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Date: February 8, 1999

FCC, Experimental Licensing Branch, Suite 230, 2000 M ST., MS 1300E1,
Washington, DC 20554

Gentlemen:

Please find enclosed a copy of the progress report on the usage of the Experimental License issued to the GeoPhone Company LLC to allow operation of C- Band Earth Stations over satellites. This report covers and summarizes the testing that was conducted from November 1997 through July 1998. A copy of this report is also being submitted to the FCC Satellite Engineering Branch, Room 512, 2000 M St., MS 08000B1, Washington D.C. 20554, Attention : Mr. Karl Kensinger.
Any questions pertaining to the following information should be directed to the undersigned.

Operations Manager
Theodore L. Battle

cc: Steve Chen
Ron Kubicki

PROGRESS REPORT SATELLITE TESTING

1.0 Scope

This report contains information on the progress of C- Band satellite link testing of GeoPhone Developmental Earth Stations located at GeoPhone test and manufacturing facility at 905 Commerce Drive in Annapolis MD during the period of November 1997 through December 1998. The testing was done under a class XD FX Experimental License issued to GeoPhone Company LLC under the call sign WA2XPD under file number 5930-EX-PI-97.

Testing was done over the GE3 C-Band Satellite located at 87 Degrees West Longitude using GeoPhone designed VSATS. These Very Small Aperture Terminals (VSATS) are capable of transmitting a frequency hopped spread spectrum signal in the 5.925 - 6.425 GHz band and receiving in the 3.7 - 4.2 GHz band. The developmental equipment was operated within an occupied bandwidth of approximately 1 MHz although a complete 43 MHz transponder was leased for the testing.

Antenna Coordinates: The VSAT antenna coordinates are 38.9935 degrees North Latitude and 76.5466 degrees West Longitude.

Antenna Pointing: The VSAT antennas were pointed at an elevation of 43.55 degrees above the horizon plane and at an azimuth angle of 163.66 degrees from the Geographic North.

Test Configuration: The test configurations will allow IF test loops and a complete RF test loop including the satellite to be configured. The testing will be done in a sequence to maximize the use of satellite test time to obtain data.

Maximum output power: The maximum available output power from the outdoor unit is 5 watts in the 5.925 - 6.425 GHz band.

Approval: Approval was provided for the operation of these earth stations under a FCC class XD FX Experimental License Issued to GeoPhone Company LLC under the call sign WA2XPD under file number 5930 - EX - PL- 97 A copy of the license is attached at the end of this report.

Applicable Documents:

1. Commercial documents including by not limited to commercial standards, specifications and drawing, as well as all applicable FCC documents.
2. Industry Documents were GE Uplink Requirements Document.

2.0 Purpose

Tests performed on these terminals will provide the initial technology evaluation in the GeoPhone Corporation's VSAT Network product development effort.

The key technologies to be evaluated during this test program will consist of low-rate vocoders, new signal processing algorithms, a new spread spectrum modem and a unique RF hardware architecture.

The purpose of the test series was to establish that the CAMA Waveform could be used to provide multiple two way duplex voice links over an operational C-Band satellite and to determine how robust the connection was both during the call establishment and the conversation phase. The operation of a six-site network would be established at this location, and the effects of loading, power balancing and control will be tested and evaluated.

The evaluation of GeoPhone's Proprietary Spread Spectrum Modems using the CAMA waveform and low rate vocoder over a satellite link under varying operational conditions while measuring the subjective quality of the voice transmissions and BER performance is one of the goals of this test series. The link design analysis will also be validated during these tests.

3.0 Satellite Accesses

All Satellite accesses were coordinated through The GE Communication Network Operations and were completely in compliance with GE access procedures and requirements for the GE-3 and GE-1satellites. Several transponders were used for the testing with transmission always on the Horizontal Polarization and reception on the Vertical Polarization.

The FCC type approved 1.8 meter Prodelin antennas were pointed and optimized to maximize receive and transmitted signals and to minimize cross polarization interference.

The following table indicates typical access times and the transponders used during the satellite test program. All testing done during this test series utilize the Annapolis Build version of the GeoPhone VSAT's with all testing done over the GE-3 and GE-1 Satellite.

SATELLITE ACCESS EVENTS

DATE	START/END (HRS)	TRANSPONDER GE-3	GE-1
3/05/98	17:15 - 17:30	23	
3/09/98	05:00 - 05::15	6	
3/10/98	07:00 - 07:30	6	
3/11/98	16:30 - 16:45	8	
3/25/98	16:30 -16:45	8	
3/26/98	10:00 - 10:15	8	
3/26/98	11:00 - 11:15	8	
3/26/98	17:00 - 17:15	8	
3/26/98	19:15 -19:30	8	
4/23/98	11:30 - 11:45	8	
5/04/98	16:00 - 16:15	8	
5/04/98	17:00 - 17:30	8	
5/05/98	10:00 - 10;15	8	
5/05/98	10:30 - 10:45	8	

5/05/98	16:00 – 1615	8
5/06/98	18:00 -18:15	8
5/06/98	18:30 - 18:45	8
5/06/98	19:15 - 19:30	8
5/07/98	11:00 - 11:15	8
5/07/98	16:00 - 16:15	8
5/08/98	11:00 - 11:15	8
5/08/97	12:15 - 12:30	8
5/08/98	13:00 - 13:30	8
5/20/98	15:15 - 15:30	8
5/22/98	08:00 - 08:15	8
5/22/98	09:30 - 09:45	8
5/22/98	10:30 - 11:00	8
5/28/98	20:45 - 21:00	8
5/29/98	07:15 - 07:30	8
5/29/98	09:15 - 09:45	8
5/29/98	09:45 - 10:45	8
5/29/98	12:45 - 13:00	8
6/02/98	17:05 - 17:20	8
6/02/98	18:35 - 18:50	8
6/04/98	16:00 - 16:15	8
6/04/98	17:00 - 17:15	8
6/08/98	11:00 - 11:15	8
6/08/98	15:00 - 15:15	8
6/09/98	13:30 - 13:45	8
6/10/98	10:00 - 10:15	8
6/10/98	17:00 - 18:15	8
6/12/98	12:15 - 12:30	8
6/12/98	12:45 - 13:00	8
6/12/98	15:30 - 15:45	8
6/16/98	11:30 - 11:45	8
6/16/98	13:45 - 14:15	8
6/17/98	14:30 - 14:45	8
6/18/98	13:35 - 14:05	8
6/19/98	15:00 - 15:30	8
6/24/98	09:00 - 09:15	8

6/24/98	10:00 - 10:15	8
6/25/98	17:00 - 17:15	8
7/01/98	11:30 - 11:45	8
7/02/98	10:00 - 10:30	8
7/07/98	11:30 - 11:45	8
7/08/98	13:30 - 14:00	8
7/09/98	10:30 - 10:45	8
7/09/98	15:00 - 15:30	8
7/13/98	10:30 - 10:45	8
7/13/98	14:00 - 14:30	8
7/20/98	14:00 – 14:15	8
7/20/98	16:00 – 16:15	8
7/22/98	15:30 – 15:45	8
7/23/98	17:30 – 18:00	8
7/23/98	15:00 – 15:15	8
7/27/98	15:00 – 15:15	8
7/27/98	15:45 – 16:45	8
7/28/98	15:30 – 16:30	8
7/28/98	15:00 – 15:15	8
7/30/98	13:30 – 13:45	8
7/30/98	12:30 – 12:45	8
7/31/98	12:30 – 12:45	8
7/31/98	14:00 – 14:15	8
7/31/98	14:30 – 15:00	8
8/04/98	09:00 – 09:15	8
8/04/98	10:00 – 10:15	8
8/04/98	11:45 – 12:00	8
8/04/98	17:00 – 18:00	8
8/05/98	13:30 –13:45	8
8/05/98	14:00 – 15:00	8
8/11/98	09:00 – 09:15	8
8/11/98	11:30 –12:00	8
8/12/98	14:45 – 15:15	8
9/03/98	14:15 – 14:30	23
9/04/98	10:00 – 10:15	23
9/04/98	10:45 – 11:00	23

9/08/98	09:00 – 09:15	23
9/08/98	11:30 – 12:15	23
9/10/98	09:30 – 09:45	23
9/11/98	11:45 – 12:30	23
9/23/98	10:45 – 11:15	13
12/21/98	14:00 – 14:30	13

4.0 Test Results

Reviewing the testing program over the last 12 months, it can be seen that very effective use was made of satellite access time. The performance of these tests in a laboratory environment, enabled GeoPhone to improve the design of the next generation of its products by incorporating design features that were uncovered during this experimental testing series. The key technologies evaluated during this experimental terminal program was to evaluate low rate vocoders, new signal processing algorithms, a new spread spectrum modem and a unique hardware architecture. The terminals were also used to demonstrate operation over existing commercial satellites.

The tests performed during the experimental terminal program were designed to test that the CAMA waveform could be used to provide a two way duplex voice link over an operational C- band satellite and how robust the connection was during the call establishment and the conversation phase. These tests were made over varying operational conditions while measuring the subjective quality of the voice transmissions and BER bit error rate.

We were able to determine how this new CAMA technique would operate in a commercial satellite environment, with its rain fading, proximity of other carriers, Doppler frequency variations, satellite frequency offsets, cross polarization interference effects.

The optimal signal levels for operating the various components in the system and the sensitivity of this type of modulation to the non linear effects of saturation of components in the system were determined which helped us to finalize the system design for the production terminals.
During this testing we were able to test and evaluate the following satellite and terminal characteristics and determine solutions for implementing them in the pre production prototypes.

- Compensation of the Doppler shifted frequency of the satellite
- Satellite flux density measurement (SFD)
- Effect of the satellite transponder saturation characteristics on performance

- Compensation of rate of drift and instability of the satellite frequency translation
- Evaluation of power stability of link budget including fading characteristics
- Effect of spatial satellite movement on link performance with a fixed antenna
- Effect of interference signals in satellite environment
- Telephone call setup, connection, and tear down over the satellite.

The following design enhancements were added to the production units as a result of the Experimental Terminal testing program and engineering development.

1) Cost reduction.

2) Frequency Acquisition/Tracking.

3) Power control/ Throttling

4) 500 MHz agility

5) Design for C-band and Extended C-band operation

6) Time multiplexed channels

7) Flexible hardware design allowing enhancements to be added via software upgrade.

8) Frequency Hopping for time multiplexed channels.

9) Automatic switching of data, facsimile and voice traffic.

5.0 Future Testing Plans

5.1 C-Band Testing

GeoPhone will continue to perform some C-Band testing for C-Band Applications, but the emphasis in the near future will be on Ku-Band testing of our network.

5.2 KU- Band Testing

GeoPhone is in the process of installing an eight terminal KU Band Network utilizing redesigned RF Equipment by February 1999 that will allow us to fully test the effects of network performance characteristics such as channel loading tests, capacity tests as well as network power and frequency control algorithms at KU Band Frequencies. The antennas used for this series of testing will be the FCC and Intelsat approved Prodelin 1.8Meter Ku Band antennas as well as the existing 1.2Meter Channel Master antennas. The 1.8Meter Antennas will be located in Annapolis, at 905 Commerce Drive, well within the approved 161 Km FCC limit. We also have plans to locate a 1.2 Meter antenna in Dundalk Md. Also within the 161 km FCC limit

The risk of operating a network at customer sites which will be located in developing countries will be greatly reduced as a result of GeoPhone having tested and evaluated an operational nine terminal KU band satellite network in Annapolis with some geographic dispersal.

Once we have completed this series of testing, we will be able to start to ship KU Band networks to our customers in developing countries for implementation. We have received an extension to the existing license from the FCC to facilitate this next phase of testing and network development.