SBC Technology Resources, Inc.

Roger V. Thompson
512-372-5810

January 22, 1999

Mr. Dale Hatfield
Chief – Office of Engineering and Technology
Federal Communications Commission
2000 M Street, NW
Room 480
Washington, DC 20554

Re: Southwestern Bell Technology Resources, Inc.
Call Sign KM2XBI
File Number: 4703-EX-ML-95
Progress Report Number Twenty Three

Dear Mr. Smith:

In accordance with the Federal Rules and Regulations Part 5, Section 5.204(b), attached please find the annual progress report (report number twenty three) for SBC Technology Resources, Inc. (TRI) in connection with our personal/wireless communications testbeds.

The main objective of our Austin testbed is to verify performance of the emerging wireless communications systems and technologies prior to integration into one of SBC Communications Inc.'s business units.

Please direct any inquiries to me at 512-372-5810.

Sincerely,

Roger V Thomp

Roger V. Thompson
Director, Wireless Communications

Attachment

FCC Progress Report Number Twenty Three (23) in Connection with Personal/Wireless Communications Testbeds

Conducted by SBC Technology Resources, Inc.

January 26, 1999

Authorized by FCC Experimental License
Call Sign KM2XBI, File Number 4703-EX-ML-95
(expansion/continuation of 3037-EX-PL-92)

1.0 Introduction

In 1998, there were two projects that involved transmissions covered under this experimental license. These were 1) several range and throughput tests to verify the performance of a wireless packet data system operating in the ISM band, and 2) a technical trial of a commercially available wireless local loop system.

SBC Technology Resources, Inc. (TRI) has deployed an outdoor testbed located around its offices at 9505 Arboretum Blvd. in Austin, TX. This testbed will be used to perform tests on emerging wireless systems and to validate improvements to existing systems. Each site consists of a 45 ft. pole, an equipment cabinet with power, and a 38 GHz microwave link to interconnect it with TRI's Wireless Technology Laboratory within TRI's office building.

2.0 Testing of a wireless data system in the ISM band

The test system is a packet radio system that operates in the 2.4 GHz ISM band using a transmit power of 400 mW and an 8.5 dBi antenna (EIRP = 34.5 dBm). Range and throughput tests were conducted with base stations installed on pole-tops at a height of 45 feet (the testbed referred to in the introduction), and on top of our office building roof at 125 feet. An end user transceiver was used to make connections with the base station from multiple locations within a 3 mile radius of the base station location. The end-user transceiver was kept at a height of about 1 –1.5 m. The end user transceiver and base station have identical radio systems.

Results: Range: 3,084-10,292 feet with antenna at 175 feet
2,352- 6,064 feet with antenna at 45 feet.
Throughput: Average = 75 kbps.

3.0 Technical Trial of a Wireless Local Loop System

3.1 Introduction and Purpose

Fixed Wireless Access (FWA) has become a subject of major importance over the last few years, and will pose opportunities for telecommunication services providers to economically extend service to areas which have heretofore been too expensive to serve. Most of the FWA systems installed to this point have been based on fixed use of a mobile network technology. However, a new class of FWA systems, designed for wireline

transparency, has recently entered the market. It also appears that the 3.4-3.6 GHz band is becoming a worldwide de facto FWA allocation. In order to gain further insight into this new class of FWA systems, and into propagation at 3.4 GHz, TRI conducted a technical field trial of a WLL system in Austin, TX.

The WLL test system is designed to provide POTS and ISDN services. The trial consisted of eight TRI employees as participants, being served by a single-sector base station mounted on top of TRI's office building at 9505 Arboretum Blvd. Of the eight participants, 6 were provided POTS service and 2 were given ISDN service. In addition, TRI's test van was outfitted with subscriber and test gear to explore RF coverage issues within a 4 mile radius of the base station.

3.2 Preparation

As stated in TRI Progress Report #22, the PerCon Master Frequency Database revealed no transmitters in Travis or Williamson County in the 3.4-3.6 GHz frequency range. The U.S. Military uses 3.1-3.6 GHz for airborne radars such as AWACS, but since Austin is not the site of military training no conflict was anticipated. Before any transmissions took place, TRI conducted RF measurements of this area for potential users of the band, and informed the FCC Compliance and Information Bureau field office in Dallas prior to transmissions.

The test configuration is shown below in Figure 1.

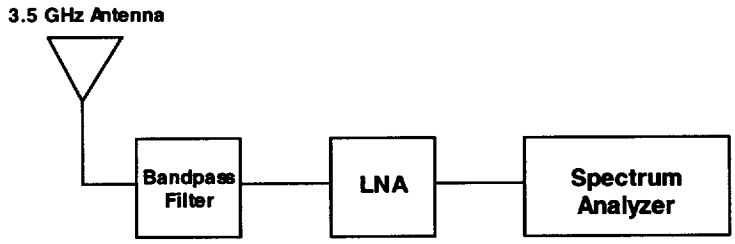

Figure 1 – Test Configuration

The antenna used was the same antenna as that used on the base station, and was a 90 degree sector antenna with a gain of 15 dBi. The filter has a center frequency of 3.498 GHz with a 3 dB bandwidth of 326.4 MHz and a Q of 10.4. The LNA provided 28 dB of gain. The spectrum analyzer was used to examine the received spectrum over the 3.45 to 3.65 GHz band and stored the resulting traces.

At each test location, we recorded the GPS location and performed a spectrum measurement. To ensure the test setup was operating properly, we first ran a test, without the filter, at 1.9 GHz where we could be sure that there would be signals present (this test used a 1.9 GHz antenna). Once it was determined that the system was operating properly, we added the filter and substituted the 3.5 GHz antenna.

The TRI office building (and subsequent base station location) is located at GPS location:

N 30 ° 23.461'

W 97 ° 45.070'

The TRI building is 9 stories tall, the roof is about 120 feet AGL. We tested various locations and pointing angles on the roof. The other locations tested were:

Jester Subdivision:

GPS coordinates: N 30° 23.216'

W 97° 47.962'

This location is about 3 miles West of the TRI building, on the West edge of the trial area.

Lakeline Mall:

The next measurement made was in the NE corner of the parking lot of Lakeline mall, located approximately 8 miles north of the TRI office building.

GPS coordinates: N 30° 28.385'

W 97° 48.342'

Park & Ride on Highway 183:

The next measurement was made at a Park & Ride location just off highway 183, about 2 miles North of the TRI building, and East of the trial area.

GPS coordinates: N 30° 25.595'

W 97° 45.424'

2515 Brockton

This location is about 3 miles NE of TRI's office building. It is 2-3 miles East of the trial area.

GPS coordinates: N 30° 23.579'

W 97° 43.097'

At each position we conducted a 360° sweep. The spectrum sweep measurements determined that there were no signals detected within the band of interest, 3.45-3.6 GHz.

3.3 Technical Trial

A single base station with a 90 degree sector antenna was deployed on top of the TRI office building. This is a CDMA system with a 5 MHz channel using Frequency Division Duplexing (FDD). The specific frequency channels used were 3.4525 GHz for the reverse link and 3.5525 GHz for the forward link. The output EIRP was 33.7 dBm spread over 5 MHz for a max peak value of less than 9×10^{-7} watts. As mentioned before, 8 TRI employees had subscriber equipment mounted at their homes and used the system to make phone calls over a 3 month period.

During the course of the trial we tested the following parameters:

- Voice Quality
- Capacity
- Voiceband Data Capability
- ISDN Data Rates
- Feature Transparency
- Network Transparency
- Range and Coverage
- Reliability
- User Perceptions
- Battery Backup
- Network Management

It is also important that we investigate the ability of common planning tools to accurately model the propagation characteristics of this band and the impacts of the fixed, as opposed to mobile, application of radio systems. To investigate these two issues, TRI conducted an RF survey in the trial area to determine the propagation characteristics, and to compare the survey data with the signal level predictions from a common RF planning tool. While the number of survey points taken in this trial are insufficient to derive a new model, it provided insight into whether or not the basic propagation model in the RF planning tool is reasonably accurate or needs modification.

The trial area is hilly with significant vegetation, mostly live oak and pecan trees. The environment would be classified as U.S. suburban with mostly one and two-story single family homes. The measurements were made at the street in each location.

The range testing was conducted using a subscriber unit mounted to an extendable mast. This was transported throughout the trial area and measurements were made at 40 locations. At each location, the received signal strength was measured at 3 antenna heights. The maximum range obtained during the trial was about 3.5 miles. The results of this RF survey were compared the predictions obtained from our standard RF planning tool. The results showed, in this environment, that a shadow fading margin of greater than 14 dB was required in the model. This is somewhat higher than typically used in a mobile environment and is the result of hilly terrain and the granularity of the terrain database in the model. The prediction of signal strength for different subscriber antenna heights is the greatest challenge for existing RF propagation models. However the slope intercept model still performed well at this frequency, and greater insight was gained into the effects of terrain impairments, foliage attenuation, and propagation characteristics at this frequency.