# TEST REPORT OF A 2.4 GHZ LOW POWER RLAN MINIPCI CARD, BRAND AGERE, TYPE MPCI3A-20/R, BUILT INTO NOTEBOOK TYPE LATITUDE X200, BRAND DELL, IN CONFORMITY WITH CFR 47 PART 15.107, 15.109, 15.205, 15.207 AND 15.209 (2001-5-24)

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# MEASUREMENT/TECHNICAL REPORT

## Agere Systems Nederland B.V.

## Model : MPCI3A-20/R

## FCC ID: IMRMPCIDE3

March 18, 2002

| | | |
|---|---|---|
| This report concerns (strike out one): | ~~Original grant/certification~~ Class 2 change ~~Verification~~ | |
| Equipment type: | Direct Sequence Spread Spectrum Transceiver | |
| Deferred grant requested per 47 CFR 0.457(d)(1)(ii) ? | ~~Yes~~ No | |
| Report prepared by: | Name | : D.H. Kruiter, B.Sc. E.E., B.Sc. T.M. |
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The data taken for this test and report herein was done in accordance with CFR 47 Part 15 and the measurement procedures of ANSI C63.4-1992. TNO Certification EPS 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 as 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: March 18, 2002 Signature:

P. de Beer
TNO Certification EPS

## Description of test item

| | | |
|---|---|---|
| Test item | : | 2.4 GHz low power RLAN MiniPCI card built into notebook type Latitude X200, brand Dell |
| Manufacturer | : | Agere Systems Nederland B.V. |
| Brand | : | Agere |
| Type | : | MPCI3A-20/R |
| Revision | : | 8U354 |
| Receipt number | : | 2 |
| Receipt date | : | March 13, 2002 |

## Applicant information

| | | |
|---|---|---|
| Applicant's representative | : | Mr. W. Kerkhof |
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| Address | : | Zadelstede 1-10 |
| Postal code | : | 3431 JZ |
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## Test(s) performed

| | | |
|---|---|---|
| Location | : | Niekerk |
| Test(s) started | : | March 14, 2002 |
| Test(s) completed | : | March 17, 2002 |
| Purpose of test(s) | : | Type approval / certification |
| Test specification(s) | : | CFR 47 Part 15.107, 15.109, 15.205, 15.207 and 15.209 (2001-5-24) |

| | | | |
|---|---|---|---|
| Test engineer | : | P.A.J.M. Robben, B.Sc.E.E. | |
| Project leader | : | P.A.J.M. Robben, B.Sc.E.E. | |
| Report written by | : | D.H. Kruiter, B.Sc. E.E., B.Sc. T.M. | D.H. Kruiter |
| Report approved by | : | P.A.J.M. Robben, B.Sc.E.E. | |
| Report date | : | March 18, 2002 | |

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# 1 General information

## 1.1 Product description

The 2.4 GHz low power RLAN MiniPCI card, brand Agere, type MPCI3A-20/R, is designed to operate in the 2.4 GHz ISM frequency band, channels 1 to 11 (2412 MHz to 2462 MHz), as specified by the Federal Communications Commission in the USA.

The 2.4 GHz low power RLAN MiniPCI card, brand Agere, type MPCI3A-20/R, utilizes Direct Sequence Spread Spectrum (DSSS) technology.

The 2.4 GHz low power RLAN MiniPCI card, brand Agere, type MPCI3A-20/R, is intended for use in notebooks with a factory installed integrated antenna. Only antennas, which have been certified by the Federal Communications Commission for use with this specific 2.4 GHz low power RLAN MiniPCI card, may be connected to the antenna connector of this device.

## 1.2 Related submittal(s) and/or Grant(s)

Not applicable.

## 1.3 Tested system details

Details and an overview of the system and all its components, as it has been tested, can be found in table 1 below. FCC ID's are stated in this overview where applicable. The EUT is listed in the first row of this table 1.

| Description | Type number | Serial number | FCC ID | Cable descriptions |
|---|---|---|---|---|
| 2.4 GHz low power RLAN MiniPCI card | MPCI3A-20/R | - | - | Coaxial antenna cable connected to a factory installed integrated antenna, having a gain of 0.9 dBi |
| Notebook computer | Latitude X200 | KR-07J510-36521-218-2068 | n.a. (DoC) | Unshielded DC power cord to AC/DC adapter<br><br>Shielded parallel cable to printer |
| Dell AC/DC power adapter<br><br>100-240 VAC/1.2 Amps to +20 VDC/2.5 Amps | ADP-50FH, PA-8 family | TH-08H051-17971-1CR-1RC7 | n.a. (DoC) | Unshielded DC power cord to notebook computer<br><br>Unshielded power cord to AC mains |
| Factory installed integrated antenna, brand Amphenol KAE, having a gain of 0.9 dBi | PIFA | n.a. | n.a. | Coaxial antenna cable to EUT |
| HP DeskJet 895Cxi | C6410A | ES8B42307H | n.a. (DoC) | Unshielded DC power cord to AC/DC adapter<br><br>Shielded parallel cable to notebook computer |
| HP AC/DC power adapter<br><br>100-240 VAC/1 Amps to +18 VDC/1.1 Amps | C6409-60014 | n.a. | n.a. (DoC) | Unshielded DC power cord to printer<br><br>Unshielded power cord to AC mains |

Table 1 - Tested system details overview.

## 1.4 Test methodology

The test methodology used is based on the requirements of CFR 47 Part 15, issue of May 24, 2001, sections 15.107, 15.109, 15.205, 15.207 and 15.209.

The test methods, which have been used, are based on ANSI C63.4: 1992.

Radiated emission tests above 30 MHz were performed at a measurement distance of 3 meters. Below 30 MHz the radiated emission tests were carried out at measurement distances of 3 and 10 meters. The test results regarding the radiated emission tests on frequencies below 30 MHz have been extrapolated in order to determine the field strength of the measured values at measurement distances of 30 and 300 meters (as required by CFR 47 Part 15).

Radiated emission tests on frequencies above 1 GHz were performed with appropriate pre-amplifiers, antennas and a spectrum analyzer. At frequencies on which radiated emissions were found the level at the input of the pre-amplifier was reproduced by means of a RF signal generator. The output level of the signal generator was then increased with the antenna factor in order to obtain the actual field strength value for each individual frequency on which radiated emissions were found.

## 1.5 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at TNO Certification EPS, located in Niekerk, 9822 TL Smidshornerweg 18, The Netherlands, and has found these test facilities to be in compliance with the requirements of CFR 47 Part 15, section 2.948, per October 23, 2000.

The description of the test facilities has been filed at the Office of the Federal Communications Commission. The facility has been added to the list of those laboratories performing these test services for the public on a fee basis.

The list of all public test facilities is available on the Internet at http://www.fcc.gov.

## 1.6 Product labeling

In accordance with CFR 47 Part 15.19 (a)(3) the following text shall be placed on a label, which is attached to the notebook computer (host-system), in which the EUT is built-in:

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

The FCC ID of the EUT must be placed on a label, which is attached to the notebook computer (host-system), in which the EUT is built-in.

For further details about the labeling requirements (size, legibility, etc.) as set by the Federal Communications Commission see CFR 47 Part 15.19 (a)(3), CFR 47 Part 15.19 (b)(2), CFR 47 Part 15.19 (b)(4), CFR 47 Part 2.925 and CFR 47 Part 2.926.

## 1.7 System test configuration

### 1.7.1 Justification

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

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4: 1992.

Tests were performed at 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). Further details may be found in table 2 below.

| Channel | Operating frequencies (MHz) | Rated output power (dBm) | Test performed |
|---|---|---|---|
| 1 | 2412 | +15 | ***yes*** |
| 2 | 2417 | +15 | no |
| 3 | 2422 | +15 | no |
| 4 | 2427 | +15 | no |
| 5 | 2432 | +15 | no |
| 6 | 2437 | +15 | ***yes*** |
| 7 | 2442 | +15 | no |
| 8 | 2447 | +15 | no |
| 9 | 2452 | +15 | no |
| 10 | 2457 | +15 | no |
| 11 | 2462 | +15 | ***yes*** |

Table 2 - Specification of channels and rated maximum output power (excluding antenna gain of 0.9 dBi).

The EUT was tested in a notebook computer with a factory installed integrated antenna, having a declared gain of 0.9 dBi, connected to the antenna port. Only radiated emission measurements and conducted emission measurements on the AC mains connection terminals of the notebook computer were carried out. The results of all other measurements, as required by CFR 47 Part 15.247, may be found in the "base" test report with reference number 02031401.r00.

### 1.7.2 EUT exercise software

The EUT could be enabled to transmit or receive continuously on channels 1 (2412 MHz), 6 (2437 MHz) and 11 (2462 MHz) by means of test software, which was supplied by the manufacturer of the EUT. Furthermore, the utilized test software also enables various transmission bit-rate settings in the range of 1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s.

## 1.8 Special accessories

No special accessories are used and/or needed to achieve compliance with the appropriate sections of CFR 47 Part 15.

## 1.9 Equipment modifications

No modifications have been made to the equipment in order to achieve compliance with the appropriate sections of CFR 47 Part 15.

## 1.10 Configuration of the tested system

Not applicable. See table 1 in section 1.3 of this test report and the test setup photographs, which are available in an addendum (with reference number 02031401.r06) to this test report.

## 1.11 Block diagram(s) of the EUT

The block diagram is available as part of the documentation which is to be submitted to the FCC/TCB.

# 2 Radiated emission data

## 2.1 Test results with EUT operating in receive mode on channel 1

The results of the radiated emission tests, carried out in accordance with CFR 47 Part 15.109 and CFR 47 Part 15.209 with the EUT operating in receive mode on channel 1 (2412 MHz), are depicted in table 3.

| Frequency (MHz) | Test results quasi peak (dBµV/m) | | Test results average (dBµV/m) | | Test results peak (dBµV/m) | | Resolution bandwidth (kHz) | Quasi peak limits (dBµV/m) | Average limits (dBµV/m) | Peak limits (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | V | H | V | H | V | H | | | | |
| 66.600 | 14.0 | 7.3 | - | - | - | - | 120 | 40.0 | - | - |
| 71.560 | 15.6 | 19.2 | - | - | - | - | 120 | 40.0 | - | - |
| 83.690 | 22.3 | 10.0 | - | - | - | - | 120 | 40.0 | - | - |
| 98.300 | 26.9 | 22.4 | - | - | - | - | 120 | 43.5 | - | - |
| 229.080 | 23.7 | 24.8 | - | - | - | - | 120 | 46.0 | - | - |
| 233.460 | 25.4 | 27.6 | - | - | - | - | 120 | 46.0 | - | - |
| 245.750 | 29.5 | 32.3 | - | - | - | - | 120 | 46.0 | - | - |
| 260.820 | 26.6 | 31.5 | - | - | - | - | 120 | 46.0 | - | - |
| 300.700 | 31.0 | 28.8 | - | - | - | - | 120 | 46.0 | - | - |
| 313.480 | 31.5 | 39.1 | - | - | - | - | 120 | 46.0 | - | - |
| 325.040 | 33.0 | 40.3 | - | - | - | - | 120 | 46.0 | - | - |
| 330.000 | 27.9 | 32.9 | - | - | - | - | 120 | 46.0 | - | - |
| 333.020 | 34.9 | 38.8 | - | - | - | - | 120 | 46.0 | - | - |
| 391.170 | 30.4 | 25.4 | - | - | - | - | 120 | 46.0 | - | - |
| 429.920 | 35.7 | 37.7 | - | - | - | - | 120 | 46.0 | - | - |
| 456.410 | 28.4 | 26.9 | - | - | - | - | 120 | 46.0 | - | - |
| 480.070 | 37.0 | 34.0 | - | - | - | - | 120 | 46.0 | - | - |
| 501.170 | 35.6 | 31.3 | - | - | - | - | 120 | 46.0 | - | - |
| 720.110 | 37.9 | 32.0 | - | - | - | - | 120 | 46.0 | - | - |
| 732.510 | 40.9 | 30.0 | - | - | - | - | 120 | 46.0 | - | - |
| 768.110 | 37.4 | 30.7 | - | - | - | - | 120 | 46.0 | - | - |
| 785.870 | 34.0 | 30.7 | - | - | - | - | 120 | 46.0 | - | - |
| 816.120 | 36.8 | 31.3 | - | - | - | - | 120 | 46.0 | - | - |
| 884.720 | 35.0 | 39.9 | - | - | - | - | 120 | 46.0 | - | - |
| 912.900 | 34.9 | 33.3 | - | - | - | - | 120 | 46.0 | - | - |
| 983.000 | 38.8 | 40.4 | - | - | - | - | 120 | 54.0 | - | - |
| 1056.000 | - | - | n.t. | n.t. | 41.3 | 42.8 | 1000 | - | 54.0 | 74.0 |
| 1196.000 | - | - | n.t. | n.t. | 41.5 | 40.8 | 1000 | - | 54.0 | 74.0 |
| 1238.000 | - | - | n.t. | n.t. | 33.0 | 41.5 | 1000 | - | 54.0 | 74.0 |
| 1333.000 | - | - | n.t. | n.t. | 42.3 | 37.4 | 1000 | - | 54.0 | 74.0 |
| 1462.000 | - | - | n.t. | n.t. | 42.9 | 41.0 | 1000 | - | 54.0 | 74.0 |
| 1592.000 | - | - | n.t. | n.t. | 43.3 | 38.0 | 1000 | - | 54.0 | 74.0 |
| 1732.000 | - | - | n.t. | n.t. | 38.5 | 34.1 | 1000 | - | 54.0 | 74.0 |
| 1865.000 | - | - | n.t. | n.t. | 39.9 | <30.0 | 1000 | - | 54.0 | 74.0 |
| 2208.000 | - | - | n.t. | n.t. | 40.3 | <30.0 | 1000 | - | 54.0 | 74.0 |
| 2274.000 | - | - | n.t. | n.t. | 39.2 | <30.0 | 1000 | - | 54.0 | 74.0 |

Table 3 - Test results with the EUT operating in receive mode on channel 1 (2412 MHz).

Note: Above 1 GHz, all measured values of the spurious emissions with the detector in peak mode are below the applicable limits which are valid when using an average detector.
Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested).
Note: Field strength values of radiated emissions at frequencies not listed in table 3 are more than 20 dB below the applicable limit.

Test engineer
Signature : 

Name : P.A.J.M. Robben, B.Sc.E.E. Date : March 18, 2002

## 2.2 Test results with EUT operating in receive mode on channel 6

The results of the radiated emission tests, carried out in accordance with CFR 47 Part 15.109 and CFR 47 Part 15.209 with the EUT operating in receive mode on channel 6 (2437 MHz), are depicted in table 4.

| Frequency (MHz) | Test results quasi peak (dBµV/m) | | Test results average (dBµV/m) | | Test results peak (dBµV/m) | | Resolution bandwidth (kHz) | Quasi peak limits (dBµV/m) | Average limits (dBµV/m) | Peak limits (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | V | H | V | H | V | H | | | | |
| 66.600 | 14.0 | 7.3 | - | - | - | - | 120 | 40.0 | - | - |
| 71.560 | 15.6 | 19.2 | - | - | - | - | 120 | 40.0 | - | - |
| 83.690 | 22.3 | 10.0 | - | - | - | - | 120 | 40.0 | - | - |
| 98.300 | 26.9 | 22.4 | - | - | - | - | 120 | 43.5 | - | - |
| 229.080 | 23.7 | 24.8 | - | - | - | - | 120 | 46.0 | - | - |
| 233.460 | 25.4 | 27.6 | - | - | - | - | 120 | 46.0 | - | - |
| 245.750 | 29.5 | 32.3 | - | - | - | - | 120 | 46.0 | - | - |
| 260.820 | 26.6 | 31.5 | - | - | - | - | 120 | 46.0 | - | - |
| 300.700 | 31.0 | 28.8 | - | - | - | - | 120 | 46.0 | - | - |
| 313.480 | 31.5 | 39.1 | - | - | - | - | 120 | 46.0 | - | - |
| 325.040 | 33.0 | 40.3 | - | - | - | - | 120 | 46.0 | - | - |
| 330.000 | 27.9 | 32.9 | - | - | - | - | 120 | 46.0 | - | - |
| 333.020 | 34.9 | 38.8 | - | - | - | - | 120 | 46.0 | - | - |
| 391.170 | 30.4 | 25.4 | - | - | - | - | 120 | 46.0 | - | - |
| 429.920 | 35.7 | 37.7 | - | - | - | - | 120 | 46.0 | - | - |
| 456.410 | 28.4 | 26.9 | - | - | - | - | 120 | 46.0 | - | - |
| 480.070 | 37.0 | 34.0 | - | - | - | - | 120 | 46.0 | - | - |
| 501.170 | 35.6 | 31.3 | - | - | - | - | 120 | 46.0 | - | - |
| 720.110 | 37.9 | 32.0 | - | - | - | - | 120 | 46.0 | - | - |
| 732.510 | 40.9 | 30.0 | - | - | - | - | 120 | 46.0 | - | - |
| 768.110 | 37.4 | 30.7 | - | - | - | - | 120 | 46.0 | - | - |
| 785.870 | 34.0 | 30.7 | - | - | - | - | 120 | 46.0 | - | - |
| 816.120 | 36.8 | 31.3 | - | - | - | - | 120 | 46.0 | - | - |
| 884.720 | 35.0 | 39.9 | - | - | - | - | 120 | 46.0 | - | - |
| 912.900 | 34.9 | 33.3 | - | - | - | - | 120 | 46.0 | - | - |
| 983.000 | 38.8 | 40.4 | - | - | - | - | 120 | 54.0 | - | - |
| 1060.000 | - | - | n.t. | n.t. | 42.6 | 43.6 | 1000 | - | 54.0 | 74.0 |
| 1200.000 | - | - | n.t. | n.t. | 42.2 | 36.4 | 1000 | - | 54.0 | 74.0 |
| 1333.000 | - | - | n.t. | n.t. | 42.3 | 38.0 | 1000 | - | 54.0 | 74.0 |
| 1469.000 | - | - | n.t. | n.t. | 44.0 | 40.7 | 1000 | - | 54.0 | 74.0 |
| 1595.000 | - | - | n.t. | n.t. | 40.0 | 37.0 | 1000 | - | 54.0 | 74.0 |
| 1739.000 | - | - | n.t. | n.t. | 40.0 | 34.6 | 1000 | - | 54.0 | 74.0 |
| 1865.000 | - | - | n.t. | n.t. | 41.4 | 31.6 | 1000 | - | 54.0 | 74.0 |

Table 4 - Test results with the EUT operating in receive mode on channel 6 (2437 MHz).

Note: Above 1 GHz, all measured values of the spurious emissions with the detector in peak mode are below the applicable limits which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested).

Note: Field strength values of radiated emissions at frequencies not listed in table 4 are more than 20 dB below the applicable limit.

Test engineer

Signature : 

Name : P.A.J.M. Robben, B.Sc.E.E.

Date : March 18, 2002

## 2.3 Test results with EUT operating in receive mode on channel 11

The results of the radiated emission tests, carried out in accordance with CFR 47 Part 15.109 and CFR 47 Part 15.209 with the EUT operating in receive mode on channel 11 (2462 MHz), are depicted in table 5.

| Frequency (MHz) | Test results quasi peak (dBµV/m) | | Test results average (dBµV/m) | | Test results peak (dBµV/m) | | Resolution bandwidth (kHz) | Quasi peak limits (dBµV/m) | Average limits (dBµV/m) | Peak limits (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | V | H | V | H | V | H | | | | |
| 66.600 | 14.0 | 7.3 | - | - | - | - | 120 | 40.0 | - | - |
| 71.560 | 15.6 | 19.2 | - | - | - | - | 120 | 40.0 | - | - |
| 83.690 | 22.3 | 10.0 | - | - | - | - | 120 | 40.0 | - | - |
| 98.300 | 26.9 | 22.4 | - | - | - | - | 120 | 43.5 | - | - |
| 229.080 | 23.7 | 24.8 | - | - | - | - | 120 | 46.0 | - | - |
| 233.460 | 25.4 | 27.6 | - | - | - | - | 120 | 46.0 | - | - |
| 245.750 | 29.5 | 32.3 | - | - | - | - | 120 | 46.0 | - | - |
| 260.820 | 26.6 | 31.5 | - | - | - | - | 120 | 46.0 | - | - |
| 300.700 | 31.0 | 28.8 | - | - | - | - | 120 | 46.0 | - | - |
| 313.480 | 31.5 | 39.1 | - | - | - | - | 120 | 46.0 | - | - |
| 325.040 | 33.0 | 40.3 | - | - | - | - | 120 | 46.0 | - | - |
| 330.000 | 27.9 | 32.9 | - | - | - | - | 120 | 46.0 | - | - |
| 333.020 | 34.9 | 38.8 | - | - | - | - | 120 | 46.0 | - | - |
| 391.170 | 30.4 | 25.4 | - | - | - | - | 120 | 46.0 | - | - |
| 429.920 | 35.7 | 37.7 | - | - | - | - | 120 | 46.0 | - | - |
| 456.410 | 28.4 | 26.9 | - | - | - | - | 120 | 46.0 | - | - |
| 480.070 | 37.0 | 34.0 | - | - | - | - | 120 | 46.0 | - | - |
| 501.170 | 35.6 | 31.3 | - | - | - | - | 120 | 46.0 | - | - |
| 720.110 | 37.9 | 32.0 | - | - | - | - | 120 | 46.0 | - | - |
| 732.510 | 40.9 | 30.0 | - | - | - | - | 120 | 46.0 | - | - |
| 768.110 | 37.4 | 30.7 | - | - | - | - | 120 | 46.0 | - | - |
| 785.870 | 34.0 | 30.7 | - | - | - | - | 120 | 46.0 | - | - |
| 816.120 | 36.8 | 31.3 | - | - | - | - | 120 | 46.0 | - | - |
| 884.720 | 35.0 | 39.9 | - | - | - | - | 120 | 46.0 | - | - |
| 912.900 | 34.9 | 33.3 | - | - | - | - | 120 | 46.0 | - | - |
| 983.000 | 38.8 | 40.4 | - | - | - | - | 120 | 54.0 | - | - |
| 1066.000 | - | - | n.t. | n.t. | 40.8 | 43.6 | 1000 | - | 54.0 | 74.0 |
| 1197.000 | - | - | n.t. | n.t. | 37.2 | 36.2 | 1000 | - | 54.0 | 74.0 |
| 1327.000 | - | - | n.t. | n.t. | 43.1 | 38.0 | 1000 | - | 54.0 | 74.0 |
| 1465.000 | - | - | n.t. | n.t. | 38.1 | 40.7 | 1000 | - | 54.0 | 74.0 |
| 1593.000 | - | - | n.t. | n.t. | 32.4 | 37.0 | 1000 | - | 54.0 | 74.0 |

Table 5 - Test results with the EUT operating in receive mode on channel 11 (2462 MHz).

Note: Above 1 GHz, all measured values of the spurious emissions with the detector in peak mode are below the applicable limits which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested).

Note: Field strength values of radiated emissions at frequencies not listed in table 5 are more than 20 dB below the applicable limit.

Test engineer

Signature : 

Name : P.A.J.M. Robben, B.Sc.E.E.

Date : March 18, 2002

## 2.4 Test results with EUT operating in transmit mode on channel 1.

The results of the radiated emission tests, carried out in accordance with CFR 47 Part 15.205 (restricted bands of operation) with the EUT operating in transmit mode on channel 1 (2412 MHz), are depicted in table 6.

| Frequency (MHz) | Test results quasi peak (dBµV/m) | | Test results average (dBµV/m) | | Test results peak (dBµV/m) | | Resolution bandwidth (kHz) | Quasi peak limits (dBµV/m) | Average limits (dBµV/m) | Peak limits (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | V | H | V | H | V | H | | | | |
| 66.600 | 19.3 | 14.6 | - | - | - | - | 120 | 40.0 | - | - |
| 71.590 | 16.3 | 7.8 | - | - | - | - | 120 | 40.0 | - | - |
| 83.690 | 22.3 | 10.0 | - | - | - | - | 120 | 40.0 | - | - |
| 98.300 | 27.0 | 22.2 | - | - | - | - | 120 | 43.5 | - | - |
| 100.230 | 39.2 | 12.1 | - | - | - | - | 120 | 43.5 | - | - |
| 229.080 | 26.3 | 24.0 | - | - | - | - | 120 | 46.0 | - | - |
| 233.460 | 26.7 | 28.3 | - | - | - | - | 120 | 46.0 | - | - |
| 235.750 | 28.9 | 22.7 | - | - | - | - | 120 | 46.0 | - | - |
| 260.820 | 26.4 | 31.7 | - | - | - | - | 120 | 46.0 | - | - |
| 286.360 | 30.6 | 35.1 | - | - | - | - | 120 | 46.0 | - | - |
| 294.910 | 32.4 | 35.1 | - | - | - | - | 120 | 46.0 | - | - |
| 300.700 | 31.0 | 28.4 | - | - | - | - | 120 | 46.0 | - | - |
| 325.040 | 35.1 | 34.7 | - | - | - | - | 120 | 46.0 | - | - |
| 331.320 | 35.1 | 33.8 | - | - | - | - | 120 | 46.0 | - | - |
| 480.000 | 37.8 | 35.9 | - | - | - | - | 120 | 46.0 | - | - |
| 501.170 | 35.8 | 32.3 | - | - | - | - | 120 | 46.0 | - | - |
| 639.250 | 34.8 | 27.7 | - | - | - | - | 120 | 46.0 | - | - |
| 732.510 | 41.0 | 32.1 | - | - | - | - | 120 | 46.0 | - | - |
| 768.410 | 36.1 | 30.7 | - | - | - | - | 120 | 46.0 | - | - |
| 786.420 | 39.8 | 34.1 | - | - | - | - | 120 | 46.0 | - | - |
| 816.120 | 36.1 | 31.3 | - | - | - | - | 120 | 46.0 | - | - |
| 884.720 | 34.7 | 38.3 | - | - | - | - | 120 | 46.0 | - | - |
| 1058.000 | - | - | n.t. | n.t. | 41.3 | 42.8 | 1000 | - | 54.0 | 74.0 |
| 1200.000 | - | - | n.t. | n.t. | 41.6 | 40.9 | 1000 | - | 54.0 | 74.0 |
| 1326.000 | - | - | n.t. | n.t. | 33.3 | 41.7 | 1000 | - | 54.0 | 74.0 |
| 1465.000 | - | - | n.t. | n.t. | 42.7 | 37.8 | 1000 | - | 54.0 | 74.0 |
| 4825.000 | - | - | n.t. | n.t. | 40.7 | 37.0 | 1000 | - | 54.0 | 74.0 |
| 7236.000 | - | - | n.t. | n.t. | 40.3 | 40.7 | 1000 | - | 54.0 | 74.0 |

Table 6 - Test results with the EUT operating in transmit mode on channel 1 (2412 MHz).

Note: Radiated emission tests have been performed with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 6.

Note: Above 1 GHz, all measured values of the spurious emissions with the detector in peak mode are below the applicable limits which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested).

Note: Field strength values of radiated emissions at frequencies not listed in table 6 are more than 20 dB below the applicable limit.

Test engineer

Signature : 

Name : P.A.J.M. Robben, B.Sc.E.E.

Date : March 18, 2002

## 2.5 Test results with EUT operating in transmit mode on channel 6.

The results of the radiated emission tests, carried out in accordance with CFR 47 Part 15.205 (restricted bands of operation) with the EUT operating in transmit mode on channel 6 (2437 MHz), are depicted in table 7.

| Frequency (MHz) | Test results quasi peak (dBµV/m) | | Test results average (dBµV/m) | | Test results peak (dBµV/m) | | Resolution bandwidth (kHz) | Quasi peak limits (dBµV/m) | Average limits (dBµV/m) | Peak limits (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | V | H | V | H | V | H | | | | |
| 66.600 | 19.3 | 14.6 | - | - | - | - | 120 | 40.0 | - | - |
| 71.590 | 16.3 | 7.8 | - | - | - | - | 120 | 40.0 | - | - |
| 83.690 | 22.3 | 10.0 | - | - | - | - | 120 | 40.0 | - | - |
| 98.300 | 27.0 | 22.2 | - | - | - | - | 120 | 43.5 | - | - |
| 100.230 | 39.2 | 12.1 | - | - | - | - | 120 | 43.5 | - | - |
| 229.080 | 26.3 | 24.0 | - | - | - | - | 120 | 46.0 | - | - |
| 233.460 | 26.7 | 28.3 | - | - | - | - | 120 | 46.0 | - | - |
| 235.750 | 28.9 | 22.7 | - | - | - | - | 120 | 46.0 | - | - |
| 260.820 | 26.4 | 31.7 | - | - | - | - | 120 | 46.0 | - | - |
| 286.360 | 30.6 | 35.1 | - | - | - | - | 120 | 46.0 | - | - |
| 294.910 | 32.4 | 35.1 | - | - | - | - | 120 | 46.0 | - | - |
| 300.700 | 31.0 | 28.4 | - | - | - | - | 120 | 46.0 | - | - |
| 325.040 | 35.1 | 34.7 | - | - | - | - | 120 | 46.0 | - | - |
| 331.320 | 35.1 | 33.8 | - | - | - | - | 120 | 46.0 | - | - |
| 480.000 | 37.8 | 35.9 | - | - | - | - | 120 | 46.0 | - | - |
| 501.170 | 35.8 | 32.3 | - | - | - | - | 120 | 46.0 | - | - |
| 639.250 | 34.8 | 27.7 | - | - | - | - | 120 | 46.0 | - | - |
| 732.510 | 41.0 | 32.1 | - | - | - | - | 120 | 46.0 | - | - |
| 768.410 | 36.1 | 30.7 | - | - | - | - | 120 | 46.0 | - | - |
| 786.420 | 39.8 | 34.1 | - | - | - | - | 120 | 46.0 | - | - |
| 816.120 | 36.1 | 31.3 | - | - | - | - | 120 | 46.0 | - | - |
| 884.720 | 34.7 | 38.3 | - | - | - | - | 120 | 46.0 | - | - |
| 1058.000 | - | - | n.t. | n.t. | 38.4 | 42.1 | 1000 | - | 54.0 | 74.0 |
| 1198.000 | - | - | n.t. | n.t. | 35.5 | 34.0 | 1000 | - | 54.0 | 74.0 |
| 1325.000 | - | - | n.t. | n.t. | 43.3 | 38.5 | 1000 | - | 54.0 | 74.0 |
| 1459.000 | - | - | n.t. | n.t. | 38.3 | 34.8 | 1000 | - | 54.0 | 74.0 |
| 4874.000 | - | - | n.t. | n.t. | 38.4 | 34.9 | 1000 | - | 54.0 | 74.0 |
| 7310.000 | - | - | n.t. | n.t. | 37.1 | 36.4 | 1000 | - | 54.0 | 74.0 |

Table 7 - Test results with the EUT operating in transmit mode on channel 6 (2437 MHz).

Note: Radiated emission tests have been performed with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 7.

Note: Above 1 GHz, all measured values of the spurious emissions with the detector in peak mode are below the applicable limits which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested).

Note: Field strength values of radiated emissions at frequencies not listed in table 7 are more than 20 dB below the applicable limit.

Test engineer

Signature : 

Name : P.A.J.M. Robben, B.Sc.E.E.

Date : March 18, 2002

## 2.6 Test results with EUT operating in transmit mode on channel 11.

The results of the radiated emission tests, carried out in accordance with CFR 47 Part 15.205 (restricted bands of operation) with the EUT operating in transmit mode on channel 11 (2462 MHz), are depicted in table 8.

| Frequency (MHz) | Test results quasi peak (dBµV/m) | | Test results average (dBµV/m) | | Test results peak (dBµV/m) | | Resolution bandwidth (kHz) | Quasi peak limits (dBµV/m) | Average limits (dBµV/m) | Peak limits (dBµV/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | V | H | V | H | V | H | | | | |
| 66.600 | 19.3 | 14.6 | - | - | - | - | 120 | 40.0 | - | - |
| 71.590 | 16.3 | 7.8 | - | - | - | - | 120 | 40.0 | - | - |
| 83.690 | 22.3 | 10.0 | - | - | - | - | 120 | 40.0 | - | - |
| 98.300 | 27.0 | 22.2 | - | - | - | - | 120 | 43.5 | - | - |
| 100.230 | 39.2 | 12.1 | - | - | - | - | 120 | 43.5 | - | - |
| 229.080 | 26.3 | 24.0 | - | - | - | - | 120 | 46.0 | - | - |
| 233.460 | 26.7 | 28.3 | - | - | - | - | 120 | 46.0 | - | - |
| 235.750 | 28.9 | 22.7 | - | - | - | - | 120 | 46.0 | - | - |
| 260.820 | 26.4 | 31.7 | - | - | - | - | 120 | 46.0 | - | - |
| 286.360 | 30.6 | 35.1 | - | - | - | - | 120 | 46.0 | - | - |
| 294.910 | 32.4 | 35.1 | - | - | - | - | 120 | 46.0 | - | - |
| 300.700 | 31.0 | 28.4 | - | - | - | - | 120 | 46.0 | - | - |
| 325.040 | 35.1 | 34.7 | - | - | - | - | 120 | 46.0 | - | - |
| 331.320 | 35.1 | 33.8 | - | - | - | - | 120 | 46.0 | - | - |
| 480.000 | 37.8 | 35.9 | - | - | - | - | 120 | 46.0 | - | - |
| 501.170 | 35.8 | 32.3 | - | - | - | - | 120 | 46.0 | - | - |
| 639.250 | 34.8 | 27.7 | - | - | - | - | 120 | 46.0 | - | - |
| 732.510 | 41.0 | 32.1 | - | - | - | - | 120 | 46.0 | - | - |
| 768.410 | 36.1 | 30.7 | - | - | - | - | 120 | 46.0 | - | - |
| 786.420 | 39.8 | 34.1 | - | - | - | - | 120 | 46.0 | - | - |
| 816.120 | 36.1 | 31.3 | - | - | - | - | 120 | 46.0 | - | - |
| 884.720 | 34.7 | 38.3 | - | - | - | - | 120 | 46.0 | - | - |
| 1066.000 | - | - | n.t. | n.t. | 40.7 | 42.2 | 1000 | - | 54.0 | 74.0 |
| 1201.000 | - | - | n.t. | n.t. | 36.5 | 34.2 | 1000 | - | 54.0 | 74.0 |
| 1327.000 | - | - | n.t. | n.t. | 43.1 | 38.1 | 1000 | - | 54.0 | 74.0 |
| 1469.000 | - | - | n.t. | n.t. | 38.5 | 35.0 | 1000 | - | 54.0 | 74.0 |
| 1602.000 | - | - | n.t. | n.t. | 39.2 | 33.5 | 1000 | - | 54.0 | 74.0 |
| 4825.000 | - | - | n.t. | n.t. | 40.7 | 37.0 | 1000 | - | 54.0 | 74.0 |
| 7236.000 | - | - | n.t. | n.t. | 40.3 | 40.7 | 1000 | - | 54.0 | 74.0 |

Table 8 - Test results with the EUT operating in transmit mode on channel 11 (2462 MHz).

Note: Radiated emission tests have been performed with all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s) in transmit mode. The highest values measured of the spurious emission components are reported by means of table 8.

Note: Above 1 GHz, all measured values of the spurious emissions with the detector in peak mode are below the applicable limits which are valid when using an average detector. Therefore, all spurious emissions above 1 GHz have been measured with the peak detector only (n.t. = not tested).

Note: Field strength values of radiated emissions at frequencies not listed in table 8 are more than 20 dB below the applicable limit.

Test engineer

Signature : 

Name : P.A.J.M. Robben, B.Sc.E.E.

Date : March 18, 2002

# 3 Conducted emission data

The (worst-case) results of the conducted emission tests at the 110 Volts AC mains connection terminals of the notebook computer in which the EUT is built-in, carried out in accordance with CFR 47 Part 15.107 and CFR 47 Part 15.207 with the EUT operating in transmit and/or receive mode on channels 1 (2412 MHz), 6 (2437 MHz) and 11 (2462 MHz) while utilizing all possible transmission bit-rates (1 Mbit/s, 2 Mbit/s, 5.5 Mbit/s and 11 Mbit/s), are depicted in table 9.

| Frequency (MHz) | Measurement results dB(µV) Neutral | Measurement results dB(µV) Line 1 | Limits dB(µV) | Margin (dB) Neutral | Margin (dB) Line 1 | Result |
|---|---|---|---|---|---|---|
| | QP | QP | QP | QP | QP | |
| 0.511 | 34.4 | 35.0 | 48.0 | -13.6 | -13.0 | PASS |
| 0.600 | 34.5 | 33.3 | 48.0 | -13.5 | -14.7 | PASS |
| 0.685 | 34.5 | 31.5 | 48.0 | -13.5 | -16.5 | PASS |
| 5.121 | 36.4 | 34.6 | 48.0 | -11.6 | -13.4 | PASS |
| 5.555 | 36.4 | 34.2 | 48.0 | -11.6 | -13.8 | PASS |
| 5.642 | 35.0 | 31.1 | 48.0 | -13.0 | -16.9 | PASS |
| 10.095 | 34.6 | 34.6 | 48.0 | -13.4 | -13.4 | PASS |
| 10.443 | 34.6 | 34.9 | 48.0 | -13.4 | -13.1 | PASS |
| 10.531 | 34.5 | 35.1 | 48.0 | -13.5 | -12.9 | PASS |
| 10.964 | 34.7 | 35.0 | 48.0 | -13.3 | -13.0 | PASS |
| 11.310 | 35.1 | 35.1 | 48.0 | -12.9 | -12.9 | PASS |
| 11.398 | 35.1 | 35.0 | 48.0 | -12.9 | -13.0 | PASS |
| 11.486 | 34.9 | 35.1 | 48.0 | -13.1 | -12.9 | PASS |
| 11.573 | 35.1 | 34.8 | 48.0 | -12.9 | -13.2 | PASS |
| 11.662 | 35.3 | 34.6 | 48.0 | -12.7 | -13.4 | PASS |
| 11.835 | 35.4 | 34.1 | 48.0 | -12.6 | -13.9 | PASS |
| 11.923 | 35.1 | 34.7 | 48.0 | -12.9 | -13.3 | PASS |
| 12.097 | 35.1 | 34.1 | 48.0 | -12.9 | -13.9 | PASS |
| 12.185 | 35.1 | 33.9 | 48.0 | -12.9 | -14.1 | PASS |
| 12.273 | 34.7 | 33.6 | 48.0 | -13.3 | -14.4 | PASS |

Table 9 - Test results with the EUT operating in transmit/receive mode.

Note: Disturbance voltage values of conducted emissions at frequencies not listed in table 9 are more than 20 dB below the applicable limit.

Test engineer

Signature : 

Name : P.A.J.M. Robben, B.Sc.E.E.

Date : March 18, 2002

# 4 List of utilized test equipment

| Inventory number | Description | Brand | Type |
|---|---|---|---|
| 12471 | Biconical antenna 20MHz-200MHz | EATON | 94455-1 |
| 12473 | Log-per antenna 200-1000MHz | EATON | 96005 |
| 12476 | Antenna mast | EMCO | TR3 |
| 12477 | Antenna mast 1-4 mtr | Poelstra | -- |
| 12482 | Loop antenna | EMCO | 6507 |
| 12483 | Guidehorn | EMCO | 3115 |
| 12484 | Guidehorn | EMCO | 3115 |
| 12488 | Guidehorn 18 - 26.5 GHz | EMCO | RA42-K-F-4B-C |
| 12533 | Signalgenerator | MARCONI | 2032 |
| 12559 | Digital storage oscilloscope | Le Croy | 9310M |
| 12561 | DC Power Supply 20A/70V | DELTA | SM7020D |
| 12567 | Plotter | HP | 7440A |
| 12605 | calibrated dipole 28MHz-1GHz | Emco | 3121c |
| 12608 | HF milliwattmeter | Hewlett Packard | HP435a |
| 12609 | Power sensor 10MHz-18GHz | Hewlett Packard | HP8481A |
| 12636 | Polyester chamber | Polyforce | -- |
| 12640 | Temperature chamber | Heraeus | VEM03/500 |
| 13664 | Spectrum analyzer | HP | HP8593E |
| 13078 | Preamplifier 0.1 GHz - 12 GHz | Miteq | AMF-3D-001120-35-14p |
| 13452 | Digital multi meter | HP | 34401A |
| 13526 | Signalgenerator 20 GHz | Hewlett & Packard | 83620A |
| 13594 | Preamplifier 10 GHz - 25 GHz | Miteq | AMF-6D-100250-10p |
| 13886 | Open Area testsite | Comtest | -- |
| 14051 | Anechoic room | Comtest | -- |
| 14450 | 2.4 GHz bandrejectfilter | BSC | XN-1783 |
| 15633 | Biconilog Testantenna | Chase | CBL 6111B |
| 15667 | Measuring receiver | R&S | ESCS 30 |
| 99045 | DC Power Supply 3A/30V | DELTA | E030/3 |
| 99055 | Non-conducting support | NMi | -- |
| 99061 | Non-conducting support 150cm | NMi | -- |
| 99068 | Detector N-F/BNC-F | Radiall | R451576000 |
| 99069 | Cable 5m RG214 | NMi | -- |
| 99071 | Cable 10m RG214 | NMi | -- |
| 99076 | Bandpassfilter 4 - 10 GHz | Reactel | 7AS-7G-6G-511 |
| 99077 | Regulating trafo | RFT | LTS006 |
| 99112 | Tripod | Chase | -- |
| 99136 | Bandpassfilter 10 - 26.5 GHz | Reactel | 9HS-10G/26.5G-S11 |