ELECTROMAGNETIC EMISSIONS TEST REPORT

and subpart B

for

ABEST COMMUNICATION CORP.

EQUIPMENT UNDER TEST:

Wireless Multi-Handset System (PBX) Handset

FCC ID: OB5WPBX-9000-H

Prepared by: ____________
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ACCREDITED
839.01
Electrical

Description of equipment under test

Test items	Handset frequency hopping transceiver FCC ID:OB5WPBX-9000-H
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	
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Country	Taiwan, R.O.C.
Telephone number	+886 2 2623 7902
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Test performance

Project Number:	13308
Location	Hermon Laboratories
Test performed	February 25, July 21, 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, 15.209, 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.

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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)
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 handset, 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 $h \cong 0.5$, which creates a modulated signal with a 20 dB bandwidth of about 500 kHz.

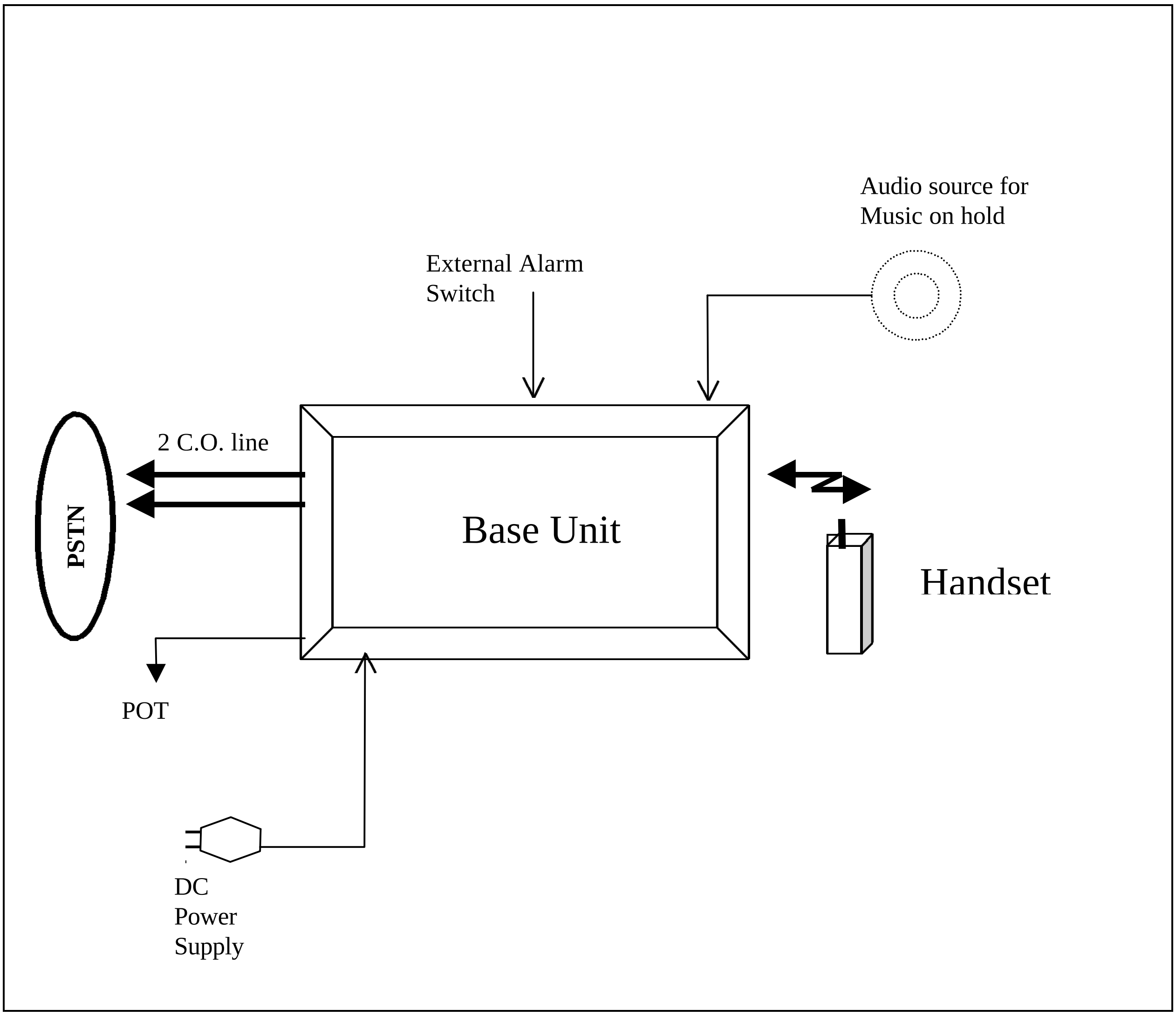
The handset antenna is internal to the handset's housing and is therefore not visible to the user. It is located above the earphone at the top of the handset, at a point which is typically relatively exposed electromagnetically (not obscured by the hand holding the handset).
The antenna is a two spiral elements top-loaded monopole element with an omni-directional vertically polarized radiation.
The antenna dimensions are approximately 6.5 mm diameter, 38 mm length.
The RF transceiver module incorporates passive matching components, which serve to match the 50 Ohm output impedance of the transmitter to the impedance of the antenna element.
The maximal gain achieved by this antenna is –1dBi.

The handset is powered by 4.5 V internal battery.

1.4 EUT test configuration

Throughout the testing the radio link was maintained with WPBX-9000-2L base unit as shown in Figure 1.1.

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

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

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: Pitt
Position: test engineer   Date: July 22, 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: July 22, 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 (0.465 MHz maximum, see Table 3.2.1) required by the standard. The EUT successfully passed this test.

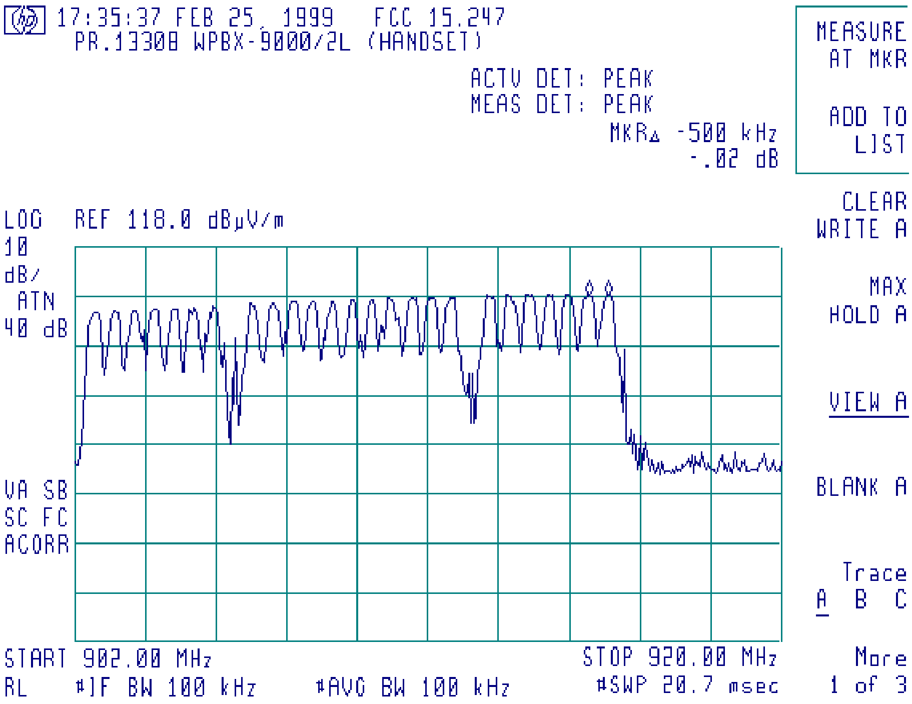
Reference numbers of test equipment used

HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1175

Full description is given in Appendix A.

Plot 3.1.1

Test specification: § 15.247(a)(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	409.5	500	Pass
915.0	465	500	Pass
927.0	450	500	Pass

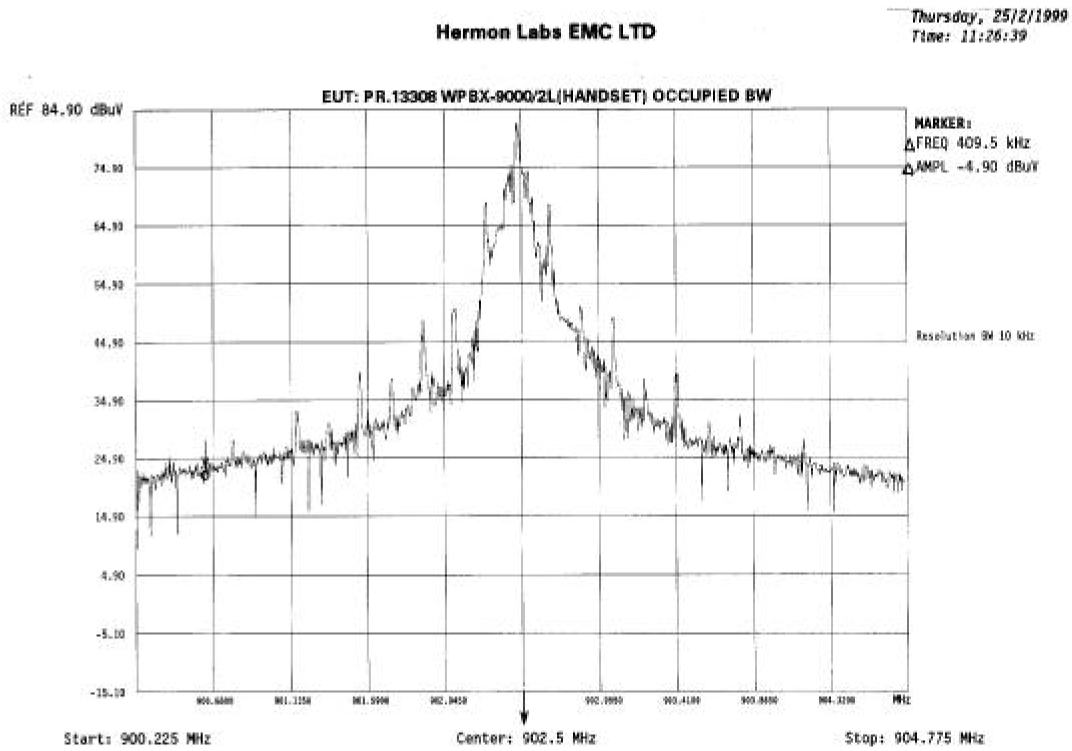
Reference numbers of test equipment used

Hl 0027	HL 0034	HL 0593	HL 0813	HL 1175		

Full description is given in Appendix A.

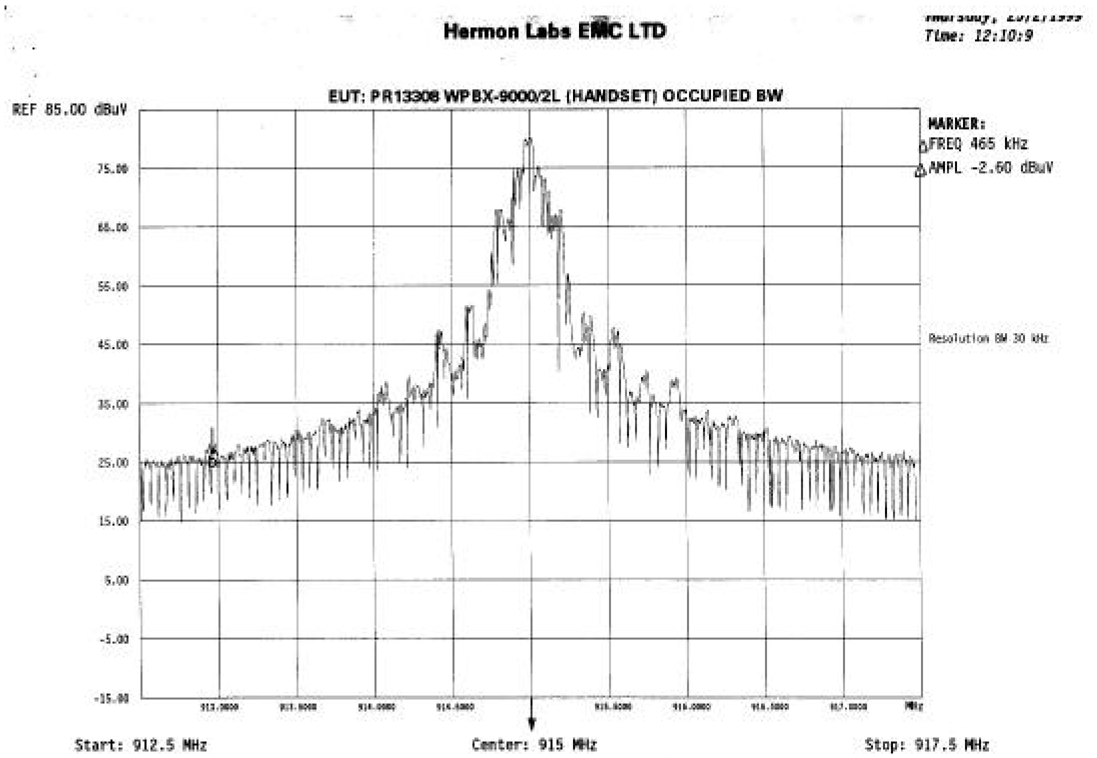
Plot 3.2.1

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



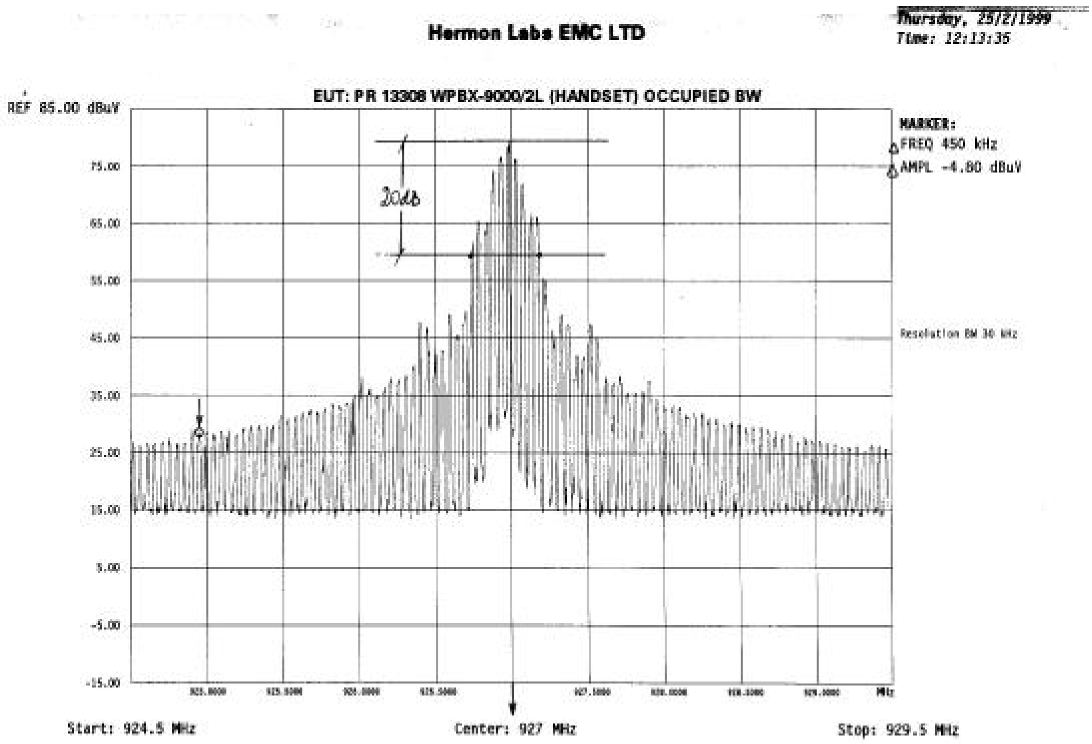
Plot 3.2.2

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 = 221.25 msec (see Plot 3.3.1)
Pulse duration (transmitting on) = 0.675 msec (see Plot 3.3.2)
Total transmission time at 25 frequencies = 221.25 msec x 25 = 5.531sec
Each frequency is used within 10 sec period: 10 / 5.531 ≈ 2 times

Average occupancy time on any frequency = 0.675 msec x 2 = 0.0014 sec, which is less than the required 0.4 sec.

3.3.3 Average factor (duty cycle correction) test § 15.35

The test was performed to define total time of transmitting energy occupancy during any 100 msec time interval.
This average factor (duty cycle correction) applies for the actual emission level calculation.
The pulse train duration measurement for average factor calculation is shown in Plot 3.3.2.
Average factor is equal to 20 log (0.675/100) = -43 dB,
where the pulse train duration within 100 msec is 0.675 msec.

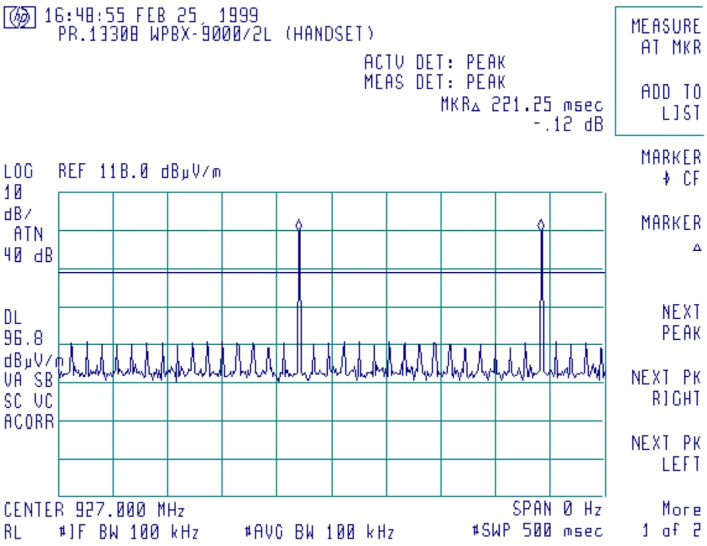
Reference numbers of test equipment used

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

Full description is given in Appendix A.

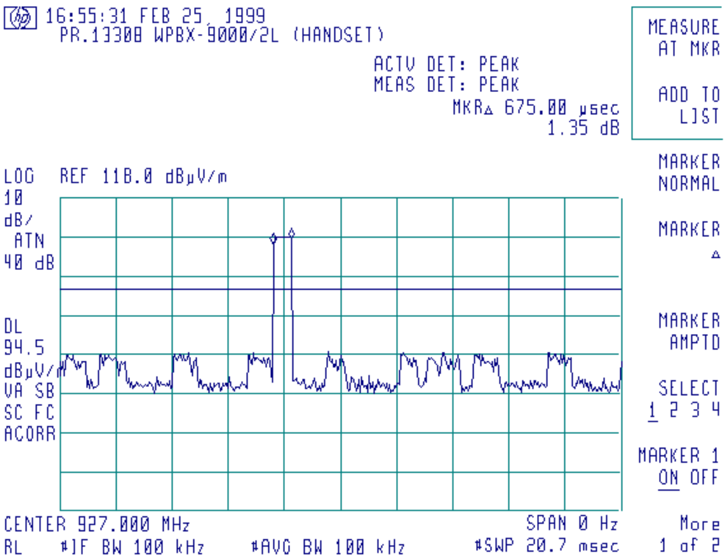
Plot 3.3.1

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 at the open field test site at 3 meter test distance with log periodic 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. 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.

3.4.3 Test results

The peak output power was measured by substitution method at 3 carrier (channel) frequencies (low, middle, high). All measured results are given in Plots 3.4.1 to 3.4.3 and in Table 3.4.

Table 3.4
Transmitter output RF power test results

Frequency, MHz	Measured radiated emission, dB(μV/m)	Peak output power, dBm	Limit, dBm	Margin dB	Result
902.5	110.7	15.6	24	8.4	Pass
915.0	111.2	16.1	24	7.9	Pass
927.0	112.4	17.3	24	6.7	Pass

Reference numbers of test equipment used

HL 0027	HL 0557	HL 0614	HL 0813	HL 0815	HL 0816	HL 1175

Full description is given in Appendix A.

3.4.4 Exposure limit according to part 1, §1.1310

The EUT is a portable device. 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 $P\ (mW/cm^2) = \dfrac{P_T}{4\pi\ r^2}$, where

P_T - the transmitted power

r - the allowed distance=20 cm, where RF exposure limits may not be exceeded

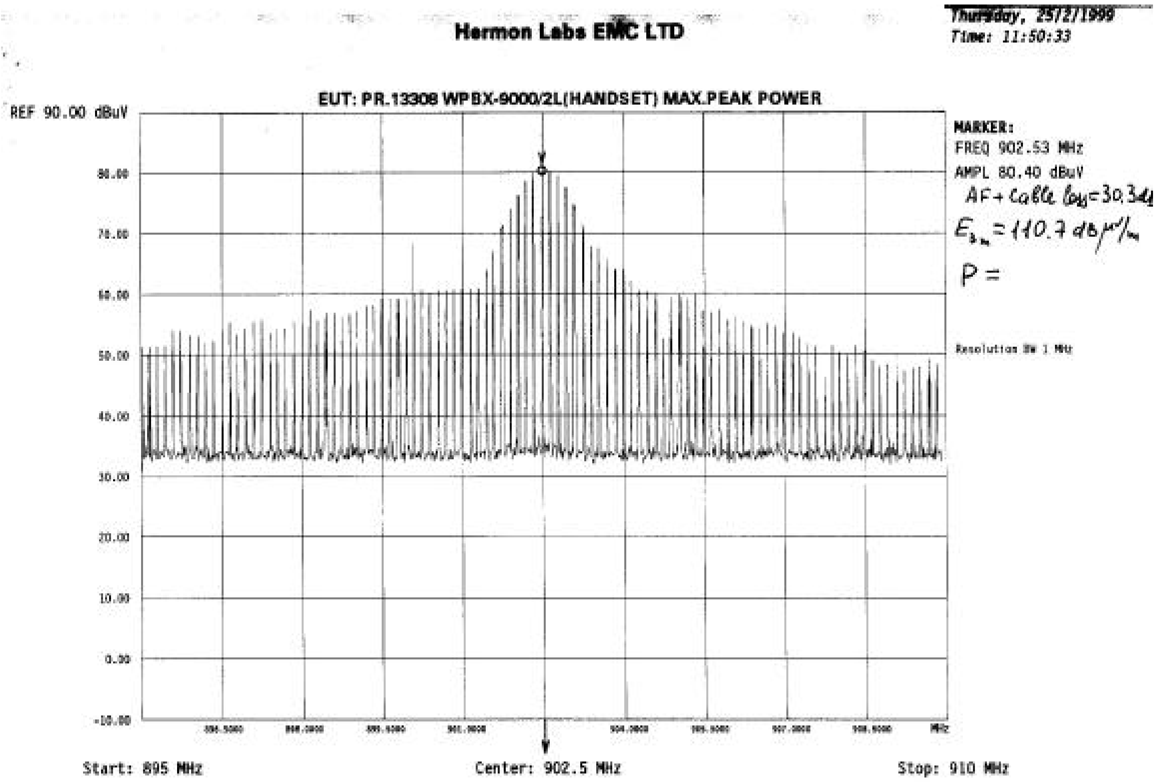
Hence, allowed transmitted power level is

$$P_T = 4\pi\ r^2 \times 0.6\ (mW/\ cm^2) = 4 \times 3.14 \times 400 \times 0.6 = 3000\ mW$$

The transmitter output power is 17.3 dBm plus maximum antenna gain -1 dBi, the maximum output transmitter power is 54 mW which is less than allowed level. The public cannot be exposed to dangerous RF level.

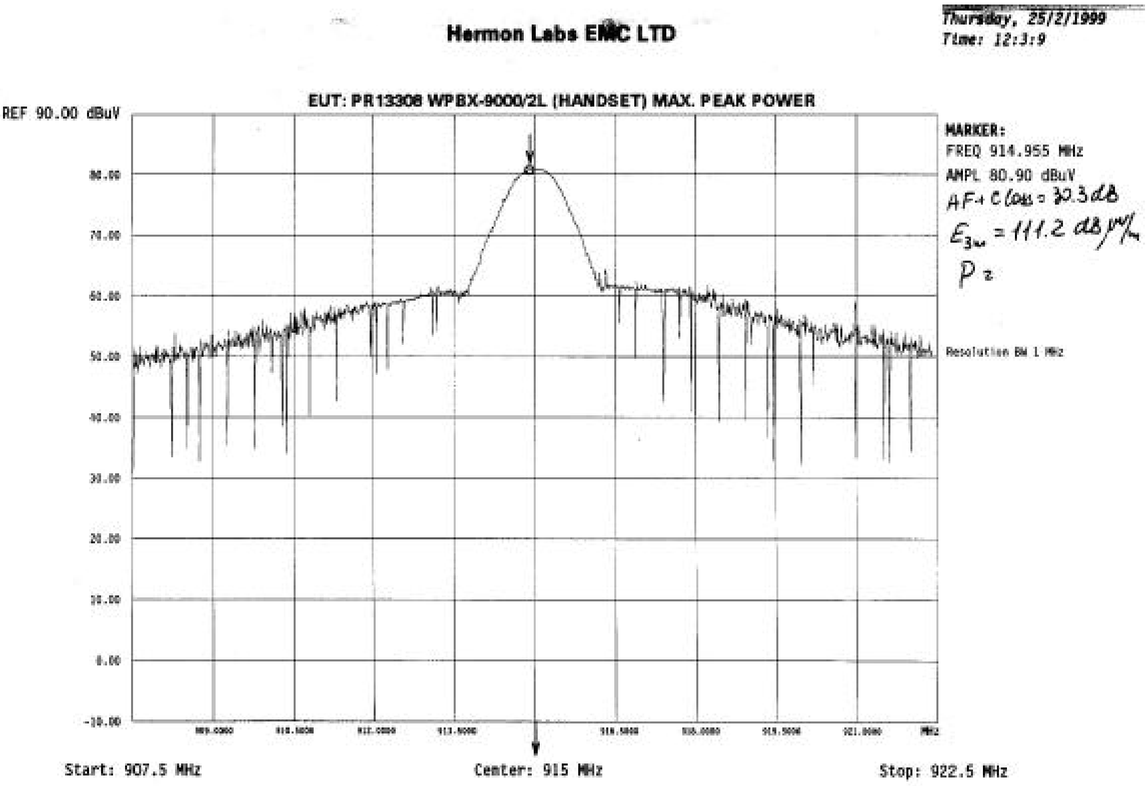
Plot 3.4.1

Test specification: § 15.247(b)(2)
Output power test (P=15.6 dBm)



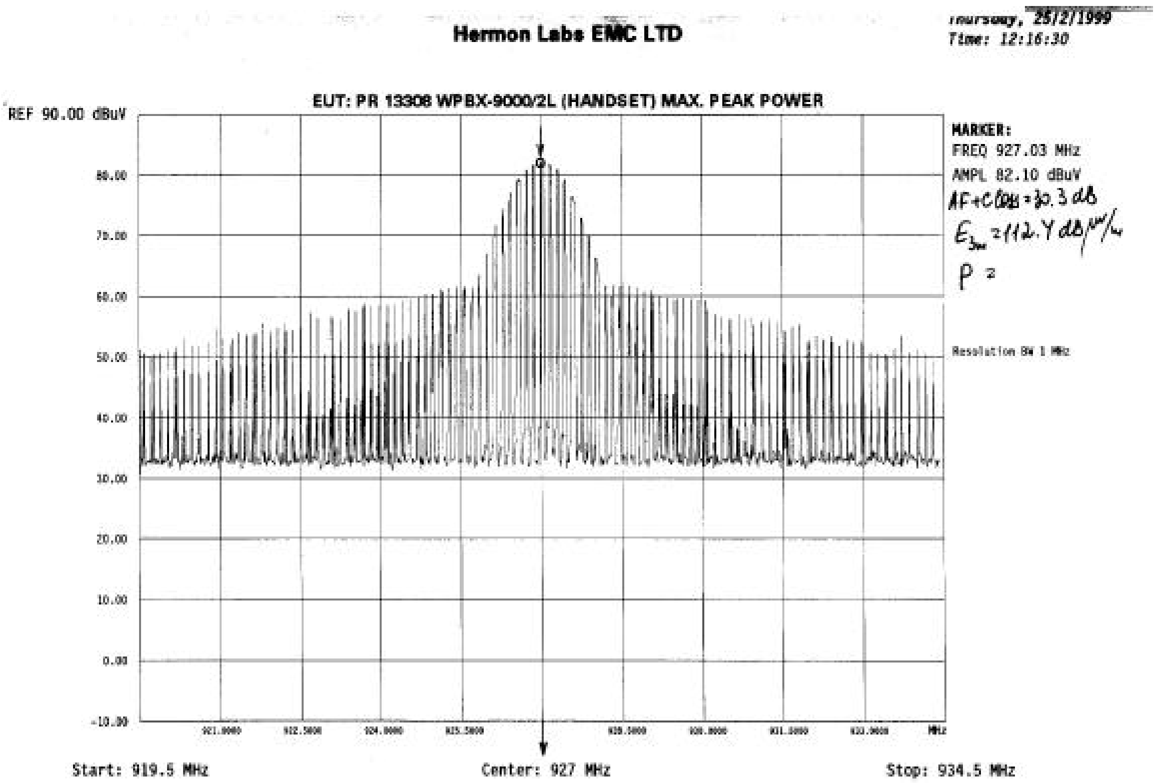
Plot 3.4.2

Test specification: § 15.247(b)(2)
Output power test (P=16.1 dBm)



Plot 3.4.3

Test specification: § 15.247(b)(2)
Output power test (P=17.3 dBm)



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 antenna from 30 MHz to 2 GHz and at open field test site with double ridged guide antenna from 2 GHz to 9.3 GHz at 3 meters test distance as shown in Photographs 3.5.1, 3.5.2.

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 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 3.5.5 show the in-band signal (902.5 and 927 MHz), Plots 3.5.2 to 3.5.4 and 3.5.6 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. Test results are brought in Table 3.5.1. Duty cycle correction factor calculation is given in section 3.3.3.
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 0027	HL 0038	HL 0041	HL 0412	HL 0465	HL 0521
HL 0554	HL 0589	HL 0593	HL 0594	HL 0604	HL 0815	HL 0816
HL 1175						

Full description is given in Appendix A.

Table 3.5.1 Out of band radiated emission measurements test results frequency range 2 GHz – 9.3 GHz

DATE: July 21, 1999
RELATIVE HUMIDITY: 51%
AMBIENT TEMPERATURE: 24°C

MEASUREMENTS PERFORMED AT 3 METRES DISTANCE

Frequency MHz	Measured Result dB (μV)	Antenna Factor dB(1/m)	Cable Loss dB	Average Factor dB	Radiated Emissions dB (μV/m)	Spec. Limit dB (μV/m)	Spec. Margin dB	Pass/ Fail
2707.9	48.7	30	2	NA	60.7	74	13.3	Pass
2707.9	48.7	30	2	-43	17.7	54	36.3	Pass
2745.0	49.4	30	2	NA	61.4	74	12.6	Pass
2745.0	49.4	30	2	-43	18.4	54	35.6	Pass
2782.6	48.4	30	2	NA	60.4	74	13.6	Pass
2782.6	48.4	30	2	-43	17.4	54	36.6	Pass
4512.4	47.4	32.2	2.6	NA	62.4	74	11.6	Pass
4512.4	47.4	32.2	2.6	-43	19.4	54	34.6	Pass
4574.6	46.3	32.2	2.6	NA	61.3	74	12.7	Pass
4574.6	46.3	32.2	2.6	-43	18.3	54	35.7	Pass
4635.6	47.7	32.2	2.6	NA	62.7	74	11.3	Pass
4635.6	47.7	32.2	2.6	-43	19.7	54	34.3	Pass

Notes to table calculations:

The measurements were performed with peak detector. During the measurements the received emissions were amplified, the amplifier gain = 20 dB.
Antenna type: double ridged guide
Antenna polarization: vertical
Resolution bandwidth = 1 MHz
Video bandwidth = 1 MHz

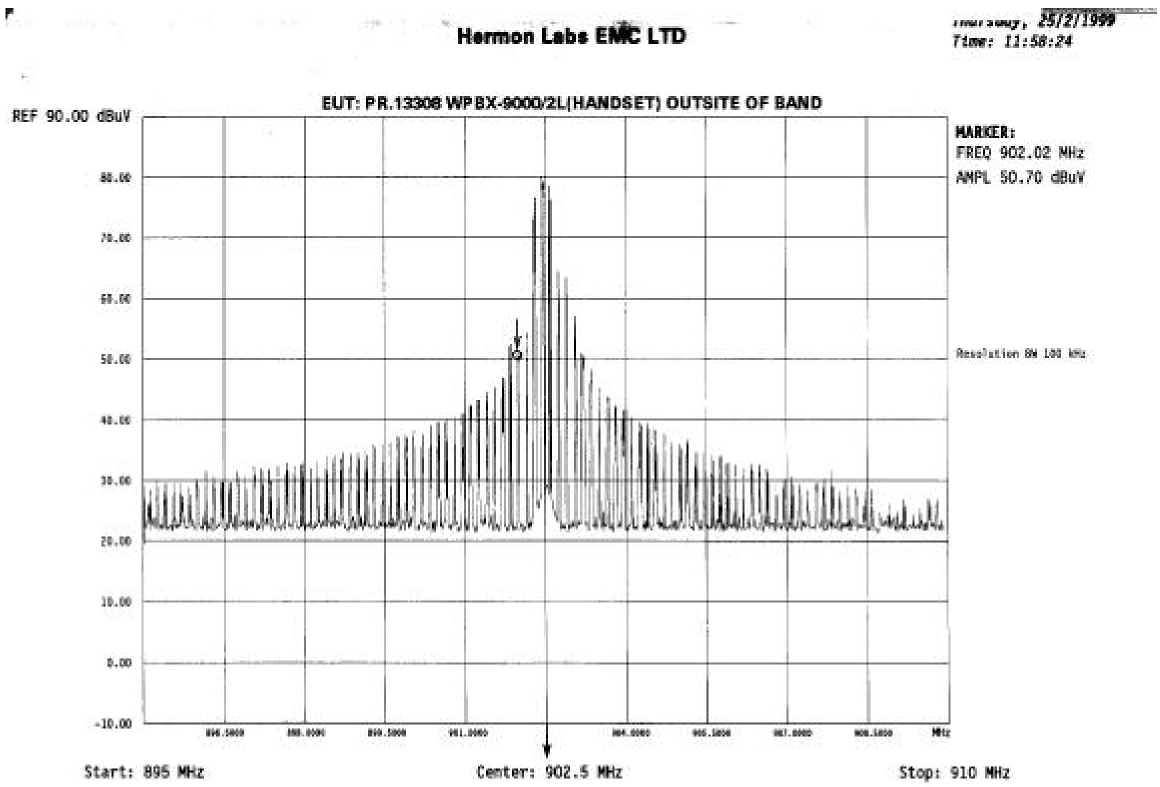
Average radiated emission [dB(μV/m)] = measured result [dB(μV)] + antenna factor [dB(1/m)] + cable loss (dB) - amplifier gain (dB) + average factor (dB) < 54 dB, maximum permitted average limit

Peak radiated emission [dB(μV/m)] = measured result [dB(μV)] + antenna factor [dB(1/m)] + cable loss (dB) – amplifier gain (dB) < (54 + 20) dB

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

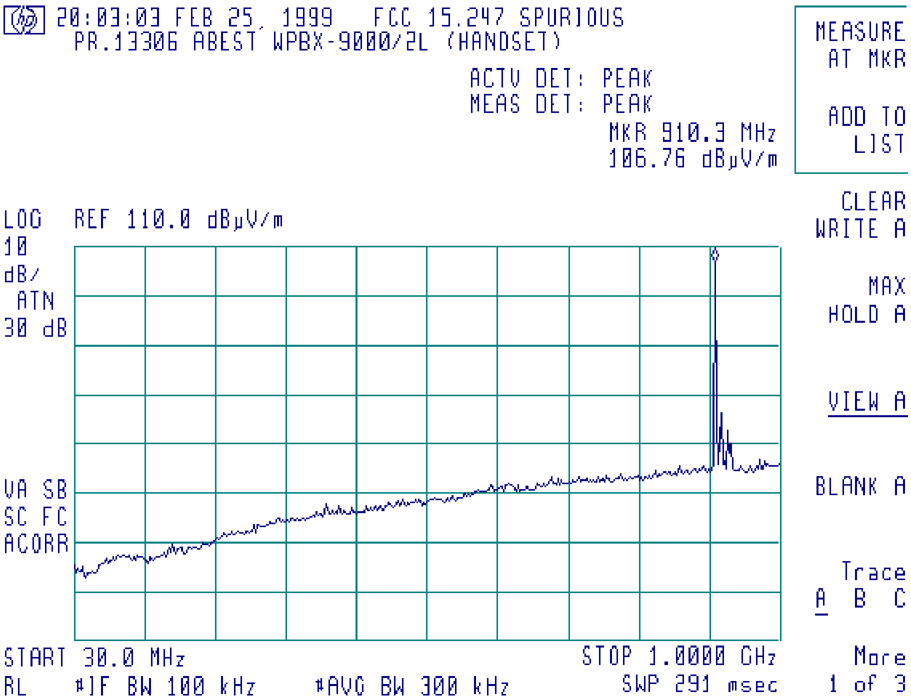
Plot 3.5.1

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



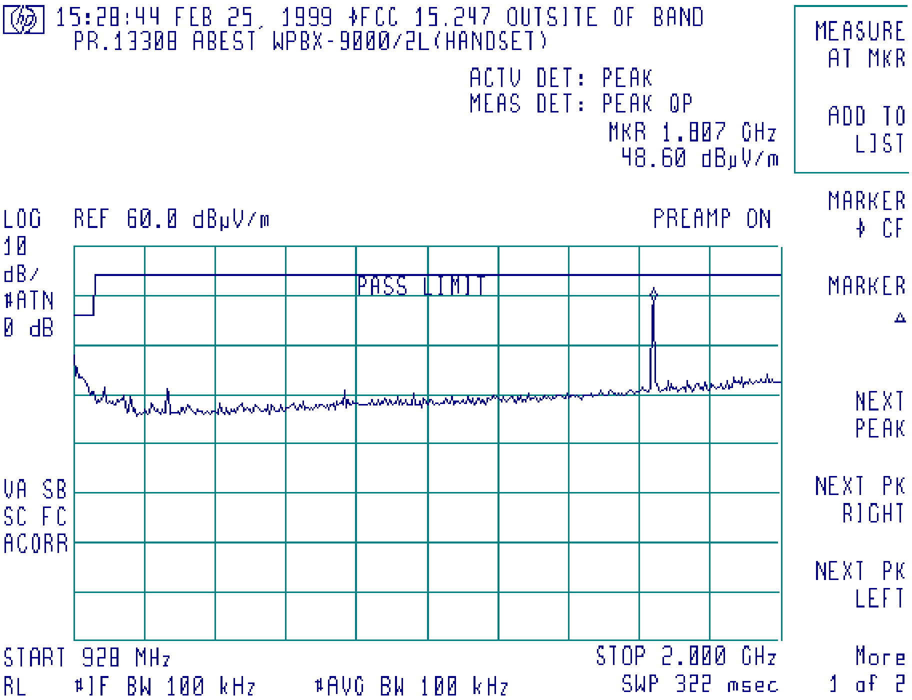
Plot 3.5.2

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



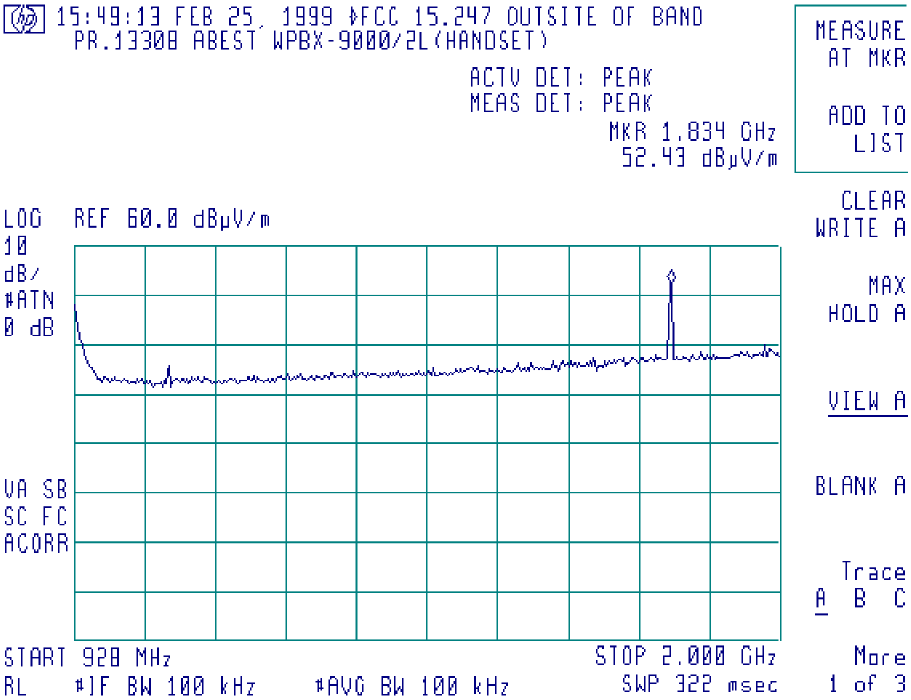
Plot 3.5.3

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



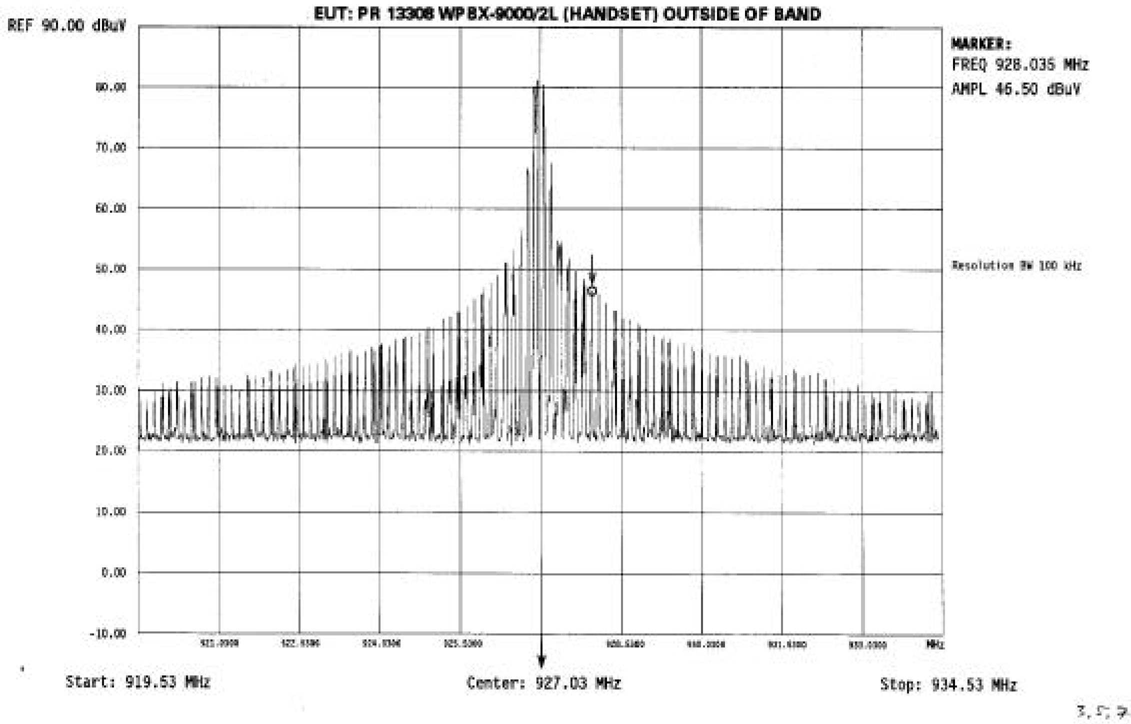
Plot 3.5.4

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



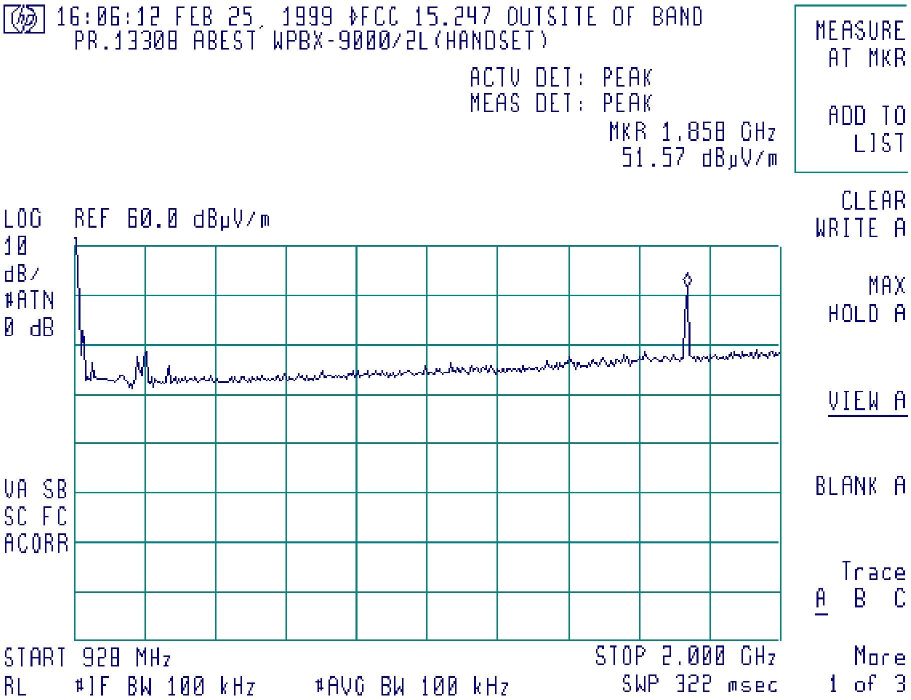
Plot 3.5.5

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

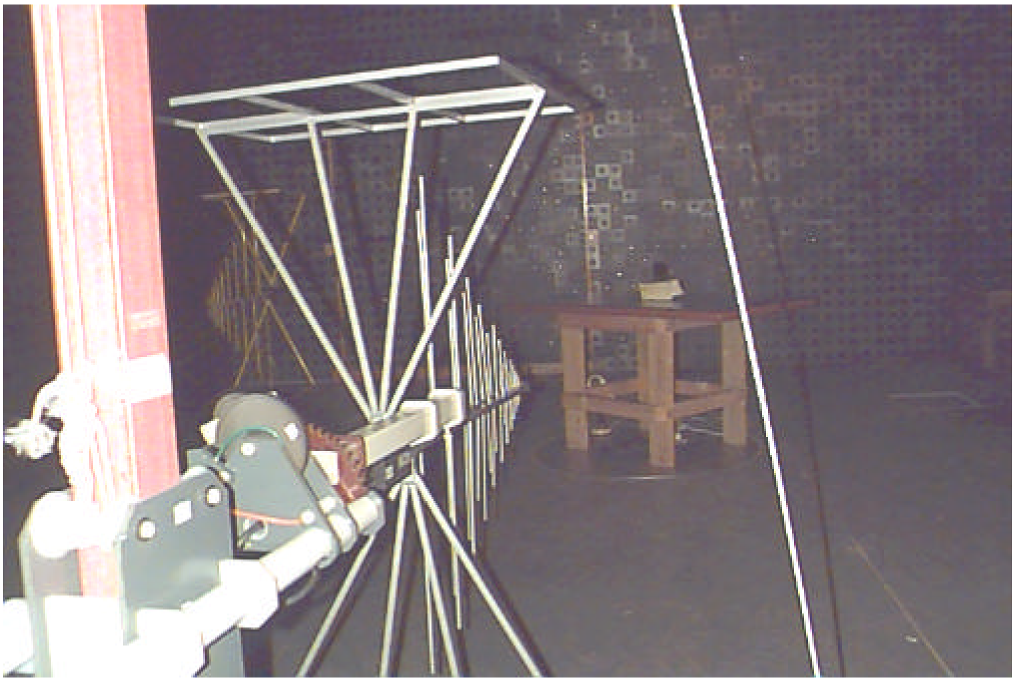


Plot 3.5.6

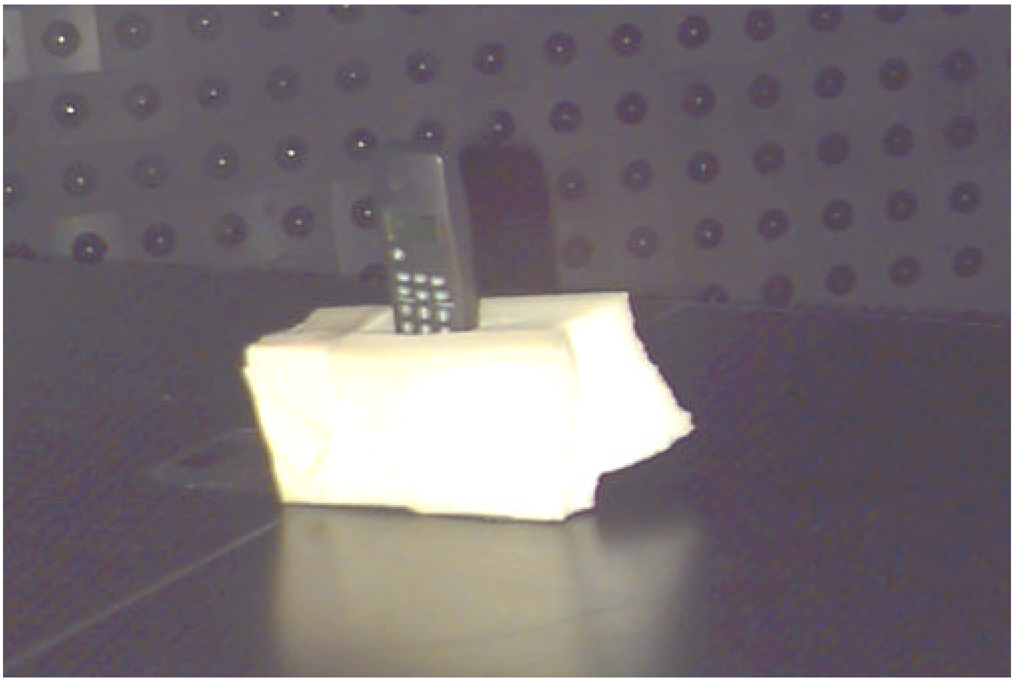
Test specification: § 15.247 (c)
Out-of-band radiated emissions test
Frequency: 927 MHz



Photograph 3.5.1
Radiated emissions measurement setup



Photograph 3.5.2
Radiated emissions measurement setup



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 3.5.1, 3.5.2.
To find maximum radiation the turntable was rotated 360^{o}, 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 receiver radiated emission measurements from 1 GHz up to 5 GHz were performed with the spectrum analyzer settings: RBW=VBW=1 MHz, quasi peak detector was used. The results of measurements were recorded into Table 3.6.1 and are shown in Plots 3.6.1 to 3.6.4.

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

DATE: February 25, 1999
RELATIVE HUMIDITY: 47%
AMBIENT TEMPERATURE: 23°C

MEASUREMENTS PERFORMED AT 3 METRES DISTANCE

Frequency MHz	Antenna Type	Antenna Polarization	RBW kHz	Radiated Emissions dB (µV/m)	Spec. Limit dB (µV/m)	Spec. Margin dB	Pass/ Fail
348.024	BL	H	120	29.40	46.0	16.60	Pass
888.013	BL	V	120	38.05	46.0	7.95	Pass
927.003	BL	V	120	41.55	46.0	4.45	Pass
936.003	BL	V	120	37.96	46.0	8.04	Pass
2781.009	DRG	V	1000	49.56	54.0	4.44	Pass

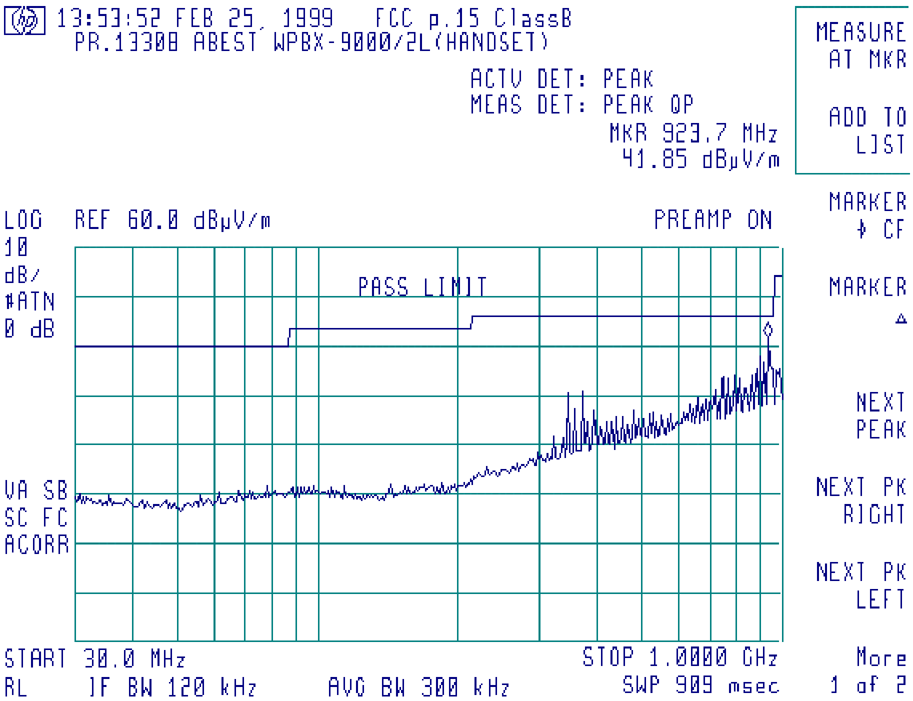
Notes to table calculations:

Measurements were performed with quasi-peak detector.

Antenna type: BL – biconilog, DRG – double ridged guide
Antenna polarization: H – horizontal, V – vertical
RBW – resolution bandwidth
Spec. Margin = Specification margins = dB below (negative if above) specification limit.

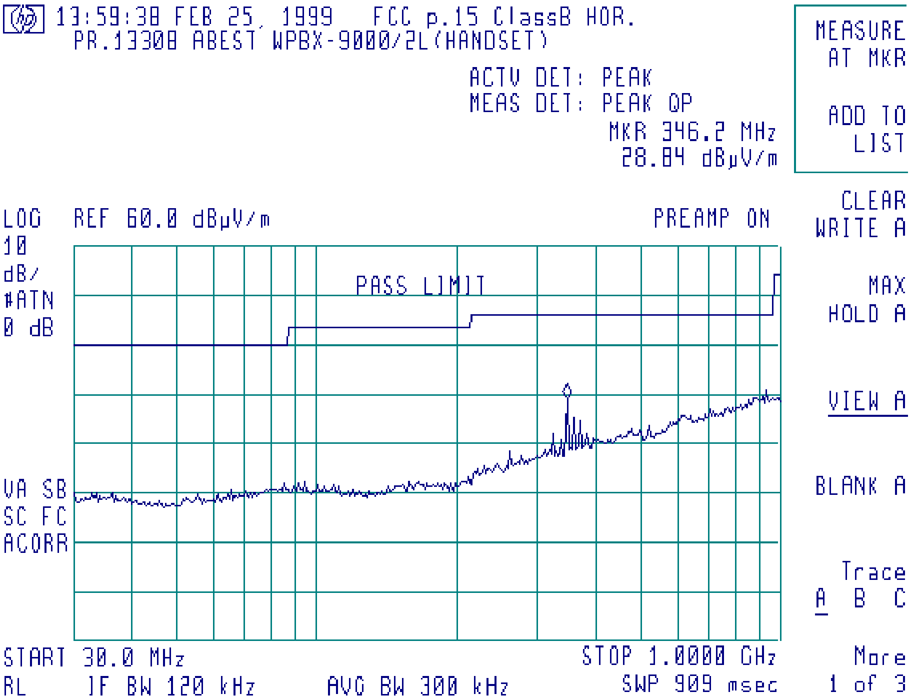
Plot 3.6.1

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



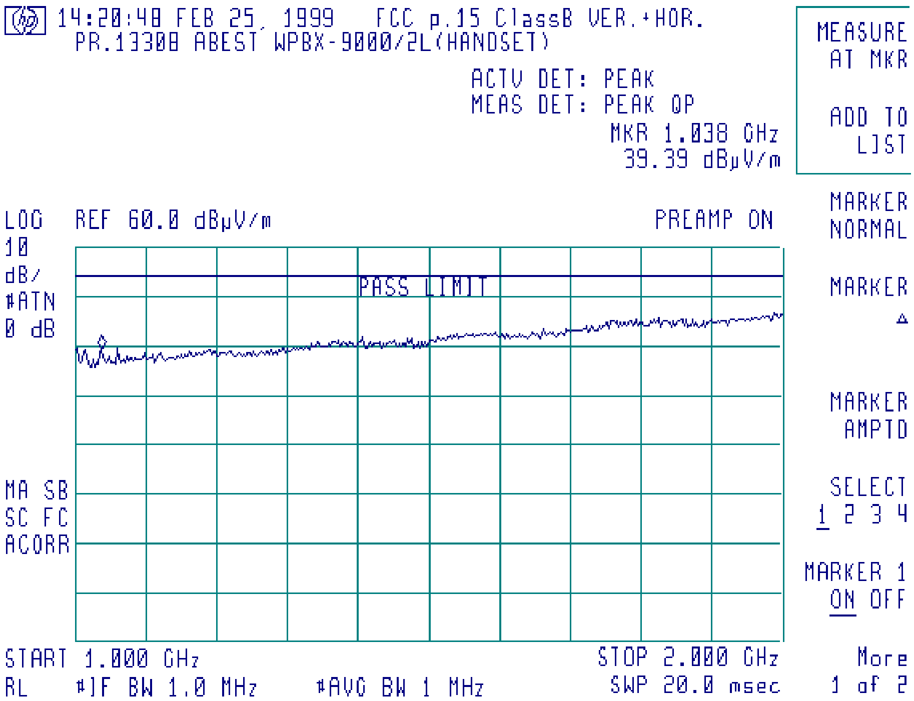
Plot 3.6.2

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



Plot 3.6.3

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



Plot 3.6.4

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

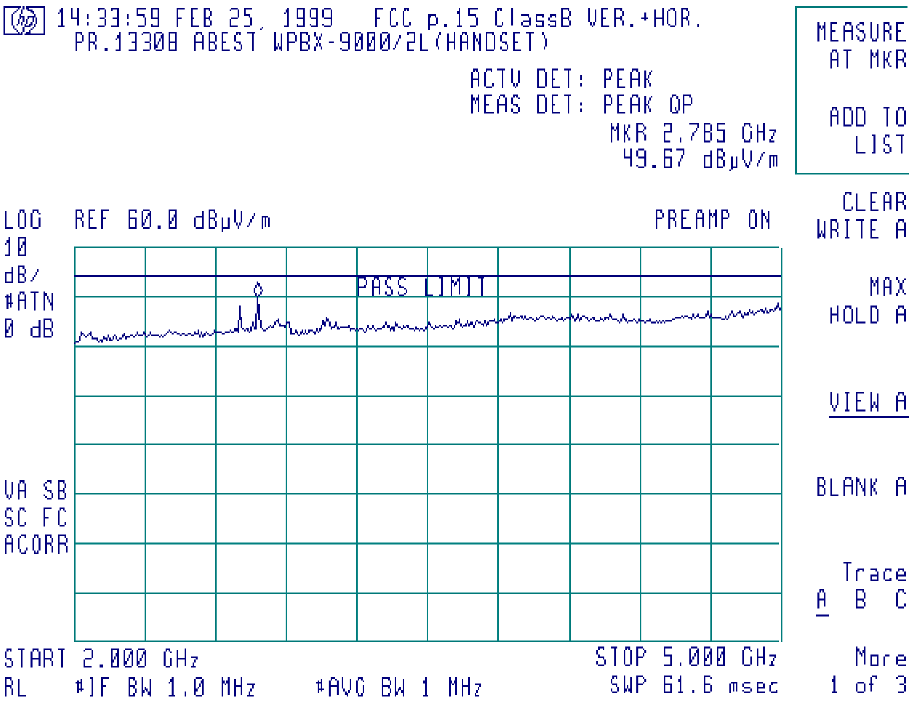
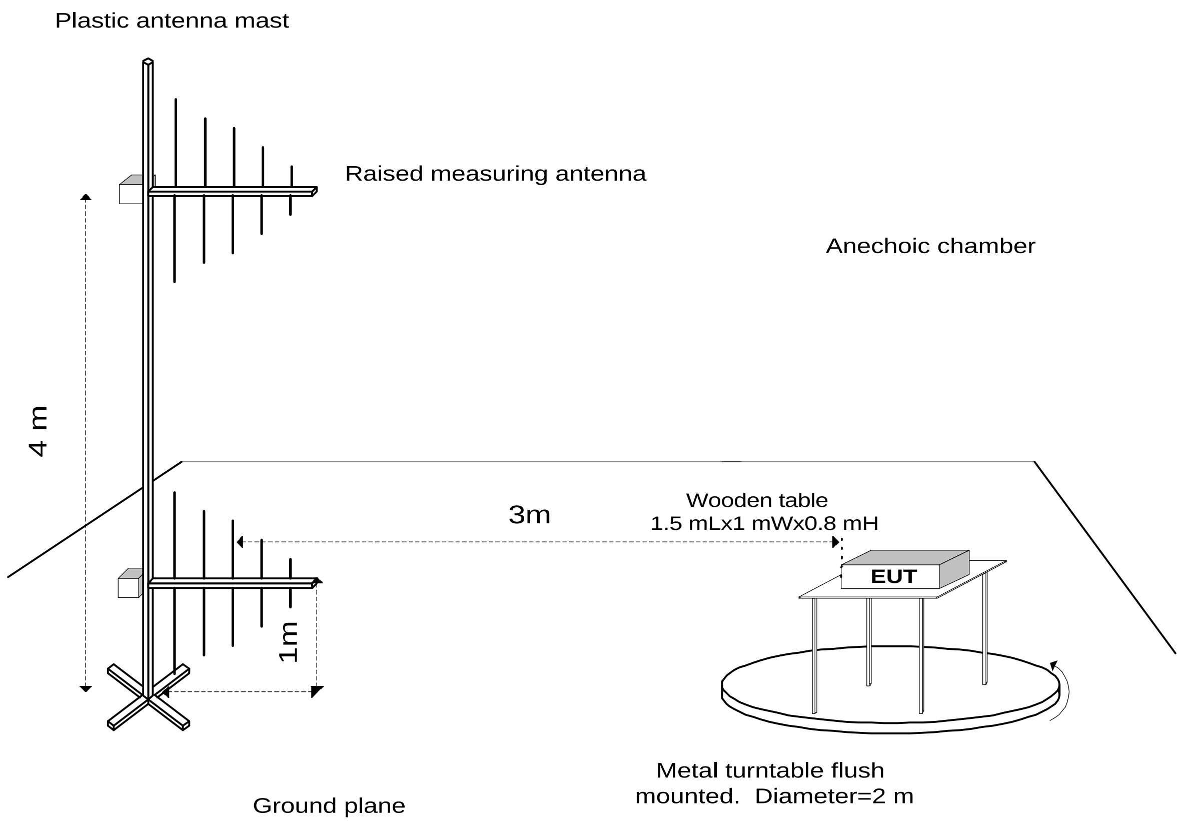


Figure 3.6.1
Radiated emission test setup



10 Summary and signatures

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

<u>Test performed by:</u>

Mrs. Eleonora Pitt, test engineer

<u>Responsible person from ABEST Communication Corp.</u>

Mr. Jason Chen, product manager

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
0027	4838	Spectrum Analyzer, 50 Hz-2 GHz	Anritsu	MS-611A	10/99
0034	1988	Log Periodic Antenna, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	3/00
0038	028	Antenna Mast, 1-4 m	Hermon Labs	AM-1	2/00 Check
0041	2811	Ridged Guide Horn Antenna, 1-18 GHz	Electro-Metrics,	RGA 50/60	7/00
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	7/00
0554	4300	Amplifier, RF, 2-18 GHz	Miteq	AFD4	12/99
0557	080	Signal Generator, 9 kHz – 1.2 GHz	Marconi Instruments	52023-002E	11/99
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	7/00
0614	334	Antenna Dipole Tunable 200 –1000 MHz	Electro-Metrics	TDS 30-1/30-2	2/02
0813	149	Cable, coax, RG-214, 12 m, N-type connectors	Hermon Labs	C214-12	8/99
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
1175		Microwave 5 m cable	Gore	84C01C0224 5.2	2/00

APPENDIX B-Test equipment correction factors

Antenna factor
Double ridged guide antenna
Electro-Metrics, model RGA-50/60
Ser.No.2811

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

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

Antenna factor
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.1988

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
200	15.1	625	25.3
225	15.0	650	25.9
250	16.3	675	27.2
275	17.3	700	27.5
300	18.5	725	28.1
325	19.1	750	28.0
350	19.4	775	28.3
375	20.0	800	28.5
400	20.8	825	29.1
425	21.3	850	29.5
450	22.0	875	29.9
475	22.8	900	30.3
500	23.4	925	30.3
525	23.8	950	30.6
550	24.2	975	31.2
575	24.6	1000	31.8
600	24.8		

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