In support of NextNet Wireless's application for an Experimental License in the 2.3-2.4 GHz band

Proposed program of Research and Experimentation

NextNet wireless has undertaken the design of a new radio product, operating in the 2.3-2.4 GHz band for the delivery of Broadband Wireless services. These products are derivatives of currently deployed products in the American market:

- PHX-MMDS-BASE2 Base Station
- PHX-MMDS-CPE5 Residential Subscriber Unit
- PHX-MMDS-CPE6 Outdoor Subscriber Unit
- PHX-MSU2510A Mobile Subscriber Unit

The 2.3-2.4 GHz products are intended to be sold and used only in foreign countries.

The development program comprises the design and testing of new transmitter and receiver circuitry, based on those of the existing Broadband Radio Service ("BRS" formerly MDS) and Educational Broadband Radio Service ("EBS" formerly ITFS) products, verification of the design against regulatory requirements of a number of Pacific Rim countries, and extensive ongoing testing of the system level performance of the product in laboratory and field conditions.

System Operation

NextNet Expedience™ is an end-to-end, high-speed wireless network access system designed in a number of licensed bands from 2.3-3.6 GHz. It is a local loop wireless alternative offering business and residential users high speed access to network communication systems, such as private networks and the Internet. The system consists of two major components:

1) a base station component connecting to a service provider's backbone network which may ultimately provides access to the Internet, and
2) a subscriber unit (CPE) installed and operated at each end user's computer.

The base station may be deployed in a cellularized and sectorized fashion and is designed to provide high speed throughput for dense user capacities. It is targeted to be best utilized and deployed in high density suburban or urban areas. The base station coverage area (sector) is approximately a 1 to 3 mile radius from the transmitting tower in an urban deployment, 20 miles maximum in rural applications where the terrain permits. These sectors may overlap when an additional base stations are deployed thus allowing a given user in an area to potentially communicate to one of multiple base stations depending upon the signal quality. Adding a base station to a cell increases the user density and maintains the quality of service intended for a particular subscriber.

The subscriber unit or customer premises equipment (CPE) is a transceiver, modem and directional antenna integrated into a single enclosure. The CPE is a low cost, customer-installable device. This is intended to be mass marketed and sold as a consumer device, much in the same way as dial-up modems or other commercial off the shelf components are sold.

The NextNet air link functions as an IP Ethernet bridge. NextNet CPE, if able to receive signals from more than one base station, are able to select the base station providing the best quality signal.

The modulation used is orthogonal frequency division multiplexing (OFDM). The OFDM shall consist of 1024 sub-carriers with only 811 sub-carriers transmitted. Each sub-carrier is

modulated using 4QAM, 16 QAM, or 64QAM on each of the information sub-carriers in each OFDM modulation symbol. The order of QAM modulation is automatically and dynamically selected by the system for each link between base station and CPE, based on the measured channel quality.

Time division duplex and cellular deployment support considerable flexibility in adjusting downlink vs. uplink airtime to actual two-way traffic flow. The downstream/upstream ratio is selectable by the system operator, with values in the range of approximately 1:1 to 5:1. The resultant transmit duty cycle of the base station ranges from 42.9% to 74.2%; the resultant transmit duty cycle of a CPE during a continuous upload at maximum throughput ranges from 3.3% to 14.3%.

The system channel bandwidth is adjustable over the range of 3-7 MHz.

Maximum output power of both the base station and CPE is 2.0W. In normal operation, the base station operates at a constant 2W output level during its transmit cycle. The CPE is automatically adjusted in the range of 0.2 mW to 2W, dependant upon its distance from the base station, and the channel conditions, to produce a minimum acceptable receive signal level at the base station.

The EIRP of the base station is dependant on the antenna used, which is engineered according to the cellularization plan employed in a particular deployment. The CPE has a built-in antenna, whose gain varies with the band used. In this band, the CPE antenna gain is approximately 13 dBi.

Specific Objectives of the Experimentation

The product is expected to evolve significantly as new markets are developed, and there is need for ongoing validation of design changes and new system applications. Validation of the initial product, and of subsequent design changes, requires extensive testing of the radio performance, including features such as automatic adaptive modulation operation, transmitter power control operation, operation of TDD functions, such as ranging and turn-around time, and sector-sector handoff operation for nomadic or mobile applications. This can only be accomplished using a multi-sectored on-the-air test environment, as provided with the use of this experimental license.

Contribution to the development, expansion, or utilization of the Radio Art

NextNet Wireless' Expedience product is the first practical Non-Line-of-Sight broadband wireless access product, and in its 2.5-2.7 GHz version is widely deployed in the United States, as well as several other countries. NextNet's OFDM airlink is very similar to that of the proposed IEEE 802.16e standard, and delivers the range of features planned for this evolving standard. NextNet is currently partnering with the major developer of chipsets for this evolving standard, and is providing guidance for the optimization of this new standard, based on ongoing experimentation with the Expedience product. This experimental license will assist NextNet to expand this new technology into a new band, as used extensively in Pacific Rim countries, bringing the benefits of effective NLOS technology to new world markets.