ELECTROMAGNETIC EMISSIONS TEST REPORT

according to FCC Part 15 subpart C, §15.247 and subpart B

for

ABEST COMMUNICATION CORP.

EQUIPMENT UNDER TEST:

Wireless Multi-Handset System (PBX) Base Unit

FCC ID: OB5WPBX-9000-2L

Prepared by: _____
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Hermon Labs

Approved by: _____
Mr. A. Usoskin, QA manager
Hermon Labs

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ACCREDITED
839.01
Electrical

Description of equipment under test

Test items	Base unit frequency hopping transceiver FCC ID:OB5WPBX-9000-2L
Manufacturer	ABEST .Communication Corp.
Brand mark	ABEST Apollo
Types (Models)	WPBX-9000-2L
Receipt date	February 22, 1999

Applicant information

Applicant's representative	Mr. Oren Eliezer, chief engineer
Applicant's responsible person	Mr. Jason Chen, product manager
Company	ABEST .Communication Corp.
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Postal code	
City	Tamsui, Taipei
Country	Taiwan, R.O.C.
Telephone number	+886 2 2623 7902
Telefax number	+886 2 2621 7261

Test performance

Project Number:	13306
Location	Hermon Laboratories
Test started	February 22, 1999
Test completed	February 25, 1999
Purpose of test	The EUT certification in accordance with CFR 47, part 2, §2.1033
Test specification(s)	FCC Part 15, Subpart C, §15.247, §§15.205, 15.207, 15.209, 15.107, 15.109

The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation by A2LA
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.

Table of Contents

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)
BER	bit error rate
BW	bandwidth
CE	conducted emissions
cm	centimeter
CW	sine wave
dB	decibel
dBm	decibel referred to one milliwatt
dB(μA)	decibel referred to one microampere
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
DC	direct current
EMC	electromagnetic compatibility
EUT	equipment under test
FSK	frequency shift keying
GHz	gigahertz
H	height
HL	Hermon Laboratories
Hz	hertz
IF	Intermediate frequency
kHz	kilohertz
L	length
LISN	line impedance stabilization network
m	meter
mm	millimeter
MHz	megahertz
msec	millisecond
NA	not applicable
NARTE	National Association of Radio and Telecommunications Engineers, Inc.
nF	nanofarad
Ω	ohm
QP	quasi-peak (detector)
PC	personal computer
RBW	resolution bandwidth
RF	radio frequency
RE	radiated emission
sec	second
UTP	unshielded twisted pair
V	volt
V/m	volt per meter
W	watt

1.2 Specification references

CFR 47 part 15:1998	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.

1.3 EUT description

The EUT, WPBX-9000-2L base unit is a part of the wireless multi-handset system (PBX). The wireless PBX uses a spread spectrum frequency hopping RF link to transfer control data and digital compressed voice at a bit rate of approximately 115 kbit/sec in each direction. PBX features such as digital voice data switching, CO lines interface control and extension controls are all done at the base module. System basic configuration is done from the handsets.
The transmitter and receiver in the RF module share a single antenna terminal which is switched between them on a TDD basis (time division duplex), i.e., when a data packet is received the transmitter is inactive and does not interfere with the reception, and the reception is inactive during transmissions.
The transceiver employs frequency hopping spread spectrum which is managed by the baseband processor (external to the RF module).
The transmission and reception are based on synthesized oscillators that share the same 12 MHz reference clock which is provided as an input to the module.

- **Carrier frequencies**

The transceiver's 50 frequencies are: 902.5MHz, 903.0MHz, 903.5MHz…927.0MHz (902.5MHz to 927.0MHz with 0.5 MHz channel separation).

- **Modulation and bandwidth**

The modulation index of the FSK modulation is set to h≅0.5, which creates a modulated signal with a 20 dB bandwidth of about 500 kHz.

The base unit antenna (3 dBi gain) is an external rotational element with an internal extension element intended to bridge the gap between the external mounting point of the antenna (on the plastic housing) and the internal antenna port of the transceiver. The internal extension is perpendicular to the external one.

The base unit requires a 9 volts 1 A DC power adapter.

1.4 Changes made in EUT

To withstand the FCC part 15 class B requirements the following changes were made in EUT:

1) A ferrite bead P/N 0443164151 manufactured by Fair-Rite (with two turns) was connected to power supply cable from the base unit side

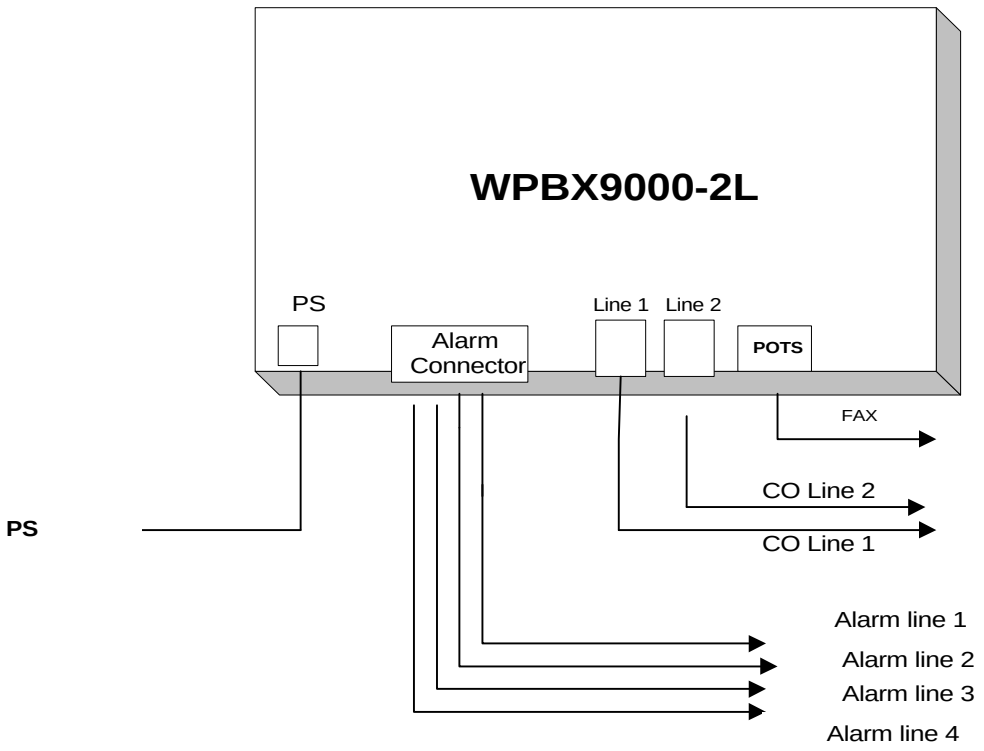
2) Digital portion of the schematic on the printed circuit board was shielded by metal cans.

3) The EUT was tested in typical installation as shown in sketch below:

a) the power supply was placed at a minimum distance of 0.5 meter from the base unit

b) the alarm cables were replaced for shielded ones

c) the telephone and alarm cables were routed as far as possible from the power supply cable.



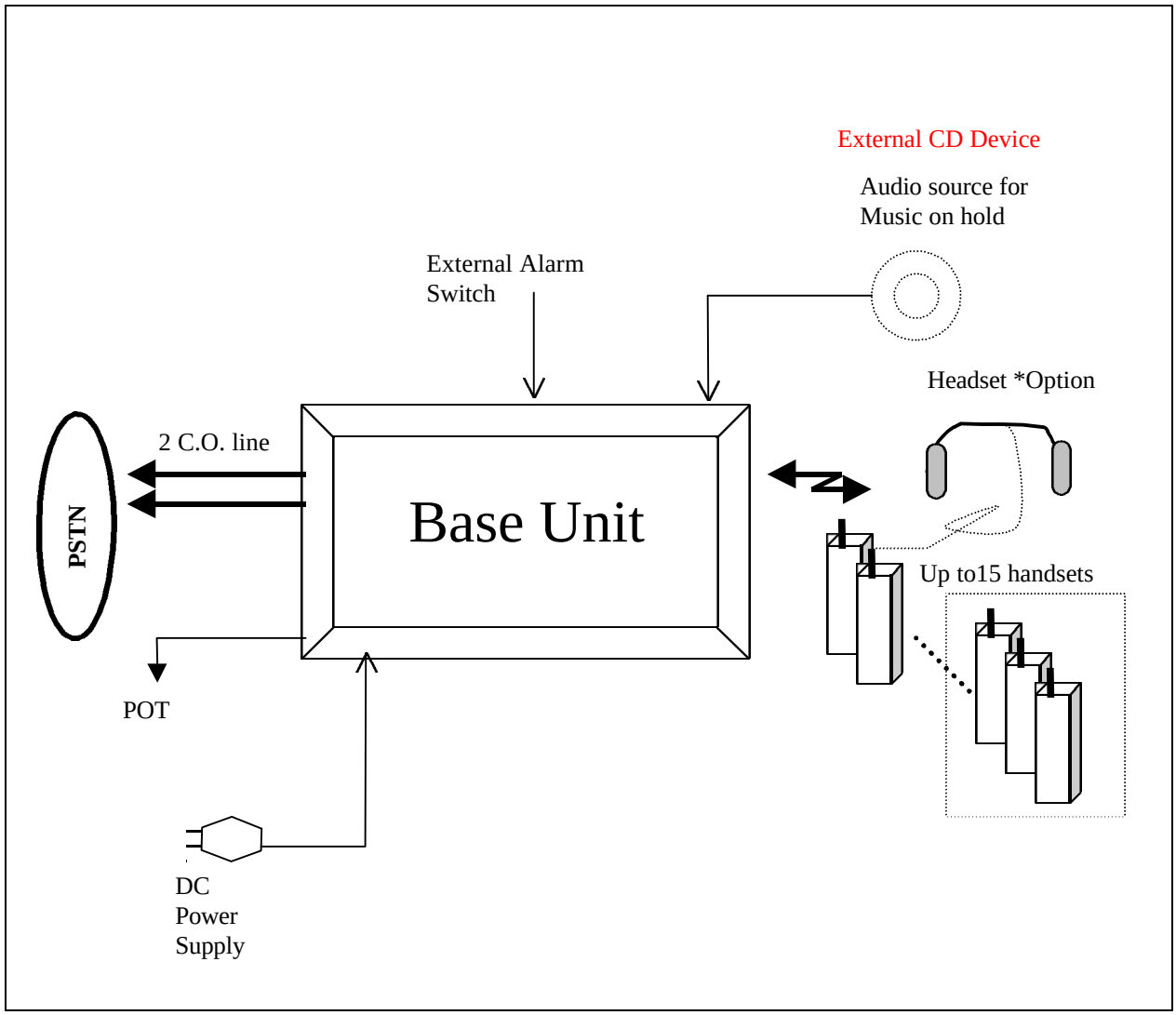
1.5 EUT test configuration

The EUT ports and lines description is given in Table 1.1. Throughout the testing the radio link was maintained with WPBX-9000-H handset. The EUT test configuration is shown in Figure 1.1.

Table 1.1 EUT ports and lines

Port type	Port description	Quantity	Cable type description	Cable length, m	Connected to
Power	power	1	unshielded	1.5	AC/DC adapter
Terminal block	alarm (dry contact)	2	STP	2	not connected
RJ-11	Central Office line	2	UTP	2	600 Ω termination
1RJ-11	POT	1	UTP	1	telephone
RL3.5 mm	audio input	1	unshielded-	1	not connected

Figure 1.1
EUT test configuration



2 Test Facility Description

2.1 General

Tests were performed at Hermon Laboratories, 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), listed by Industry Canada for radiated measurements (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), recognized by VDE (Germany) for witness test, certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-809 for anechoic chamber, C-845 for conducted emissions site), assessed by NMi Certin B.V. (Netherlands) for a number of EMC, Telecommunications and Safety standards, recognized by TUV Sudwest (Germany) for Safety testing, and Accredited by AMTAC (UK) for safety of Medical Devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO GUIDE 25/EN 45001 for EMC, Telecommunications and Product Safety Information Technology Equipment (Certificate No. 839.01).

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

2.2 Equipment calibration

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of MIL-STD-45662A.
The laboratory standards are calibrated by the third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

2.2.1 Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Conducted emissions with LISN	9 kHz to 30 MHz: ± 2.1 dB
Radiated emissions in the open field test site at 10 m measuring distance	Biconilog antenna: ±3.2 dB Log periodic antenna: ±3 dB Biconical antenna: ±4 dB
Radiated emissions in the anechoic chamber at 3 m measuring distance	Biconilog antenna: ±3.2 dB Double ridged guide antenna: ±2.36 dB

2.3 Laboratory personnel

The two people of Hermon Laboratories that have participated in measurements and documentation preparation are: Mrs. Eleonora Pitt - test engineer and Mrs. Marina Cherniavsky – certification engineer. E. Pitt is an EMC accredited test laboratory engineer and M. Cherniavsky is a telecommunication engineer, certified by the National Association of Radio and Telecommunications Engineers (NARTE, USA.).
The Hermon Laboratories personnel that participated in this project have more than 50 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 an engineer, graduated from the University in 1974 with an MScEE degree, have obtained 26 years experience in EMC measurements and have been with Hermon Laboratories since 1991. Also, I am an EMC accredited test laboratory engineer certified by the National Association of Radio and Telecommunications Engineers, Inc. (USA.), the certificate no. is ATL-0006-E.

Name: Mrs. Eleonora Pitt Signature: _____
Position: Test Engineer Date: June 16, 1999

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 am an engineer, graduated from university in 1971, with an MScEE degree, have obtained 26 years experience in electronic products design and development and have been with Hermon Labs since 1991. Also, I am a Telecommunication Class II engineer certified by the National Association of Radio and Telecommunications Engineers, Inc. (USA.), the certificate no. is E2-03410.

Name: Mrs. Marina Cherniavsky Signature: _____
Position: certification engineer Date: June 16, 1999

3 Emission Measurements

3.1 Frequency hopping channels separation and hopping frequency usage test according to §15.247(a)(1)(i)

3.1.1 Definition of the test

This test was performed to prove that the EUT frequency hopping system uses at least 25 hopping frequencies and has hopping channel carrier frequencies separation by a minimum of 25 kHz or by the 20 dB bandwidth of the hopping channel, whichever is greater.

3.1.2 Test set-up

The test was performed in the anechoic chamber at 3 meter test distance with biconilog antenna. The EUT was installed on the 0.8 m high wooden table which was on the top of the metal turntable flush mounted with the ground plane.

The spectrum analyzer settings are shown in the plot.

3.1.3 Test results

The Plot 3.1.1 shows 25 channels and the 0.5 MHz spacing between carriers which is greater than 20 dB channel occupied bandwidth separation (0.450 MHz maximum, see Table 3.2.1) required by the standard. The EUT successfully passed this test.

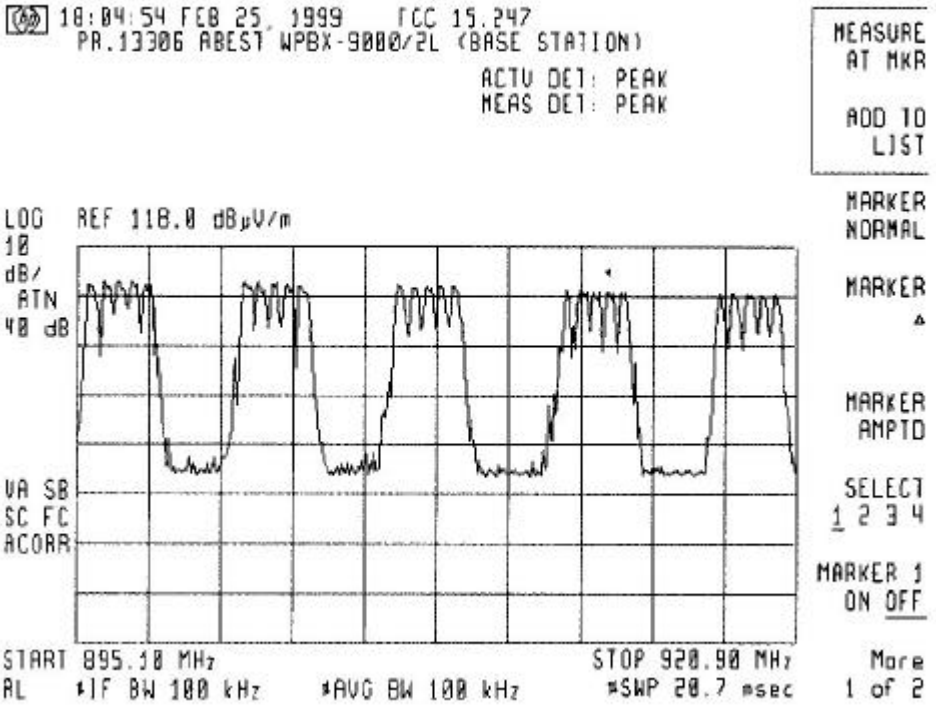
Reference numbers of test equipment used

HL 0412	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604

Full description is given in Appendix A.

Plot 3.1.1

Test specification: § 15.2479a)(1)(i)
Hopping channels separation test results



3.2 Occupied bandwidth test according to § 15.247(a)(1)(i)

3.2.1 Definition of the test

This test was performed to prove that the maximum 20 dB bandwidth of the hopping channel is less than 500 kHz.

3.2.2 Test set-up

The test setup was the same as in test 3.1.

3.2.3 Test results

The measurements were performed in normal mode of operation with 115 kbit/sec rate. The occupied bandwidth measurement was performed for carrier (channel) frequency at low and high edges and at the middle of the 902 - 928 MHz frequency band. Table 3.2.1 and Plots 3.2.1 to 3.2.3 demonstrate the test results of the occupied bandwidth measurements. The spectrum analyzer settings are shown in plots.

Table 3.2.1 Occupied bandwidth test results

Carrier frequency, MHz	Measured 20 dB BW, kHz	Limit, kHz	Result
902.5	438	500	Pass
915.0	450	500	Pass
927.0	425	500	Pass

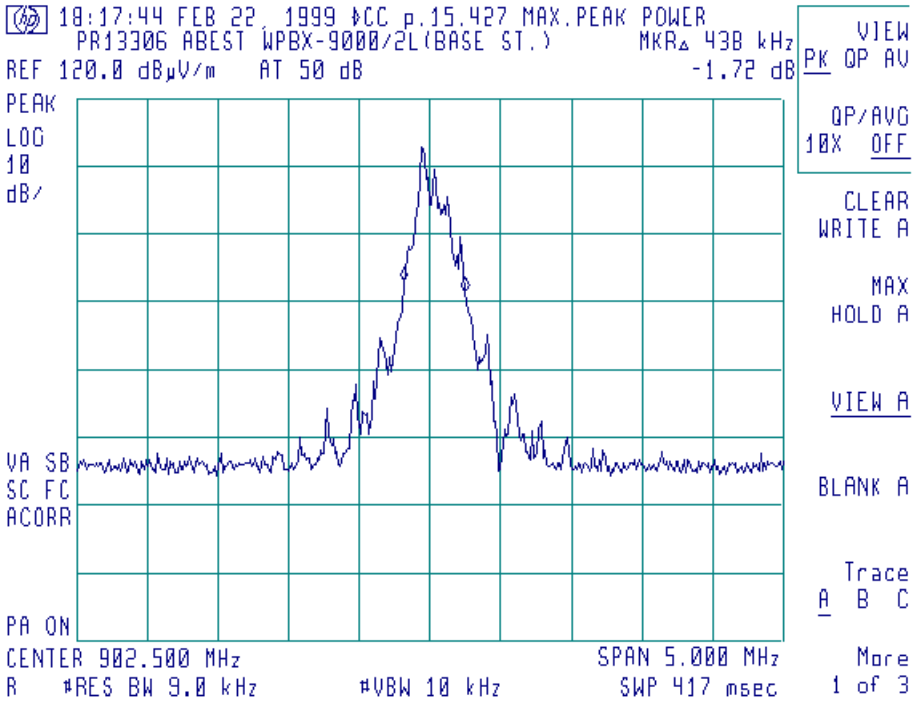
Reference numbers of test equipment used

HL 0412	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604

Full description is given in Appendix A.

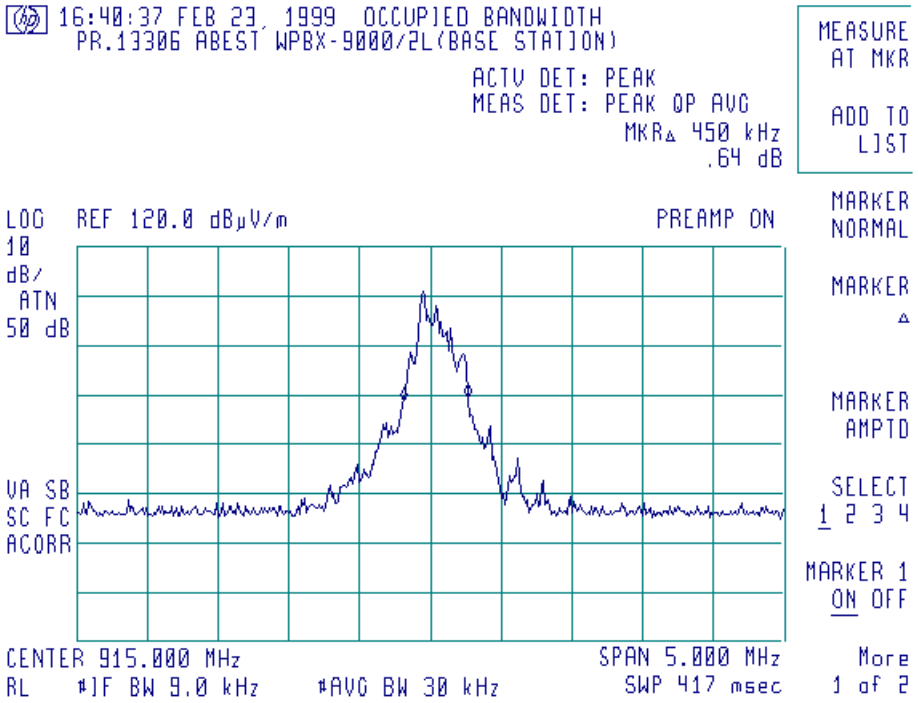
Plot 3.2.1

Test specification: § 15.247(a)(1)(i)
Occupied bandwidth test results



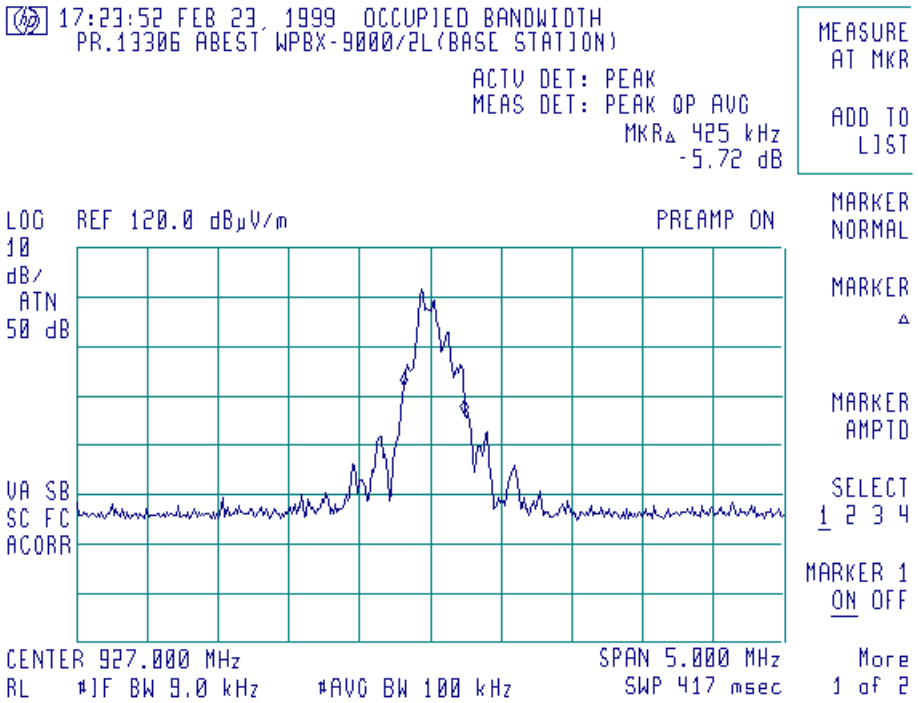
Plot 3.2.2

Test specification: § 15.247(a)(1)(i)
Occupied bandwidth test results



Plot 3.2.3

Test specification: § 15.247(a)(1)(i)
Occupied bandwidth test results



3.3 Average time of occupancy definition according to § 15.247(a)(1)(i)

3.3.1 Definition

This parameter was checked to prove that the average time of occupancy on any frequency is not greater than 0.4 seconds within any 10 second period.

3.3.2 Calculation

The average occupancy time was calculated from the following equation:

Number of channels (hop frequencies) = 25
Hopping dwell time = 13.82 msec (see Plot 3.3.1)
Pulse duration (transmitting on) = 0.85 msec (see Plot 3.3.2)
Total transmission time at 25 frequencies = 13.82 msec x 25 = 345.5 msec
Each frequency is used within 10 sec period: 10 / 0.3455 ≈29 times

Average occupancy time at any frequency = 0.85 msec x 29 = 0.025 sec, which is less than the required 0.4 sec.

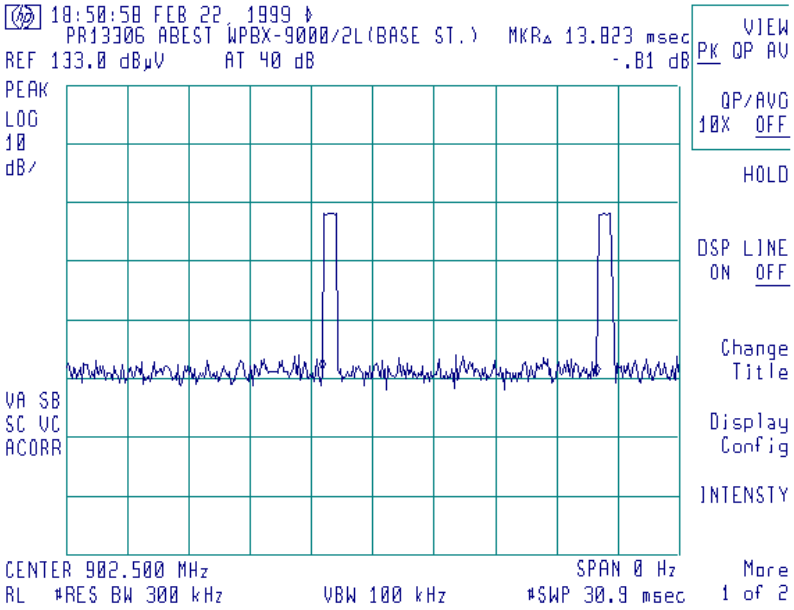
Reference numbers of test equipment used

HL 0412	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604

Full description is given in Appendix A.

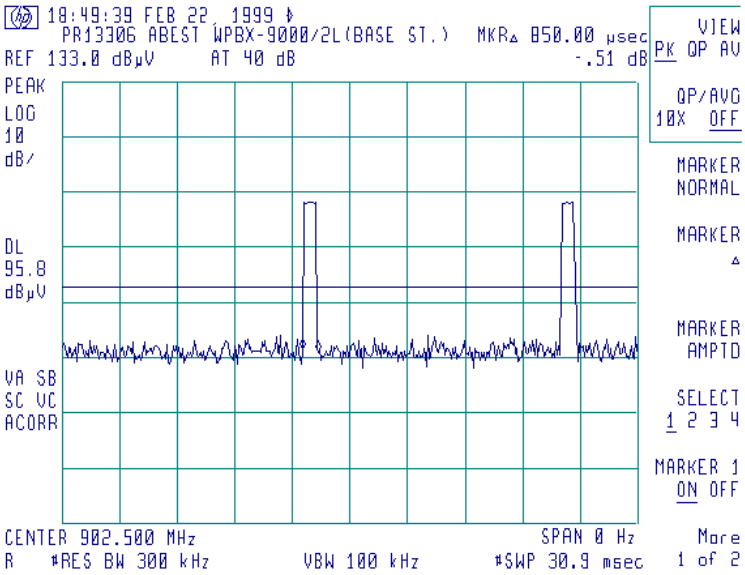
Plot 3.3.1

Test specification: § 15.247(a)(1)(i)
Average time of occupancy test results
Hopping dwell time measurement



Plot 3.3.2

Test specification: § 15.247(a)(1)(i)
Average time of occupancy test results
Transmitting on time measurement



3.4 Maximum peak output power test according to §15.247 (b)(2)

3.4.1 Definition of the test

This test was performed to demonstrate that the maximum RF peak output power of the transmitter does not exceed 0.25 watt (24 dBm).

3.4.2 Test set-up

The test was performed in the anechoic chamber at 3 meter test distance with biconilog antenna as shown in Photographs 3.4.1 and 3.4.2. The EUT was installed on the 0.8 m high wooden table which was on the top of the metal turntable flush mounted with the ground plane. To find the maximum radiation measuring antenna height was changed from 1 to 4 m, the turntable was rotated 360° and the antenna's polarization was changed from vertical to horizontal.

3.4.3 Test results

The maximum RF output power was measured at 3 carrier (channel) frequencies (low, middle, high). All measured results given in Plots 3.4.1 to 3.4.3. The Table 3.4 below gives output power in dBm.

Table 3.4
Transmitter output RF power test results

Frequency, MHz	Peak output power, dBm	Limit, dBm	Margin dB	Result
902.5	20.8	24	3.2	Pass
915	18.0	24	6.0	Pass
927	19.2	24	4.8	Pass

Reference numbers of test equipment used

HL 0412	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604
HL 0815	HL 0816					

Full description is given in Appendix A.

3.4.4 Exposure limit according to part 1, §1.1310

Limit for power density for general population/uncontrolled exposure is

$$P\ (mW/cm^2) = f/1500 = 902/1500 = 0.6\ mW/cm^2.$$

The power density $P\ (mW/cm^2) = \frac{P_T}{4\pi r^2}$, where

P_T - the transmitted power, which is equal to the transmitter output power 20.8 dBm plus maximum antenna gain 3 dBi, the maximum output transmitter power is 23.8 dBm = 240 mW.

$$0.6\ (mW/cm^2) = 240\ mW / 4\pi r^2$$

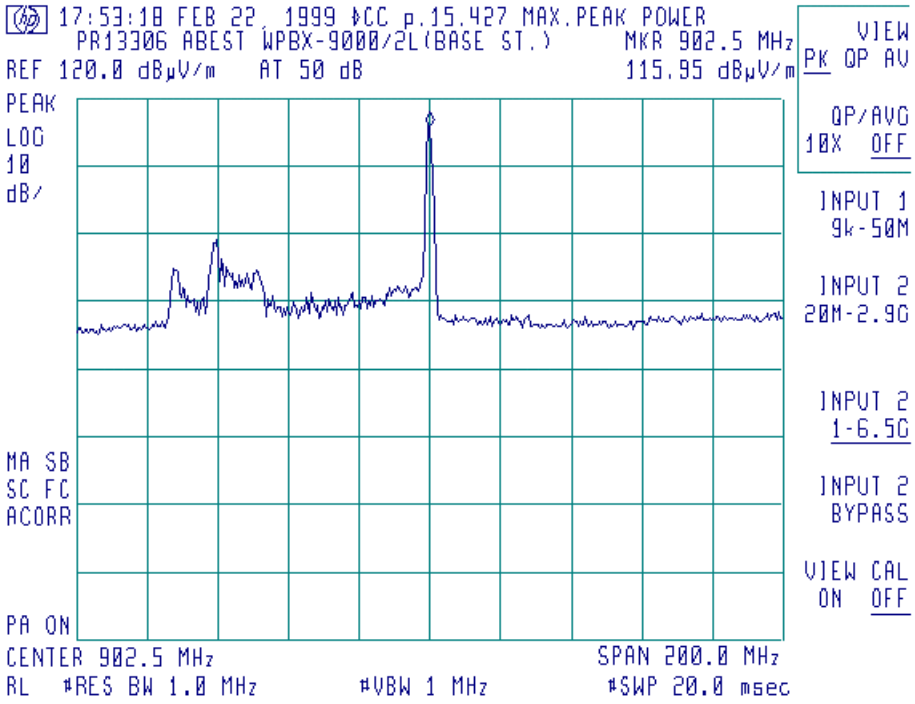
The allowed distance “r”, where RF exposure limits may not be exceeded, is 5.64 cm:

$$r = \sqrt{P_T} / 0.6 \times 4\pi = \sqrt{240} / 2.4 \times 3.14 \approx 5.64\ (cm).$$

The public cannot be exposed to dangerous RF level.

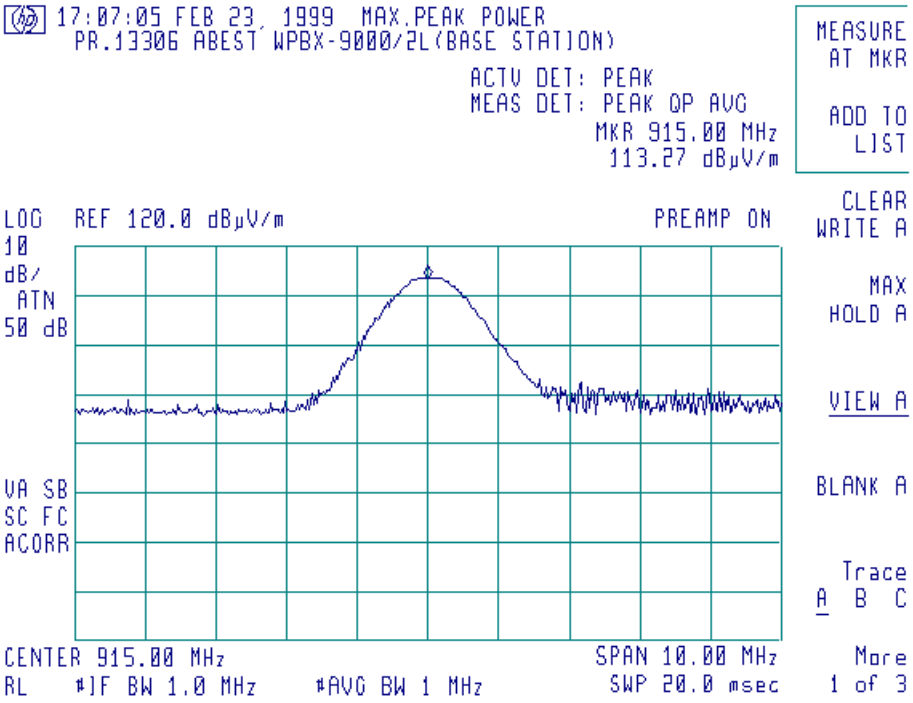
Plot 3.4.1

Test specification: § 15.247(b)(2)
Output power test (P=20.8 dBm)



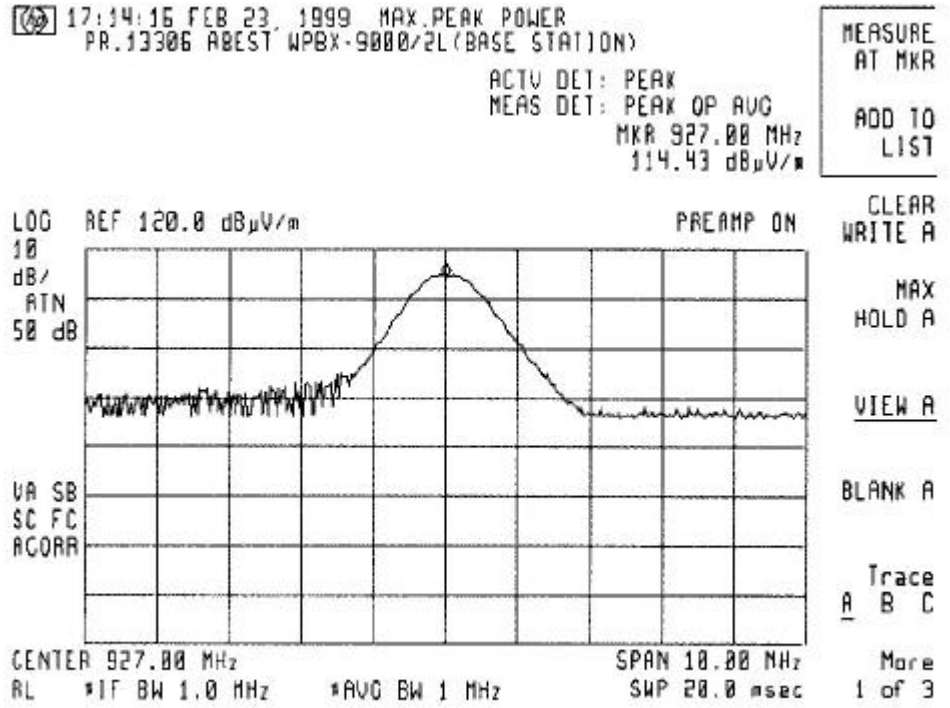
Plot 3.4.2

Test specification: § 15.247(b)(2)
Output power test (P=18 dBm)



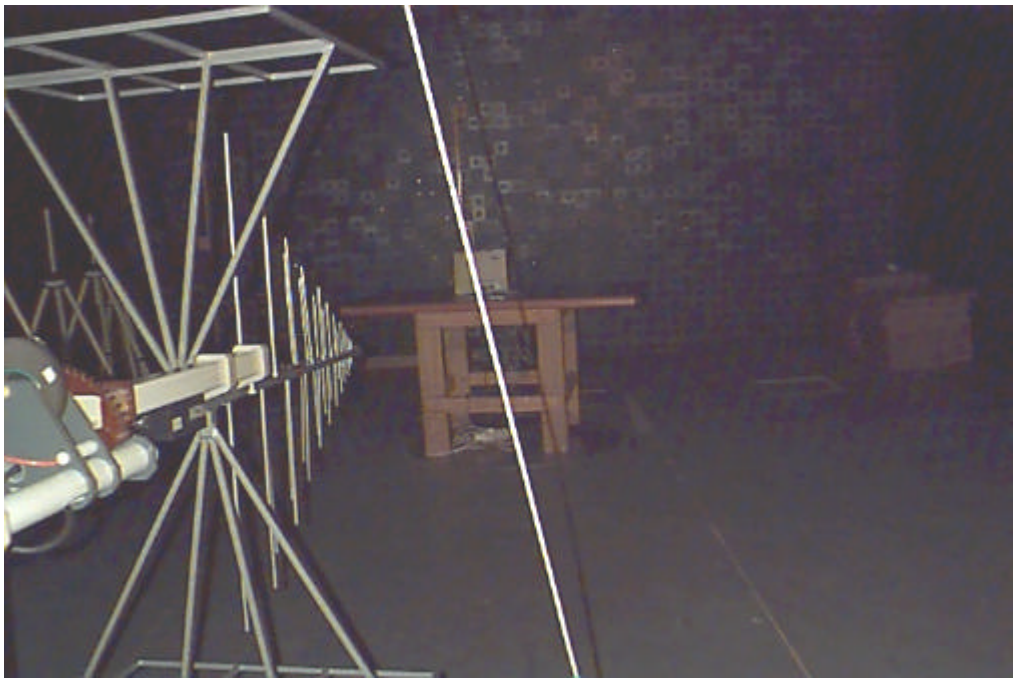
Plot 3.4.3

Test specification: § 15.247(b)(2)
Output power test (P=19.2 dBm)

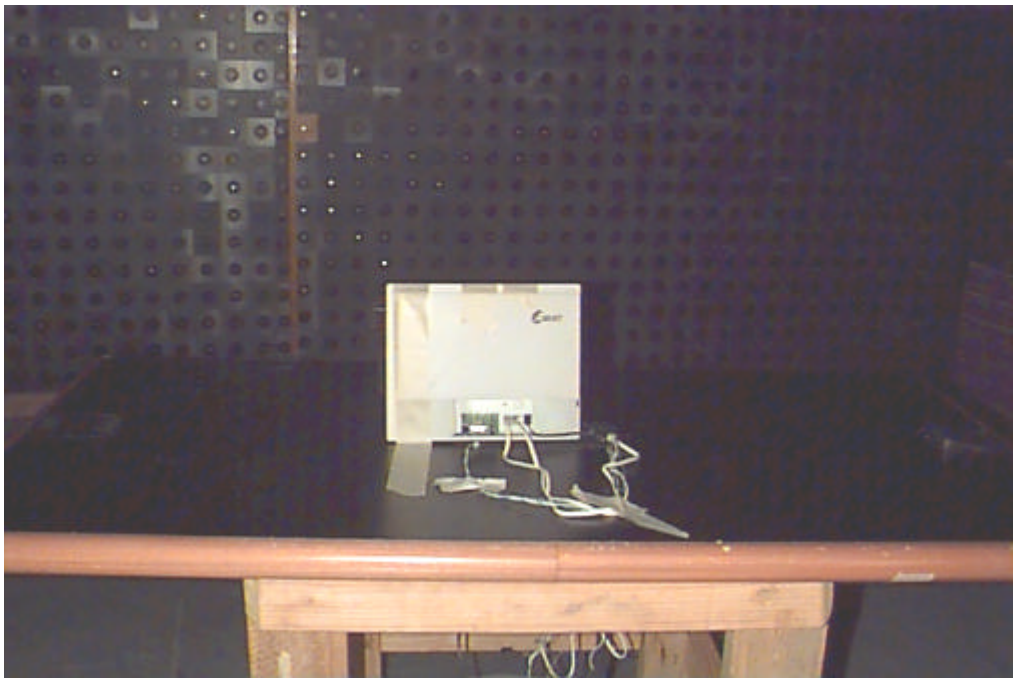


P=19.2 dBm

Photograph 3.4.1
Maximum power and radiated emissions measurement setup



Photograph 3.4.2
Maximum power and radiated emissions measurement setup



3.5 Out of band radiated emissions test according to §15.247(c) and § 15.205, 15.209(a)

3.5.1 Definition of the test

This test was performed
1) to prove that the EUT out-of-band emissions in any 100 kHz bandwidth outside 902 to 928 MHz are at least 20 dB below maximum power content as measured in any 100 kHz bandwidth within the band that contains the highest level of the desired power and
2) to measure radiated emissions except carriers generated by the transmitter.

3.5.2 Test set-up

The radiated emissions measurements were performed in the anechoic chamber with the biconilog and double ridged guide antennas at 3 meters test distance as shown in Photographs 3.4.1, 3.5.1 to 3.5.3. The frequency range from 30 MHz to 9.3 GHz was investigated.

The EUT was installed on the 0.8 m high wooden table which was on the top of the metal turntable flush mounted with ground plane. To find the maximum radiation measuring antenna height was changed from 1 to 4 m, the turntable was rotated 360° and the antennas polarization was changed from vertical to horizontal.

3.5.3 Test results

The test was performed with transmitter operating at 3 carrier (channels) frequencies 902.5, 915 and 927 MHz. Plots 3.5.1 and 3.5.9 show the in-band signal (902.5 and 927 MHz), Plots 3.5.2 to 3.5.8, 3.5.10 to 3.5.14 show that the out of bands measured signals were more than 20 dBc. Radiated emissions which fall in the restricted bands comply with §15.209(a) limits.
Emissions found in 30 - 1000 MHz range were due to the incorporated digital device and are brought in section 3.6 of this test report.

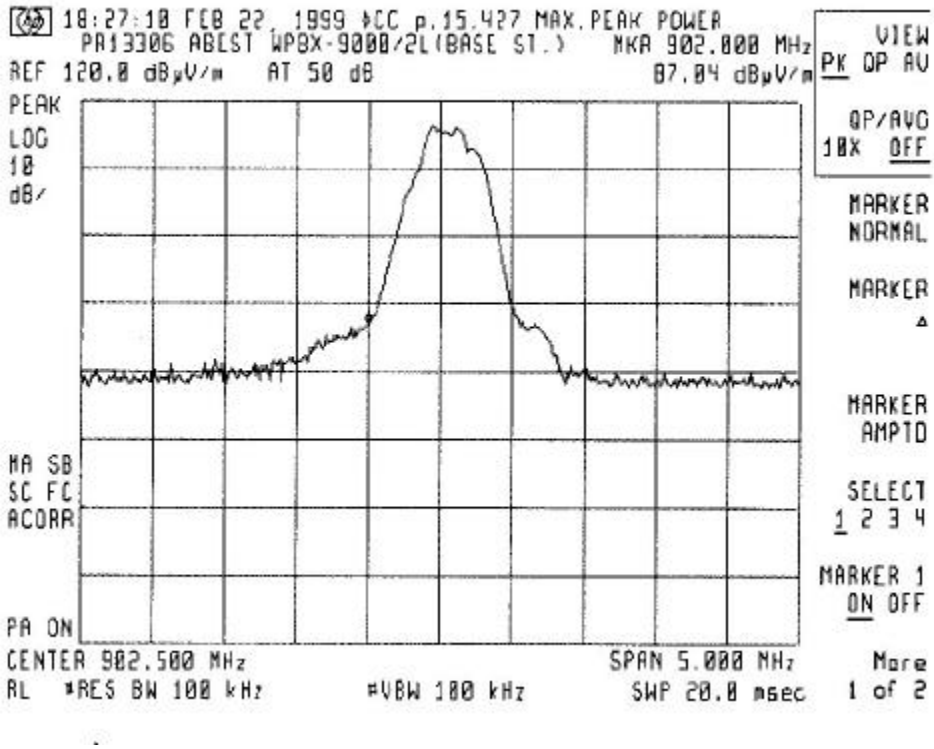
Reference numbers of test equipment used

HL 0025	HL 0041	HL 0412	HL 0465	HL 0521	HL 0589	HL 0593
HL 0594	HL 0604	HL 0815	HL 0816			

Full description is given in Appendix A.

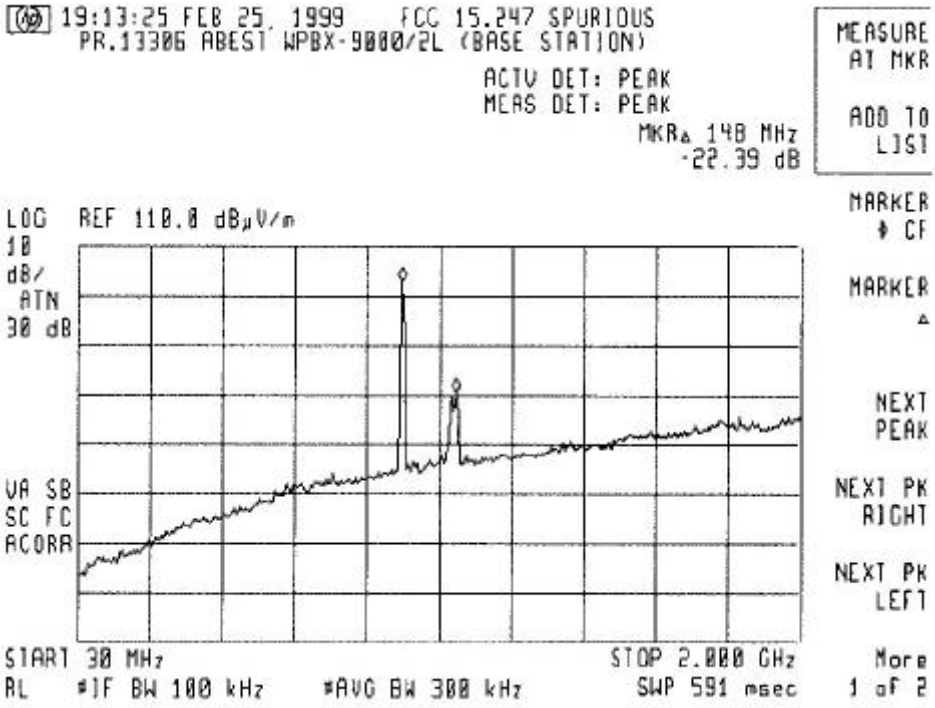
Plot 3.5.1

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 902.5 MHz , in-band signal



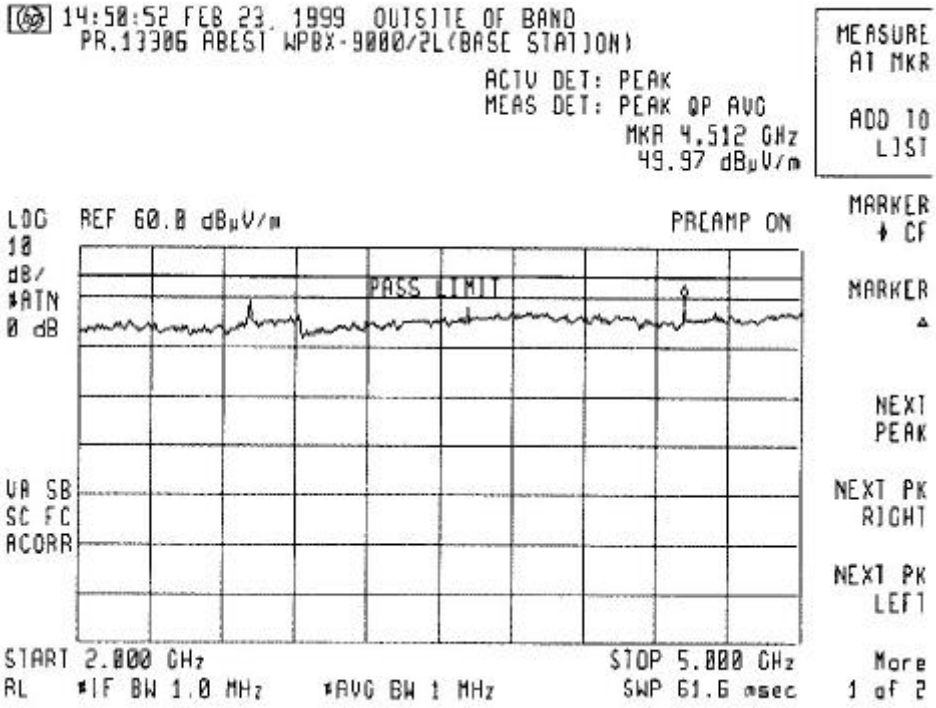
Plot 3.5.2

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 902.5 MHz



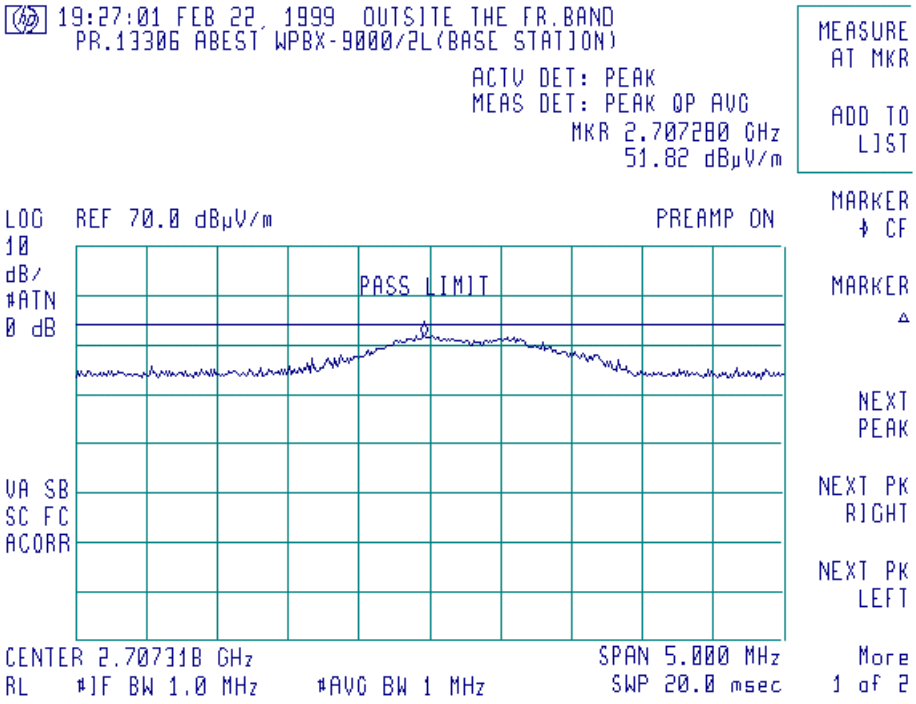
Plot 3.5.3

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 902.5 MHz



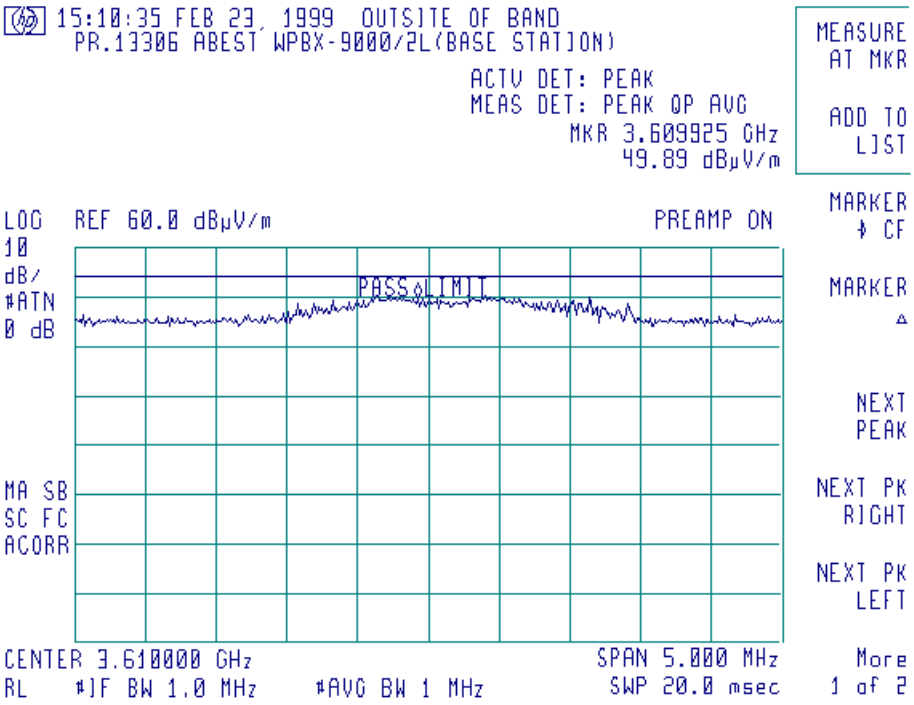
Plot 3.5.4

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 902.5 MHz



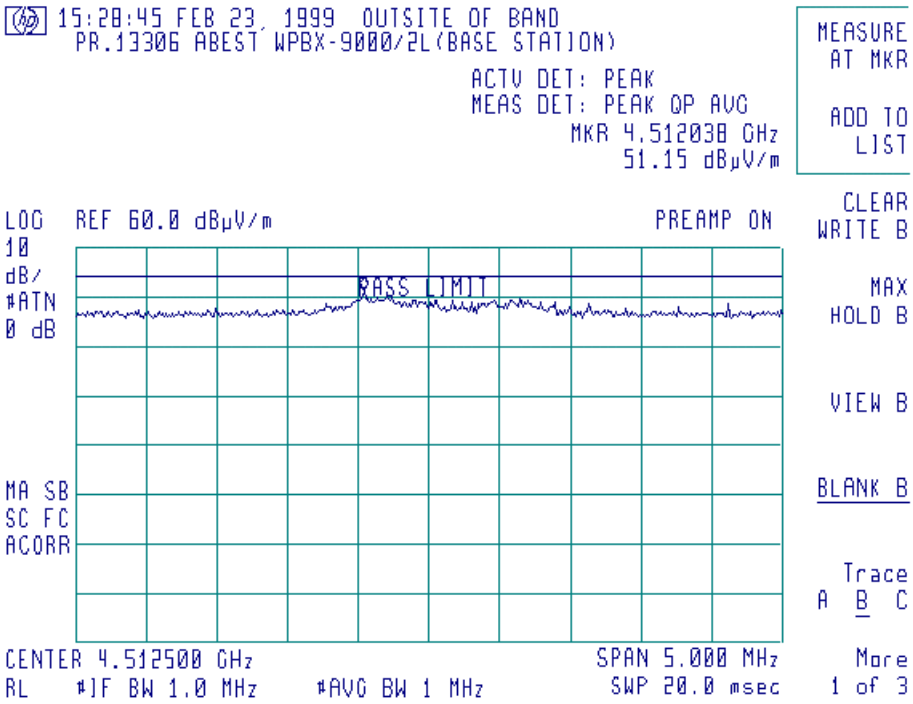
Plot 3.5.5

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 902.5 MHz



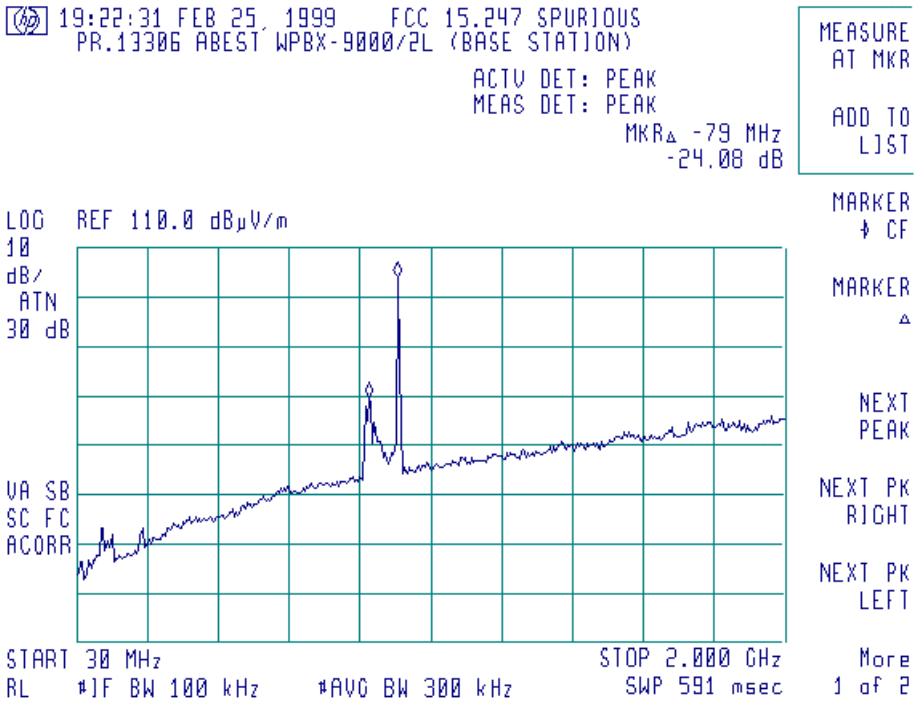
Plot 3.5.6

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 902.5 MHz



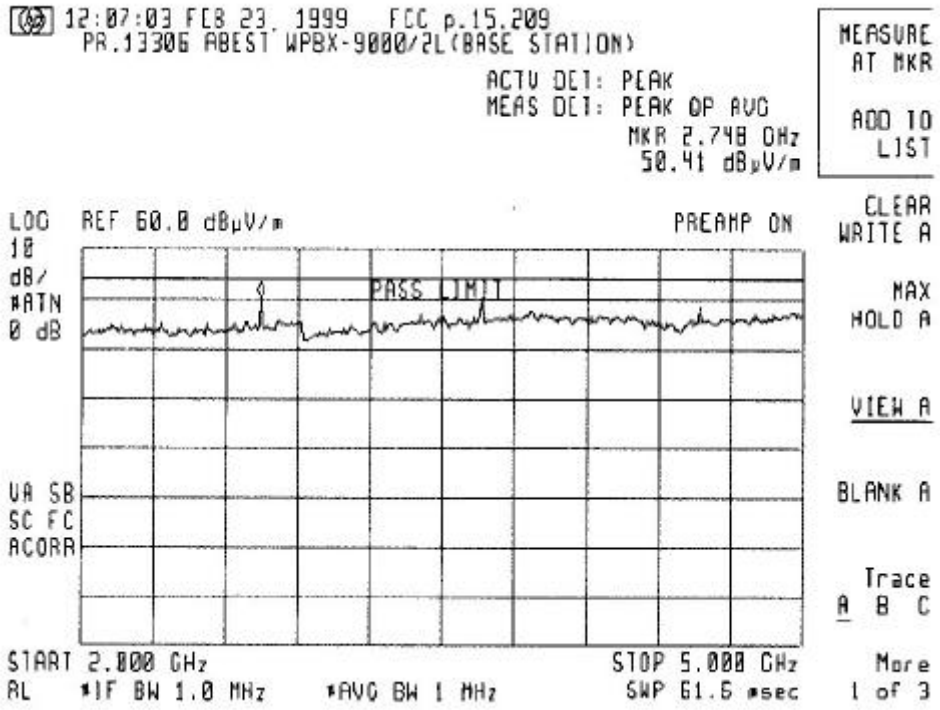
Plot 3.5.7

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 915 MHz



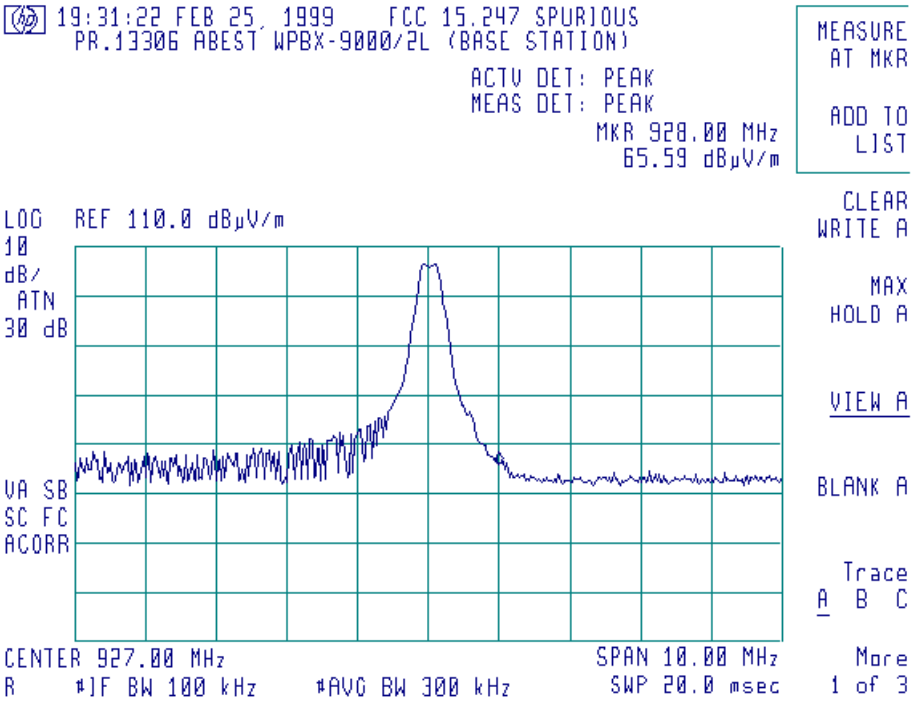
Plot 3.5.8

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 915 MHz



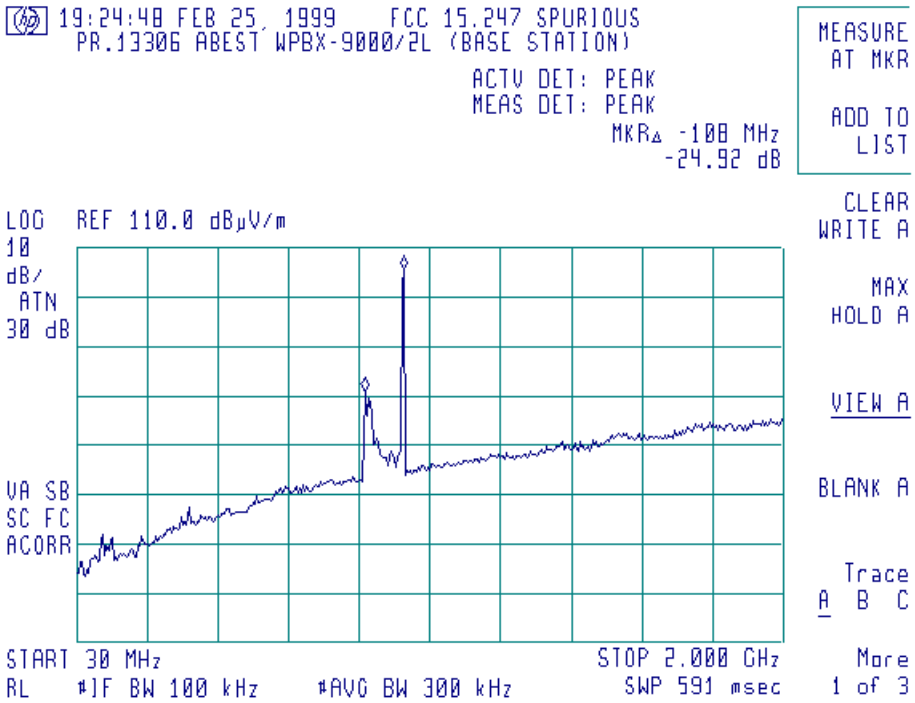
Plot 3.5.9

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 927 MHz, in-band signal



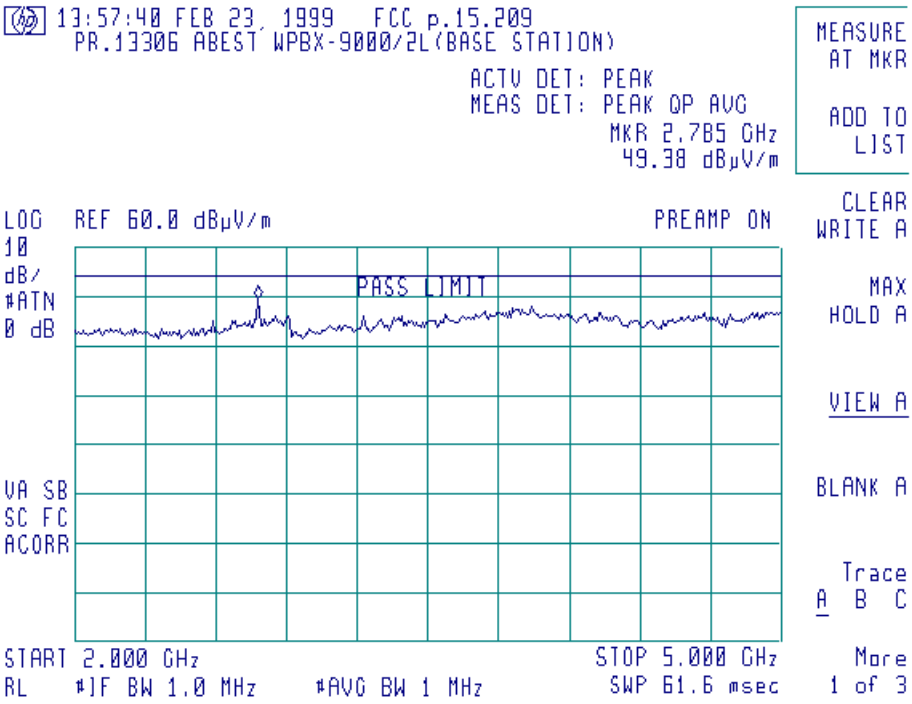
Plot 3.5.10

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 927 MHz



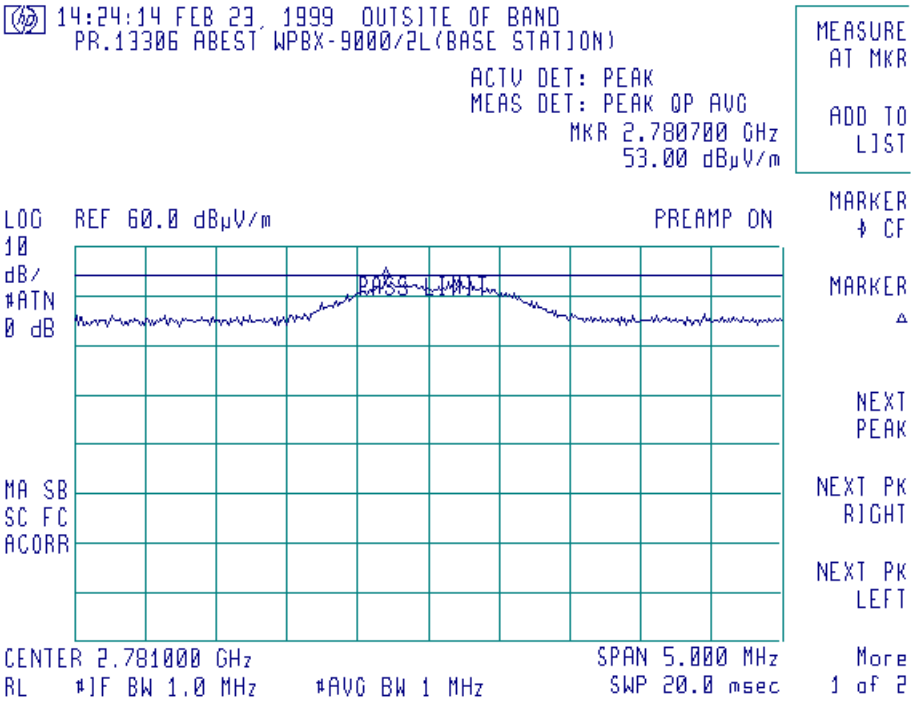
Plot 3.5.11

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 927 MHz



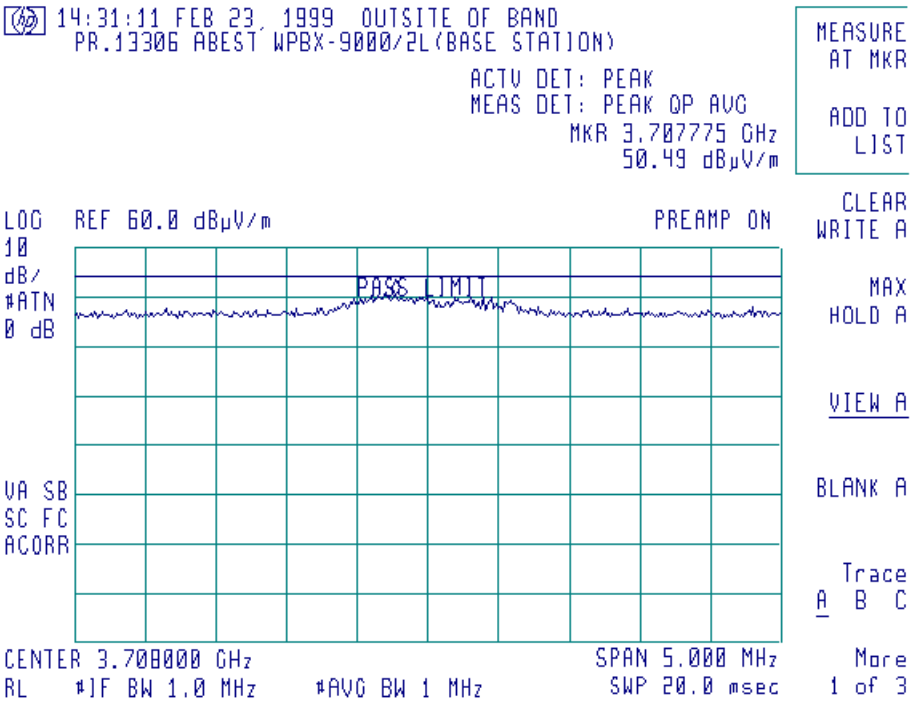
Plot 3.5.12

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 927 MHz



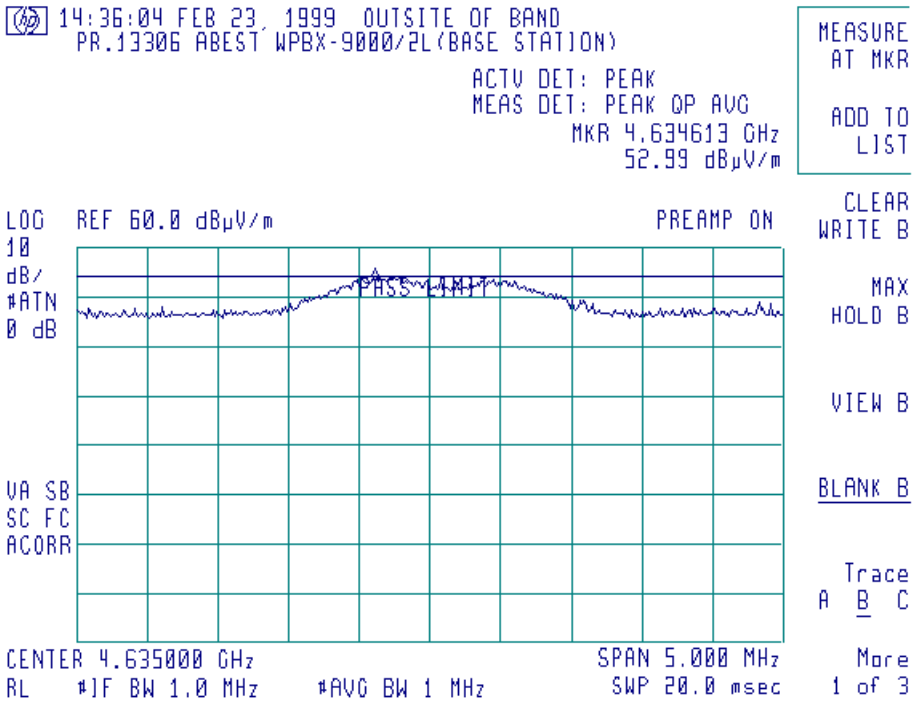
Plot 3.5.13

Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 927 MHz

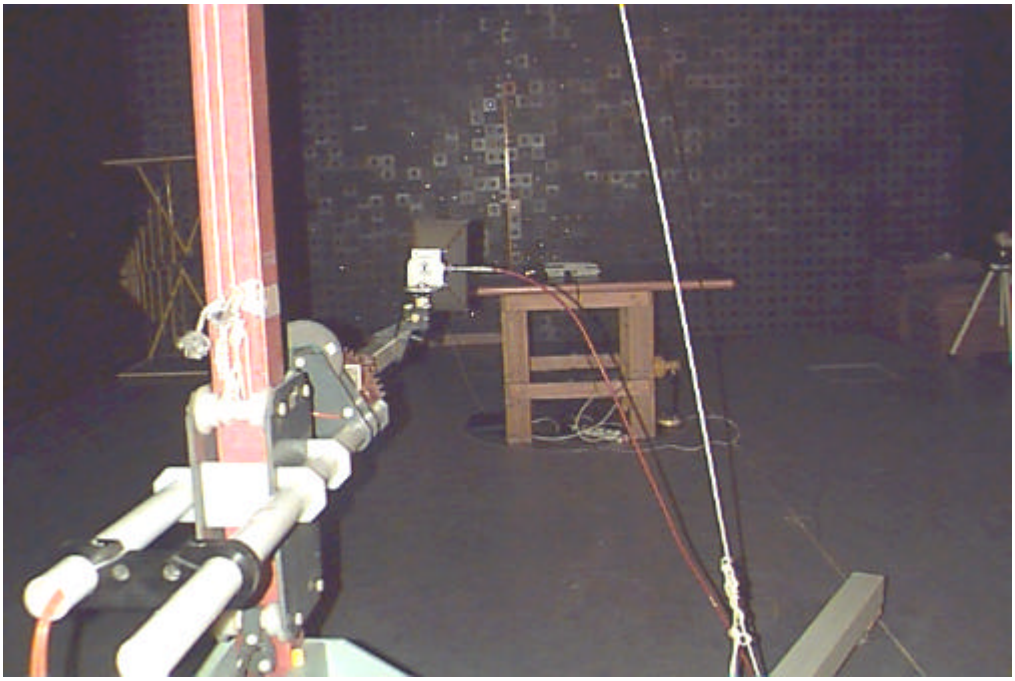


Plot 3.5.14

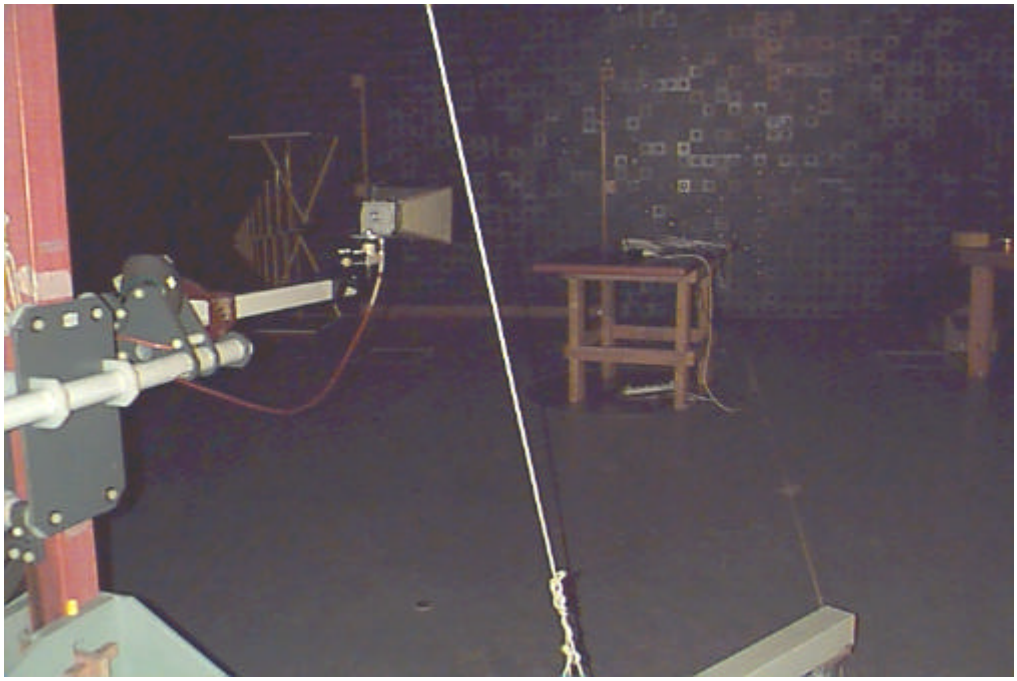
Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 927 MHz



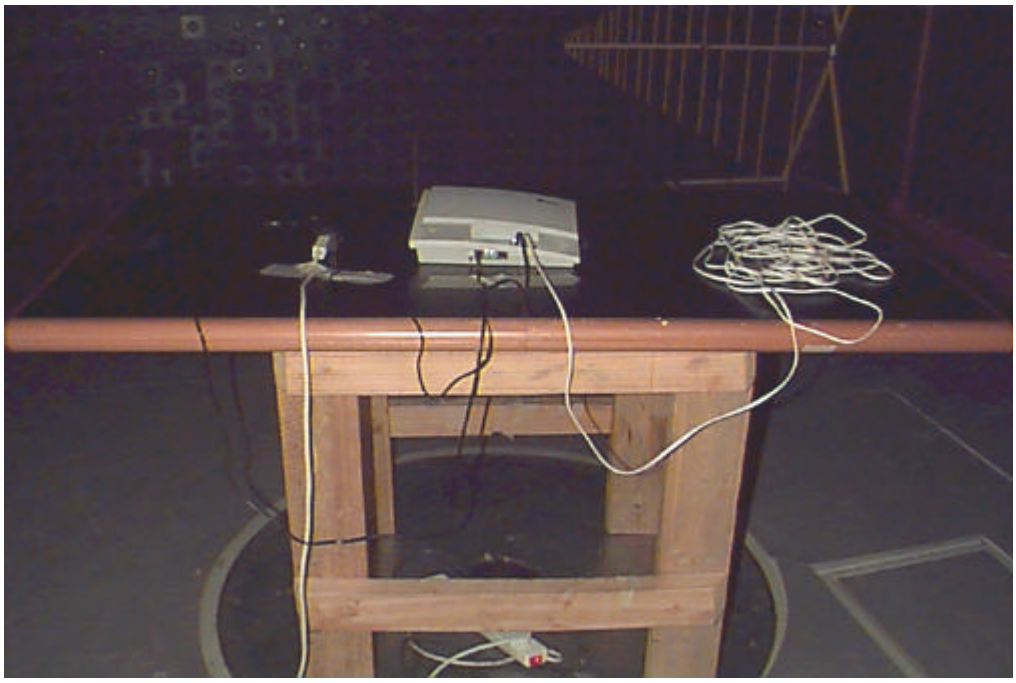
Photograph 3.5.1
Radiated emissions measurement setup



Photograph 3.5.2
Radiated emissions measurement setup



Photograph 3.5.3
Radiated emissions measurement setup



3.6 Unintentional Radiated emissions (class B digital device) test according to §15.109

3.6.1 Definition of the test

This test was performed to measure radiated emissions from the incorporated digital device of the EUT and also to verify the EUT full compliance with §15.109.

3.6.2 Test set-up

The radiated emissions measurements of the EUT incorporated digital device and receiver were performed in the anechoic chamber at 3 meters measuring distance with biconilog antenna. The measurements were done from 30 MHz to 5^{th} harmonic. The EUT was placed on the wooden table as shown in Figure 3.6.1 and Photographs 3.6.1, 3.6.2.
To find maximum radiation the turntable was rotated 360^{o}, the cables position was varied, the measuring antenna height changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal. In frequency range from 30 to 1000 MHz the EMI receiver settings were: RBW=120 kHz, quasi-peak detector. The results of measurements were recorded into Table 3.6.1 and are shown in Plots 3.6.1, 3.6.2.

The receiver radiated emission measurements from 1 GHz up to 5 GHz were performed with the spectrum analyzer settings: RBW=VBW=1 MHz, peak detector was used. All the found emissions were at least 20 dB below specified limit.

Reference numbers of test equipment used

HL 0275	HL 0465	HL 0521	HL 0593	HL 0594	HL 0604	HL 0815
HL 0816						

Full description is given in Appendix A.

Table 3.6.1 Radiated emission measurements test results
frequency range 30 MHz - 5 GHz

TEST SPECIFICATION: FCC part 15 subpart B § 15.109
COMPANY: ABEST Ltd.
EUT: WPBX-9000-2L
DATE: February 28, 1999
RELATIVE HUMIDITY: 49%
AMBIENT TEMPERATURE: 23°C

MEASUREMENTS PERFORMED AT 3 METRES DISTANCE

Frequency MHz	Radiated Emissions dB (μV/m)	Spec. Limit dB (μV/m)	Spec. Margin dB	Pass/ Fail
32.767	30.36	40.0	9.65	Pass
100.001	37.33	43.5	6.17	Pass
180.000	30.91	43.5	12.59	Pass
360.000	30.67	46.0	15.33	Pass
527.996	32.12	46.0	13.88	Pass

Notes to table calculations:

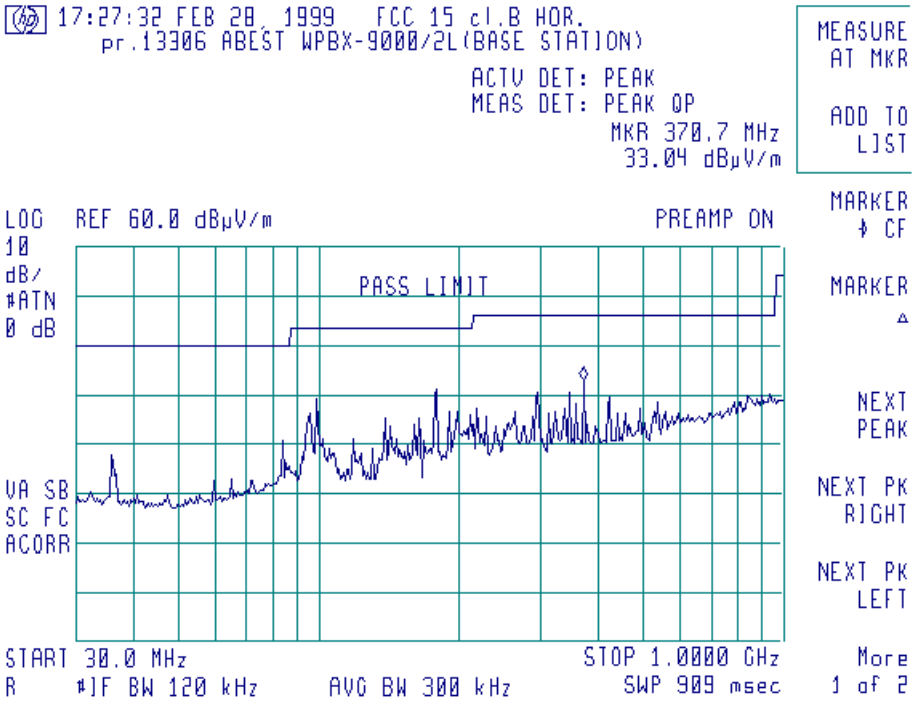
Measurements were performed with biconilog antenna and quasi-peak detector.
Resolution bandwidth = 120 kHz
Spec. Margin = Specification margins = dB below (negative if above) specification limit.

Test performed by:
Mrs. Eleonora Pitt, test engineer

_____
Hermon Labs

Plot 3.6.1

Test Specification: §15.109
Radiated emissions of receiver and digital incorporated device
Horizontal antenna polarization



Plot 3.6.2

Test Specification: §15.109
Radiated emissions of receiver and digital incorporated device
Vertical antenna polarization

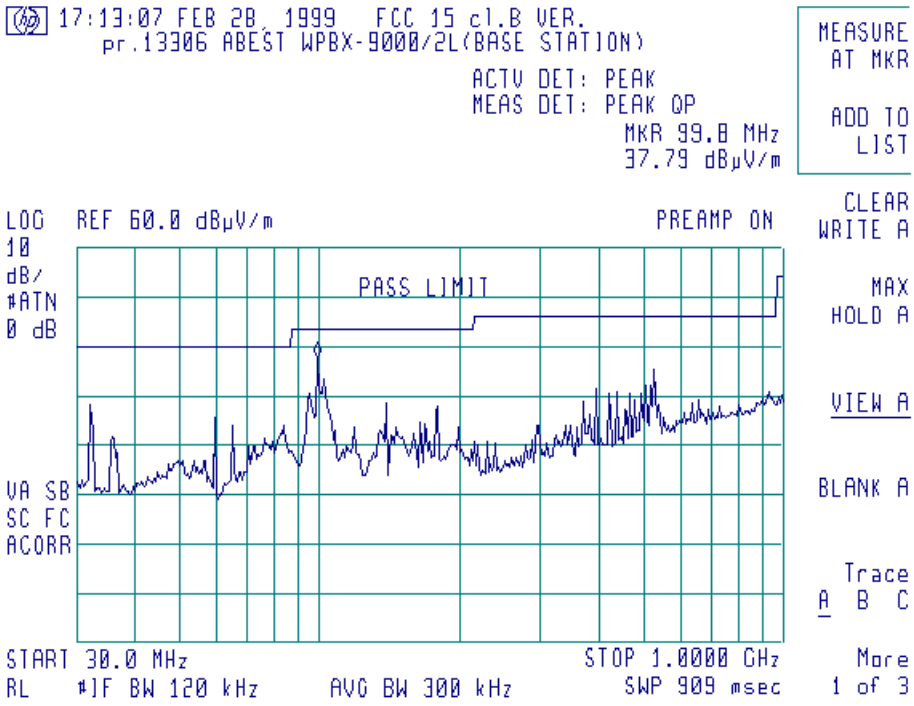
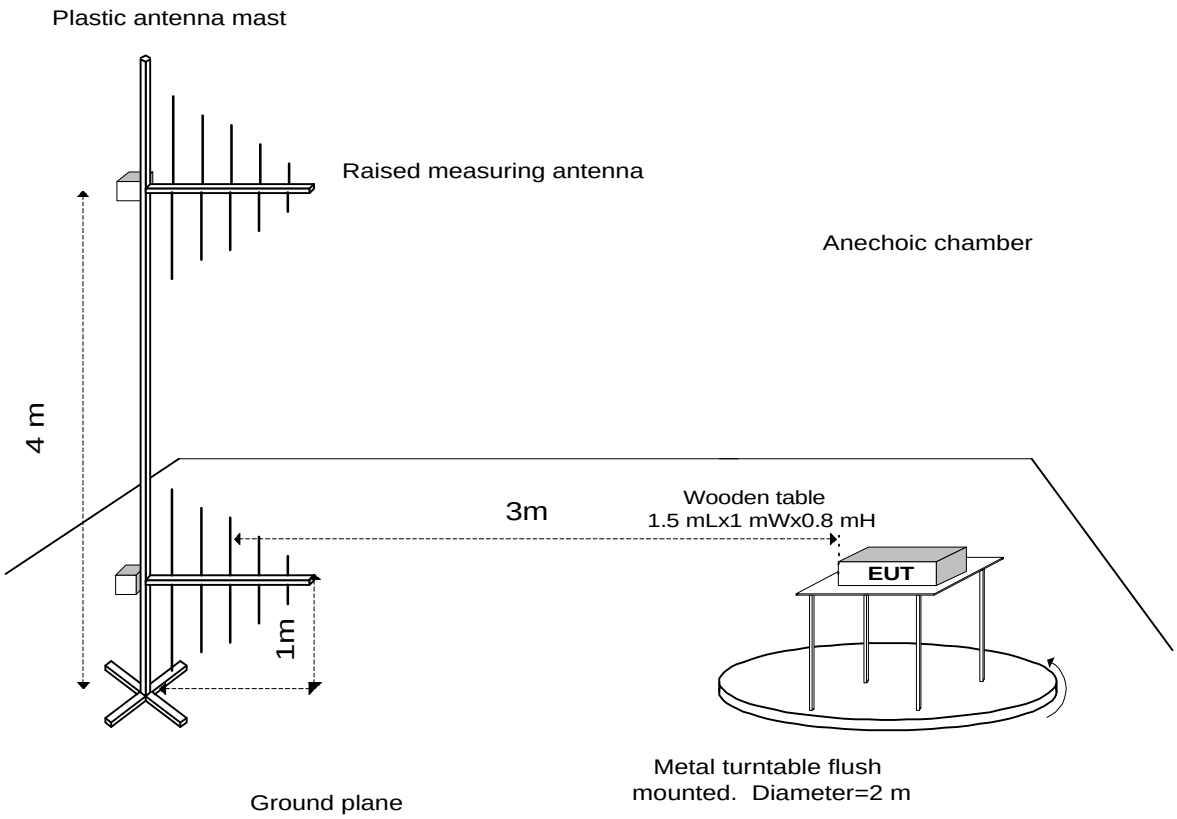
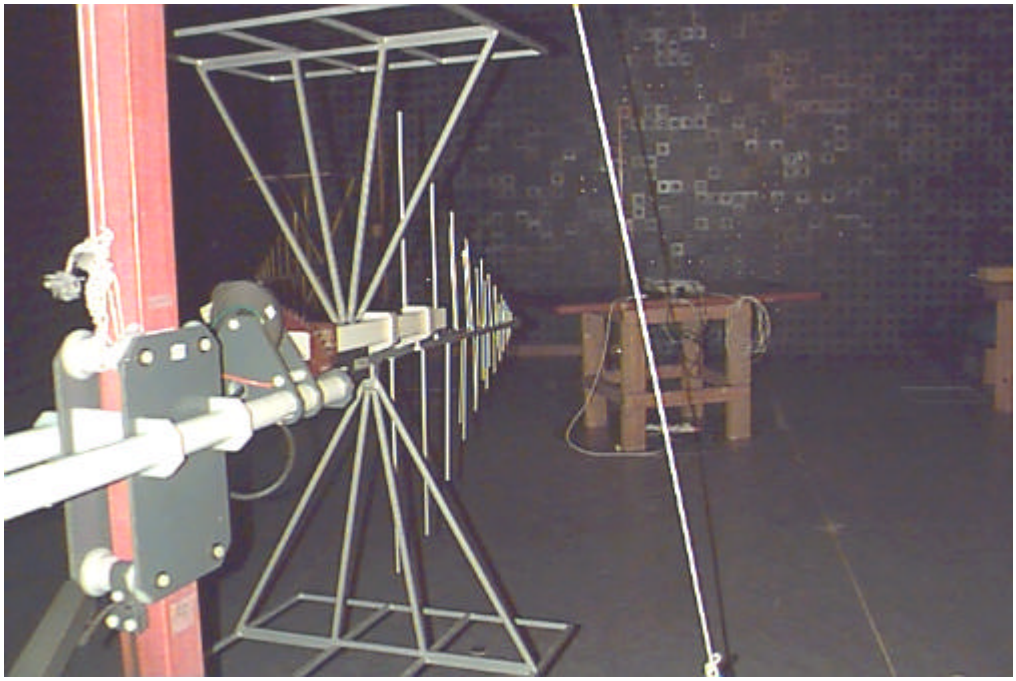


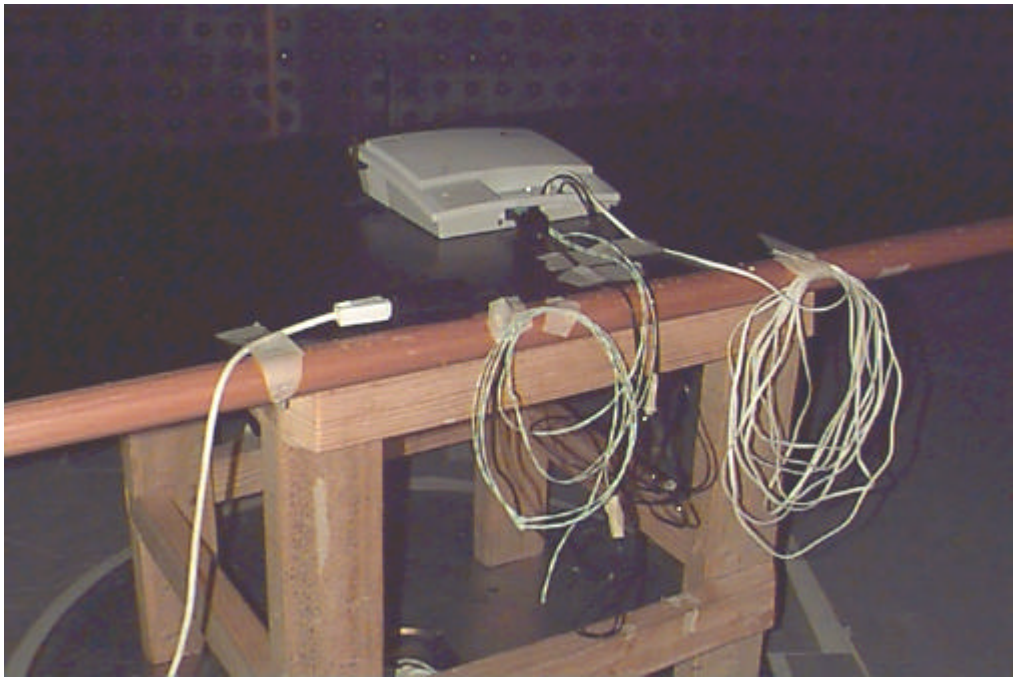
Figure 3.6.1
Radiated emission test setup



Photograph No. 3.6.1
Radiated emission measurement test setup



Photograph No. 3.6.2
Radiated emission measurement test setup



3.7 Conducted Emission Measurements according to §15.107, §15.207

3.7.1 Definition of the test

This test was performed to measure conducted emissions.

3.7.2 Test set-up

The test was performed in the shielded room. The EUT was setup as shown in Figure 3.7.1 and Photographs 3.7.1 to 3.7.2.

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

The measurements were performed on the EUT 120 V AC power lines (both neutral and phase) by means of the LISN, connected to the spectrum analyzer. The unused 50 Ω connector of the LISN was resistively terminated in 50 Ω when not connected to the measuring instrument. The position of the EUT cables was varied to determine maximum emission level. The quasi peak detector (resolution bandwidth = 9 kHz) was used. The test results are shown in Table 3.7.1 and Plots 3.7.1, 3.7.2.

Reference numbers of test equipment used

HL 0163	HL 0466	HL 0521	HL 0787	HL 0817	HL 1003	

Full description is given in Appendix A.

Table 3.7.1 Conducted emission measurements on EUT power lines

Frequency range : 450 kHz - 30 MHz
Detector : quasi peak

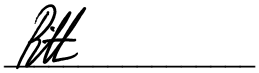
TEST SPECIFICATION:	FCC part 15 subpart B Class B
COMPANY:	ABEST Ltd.
EUT:	WPBX-9000-2L
DATE:	February 25, 1999
RELATIVE HUMIDITY:	47%
AMBIENT TEMPERATURE:	23°C

Frequency MHz	Line ID	Measured Conducted Emissions dB (μV)	Specified Limit dB (μV)	Spec. Limit Margins dB	Pass/ Fail
0.509	Ph, N	43.16	48	4.84	Pass
0.612	Ph, N	37.25	48	10.75	Pass
0.714	Ph, N	35.74	48	12.26	Pass
0.817	Ph, N	32.66	48	15.34	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).

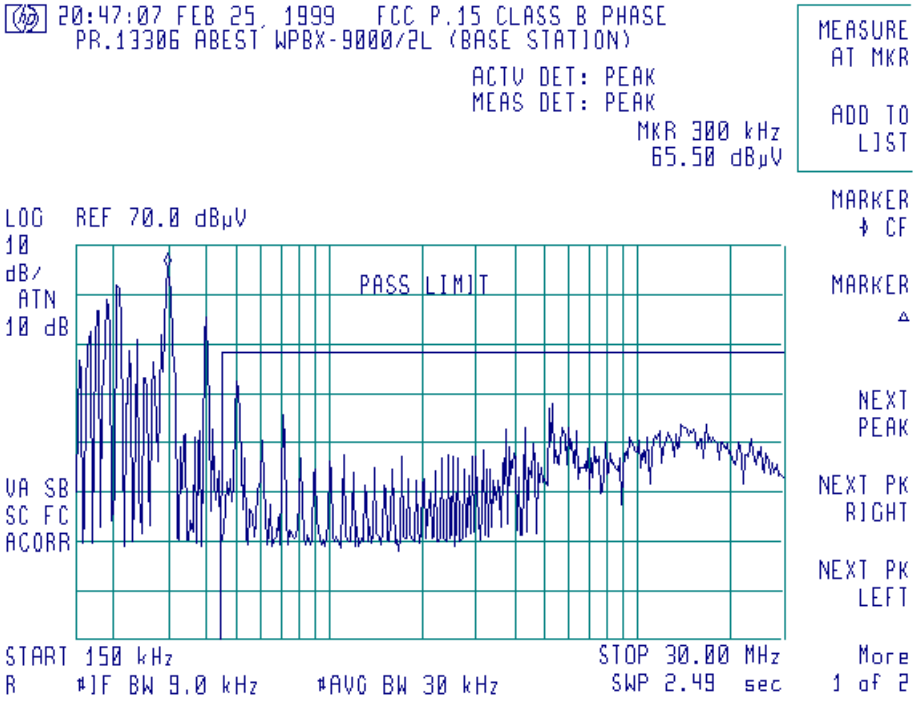
Test performed by:
Mrs. Eleonora Pitt, test engineer



Hermon Labs

Plot 3.7.1

Test Specification: § 15.107, § 15.207
Conducted emission measurements on power line
Frequency range: 450 kHz-30 MHz
Line: phase



Plot 3.7.2

Test Specification: § 15.107, § 15.207
Conducted emission measurements on power line
Frequency range: 450 kHz-30 MHz
Line: neutral

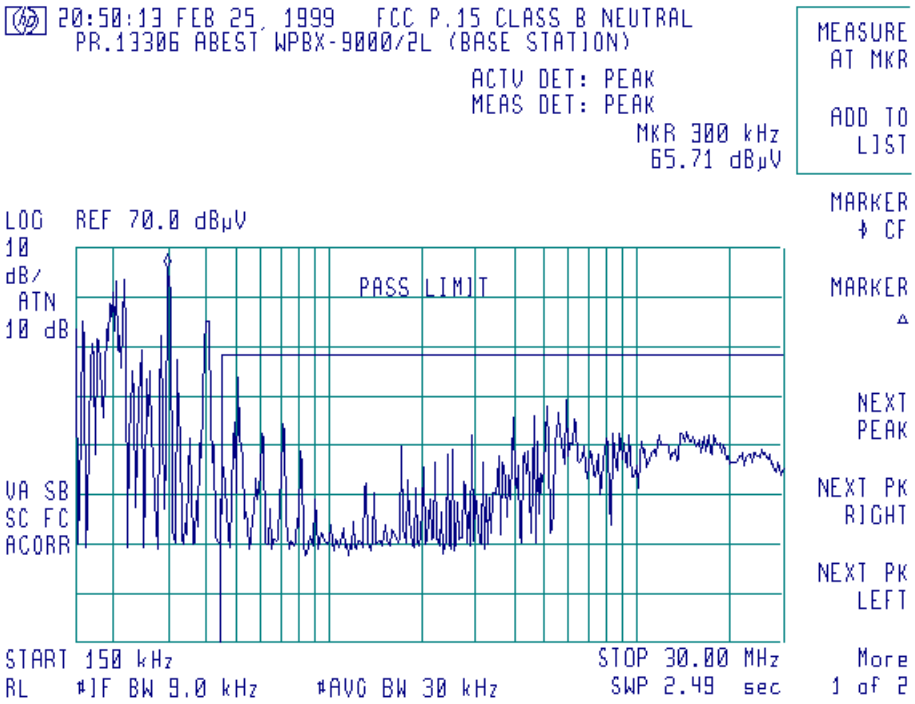
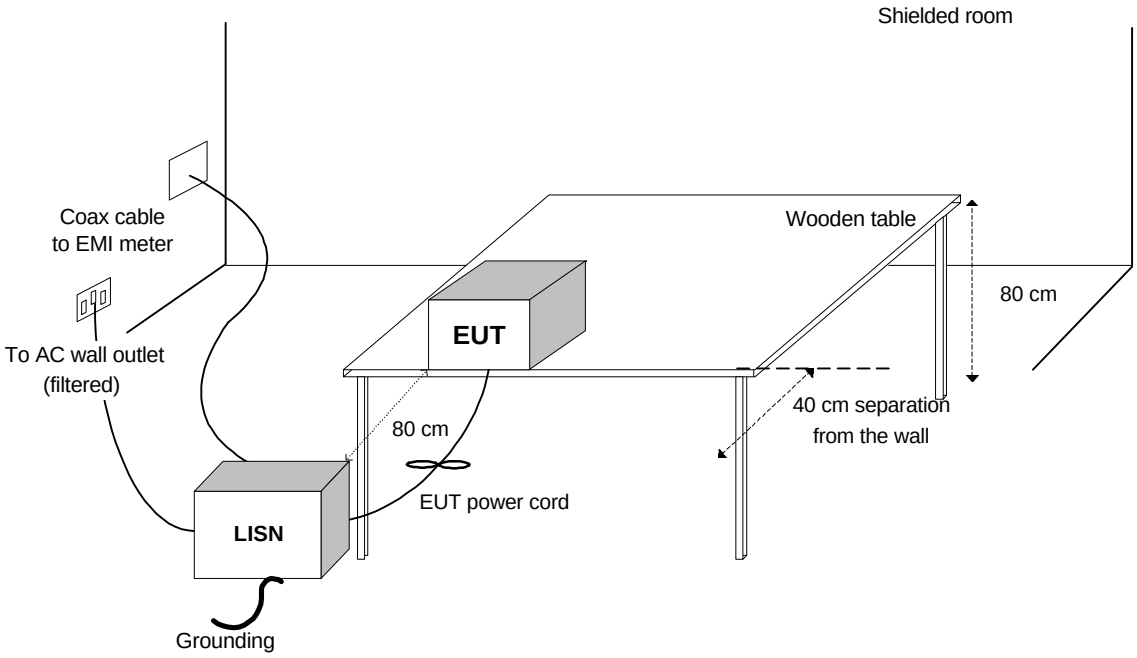
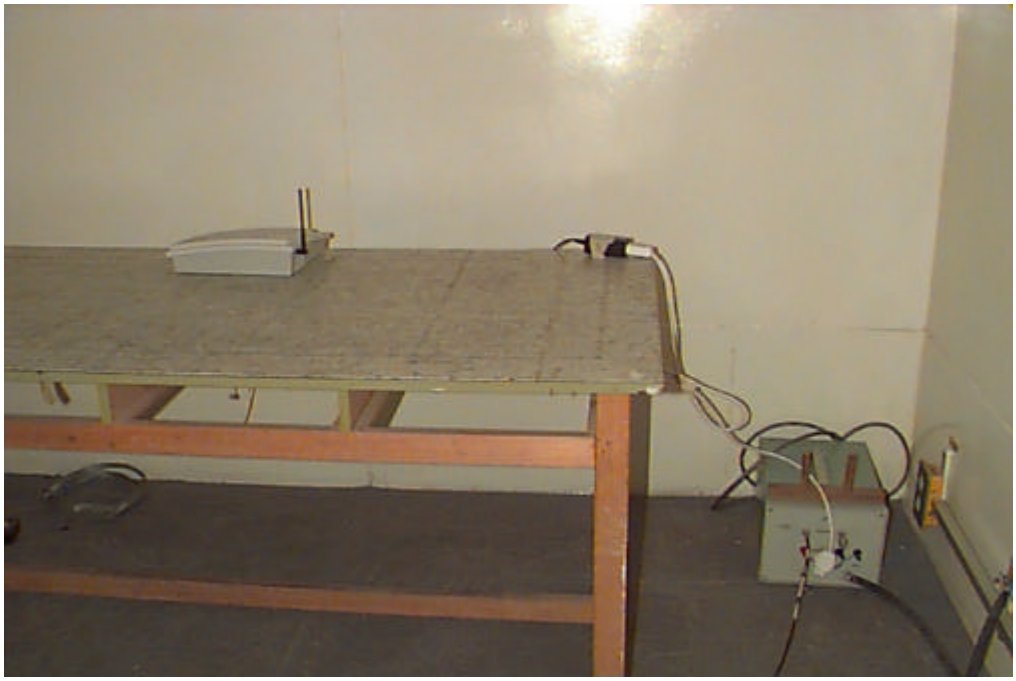


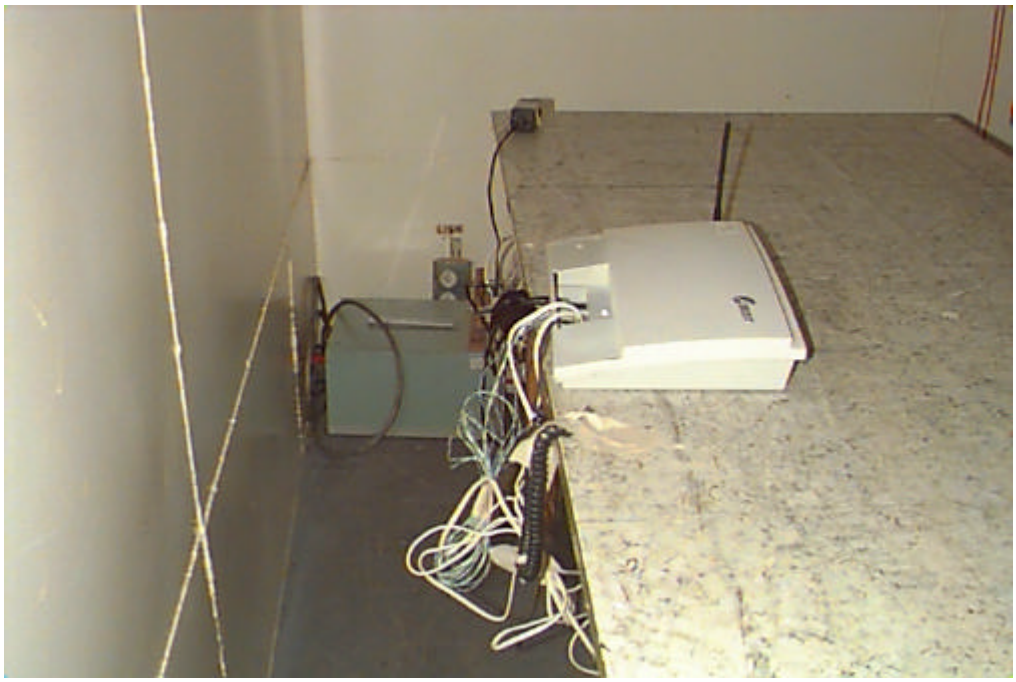
Figure 3.7.1
Conducted emission test setup



Photograph 3.7.1
Conducted emission measurement test setup



Photograph 3.7.2
Conducted emission measurement test setup



4 Summary and Signatures

The EUT was found to be in compliance with the limits of FCC part 15 subpart C §15.205, §15.207, §15.209 (a), §15.247 and Subpart B, §15.107, §15.109.

Test performed by:

Mrs. Eleonora Pitt, test engineer

_____

Responsible Person from ABEST Communication Corp.

Mr. Jason Chen, product manager

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APPENDIX A - Test equipment and ancillaries used for tests

HL Serial No.	Serial No.	Description	Manufacturer	Model No.	Due Calibr.
0025	5837	Spectrum Analyzer, 10 kHz-23 GHz	Anritsu	MS-710C	8/99
0041	2811	Ridged Guide Horn Antenna, 1-18 GHz	Electro-Metrics,	RGA 50/60	7/99
0163	1314	LISN, 9kHz-100MHz	Electro-Metrics	ANS-25/2	11/99
0275	040	Table non-metallic, adjustable height, 1.5 x 1.0 x 0.8 m	Hermon Labs	TNM	3/00 Check
0412	8769	Cable coax, Microwave, DC-18 GHz, N-N, 3 m	Gore	36Q01Q0111 8.2	9/99
0465	023	Anechoic Chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	10/99
0466	024	Shielded Room 3 (L) x 3 (W) x 2.4 (H) m	Hermon Labs	SR-1	5/02 Check
0521	0319	Spectrum Analyzer with RF filter section (EMI Receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	7/99
0589	589	Cable Coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	11/99
0593	101	Antenna Mast, 1-4 m/ 1-6 m Pneumatic	Hermon Labs	AM-F1	4/00 check
0594	102	Turntable for Anechoic Chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	WDC1	11/99
0604	9611-1011	Antenna Biconilog Log-Periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	7/99
0787	1877	Transient limiter	Hewlett Packard	11947A-8ZE	11/99
0815	151	Cable, coax, RG-214, 7.3 m, N-type connectors, inside anechoic chamber	Hermon Labs	C214-7	8/99
0816	152	Cable, coax, RG-214, 8 m, N-type connectors, outside anechoic chamber	Hermon Labs	C214-8	8/99
0817	153	Cable, coax, RG-58, 8 m, N-type connectors	Hermon Labs	C58-8	8/99
1003	161	Cable coaxial, M17/164, 10 m	Hermon Labs	C17164-10	3/00

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/μv) of the interference analyzer or spectrum analyzer.

Antenna Factor
Double Ridged Guide Antenna
Electro-Metrics, Model RGA-50/60
Ser.No.2811

Frequency, MHz	Antenna Factor, dB(1/m)
1000	24.3
1500	25.4
2000	28.4
2500	29.2
3000	30.5
3500	31.6
4000	33.7
4500	32.2
5000	34.5
5500	34.5
6000	34.6
6500	35.3
7000	35.5
7500	35.9
8000	36.6
8500	37.3
9000	37.7
9500	37.7
10,000	38.2
10,500	38.5
11,000	39.0
11,500	40.1
12,000	40.2
12,500	39.3
13,000	39.9
13,500	40.6
14,000	41.1
14,500	40.5
15,000	39.9
15,500	37.8
16,000	39.1
16,500	41.1
17,000	41.7
17,500	45.1
18,000	44.3

Antenna factor dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/meter).

Antenna Factor at 3m calibration
Biconilog Antenna EMCO Model 3141
Ser.No.1011

Frequency, MHz	Antenna Factor, dB(1/m)
26	7.8
28	7.8
30	7.8
40	7.2
60	7.1
70	8.5
80	9.4
90	9.8
100	9.7
110	9.3
120	8.8
130	8.7
140	9.2
150	9.8
160	10.2
170	10.4
180	10.4
190	10.3
200	10.6
220	11.6
240	12.4
260	12.8
280	13.7
300	14.7
320	15.2
340	15.4
360	16.1
380	16.4
400	16.6
420	16.7
440	17.0
460	17.7
480	18.1
500	18.5
520	19.1
540	19.5
560	19.8
580	20.6
600	21.3
620	21.5
640	21.2
660	21.4
680	21.9
700	22.2
720	22.2
740	22.1
760	22.3
780	22.6
800	22.7
820	22.9
840	23.1
860	23.4
880	23.8
900	24.1
920	24.1

Frequency, MHz	Antenna Factor, dB(1/m)
940	24.0
960	24.1
980	24.5
1000	24.9
1020	25.0
1040	25.2
1060	25.4
1080	25.6
1100	25.7
1120	26.0
1140	26.4
1160	27.0
1180	27.0
1200	26.7
1220	26.5
1240	26.5
1260	26.5
1280	26.6
1300	27.0
1320	27.8
1340	28.3
1360	28.2
1380	27.9
1400	27.9
1420	27.9
1440	27.8
1460	27.8
1480	28.0
1500	28.5
1520	28.9
1540	29.6
1560	29.8
1580	29.6
1600	29.5
1620	29.3
1640	29.2
1660	29.4
1680	29.6
1700	29.8
1720	30.3
1740	30.8
1760	31.1
1780	31.0
1800	30.9
1820	30.7
1840	30.6
1860	30.6
1880	30.6
1900	30.6
1920	30.7
1940	30.9
1960	31.2
1980	31.6
2000	32.0

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