# SAR Evaluation Report

**in accordance with the requirements of**
**FCC Report and Order: ET Docket 93-62, and OET Bulletin 65 Supplement C**

for

**NoteBook PC With 802.11a/b/g Module**

**MODEL: BQ12**

**FCC ID: NKRBQ12AB**

**May 15, 2003**

**REPORT NO: 03T1780-1**
(Additional test at worse case position for all data rates)

*Prepared for*

**Wistron NeWeb Corporation**
**No. 10-1, Li-Hsin Road I**
**Science-Based Industrial Park**
**Hsinchu, Taiwan, R. O. C.**

*Prepared by*

**COMPLIANCE CERTIFICATION SERVICES**
**561F MONTEREY ROAD**
**MORGAN HILL, CA 95037 USA**
**TEL: (408) 463-0885**

# 1. MEASUREMENT RESULTS

## 1.1. SYSTEM VALIDATION

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

IEEE P1528 Recommended Reference Value

| Frequency (MHz) | 1 g SAR | 10 g SAR | Local SAR at surface (Above feed point) | Local SAR at surface (y=2cm offset from feed point) |
|---|---|---|---|---|
| 300 | 3.0 | 2.0 | 4.4 | 2.1 |
| 450 | 4.9 | 3.3 | 7.2 | 3.2 |
| 835 | 9.5 | 6.2 | 14.1 | 4.9 |
| 900 | 10.8 | 6.9 | 16.4 | 5.4 |
| 1450 | 29.0 | 16.0 | 50.2 | 6.5 |
| 1800 | 38.1 | 19.8 | 69.5 | 6.8 |
| 1900 | 39.7 | 20.5 | 72.1 | 6.6 |
| 2000 | 41.1 | 21.1 | 74.6 | 6.5 |
| 2450 | 52.4 | 24.0 | 104.2 | 7.7 |
| 3000 | 63.8 | 25.7 | 140.2 | 9.5 |

**System Validation Results**

**Ambient conduction:** Temperature 25.7°C; Relative humidity 35%

**System Validation Dipole:** D2450V2 SN: 706 **Date of measured**: May 15, 2003

| Medium | | | Parameters | Target | Measured | Deviation[%] | Limited[%] |
|---|---|---|---|---|---|---|---|
| Type | Temp. [°C] | Depth [cm] | | | | | |
| Head 2450 MHz | 24.70 | 15.00 | Permitivity: | 39.2 | 39.0162 | -0.47 | ± 10 |
| | | | Conductivity: | 1.8 | 1.8239 | 1.33 | ± 5 |
| | | | 1g SAR: | 52.4 | 55.2 | 5.34 | ± 10 |

## 1.2. TEST LIQUID CONFIRMATION

### Simulated Tissue Liquid Parameter confirmation

The dielectric parameters were checked prior to assessment using the HP85070C dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

### IEEE SCC-34/SC-2 P1528 recommended Tissue Dielectric Parameters

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in P1528

| Target Frequency | Head | | Body | |
|---|---|---|---|---|
| (MHz) | $\varepsilon_r$ | $\sigma$ (S/m) | $\varepsilon_r$ | $\sigma$ (S/m) |
| 150 | 52.3 | 0.76 | 61.9 | 0.80 |
| 300 | 45.3 | 0.87 | 58.2 | 0.92 |
| 450 | 43.5 | 0.87 | 56.7 | 0.94 |
| 835 | 41.5 | 0.90 | 55.2 | 0.97 |
| 900 | 41.5 | 0.97 | 55.0 | 1.05 |
| 915 | 41.5 | 0.98 | 55.0 | 1.06 |
| 1450 | 40.5 | 1.20 | 54.0 | 1.30 |
| 1610 | 40.3 | 1.29 | 53.8 | 1.40 |
| 1800-2000 | 40.0 | 1.40 | 53.3 | 1.52 |
| 2450 | 39.2 | 1.80 | 52.7 | 1.95 |
| 3000 | 38.5 | 2.40 | 52.0 | 2.73 |
| 5800 | 45.3 | 5.27 | 48.2 | 6.00 |

($\varepsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$ = 1000 kg/m$^3$)

### Liquid Confirmation Results

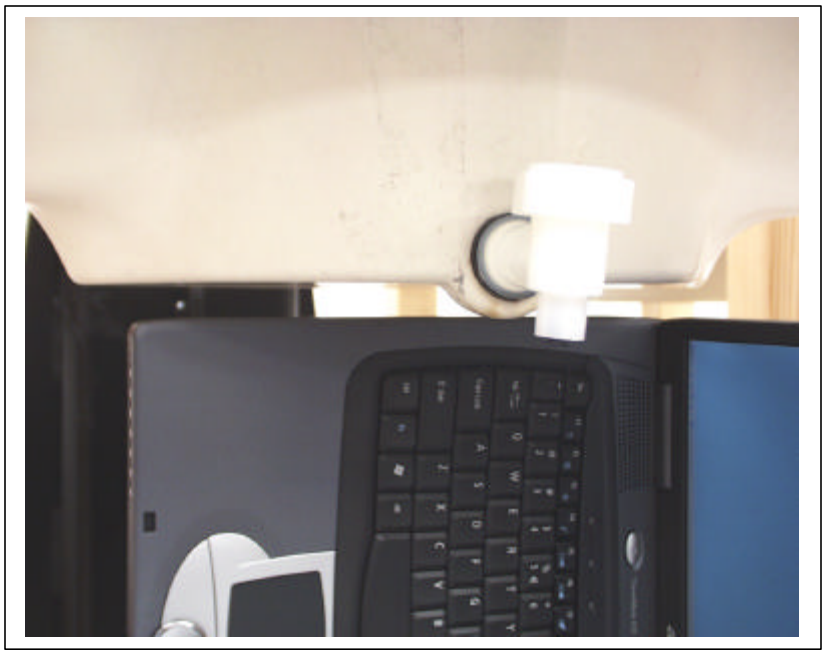
**Ambient conduction** – Temperature: 25.5°C; Relative humidity: 35% **Date:** May 15, 2003

| Medium | | Parameters | Target | Measured | Deviation[%] | Limited[%] |
|---|---|---|---|---|---|---|
| Type | Temp. [°C] | | | | | |
| Muscle 2450 MHz | 24.5 | Permitivity: | 52.7 | 51.6364 | -2.02 | ± 10 |
| | | Conductivity: | 1.95 | 1.9488 | -0.06 | ± 5 |

## 1.3. EUT SETUP PHOTOS

**EUT Set-up Configuration 3 (Antenna B)**

1. Installation conditions between EUT and phantom - Right side of panel perpendicular to flat phantom.
2. Spacing between EUT and phantom - 1.5 cm



## 1.4. SAR MEASUREMENT RESULTS

### 1.4.1. 802.11b

Modulation type: DSSS (Crest factor: 1) Depth of liquid: 15.0 cm

**EUT Setup Configuration 3 (Antenna B)** Date: May 15, 2003

| EUT Set-up conditions | | Frequency | | | Conducted Power [dBm] (**Peak**) | | Liquid Temp [°C] | **SAR** (W/kg) | Limit (W/kg) |
|---|---|---|---|---|---|---|---|---|---|
| Sep. [cm] | Antenna | Ch. | MHz | Rate | Before | After | | | |
| 1.5 | Aux antenna | 1 | 2412 | 2 | 17.21 | 17.18 | 24.1 | Cube 0: 0.139<br>Cube 1: 0.105 | 1.6 |
| | | | | 5.5 | 17.23 | 17.19 | 23.8 | Cube 0: **0.141**<br>Cube 1: 0.103 | |
| | | | | 11 | 17.19 | 17.17 | 23.7 | Cube 0: 0.135<br>Cube 1: 0.100 | |

Note (s):
Please refer to attachment for each configuration presentation in plot format.

### 1.4.2. 802.11g

Modulation type: OFDM (Crest factor: 1) Depth of liquid: 15.0 cm

**EUT Setup Configuration 3 (Antenna B)** Date: May 15, 2003

| EUT Set-up conditions | | Frequency | | | Conducted Power [dBm] (**Peak**) | | Liquid Temp [°C] | **SAR** (W/kg) | Limit (W/kg) |
|---|---|---|---|---|---|---|---|---|---|
| Sep. [cm] | Antenna | Ch. | MHz | Rate | Before | After | | | |
| 1.5 | Aux antenna | 1 | 2437 | 9 | 17.21 | 17.19 | 23.6 | Cube 0: **0.0462**<br>Cube 1: 0.0384 | 1.6 |
| | | | | 12 | 17.20 | 17.17 | 23.5 | Cube 0: 0.0455<br>Cube 1: 0.0388 | |
| | | | | 18 | 17.19 | 17.18 | 23.4 | Cube 0: 0.0439<br>Cube 1: 0.035 | |
| | | | | 24 | 17.19 | 17.17 | 23.5 | Cube 0: 0.0439<br>Cube 1: 0.0358 | |
| | | | | 36 | 17.20 | 17.18 | 23.5 | Cube 0: 0.0454<br>Cube 1: 0.0346 | |
| | | | | 48 | 17.21 | 17.18 | 23.6 | Cube 0: 0.0451<br>Cube 1: 0.0345 | |
| | | | | 54 | 17.19 | 17.17 | 23.5 | Cube 0: 0.0428<br>Cube 1: 0.0346 | |

Note (s):
Please refer to attachment for each configuration presentation in plot format.

## 2. EQUIPMENTS LIST & CALIBRATION STATUS

| Name of Equipment | Manufacturer | Type/Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | last cal. | due date |
| S-Parameter Network Analyzer | Agilent | 8753ES | MY40001647 | 8/6/02 | 8/6/03 |
| Electronic Probe kit | Hewlett Packard | 85070C | N/A | N/A | N/A |
| 3.5 mm Calibration Kit | Agilent | 85033D | 3423A07200 | 8/6/02 | 8/6/03 |
| Power Meter | Agilent | E5516A | GB41291160 | 8/9/02 | 8/9/03 |
| Power Sensor | Agilent | E9327A | US40440755 | 9/5/02 | 9/5/03 |
| Universal Radio Communication Tester | Rohde & Schwarz | CMU 200 | 838114/032 | 2/14/03 | 2/14/04 |
| Amplifier | Mini-Circuit | ZHL-42W | D072701-5 | N/A | N/A |
| DC Power generator | Kenwood | PA36-3A | 7060074 | N/A | N/A |
| Data Acquisition Electronics (DAE) | SPEAG | DAE3 V1 | 427 | 2/4/03 | 2/4/04 |
| Dosimetric E-Field Probe | SPEAG | ET3DV6 | 1577 | 2/7/02 | 2/7/04 |
| 450 MHz System Validation Dipole | SPEAG | D450V2 | 1003 | 4/5/02 | 4/19/04 |
| 900 MHz System Validation Dipole | SPEAG | D900V2 | 108 | 4/10/03 | 4/10/05 |
| 1800 MHz System Validation Dipole | SPEAG | D1800V2 | 294 | 4/09/03 | 4/19/05 |
| 2450 MHz System Validation Dipole | SPEAG | D2450V2 | 706 | 6/4/02 | 6/4/04 |
| Probe Alignment Unit | SPEAG | LB (V2) | 261 | N/A | N/A |
| Robot | Staubli | RX90B L | F00/5H31A1/A/01 | N/A | N/A |
| Generic Twin Phantom | SPEAG | N/A | N/A | N/A | N/A |
| SAM Phantom | SPEAG | N/A | N/A | N/A | N/A |
| Devices Holder | SPEAG | N/A | N/A | N/A | N/A |
| Head 450 MHz | CCS | H450A | N/A | Daily | N/A |
| Muscle 450 MHz | CCS | M450A | N/A | Daily | N/A |
| Head 835 MHz | CCS | H835A | N/A | Daily | N/A |
| Muscle 835 MHz | CCS | M835A | N/A | Daily | N/A |
| Head 900 MHz | CCS | H900A | N/A | Daily | N/A |
| Muscle 900 MHz | CCS | M900A | N/A | Daily | N/A |
| Head 1800 MHz | CCS | H1800A | N/A | Daily | N/A |
| Muscle 1800 MHz | CCS | M1800A | N/A | Daily | N/A |
| Head 1900 MHz | CCS | H1900A | N/A | Daily | N/A |
| Muscle 1900 MHz | CCS | M1900A | N/A | Daily | N/A |
| Head 2450 MHz | CCS | H2450A | N/A | Daily | N/A |
| Muscle 2450 MHz | CCS | M2450A | N/A | Daily | N/A |

## 3. ATTACHMENTS

| Exhibit | Contents | No. of page (s) |
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| 1 | System Validation Plots | 1 |
| 2 | SAR Test Plots – 802.11b | 6 |
| 3 | SAR Test Plots – 802.11g | 10 |
| 3 | Dosimetric E-Field Probe - ET3DV6, S/N: 1577 | 14 |

**End of Report**