
Section 9

RF Exposure Information

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Radio Frequency Radiation Exposure Evaluation

FCC Rules: 1.1307, 1.1310, 2.1091, 27.52
IC Rules: RSS-Gen, RSS-102, RSS-193 clause 5.4,
Health Canada Safety Code 6,
Client Procedure Circular (CPC) 2-0-03

FCC Requirement: < 1mW/cm² General Population / Uncontrolled Exposure
< 5 mW/cm² Occupational / Controlled Exposure

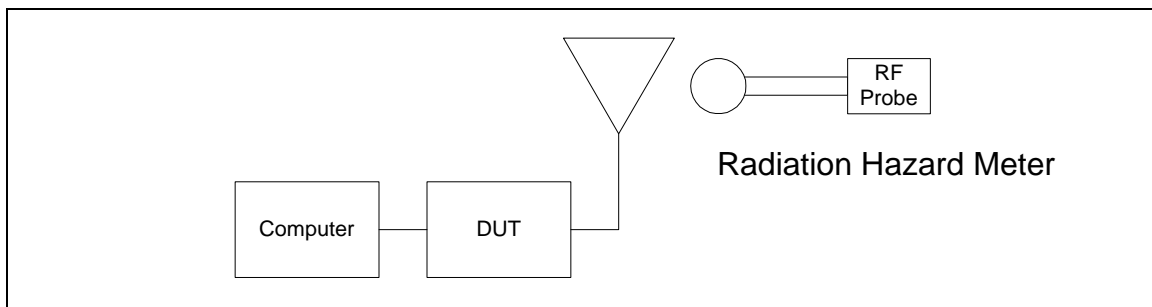
IC Requirement: < 10 W/m² General Public
< 50 W/m² Occupationally Exposed Persons

Standard: IEEE Std C95.3 - 2002

Procedure: The NextNet Wireless, Inc. Expedience system operates as a Time Division Duplex (TDD) product with a Time Division Multiplex (TDM) frame structure. Because the base station is capable of transmitting at a 100% duty cycle in test mode, radiation hazard testing is performed with the maximum exposure potential. To measure the RF Exposure, the base station transmitter is enabled in a test mode and transmitting random data at the 5-watt power level into the antenna. Measurements have also been performed when 4 base station transmitters are combined and applied to 1 antenna. Radiation hazard levels are measured with a radiation hazard meter that is scanned over the calculated safe distance from the antenna in 3 dimensions. Measurements are performed at low, mid, and high channels.

Conditions: Frequency = as listed in Radiation Hazard table
Temperature = 25°C
Supply Voltage = 48 VDC

Set-Up:



General Information:

The NextNet Wireless Expedience BTS-2500-E operates at a maximum of 2 watts (33 dBm) or 5 watts (37 dBm) [when optional high power mode purchased with channel filter] average power while transmitting in the 2496-2690 MHz band. The BTS-2500-E has a maximum transmit duty cycle of 100 % when in test mode. The maximum RF power of 5 watts is used for radiation hazard calculations and measurements. The NextNet Wireless Base Station does not contain an integral antenna therefore testing will be performed on antennas that are recommended by NextNet Wireless for installation.

The maximum gain antenna that has been tested with the NextNet Wireless Base Station had 19 dBi of gain.

For this gain, the maximum radiated transmit power for a single channel would be:

100% Transmit Duty Cycle:

$$P_{max} = P_{tx}(\text{dBm}) + G(\text{antenna}(\text{dBi})) - 10 \cdot \log(\text{duty cycle})(\text{dB})$$

$$P_{max} = 37 + 19 - 10 \cdot \log(1) = 37 + 19 - 0$$

$$P_{max} = 56 \text{ dBm} = 398.1 \text{ Watts EIRP}$$

The maximum radiated transmit power from four different channels combined and applied to one antenna would be:

100% Transmit Duty Cycle:

$$P_{max}/\text{channel} = 5 \text{ Watts}$$

$$P_{max}/4 \text{ channels} = 4 * 5 = 20 \text{ Watts} = 43 \text{ dBm}$$

$$P_{max} = P_{tx}(\text{dBm}) + G(\text{antenna}(\text{dBi})) - 10 \cdot \log(\text{duty cycle})(\text{dB})$$

$$P_{max} = 43 + 19 - 10 \cdot \log(1) = 43 + 19 - 0$$

$$P_{max} = 62 \text{ dBm} = 1585 \text{ Watts EIRP total}/4\text{channels}$$

Calculations:

The following calculations can be used to determine the distance from the transmitting antenna that must be maintained to ensure that the exposure limits for the General Public / Uncontrolled Exposure and the Occupational / Controlled Exposure are met.

The maximum power level from the previous calculations will be used.

$$S = \text{EIRP}/4\pi R^2$$

or

$$R = (\text{EIRP}/4\pi S)^{0.5}$$

2496-2690 MHz Band:

1 Base station at 5 Watts	4 Base Stations at 5 Watts each For 20 Watts total power
General Public Limit: $S = 1 \text{ mW/cm}^2$	
EIRP = 398.1 W	EIRP = 1585 W
EIRP = 398100 mW	EIRP = 1585000 mW
$R = (398100/(4*\pi*1))^{0.5}$	$R = (1585000/(4*\pi*1))^{0.5}$
R = 178 cm	R = 355 cm
Occupationally Exposed Person limit: $S = 5 \text{ mW/cm}^2$	
EIRP = 398.1 W	EIRP = 1585 W
EIRP = 398100 mW	EIRP = 1585000 mW
$R = (398100/(4*\pi*5))^{0.5}$	$R = (1585000/(4*\pi*5))^{0.5}$
R = 79.6 cm	R = 159 cm

The antennas recommended by NextNet Wireless to be used for base site installations are phased array or omni antennas. A measurement of the radiation hazard level at the calculated safe distance for the General Public for all antennas recommended by NextNet Wireless is shown in the table on the following pages. For each frequency tested, the maximum value observed during the measurement is listed. This table is a compilation of all radiation hazard measurements that have been performed by NextNet Wireless for this product certification and applicable product certifications that have been submitted and approved in previous applications.

Test Results: Single Base Station to Single Antenna

Test Results: Single Base Station configuration								
NN Part Number	Vendor	Vendor Part # or Model Number / Description	Test Date	Transmit Power (W)	Gain (dBi)	Test Distance (cm)	Test Frequency (MHz)	Maximum Measured Radiation Hazard Level (mW/cm ²)
501-3004-2601	Stella Doradus	25SD2360 omni	11/28/2005	5	10.0	63	2503 2593 2689	.239 .133 .160
501-1006-2701	Stella Doradus	26SD9860NV 60°x7°	11/28/2005	5	17.5	150	2503 2593 2689	.319 .359 .426
501-1009-2701	Stella Doradus	26SD9890NV (test sample #1) 90°x7°	11/28/2005	5	16.0	126	2503 2593 2689	.266 .293 .333
501-1009-2701	Stella Doradus	26SD9890NV (test sample #2) 90°x7°	12/21/2005	5	16.0	126	2503 2593 2689	.305 .320 .245
501-1009-2701	Stella Doradus	26SD9890NV (test sample #3) 90°x7°	12/21/2005	5	16.0	126	2503 2593 2689	.337 .294 .313
501-1009-2701w	Stella Doradus	26SD9890NVw 90°x7°	11/29/2005	5	16.0	126	2503 2593 2689	.129 .215 .257

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IC: 4022A-BTS2500E

Test Results: Single Base Station configuration								
NN Part Number	Vendor	Vendor Part # or Model Number / Description	Test Date	Transmit Power (W)	Gain (dBi)	Test Distance (cm)	Test Frequency (MHz)	Maximum Measured Radiation Hazard Level (mW/cm ²)
501-1009-2791	Stella Doradus	26SD9890NV-SUS1 90°x7°	12/21/2005	5	15.8	123	2503	.380
							2593	.431
							2689	.414
501-1009-2793	Stella Doradus	26SD9890NV-SUS3 90°x7°	12/21/2005	5	15.7	122	2503	.427
							2593	.412
							2689	.446
501-1009-2795	Stella Doradus	26SD9890NV-SUS5 90°x7°	12/21/2005	5	15.8	123	2503	.388
							2593	.403
							2689	.352
501-1009-2792	Stella Doradus	26SD9890NV-T2 90°x7°	12/21/2005	5	16.2	129	2503	.300
							2593	.328
							2689	.257
501-1009-2794	Stella Doradus	26SD9890NV-T4 90°x7°	12/21/2005	5	15.8	123	2503	.315
							2593	.450
							2689	.302
501-1002-2701	Stella Doradus	26SD98120NV 120°x7°	11/28/2005	5	15.0	112	2503	.160
							2593	.133
							2689	.146
501-1002-2701w	Stella Doradus	26SD98120NVw 120°x7°	11/29/2005	5	15.0	112	2503	.236
							2593	.300
							2689	.236

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FCC ID: PHX-BTS2500E
IC: 4022A-BTS2500E

Test Results: Single Base Station configuration								
NN Part Number	Vendor	Vendor Part # or Model Number / Description	Test Date	Transmit Power (W)	Gain (dBi)	Test Distance (cm)	Test Frequency (MHz)	Maximum Measured Radiation Hazard Level (mW/cm ²)
	Stella Doradus	26SD12005V 120°x5°	3/31/2004	5	18	188	2503 2593 2683	.11 .11 .11
	Stella Doradus	26SD9007VN 90°x7.5°	3/31/2004	5	19	188	2503 2593 2683	.21 .26 .21
	Stella Doradus	26SD9005V/H 90°x5°	3/31/2004	5	18	188	2503 2593 2683	.11 .11 .11
	Til-Tek	TA-2550 omni	3/31/2004	5	10	188	2587 2599 2629 2641	.21 .16 .16

Test Results: Four Base Stations to Single Antenna

Test Results: 4 Base Station configuration								
NN Part Number	Vendor	Vendor Part # or Model Number / Description	Test Date	Transmit Power (W)	Gain (dBi)	Test Distance (cm)	Test Frequency (MHz)	Maximum Measured Radiation Hazard Level (mW/cm ²)
	Stella Doradus	26SD12005V 120°x5°	3/31/2004	20	18	396	2587 2599 2629 2641	.11 4 bases into 1 antenna
	Stella Doradus	26SD9007VN 90°x7.5°	3/31/2004	20	19	396	2587 2599 2629 2641	.37 4 bases into 1 antenna
	Stella Doradus	26SD9005V 90°x5°	3/31/2004	20	18	396	2587 2599 2629 2641	.26 4 bases into 1 antenna
	Til-Tek	TA-2550 omni	3/31/2004	20	10	396	2587 2599 2629 2641	.11 4 bases into 1 antenna

Conclusions

Test Conclusion: The NextNet Wireless, Inc., Expedience, Base Station product and operator selected antenna must be installed such that the RF Exposure requirements as detailed in FCC Rules 47CFR1.1310 and Health Canada Safety Code 6 requirements are met.

Notices: The “Configuring, Installing, and Using Carrier Infrastructure” manual contains a list of approved antennas and the following information for antenna installations:

WARNING: *This equipment has been tested with a 19 dBi gain antenna and found to comply with the FCC and Industry Canada guidelines for Radio Frequency Radiation Exposure Limits as detailed below. For a single base 5 watt transmitter connected to the antenna, a minimum of 2 meters or 6.5 feet of separation between the antenna and all persons must be maintained. The minimum separation increases when additional base transmitting signals are combined and applied to the same antenna. Four base 5 watt transmitters combined to use a single antenna need a minimum separation of 4 meters or 13 feet from all persons.*