# TEST REPORT OF A 2.4 GHz RLAN PCMCIA CARD, BRAND GEMTEK, MODEL NUMBER WL 211P, IN CONFORMITY WITH FCC PART 15 AND ANSI C63.4-1992

FCC report layout endorsed by the FCC by Public Notice of March 11, 1992.

| | | |
|---|---|---|
| Accredited by | : | STERLAB accreditation number L029<br>D.A.R., TTI-P-G.127/96-00 |
| Competent body | : | Article 10-2 EMC Directive |
| Notified body | : | Article 10-5 EMC Directive<br>Low Voltage Directive<br>Number 0122 TTE Directive |
| Designated laboratory | : | TTE Directive |
| Notified test service | : | Automotive Directive |
| FCC listed | : | 31040/SIT |
| VCCI listed | : | R 592 and C 507 |
| Certification body | : | Electrical Products Safety Regulation Hong Kong |

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NMi International B.V. (27239176)

# MEASUREMENT/TECHNICAL REPORT

## GemTek

## Modelnumber : WL-211P

## FCC ID: MXF WL211P

August 10, 2000

| | | |
|---|---|---|
| This report concerns (check one): | Original grant | ~~Class II change~~ |
| Equipment type: Direct Sequence Spread Spectrum Transceiver | | |
| Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? | ~~Yes~~ | no |
| If yes defer until: | _____ | |
| GemTek Technology Co., Ltd, No. 1, Jen Ai Road, Hsinchu Industrial Park, Hukuo Hsiang, Hsinchu Hsien, Taiwan, R.O.C. agrees to notify the Commission by _____ of the intended date of announcement of the product so that the grant can be issued on that date. | | |
| Transition Rules Request per 15.37 | ~~yes~~ | no |
| If no, assumed Part 15, Subpart B for unintentional radiators – the new 47 CFR (10-1-90 Edition) provision. | | |
| Report prepared by: | Name | : D. S. Sariredjo BSc. E.E. |
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| | Country | : The Netherlands |

The data taken for this test and report herein was done in accordance with FCC Part 15 and measurement Procedures of ANSI C63.4-1992 and were relevant the procedures as specified in the sheets from the FCC attached to this test report. NMi Certin B.V. at Niekerk, The Netherlands, certifies that the data is accurate and contains a true representation of the emission-profile of the Equipment Under Test (EUT) on the date of the test noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: August 10, 2000 Signature:

P.A.J.M. Robbers BSc.EE
Department EMC and Telecommunication

NMi Certin B.V.

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# 1 General information.

## 1.1 Product description.

The GemTek 2.4 GHz Radio LAN PCMCIA card, type WL-211P (referred to as EUT in this report), functions as an extension of any Ethernet network. Portable PC's equipped with GemTek WL-211P PC Cards have full access to the enterprise network from anywhere in the facility where compatible Access Points are installed. It fits to any laptop PC that operates under Windows and provides access to the wireless LAN through a small integrated antenna. The GemTek WL-211P PC card features high-speed wireless connection, up to 11 Mbps and supports full mobility and seamless roaming from cell to cell (handover). The air interface is interoperable with IEEE 802.11.

The EUT is powered from the PCMCIA slot of a Laptop/Notebook Personal Computer host and has no external power supply.

## 1.2 Related Submittal(s)/Grant(s).

Not applicable.

## 1.3 Tested System Details.

The FCC ID's for all equipment, plus descriptions of all cables used in the tested system (included inserted cards, which have Grants) are:

| Model | Serial # | FCC ID | Description | Cable Descriptions |
|---|---|---|---|---|
| **EUT:** GemTek WL-211P | n.a. | MXF WL211P | PCMCIA 2.4 GHz RLAN card | direct connection with laptop PC via PCMCIA slot |
| MS InPort Mouse | n.a. | C3K7PN9937 | Serial PC mouse | serial cable to serial PC port |
| IBM Thinkpad type 2644 | #553782N | n.a. | Laptop/Notebook PC | power cord to adapter<br>serial cable to PC mouse<br>printer cable to HP printer |
| HP Deskjet 500 | #3228S37407 | B94C2106X | Printer | printer cable to Laptop PC<br>power cord to adapter |

## 1.4 Test Methodology.

The test methodology used has been based on the requirements of FCC Part 15, (10-1-97 edition), relevant clauses 15.205, 15.207, 15.209 and 15.247,. The used measuring methods are based on the ANSI C63.4-1992 document.
Radiated tests above 30 MHz were performed at a distance of 3 meter. Below 30 MHz the measurement was carried out on a distance of 10 meter. The eventual found results will be calculated to values for the required measuring distance of 30/300 meter.
Fieldstrength measurements on frequencies above 1 GHz were measured with appropriate pre-amplifiers, antennas and a spectrum analyzer. On found frequencies the actual level at the input of the pre-amplifier was generated with aid of a signal generator. The output level of the signal generator was increased with the antenna-factor to obtain the fieldstrength.

## 1.5 Test Facility

The FCC has per Public Notice declared that the measurement facilities located at the NMi Certin B.V. Testsite Niekerk, Smidshornerweg 18, The Netherlands, has been reviewed and found to be in compliance with the requirements of section 2.948 (previously section 15.38) of the FCC rules per August 2, 1994.

The description of the measuring facilities have been filed with reference 31040/SIT, 1300B3 at the FCC's Offices.

## 1.6 List of measurement equipment.

| NMi number | Description | Brand | Type |
|---|---|---|---|
| 12471 | Biconical antenna 20MHz-200MHz | EATON | 94455-1 |
| 12473 | Log-per antenna 200-1000MHz | EATON | 96005 |
| 12475 | Loop antenna | EMCO | 6502/2 |
| 12476 | Antenna mast | EMCO | TR3 |
| 12477 | Antenna mast 1-4 mtr | Poelstra | -- |
| 12478 | Control unit / portable turn table | NMi | DFO |
| 12483 | Guidehorn | EMCO | 3115 |
| 12484 | Guidehorn | EMCO | 3115 |
| 12486 | Spectrum analyzer | Anritsu | MS2601A |
| 12488 | Guidehorn 18-26.5 GHz | EMCO | RA42-K-F-4B-C |
| 12491 | Measuring receiver 0.01Mhz-30MHz | R&S | ESH3 |
| 12492 | Measuring receiver 20MHz-1300MHz | R&S | ESVP- |
| 12493 | EZM Spectrum Monitor | R&S | EZM |
| 12494 | Measuring receiver 20MHz-1000 MHz | R&S | ESV- |
| 12497 | Spectrum analyzer | HP | 8592A |
| 12498 | Rejectfilter | K&L | 3TNF-100/200-N |
| 12499 | Rejectfilter | K&L | 3TNF-50/100-N |
| 12500 | Rejectfilter | K&L | 3TNF-250/500-N |
| 12501 | Rejectfilter | K&L | 3TNF-25/50-N |
| 12507 | Artificial mains network 3-phase | R&S | ESH2-Z5 |
| 12516 | Signalgenerator 100kHz-1000MHz | R&S | SMX |
| 12519 | RF amplifier | ENI | 603L |
| 12524 | Signalgenerator | R&S | SMHU |
| 12525 | POCSAG generator | NMi | SMF-3 |
| 12527 | Signalgenerator 100kHz-1000 MHz | R&S | SMG |
| 12528 | ERMES generator | NMi | -- |
| 12533 | Signalgenerator | MARCONI | 2032 |
| 12538 | Attenuator 100W/20dB | Bird electronic | 8340-200 |

| | | | |
|---|---|---|---|
| 12545 | Directional coupler | HP | HP778D |
| 12546 | Measuring cable to plateau | -- | RG 213 |
| 12548 | Meas.cable 2 metre, color:green | Radiall | R287571005 |
| 12549 | Oscilloscope 20 MHz | KENWOOD | CS-8010 |
| 12553 | Communication Analyzer | R&S | CMTA 84 |
| 12558 | Communication Analyzer | R&S | CMTA 54 |
| 12559 | Digital storage oscilloscope | Le Croy | 9310M |
| 12560 | DC Power Supply 20A/60V | DELTA | SM6020 |
| 12561 | DC Power Supply 20A/70V | DELTA | SM7020D |
| 12567 | Plotter | HP | 7440A |
| 12605 | calibrated dipole 28MHz-1GHz | Emco | 3121c |
| 12607 | Calibrated attenuator set | HP | HP11581a |
| 12608 | HF milliwattmeter | HP | HP435a |
| 12609 | Power sensor 10MHz-18GHz | HP | HP8481A |
| 12620 | Spectrum analyzer | Advantest | R4131B |
| 12635 | Measurement platform | WOLFF | -- |
| 12636 | Plastic measurement room | Polyforce | -- |
| 12640 | Temperature chamber | Heraeus | VEM03/500 |
| 13078 | Wideband Pre-Amplifier (1GHz-5GHz) | Miteq | AMF3D0100503010 |
| 13313 | Impuls limiter | R&S | ESH3Z2.357... |
| 13452 | Digital multi meter | HP | 34401A |
| 13664 | Spectrum analyzer | HP | HP8593E |
| 13886 | Open Area Test Site | Comtest | -- |
| 14051 | Anechoic room | Comtest | -- |
| 14277 | Antennamast 4m | Heinrich Deisel | HD100 |
| 14278 | Controller OATS | Heinrich Deisel | MA240 |
| 14340 | Biconilog antenna 20MHz - 1100MHz | EMCO | 3143 |
| 14351 | Biconilog | EMCO | 9143 |
| 14450 | 2.4 GHz bandrejectfilter | BSc | xn-1783 |
| 14987 | Stripline cell | Marconi | TC5010 |
| 15232 | Tektronics storage scope | Tektronics | -- |
| 15453 | Magnetic loop | Chase | -- |
| 15633 | Biconilog Testantenna | Chase | CBL 6111B |
| 15667 | Measuring receiver 9kHz - 2750MHz | R&S | ESCS30 |
| 99012 | ITU-R recomm. 559-2 noise generator | NMi | -- |
| 99040 | Attenuator 25W/20dB | Bird electronic | 8340-200 |
| 99041 | Attenuator 25W/10dB | BIRD | 8340-100 |
| 99042 | Attenuator 10W/3dB | Bird electronic | 8304-030-N |
| 99043 | Attenuator 25W/20dB | Bird electronic | 8340-200 |
| 99044 | Attenuator 10W/3dB | Bird electronic | 8304-030-N |
| 99045 | DC Power Supply 3A/30V | DELTA | E030/3 |
| 99046 | Fluke Multimeter | John Fluke | 12 |
| 99050 | Wideband Pre-Amplifier (5GHz-10GHz) | Miteq | AMF3D0501004010 |
| 99055 | Non-conducting support | NMi | -- |
| 99056 | Isolating transformer 1:1 | NMi | -- |
| 99061 | Non-conducting support 150cm | NMi | -- |
| 99068 | Detector N-F/BNC-F | Radiall | R451576000 |
| 99069 | Cable 5m RG214 | NMi | -- |
| 99070 | Cable 15m RG214 | NMi | -- |
| 99071 | Cable 10m RG214 | NMi | -- |
| 99076 | Bandpassfilter 4-10GHz | Reactel | 7AS-7G-6G-511 |
| 99077 | Regulating trafo | RFT | LTS006 |
| 99079 | RF Combiner | R&S | DVU 4 |
| 99108 | Turntable OATS | Heinrich Deisel | HD050 |
| 99111 | magnetic loop power supply | Chase | -- |
| 99112 | Tripod | Chase | -- |
| 99115 | Voltage probe | Schwarzbeck | TK9416 |

## 1.7 Bandwidth and antenna factors.

The utilized measuring equipment is stated in § 1.6. The bandwidth of the receiver switches automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. Also the antennafactors are included in the testreceiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate correction factor for the cable loss. The total correction is automatically added to the measured value.

# 2 Product labelling.

## 2.1 FCC ID Label

The following label shall be attached to the device under test.

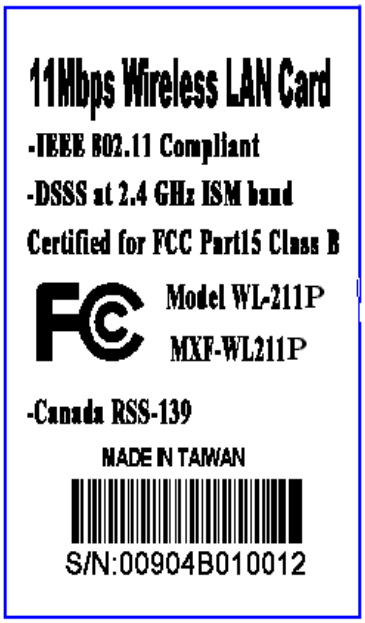



Figure 2.1. FCC ID label

The dimensions of the label, the location of the label and the type of font can be found in the FCC regulation book CFR 47, parts 0 to 19, revised as per October 1, 1993.

## 2.2 Location of the FCC ID Label on the EUT

The FCC ID Label will be placed on the rear side of the WLAN PC card

See attached documentation-sheet for more detailed information.

# 3 System test configuration.

## 3.1 Justification.

The system was configured for testing in a typical fashion (as a customer would normally use it).

The justification of cables and equipment has been carried out as prescribed in the ANSI C63.4-1992 document.

The measurements were performed on the lowest operating frequency (channel 1: 2412 MHz), the operating frequency in the middle of the specified frequency band (channel 6: 2437 MHz) and the highest operating frequency (channel 11: 2462 MHz).

**Operating frequencies and rated output power levels**

| channel | Operating frequencies (MHz) | Rated output power (dBm) | test performed |
|---|---|---|---|
| 1 | 2412 | +13 | yes |
| 2 | 2417 | +13 | no |
| 3 | 2422 | +13 | no |
| 4 | 2427 | +13 | no |
| 5 | 2432 | +13 | no |
| 6 | 2437 | +13 | yes |
| 7 | 2442 | +13 | no |
| 8 | 2447 | +13 | no |
| 9 | 2452 | +13 | no |
| 10 | 2457 | +13 | no |
| 11 | 2462 | +13 | yes |

Table 3.1: Operating frequencies and rated output power levels

To complete the configuration required by the FCC, the transmitter was tested in a Laptop/Notebook PC.

## 3.2 EUT exercise software.

The EUT was enabled to continuously transmit, which was verified by a receiving unit during testing. The carrier was also checked to verify that the information was being transmitted.

## 3.3 Special accessories.

No special accessories are used to achieve FCC compliance.

### 3.4 Equipment modifications.

No modifications have been made to the equipment to achieve compliance.

| | | | |
|---|---|---|---|
| Applicant Signature | : n.a. | Date | : n.a. |
| Printed name | : n.a. | Position | : n.a. |

### 3.5 Configuration of the tested system.

Blockdiagrams of the tested system are included in Annex attached to this report.

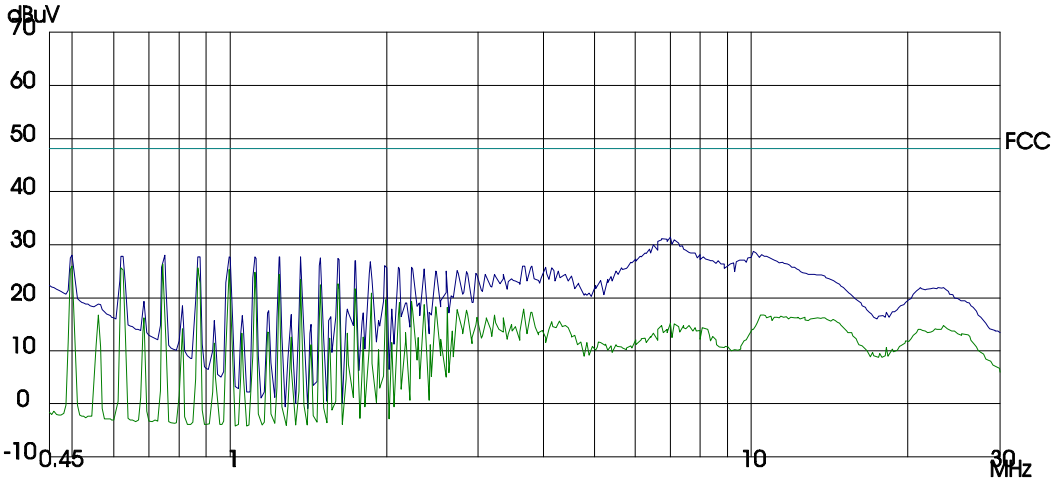
## 4 Block diagram(s) of the tested model.

Information is annexed in the technical documentation supplied by the applicant.

# 5 Conducted emission data.

The initial step in collecting conducted data is a scan of the measurement range. Significant signals are then marked and these signals are then measured using a quasi-peak detector.

Line 1




Plot 5.1: Conducted emissions on channel 6.

The following table lists worst case conducted emission data in accordance with FCC 15.207. The conducted test was performed with the EUT exercise program loaded. Photographs of the testsetups are included in annex attached to this report.

| Frequency (MHz) | Measurements results QP (dBµV) | Margin (dBµV) | Limits (dBµV) |
|---|---|---|---|
| 0.16 | 45.1 | 2.9 | 48.0 |
| 0.185 | 42.0 | 6.0 | 48.0 |
| 0.247 | 38.1 | 9.9 | 48.0 |
| 0.371 | 37.6 | 10.4 | 48.0 |
| 0.495 | 32.5 | 15.5 | 48.0 |
| 0.619 | 32.3 | 15.7 | 48.0 |
| 0.745 | 32.0 | 16.0 | 48.0 |
| 0.992 | 31.7 | 16.3 | 48.0 |
| 1.48 | 31.6 | 16.4 | 48.0 |
| 2.11 | 28.5 | 19.5 | 48.0 |
| 3.53 | 25.5 | 22.5 | 48.0 |
| 4.03 | 27.0 | 21.0 | 48.0 |
| 8.0 | 32.9 | 15.1 | 48.0 |
| 22.9 | 25.5 | 22.5 | 48.0 |
| other frequencies | << | >20.0 | 48.0 |

Table 5.1 : Conducted emissions on channel 6.
<< means that the measured value is more .then 20 dB below limit // QP means Quasi-Peak

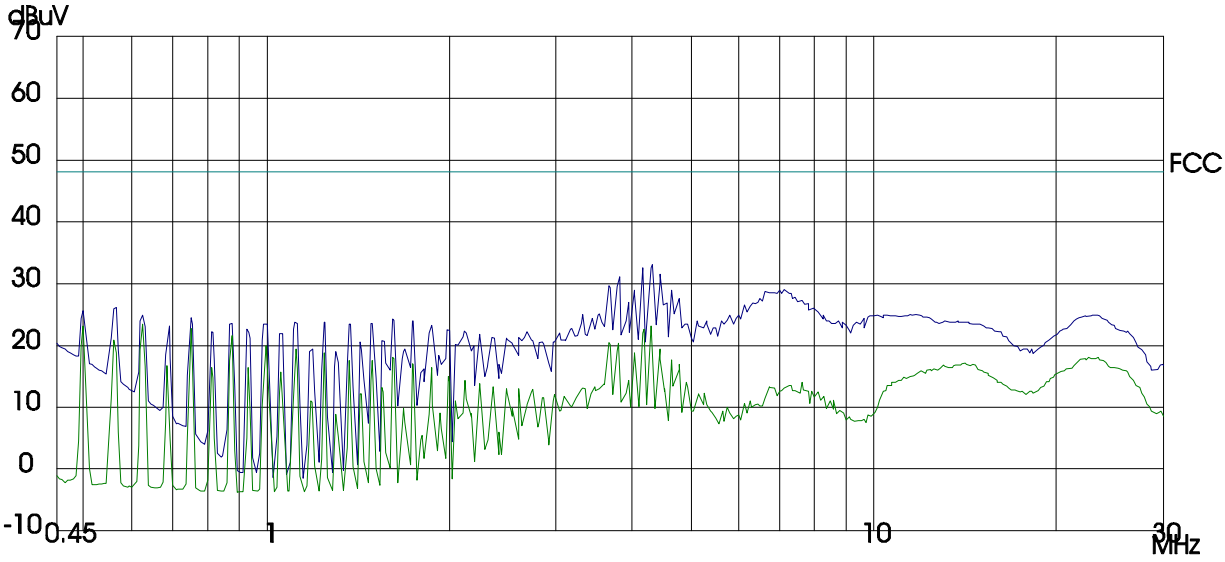
The conducted emission measurement has been carried out with an AC supply voltage of 120 V.

Testpersonnel:

Signature :
Printed name : O.H. Hoekstra

Date: March 22, 2000

Neutral L2




Plot 5.2: Conducted emissions on channel 6.

The following table lists worst case conducted emission data in accordance with FCC 15.207. The conducted test was performed with the EUT exercise program loaded. Photographs of the testsetups are included in annex attached to this report

| Frequency (MHz) | Measurements results QP (dBµV) | Margin (dBµV) | Limits (dBµV) |
|---|---|---|---|
| 0.16 | 45.1 | 2.9 | 48.0 |
| 0.185 | 43.1 | 4.9 | 48.0 |
| 0.247 | 40.9 | 7.1 | 48.0 |
| 0.371 | 32.8 | 15.2 | 48.0 |
| 0.495 | 28.0 | 20.0 | 48.0 |
| 0.619 | 28.0 | 20.0 | 48.0 |
| 0.745 | 27.9 | 20.1 | 48.0 |
| 0.992 | 27.5 | 20.5 | 48.0 |
| 1.48 | 27.1 | 20.9 | 48.0 |
| 2.11 | 25.1 | 22.9 | 48.0 |
| 3.53 | 26.4 | 21.6 | 48.0 |
| 4.03 | 33.5 | 14.5 | 48.0 |
| 8.0 | 31.8 | 16.2 | 48.0 |
| 22.9 | 27.5 | 20.5 | 48.0 |
| other frequencies | << | >20.0 | 48.0 |

Table 5.2 : Conducted emissions on channel 6.
<< means that the measured value is more than 20 dB below limit // QP means Quasi-Peak

The conducted emission measurement has been carried out with an AC supply voltage of 120 V.

Test engineer:

Signature : Date: March 22, 2000

Printed name : O.H. Hoekstra

# 6 Radiated emission data

The following data lists the significant emission frequencies (worst case), measured levels in accordance with FCC 15.209. Photographs of the testsetups are included in annexes attached to this report.

## 6.1 Radiated emissions below 1 GHz

| Vertical polarization | | | |
|---|---|---|---|
| Frequency | Measured Value QP (3m) | FCC limit | FCC margin |
| MHz | dBuV/m | dBuV/m | dB |
| 170.030 | 33.9 | 43.5 | -9.6 |
| 264.050 | 32.4 | 46.0 | -13.6 |
| 352.050 | 34.3 | 46.0 | -11.7 |
| 528.075 | 39.7 | 46.0 | -6.3 |
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Table 6.1: Radiated emissions on channel 6 (Vertical)

Notes:
All measured levels in quasi-peak mode, polarization refers to measuring antenna, negative margin means it is below the limit. All radiated harmonic emissions were found to be > 25dB below limits.

The radiated emission measurement has been carried out with an AC supply voltage of 120 V.

Test engineer:

Signature :

Date: March 22, 2000

Printed name : O.H. Hoekstra

| Horizontal polarization | | | |
|---|---|---|---|
| Frequency | Measured Value QP (3m) | FCC limit | FCC margin |
| MHz | dBuV/m | dBuV/m | dB |
| 170.030 | 39.8 | 43.5 | -3.7 |
| 264.050 | 34.6 | 46.0 | -11.4 |
| 352.050 | 36.3 | 46.0 | -9.7 |
| 528.075 | 40.1 | 46.0 | -5.9 |
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Table 6.2: Radiated emissions on channel 6 (Horizontal)

Notes:
All measured levels in quasi-peak mode, polarization refers to measuring antenna, negative margin means it is below the limit. All radiated harmonic emissions were found to be > 25dB below limits.

The radiated emission measurement has been carried out with an AC supply voltage of 120 V.

Test engineer:

Signature : Date: March 22, 2000

Printed name : O.H. Hoekstra

## 6.2 Radiated emissions above 1 GHz

| Vertical polarization | | |
|---|---|---|
| Frequency | Measured Value Peak (3m) | FCC limit |
| MHz | uV/m | uV/m |
| 2070 | 81.0 | 500 |
| 4138 | 76.0 | 500 |
| 4885 | 33.0 | 500 |
| | | |
| | | |

**Table 6.3: Peak radiated emissions above 1GHz on channel 6 (Vertical)**

| Horizontal polarization | | |
|---|---|---|
| Frequency | Measured Value Peak (3m) | FCC limit |
| MHz | uV/m | uV/m |
| 2070 | 82.0 | 500 |
| 4138 | 68.0 | 500 |
| 4885 | 28.0 | 500 |
| | | |
| | | |

**Table 6.4: Peak radiated emissions above 1GHz on channel 6 (Horizontal)**

Notes:
Polarization refers to measuring antenna.
Measured signal is narrow band continuous wave with peak value equal to average value.
All radiated harmonic emissions were found to be > 25dB below limits.

The radiated emission measurement has been carried out with an AC supply voltage of 120 V.

Test engineer:

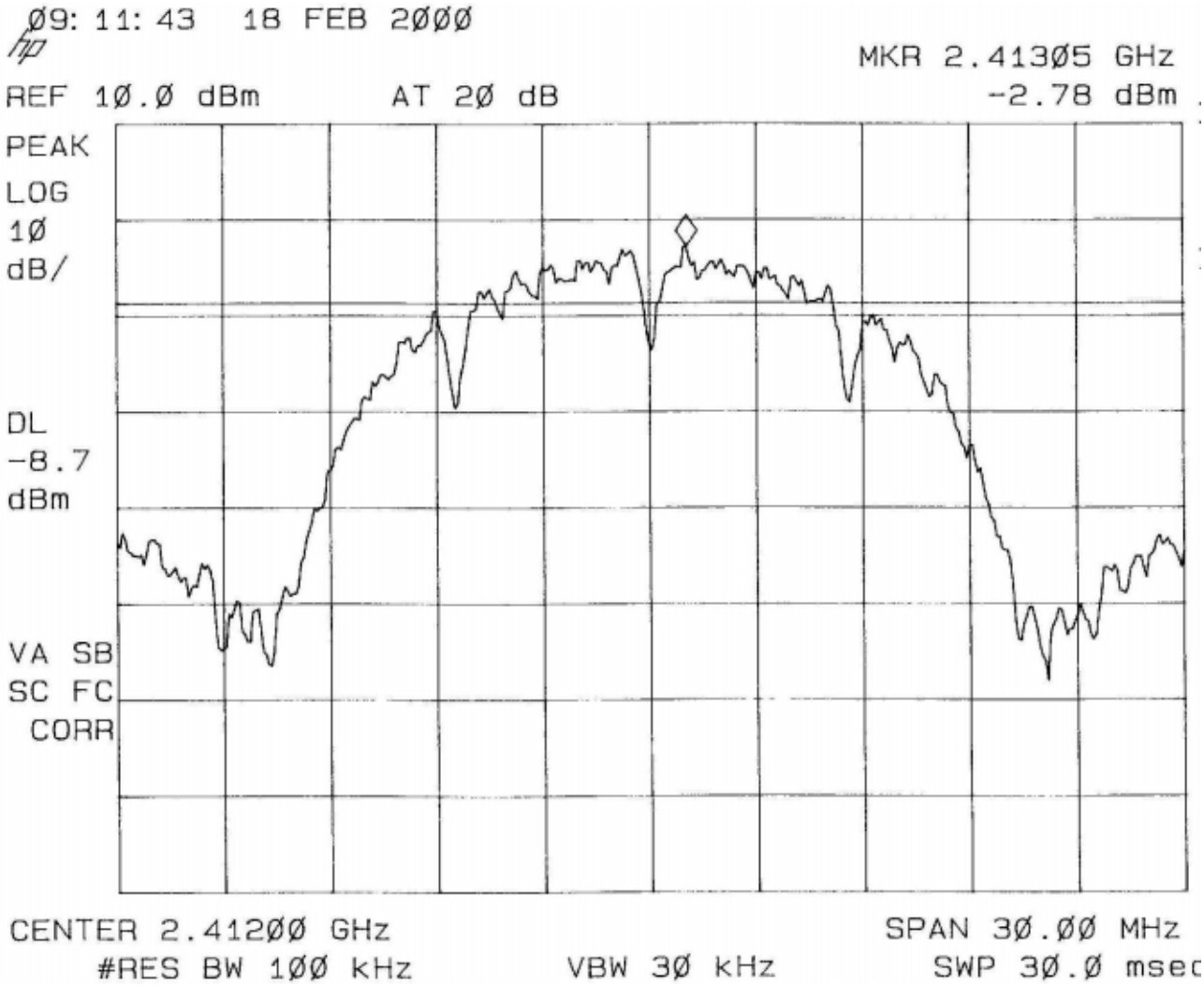
Signature :
Printed name : O.H. Hoekstra

Date: March 22, 2000

# 7 -6 dB Bandwidth measurements.

The minimum 6 dB bandwidth measurement was performed in accordance with FCC 15.247 (a)

## 7.1 Channel 1




Plot 7.1: -6 dB bandwidth plot of channel 1

Modulation = 11.0 Mbps

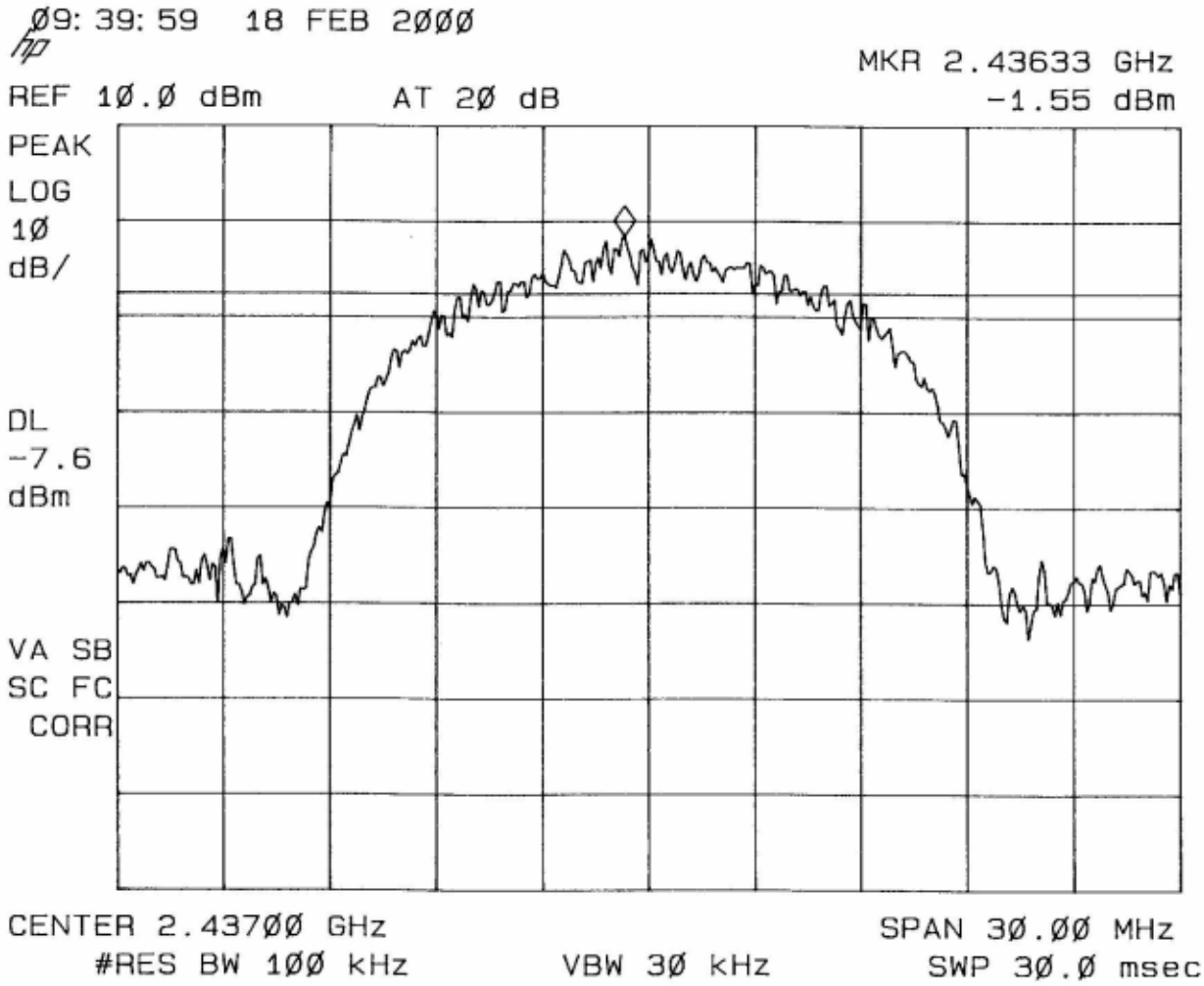
The minimum -6 dB modulated bandwidth on channel 1 : 10.21 MHz.

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

## 7.2 Channel 6




Plot 7.2: -6 dB bandwidth plot of channel 6

Modulation = 11.0 Mbps

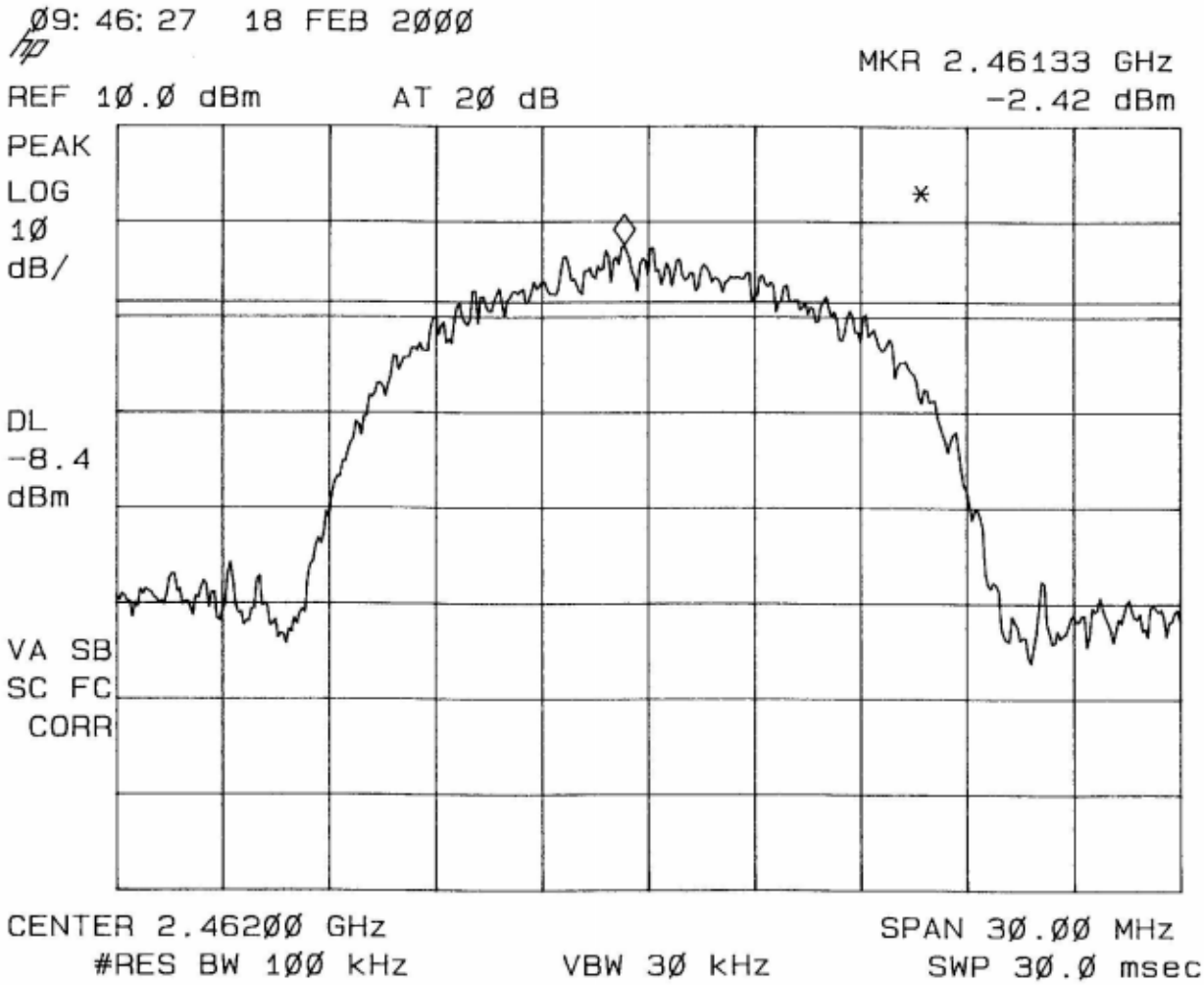
The minimum -6 dB modulated bandwidth on channel 6 : 9.97 MHz.

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

## 7.3 Channel 11




Plot 7.3: -6 dB bandwidth plot of channel 11

Modulation = 11.0 Mbps

The minimum -6 dB modulated bandwith is on channel 11 : 9.97 MHz.

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

# 8 Peak power

The peak power measurement was performed in accordance with FCC 15.247 (b). The plot is made with the highest bandwidth being worst case. The maximum value is then marked and the peak value of this signal is measured using a wideband diode detector.

| Channel | Peak Power (dBm) |
|---|---|
| 1 | 12.6 |
| 6 | 12.4 |
| 11 | 11.8 |

**Table 8.1: Peak Power**

Test engineer:

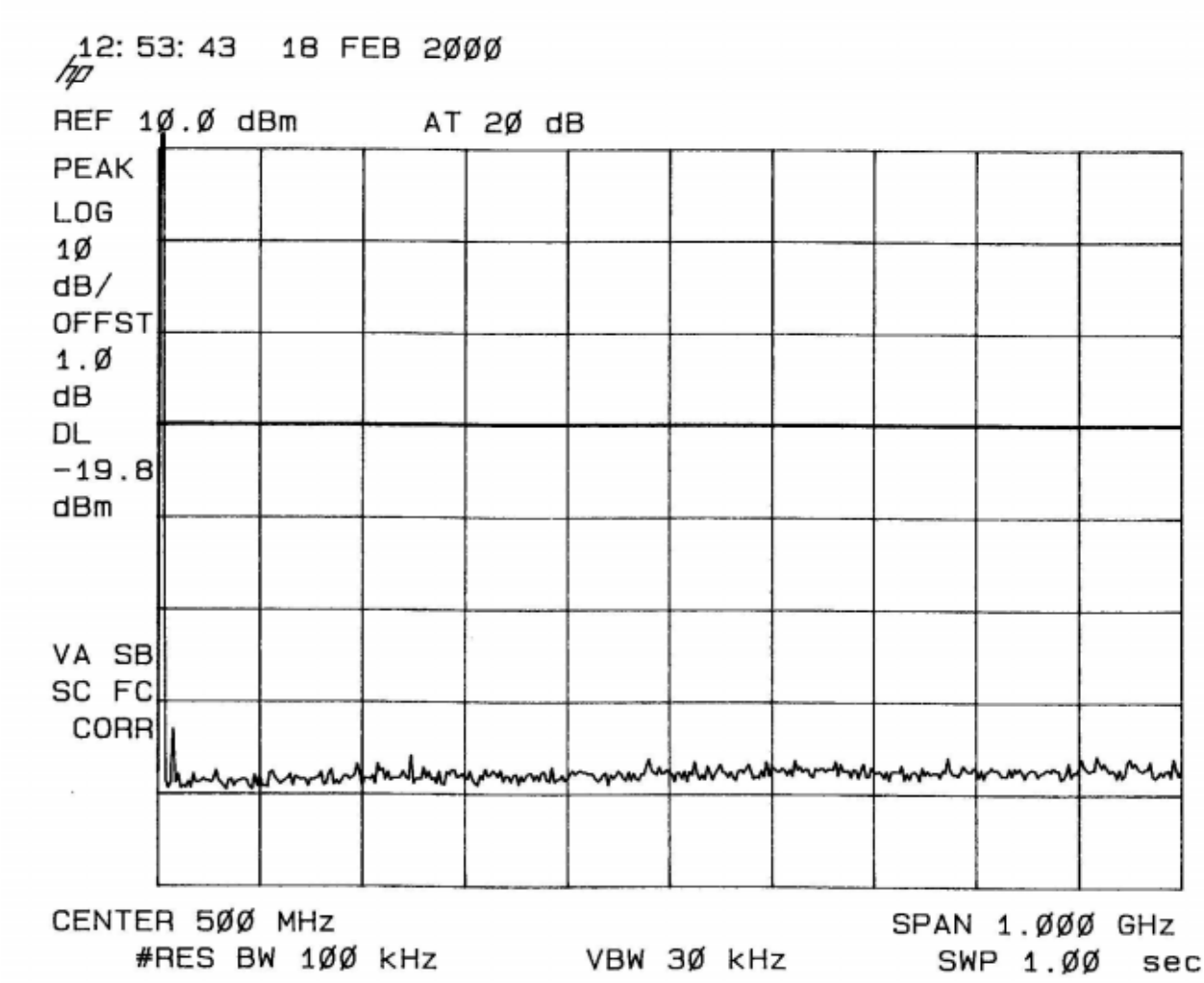
Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

# 9 Conducted emissions at the antenna output

Antenna spurious emission per FCC 15.247(c) was measured from the EUT antenna port using a 50 Ohm spectrum analyzer with the resolution/video bandwidth set at 100 kHz. The worst case values are plot below.

## 9.1 Channel 6

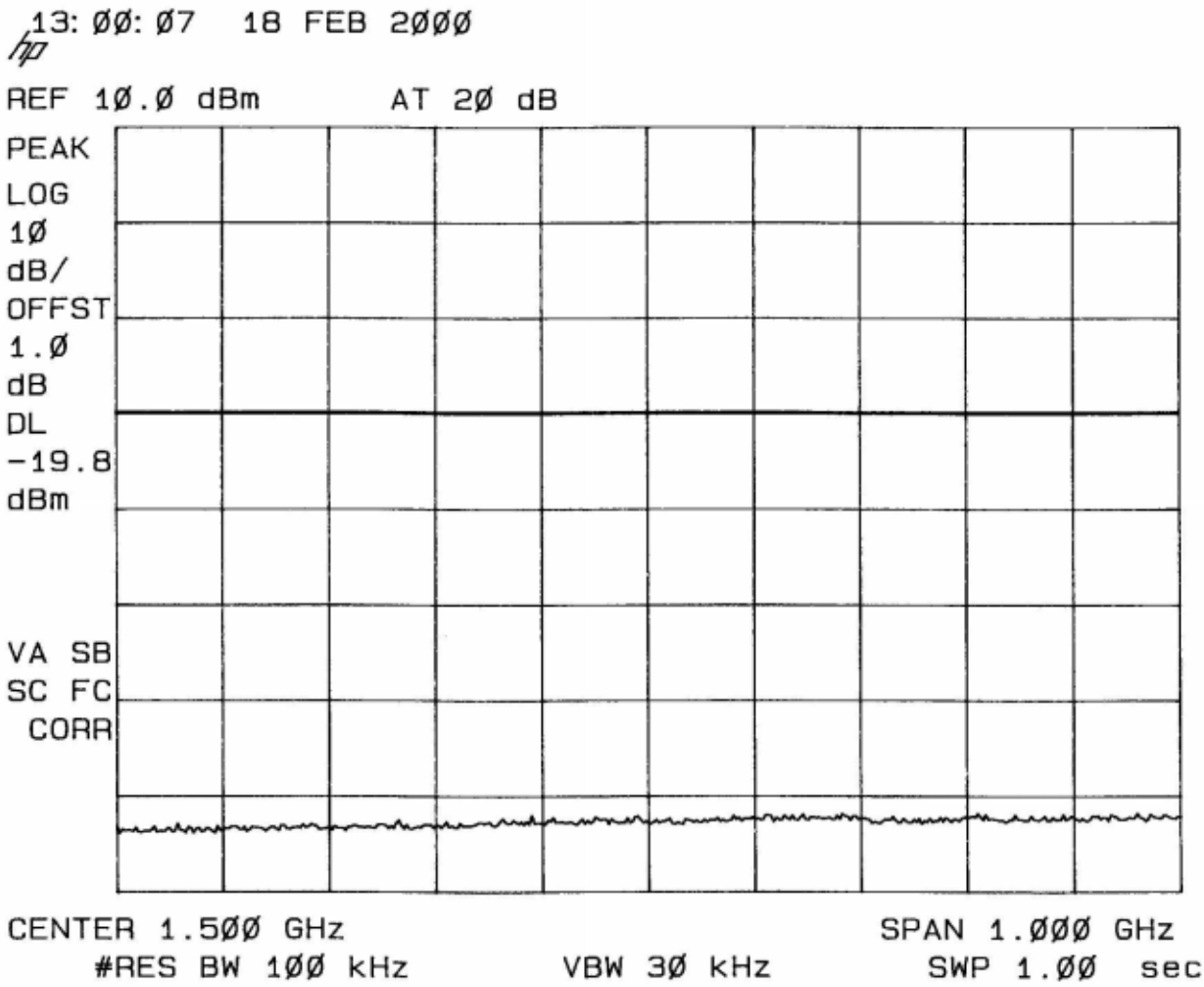



Plot 9.1: Conducted emissions 0 MHz – 1000 MHz

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

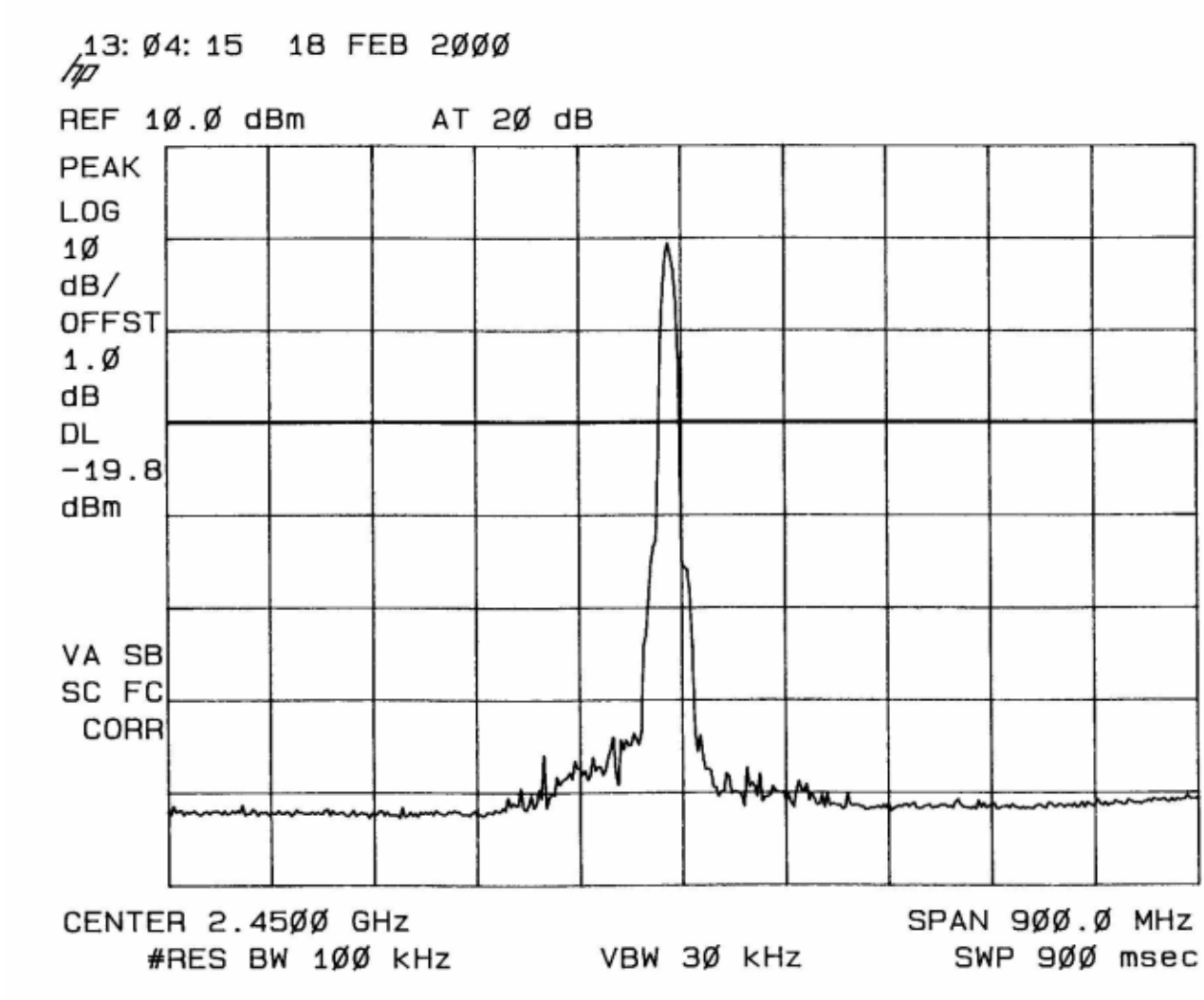



Plot 9.2: Conducted emissions 1.0 GHz – 2.0 GHz

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

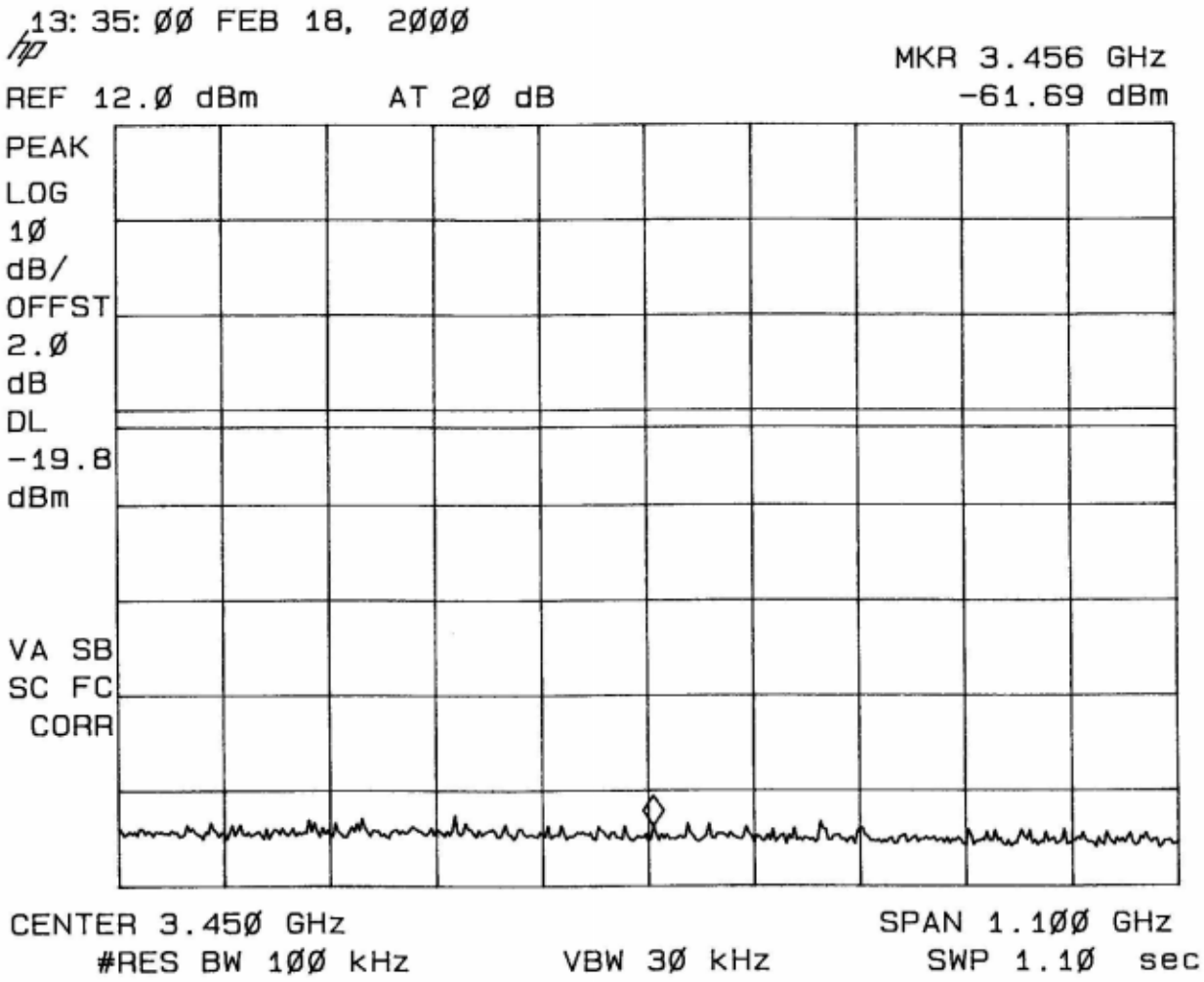



Plot 9.3: Conducted emissions 2.0 GHz – 2.9 GHz

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

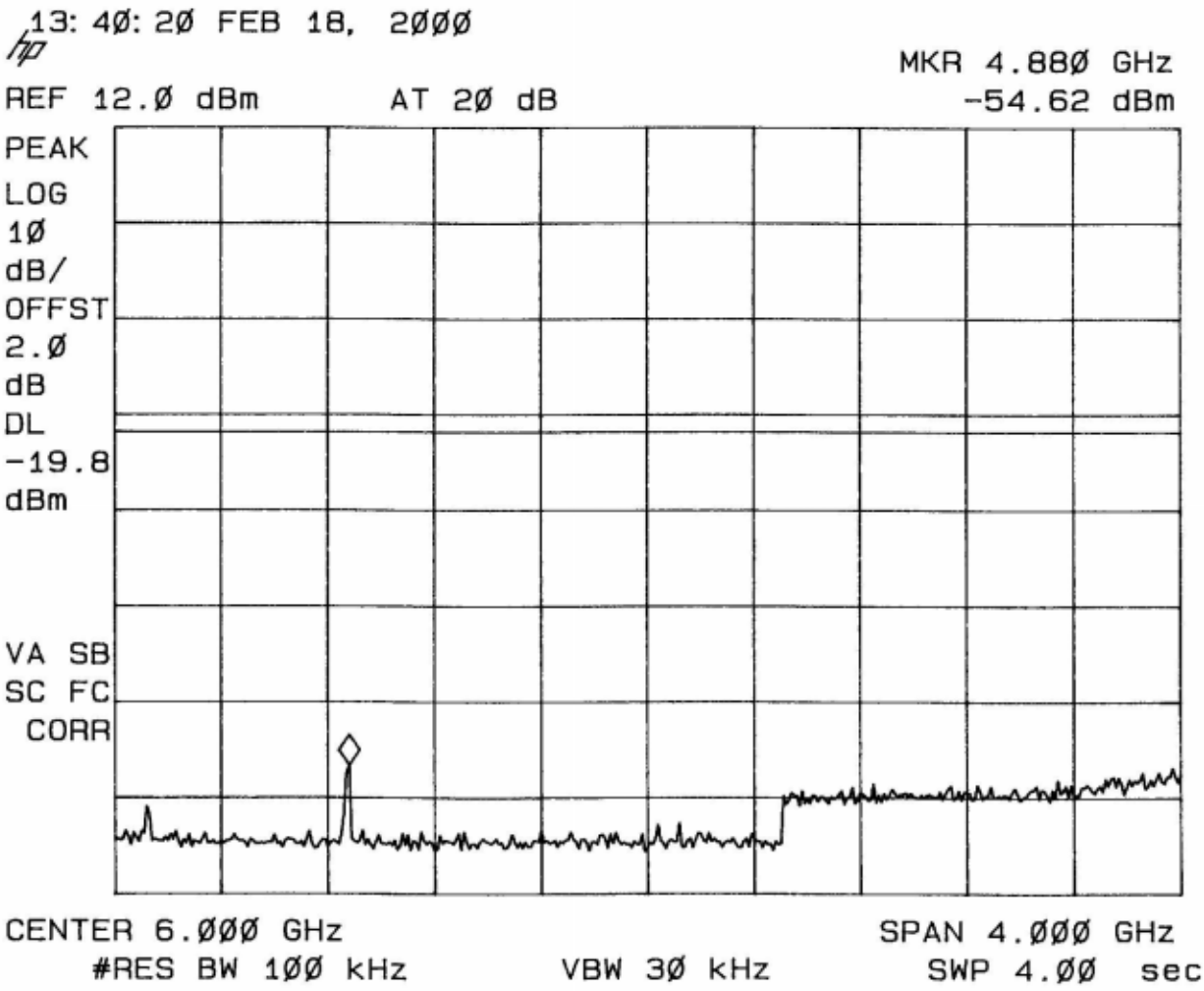



Plot 9.4: Conducted emissions 2.9 GHz – 4.0 GHz

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

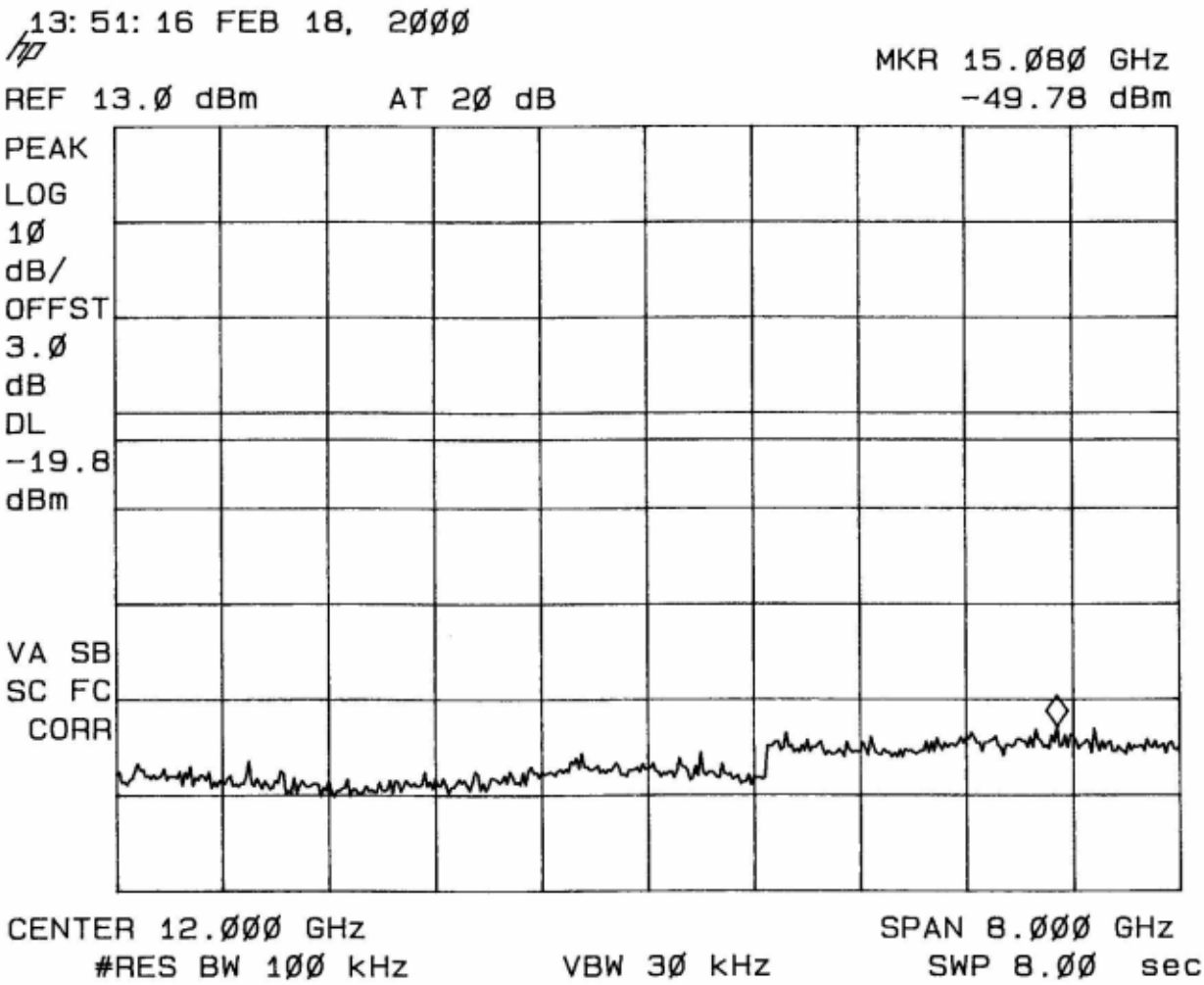



Plot 9.5: Conducted emissions 4.0 GHz – 8.0 GHz

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

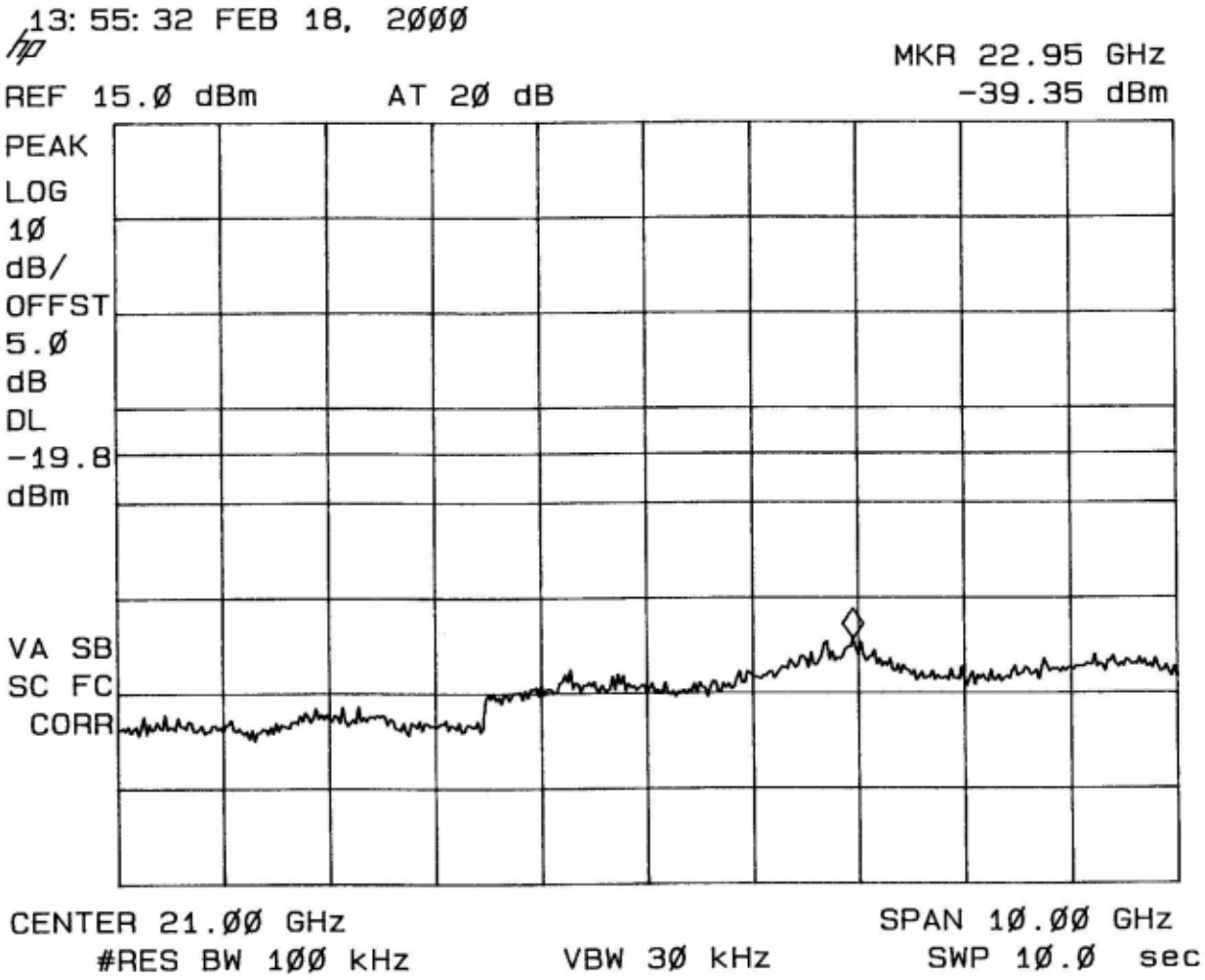



Plot 9.6: Conducted emissions 8.0 – 16.0 GHz

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra




Plot 9.7: Conducted emissions 16.0 – 26.0 GHz

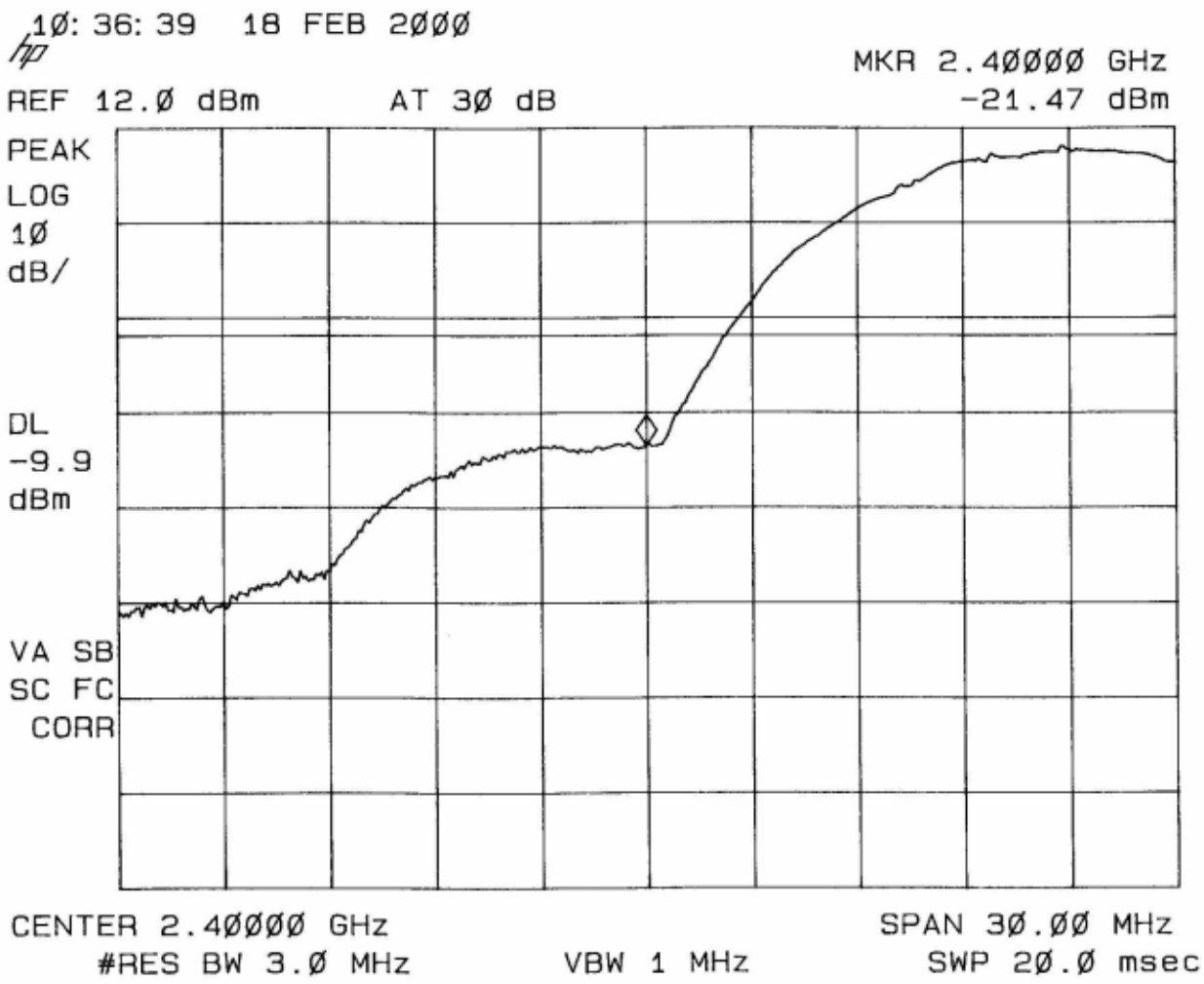
Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

# 10 Restricted bands of operation.

The following plots shows the maximum emissions at the band edges. The measurement was performed in accordance with FCC 15.247 (a)

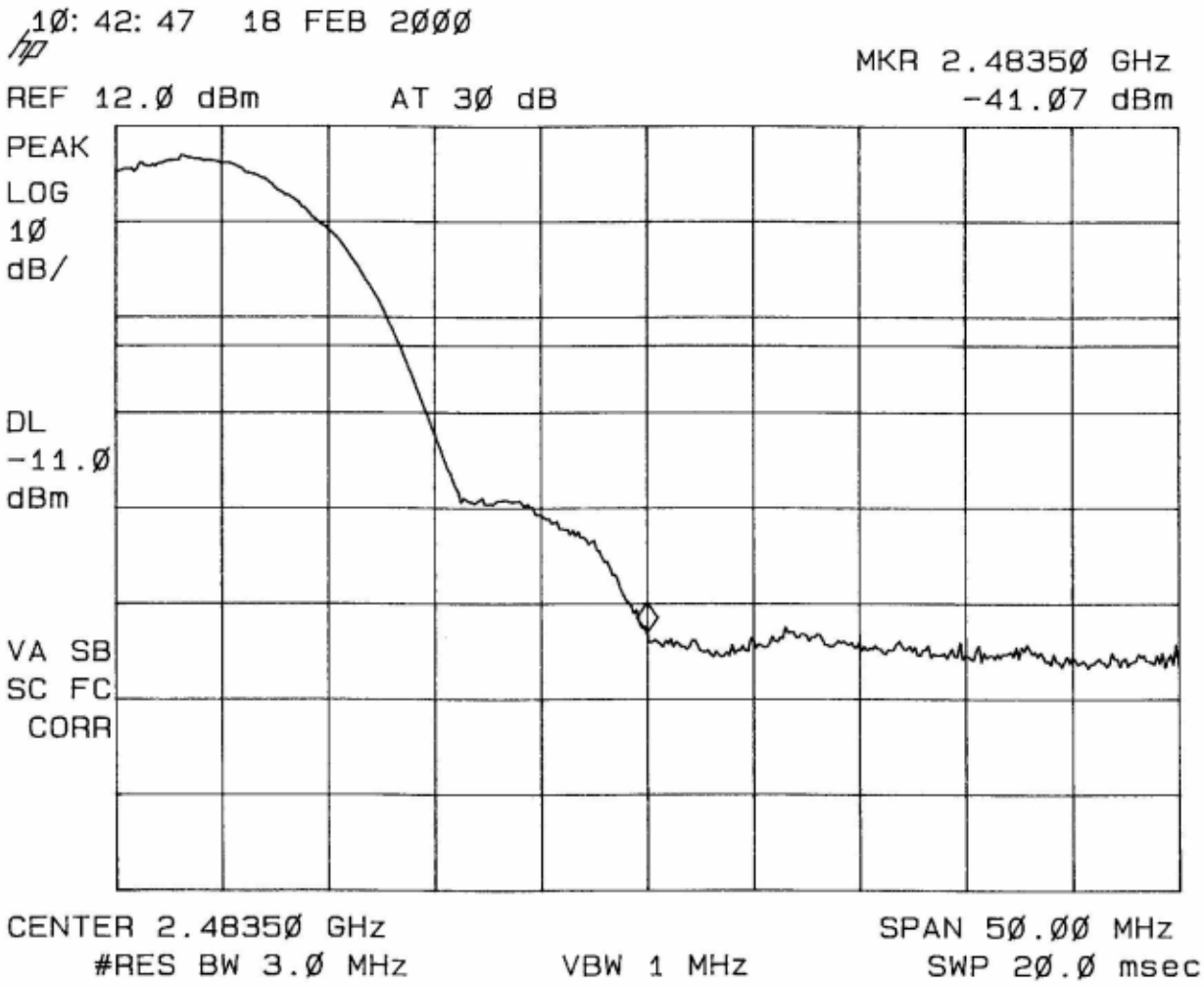



Plot 10.1: Conducted emissions at 2.400 GHz centre frequecy

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra




Plot 10.2: Conducted emissions at 2.4835 GHz centre frequecy

Test engineer:

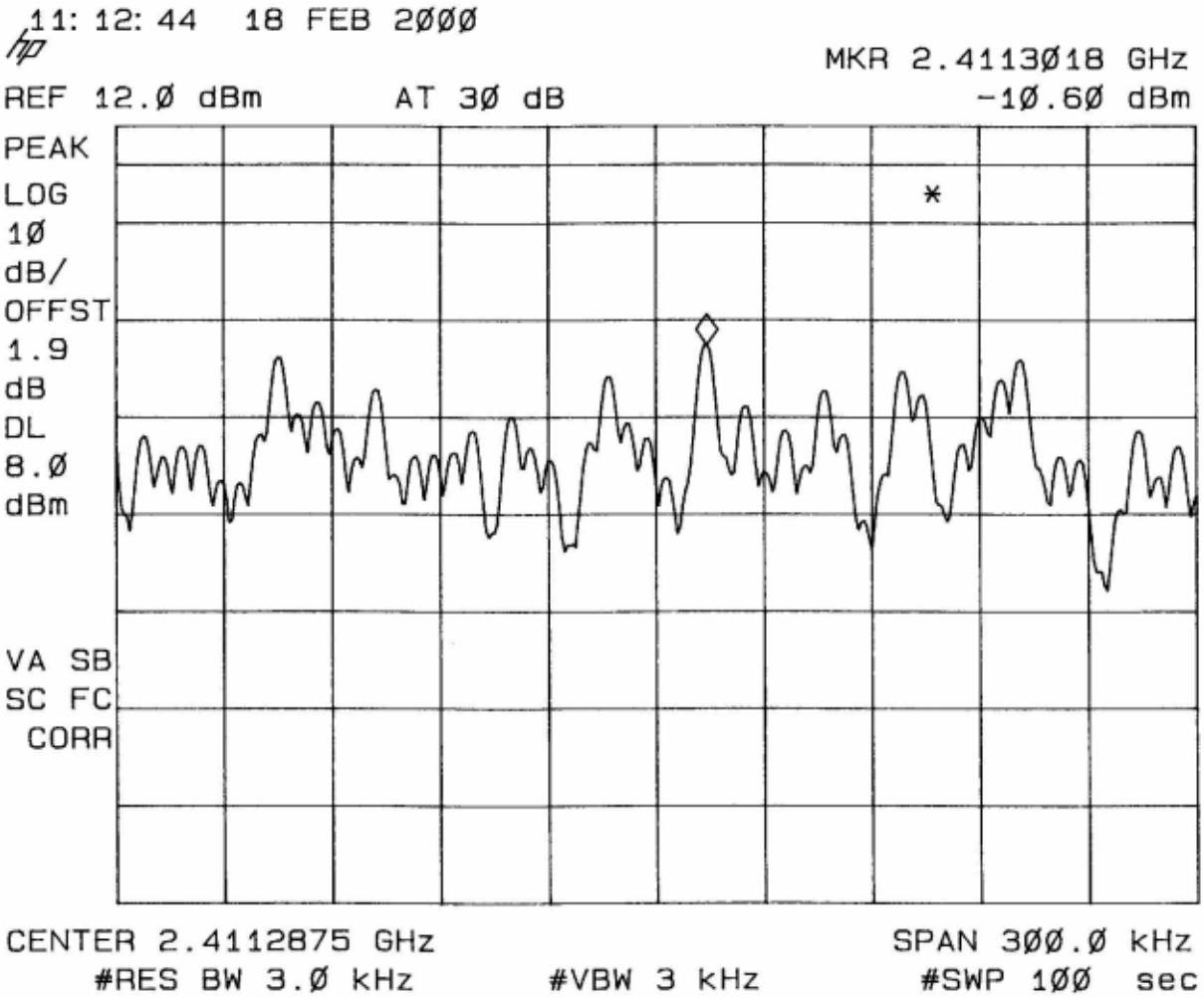
Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

# 11 Peak power density

The peak power measurement was performed in accordance with FCC 15.247 (d)

## 11.1 Channel 1




Plot 11.1: Peak Power Spectral Density plot of channel 1

Modulation = 11.0 Mbps

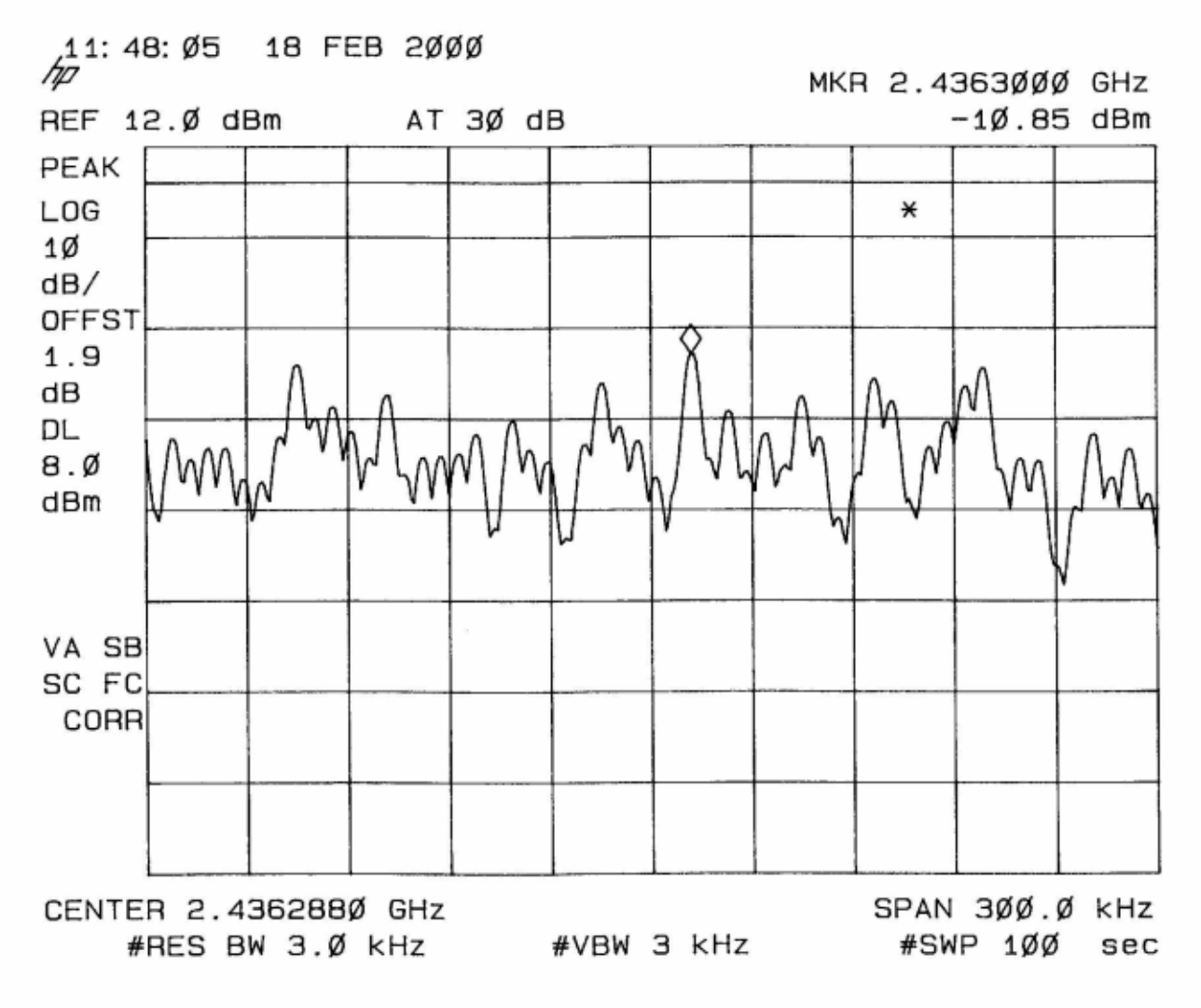
The peak power spectral density on channel 1 : -10.6 dBm.

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

## 11.2 Channel 6




Plot 11.2: Peak Power Spectral Density plot of channel 6

Modulation = 11.0 Mbps

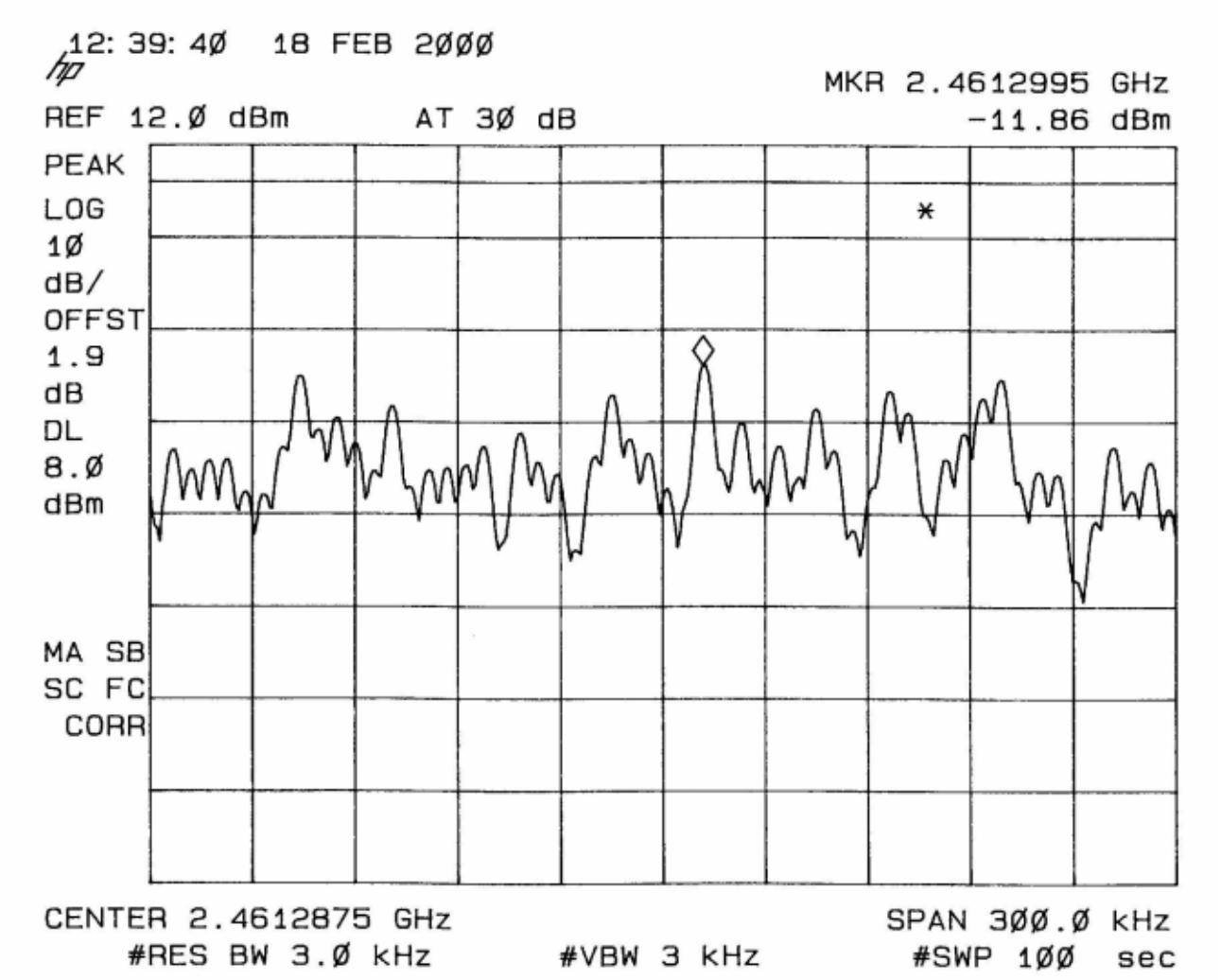
The peak power spectral density on channel 6 : -10.85 dBm.

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

## 11.3 Channel 11




Plot 11.3: Peak Power Spectral Density plot of channel 11

Modulation = 11.0 Mbps

The peak power spectral density on channel 11 : -11.86 dBm.

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

# 12 Processing gain

## 12.1 Processing gain at 11.0 Mb/s

The processing gain is measured using the CW jamming margin method. A signal generator is stepped in 50 kHz increments across the passband of the system. At each point the generator level required to produce a Bit Error Rate equivalent to BER=1.0 x 10E-5 is recorded as the Jammer level (J). The output power of the transmitter is measured at the same point and recorded as Signal (S). The Jammer to Signal ratio (J/S) is then calculated with 20% of the worst datapoints discarded. The lowest remaining J/S ratio is used to calculate the processing gain using formula:

$$Gp = (S/N)o + Mj + Lsys$$

with:
(S/N)o = 20.7 dB for 11.0 Mb/s (obtained from manufacturer's specification of spreading processor Harris semiconductor model HFA3861)

Lsys = 2.0 dB

Measured lowest remaining J/S = Mj = -8.8 dB

**Gp = 20.7 dB + (-8.8 dB) + 2.0 dB = 13.9 dB (for 11.0 Mb/s modulation)**

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

## 12.2 Blockdiagram CW Jamming testsetup

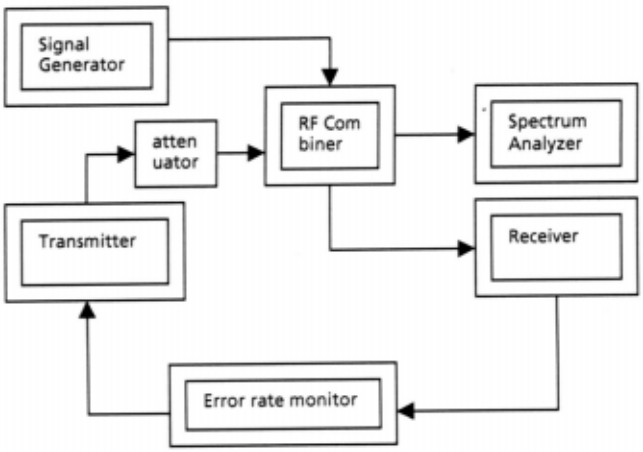



**figure 12.1: blockdiagram of testsetup**

## 12.3 Processing Gain at 11Mb/s testresults tables

**pass band = fo ± 5MHz ( 5000 kHz = 100 x 50 kHz)**
**channel: 07 = 2442.0 MHz 1 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| 100 | 2447.00 | -56.30 | -52.30 | -4.00 |
| 99 | 2446.95 | -57.00 | -52.30 | -4.70 |
| 98 | 2446.90 | -57.30 | -52.30 | -5.00 |
| 97 | 2446.85 | -56.90 | -52.30 | -4.60 |
| 96 | 2446.80 | -57.00 | -52.30 | -4.70 |
| 95 | 2446.75 | -56.80 | -52.30 | -4.50 |
| 94 | 2446.70 | -58.10 | -52.30 | -5.80 |
| 93 | 2446.65 | -58.20 | -52.30 | -5.90 |
| 92 | 2446.60 | -58.20 | -52.30 | -5.90 |
| 91 | 2446.55 | -57.40 | -52.30 | -5.10 |
| 90 | 2446.50 | -57.50 | -52.30 | -5.20 |
| 89 | 2446.45 | -57.00 | -52.30 | -4.70 |
| 88 | 2446.40 | -59.00 | -52.30 | -6.70 |
| 87 | 2446.35 | -57.20 | -52.30 | -4.90 |
| 86 | 2446.30 | -56.40 | -52.30 | -4.10 |
| 85 | 2446.25 | -56.60 | -52.30 | -4.30 |
| 84 | 2446.20 | -56.70 | -52.30 | -4.40 |
| 83 | 2446.15 | -56.40 | -52.30 | -4.10 |
| 82 | 2446.10 | -57.10 | -52.30 | -4.80 |
| 81 | 2446.05 | -57.50 | -52.30 | -5.20 |
| 80 | 2446.00 | -58.30 | -52.30 | -6.00 |
| 79 | 2445.95 | -60.00 | -52.30 | -7.70 |
| 78 | 2445.90 | -60.50 | -52.30 | -8.20 |
| 77 | 2445.85 | -61.10 | -52.30 | -8.80 |
| 76 | 2445.80 | -61.60 | -52.30 | -9.30 |
| 75 | 2445.75 | -61.10 | -52.30 | -8.80 |
| 74 | 2445.70 | -62.30 | -52.30 | -10.00 |
| 73 | 2445.65 | -62.00 | -52.30 | -9.70 |
| 72 | 2445.60 | -61.10 | -52.30 | -8.80 |
| 71 | 2445.55 | -59.90 | -52.30 | -7.60 |
| 70 | 2445.50 | -59.70 | -52.30 | -7.40 |
| 69 | 2445.45 | -59.20 | -52.30 | -6.90 |
| 68 | 2445.40 | -59.40 | -52.30 | -7.10 |
| 67 | 2445.35 | -59.00 | -52.30 | -6.70 |
| 66 | 2445.30 | -59.30 | -52.30 | -7.00 |
| 65 | 2445.25 | -59.50 | -52.30 | -7.20 |
| 64 | 2445.20 | -59.70 | -52.30 | -7.40 |
| 63 | 2445.15 | -60.20 | -52.30 | -7.90 |
| 62 | 2445.10 | -60.40 | -52.30 | -8.10 |
| 61 | 2445.05 | -60.20 | -52.30 | -7.90 |
| 60 | 2445.00 | -61.00 | -52.30 | -8.70 |

**Table 12.1 : Processing gain testresults for 11.0 Mb/s**

**channel: 07 = 2442.0 MHz 2 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| 59 | 2444.95 | -60.90 | -52.30 | -8.60 |
| 58 | 2444.90 | -60.60 | -52.30 | -8.30 |
| 57 | 2444.85 | -60.20 | -52.30 | -7.90 |
| 56 | 2444.80 | -59.20 | -52.30 | -6.90 |
| 55 | 2444.75 | -59.10 | -52.30 | -6.80 |
| 54 | 2444.70 | -58.90 | -52.30 | -6.60 |
| 53 | 2444.65 | -58.00 | -52.30 | -5.70 |
| 52 | 2444.60 | -58.30 | -52.30 | -6.00 |
| 51 | 2444.55 | -58.00 | -52.30 | -5.70 |
| 50 | 2444.50 | -59.10 | -52.30 | -6.80 |
| 49 | 2444.45 | -59.90 | -52.30 | -7.60 |
| 48 | 2444.40 | -60.70 | -52.30 | -8.40 |
| 47 | 2444.35 | -60.60 | -52.30 | -8.30 |
| 46 | 2444.30 | -60.80 | -52.30 | -8.50 |
| 45 | 2444.25 | -62.20 | -52.30 | -9.90 |
| 44 | 2444.20 | -61.50 | -52.30 | -9.20 |
| 43 | 2444.15 | -61.30 | -52.30 | -9.00 |
| 42 | 2444.10 | -61.50 | -52.30 | -9.20 |
| 41 | 2444.05 | -61.20 | -52.30 | -8.90 |
| 40 | 2444.00 | -61.10 | -52.30 | -8.80 |
| 39 | 2443.95 | -61.00 | -52.30 | -8.70 |
| 38 | 2443.90 | -61.00 | -52.30 | -8.70 |
| 37 | 2443.85 | -60.80 | -52.30 | -8.50 |
| 36 | 2443.80 | -60.80 | -52.30 | -8.50 |
| 35 | 2443.75 | -60.20 | -52.30 | -7.90 |
| 34 | 2443.70 | -60.10 | -52.30 | -7.80 |
| 33 | 2443.65 | -60.30 | -52.30 | -8.00 |
| 32 | 2443.60 | -60.20 | -52.30 | -7.90 |
| 31 | 2443.55 | -60.40 | -52.30 | -8.10 |
| 30 | 2443.50 | -60.60 | -52.30 | -8.30 |
| 29 | 2443.45 | -61.00 | -52.30 | -8.70 |
| 28 | 2443.40 | -60.60 | -52.30 | -8.30 |
| 27 | 2443.35 | -60.50 | -52.30 | -8.20 |
| 26 | 2443.30 | -60.40 | -52.30 | -8.10 |
| 25 | 2443.25 | -60.90 | -52.30 | -8.60 |
| 24 | 2443.20 | -60.80 | -52.30 | -8.50 |
| 23 | 2443.15 | -61.00 | -52.30 | -8.70 |
| 22 | 2443.10 | -60.60 | -52.30 | -8.30 |
| 21 | 2443.05 | -61.10 | -52.30 | -8.80 |
| 20 | 2443.00 | -60.70 | -52.30 | -8.40 |

**Table 12.2 : Processing gain testresults for 11.0 Mb/s**

**channel: 07 = 2442.0 MHz 3 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| 19 | 2442.95 | -60.90 | -52.30 | -8.60 |
| 18 | 2442.90 | -61.40 | -52.30 | -9.10 |
| 17 | 2442.85 | -61.10 | -52.30 | -8.80 |
| 16 | 2442.80 | -61.30 | -52.30 | -9.00 |
| 15 | 2442.75 | -60.90 | -52.30 | -8.60 |
| 14 | 2442.70 | -61.10 | -52.30 | -8.80 |
| 13 | 2442.65 | -61.30 | -52.30 | -9.00 |
| 12 | 2442.60 | -61.20 | -52.30 | -8.90 |
| 11 | 2442.55 | -62.00 | -52.30 | -9.70 |
| 10 | 2442.50 | -61.40 | -52.30 | -9.10 |
| 9 | 2442.45 | -62.30 | -52.30 | -10.00 |
| 8 | 2442.40 | -62.50 | -52.30 | -10.20 |
| 7 | 2442.35 | -62.40 | -52.30 | -10.10 |
| 6 | 2442.30 | -63.30 | -52.30 | -11.00 |
| 5 | 2442.25 | -64.10 | -52.30 | -11.80 |
| 4 | 2442.20 | -62.80 | -52.30 | -10.50 |
| 3 | 2442.15 | -62.40 | -52.30 | -10.10 |
| 2 | 2442.10 | -61.70 | -52.30 | -9.40 |
| 1 | 2442.05 | -61.60 | -52.30 | -9.30 |
| 0 | 2442.00 | -61.50 | -52.30 | -9.20 |
| -100 | 2437.00 | -55.50 | -52.30 | -3.20 |
| -99 | 2437.05 | -55.00 | -52.30 | -2.70 |
| -98 | 2437.10 | -55.00 | -52.30 | -2.70 |
| -97 | 2437.15 | -55.20 | -52.30 | -2.90 |
| -96 | 2437.20 | -55.10 | -52.30 | -2.80 |
| -95 | 2437.25 | -55.30 | -52.30 | -3.00 |
| -94 | 2437.30 | -55.90 | -52.30 | -3.60 |
| -93 | 2437.35 | -55.80 | -52.30 | -3.50 |
| -92 | 2437.40 | -56.00 | -52.30 | -3.70 |
| -91 | 2437.45 | -56.10 | -52.30 | -3.80 |
| -90 | 2437.50 | -56.30 | -52.30 | -4.00 |
| -89 | 2437.55 | -56.50 | -52.30 | -4.20 |
| -88 | 2437.60 | -56.70 | -52.30 | -4.40 |
| -87 | 2437.65 | -56.60 | -52.30 | -4.30 |
| -86 | 2437.70 | -58.00 | -52.30 | -5.70 |
| -85 | 2437.75 | -58.50 | -52.30 | -6.20 |
| -84 | 2437.80 | -59.00 | -52.30 | -6.70 |
| -83 | 2437.85 | -59.10 | -52.30 | -6.80 |
| -82 | 2437.90 | -59.30 | -52.30 | -7.00 |
| -81 | 2437.95 | -58.10 | -52.30 | -5.80 |
| -80 | 2438.00 | -58.50 | -52.30 | -6.20 |

**Table 12.3 : Processing gain testresults for 11.0 Mb/s**

**channel: 07 = 2442.0 MHz 4 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| -79 | 2438.05 | -58.10 | -52.30 | -5.80 |
| -78 | 2438.10 | -57.40 | -52.30 | -5.10 |
| -77 | 2438.15 | -57.60 | -52.30 | -5.30 |
| -76 | 2438.20 | -58.00 | -52.30 | -5.70 |
| -75 | 2438.25 | -57.60 | -52.30 | -5.30 |
| -74 | 2438.30 | -56.50 | -52.30 | -4.20 |
| -73 | 2438.35 | -55.90 | -52.30 | -3.60 |
| -72 | 2438.40 | -56.10 | -52.30 | -3.80 |
| -71 | 2438.45 | -56.30 | -52.30 | -4.00 |
| -70 | 2438.50 | -56.50 | -52.30 | -4.20 |
| -69 | 2438.55 | -58.90 | -52.30 | -6.60 |
| -68 | 2438.60 | -59.70 | -52.30 | -7.40 |
| -67 | 2438.65 | -60.50 | -52.30 | -8.20 |
| -66 | 2438.70 | -61.70 | -52.30 | -9.40 |
| -65 | 2438.75 | -63.10 | -52.30 | -10.80 |
| -64 | 2438.80 | -61.10 | -52.30 | -8.80 |
| -63 | 2438.85 | -59.20 | -52.30 | -6.90 |
| -62 | 2438.90 | -59.50 | -52.30 | -7.20 |
| -61 | 2438.95 | -60.70 | -52.30 | -8.40 |
| -60 | 2439.00 | -60.00 | -52.30 | -7.70 |
| -59 | 2439.05 | -60.00 | -52.30 | -7.70 |
| -58 | 2439.10 | -59.30 | -52.30 | -7.00 |
| -57 | 2439.15 | -59.10 | -52.30 | -6.80 |
| -56 | 2439.20 | -58.80 | -52.30 | -6.50 |
| -55 | 2439.25 | -59.40 | -52.30 | -7.10 |
| -54 | 2439.30 | -59.70 | -52.30 | -7.40 |
| -53 | 2439.35 | -59.60 | -52.30 | -7.30 |
| -52 | 2439.40 | -59.50 | -52.30 | -7.20 |
| -51 | 2439.45 | -60.60 | -52.30 | -8.30 |
| -50 | 2439.50 | -59.40 | -52.30 | -7.10 |
| -49 | 2439.55 | -60.80 | -52.30 | -8.50 |
| -48 | 2439.60 | -61.00 | -52.30 | -8.70 |
| -47 | 2439.65 | -59.30 | -52.30 | -7.00 |
| -46 | 2439.70 | -59.50 | -52.30 | -7.20 |
| -45 | 2439.75 | -59.10 | -52.30 | -6.80 |
| -44 | 2439.80 | -59.20 | -52.30 | -6.90 |
| -43 | 2439.85 | -57.50 | -52.30 | -5.20 |
| -42 | 2439.90 | -57.10 | -52.30 | -4.80 |
| -41 | 2439.95 | -57.30 | -52.30 | -5.00 |
| -40 | 2440.00 | -57.80 | -52.30 | -5.50 |

**Table 12.4 : Processing gain testresults for 11.0 Mb/s**

**channel: 07 = 2442.0 MHz 5 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| -39 | 2440.05 | -59.50 | -52.30 | -7.20 |
| -38 | 2440.10 | -59.40 | -52.30 | -7.10 |
| -37 | 2440.15 | -59.60 | -52.30 | -7.30 |
| -36 | 2440.20 | -60.40 | -52.30 | -8.10 |
| -35 | 2440.25 | -60.90 | -52.30 | -8.60 |
| -34 | 2440.30 | -61.70 | -52.30 | -9.40 |
| -33 | 2440.35 | -61.00 | -52.30 | -8.70 |
| -32 | 2440.40 | -60.90 | -52.30 | -8.60 |
| -31 | 2440.45 | -61.00 | -52.30 | -8.70 |
| -30 | 2440.50 | -60.90 | -52.30 | -8.60 |
| -29 | 2440.55 | -60.80 | -52.30 | -8.50 |
| -28 | 2440.60 | -61.00 | -52.30 | -8.70 |
| -27 | 2440.65 | -61.20 | -52.30 | -8.90 |
| -26 | 2440.70 | -60.80 | -52.30 | -8.50 |
| -25 | 2440.75 | -60.70 | -52.30 | -8.40 |
| -24 | 2440.80 | -60.90 | -52.30 | -8.60 |
| -23 | 2440.85 | -60.90 | -52.30 | -8.60 |
| -22 | 2440.90 | -60.80 | -52.30 | -8.50 |
| -21 | 2440.95 | -62.10 | -52.30 | -9.80 |
| -20 | 2441.00 | -62.10 | -52.30 | -9.80 |
| -19 | 2441.05 | -60.50 | -52.30 | -8.20 |
| -18 | 2441.10 | -60.10 | -52.30 | -7.80 |
| -17 | 2441.15 | -59.80 | -52.30 | -7.50 |
| -16 | 2441.20 | -59.80 | -52.30 | -7.50 |
| -15 | 2441.25 | -59.10 | -52.30 | -6.80 |
| -14 | 2441.30 | -59.90 | -52.30 | -7.60 |
| -13 | 2441.35 | -60.40 | -52.30 | -8.10 |
| -12 | 2441.40 | -60.60 | -52.30 | -8.30 |
| -11 | 2441.45 | -61.10 | -52.30 | -8.80 |
| -10 | 2441.50 | -61.60 | -52.30 | -9.30 |
| -9 | 2441.55 | -61.50 | -52.30 | -9.20 |
| -8 | 2441.60 | -59.70 | -52.30 | -7.40 |
| -7 | 2441.65 | -60.40 | -52.30 | -8.10 |
| -6 | 2441.70 | -61.50 | -52.30 | -9.20 |
| -5 | 2441.75 | -61.20 | -52.30 | -8.90 |
| -4 | 2441.80 | -61.00 | -52.30 | -8.70 |
| -3 | 2441.85 | -61.10 | -52.30 | -8.80 |
| -2 | 2441.90 | -61.30 | -52.30 | -9.00 |
| -1 | 2441.95 | -61.10 | -52.30 | -8.80 |

**Table 12.5 : Processing gain testresults for 11.0 Mb/s**

## 12.4 Processing gain at 2.0 Mb/s

The processing gain is measured using the CW jamming margin method. A signal generator is stepped in 50 kHz increments across the passband of the system. At each point the generator level required to produce a Bit Error Rate equivalent to BER=10E-5 is recorded as the Jammer level (J). The output power of the transmitter is measured at the same point and recorded as Signal (S). The Jammer to Signal ratio (J/S) is then calculated with 20% of the worst datapoints discarded. The lowest remaining J/S ratio is used to calculate the processing gain using formula:

$$Gp = (S/N)o + Mj + Lsys$$

with:
(S/N)0 = 21.0 dB for 2.0 Mb/s (obtained from manufacturer's specification of spreading processor Harris semiconductor model HFA3861)

Lsys = 2.0 dB

Measured lowest remaining J/S = Mj = -2.0 dB

**Gp = 21.0 dB +(-2.0) dB + 2.0 dB = 21.0 dB (for 2.0 Mb/s modulation)**

Test engineer:

Signature : Date: February 18, 2000

Printed name : O.H. Hoekstra

## 12.5 Processing Gain at 2.0 Mb/s testresults tables

**pass band = fo ± 5MHz ( 5000 kHz = 100 x 50 kHz)**
**channel: 07 = 2442.0 MHz 1 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| 100 | 2447.00 | -51.50 | -52.30 | 0.80 |
| 99 | 2446.95 | -51.20 | -52.30 | 1.10 |
| 98 | 2446.90 | -51.10 | -52.30 | 1.20 |
| 97 | 2446.85 | -51.00 | -52.30 | 1.30 |
| 96 | 2446.80 | -51.10 | -52.30 | 1.20 |
| 95 | 2446.75 | -51.80 | -52.30 | 0.50 |
| 94 | 2446.70 | -51.50 | -52.30 | 0.80 |
| 93 | 2446.65 | -51.80 | -52.30 | 0.50 |
| 92 | 2446.60 | -52.10 | -52.30 | 0.20 |
| 91 | 2446.55 | -52.10 | -52.30 | 0.20 |
| 90 | 2446.50 | -52.30 | -52.30 | 0.00 |
| 89 | 2446.45 | -51.30 | -52.30 | 1.00 |
| 88 | 2446.40 | -51.20 | -52.30 | 1.10 |
| 87 | 2446.35 | -51.10 | -52.30 | 1.20 |
| 86 | 2446.30 | -51.60 | -52.30 | 0.70 |
| 85 | 2446.25 | -51.90 | -52.30 | 0.40 |
| 84 | 2446.20 | -52.00 | -52.30 | 0.30 |
| 83 | 2446.15 | -52.50 | -52.30 | -0.20 |
| 82 | 2446.10 | -52.80 | -52.30 | -0.50 |
| 81 | 2446.05 | -53.10 | -52.30 | -0.80 |
| 80 | 2446.00 | -53.50 | -52.30 | -1.20 |
| 79 | 2445.95 | -53.00 | -52.30 | -0.70 |
| 78 | 2445.90 | -53.30 | -52.30 | -1.00 |
| 77 | 2445.85 | -53.00 | -52.30 | -0.70 |
| 76 | 2445.80 | -53.20 | -52.30 | -0.90 |
| 75 | 2445.75 | -53.70 | -52.30 | -1.40 |
| 74 | 2445.70 | -53.30 | -52.30 | -1.00 |
| 73 | 2445.65 | -53.60 | -52.30 | -1.30 |
| 72 | 2445.60 | -52.30 | -52.30 | 0.00 |
| 71 | 2445.55 | -52.10 | -52.30 | 0.20 |
| 70 | 2445.50 | -51.80 | -52.30 | 0.50 |
| 69 | 2445.45 | -51.50 | -52.30 | 0.80 |
| 68 | 2445.40 | -51.40 | -52.30 | 0.90 |
| 67 | 2445.35 | -51.50 | -52.30 | 0.80 |
| 66 | 2445.30 | -53.30 | -52.30 | -1.00 |
| 65 | 2445.25 | -53.40 | -52.30 | -1.10 |
| 64 | 2445.20 | -54.00 | -52.30 | -1.70 |
| 63 | 2445.15 | -54.60 | -52.30 | -2.30 |
| 62 | 2445.10 | -55.00 | -52.30 | -2.70 |
| 61 | 2445.05 | -54.80 | -52.30 | -2.50 |
| 60 | 2445.00 | -54.90 | -52.30 | -2.60 |

**Table 12.6 : Processing gain testresults for 2.0 Mb/s**

**channel: 07 = 2442.0 MHz 2 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| 59 | 2444.95 | -54.20 | -52.30 | -1.90 |
| 58 | 2444.90 | -53.80 | -52.30 | -1.50 |
| 57 | 2444.85 | -53.20 | -52.30 | -0.90 |
| 56 | 2444.80 | -53.60 | -52.30 | -1.30 |
| 55 | 2444.75 | -52.80 | -52.30 | -0.50 |
| 54 | 2444.70 | -53.60 | -52.30 | -1.30 |
| 53 | 2444.65 | -52.90 | -52.30 | -0.60 |
| 52 | 2444.60 | -52.60 | -52.30 | -0.30 |
| 51 | 2444.55 | -52.30 | -52.30 | 0.00 |
| 50 | 2444.50 | -51.90 | -52.30 | 0.40 |
| 49 | 2444.45 | -52.40 | -52.30 | -0.10 |
| 48 | 2444.40 | -52.00 | -52.30 | 0.30 |
| 47 | 2444.35 | -53.00 | -52.30 | -0.70 |
| 46 | 2444.30 | -54.50 | -52.30 | -2.20 |
| 45 | 2444.25 | -54.90 | -52.30 | -2.60 |
| 44 | 2444.20 | -55.20 | -52.30 | -2.90 |
| 43 | 2444.15 | -55.10 | -52.30 | -2.80 |
| 42 | 2444.10 | -55.10 | -52.30 | -2.80 |
| 41 | 2444.05 | -54.90 | -52.30 | -2.60 |
| 40 | 2444.00 | -54.50 | -52.30 | -2.20 |
| 39 | 2443.95 | -53.20 | -52.30 | -0.90 |
| 38 | 2443.90 | -53.60 | -52.30 | -1.30 |
| 37 | 2443.85 | -52.70 | -52.30 | -0.40 |
| 36 | 2443.80 | -52.90 | -52.30 | -0.60 |
| 35 | 2443.75 | -53.00 | -52.30 | -0.70 |
| 34 | 2443.70 | -53.30 | -52.30 | -1.00 |
| 33 | 2443.65 | -53.80 | -52.30 | -1.50 |
| 32 | 2443.60 | -54.00 | -52.30 | -1.70 |
| 31 | 2443.55 | -54.10 | -52.30 | -1.80 |
| 30 | 2443.50 | -53.90 | -52.30 | -1.60 |
| 29 | 2443.45 | -54.10 | -52.30 | -1.80 |
| 28 | 2443.40 | -53.40 | -52.30 | -1.10 |
| 27 | 2443.35 | -53.70 | -52.30 | -1.40 |
| 26 | 2443.30 | -55.00 | -52.30 | -2.70 |
| 25 | 2443.25 | -55.20 | -52.30 | -2.90 |
| 24 | 2443.20 | -54.90 | -52.30 | -2.60 |
| 23 | 2443.15 | -54.60 | -52.30 | -2.30 |
| 22 | 2443.10 | -54.70 | -52.30 | -2.40 |
| 21 | 2443.05 | -54.00 | -52.30 | -1.70 |
| 20 | 2443.00 | -54.30 | -52.30 | -2.00 |

**Table 12.7 : Processing gain testresults for 2.0 Mb/s**

**channel: 07 = 2442.0 MHz 3 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| 19 | 2442.95 | -53.40 | -52.30 | -1.10 |
| 18 | 2442.90 | -53.90 | -52.30 | -1.60 |
| 17 | 2442.85 | -53.60 | -52.30 | -1.30 |
| 16 | 2442.80 | -54.00 | -52.30 | -1.70 |
| 15 | 2442.75 | -54.30 | -52.30 | -2.00 |
| 14 | 2442.70 | -54.80 | -52.30 | -2.50 |
| 13 | 2442.65 | -53.90 | -52.30 | -1.60 |
| 12 | 2442.60 | -53.10 | -52.30 | -0.80 |
| 11 | 2442.55 | -51.80 | -52.30 | 0.50 |
| 10 | 2442.50 | -51.20 | -52.30 | 1.10 |
| 9 | 2442.45 | -49.90 | -52.30 | 2.40 |
| 8 | 2442.40 | -48.80 | -52.30 | 3.50 |
| 7 | 2442.35 | -47.40 | -52.30 | 4.90 |
| 6 | 2442.30 | -47.70 | -52.30 | 4.60 |
| 5 | 2442.25 | -48.00 | -52.30 | 4.30 |
| 4 | 2442.20 | -47.90 | -52.30 | 4.40 |
| 3 | 2442.15 | -47.90 | -52.30 | 4.40 |
| 2 | 2442.10 | -48.60 | -52.30 | 3.70 |
| 1 | 2442.05 | -50.50 | -52.30 | 1.80 |
| 0 | 2442.00 | -52.20 | -52.30 | 0.10 |
| -100 | 2437.00 | -48.00 | -52.30 | 4.30 |
| -99 | 2437.05 | -48.90 | -52.30 | 3.40 |
| -98 | 2437.10 | -50.40 | -52.30 | 1.90 |
| -97 | 2437.15 | -51.00 | -52.30 | 1.30 |
| -96 | 2437.20 | -51.50 | -52.30 | 0.80 |
| -95 | 2437.25 | -51.60 | -52.30 | 0.70 |
| -94 | 2437.30 | -52.00 | -52.30 | 0.30 |
| -93 | 2437.35 | -51.40 | -52.30 | 0.90 |
| -92 | 2437.40 | -51.30 | -52.30 | 1.00 |
| -91 | 2437.45 | -51.40 | -52.30 | 0.90 |
| -90 | 2437.50 | -51.60 | -52.30 | 0.70 |
| -89 | 2437.55 | -51.50 | -52.30 | 0.80 |
| -88 | 2437.60 | -51.20 | -52.30 | 1.10 |
| -87 | 2437.65 | -51.40 | -52.30 | 0.90 |
| -86 | 2437.70 | -51.30 | -52.30 | 1.00 |
| -85 | 2437.75 | -52.00 | -52.30 | 0.30 |
| -84 | 2437.80 | -52.40 | -52.30 | -0.10 |
| -83 | 2437.85 | -51.90 | -52.30 | 0.40 |
| -82 | 2437.90 | -51.80 | -52.30 | 0.50 |
| -81 | 2437.95 | -51.60 | -52.30 | 0.70 |
| -80 | 2438.00 | -52.70 | -52.30 | -0.40 |

**Table 12.8 : Processing gain testresults for 2.0 Mb/s**

**channel: 07 = 2442.0 MHz 4 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| -79 | 2438.05 | -52.80 | -52.30 | -0.50 |
| -78 | 2438.10 | -52.20 | -52.30 | 0.10 |
| -77 | 2438.15 | -52.50 | -52.30 | -0.20 |
| -76 | 2438.20 | -51.30 | -52.30 | 1.00 |
| -75 | 2438.25 | -51.70 | -52.30 | 0.60 |
| -74 | 2438.30 | -51.90 | -52.30 | 0.40 |
| -73 | 2438.35 | -51.10 | -52.30 | 1.20 |
| -72 | 2438.40 | -51.60 | -52.30 | 0.70 |
| -71 | 2438.45 | -51.40 | -52.30 | 0.90 |
| -70 | 2438.50 | -52.30 | -52.30 | 0.00 |
| -69 | 2438.55 | -53.00 | -52.30 | -0.70 |
| -68 | 2438.60 | -53.40 | -52.30 | -1.10 |
| -67 | 2438.65 | -54.10 | -52.30 | -1.80 |
| -66 | 2438.70 | -54.20 | -52.30 | -1.90 |
| -65 | 2438.75 | -54.00 | -52.30 | -1.70 |
| -64 | 2438.80 | -53.10 | -52.30 | -0.80 |
| -63 | 2438.85 | -52.10 | -52.30 | 0.20 |
| -62 | 2438.90 | -52.20 | -52.30 | 0.10 |
| -61 | 2438.95 | -52.10 | -52.30 | 0.20 |
| -60 | 2439.00 | -51.90 | -52.30 | 0.40 |
| -59 | 2439.05 | -52.10 | -52.30 | 0.20 |
| -58 | 2439.10 | -51.80 | -52.30 | 0.50 |
| -57 | 2439.15 | -52.40 | -52.30 | -0.10 |
| -56 | 2439.20 | -52.90 | -52.30 | -0.60 |
| -55 | 2439.25 | -53.20 | -52.30 | -0.90 |
| -54 | 2439.30 | -53.50 | -52.30 | -1.20 |
| -53 | 2439.35 | -53.10 | -52.30 | -0.80 |
| -52 | 2439.40 | -53.50 | -52.30 | -1.20 |
| -51 | 2439.45 | -53.90 | -52.30 | -1.60 |
| -50 | 2439.50 | -53.80 | -52.30 | -1.50 |
| -49 | 2439.55 | -54.40 | -52.30 | -2.10 |
| -48 | 2439.60 | -54.30 | -52.30 | -2.00 |
| -47 | 2439.65 | -54.80 | -52.30 | -2.50 |
| -46 | 2439.70 | -54.30 | -52.30 | -2.00 |
| -45 | 2439.75 | -54.10 | -52.30 | -1.80 |
| -44 | 2439.80 | -52.80 | -52.30 | -0.50 |
| -43 | 2439.85 | -51.90 | -52.30 | 0.40 |
| -42 | 2439.90 | -52.00 | -52.30 | 0.30 |
| -41 | 2439.95 | -51.90 | -52.30 | 0.40 |
| -40 | 2440.00 | -53.00 | -52.30 | -0.70 |

**Table 12.9 : Processing gain testresults for 2.0 Mb/s**

**channel: 07 = 2442.0 MHz 5 of 5 (No Wires Needed Access point to GemTek WL-211P PC card)**

| Step | Freq.(MHz) | J(dBm) | S(dBm) | J/S(dB) |
|---|---|---|---|---|
| -39 | 2440.05 | -53.80 | -52.30 | -1.50 |
| -38 | 2440.10 | -54.30 | -52.30 | -2.00 |
| -37 | 2440.15 | -54.30 | -52.30 | -2.00 |
| -36 | 2440.20 | -54.60 | -52.30 | -2.30 |
| -35 | 2440.25 | -55.00 | -52.30 | -2.70 |
| -34 | 2440.30 | -55.20 | -52.30 | -2.90 |
| -33 | 2440.35 | -54.60 | -52.30 | -2.30 |
| -32 | 2440.40 | -54.10 | -52.30 | -1.80 |
| -31 | 2440.45 | -54.20 | -52.30 | -1.90 |
| -30 | 2440.50 | -54.10 | -52.30 | -1.80 |
| -29 | 2440.55 | -54.70 | -52.30 | -2.40 |
| -28 | 2440.60 | -54.70 | -52.30 | -2.40 |
| -27 | 2440.65 | -54.90 | -52.30 | -2.60 |
| -26 | 2440.70 | -54.00 | -52.30 | -1.70 |
| -25 | 2440.75 | -53.20 | -52.30 | -0.90 |
| -24 | 2440.80 | -53.10 | -52.30 | -0.80 |
| -23 | 2440.85 | -53.20 | -52.30 | -0.90 |
| -22 | 2440.90 | -53.60 | -52.30 | -1.30 |
| -21 | 2440.95 | -53.10 | -52.30 | -0.80 |
| -20 | 2441.00 | -54.90 | -52.30 | -2.60 |
| -19 | 2441.05 | -54.70 | -52.30 | -2.40 |
| -18 | 2441.10 | -54.60 | -52.30 | -2.30 |
| -17 | 2441.15 | -55.00 | -52.30 | -2.70 |
| -16 | 2441.20 | -55.40 | -52.30 | -3.10 |
| -15 | 2441.25 | -55.20 | -52.30 | -2.90 |
| -14 | 2441.30 | -55.10 | -52.30 | -2.80 |
| -13 | 2441.35 | -53.50 | -52.30 | -1.20 |
| -12 | 2441.40 | -52.90 | -52.30 | -0.60 |
| -11 | 2441.45 | -53.40 | -52.30 | -1.10 |
| -10 | 2441.50 | -53.60 | -52.30 | -1.30 |
| -9 | 2441.55 | -54.20 | -52.30 | -1.90 |
| -8 | 2441.60 | -54.80 | -52.30 | -2.50 |
| -7 | 2441.65 | -55.80 | -52.30 | -3.50 |
| -6 | 2441.70 | -55.80 | -52.30 | -3.50 |
| -5 | 2441.75 | -54.70 | -52.30 | -2.40 |
| -4 | 2441.80 | -54.50 | -52.30 | -2.20 |
| -3 | 2441.85 | -54.20 | -52.30 | -1.90 |
| -2 | 2441.90 | -53.40 | -52.30 | -1.10 |
| -1 | 2441.95 | -52.60 | -52.30 | -0.30 |

**Table 12.10 : Processing gain testresults for 2.0 Mb/s**

## 12.6 Photograph of Processing gain testsetup

**Photograph 12.1: testsetup**