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Electrical

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ELECTROMAGNETIC EMISSION TEST REPORT

ACCORDING TO 47CFR PART 15, SUBPART C § 15.249, 15.209, 15.205 and SUBPART B

for

Hi-G-Tek Ltd.

EQUIPMENT UNDER TEST:

Data tag transceiver

Model: IG-DT-40-916

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1 Project information

Description of equipment under test

Test item	Data tag transceiver
Manufacturer	Hi-G-Tek Ltd.
Type (Model)	IG-DT-40-916
Software release	3.01
Serial number	QGHA52101178
Equipment FCC code[1]	DSR

Applicant information

Applicant's responsible person	Mr. Roni Cohen, project manager
Company	Hi-G-Tek Ltd.
Address	16, Haharoshet street
City	Or-Yehuda
Postal code	60375
Country	Israel
Telephone number	+972 35331575
Telefax number	+972 35339225

Test performance

Project number:	15297
Location	Hermon Laboratories
Receipt date	October 6, 2002
Test started	October 6, 2002
Test completed	October 21, 2002
Purpose of test	Apparatus compliance verification in accordance with emission requirements
Test specifications	47CFR Part 15, §15.249, 15.209, 15.205 and subpart B

[1] FCC Equipment codes – see Appendix D

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2 Summary of tests

The tests listed in the table below were performed. The EUT was found complying with the limits of 47CFR Part 15, §15.249, 15.209, 15.205 and subpart B.

Parameter		Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
Transmitter characteristics, §15.249, §15.209									
Field strength of fundamental	**916.5 MHz**	15.249(a)	**C**				Mrs. E. Pitt, test engineer	October 13, 2002	
	125 kHz	15.209(a)	**C**					October 21, 2002	
Field strength of harmonics for916.5 MHz fundamental		15.249(a) (a)	**C**				Mrs. E. Pitt, test engineer	October 13, 2002	
Out of band spurious emissions (radiated) for fundamental	**916.5 MHz**	15.249(c)	**C**				Mrs. E. Pitt, test engineer	October 13, 2002	
	125 kHz	15.209(c)	**C**					October 21, 2002	
Unintentional radiation, §15.107, §15.109									
Conducted emissions		15.107				**NA**			
Radiated emissions (including receiver)		15.109, 15.209	**C**				Mrs. E. Pitt, test engineer	October 13 and 21, 2002	

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.

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Parameter	Subclause	C	NC	NT	NA	Remarks
General conditions under Part 15						
The Intentional radiator operates at 125 kHz and 916.5 MHz.	15.209, 15.249	**C**				
The intentional radiator does not operate in the restricted bands of operation.	15.205	**C**				
The intentional radiator has permanently attached antenna or antenna that uses a unique coupling to the intentional radiator.	15.203	**C**				
The intentional radiator has a standard connector and must be professionally installed. To demonstrate that professional installation is required, the following three points must be addressed: (a) the application (or intended use) of the EUT; (b) the installation requirements of the EUT, and (c) the method by which the EUT will be marketed.	15.203				**NA**	
No antenna other than that furnished by the responsible party can be used with the device.	15.203				**NA**	
Antenna technical characteristics, as referred to in "Transmitter description" table in the test report	15.204	**C**				
NOTE: C: The parameter is compliant with the requirements. NC: The parameter is not compliant with the requirements. NT: The parameter is not tested. NA: The test of this parameter is not applicable.						

Test report prepared by: Ms. N. Averin, certification engineer

Mr. M. Nikishin, EMC group leader

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

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3 EUT specification

3.1 General description

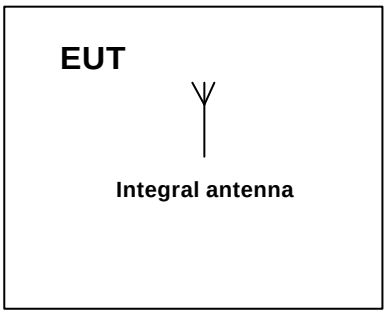
The EUT, a data tag, model IG-DT-40-916, is a transceiver intended for automatic processing of secured cargoes and real time monitoring of cargoes in transit and in storage. The data tag is a stand-alone unit, it has two RF channels, high frequency and low frequency. The device operates at 916.5 MHz and at 125 kHz and is powered from 3.6 V lithium battery.

Local oscillator frequencies are: 32.768 kHz, 8 MHz, 26.641176 MHz and 28.64062 MHz.

3.2 EUT test configuration

The EUT test configuration is shown in Figure 3.2.1.

Figure 3.2.1 EUT test configuration



3.2.1 Changes made in EUT

To withstand the standard requirements the following changes were made in the EUT during the testing.

1. 100 pF capacitor C54 was replaced with 2.2 pF one.
2. 22 kΩ resistor R44 was replaced with 27 kΩ one.

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

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3.3 Transmitter description

Type of equipment						
Ú	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	A: 916.5 MHz B: 125 kHz					
Transmitter aggregate data rate (bits per second)	A: 15625 B: 4000					
Normal test signal	Transmit carrier					
Maximum rated output power						
	At transmitter permanent external 50Ω rf output connector (dBm)					
	Effective radiated power (for equipment with integral antenna) (dBm)	A: -8.5 B: -25				
	Is transmitter output power variable?	Ú	No			
			Yes		continuous variable	
					stepped variable	
					stepsize (dB):	
					minimum RF power (dBm):	
					maximum RF power (dBm):	
Transmitter power source						
Ú	**Battery**	**Nominal rated voltage (VDC)**	**3.6**			
	Nickel Cadmium					
Ú	Lithium					
	Other					
	DC	**Nominal rated voltage (VDC)**				
	AC mains	**Nominal rated voltage (VAC)**				
Is there common power source for transmitter and receiver			Ú	yes		no

Antenna technical characteristics						
			Type	**Manufacturer**	**Model number**	**Gain**
Integral		with temporary RF connector				
	Ú	without temporary RF connector	A: Path	HI-G-TEK	ANT47016	-5dBi
			B: Ferrite	HI-G-TEK	ANT251	NA
External						

External antenna connection			

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4 Tests results

4.1 Field strength of fundamental according to § 15.249 (a), §15.209(a)

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4
DATE: October 13, 2002
RELATIVE HUMIDITY: 45 %
AMBIENT TEMPERATURE: 24 °C
AIR PRESSURE: 1010 hPa
TEST PERFORMED IN: ANECHOIC CHAMBER
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
ANTENNA TYPE: BICONILOG

Peak detector

Carrier frequency, MHz	Field strength, dB(μV/m)	Specification limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
916.5	86.39	94	7.61	A1
Measurement uncertainty, dB		+5.73 / -5.57		

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1003	HL 1004	HL 2009

LIMIT

Operating frequency range, MHz	Field strength of fundamental, dB(μV/m)
902-928	94
2400-2483.5	94
5275-5850	94
24000-24250	107.95

For frequencies above 1000 MHz, the above field strength limits are based on average limits.

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.

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METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4
DATE: October 21, 2002
RELATIVE HUMIDITY: 45 %
AMBIENT TEMPERATURE: 24 °C
AIR PRESSURE: 1010 hPa
TEST PERFORMED IN: ANECHOIC CHAMBER
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
ANTENNA TYPE: LOOP

Peak detector

Carrier frequency, kHz	Field strength, dB(μV/m)	Limit*, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
125.531	63.00	105.68	42.68	A2
Measurement uncertainty, dB		±4		

* The limit is based on measurements employing an average detector according to §15.209(d).

The 26 dB bandwidth was found to be 125.461 – 125.600 kHz, as demonstrated in Plots A3 and A4.

TEST EQUIPMENT USED:

HL 0446	HL 0465	HL 0521	HL 0589	HL 0594	HL 1003	HL 1004	HL 2009

LIMIT

Frequency, MHz	Limit, dB(μV/m)	Measurement distance, m
0.009 – 0.490	67.60-20logF*	300**
0.490 – 1.705	87.60-20logF*	30**
1.705 - 30	29.5	30**
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

* F is frequency in kHz.

**The limit for 3 m distance was calculated using the inverse square distance extrapolation factor as follows:

$Lim S_2 = Lim\ S_1 + 40 \log (S_1/S_2)$, where S_1 = 300 m or 30 m, S_2 = 3 m.

At 124.8 kHz the limit was calculated:

$Lim_{3m} = 67.60 - 20 \log 124.8 + 40 \log (300/3) = 105.68$ dB(μV/m)

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table in each of three orthogonal planes in turn.

The loop antenna was positioned with its plane horizontal. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360°. Then the loop position was changed to vertical. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis. Plots A2 to A4 in Appendix A refer to vertical antenna polarization as the worst case.

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4.2 Field strength of harmonics according to § 15.249 (a)

METHOD OF MEASUREMENTS:	ANSI 63.4 §13.1.4
DATE:	October 13, 2002
RELATIVE HUMIDITY:	45 %
AMBIENT TEMPERATURE:	24 °C
AIR PRESSURE:	1010 hPa
CARRIER FREQUENCY:	916.5 MHz
TEST PERFORMED IN:	ANECHOIC CHAMBER
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
ANTENNA TYPE:	DOUBLE RIDGED GUIDE

Average detector

Harmonic, MHz	Ant. pol.	TT pos., (^{o})	Field strength, dB(μV/m)	Average limit, dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
1833	V	244	48.6	54	5.4	A6
3666	H	247	52.7	54	1.3	A8
Measurement uncertainty, dB				+5.73 / -5.57		

The test results recorded in the table were obtained throughout the testing with antenna at 1.6 m height.

Table calculations and abbreviations:
Ant. pol. = antenna polarization (V – vertical, H – horizontal).
TT pos. = turntable position in degrees, (EUT front panel = 0^o).
Margin = dB below (negative if above) specification limit.

TEST EQUIPMENT USED:

HL 0041	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 1004	HL 1424	HL 1947

LIMIT

Operating frequency range, MHz	Field strength of harmonics, dB(μV/m)	
	Peak limit	Average limit
902-928	74	54
2400-2483.5	94	74
5275-5850	94	74
24000-24250	107.95	87.95

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.

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4.3 Out of band spurious emissions according to § 15.249 (d), §15.209

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4/ §13.1.5
MODE OF OPERATION: Tx
DATE: October 13, 2002
RELATIVE HUMIDITY: 45 %
AMBIENT TEMPERATURE: 24 °C
AIR PRESSURE: 1010 hPa
TEST DISTANCE: 3 m
CARRIER FREQUENCY: 916.5 MHz
FIELD STRENGTH LEVEL AT WHICH THE MEASUREMENT HAS BEEN PERFORMED: 86.39 dB(µV/m)
FREQUENCY RANGE: 9 kHz – 9.5 GHz

TEST PERFORMED IN: ANECHOIC CHAMBER
FREQUENCY RANGE: 9 kHz – 30 MHz
ANTENNA TYPE: LOOP

Peak detector

Frequency, MHz	Radiated emission, dB (■V/m)	Limit, dB(■V/m)	Margin, dB	Reference to Plots in Appendix A
0.009 – 0.15	No spurious emissions were found			A9
0.15 - 30	No spurious emissions were found			A10
Measurement uncertainty, dB	±4			

TEST PERFORMED IN: ANECHOIC CHAMBER
FREQUENCY RANGE: 30 MHz – 1 GHz

Quasi-peak detector

Frequency, MHz	Radiated emission, dB (■V/m)	Limit, dB(■V/m)	Margin, dB	Reference to Plots in Appendix A
859.2	29.6	46.0	16.4	A12
887.9	32.9	46.0	13.1	A12
945.2	31.6	46.0	14.4	A13
949.4	29.3	46.0	16.7	A13
Measurement uncertainty, dB	+5.73 / -5.57			

The test results recorded in the tables were obtained throughout the testing with biconilog antenna in vertical polarization at 1 m height and 247 ^{o} azimuth.

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

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MODE OF OPERATION: Tx
TEST PERFORMED IN: ANECHOIC CHAMBER
FREQUENCY RANGE: 1 – 9.5 GHz
ANTENNA TYPE: DOUBLE RIDGED GUIDE

Peak detector

Frequency, MHz	Antenna polarization	Radiated emission, dB (■V/m)	Limit, dB(■V/m)	Margin, dB	Reference to Plots in Appendix A
1000 – 29000	V+H	No spurious emissions were found except harmonics			A5
2900 – 6000	V+H	No spurious emissions were found except harmonics			A7
6000 – 8000	V+H	No spurious emissions were found			A14
8000 – 9500	V+H	No spurious emissions were found			A15
Measurement uncertainty, dB		+5.73 / -5.57			

Table abbreviations:
Antenna polarization: V = vertical, H = horizontal

LIMIT

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

TEST EQUIPMENT USED:

HL 0041	HL 0446	HL 0465	HL 0521	HL 0554	HL 0589	HL 0593
HL 0594	HL 0604	HL 1004	HL 1424	HL 1567	HL 1942	HL 1947

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table in each of three orthogonal planes in turn.

9 kHz – 30 MHz. 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 A9 and A10 in Appendix A refer to vertical antenna polarization as the worst case.

30 MHz – 9.5 GHz. 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.

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METHOD OF MEASUREMENTS:	ANSI 63.4 §13.1.4/ §13.1.5
MODE OF OPERATION:	Tx
DATE:	October 21, 2002
RELATIVE HUMIDITY:	45 %
AMBIENT TEMPERATURE:	24 °C
AIR PRESSURE:	1010 hPa
TEST DISTANCE:	3 m
CARRIER FREQUENCY:	125 kHz
FIELD STRENGTH LEVEL AT WHICH THE MEASUREMENT HAS BEEN PERFORMED:	64.71 dB(µV/m)
FREQUENCY RANGE:	9 kHz – 30 MHz

TEST PERFORMED IN:	ANECHOIC CHAMBER
FREQUENCY RANGE:	9 kHz – 30 MHz
ANTENNA TYPE:	LOOP

Peak detector

Frequency, MHz	Radiated emission, dB (µV/m)	Limit, dB(µV/m)	Margin, dB	Reference to Plots in Appendix A
0.009 – 0.15	No spurious emissions were found			A16
0.15 - 30	No spurious emissions were found			A17
Measurement uncertainty, dB	±4			

LIMIT

Radiated emissions must comply with §15.209(a) limits.

TEST EQUIPMENT USED:

HL 0446	HL 0465	HL 0521	HL 0589	HL 1003	HL 1004	

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table in each of three orthogonal planes in turn.

The loop antenna was positioned with its plane horizontal. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360°. Then the loop position was changed to vertical. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis. Plots A16 and A17 in Appendix A refer to vertical antenna polarization as the worst case.

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4.4 Unintentional radiated emissions including receiver, according to §15.209, §15.109

METHOD OF MEASUREMENT:	ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
TEST PERFORMED IN:	ANECHOIC CHAMBER
MODE OF OPERATION:	Rx
DATE:	October 13, 2002
RELATIVE HUMIDITY:	45 %
AMBIENT TEMPERATURE:	24 °C
AIR PRESSURE:	1010 hPa
DISTANCE BETWEEN ANTENNA AND EUT:	3 m
THE EUT WAS TESTED AS:	TABLE-TOP

RECEIVER HIGHEST OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	9 kHz – 5 GHz

The EUT highest used frequency (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

In 30 – 1000 MHz the EUT was tested in Rx mode. All the measured emissions were found below the limits of §15.109 as shown in Plot A18.

Below 30 MHz and above 1 GHz the device was tested in Tx mode, and emissions were found below the limits of §15.209 (9 kHz – 30 MHz) and §15.109 (1 – 5 GHz) as shown in Plots A5, A7, A16 and A17.

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LIMIT

(§ 15.209)

Frequency, MHz	Limit, dB(μV/m)	Measurement distance, m
0.009 – 0.490	67.60-20logF*	300**
0.490 – 1.705	87.60-20logF*	30**
1.705 - 30	29.5	30**

* F is frequency in kHz.

**The limit for 3 m distance was calculated using the inverse square distance extrapolation factor as follows:

$Lim S_2 = Lim\ S_1 + 40 \log (S_1/S_2)$, where S_1 = 300 m or 30 m, S_2 = 3 m.

(§ 15.109)

Frequency, MHz	Class B limit, dB(μV/m)	Measurement distance, m
30 - 88	40	3
88 - 216	43.5	3
216 - 960	46	3
960 - 5000	54	3

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1004

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height turntable.

30 – 1000 MHz. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

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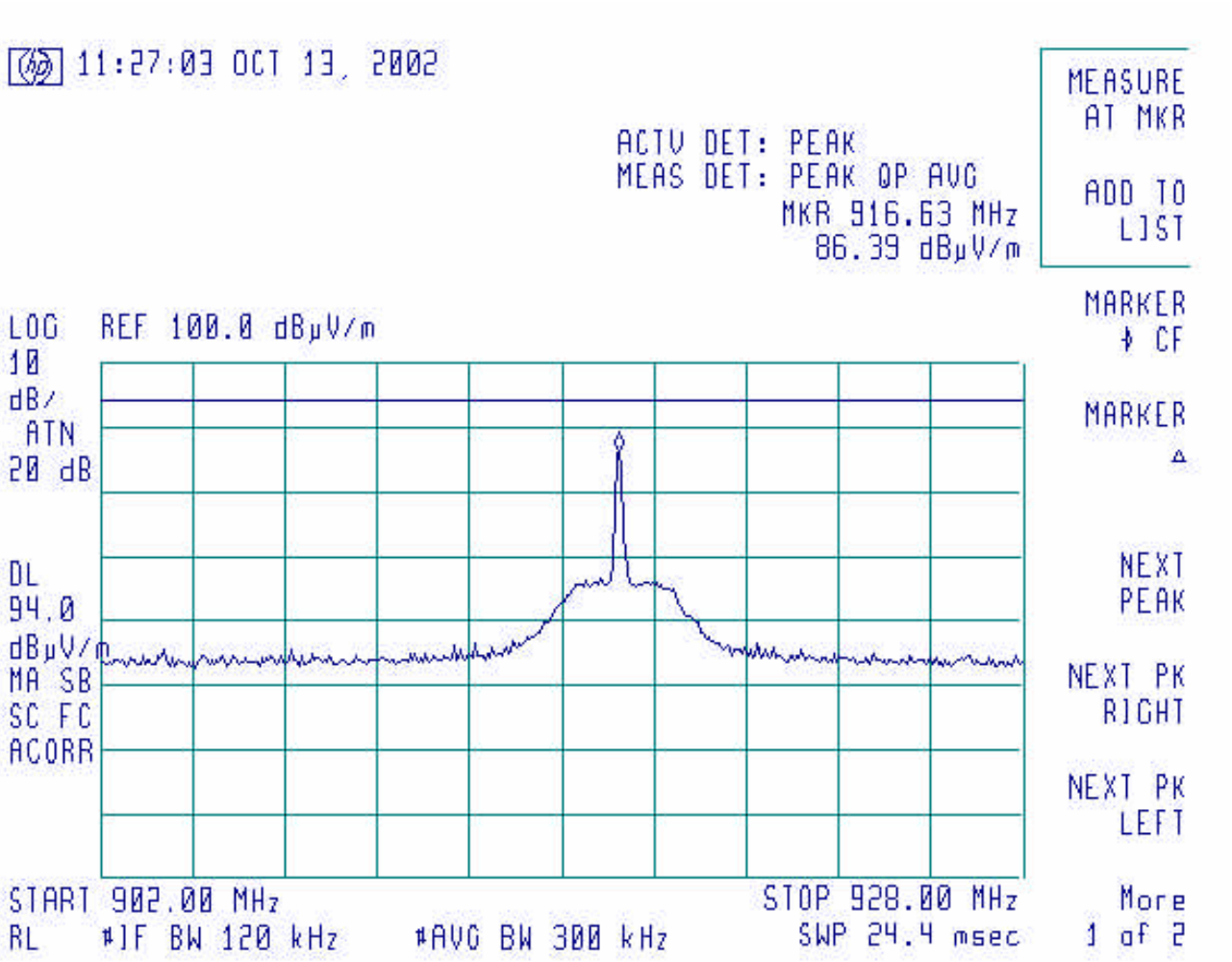
Appendix A Plots

Plot A1
916.5 MHz carrier field strength



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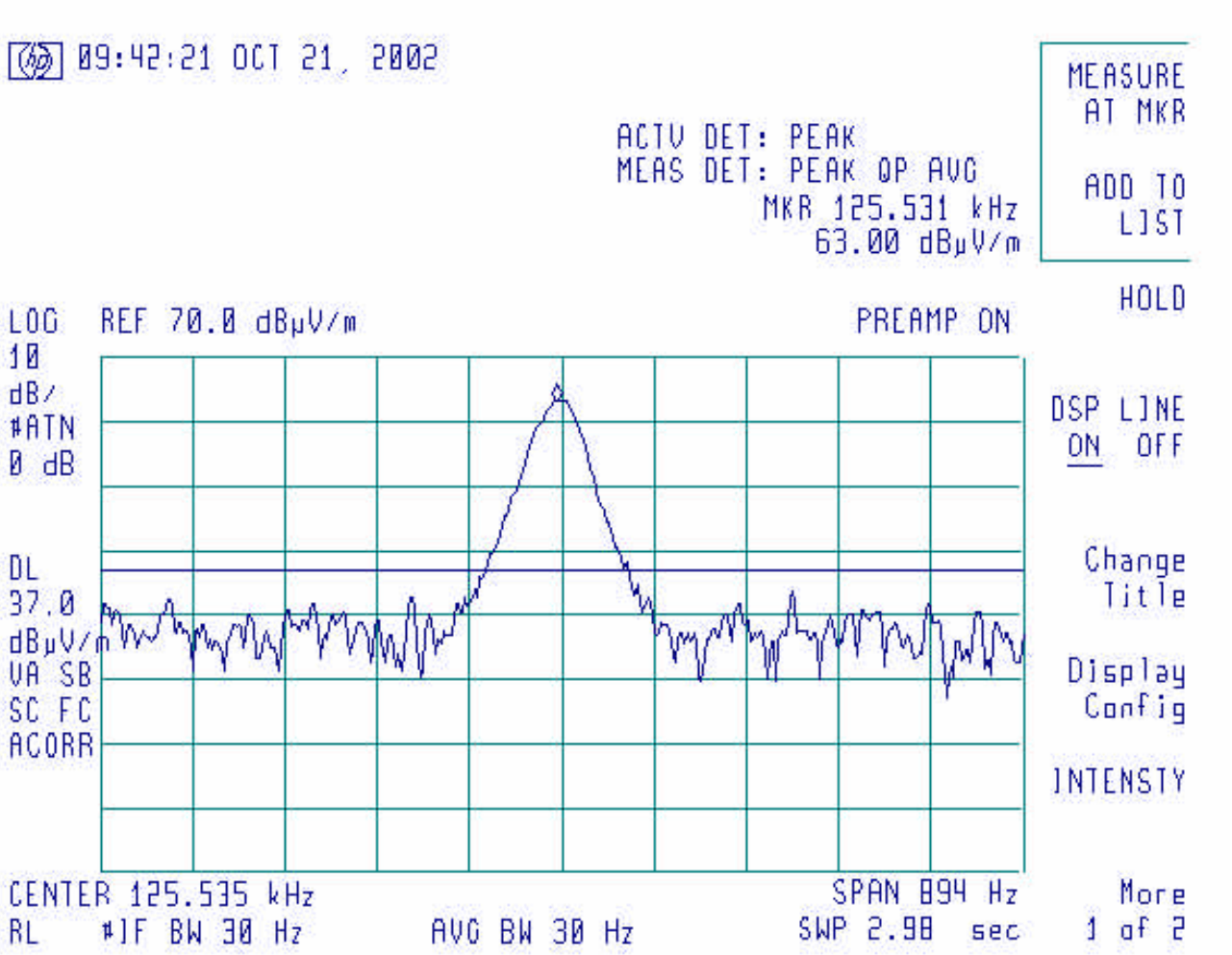
Plot A2
125 kHz carrier field strength



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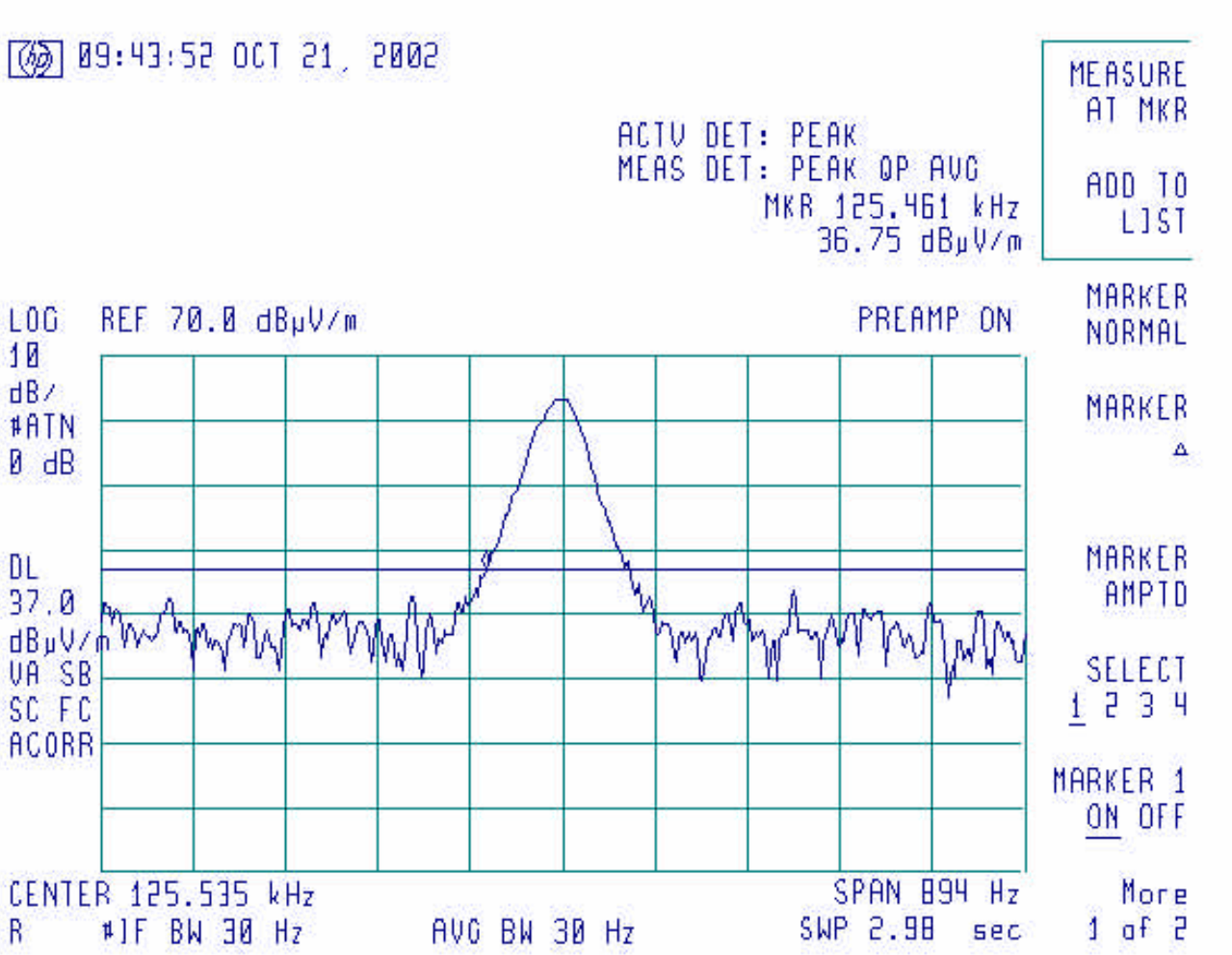
Plot A3
26 dB bandwidth measurements for 125 kHz carrier frequency, left edge



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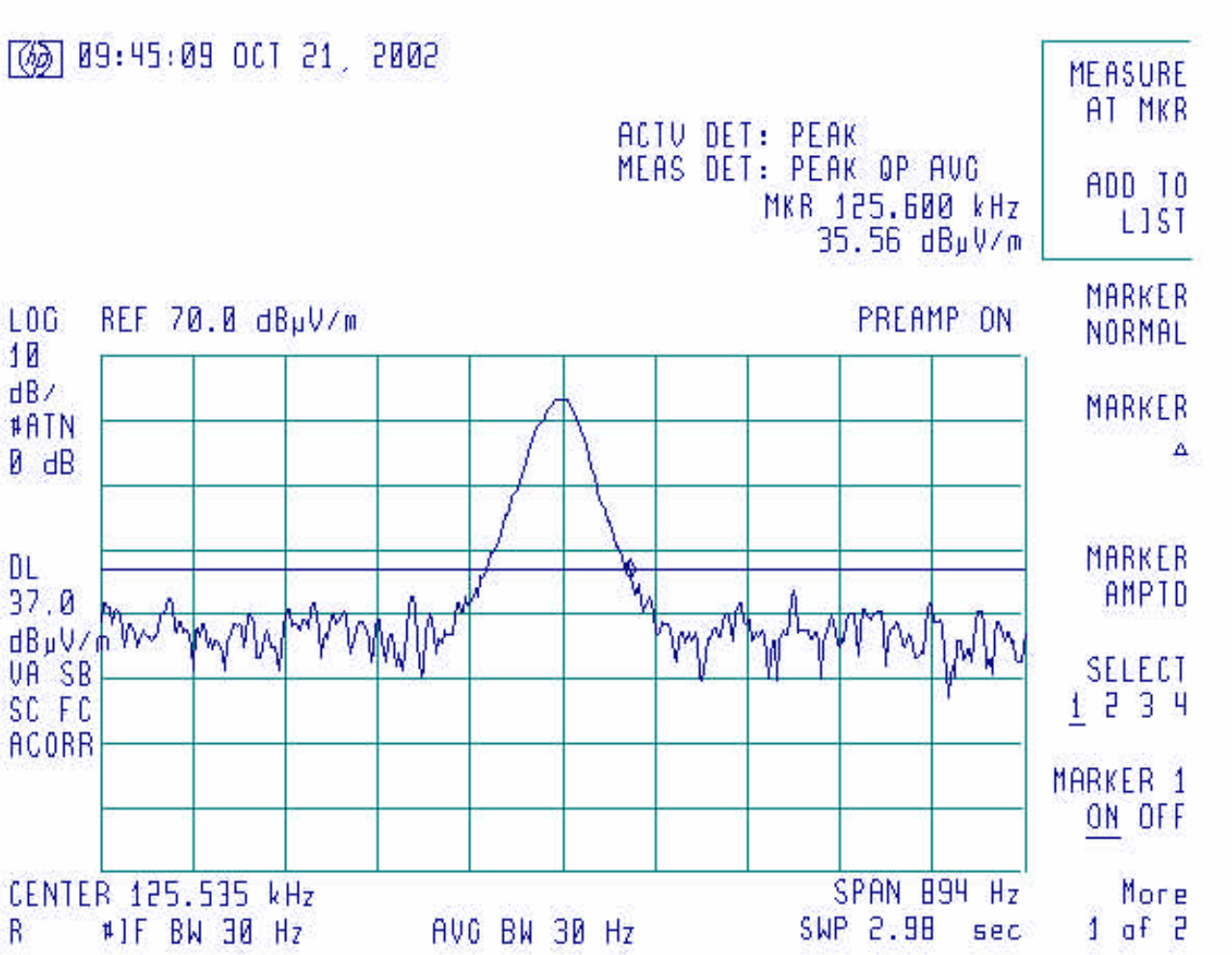
Plot A4
26 dB bandwidth measurements for 125 kHz carrier frequency, right edge



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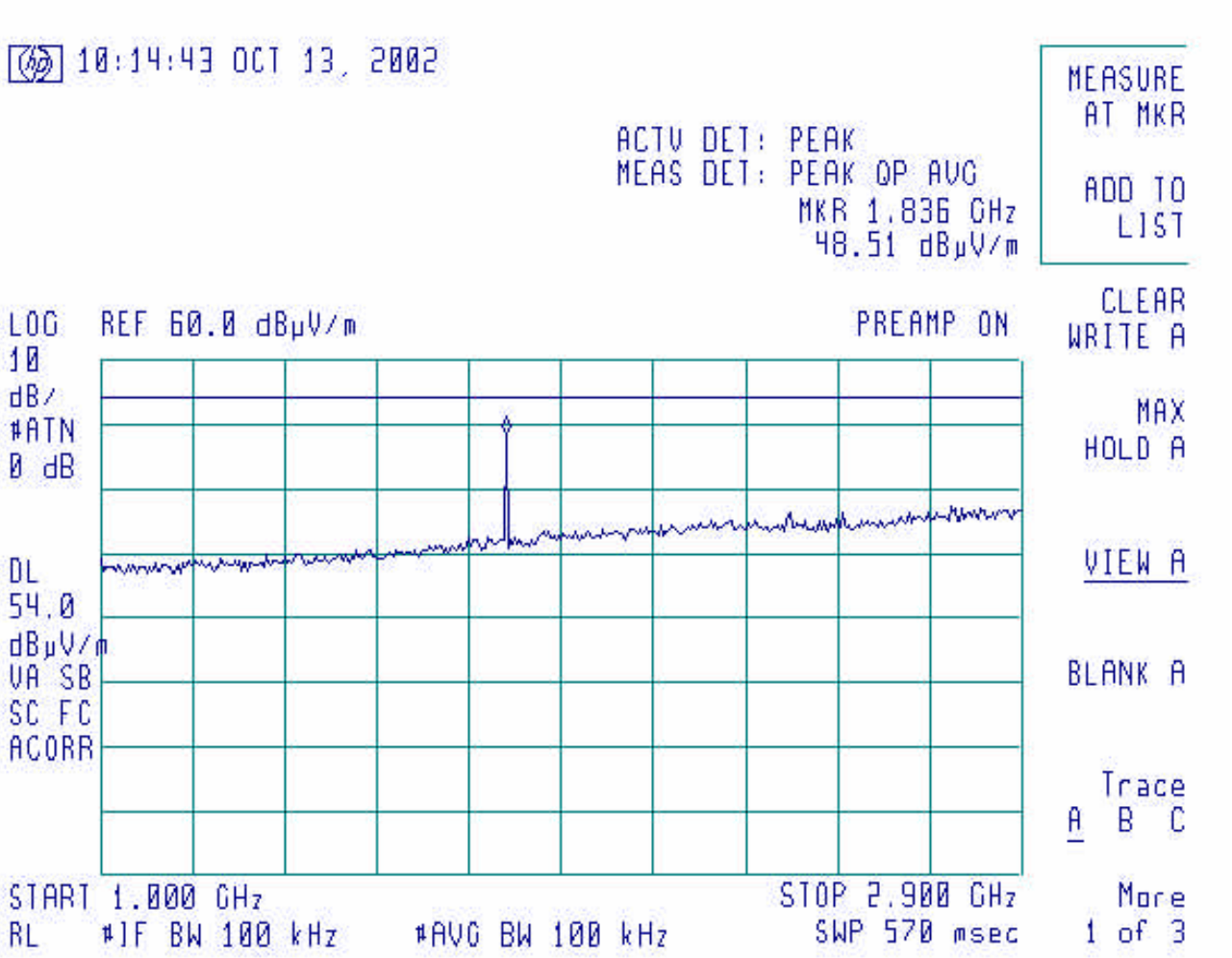
Plot A5
Field strength of harmonics

EUT OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	1 – 2.9 GHz



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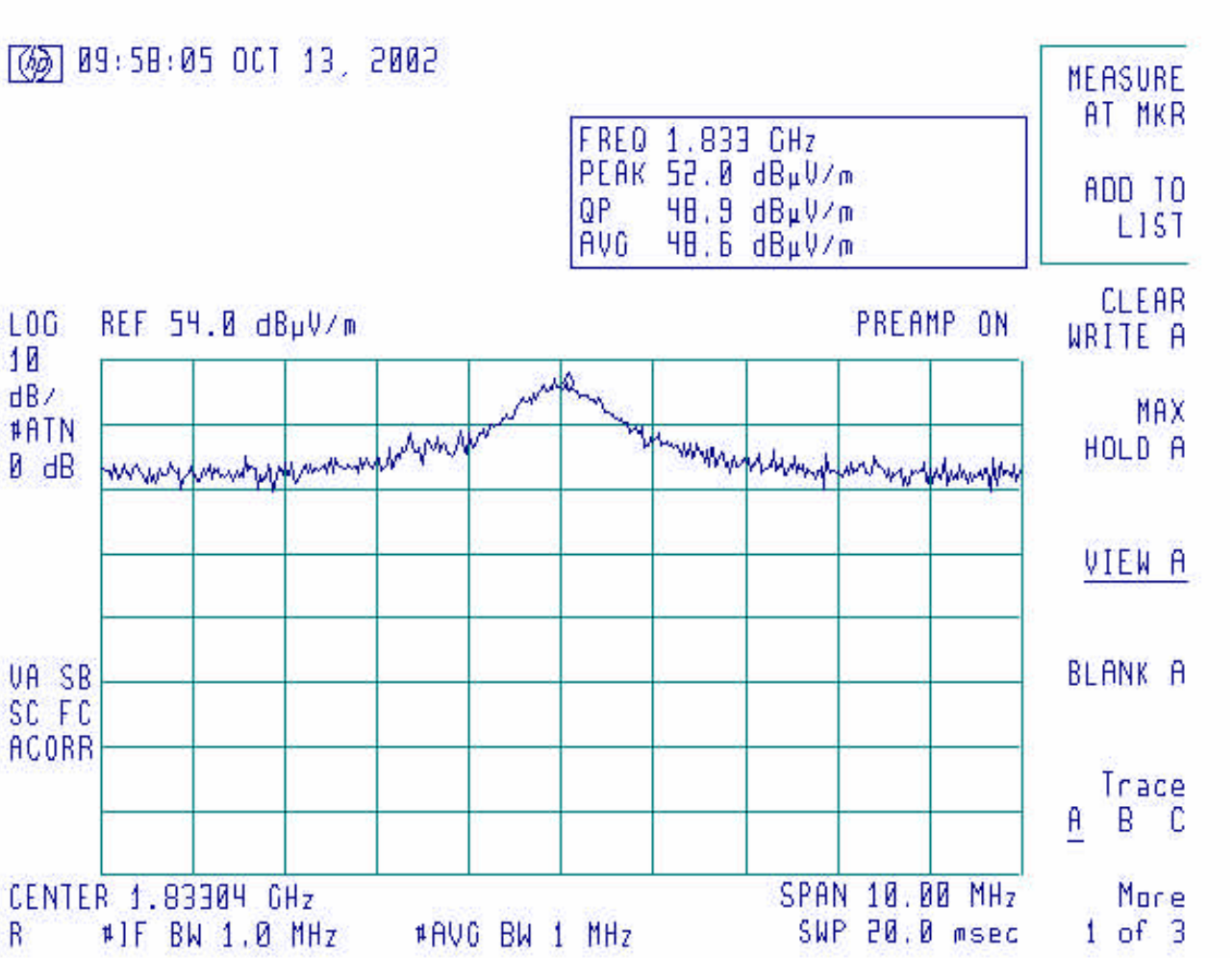
Plot A6
The 2nd harmonic

EUT OPERATING FREQUENCY:	916.5 MHz
CENTER FREQUENCY:	1.833 GHz



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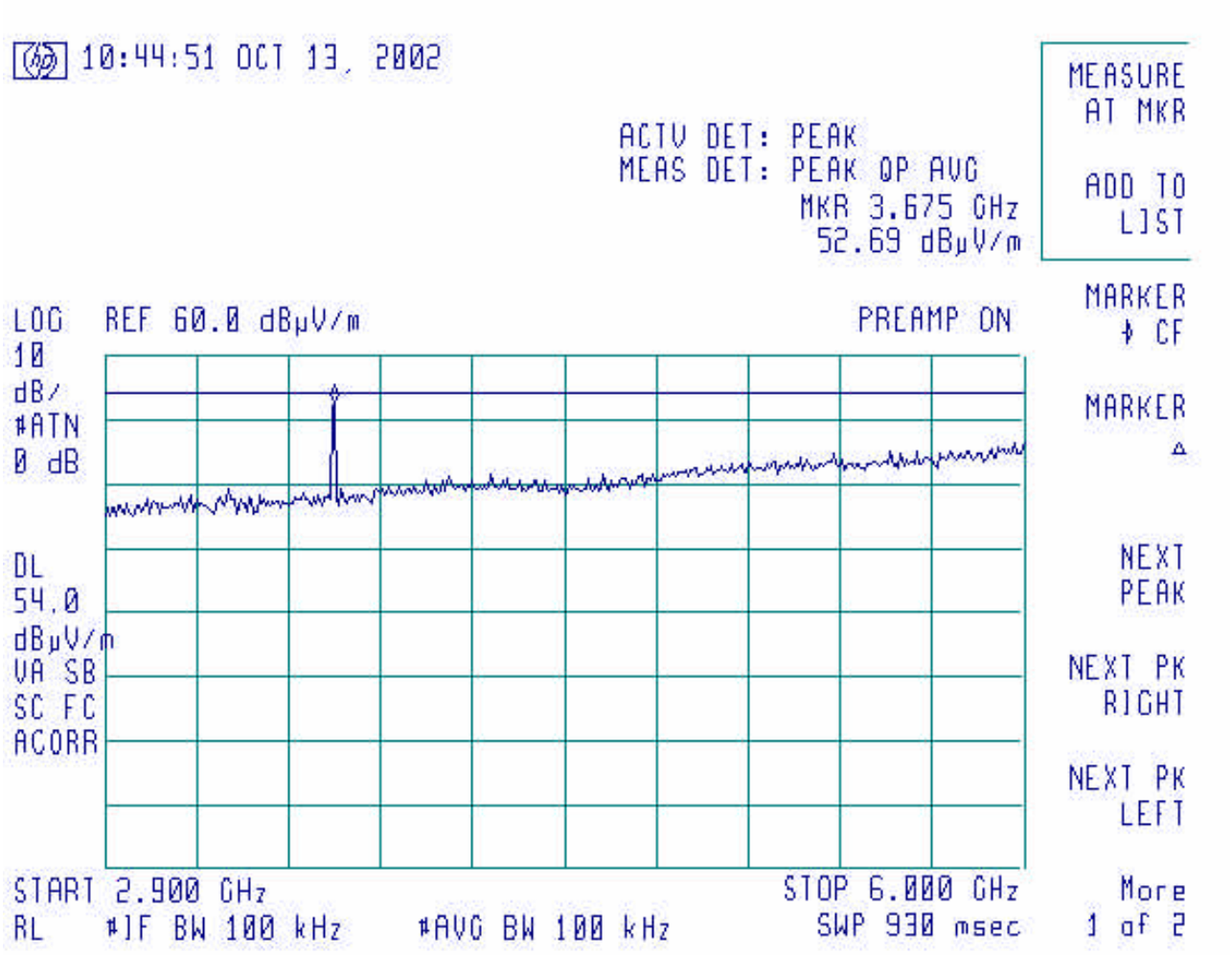
Plot A7
Field strength of harmonics

EUT OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	2.9 – 6.0 GHz



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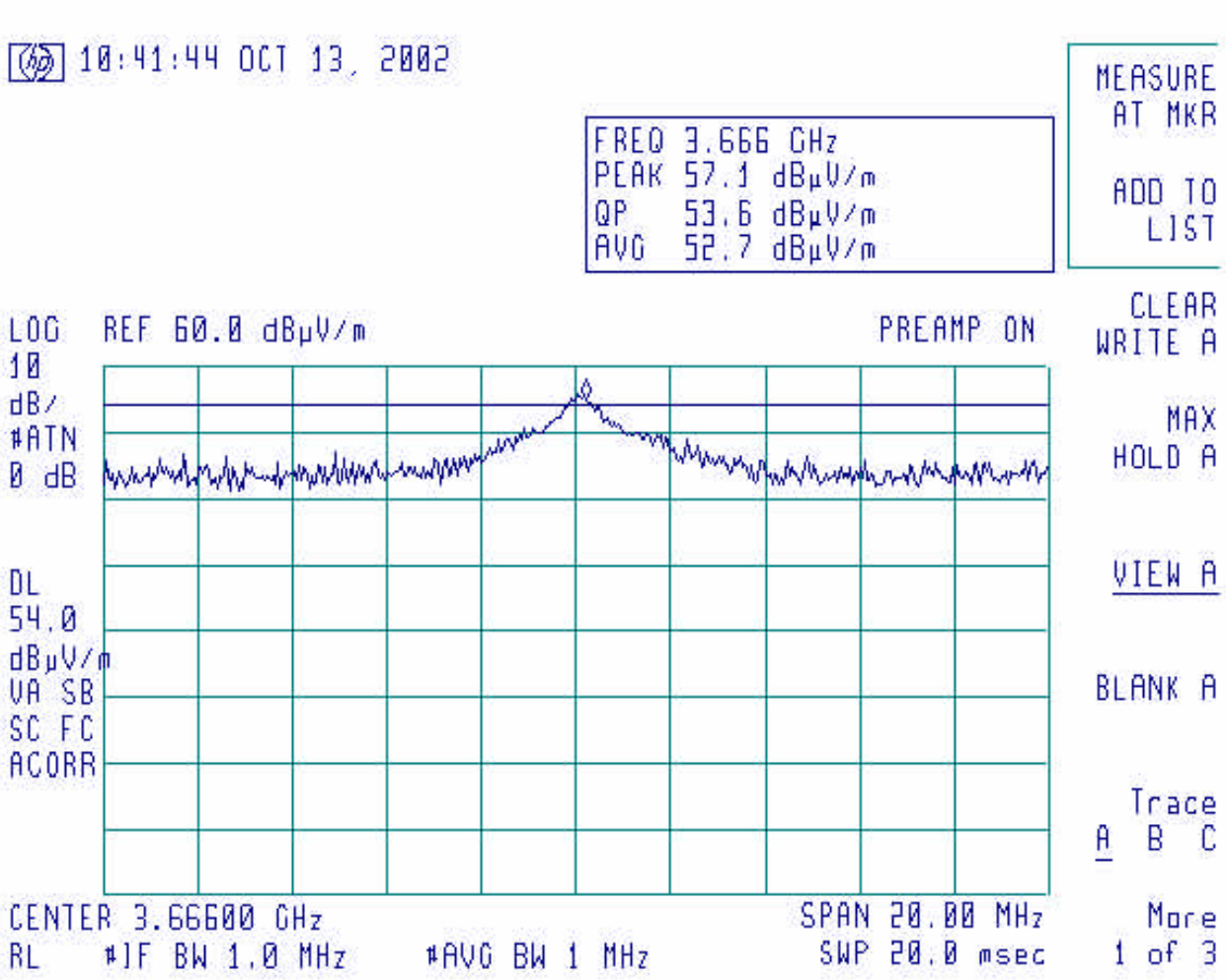
Plot A8
The 4th harmonic

EUT OPERATING FREQUENCY:	916.5 MHz
CENTER FREQUENCY:	3.666 GHz



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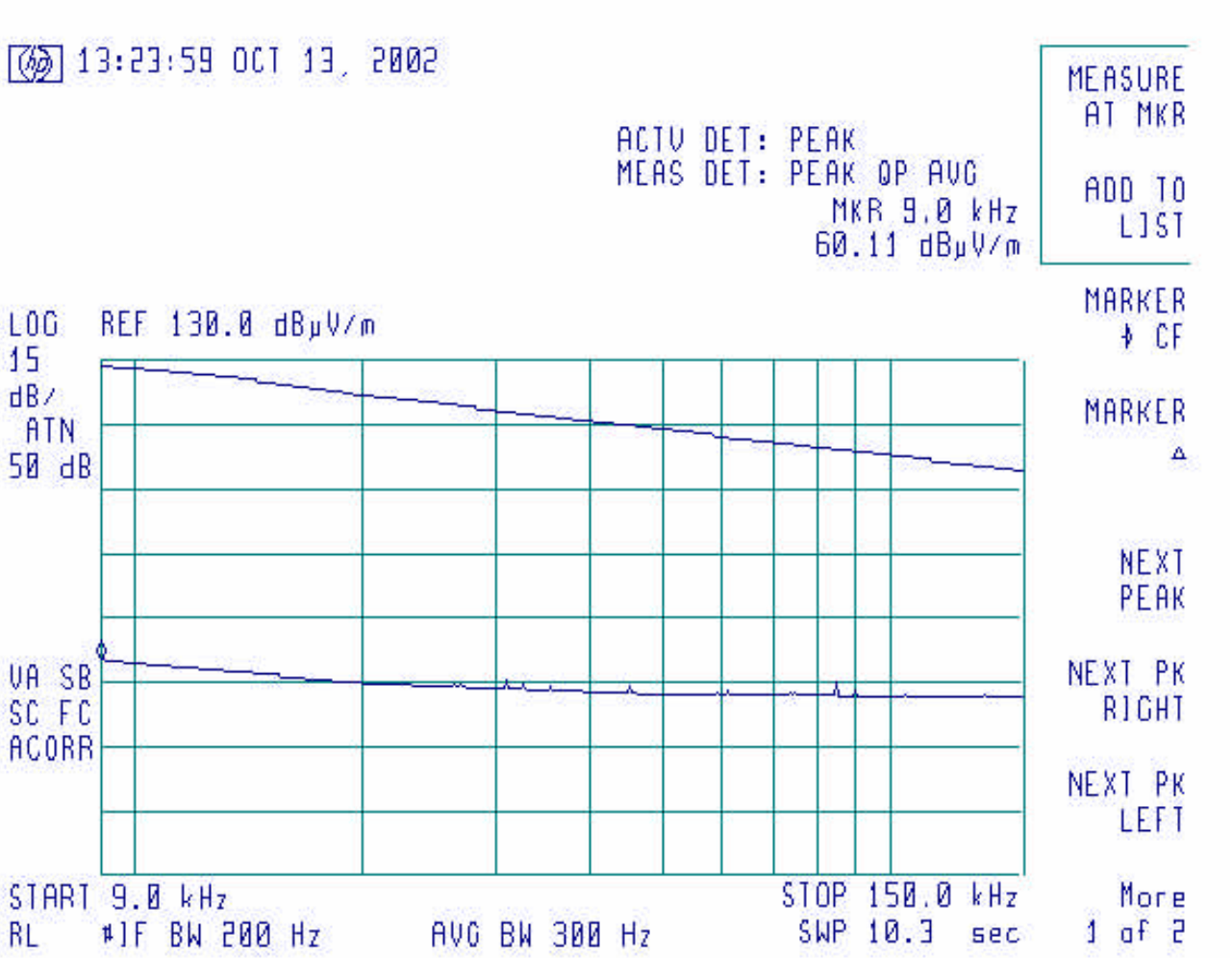
Plot A9
Out of band spurious emissions test results

EUT OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	9 – 150 kHz



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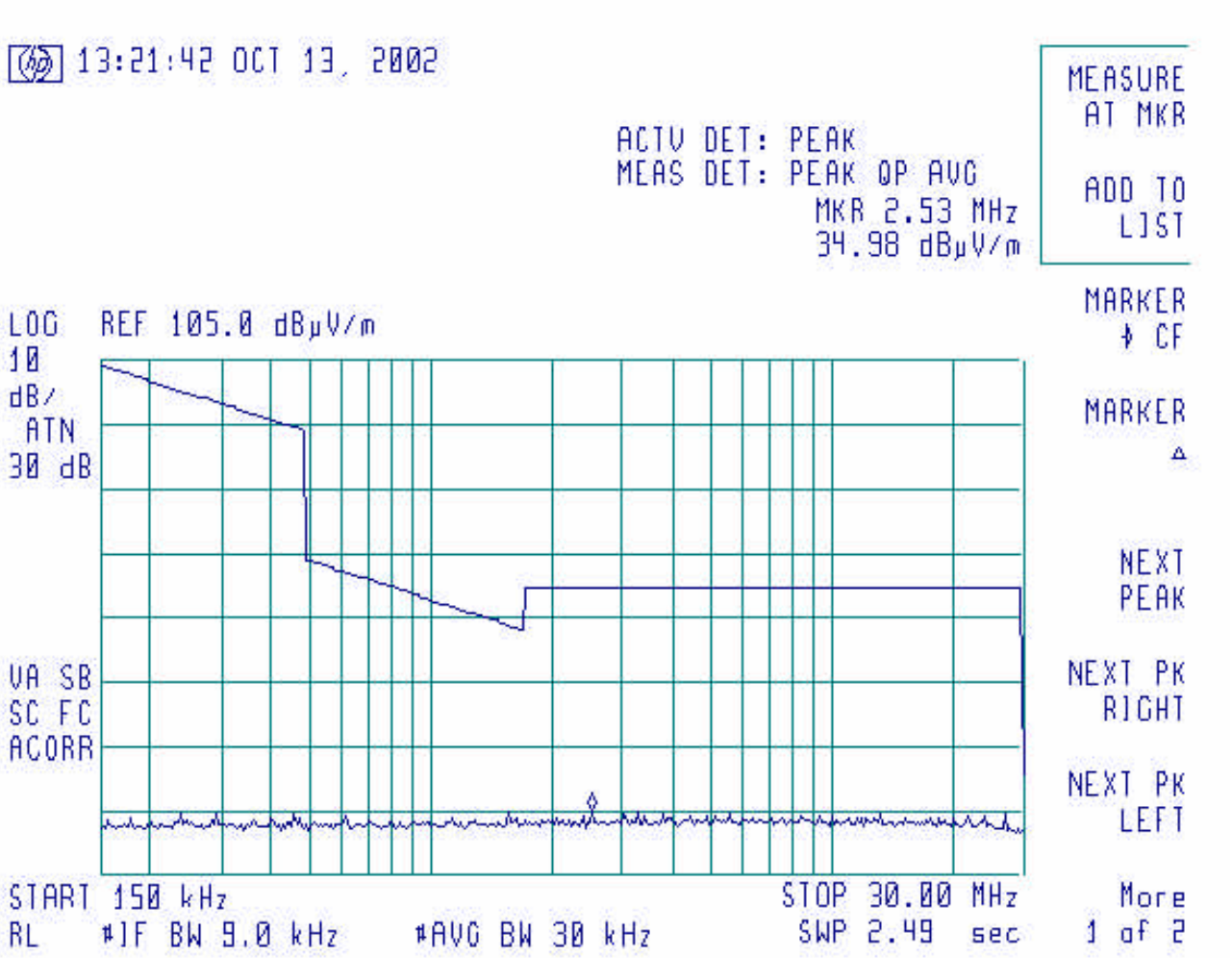
Plot A10
Out of band spurious emissions test results

EUT OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	0.15 – 30 MHz



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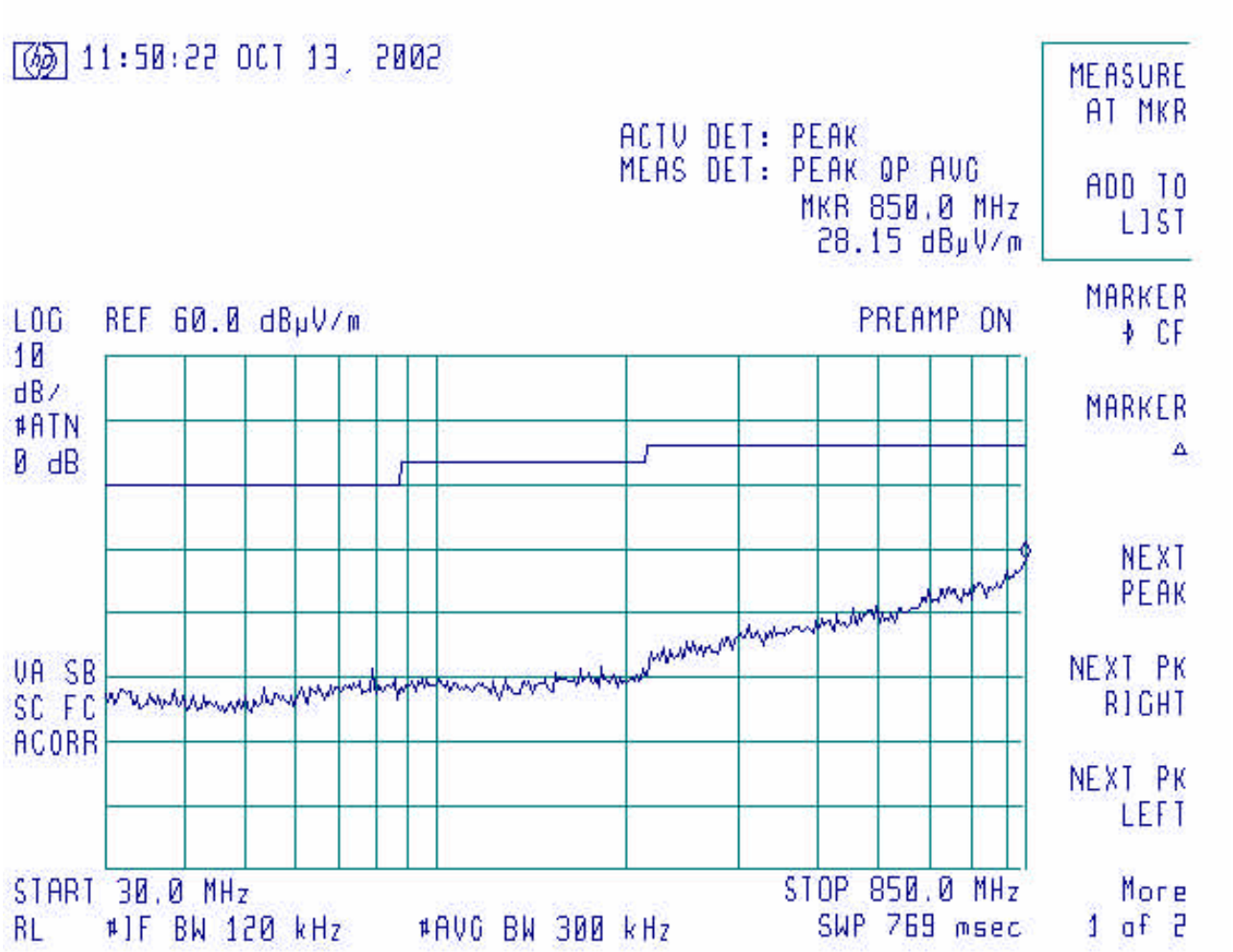
Plot A11
Out of band spurious emissions test results

EUT OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	30 – 850 MHz



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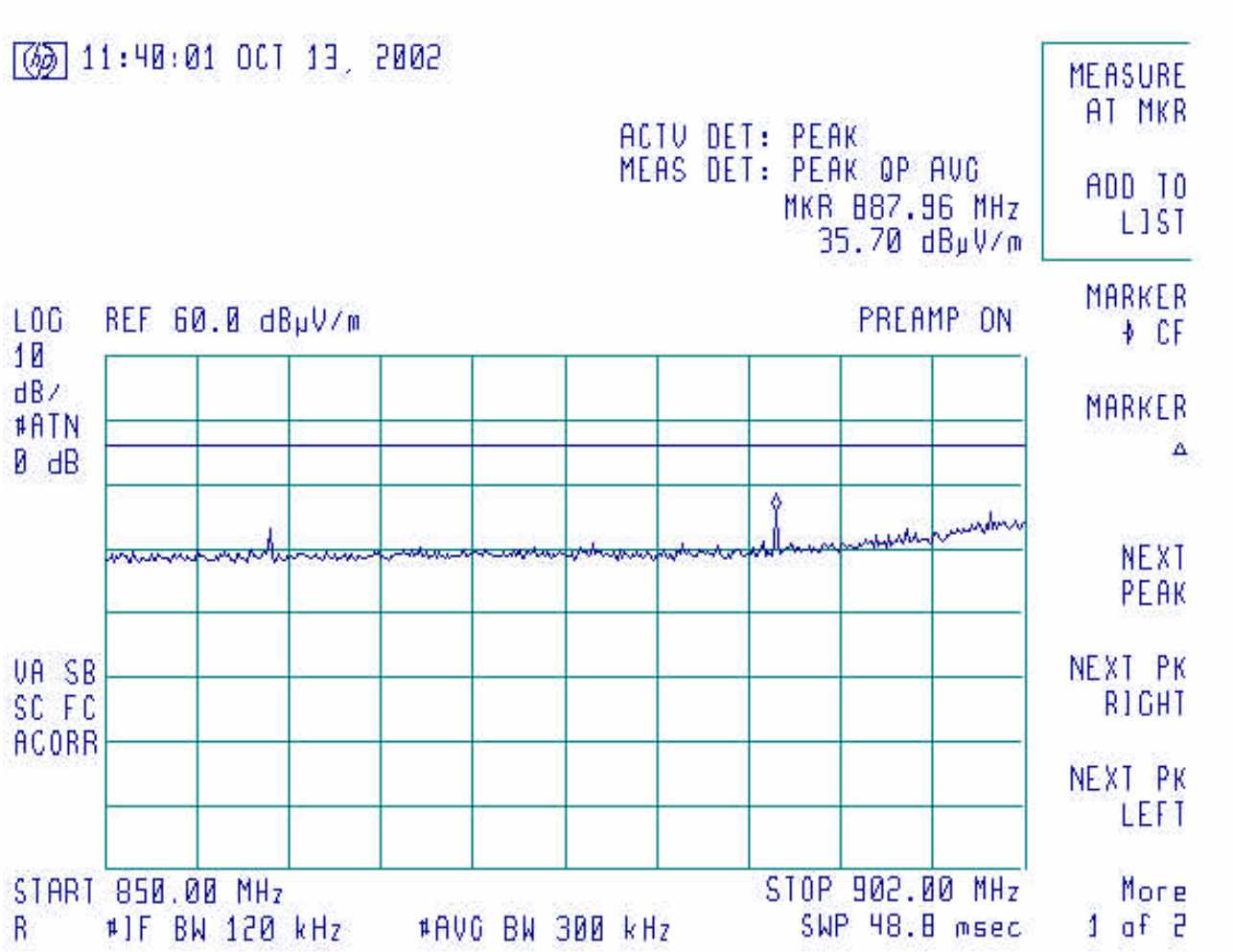
Plot A12
Out of band spurious emissions test results

EUT OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	850 – 902 MHz



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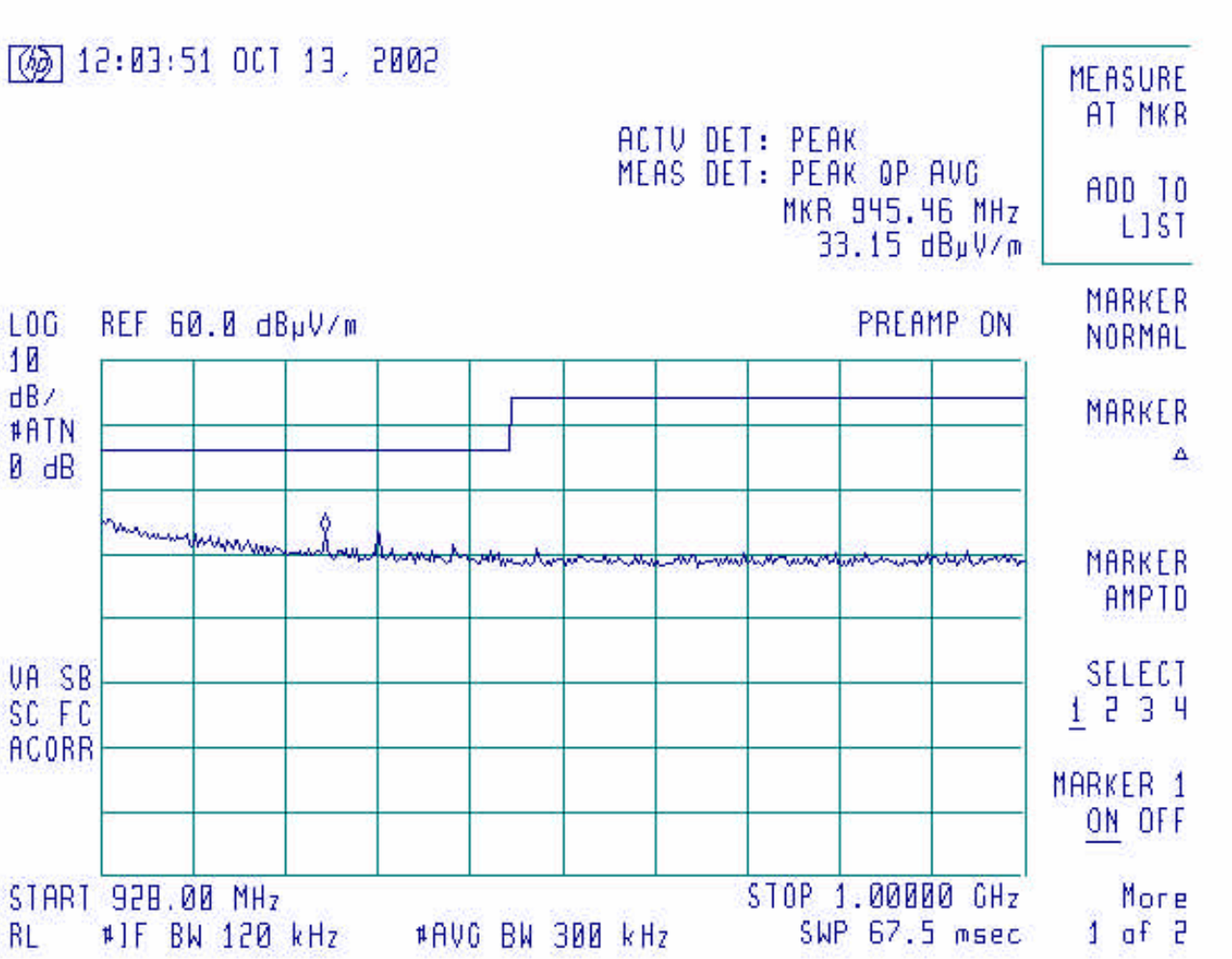
Plot A13
Out of band spurious emissions test results

EUT OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	928 – 1000 MHz



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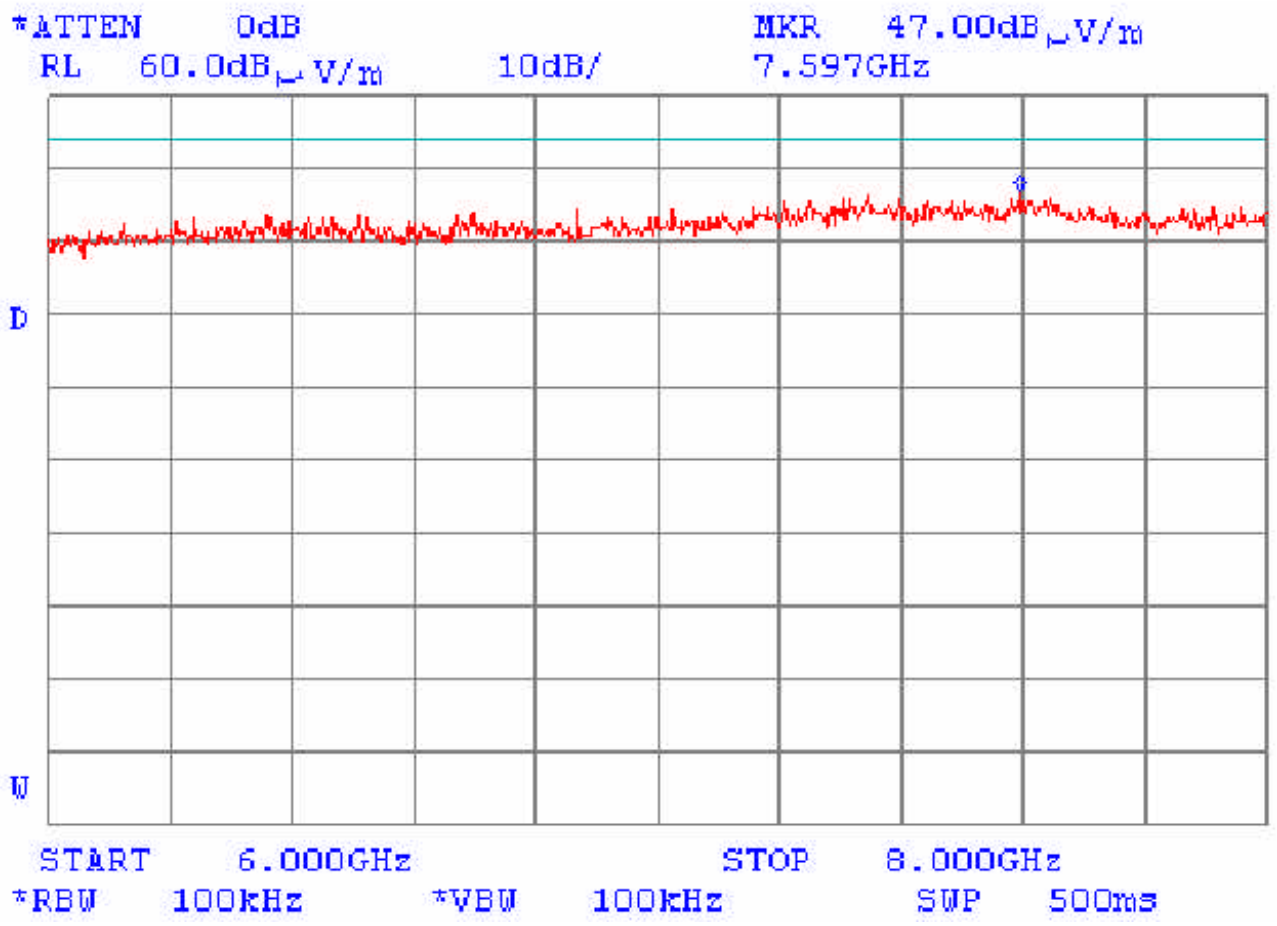
Plot A14
Out of band spurious emissions test results

EUT OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	6000 – 8000 MHz



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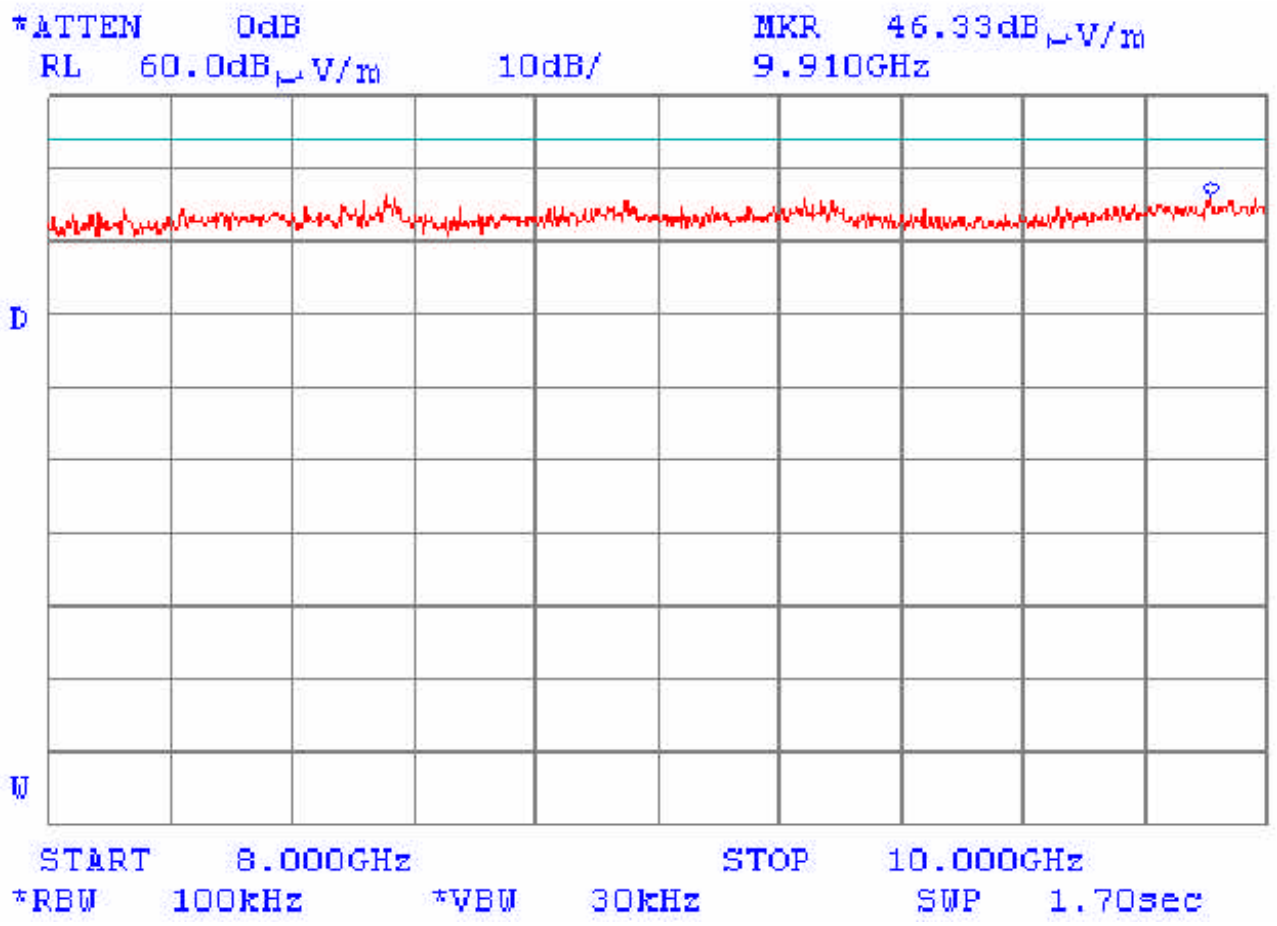
Plot A15
Out of band spurious emissions test results

EUT OPERATING FREQUENCY:	916.5 MHz
FREQUENCY RANGE:	8000 – 10000 MHz



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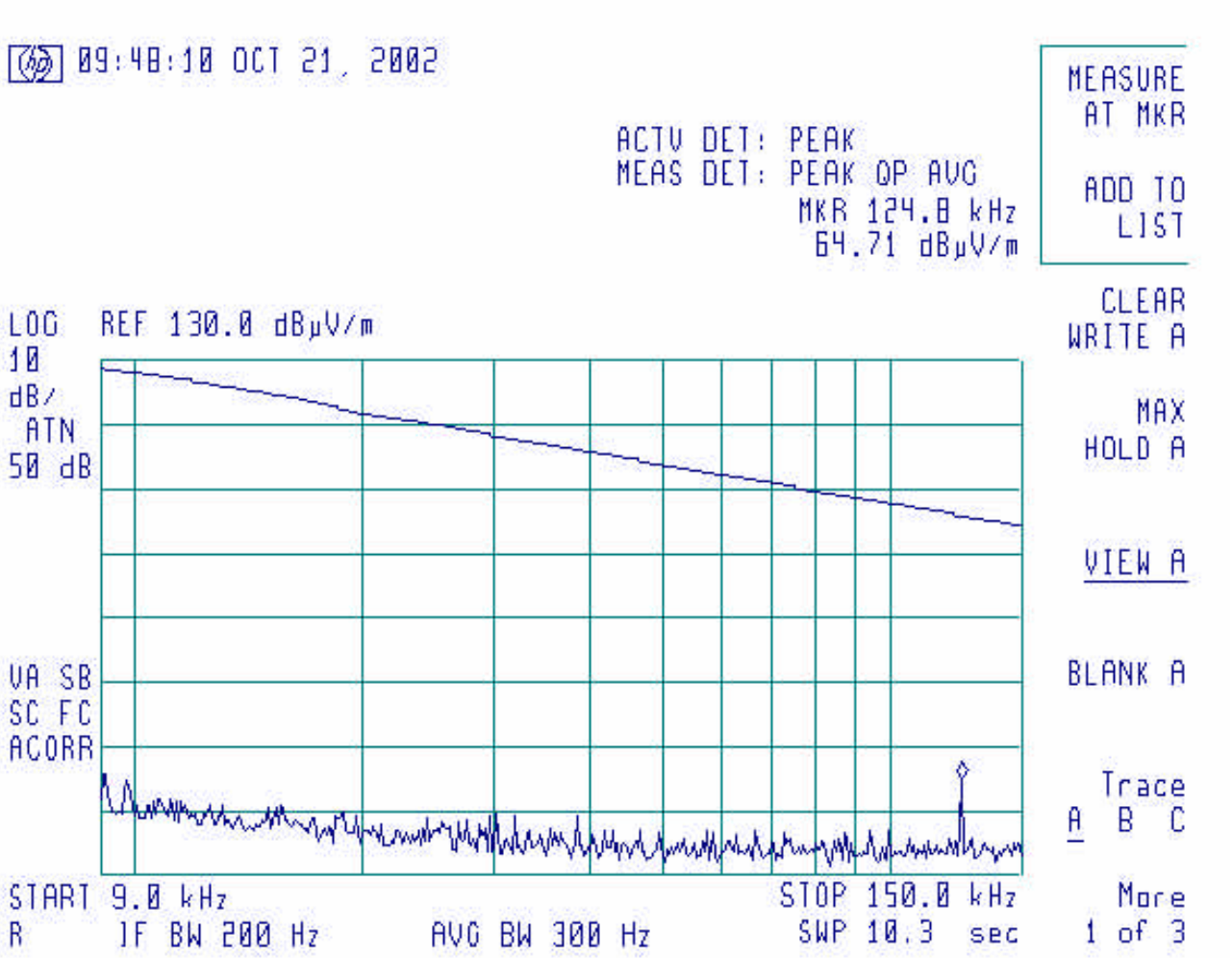
Plot A16
Out of band spurious emissions test results

EUT OPERATING FREQUENCY:	125 kHz
FREQUENCY RANGE:	9 – 150 kHz



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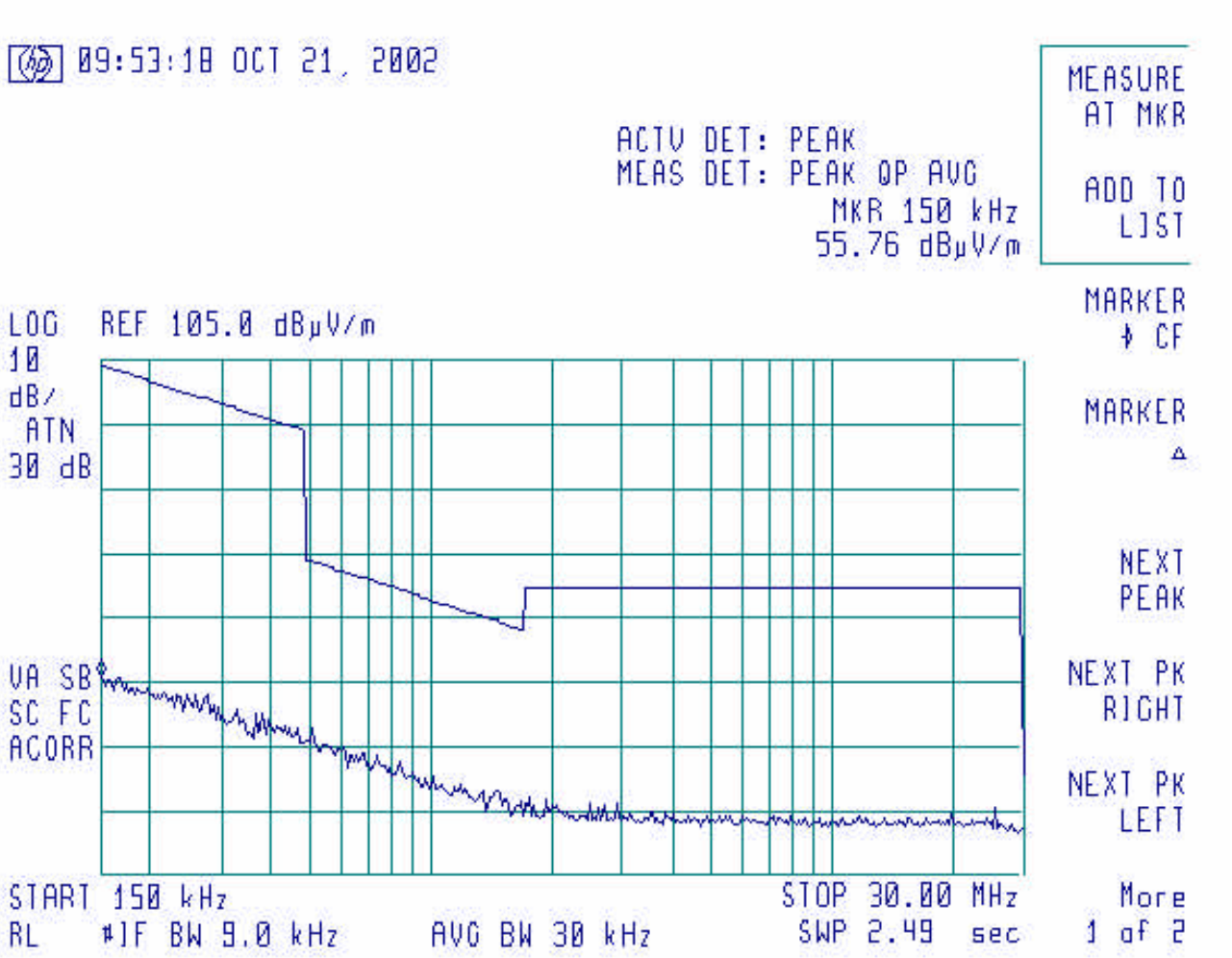
Plot A17
Out of band spurious emissions test results

EUT OPERATING FREQUENCY:	125 kHz
FREQUENCY RANGE:	150 kHz – 30 MHz



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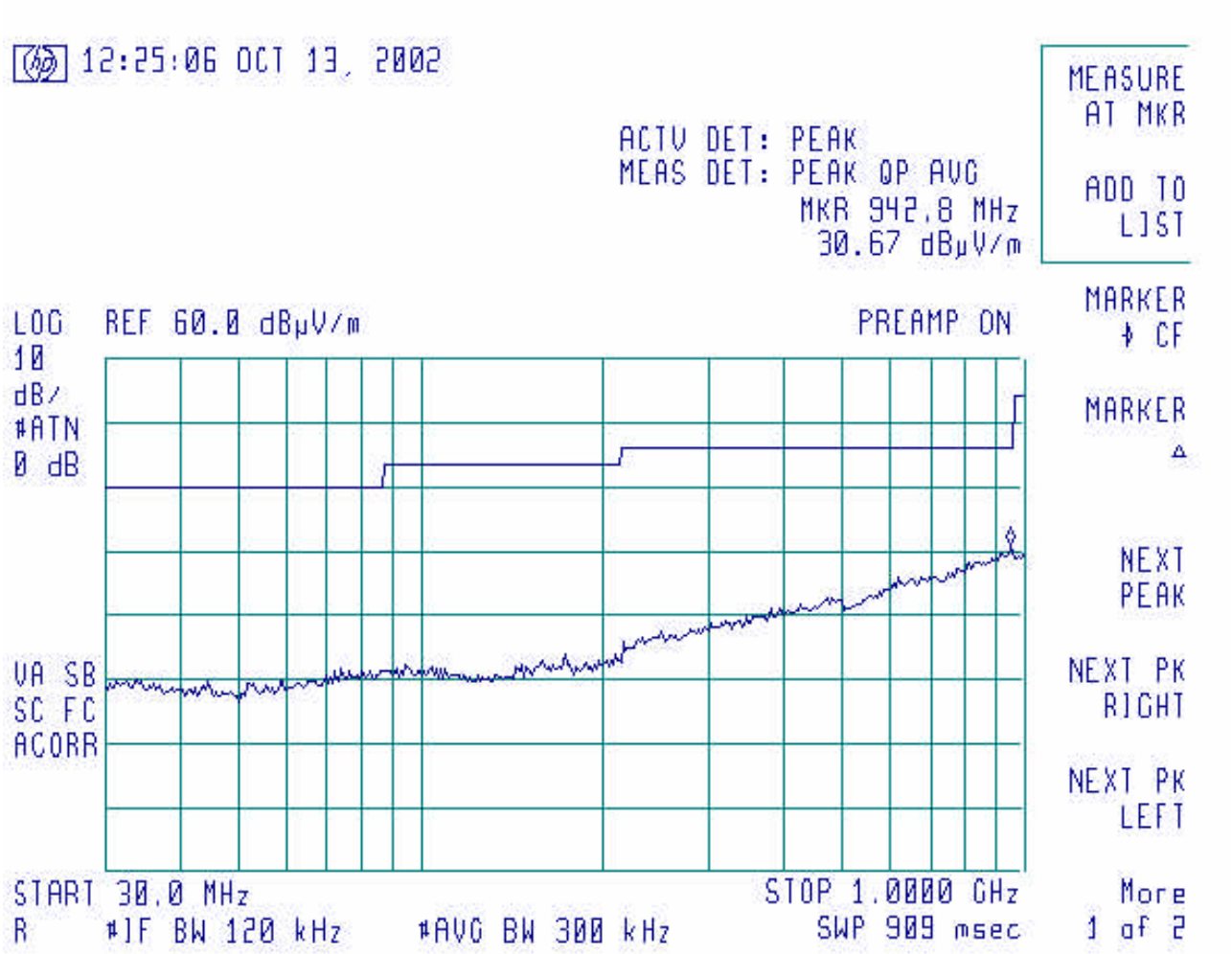
Plot A18
Receiver spurious emissions test results

EUT HIGHEST OPERATING FREQUENCY: 916.5 MHz
FREQUENCY RANGE: 30 – 1000 MHz



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Appendix B Test setup photographs

Photograph 1
Radiated emission measurements test setup with loop antenna,
9 kHz – 30 MHz frequency range, anechoic chamber method

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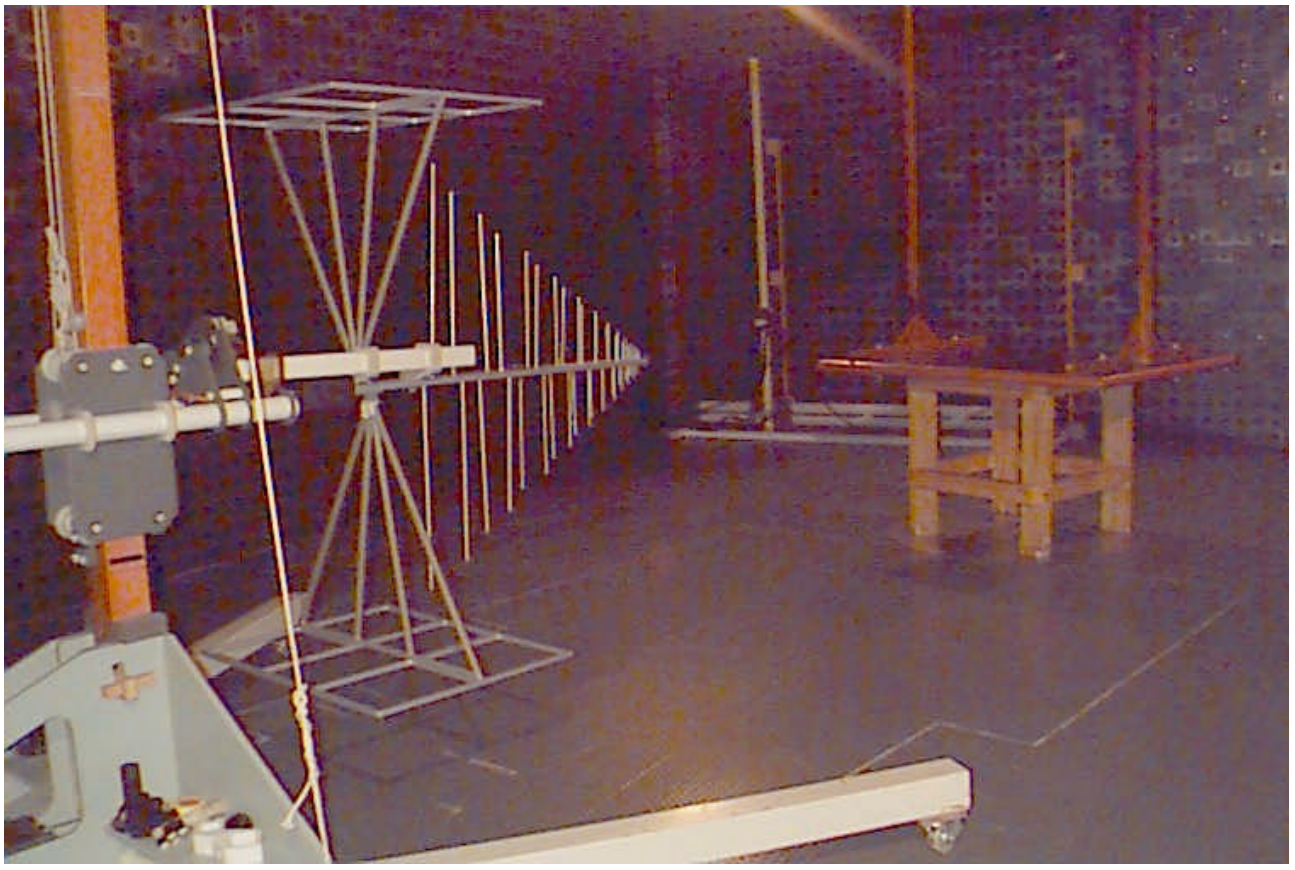
Photograph 2
Radiated emission measurements test setup with biconilog antenna,
30 MHz – 1000 MHz frequency range, anechoic chamber method



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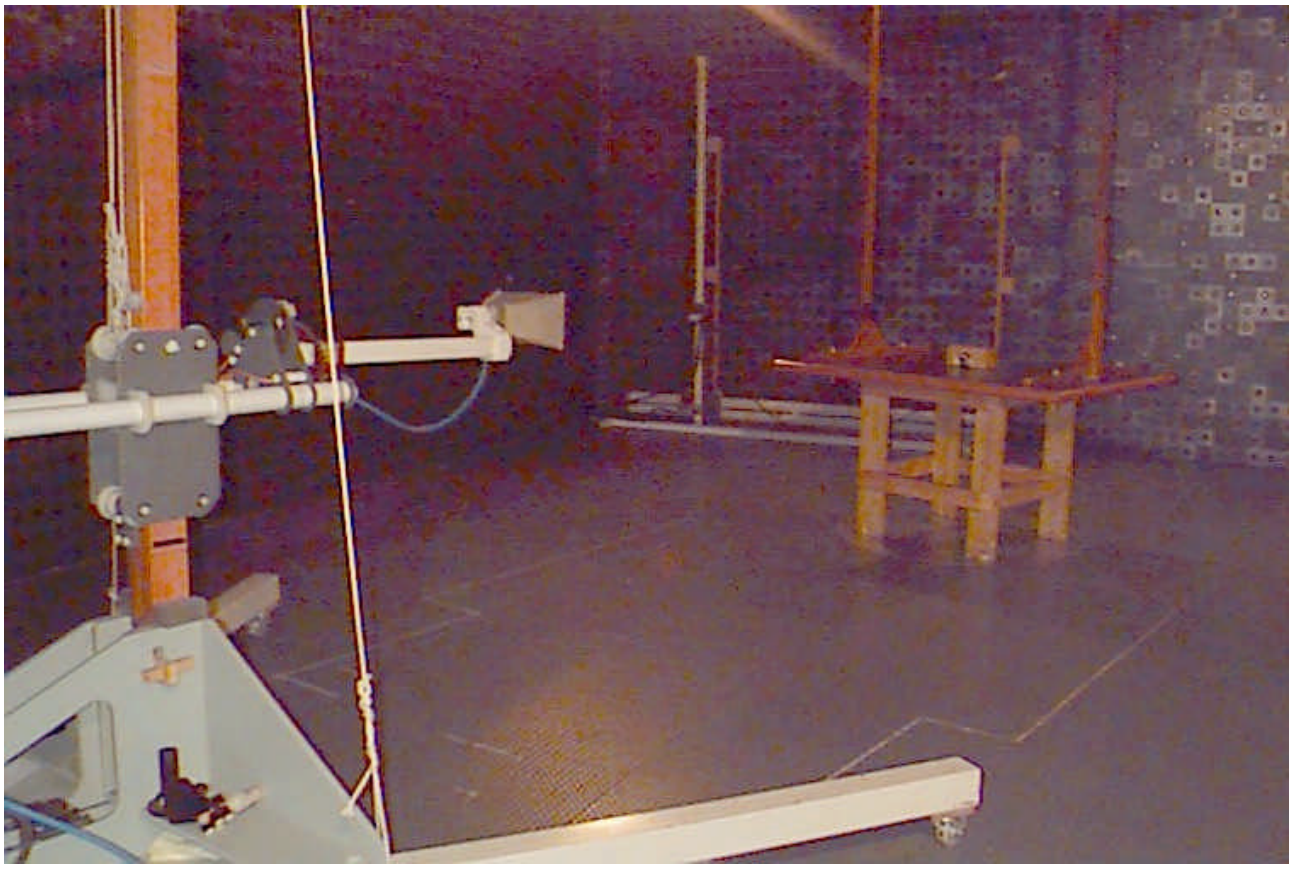
Photograph 3
Radiated emission measurements test setup with double ridge guide antenna, 1 GHz – 10 GHz frequency range, anechoic chamber method



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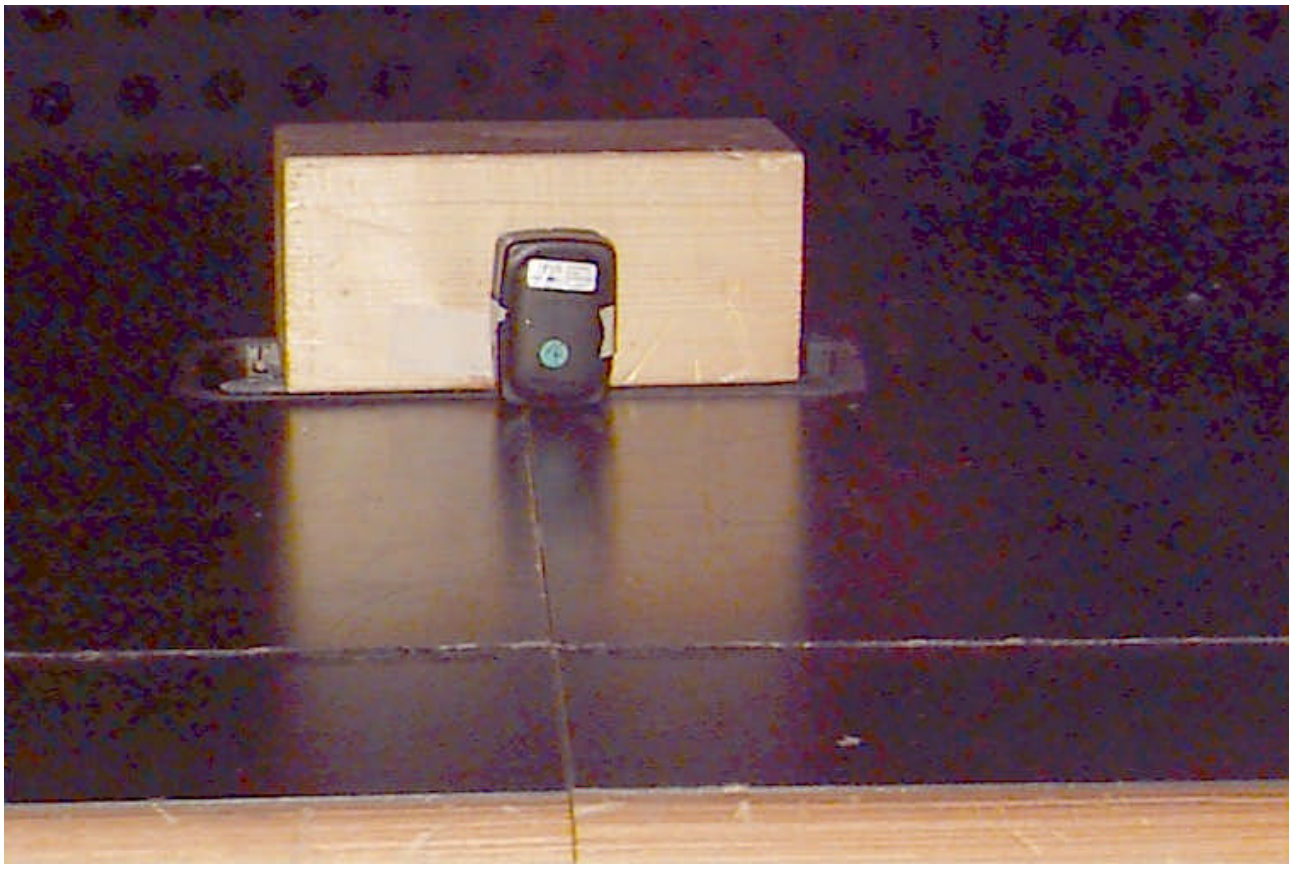
Photograph 4
Radiated emission measurements test setup,
EUT bottom placed vertically, anechoic chamber method



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Photograph 5
Radiated emission measurements test setup,
EUT bottom placed horizontally, anechoic chamber method

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Appendix C Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
0041	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	2811	3/03
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	11/03
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/03
0554	Amplifier, 2 – 18 GHz RF	Miteq	AFD-4	4300	12/02
0589	Cable coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	12/02
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
1003	Cable coaxial, M17/164, 10 m	Hermon Labs	C17164-10	161	12/02
1004	Cable, coaxial ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/02
1424	Spectrum analyzer, 30 Hz – 40 GHz	Agilent Technologies	8564 EC	3946A00219	8/03
1567	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13095/4PE	12/02
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
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	12/02

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Appendix D General information

Test facility description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private EMC, Safety and Telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, Telecommunications, Safety standards, and by AMTAC (UK) for safety of Medical Devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for Electromagnetic Compatibility, Product Safety, Telecommunications Testing and Environmental Simulation (for exact scope please refer to Certificate No. 839.01).

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

Abbreviations and acronyms

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

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: 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.

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FCC Equipment codes and descriptions

CYY	Communications Receiver used w/ P.15 transmitter
DCD	Part 15 Low Power transmitter Below 1705 kHz
DSC	Part 15 Security/Remote Control Transmitter
DSR	Part 15 Remote Control/Security Device Transceiver
DSS	Part 15 Spread Spectrum Transmitter
DXX	Part 15 Low Power Communication Device Transmitter
EAV	Part 15 Automatic Vehicle Identification System
ETB	Part 15 Cordless Telephone Base Transceiver
ETR	Part 15 Cordless Telephone Remote Transceiver
ETS	Part 15 Cordless telephone system
FAP	Part 15 Anti-Pilferage Device
FDS	Part 15 Field Disturbance Sensor
GAT	Part 15 Auditory Assistance Device (Transmitter)
HID	Part 15 TV Interface Device
JBC	Part 15 Class B Computing Device/ Personal Computer
JBP	Part 15 Class B Computing Device Peripheral
PUB	Part 15 Unlicensed PCS base station
PUE	Part 15 Unlicensed PCS portable Tx held to ear
PUF	Part 15 Unlicensed PCS portable Tx held to face
PUT	Part 15 Unlicensed PCS portable Tx worn on body

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Appendix E Test equipment correction factors

Antenna Factor
Active Loop Antenna
Model 6502
S/N 2857

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

Antenna factor is to be added to receiver meter reading in dB(μV) to convert to field intensity in dB(μV/meter)

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Antenna Factor
Biconilog Antenna EMCO Model 3141
Ser.No.1011

Frequency, MHz	Antenna Factor, dB(1/m)	Frequency, MHz	Antenna Factor, dB(1/m)
26	7.8	940	24.0
28	7.8	960	24.1
30	7.8	980	24.5
40	7.2	1000	24.9
60	7.1	1020	25.0
70	8.5	1040	25.2
80	9.4	1060	25.4
90	9.8	1080	25.6
100	9.7	1100	25.7
110	9.3	1120	26.0
120	8.8	1140	26.4
130	8.7	1160	27.0
140	9.2	1180	27.0
150	9.8	1200	26.7
160	10.2	1220	26.5
170	10.4	1240	26.5
180	10.4	1260	26.5
190	10.3	1280	26.6
200	10.6	1300	27.0
220	11.6	1320	27.8
240	12.4	1340	28.3
260	12.8	1360	28.2
280	13.7	1380	27.9
300	14.7	1400	27.9
320	15.2	1420	27.9
340	15.4	1440	27.8
360	16.1	1460	27.8
380	16.4	1480	28.0
400	16.6	1500	28.5
420	16.7	1520	28.9
440	17.0	1540	29.6
460	17.7	1560	29.8
480	18.1	1580	29.6
500	18.5	1600	29.5
520	19.1	1620	29.3
540	19.5	1640	29.2
560	19.8	1660	29.4
580	20.6	1680	29.6
600	21.3	1700	29.8
620	21.5	1720	30.3
640	21.2	1740	30.8
660	21.4	1760	31.1
680	21.9	1780	31.0
700	22.2	1800	30.9
720	22.2	1820	30.7
740	22.1	1840	30.6
760	22.3	1860	30.6
780	22.6	1880	30.6
800	22.7	1900	30.6
820	22.9	1920	30.7
840	23.1	1940	30.9
860	23.4	1960	31.2
880	23.8	1980	31.6
900	24.1	2000	32.0
920	24.1		

Antenna factor is to be added to receiver meter reading in dB(μV) to convert to field intensity in dB(μV/meter).

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Antenna Factor
Double Ridged Guide Antenna
Model RGA-50/60
S/N 2811

Frequency, MHz	Antenna Factor, dB
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 is to be added to receiver meter reading in dB(μV) to convert to field intensity in dB(μV)/meter

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Cable RF, 2m, model: Sucoflex 104PE, s/n 13095/4PE (HL 1567)
Calibration data

No.	Parameter	SET, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB	Notes
1	Insertion Loss	30	0.09	-	5.0	±0.12	
2		50	0.15	-			
3		100	0.23	-			
4		300	0.31	-			
5		500	0.46	-			
6		800	0.63	-			
7		1000	0.67	-			
8		1500	0.89	-			
9		2000	1.05	-			
10		2500	1.18	-			
11		300	1.26	-			
12		5300	1.51	-			
13		4000	1.66	-			
14		4500	1.61	-		±0.17	
15		5000	1.67	-			
16		5500	1.91	-			
17		6000	1.98	-			
18		6500	1.91	-			
19		7000	2.04	-			
20		7500	2.36	-			
21		8000	2.36	-			
22		8500	2.61	-			
23		9000	2.69	-			
24		9500	2.62	-			
25		10000	2.73	-			
26		10500	2.83	-			
27		11000	2.84	-			
28		11500	3.22	-			
29		12000	3.17	-			
30		12500	3.17	-		±0.26	
31		13000	3.18	-			
32		13500	3.49	-			
33		14000	3.43	-			
34		14500	3.57	-			
35		15000	3.76	-			
36		15500	4.20	-			
37		16000	4.10	-			
38		16500	4.49	-			
39		17000	4.53	-			
40		17500	4.46	-			
41		18000	4.47	-			

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Cable 18GHz, 4 m, blue, model: SPS-1803A-4000-NPS, s/nT4658 (HL 1942)
Calibration data

Frequency, GHz	Insertion Loss, dB
	HL1942
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
	HL1942
6.10	2.88
6.30	2.90
6.50	2.97
6.70	3.02
6.90	3.04
7.10	3.07
7.30	3.12
7.50	3.13
7.70	3.19
7.90	3.24
8.10	3.30
8.30	3.36
8.50	3.45
8.70	3.41
8.90	3.45
9.10	3.42
9.30	3.55
9.50	3.48
9.70	3.58
9.90	3.61
10.10	3.66
10.30	3.68
10.50	3.70
10.70	3.70
10.90	3.75
11.10	3.78
11.30	3.86
11.50	3.98
11.70	4.10
11.90	4.12
12.10	4.09
12.40	4.13
13.00	4.23
13.50	4.35
14.00	4.40
14.50	4.44
15.00	4.57
15.50	4.66
16.00	4.64
16.50	4.66
17.00	4.75
17.50	4.85
18.00	4.93

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Cable 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

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Cable coaxial M17/164
Model: C17164-10, s/n 161 (HL 1003)
Calibration data

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

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Cable Coaxial, GORE A2P01POL118, 2.3 m, model:GORE-3, s/n 176 (HL 0589)
+ Cable Coaxial, ANDREW PSWJ4, 6m, model: ANDREW-6, s/n 163 (HL 1004)
Calibration data

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

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Cable RF, 8 m, model:RG-214, s/n C-56 (HL 2009)
Calibration data

No.	Parameter	SET, MHz	Measured, dB	Deviation	Tolerance (Specification)	Meas. Uncert., dB	Notes
1	Insertion Loss	1	0.10	NA	NA	±0.12	
2		10	0.14				
3		30	0.25				
4		50	0.34				
5		100	0.53				
6		300	0.99				
7		500	1.31				
8		800	1.73				
9		1000	1.98				
10		1100	2.11				
11		1200	2.21				
12		1300	2.35				
13		1400	2.46				
14		1500	2.55				
15		1600	2.68				
16		1700	2.78				
17		1800	2.88				
18		1900	2.98				
19		2000	3.09				