



**TTI-P-G 166/98-20**

## **Accredited Bluetooth™ Test Facility (BQTF)**

**Test report no.: 2\_2592-4-D/01**  
**FCC Part 15.247 / CANADA RSS-210**  
**802.11b Mini PCI Card WLAN**  
**802.11b Mini PCI Card + v.90/92 WLAN**  
**FCC ID: PUBWCM1001**

CETECOM – ICT Services GmbH  
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### 1 General Information

#### 1.1 Notes

**The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.**

#### 1.2 Testing Laboratory

CETECOM ICT Services GmbH

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66117 Saarbrücken

Germany

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Internet : www.cetecom-ict.de

#### **Accredited testing laboratory**

**DAR-registration number : TTI-P-G 166/98-20**

**Accredited Bluetooth™ Test Facility (BQTF)**

**BLUETOOTH is a trademark owned by Bluetooth SIG, Inc. and licensed to CETECOM**

## 1.3 Details of Applicant

Name : Philips Components  
Street : 620A Lorong 1, TP3 Level 5  
City : Toa Payoh 319762  
Country : Singapore  
Telephone : +65 350 2766  
Telefax : +65 252 6201  
Contact : Mr M. Guruprasad  
Telephone : +65 350 2766

## 1.4 Application Details

Date of receipt of application : 02.08.01  
Date of receipt of test item : 09.08.01  
Date of test : 21.08.01  
Revised : 28.05.02

## 1.5 Test Item

Type of equipment : DSSS RLAN  
Type designation : 802.11b Mini PCI Card WLAN:PH10766 or WLM1100  
802.11b Mini PCI Card + v. 90/92 WLAN:PH10754 or  
WLM1100M  
Manufacturer : See applicant  
Street :  
City :  
Country :

### Additional information :

Frequency : 2412 – 2472 MHz  
Type of modulation : 22M0P7D (DSSS)  
Number of channels : 13  
Antenna : Lambda/4 antenna, see discription  
Power supply : 3,3 V DC from PC  
Peak output power : Conducted : 19.46 dBm / 88.31 mW  
Temperature range : -10°C - +60°C  
FCC ID : PUBWCM1001

### Model name:

Model PH10766 and WLM1100 are identical except the model name.

Model PH10754 and WLM1100M are identical except the model name.

Model PH10766 and PH10754 are identical except PH10766 is designated without modem part.

Model PH10766, the worst case, was chosen for testing

### Antenna:

The testfixture antenna is a groundplane antenna made of a semi-rigid coax and with a impedance of 50Ohm. The antenna connector type is UFL

1.6 Test Specifications: FCC Part 15 §15.247  
CANADA RSS-210

## 2 Technical test

### 2.1 Summary of test results

The radiated measurements were performed vertical and horizontal over the whole frequency range. We start at 1 m high with vertical receiving antenna and rotate the dish continuously. During rotation we use the antenna lift system to vary the high from 1 to 4 m. So we find maximum radiation output. At this points we do manual re-measurements. After this we do the same measurements in horizontal position of the receiving antenna. This (horizontal and vertical) is made for all the three planes of the test sample. We use the maximum received results.

The detector function and selection of bandwidth are according ANSI C63.2-1996 item 8.2.1 and ANSI C63.4-1992 Item 4.2.

Antennas are conform with ANSI C63.2-1996 item 15.

150 kHz - 30 MHz: Quasi Peak measurement, 9kHz Bandwidth, passive loop antenna.

30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna

200MHz - 1GHz: Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna

1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horn

The antenna gain measurement was performed by the difference between conducted and radiated output measurement.

All measurement settings are according to FCC 15.35, 15.205, 15.209, 15.247 and the „Measurement guidelines for DSSS systems“.

The product fullfills also the requirements for CANACA RSS-210

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

### Final verdict : PASS

Technical responsibility for area of testing :

03.09.2001 RSC 8411 Berg M.

Date Section Name

  
Signature

Technical responsibility for area of testing :

03.09.2001 RSC8412 Hausknecht D.

Date Section Name

  
Signature

**2.2 Testreport**

**TEST REPORT**

**Testreport no. : 2\_2592-4-D/01**

## TEST REPORT REFERENCE

## LIST OF MEASUREMENTS

Paragraph	PARAMETER TO BE MEASURED	PAGE
	<b>Transmitter parameters</b>	
§ 15.247 (a)(2)	Spectrum Bandwidth of a DSSS System	7
§ 15.247 (b)(1)	Maximum peak output power	11
§ 15.247 (b) (4)	RF Exposure calculation	15
§ 15.247 (c)(1)	Emission limitations	16
§ 15.247 (c)	Band edge compliance	33
§ 15.247 (d)	Power Spectral Density	36
§ 15.247 (e)	Processing Gain of DSSS System	40
§ 15.107/207	Conducted emissions	
	<b>Receiver parameters</b>	
§ 15.209	Spurious radiations - Radiated	41
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Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**SPECTRUM BANDWITH OF DSSS-SYSTEM**

**SUBCLAUSE § 15.247 (a)(2)**

TEST CONDITIONS		6 dB BANDWIDTH ( kHz )		
		2412	2442	2472
Frequency (MHz)				
T <sub>nom</sub> ( 24 )°C	V <sub>nom</sub> ( 3.3 )V	11172	11222	11222
Measurement uncertainty		±3dB		

RBW = 100 KHz, Span >> RBW, here 25 MHz

**LIMIT**

**SUBCLAUSE §15.247(a) (2)**

**The minimum 6dB bandwith shall shall be at least 500 KHz**

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**

(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

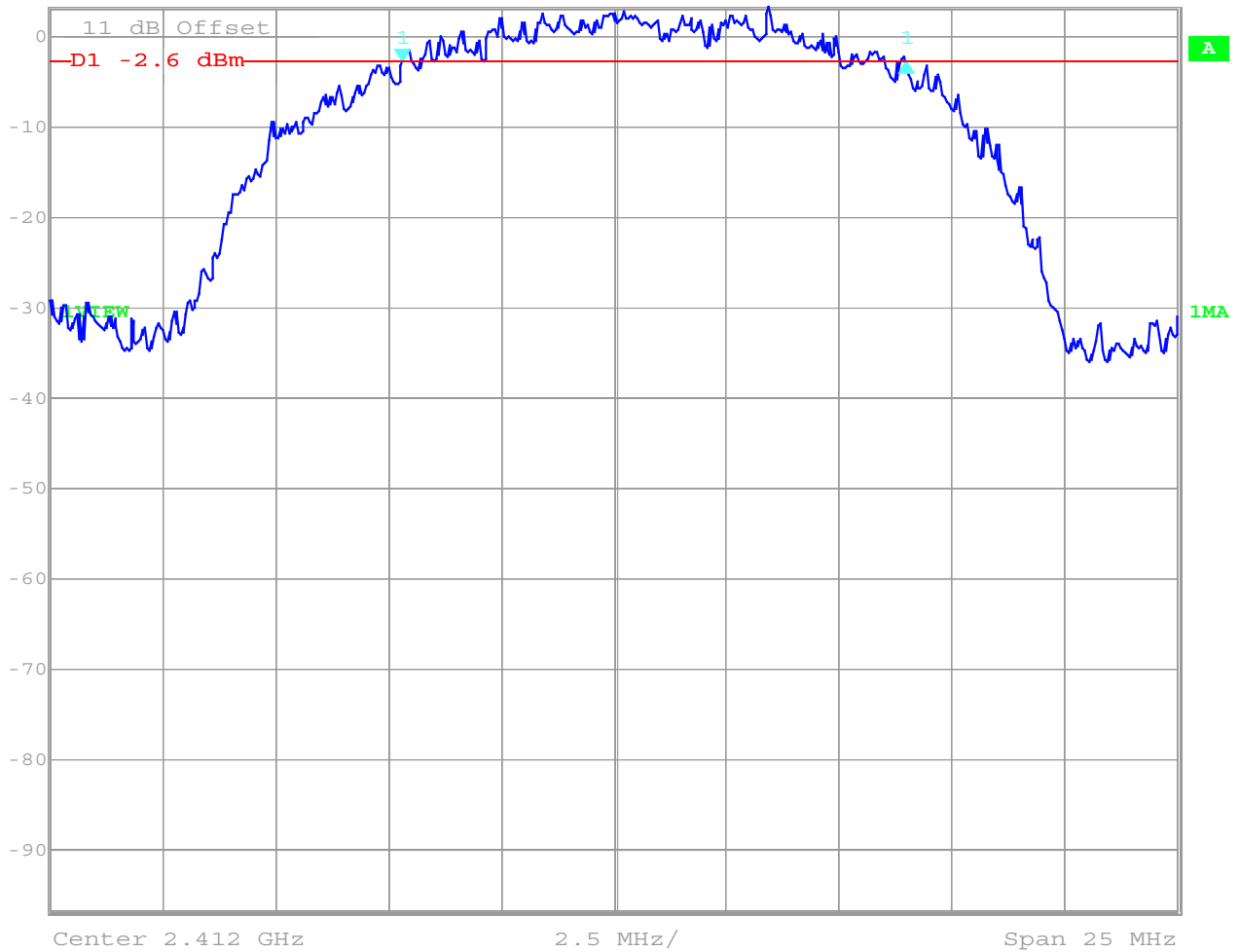
Relative humidity : 45%

## SPECTRUM BANDWIDTH OF DSSS-SYSTEM 2412 MHz

## SUBCLAUSE § 15.247 (a)(2)



Delta 1 [T1]	RBW	100 kHz	RF Att	20 dB
0.06 dB	VBW	3 MHz		
Ref Lvl	SWT	6.5 ms	Unit	dBm
3.4 dBm				



Date: 22.AUG.2001 08:19:17

RBW = 100 KHz, Span >> RBW, here 25 MHz

### LIMIT

### SUBCLAUSE §15.247(a) (2)

The minimum 6dB bandwidth shall be at least 500 KHz , here 8.317 MHz

### REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)



Equipment under test : PH10766

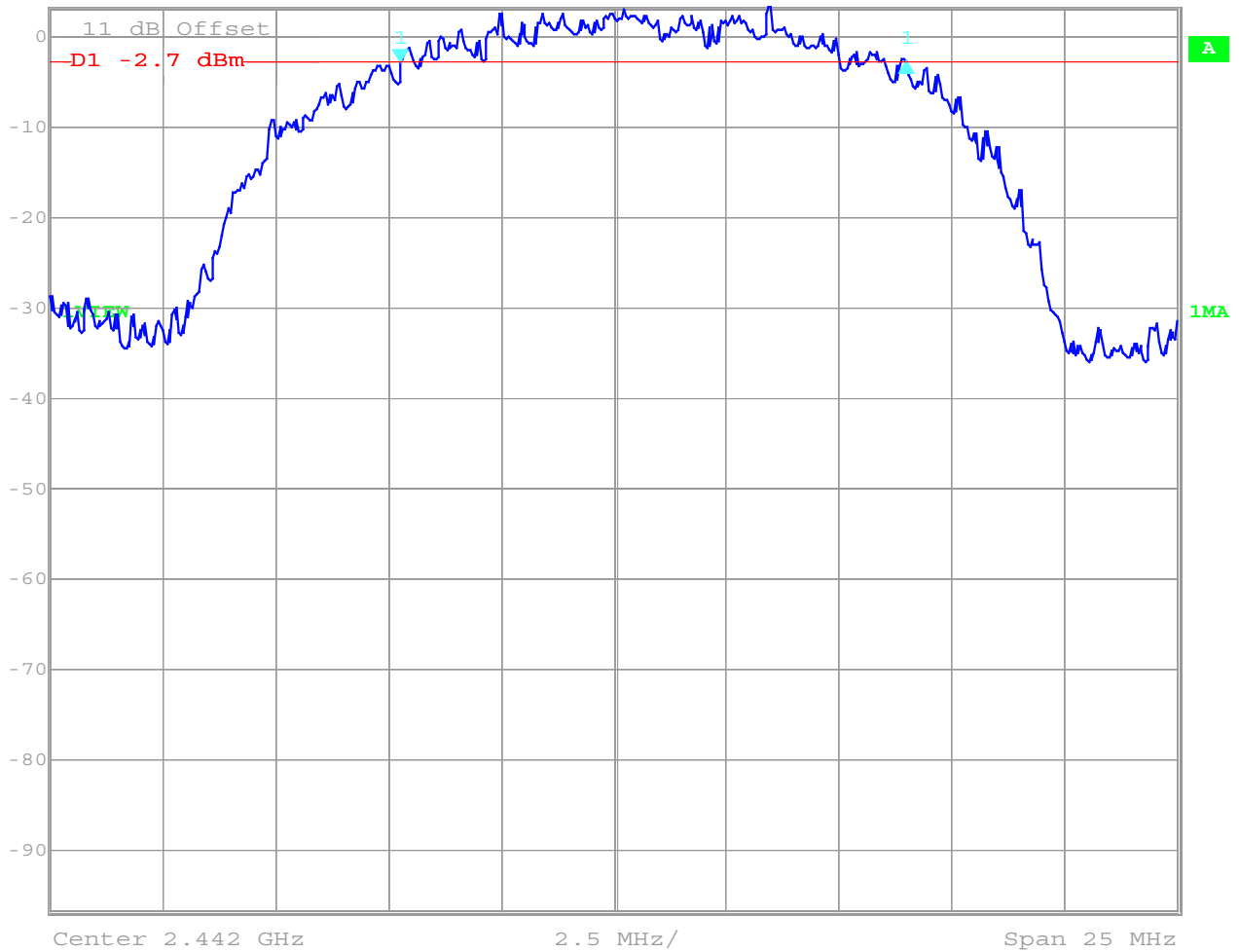
Ambient temperature : 23°C

Relative humidity : 45%

**SPECTRUM BANDWIDTH OF DSSS-SYSTEM**  
2442 MHz

**SUBCLAUSE § 15.247 (a)(2)**

	Delta 1 [T1]	RBW	100 kHz	RF Att	20 dB
	Ref Lvl	0.14 dB	VBW	3 MHz	
	3.3 dBm	11.22244489 MHz	SWT	6.5 ms	Unit
					dBm



Date: 22.AUG.2001 08:21:09

RBW = 100 KHz, Span >> RBW, here 25 MHz

**LIMIT**

**SUBCLAUSE §15.247(a) (2)**

The minimum 6dB bandwidth shall be at least 500 KHz , here 10.17 MHz

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**

(for reference numbers see test equipment listing)

Equipment under test : PH10766

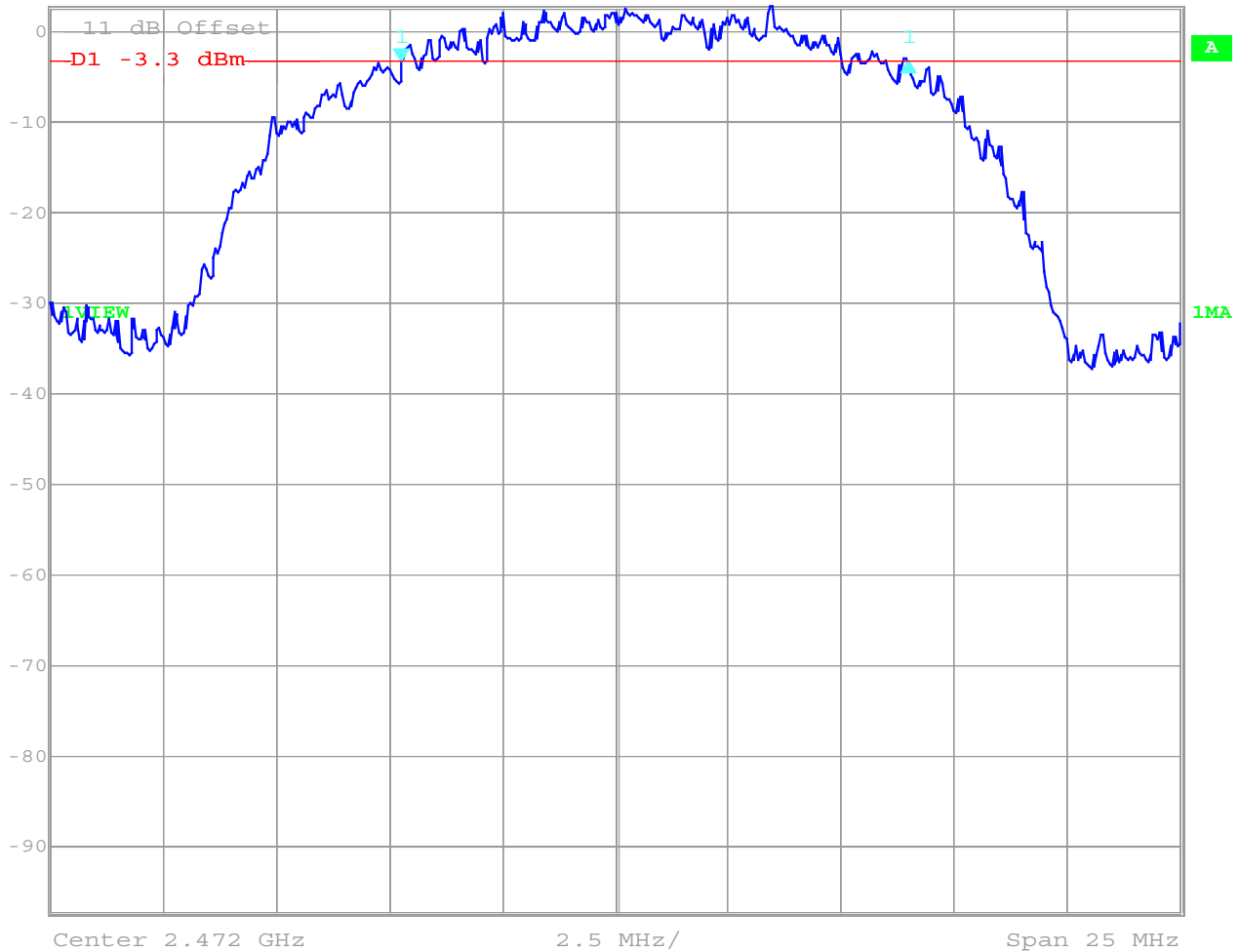
Ambient temperature : 23°C

Relative humidity : 45%

## PECTRUM BANDWITH OF DSSS-SYSTEM 2472 MHz

## SUBCLAUSE § 15.247 (a)(2)

RS	Delta 1 [T1]	RBW	100 kHz	RF Att	20 dB
	Ref Lvl	-0.05 dB	VBW	3 MHz	
	2.7 dBm	11.22244489 MHz	SWT	6.5 ms	Unit dBm



Date: 22.AUG.2001 08:22:23

RBW = 100 KHz, Span >> RBW, here 25 MHz

### LIMIT

### SUBCLAUSE §15.247(a) (2)

The minimum 6dB bandwidth shall be at least 500 KHz , here 9.569 MHz

### REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**MAXIMUM PEAK OUTPUT POWER  
(CONDUCTED)**

**SUBCLAUSE § 15.247 (b) (1)**

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
		2412	2442	2472
Frequency (MHz)				
T <sub>nom</sub> ( 20 )°C	V <sub>nom</sub> ( 3.3 )V	Peak: 19.46 AV: 11.26	Peak 19.38 AV: 11.48	Peak 19.11 AV: 11.41
Maximum deviation from output power under extreme test conditions (dBc)		not performed	not performed	not performed
Measurement uncertainty		±3dB		

Settings: RBW/VBW 10 MHz

**LIMIT**

**SUBCLAUSE § 15.247 (b) (1)**

Frequency range	RF power output
2400-2483.5 MHz / 5725 – 5850 MHz	30 dBm

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

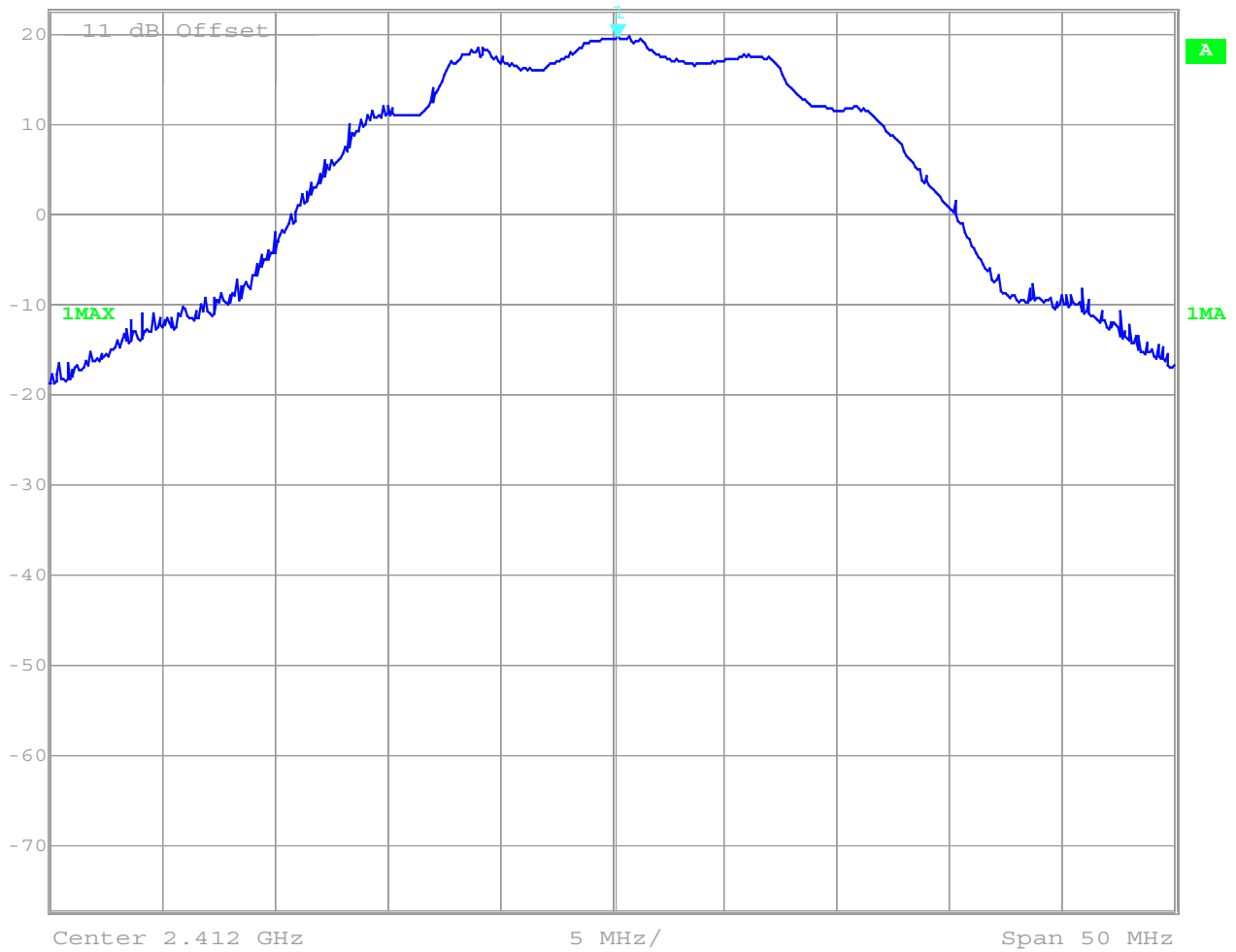
Relative humidity : 45%

**MAXIMUM PEAK OUTPUT POWER  
(CONDUCTED) (Peak)  
2412 MHz**

**SUBCLAUSE § 15.247 (b) (1)**



Ref Lvl	22.7 dBm	Marker 1 [T1]	19.46 dBm	RBW	10 MHz	RF Att	40 dB
			2.41225050 GHz	VBW	10 MHz		
				SWT	5 ms	Unit	dBm



Date: 22.AUG.2001 08:25:54

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## MAXIMUM PEAK OUTPUT POWER (CONDUCTED) (Peak)

## SUBCLAUSE § 15.247 (b) (1)

2442 MHz



Marker 1 [T1]

RBW 10 MHz RF Att 40 dB

Ref Lvl 19.38 dBm

VBW 10 MHz

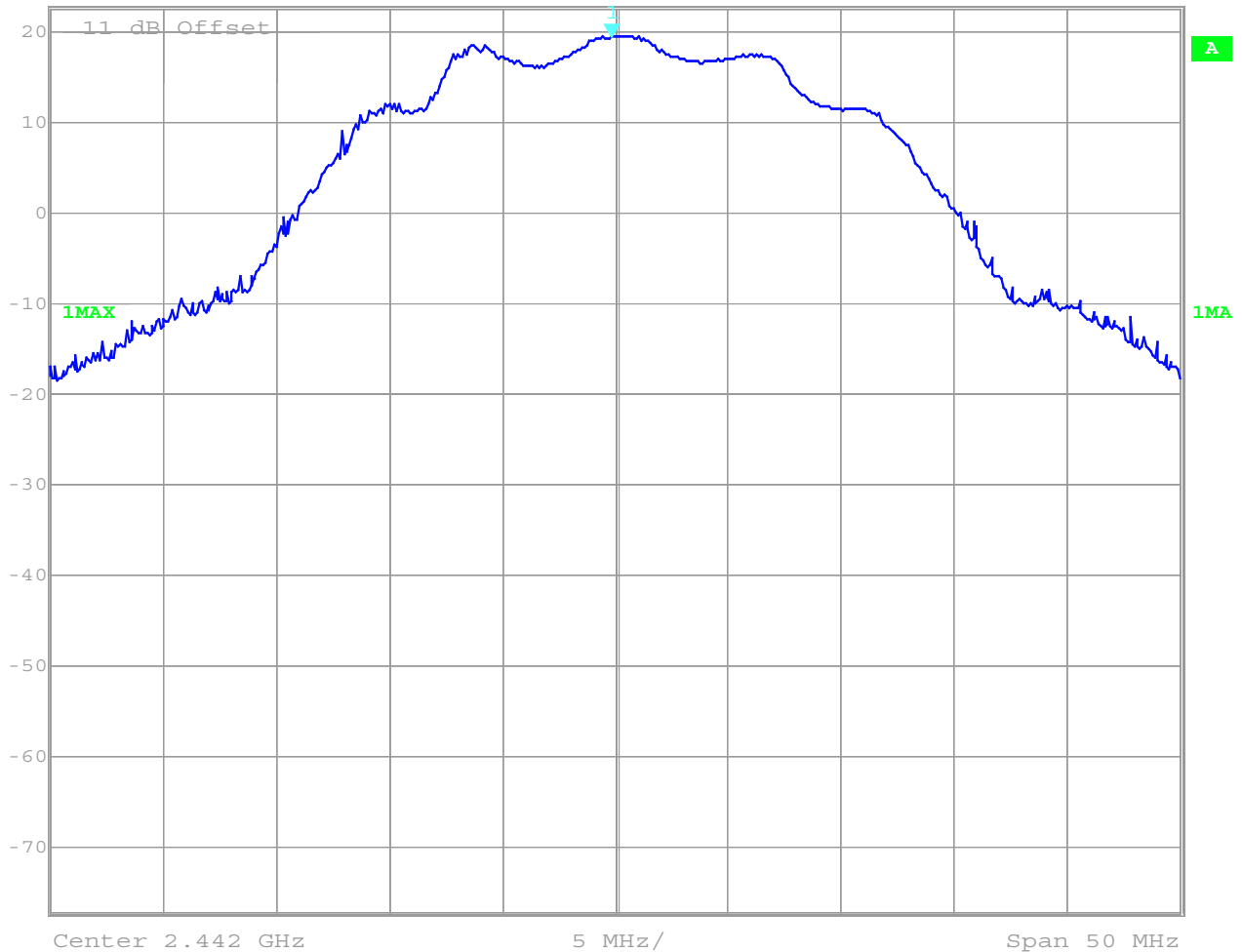
22.7 dBm

2.44184970 GHz

SWT 5 ms

Unit

dBm



Date: 22.AUG.2001 08:25:08

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**MAXIMUM PEAK OUTPUT POWER  
(CONDUCTED) (Peak)**

**SUBCLAUSE § 15.247 (b) (1)**

2472 MHz



Marker 1 [T1]

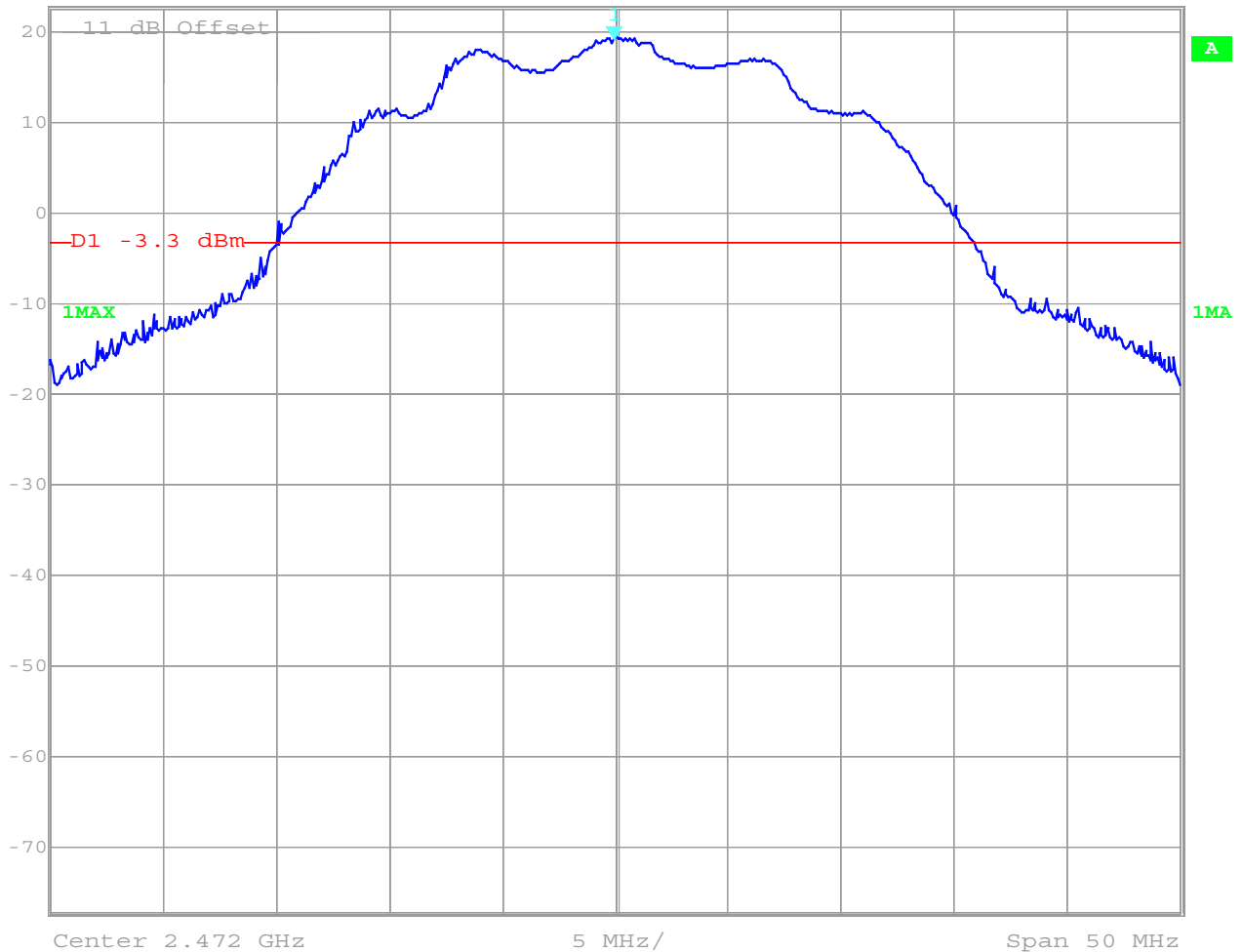
RBW 10 MHz RF Att 40 dB

Ref Lvl 19.11 dBm

VBW 10 MHz

22.7 dBm 2.47194990 GHz

SWT 5 ms Unit dBm



Date: 22.AUG.2001 08:24:23

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)**

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## MAXIMUM PEAK OUTPUT POWER (RADIATED)

SUBCLAUSE § 15.247 (b) (1)

This test was performed to find the antenna gain .

The maximum output was measured in vertikal polarisation.  
Emissions in horizontal polarisation were up to 20 dB lower.

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (W)		
Frequency (MHz)		2412	2442	2472
T <sub>nom</sub> ( 23 )°C	V <sub>nom</sub> ( 3.3 )V	Peak 0.033 (+15.2 dBm)	Peak 0.028 (+14.4 dBm)	Peak 0.029 (+14.6 dBm)
Antenna Gain Power cond. – Power rad.		-4.26 dB	-4.94 dB	--4.51 dB
Measurement uncertainty		±3dB		

Settings: RBW/VBW 10 MHz

## LIMIT

SUBCLAUSE § 15.247 (b) (1)

Frequency range	RF power output
2400-2483.5 MHz / 5725 – 5850 MHz	1.0 Watt

## RF EXPOSURE CALCULATION

SUBCLAUSE § 15.247 (B) (4)

The maximal power density at 20cm distance is calculated as:  $P_d = (P_{out} * G)/(4\pi * r^2)$

$$33.11mW / 4\pi 400cm^2 = 0.00659mW/cm^2$$

The Limit for general population/uncontrolled exposures according §1.1307(b) is 1mW/cm<sup>2</sup>

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

EMISSION LIMITATIONS (Transmitter)

SUBCLAUSE § 15.247 (c) (1)

conducted (radiated emissions in restricted bands see next table)

2412 MHz

SPURIOUS LIMITATIONS					
f (MHz)		amplitude of emission (dBm)	limit max. allowed emission		results
all	Peaks	<< Limit			
Measurement uncertainty		± 3dB			

RBW/VBW according to FCC requirements.

LIMITS

SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)



Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**EMISSION LIMITATIONS (Transmitter) SUBCLAUSE § 15.247 (c) (2)**

**radiated** (Antenna vertikal polarisation, horiz. emissions were up to 20dB lower)

2412 MHz

SPURIOUS LIMITATIONS					
f (MHz)		amplitude of emission (dBµV/m)	limit max. allowed emission		results
42.03	rad.	QP: 33.5	40,0 dBµV/m		complies
81.32	rad.	QP: 29.2	40.0 dBµV/m		complies
101.32	rad.	QP: 27.7	43.5 dBµV/m		complies
167.63	rad.	QP: 31.6	43.5 dBµV/m		complies
186.66	rad.	QP: 27.9	43.5 dBµV/m		complies
2067.7	rad.	AV:46.3	54.0 dBµV/m		complies
4078.8	rad	AV: 30.2	54.0 dBµV/m		complies
<b>Measurement uncertainty</b>			<b>± 3dB</b>		

Measurement were performed up to 1 GHz with a CISPR quasi peak adapter and 100/120 kHz BW. Measurements above 1 GHz were performed with RBW/VBW 1 MHz in Peak and Average.

**LIMITS SUBCLAUSE § 15.247 (c)**

**In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).**

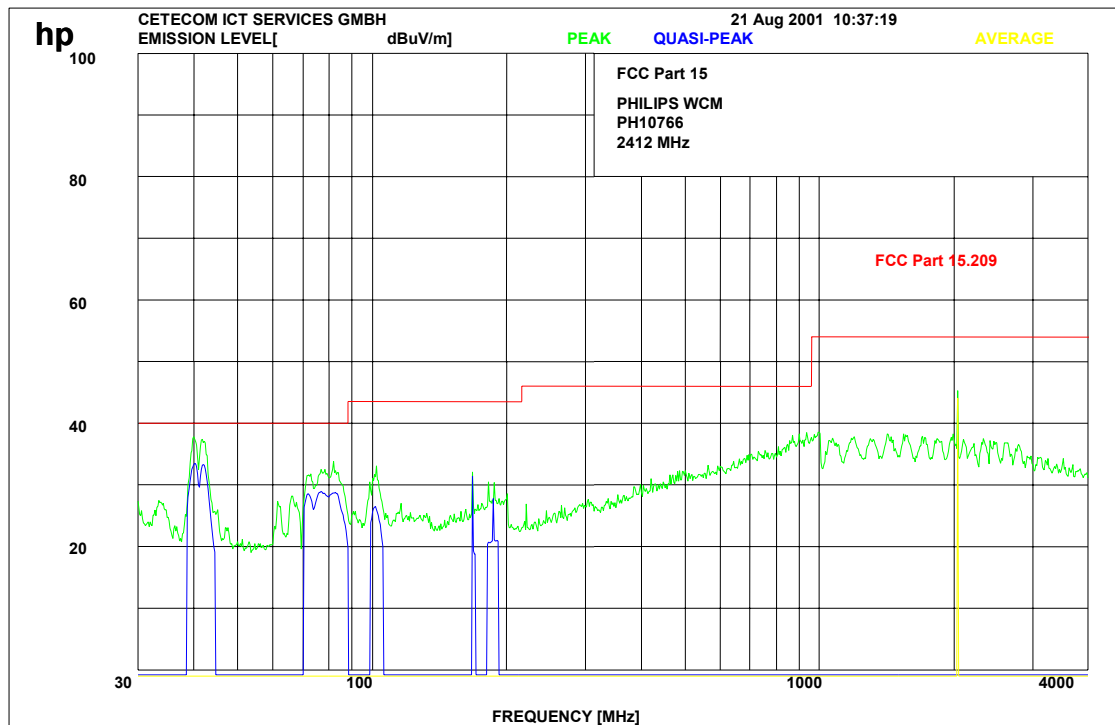
**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## 2412 MHz radiated up to 4000 MHz



This is only a scan:

Measurements were performed with a CISPR quasi peak adapter and 100/120 kHz BW up to 1 GHz ( blue lines), higher frequencies with average (yellow lines) and peak (green lines) and RBW/VBW 1MHz.

Carrier is suppressed by a stub tuner to avoid oversteering of the lownoise amplifier of the measuring system.

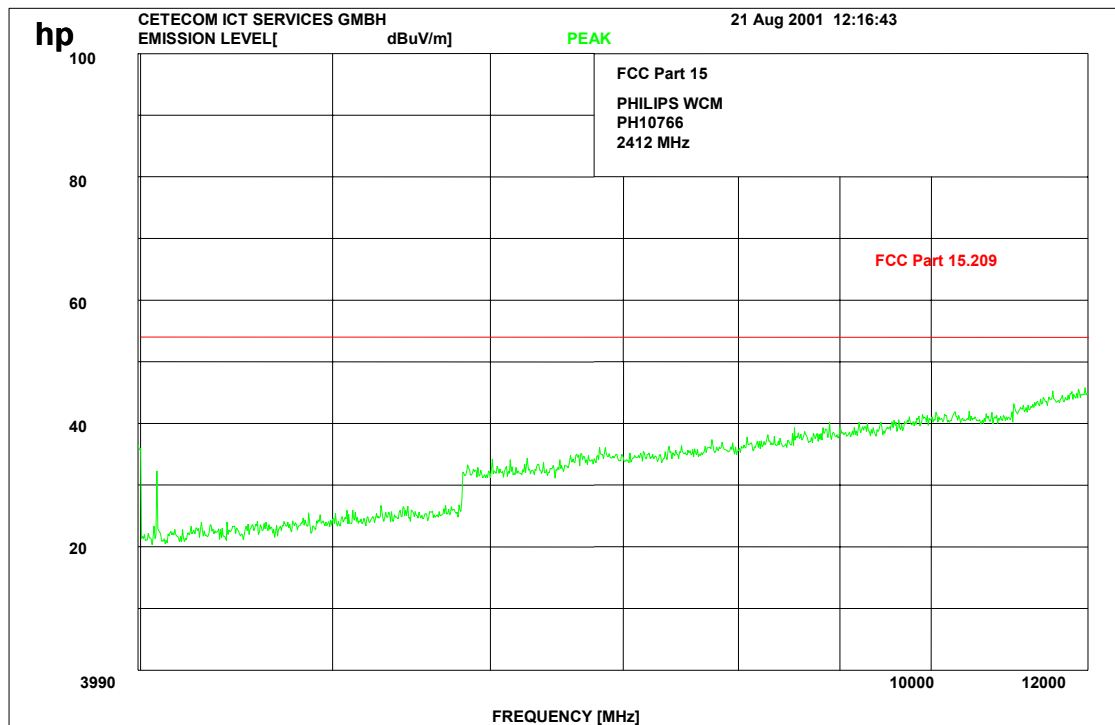
**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**2412 MHz up to 12 GHz radiated**



Measurements were performed with 1MHz RBW/VBW

**LIMITS**

**SUBCLAUSE § 15.247 (c)**

**In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).**

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**2412 MHz up to 18GHz radiated** (This plot is valid for all 3 channels, there were no peaks found)

Average



Marker 1 [T1]

RBW 1 MHz RF Att 0 dB

Ref Lvl

17.41 dBμV

VBW 1 MHz

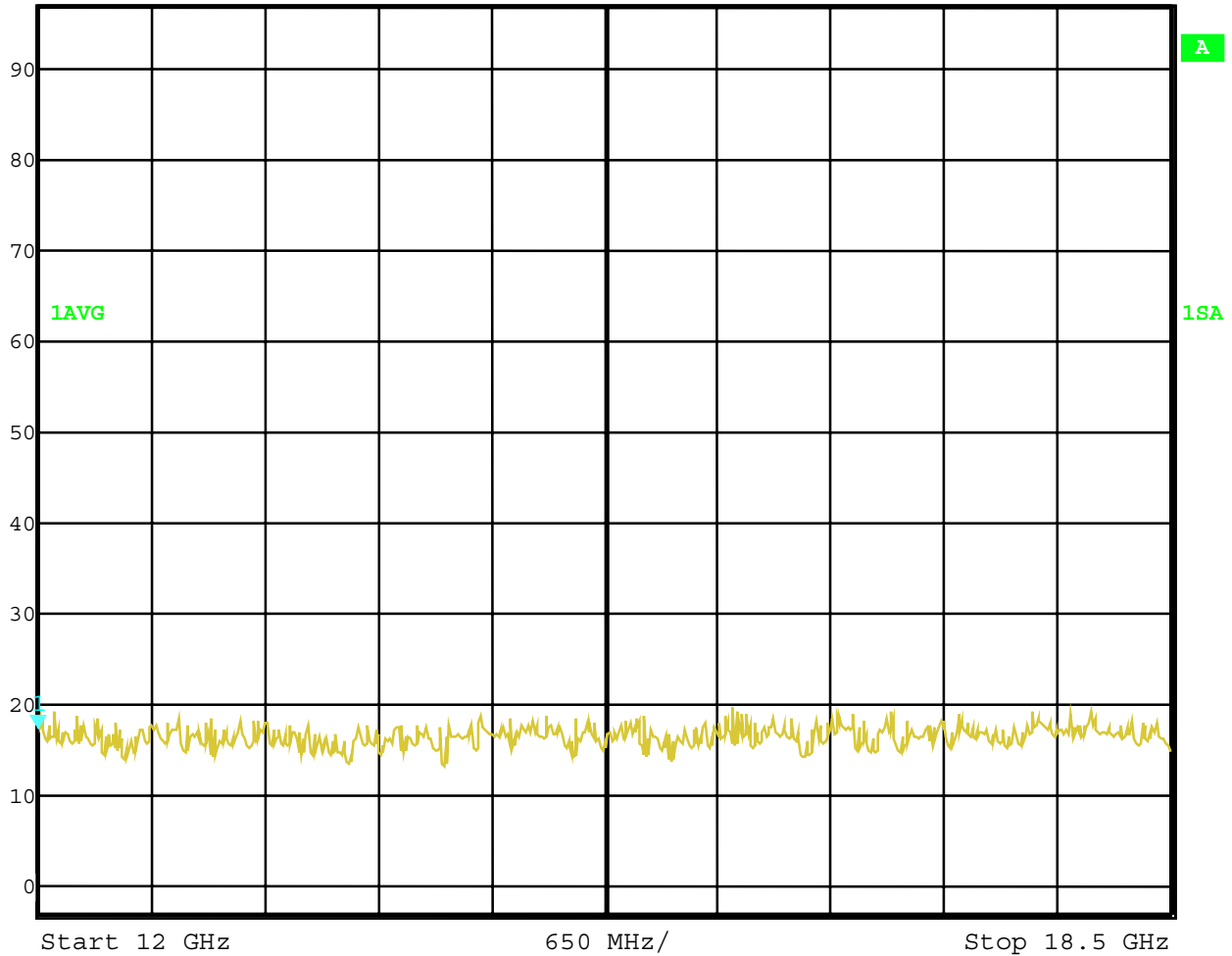
97 dBμV

12.00000000 GHz

SWT 37 ms

Unit

dBμV



REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**2412 MHz up to 25GHz radiated** (This plot is valid for all 3 channels, there were no peaks found)

Average



Marker 1 [T1]

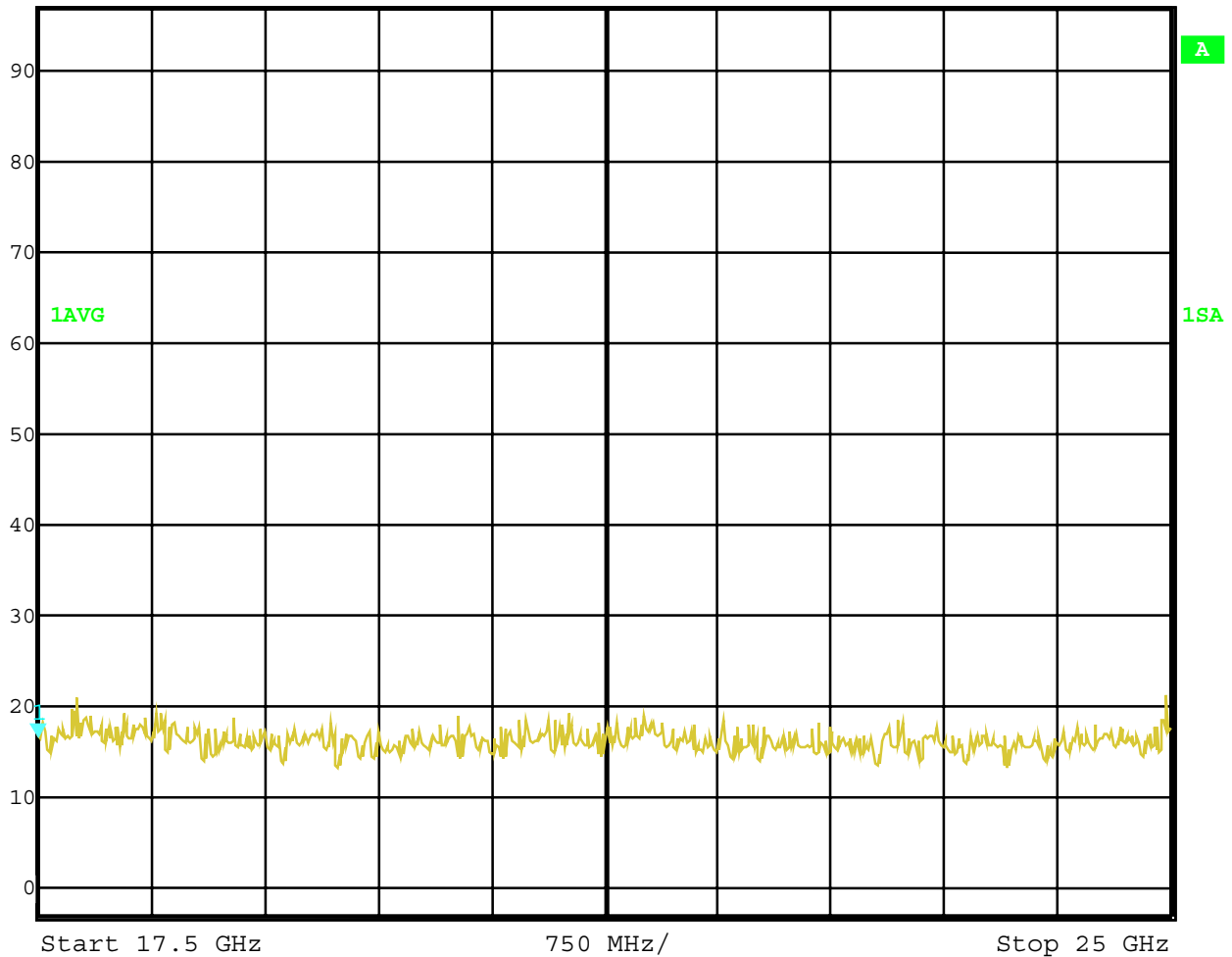
RBW 1 MHz RF Att 0 dB

Ref Lvl 16.58 dB $\mu$ V

VBW 1 MHz

97 dB $\mu$ V 17.5000000 GHz

SWT 43 ms Unit dB $\mu$ V



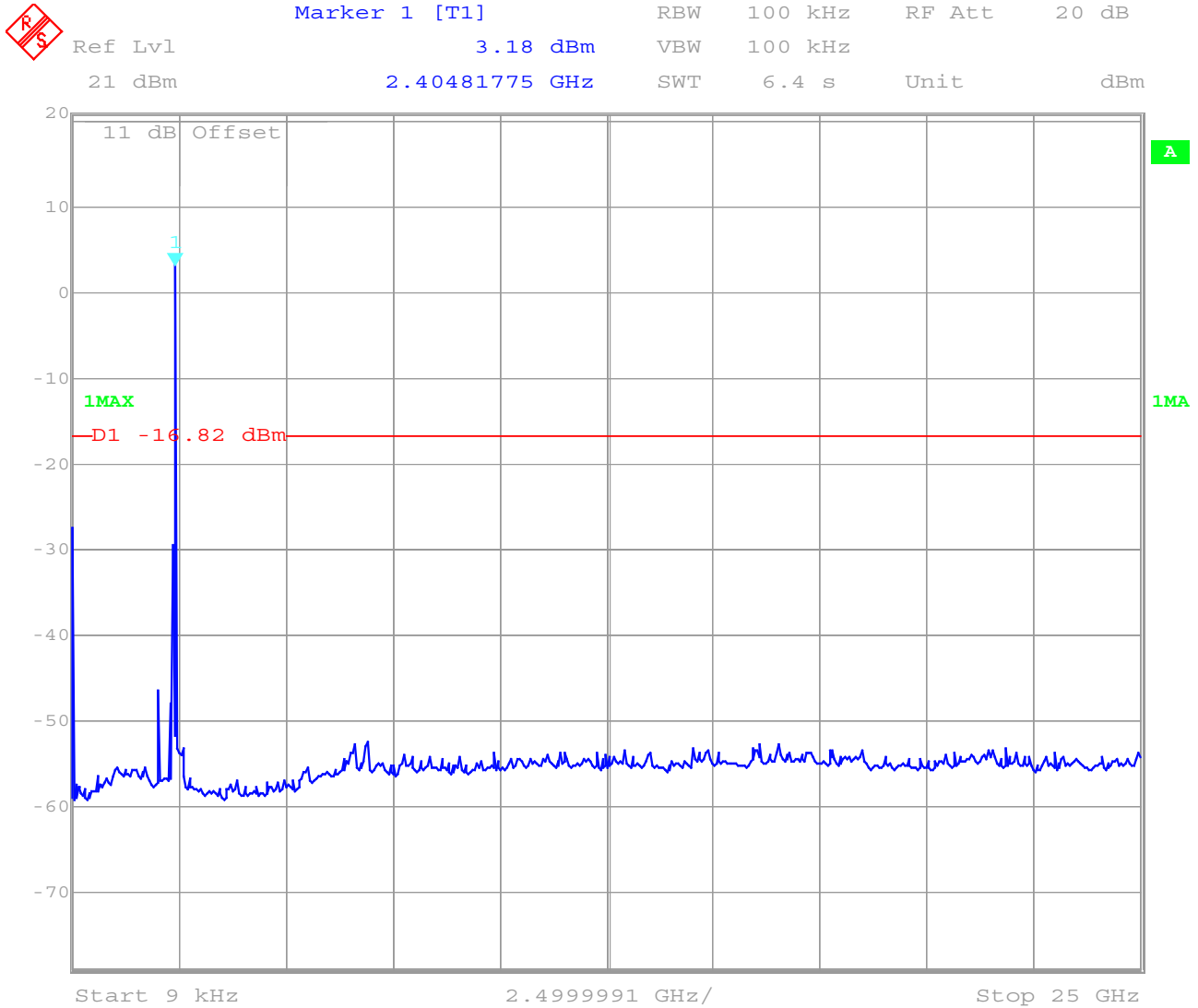
**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

2412 MHz conducted up to 25 GHz



Date: 22.AUG.2001 08:00:20

**LIMITS**

**SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
 (for reference numbers see test equipment listing)

Equipment under test : PH10766  
 Ambient temperature : 23°C  
 Relative humidity : 45%

**EMISSION LIMITATIONS (Transmitter)      SUBCLAUSE § 15.247 (c) (1)**

**conducted** (radiated emissions in restricted bands see next table)

2442 MHz

SPURIOUS LIMITATIONS					
f (MHz)		amplitude of emission (dBm)	limit max. allowed emission		results
All	peaks	<< Limit			
Measurement uncertainty		± 3dB			

RBW/VBW according to FCC requirements.

**LIMITS      SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**EMISSION LIMITATIONS (Transmitter) SUBCLAUSE § 15.247 (c) (2)**

**radiated (Antenna vertikal polarisation, horiz. emissions were up to 20dB lower)**

**2442 MHz**

SPURIOUS LIMITATIONS					
f (MHz)		amplitude of emission (dBµV/m)	limit max. allowed emission		results
42.03	rad.	QP:33.5	40,0 dBµV/m		complies
81.32	rad.	QP:29.2	40.0 dBµV/m		complies
101.32	rad.	QP:27.7	43.5 dBµV/m		complies
167.63	rad.	QP:31.6	43.5 dBµV/m		complies
186.66	rad.	QP:27.9	43.5 dBµV/m		complies
2067.7	rad	AV: 46.3	54.0 dBµV/m		complies
4142.1	rad.	AV:40.9	54.0 dBµV/m		complies
Measurement uncertainty			± 3dB		

Measurement were performed up to 1 GHz with a CISPR quasi peak adapter and 100/120 kHz BW. Measurements above 1 GHz were performed with RBW/VBW 1 MHz in Peak and Average.

**LIMITS**

**SUBCLAUSE § 15.247 (c)**

**In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).**

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

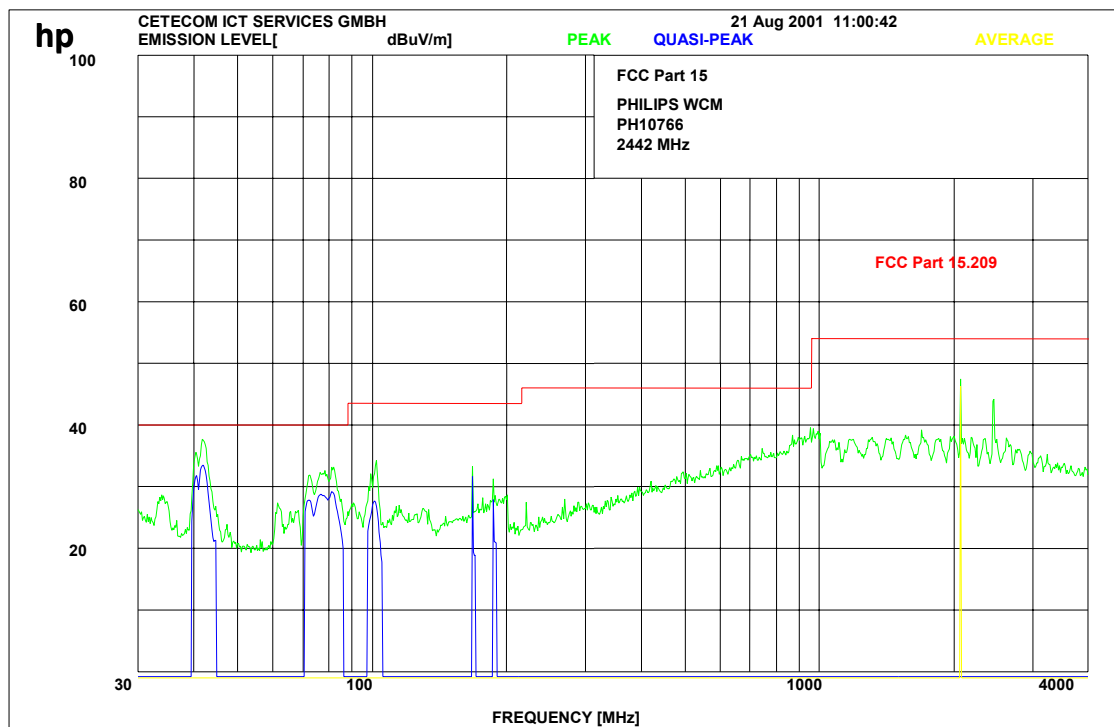


Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## 2442 MHz radiated up to 4000 MHz



This is only a scan:

Measurements were performed with a CISPR quasi peak adapter and 100/120 kHz BW up to 1 GHz ( blue lines), higher frequencies with average (yellow lines) and peak (green lines) and RBW/VBW 1MHz.

Carrier is suppressed by a stub tuner to avoid oversteering of the lownoise amplifier of the measuring system.

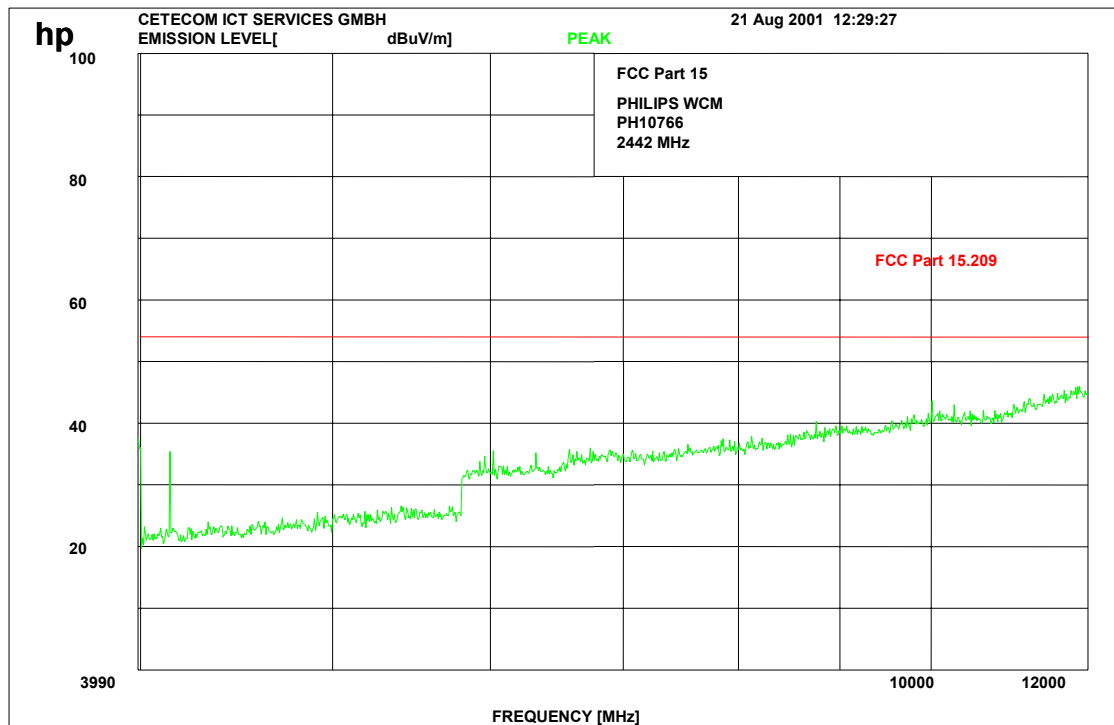
**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

2442 MHz up to 12 GHz radiated



This is only a scan.

Measurements were performed with 1MHz RBW/VBW

**LIMITS**

**SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**

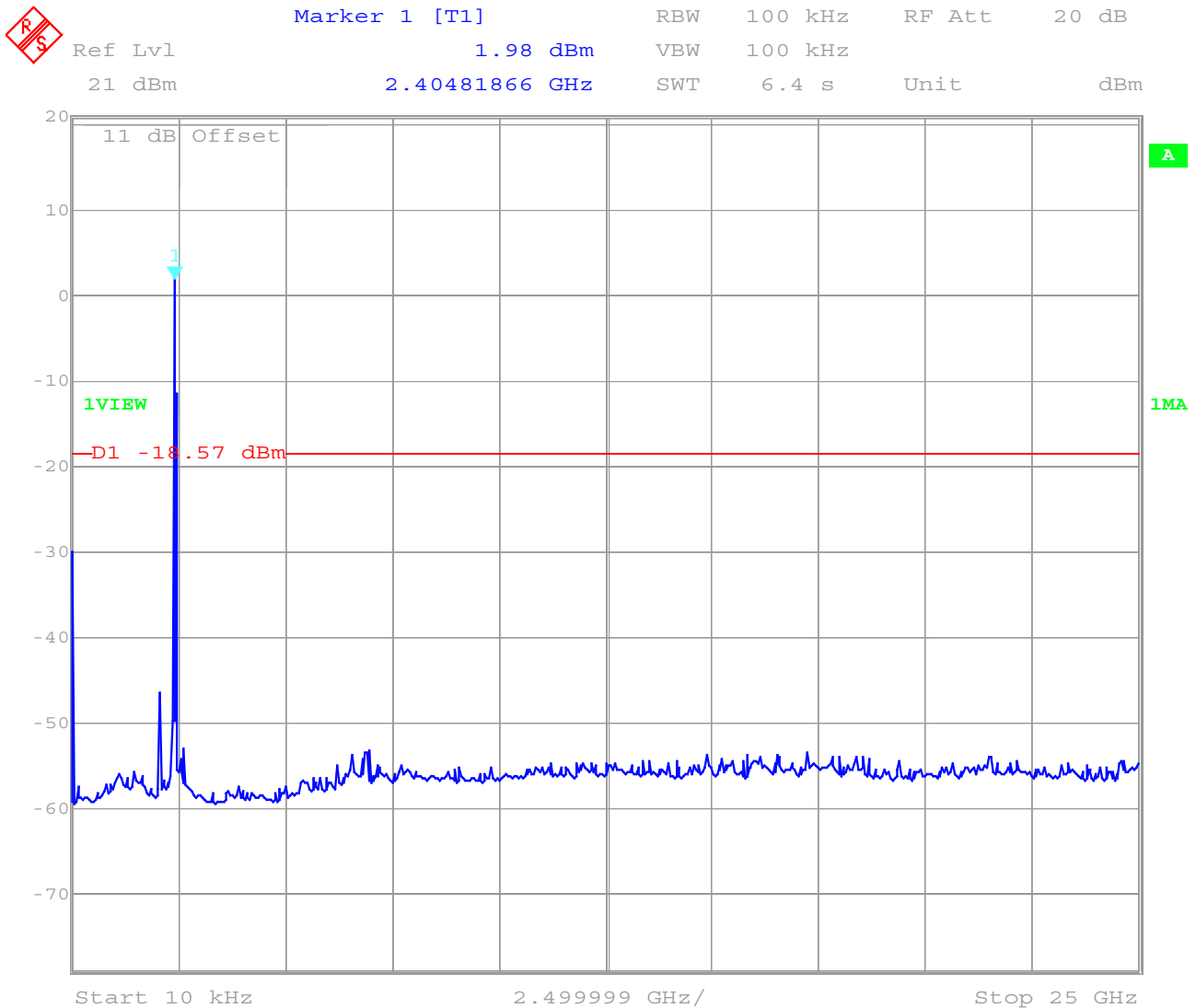
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**2442 MHz conducted up to 25 GHz**



Date: 22.AUG.2001 08:01:50

**LIMITS**

**SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
 (for reference numbers see test equipment listing)

Equipment under test : PH10766  
 Ambient temperature : 23°C  
 Relative humidity : 45%

**EMISSION LIMITATIONS (Transmitter)      SUBCLAUSE § 15.247 (c) (1)**

**conducted** (radiated emissions in restricted bands see next table)

**2472 MHz**

SPURIOUS LIMITATIONS					
f (MHz)		amplitude of emission (dBm)	limit max. allowed emission		results
all	peaks	<< limit			
Measurement uncertainty		± 3dB			

**RBW/VBW according to FCC requirements.**

**LIMITS      SUBCLAUSE § 15.247 (c)**

**In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).**

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**EMISSION LIMITATIONS (Transmitter) SUBCLAUSE § 15.247 (c) (2)**

**radiated** (Antenna vertikal polarisation, horiz. emissions were up to 20dB lower)

2472 MHz

SPURIOUS LIMITATIONS					
f (MHz)		amplitude of emission (dBµV/m)	limit max. allowed emmission		results
42.03	rad.	QP: 32.6	43.5 dBµV/m		complies
81.71	rad.	QP:29.0	43.5 dBµV/m		complies
101.32	rad.	QP:27.6	46.0 dBµV/m		complies
168.45	rad.	QP:31.7	46.0 dBµV/m		complies
187.58	rad.	QP:27.8	46.0 dBµV/m		complies
2098.2	rad.	AV:43.8	54.0 dBµV/m		complies
4197.1	rad.	AV:39.8	54.0 dBµV/m		complies
6291.5	rad.	AV: 31.3	54.0 dBµV/m		complies
no	radiated	spurs	above	2472 MHz	
Measurement uncertainty		± 3dB			

Measurement were performed up to 1 GHz with a CISPR quasi peak adapter and 100/120 kHz BW. Measurements above 1 GHz were performed with RBW/VBW 1 MHz in Peak and Average.

**LIMITS**

**SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

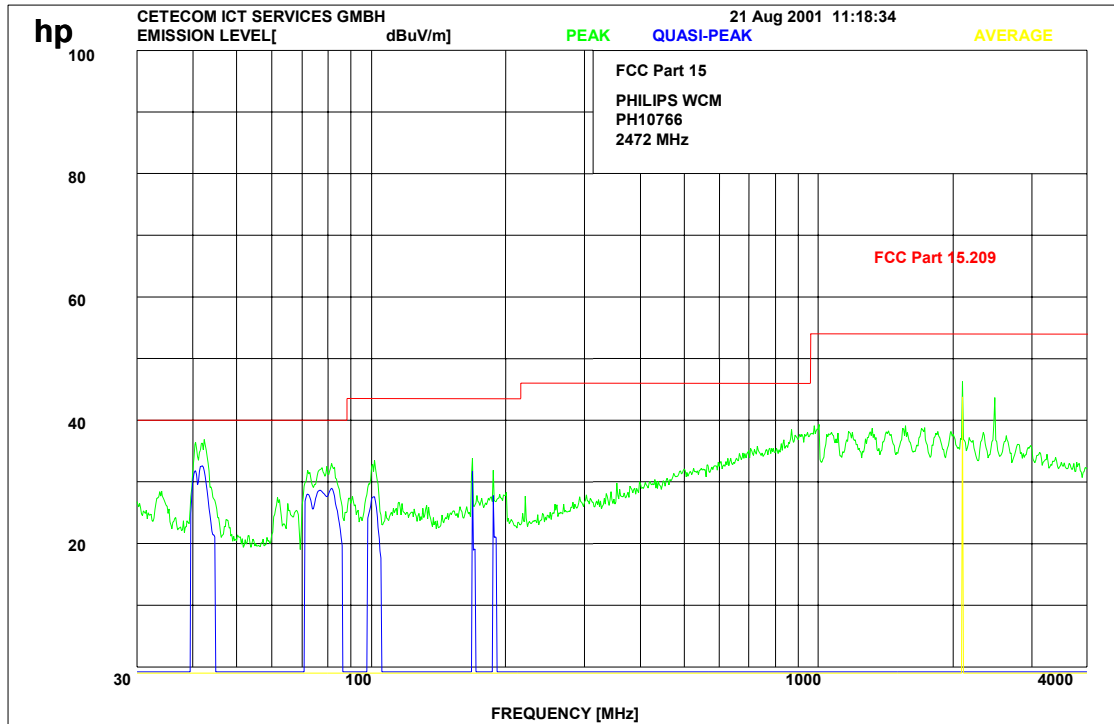
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## 2472 MHz up to 4 GHz radiated



This is only a scan:

Measurements were performed with a CISPR quasi peak adapter and 100/120 kHz BW up to 1 GHz ( blue lines), higher frequencies with average (yellow lines) and peak (green lines) and RBW/VBW 1MHz.

Carrier is suppressed by a stub tuner to avoid oversteering of the lownoise amplifier of the measuring system.

### LIMITS

### SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

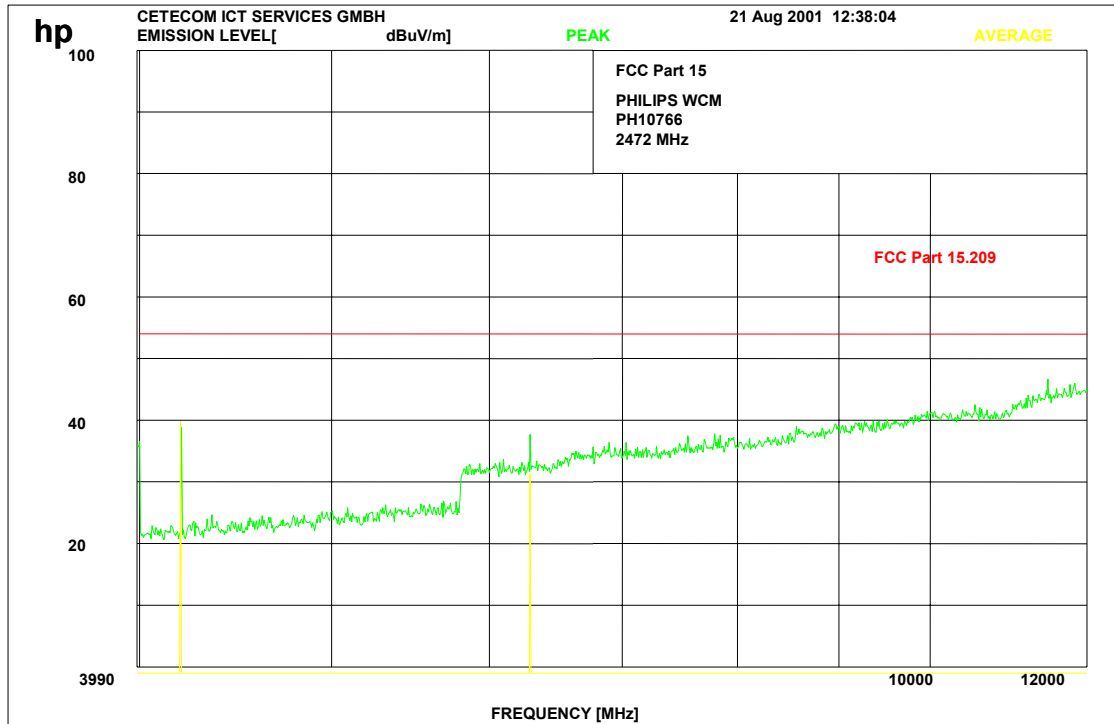
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## 2472 MHz up to 12 GHz radiated



### LIMITS

### SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

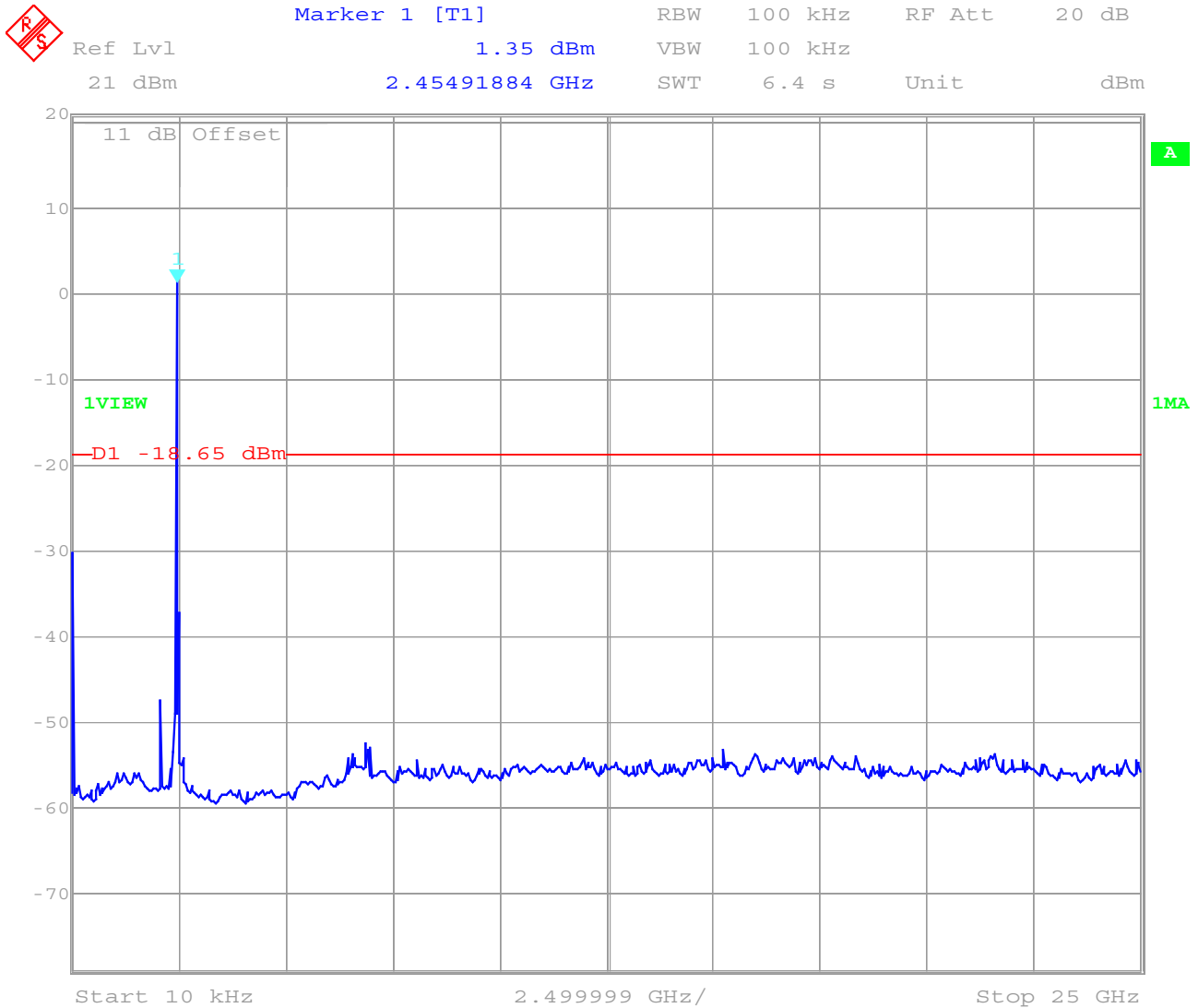
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

2472 MHz conducted up to 25 GHz



Date: 22.AUG.2001 08:03:30

**LIMITS**

**SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
 (for reference numbers see test equipment listing)



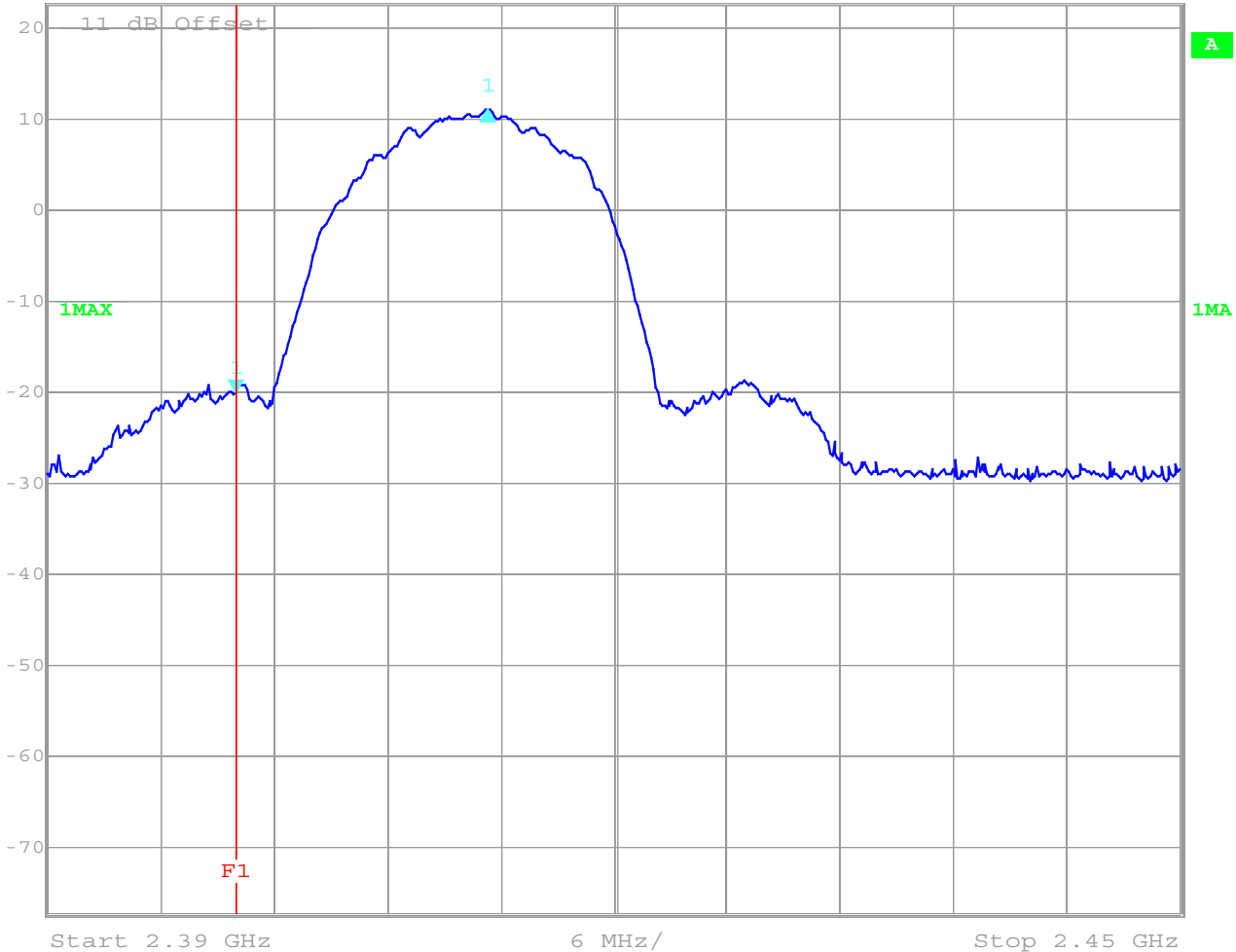
Equipment under test : PH10766  
 Ambient temperature : 23°C  
 Relative humidity : 45%

Band-edge compliance of conducted emissions

§15.247 (c)



	Delta 1 [T1]	RBW	1 MHz	RF Att	40 dB
Ref Lvl	31.02 dB	VBW	1 MHz		
22.7 dBm	13.34669339 MHz	SWT	5 ms	Unit	dBm



Date: 22.AUG.2001 08:28:16

LIMITS

SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power.

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
 (for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

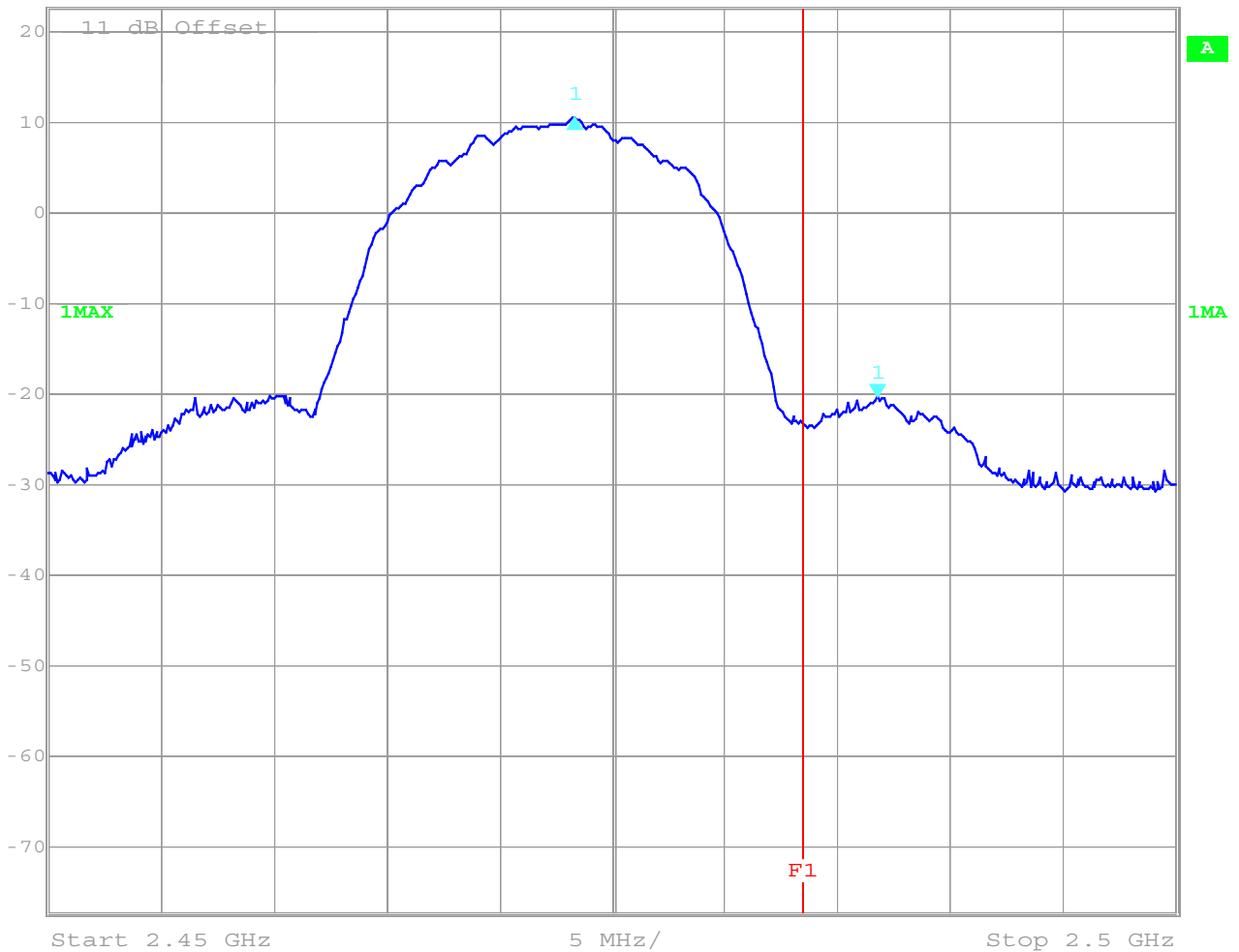
Relative humidity : 45%

Band-edge compliance of conducted emissions

§15.247 (c)



	Delta 1 [T1]	RBW	1 MHz	RF Att	40 dB
Ref Lvl	30.76 dB	VBW	1 MHz		
22.7 dBm	-13.42685371 MHz	SWT	5 ms	Unit	dBm



Date: 22.AUG.2001 08:29:32

**LIMITS**

**SUBCLAUSE § 15.247 (c)**

**In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power.**

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
 (for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

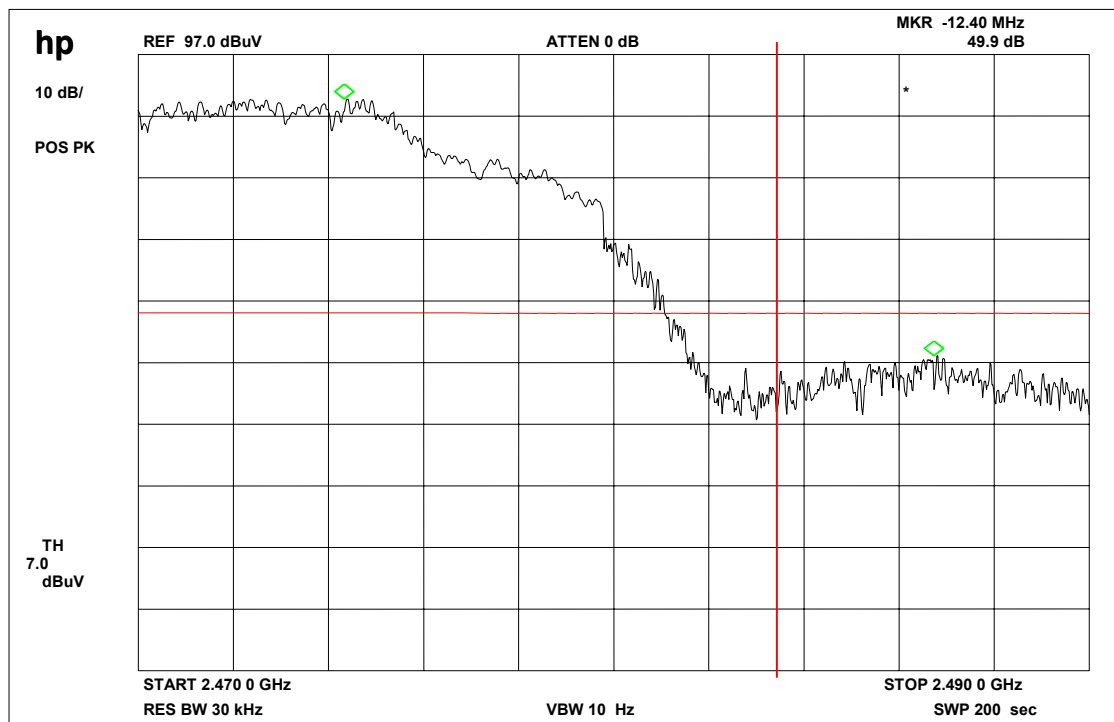
Relative humidity : 45%

Band-edge compliance of conducted emissions

§15.247 (c)

**Spurious radiations in the restricted band 2483.5 to 2500 MHz**

**Average**



**LIMITS**

**SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**

(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

**POWER SPECTRAL DENSITY**

**SUBCLAUSE § 15.247 (d)**

TEST CONDITIONS		RF POWER LEVEL IN 3 kHz BW		
		2412	2442	2472
Frequency (MHz)				
T <sub>nom</sub> ( 23 )°C	V <sub>nom</sub> (3.3)V	-21,3	-20,31	-20,96
Maximum deviation from output power under extreme test conditions (dBc)		--	--	--
Measurement uncertainty		±3dB		

The measurement was performed with RBW 3 kHz, VBW 10 kHz, Span 1.5 MHz, Sweep 500 sec.

**LIMIT**

**SUBCLAUSE §15.247(d)**

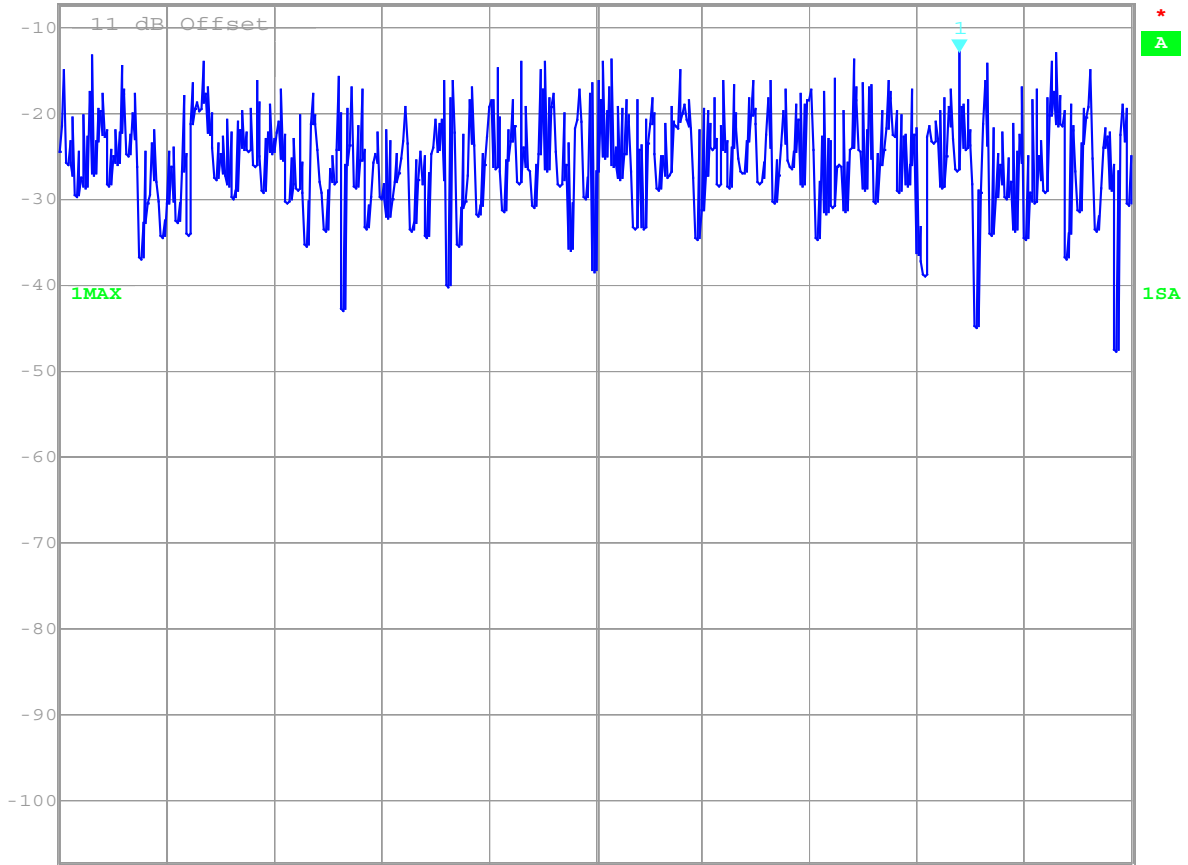
The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band

Equipment under test : PH10766  
 Ambient temperature : 23°C  
 Relative humidity : 45%

**POWER SPECTRAL DENSITY**  
**2412 MHz**

**SUBCLAUSE § 15.247 (d)**

	Marker 1 [T1 NOI]	RBW	3 kHz	RF Att	10 dB
	Ref Lvl	-56.10 dBm/Hz	VBW	10 kHz	
	-7.3 dBm	2.41096643 GHz	SWT	500 s	Unit dBm



Center 2.410456914 GHz 150 kHz/ Span 1.5 MHz

Date: 22.AUG.2001 08:56:53

to convert dBm/ Hz to dBm/3kHz add 34,8 dB

**LIMIT**

**SUBCLAUSE §15.247(d)**

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
 (for reference numbers see test equipment listing)

Equipment under test : PH10766

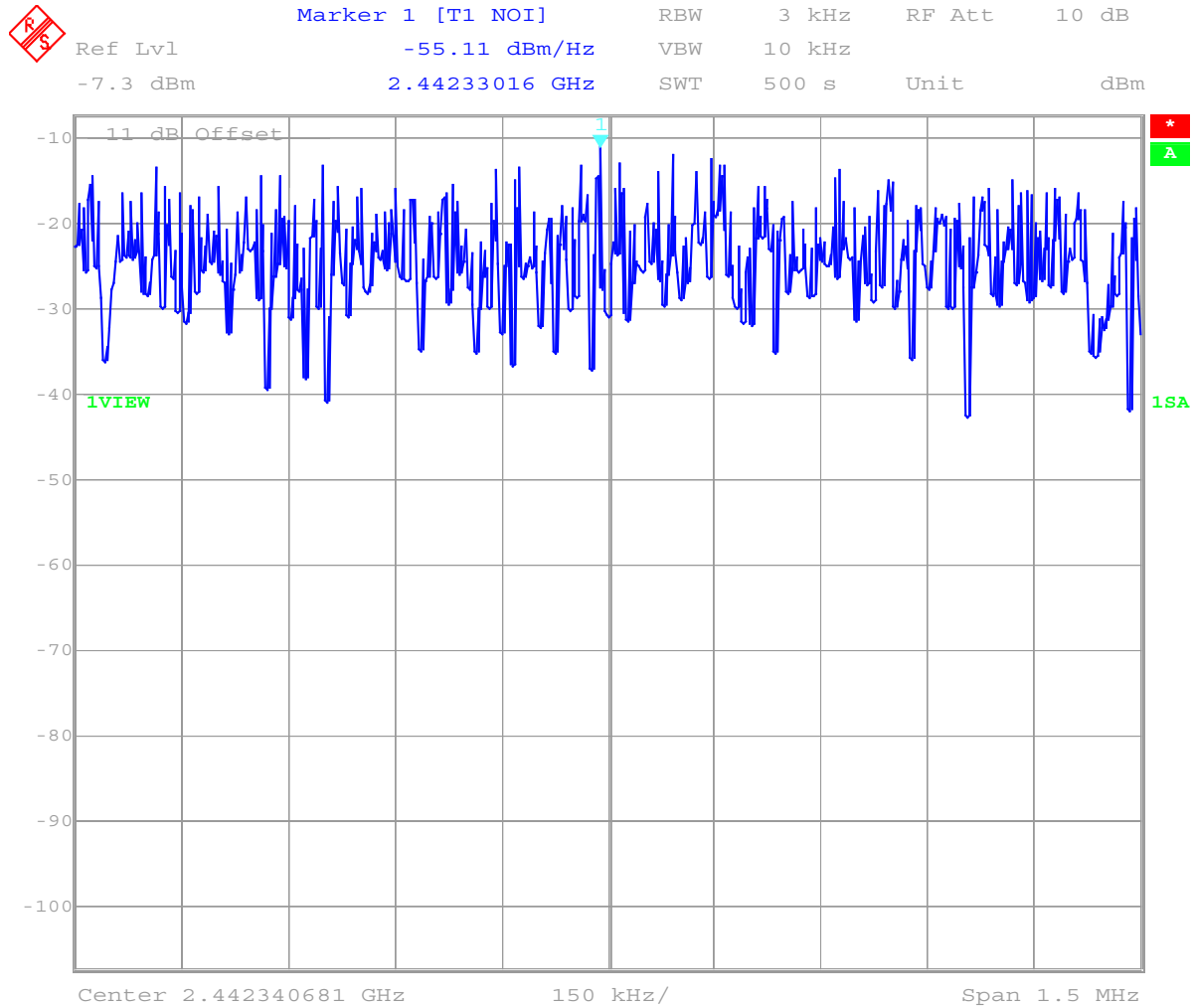
Ambient temperature : 23°C

Relative humidity : 45%

2442 MHz

POWER SPECTRAL DENSITY

SUBCLAUSE § 15.247 (d)



Date: 22.AUG.2001 08:48:45

to convert dBm/ Hz to dBm/3kHz add 34,8 dB

LIMIT

SUBCLAUSE §15.247(d)

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

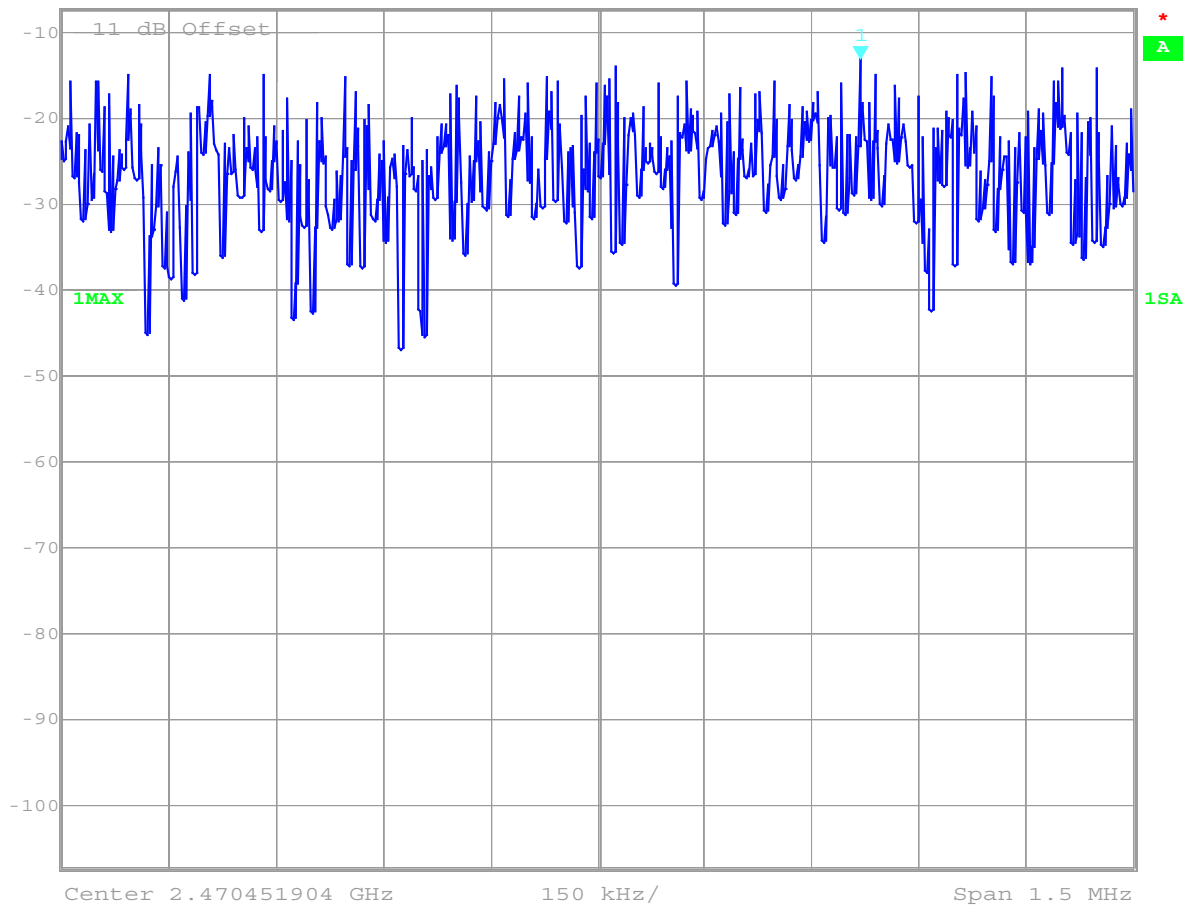
Relative humidity : 45%

## POWER SPECTRAL DENSITY

## SUBCLAUSE § 15.247 (d)

2472 MHz

	Marker 1 [T1 NOI]	RBW	3 kHz	RF Att	10 dB
	Ref Lvl	-55.76 dBm/Hz	VBW	10 kHz	
	-7.3 dBm	2.47082014 GHz	SWT	500 s	Unit dBm



Date: 22.AUG.2001 08:41:32

to convert dBm/ Hz to dBm/3kHz add 34,8 dB

**LIMIT**

**SUBCLAUSE §15.247(d)**

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## PROCESSING GAIN OF DSSS SYSTEMS SUBCLAUSE §15.247 (e)

The processing gain of this product:

For 11 Mbit/s :  $18 \text{ dB} + (-7,1)+2 = 12,9 \text{ dB}$

For 5,5 Mbit/s :  $15 \text{ dB} + (-3,2)+2 = 13,8 \text{ dB}$

For 2 Mbit/s :  $15 \text{ dB} + (-3,6)+2 = 13,4 \text{ dB}$

For 1 Mbit/s :  $13 \text{ dB} + (-1,3)+2 = 13,7 \text{ dB}$

See additional CETECOM ICT Services GmbH test report no.: 2\_2592-4-C/01



Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## RECEIVER SPURIOUS RADIATION

§ 15.209

### Radiated

SPURIOUS EMISSIONS LEVEL (dB $\mu$ V/m)								
2412 MHz			2442 MHz			2472 MHz		
f (MHz)	Detector	Level dB $\mu$ V/m	f (MHz)	Detector	Level ( $\mu$ V/m)	f (MHz)	Detector	Level ( $\mu$ V/m)
42.03	QP	32.6	42.03	QP	33.5	42.03	QP	43.5
81.32	QP	29.0	81.32	QP	29.2	81.71	QP	43.5
101.32	QP	27.6	101.32	QP	27.7	101.32	QP	46.0
167.63	QP	31.7	167.63	QP	31.6	168.45	QP	46.0
186.66	QP	27.8	186.66	QP	27.9	187.58	QP	46.0
2067.7	AV	43.8	2067.7	AV	46.3	2098.2	AV	54.0
4078.8	AV	30.12	40135.4	AV	35.4	4197.1	AV	39.8
Measurement uncertainty			±3 dB					

All spurious including such in restricted bands are below the limits.

Measurement distance see table

### Limits

SUBCLAUSE § 15.209

Frequency (MHz)	Field strength (dB $\mu$ V/m)	Measurement distance (m)
30 - 88	40	3
88 - 216	43.5	3
216 - 960	46	3
above 960	54	3

### REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

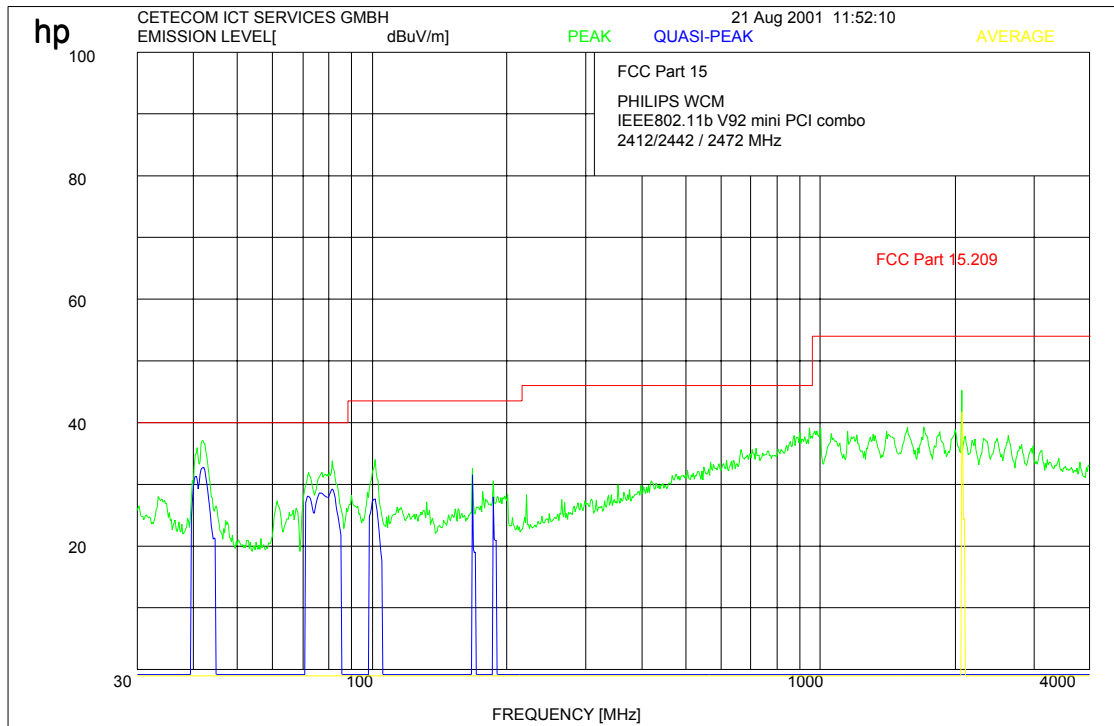
Relative humidity : 45%

## RECEIVER SPURIOUS RADIATION

§ 15.209

### up to 4 GHz

The following plots are valid for all three measured frequencies.



This is only a scan:

Measurements were performed with a CISPR quasi peak adapter and 100/120 kHz BW up to 1 GHz ( blue lines), higher frequencies with average (yellow lines) and peak (green lines) and RBW/VBW 1MHz.

### Limits

### SUBCLAUSE § 15.209

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

### REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

17 - 24

Equipment under test : PH10766

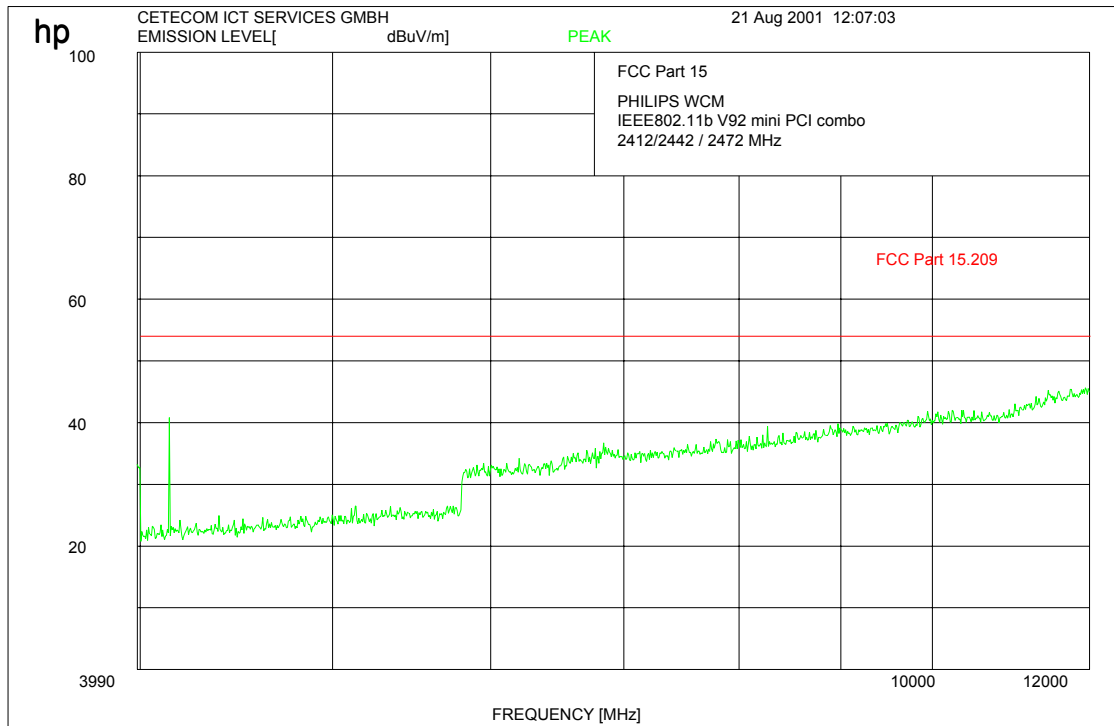
Ambient temperature : 23°C

Relative humidity : 45%

## RECEIVER SPURIOUS RADIATION

§ 15.209

### up to 12 GHz



The measurements were performed up to 25 GHz. There were no peaks found.

Measurements were performed with RBW/VBW 1 MHz.

### Limits

### SUBCLAUSE § 15.209

Frequency (MHz)	Field strength ( $\mu\text{V/m}$ )	Measurement distance (m)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

### REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## RECEIVER SPURIOUS EMISSIONS conducted

§ 15.209

2412 MHz



Marker 3 [T1]

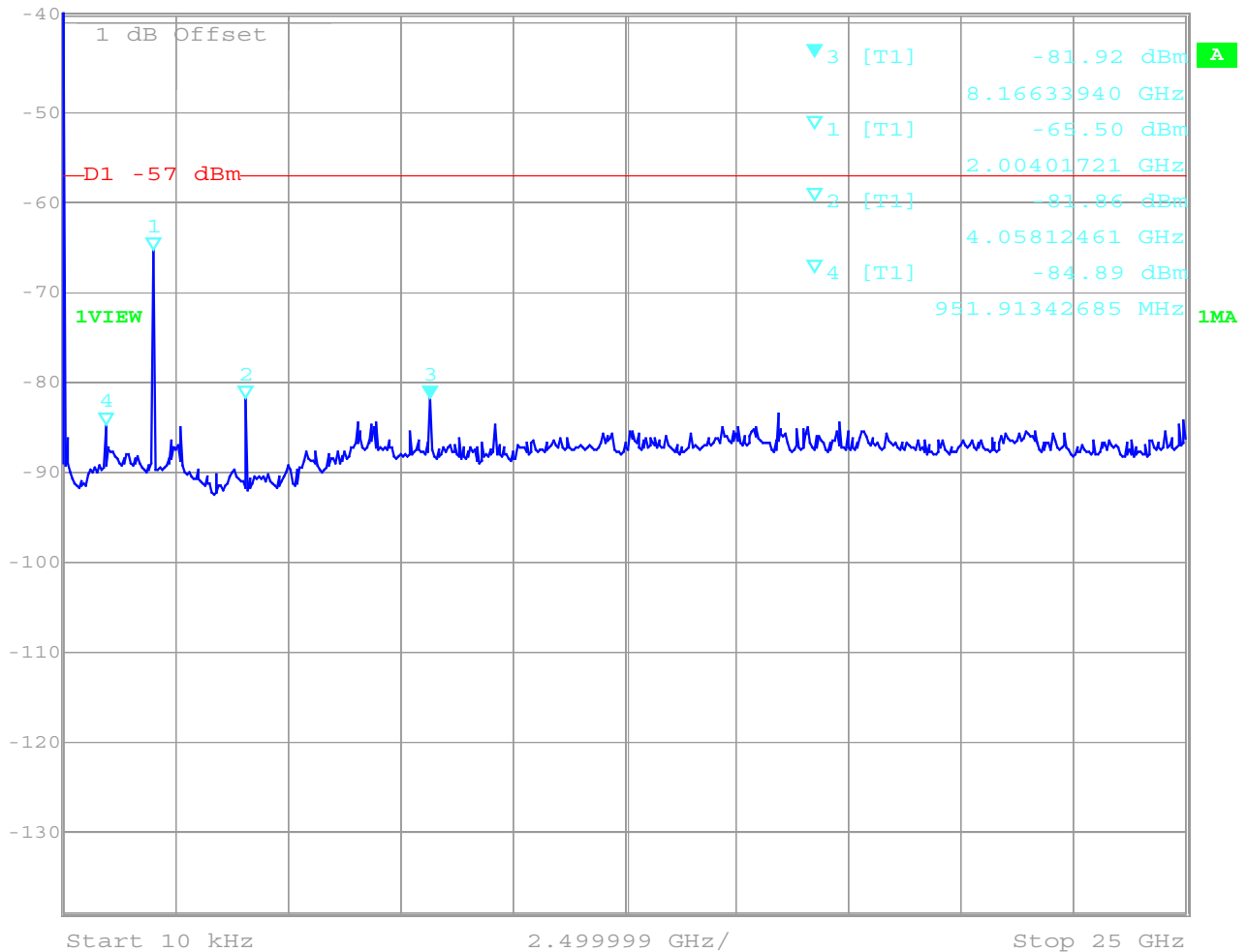
RBW 100 kHz RF Att 0 dB

Ref Lvl -81.92 dBm

VBW 100 kHz

-39 dBm 8.16633940 GHz

SWT 6.4 s Unit dBm



Date: 22.AUG.2001 08:09:40

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

Relative humidity : 45%

## RECEIVER SPURIOUS EMISSIONS conducted

§ 15.209

2442 MHz



Marker 4 [T1]

RBW 100 kHz RF Att 0 dB

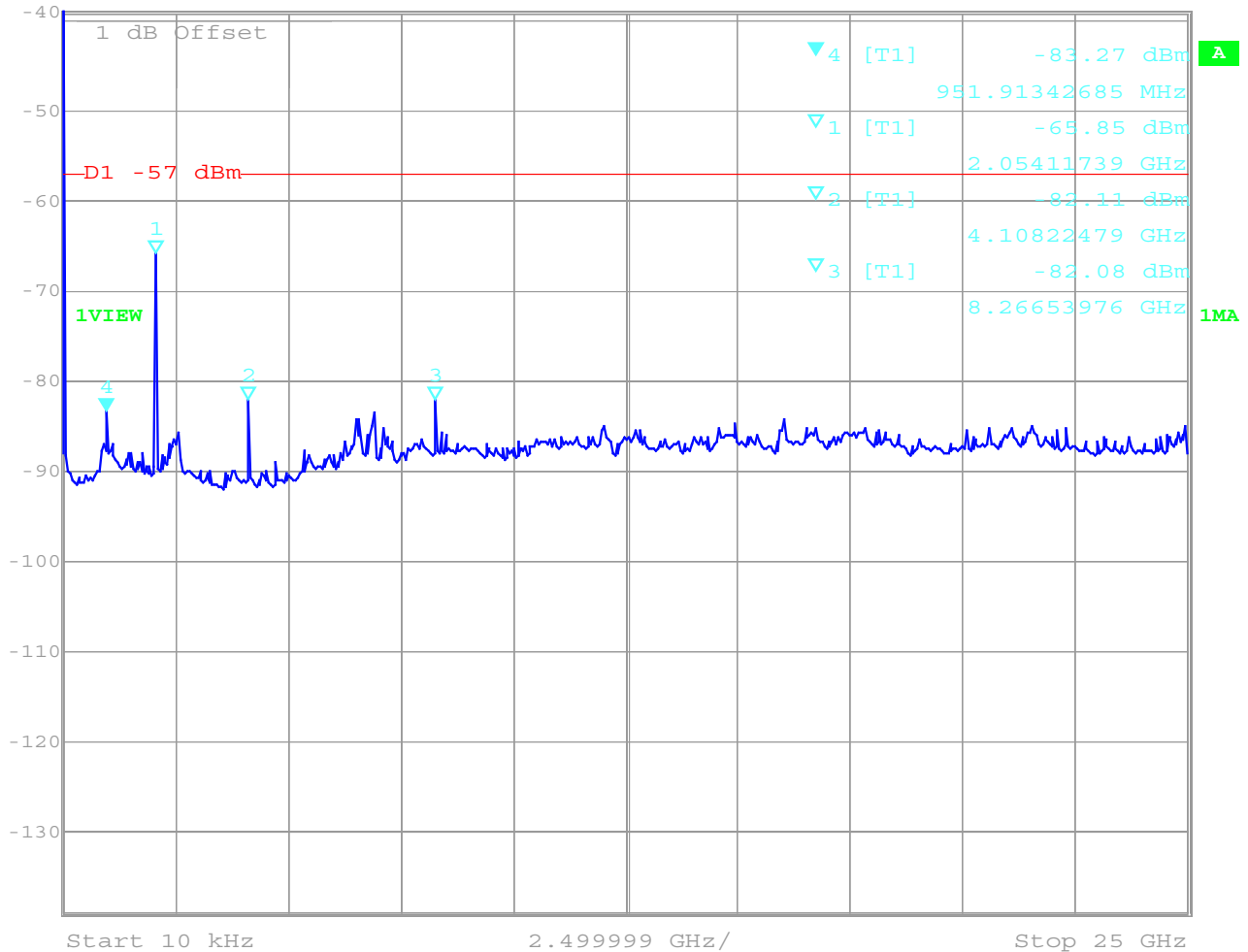
Ref Lvl -39 dBm -83.27 dBm

VBW 100 kHz

951.91342685 MHz

SWT 6.4 s

Unit dBm



Date: 22.AUG.2001 08:08:47

### REFERENCE NUMBER(S) OF TEST EQUIPMENT USED

(for reference numbers see test equipment listing)

Equipment under test : PH10766

Ambient temperature : 23°C

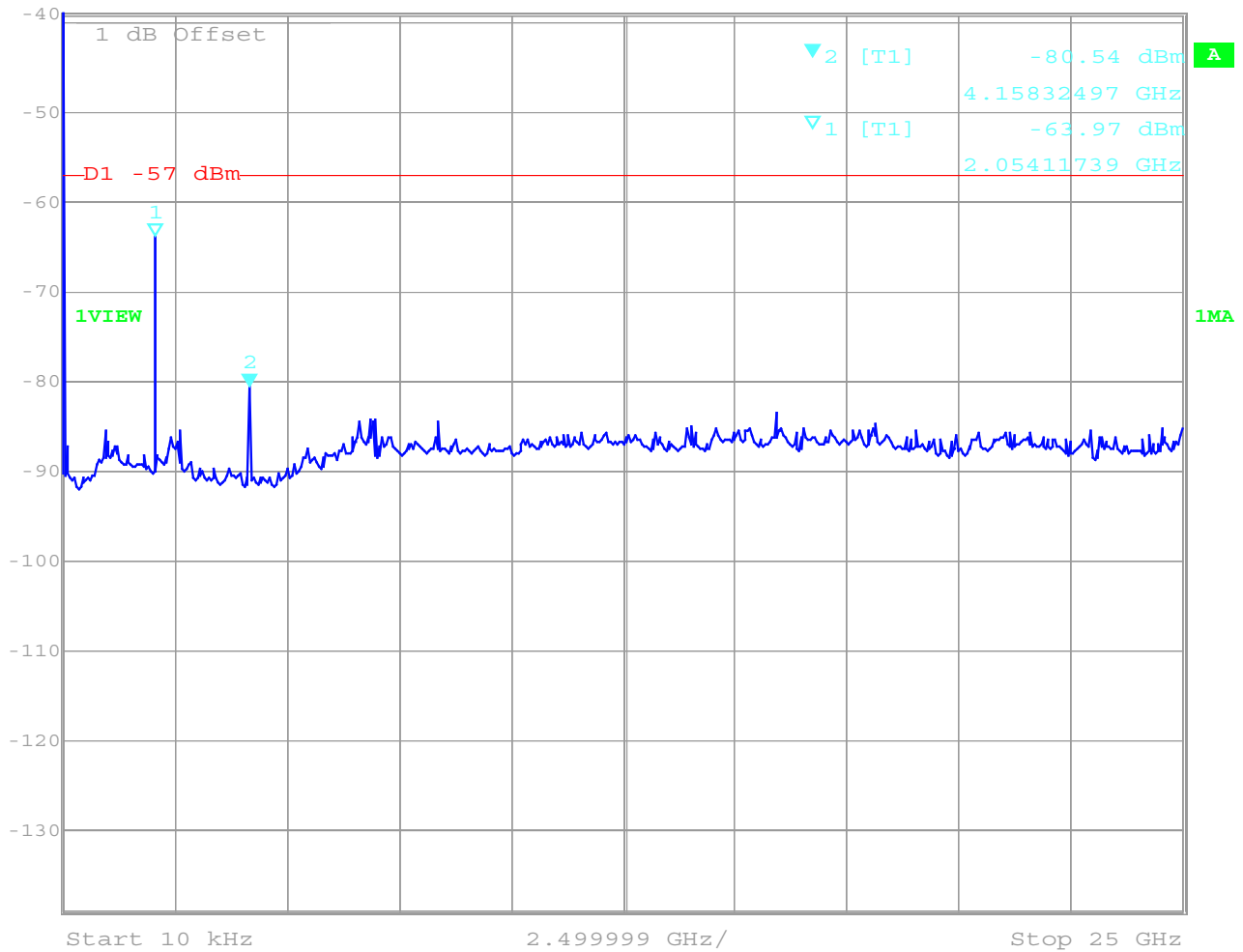
Relative humidity : 45%

## RECEIVER SPURIOUS EMISSIONS conducted

§ 15.209

2472 MHz

	Ref Lvl	Marker 2 [T1]	RBW	100 kHz	RF Att	0 dB
	-39 dBm	-80.54 dBm	VBW	100 kHz		
		4.15832497 GHz	SWT	6.4 s	Unit	dBm



Date: 22.AUG.2001 08:06:47

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
 (for reference numbers see test equipment listing)

## CONDUCTED EMISSIONS

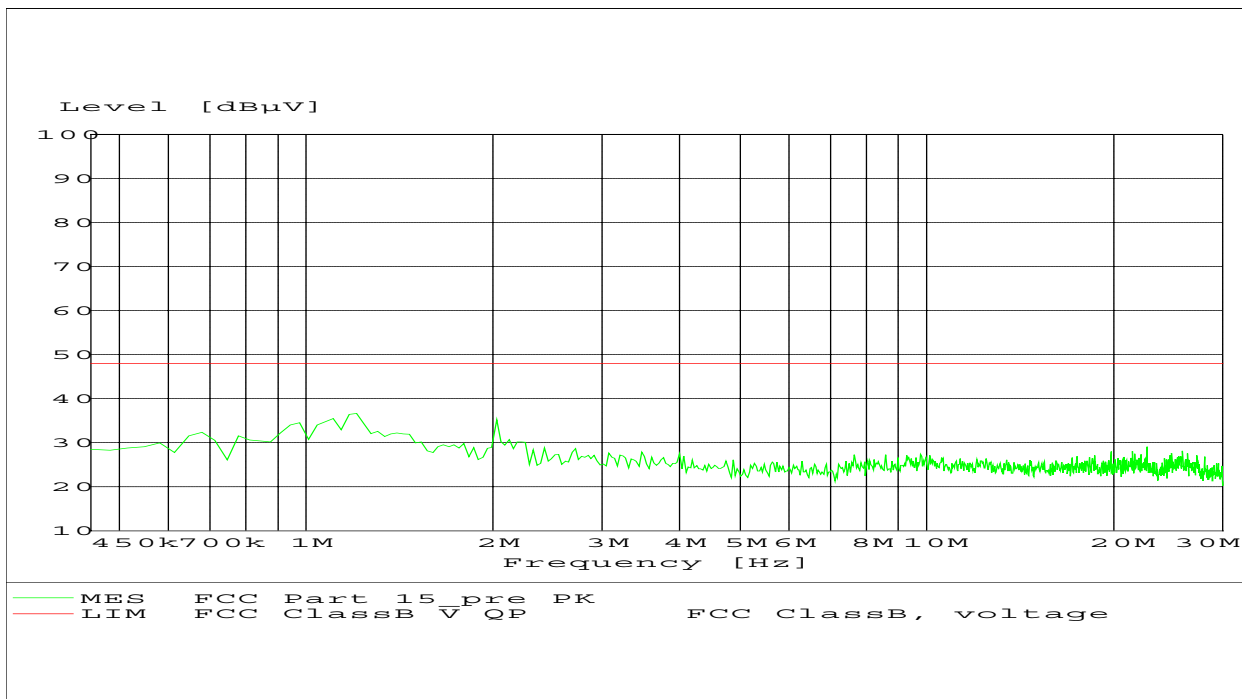
§ 15.107/207

EUT: PH10766  
 Applicant: ECCT  
 Operating condition: Line / N  
 Test Site: CETECOM ICT Services GmbH Saarbrücken, Room 006  
 Operator: Berg

Power Supply: 115V  
 Start of Test: 28.05.02 / 09:46:23

### SCANTABELLE: "FCC Part 15 AC"

Kurzbeschreibung:		Voltage Mains 1.60				
Start-	Stop-	Schritt-	Detektor	Meß-	ZF-	Transducer
Frequenz	Frequenz	weite		zeit	Bandbr.	
450.0 kHz	30.0 MHz	6.0 kHz	MaxPeak	100.0 ms	10 kHz	ESH3-Z5 L1 2209



## TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	8566 A	Hewlett-Packard	1925A00257
02	Analyzer Display	8566 A	Hewlett-Packard	1925A00860
03	Oscilloscope	7633	Tektronix	230054
04	Radio Analyzer	CMTA 54	Rohde & Schwarz	894 043/010
05	System Power Supply	6038 A	Hewlett-Packard	2848A07027
06	Signal Generator	8111 A	Hewlett-Packard	2215G00867
07	Signal Generator	8662 A	Hewlett-Packard	2224A01012
08	Funktionsgenerator	AFGU	Rohde & Schwarz	862 480/032
09	Regeltrenntrafo	MPL	Erfi	91350
10	Netznachbildung	NNLA 8120	Schwarzbeck	8120331
11	Relais-Matrix	PSU	Rohde & Schwarz	893 285/020
12	Power-Meter	436 A	Hewlett-Packard	2101A12378
13	Power-Sensor	8484 A	Hewlett-Packard	2237A10156
14	Power-Sensor	8482 A	Hewlett-Packard	2237A00616
15	Modulationsmeter	9008	Racal-Dana	2647
16	Frequenzzähler	5340 A	Hewlett-Packard	1532A03899
17	Absorber Schirmkabine	---	MWB	87400/002
18	Spectrum Analyzer	85660 B	Hewlett-Packard	2747A05306
19	Analyzer Display	85662 A	Hewlett-Packard	2816A16541
20	Quasi Peak Adapter	85650 A	Hewlett-Packard	2811A01131
21	RF-Preselector	85685 A	Hewlett-Packard	2833A00768
22	Biconical Antenne	3104	Emco	3758
23	Log. Per. Antenne	3146	Emco	2130
24	Double Ridge Horn	3115	Emco	3088
25	EMI-Testreceiver	ESAI	Rohde & Schwarz	863 180/013
26	EMI-Analyzer-Display	ESAI-D	Rohde & Schwarz	862 771/008
27	Biconical Antenne	HK 116	Rohde & Schwarz	888 945/013
28	Log. Per. Antenne	HL 223	Rohde & Schwarz	825 584/002
29	Relais-Switch-Unit	RSU	Rohde & Schwarz	375 339/002
30	Highpass	HM985955	FSY Microwave	001
31	Amplifier	P42-GA29	Tron-Tech	B 23602
32	Absorber Schirmkabine		Frankonia	
33	Steuerrechner	PSM 7	Rohde & Schwarz	834 621/004
34	EMI Test Reciever	ESMI	Rohde & Schwarz	827 063/010
35	EMI Test Receiver	Display	Rohde & Schwarz	829 808/010



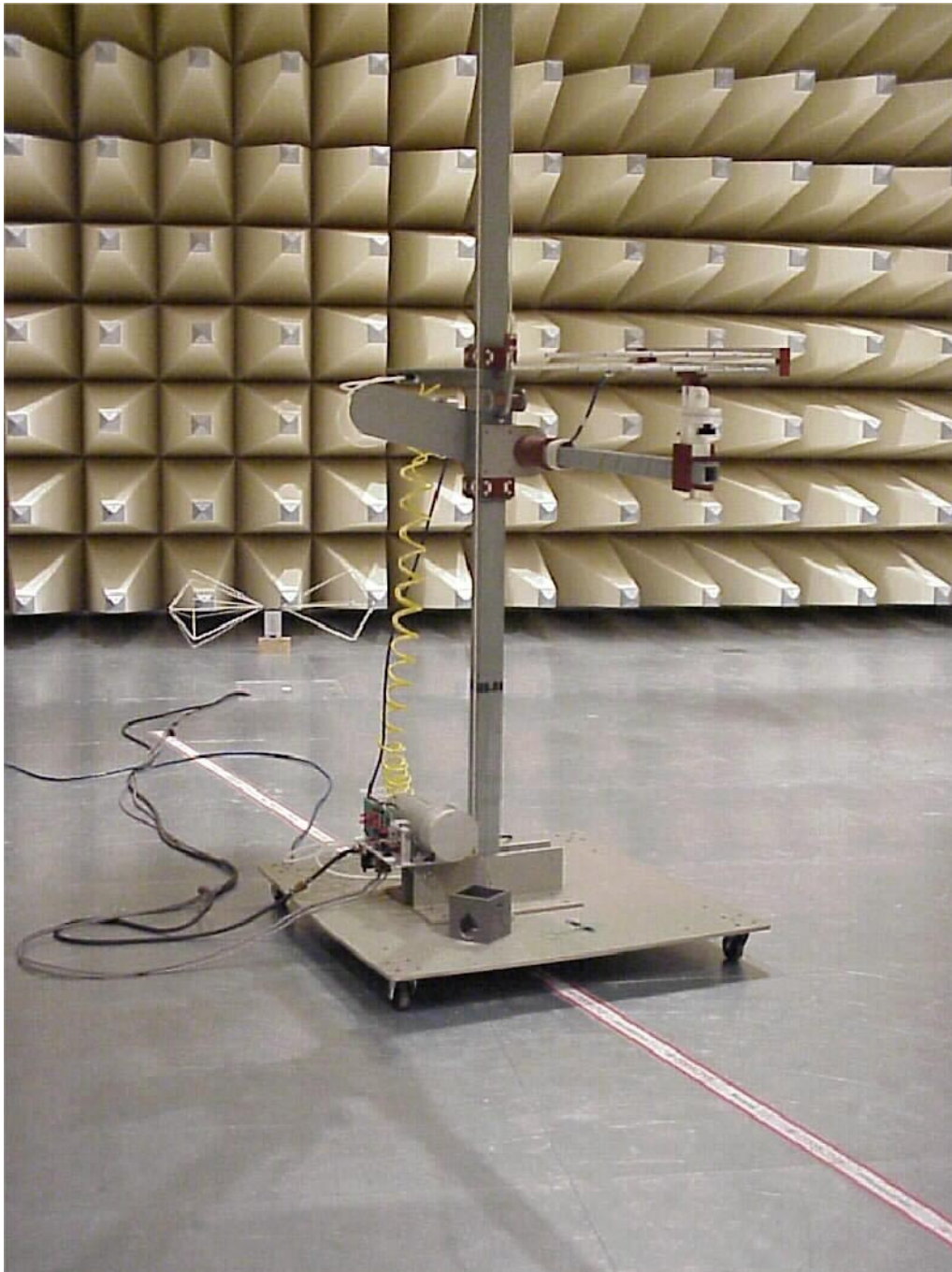
## TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
36	Controler	HD 100	Deisel	100/322/93
37	Relais Matrix	PSN	Rohde & Schwarz	829 065/003
38	Control Unit	GB 016 A2	Rohde & Schwarz	344 122/008
39	Relais Switch Unit	RSU	Rohde & Schwarz	316 790/001
40	Power Supply	6032A	Hewlett Packard	2846A04063
41	Spektrum Monitor	EZM	Rohde & Schwarz	883 720/006
42	Meßempfänger	ESH 3	Rohde & Schwarz	890 174/002
43	Meßempfänger	ESVP	Rohde & Schwarz	891 752/005
44	Biconi Ant. 20-300MHz	HK 116	Rohde & Schwarz	833 162/011
45	Logper Ant. 0.3-1 GHz	HL 223	Rohde & Schwarz	832 914/010
46	Amplifier 0.1-4 GHz	AFS4	Miteq Inc.	206461
47	Logper Ant. 1-18 GHz	HL 024 A2	Rohde & Schwarz	342 662/002
48	Polarisationsnetzwerk	HL 024 Z1	Rohde & Schwarz	341 570/002
49	Double Ridge G Horn Antenne 1-26.5 GHz	3115	EMCO	9107-3696
50	Microw. Sys. Amplifier 0.5- 26.5 GHz	8317A	Hewlett Packard	3123A00105
51	Audio Analyzer	UPD	Rohde & Schwarz	1030.7500.04
52	Steuerrechner	PSM 7	Rohde & Schwarz	883 086/026
53	DC V-Netzwerk	ESH3-Z6	Rohde & Schwarz	861 406/005
54	DC V-Netzwerk	ESH3-Z6	Rohde & Schwarz	893 689/012
55	AC 2 Phasen V-Netzwerk	ESH3-Z5	Rohde & Schwarz	861 189/014
56	AC 2 Phasen V-Netzwerk	ESH3-Z5	Rohde & Schwarz	894 981/019
57	AC-3 Phasen V-Netzwerk	ESH2-Z5	Rohde & Schwarz	882 394/007
58	Stromversorgung	6032A	Rohde & Schwarz	2933A05441
59	HF-Test Empfänger	ESVP.52	Rohde & Schwarz	881 487/021
60	Spectrum Monitor	EZM	Rohde & Schwarz	883 086/026
61	HF-Test Empfänger	ESH3	Rohde & Schwarz	881 515/002
62	Relais Matrix	PSU	Rohde & Schwarz	882 943/029
63	Relais Matrix	PSU	Rohde & Schwarz	828 628/007
64	Spectrum Analyzer	FSIQ 26	Rohde & Schwarz	119.6001.27
67				

Test site  
RADIATED EMISSIONS

Picture 1:



Photographs of the equipment

PH10754

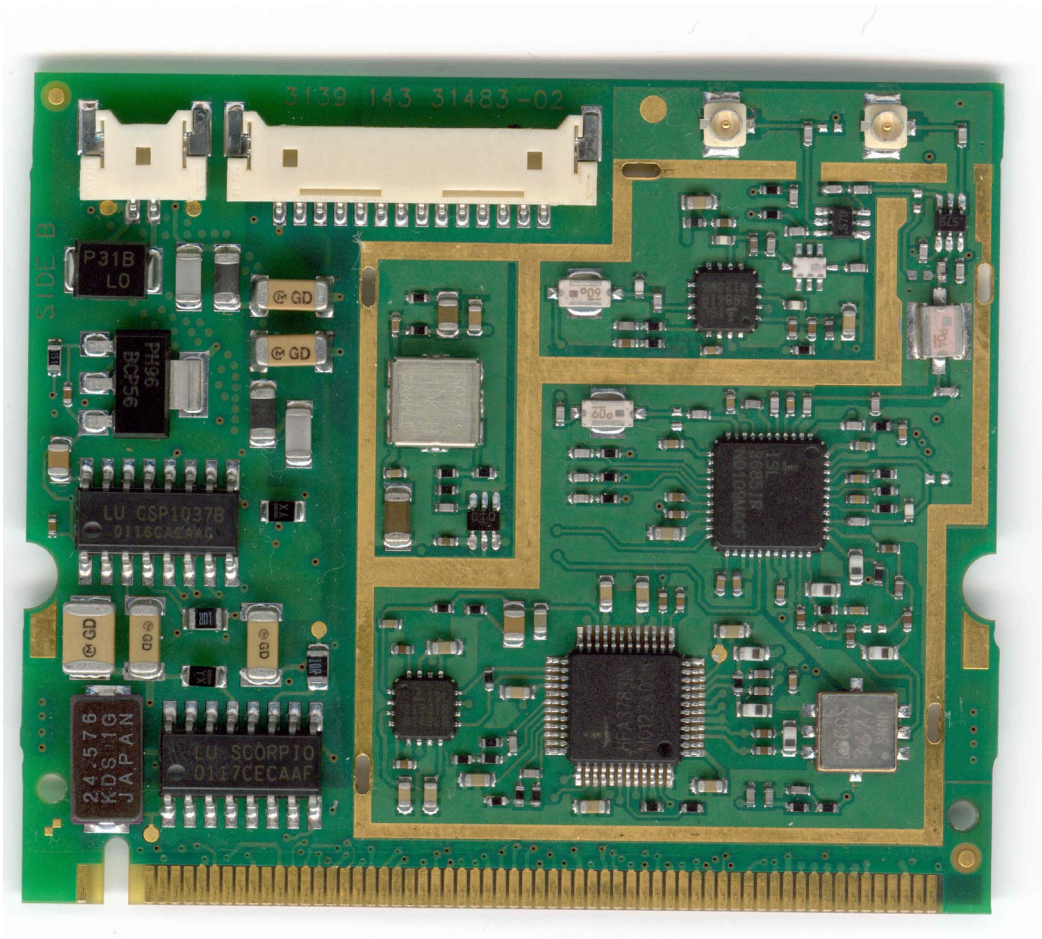






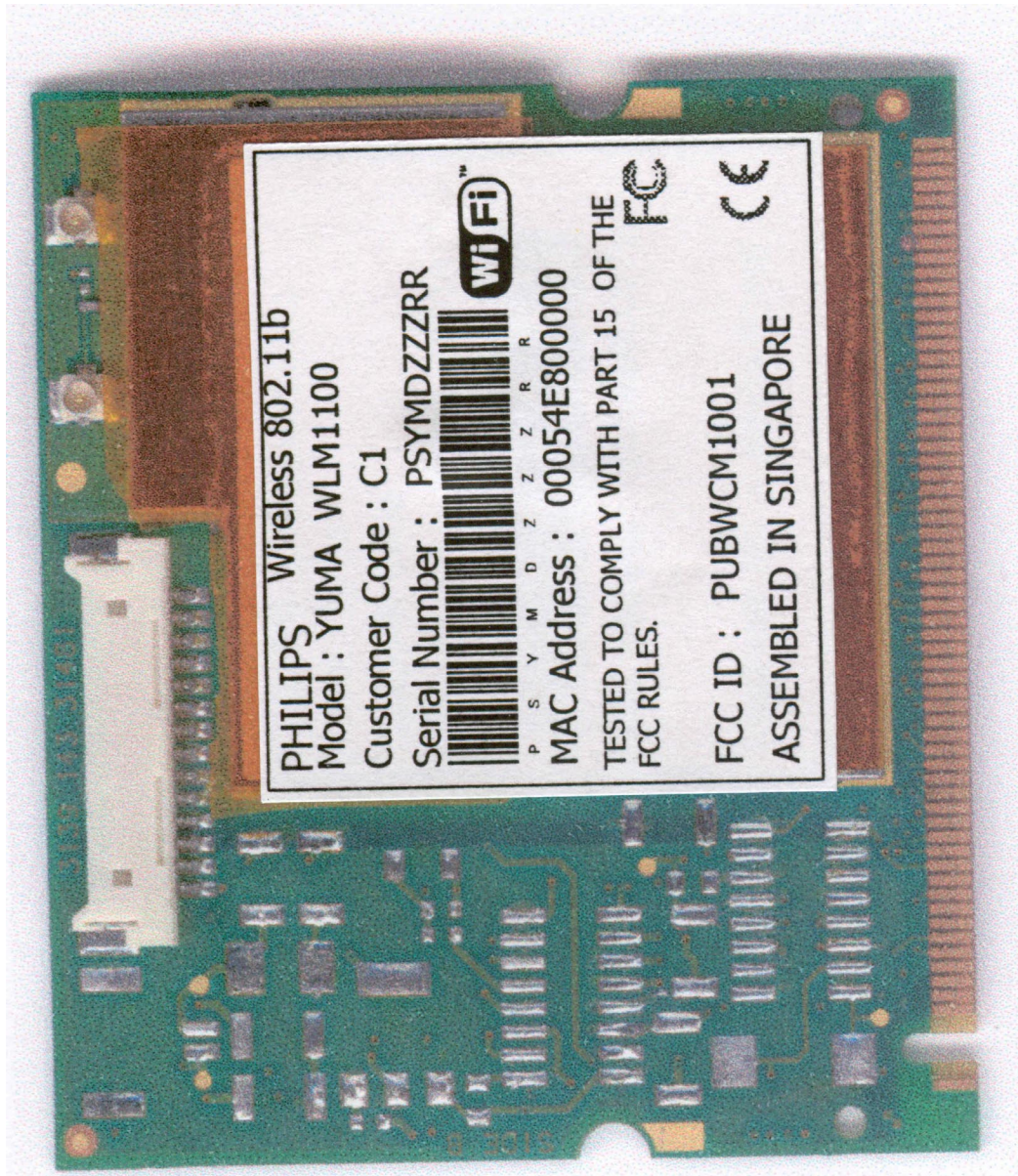
Photographs of the equipment

PH10754



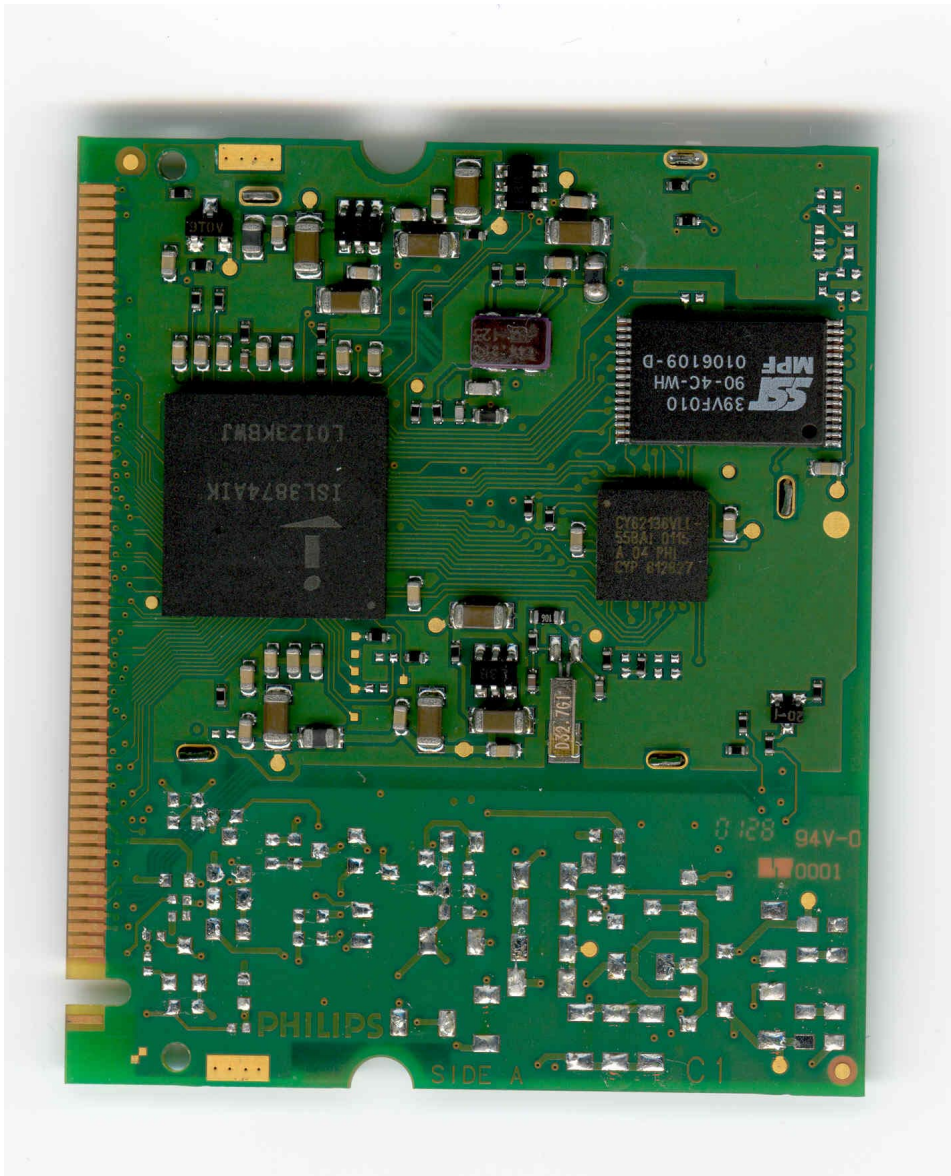


Photographs of the equipment  
PH10766



Photographs of the equipment

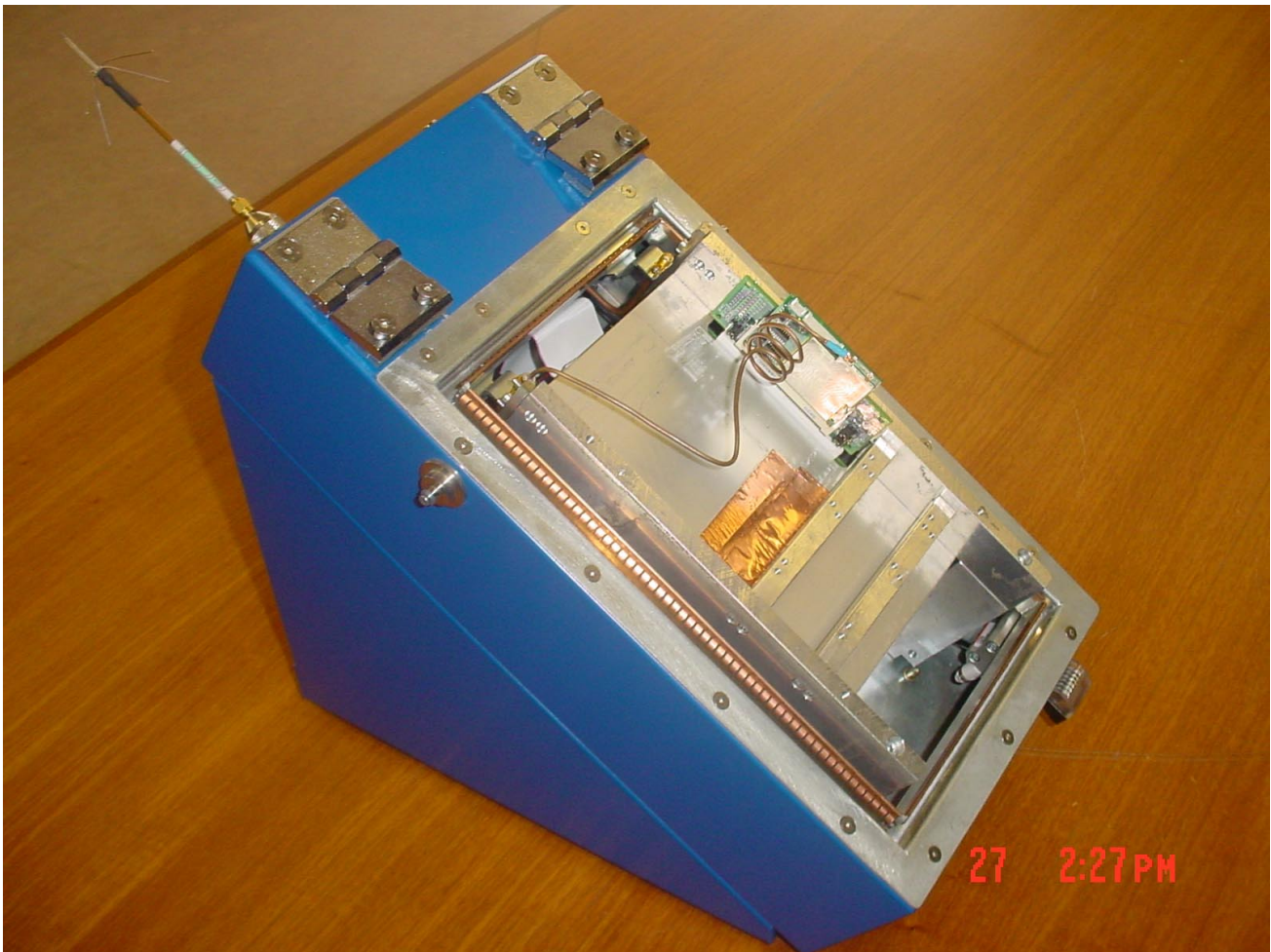
PH10766





Photographs of the equipment

Test fixture

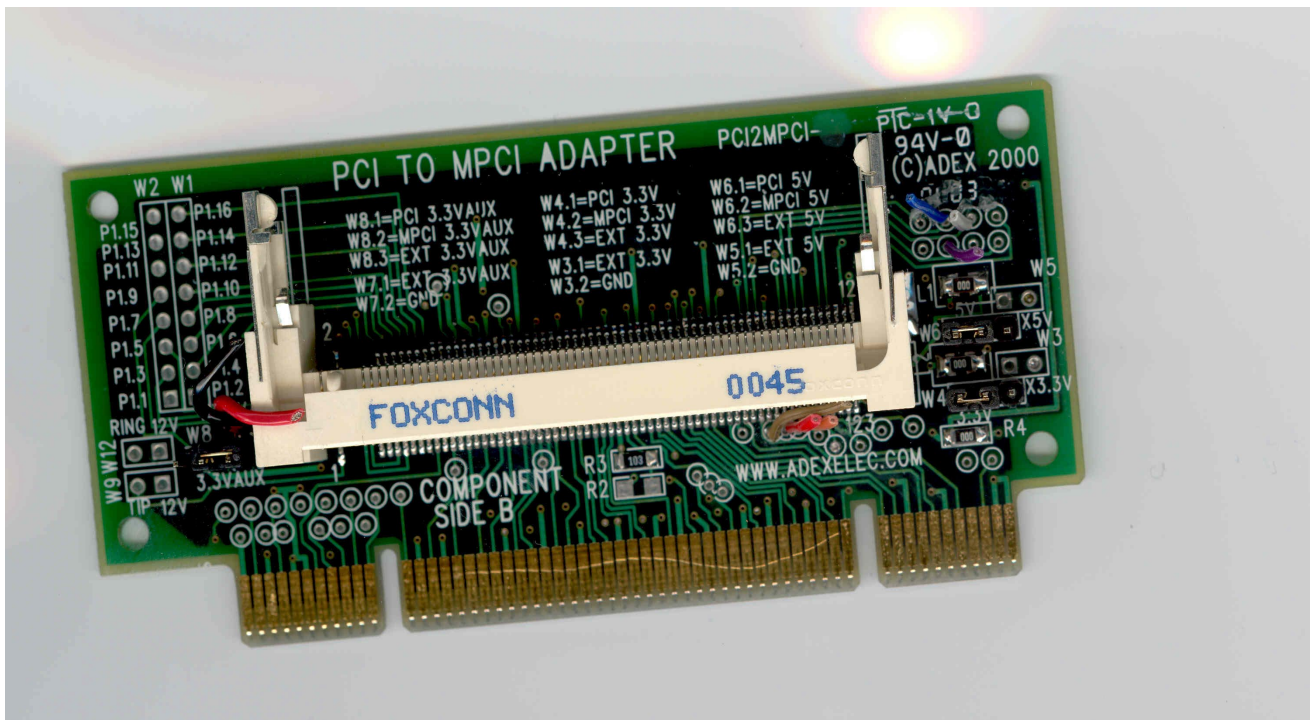


Photograph shows the test fixture with the plugged mini PCI Card.

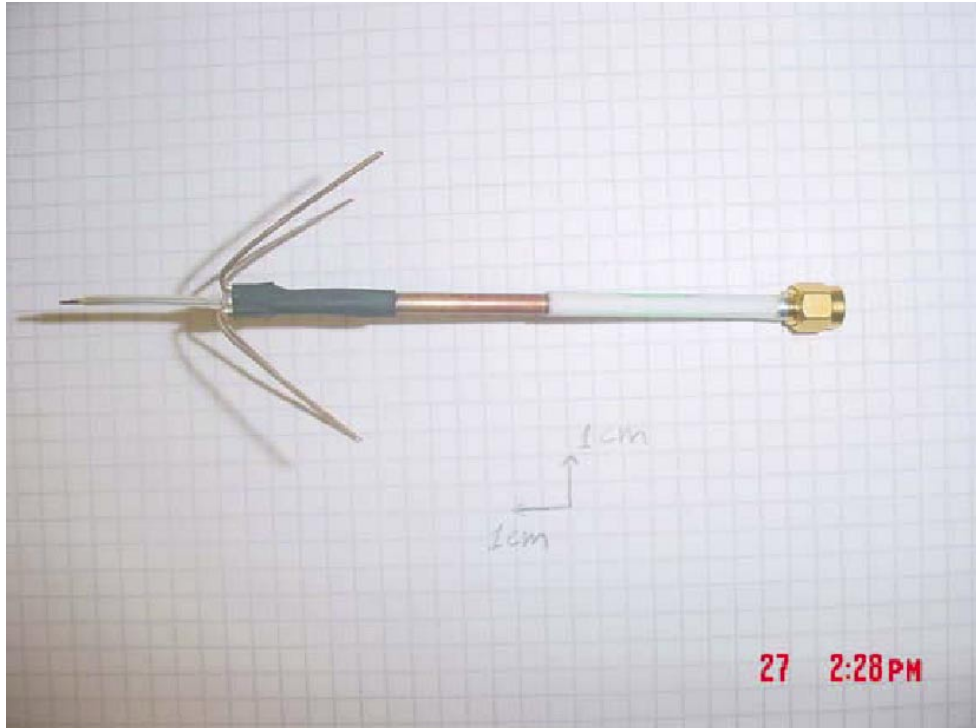


Photographs of the equipment

Photograph shows the used PCI / mini PCI adapter



**Photographs of the equipment**



The photographs shows the used antenna for the radiated measurements .