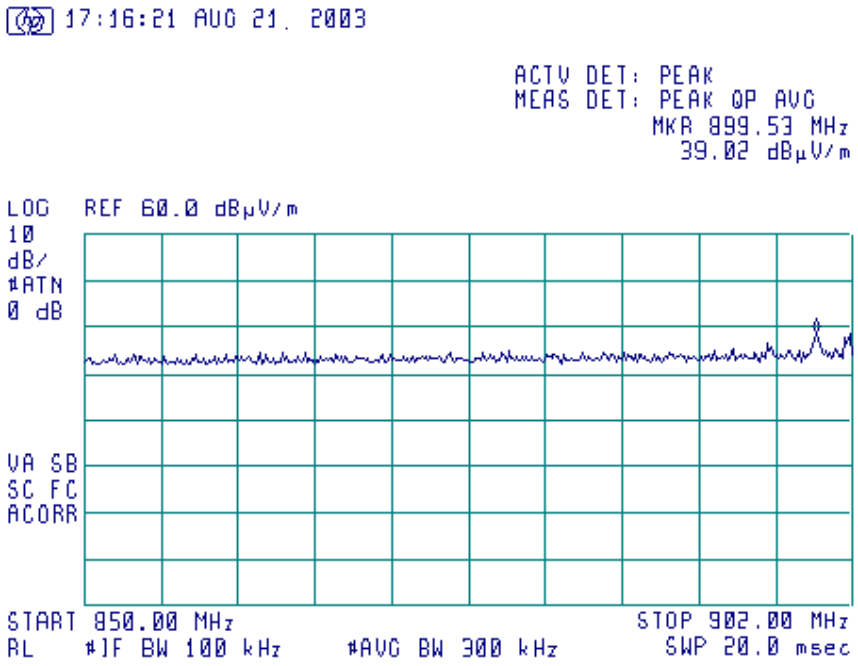
Plot A38

Radiated spurious emission measurements
in 850 – 902 MHz range
F_{MIDDLE} = 921.2493 MHz

Horizontal polarization



The limit for radiated spurious emissions is 91.95 dB(µV/m)

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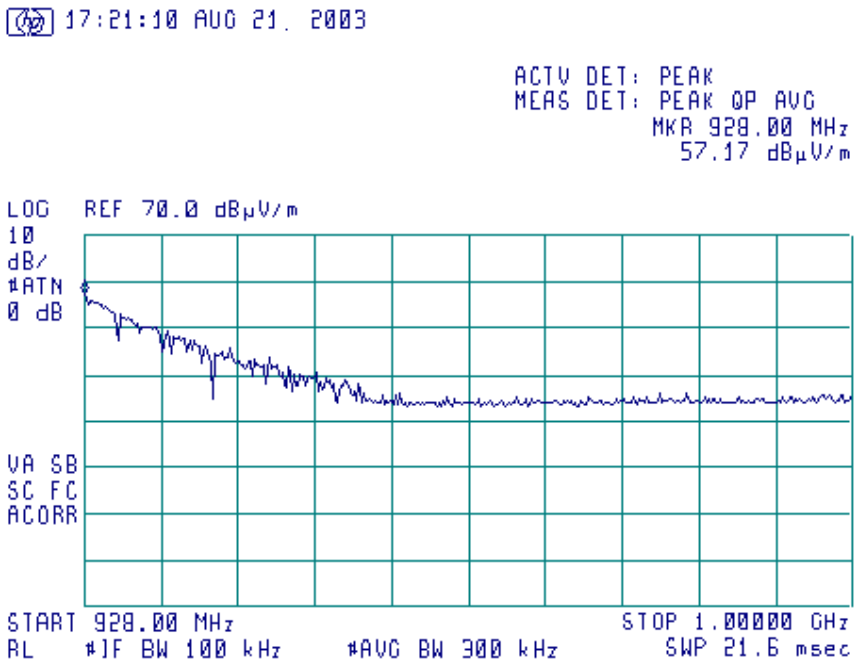
Plot A39

Radiated spurious emission measurements
in 928 – 1000 MHz range
F_{MIDDLE} = 921.2493 MHz

Vertical polarization



The limit for radiated spurious emissions in 928 – 960 MHz range is 91.05 dB(µV/m).

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Binyamina 30500, Israel
Tel.+972 46288001
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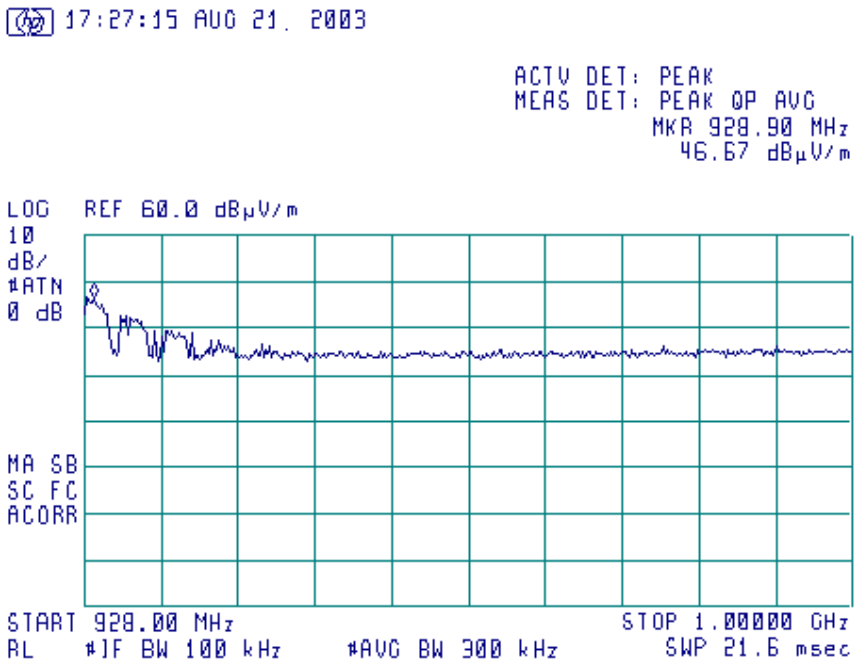
Plot A40

Radiated spurious emission measurements
in 928 – 1000 MHz range
F_{MIDDLE} = 921.2493 MHz

Horizontal polarization



The limit for radiated spurious emissions in 928 – 960 MHz range is 91.05 dB(µV/m).

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Binyamina 30500, Israel
Tel.+972 46288001
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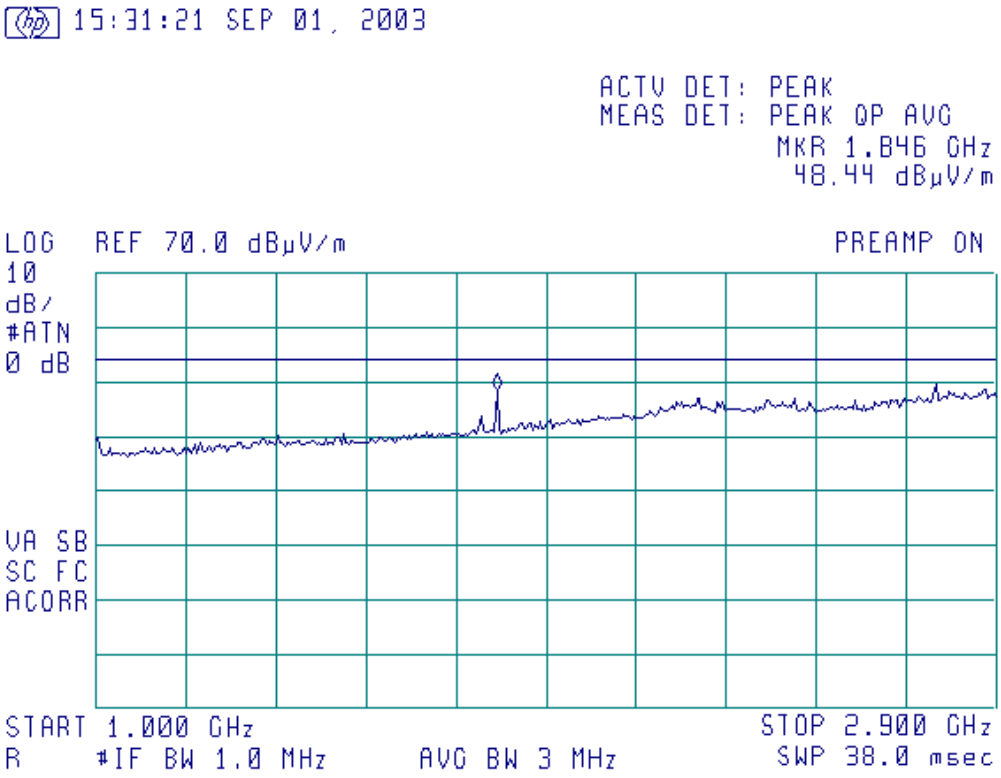
Plot A41

Radiated spurious emission measurements
in 1 – 2.9 GHz range
F_{MIDDLE} = 921.2493 MHz

Vertical and horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions except the 2nd and the 3rd harmonics were found.

The 2nd harmonic does not fall into the restricted band

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P.O.Box 23
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Tel.+972 46288001
Fax.+972 46288277
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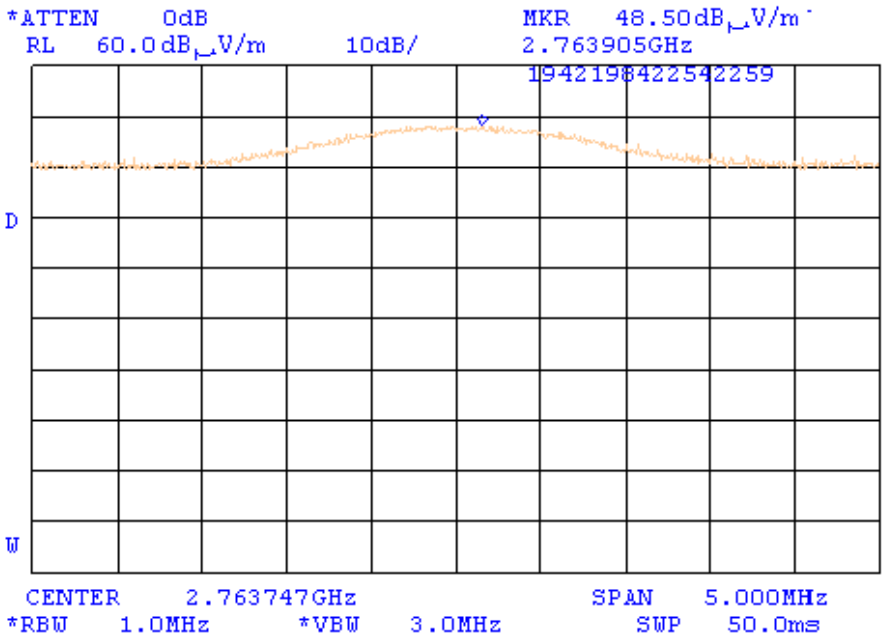
Plot A42

Radiated spurious emission measurements
3rd harmonic
F_{MIDDLE} = 921.2493 MHz

Vertical polarization,
peak detector



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

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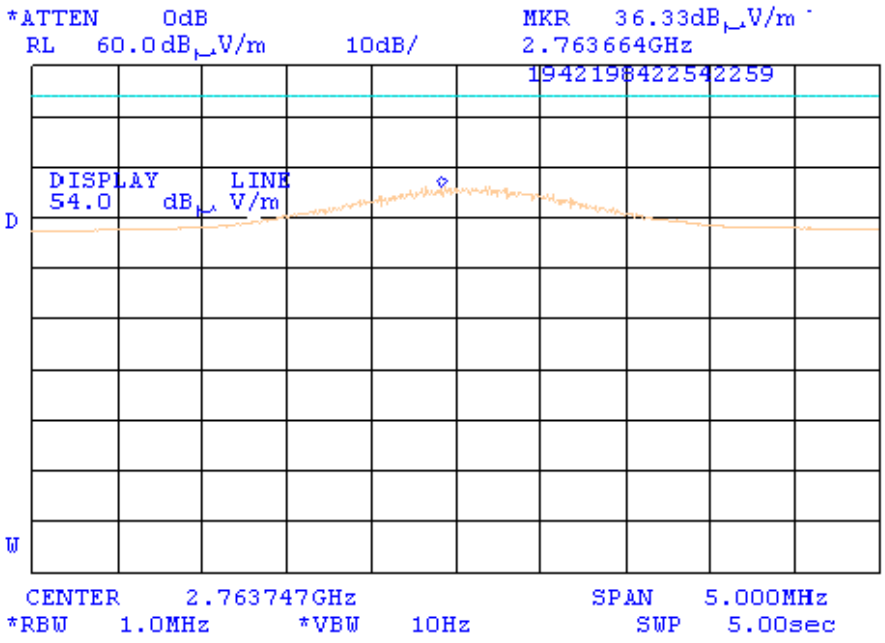
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A43

Radiated spurious emission measurements
3rd harmonic
F_{MIDDLE} = 921.2493 MHz

Vertical polarization,
average detector



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

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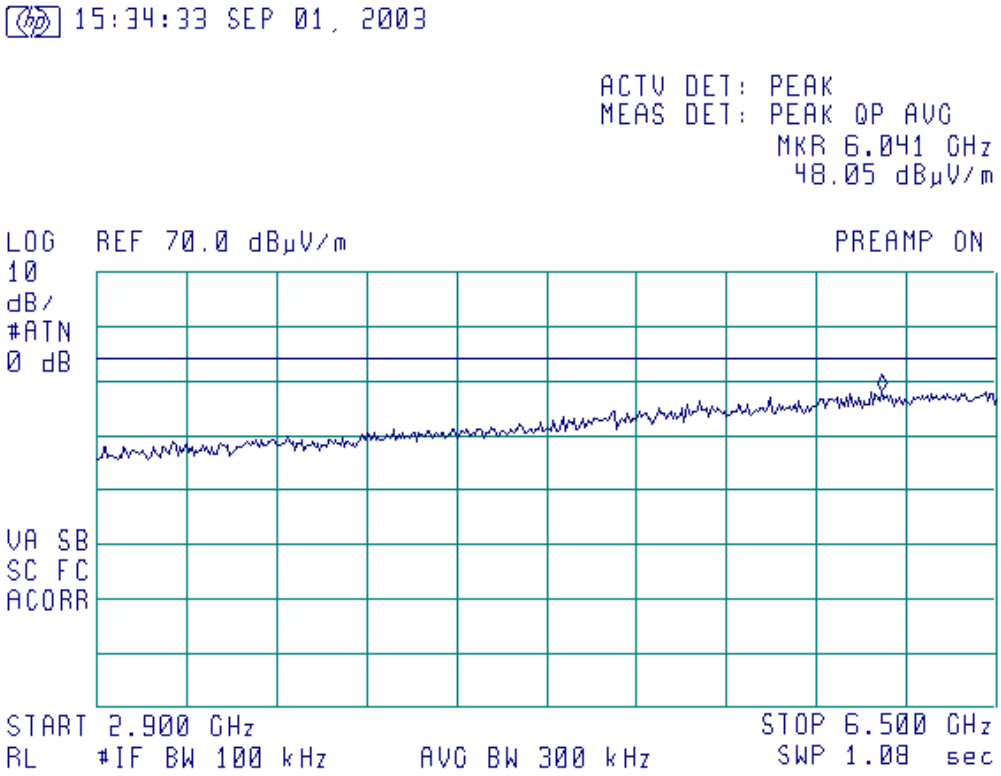
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A44

Radiated spurious emission measurements
in 2.9 – 6.5 GHz range
F_{MIDDLE} = 921.2493 MHz

Vertical and horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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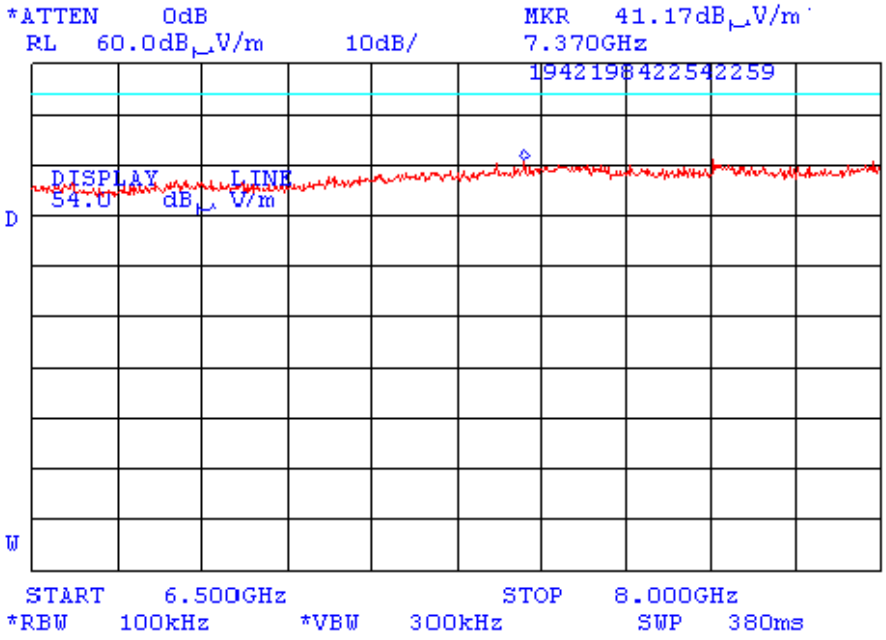
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A45

Radiated spurious emission measurements
in 6.5 – 8 GHz range
F_{MIDDLE} = 921.2493 MHz

Vertical polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
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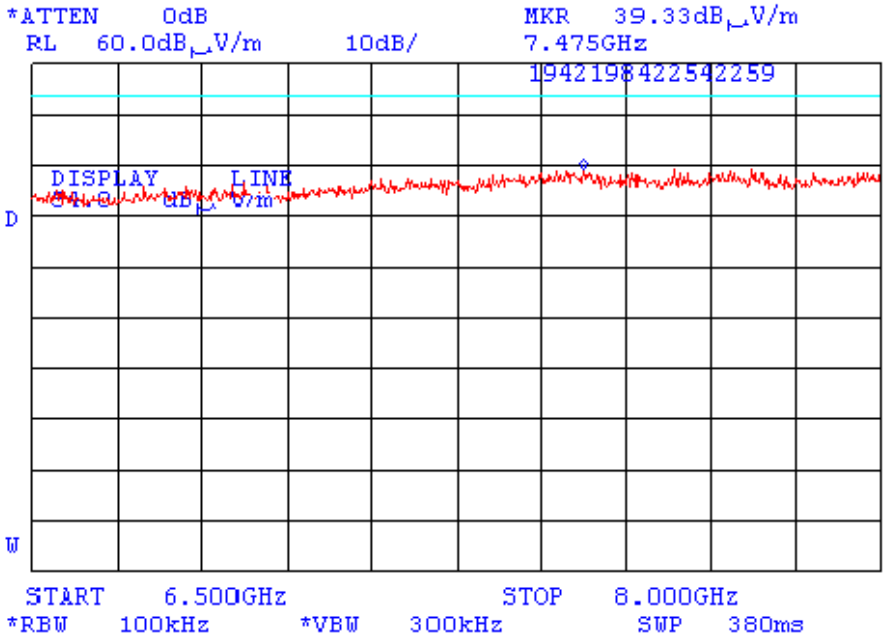
Plot A46

Radiated spurious emission measurements
in 6.5 – 8 GHz range
F_{MIDDLE} = 921.2493 MHz

Horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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Fax.+972 46288277
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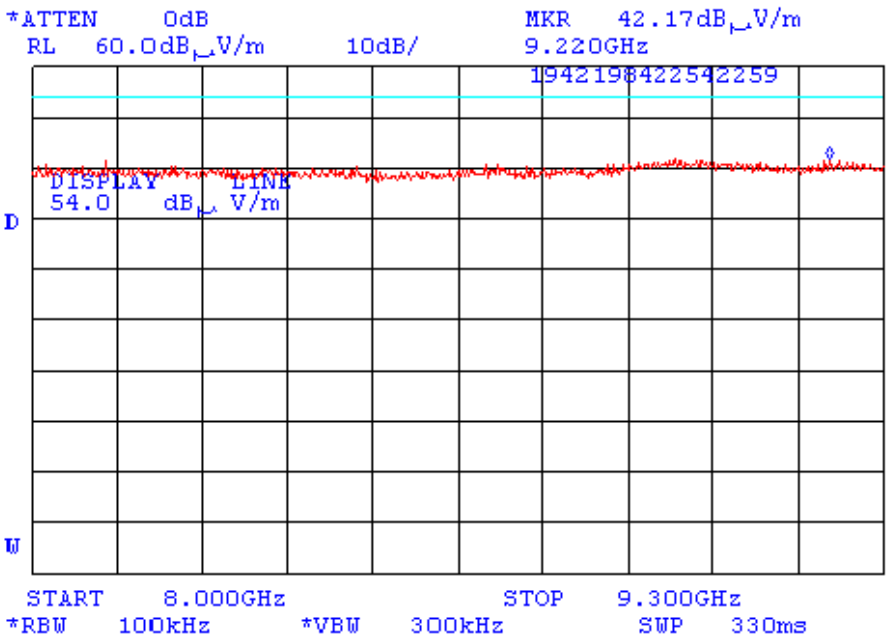
Plot A47

Radiated spurious emission measurements
in 8 – 9.3 GHz range
F_{MIDDLE} = 921.2493 MHz

Vertical polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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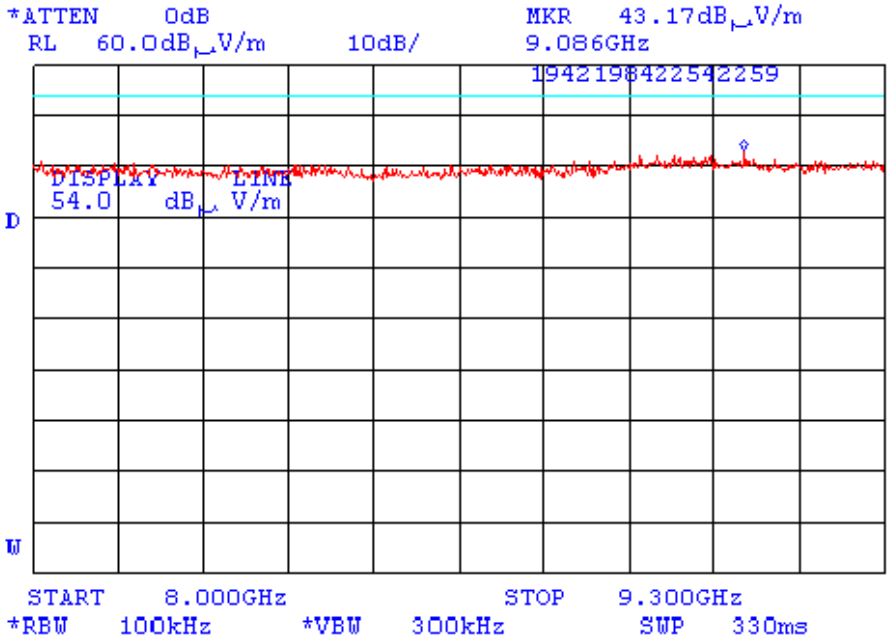
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A48

Radiated spurious emission measurements
in 8 – 9.3 GHz range
F_{MIDDLE} = 921.2493 MHz

Horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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Fax.+972 46288277
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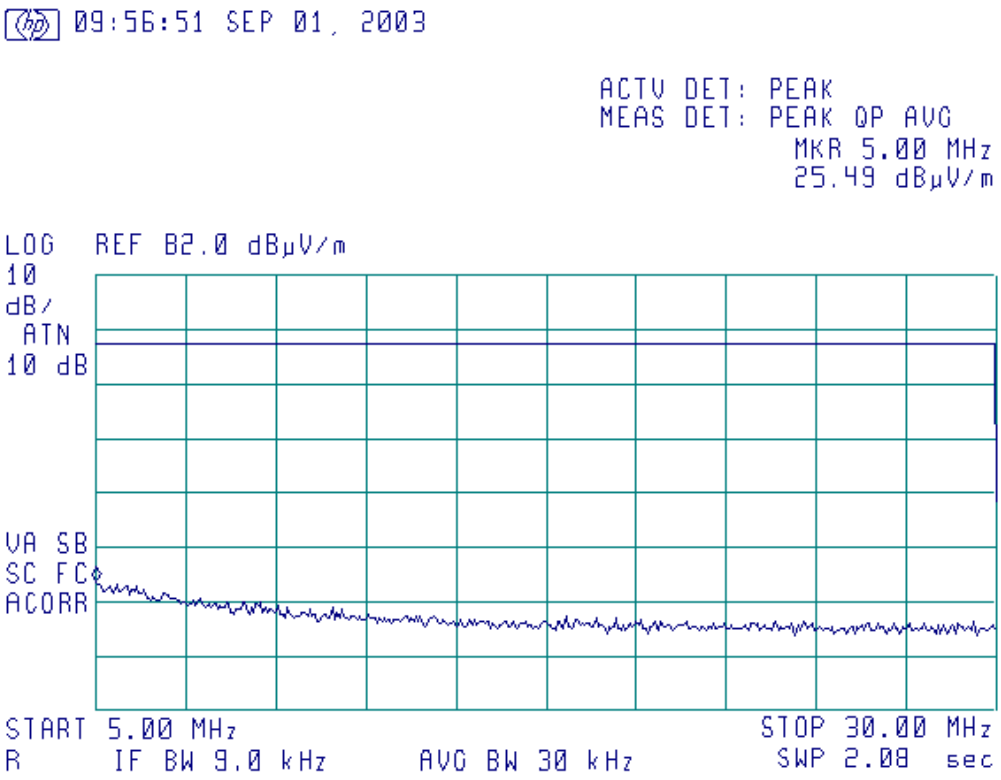
Plot A49

Radiated spurious emission measurements
in 5 – 30 MHz range
F_{HIGH} = 927.6493 MHz



No spurious emissions were found

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Tel.+972 46288001
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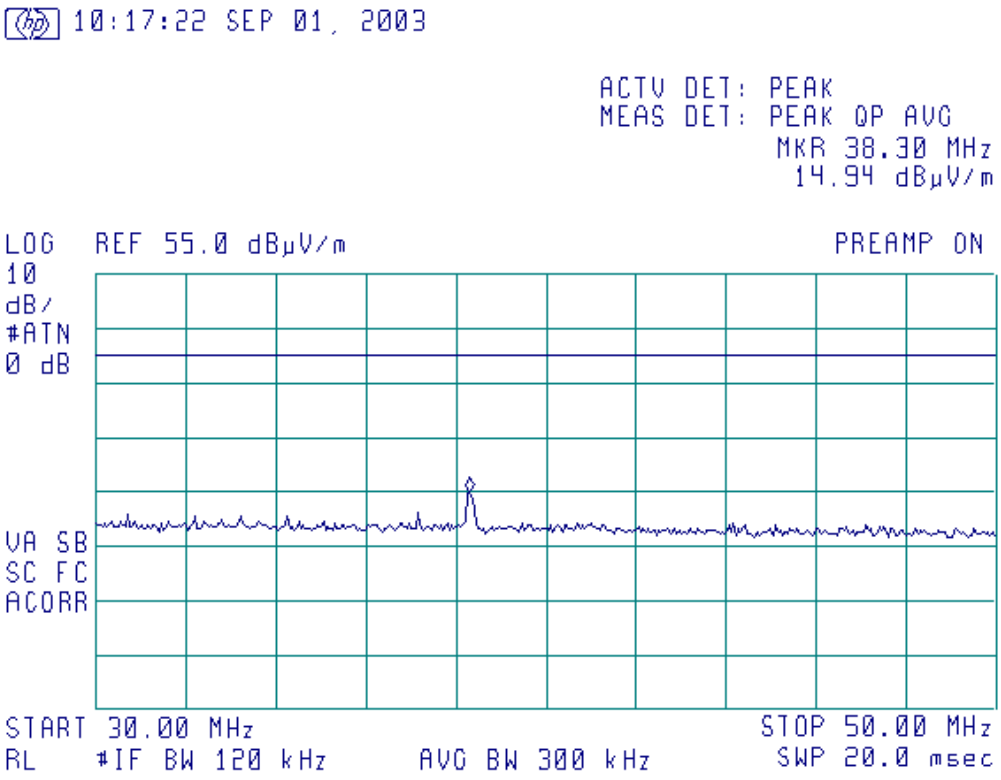
Plot A50

Radiated spurious emission measurements
in 30 – 50 MHz range
F_{HIGH} = 927.6493 MHz



Limit (quasi-peak) for radiated spurious emissions in restricted bands is 40 dB(µV/m)

No spurious emissions were found.

Ambient noise more than 20 dB below the limit

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P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
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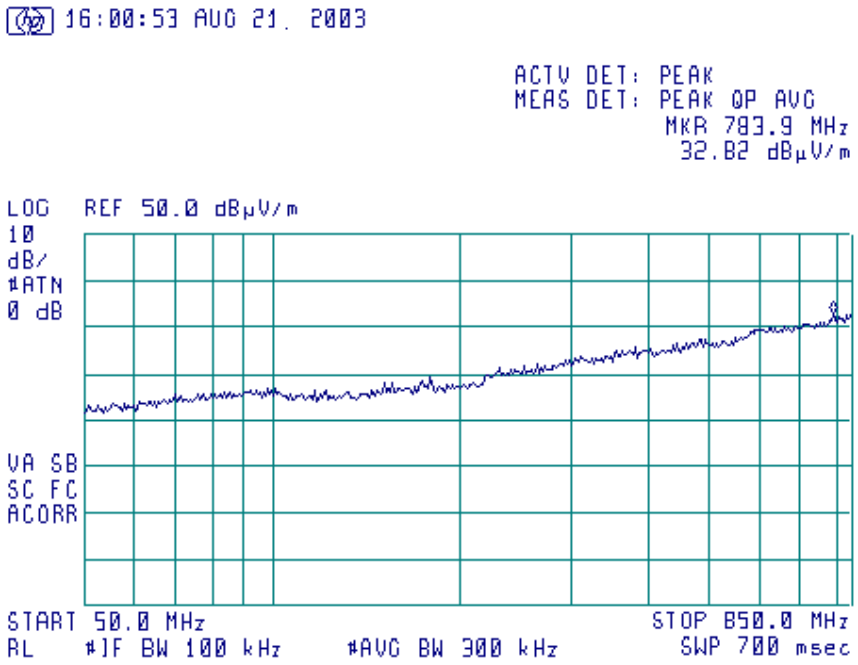
Plot A51

Radiated spurious emission measurements
in 50 – 850 MHz range
F_{HIGH} = 927.6493 MHz

Vertical polarization



No spurious emissions were found

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P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
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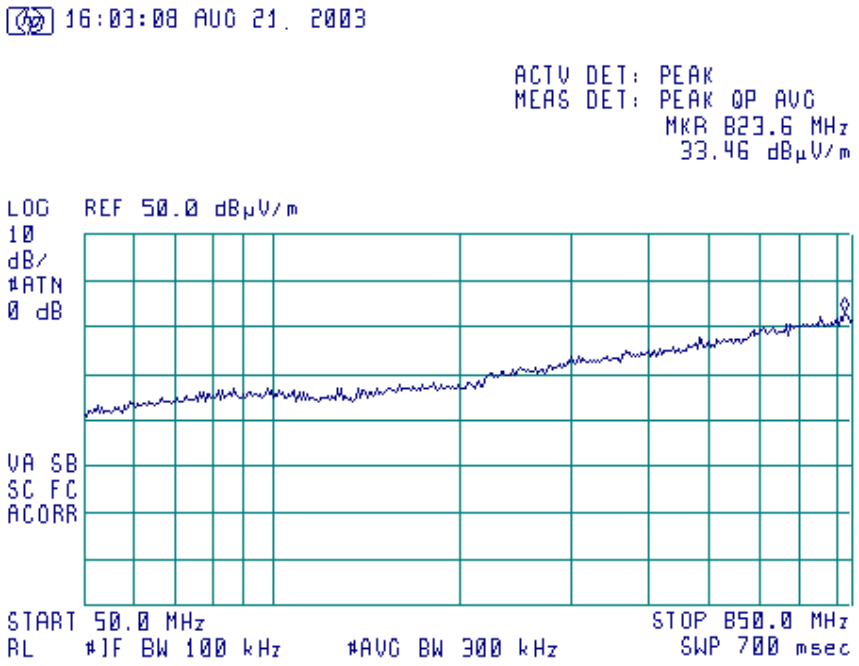
Plot A52

Radiated spurious emission measurements
in 50 – 850 MHz range
F_{HIGH} = 927.6493 MHz

Horizontal polarization



No spurious emissions were found

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P.O.Box 23
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Tel.+972 46288001
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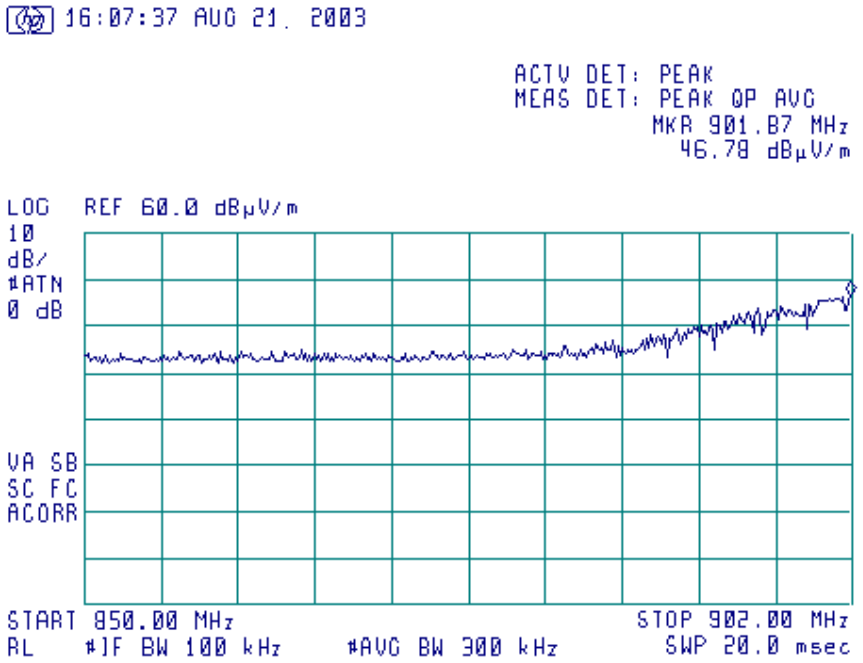
Plot A53

Radiated spurious emission measurements
in 850 – 902 MHz range
F_{HIGH} = 927.6493 MHz

Vertical polarization



The limit for radiated spurious emissions is 90.89 dB(µV/m)

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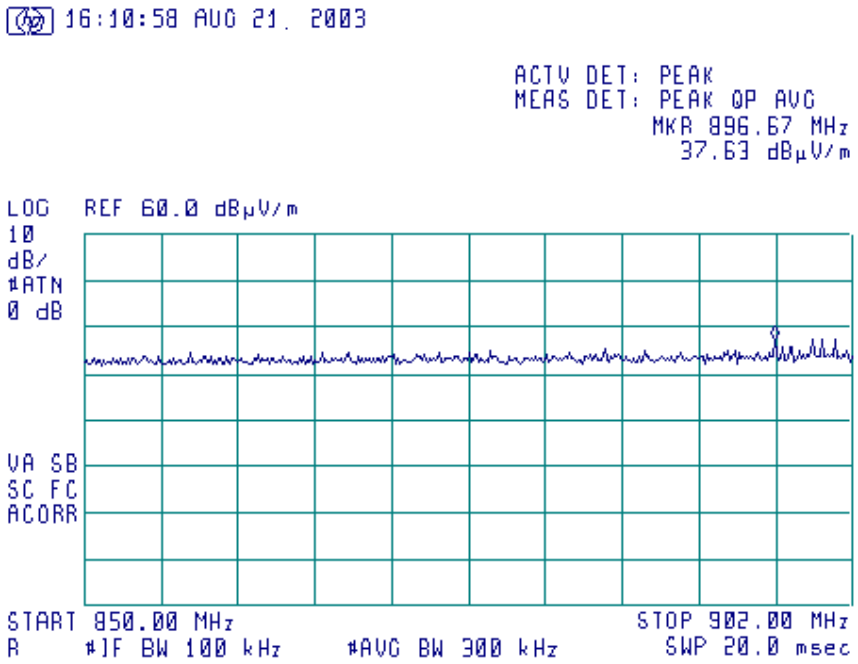
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A54

Radiated spurious emission measurements
in 850 – 902 MHz range
F_{HIGH} = 927.6493 MHz

Horizontal polarization



The limit for radiated spurious emissions is 90.89 dB(µV/m)

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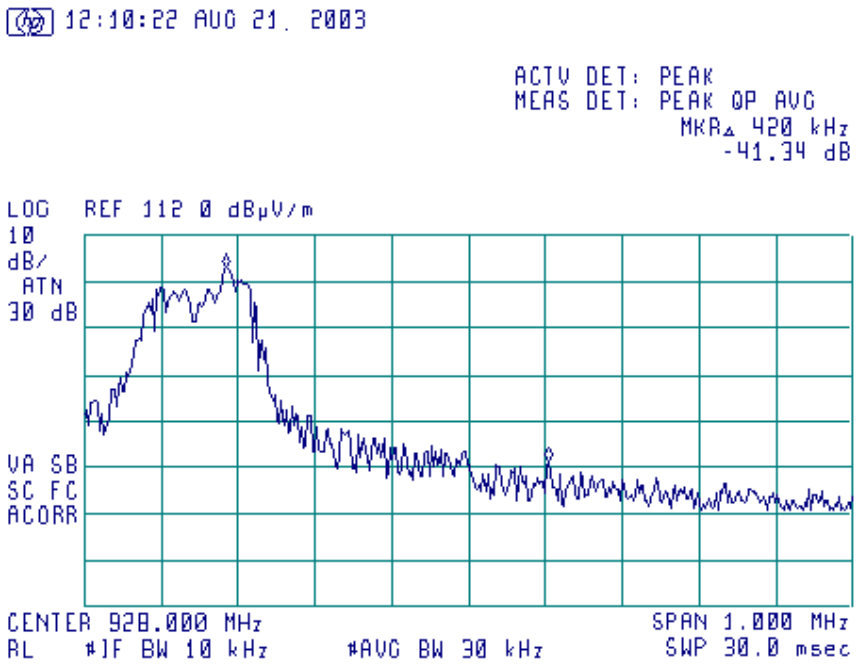
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A55

Radiated spurious emission measurements
at the upper band edge,
center 928.00
F_{HIGH} = 927.6493 MHz

Vertical polarization



Emission level at the upper band edge is more than 40 dB below the carrier field strength level

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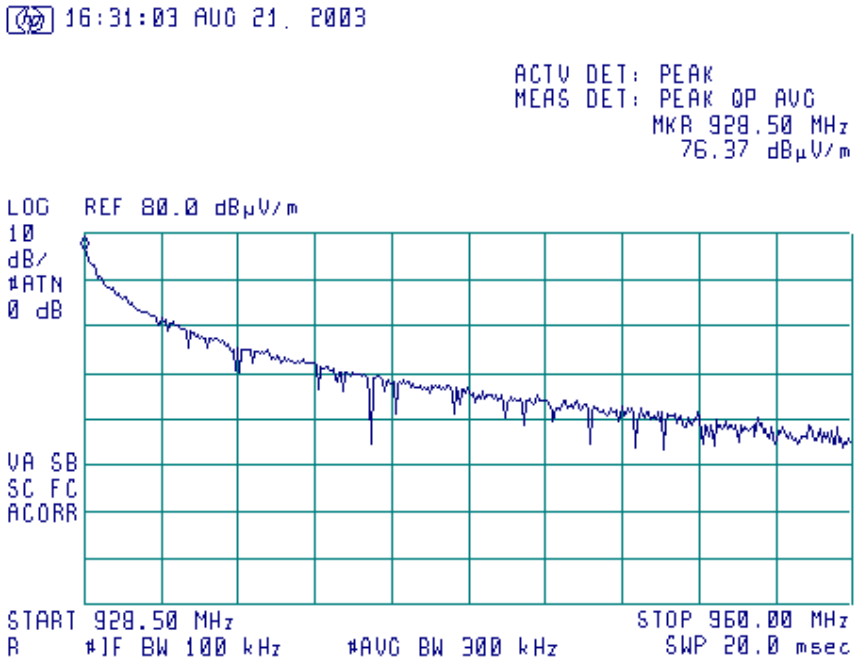
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A56

Radiated spurious emission measurements
in 928.5 – 960 MHz range
F_{HIGH} = 927.6493 MHz

Vertical polarization



The limit for radiated spurious emissions is 90.89 dB(µV/m)

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P.O.Box 23
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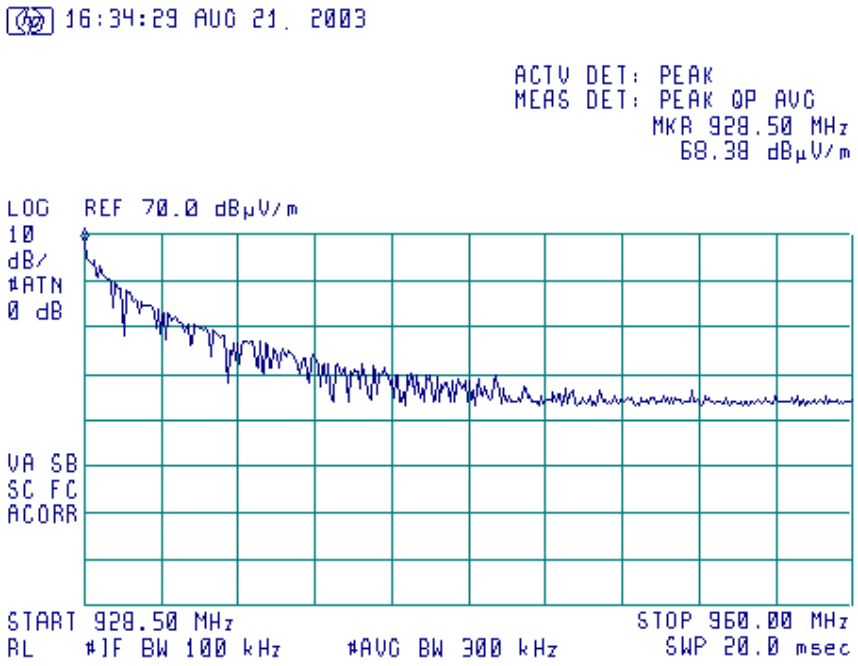
Plot A57

Radiated spurious emission measurements
in 928.5 – 960 MHz range
F_{HIGH} = 927.6493 MHz

Horizontal polarization



The limit for radiated spurious emissions is 90.89 dB(µV/m)

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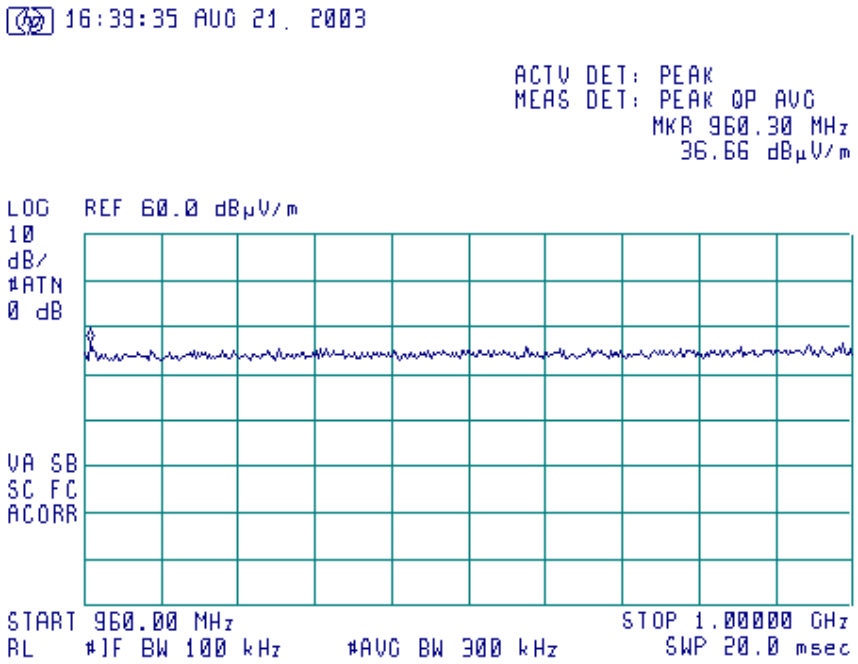
Plot A58

Radiated spurious emission measurements
in 960 – 1000 MHz range
F_{HIGH} = 927.6493 MHz

Vertical polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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P.O.Box 23
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Tel.+972 46288001
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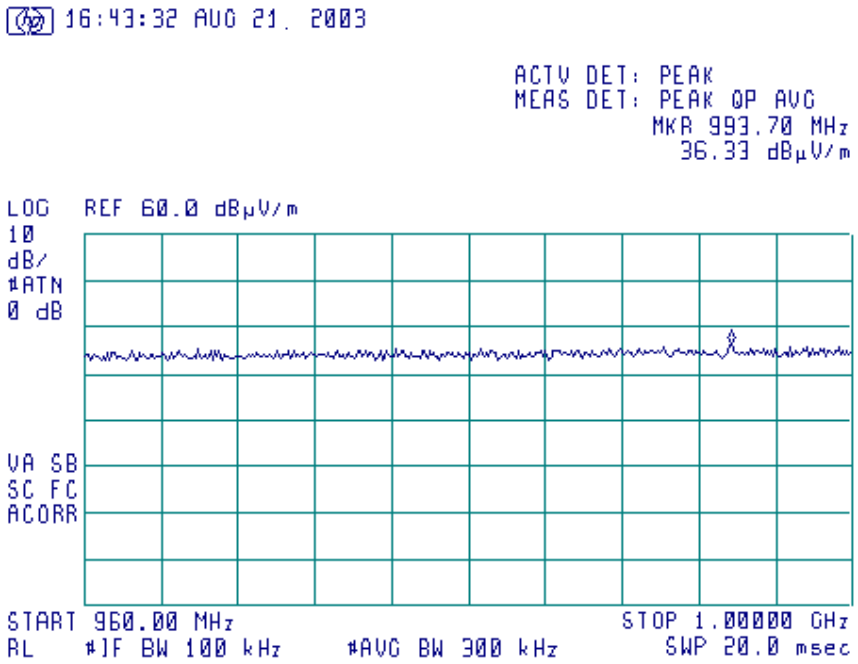
Plot A59

Radiated spurious emission measurements
in 960 – 1000 MHz range
F_{HIGH} = 927.6493 MHz

Horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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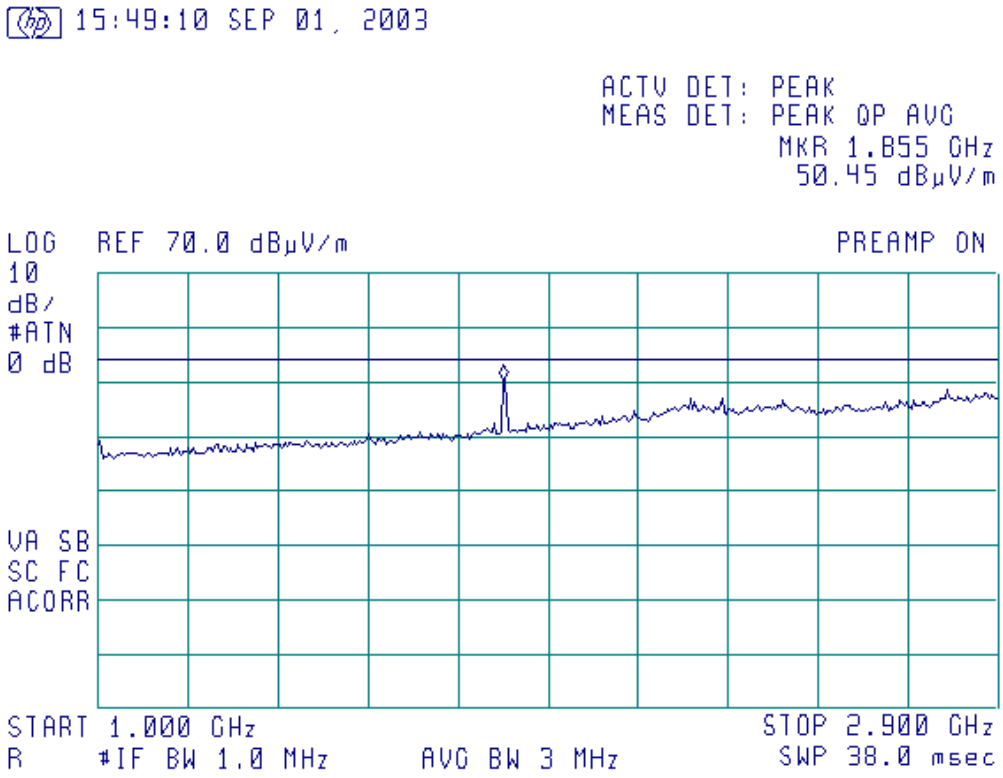
Plot A60

Radiated spurious emission measurements
in 1 – 2.9 GHz range
F_{HIGH} = 927.6493 MHz

Vertical and horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m).

No spurious emissions except the 2nd and the 3rd harmonics were found.

The 2nd harmonic does not fall into the restricted band.

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Tel.+972 46288001
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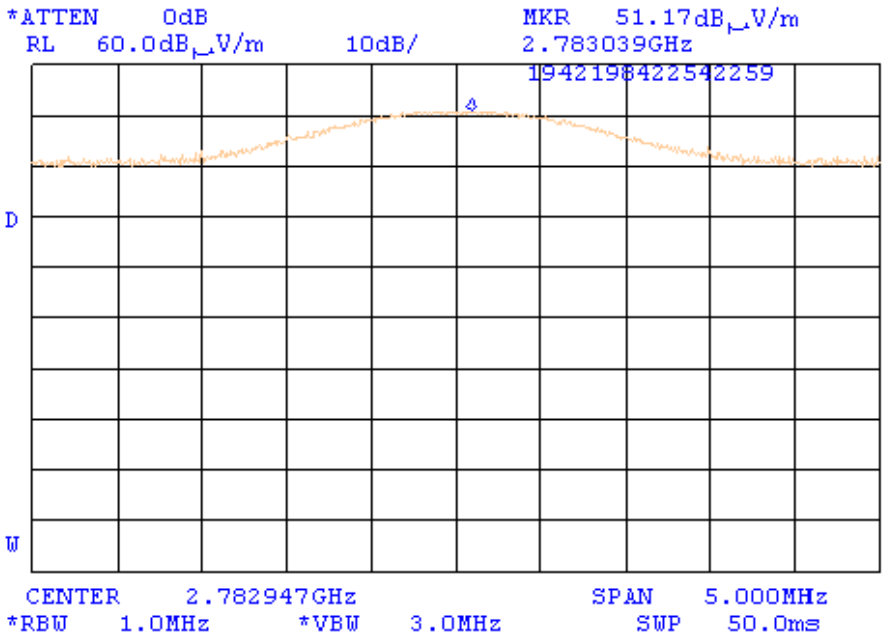
Plot A61

Radiated spurious emission measurements
3rd harmonic
F_{HIGH} = 927.6493 MHz

Vertical polarization,
peak detector



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

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P.O.Box 23
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Tel.+972 46288001
Fax.+972 46288277
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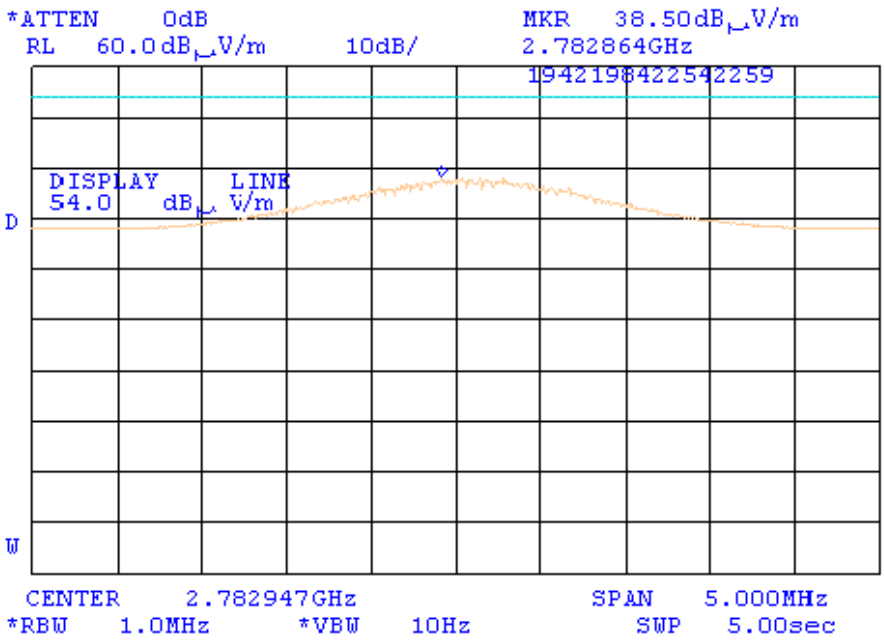
Plot A62

Radiated spurious emission measurements
3rd harmonic
F_{HIGH} = 927.6493 MHz

Vertical polarization,
average detector



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

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P.O.Box 23
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Tel.+972 46288001
Fax.+972 46288277
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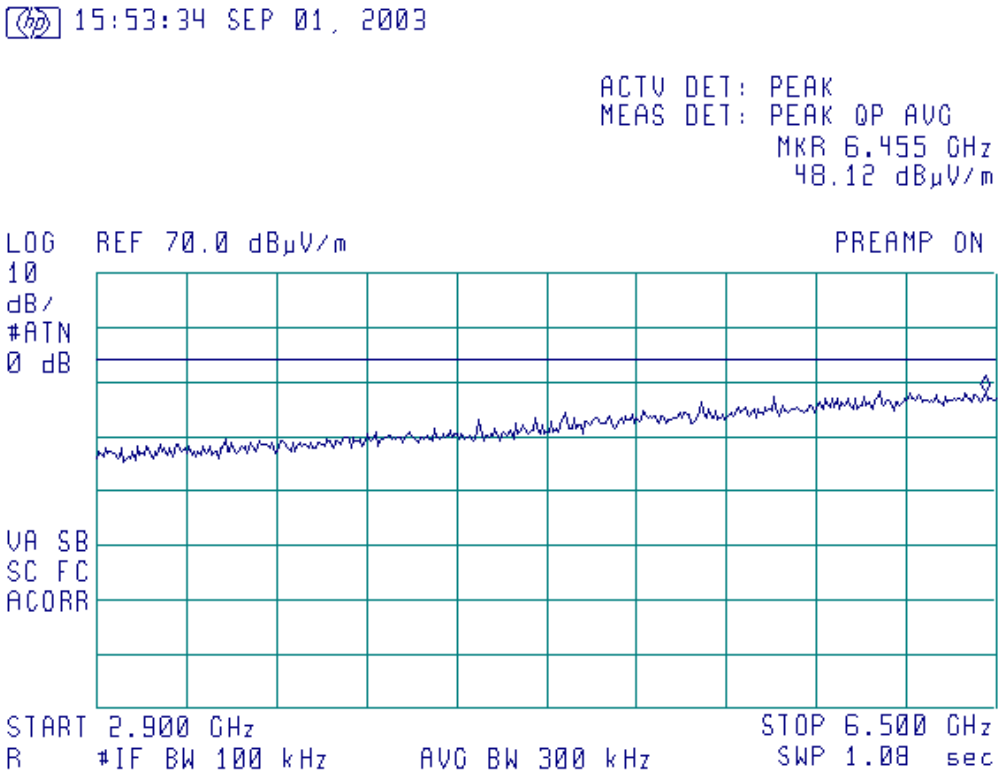
Plot A63

Radiated spurious emission measurements
in 2.9 – 6.5 GHz range
F_{HIGH} = 927.6493 MHz

Vertical and horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
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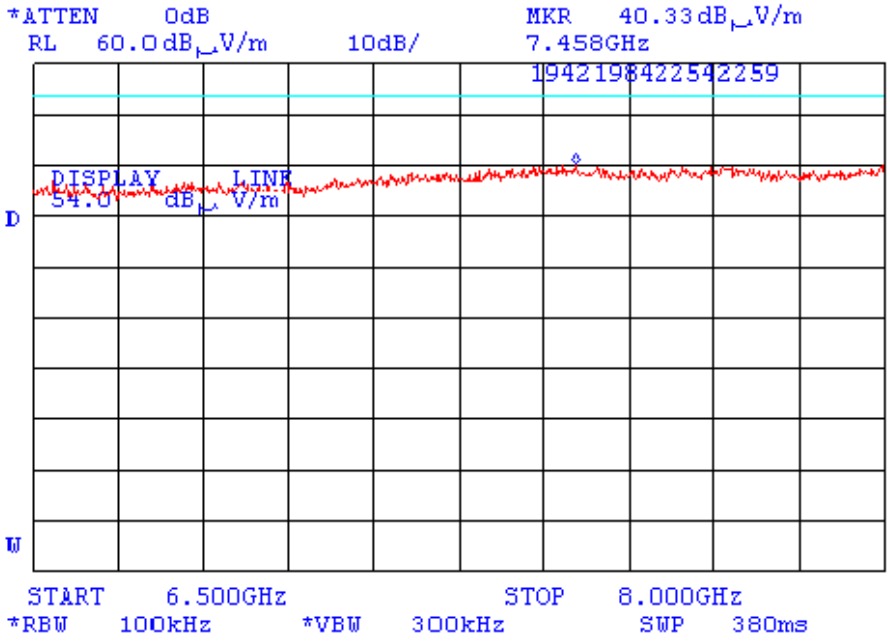
Plot A64

Radiated spurious emission measurements
in 6.5 – 8 GHz range
F_{HIGH} = 927.6493 MHz

Vertical polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
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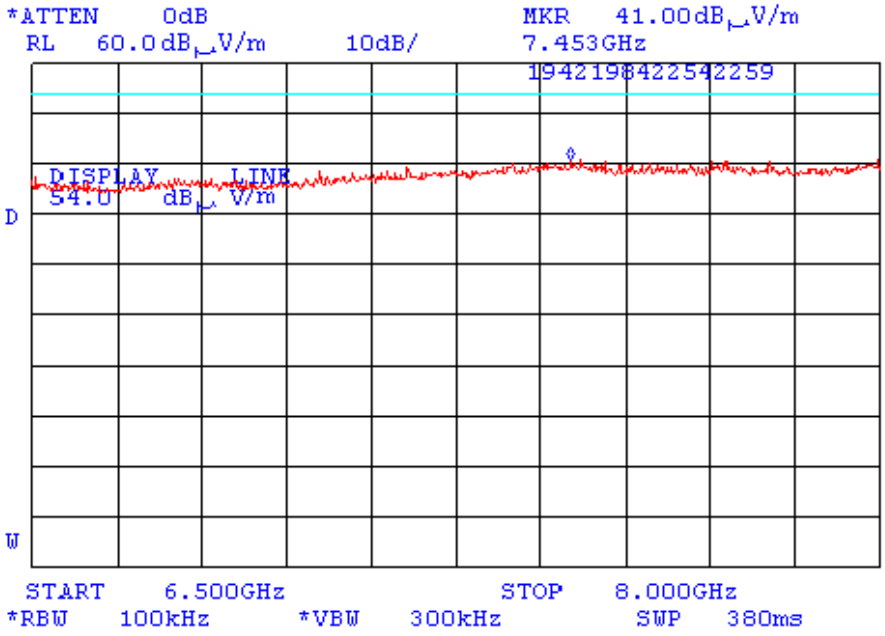
Plot A65

Radiated spurious emission measurements
in 6.5 – 8 GHz range
F_{HIGH} = 927.6493 MHz

Horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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Tel.+972 46288001
Fax.+972 46288277
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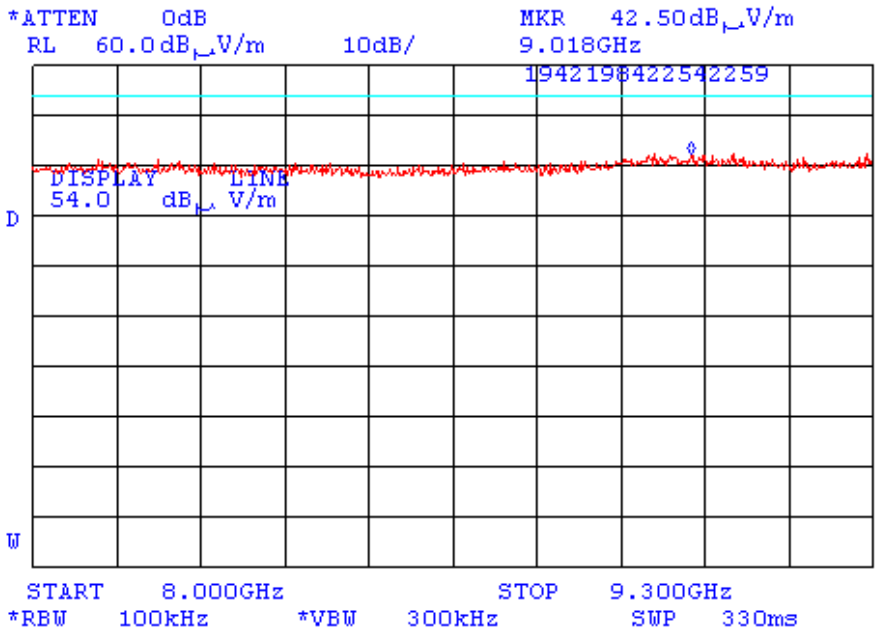
Plot A66

Radiated spurious emission measurements
in 8 – 9.3 GHz range
F_{HIGH} = 927.6493 MHz

Vertical polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
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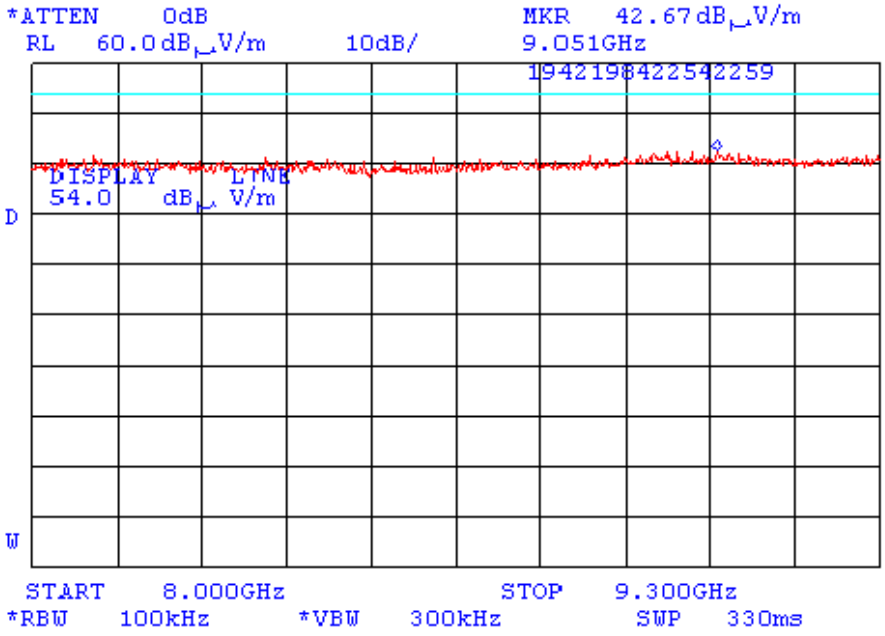
Plot A67

Radiated spurious emission measurements
in 8 – 9.3 GHz range
F_{HIGH} = 927.6493 MHz

Horizontal polarization



Limit (average) for radiated spurious emissions in restricted bands is 54 dB(µV/m)

No spurious emissions were found

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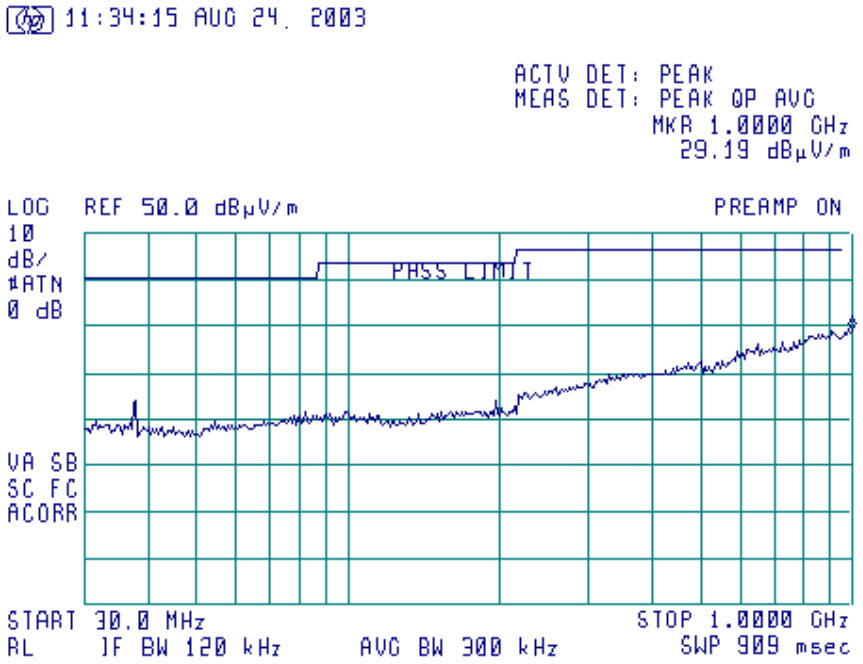
Plot A68

Unintentional radiated emission measurements in 30 – 1000 MHz range, Rx mode

Vertical polarization



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Binyamina 30500, Israel
Tel.+972 46288001
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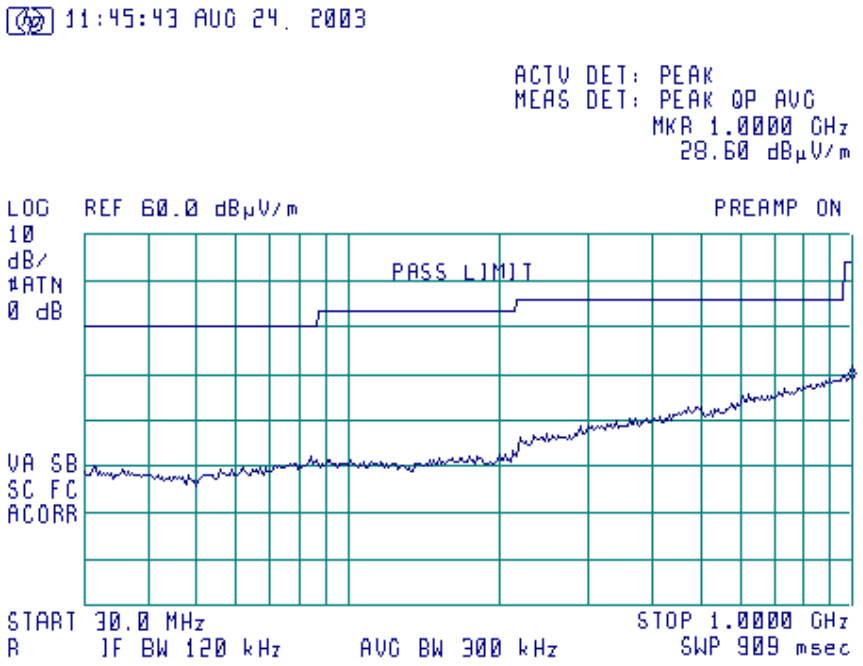
Plot A69

Unintentional radiated emission measurements in 30 – 1000 MHz range, Rx mode

Horizontal polarization



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Tel.+972 46288001
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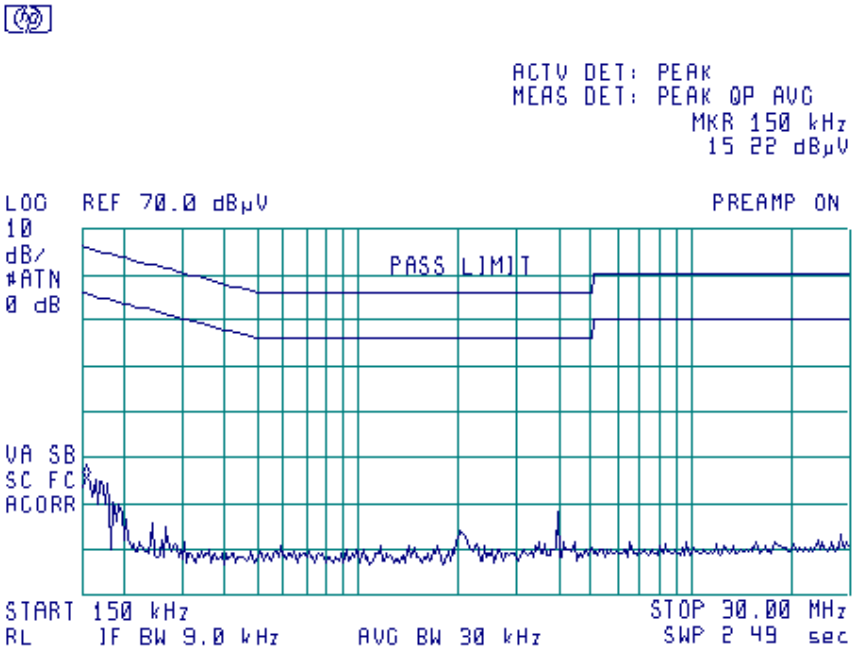
Plot A70

Conducted emission measurements at mains terminals

FREQUENCY RANGE:	0.15 – 30 MHz
MODE OF OPERATION:	Tx
LINE:	Phase
LIMIT:	Quasi-peak, average
DETECTOR:	Peak



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P.O.Box 23
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Tel.+972 46288001
Fax.+972 46288277
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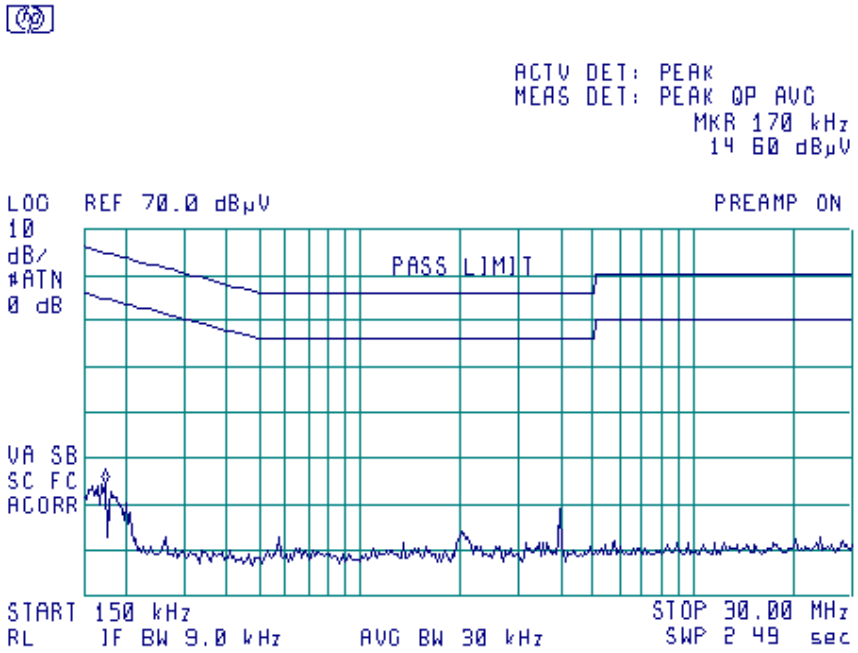
Plot A71

Conducted emission measurements at mains terminals

FREQUENCY RANGE:	0.15 – 30 MHz
MODE OF OPERATION:	Tx
LINE:	Neutral
LIMIT:	Quasi-peak, average
DETECTOR:	Peak

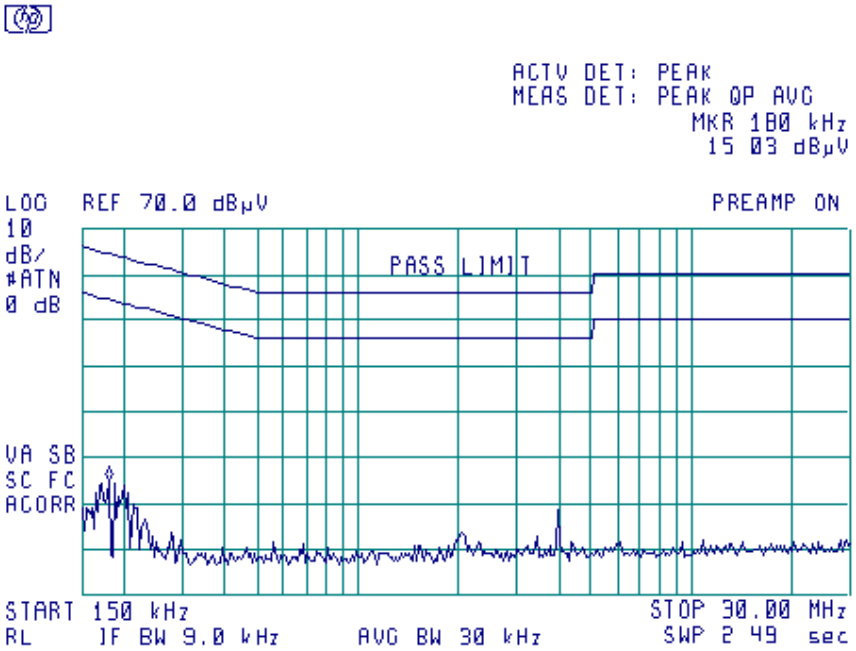


Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A72

Conducted emission measurements at mains terminals

FREQUENCY RANGE:	0.15 – 30 MHz
MODE OF OPERATION:	Rx
LINE:	Phase
LIMIT:	Quasi-peak, average
DETECTOR:	Peak



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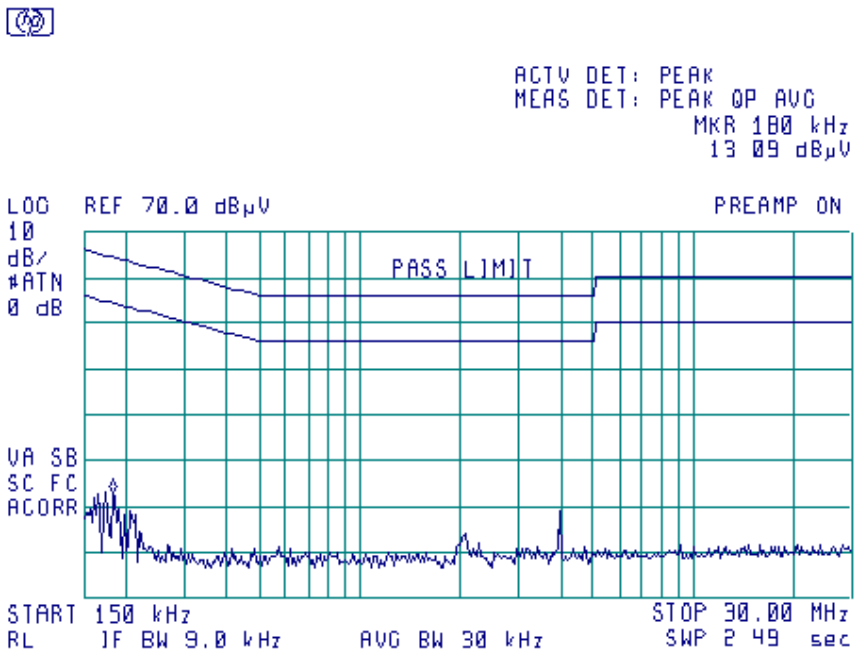
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Plot A73

Conducted emission measurements at mains terminals

FREQUENCY RANGE:	0.15 – 30 MHz
MODE OF OPERATION:	Rx
LINE:	Neutral
LIMIT:	Quasi-peak, average
DETECTOR:	Peak



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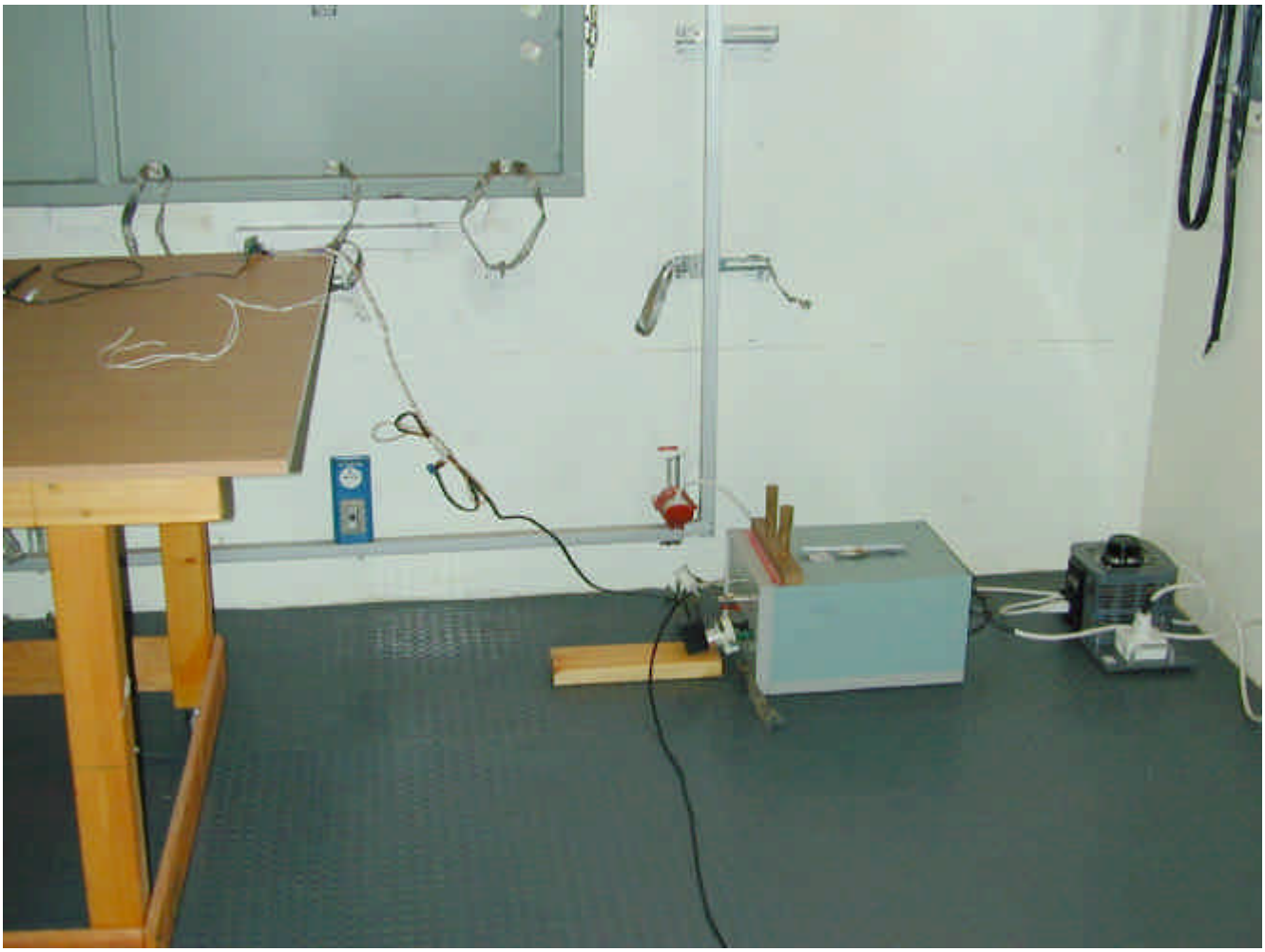
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Appendix B Test setup photographs

Photograph 1

Setup for conducted emission at AC line measurements



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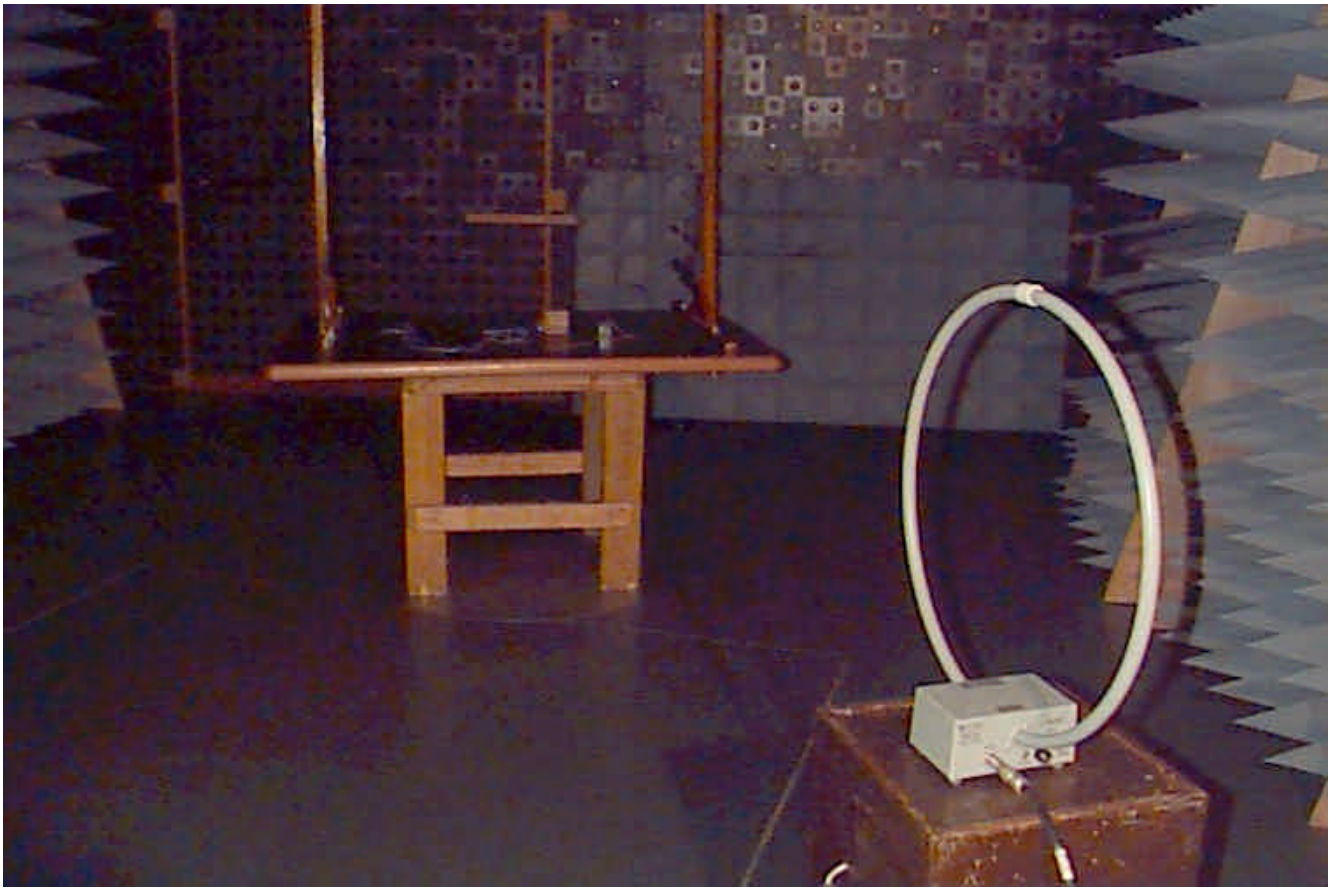
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Photograph 2

Spurious emission measurement setup in anechoic chamber,

Loop antenna in vertical polarization



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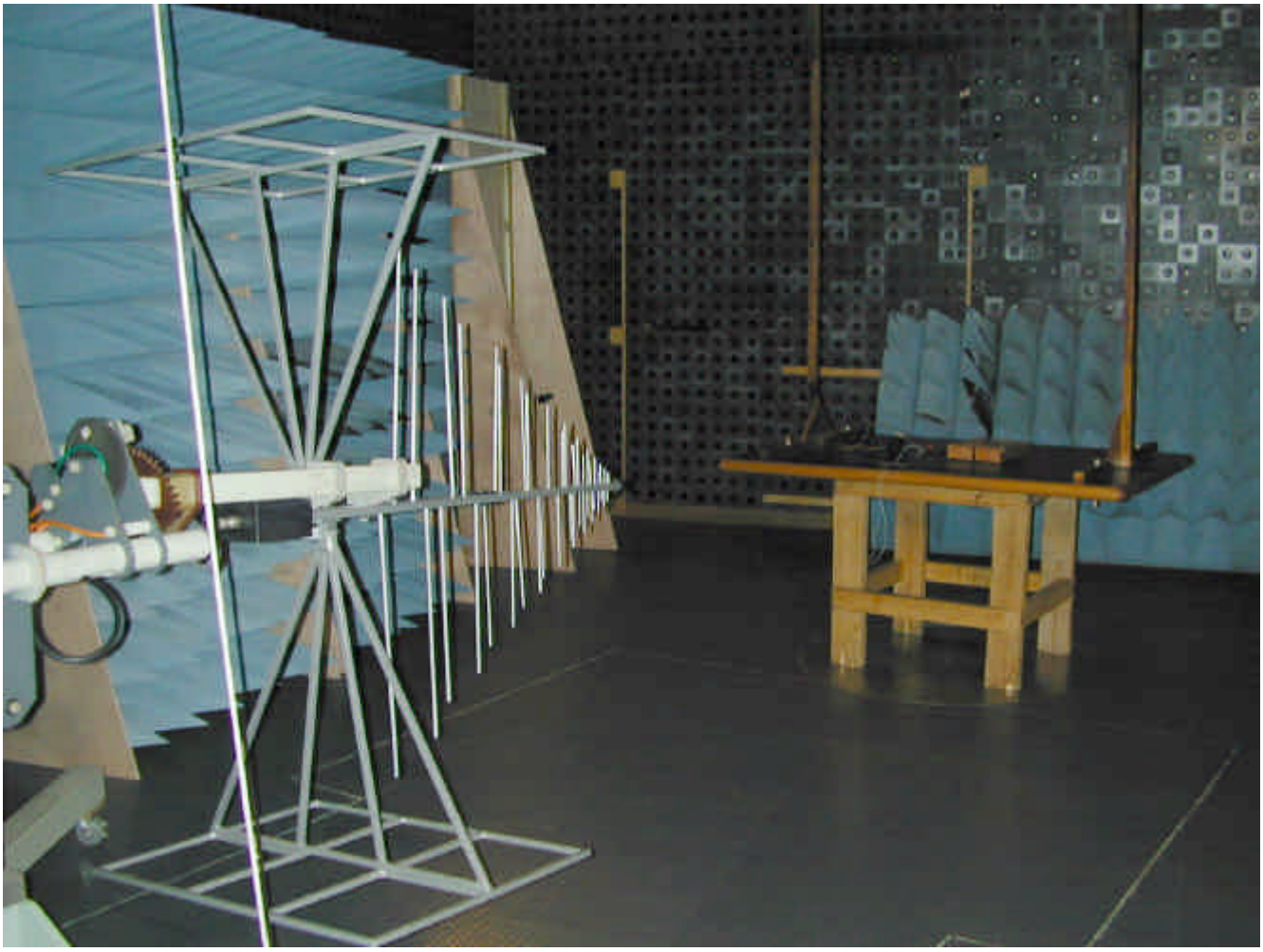
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Photograph 3

Spurious emission measurement setup in anechoic chamber,

Biconilog antenna in vertical polarization



Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Photograph 4

Spurious emission measurement setup in anechoic chamber,

Double ridged guide antenna in vertical polarization

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Photograph 5

Spurious emission measurement setup at OATS,

Double ridged guide antenna in vertical polarization

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Appendix C Example of hopping frequency

Frequency Hopping Sequence Table

Frequency [MHz]	Frequency Assignment	Frequency [MHz]	Frequency Assignment
919.296	18	916.736	8
918.784	16	922.112	29
921.856	28	914.688	0
916.48	7	926.72	47
918.272	14	920.064	21
920.832	24	915.712	4
917.248	10	922.624	31
919.552	19	921.6	27
926.208	45	924.672	39
917.504	11	924.16	37
925.696	43	927.488	50
922.368	30	921.344	26
919.04	17	923.648	35
920.32	22	924.416	38
915.2	2	925.184	41
915.968	5	914.944	1
919.808	20	915.456	3
918.016	13	925.44	42
924.928	40	916.992	9
922.88	32	916.224	6
923.392	34	917.76	12
925.952	44	923.136	33
923.904	36	918.528	15
926.464	46	920.576	23
921.088	25	926.976	48
927.232	49		

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Appendix D Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibration Month/ year
		Name	Model No.	Serial No.	
0026	Spectrum analyzer, 100 Hz-2.2 GHz	Anritsu	MS 2601A	3460	9/04
0163	LISN FCC/VDE/MIL -STD	Electro-Metrics	ANS-25/2	1314	10/03
0337	Probe set, hand held, 5 probes	Electro-Metrics	EHFP-30	238	6/04
0446	Active loop antenna 10 kHz-30 MHz	Electro-Mechanics	6502	2857	10/03
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	7/04
0589	Cable coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	11/03
0592	Position controller	Hermon Labs	L2-SR3000	100	5/04 check
0593	Antenna Mast, 1-4 m/1-6 m Pneumatic	Hermon Labs	AM-F1	101	2/04 check
0594	Turntable for Anechoic Chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	WDC1	102	01/04 check
0604	Antenna biconilog log-periodic/T bow-tie, 26 - 2000 MHz	EMCO	3141	9611-1011	01/04
0787	Transient limiter	Hewlett Packard	11947A-8ZE	3107A01877	11/03
1004	Cable coaxial, ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/03
1200	Quadruplexer, 1-12 GHz	Elettronica S.p.A.-Roma	UE 84	0240	4/04 check
1202	One phase voltage regulator, 2kVA, 0-250V	Hermon Labs	TDGC-2	24	11/03 check
1424	Spectrum analyzer, 30 Hz - 40 GHz	Agilent Technologies	8564EC	3946A00219	8/04
1502	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1502	12/03 check
1510	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1510	12/03
1511	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1511	9/04 check
1562	Oscilloscope 100 MHz, DMM	Tektronix	THS720A	B039444	9/04
1942	Cable 18 GHz, 4 m, blue	Rhophase Microwave Ltd	SPS-1803A-4000-NPS	T4658	10/03
1947	Cable 18 GHz, 6.5 m, blue	Rhophase Microwave Ltd	NPS-1803A-6500-NPS	T4974	10/03
1984	Antenna, double ridged waveguide horn, 1-18 GHz, 300W, N-type	EMC Test Systems	3115	9911-5964	3/04
2009	Cable RF, 8 m	Alpha Wire	RG-214	2009	12/03
2254	Cable 40GHz, 0.8 m, blue	Rhophase Microwave Limited	KPS-1503A-800-KPS	W4907	11/03
2259	Amplifier low noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	11/03
2432	Antenna, Double-Ridged Waveguide Horn	EMC Test Systems	3115	000271777	7/04

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Appendix E Test equipment correction factors

**Antenna factor,
active loop antenna,
model 6502,
serial number 2857 (HL 0446)**

Frequency, MHz	Antenna factor, dB
0.009	-32.8
0.010	-33.8
0.020	-38.3
0.050	-41.1
0.075	-41.3
0.100	-41.6
0.150	-41.7
0.250	-41.6
0.500	-41.8
0.750	-41.9
1.000	-41.4
2.000	-41.5
3.000	-41.4
4.000	-41.4
5.000	-41.5
10.000	-41.9
15.000	-41.9
20.000	-42.2
25.000	-42.8
30.000	-44.0

Antenna factor 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).

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Antenna factor
biconilog antenna EMCO, model 3141,
serial number 1011 (HL 0604)

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).

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Antenna factor
Double-ridged wave guide horn antenna
Model 3115
Serial no: 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 is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Antenna factor
Double-ridged guide 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).

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

**Correction factor,
line impedance stabilization network,
model ANS-25/2,
serial number 1314 (HL 0163)**

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.

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Cable coaxial, GORE A2P01POL118, 2.3 m, model:GORE-3, serial number 176 (HL 0589) + Cable coaxial, ANDREW PSWJ4, 6m, model: ANDREW-6, serial number 163 (HL 1004) Calibration data

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB
1	Insertion loss	30	0.33	-	= 6.5	±0.12
2		50	0.40	-		
3		100	0.57	-		
4		300	0.97	-		
5		500	1.25	-		
6		800	1.59	-		
7		1000	1.81	-		
8		1200	1.97	-		
9		1400	2.15	-		
10		1600	2.28	-		
11		1800	2.43	-		
12		2000	2.61	-		
13		2200	2.75	-		
14		2400	2.89	-		
15		2600	2.97	-		
16	Insertion loss	2800	3.21	-	= 6.5	±0.12
17		3000	3.32	-		
18		3300	3.47	-		
19		3600	3.62	-		
20		3900	3.84	-		
21		4200	3.92	-		±0.17
22		4500	4.07	-		
23		4800	4.36	-		
24		5100	4.62	-		
25		5400	4.78	-		
26		5700	5.16	-		
27		6000	5.67	-		
28		6500	5.99	-		

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Cable RF, 6 m, model: M17/167 MIL-C-17, serial number 1502 (HL 1502)
Calibration data

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

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Cable RF, 8m, model: M17/167 MIL-C-17, serial number 1510 (HL 1510)
Calibration data

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

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Cable RF, 2m, model: Sucoflex 104PE, serial number 13094/4PE (HL 1566)
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB
1	Insertion loss	30	0.10	-	= 5.0	±0.12
2		50	0.13	-		
3		100	0.20	-		
4		300	0.33	-		
5		500	0.45	-		
6		800	0.60	-		
7		1000	0.65	-		
8		1500	0.91	-		
9		2000	1.08	-		
10		2500	1.19	-		
11		3000	1.28	-		
12		3500	1.49	-		
13		4000	1.63	-		
14	Insertion loss	4500	1.63	-	= 5.0	±0.17
15		5000	1.66	-		
16		5500	1.88	-		
17		6000	1.96	-		
18		6500	1.93	-		
19		7000	2.07	-		
20		7500	2.37	-		
21		8000	2.34	-		
22		8500	2.64	-		
23		9000	2.68	-		
24		9500	2.64	-		
25		10000	2.70	-		
26		10500	2.84	-		
27		11000	2.88	-		
28		11500	3.19	-		
29		12000	3.15			
30	Insertion Loss	12500	3.20		= 5.0	±0.26
31		13000	3.22			
32		13500	3.47			
33		14000	3.41			
34		14500	3.59			
35		15000	3.79			
36		15500	4.24			
37		16000	4.12			
38		16500	4.46			
39		17000	4.50			
40		17500	4.49			
41		18000	4.45			

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Cable 18GHz, 4 m, blue, model: SPS-1803A-4000-NPS, serial number T4658 (HL 1942)
Calibration data

Frequency, GHz	Insertion 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	Insertion 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

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Cable 18GHz, 6.5 m, blue, model: NPS-1803A-6500-NPS, s/n T4974 (HL 1947)
Calibration data

Frequency, GHz	Insertion Loss, dB
	HL1947
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	Insertion Loss, dB
	HL1947
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

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Cable 40GHz, 0.8 m, blue, model: KPS-1503A-800-KPS, s/n W4907 (HL 2254)
Calibration data

Frequency, GHz	Insertion loss, dB	Frequency, GHz	Insertion loss, dB
0.03	0.04	5.10	0.80
0.05	0.07	5.30	0.83
0.10	0.09	5.50	0.83
0.20	0.15	5.70	0.84
0.30	0.19	5.90	0.87
0.50	0.25	6.10	0.86
0.70	0.29	6.30	0.89
0.90	0.33	6.50	0.90
1.10	0.37	6.70	0.89
1.30	0.41	6.90	0.93
1.50	0.44	7.10	0.92
1.70	0.45	7.30	0.95
1.90	0.48	7.50	0.96
2.10	0.51	7.70	0.97
2.30	0.53	7.90	1.01
2.50	0.54	8.10	1.00
2.70	0.57	8.30	1.05
2.90	0.59	8.50	1.04
3.10	0.61	8.70	1.07
3.30	0.64	8.90	1.11
3.50	0.65	9.10	1.09
3.70	0.68	9.30	1.14
3.90	0.69	9.50	1.12
4.10	0.71	9.70	1.15
4.30	0.73	9.90	1.16
4.50	0.75		
4.70	0.77		
4.90	0.79		

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Cable RF, 8 m, model:RG-214, serial number C-56 (HL 2009)
Calibration data

No.	Parameter	Set, MHz	Measured, dB	Meas. Uncert., dB
1	Insertion loss	1	0.10	±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	

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30500, Israel
Tel.+972 46288001
Fax.+972 46288277
e-mail: *mail@hermonlabs.com*

Appendix F 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).

Address: PO Box 23, Binyamina 30500, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, QA manager.

Abbreviations and acronyms

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

AC	alternating current
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
DSS	Part 15 spread spectrum transmitter
EMC	electromagnetic compatibility
EUT	equipment under test
GHz	gigahertz
H	height
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
LISN	line impedance stabilization network
m	meter
MHz	megahertz
QP	quasi-peak
RF	radio frequency
RE	radiated emission
s	second
V	volt
W	width

Specification references

47CFR part 15: 2003	Radio Frequency Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 1992	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.