



HERMON LABORATORIES

Test Report: CTPFCC.13032.rev2.doc

Date: October 98

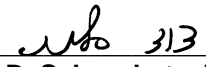
Total: 36 pages


# ELECTROMAGNETIC COMPATIBILITY TEST REPORT

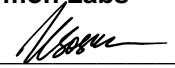
ACCORDING TO 47 CFR PART 15, SUBPART B

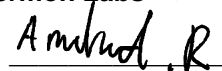
for  
**CTP Systems Ltd.**

**EQUIPMENT UNDER TEST:**  
**Unified Base Station of the CT Phone 1900**

Prepared by:   
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Hermon Labs

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### Description of equipment under test

Test items	Wireless PBX
Manufacturer	CTP Systems Ltd.
Brand mark	CTP Systems Ltd.
Types (Models)	CT Phone 1900, Unified Base Station (1900-UBS)
Serial number	B24D03
Receipt date	August 20, 1998

### Applicant information

Applicant's representative	Mr. Amihud Rothman, manager, QA department
Applicant's responsible person	Mr. Amihud Rothman, manager, QA department
Company	CTP Systems Ltd.
Address	16 Bazel Street
PO Box	10097
Postal code	49001
City	Petach Tikva
Country	Israel
Telephone number	+972-(0)3-9260000
Telefax number	+972-(0)3-9241496

### Test performance

Project Number:	13032
Location	Hermon Laboratories
Test started	August 20, 1998
Test completed	September 14, 1998
Purpose of test	Apparatus verification in accordance with FCC part 15 requirements
Test specification(s)	FCC part 15 subpart B (15109 (b),(c) 15.33 15.35) Radiated Emissions class A.

Through this report a point is used as the decimal separator and the thousands are counted with a comma.  
This report is in conformity with EN 45001 and ISO GUIDE 25.  
The test results relate only to the items tested.



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# 1 General Information

## 1.1 Abbreviations and Acronyms

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

AC	Alternating current
AVRG	Average (Detector)
dB	decibel
dBm	decibel referred to one milliwatt
dB( $\mu$ V)	decibel referred to one microvolt
dB( $\mu$ V/m)	decibel referred to one microvolt per meter
cm	centimeter
DC	Direct Current
EMC	Electromagnetic Compatibility
EUT	Equipment Under Test
GHz	Gigahertz
H	Height
HP	Hewlett Packard
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
m	meter
MHz	megahertz
NA	Not Applicable
QP	Quasi-Peak (Detector)
RE	Radiated Emission
RMS	Root-mean-square
sec	second
V	Volt
W	Width
PC	Personal Computer

## 1.2 Specification References

CFR 47 part 15 subpart B: 10/1997	Radio Frequency Devices, Subpart B.
ANSI C63.2:06/1987	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.

## 1.3 EUT Description supplied by customer

The CTPhone 1900 family of products add wireless phone services to existing Private Branch Exchange (PBX), Centrex services, or key systems. The CTPhone 1900 system operates in both single building and campus environments. Components of the CTPhone 1900 are base stations, handsets, and a CTPhone controller.



## 1.4 EUT Test Configuration

The Unified Base Station has two power supply options, remote power and local power.

The equipment was tested with and without the external antenna.

The local power is a transformer 120 VAC to 5 VDC.

The remote power is 48 VDC from the E1 line.

Test configuration is given in Figure 1.1.

**EUT Support/Test Equipment**

Description	Model number	Serial number
Unified Handset	1900-HS	7605

**EUT Ports and Lines**

Port Type	Port Description	Quantity	Cable Type Description	Cable Length	Connected to
RJ11	E1	2	Unshielded	Max 1 km	BSIA
SMA	External Antenna	1	RG58	Max 30 meters	External antenna
DC jack	DC supply	1	Unshielded	2 meters	AC power supply

A ferrite s/n 0443161151 was added on AC power supply cable during conducted emissions testing.



## 1.5 EUT Verification. Labeling Requirements (CFR 47, FCC part 15, Sections 15.19, 15.109)

A device subject to verification shall bear the following label in a conspicuous location on the device:

**This device complies with Part 15 of the FCC Rules.  
Operation is subject to the following two conditions:**  
(1) **This device may not cause harmful interference, and**  
(2) **this device must accept any interference received, including interference that may cause undesired operation.**

For a Class A digital device the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

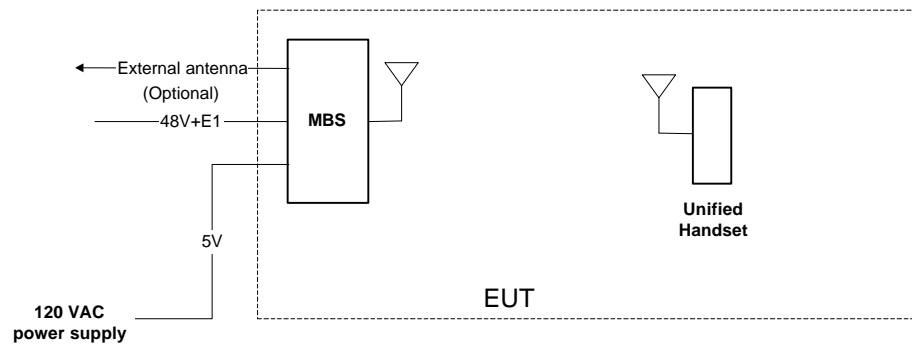
**NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.**

For a Class A and Class B digital device the instructions furnished the user shall include the following caution:

**Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**



**Figure 1.1**  
**EUT Test configuration**







## 1.6 Statement of Manufacturer

I, Amihud Rothman, manager, QA department of CTP Systems Ltd. declare that Unified Base Station of the CT Phone 1900 was tested on August 20<sup>th</sup> to September 14<sup>th</sup>, 1998 by Hermon Laboratories and which this test report applies to is identical to the equipment that will be marketed.

The term identical means identical within the variations that can be expected to arise as a result of quantity production technique.

Mr. Amihud Rothman, manager, QA department  
CTP Systems Ltd.

Signature: Amihud . R

Date: \_\_\_\_\_





## 2.3 Laboratory Personnel

The four people of Hermon Laboratories that have participated in measurements and documentation preparation are: Dr. Edward Usoskin - C.E.O., Mr. Michael Feldman - test technician, Mr. Igor Silberstein - test technician and Mr. David Salamah - technical writer. Dr. E. Usoskin is an EMC Specialist certified by the National Association of Radio and Telecommunications Engineers (NARTE, USA.). The Hermon Laboratories' personnel that participated in this project have more than 85 years combined experience time in EMC measurements and electronic products design.

## 2.4 Statement of Qualification

The test measurement data supplied in this test measurement report having been received by me, is hereby duly certified. The following is a statement of my qualifications.  
I am a Technician, have obtained 29 years experience in electronics and measurements.  
I have been with Hermon Laboratories since 1995.

Name: Mr. Michael Feldman  
Position: test technician

Signature:   
Date: October 26, 1998

The test measurement data supplied in this test measurement report having been received by me, is hereby duly certified. The following is a statement of my qualifications.  
I am a Radio Technician graduated from technical college in 1979 and have obtained 18 years experience in electronics and have been with Hermon Laboratories since 1996.

Name: Igor Silberstein  
Position: test technician

Signature:   
Date: October 26, 1998

I hereby certify that this test measurement report was prepared by me and is hereby duly certified. The following is a statement of my qualifications.  
I have learned in the Netherlands for six years and I have a high collective college school diploma and I have learned for two years in a technical college.  
I have been with Hermon Laboratories since November 1996.

Name: Mr. David Salamah  
Position: technical writer

Signature:   
Date: October 26, 1998

I hereby certify that this test measurement report was prepared under my direction and that to the best of my knowledge and belief, the facts set in the report and accompanying technical data are true and correct.  
The following is a statement of my qualifications.  
I have a Ph.D. degree in electronics, have obtained more than 40 years of experience in EMC measurements and electronic product design.  
Also, I am an EMC engineer certified by the National Association of Radio and Telecommunications Engineers, Inc. (USA). The certificate no. is EMC-000623-NE, senior member. I have been with Hermon Laboratories since 1986.

Name: Dr. Edward Usoskin  
Position: C.E.O.

Signature:   
Date: October 26, 1998



### 3 Conducted Emission Measurements

#### 3.1 Conducted Emission Measurements, General

Conducted emission measurements specification limits are given in Table 3.1 below

**Table 3.1 Limits for mains terminal radio interference voltage**

Frequency, MHz	Class A equipment limit, dB( $\mu$ V)	Frequency, MHz	Class B equipment limit, dB( $\mu$ V)
0.45 - 1.705	60	0.45 - 30	48
1.705 - 30	69.5		

#### 3.2 Conducted Emission Measurements, Test Procedure

The EUT was tested in full configuration. For test configuration refer to Figure 1.1. The EUT was set up as shown in Figure 3.1 and Photographs 3.1 and 3.2. The EUT was tested with and without an external antenna (as described in paragraph 1.4). The worst case test results are given for the configuration with the external antenna).

The frequency range from 450 kHz to 30 MHz was investigated.

The measurements were performed on the 120 V AC 60 Hz power lines (both neutral and phase) by means of the LISN, connected to the spectrum analyzer. All unused 50  $\Omega$  connectors of the LISN were resistively terminated in 50  $\Omega$  when not connected to the measuring instrument. The position of the EUT cables was varied to determine maximum emission level. Quasi peak detector (resolution bandwidth = 9 kHz) was used.

The test results were recorded in Table 3.2 and shown in Plots 3.1 to 3.4.

#### Reference numbers of test equipment used

HL 0026	HL 0163	HL 0466	HL 0521
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Full description is in Appendix A.



### 3.3 Conducted Emission Measurements, Test Results

Table 3.2 Conducted emission measurements on EUT power lines

Frequency range : 450 kHz - 30 MHz

Detector : quasi peak

TEST SPECIFICATION: FCC part 15 subpart B Class B  
COMPANY: CTP Systems Ltd.  
EUT: Unified Base Station of the CT Phone 1900  
DATE: October 14, 1998  
RELATIVE HUMIDITY: 50%  
AMBIENT TEMPERATURE: 21°C

Frequency (MHz)	Line ID	Measured Conducted Emissions dB (μV)	Spec. QP Limit dB (μV)	QP Limit Margins dB	Pass/ Fail
9.605	Ph	42.57	48.0	5.4	Pass
5.630	Ph	40.68	48.0	7.3	Pass
11.900	Ph	38.71	48.0	9.3	Pass
9.853	N	42.56	48.0	5.4	Pass
9.605	N	41.41	48.0	6.6	Pass
11.901	N	38.98	48.0	9.0	Pass

**Test parameters:**

Detector type = QP (quasi peak).

Resolution bandwidth = 9 kHz.

**Table calculations and abbreviations:**

Conducted emission = EMI meter reading (dBμV) + Cable Loss (dB) + LISN correction factor (dB). (For LISN correction factor refer to Appendix B).

Spec. limit = specification limit.


Spec. margin = dB below (negative if above) specification limit.

Line ID = Line Identification (Ph - phase, N - neutral).

Test performed by:  
Mr. Igor Silberstein - test technician

  
Hermon Labs

Customer representative person:  
Mr. Amihud Rothman, manager, QA department

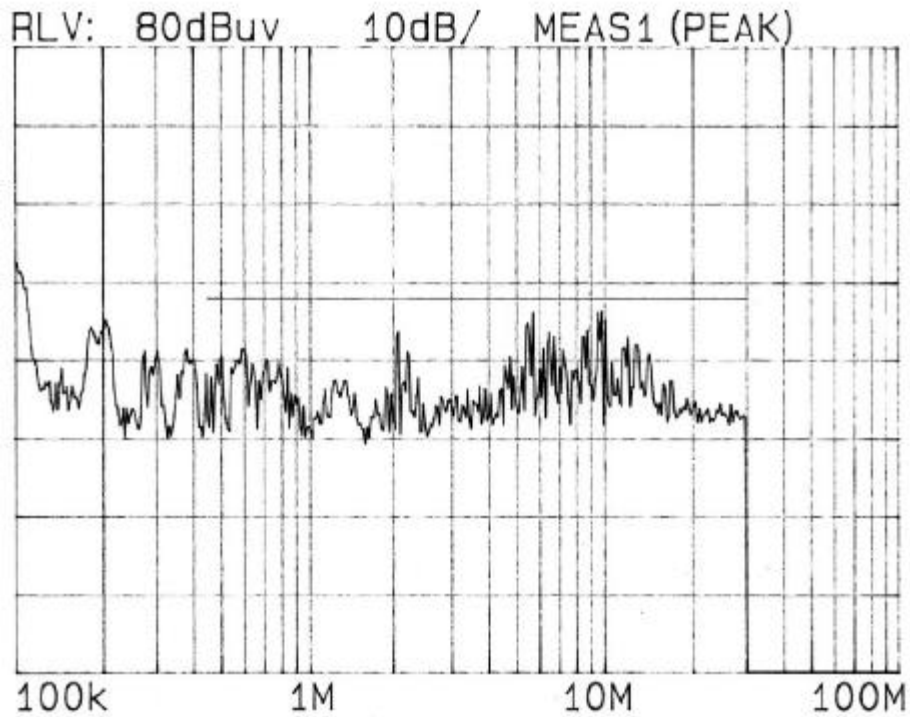
  
CTP Systems Ltd.



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**Plot 3.1**

Test specification: FCC part 15 subpart B class A  
Conducted emission measurements on power line  
Frequency range: 450 kHz-30 MHz  
Line: phase  
Detector: PEAK  
EUT: Unified Base Station of the CT Phone 1900

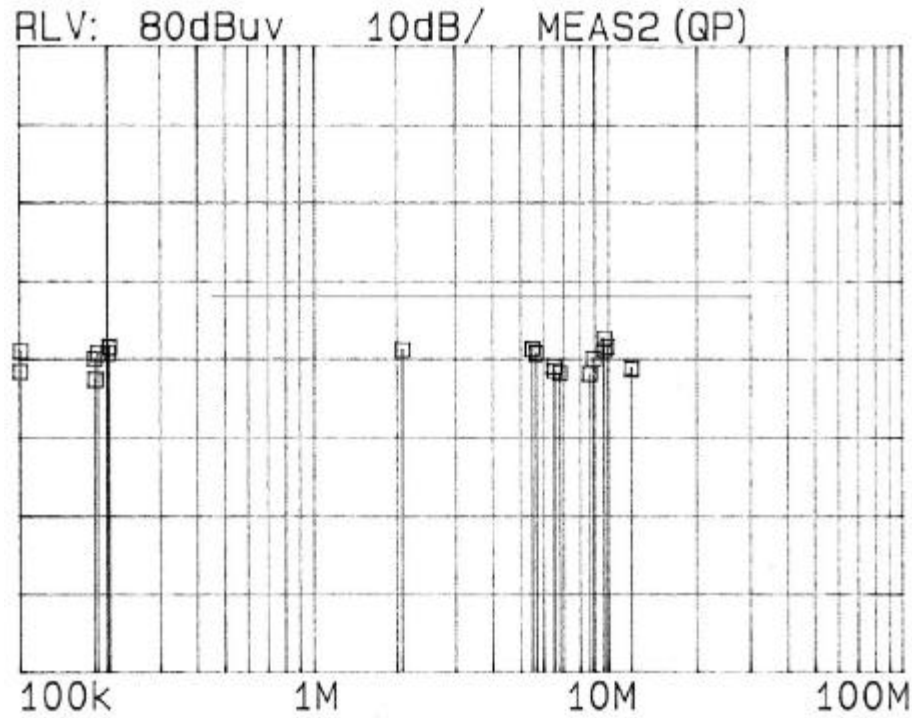




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**Plot 3.2**

Test specification: FCC part 15 subpart B class A  
Conducted emission measurements on power line  
Frequency range: 450 kHz-30 MHz  
Line: phase  
Detector: PEAK  
EUT: Unified Base Station of the CT Phone 1900

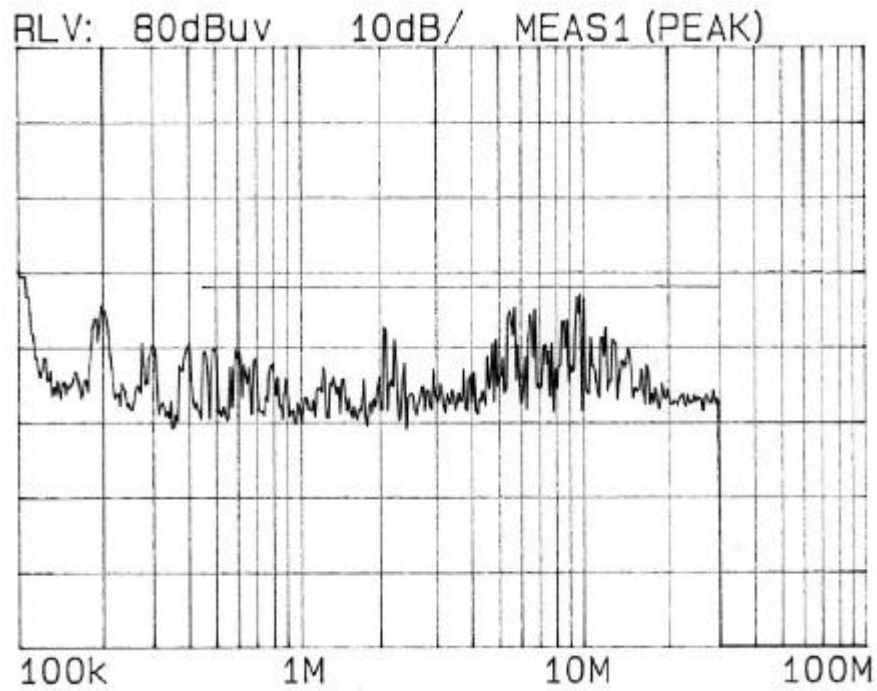




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**Plot 3.3**

Test specification: FCC part 15 subpart B class A  
Conducted emission measurements on power line  
Frequency range: 450 kHz-30 MHz  
Line: neutral  
Detector: PEAK  
EUT: Unified Base Station of the CT Phone 1900



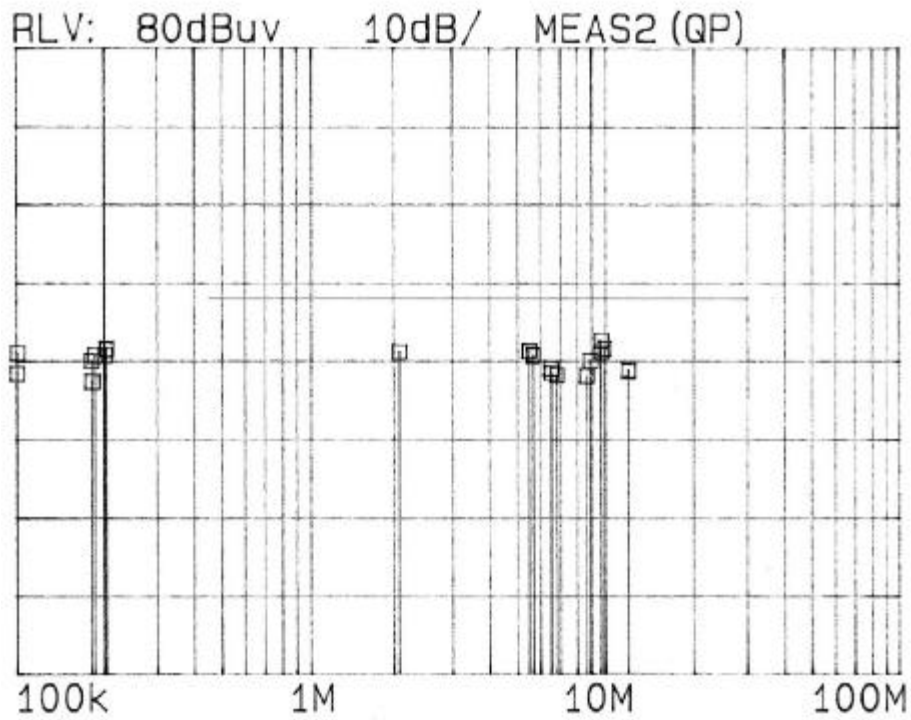




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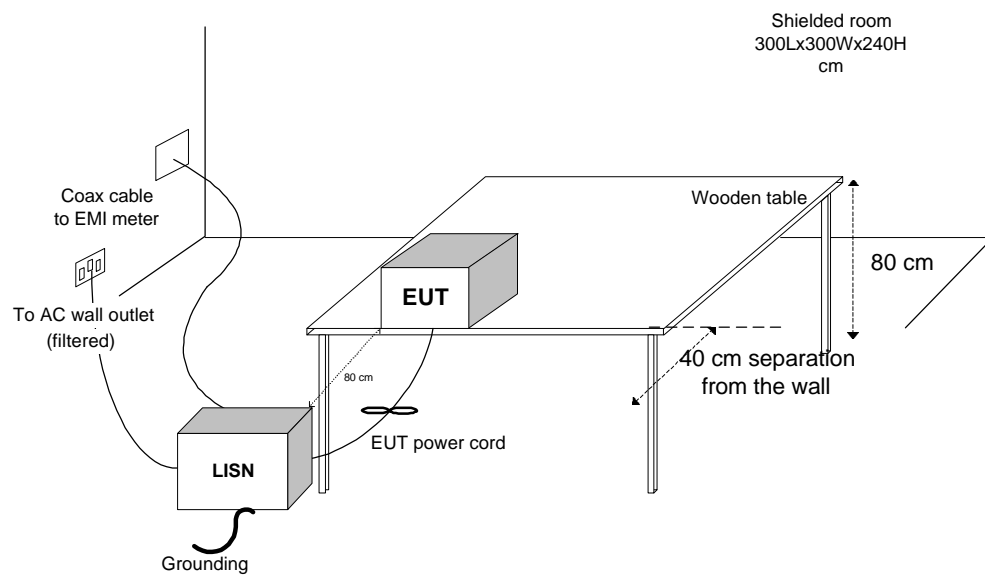
**Plot 3.4**

Test specification: FCC part 15 subpart B class A  
Conducted emission measurements on power line  
Frequency range: 450 kHz-30 MHz  
Line: neutral  
Detector: QP  
EUT: Unified Base Station of the CT Phone 1900



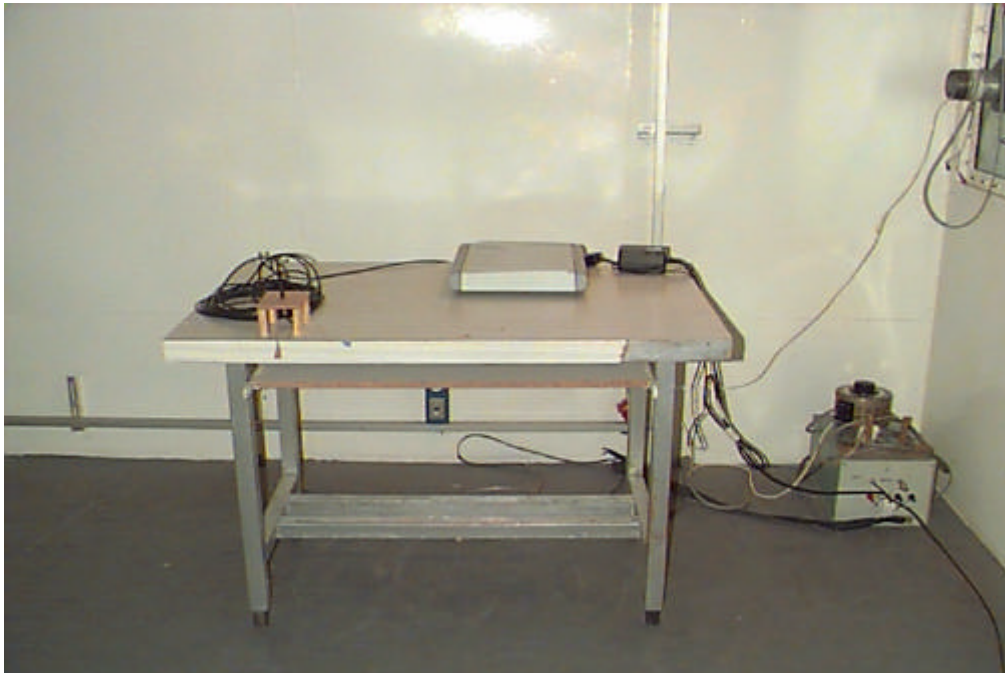


**Figure 3.1**  
**Setup for conducted emissions test**



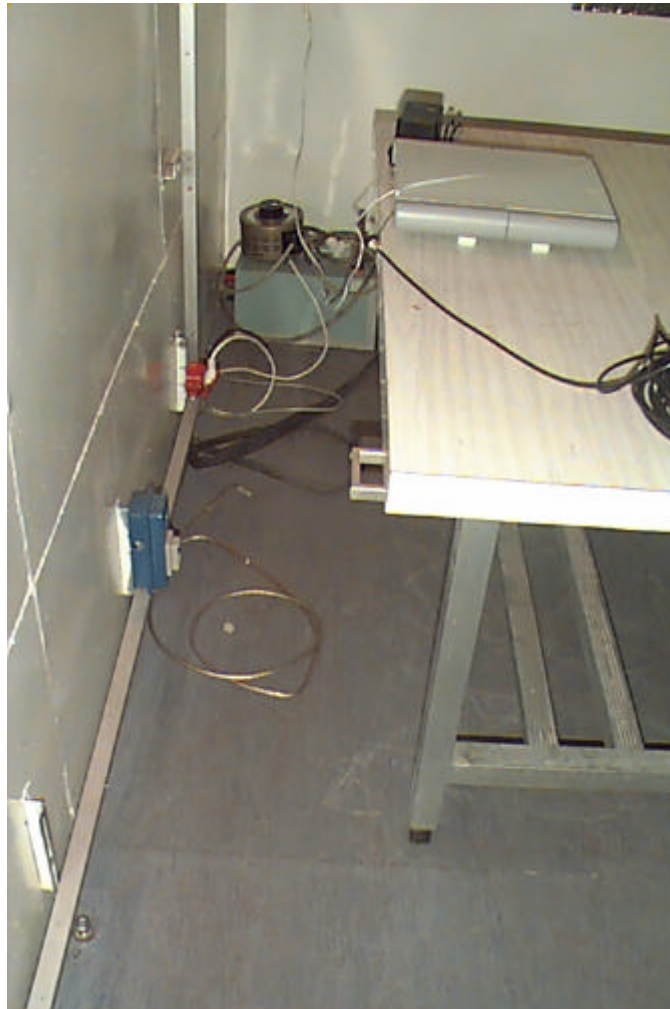


**Photograph 3.1**  
**Setup for conducted emissions measurements (with External Antenna)**





**Photograph 3.2**  
**Setup for conducted emissions measurements (with External Antenna)**





## 4 Radiated Emission Measurements

### 4.1 Radiated Emission Measurements, General

Radiated emission measurements specification limits are given in Table 4.1 below:

**Table 4.1 Limits for Electric field strength at 3 meters distance**

Frequency MHz	Detector	Class A Equipment dB( $\mu$ V/m)
30 - 88	Quasi-peak	49.5
88 - 216	Quasi-peak	54.0
216 - 960	Quasi-peak	56.4
960 - 1000	Quasi-peak	59.5*
Above 1000	Average/Peak	59.5 (AVG)/79.5 (Peak)

### 4.2 Radiated Emission Measurements, Test Procedure

The EUT was tested in full configuration as shown in Figure 1.1. The test was performed at the Hermon Labs anechoic chamber. The EUT was set up as shown in Figure 4.1 and Photographs 4.1 to 4.3. The EUT was tested with and without an external antenna (as described in paragraph 1.4). The worst case test results are given for the configuration with the external antenna).

Biconilog and Double Ridged Guide Horn antennas were used. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, the EUT cables were moved and the antennas polarization was changed from vertical to horizontal.

The EUT was tested in local power mode and remote power mode.

The frequency range from 30 MHz to 10 GHz was investigated. From 30 MHz to 1 GHz peak and quasi-peak detectors were used. Above 1 GHz a peak detector was used.

The test results are recorded in Table 4.2 and shown in Plots 4.1 to 4.5.

Above 1 GHz no signals due to incorporated digital device were found – manual scan with reduced video bandwidth was also performed. The measurement noise floor was at least 10 dB below the average limit required by the standard (and at least 30 dB below the peak limit).

#### Reference numbers of test equipment used

HL 0038	HL 0275	HL 0287	HL 0465	HL 0521	HL 0604	HL 0041	HL 0792
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Full description is in Appendix A.



### 4.3 Radiated Emission Measurements, Test Results

**Table 4.2 Radiated emission measurements test results**  
(Electric field, frequency range 30 MHz - 10 GHz)

TEST SPECIFICATION: FCC part 15 subpart B Class A  
 COMPANY: CTP Systems Ltd.  
 EUT: Unified Base Station of the CT Phone 1900  
 DATE: August 20, 1998  
 RELATIVE HUMIDITY: 50%  
 AMBIENT TEMPERATURE: 21°C

MEASUREMENTS PERFORMED AT 3 METERS DISTANCE

Frequency MHz	Ant. Type	Ant. Pol.	Ant. Hgt.	TT Pos. (°)	Radiated Measured Result dB (μV)	Correction Factor dB (1/m)	Radiated Emissions dB (μV/m)	Spec. Limit dB (μV/m)	Spec. Margin dB	Pass/ Fail
115.23613	BL	H	1.7	321	28.17	10.06	39.23	54.0	14.77	Pass

**Test parameters:**

Detector type = QP (quasi peak) in 30 MHz – 1 GHz, Peak above 1 GHz.  
 Resolution bandwidth = 120 kHz in 30 MHz – 1 GHz, 1 MHz above 1 GHz.

**Table calculations and abbreviations:**

Radiated emission dB(μV/m) = measured results dB(μV) + correction factor dB(1/m).  
 Correction factor = antenna factor + cable loss (for antenna factor and cable loss refer to Appendix B).

Ant. type = antenna type (BL - biconilog).

Ant. pol. = antenna polarization (V-vertical, H-horizontal).

Ant. hgt. = antenna height.

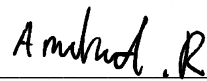
TT pos. = turntable position in degrees, (EUT front panel = 0°).

Spec. margin = specification margins = dB below (negative if above) specification limit.

Test performed by:  
Mr. Michael Feldman, test technician

Customer representative person:  
Mr. Amihud Rothman, manager, QA department

  
Hermon Labs

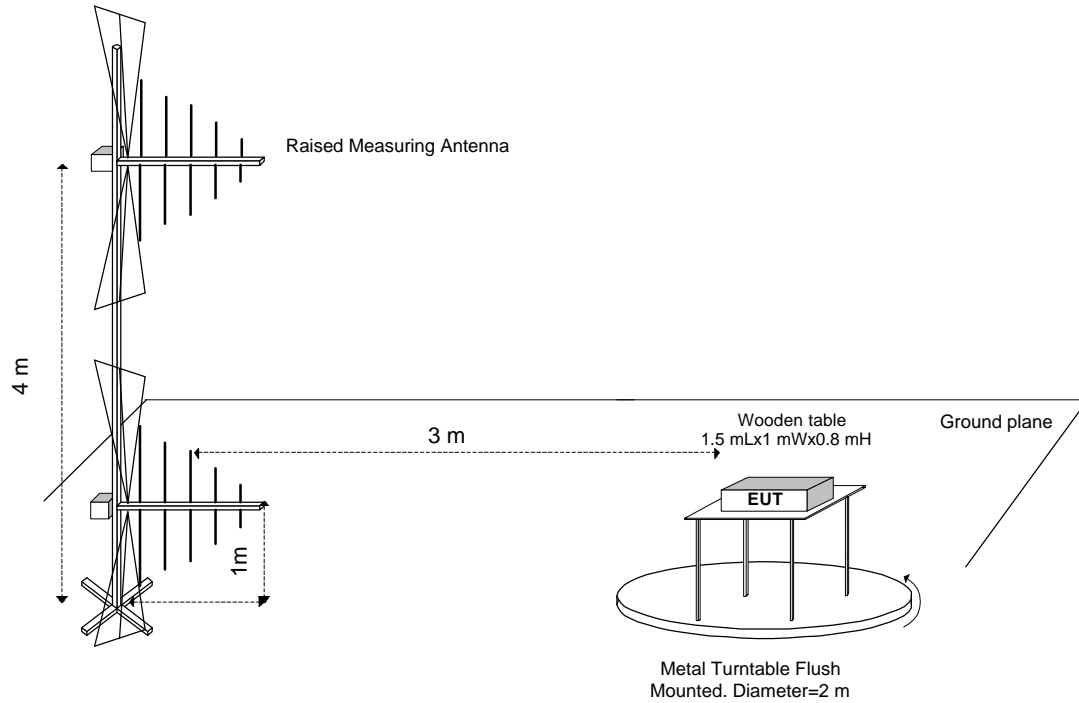
  
CTP Systems Ltd.

**Figure 4.1**  
**Setup for Radiated emissions test**



Anechoic Chamber

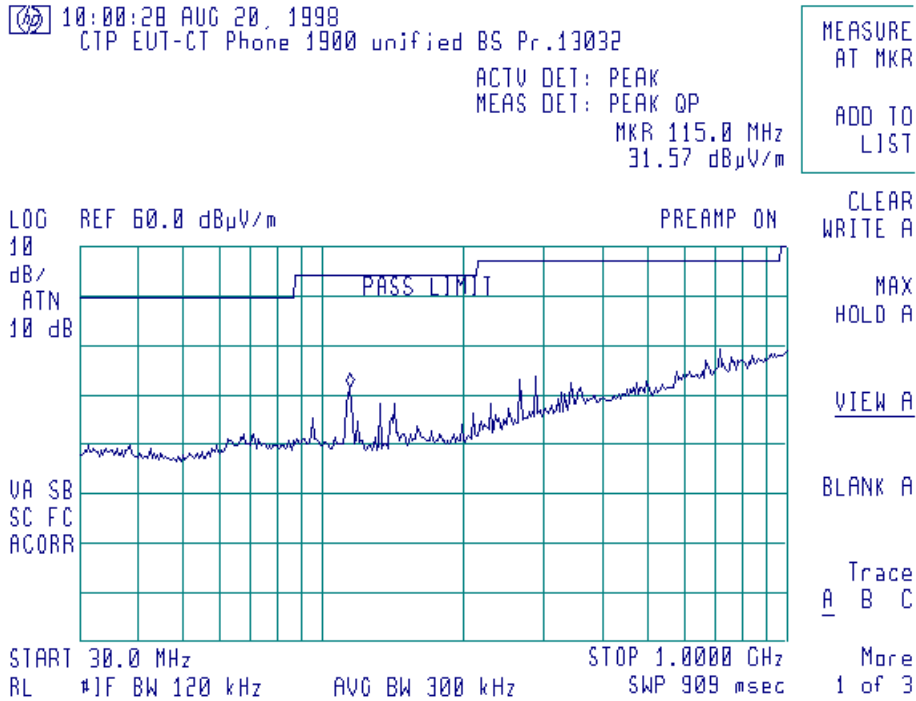
Plastic Antenna Mast





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**Plot 4.1**  
**Mini Base Station**  
**Local power**

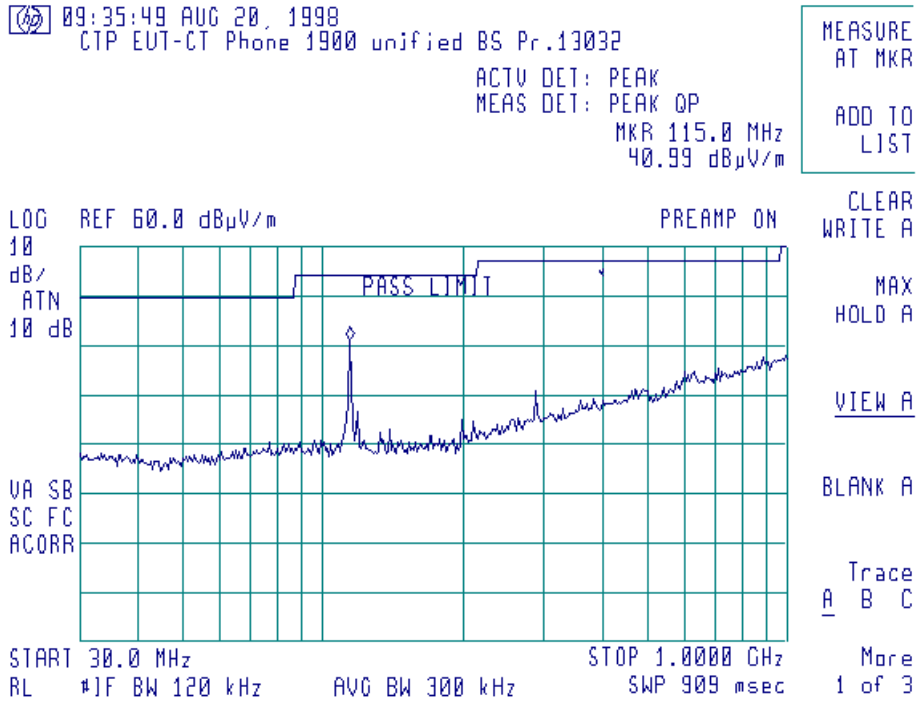






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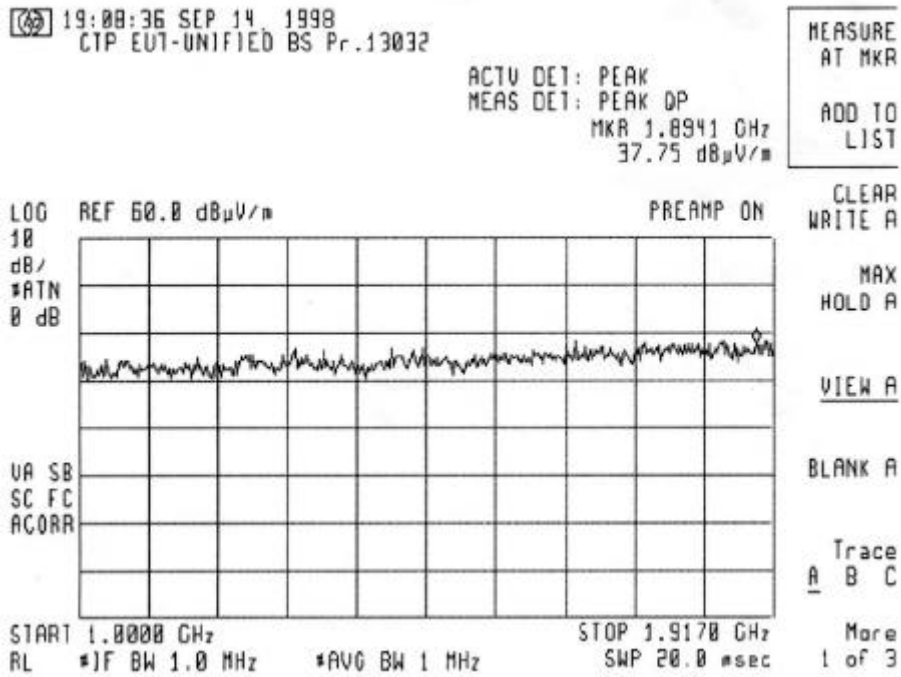
**Plot 4.2**  
**Mini Base Station**  
**Remote power**





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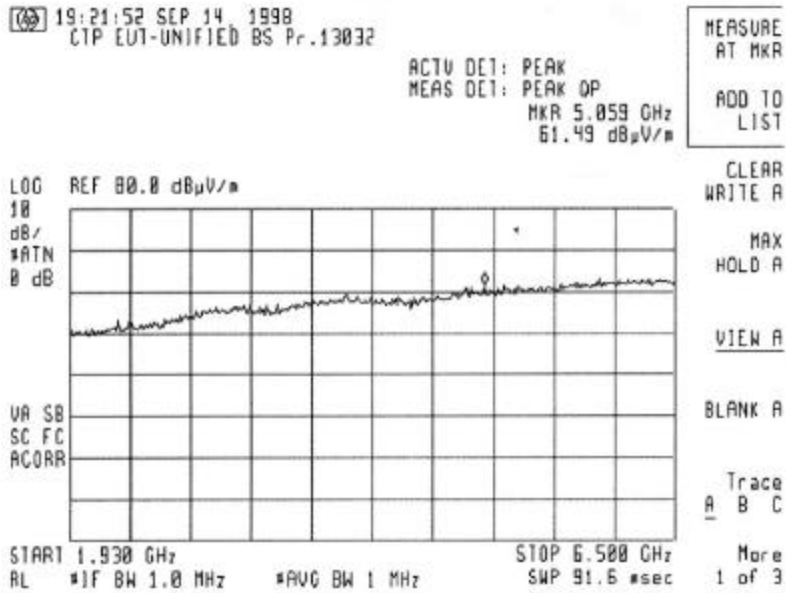
**Plot 4.3**  
**Mini Base Station**  
**Local power**





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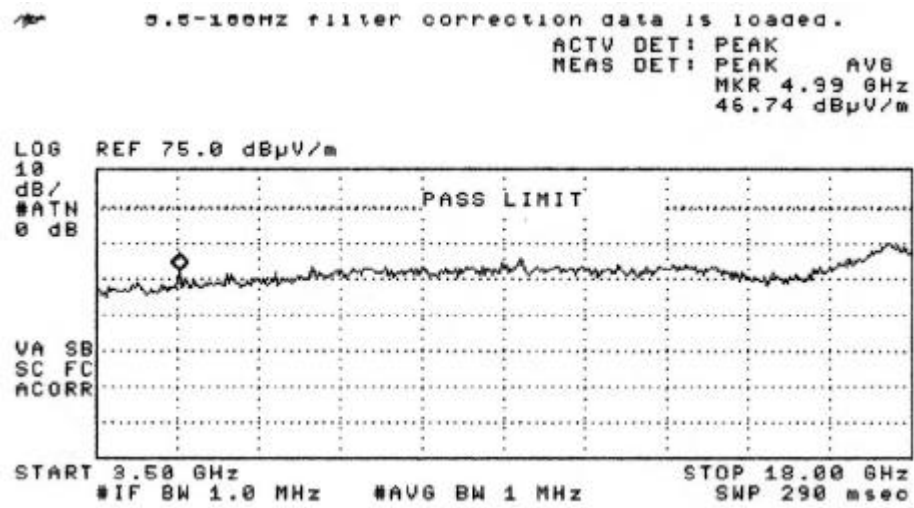
**Plot 4.4**  
**Mini Base Station**  
**Local power**





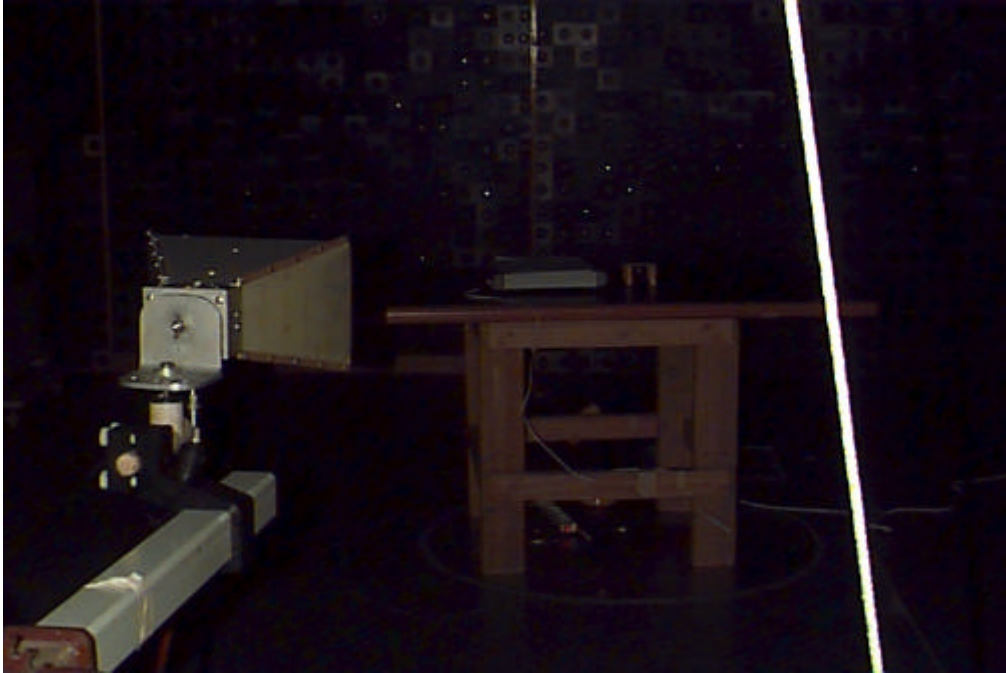
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Plot 4.5  
Mini Base Station  
Local power





**Photograph 4.1**  
**Setup for radiated emissions measurements (with External Antenna)**





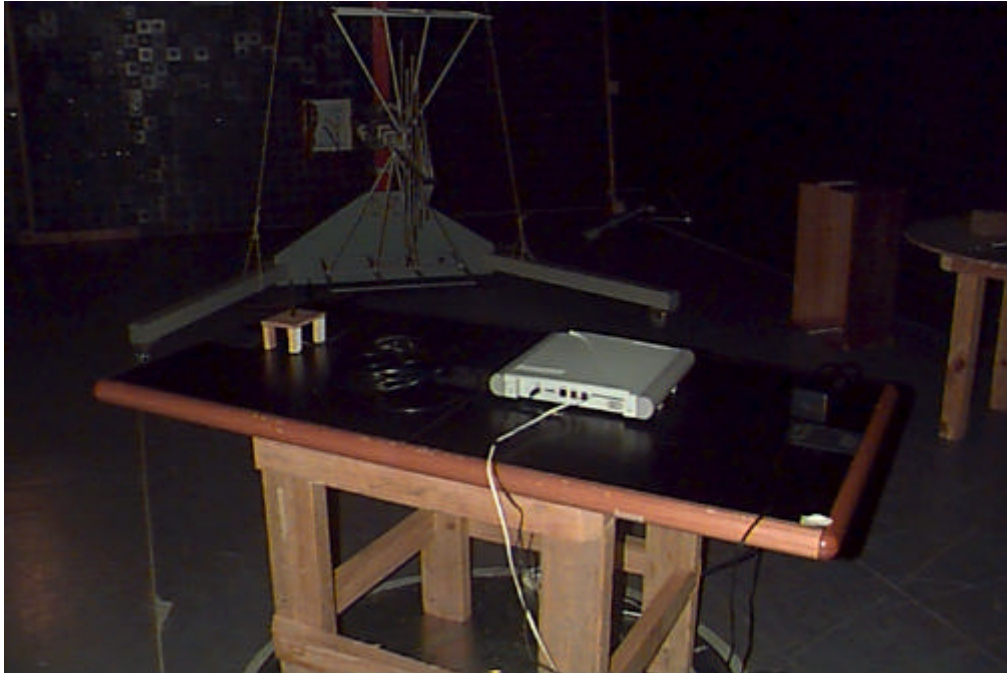
**Photograph 4.2**  
**Setup for radiated emissions measurements (with External Antenna)**





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**Photograph 4.3**  
**Setup for radiated emissions measurements (with External Antenna)**





## 5 Summary and Signatures

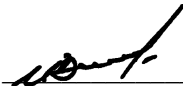
The EUT, Unified Base Station of the CT Phone 1900, was found to be in compliance with the requirements of FCC part 15 subpart B class A.

**Test performed by:**

Mr. Michael Feldman, test technician



Mr. Igor Silberstein, test technician



**Approved by:**

Dr. Edward Usoskin, C.E.O.



**Responsible Person from**  
**CTP Systems Ltd.**

Mr. Amihud Rothman, manager, QA department





**APPENDIX A - Test equipment and ancillaries used for tests**

<b>HL Serial No.</b>	<b>Serial No.</b>	<b>Description</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Due Calibr.</b>
0026	3460	Spectrum Analyzer, 100 Hz-2.2 GHz	Anritsu	MS 2601A	8/99
0038	0038	Antenna Mast, 1-4 m	Hermon Labs	NA	NA
0041	2811	Antenna, Horn, Ridged Guide , 1 - 18 GHz	Electro-Metrics	RGA 50/60	8/00
0163	1314	LISN, 9kHz-100MHz	Electro-Metrics	ANS-25/2	11/98
0185	1765	Graphics Plotter	Hewlett Packard	7475A	NA
0275	0275	Wooden Table, 1.5 x 1.0 x 0.8	Hermon Labs	NA	3/99
0287	0287	Metal Turntable Flush Mounted	Hermon Labs	NA	4/99
0447	447	LISN, 16/2, 300 V RMS	Hermon Labs	NA	2/99
0465	0465	Anechoic Chamber 9 m x 6.5 m x 5.5 m	Hermon Labs	NA	10/99
0466	0466	Shielded Room 3 m x 3 m x 2.4 m	Hermon Labs	NA	5/99
0521	0319	Spectrum Analyzer with RF filter section (EMI Receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	7/99
0604	1011	Antenna Log-Periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141 BICONILOG	12/98
0792	2006	Series Microwave EMI Measurement System, 1 - 26.5 GHz	Hewlett Packard	HP 84125	8/99



## APPENDIX B - Test Equipment Correction Factors

**Correction Factor**  
**Line Impedance Stabilization Network**  
**Model ANS-25/2**  
**Electro-Metrics**

Frequency, kHz	Correction Factor
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 dB is to be added to the meter readings (dB/ $\mu$ v) of the interference analyzer or spectrum analyzer.



**Antenna Factor at 3m calibration**  
**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( $\mu$ V) to convert to field intensity in dB( $\mu$ V/meter).



**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( $\mu$ V) to convert to field intensity in dB( $\mu$ V)/meter