Reply to FCC questions for Netgear Inc. FCC ID:PY3HA501RB, Conformation number: EA894588 (UNII ) and EA 393713 (DTS ).  CRN:23743 and 23744

EMC RT:
A) This is now a composite device per your 8/19/2002 correspondence.  File another application for the DTS application.  Revise/correct the pending application by submitting only information on the NII application portion.  All other information will be deleted to avoid confusion.  Indicate what the new specifications such as output power and frequency are for the NII portion.

CCS reply: UNII and DTS test reports have been uploaded to the Commissions.  We would like to change the following information that we filed on UNII and DTS applications:

For DTS /EA393713 Form 731:
Frequency range :5745-5825MHZ.  Output power:0.125W

For UNII/EA894588 Form 731:
Frequency range:5150 – 5250MHz.  Output power:0.046W
Frequency range:5250-5350MHz. Output power:0.126W.
The highest SAR value per reply to Question 7 is 0.976W/kg.

SAR RT:

1)  Submit users manual RF exposure statements

CCS reply: Revised User manual with RF exposure statement has been uploaded to FCC.

2)  Form 731 shows 150mW, SAR done at 126mW nominal.  Grant will use 126mW.

CCS reply: Acknowledged.

3)  Please submit data or screen-shots from dielectric test system for complex permittivity at approx. 5.3 and 5.8 GHz.

**Reply:**

As given on page 2 of the SAR Test Report, the Hewlett Packard Model HP85070B Dielectric Probe (rated frequency band 200 MHz to 20 GHz) in conjunction with HP Model 8720C Network Analyzer (50 MHz-20 GHz) is used for measurement of the dielectric properties of the tissue-simulant fluid given in item 4. This commercial probe (see Fig. d) is an open-circuited transmission-line (coaxial line) probe described in Section B.1.2 of the Draft IEEE Standard 1528 [b]. The theory of the open-circuited coaxial line method has been described in scientific literature [c, d, e]. We have previously used this method in determining the dielectric properties of tissue-simulant materials at 6 GHz [f]. In this method, the complex reflection coefficient $\Gamma^*$ measured for the open end of the coaxial line can be used to calculate the complex permittivity $\varepsilon^*$ from the following equation [f]

$$\varepsilon^* = \frac{1-\Gamma^*}{j\omega Z_0 C_o \left(1+\Gamma^*\right)} - \frac{C_f}{C_o} \tag{1}$$

where $Z_o$ is the characteristic impedance (50 Ω) for the coaxial line, $C_o$ is the capacitance when the line is in air and $C_f$ is the capacitance that accounts for the fringing fields in the dielectric of the coaxial line.

For the HP85070B Dielectric Probe with diameters of the outer and inner conductors 2b = 3.00 mm and 2a = 0.912 mm, respectively, the following capacitances were obtained using deionized water and methanol as the calibration fluids. The following capacitances were obtained:

$$C_o = 0.022 \text{ pF}$$

$$C_f = 0.005 \text{ pF}$$

Using the network analyzer HP8720C, we measured the reflection coefficient $\Gamma^*$ for the open end of the coaxial line that was submerged in the tissue-simulant fluid. Using Eq. 1, the complex permittivity of the fluid was measured at a midband frequency of 5.30 GHz. From the imaginary part of the complex permittivity $\mathrm{Im}(\varepsilon^*)$, we can obtain the conductivity $\sigma$ from the relationship

$$\sigma = \frac{\mathrm{Im}(\varepsilon^*)}{\omega\varepsilon_o} \tag{2}$$

For the tissue-simulant fluid, we obtain $\varepsilon_r = 48.5 \pm 1.7$ and $\sigma = 5.40 \pm 0.08$ S/m. From the FCC Supplement C, we obtain the desired dielectric properties to simulate the body tissue at the midband frequency of 5.30 GHz to be $\varepsilon_r = 48.9$ and $\sigma = 5.42$ S/m. Thus, the measured properties for the body-simulant fluid are close to the desired values.

### Additional References


a. Q. Yu, O. P. Gandhi, M. Aronsson, and D. Wu, "An Automated SAR Measurement System for Compliance Testing of Personal Wireless Devices," *IEEE Transactions on Electromagnetic Compatibility*, Vol. 41(3), pp. 234-245, August 1999 (attached as Appendix A of the SAR Compliance Test Report).

b. IEEE Draft Standard P1528, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communication Devices: Experimental Techniques," Draft CBD1.0, April 4, 2002 (IEEE Standards Coordinating Committee 34).

c. T. W. Athey, M. A. Stuchly, and S. S. Stuchly, "Measurement of Radiofrequency Permittivity of Biological Tissues with an Open-Circuited Coaxial Line - Part I," *IEEE Transactions on Microwave Theory and Techniques*, Vol. MTT-30, pp. 82-86, 1982.

d. M. A. Stuchly, T. W. Athey, G. M. Samaras, and G. E. Taylor, "Measurement of Radiofrequency Permittivity of Biological Tissues with an Open-Circuited Coaxial Line - Part II - Experimental Results," *IEEE Transactions on Microwave Theory and Techniques*, Vol. MTT-30, pp. 87-92, 1982.

e. C. L. Pournaropoulos and D. K. Misra, "The Coaxial Aperture Electromagnetic Sensor and Its Application for Material Characterization," *Measurement Science and Technology*, Vol. 8, pp. 1191-1202, 1997.

f. O. P. Gandhi and J-Y. Chen, "Electromagnetic Absorption in the Human Head from Experimental 6-GHz Handheld Transceivers," *IEEE Transactions on Electromagnetic Compatibility*, Vol. 39(4), pp. 547-558, 1995.


Fig. d. Photograph of the Hewlett Packard Model 85070B Dielectric Probe. This is an open-circuited coaxial line probe.

4) To verify liquid depth and proper test system operation, we have been requesting graphs of SAR vs depth into liquid at the peak SAR configuration(s). Please submit.

The measured variations of SAR vs. depth into the liquid at the peak SAR locations from Tables 1-4 (Above-lap position) are plotted in Fig. a, while those from Tables 5-8 (End-on position) are plotted in Fig. b. Both Figs. a and b are attached here.

5) Suppl C and draft IEEE Std 1528 requests dipole test for SAR system verification. Please submit.

**Reply:**

**As given in Appendix A [a] of the SAR Test Report, a half-wave dipole at 1900 MHz (l/2)= 78.95 mm) was used for system verification. A dipole at 1900 MHz was used in the absence of dipoles at 2450 MHz or for the frequency band 5.18-5.825 GHz. This dipole of length 76.0 mm and diameter 1.5 mm and h = 39.5 mm is shown in Fig. a. The measured SAR distributions for variable spacing of 10, 15, 20, and 25 mm of the dipole for a flat phantom and spacings of 5, 15, and 25 mm of the dipole for a sphere phantom are given in Figs. 5 and 7 of Appendix A. Also given in the same figures are the SAR values calculated using the FDTD numerical method. The agreement of the measured SAR distributions with those obtained numerically using the FDTD method is very good.**
**Taken from Tables IV and V of Appendix A, the difference between measured and calculated peak 1-g SARs are less than ± 5 percent at 1900 MHz.**

Fig. a. Photograph of the half-wave dipole at 1900 MHz used for system verification.

6) Suppl C App. B II 7 c) states "description, illustration and SAR distribution plots showing the peak SAR locations with respect to the phantom and the test device." Please submit.

Reply:
An illustration (top view) showing the peak SAR location with respect to the phantom and the Netgear CardBus Card for the laptop computer pressed against the bottom of the planar tissue-simulant phantom is attached here as Fig. b. As stated in Section IV of the SAR Test Report, the highest SARs were measured for the region of the phantom above the PC card. The highest peak 1-g SAR was measured for the region above the radiating antenna as shown in Fig. b.
This region was measured with a stepper-motor-controlled step size of 2 mm along the three orthogonal axes to obtain peak 1-g SAR. The SAR distributions measured with a step size of 2 mm have been given in Tables 1-4 (of the SAR Test Report) for frequencies of 5.18, 5.32, 5.745, and 5.825 GHz, respectively.
An illustration showing the peak 1-g SAR location for the End-on placement (with the card edge at 90° and separated from the bottom of the phantom by 2.5 cm) is given in Fig. c. The detailed SAR distributions measured with a step size of 2 mm are given in Tables 5-8 of the SAR Test Report for frequencies of 5.18, 5.32, 5.745, and 5.825 GHz, respectively.

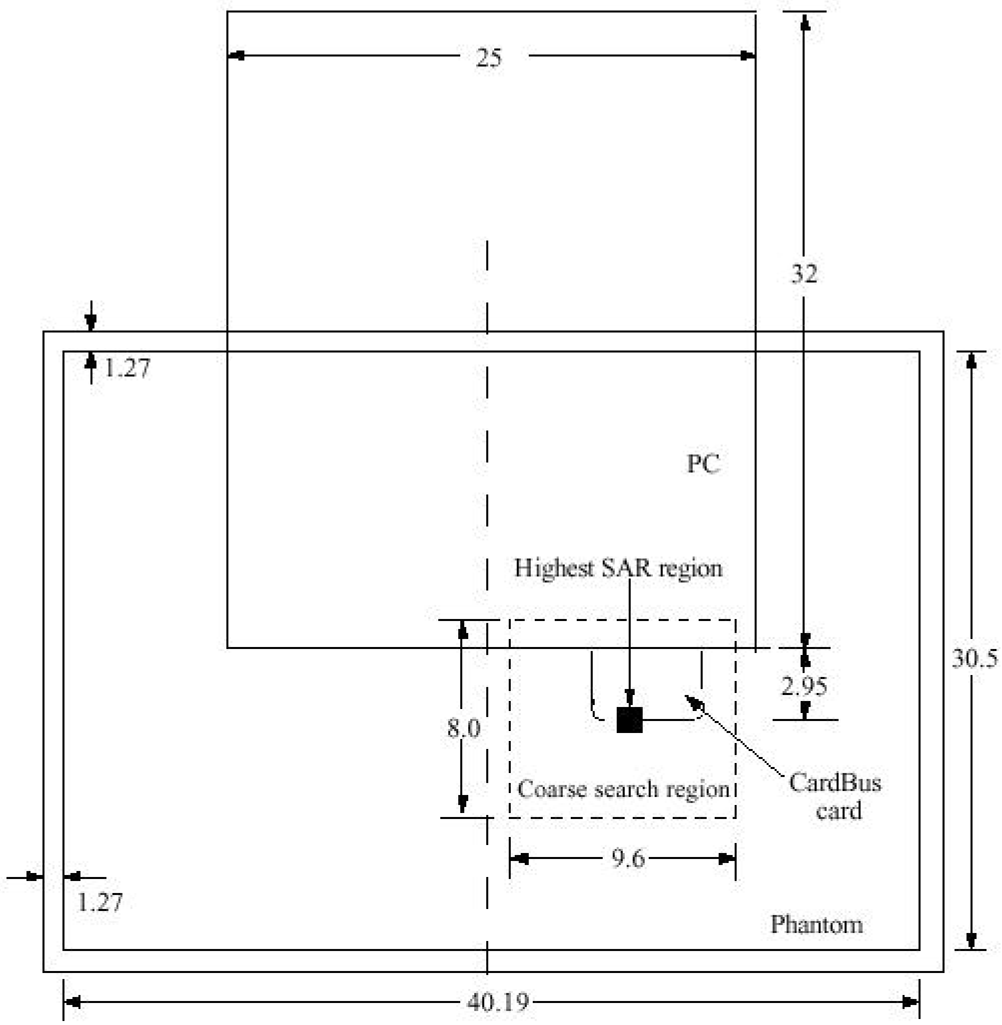


Fig. b. Illustration of the peak SAR location with respect to the phantom and the Atheros Model AR5BCB CardBus Card for the **Above-lap position** (measured SARs for the 1 $cm^3$ peak SAR region are given in Tables 1-4 of the SAR Test Report). All dimensions are in cm.

7) Probe was calibrated at 5.3 GHz. What is expected change in probe cal factor and expected resulting change in SAR at 5.8 GHz?

Reply:
the data for the highest SAR region for each of the placements of the PC card is measured with a stepper-motor-controlled step size of 2 mm. The extrapolated SARs with 2 mm resolution for xy planes at heights z of 1, 3, 5, 7 and 9 mm for each of the placements of the PC card relative to the flat phantom are given in Tables 1 to 8 of the SAR Test

Report. The individual SAR values for this grid of 5 × 5 × 5 or 125 points are averaged to obtain the peak 1-g SAR values (for a volume of 1 $cm^3$) and are given in Table 9 of the SAR Test Report.
A format for presenting the SAR data is given on p. 40 of Supplement C. Unfortunately, this format is pertinent to SAR tests of a hand-held cellular telephone. Table 9 of the SAR Test Report gives all of the needed peak 1-g SARs for four measurement frequencies for two required placements of the PC relative to the flat phantom.
For the Netgear card, the peak 1-g SAR varies from
0.249 to 0.976 W/kg. All of the measured SAR values are smaller than the FCC limit of 1.6 W/kg.

8) Discussion of how the EUT was operated/controlled during the test to assure the testing of all appropriate modes, maximum power, and any duty factor driven parameters, per Supplement C Appendix B part I 2. If possible provide post test power data to confirm that the EUT was operating at full power throughout the test.

Reply:
The Netgear cardbus card was inserted into a host
laptop for SAR testing. This laptop was loaded with Atheros Radio Test (ART) software that enabled control of the device-under-test via menu driven keyboard commands. Device operating conditions that are controlled by the software include channel frequency, data rate, output power, and duty cycle. During the SAR test, the device-under-test was configured for a 126mW (21dBm) output power, 99% duty cycle, 6Mbps data rate. The card's closed loop power control circuit was enabled by the software to set and maintain a constant 21dBm output power level for each of the tested channel frequencies.

9) Please provide mixing procedure for body liquid.

Reply:
On page 2 of the SAR Test Report, we give the composition of the tissue-simulant fluid used for present measurements. This composition developed at the University of Utah consists of 68.0% water, 31.0% sugar, and 1% HEC. The measured and pre-weighed amount of water is mixed slowly with the pre-weighed amount of sugar (310 g for each kg of the final fluid) while stirring the water in. The 1% HEC is added into the thick syrupy fluid at the end and mixed in. Because of micro bubbles that result, the fluid is allowed to stand for a period of 3-7 days until it is cleared of the air bubbles and is transparent at that stage.