Report

Rev.Date	Rev.	Document ID
2005-03-04	A	106393

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Nera BGAN PUT
Radiation Hazard Report

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Change Record

Rev	Date	Pages affected	Changes
A	2005-03-04	all	Initial Revision

1. INTRODUCTION

This report analyses the power flux density levels in the near field and far field regions for the Nera BGAN PUT satellite terminal antenna and calculates the safe separation distance based on the FCC Office of Engineering and Technology Bulletin 65. Edition 97-01 guideline. The OET Bulletin 65 specifies that the Maximum Permissible Exposure (MPE) limit for persons in an uncontrolled/public environment to non-ionising radiation in the transmit frequency band of interest over a 30 minute period is a power density equal to 1 mW/cm^2.

The antenna size of the Nera BGAN PUT terminal is H=7,3 cm x B=7,3 cm. The equations provided in the OET Bulletin 65. Edition 97-01 applies to parabolic aperture antennas with circular cross sections. However, in order to use those equations to evaluate the specific case of Nera BGAN PUT planar antenna, the diameter of the aperture is calculated as the effective diameter based on the relation between antenna gain and effective antenna area. The following parameters are used in the analysis and calculations:

Effective Antenna Diameter (D)	=	15,4 cm
Wavelength at 1643,5 MHz (λ)	=	18,2 cm
Peak Transmit Antenna Gain (G)	=	8,5dBi @ 1643,5 MHz or 7,079 in power ratio
Max. power fed to the antenna (P)	=	1,5dBW or 1413mW
Maximum EIRP (PG)	=	10dBW
MPE	=	1mW/ cm^2

2. NEAR FIELD CLACULATIONS

The distance to the end of the near field region can be determined by the following equation given in OET Bulletin 65:

Extent of near field,

$$R_{nf} = \frac{D^2}{4\lambda} = 3{,}3cm$$

The maximum power density in the near field for a reflector antenna is given by:

$$S_{nf} = \frac{EIRP}{4\pi R_{nf}^2} = 73mW/cm^2$$

3. FAR FIELD CALCULATIONS

The distance to the far field region is found by the following equation:

$$R_{ff} = \frac{0{,}6D^2}{\lambda} = 7{,}8cm$$

The maximum power density in the far field is given as follows:

$$S_{ff} = \frac{EIRP}{4\pi R_{ff}^{\ 2}} = 13.0mW/cm^2$$

4. SAFE SEPARATION DISTANCE

The safe separation distance at which the Nera BGAN PUT operating on its maximum EIRP of 10dBW will not exceed the OET Bulletin 65, Edition 97-01, MPE power density limit of 1 mW/cm^2 is calculated below:

$$d = \sqrt{\frac{EIRP}{4\pi MPE}} = 28{,}2cm \quad or \quad 11{,}1\ inches$$

At the rear of the terminal the antenna gain is always more than 18.5dB below the gain in the direction of the antenna's maximum directivity. Hence, the EIRP will for all angles "behind" the antenna be below –8.5dBW. Consequently, the safe separation distance behind the terminal/antenna is calculated as:

$$d_{rear} = \sqrt{\frac{EIRP_{rear}}{4\pi MPE}} = 3{,}4cm$$

5. CONCLUSION

The Nera BGAN Pocket User Terminal will meet the OET Bulletin 65, Edition 97-01, MPE power density limit for separation distance of 28,2 cm. As an additional safety measure a warning label is attached to each terminal cautioning users to stay **at least 0,5 meter (20 inches) from the satellite facing side of the antenna** when the terminal is in operation.

There will be no warning with respect to radiation hazard at the rear of the antenna as 3.4cm approximates the thickness of the terminal.

Detailed instructions related to the use of the terminals will be provided in an operating manual, which will give added protection against non-ionising radiation.